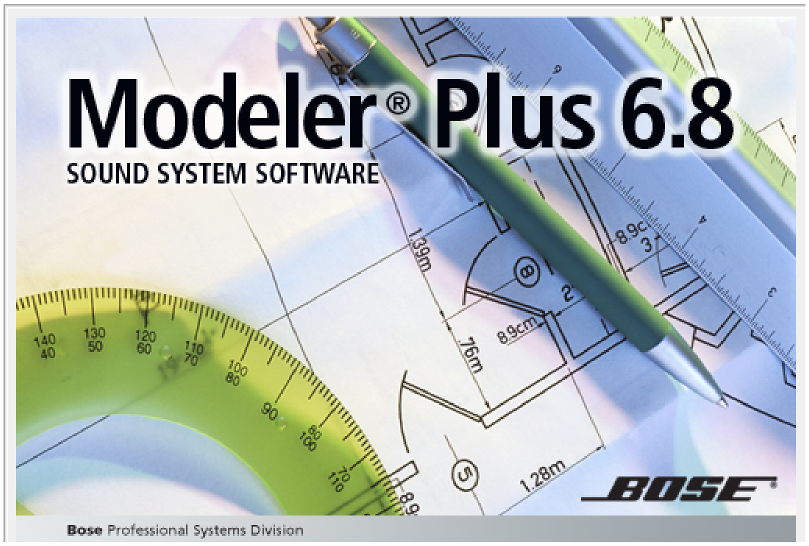
Modeler® Sound System Software 6.8

User's Guide



Introduction

Welcome

Welcome to Bose® Modeler® software version 6.8. Modeler is a powerful software tool for designing sound systems and predicting their performance.

Modeler 6.8 software is available in a Standard and Plus version and includes the following updated functions:

Standard - The standard version of Modeler offers all major features and functions for creating room models, creating a sound system design and simulating the system’s performance. Mapping of key system metrics such as coverage, loudness and speech intelligibility are available.

Plus - Modeler Plus incorporates proprietary prediction and signal processing algorithms that allow auralization of multiple room models and listener positions. Playback is accomplished using the Bose Auditioner® playback system.

For simplicity, the features and functions of both the Standard and Plus applications are covered in this help system. Note that the auralization features, Playlist Tab, Playback Tab and enable listeners tools are not available within the Standard version of the Modeler software.

Click here to get started with the Modeler software help system.

New In This Release

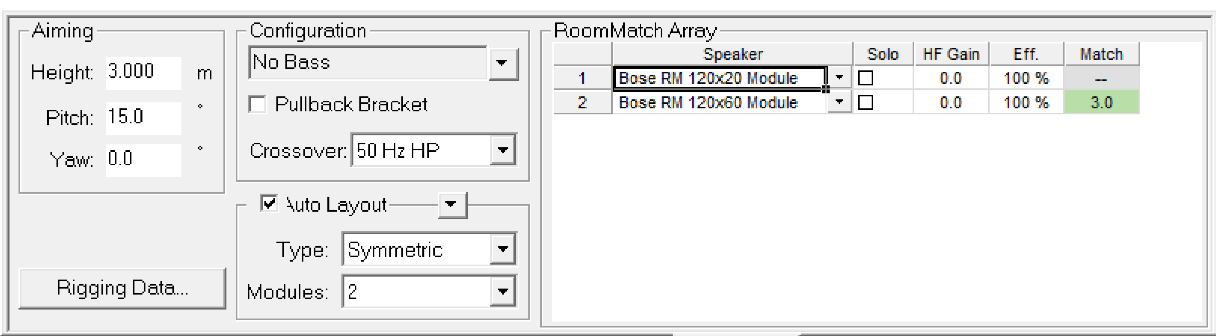
Modeler software version 6.8 includes the following new features and functional improvements.

- RoomMatch array properties improvements
- Improvements to RoomMatch Array Auto Layout function
- Auto Layout of horizontally asymmetric RoomMatch arrays
- The RoomMatch rigging calculator
- Modeler Data Exchange file format

RoomMatch Array Properties Improvements

RoomMatch array properties improvements include addition of all flown bass configurations, user selectable crossover point, and addition of rigging components in CAD views.

The new RoomMatch array properties control panel includes Aiming, Rigging Data, Configuration, Auto Layout, Crossover and RoomMatch Array. See RoomMatch Array Properties for a description of each control.



RoomMatch Array Auto Layout Improvements

The auto layout function for RoomMatch systems is significantly improved, as compared to the 6.7 release of Modeler software. Auto Layout improvements have been made in the following areas:

- Target coverage area within the Projection View can be dragged/adjusted from within the Projection View directly.
- Auto Layout has been extended to include asymmetric RoomMatch modules.
- Auto Layout algorithm horizontal coverage definition has changed to use the -6 dB point of the module’s horizontal coverage pattern resulting in improved module selection.

See Adjusting the Target Coverage Area.

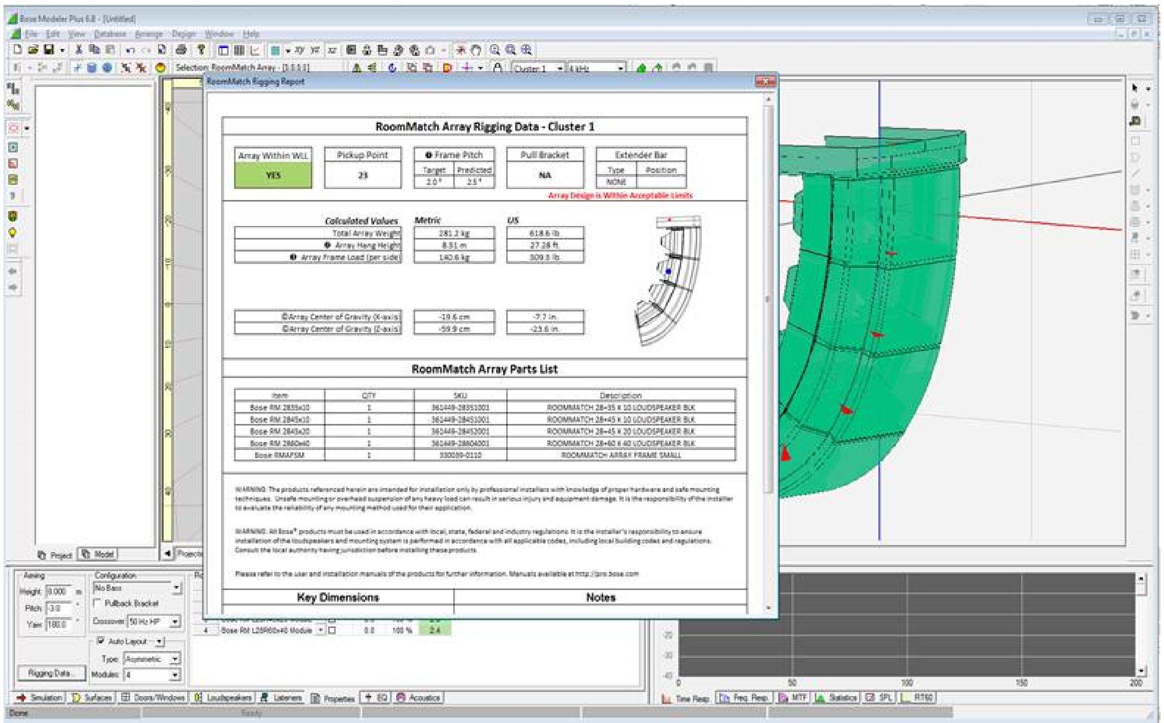
Auto Layout of Horizontally Asymmetric RoomMatch Arrays

Auto Layout of horizontally asymmetric RoomMatch arrays is supported using the RoomMatch auto layout function.

When designing a RoomMatch array it is now possible to easily switch between a symmetric and asymmetric design, by selecting the Type item within the Auto Layout area of the RoomMatch array properties. When working with an asymmetric array, the target coverage area is divided into two parts separated by the mechanical center line of the modules. See the Auto Layout description in RoomMatch Array Properties.

RoomMatch Rigging Data

The RoomMatch rigging data report displays the recommended rigging information for a selected RoomMatch array including cluster weight, grid frame type, and grid frame pick up points. See RoomMatch Rigging Data.htm.



Additions to the Bose® Loudspeaker Database

RoomMatch Loudspeaker Data

The Bose loudspeaker database has been re-organized to accommodate new RoomMatch modules, new RoomMatch subwoofer configurations, and to facilitate designs created both with the RoomMatch array properties and with manual placement of loudspeakers within a room model.

The RoomMatch section of the Bose loudspeaker database is now organized as follows:

Directory Path	Contents
Bose\RoomMatch	RoomMatch loudspeaker data
Bose\RoomMatch\50 Hz HP	Data files used by the RoomMatch array properties when 50 Hz is selected as the crossover point for the array.
Bose\RoomMatch\80 Hz HP	Data files used by the RoomMatch array properties when 80 Hz is selected as the crossover point for the array.
Bose\RoomMatch\Bass	Contains all RoomMatch bass data for RMS 215 and RMS 218. Data files are named based on the low pass crossover applied to the

Directory Path	Contents
	data.

Two new loudspeakers have been added to the Bose loudspeaker database for this release – the RoomMatch RMS218 subwoofer, and the RMU208 loudspeaker.

RMS218 data is included in the RoomMatch directories so that it can be used in RoomMatch arrays designed with the array properties, and in a separate directory for designs where the subwoofer is not part of the RoomMatch array.

Modeler Data Exchange File Format

Accessed from the Export Menu item within the File Menu, the Modeler Data Exchange exports the full contents of the room model and system in an XML file format. The Modeler Data Exchange will be used with future versions of ControlSpace® Designer software, and will appear as a data import function. It will be available within ControlSpace Designer software version 4.1.

Training, Application, and Support

Additional information on the Modeler software, and other Bose Professional products can be found at pro.Bose.com.

A number of tutorials are included with the Modeler software help system.

- Modeling Workshop
- Working With Projects
- D²R∆STIc Design Process
- Using Extrusion Tools

The most recent application notes are always available at pro.Bose.com.

The Modeler software User’s Forum is a private forum for Modeler users to share with other users, request new product features and functions, report any problems or issues with the software, and interact with the product development team.

To join the Modeler User’s forum go to proforum.Bose.com.

Getting Started

System requirements

It is highly recommended that you use a scroll-wheel mouse with either Modeler Standard or Modeler Plus software.

Modeler Standard Minimum System Requirements

- Microsoft Windows XP Professional, Service Pack 2 (or later)
- Microsoft Windows 7, (Professional or Ultimate)
- 1GHz 32-bit (x86) or 64-bit (x64 processor) or better
- 512MB of RAM available (1GB recommended)
- 512MB of disk space available (1GB recommended)
- 1024 x 768 32-bit XGA color video display adapter, open GL (or better)
- A USB copy protection hardware key (supplied with the software)
- 1 open USB port for Modeler hardware key
- A scroll-wheel mouse (highly recommended)

Modeler Plus

- Requires an additional USB port for the Auditioner® Playback System

Note: You must have administrative rights on your computer to install Bose Modeler software. Administrative rights are not required to run Modeler software after installation.

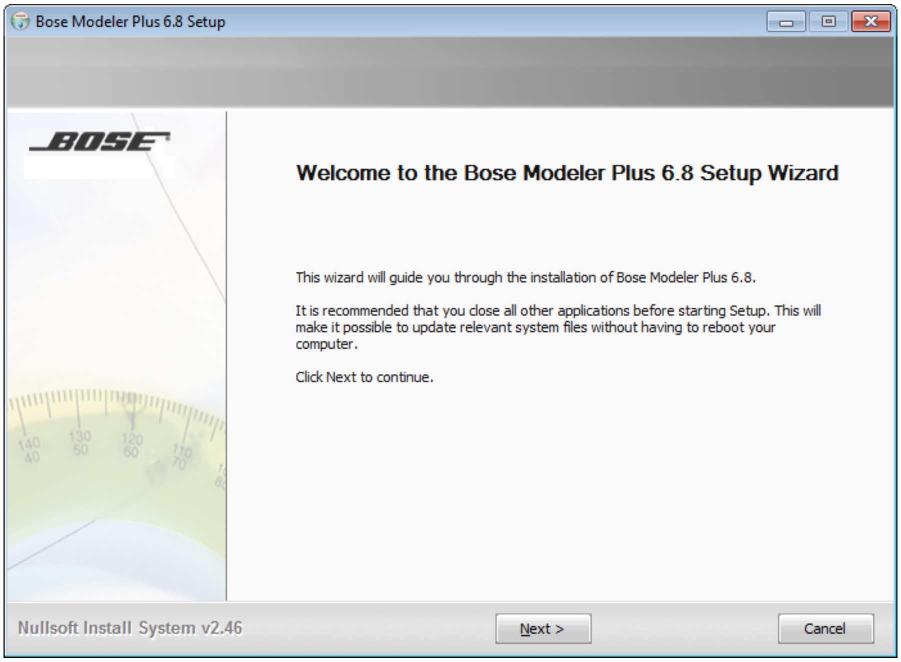
Software registration

Before you install Modeler software, you must register with Bose Professional Systems. Navigate your web browser to http://pro.Bose.com/modeler. Click on Software Registration and fill out the necessary information.

Installing Modeler Software

1. Launch the Modeler software setup wizard that was downloaded during the registration process.

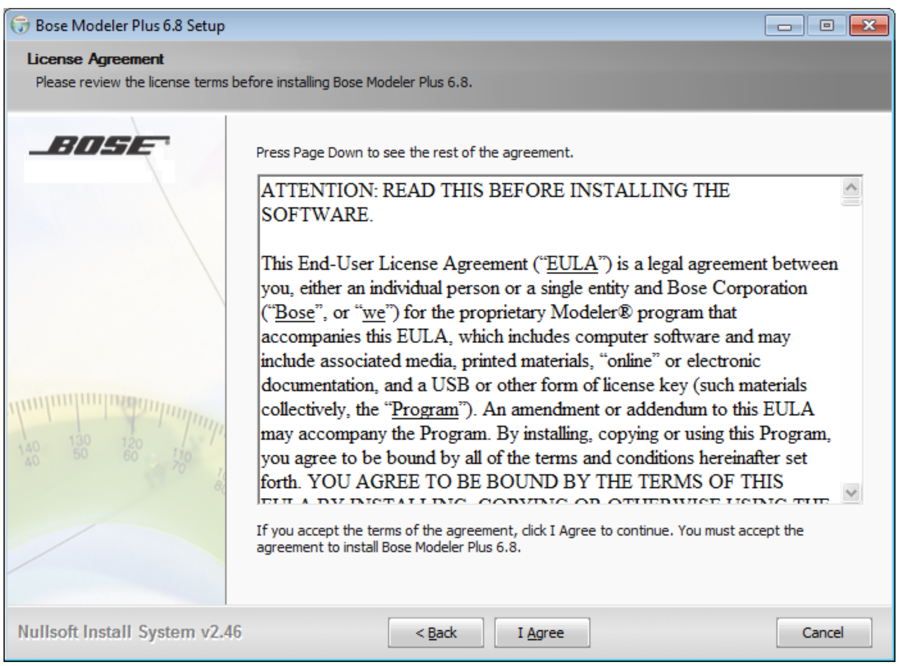
   The welcome window is displayed:



Installer Welcome window

2. Click **Next** to begin the installation process.

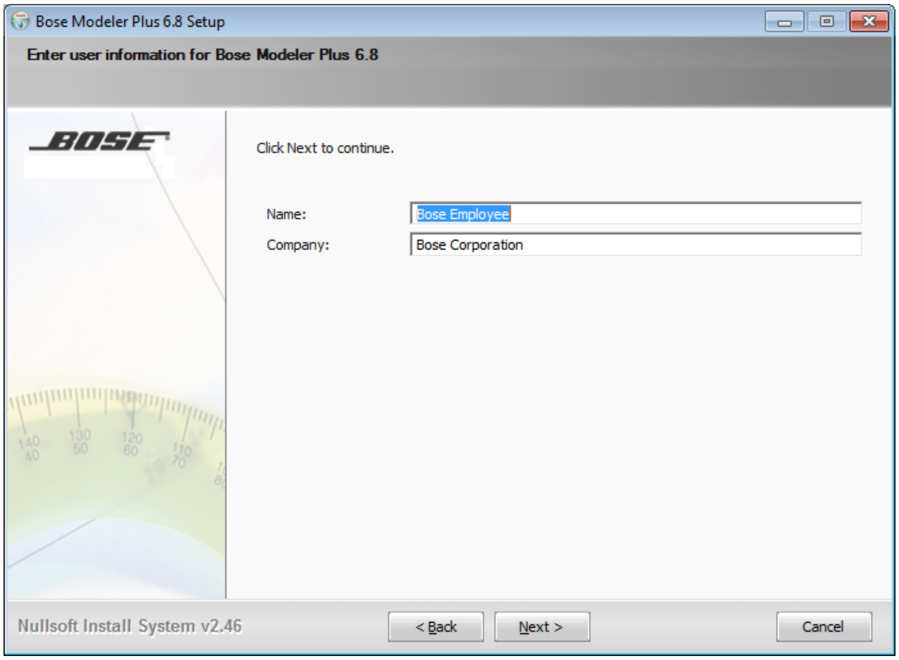
   The window displays the software License Agreement:



Software License Agreement

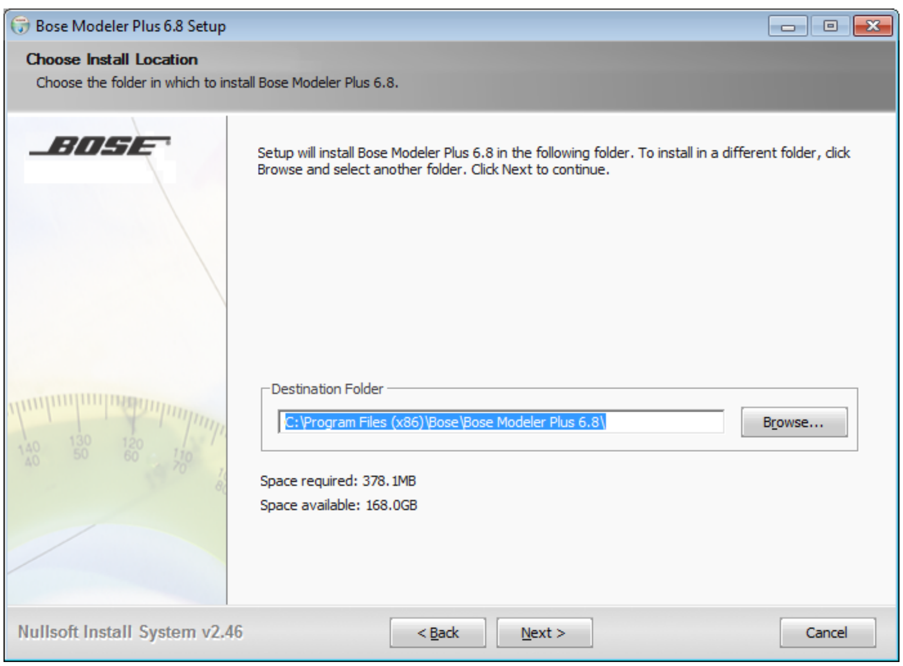
3. Please read the License Agreement and then click **I Agree** to accept the terms of the agreement.

   The user information window is displayed:



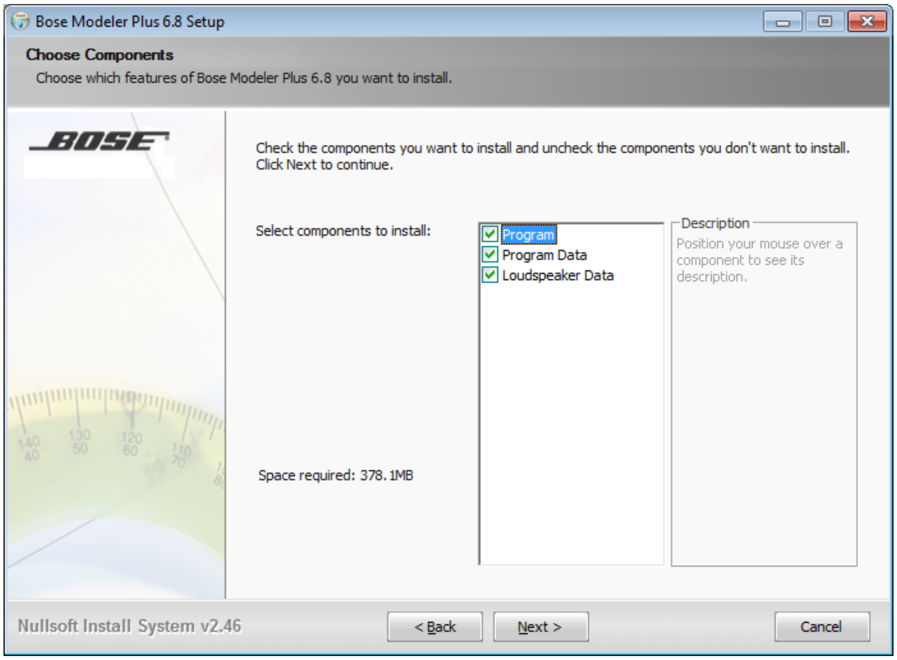
User information entry

4. Enter user information and click **Next** when you are finished.
   The window displays the Destination Folder for the software to be installed:



Software installation folder

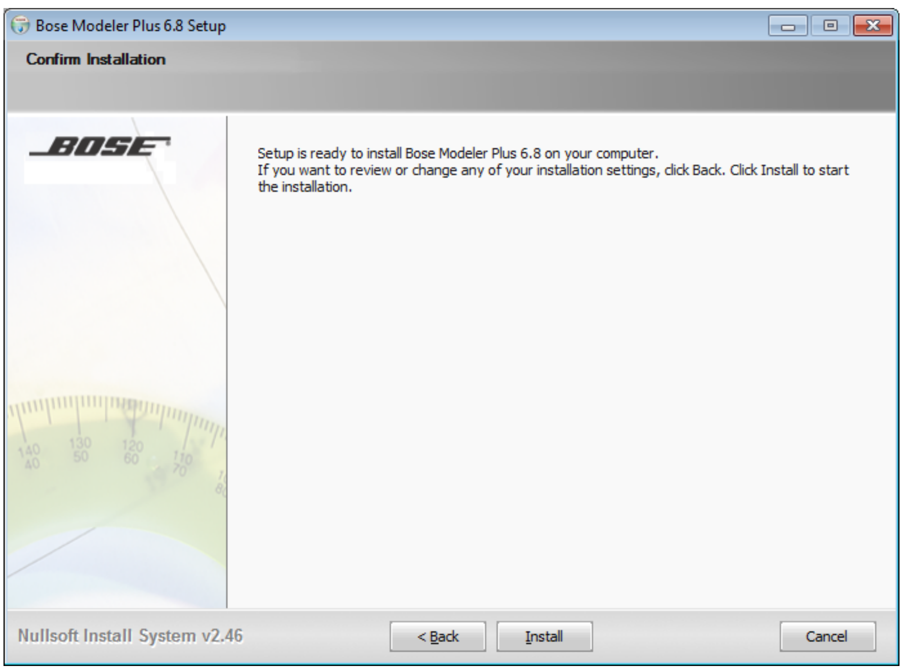
5. Choose where you would like to install the software. Click **Next**.
   The software component selections are displayed:



Available application components

6. Select the application components you wish to install. Click **Next**.

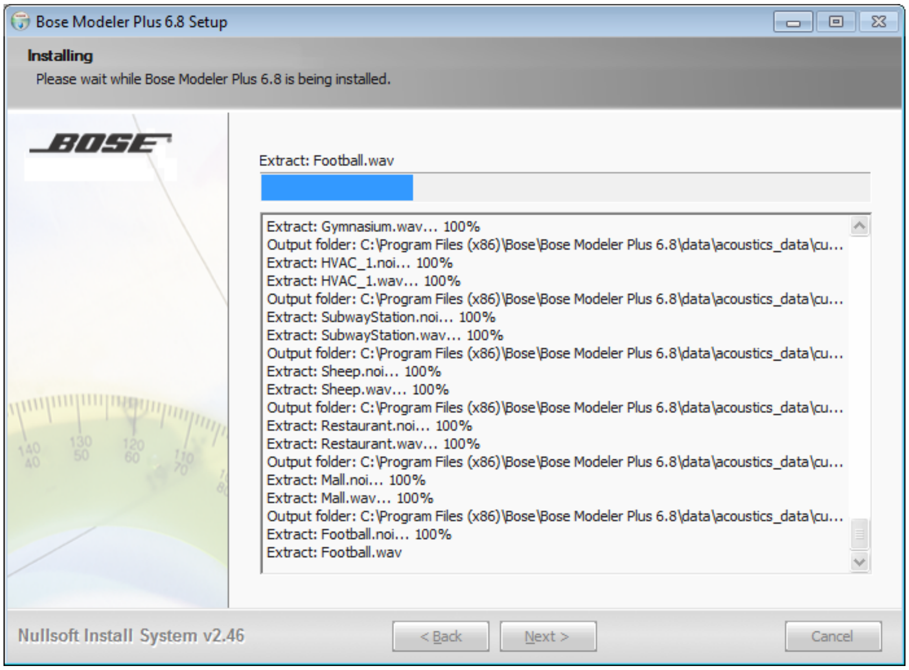
The installation utility is ready to install the software:



Confirming installation

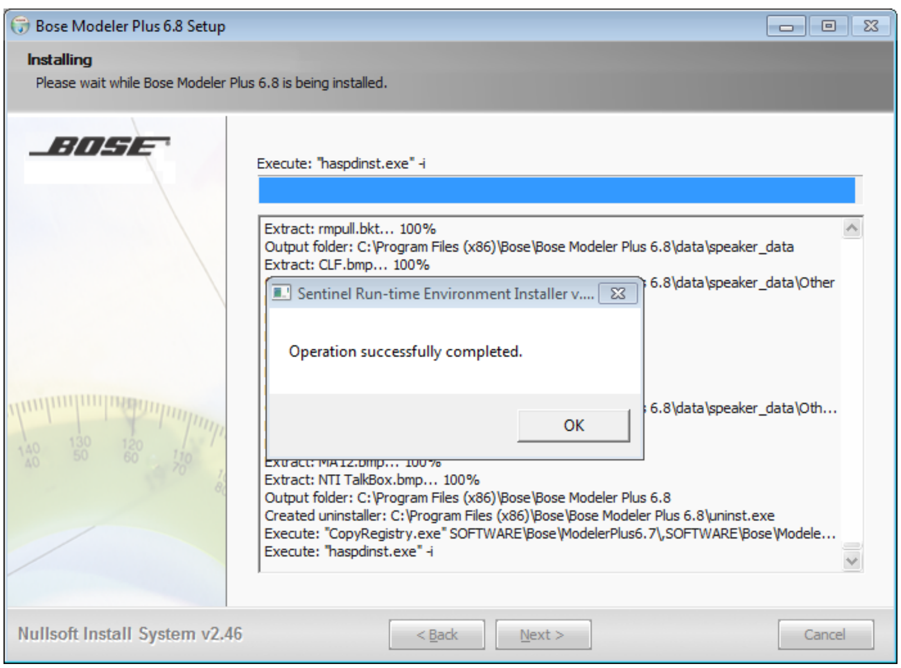
7. Click **Next** to start the application installation>

The installation progress bar is displayed while the Modeler software and its application components are installed in the selected location:



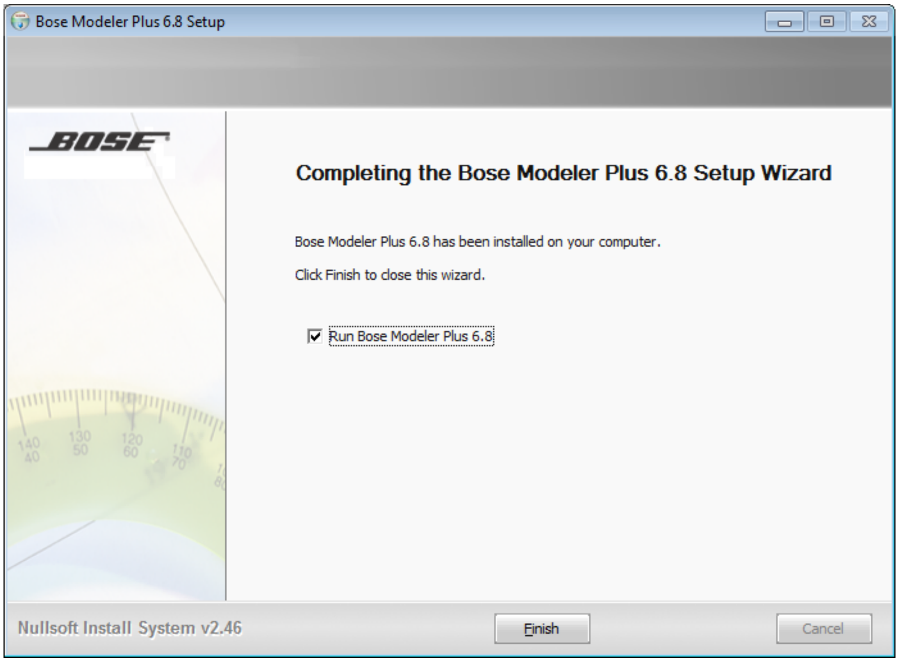
Installation Progress

8. When you see the message, "Operation successfully completed," click **OK**.



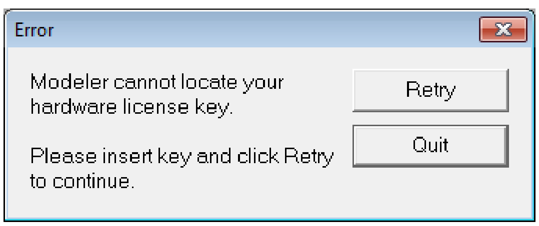
Installation complete message

9. Click **Finish** to close the installation wizard.



Software License Hardware Key

The Modeler software, both standard and plus versions, require the use of a USB software protection key. Before launching the application you must insert the supplied USB hardware key into an active USB port on your computer. Attempting to run the software without the hardware key inserted causes the following error dialog to be presented:



Missing hardware key error

If you see this error message you must insert a valid hardware key and click Retry, or quit the application.

Two hardware keys are shipped with Modeler software. If you wish to order more keys, please contact your local Bose sales representative

Modeler Plus Hardware Key

The Modeler Plus hardware key enables specific features and functions within the software to enable the playback of audio on the Auditioner playback system. In addition, the Modeler Plus software keys are configured to expire on a specific date.

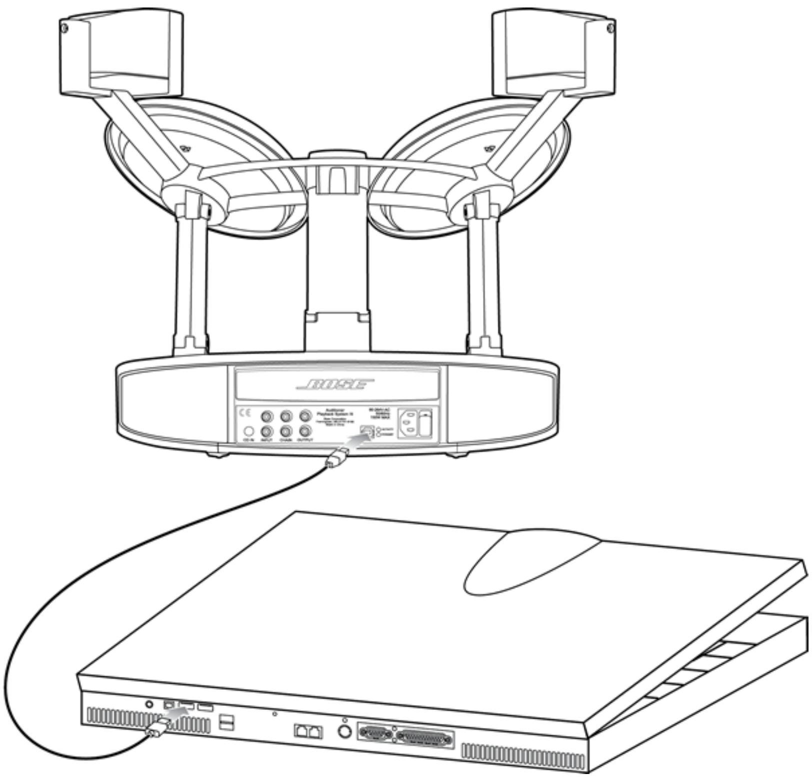
If you have a project open and do not see the Playlist and Playback tabs, you may not be using a Modeler Plus software enabled hardware key. Please contact your Bose representative for assistance.

Two hardware keys are provided for each licensed user of Modeler Plus Software. These keys have an expiration date, which is printed on the sticker attached to the hardware key. If you wish to order more keys, or if your key has expired (the software will provide warnings starting from 30 days prior to key expiration), please contact your local Bose sales representative.

Auditioner® Playback System Connection

The Auditioner Playback System III lets you use your ears to judge the sound quality of your design, and is used in conjunction with the Modeler Plus software. The Modeler Plus software predicts and generates a special binaural impulse response for the selected room model and listener position which is convolved with a dry audio signal. The resulting audio signal, when played back on the Auditioner Playback System, is an accurate representation of the sound system's performance in the room.

To enable the filter playback functions within the Modeler Plus software, the Auditioner Playback System must be connected to your PC through an active USB port, and the unit must be ON.



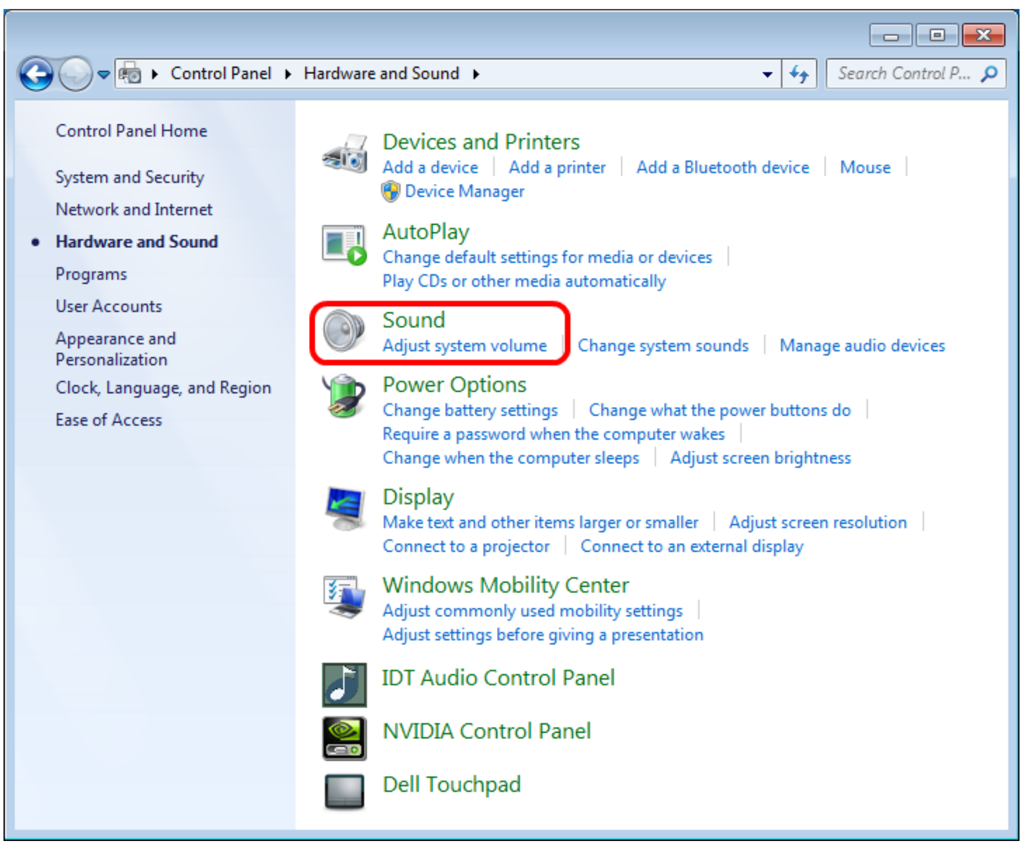
Auditioner Playback System III Connection to PC

Note: For more information on using the Auditioner Playback System III, see the Auditioner Playback System III user's Guide.

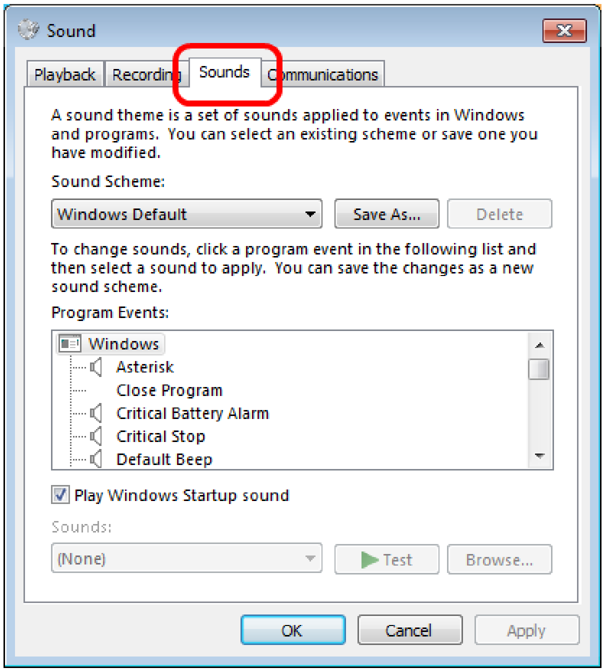
When the Auditioner® Playback System III is connected to your computer it is recognized as a USB audio device, and system sounds, such as the Windows startup sound, will be played back through the system. To prevent your computer system sounds from being played through the Auditioner Playback System III, follow these steps:

1. Go to **Start>Control Panel** and click **Hardware and Sound**.

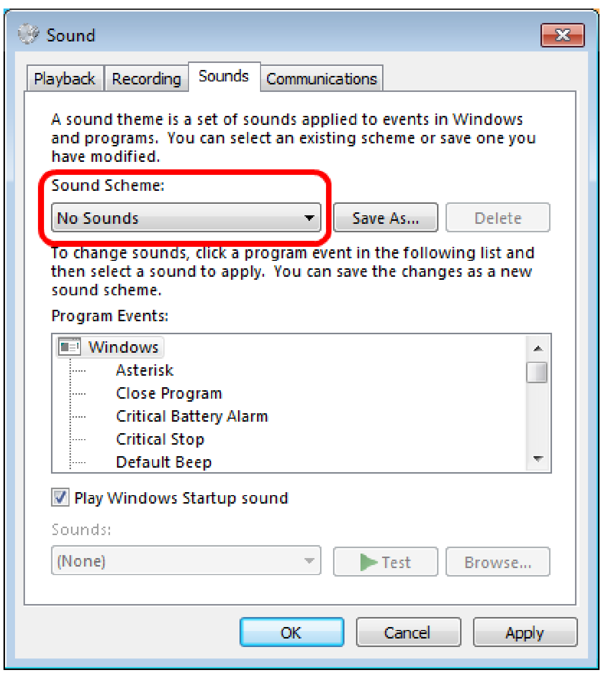
2. Click **Sound**.



3. Click the **Sounds** tab.



4. In the **Sound Scheme** drop-down menu, select **No Sounds**.



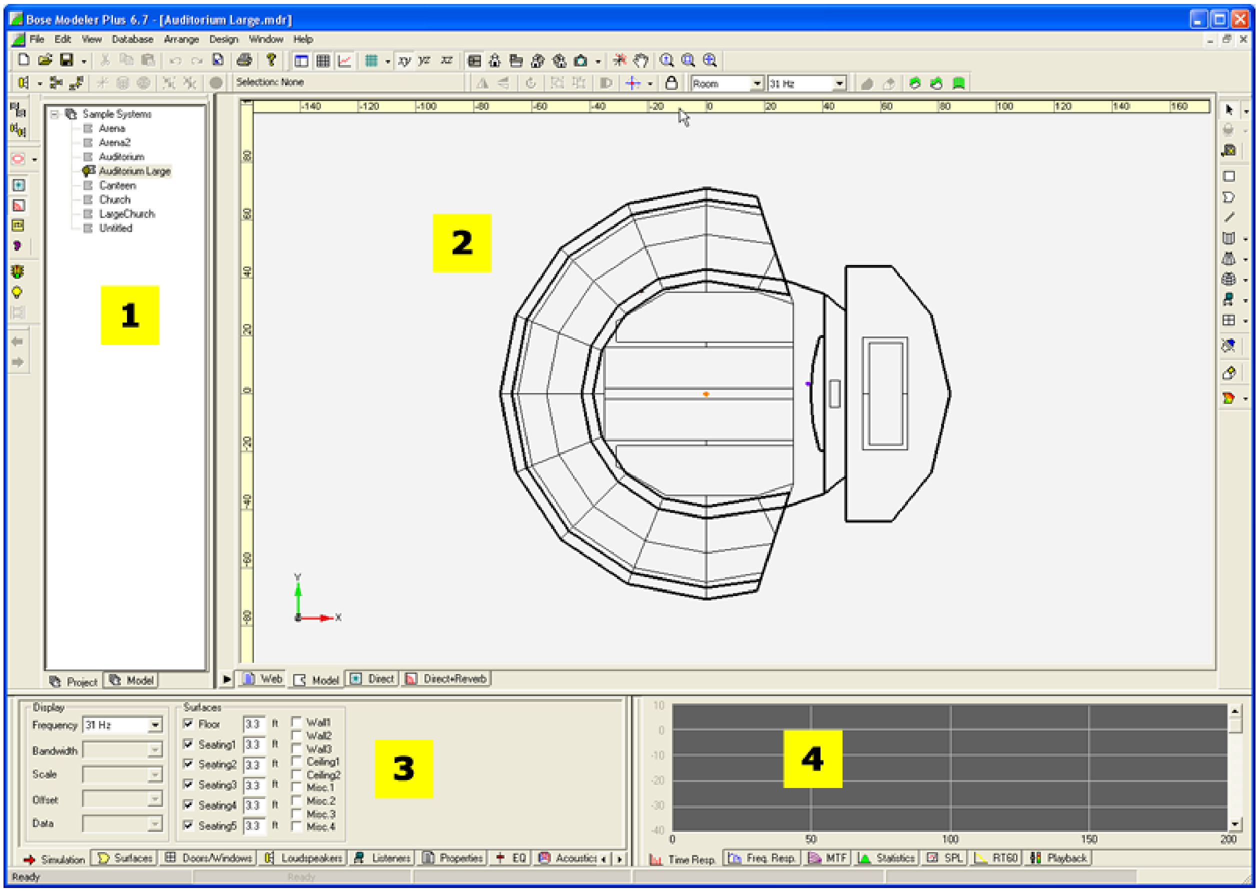
5. Click **OK** to save this setting and close the window.

Modeler Software Interface

Interface Overview

The Modeler software interface comprises four main sections:

- Project View [1]
- Model View [2]
- Detail View [3]
- Data View [4]



Modeler Software Primary Interface Components

All of the views, with the exception of the Model View, are enabled using the View controls section of the View Toolbar. The Project, Detail and Data Views may be undocked from the main application window, and placed anywhere on the screen.

[1] - Project View tabs provide directory tree views of the Project File and the active room model. From within the room model directory views you may select individual model elements and quickly navigate surfaces, listeners and loudspeakers. From within the project directory view you may add and remove models from a project, as well as open and close models.

[2] - Model View serves as the primary workspace for the creation of the room model and sound system design. From within the Room View you can construct the room model, implement the sound system design, view target coverage areas, view and edit cluster and arrays, and view coverage maps describing sound system performance, and access help functions.

[3] - Detail View tabs are used to modify the calculation settings, properties of various model components, system equalization and provide access to general acoustic properties used in various calculations. Within the Data view there are three types of tabs available:

- Calculation Parameters – control over items used in various calculations and acoustic parameters such as background noise levels.
- Object Properties – displays the properties of model objects as either list views of all model objects of a specific type, or the complete properties for an individual object selected within the model.
- Design Aids – design aids assist with the process of creating arrays and matching reverberation times. The Detail View area is used to access these functions

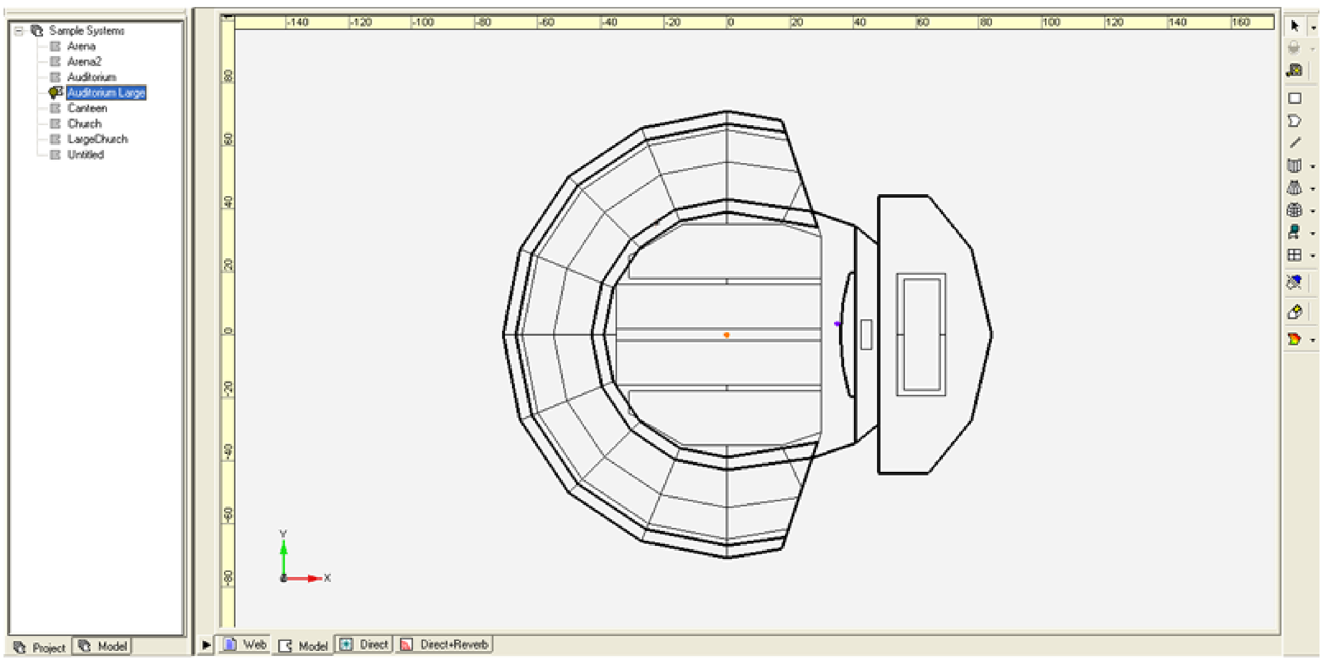
[4] - Data View tabs provide information on the predicted performance of your sound system design. Data from the predictions within the Modeler software are displayed in a graphical format that can be used to analyze system performance in more detail than is provided in the standard map views.

Within the Data view, Modeler software displays the following data types:

- Location-dependent data - displayed in the Time Response, Frequency Response, and MTF tabs. Location dependent data is unique to a single location in the room. This location is defined by the placement of the Sample tool in the coverage map. The data that is shown in these tabs is specific to the location of the Sample tool and will change as the tool is moved around the coverage map.
- Room response data - displayed in the Statistics and SPL tabs. Room response data pertains to the sum of the energy in the entire coverage map, and is not location dependent. The data in these tabs will be different for each coverage map.
- Room acoustics data -displayed in the RT60 tab. Room acoustics data is determined by a room's geometry and acoustic properties as a whole. This includes variables like the reflective or absorptive properties of the materials used in the room construction, the temperature and humidity of the air in the room, and the number of people in the audience.

Project View

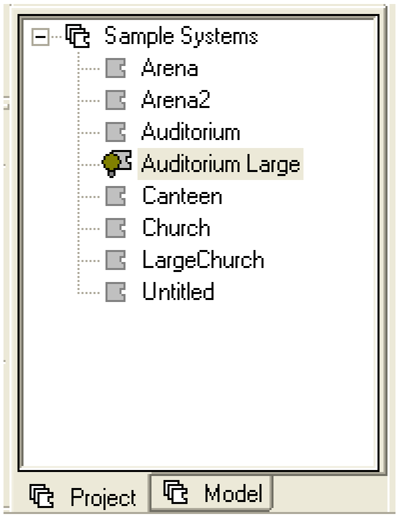
The tabs within the Project View provide a convenient way to view and navigate the files within the Modeler project file or the active room model. Each tab includes an extensive right-click context menu with additional functionality specific to the tab being displayed.



Project View

Project Tab

The Project Tab displays all the room models within the project and their current state.



Project View – Project Tab

You can use the appearance model icon in the Project window to determine the state of the model:

 Model closed

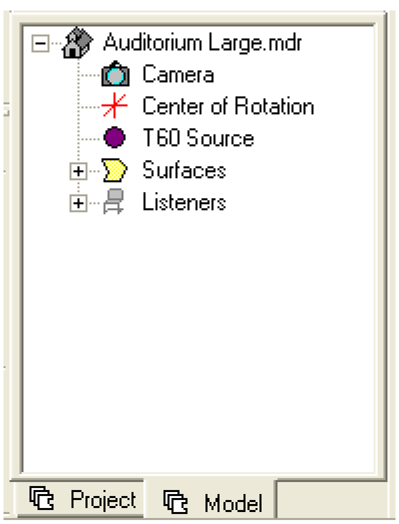
 Model open, D2RΔSTIc Engine off

 Model open, D2RΔSTIc Engine on

To open a model, double-click on the model icon in the Project window. The model opens in the Modeling window.

Model Tab

The **Model Tab** displays all the components within the currently active room model, and their current state.



Project View – Model Tab

You can use the appearance icons in the Model Tab to determine the state of the various room model components:

Camera (visible / not visible) in the room model

Center of Rotation (visible / not visible) in the room model

RT60 Source (visible / not visible) in the room model

Surface (visible / not visible) in the room model

Cluster (visible / not visible) in the room model

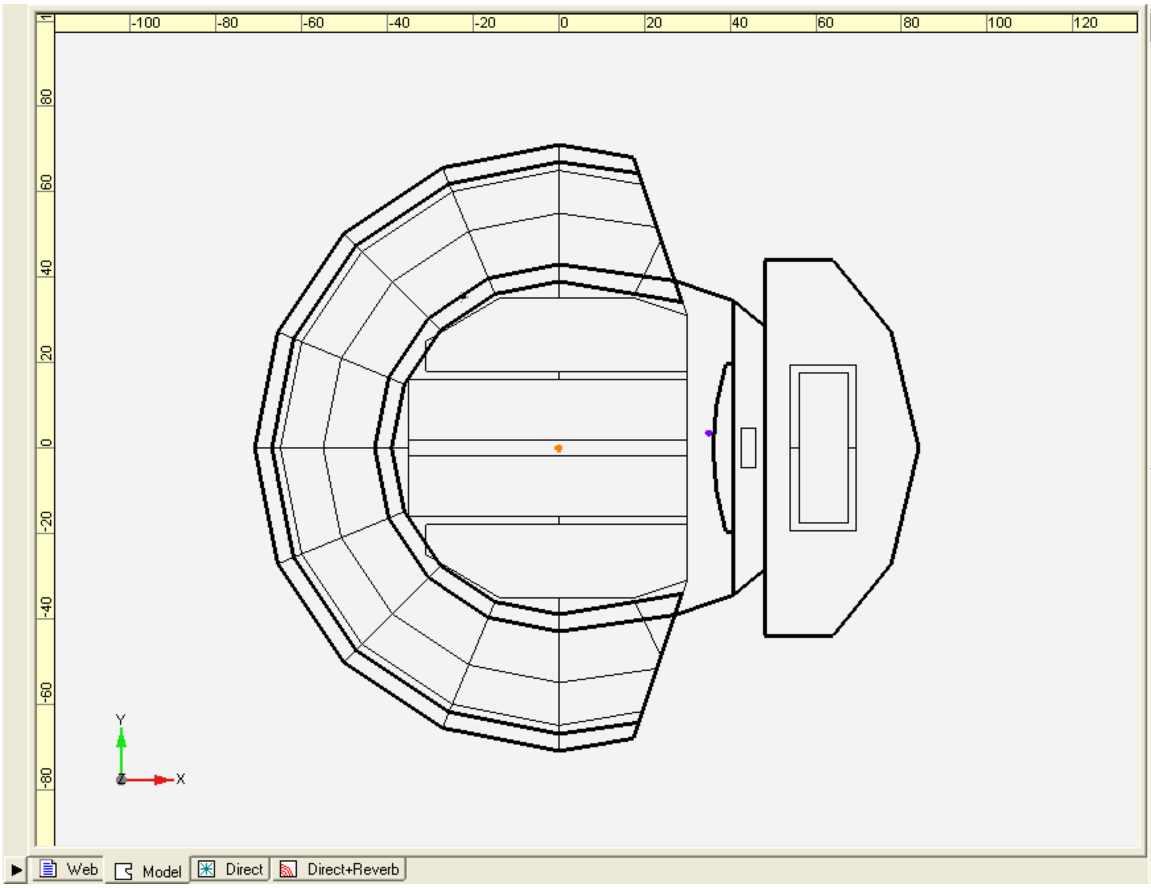
Array (visible / not visible) in the room model

Loudspeaker (visible / not visible) in the room model

Listener (visible / not visible) in the room model

Model View

The tabs in the Model View serve as the primary workspace for the creation of the room model and sound system design. From within the Model View you can construct the room model, implement the sound system design, view target coverage areas, view and edit cluster and arrays, view coverage maps describing sound system performance, and access help functions.



Model View - Model Tab

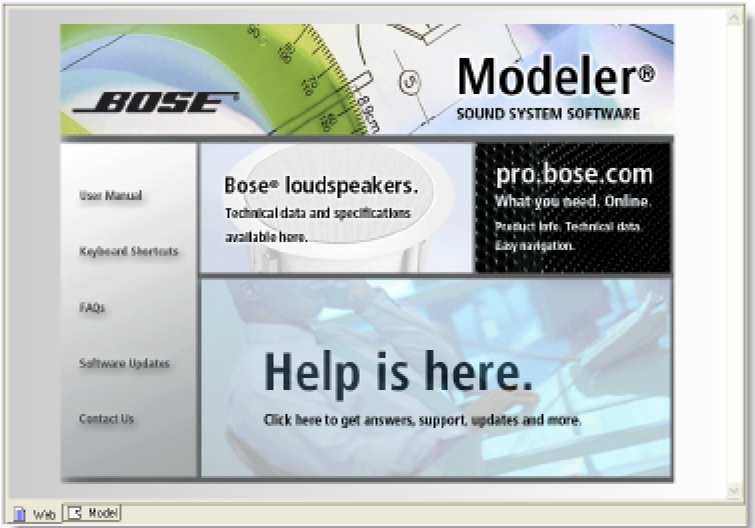
Within the Model View the following Tabs are provided:

- **Web** – includes links to the built-in help system, keyboard shortcuts and on-line help.
- **Model** – use this tab for constructing and editing the room model and system design.
- **Coverage Map tabs** – display the results of selected mapping functions, and these tabs are active only when the coverage maps are calculated. Map tabs include the Direct Field Coverage, Direct+Reverberant Field Coverage, and the Speech Intelligibility maps.

In addition to the tab views at the bottom of the Model View it is possible to create a split view within the Room View area. The Split View function allows you to view the target coverage area for a loudspeaker cluster or array while simultaneously viewing the room model or coverage map.

Web Tab

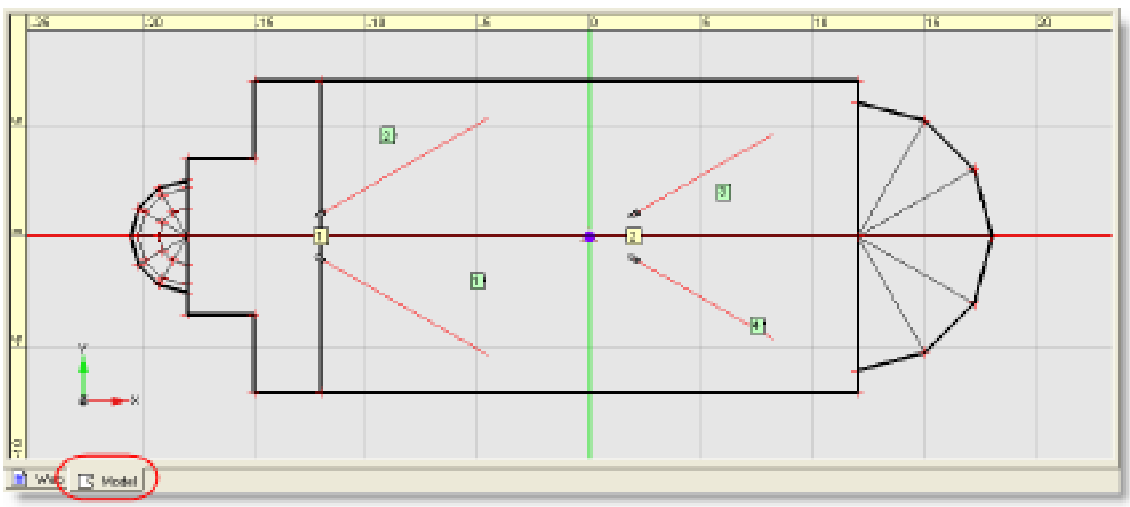
The Web Tab includes links to the keyboard shortcuts, the Modeler User's Forum, and information related to Bose Modeler software and Bose Professional Systems at pro.Bose.com. You must be connected to the internet for these links to be active.



Web tab selected

Model Tab

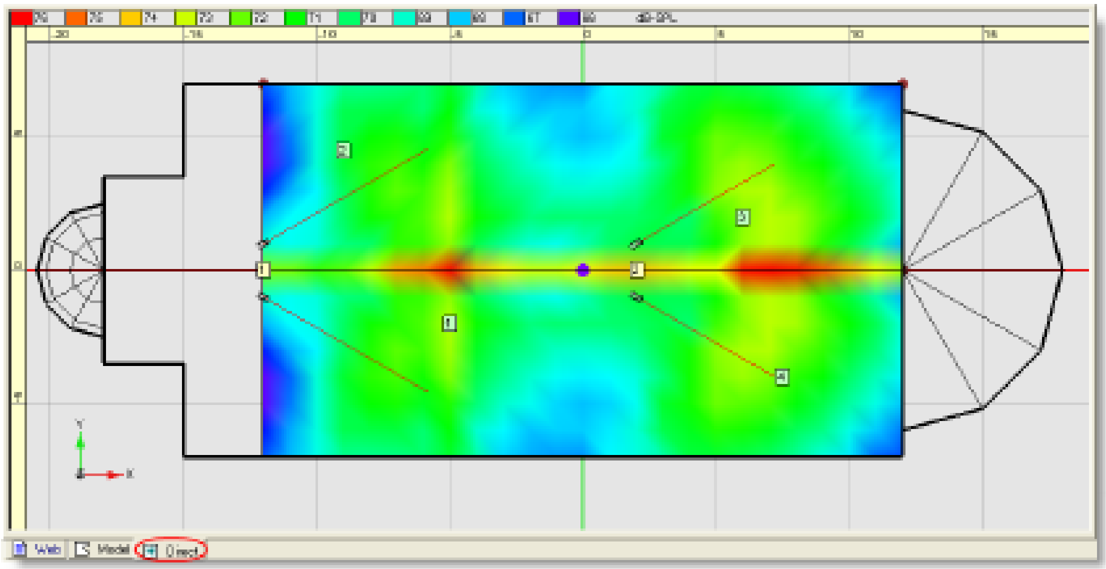
The Model tab is used to create and view a model. Modeling tools are only active when the Model tab is active.



Model Tab

Direct Field Coverage Tab

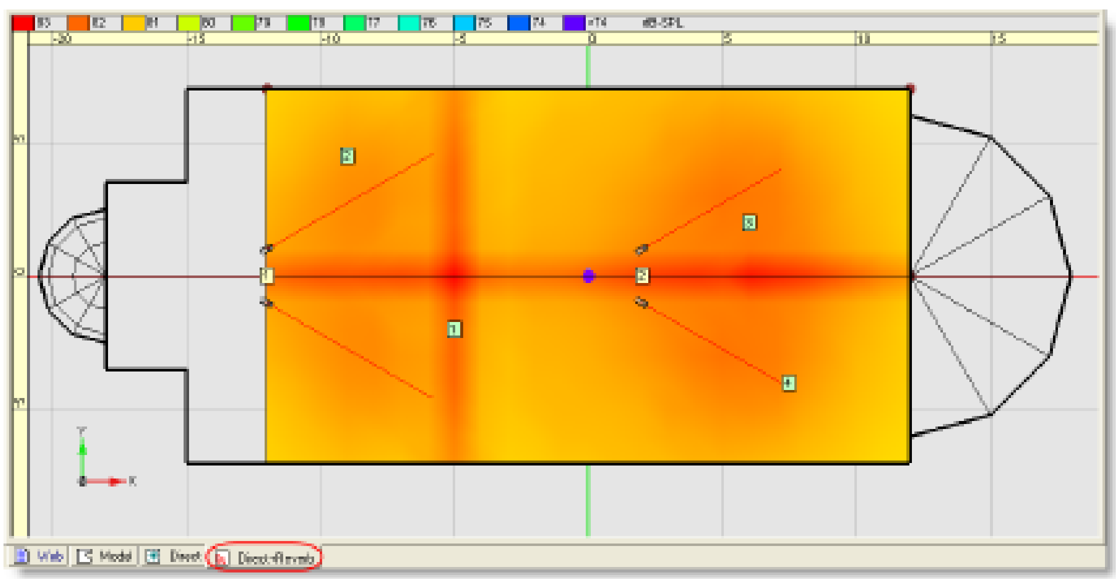
When Direct Field Coverage is enabled the Direct Field Coverage Tab is active.



Direct Field Coverage Tab

Direct+Reverberant Field Coverage Tab

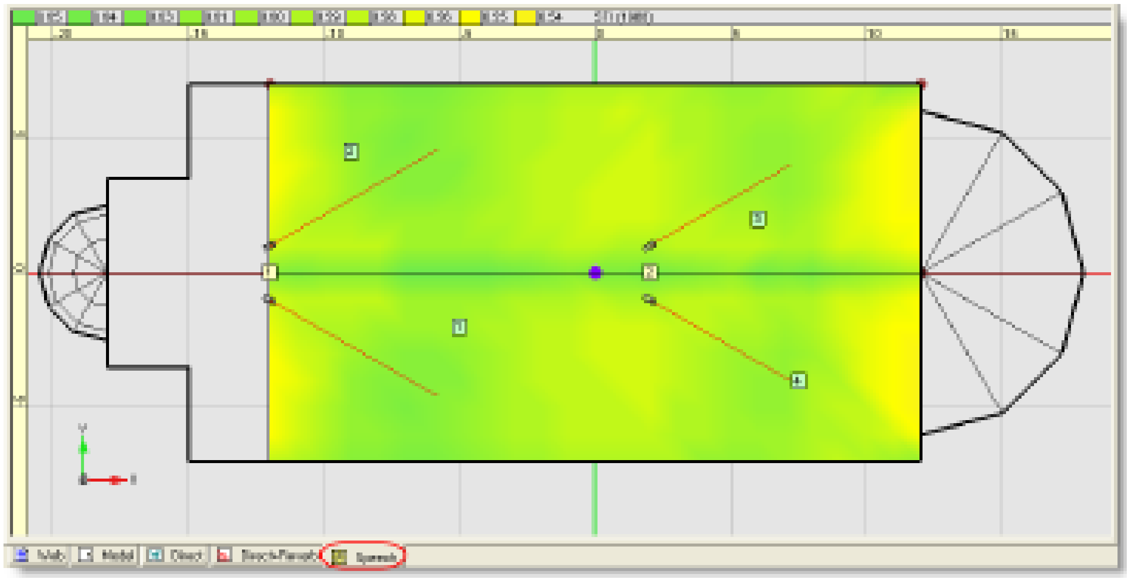
When Direct+Reverberant Field Coverage calculation is enabled the Direct+Reverberant Field Coverage Tab is active.



Direct+Reverberant Field Coverage Tab

Speech Intelligibility Coverage Tab

When The STI calculation is enabled the Speech Map is active.

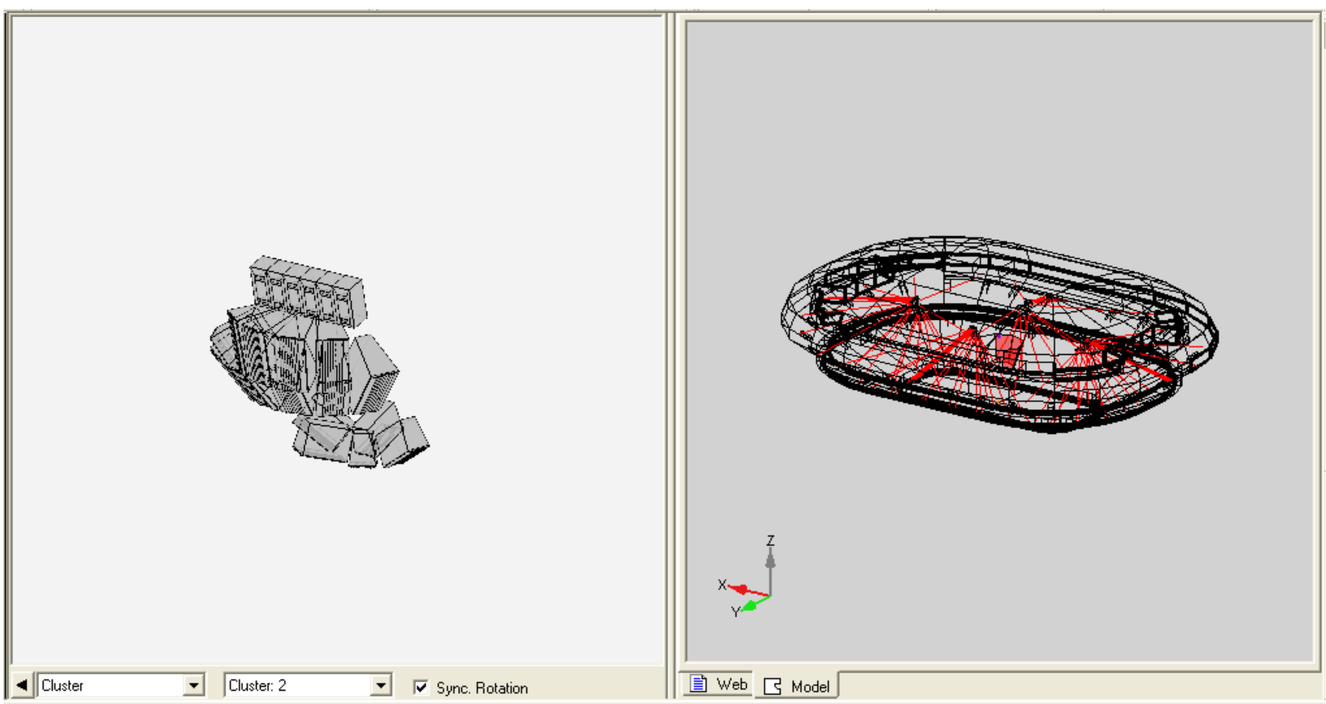


Speech Intelligibility Coverage Tab

Split View

When active, the Split View pane is capable of presenting a number of graphic or table displays adjacent to the room model view. The default display within the Split View is a projection view of the room model from the selected loudspeaker cluster's perspective.

Additional views are available for a cluster view for the selected cluster, as well as the option to display the complete Properties, Listeners, Loudspeakers, Doors/Windows, or Surfaces list views.



Split View Active – Cluster Display Shown

From within the Split View the following controls and views are available:

Rulers along the top and side display Yaw and Pitch angles, with the center of the display representing the hit point of the selected loudspeaker.

The Show/Hide Control will cause the Split View to either expand or collapse, based on its current state.

View Control selects the item to display within the Split View. Available selections are:

> **Cluster** displays wireframe of the selected cluster. Cluster selection is controlled using the Cluster Selection drop down item.
>
> **Projection** (default) displays the model in a projection view from the perspective of the selected cluster, or loudspeaker. Cluster selection is controlled from the Cluster Selection drop down item.
>
> **Properties** displays the list of item properties for the item currently selected within the Model Tab.
>
> **Listeners** displays the contents of the Listeners Tab.
>
> **Loudspeakers** displays the contents of the Loudspeakers Tab.
>
> **Doors/Windows** displays the contents of the Doors/Windows Tab.
>
> **Surfaces** displays the contents of the Surfaces Tab.

Cluster Selection selects the cluster to be displayed within the Split View Pane.

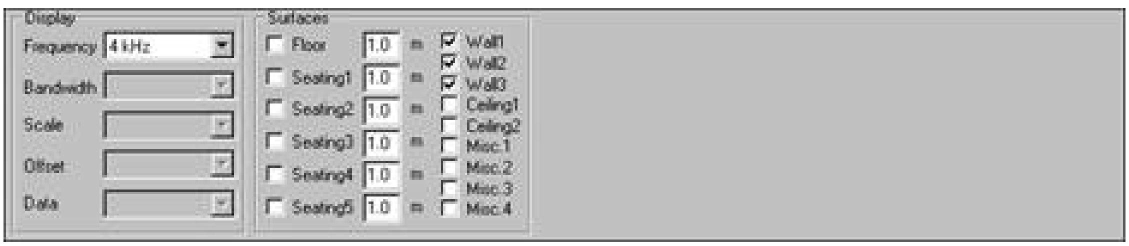
Synchronize Views orients the cluster view and the model view to the same rotational angle.

Detail View

Simulation Tab

Default View

The default view for the updated Simulation tab is displayed when the Model tab is active in the Model View, and only displays those items which are common to all map views:

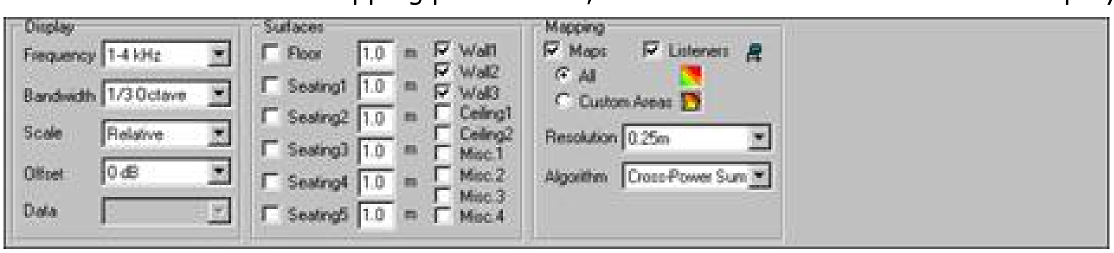


Default Simulation Tab

> **Display** – contains selections that control the way the coverage map is displayed. Many of the items in this section are disabled when the Model is active.
>
> **Frequency** – selects the frequency that will be used for the display of Isobar data, when the Isobar display is active.
>
> **Surfaces –** contains selections the surface types that will be mapped and the map height parameter for Floor and Seating surface types.

Direct Field Coverage Map

When a Direct Field or Direct+Reverberant Field Coverage Map is active the Simulation tab displays selections which control the mapping parameters, and define the methods used to display the calculation.



Direct and Direct+Reverberant Simulation Tab

Display – contains selections that control the way the coverage map is displayed. These items are disabled when the Model is active.

Frequency – selects the frequency that will be displayed within the coverage map. Options include 1/3 octave-band center frequencies, 1-4 kHz average and 31 Hz – 16 kHz Average.

Bandwidth – sets the bandwidth for the frequency display of the coverage map. Options include 1/3 Octave and Octave.

Scale – sets the mapping scale to either absolute or relative dB values. **Absolute** displays the map legend in actual dB SPL values while **Relative** displays the SPL values relative to the highest reading.

Offset – shifts the maximum value of the mapping scale by +/- 20 dB. In the case of an SPL "hot spot" in front of a loudspeaker that is preventing the display of lower SPLs in other areas of the map, use the offset feature to more clearly display coverage in the areas of lower SPL.

Data – is disabled in this view.

Surfaces – contains selections the surface types that will be mapped and the map height parameter for Floor and Seating surface types. Normally, coverage is viewed on surfaces that are occupied by listeners (seating and floor surfaces).

Mapping – contains the various parameters which define how the coverage map will be generated.

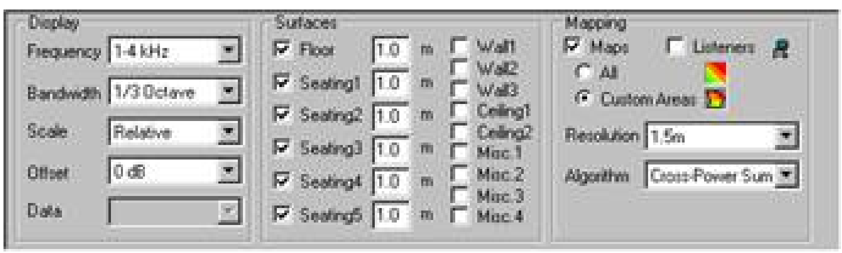
Map Areas– select this item to map the coverage using either the Standard Mapping (surfaces), or Custom Areas.

Listeners– select this item to include the listeners on active surfaces in the calculation.

Resolution – defines the sample grid size for the coverage map. This item is disabled if only Listeners are selected. Lower values provide finer resolution but longer computation times. Higher values provide coarser resolution with faster computation times. Increasing resolution by one step roughly doubles the number of samples and the calculation time.

Algorithm– defines the algorithm that will be used in the calculation of the coverage map; options include Power Sum or Cross-Power Sum. **Power Sum** calculates sound pressure without regard to phase interactions between sound sources. **Cross-Power Sum** takes into account the interference effects between sound sources.

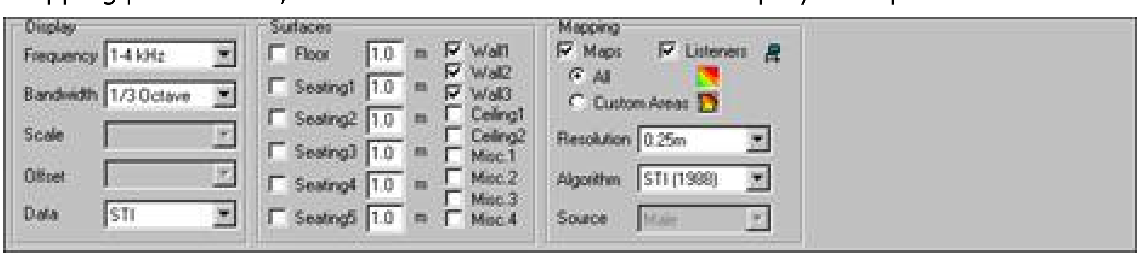
Note: To display a Map created using the Draw Custom Areas tool, check the surface types you are mapping (Floor, Seating, etc.), the Maps checkbox, and the custom Areas radio button.



Note: The Draw Custom Areas tool works on all mapping functions in Direct, Direct plus Reverberant, and Speech.

Speech Intelligibility Coverage Map

When a Speech Intelligibility Coverage Map is active the Simulation tab displays selections which control the mapping parameters, and define the methods used to display the Speech Transmission Index calculation.



Speech Intelligibility Simulation Tab

Display – contains selections that control the way the coverage map is displayed. These items are disabled when the Model is active.

Frequency – selects the frequency that will be displayed within the coverage map. Options include 1/3 octave-band center frequencies, 1-4 kHz average and 31 Hz – 16 kHz Average. This has no effect on the speech display.

Bandwidth – sets the bandwidth for the frequency display of the coverage map. Options include 1/3 Octave and Octave. This has no effect on the speech display.

Scale – Disabled in this view. The map scale is automatically scaled between the minimum and maximum STI values for the mapped area.

Offset – Disabled in this view.

Data – selects the data that will be displayed within the Map. Available selections are STI, %ALcons, and %PB.

Surfaces – contains selections of the surface types that will be mapped, and the map height parameter for Floor and Seating surface types. Normally, coverage is viewed on surfaces that are occupied by listeners (seating and floor surfaces). Mapping height for other surface types is zero meters.

Mapping – contains the various parameters which define how the coverage map will be generated.

Map Areas– select this item to map the coverage using either the Standard Mapping (surfaces), or Custom Areas.

Listeners– select this item to include the listeners on active surfaces in the calculation.

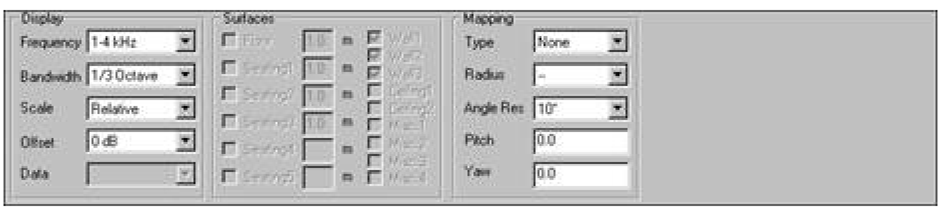
Resolution – defines the sample grid size for the coverage map. This item is disabled if only Listeners are selected. Lower values provide finer resolution but longer computation times. Higher values provide coarser resolution with faster computation times.

Algorithm– defines the algorithm that will be used in the calculation of the coverage map; options include 1988, 1998, 2003 and 2011 versions of the STI standard, (IEC 60268-16), and STI-PA according to the 2003 standard.

Source – active when the STI (1998), STI (2003), or STI (2011) algorithms are selected. Select between Male or Female speech spectrum.

Cluster Mapping

When mapping the anechoic performance of a loudspeaker, loudspeaker cluster or array. When the cluster mapping function is active the Simulation tab displays selections which control the mapping parameters, and define the methods used for the display of the cluster map.



Cluster Mapping Simulation Tab

Display – contains selections that control the way the coverage map is displayed.

Frequency – selects the frequency that will be displayed within the coverage map. Options include 1/3 octave-band center frequencies, 1-4 kHz average and 31 Hz – 16 kHz Average.

Bandwidth – sets the bandwidth for the frequency display of the coverage map. Options include 1/3 Octave and Octave.

Scale – Disabled in this view. The map scale is automatically scaled between the minimum and maximum STI values for the mapped area.

Offset – Disabled in this view.

Data – disabled within Cluster Mapping.

Surfaces – disabled when Cluster Mapping is active.

Mapping – contains the various parameters which define how the coverage map will be generated.

Type– defines the type of mapping surface that will be used. Selections include Hemisphere, Full Sphere and Plane.

Radius– defines the distance between the cluster origin and the mapping surface.

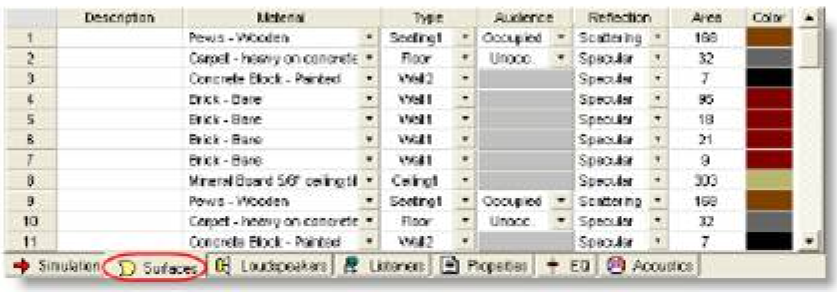
Angle Resolution – defines the angular resolution used for the coverage map. Available selections are 2, 5, 10 and 20 degrees.

Pitch– defines the pitch of the surface being mapped, relative to the loudspeaker. This function may be used to pitch a planar mapping surface to approximate the rake of a seating surface to better visualize the coverage provided by the loudspeaker cluster or array.

Yaw – defines the yaw of the surface being mapped, relative to the loudspeaker.

Surfaces Tab

The Surfaces tab is used to view and modify properties of the surfaces within the model. Each surface within the model is represented on a single row in the Surfaces Tab, and includes information about the surface, as well as its acoustic properties.



Surfaces tab

From within the Surfaces Tab the following properties and selections are available.

Description is a text field where you can add descriptive information about the surface. For example “Rear wall”.

Material specifies the type of material used to construct the surface. The absorption data for this material is then used in various predictions within the Modeler software. The list of materials is compiled in the Material Database.

Type specifies the type of surface based on function: Floor, Wall, Seating, Ceiling, and Misc.

Audience allows you to indicate whether the surface is occupied by an audience or is unoccupied. Occupancy level of the model is designated in the Acoustics tab. Only Floor, Seating, and Misc. type surfaces can be occupied by an audience.

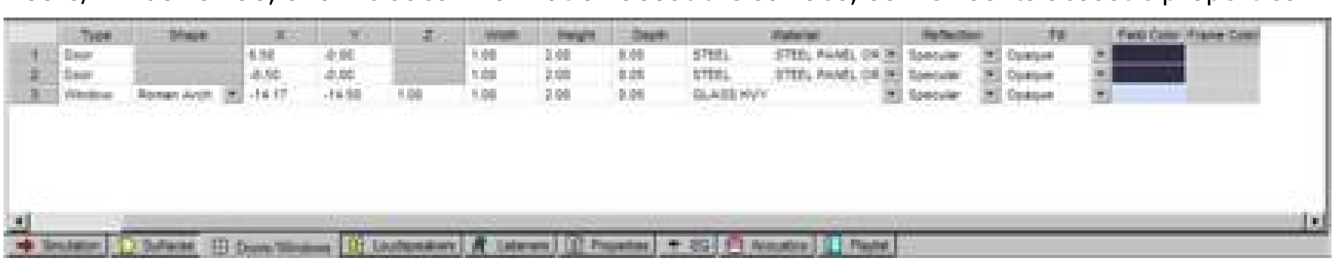
Reflection determines how sound will reflect from this surface. Select **Scattering** to indicate a surface that reflects sound in all directions. Select **Specular** to indicate a surface that reflects like a mirror.

Area is the total surface area of the surface in square meters or feet, depending on the Model settings.

Color opens (double-click) the Windows Color Picker so that you can assign a color to this material type. All surfaces of the material type will display in the selected color in Camera View.

Doors/Windows Tab

The Doors/Windows tab is used to view and modify properties of the doors, windows and acoustic panel objects within the model. Each door/window/panel within the model is represented on a single row in the Doors/Windows Tab, and includes information about the surface, as well as its acoustic properties.



Doors/Windows tab

From within the Doors/Windows Tab the following properties and selections are available.

Type defines the type of object. This field may not be modified.

Shape describes the shape of the window or acoustic panel. Available selections are Rectangular, Round, Arch and Roman Arch.

X defines the distance in the X Axis between the bottom center of the new object and the origin of the room model.

Y defines the distance in the Y Axis between the bottom center of the new object and the origin of the room model.

Z defines the height of the bottom end of the new object relative to the parent surface.

Width defines the overall width of the object.

Height defines the overall height of the object.

Depth defines the depth of the object. Depth is only a visual parameter and it does not affect acoustics.

Material describes what material type will be applied to the object.

Reflection describes the reflection properties of the object.

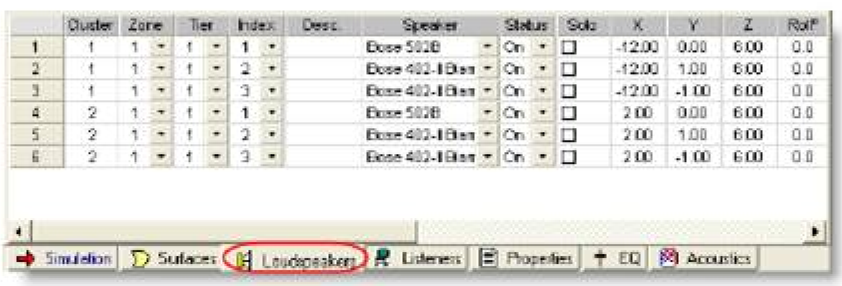
Fill describes the transparency level that will be used for the window in rendered views.

Field Color describes the inside fill color of the window.

Frame Color describes the outside frame color of the window.

Loudspeakers Tab

The Loudspeakers tab is used to view and modify properties of the loudspeakers in your system design. Each loudspeaker or loudspeaker array is represented within the loudspeaker tab, and contains a number of properties which define its position within the room model, sorting and ordering functions, its status, and basic signal parameters.



Loudspeakers tab

From within the Loudspeaker Tab the following properties and selections are available.

Cluster is a number automatically assigned by Modeler software. Individual loudspeakers are aggregated into clusters based on their proximity to other loudspeakers. Cluster numbers are sequentially assigned as loudspeakers are added to the model.

Zone is a number assigned to multiple clusters of loudspeakers to create a group.

Tier is a number assigned to a group of loudspeakers that are in the same row.

Index is an identification number assigned to each individual loudspeaker in the model.

Desc. is a text field in which you can add descriptive information on each loudspeaker in the model. For example, "Center cluster fill."

Speaker displays the current loudspeaker type placed within the model. This is also a drop-down menu that allows you to change the type of loudspeaker in this location. If you change the loudspeaker, all other data for the loudspeaker will remain the same, including loudspeaker identifier numbers and position data.

Status is a drop-down menu that allows you to turn the loudspeaker on and off. When the status is “off”, the information for the loudspeaker is displayed in italics in the Loudspeakers tab.

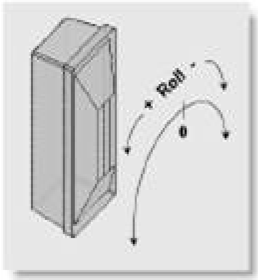
Solo is a check box that, when selected with an X, mutes all other loudspeakers in the model. This is used to isolate the coverage pattern of a particular loudspeaker.

X is the distance from the model origin along the X Axis to the position of the loudspeaker.

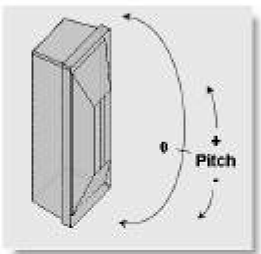
Y is the distance from the model origin along the Y Axis to the position of the loudspeaker.

Z is the distance from the model origin along the Z Axis to the position of the loudspeaker.

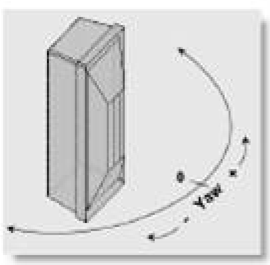
Roll specifies the rotation of the loudspeaker around the X axis in degrees.



Pitch specifies the rotation of the loudspeaker around the Y axis in degrees.



Yaw specifies the rotation of the loudspeaker around the Z axis in degrees.



Gain is the amount of gain, in decibels, (dB), applied to the loudspeaker. A setting of 0 dB gain is equivalent to 1 Watt of electrical input power.

Tap is only available for high impedance loudspeakers which use a transformer to determine the amount of power applied to the loudspeaker. The available tap settings match the capabilities of the chosen loudspeaker in Watts.

Pwr In is the power applied to the loudspeaker, limited to the actual power handling of the loudspeaker. This item is a calculated field and is based upon the array gain and any impact of the equalization of the speaker.

Polarity sets the polarity of the loudspeaker to positive (+) or negative (-).

Delay sets the signal delay of the loudspeaker or array in milliseconds.

Color sets the color of the loudspeaker enclosure, as seen using Camera View.

Within the Loudspeaker Tab different types of loudspeakers and arrays each have a unique display method.

Full Range Loudspeakers

Full range devices are represented using a single row within the Loudspeaker Tab.

		Cluster	Speaker	Status	Solo	Z	Pitch°	Yaw°	Gain	Pwr In	Delay
1		1	Bose 402-II Fullrange	On	☐	2.000	0.0	0.0	0.0	1.0	0.00

Full Range Device within the Loudspeakers Tab (Not all Columns Shown)

Multi-Way Loudspeakers

Multi-way, or biamplified, loudspeakers are represented using multiple rows in the Loudspeakers Tab. Multi-way loudspeakers are shown, by default, using a single row. This row may be expanded to display individual acoustic elements within the loudspeaker. Each acoustic element represents a set of acoustic data used in the Modeler software predictions.

Multi-way loudspeakers include element and device settings for the Gain and Delay properties. This allows you to define a gain offset between individual acoustic elements, and still maintain an overall loudspeaker Gain.

		Cluster	Speaker	Status	Solo	Z	Pitch°	Yaw°	Gain	Pwr In	Delay
1	+	1	Bose LT9402-III Biamped	On	☐	2.000	0.0	0.0	0.0		0.00
2	−	1	Bose LT9402-III Biamped	On	☐	2.000	0.0	0.0	0.0		0.00
3			MF9402						0.0	1.0	0.00
4			HF9402						0.0	1.0	0.00

Multi-way Devices within the Loudspeakers Tab (Not all columns shown)

Arrays

An array is a special group of several full range or multi-way loudspeakers. Within the Modeler software, arrays are created using one of the special Array tools located in the Loudspeakers Toolbar.

Within the Loudspeakers Tab arrays are indicated using a color fill in the first row of the array. Loudspeakers within the array are then listed below, and are represented according to the loudspeaker type, full range or multi-way.

Similar to multi-way loudspeakers Arrays have a master Delay item for use in alignment between main and delay clusters in large systems.

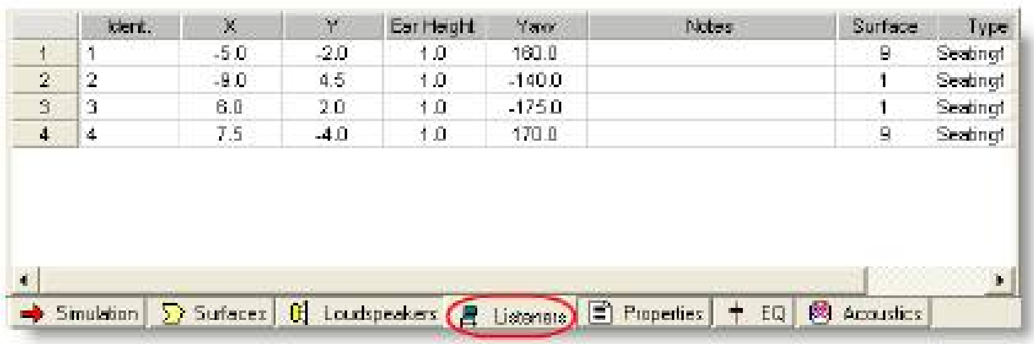
		Cluster	Speaker	Status	Solo	Z	Pitch°	Yaw°	Gain	Pwr In	Delay
1						3.000	0.0	0.0			0.00
2	+	1	Bose RM 055x20 Module	On	☐	3.000	0.0	0.0	0.0		0.00
3	+	1	Bose RM 070x10 Module	On	☐	2.603	-15.0	0.0	0.0		0.00

Arrays within the Loudspeakers Tab (Not all Columns Shown)

Listeners Tab

The Listeners tab contains a listing of all listener positions placed within the model. From within the Listeners tab you can view and modify the characteristics of the listeners within the model.

Tip: The Listeners tab can also be used to drive data views within the Data tabs. For example to step through the Frequency Response display for a number of listener positions, use the arrow up/down keys to select listener positions, and the Data View will automatically update.



Listeners tab

From within the Loudspeaker Tab the following properties and selections are available.

Ident. is a listener identifier number which is generated automatically when you place a listener. You may assign your own custom identifier within a 4 character limit.

X is the distance of the listener location from the model origin along the X Axis.

Y is the distance of the listener location from the model origin along the Y Axis.

Ear Height is the distance above the model surface of the listener's ears. This number should be chosen based on whether the listeners are sitting or standing. The default value is 1.0 m (3.3 ft) above the ground. Ear height must be between 0 and 2.13 m (7 ft).

Yaw is the direction that the listener is facing. The default position is 0° (positive X direction).

Notes is a text field that can be used for notes about the listener location. For example, you may want to note specific acoustic prediction characteristics for a given listener location.

Surface is the identifier number of the surface that the listener location is on. Use this number to easily locate the surface in the Surfaces tab.

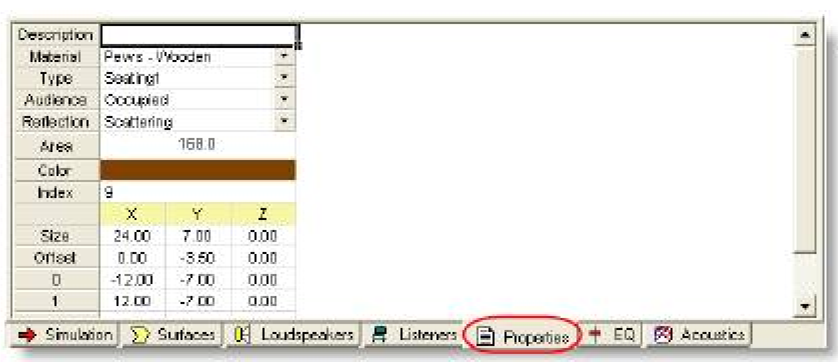
Type indicates whether the listener location is on a Floor or Seating surface.

Properties Tab

View and modify characteristics for various elements in the model. After selecting an item, click on the **Properties** tab to display information for the selected item. You can view properties for surfaces, loudspeakers, arrays, listeners, the camera, and the RT60 source. The information available within the Properties Tab is greater than that which is available in other tabs such as Loudspeakers or Surfaces.

Surface Properties

Select a surface within the room model or within the Surfaces tab and then select the **Properties** tab.



Surface Properties within the Properties tab

Description is a text field where you can add descriptive information on each surface in the model. For example "Rear wall".

Material specifies the type of material used to construct the surface. The absorption data for this material is then used in various predictions within the Modeler software. The list of materials is compiled in the Material Database.

Type specifies the type of surface based on function: Floor, Wall, Seating, Ceiling, and Misc.

Audience allows you to indicate whether the surface is occupied by an audience or is unoccupied. Occupancy level of the model is designated in the Acoustics tab. Only Floor, Seating, and Misc. type surfaces can be occupied by an audience.

Reflection determines how sound will reflect from this surface. Select **Scattering** to indicate a surface that reflects sound in all directions. Select **Specular** to indicate a surface that reflects like a mirror.

Area is the total surface area of the surface in square meters or feet, depending on the Preference settings.

Color opens (double-click) the Windows Color Picker so that you can assign a color to this material type. All surfaces of the material type will display in the selected color in Camera View.

Index is the unique identifier number for the selected surface.

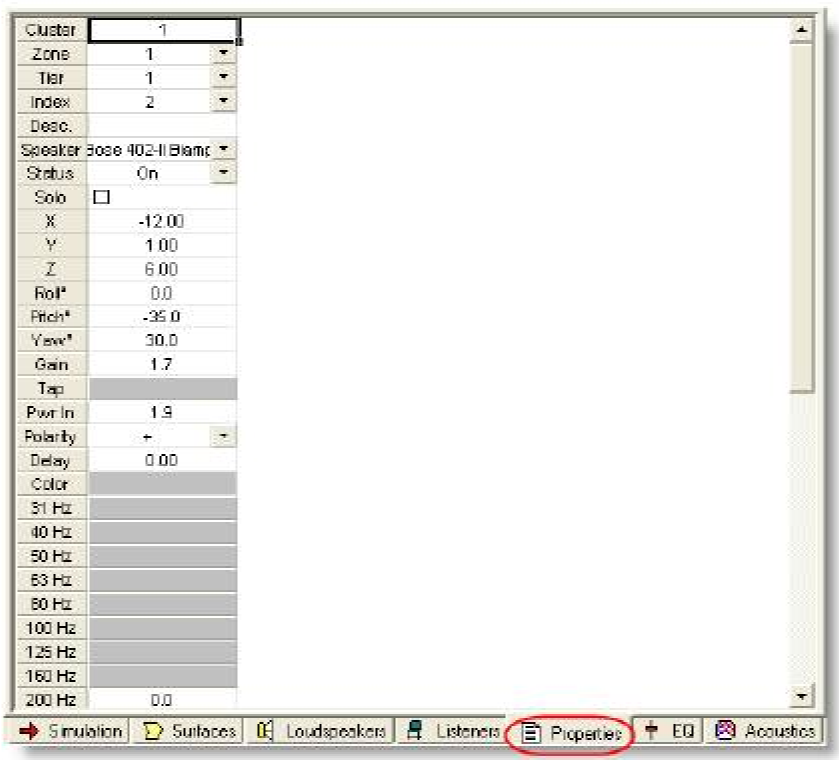
Size is the total length of the surface in the given dimension.

Offset is the distance from the room model origin to the center of the surface. The center of the surface is defined by the midpoint of the total length in each dimension. Enter new values to move the surface in a given dimension.

Vertex numbers are the coordinates of each vertex on the surface, relative to the model origin. Enter new values to move a vertex.

Loudspeaker Properties

Select a loudspeaker within the room model or within the Loudspeakers Tab and then select the **Properties** tab.



Loudspeaker Properties within the Properties tab

Cluster is a number automatically assigned by Modeler software. Individual loudspeakers are aggregated into clusters based on their proximity to other loudspeakers. Cluster numbers are sequentially assigned as loudspeakers are added to the model.

Zone is a number assigned to multiple clusters of loudspeakers to create a group.

Tier is a number assigned to a group of loudspeakers that are in the same row.

Index is an identification number assigned to each individual loudspeaker in the model.

Desc. is a text field in which you can add descriptive information on each loudspeaker in the model. For example, "Center cluster fill."

Speaker displays the current loudspeaker type placed within the model. This is also a drop-down menu that allows you to change the type of loudspeaker in this location. If you change the loudspeaker, all other data for the loudspeaker will remain the same, including loudspeaker identifier numbers and position data.

Status is a drop-down menu that allows you to turn the loudspeaker on and off. When the status is “off”, the information for the loudspeaker is displayed in italics in the Loudspeakers tab.

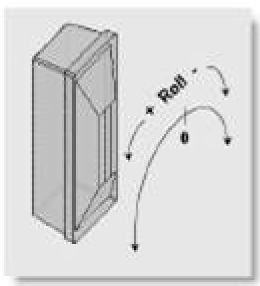
Solo is a check box that, when selected with an X, mutes all other loudspeakers in the model. This is used to isolate the coverage pattern of a particular loudspeaker.

X is the distance from the model origin along the X Axis to the position of the loudspeaker.

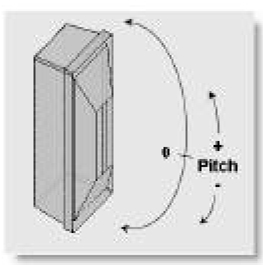
Y is the distance from the model origin along the Y Axis to the position of the loudspeaker.

Z is the distance from the model origin along the Z Axis to the position of the loudspeaker.

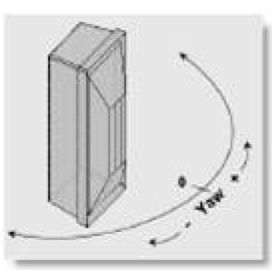
Roll specifies the rotation of the loudspeaker around the X axis in degrees.



Pitch specifies the rotation of the loudspeaker around the Y axis in degrees.



Yaw specifies the rotation of the loudspeaker around the Z axis in degrees.



Gain is the amount of gain, in decibels, (dB), applied to the loudspeaker. A setting of 0 dB gain is equivalent to 1 Watt of electrical input power.

Tap is only available for high impedance loudspeakers which use a transformer to determine the amount of power applied to the loudspeaker. The available tap settings match the capabilities of the chosen loudspeaker in Watts.

Pwr In is the power applied to the loudspeaker, limited to the actual power handling of the loudspeaker. This item is a calculated field and is based upon the gain and any impact of the equalization of the speaker.

Polarity sets the polarity of the loudspeaker to positive (+) or negative (-).

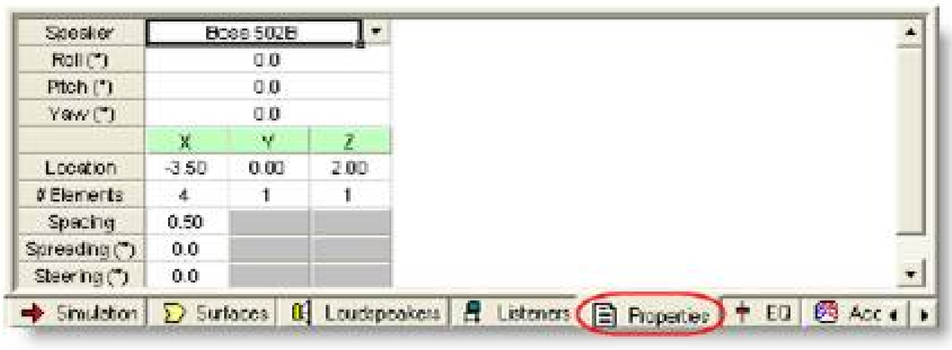
Delay sets the signal delay of the loudspeaker in milliseconds.

Color sets the color of the loudspeaker enclosure, as seen using Camera View.

Equalization Settings adjust the equalization of the loudspeaker at the given frequency. Values must be between -15 and 15.

Array Properties (Standard Array)

Select an array within the room model (making sure that the array, and not the Cluster is selected) or within the Loudspeakers tab and then select the **Properties** tab**.**



Array Properties within the Properties tab

Speaker defines the speaker used in the array.

Roll specifies the roll of the entire array.

Pitch specifies the pitch of the entire array.

Yaw specifies the yaw of the entire array.

Location defines the physical position of the center of the array in the room model in X, Y and Z, relative to the model origin.

 # Elements defines the quantity of loudspeakers within each of the three dimensions X, Y and Z.

Spacing defines the spacing between loudspeakers in X, Y and Z dimensions.

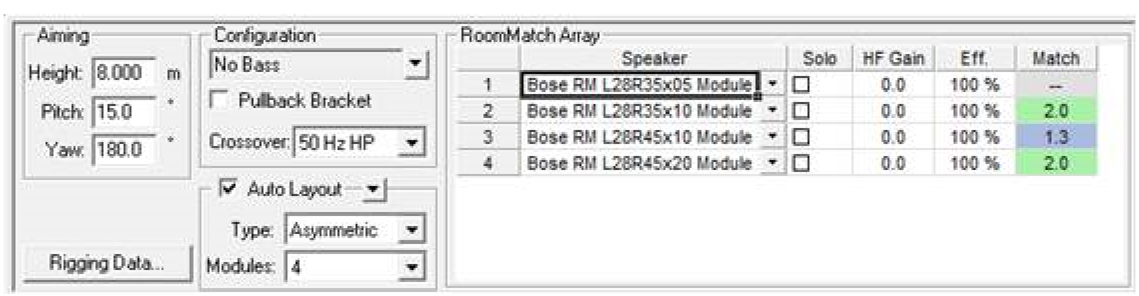
Loudspeakers are placed on a regular grid using array dimension attributes.

Spreading defines the amount of spreading of the main beam(s) in the X, Y and Z directions. Spreading is a value from 0 to +/-180°.

Steering defines the amount of steering of the main beam(s) in the X, Y and Z directions. Steering values range from -90° (endfire down) to +90° (endfire up).

RoomMatch Array Properties

Select a RoomMatch™ array within the room model (making sure that the array, and not the Cluster is selected) or within the Loudspeakers Tab and then select the **Properties** tab.



RoomMatch™ Array Properties within the Properties tab

The RoomMatch Array properties control the placement, aiming and construction of the RoomMatch Array. Use this design interface to create unique custom Progressive Directivity Arrays for the system design. The RoomMatch array properties are organized into four groups: Aiming, Configuration, Auto Layout and RoomMatch Array.

Aiming describes the placement, orientation and construction used for the entire array.

Height defines the height of the array within the room model. The height shown here is the midpoint of the topmost module within the array.

Pitch defines the overall pitch of the array.

Yaw defines the yaw (left/right aiming) of the array.

Configuration defines the type of array being created within the RoomMatch array tool and includes the following options:

Array Configuration defines the type of array. Available selections include arrays consisting of RoomMatch modules only, arrays with modules and integrated subwoofers, and flown subwoofer only configurations.

Note that the only bass configurations that include steering are the end-fire configurations. If a vertically steered array is desired, the Bass array tool should be used for these applications.

Pullback Bracket, when selected, will include a pullback bracket on the bottom module of the array. A pullback bracket is recommended for use when the desired array pitch cannot be achieved with the main grid frame mounting points.

Crossover defines the high pass crossover point of the array. Available selections are 50 and 80 Hz. Based on the array crossover point the corresponding subwoofer low pass crossover settings are applied.

Auto Layout contains the control necessary for generating a RoomMatch array solution based on user defined target coverage area.

Auto Layout Activation enables / disables the auto layout function.

Auto Layout Wing Menu displays the values which define the target coverage area. While the target coverage area can be directly defined within the Projection View, values can be edited here for fine tuning.

Type defines the type of modules to be used for the array – symmetric or asymmetric.

Modules defines the quantity of modules to be used in the array. Based on the target coverage area definition the auto layout function will determine the best module choices based on the number of modules selected.

RoomMatch Array includes the modules within the array, and provides the ability to modify the modules to create a new RoomMatch array manually.

Speaker identifies each RoomMatch module within the array. Each row in the table represents a module position within the array. An array may have up to eight devices, subwoofer or speaker. Use the drop down selection to choose the module type for that position in the array.

Solo activates the solo function for the selected module.

HF Gain allows adjustment of the high frequency gain for each module within the array. All modules default to 0 dB of gain adjustment, but can accommodate +18.8 / -50 dB of gain adjustment.

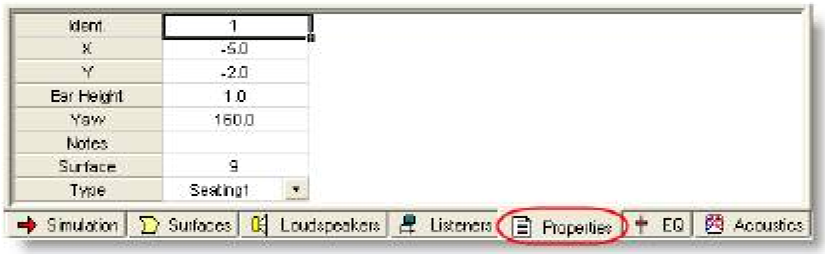
Eff. (Efficiency) displays the calculated module efficiency for each RoomMatch module in the array. Efficiency is a key metric for determining if modules can be split or combined. For example, two 20 degree vertical modules operating at 30% efficiency can be combined to a single 40 degree vertical module.

Match displays the quality of the match between two adjacent modules. Modules that are well matched will exhibit seamless vertical coverage. Modules that are not well matched will exhibit the presence of an audible seam between the two devices.

Rigging Data... displays the RoomMatch rigging data for the selected array.

Listener Properties

Select a Listener within the room model or within the Listeners tab and then select the **Properties** tab.



Listener Properties within the Properties tab

Ident. is a listener identifier number which is generated automatically when you place a listener. You may assign your own custom identifier within a 4 character limit.

X is the distance of the listener location from the model origin along the X Axis.

Y is the distance of the listener location from the model origin along the Y Axis.

Ear Height is the distance above the model surface of the listener's ears. This number should be chosen based on whether the listeners are sitting or standing. The default value is 1.0 m (3.3 ft) above the ground. Ear height must be between 0 and 2.13 m (7 ft).

Yaw is the direction that the listener is facing. The default position is 0° (positive X direction).

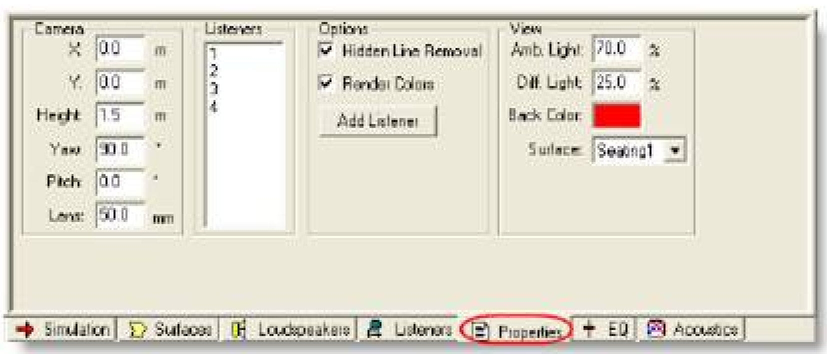
Notes is a text field that can be used for notes about the listener location. For example, you may want to note specific acoustic prediction characteristics for a given listener location.

Surface is the identifier number of the surface that the listener location is on. Use this number to easily locate the surface in the Surfaces tab.

Type indicates whether the listener location is on a Floor or Seating surface.

Camera Properties

Select the Camera within the room model or within the Model tab and then select the **Properties** tab.



Camera properties within the Properties tab

X is the distance of the camera from the model origin along the X Axis.

Y is the distance of the camera from the model origin along the Y Axis.

Height is the height of the lens along the Z axis relative to the Surface upon which the camera is placed.

Yaw is the horizontal rotation of the camera in degrees. The default yaw is 90°, or the positive Y direction.

Pitch is the vertical rotation of the camera in degrees. The default pitch is 0 degrees, or parallel to the XY plane. Positive pitch aims the camera up, negative pitch aims the camera down.

Lens is the focal length of the lens in mm. Values must be between 6 and 1200 mm.

Listeners snaps the camera to a listener location to view the model from this specific location.

Hidden Line Removal allows you to remove lines that would not normally be visible to the eye. When unchecked, surfaces appear transparent in camera view.

Render Colors displays the selected surface colors in camera view. Hidden Line Removal must be checked to render colors.

Add Listener adds a listener location to the model at the same height and location of the camera, facing in the direction that the camera is facing.

Amb. Light sets the amount of ambient light in the camera view. Higher percentages add more light while lower percentages add less light.

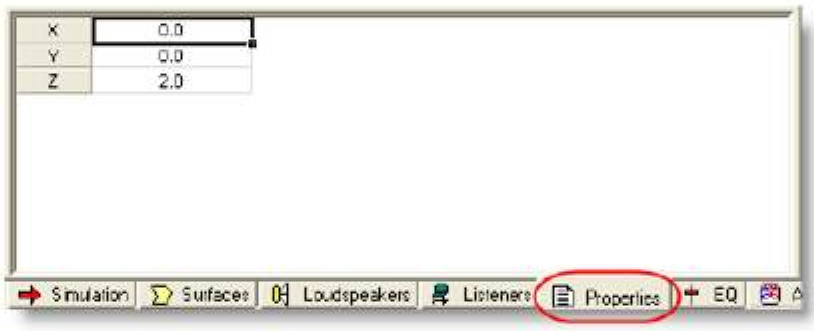
Diff. Light specifies how diffuse the light is, or how much contrast you see in the camera view. Higher numbers create more contrast, while lower numbers create less contrast.

Back Color sets background color. The color selected will be shown for areas that are not part of the model. For example, if you have a missing wall on a building, that wall will be colored the chosen Back Color. This feature may also be used to color the sky in semi-open models.

Surface is the identifier number of the surface that the listener location is on. Use this number to easily locate the surface in the Surfaces tab.

Model Center of Rotation Properties

Select the Center of Rotation within the Model tab of either the Model or the Project view and then select the **Properties** tab.



Center of Rotation within the Properties tab

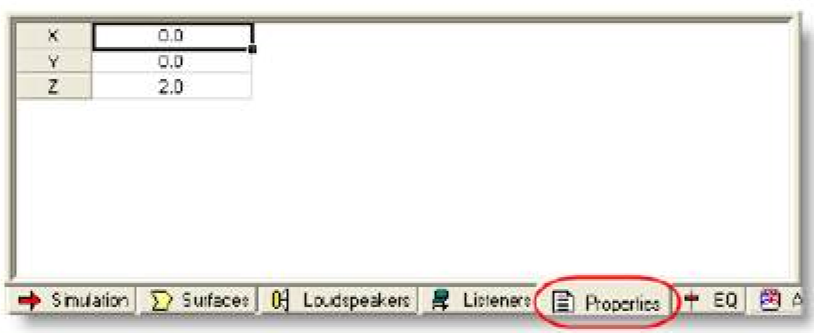
X is the distance of the Center of Rotation from the origin along the X Axis.

Y is the distance of the Center of Rotation from the origin along the Y Axis.

Z is the distance of the Center of Rotation from the origin along the Z Axis.

Cluster Properties

Select a Loudspeaker Cluster within the Model tab of either the Model or the Project view and then select the **Properties** tab.



Cluster Properties within the Properties tab

X is the distance of the cluster from the origin along the X Axis.

Y is the distance of the cluster from the origin along the Y Axis.

Z is the distance of the cluster from the origin along the Z Axis.

Group Properties

Select a Group within the room model or within the Model tab and then select the **Properties** tab.

Group Properties within the Properties tab

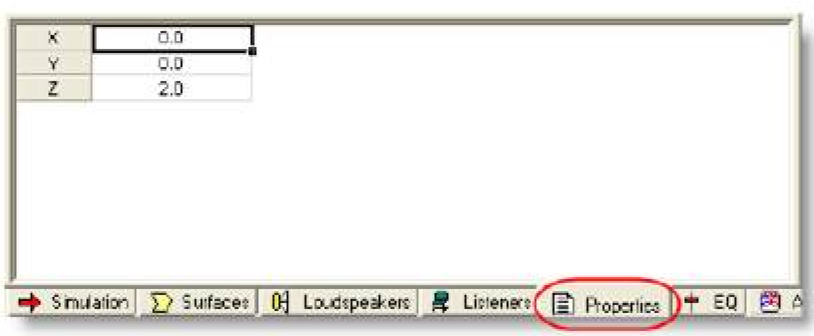
Length (X) is the total length of the group in the X Axis. Enter a new value to extend the group in this dimension.

Width (Y) is the total width of the group in the Y Axis. Enter a new value to extend the group in this dimension.

Height (Z) is the total height of the group in the Z Axis. Enter a new value to extend the group in this dimension.

RT60 Source Properties

Select the RT60 source within the Model tab of either the Model or the Project view and then select the Properties Tab.



RT60 properties within the Properties tab

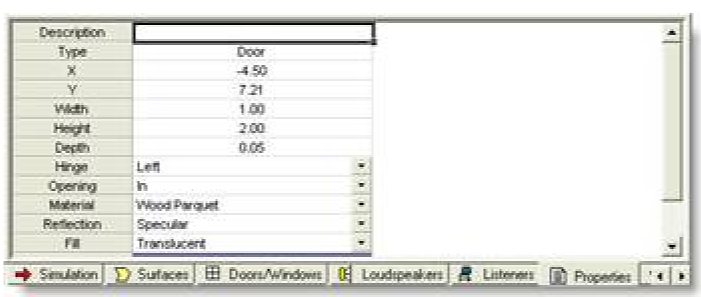
X is the distance of the RT60 source from the origin along the X Axis.

Y is the distance of the RT60 source from the origin along the Y Axis.

Z is the distance of the RT60 source from the origin along the Z Axis.

Door Properties

Select a door within the Model tab of either the Model or the Project view and then select the Properties tab.



Door Properties within the Properties tab

Description provides a text field for entering descriptive information about the object.

Type describes the type of door that was inserted.

X defines the distance in the X Axis between the bottom center of the new door and the origin of the room model.

Y defines the distance in the Y Axis between the bottom center of the new door and the origin of the room model.

Width describes the total width of the door. The door width will be centered on the X/Y offset.

Height defines the overall height of the door.

Depth defines the depth of the door.

Hinge defines if the door opens to the left or right.

Opening defines if the door opens in or out.

Material describes what material type will be applied to the door.

Reflection describes the reflection properties of the door.

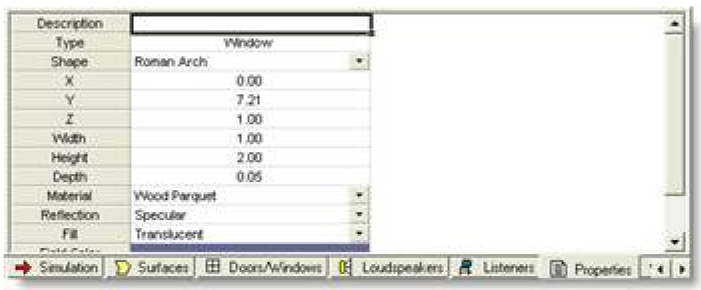
Fill describes the transparency level that will be used for the door in rendered views.

Field Color describes the inside fill color of the door.

Frame Color describes the outside frame color of the door.

Window Properties

Select a Window within the Model tab of either the Model or the Project view and then select the **Properties** tab.



Window Properties within the Properties tab

Description provides a text field where descriptive information about the object may be entered.

Type describes the type of window that was inserted.

Shape describes the overall shape of the window. Available choices are Rectangular, Round, Roman Arch and Gothic Arch.

X defines the distance in the X Axis between the bottom center of the new window and the origin of the room model.

Y defines the distance in the Y Axis between the bottom center of the new window and the origin of the room model.

Z defines the height of the bottom end of the new window relative to the parent surface.

Width defines the overall width of the window.

Height defines the overall height of the window.

Depth defines the depth of the window.

Material describes what material type will be applied to the window.

Reflection describes the reflection properties of the window.

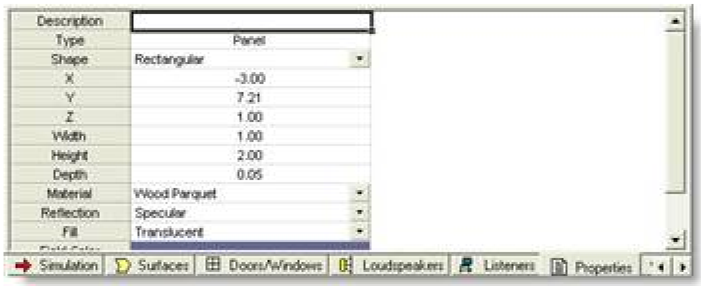
Fill describes the transparency level that will be used for the window in rendered views.

Field Color describes the inside fill color of the window.

Frame Color describes the outside frame color of the window.

Panel Properties

Select a Panel within the Model tab of either the Model or the Project view and then select the **Properties** tab.



Panel Properties within the Properties tab

Description provides a text field where descriptive information about the object may be entered.

Type describes the type of panel that was inserted.

Shape describes the overall shape of the panel. Available choices are Rectangular, Round, Roman Arch and Gothic Arch.

X defines the distance in the X Axis between the bottom center of the new panel and the origin of the room model.

Y defines the distance in the Y Axis between the bottom center of the new panel and the origin of the room model.

Z defines the height of the bottom end of the new panel relative to the parent surface.

Width defines the overall width of the panel.

Height defines the overall height of the panel.

Depth defines the depth of the panel. Depth is only a visual parameter and it does not affect acoustics.

Material describes that material type that will be applied to the panel.

Reflection describes the reflection properties of the panel.

Fill describes the transparency level that will be used for the panel in rendered views.

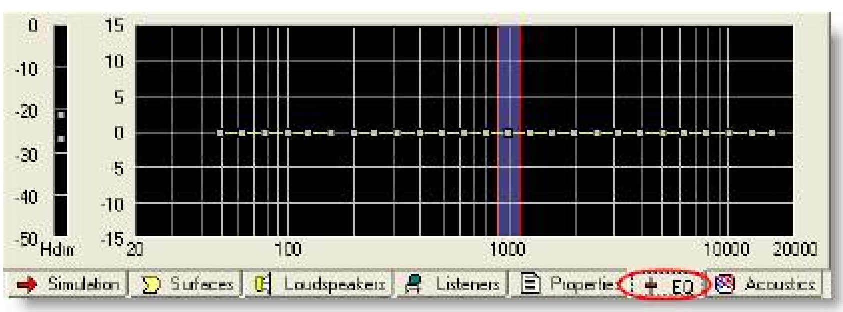
Field Color describes the inside fill color of the panel.

Frame Color describes the outside frame color of the panel.

EQ Tab

The EQ tab displays the equalization settings for a given loudspeaker or loudspeakers, and allows you to adjust the equalization and gain. As you make adjustments in the **EQ** tab, you can see the results of your adjustments in the **SPL** tab (when viewing Direct or Direct plus Reverberation coverage maps).

The equalization is applied to those loudspeakers selected within the room model or loudspeaker tab.



EQ tab with all active loudspeakers selected

Tip: You select specific loudspeaker for equalization using the right-click context menu of the EQ tab. Right-click in the EQ tab and choose Select Speakers... From within the Select dialog you can select the speakers for which to display and modify EQ data.

Tip: A quick way to select all active loudspeakers is to right click in the EQ tab and choose Select Active Speakers (or press the F4 key).

From within the EQ Tab the following functions are available.

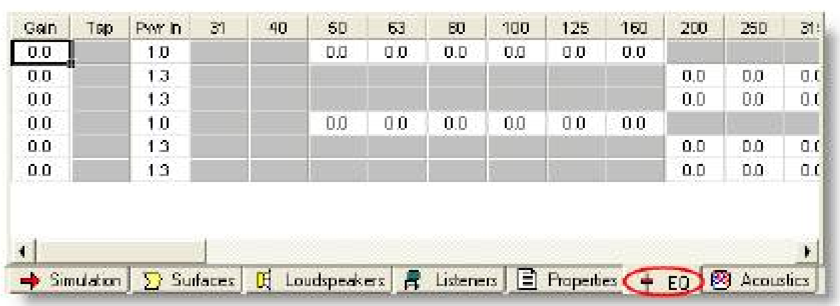
Hdrm displays the current system headroom for the selected loudspeaker. 0 dB or headroom represents the maximum power being applied to the loudspeaker. Each loudspeaker is represented with a square. To adjust the gain of a loudspeaker grab the loudspeaker's headroom icon and move it up or down.

1/3 Octave-Band EQ each loudspeaker includes a 1/3 octave-band equalization. The equalization for the loudspeaker is adjusted by moving the EQ slider up or down. At total of +/- 15 dB of equalization may be applied per band.

When multiple loudspeakers are selected, dragging will change the gain while maintaining the relative level differences. Shift + drag will apply the same gain to all selected loudspeakers.

Note: Boosting the EQ in a specified band adds gain to the loudspeaker, and reduces headroom. When the loudspeaker has 0 dB of headroom, additional EQ boost may not be applied.

The EQ tab also includes a tabular display of the equalization applied to the loudspeaker. To access the table view of the equalization right-click on the EQ tab and select **EQ Grid**.



EQ Grid

From within the EQ Grid in the EQ Tab the following functions are available:

Gain is the amount of gain, in decibels, (dB), applied to the loudspeaker. A setting of 0 dB gain is equivalent to 1 Watt of electrical input power.

Tap is only available for high impedance loudspeakers which use a transformer to determine the amount of power applied to the loudspeaker. The available tap settings match the capabilities of the chosen loudspeaker in Watts.

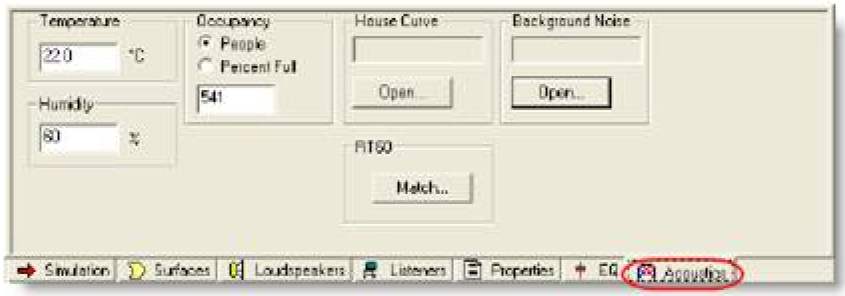
Pwr In displays the amount of power, in Watts, applied to the loudspeaker.

EQ (31 Hz – 16 kHz) displays the amount of EQ applied in each 1/3 octave band.

For more information on using the EQ Tab, in combination with the System SPL tab to equalize the sound system within the Model see how to adjust the equalization in the D^{2}R∆STIc design process.

Acoustics Tab

The Acoustics tab displays, and provides access to the various acoustic parameters that affect calculations used within the Modeler software.



Acoustics tab

From within the Acoustics Tab the following functions are available.

Temperature is the ambient temperature in the room (affects speed of sound).

Humidity is the relative humidity in the room (affects air absorption).

Occupancy is the number of people in the room. Occupancy may be specified as either a total number of people within the model, or as a percentage of occupancy. The Modeler software distributes the absorption for the audience evenly across all "occupied" surfaces.

House Curve is a target room-response curve. Select Open… to display the House Curve database viewer.

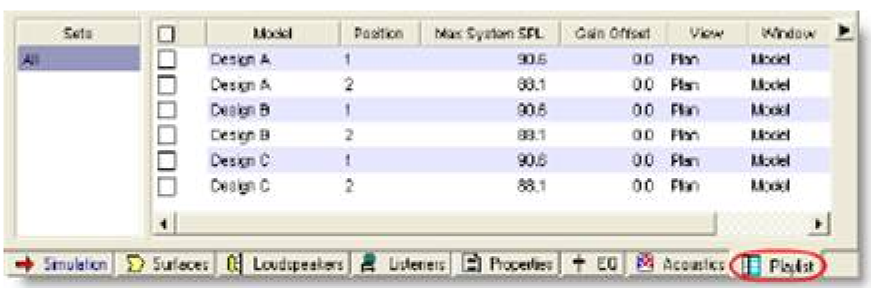
Background Noise is the background noise in the room. Select Open… to display the Background Noise database viewer.

RT60 Select Match… to access the Reverberation Time matching function. This function matches the room's predicted reverberation times to a set of measured reverberation times.

Playlist Tab

The Playlist tab is only available within the Plus version of Modeler which includes features related to the Auditioner® system technology. In addition, the Playlist tab is only active when a Project file is open, and is not available if a room model only is open.

The Playlist tab contains a list of all Listener positions which will be simulated using the Auditioner technology, and allows you to group Listener positions for various models into unique Playlists for demonstration purposes.



Playlist tab

From within the Playlist tab the following functions are available.

Sets contains a list of all unique playback sets, or playlists. The default set is All Listener positions. To add a new playlist set, right-click in the Sets window and select **New Set**.

Add Listener positions to a playlist set by dragging them from the list of Listener Positions to the desired playlist set.

Activate Listener Position Checkboxes are in the first column. Listener positions will not be loaded and played unless they are selected, which is indicated with an X appearing in the selection box.

There are three ways to select items: double-click on the listener row to load it into the queue, place an "X" in the box next to the listener to load it into the queue, or place an "X" in the box in the column header to load all listeners into the queue at once. If an audio track is playing in the Bose Media Player, you are able to listen as soon as a listener is loaded.

The item currently playing is indicated in the second column using a loudspeaker icon:

Model displays the room model name where the Listener is located.

Position indicates the unique Listener Position number in the model. Listeners appear in light gray if the surfaces they are on have been unchecked in the Simulation tab. Listeners appear in italics if their data has not been recalculated since a change has been made to the model.

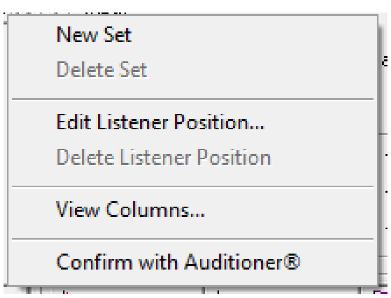
Note: To make sure that the Listener data gets calculated when the engine is turned on, you must select the Listeners box in the Simulation tab, and the Surface types that contain those Listeners.

Gain Offset contains a value used by the level match feature described in [Chapter 24: Using Level Match].

View and **Window** columns for each listener allow you to assign a specific View and Window to be displayed in the Modeling window when the listener is selected in the queue.

Right-click in the **View** and **Window** columns in the **Playlist** tab to assign a view and window to each position. You can select multiple listeners and right-click to change the **View** and **Window** for multiple listeners at once.

Play button Clicking this button presents:



Data View

Time Response Tab

Data in the **Time Resp.** tab is location dependent, and therefore can only be seen when the Sample tool is placed in your coverage map. The **Sample** tool allows you to specify an exact location from which to generate acoustic prediction data.

Time Response data is only displayed for a single frequency band, and the data displayed is dependent upon the coverage map selected within the Model View. Data cannot be displayed for the 1-4 kHz and 31 Hz-16 kHz coverage maps.

Note: Time arrival is only displayed for a single frequency band. The Time Resp tab will be grayed out and a warning will be displayed in the graph, indicating to pick a single frequency band from the Frequency drop-down menu.

Frequency band warning

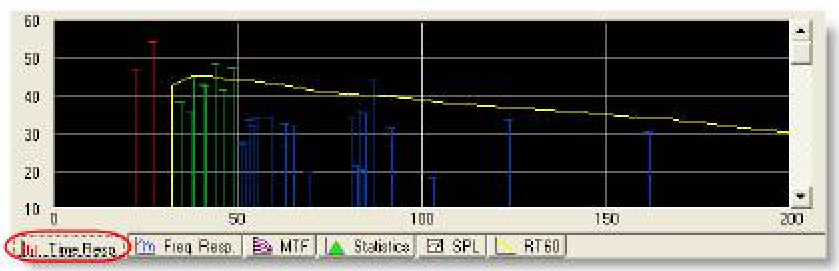
The **Time Resp.** tab displays elapsed time on the horizontal axis and dB SPL on the vertical axis. Each pin in the graph represents an arrival of sound at the exact location where you placed the **Sample** tool. Pins are color coded based on the flight path between the loudspeaker and the sample point.

Red pins direct arrivals from the sound source.

Green pins are first order reflections. They have reflected off of one surface.

Blue pins are second order reflections. They are arriving at the sample point after reflecting off of two surfaces.

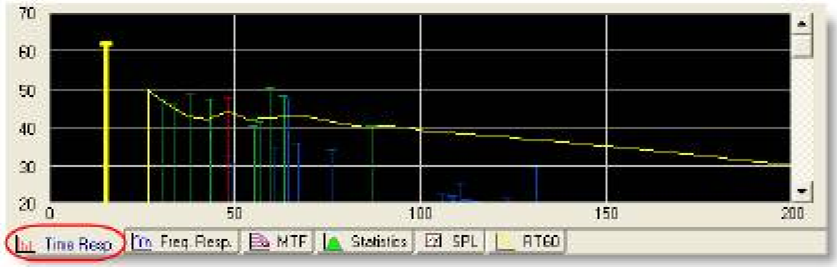
Yellow lines are the Reverberant Field Envelope Function (RFEF), which shows the build-up and decay of reverberant energy at the particular listener or sample location.



Time Resp. tab

Note: In the HEDC™ Time Resp window, the direct arrival from each cluster is represented by a single pin. Its level is calculated using x-power sum on all individual arrivals from that cluster. Its time is set equal to the time of arrival of the first individual arrival time.

Click on a pin in the graph to view the flight path from the source to the listener location, which is viewed in the **Modeling** window. You can scroll through the pins sequentially using the scroll bar to the right of the **Time Resp.** graph.



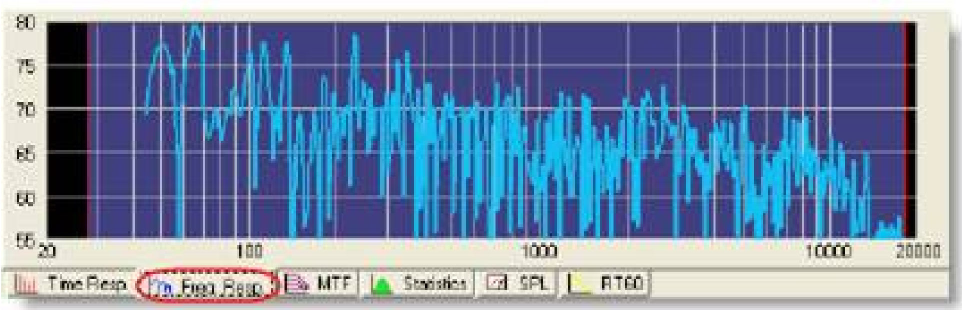
Time Resp. tab, first pin highlighted

Frequency Response Tab

The **Freq. Resp.** tab displays dB SPL on the vertical axis, and the frequency on the horizontal axis. The frequency response at a specific location in the coverage map can be displayed by placing the **Sample** tool at the desired location.

The algorithm used to generate frequency response data is based upon the coverage map being displayed within the Model View. For example, when the Direct Field coverage map is active the displayed Frequency Resp. is generated using direct field data. Likewise when the STI map is active the Frequency Resp. is generated using the HEDC-STI data.

Because frequency response is position-dependent, the data changes as you change the location of the **Sample** tool. In addition, the **Sample** tool snaps to the listener location when you drag the tool near a listener. As you make changes to your sound system, these listener locations allow you to return to a specific and consistent location in the model to evaluate acoustic prediction.



Freq. Resp. tab

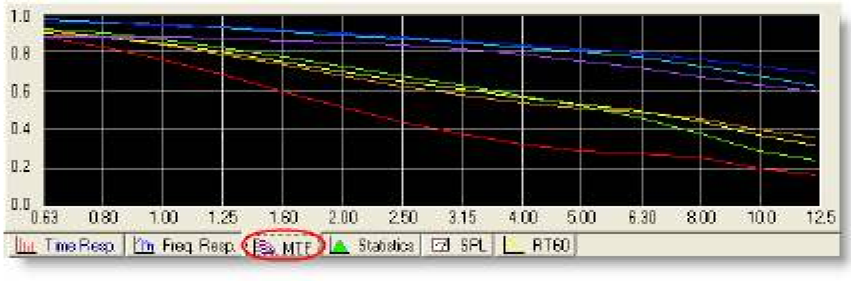
Tip: The data within the Frequency Resp. tab is continuously updated as you move the sample tool; move the sample tool across the coverage map and see the response for a variety of locations.

Note: You can change the smoothing of the frequency response curve by right-clicking in the Freq Resp tab and choosing a different octave value. Lower values produce finer resolution.

MTF Tab

The MTF (Modulation Transfer Function) tab only contains data when an STI map is displayed. STI is calculated using band limited noise in seven octave bands. Each band is modulated at 14 different frequencies between 0.63 and 12.5 Hz. Each of these curves represents one of the seven octave bands, and is called an **MTF** curve. Each MTF curve is color coded, and corresponds to one of the 7 octave-bands between 125 Hz and 8 kHz.

The MTF is a graphic description of the Speech Transmission Index calculation and tells us how well the speech signal was preserved when it arrived at the listener after leaving the loudspeaker and traveling through the room. If the signal is perfect upon arrival the MTF curve is a flat line at the top of the graph representing no signal degradation (100% integrity); if it were totally degraded it would be a flat line at the bottom of the graph. By looking at the shape of the MTF curve we can determine the probable cause of reduced intelligibility.



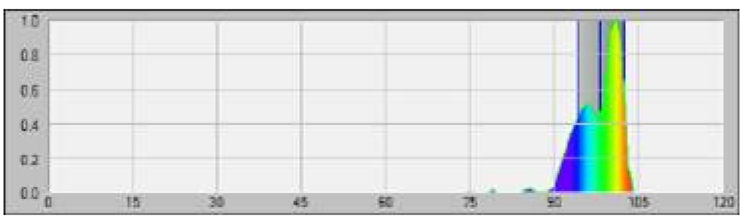
MTF tab

Tip: You can copy a graph or the data into Excel by right-clicking in the graph window and selecting either Copy Graph or Copy Data.

Statistics Tab

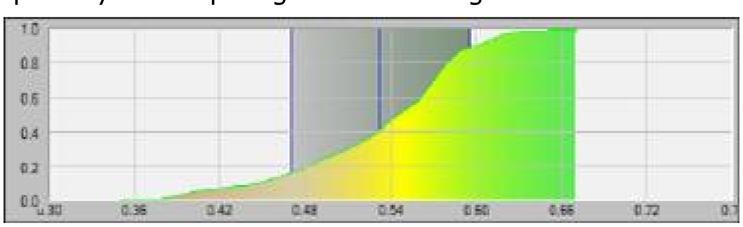
The **Statistics** tab displays coverage map data using either a probability or cumulative distribution function for further analysis of coverage map data. Additional detailed information is displayed directly below the Statistics Tab in the **Status Bar** of main application frame.

The probability distribution function plots map data (SPL or STI score) along the X axis, and the probability of occurrence along the Y axis. In this view the mean value and standard deviation are also displayed.



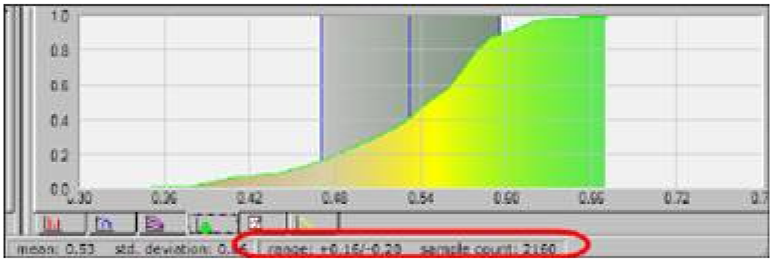
Statistics Tab – Probability Distribution Function

The cumulative distribution function plots map data along the X axis, and the percentage of all samples for each data point along the Y axis. This view makes interpretation of STI data simpler, allowing you to see the quantity of samples greater than a given STI score.



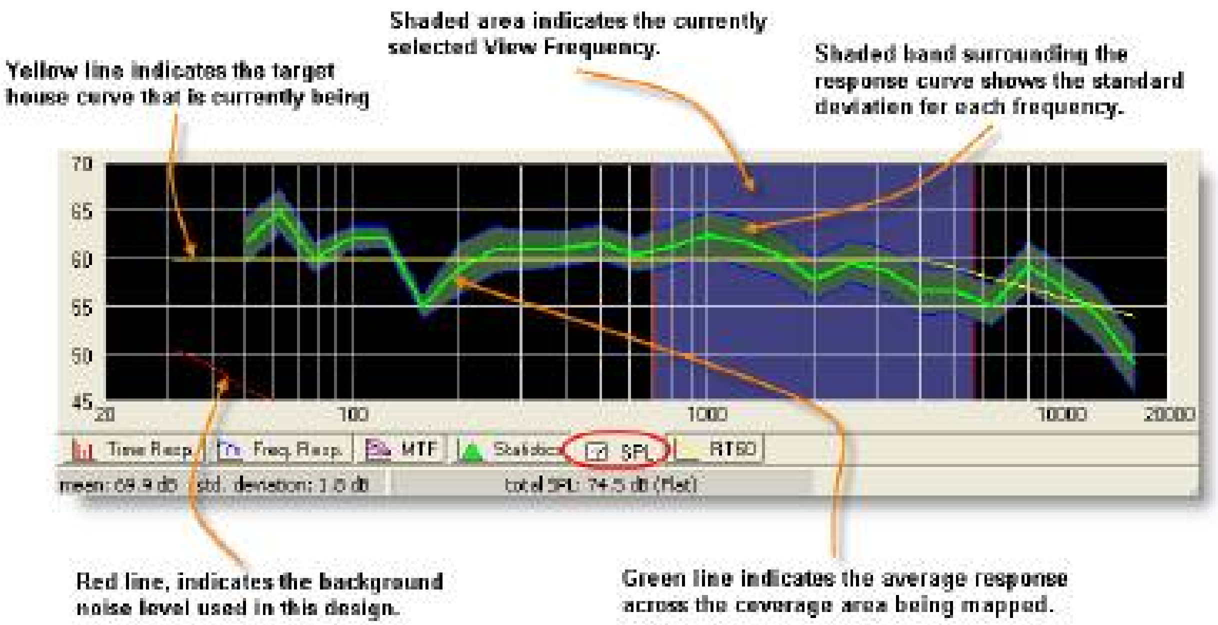
Statistics Tab – Cumulative Distribution Function

Within the Status Bar additional statistical information is available which describes the coverage map data. Included here are the Mean value, Standard Deviation, Data Range about the mean, and the total number of samples included in the coverage map.


Statistics Tab – Status Bar Information

SPL Tab

The Sound Pressure Level (**SPL**) tab shows the room frequency response, with dB SPL on the vertical axis and the frequency in Hz on the horizontal axis.



SPL tab

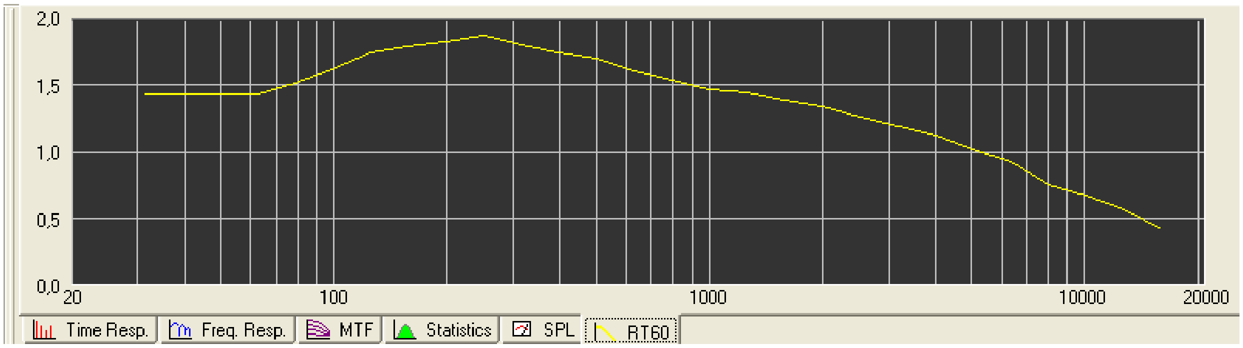
The **SPL** tab displays the mean SPL, standard deviation, and average total SPL in the status bar below the graph.

Note: The shaded bandwidth region can be dragged across the frequency spectrum to display Sound Pressure Levels at different frequencies in the Direct or Direct plus Reverberant coverage maps.

Selecting a certain frequency band in the Detail or Data Views will also drive the mapping display in the Model View.

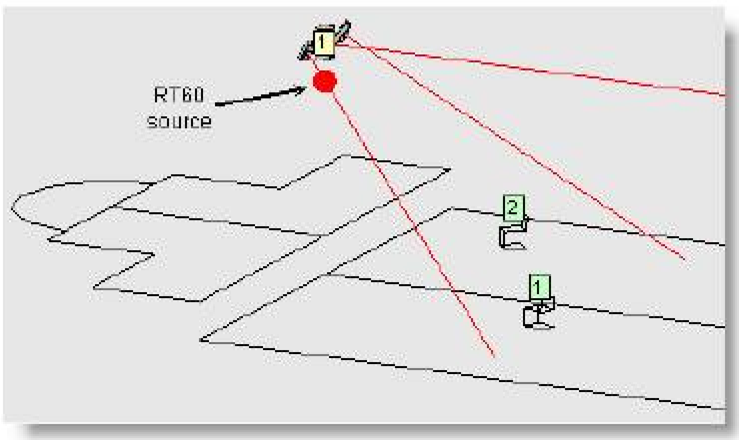
RT60 Tab

RT60 (Reverberation Time) is a measure of the amount of time it takes for the sound pressure level in a room to decay by 60 dB. Modeler software displays predicted reverberation time data for the room across the entire frequency range in the **RT60** tab.



The RT60 Tab

By default, reverberation time is predicted using a proprietary ray tracing algorithm which tracks the decay of sound energy generated by an omni-directional source placed within the model.



The RT60 source

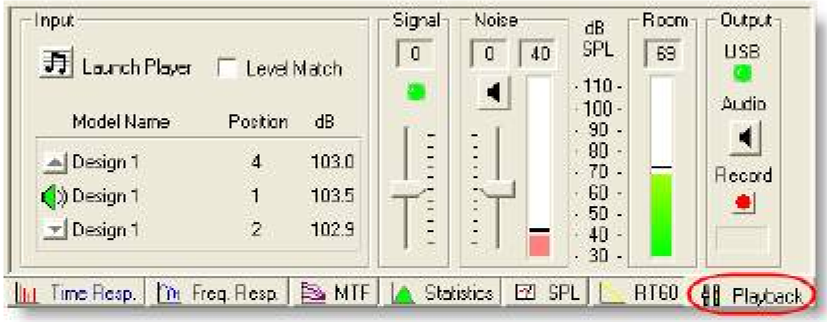
The RT60 Tab can also display the reverberation time as computed using the Norris-Erying method. This selection is available using the right-click context menu.

Note: If you do not see data in the RT60 tab, the RT60 source may be located outside of your room model, or it is a Model where more than 95% of the energy from the RT60 source is removed within one reflection. The source must be located inside the walls of your model to provide data. Reposition the RT60 source so that it is inside the room model.

Playback Tab

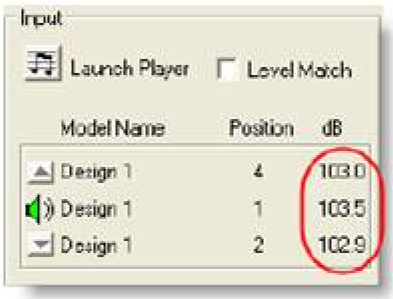
The Playback tab is only available within the Plus version of Modeler which includes features related to the Auditioner system technology. In addition, the Playback tab is only active when a Project file is open, and is not available if a room model only is open.

The Playback tab controls the playback of Auditioner filters, and is partitioned into five sections: Input, Signal, Noise, Room, and Output.



Playback tab

Input



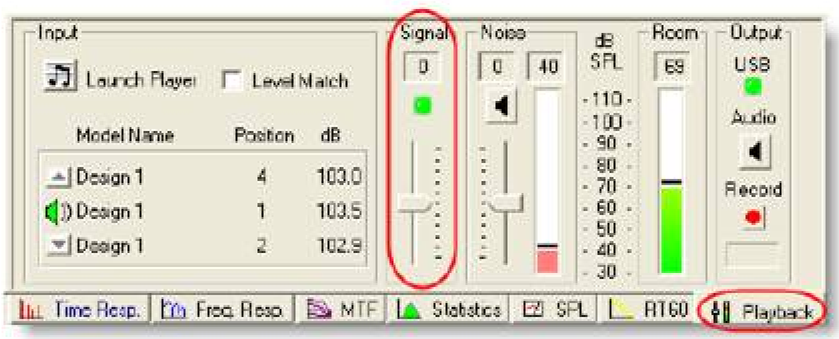
Launch Player opens the Bose Media Player window. From within the media player window you may select the dry audio that will be convolved with the Auditioner filters.

Level Match - For a description of the level match feature, see *Chapter 24: Using Level Match*.

Playback Queue - Displayed in the lower left of the Playback tab, it contains three columns. The first two are the model name and the position label for each listener. The third column is typically the maximum system SPL. However, when level match is selected, this column instead displays the gain offset.

Of the Auditioner® enabled listeners that have been loaded into the queue, three appear in the list: The current listener, the previous listener, and the next listener. The playback queue is a continuous loop regardless of how many listeners are loaded. When you reach the end of the queue, the first listener will be the next one to load.

Signal Level



Signal Level – This is the output control to the Auditioner Playback System. Conceptually, the signal level controls the signal drive level the system in the same way the master output of the house mixer controls the drive level of the system.   As the slider is adjusted, the SPL of the room changes accordingly.

System Clip Indicator – It is possible to increase the signal level to a point above the level that the installed system is capable of reproducing at a given listener location. When this occurs the system clip indicator is used to indicate this state. The system clip indicator, shown below, has three states: No signal present (gray), signal present and not clipping (green), and signal present and clipping (red).

Note: Only the sound system signal is used to set the state of this System Clip indicator. In other words, the background noise cannot cause system clipping.

Background Noise Level

The inclusion of background noise in an Auditioner simulation can improve the evaluation of speech intelligibility for a given room, and can provide a more realistic demonstration of the system's performance when the acoustics of the room assume an audience. The Noise level control mixes a pre-selected background noise source into the Auditioner simulation.

Note: Background noise will only be included in the simulation when a background noise file containing audio data is selected from within the Acoustics Tab.

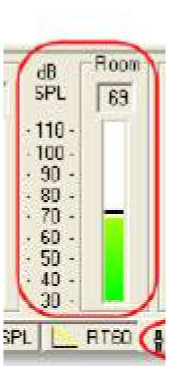
Background Noise Level - Adjust the noise level for custom noise only. Standard noise files are locked and cannot be adjusted. The current offset value is shown in the gain offset field above the slider.

When the noise level is changed, the new value is used to calculate STI. If the map is visible, it will be updated automatically.

Background Noise Meter - The noise playback level is displayed in dB SPL on the meter next to the noise level slider. The noise level field above the meter bar is updated every 1.25 seconds, while the meter bar is updated every 250 milliseconds.

Noise mute - The noise can be muted and unmuted using the toggle button shown below.

Room Level Meter



Room level Meter – Displays the total sound pressure level in the room. This level represents the combined level of both the signal and the noise in the room at the current listening location. The room level is displayed in dB SPL on the meter shown below. The room level field above the meter bar is updated every 1.25 seconds, while the meter bar is updated every 250 milliseconds.

Note: When noise is muted, the room level meter will only measure the processed signal. Conversely, to meter only noise, pause or stop the program material in the Bose Media Player.

Output

USB Detection Indicator - The USB detection indicator is green when the Auditioner® playback unit is detected. When the playback unit is not detected, or becomes disconnected, the indicator is red and no audio can be processed.

Note: Remember, if the Auditioner® Playback System III is unplugged or powered off, the Bose Media Player will not open.

System Mute - Use the **System Mute** button to mute the playback. When you press the button again to unmute, there is a short ramp-up time before full volume is restored. The ramp-up time cannot be adjusted.

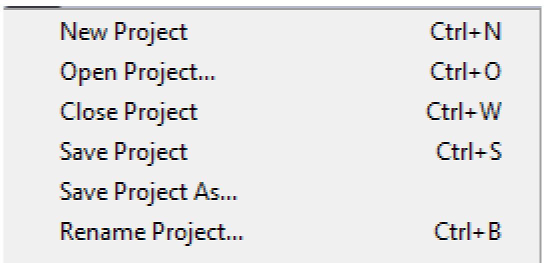
Tip: If you have enabled Direct keys, you can use the direct key shortcut to mute the sound: the M key. You can enable Direct keys in the General tab of the Application Preferences dialog box. To mute the signal, press pause in Media Player.

Record Button and Recording Time - Processed audio can be recorded and saved to a (.wav) file for future playback. While recording, the elapsed time of the recording is displayed. To stop recording, click on the toggle a second time.

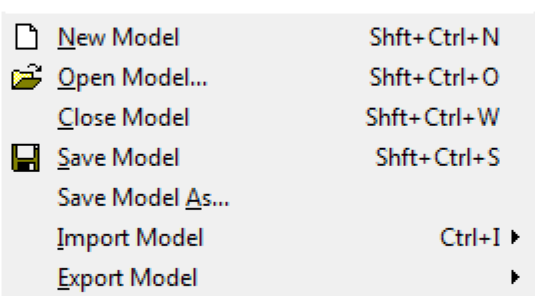
Menu Reference

Modeler Application Interface

File menu



New Project...	Creates a new project file (.pjt) and project folder and specifies its location on the hard drive. You will be prompted to create a new model, add an existing model, or import a model into the project. If a project is currently open, you will be prompted to close it before creating a new project.
Open Project...	Opens an existing project by locating it on the hard drive and choosing the .pjt file. If a project is currently open, you will be prompted to close it before opening a new project.
Close Project	Closes the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project	Saves changes to the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project As...	Creates a copy of the project and saves it with a different name. All models within the project will be copied. The new saved project will remain open and the original project will be closed.
Rename Project...	Changes the name of the project, but does not affect project file contents.

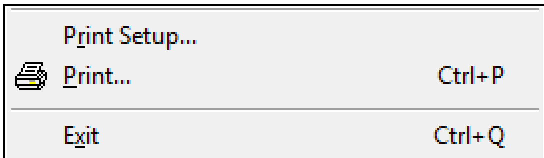


New Model	Creates a new model. You will be prompted to name the new model. If a project is not open, a new model will be created without being added to a project. This model is named “Untitled” by default and can be renamed at any time by choosing Save Model.
Open Model...	Adds an existing model to the project. A copy of the model will be added to the project folder.
Close Model	Closes the model.
Save Model	Saves changes to the selected model.

	Save Model As...	Creates a copy of the model and saves it with a different name. Use this option to save a version of the model you are currently working on. The new saved model remains open and active, and is added to the project. The original model is closed and remains in the state that it was last saved. If no project is open, you will be prompted to choose a location in which to save the model.
Macintosh Modeler File (.mac) Modeler MTF File (.mtf) EASE XFC File (.xfc) EASE PPJ File (.ppj) AutoCAD DXF File (.dxf)	**Import Model**	imports a model that was not created in Bose Modeler software. The model will be added to the currently open project file. Choose to import a Macintosh Modeler software file (.mac), a Modeler Transfer File (.mtf), and EASE faces file (.xfc), or an EASE project file (.ppj). Note that the file must have the appropriate file extension (.mac, .xfc, .ppj, .dxf) to be imported into Bose Modeler software. If a project is not open, the model will be imported without being added to any project.
EQ Values... Modeler MTF File (.mtf) RoomMatch Array (.xml)	**Export Model**	Exports loudspeaker data to a text (.txt) file with tab delimited data for all loudspeakers in the room model. Data includes loudspeaker properties and equalization data for each device. Export a Modeler Transfer File (.mtf) which contains all the room model data in a proprietary text format for use in other modeling applications.

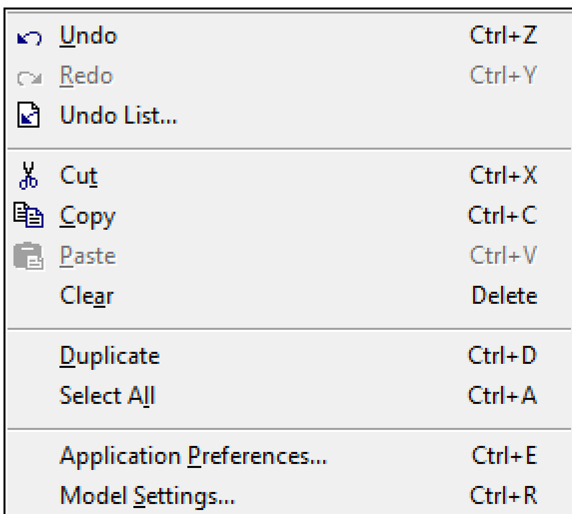
Duplicate Model Ctrl+K Rename Model Shft+Ctrl+B Remove Model Ctrl+J Model Properties... Shft+Ctrl+I Recent Projects Recent Models	**Duplicate Model**	Duplicates the selected model in the project. To select which model to duplicate, click on the model name in the Project window. You will be prompted to name the duplicate model. Modeler software will copy the model and add it to the “parent” project. This option exists only when the model is associated with a project.
	Rename Model	Renames the selected model in the project. This option exists only when the model is associated with a project.
	Remove Model	Removes the selected model from the project. You will be prompted to remove the model from the disk. Choose Yes to delete the model from your hard drive. Choose No to remove the model from the project but not from the hard drive. It is saved in the project folder and can be added back to the project or to another project at a later time.
	Model Properties...	Displays information on the active model

	file, including its location on your hard drive, the date that it was created and updated, the size of the file, and what version of software created it. You can also enter information including the name of the sound system designer, the name of the facility, and any relevant comments about the model.
Recent Projects	Allows you to choose one of the four most recently opened projects from the list. If a project is open, you will be prompted to close the project that is open before you open a new project.
Recent Models	Allows you to choose one of the four most recently opened models from the list. If a project is open, a copy of the model will be added to the project. If a project is not open, the model will be opened without being added to any project.



Print Setup...	Opens the standard Windows Print Setup dialog box where you can choose a printer, set printer properties and select paper options.
Print...	opens the Modeler software Print dialog box. From within this dialog you can choose which items (model views, maps, etc.) will be printed as part of the Engineering Report.
Exit	Quits Modeler software. You will be prompted to save any changes to open models. later time.

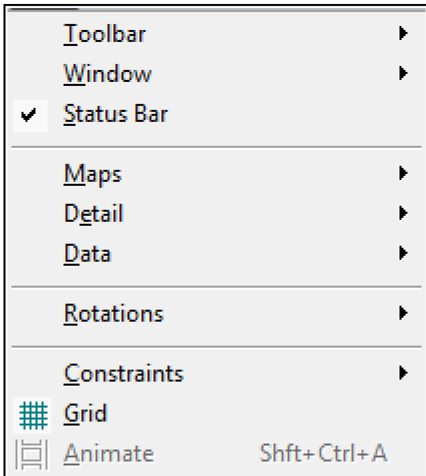
Edit menu



Undo	Reverses your last action or multiple actions up to the point at which the model was opened.
Redo	Re-applies your last action (after undo) or multiple undo actions up to the most recent action.
Undo List...	Opens the list of actions available for Undo and Redo. Double-click on an Undo or Redo action to jump to that state.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids
Paste	Pastes the contents of the clipboard (standard Windows editing function).
Clear	Deletes the selected item.
Duplicate	Copies and pastes the selected item to

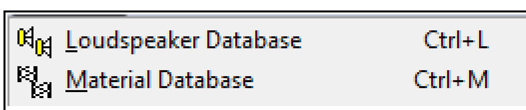
		create a duplicate of it.
	Select All	Selects all items in the active window.
	Application Preferences...	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.

View menu



Toolbar	Expands to display a list of all toolbars available within the Modeler application interface. Selects a toolbar to toggle between show (checkmark) and hide (no checkmark)
Window	Displays a list of the three main view windows within the Modeler application interface. Select a window to toggle between show (checkmark) and hide (no checkmark).
Status Bar	Toggles the Status bar between show (checkmark) and hide (no checkmark).
Maps	Expands to display a list of all active coverage maps for the current model. Choose which map is displayed in the **Modeling** window.
Detail	Expands to display a list of all Detail View tabs. Choose which tab is selected in the **Detail** window.
Data	Expands to display a list of all Data View tabs. Choose which tab is selected in the **Data** window.
Rotations	Expands to display a list of all available model view orientations. Select the angle from which to view the model.
Constraints	Expands to display a list of available drawing constraints. Select which plane your actions are constrained to in the **Modeling** window.
Grid	Toggles the grid between show (checkmark) and hide (no checkmark).
Animate	Turns on map animation which automatically cycles the Direct Field, or Direct plus Reverberant Field coverage data through all of the frequency settings in the Frequency drop-down in the Simulation tab. Use the arrow keys to speed up or slow down the animation, and press Esc to close the animation.

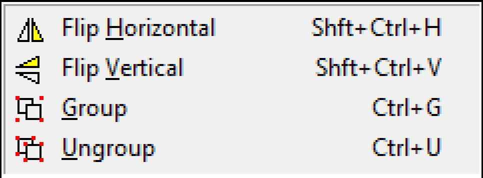
Database Menu



Loudspeaker Database	Opens the Loudspeaker Database viewer.
Material Database	Opens the Materials Database viewer

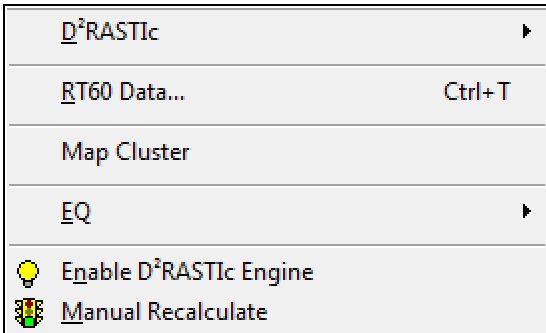
Arrange Menu

The items in the Arrange menu are used when one or more surfaces are selected in the model.



Flip Horizontal	Mirrors the selected surface(s) along an axis parallel to the Y axis.
Flip Vertical	Mirrors the selected surface(s) along an axis parallel to the X axis.
Group	Joins the selected objects together in case they are co-planar. Grouped surfaces will act as one surface when being moved, rotated, flipped or scaled. The individual sections of a Conical, Spherical, and Cylindrical surface are grouped by default when they are created. Grouped surfaces have sizing handles that can be used to resize the group in three dimensions. Listeners can be grouped together. Loudspeakers cannot be grouped together. Groups may be grouped.
Ungroup	Separates the selected objects that are part of a group. The objects will act independently after being ungrouped.

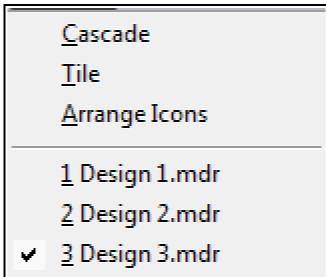
Design Menu



D^{2}RΔSTIc	Expands to display a list of the D^{2}RΔSTIc step calculations. When an item within the list is selected the selected coverage map is automatically calculated using pre-defined default settings. Selections include calculate the Direct Field coverage map for the 1 - 4 kHz frequency range, calculate the Direct plus Reverberant Field coverage map for the 31 Hz - 16 kHz frequency range, calculate time-arrivals at 2 kHz, and calculate the Speech Transmission Index (STI) coverage map. The D^{2}RΔSTIc Engine must be enabled to generate these coverage maps. For more information, see the DRASTIc_ Design_Process.htm.
RT60 Data...	opens the Room Reverberation window to display the RT60 times of the room model for the full frequency range.
EQ	Expands to display the options available for applying an equalization curve to the sound system. Selections include select loudspeakers to equalize, apply a house curve, or zero the equalizer
Enable D^{2}RΔSTIc Engine	Enables the D^{2}RΔSTIc engine to automatically calculate acoustic prediction data. When the D^{2}RΔSTIc engine is enabled, Modeler software only calculates those steps in the acoustic prediction calculation that are necessary, based on what changes have been made to the model.
Manual Recalculate	This item is only available when the D^{2}RΔSTIc Engine is inactive. When selected all acoustic predictions are recalculated based on current model settings. Manual recalculation causes Modeler soft-

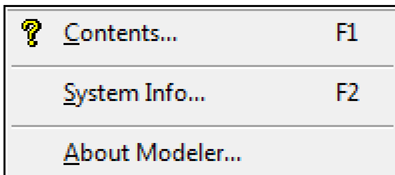
		ware to execute all steps in the acoustic prediction calculation. Therefore, there may be a slightly longer calculation time compared to automatic recalculation using the D^{2}RΔSTIc engine.

Window menu



Cascade	Places multiple models on top of each other in a cascading manner, so that all are visible in the Model View.
Tile	Fits multiple models side by side so that all are visible in the Model View.
Arrange Icons	Arranges the model icons when all models have been minimized in the Model View (a standard Microsoft Windows feature)
Open Model List	Displays a list of all open models. Selects a model to view from the list of open models. The active window has a checkmark next to it. Up to five models may be open at any one time within the application.

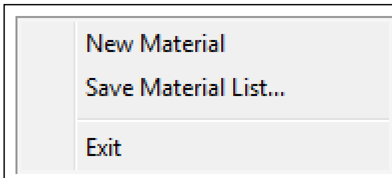
Help Menu



Contents...	Opens the Modeler software help system.
System Info...	Opens the system information window to view hardware and software settings and specifications for your computer.
About Modeler...	Opens the Modeler software splash screen, which displays version number, serial number and registration information.

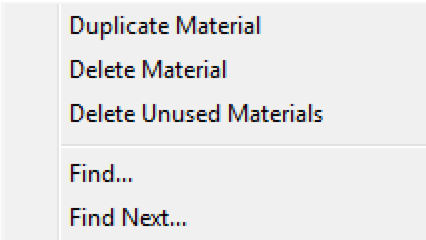
Material Database Viewer

File Menu



New Material	Creates a new material type entry within the room model’s material database. The new material may be named, and the absorption coefficient data may be specified. **Note: This material is saved with the room model file, and not with an absorption database.**
Save Material List...	Saves the current room model materials list as a new absorption database. Once saved it will appear in the master Modeler Material Database list.
Exit	Closes the Material Database viewer.

Edit Menu



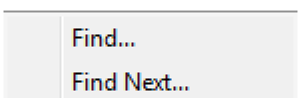
Duplicate Material	Adds a duplicate entry for the selected material within the room model material list.
Delete Material	Removes the selected material file from the room model's material list. **Note: The material is not deleted from the master material database.**
Delete Unused Materials	Removes unused materials from the room model's material list
Find...	Opens the Find dialog box to search for a material file by name.
Find Next...	Jumps to the next record that matches the Find... criteria

Loudspeaker Database Viewer

File Menu

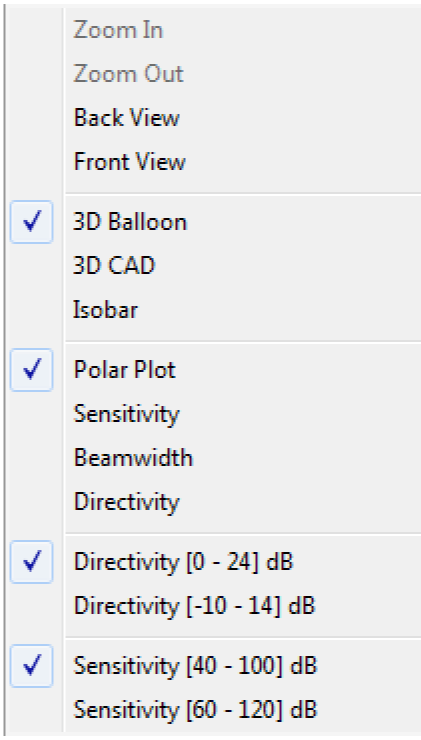
Exit	Closes the loudspeaker database viewer.

Edit Menu



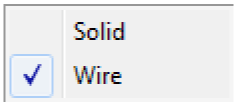
Find...	Opens the Find dialog box to search for a material file by name.
Find Next...	Jumps to the next record that matches the Find... criteria

View Menu



Zoom In	Available when the 3D CAD view is active within the 3D Viewer section. Zooms in on the loudspeaker enclosure.
Zoom Out	Available when the 3D CAD view is active within the 3D Viewer section. Zooms out from the loudspeaker enclosure.
Back View	Available when the 3D CAD view is active within the 3D Viewer section. Orients the view to the rear of the loud-speaker enclosure.
Front View	Available when the 3D CAD view is active within the 3D Viewer section. Orients the view to the front of the loud-speaker enclosure.
3D Balloon	Displays the magnitude response of the loud-speaker in a balloon format within the 3D Viewer section.
3D CAD	Displays the wireframe of the loudspeaker within the 3D Viewer section.
Isobar	Maps the sound coverage of the loudspeaker on a hemisphere for the selected frequency band within the 3D Viewer section.
Polar Plot	Displays the horizontal and vertical polar plot for the loudspeaker at the selected frequency band within the 2D Viewer section.
Sensitivity	Displays a graph of sensitivity versus fre-quency (Hz) of the loudspeaker in dB-SPL within the 2D Viewer section.
Beamwidth	Shows the angle at which the sound pressure level is down by 6 dB relative to on-axis within the 2D Viewer section.
Directivity	Displays a graph of the loudspeaker's dir-ectivity index in dB versus frequency (Hz) within the 2D Viewer section.
Directivity [0-24] dB	Sets the vertical scale of the Directivity Dis-play to 0 to 24 dB.
Directivity [-10-14]dB	Sets the vertical scale of the Directivity Dis-play to -10 to 14 dB.
Sensitivity [40-100]dB	Sets the vertical scale of the Sensitivity Dis-play to 40 to 100 dB.
Sensitivity [60-120]dB	Sets the vertical scale of the Sensitivity Dis-play to 60 to 120 dB.

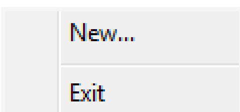
Mode Menu



Solid	Available when the 3D Balloon is displayed within the 3D Viewer section. Sets the display of the 3D Balloon data to a solid, color gradient display.
Wire	Available when the 3D Balloon is displayed within the 3D Viewer section. Sets the display of the 3D Balloon data to a wire mesh.

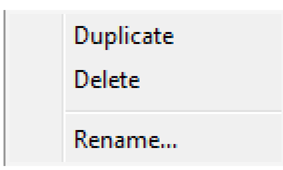
Background Noise Database Viewer

File Menu



New...	Creates a new background noise file. This file is stored with the master background noise database. Once created, the new background noise file may be named and its frequency dependent levels may be adjusted.
Exit	Closes the background noise database viewer.

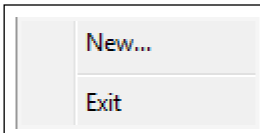
Edit Menu



Duplicate	Creates a duplicate copy of the selected background noise file. Once duplicated, the new background noise file may be renamed and its frequency dependent levels may be adjusted.
Delete	Removes the selected background noise file from the background noise database.
Rename...	Provides a text field from which you may rename the selected background noise file.

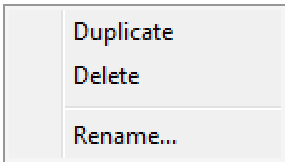
House Curve Database Viewer

File Menu



New...	Creates a new house curve file. This file is stored with the master house curve database. Once created, the new house curve file may be named and its frequency dependent levels may be adjusted.
Exit	Closes the house curve database viewer.

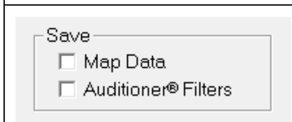
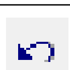
Edit Menu

	**Duplicate**	Creates a duplicate copy of the selected house curve file. Once duplicated, the new house curve file may be renamed and its frequency dependent levels may be adjusted.
	Delete	Removes the selected house curve file from the background noise database.
	Rename...	Provides a text field from which you may rename the selected house curve file.

Toolbar Reference

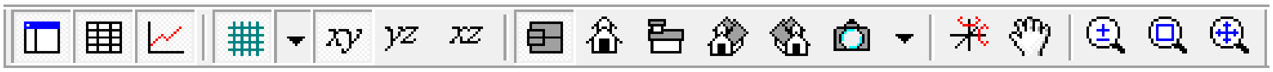
Application Interface Toolbars

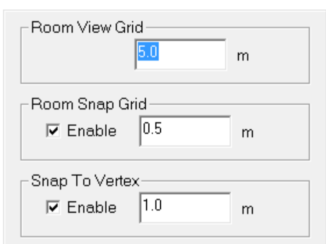
Standard toolbar

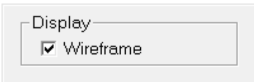
	**New Model** (Shft+Ctrl+N)	Create a new model. You will be prompted to name the new model. If a project is not open, a new model will be created without being added to a project. This model is named “Untitled” by default and can be renamed at any time by choosing Save Model.
	**Open Model** (Shft+Ctrl+O)	Add an existing model to the project. A copy of the model will be added to the project folder. If no project is open, the model will be opened without being added to a project.
	**Save Model** (Shft+Ctrl+S)	Save changes to the selected model.
	**Save Wing menu**	When checked, coverage map data that has been generated is saved with the model file.
	**Cut** (Ctrl+X)	Delete the selected item and copy to the clipboard (standard Windows editing function).
	**Copy** (Ctrl+C)	Copy the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids.
	**Paste** (Ctrl+V)	Paste the contents of the clipboard (standard Windows editing function).
	**Undo** (Ctrl+Z)	Click to undo your last action, or click multiple times to undo multiple actions up to the point at which the model was opened.
	**Redo** (Ctrl+Y)	Click to redo your last action (after undo) or click multiple times to redo multiple undo actions up to the most recent action.

	Undo List	Open the list of actions available for Undo and Redo. Double-click on an Undo or Redo action to jump to that state.
	Print (Ctrl+P)	Open the Print dialog box.
	Help (F1)	Open the help system.

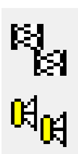
View toolbar

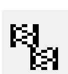
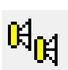


	Project View	Toggle the Project View between show and hide.
	Detail View	Toggle the Detail View between show and hide.
	Data View	Toggle the Data View between show and hide.
	Grid	Toggle the coordinate grid in the Modeling window between show and hide.
	**Grid Wing menu**	**Room View Grid -** The Room View Grid size. **Room Snap Grid** - Enable the cursor or an object to snap to the specified subdivision of the grid. **Snap To Vertex** - Enable the surface vertices to snap to the nearest adjacent vertex.
	XY Con-straint Plane (X)	Constrain the movement of an object, a surface, and the cursor to the XY Plane.
	YZ Constraint Plane (Y)	Constrain the movement of an object, a surface, and the cursor to the YZ Plane.
	XZ Constraint Plane (Z)	Constrain the movement of an object, a surface, and the cursor to the XZ Plane.
	Plan View (H)	View the model from above, looking straight down on the XY plane.
	Elevation View (J)	View the model from the side, looking straight on the YZ plane.
	Section View (K)	View the model from the side, looking straight on the XZ plane.
or	**Isometric View**	View the model in perspective, from a preset angle.

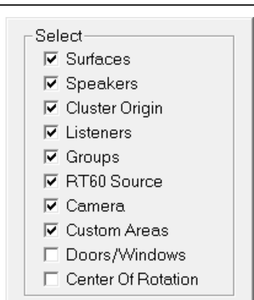
	(O)	
	**Camera View** (P)	View the model through a camera that can be placed anywhere inside or outside of the model.
	**Camera Wing menu**	Enables the display of the camera wireframe in the model.
	**Rotate View** (D)	View the model from any angle. Click and drag in the modeling window to rotate the view.
	**Pan** (SPACEBAR)	Drag the view in the modeling window to pan to a different area.
	**Zoom** ([,])	Zoom in or out on an area of the model. Click to zoom in, hold Ctrl and click to zoom out.
	**Zoom to Rect-angle**	Click and drag to draw a rectangle around an area to zoom to a particular area of the model.
	**Zoom to Fit** (HOME)	Click on the button and the model view will be adjus-ted accordingly.

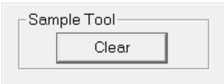
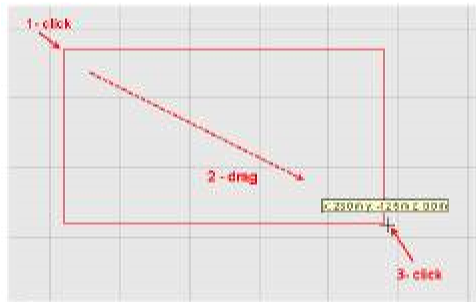
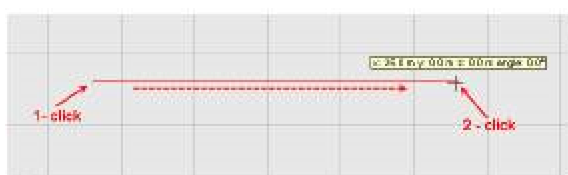
Database toolbar

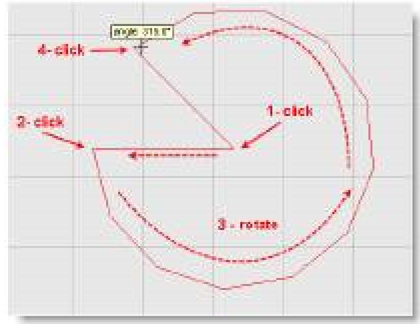
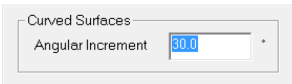
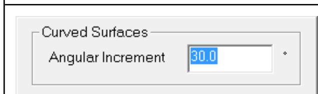


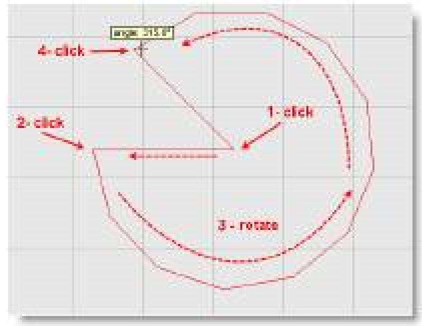
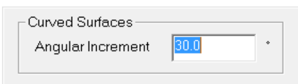
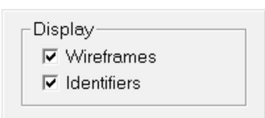
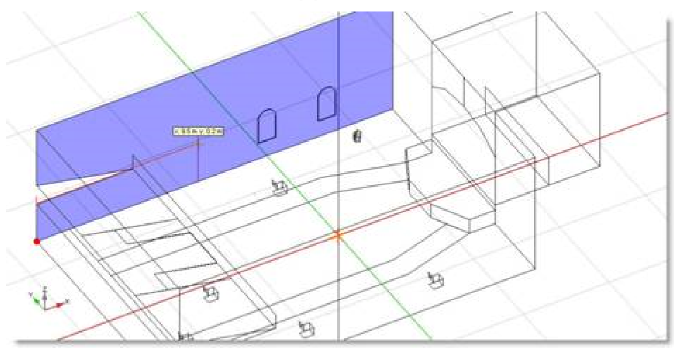
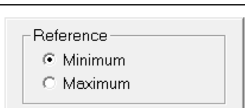
	**Material Database** (Ctrl+M)	Open the Material Database.
	**Loudspeaker Database** (Ctrl+L)	Open the Loudspeaker Database.

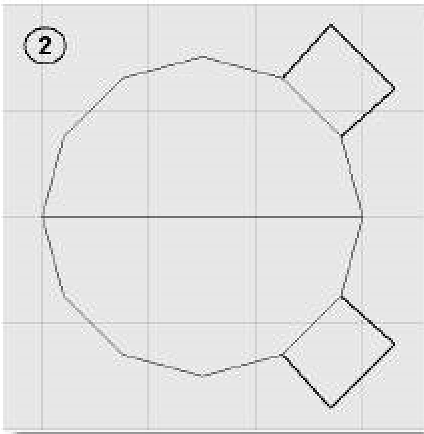
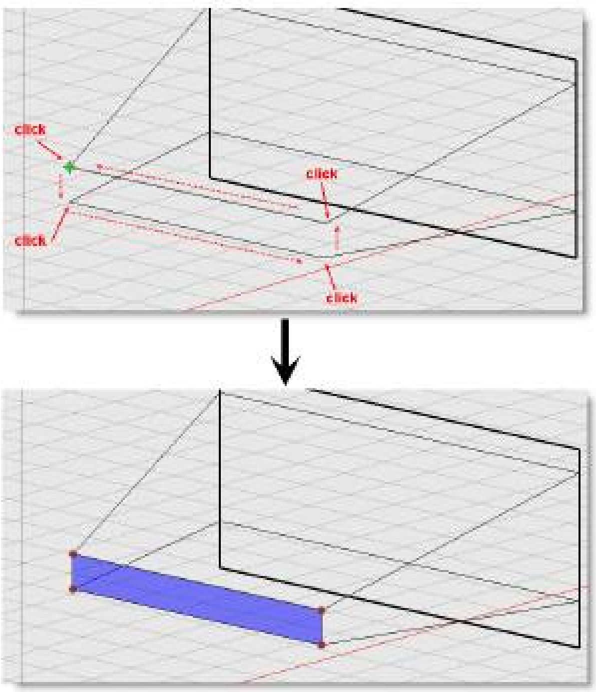
Draw toolbar

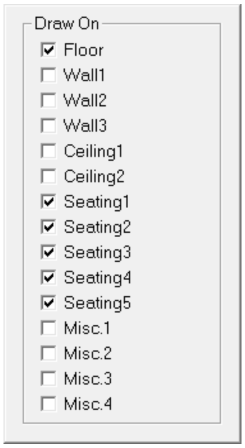
	**Select** (A)	Select an object in the model by clicking on it.
	**Select Wing menu**	Lists the types of objects which are selectable using the **Select** tool. A check indicates that the object is select-able within the Model View. Items which are unchecked will not be selected within the Model View.

	**Sample** (S)	Click at a location in the coverage map to place the Sample tool.
	**Sample Wing menu**	Click to clear the sample tool from the room model display.
	**Measure** (E)	Click and drag in the model to display distance and angle from the point where you click.
	**Draw Rectangular Surface** (R)	Create a new rectangular surface. Click to define the starting point, then click again when you have completed the shape. 
	**Draw Polygonal Surface** (Q)	Create a new polygonal surface. Click to define the starting point, then click to outline the shape. Click on the starting point to complete the shape. 
	**Draw Wall Surface** (W)	Create a new wall surface. Click to define the starting point, then click again when you have completed the shape. Wall surfaces should be created in the XY constraint plane. 
	**Draw Cylindrical Surfaces** (C)	Create a new cylindrical surface. Click to define the center axis of the cylinder or cylinder section. Click again after defining the radius of the cylinder, then rotate the radius and click to define the circumference of the cylinder.

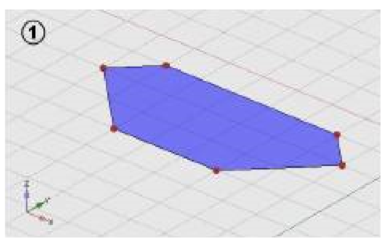
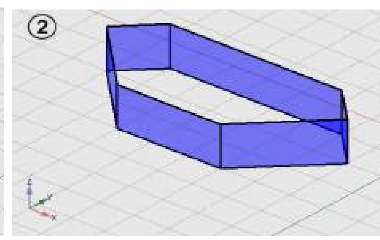
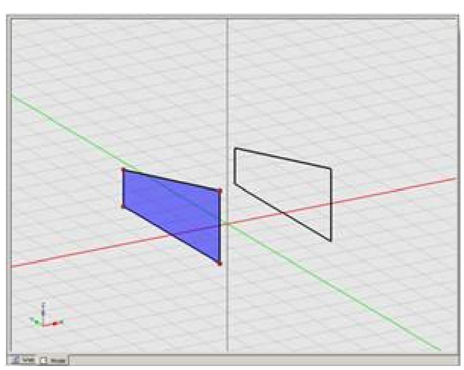
		
	**Cylindrical Surface Wing Menu**	Curved surfaces are simulated by multiple flat surfaces. A new flat surface is created at every angular increment. **Note: Smaller increments better represent curved surfaces, but may increase calculation time.**
	**Draw Conical Surfaces** (V)	Create a new conical surface. Click to define the center axis of the cone, or cone section. Click again after defining the first radius of the cone, then rotate the radius and click to define the circumference of the cone. Click again to define the second radius of the cone.  **Note: Smaller increments better represent curved surfaces, but may increase calculation time.**
	**Conical Surfaces Wing Menu**	Curved surfaces are simulated by multiple flat surfaces. A new flat surface is created at every angular increment. **Note: Smaller increments better represent curved surfaces, but may increase calculation time.**
	**Draw Spherical Surfaces** (B)	Create a new spherical surface. Click to define the center axis of the sphere, or sphere section. Click again after defining the radius of the sphere, then rotate the radius and click to define the circumference of the sphere.

		 **Note: Smaller increments better represent curved surfaces, but may increase calculation time.**
	**Spherical Surface Wing Menu**	Curved surfaces are simulated by multiple flat surfaces. A new flat surface is created at every angular increment. **Note: Smaller increments better represent curved surfaces, but may increase calculation time.**
	**Place Listener** (L)	Click in the model to create a new listener location. Listeners can only be placed on Floor and Seating surface types.
	**Place Listener Wing Menu**	Check how listeners are to be displayed in the model as a wireframe chair and/or identifier number.
	**Insert Door, Window or Panel**	Click within the room model to insert a door, window or acoustic panel into a surface. Panels can only be inserted into Wall surface types.  Once a panel is inserted into the room model, a number of properties are available to define its appearance and acoustic properties.
	**Insert Door/Window Wing Menu**	The selection determines the offset that will be displayed in the Insert Door, Window or Panel tool tip. **Minimum** will reference the object to the edge/vertex of the parent surface that is closest to the click point. **Maximum** will reference the object to the edge/vertex of the parent surface that is opposite to the click point.
	**Mirror**	Mirror the selected surface(s) along a line that you define.

		 
	**Insert Face** (I)	Insert a new surface in an existing space by defining the vertices that bound the surface. When the cursor is moved over a vertex, it will highlight in green. Vertices will turn black after you click. The starting point is highlighted in red. 
	**Draw Custom Areas**	Quickly map a section of a room (or multiple sections) to evaluate coverage for the selected area.

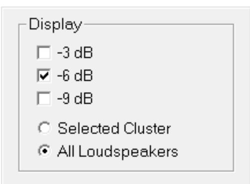
	**Custom Areas Wing Menu**	Select which surface types will be used to determine the vertex points when a new custom mapping area is drawn within the model.

Extrude Toolbar

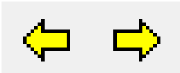
	**Extrude Walls**	Create walls from the Floor or Seating type surface(s) that is selected. The walls will be constructed around the perimeter of the selected surface. You will also have the option to add a ceiling surface. When multiple surfaces are extruded, walls will be created around the outermost perimeter only. For example, you can extrude in the negative direction, to create a raised floor surface.  
	**Extrude Surface**	The Extrude Surface tool will extrude surfaces from a reference surface within the room model. An extrusion can only be generated if the 'other' surface intersects with the extruded reference along the currently chosen extrusion axis. In order for a set of surfaces to be extruded, both a reference and termination surface must exist. Select the reference surface from within the room model: 
	**Extrude Rectangular Surface**	The Extrude Rectangular Surface tool will extrude from a defined rectangular surface towards two termination surfaces.

	**Extrude Polygonal Surface**	The Extrude Polygonal Surface tool will extrude from a polygonal surface towards two termination surfaces.
	**Extrude Arc**	The Extrude Arc tool will extrude an arc or column from a reference surface towards two termination surfaces. A floor and ceiling surface are used as the minimum and maximum extents for the new extruded surfaces.

Map toolbar

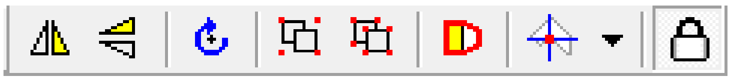
	**Isobar**	Generate Isobar map data. Click to close the Isobar map.
	**Isobar Wing Menu**	Select the Isobar value to display, -3, -6 or -9 dB. Select the Isobar display type as either Isobar data for the selected loudspeaker cluster, or for all active loudspeakers within the model.
	**Direct** (F10)	Generate the Direct Field coverage map. Click to close the Direct Field coverage map.
	**Direct + Reverberant** (F11)	Generate the Direct plus Reverberant Field coverage map. Click to close the Direct plus Reverberant Field coverage map.
	**Speech Intelligibility** (F12)	Generate the Speech Intelligibility coverage map. Click to close the Speech Intelligibility coverage map.
	**Enable Listening**	Enables the Auditioner processing for the currently selected model. When active you may listen to positions within open models using the Auditioner Playback system. This function is only available within the Modeler Plus software.
	**Manual Recalculate** (T)	If the D^2RΔSTIc engine is disabled, use Manual Recalculate to recalculate the acoustic prediction data after making a change to the model. Manual recalculation causes Modeler software to execute all steps in the acoustic prediction calculation, therefore there may be a slightly longer calculation time compared to automatic recalculation using the D2RASTIc engine.
	**Enable D^2RΔSTIc Engine** (N)	Click to enable the D^2RΔSTIc engine to automatically calculate acoustic prediction data. Click again to disable the D^2RΔSTIc engine. When the D^2RΔSTIc engine is enabled, Modeler software only calculates those steps in the acoustic prediction calculation that are necessary, based on what changes have been made to the model. This may result in a faster calculation time.
	**Animate** (Shft+Ctrl+A)	Turn on animation. Animation automatically cycles the Direct Field or Direct plus Reverberant Field coverage data through all of the frequency settings in the Frequency drop-down in the Simulation tab. Use the slider to speed up or slow down the animation, and press Esc to close the animation.

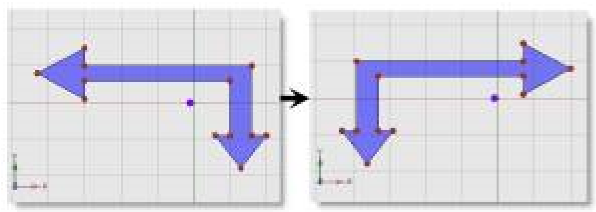
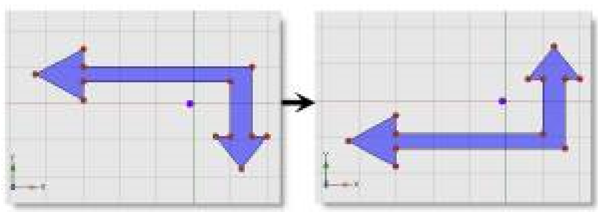
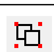
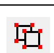
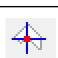
Web toolbar



	**Back**	Navigate back one page in the Web tab in the Model View.
	**Forward**	Navigate forward one page in the Web tab in the Model View.

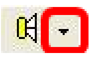
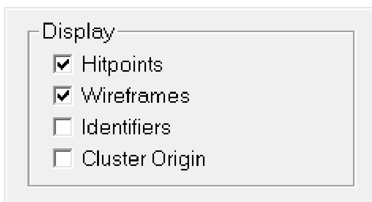
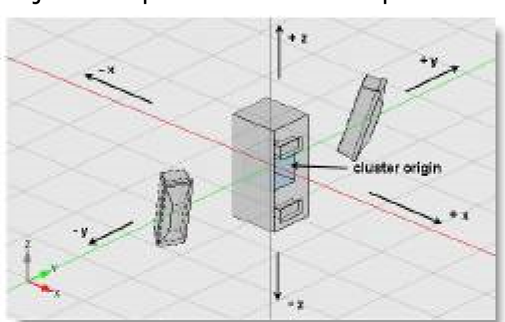
Arrange toolbar

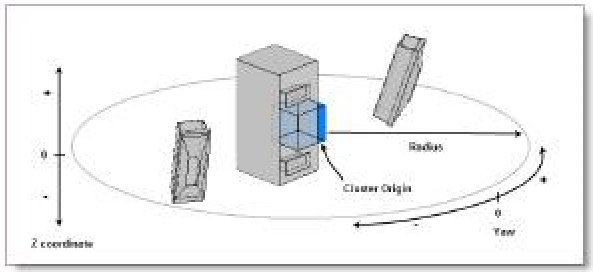
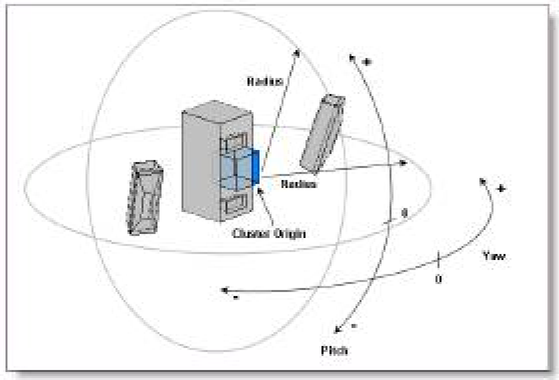


	**Flip Horizontal** (Shft+Ctrl+H)	Click to mirror the selected surface(s) along an axis parallel to the Y axis. 
	**Flip Vertical** (Shft+Ctrl+V)	Click to mirror the selected surface(s) along an axis parallel to the X axis. 
	**Rotate Selection** (F)	Click and drag to rotate the selected surface around its geometric center. The surface will be rotated in the selected constraint plane.
	**Group** (Ctrl+G)	Group the selected objects together. Grouped surfaces will act as one surface when being moved, rotated, flipped or scaled. The individual sections of a Conical, Spherical and Cylindrical surface are grouped by default when they are created. Grouped surfaces have sizing handles which can be used to resize the group in three dimensions. Listeners can be grouped together. Loudspeakers cannot be grouped together.
	**Ungroup** (Ctrl+U)	Ungroup the selected objects that are part of a group. The objects will act independently after being ungrouped.
	**Merge Surfaces**	Merge two surfaces that are co-planar and intersecting
	**Guide Layer**	Displays the Guide Layer Attributes window.

	**Guide Layer Wing Menu**	Select to toggle the Guide Layer on or off.
	**Lock Model** (Shft+Ctrl+L)	Click to lock or unlock the model. When a model is locked (button depressed), the surfaces cannot be moved independently. To move an individual surface, the model must be unlocked. Vertices, listeners and loudspeakers, the camera, and the RT60 source can still be moved when the model is locked.

Cluster toolbar

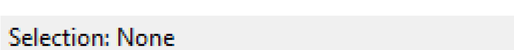
	**PlaceLoudspeaker**	Click in the model to place a loudspeaker in the selected constraint plane. The Place Loudspeaker Wing menu opens.
	**Loudspeaker Wing Menu**	This drop-down menu controls the viewing elements for loudspeakers placed within the room model. Select a box to activate the element.  **Hitpoints** - Shows the "hitpoint wand." **Wireframes** - Shows a wireframe representation of the loudspeaker. **Identifiers** - Shows the Identifier numbers for each loudspeaker. **Cluster Origin** - Shows the origin of loudspeaker clusters.
	**Place Array**	Click in the model to place an array. The **Place Array** dialog box opens. For more information on arrays, see Working_With_Arrays.htm.
	**Place RoomMatch Array**	Click within the model to place an array comprised of Bose RoomMatch loudspeakers. The RoomMatch array properties appears, and the view is automatically configured for split view in the Model View with the Projection View active.
	**Cartesian Coordinates**	This function is only available from within the Cluster View. Adjust the position of a loudspeaker using the Cartesian coordinates system. 
	**Cylindrical Coordinates**	This function is only available from within the Cluster View. Adjust the position of a loudspeaker using the cylindrical coordinates system.

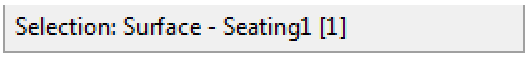
		
	Spherical Coordinates	This function is only available from within the Cluster View. Adjust the position of a loudspeaker using the spherical coordinates system. 
	Create Array	Create an array of the selected loudspeakers. This will allow you to steer and spread the sound pattern of the array.
	Unarray	Separate the selected array into individual loudspeakers. Any settings for steering and spreading will get lost after un-arraying.
	Map Cluster	View the anechoic response of all loudspeakers in the cluster, with the ability to map to a hemisphere, full sphere, or a plane. Automatically set for a radius of 10 meters, hemisphere angular resolution to 10°.

Model View Control Toolbar

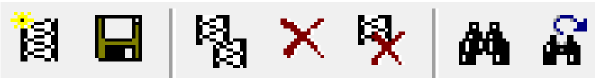
Cluster: 1	**Select Cluster**	Select a cluster in the drop-down to change to cluster view in the Modeling window. Select Roomto return to the full room view. **Note: This is the only way to enter and exit cluster view.**
1-4 kHz	**Select Frequency**	Select a frequency to display within Map views, and within the Time Response Tab within the Detail View.

Selected Item Toolbar



	**Selected Item**	Displays the type and item number of the item currently selected within the room model.

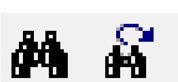
Material Database Viewer Toolbar



	New Material	Creates a new material type entry within the room model's material database. The new material may be named, and the absorption coefficient data may be specified. **Note: This material is saved with the room model file, and not with an absorption database.**
	Save Material	Saves the current room model materials list as a new absorption database. Once saved it will appear in the master Modeler Material Database list.
	Duplicate Material	Adds a duplicate entry for the selected material within the room model material list.
	Delete Material	Removes the selected material file from the room model's material list. **Note: The material is not deleted from the master material database.**
	Delete Unused Materials	Removes unused materials from the room model's material list
	Find Material	Opens the Find dialog box to search for a material file by name.
	Find Next Material	Jumps to the next record that matches the Find... criteria

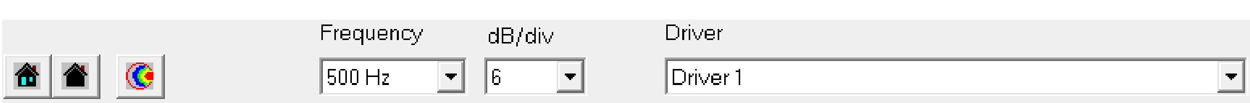
Loudspeaker Database Viewer Toolbar

Main Toolbar



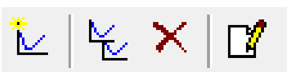
	Find Speaker	Open the Find dialog box to search for a loudspeaker file by name.
	Find Next Speaker	Jump to the next record that matches the Find Loudspeaker criteria.

3D Viewer Toolbar



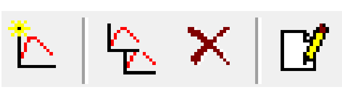
	Home	Displays original view.
or	**Wire or Solid**	Displays radiation pattern without/with color. You can only view one at a time.
Frequency	**Frequency**	Select the frequency for viewing within the 2D and 3D Viewer
dB/div 6	**dB/div**	Change the scale (dB/div) within the 3D Balloon and Isobar displays.
Driver Driver 1	**Driver**	For loudspeakers with multiple drivers, select a driver to display it's 3D Balloon, Isobar, and various specifications.

Background Noise Database Viewer Toolbar



	New Background Noise Curve	Creates a new background noise file. This file is stored with the master background noise database. Once created, the new background noise file may be named and its frequency dependent levels may be adjusted.
	Duplicate Background Noise Curve	Creates a duplicate copy of the selected background noise file. Once duplicated, the new background noise file may be renamed and its frequency dependent levels may be adjusted.
	Delete Background Noise Curve	Removes the selected background noise file from the background noise database.
	Rename Background Noise Curve	Provides a text field from which you may rename the selected background noise file.

House Curve Database Viewer Toolbar



	New House Curve	Creates a new house curve file. This file is stored with the master house curve database. Once created, the new house curve file may be named and its frequency dependent levels may be adjusted.
	Duplicate House Curve	Creates a duplicate copy of the selected house curve file. Once duplicated, the new house curve file may be renamed and its frequency dependent levels may be adjusted.
	Delete House Curve	Removes the selected house curve file from the background noise database.
	Rename House Curve	Provides a text field from which you may rename the selected house curve file.

Print Window Toolbar

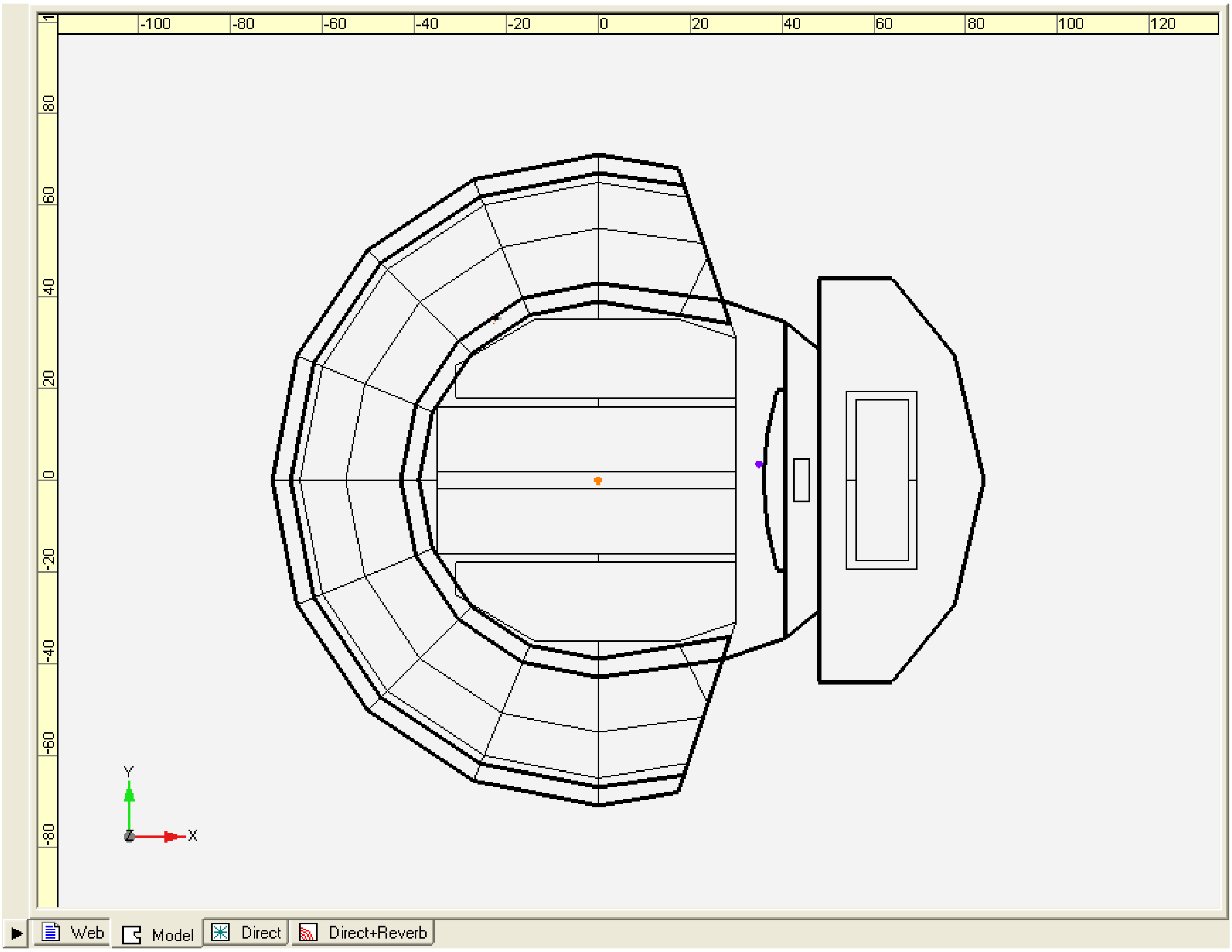
	**Print Setup**	Opens the Print Setup dialog.
	**Print Preview**	Opens the Print Preview window.
	**Print**	Opens the Print dialog.
	**Delete Page**	Removes the selected page from the Print List.
	**Application Preferences**	Opens the Application Preferences dialog from where Print/Copy preferences may be modified.

Window & Right-Click Menus

Modeler Application Interface

Model View Menus

The Model View displays the Web tab, the Model tab and any coverage maps that have been generated. Coverage maps appear as separate display tabs in the Modeling window.



Model View - Model Tab

Model View Display tabs

Display tabs change what is being displayed within the Model View. The following display tabs are available:

Web Tab Links to various information related to Bose Modeler and Bose Professional Systems. You must be connected to the internet for these links to be active.

Model Tab View and create a model.

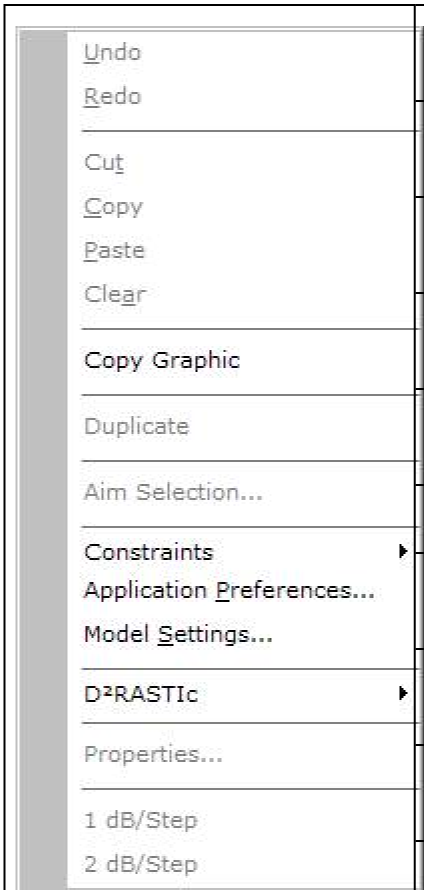
Direct Field Tab View the Direct Field coverage map.

Direct+Reverberant Field Tab View the Direct+Reverberant Field coverage map.

Speech Tab View the Speech Intelligibility coverage map

Model View Right-Click Menu

Right-click anywhere within the Model View to display its right-click menu:

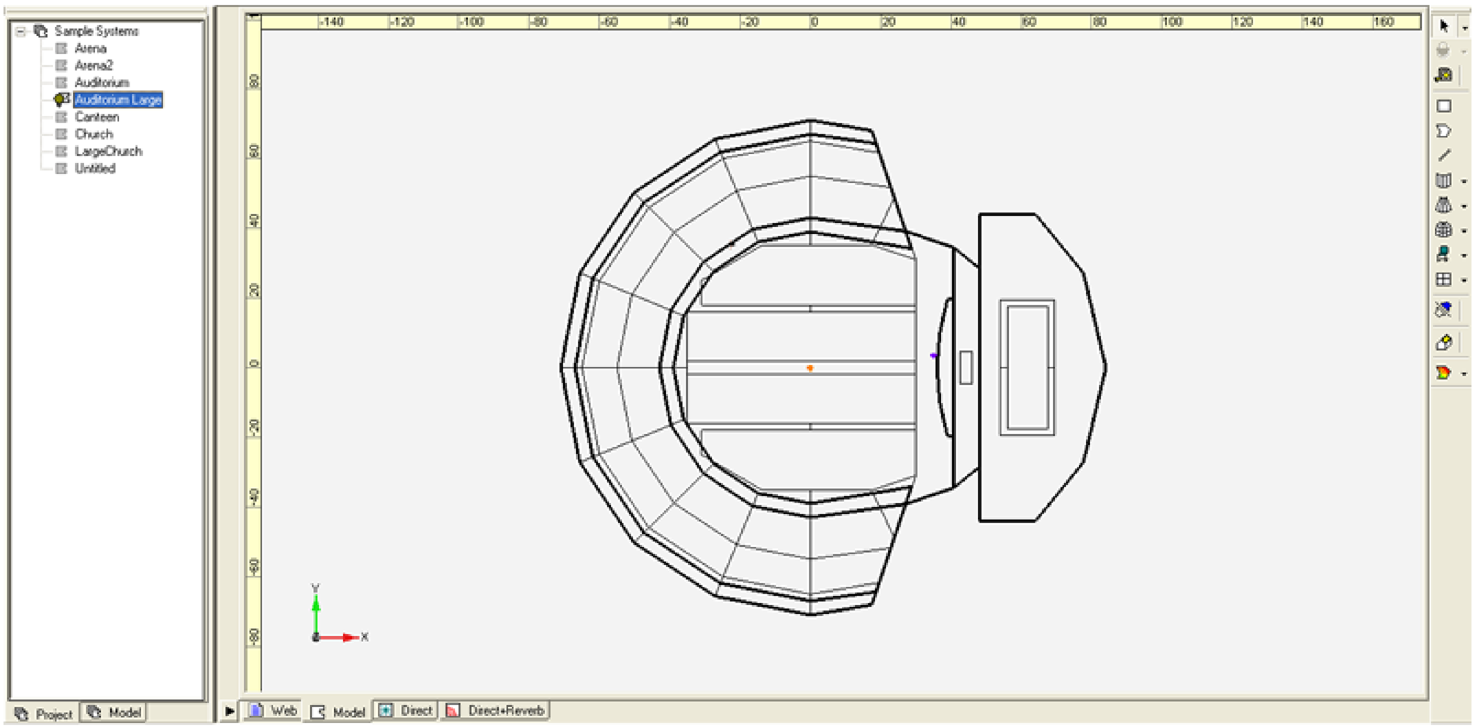


Undo	Reverses your last action or multiple actions up to the point at which the model was opened.
Redo	Re-applies your last action (after undo) or multiple undo actions up to the most recent action.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids
Paste	Pastes the contents of the clipboard (standard Windows editing function).
Clear	Deletes the selected item.
Copy Graphic	Copies the current image within the Model View to the clip-board for use in another application.
Duplicate	Copies and pastes the selected item to create a duplicate of it.
Aim Selec-tion...	Open the **Aim Selection** dialog box to stack and/or aim multiple loudspeakers.
Constraints	Expands to display the available constraint plane options. Select a constraint plane.
Application Prefer-ences...	Opens the **Application Preferences** dialog box.
Model Set-tings...	Opens the **Model Settings** dialog box.
D^{2}RΔSTIc	Expands to display a list of the D^{2}RΔSTIc step calculations. When an item within the list is selected the selected coverage map is automatically calculated using predefined default settings. Selections include calculate the Direct Field coverage map for the 1 - 4 kHz frequency range, calculate the Direct plus Reverberant Field coverage map for the 31 Hz - 16 kHz fre-quency range, calculate time-arrivals at 2 kHz, and cal-culate the Speech Transmission Index (STI) coverage map. The D^{2}RΔSTIc Engine must be enabled to generate these coverage maps. For more information, see the DRASTIc_Design_Pro-cess.htm.
Properties...	Display the Properties window for the object currently selected within the Model View.
1 dB/Step	Applies a 1 dB per step resolution to the current coverage

		map.
	2 dB/Step	Applies a 2 dB per step resolution to the current coverage map.

Project View Menus

The Project View displays the Project tab and the Model tab, each of which changes what is displayed within the Project View. Each tab displays a navigable tree view of the project and model structure.



Project View

Project Tab

The Project Tab displays a project in a hierarchical format, allowing you to see all models contained within the project. The appearance of the model icon in the Project tab corresponds to the state of the model:

 Model closed.

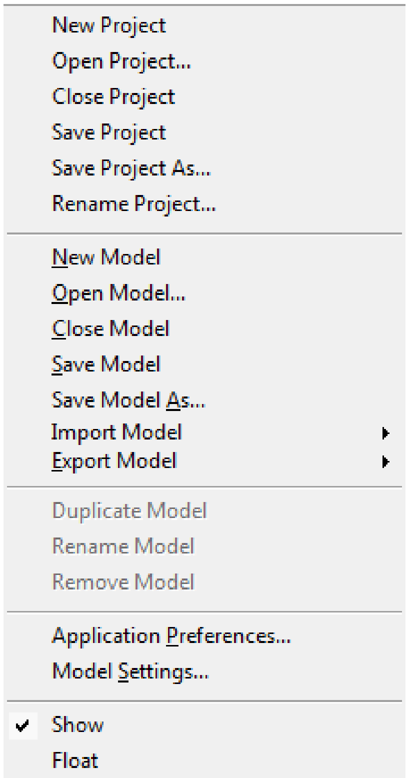
 Model open, D²RΔSTIc Engine off.

 Model open, D²RΔSTIc Engine on.

To open a model, double-click on the model icon in the Project tab. The model opens in the Model View.

Project Tab Right-Click Menu

Right-click anywhere within the Project tab of the Project View to display its right-click menu. The right-click menu contains the following options:

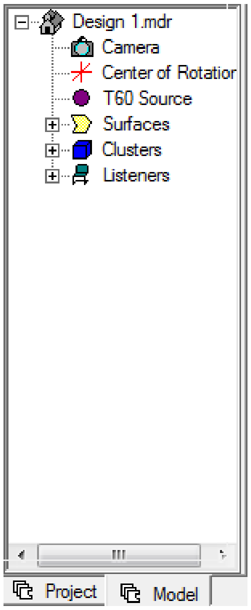


New Project...	Creates a new project file (.pjt) and project folder and specifies its location on the hard drive. You will be prompted to create a new model, add an existing model, or import a model into the project. If a project is currently open, you will be prompted to close it before creating a new project.
Open Project...	Opens an existing project by locating it on the hard drive and choosing the .pjt file. If a project is currently open, you will be prompted to close it before opening a new project.
Close Project	Closes the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project	Saves changes to the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project As...	Creates a copy of the project and saves it with a different name. All models within the project will be copied. The new saved project will remain open and the original project will be closed.
Rename Project...	changes the name of the project, but does not affect project file contents.
New Model	Creates a new model. You will be prompted to name the new model. If a project is not open, a new model will be created without being added to a project. This model is named “Untitled” by default and can be renamed at any time by choosing Save Model.
Open Model...	Adds an existing model to the project. A copy of the model will be added to the project folder.
Close Model	Closes the model.
Save Model	Saves changes to the selected model.
Save Model As...	Creates a copy of the model and saves it with a different name. Use this option to save a version of the model you are currently working on. The new saved model remains open and active, and is added to the project. The original model is closed and remains in the state that it was last saved. If no project is open, you will be prompted to choose a location in which to save the model.
Import Model	Imports a model that was not created in Bose Modeler software. The model will be added to the currently open project file. Choose to import a Macintosh Modeler software file (.mac), a Modeler Transfer File (.mtf), an EASE faces file (.xfc), an EASE project file (.ppj) or an AutoCAD drawing file (.dxf). Note that the file must have the appropriate file extension (.mac, .mtf,.xfc, .ppj, .dxf) to be imported into Bose Modeler software. If a project is not open, the model will be imported without being added to any project.
Export Model	Exports loudspeaker data to a text (.txt) file with tab delimited data for all loudspeakers in the room model. Data includes loudspeaker properties and equalization

		data for each device. Export a Modeler Transfer File (.mtf) which contains all the room model data in a proprietary text format for use in other modeling applications.
	Duplicate Model	Duplicates the selected model in the project. To select which model to duplicate, click on the model name in the Project window. You will be prompted to name the duplicate model. Modeler software will copy the model and add it to the “parent” project. This option exists only when the model is associated with a project.
	Rename Model	Renames the selected model in the project. This option exists only when the model is associated with a project.
	Remove Model	Removes the selected model from the project. You will be prompted to remove the model from the disk. Choose Yes to delete the model from your hard drive. Choose No to remove the model from the project but not from the hard drive. It is saved in the project folder and can be added back to the project or to another project at a later time.
	Application Preferences...	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Project View. Select this item to toggle the Project view on and off.
	Float	Select this item to undock the Project View from the main application interface.

Model Tab

The Model Tab displays the active room model in a hierarchical format, allowing you to see and navigate all model components.



Elements within the room model are grouped by category. To see individual elements you must expand that section of the tree view. The appearance of each icon within the Model tab indicates its visibility state within the model.

 Model element visibility set to OFF.

 Model element visibility set to ON.

The following room model elements are visible within the Model tab:

Camera– Selects the Camera within the Model Window. When the camera visibility is set to OFF in Room Model Preferences the camera may not be selected.

Center of Rotation– Selects the Center of Rotation object within the Model Window. When the Center of Rotation Object visibility is set to OFF in Room Model Preferences objects the center of rotation may not be selected.

T60 Source– Selects the Reverberation Time (RT) Source within the Model Window. When the RT Source visibility is set to OFF in Room Model Preferences objects within the RT Source may not be selected.

Surfaces– When expanded this item displays all surfaces within the room model. Selecting a surface in the list selects the object within the Model window. When the visibility for a specific surface type is set to OFF in Room Model Preferences surfaces of this type are shown, but may not be selected.

Clusters– When expanded this item displays a list of all clusters contained within the room model. Selecting a cluster selects the cluster within the Model window. When the Cluster visibility is set to OFF in Room Model Preferences objects within this group are shown, but may not be selected.

Listeners– When expanded this item displays a list of all listeners included in the room model. Selecting a listener within the tree view highlights it within the room model. The selection of a listener also causes the Time Response, Frequency Response and MTF Tabs to display data specific to the selected listener position. When the Listeners visibility is set to OFF in Room Model Preferences objects within this group are shown, but may not be selected.

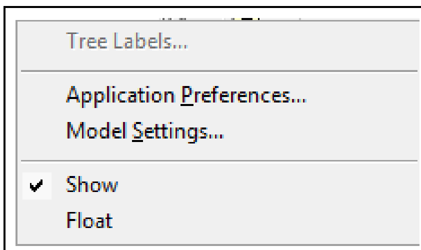
Doors/Windows– When expanded this item displays a list of all doors, windows and panels contained within the room model. Selecting an object in the list selects the object within the Model window. When the Doors/Windows visibility is set to OFF in Room Model Preferences objects within this group are shown, but may not be selected.

Custom Areas– When expanded this item displays a list of all custom mapping areas included in the room model. Selecting a mapping area within the tree view highlights it within the room model. The selection of a mapping area also causes the Statistics and System SPL tab to display data specific to the selected mapping area. When the Mapping Area’s visibility is set to OFF in Room Model Preferences, custom areas are shown. They may not be selected, but they will drive Properties.

Note: The Custom Areas element is only available if at least one Custom Area is included in the model.

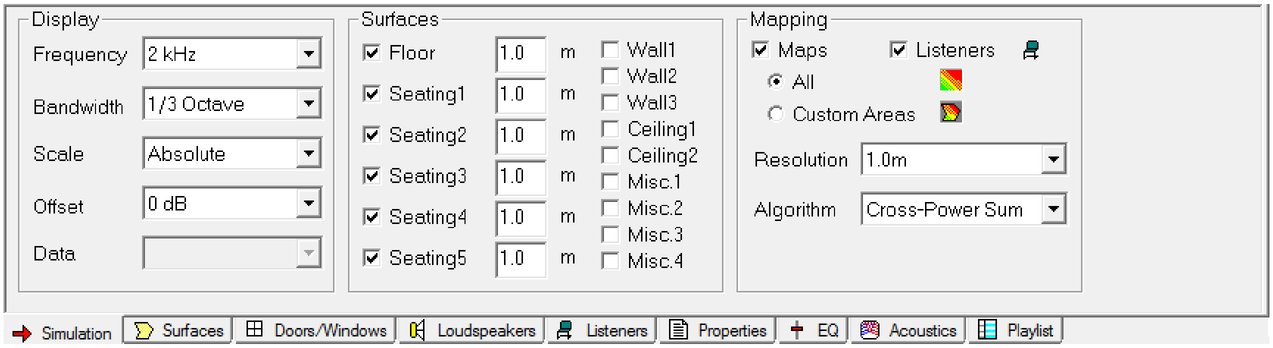
Model Tab Right Click Menu

Right-click anywhere within the Model tab of the Project View to display its right-click menu. The right-click menu contains the following options:

	**Tree Labels...**	Displays the Tree Label window. From within the Tree Label window you may select what label attributes are displayed within the Model tab.
	Application Preferences...	Opens the **Application Preferences** dialog box.
	Model Set-tings...	Opens the **Model Settings** dialog box.
	Show	Display the Project View. Select this item to toggle the Project view on and off.
	Float	Select this item to undock the Project view from the main application interface.

Detail View Menus

The Detail View displays the Simulation tab, Acoustics Tab, Properties tab Equalization tab, and tabs which contain list views of various model components.



Display Tabs change what is being displayed within the Detail View. The following display tabs are available:

Simulation Tabcontains the mapping calculation parameters.

Surfaces Tab contains a table view of all room model surfaces.

Doors/Windows Tab contains a table view of all doors, windows and panels within the model.

Loudspeakers Tab contains a table view of all loudspeakers and arrays within the model.

Listeners Tab contains a table view of all listeners within the model.

Properties Tab displays the properties of the object selected within the model view.

EQ Tab displays the equalization and gain settings for the selected loudspeakers.

Acoustics Tab displays the basic acoustic properties used in calculations for the model.

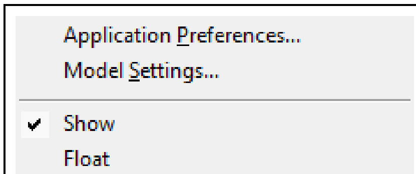
Playlist Tab displays the listener positions and playlists for the Auditioner simulation. This tab is only available within Modeler Plus software, when a project file is open.

Detail View Right-Click Menus

Right-click anywhere within the Detail View to display its right-click menu. The right-click menu options vary based on the tab being displayed.

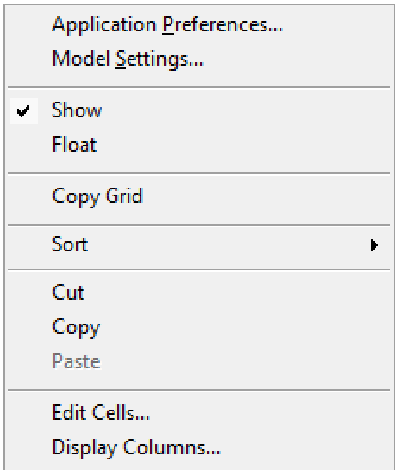
Simulation Tab Right-Click Menu

Right-click anywhere within the Simulation tab of the Detail View to display its right-click menu. The right-click menu contains the following options:

	**Application Preferences...**	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.

Surfaces Tab Right-Click Menu

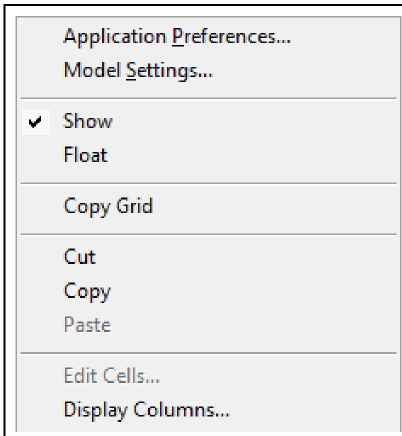
Right-click anywhere within the Surfaces tab of the Detail View to display its right-click menu. The right-click menu contains the following options:



Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail View on and off.
Float	Select this item to undock the Detail View from the main application interface.
Copy Grid	Copy the data in the Surfaces tab to paste into another application.
Sort	Expands to display a list of all surface properties. Select an item in the list to sort by the selected item. Available selections are Number, Description, Material, Type, Audience, or Reflection.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids
Paste	Pastes the contents of the clipboard (standard Windows editing function).
Edit Cells...	Displays the Edit Cells dialog. Modify the selected property for the selected surface. Hold down Ctrl to select multiple separate items, or Shift to select a range of items.
Display Columns...	Opens the Column Display dialog box. Choose which columns are displayed in the Surfaces tab.

Doors/Windows Tab Right-Click Menu

Right-click anywhere within the Doors/Windows tab of the Detail View to display its right-click menu. The right-click menu contains the following options:

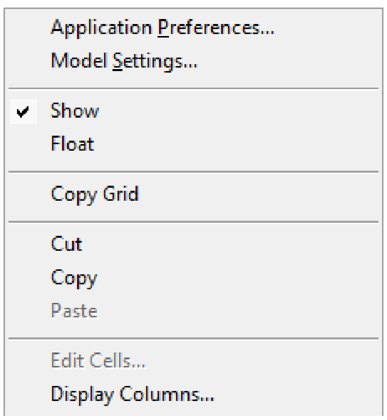


Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail view on and off.
Float	Select this item to undock the Detail view from the main application interface.
Copy Grid	Copy the data in the Doors/Windows tab to paste into another application.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy

		graphics, graphs or grids
	Paste	Pastes the contents of the clipboard (standard Windows editing function).
	Edit Cells...	Displays the Edit Cells dialog. Modify the selected property for the selected fenestration. Hold down Ctrl to select multiple separate items, or Shift to select a range of items.
	Display Columns...	Opens the Column Display dialog box. Choose which columns are displayed in the Doors/Windows tab.

Loudspeakers Tab Right-Click Menu

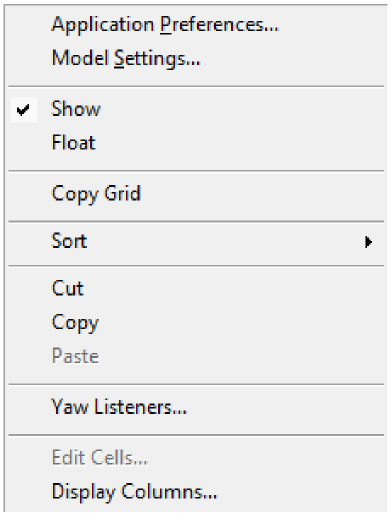
Right-click anywhere within the Loudspeakers tab of the Detail View to display its right-click menu. The right-click menu contains the following options:



Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail View on and off.
Float	Select this item to undock the Detail View from the main application interface.
Copy Grid	Copy the data in the Loudspeakers tab to paste into another application.
Sort	Expands to display a list of all loudspeaker properties. Select an item in the list to sort by the selected item. Available selections are Number, Cluster, Zone, Tier, Index, Description, Speaker or Status.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids
Paste	Pastes the contents of the clipboard (standard Windows editing function).
Edit Cells...	Displays the Edit Cells dialog. Modify the selected property for the selected loudspeaker. Hold down Ctrl to select multiple separate items, or Shift to select a range of items.
Display Columns...	Opens the Column Display dialog box. Choose which columns are displayed in the Loudspeakers tab.

Listeners Tab Right-Click Menu

Right-click anywhere within the Listeners tab of the Detail View to display its right-click menu. The right-click menu contains the following options:

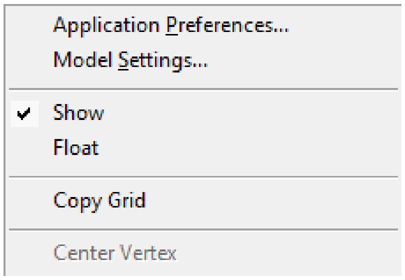


Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail View on and off.
Float	Select this item to undock the Detail View from the main application interface.
Copy Grid	Copy the data in the Listeners tab to paste into another application.
Sort	Expands to display a list of all Listener properties. Select an item in the list to sort by the selected item. Available selections are Number, Ident. or Notes.
Cut	Deletes the selected item and copies it to the clipboard (standard Windows editing function).
Copy	Copies the item to the clipboard (standard Windows editing function). Not used to copy graphics, graphs or grids
Paste	Pastes the contents of the clipboard (standard Windows editing function).
Yaw Listeners...	Displays the Yaw Listeners dialog. Will automatically yaw all selected listeners at a specific cluster within the room model. Select the cluster for listeners to face within the model within the Yaw Listeners dialog.
Edit Cells...	Displays the Edit Cells dialog. Modify the selected property for the selected surface. Hold down Ctrl to select multiple separate items, or Shift to select a range of items.
Display Columns...	Opens the Column Display dialog box. Choose which columns are displayed in the Listeners tab.

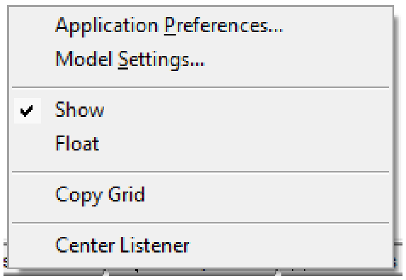
Properties Tab Right-Click Menu

Right-click anywhere within the Properties tab of the Detail View to display its right-click menu. The right-click menu contains the following options based on the item selected:

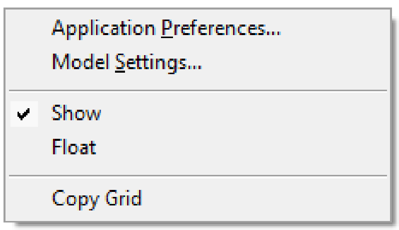
If a **Surface** is selected:	**Application Preferences...**	Opens the **Application Preferences** dialog box.



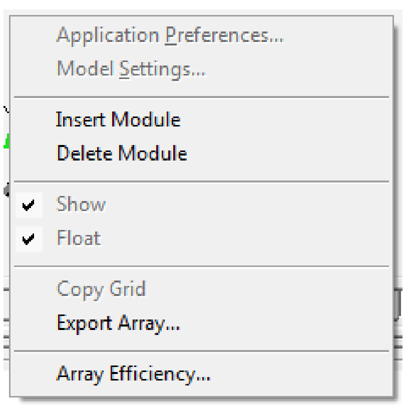
If a **Listener** is selected:



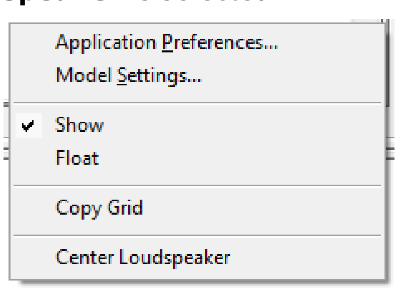
If **Center of Rotation, Custom Area, Door/Window, Grid and Ring Array, or RT60** is selected:



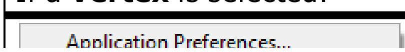
If a **RoomMatch Array** is selected:



If a **non-RoomMatch Loudspeaker** is selected:



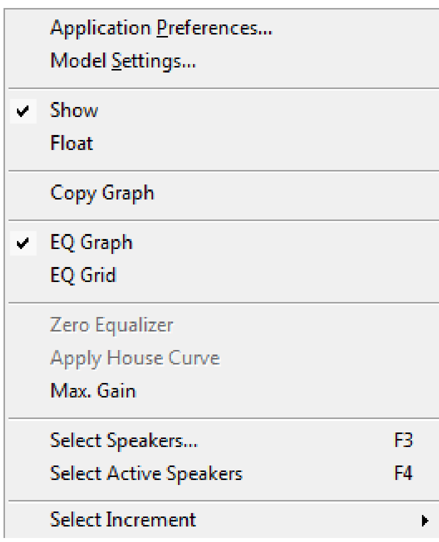
If a **Vertex** is selected:



	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Grid	Copies the current properties for use in another application.
	Export Array	Exports the array to a specified location.
	Center <ref>	Uses the selected item as a reference point to shift the room model such that this point becomes the origin of the model.

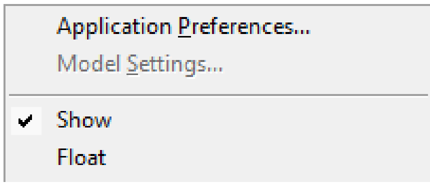
Equalization (EQ) Tab Right-Click Menu

Right-click anywhere within the Equalization tab of the Detail View to display its right-click menu. The right-click menu contains the following options:

	**Application Preferences...**	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Graph	Copies the contents of the Equalization tab to the clipboard for use in another application.
	EQ Graph	Select this item to display the EQ settings for the system in a graph format. This is the default view.
	EQ Grid	Select this item to display the EQ settings in a table format.
	Zero Equalizer	Clears all equalization settings for the selected loudspeakers.
	Apply House Curve	Applies the current house curve to the selected loudspeakers.
	Max Gain	Applies maximum gain to the system. The gain of all system devices is increased until the first device reaches its maximum.
	Select Speakers...	Open the Select Speakers dialog box to choose a loudspeaker or loudspeakers by Cluster, Zone, Tier and Index. The EQ curve is displayed for the selected loudspeaker or loudspeakers
	Select Active Speakers...	Automatically select all loudspeakers that have a Status of “On”.
	Select Increment	Expands to display a list of available increment selections. Specify the increment by which the EQ curve sliders can be moved, in dB.

Acoustics Tab Right-Click Menu

Right-click anywhere within the Acoustics tab of the Detail View to display its right-click menu. The right-click menu contains the following options:

	**Application Preferences...**	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail view on and off.
	Float	Select this item to undock the Detail View from the main application interface.

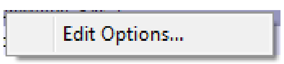
Playlist Tab Right-Click Menu

The **Playlist** tab is only available in the Modeler Plus software when a Project file is open.

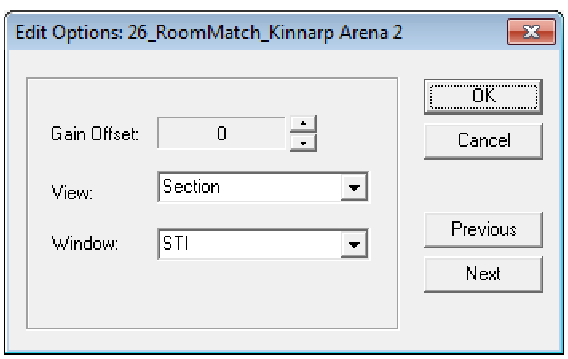
- Right-clicking over the **Sets** area presents:

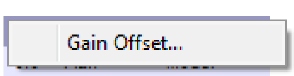
  Selecting **New Set** adds an **Untitled** Playlist set that can be renamed.
- Right-clicking over any **Model** name presents:

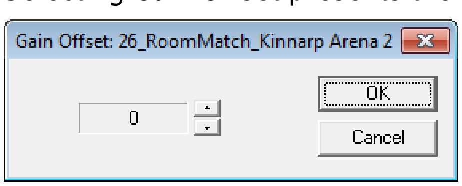
- Selecting **Edit Options** presents the following dialog:

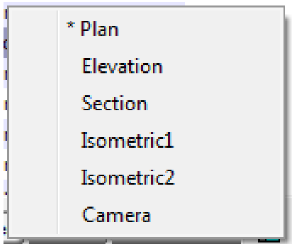
- Right-clicking over any **Gain Offset** value presents:

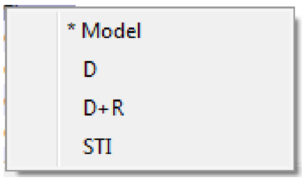
  Selecting Gain Offset presents the following dialog:

- Right-clicking over any **View** value presents:



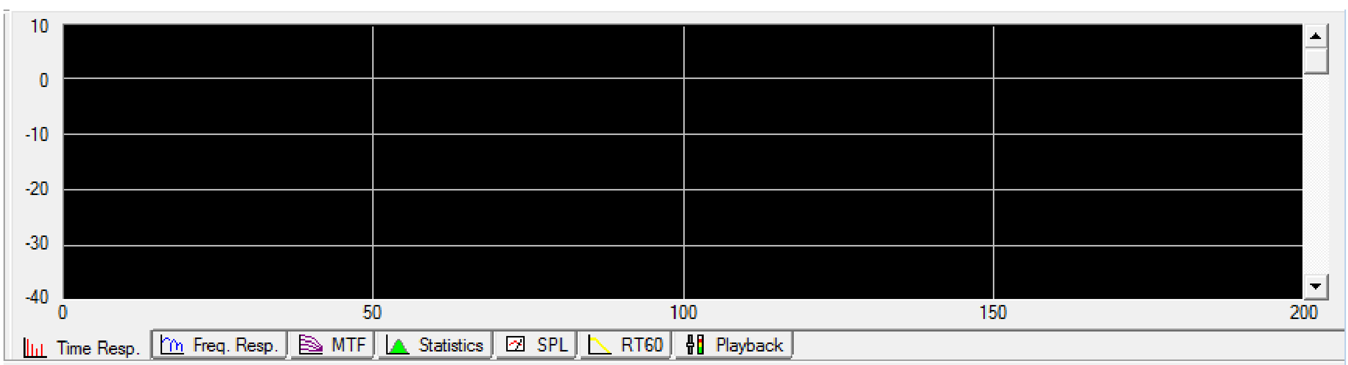
- Right-clicking over any **Window** value presents:



As the active listener is changed during Auditioner playback, the selected window value for that listener will appear to help with presentations to potential customers.

Data View Menus

The Data View displays tabs that provide statistical information on the quality of the coverage map, or predicted performance data for a listener or sample position within the model.



Display tabs change what is being displayed within the Data View. The following Display tabs are available:

Time Response tab displays direct, reflected, and reverberant arrivals at the selected listener position or sample.

Frequency Response tab displays the frequency response at the selected listener position.

MTF tab displays the modulation transfer function for the STI calculation at the selected listener position or sample.

Statistics tab displays coverage map data using either a probability or cumulative distribution function.

SPL tab displays the average frequency response for the mapped area and/or all listeners.

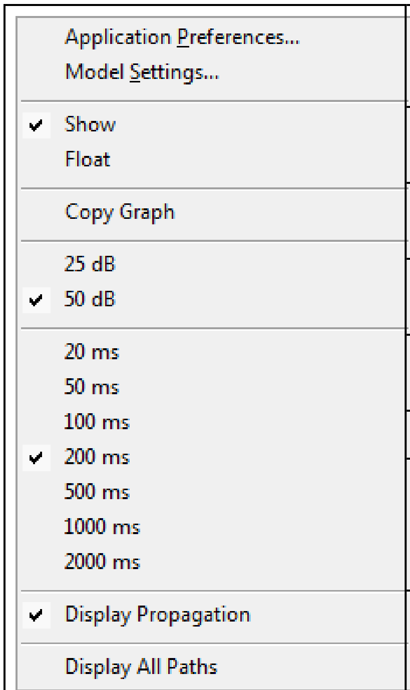
RT60 tab displays the third-octave-band reverberation times for the room model.

Data View Right-Click Menus

Right-click anywhere within the Data View to display its right-click menu. The right-click menu options vary based on the tab being displayed.

Time Response Tab Right-Click Menu

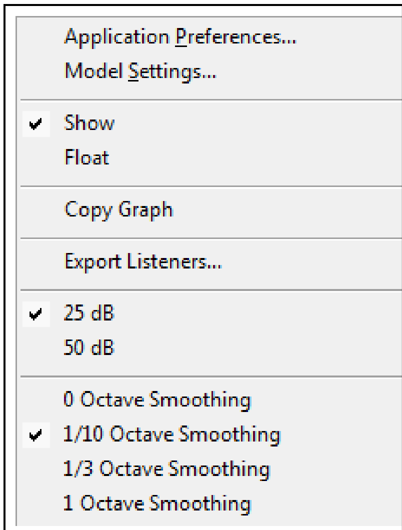
Right-click anywhere within the Time Resp. tab of the Detail View to display its right-click menu. The right-click menu contains the following options:



	Application Preferences...	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Graph	Copy the figure in the Time Response tab to paste into another application.
	25, 50 dB	Sets the vertical scale of the graph to the selected range.
	20, 50, 100, 200, 500, 1000, 2000 ms	When selected, the horizontal scale is set to this time range, in milliseconds.
	Display Propagation	When selected, the graph will include the time between when the sound is first created to the first direct arrival at the Sample tool, or the "propagation" time. When unchecked, the graph will exclude propagation time, and will set 0 ms to the arrival of the first direct sound to reach this listener position or sample.
	Display All Paths	Only available when Full STI is calculated. Displays all of the direct and reflected paths between the active loudspeakers and the selected listener position or sample.

Frequency Response Tab Right-Click Menu

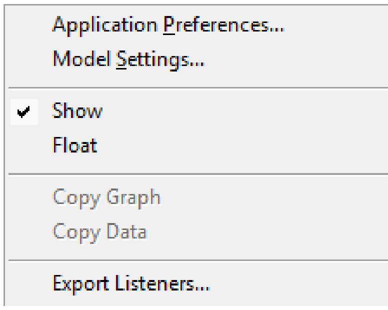
Right-click anywhere within the Freq. Resp. tab of the Data View to display its right-click menu. The right-click menu contains the following options:



	Application Preferences...	Opens the **Application Preferences** dialog box.
	Model Settings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Graph	Copy the figure in the Frequency Response tab to paste into another application.
	Export Listeners...	Exports frequency response data for all listener positions within the room model. Data is exported in a .txt format using 1/3 Octave-band smoothing.
	25, 50 dB	Sets the vertical scale of the graph to the selected range.
	Smoothing	Select the desired smoothing function to apply to the Frequency Response data. A smoothing function is applied to the frequency response curve at the selected bandwidth. Wider bandwidths result in more smoothing. Select 0 Octave to turn smoothing off.

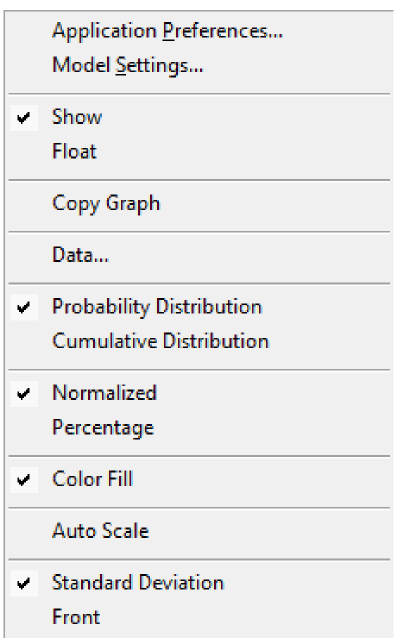
MTF Tab Right-Click Menu

Right-click anywhere within the MTF tab of the Data View to display its right-click menu. The right-click menu contains the following options:

	**Application Prefer-ences...**	Opens the **Application Preferences** dialog box.
	Model Set-tings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Graph	Copy the data in the Frequency Response tab to paste into another application.
	Copy Data	Copy the data in the **MTF** tab to paste as a table into another application.
	Export Listen-ers...	Exports STI and MTF data together with noise and speech levels for all listener positions within the room model. Data is exported in a .txt format.

Statistics Tab Right-Click Menu

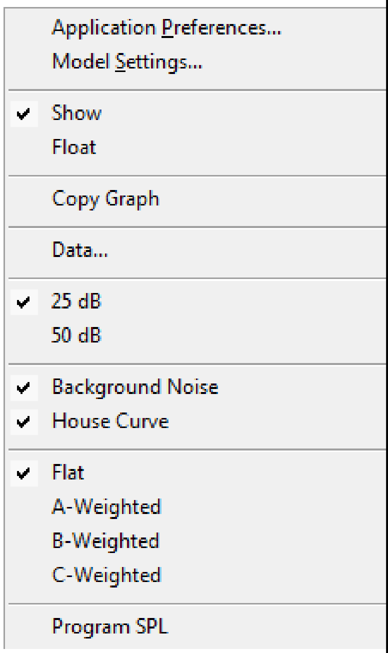
Right-click anywhere within the Statistics tab of the Data View to display its right-click menu. The right-click menu contains the following options:

	**Application Preferences...**	Opens the **Application Preferences** dialog box.
	Model Set-tings...	Opens the **Model Settings** dialog box.
	Show	Display the Detail View. Select this item to toggle the Detail View on and off.
	Float	Select this item to undock the Detail View from the main application interface.
	Copy Graph	Copy the figure in the Statistics tab to paste into another application.
	Data...	Displays the bin data for the histogram (Probability Dis-tribution). Data may be copied for use in another applic-ation.
	Probability Distribution	When selected, displays the probability distribution for the current coverage map.
	Cumulative Distribution	When selected, displays the cumulative distribution for the current coverage map.
	Normalized	Normalizes the vertical axis to the maximum value for the data being graphed.
	Percentage	Modifies the scale of the vertical axis to represent a per-centage of occurrence.
	Color Fill	Enables/disables the color fill option of the histogram.
	Auto Scale	When selected the horizontal axis is automatically

		scaled to only show values that are present within the coverage map. When this option is turned off the scale represents the full value range for the mapped option.
	Standard Deviation	Enables/disables the display of the Standard Deviation within the Statistics Tab
	Front	When selected places the standard deviation in front of the histogram.

SPL Tab Right-Click Menu

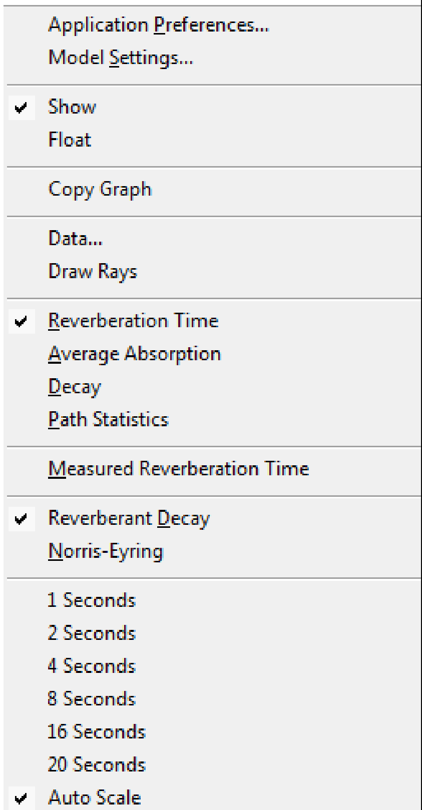
Right-click anywhere within the SPL tab of the Data View to display its right-click menu. The right-click menu contains the following options:



Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail View on and off.
Float	Select this item to undock the Detail View from the main application interface.
Copy Graph	Copy the figure in the System SPL tab to paste into another application.
25, 50 dB	Sets the vertical scale of the graph to the selected range.
Background Noise	When selected the current background noise setting is graphed within the SPL tab.
House Curve	When selected the current House Curve setting is graphed within the SPL tab.
Weighting Function: Flat, A-Weighted, B-Weighted or C-Weighted	Apply an A, B or C weighting function to the SPL data. Choose Flat to remove any weighting. Weighting is only applied to the level readout in the status bar, not to the graph.
Program SPL	Displays the maximum system SPL that can be achieved with the frequency spectrum of typical program material.

RT60 Tab Right-Click Menu

Right-click anywhere within the RT60 tab of the Data View to display its right-click menu. The right-click menu contains the following options:



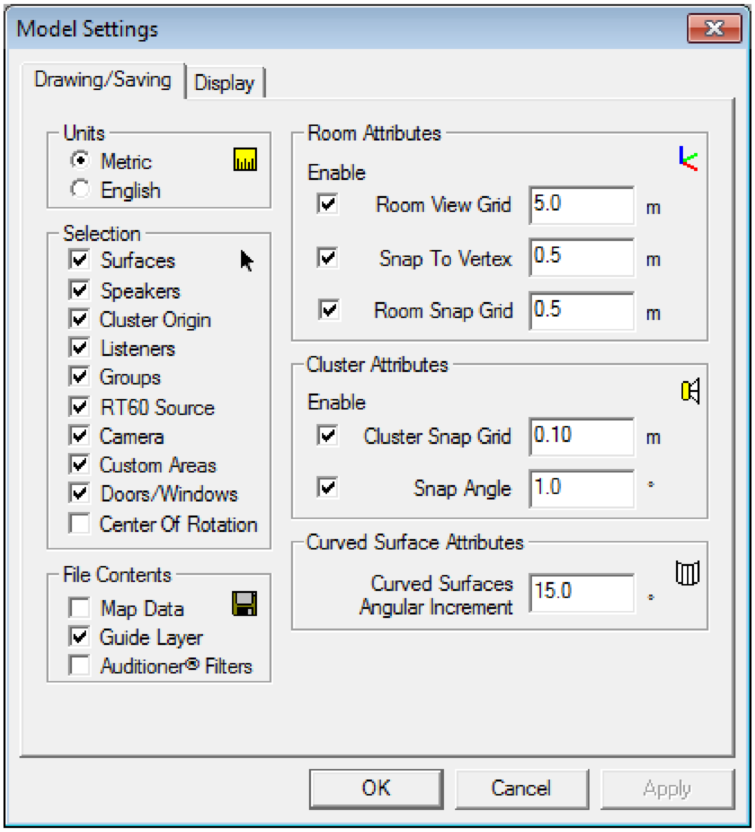
Application Prefer-ences...	Opens the **Application Preferences** dialog box.
Model Set-tings...	Opens the **Model Settings** dialog box.
Show	Display the Detail View. Select this item to toggle the Detail View on and off.
Float	Select this item to undock the Detail View from the main application interface.
Copy Graph	Copy the figure in the RT60 tab to paste into another application.
Data...	Displays the data for each 1/3 or 1/1 octave-band. Data may be copied for use in another application.
Draw Rays	Shows the ray distribution and propagation used in the RT60 calculation.
Rever-beration Time	When selected graphs the 1/3 octave-band reverberation times.
Average Absorption	When selected graphs the average absorption of the room model for each 1/3 octave-band.
Decay	Graphs the reverberant decay for a single 1/3 or 1/1 octave-band. Not available if Norris-Eyring is selected.
Path Stat-istics	Shows the normalized histogram of free path lengths (dis-tance traveled between two subsequent surface bounces) from the RT60 algorithm.
Measured Rever-beration Time	Shows the actual reverberation time measured in the room (entered in the RT60 section of the Acoustics tab).
Reverberant Decay	Calculate RT60 using Modeler's proprietary ray tracing method.
Norris Eyring	Calculate the RT60 using the Norris-Eyring method.
1-20 seconds, Auto Scale	Set the scale of the vertical axis to display the selected range. **Auto Scale** will automatically select the best scale to fit the RT60 curve in the window.

Model Settings

The Model Settings dialog contains the settings which define the display of objects and drawing preferences for the room model. Model Settings are accessed from the Edit menu by selecting Edit > Model Settings, or from any of the right-click menus within the application interface.

Drawing/Saving Tab

The Drawing/Saving tab contains those settings which define how room objects are drawn, the drawing scale, object selection preferences, and the preferences for saving predicted data with the model. Options within tab include:



Units determines the drawing units that will be used for the room model. Available selections are:

Metric – Display all units of measure using the Metric system.

English – Display all units of measure using the English system.

Selection place a check next to the items that will be selectable within the room model. Remove a check to make objects of that type not selectable within the room model.

File Contents select the items that will be saved as part of the room model file. Note that including additional items increases the room model's file size. Available selections are:

Map Data – When checked, coverage map data that has been generated is saved with the model file. When unchecked, the coverage map/s must be regenerated when you open the model. When only listener location data (no coverage maps) are generated, this data is saved with the model file. When saving map data with the model file, turn off the D^{2}RΔSTIc engine before saving to prevent Modeler software from recalculating the coverage maps when you open the file.

Guide Layer – Includes the 2D DXF guide layer in the room model file.

Auditioner® Filters – Stores the calculated Auditioner Filters for each listener position of the room model.

Note: This item is only available in the Modeler Plus software.

Room Attributes select the drawing aids that will be enabled within the Model View, and define their default settings. Available drawing aids are:

Room View Grid – The Room View Grid is displayed as a visual aid in the Modeling window. The grid is set to 5 m by default, but can be changed to show a another distance.

Enable: Place a checkmark to turn on the Room View Grid.

Distance: Enter the desired distance of the grid.

Snap to Vertex – When enabled, the Snap To Vertex feature causes the cursor or an object to snap to a vertex. The proximity limit is set to 0.5m by default, but can be changed to another value.

Enable: Place a checkmark to turn on Snap to Vertex.

Distance: Enter the desired proximity.

Room Snap Grid – When enabled, the Room Snap Grid feature causes the cursor or an object to snap to the specified subdivision of the grid. This applies to drawing and moving surfaces, placing and moving listeners and loudspeakers, moving the Camera and moving the RT_{60} source.

Enable: Place a checkmark to turn on the Room Snap Grid feature.

Distance: Enter the desired subdivision that the cursor, or objects will snap to.

Cluster Attributes select the drawing aids that will be enabled within the Cluster view, and define their default settings. Available cluster view drawing aids are:

Cluster Snap Grid – The Cluster Snap Grid feature applies when moving loudspeakers in Cluster View. A loudspeaker or loudspeakers will snap to the specified subdivision when the feature is enabled.

Enable: Place a checkmark to turn on the Cluster Snap Grid.

Angle Distance: Enter the desired subdivision that a loudspeaker will snap to.

Snap Angle – The Snap Angle features allows you to specify an angular increment for drawing and moving surfaces. When drawing a curved surface with Snap Angle enabled, the cursor will snap to the angular increment that you specify. When rotating a surface using the Rotate Selection tool, the surface will snap to the angular increment that you specify.

Enable: Place a checkmark to turn on the Snap Angle feature.

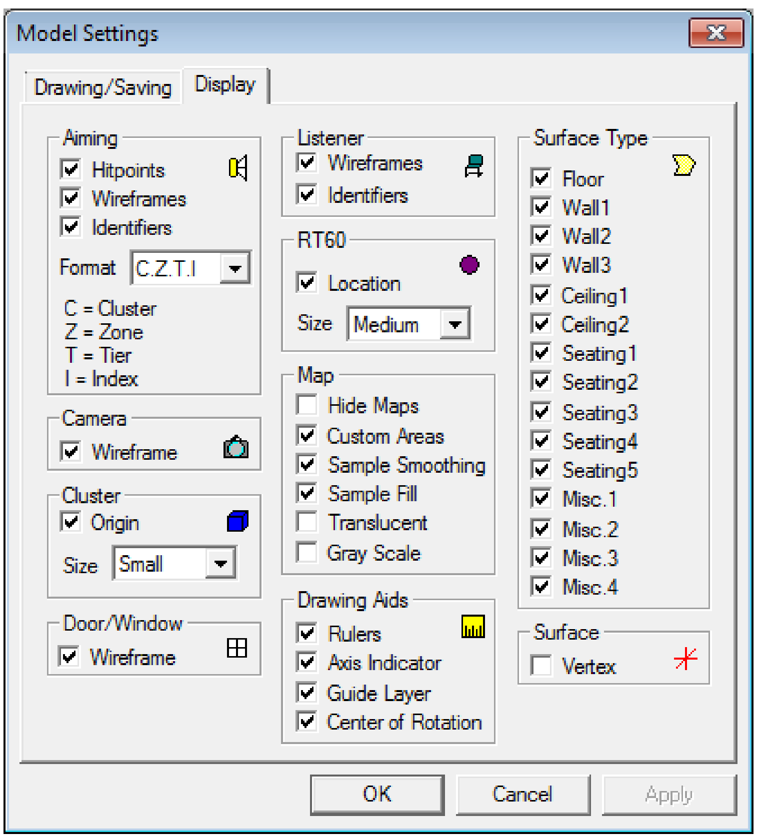
Angle: Enter an angular increment in degrees.

Curved Surface Attributes Curved surfaces in Modeler software are approximated as numerous flat surfaces joined together to form a curve:

Curved Surface Angular Increment – Used to draw the curve. At each angular increment, a new surface is created, so the angular increment dictates how many flat surfaces are used to simulate the curved surface. As the value of the angular increment gets smaller, more surfaces are used to simulate the curve, and the smoother the curve appears. It is recommended that you use the highest angular increment that will accurately represent the room construction. Using small angular increments will result in a very high number of surfaces in the model, which will add complexity and increase calculation times.

Display Tab

The Display tab contains those settings which define how room model objects are displayed within the Model View. Options within tab include:



Aiming defines the display settings related to loudspeakers, and arrays. The following options are available:

Hitpoints – Show or hide the "hitpoint wand", which is the red line (or purple when selected) indicating the location at which the loudspeaker is aimed. Click and drag the sphere at the end of the wand to aim a loudspeaker in your model.

Wireframes – Show or hide the wireframe representation of the loudspeakers in your model.

Identifiers – Show or hide the identifier numbers displayed at each loudspeaker in your model.

Format – Select the format of the identifier from a range of different combinations of the following numbers, for Cluster, Zone, Tier, and Index, separated by a period.

Camera defines the display settings related to camera location used to generate perspective views of the model's interior. The following options are available:

Wireframe – Show or hide the wireframe that represents the camera in the Model View.

Cluster defines the display settings related to display of loudspeaker clusters within the model. The following options are available:

Origin – Show or hide the cluster origin.

Size – Choose the display size of cluster origin from the drop-down list.

Door/Window defines the display settings related to display of doors, windows and acoustic panels within the model. The following options are available:

Wireframe – Show or hide the wireframe that represents the door, window or panel in the Model View.

Listener defines the display settings related to display of listener positions within the model. The following options are available:

Wireframe – Show or hide the wireframe that represents the listener position in the Model View.

Identifier – Show or hide the identifier numbers displayed at each listener location in your model.

RT60 defines the display of the RT60 source within the model. The following options are available:

Location – Show or hide the purple sphere that represents the RT60 source.

Size – Choose the size of the RT60 source from the drop-down list.

Map defines the display properties for map data generated by predictions within the Modeler software. The following options are available:

Hide Maps – When selected, all coverage maps are hidden and cannot be viewed. This is useful in situations such as a client presentation, when you might not want coverage maps to be visible.

Custom Areas – When selected, all custom mapping areas are hidden and cannot be viewed.

Sample Smoothing – When selected, a gradient fill pattern is applied to between map sample points to provide a more continuous looking coverage map.

Sample Fill – When selected, the fill between sample points is removed, and only the gradient mesh is visible.

Translucent – When selected, a transparency is applied to the coverage map allowing you to view room model objects below the coverage map.

Drawing Aids includes selections for display options of items that assist in the creation of room models. The following options are available:

Rulers – When selected, enables the drawing rulers within the Model View. Drawing ruler units are determined by the Room View Grid settings in the Drawing/Saving tab.

The drawing rulers appear on the top and left edges of the Model view in Plan, Elevation, and Section Views. Toggle the rulers between show and hide with this checkbox.

Axis Indicator – The axis indicator appears in the lower left corner of the Model View and displays the orientation of the three major axes. The axis pointers are highlighted according to the selected constraint plane. This is a useful tool for orienting yourself in three-dimensional space as well as when using constraint planes.

Guide Layer – When selected, a 2D DXF guide layer appears behind the room model and is used to provide a visual reference, or as a drawing aid for room model creation.

Center of Rotation – When selected, the Center of Rotation indicator is displayed within the Model View. The center of rotation determines the point within the room model which will serve as the center of rotation for isometric views of the model.

The Center of Rotation is independent of room model coordinates and may be placed anywhere in the model.

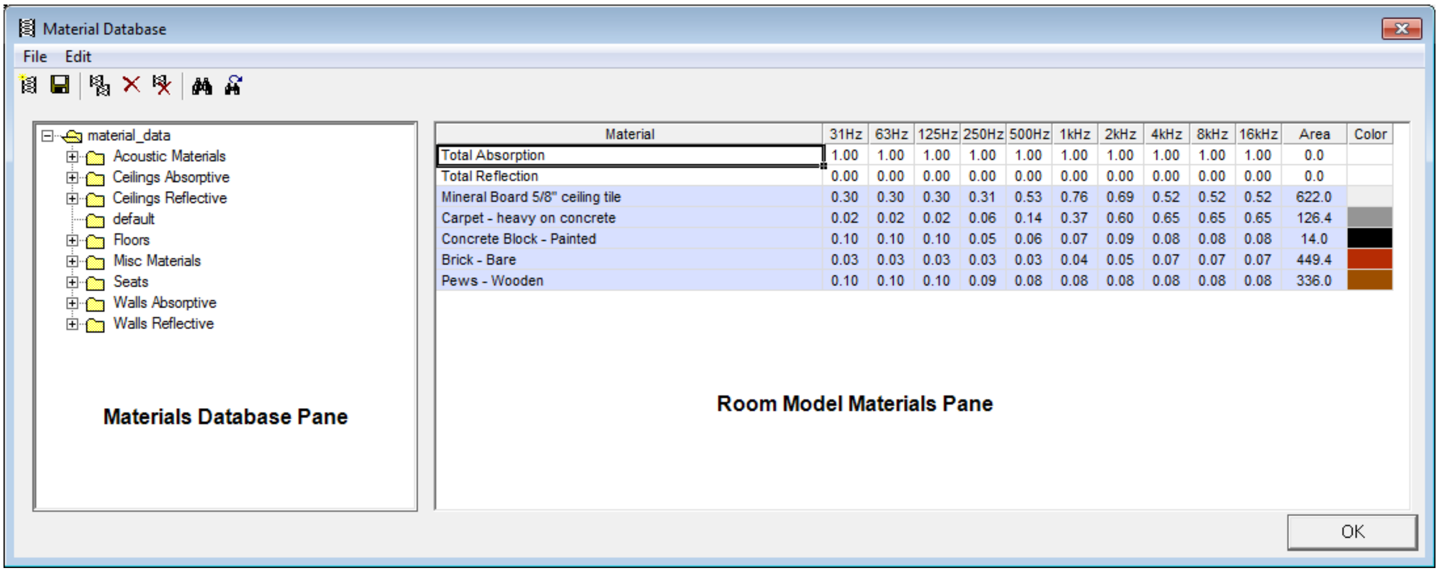
Surface Type check boxes control which surface types are displayed in the model. Remove a checkmark to hide the given surface type in the model. Surfaces are not removed from the model and will still be considered in all calculations, but are no longer visible within the Model View.

Drawing Aids includes selections for display vertices for surfaces within the room model. The following options are available:

Vertex – Show or hide the red markers that highlight each vertex in the model.

Materials Database Window

The Materials Database window displays all of the available materials within the materials database, and those materials currently stored with the room model file.



Modeler Materials Database Window

Materials Database Pane

The materials database pane of the Materials Database window contains all materials available for use within the room model. Materials are organized by surface and reflection property. To add a material to the list of materials available for use within the room model, drag the desired material from the materials database pane to the room model materials pane.

Room Model Materials Pane

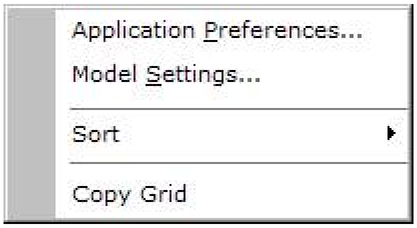
The room model materials pane contains a list of all materials available for use within the room model. These materials appear in the various Material drop down menu items within the application interface. Materials indicated with a blue highlight are those materials currently in use within the room model.

The current list of room model materials may be saved as a new, custom materials database for use in other room models. This is accomplished by selecting **File>Save Material List...**

Note: To be available for use with other room models materials database files must be located in the material_data directory. The material_data directory is located at Program Files/Bose/Bose Modeler 6.8/data/material_data.

Room Model Materials Right-Click Menu

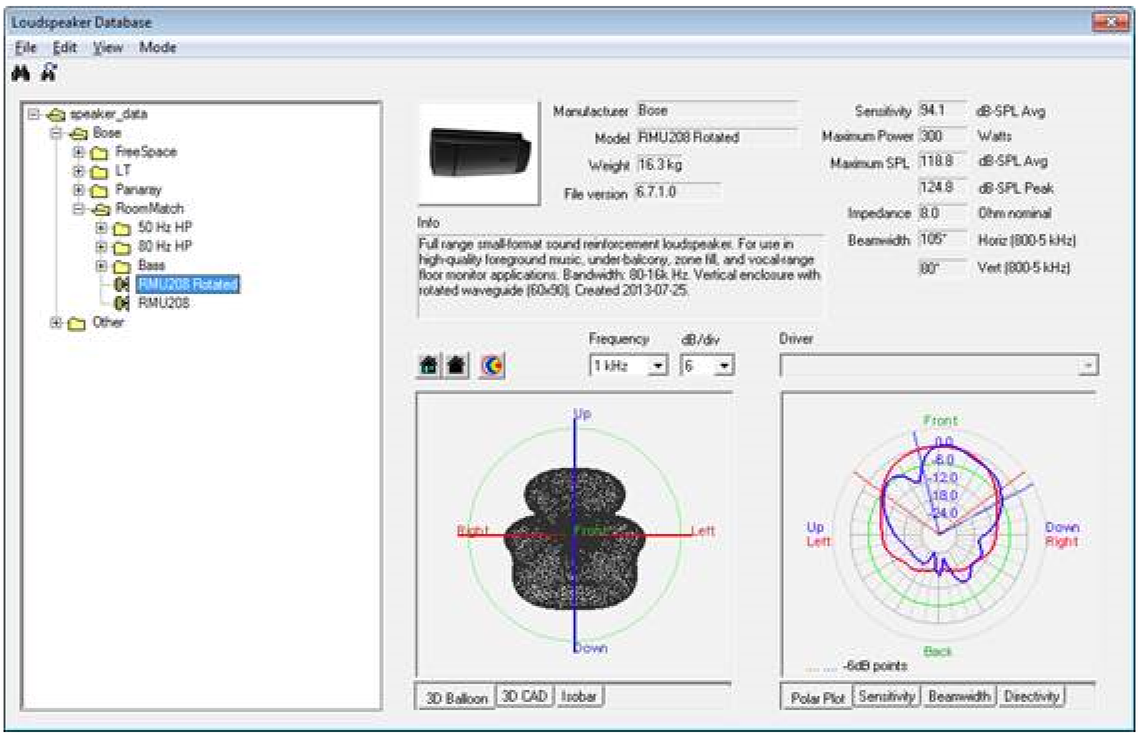
Right-click anywhere within the room model materials pane to display its right-click menu. The right-click menu contains the following options:



Application Preferences...	Opens the **Application Preferences** dialog box.
Model Settings...	Opens the **Model Settings** dialog box.
Sort	Expands to display a list of all sort options. Available selections are By Number or By Material.
Copy Grid	Copies the current list of room model surfaces and the absorption data for use in another application.

Loudspeaker Database Window

The Loudspeaker Database window displays all of the loudspeakers available within the loudspeaker database, and provides detailed technical information for the loudspeaker currently selected within the database.



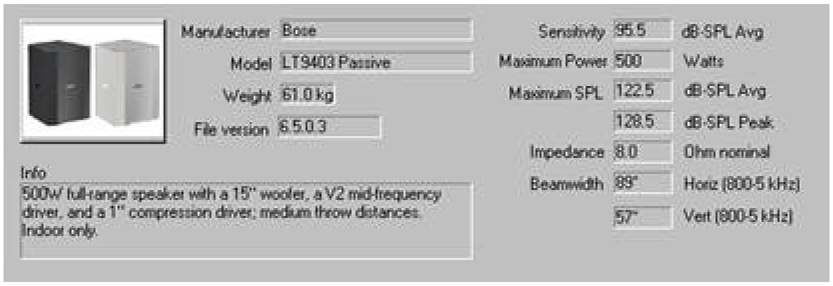
Modeler Loudspeaker Database Window

Loudspeaker Database Pane

The loudspeaker database pane of the Loudspeaker Database window contains all loudspeakers available for use within the room model. Loudspeakers are organized by manufacturer and product line. To view the technical data for a loudspeaker, select that loudspeaker within the database pane.

Loudspeaker Technical Data

The loudspeaker technical data section displays information related to loudspeaker data file, and loudspeaker performance data that would commonly be found on a technical data sheet.



Modeler Loudspeaker Database Window – Technical Data

The following information is included in this section:

Manufacturer describes the manufacturer of the loudspeaker.

Model the name/model of the loudspeaker

Weight the weight of the loudspeaker in kilograms or pounds.

File Version of the loudspeaker the loudspeaker data file.

Info describes the loudspeaker and its components.

Sensitivity of the loudspeaker across all of its operating frequencies, in dB-SPL. Sensitivity is referenced to a 1 Watt input at a distance of 1 meter.

Maximum Power handling of the loudspeaker, in Watts.

Maximum SPL output of the loudspeaker. This value is calculated based on the loudspeaker's power handling and sensitivity.

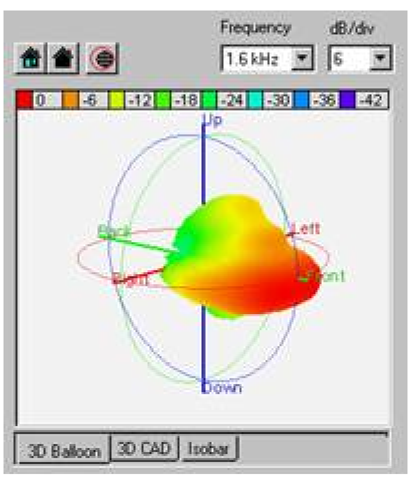
Impedance of the loudspeaker, (nominal), in Ohms.

Beamwidth indicates the angle at which the sound pressure level is 6 dB less than the on-axis sound pressure level. This is averaged over the 1/3 octave bands from 800 - 5 kHz, (or the 1 - 4 kHz octave bands).

Note: The beamwidth, as displayed here, is calculated for a single driver. In the case of multi-driver loudspeakers, this may not be the beamwidth data that is published on the product data sheet, as it does not represent all drivers operating simultaneously.

3D Data Viewer

The 3D data viewer contains visualizations of the loudspeaker data in a three dimensional format. Each visualization is available as a tab along the bottom of the 3D Data Viewer, while a basic toolbar contains controls to change the visualization settings.



Modeler Loudspeaker Database Window – 3D Data

Display Tabs change what is being displayed within the 3D Data View. The following display tabs are available:

3D Balloon Displaysthe 3D radiation characteristics of the selected loudspeaker at the selected 1/3 octave-band center frequency. Data displayed isthe loudspeaker's magnitude data contained within the loudspeaker data file.

3D CAD Displays the loudspeakers wireframe data.

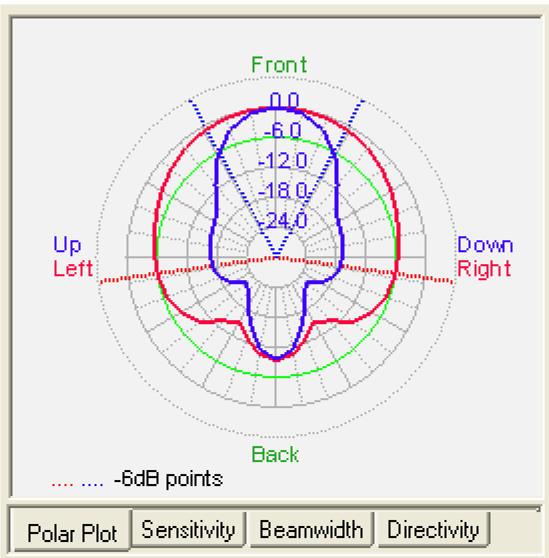
Isobar Displays the loudspeakers anechoic coverage mapped on a hemisphere at the selected 1/3 octave-band center frequency using a 1 dB per division color scale.

Tip: You can achieve free dynamic rotation, by holding down the left mouse button while moving cursor in a circular motion on the diagram for unrestricted rotation. To achieve Y (left) rotation, hold down the Ctrl key, then left-click and drag your mouse left/right. For X (up) rotation, hold down Shift key, then left-click and drag your mouse forward / backward.

2D Data Viewer

The 2D data viewer contains visualizations of the loudspeaker's performance in a graph format. Each graph is calculated based on the data contained within the loudspeaker data file.

Each visualization type is available as a tab along the bottom of the 2D Data Viewer, while a basic toolbar contains controls to change the visualization settings.



Modeler Loudspeaker Database Window – 2D Data

Display Tabs change what is being displayed within the 2D Data View. The following display tabs are available:

Polar Plot Displayshorizontal and vertical radiation pattern of the loudspeaker at the selected 1/3 octave-band center frequency. The red line represents the horizontal polar data, while the blue line represents the vertical data.

Dotted lines represent the beamwidth at the selected frequency. The dotted red lines define the horizontal beamwidth (governed by the intersection of the solid red polar plot with the green -6 dB circle). The dotted blue lines define the vertical beamwidth.

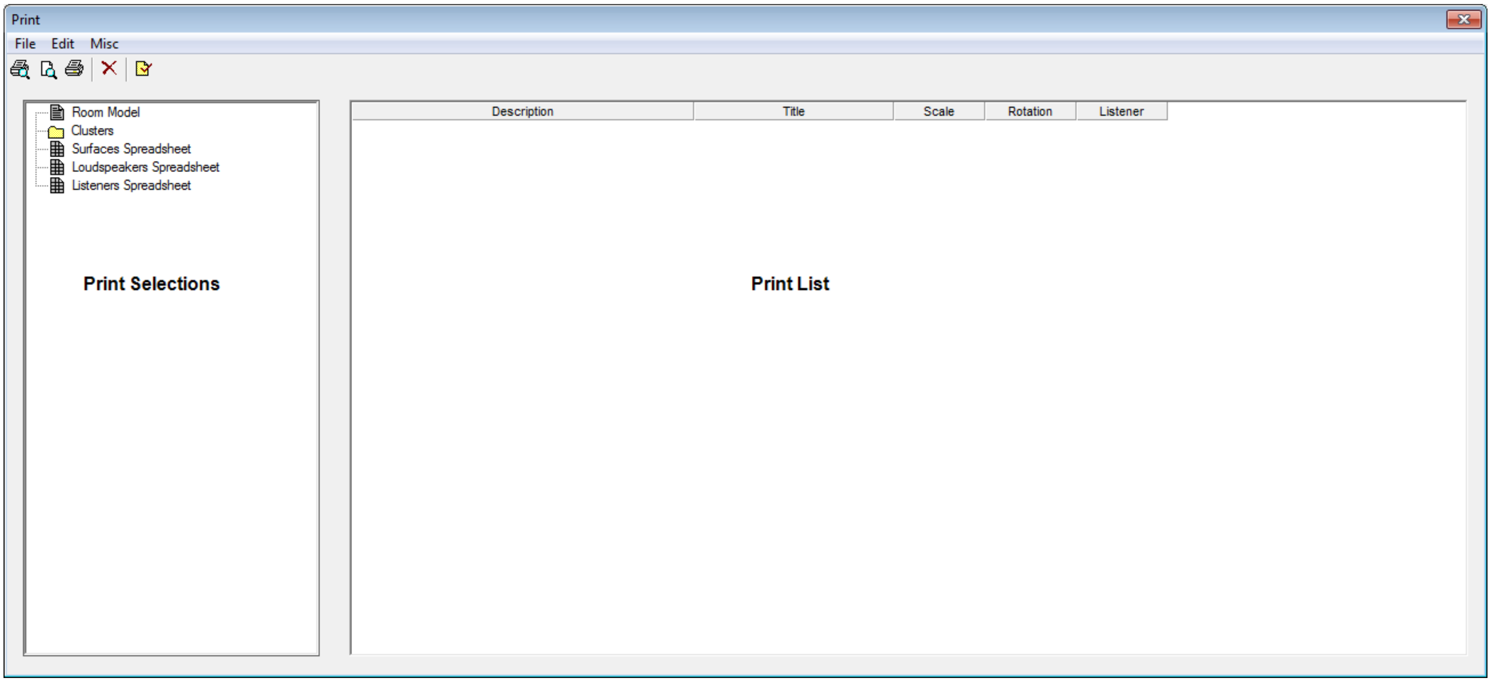
Sensitivity Graphs the sensitivity of each 1/3 octave-band (dB-SPL for 1W @ 1m) versus frequency for the selected driver.

Beamwidth Graphs the horizontal, blue, and vertical, red, beamwidth angle for each 1/3 octave-band versus frequency.

Directivity Graphs the Directivity Index of each 1/3 octave-band versus frequency.

Print Window

The Print window contains a list of available print selections, and a list of the items that will be printed, and their print settings. To access the print window, go to **File > Print**.



Modeler Print Window

Print Selections Pane

Create a list of documents to be printed by dragging items from the Print Selections Pane on the left into the Print List on the right. You can open folders and select items in the Print Selections Pane as you would in Windows Explorer.

You have the option to print:

- The room model.
- Individual clusters.
- Surfaces, Listeners, and Loudspeakers spreadsheets.
- Coverage maps.

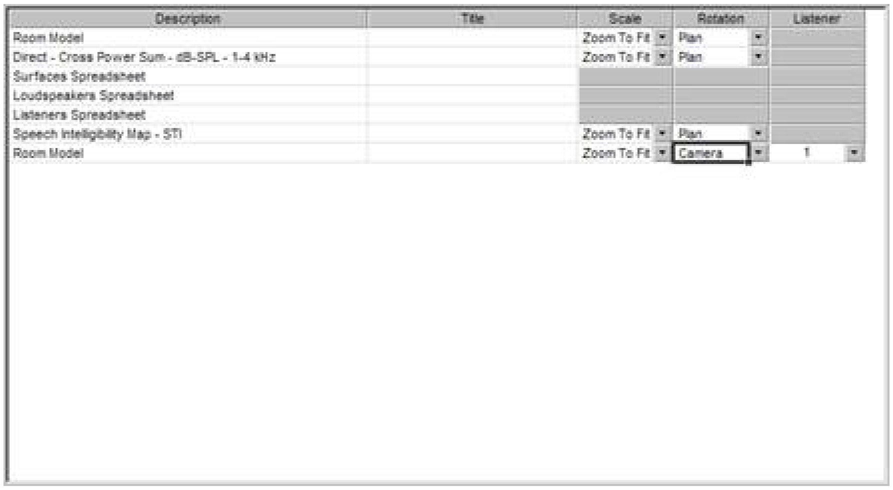
The documents that are available to print are based on the state of the room model. For example, you will not have the option to print coverage maps unless they have been generated in your model.

Keep the following things in mind when you create a print list:

- Folders cannot be dragged into the list, only individual items.
- To drag more than one item at a time, hold down Ctrl to select multiple separate items or Shift to select a range of items.
- To delete an item from the print list select the item and click the delete button in the Print Window’s toolbar.

Print List

The Print List contains all items that will be printed and the print settings for each item in the list.



Modeler Print Window – Print List

Each item within the Print List contains a number of properties to define how the item will be printed. Available print properties are as follows:

Descriptiondisplays the item to be printed. This property may not be modified.

Title adds a print title to the selected item. The print title appears in the heading with the Bose logo.

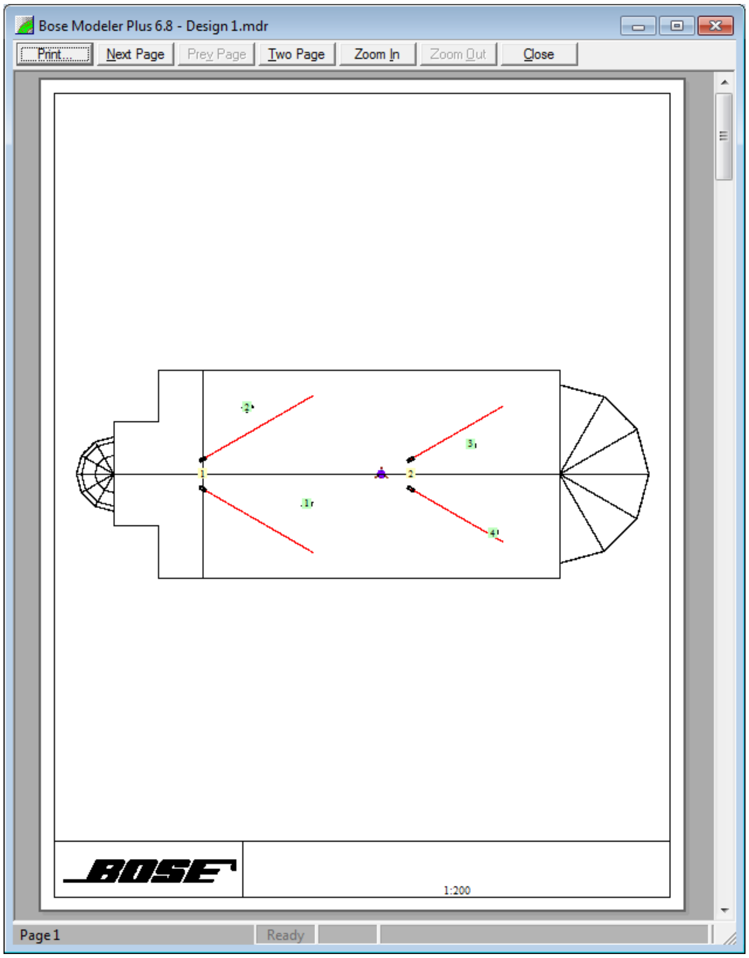
Scale sets the scale of the drawing to be printed. Available options are based on the current drawing scale units as defined in the Model Settings window.

Rotation determines the model orientation to be used for the printed item. Available selections are the standard views, (plan, side, etc.), a custom orientation, or a camera view based on a model listener location.

Listener this item is enabled when Camera is the selected option in the Rotation property. Available selections are the room model listener locations.

Print Preview Window

The Print Preview window allows you to view the items that will be printed. The Print Preview window is only accessible from within the Print Window. Select **File>Print Preview...** in the Print Window.



Modeler Print Preview Window

The Print Preview window contains basic control functions to navigate through the pages in the print list, print the document being previewed, and zoom controls. Available controls include:

Print... Open the print dialog box..

Next Page Preview the next page in the printout..

Prev Page Go back one page in the printout.

Two/One Page Switch between viewing one page at a time, and two pages at a time.

Zoom In Zoom in on the printout.

Zoom Out Zoom out on the printout

Close Close the Print Preview window and return to the Print Window.

Modeling the Room's Acoustics

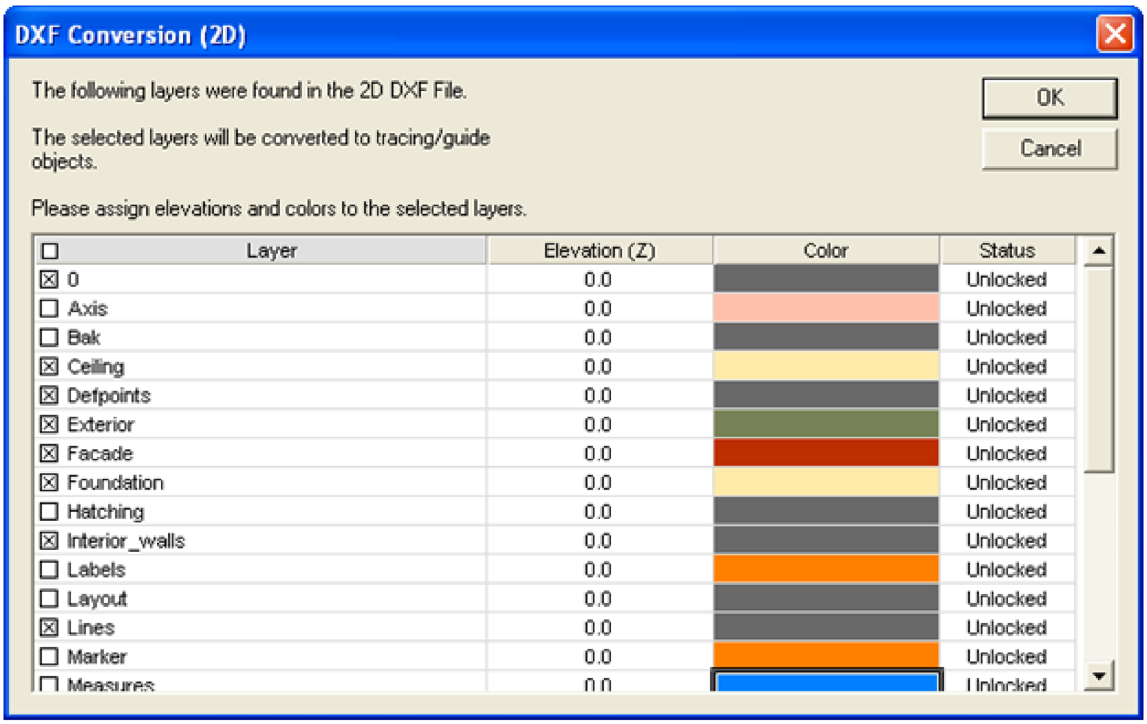
Importing Model Data

Importing AutoCAD 2D

You can either chose to open a single 2D .DXF drawing or to add it to the currently opened project. You cannot import a 2D .

To import a 2D .DXF file:

1. Select **File>Import Model>AutoCAD** (or press CRTL-I on your keyboard).
2. Browse the file system to locate the 2D AutoCAD file of interest, select it, and then click OPEN.
3. The following DXF conversion dialog will determine how the DXF file is imported as a Guide Layer within the room model:

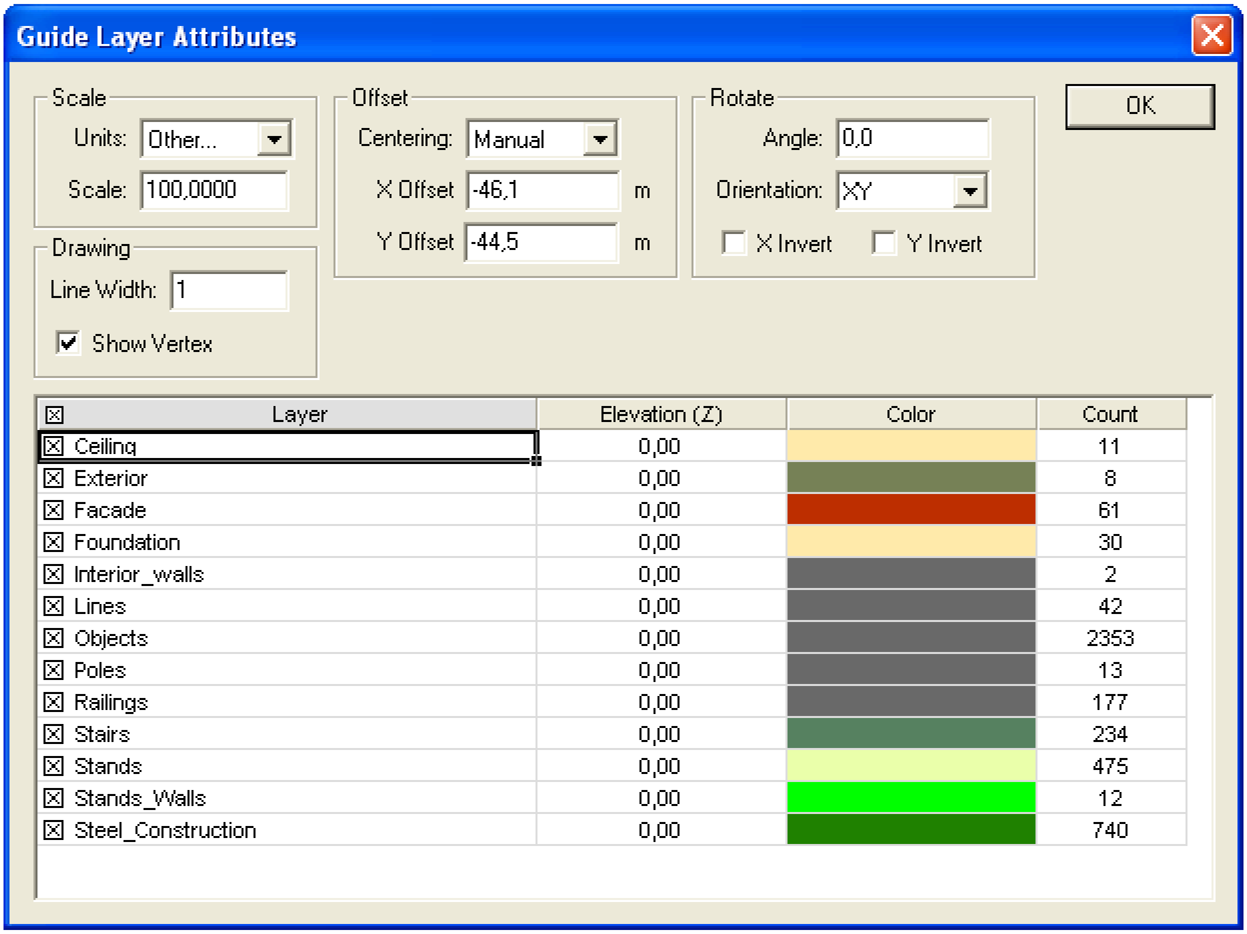


2D .DXF file conversion

Note: With very complex .DXF files, it may take a while until the DXF conversion window is displayed. Note the status bar.

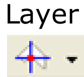
The DXF conversion dialog shows all available layers in a spreadsheet that can be sorted by clicking on the header of each column. All layers are selected for import by default but can also be checked individually. Selecting the checkbox in the Layer header toggles all layers on/off. For each layer, its elevation in the Guide Layer and its color can be adjusted. Click **OK** to accept the parameters and to begin the import process.

Once Modeler® software constructs the geometry elements from the information in the .DXF file, the Guide Layer Attributes window is displayed:



Guide Layer Attributes

Often, not all layers that are listed in the DXF conversion dialog will show up in the subsequent window for the Guide Layer attributes. There are two types of layers that won't be transferred into the Guide Layer: Empty layers and layers that only contain objects combined into blocks. If a layer contains both blocked and exploded elements, only the latter will be made available in the Guide Layer.

The Guide Layer window can be accessed at any time, also after the completion of the import process. This way, a variety of adjustments can be made to the Guide Layer during subsequent modelling. The Guide Layer can be accessed by selecting the Guide Layer icon  in the Arrange toolbar:

The Guide Layer icon also features a wing-menu that allows toggling the display state of the Guide Layer. The same functionality is available via the Display tab in the Model Settings but the fastest way is certainly to utilize the direct keyboard shortcut "g".

The Guide Layer window is organized in five main sections. The bottom of the window shows a spreadsheet with all imported layers that contained valid geometry data. Make sure that the colors set for these layers are distinguishable from the background color you chose for the Model window. As in the conversion dialog, the list can be sorted, layers can be selected for display and the elevation of the displayed layer can also be adjusted. The upper section of the Guide Layer window contains four important options to adjust the appearance of the Guide Layer content within the Model window:

- **Scale** - This section defines the Units that will be used for the imported DXF data. This selection is important since a .
- **Offset** - This section determines where Modeler® software locates the Guide Layer content within the Model Window. If the pull-down menu for "Centering" is set to "Automatic", the DXF data will be centered in the model based on the extent of the data in the two dimensions available. If the menu is set to "Manual", offset coordinates can be entered in the two respective fields. If the values are set to Zero, the origin of the "Global Coordinate System" within the original .
- **Rotate** - This section allows the adjustment of the basic orientation of the imported layer(s) as well as

any additional rotation around the Modeler software coordinate system origin. While the latter may be less frequently applied, note that you can utilize the "Orientation" setting to import a cross-sectional drawing of the room and start modeling from there, e.g., by applying the Extrude Surface tool. Note that once you change the orientation, the axis available for "Offset" will change accordingly. The "Rotate" section also allows you to invert (i.e., mirror) the Guide Layer content at one of the two available main axis.

- **Drawing** - This section allows you to enter the width of the lines as drawn in the Guide Layer. We recommend keeping this value small in order to avoid cluttering of the display. Also available is an option that allows you to display any vertices within the Guide Layer content. This function is important with regards to Modeler software's ability to have its drawing tools snap to vertices within the Guide Layer. With vertices shown, the user is able to distinguish a valid snap location from a simple crossing of two lines.

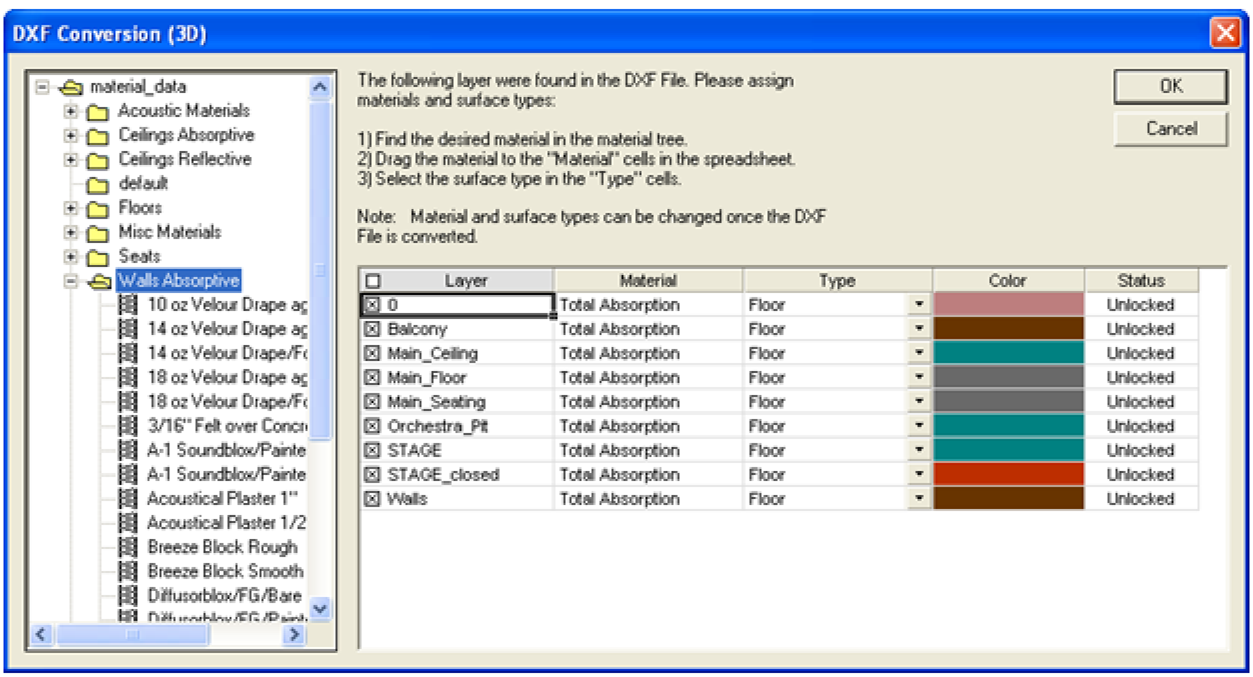
See also:
Centering a 2D Guide Layer or 3D Model
Start Working With a 2D Drawing

Importing AutoCAD 3D

You can either chose to open a single 3D .DXF model or to add it to the currently opened project.

To import a 3D .DXF file.

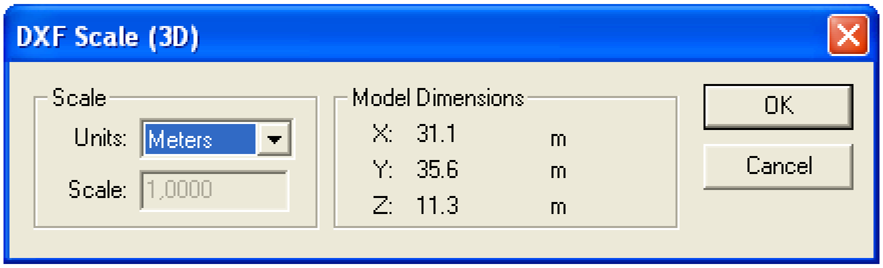
1. Select **File>Import Model>AutoCAD** (or press CRTL-I on your keyboard).
2. Browse the file system to locate the 3D AutoCAD file of interest, select it, and then click OPEN.
3. The following DXF conversion dialog will determine how the DXF file is imported as a Guide Layer within the room model:



DXF conversion dialog

As with 2D import, the 3D DXF conversion dialog shows all available layers in a spreadsheet that can be sorted by clicking on the header of each column. Again, layers can be checked individually for import. Selecting the checkbox in the Layer header toggles all layers on/off. For each layer, its material, surface type and its color can be adjusted. Assign materials to each layer by dragging the desired material from the set of material databases on the left side of the window onto the respective cell-entry within the spreadsheet. You can now also assign Modeler® software specific surface types and color to each layer. Select OK to accept the parameters and to begin the import process.

Once Modeler software constructs the geometry elements from the information in the .DXF file, a window for the scale of the DXF drawing is displayed.



3D DXF Scale

As with the Guide Layer window, the section Scale defines the units and scale that will be used for the imported DXF data. Again, select between "Metric" or "English" units or custom scaling by choosing the "Other" option and entering the scale factor in the associated text box. Model Dimensions displays the overall extents of the imported .

See Also:
Centering_a_2D_Guide_Layer_or_3D_Model.htm
Start_Working_With_a_3D_Model.htm

Centering a 2D Guide Layer or 3D Model

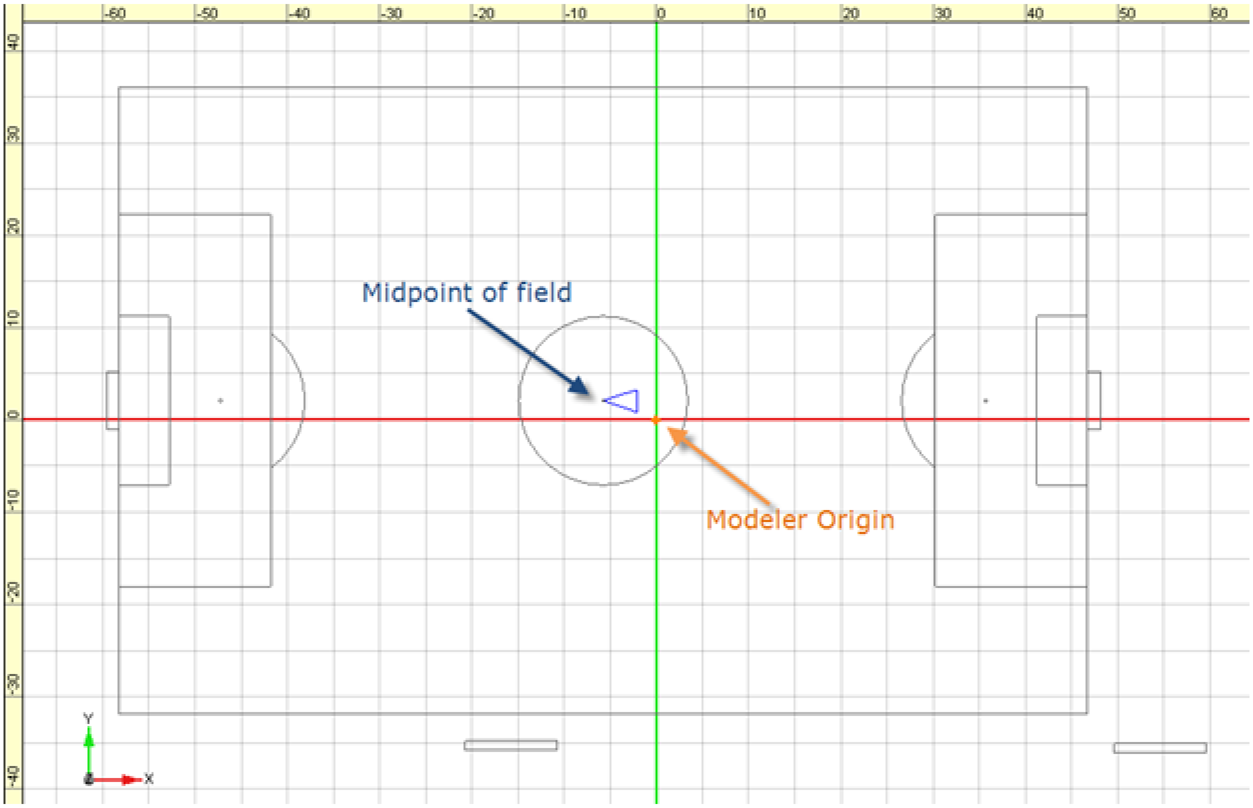
As described for the Guide Layer window, it is generally advisable to adjust the offset of the imported drawing. This section describes an easy-to-use method to exactly center the room model and, if applicable, the two-dimensional Guide Layer around a user-defined location within the room model.

Modeler® software can center the model and Guide Layer around the location of any of the following room model items:

- a vertex of any surface in the model,
- a loudspeaker or
- a listener.

For the purpose described here the first option of centering the model and Guide Layer around the vertex of a surface within the model is used. The following example attempts to explain the recommended method for application with a 2D Guide Layer. For simplicity, the .DXF drawing consists of just the playing field of a soccer arena, but the method also applies to much more complex models.

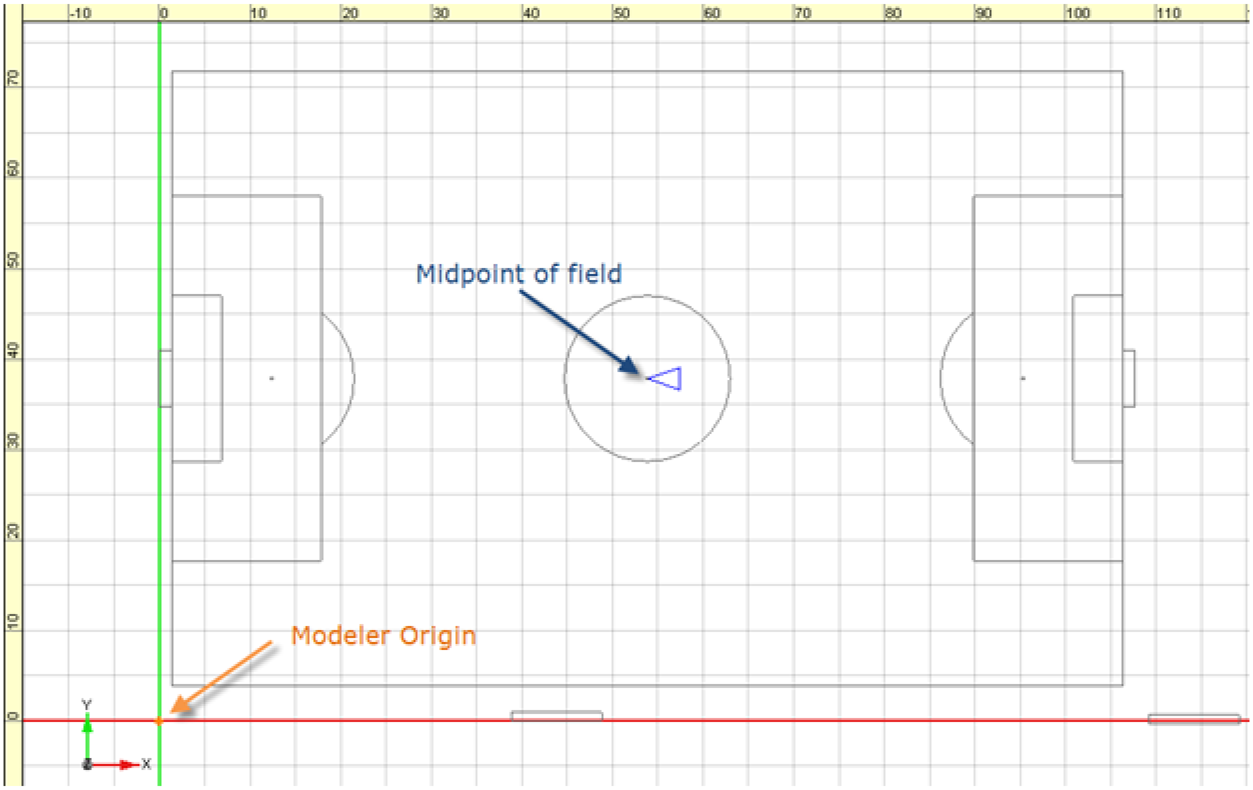
For this example, the offset of the model and the Guide Layer is adjusted such that the midpoint of the soccer field will coincide with the Modeler software (0,0,0) coordinate system origin. But first, observe how the drawing will be imported using "Automatic" offset:



Soccer field with "Automatic" Guide Layer offset

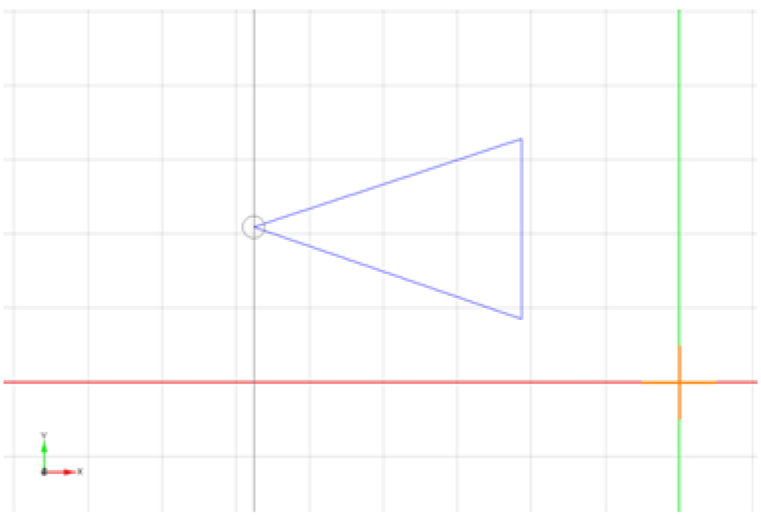
With "Automatic" centering, Modeler® software places the Guide Layer such that the maximum extent of the drawing in both dimensions (here: x and y) is centered around the Modeler software origin. In this case, the model does not only contain the soccer field (the geometry of interest) but also two other elements that skew the offset of the Guide Layer. This way, the playing field is offset to negative x and also towards positive y.

The next figure shows how the model is centered when "Manual" offset is chosen and both the x and y offsets are set to zero. This way, the Modeler software origin coincides with the origin of the Global Coordinate System within the original .DXF drawing. Using this option, the midpoint of the field is offset even further from the Modeler software origin.



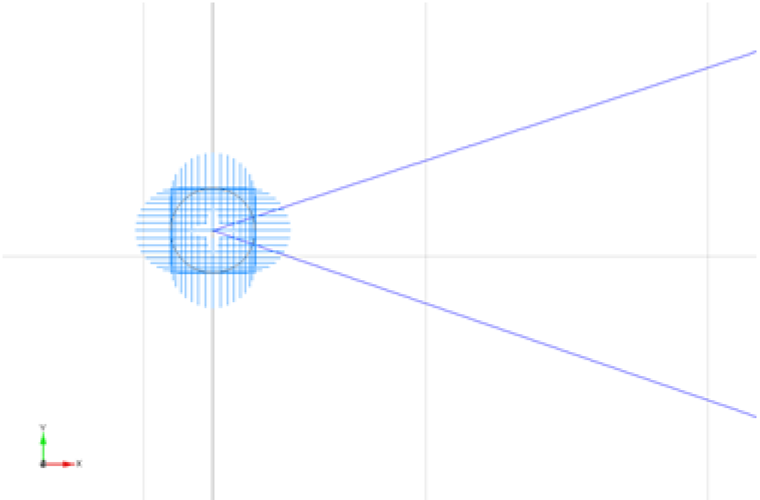
Soccer field with "manual" centering and zero offset for x and y

The .DXF drawing contains a little triangle depicted in blue to facilitate the method of centering described below:



Midpoint of soccer field with guide object for the helper surface

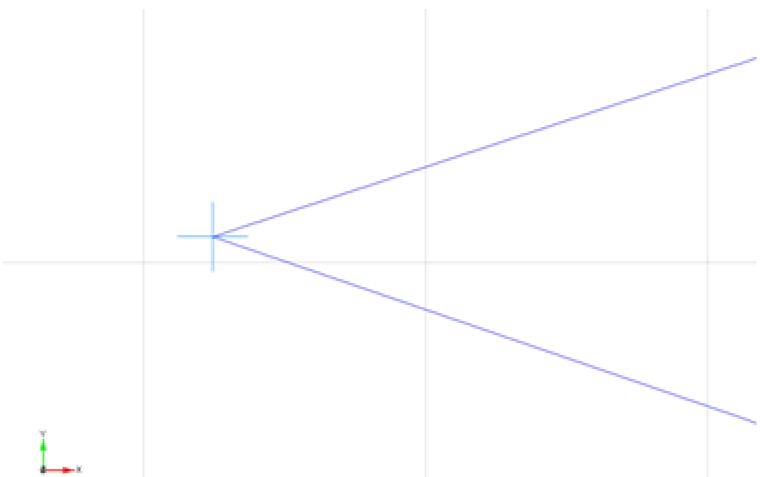
Note that the triangle is drawn such that the tip coincides with the midpoint of the field. Now, a helper surface can be drawn which utilizes the ability to snap to vertices of the Guide Layer, and coincides exactly with the blue triangle. Look closely again on the tip of the triangle, this time with the Guide Layer vertices displayed:



Midpoint of soccer field with tip of guide object (vertices turned on)

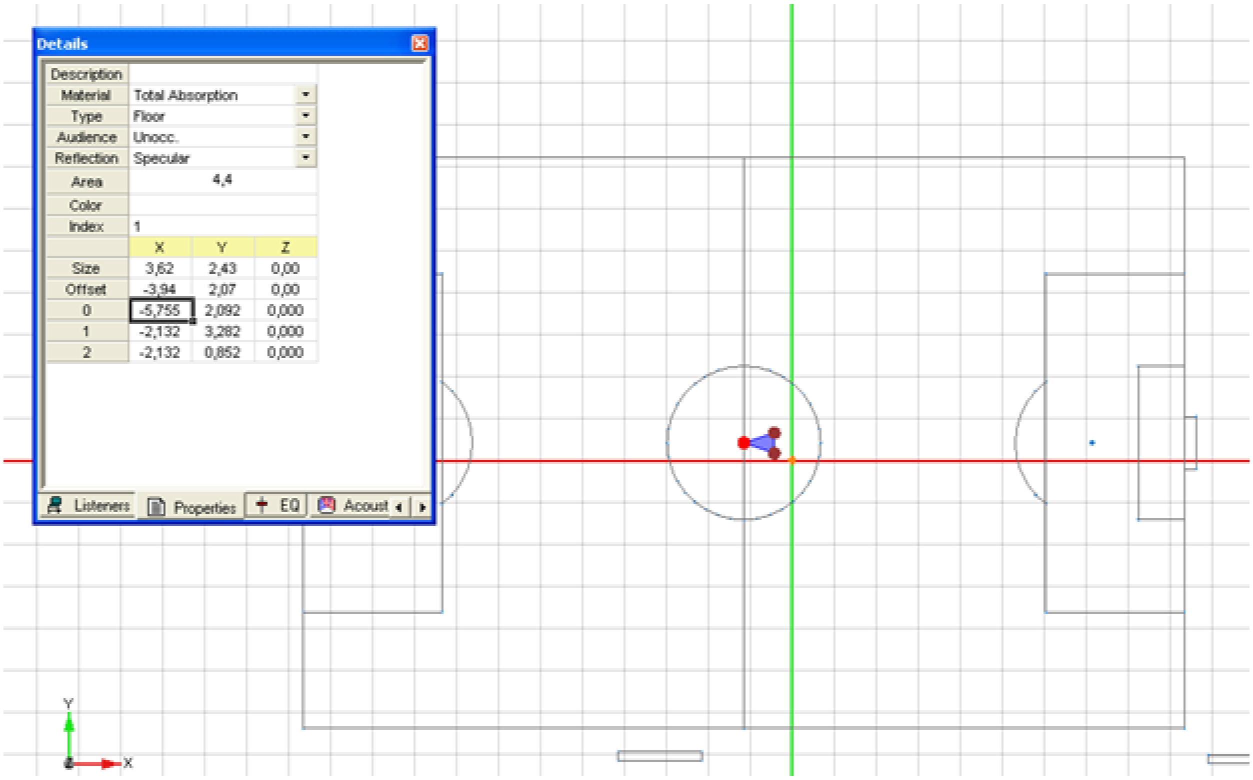
Note the many vertices that make up the small circle at the midpoint. It would be very hard to exactly place a vertex of a helper surface in this region since so many Guide Layer vertices are valid candidates for snapping.

Thus, all layers will be temporarily turned off except the one that contains the blue triangle:



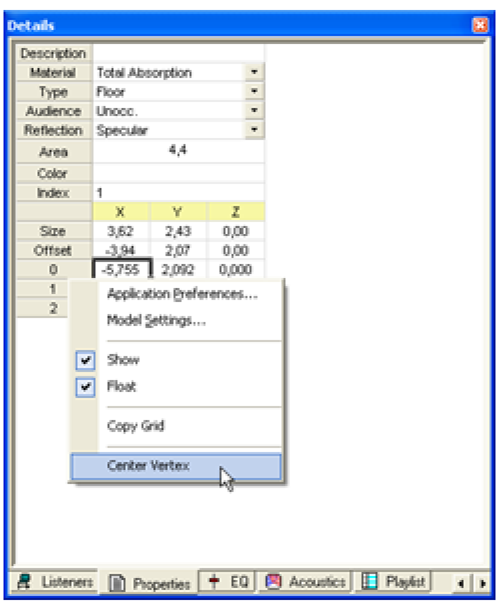
Midpoint of soccer field with field layer turned off

You can now use the Draw Polygonal Surface tool to create a helper surface on top of the triangle. The following figure shows the model including the new helper plane. For better clarity, the Detail Window has been floated and the Properties Tab chosen showing the properties of the newly created helper surface.



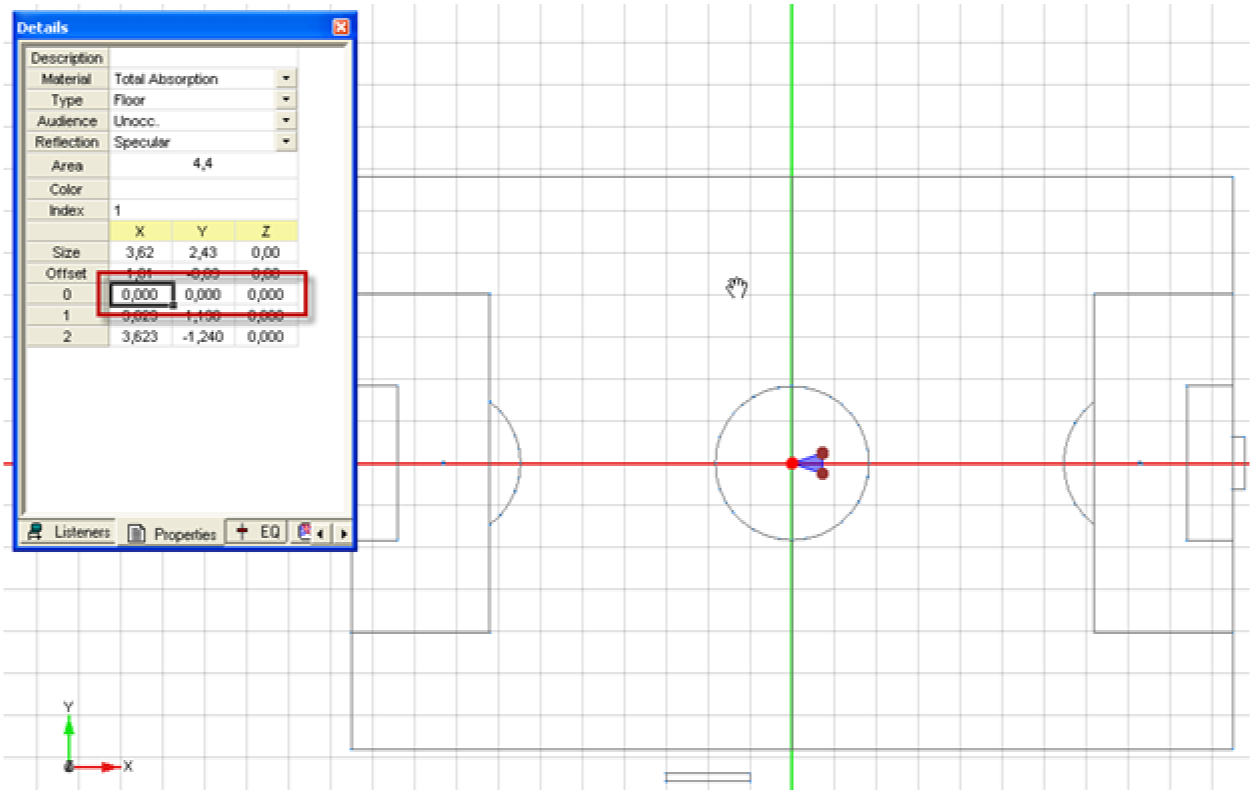
Soccer field with helper plane and vertex properties

Note that the vertex at the midpoint of the field (#0) and also its arbitrary offset from zero has been selected. Now, right-click into the row describing the coordinates of the desired vertex and chose “Center Vertex” as depicted in the figure below:



Center Vertex function

Both the model surface(s) and the Guide Layer content will now be moved such that the chosen vertex coincides precisely with the Modeler® software coordinate system origin as seen in the figure below:



Centered Guide Layer and model. Note precise midpoint placement.

Note: The "Center Vertex" functionality is only available in the Properties Tab within the Detail Window, i.e., not via the Properties in the right-click-menu.

With 3D .DXF models, the concept of centering around a surface's vertex is identical to the method above. Nonetheless, all issues related to snapping to the Guide Layer are not applicable, simply because there is no Guide Layer in use. Thus, all subsequent centering is applied to the model only. You may either center around any vertex of any surface that was imported with the 3D model or you may chose to insert a helper surface in case you don't have a vertex available in the desired location. You may also place a listener or loudspeaker at the desired location and apply the "Center Listener" or "Center Loudspeaker" algorithm, analogous to "Center Vertex". Note that the centering function works in all three major room dimensions, so in case you want to avoid that the z-coordinates of the model are changed, make sure that your reference vertex/listener/loudspeaker for centering has an elevation of zero.

Start Working With a 2D Drawing

General modeling strategies

Before you import a .DXF drawing into Modeler® software and start working with the creation of a 3D simulation model, you should think about the best way to build your geometry. The "best" way in this sense means: Minimize modeling time by utilizing as many "semi-automatic" drawing tools as possible. The tools for the extrusion of surfaces are very powerful when used in conjunction with a Guide Layer. The two following examples illustrate this:

Example #1 - Imagine you have to create a model for a room that features are complex floor shape, with lots of corners, recessed wall elements, dedicated seating areas, columns that need to be cut out of the floor, etc. but at the same time, with a relatively simple, i.e., uniform, ceiling structure. In such a case, the recommended approach is to import a floor plan into the Guide Layer and using the Draw Polygonal Surface tool to create a polygon that follows the outline of the room. Then, use the Extrude Walls tool to create side walls and a flat ceiling of continuous height. Or use the Extrude Surface tool to clip the side wall extrusion at more complicated ceiling shapes, such as a barrel vault.

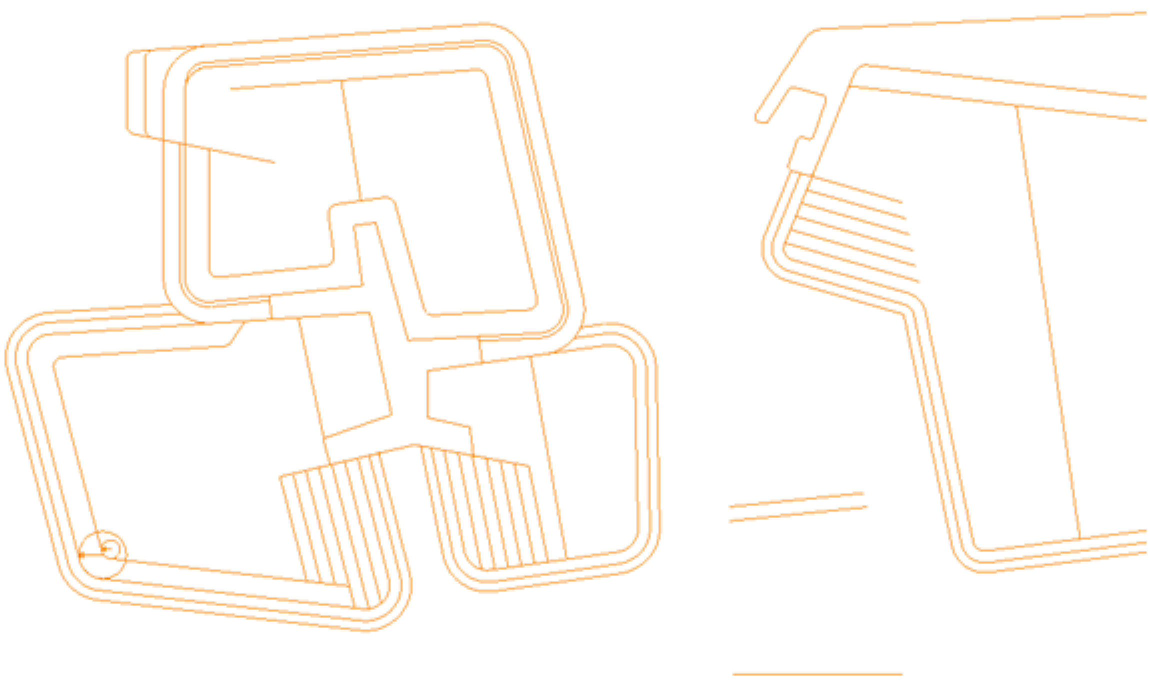
Example #2 - Should you have to model a room with a simple-shaped floor plan but a complicated, auditorium-like ceiling, it may be more efficient to import a cross-sectional drawing of the room, rotate the Guide Layer to the correct orientation and center it appropriately, e.g., such that the floor level is at zero height. Now, use the Draw Polygonal Surface tool and create a polygon that follows the outline of the room in this sectional view and which will define the footprint for an extrusion. Create two bounding surfaces at the desired location of the two side walls. Now, use the Extrude Surface tool and extrude the footprint surface towards the two boundaries with the termination setting "Closed".

How much detail ?

With a detailed architectural drawing available in the Guide Layer, it is very tempting to follow every small edge available, especially since Modeler® software allows the various drawing tools to snap onto available vertices in the Guide Layer.

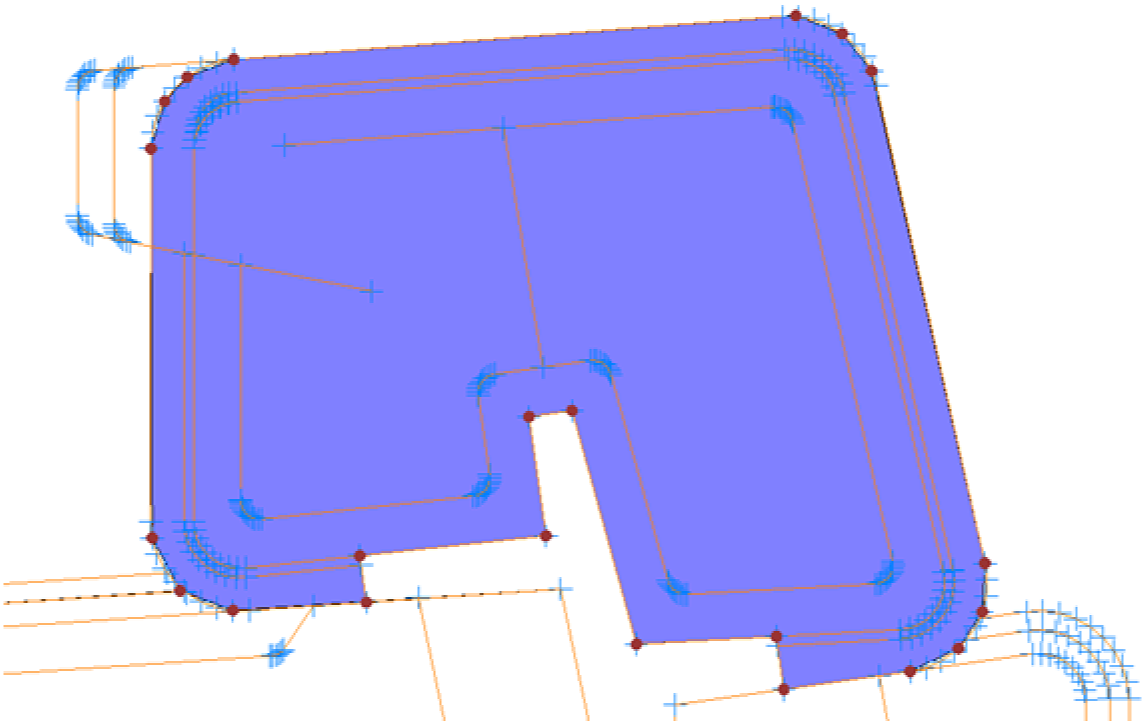
In general, it is not recommend to follow this approach for two different reasons. One is that too much detail in the geometry of a model for acoustic predictions slows down calculations. (More information about this aspect can be found in Start Working With a 3D Model). The other equally important aspect is that in general, building and especially modifying room models becomes much trickier when the vertices of surfaces leave the smallest available Room Snap Grid in Modeler software (0.1 meter). While various snapping algorithms within Modeler software help overcoming the associated problems, it is typically more time-consuming to build models whose major surfaces do not coincide with the room snap grid. The following example outlines one possible strategy to work with an imported 2D Guide Layer that has proven to work quite conveniently.

The main decision you need to make while using a Guide Layer is whether you should snap to a Guide Layer vertex or draw on top of the Guide Layer by utilizing the Room Snap Grid only. The following picture shows a screenshot of part of the ground floor of an indoor swimming pool:



Imported Guide Layer of a swimming pool.

In this example some good candidates for snapping to vertices are depicted. The angled boundaries of the pools would be especially hard to do without utilizing the snapping functions. The next screenshot shows an enlarged detail of the situation:

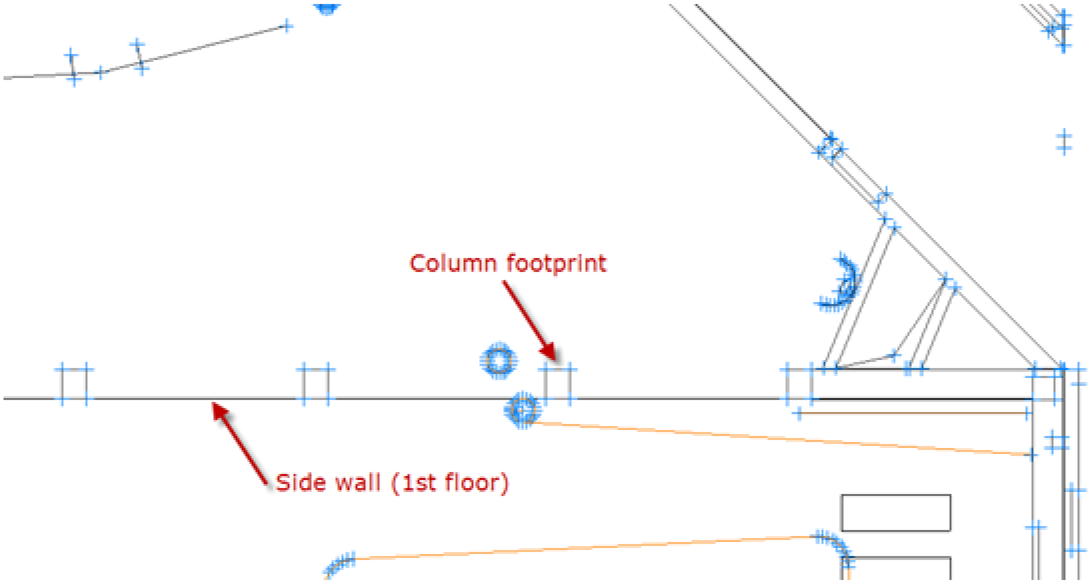


Model surface created on top of one pool.

Note the blue indicators of available vertices in the Guide Layer. Many vertices describe the various curvatures with a detail that is not required for our purpose. Thus, the contour of the pool has been followed with a reduced set of vertices.

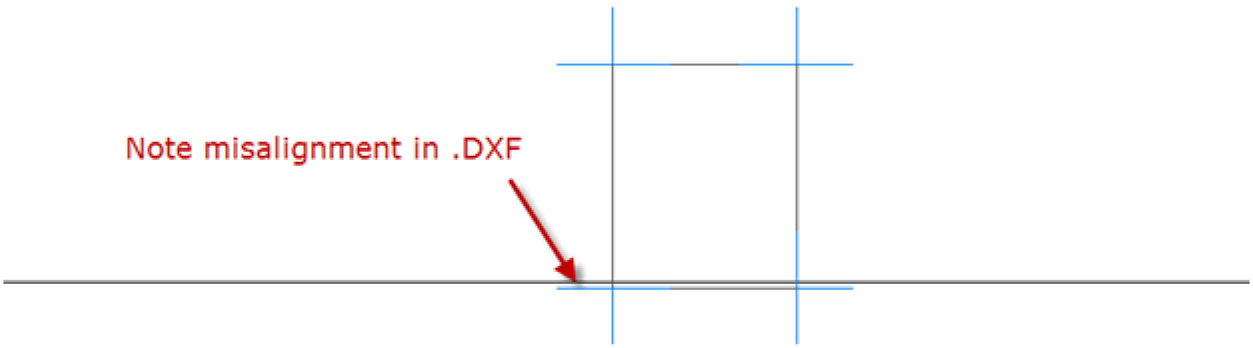
A second example (from the same project) looks at a part of the Guide Layer drawing where snapping to its vertices would be less convenient when further proceeding with the model. There are two elements in this part of the model that could be used for guidance: the location of the upper side wall and the footprints of rectangular columns that support this side wall. Again, it is possible to use the snapping functionality and place model elements precisely over the Guide Layer elements, but a detailed inspection of the side wall of this example would reveal that it is not precisely parallel to the x-axis, but offset by some millimeters at one edge.

Such a slightly angled surface is hard to work with; it gets difficult to join adjacent surfaces or to add vertices at exact locations. Thus, a wall surface is created that only comes close to the actual drawing reference but rests on the closest available room snap grid. Typically, the resulting error is in the range of a couple of centimeters and thus negligible. The following screenshot shows the respective part of this model:



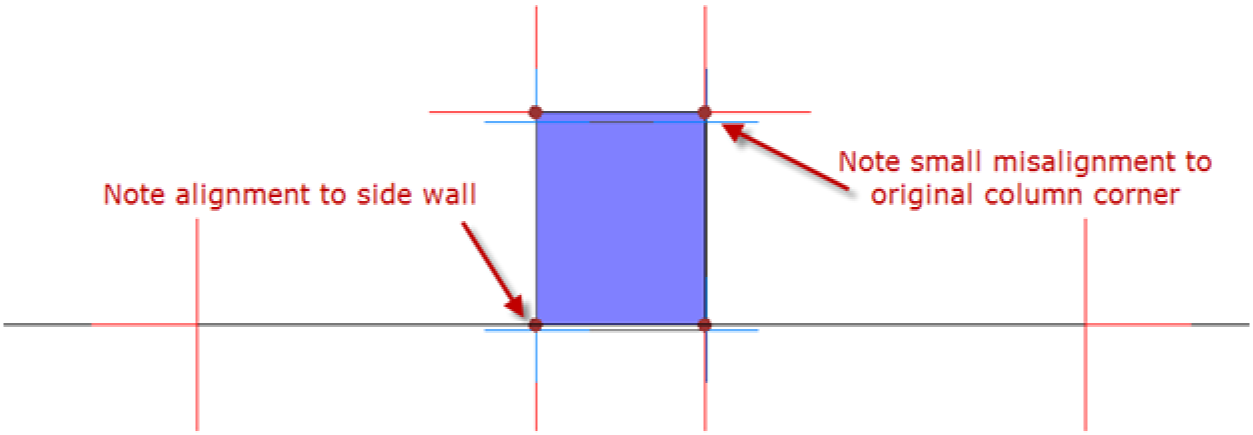
Imported Guide Layer with side walls and column locations.

The next issue with this particular Guide Layer is the fact that one edge of the square column footprints does not coincide with edge of the wall. This can be seen if one zooms into the boundary:



Misalignment of side wall and edge of column.

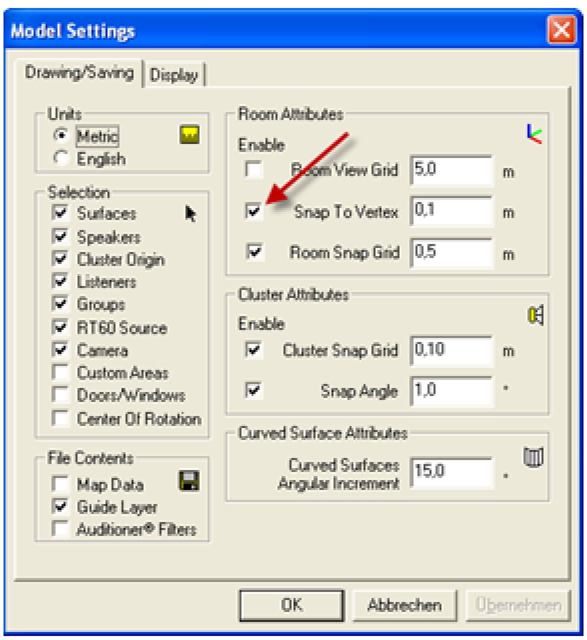
There's just no sense in trying to be accurate and to model the column where it's precisely located in the Guide Layer - it makes much more sense to have it align with the side wall. The following figure shows the same part of the model with a column footprint and a side wall element added by utilizing a 0.1 m Room Snap Grid. Note that the column edge is now precisely aligned to the side wall. Note also the very small misalignment of a few centimeters at the other side of the column.



Column footprint and wall drawn using the Room Snap Grid.

Snap to vertex functionality

As mentioned before, Modeler® software allows its various drawing tools to utilize the snapping functionality with regards to available vertices in the Guide Layer. In order to allow Modeler software to snap to the Guide Layer, you need to check the appropriate box in the Drawing/Saving tab of the Model Settings.



Model settings to enable snap to vertex .

Since vertices in the Guide Layer may be located in very close proximity to each other, it is recommend to set the sensitivity for snapping to a small value and zoom into the drawing during surface creation in order to ensure sufficient visibility of details. The Snap To Vertex setting does not distinguish between vertices in the Guide Layer or in the actual model - once activated, it applies to both. This may be disadvantageous in two situations:

- If you want to want to snap to model surfaces alone, you either need to temporarily turn off the complete Guide Layer (Keyboard shortcut ”g”) or you turn off only the layers that contain the elements that get into the way (see the centering example in Centering a 2D Guide Layer or 3D Model).
- If you want to snap to the Guide Layer alone, you need to disable the display of any model surfaces that get into the way of Guide Layer vertices by turning off the respective Surface Types in the Display Tab of

the Model Settings. This may also require to temporarily change the assignment of Surface Type to some surfaces.

The display of vertices can be toggled with a checkbox in the Drawing section of the Guide Layer window as displayed in the figure below.

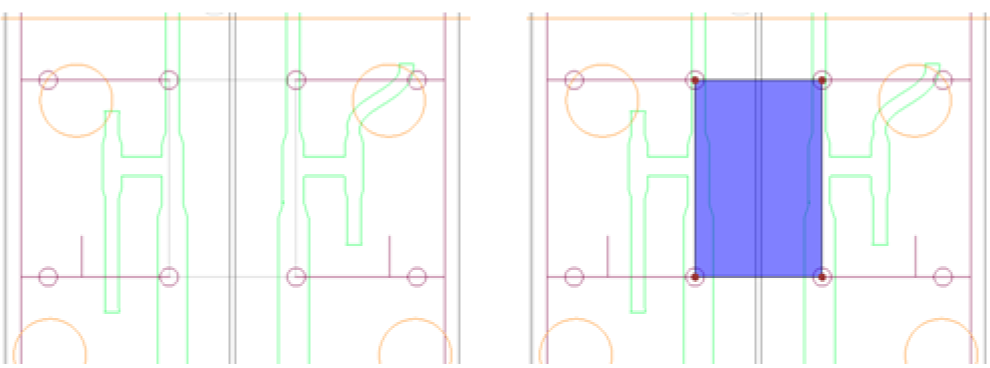
Toggle vertex display in Guide Layer Attributes.

Note: Modeler® software snaps to the available vertices of an element in the Guide Layer but not to intersections of elements. Thus, displaying the vertices of the Guide Layer is recommended.

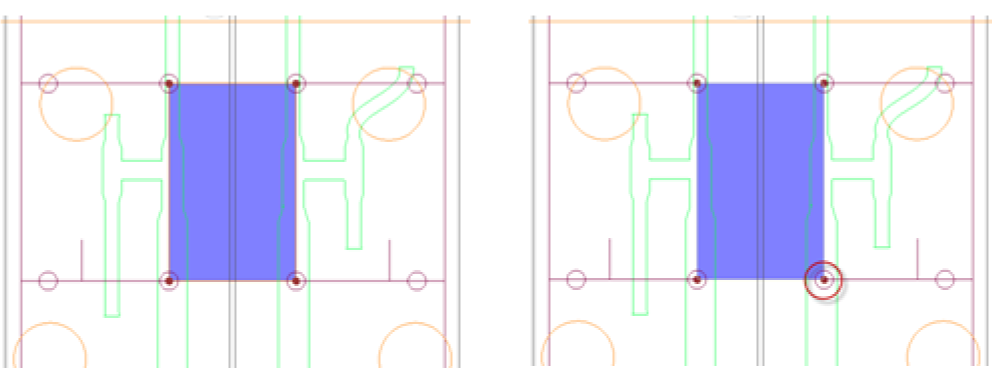
Surface visibility

Another interesting feature of the Guide Layer is the ability to choose the elevation of the various layers. This way, layers that describe floors and walls can be placed at zero height and layers that describe lighting elements, cable trusses, or ceiling support structures, can be placed at the actual mounting height in order to simplify collision detection when placing loudspeakers.

Layers are displayed in the Model view at an elevation as specified in the Guide Layer window. Depending on their z-coordinates, surfaces created in Modeler software may appear differently if their vertices result in being either above, below or at the same height as the respective layer elevation. The following images try to illustrate this situation:

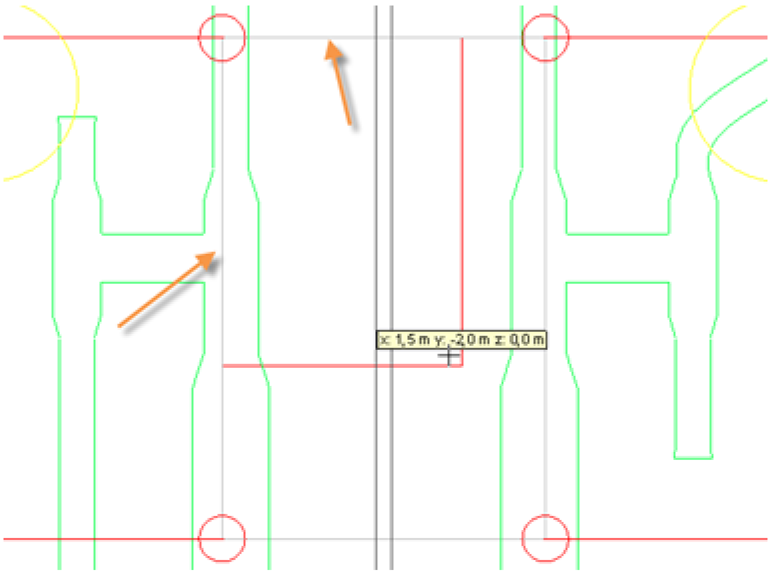


Guide Layer only (left) and with surface above (right). Note regular (black) surface edges.



Guide Layer at same height as surface (left) and above surface (right). Note color change of surface edges and details to vertex indicators.

This artifact also appears during the creation phase of a new surface whose edges lie exactly above lines from the Guide Layer, which is normal when you utilize snapping to vertices of the Guide Layer: These collinear edges disappear during surface creation as can be seen in the example below.



"Disappearing" edges of newly created surface with Guide Layer at elevation ≥ Zero.

Start Working With a 3D Model

Depending on the original purpose of the 3D .DXF model you received, it may not be suitable for acoustical modeling right away. In general, a good acoustical model requires much less detail than an architectural model. Too much detail does not only slow down calculations, it may also cause inaccurate results. It is therefore good practice to simplify a 3D model should it contain too much detail. As a general rule, don't model surfaces with an extent of less then 0.5 to 1.0 m in any dimension.

Among others, some common recommendations are:

- Don't build stairs by modeling all their individual steps. Instead, model a continuous surface with scattering reflection characteristics.
- Don't model window or door frames that are just some centimeters deep. Remove those elements and replace them by doors and windows from the respective Modeler® software toolbar. These elements are much more efficient with regards to acoustical modeling.
- Remove any decorative elements like chairs or other furniture. Instead, try to understand their acoustical behavior and assign corresponding characteristics to the underlying surfaces. Do not remove elements that do have an important acoustic property, e.g., a shelf that obstructs parts of the room from direct sound arrivals.
- Remove support structures (e.g., steel elements in the ceiling) as long as they are small (sound will typically diffract around them), unless they are required, for collision detection.

Coupled spaces

It is often likely that the original purpose of the 3D model that you have imported was not necessarily related to acoustic predictions. Depending on the complexity of the modeled building, the drawing may contain several building blocks which may or may not be acoustically coupled. A typical example would be a transportation venue that spans over several floors that are only coupled by relatively small openings. In general, coupled spaces are not recommended in Modeler software since a "global" reverberation time is assumed for the acoustical predictions. Should your 3D drawing contain such complex structures, it is recommend that you remove all building blocks except the one of interest, close any openings and restrict the predictions to the section of interest.

Bent surfaces

Depending on how much care was taken when the AutoCad® model was created, your model may also contain bent surfaces, i.e., surfaces where not all corner vertices are located in the same plane. Should Modeler software detect such surfaces during the import, it will correct the

Close Openings

For any reason, your imported room model may contain openings. Check your model carefully to detect critical, unintended openings. Modeler® software doesn't require the simulation model to be "watertight", e.g., it is allowed to model a stadium with a large opening in the ceiling, but certainly, it is undesirable that the model contains larger openings where they don't belong. It is often usually practical to search for any openings by utilizing Camera View and setting the "Back Color" to a very distinctive color, e.g., pink. You can then maneuver through your model and look around for any inconsistencies in the geometry. As with bent surfaces, the most effective way to close openings is inserting triangular surfaces with the help of the Insert Face tool.

Assign surface types & descriptions

After importing to Modeler software, you should consider assigning surface specific descriptions since these are not available in .DXF files. Also, since the

Assign acoustical properties to surfaces

As described in Start Working With a 2D Drawing, you have the option of assigning acoustical materials to individual layers during the import phase of a 3D .DXF file. Nonetheless, materials are typically assigned to each surface, so please make sure you verify the material assignment for each individual surface. In order to properly define all acoustical properties of a given surface, you also need to assign the correct reflection characteristics (scattering, specular) and, if utilized, occupancy settings to each surface. The Surface Tab in the Detail View and its capabilities for sorting allow for effective assignment of these properties.

Set Acoustical Parameters

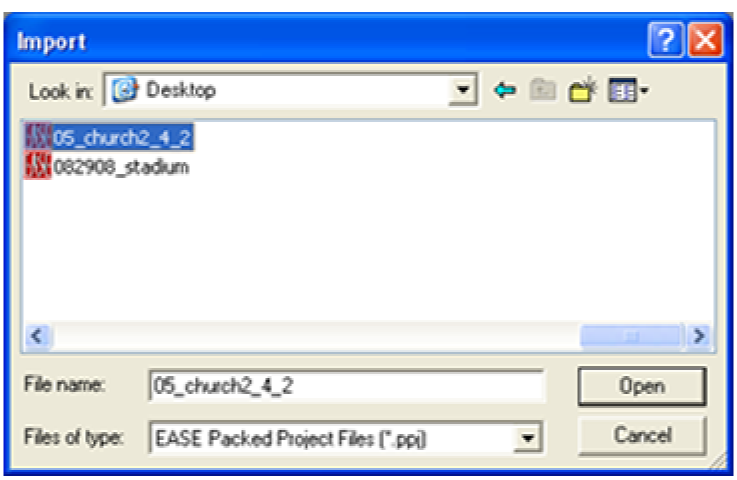
A .DXF file does not contain any information about the acoustical environment of the room model. Therefore, use the Acoustics Tab in the Detail View to set the relevant acoustical parameters like temperature, humidity, occupancy and background noise. Also, before you start performing acoustical predictions in your room model, make sure that the source used for Ray Tracing predictions of reverberation time is placed in a reasonable location.

Importing an EASE Packed Project (.ppj) File

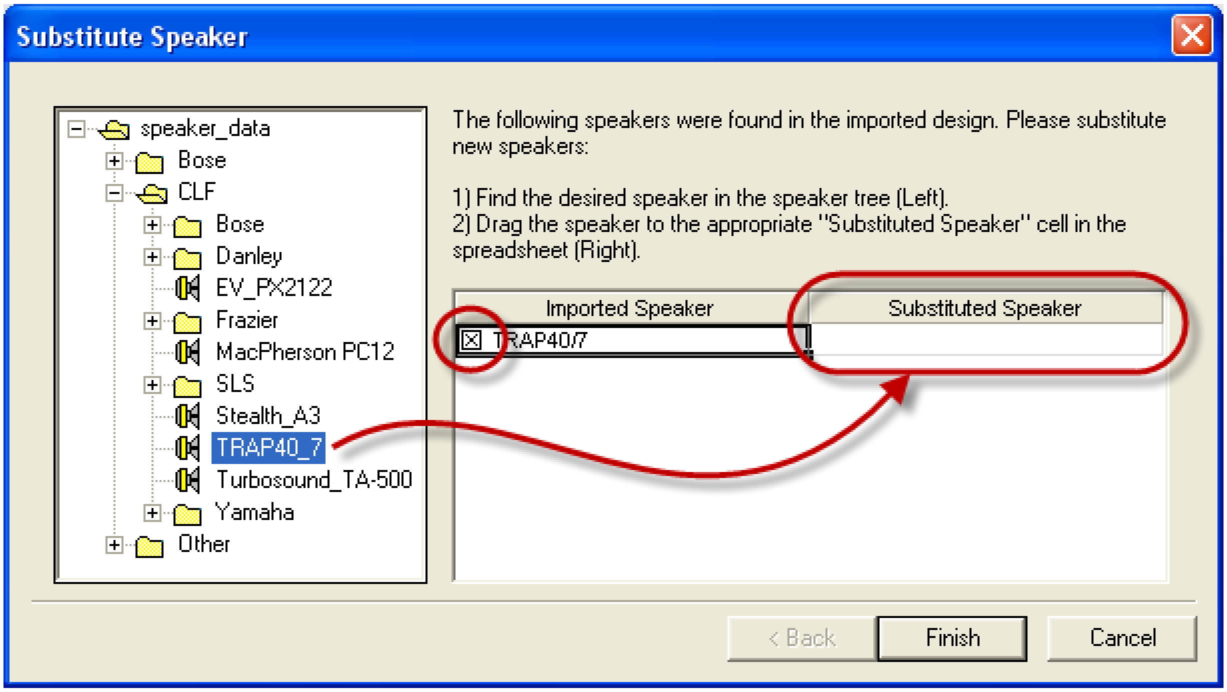
When Modeler imports an EASE packed project file (.ppj), many of the unique attributes of the original room model are leveraged. Typical attributes include room geometry, surface characteristics (descriptions and absorption coefficients), listener locations, loudspeaker locations, temperature, and humidity.

To import an EASE packed project file:

1. Click the **File** menu, Choose **Import Model**, specify the **EASE PPJ File (.ppj)** file option.

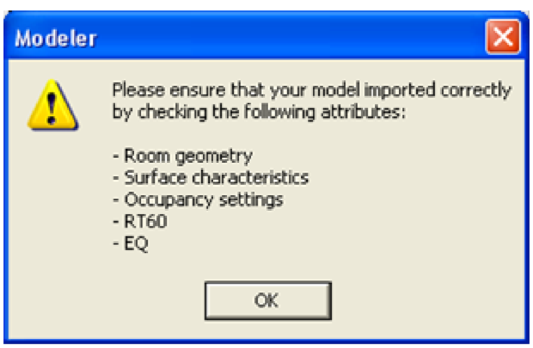


2. Select the appropriate file from the available list and click **Open**. A Substitute Speaker wizard will appear:



3. Place an "X" in the box to the left of each speaker you wish to import.
4. Click and drag substitute speakers from the loudspeaker database (left pane) to the Substituted Speaker field (right pane).
5. Click **Finish** when done.

A dialog box will appear indicating you should check model attributes for the newly imported file:



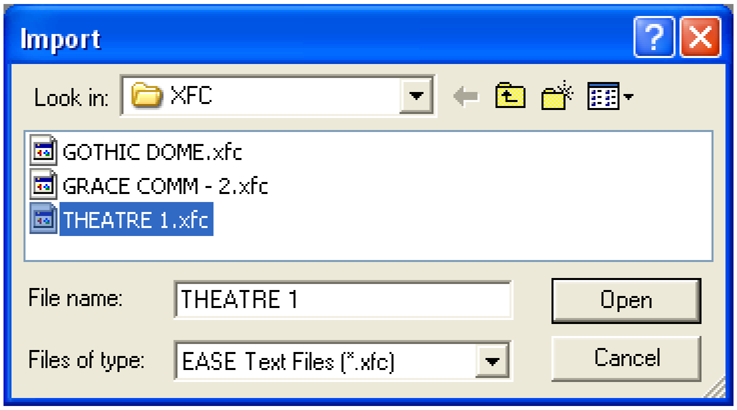
After clicking the **OK** button, your original EASE room model is visible in the modeling window. To ensure the packed project file imported correctly, a review of key model attributes is in order. See Checking Model Attributes.

Importing an EASE Faces (.xfc) File

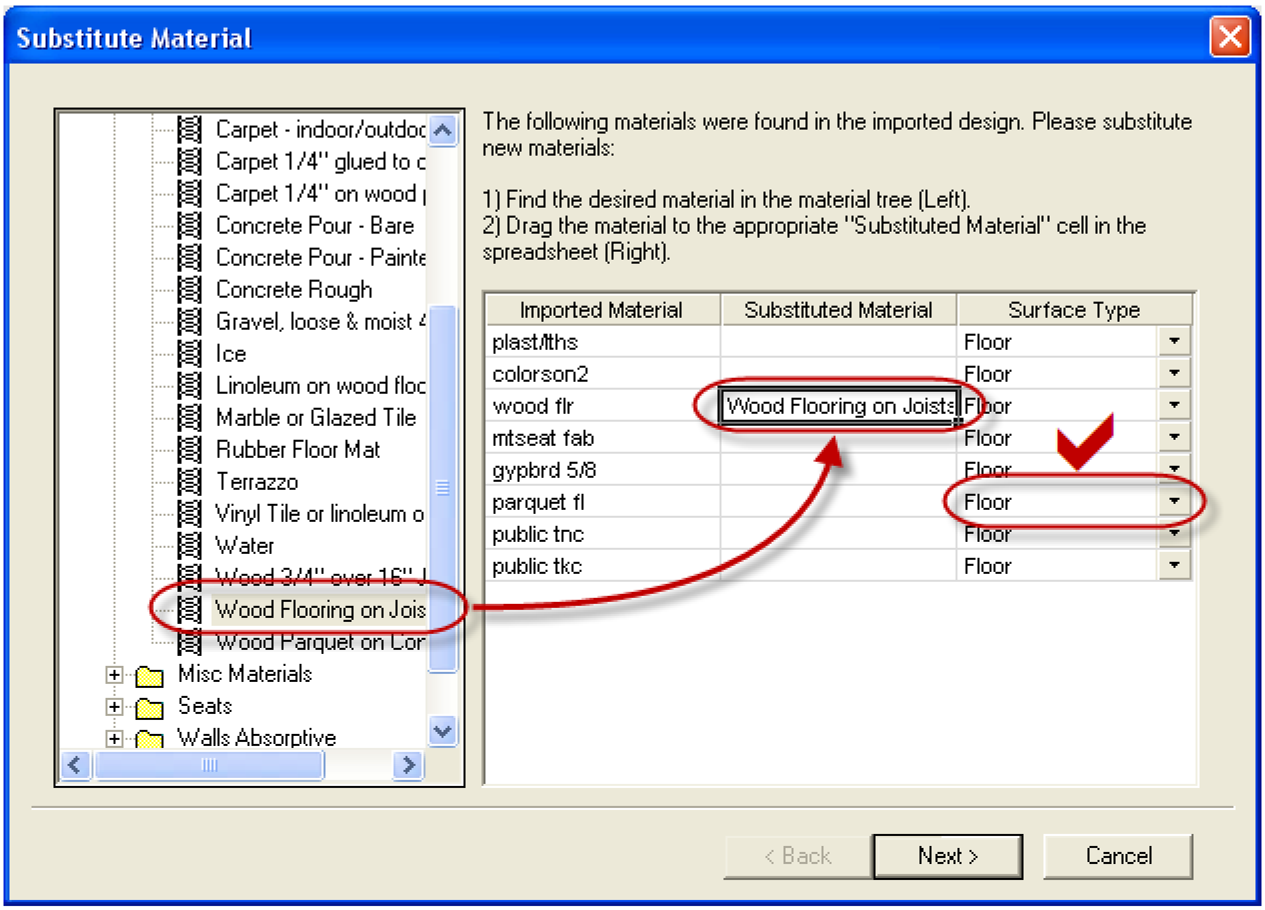
You may import EASE faces files (.xfc) from either EASE or Google SketchUp using the SU²EASE plug-in from Rahe-Kraft. When Modeler software imports an EASE faces file, surfaces are imported and room geometry is preserved.

To import an EASE faces file:

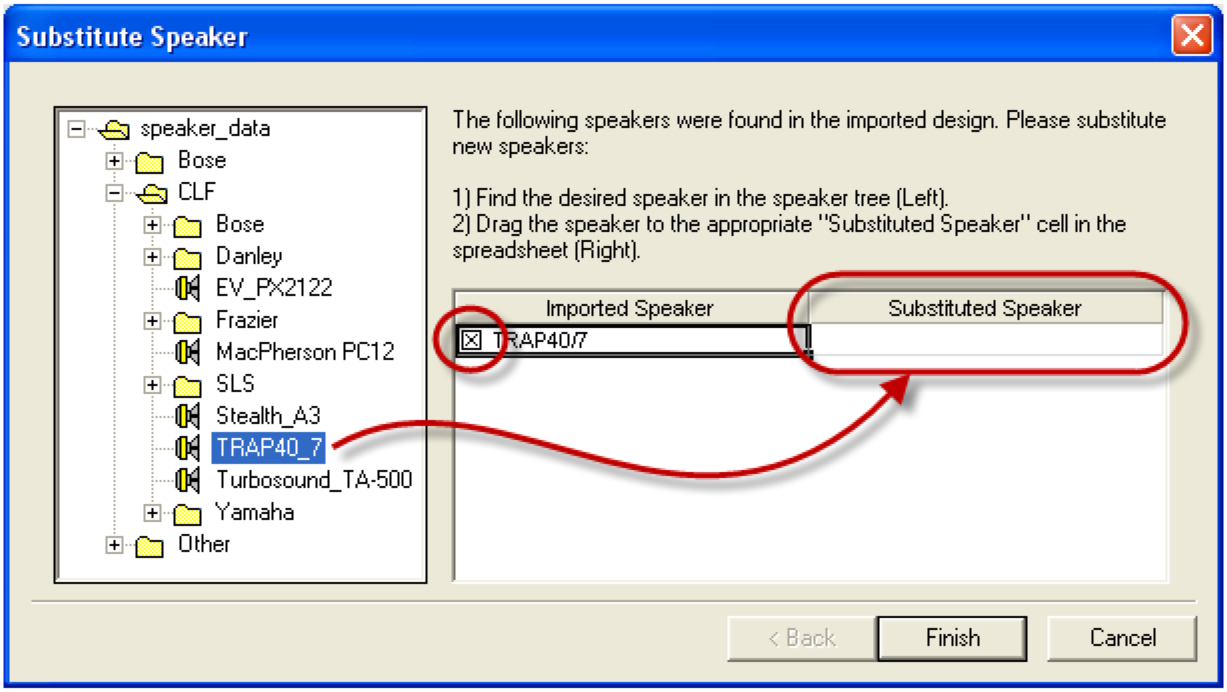
1. Click the **File** menu, Choose **Import Model**, and select the **EASE XFC File (.xfc)** file option.



2. Select the appropriate file from the available list and click **Open**. A Substitute Material wizard will appear:



3. Click and drag substitute materials from the Material Database (left pane) to the Substituted Material field (right pane).
4. Ensure Surface Types are correct by clicking on the drop down menu and modifying values as needed. Click **Next** to proceed. The Substitute Speaker wizard will appear:



5. Ensure that the speakers you wish to import have an "X" marked to the left of each imported speaker.
6. Click and drag substitute speakers from the loudspeaker database (left pane) to the Substituted Speaker field (right pane).
7. Click **Finish** when done.

After clicking the "Finish" button, your original EASE room model is visible in the modeling window. To ensure the faces file imported correctly, a review of key model attributes is in order. See Checking Model Attributes.

Special Note

When you export a faces (.xfc) file from EASE, you have the option to export double-sided planes as single surfaces (preferred when both materials are identical) or as two surfaces.

It is difficult to tell which method was used during export unless you check each surface individually, noting all doublets (surfaces on surfaces). In complicated models, this is a very tedious task.

Use single surfaces as often as possible. If front and rear sides to a surface contain different materials, it is recommended to separate the two planes by a small amount (0.33', 0.1m) and closing the gap between surfaces using the insert face tool.

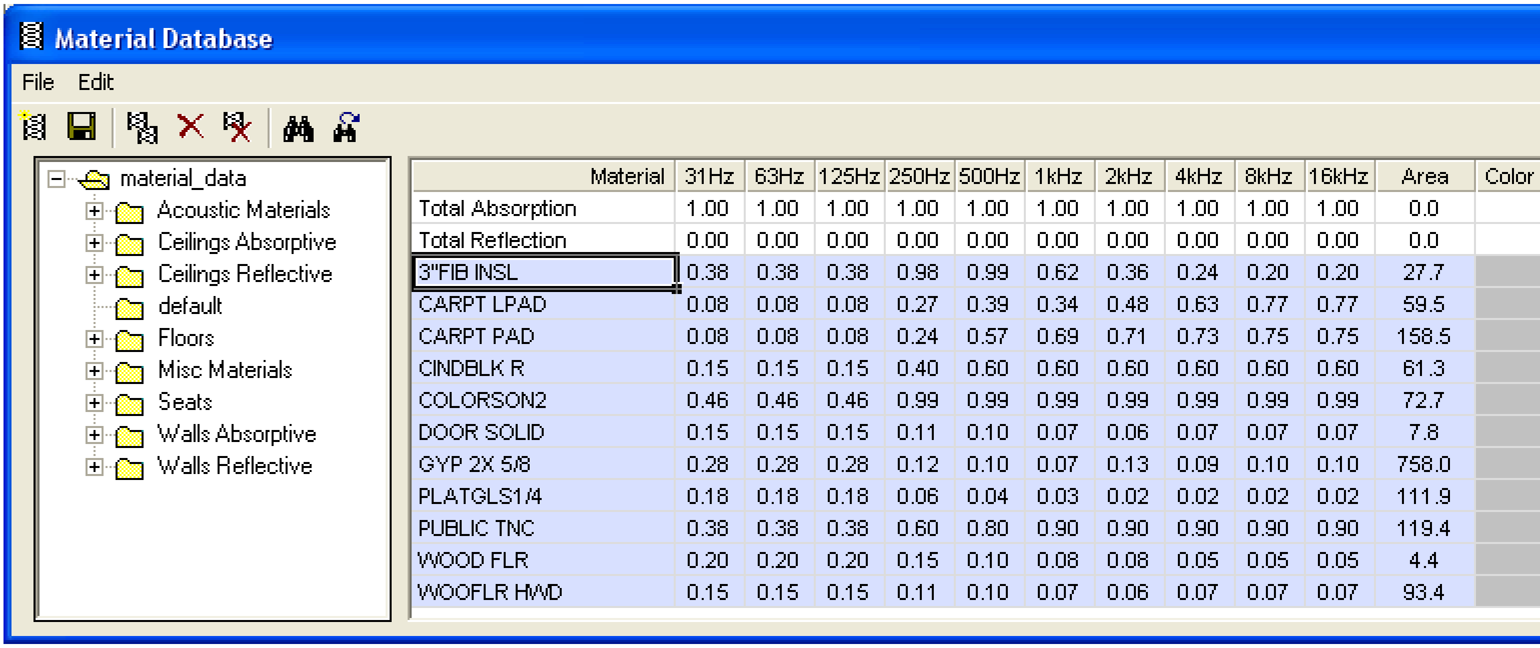
Checking Model Attributes

After importing a file, check the following to make sure the file imported correctly:

- Material database
- Surfaces tab
- Loudspeakers tab

Material Database

Access the Material database by clicking on the toolbar icon  located within the left-hand vertical tool bar. Verify that the appropriate material absorption coefficients imported as anticipated. Make any adjustments to absorption coefficients as needed.

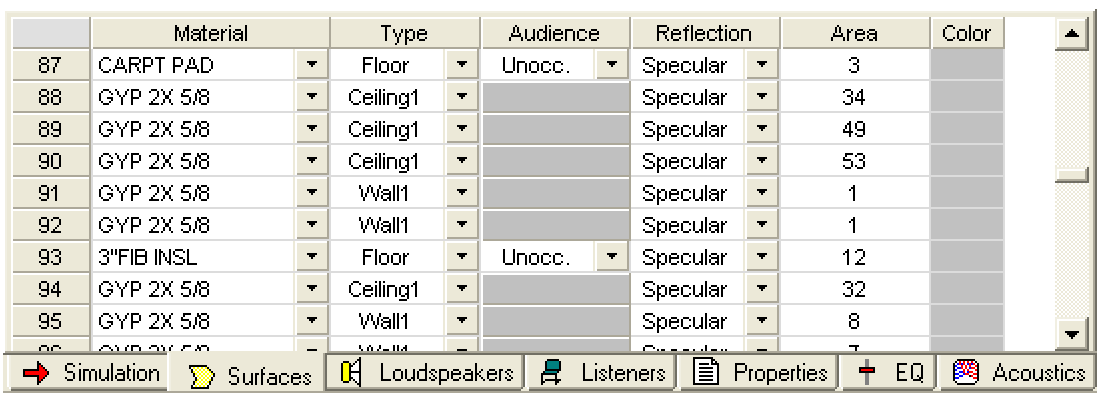


Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area	Color
Total Absorption	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.0	
Total Reflection	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	
3"FIB INSL	0.38	0.38	0.38	0.98	0.99	0.62	0.36	0.24	0.20	0.20	27.7	
CARPT LPAD	0.08	0.08	0.08	0.27	0.39	0.34	0.48	0.63	0.77	0.77	59.5	
CARPT PAD	0.08	0.08	0.08	0.24	0.57	0.69	0.71	0.73	0.75	0.75	158.5	
CINDBLK R	0.15	0.15	0.15	0.40	0.60	0.60	0.60	0.60	0.60	0.60	61.3	
COLORSON2	0.46	0.46	0.46	0.99	0.99	0.99	0.99	0.99	0.99	0.99	72.7	
DOOR SOLID	0.15	0.15	0.15	0.11	0.10	0.07	0.06	0.07	0.07	0.07	7.8	
GYP 2X 5/8	0.28	0.28	0.28	0.12	0.10	0.07	0.13	0.09	0.10	0.10	758.0	
PLATGLS1/4	0.18	0.18	0.18	0.06	0.04	0.03	0.02	0.02	0.02	0.02	111.9	
PUBLIC TNC	0.38	0.38	0.38	0.60	0.80	0.90	0.90	0.90	0.90	0.90	119.4	
WOOD FLR	0.20	0.20	0.20	0.15	0.10	0.08	0.08	0.05	0.05	0.05	4.4	
WOOFLR HWD	0.15	0.15	0.15	0.11	0.10	0.07	0.06	0.07	0.07	0.07	93.4	

Values for the 31 Hz and 63 Hz octaves are derived from the 125 Hz coefficient.
Values for the 8 kHz and 16 kHz octaves are derived from the 4 kHz coefficient.

Surfaces Tab

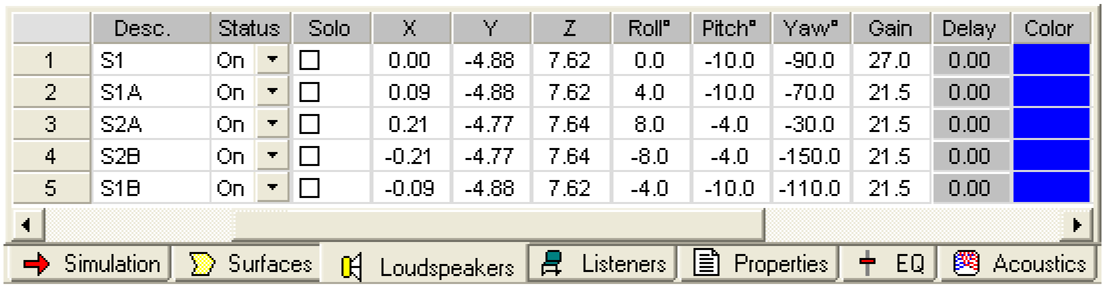
Access this tab within the Details pane. Here you will find a list of a list of all imported materials and their original names. Verify that surface types, Audience areas, and reflection characteristics are appropriate for each surface.



	Material	Type	Audience	Reflection	Area	Color
87	CARPT PAD	Floor	Unocc.	Specular	3	
88	GYP 2X 5/8	Ceiling1		Specular	34	
89	GYP 2X 5/8	Ceiling1		Specular	49	
90	GYP 2X 5/8	Ceiling1		Specular	53	
91	GYP 2X 5/8	Wall1		Specular	1	
92	GYP 2X 5/8	Wall1		Specular	1	
93	3"FIB INSL	Floor	Unocc.	Specular	12	
94	GYP 2X 5/8	Ceiling1		Specular	32	
95	GYP 2X 5/8	Wall1		Specular	8	

Loudspeakers Tab

Access this tab within the Details pane. Here you will see a list of all loudspeakers within the model. For each loudspeaker, verify that their 3D location coordinates, aiming information, original gain level, and signal delay.



	Desc.	Status	Solo	X	Y	Z	Roll°	Pitch°	Yaw°	Gain	Delay	Color
1	S1	On	☐	0.00	-4.88	7.62	0.0	-10.0	-90.0	27.0	0.00	
2	S1A	On	☐	0.09	-4.88	7.62	4.0	-10.0	-70.0	21.5	0.00	
3	S2A	On	☐	0.21	-4.77	7.64	8.0	-4.0	-30.0	21.5	0.00	
4	S2B	On	☐	-0.21	-4.77	7.64	-8.0	-4.0	-150.0	21.5	0.00	
5	S1B	On	☐	-0.09	-4.88	7.62	-4.0	-10.0	-110.0	21.5	0.00	

Room Model Construction

Basic Modeling Concepts

Modeler software includes tools for constructing three dimensional structures. The following will introduce the basics of modeling by guiding you through the process of creating a new project, setting preferences, and modeling a simple L-shaped room.

Creating a new project

Modeler software uses the project structure to organize your work environment. A project can contain multiple models. For example, a project might contain models of different rooms in the same building, or a project might contain multiple versions of the same room, each with different sound system designs.

Before getting started, you must create a new project and a new model:

1. Launch Modeler software by choosing **Start > All Programs > Bose Modeler 6.***.
2. Click on **File > New Project**.
3. Name the new project “Headquarters” and navigate to an appropriate folder to save the project in, or just choose the desktop. Click **Save**.
4. When prompted by the **New Project** window to create a new model or open an existing one, choose **New**.

Preferences

Part of creating a new model includes adjusting Preferences. There are two types of Preferences:

Application Preferences are global for the entire application and relate to all models in the project. In general, these are preferences you set once.

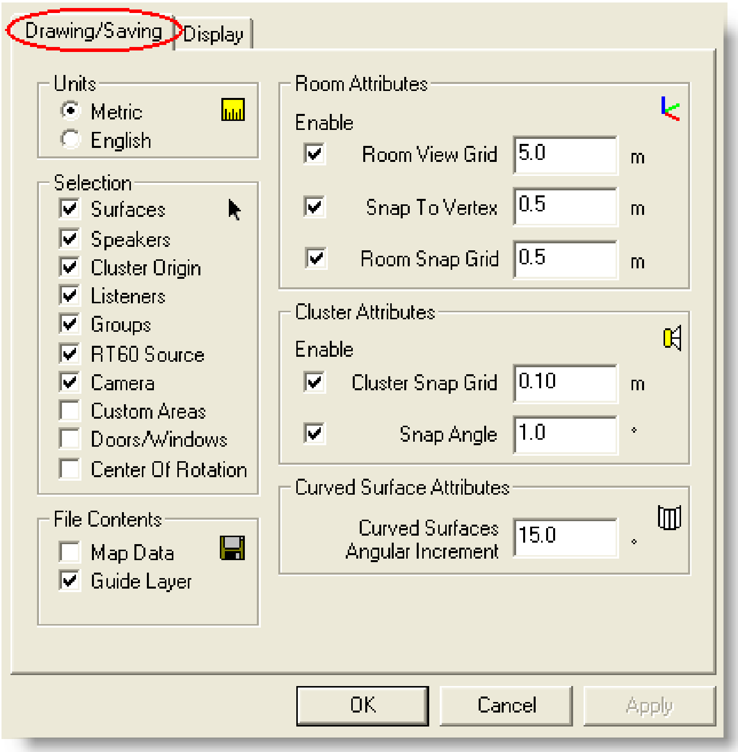
Model Settings are local to and saved with the model, and typically change as you work through the design. Different models in a project can have different model settings.

Adjusting Model Settings

You have the ability to specify how the features will behave. Note that after you create a new project or model as you progress along within your design, the Model Settings window opens automatically.

Follow these steps to set the preferences for creating the L-shaped boardroom:

1. If **Model Settings** is not already displayed: Click **Edit > Model Settings**. The **Model Settings** dialog box opens with the **Drawing/Saving** tab selected by default.



Drawing/Saving tab

2. When in the **Drawing/Saving** tab, make the following changes:
   A. Under **Room Attributes** (in the top-right corner), place a checkmark next to **Snap to Vertex**. The vertices of new surfaces may now snap to other surfaces in the room model.
   B. Under **Room Attributes** (in the top-right corner), place a checkmark to enable **Room Snap Grid**, enter **1.0 m** in the field. The vertices of each surface will now snap to one-meter subdivisions of the grid.

The following settings are located in the Drawing/Saving tab:

Units - Selects the unit of measure.

Selection - Determines the types of objects to be selected using the Select tool.

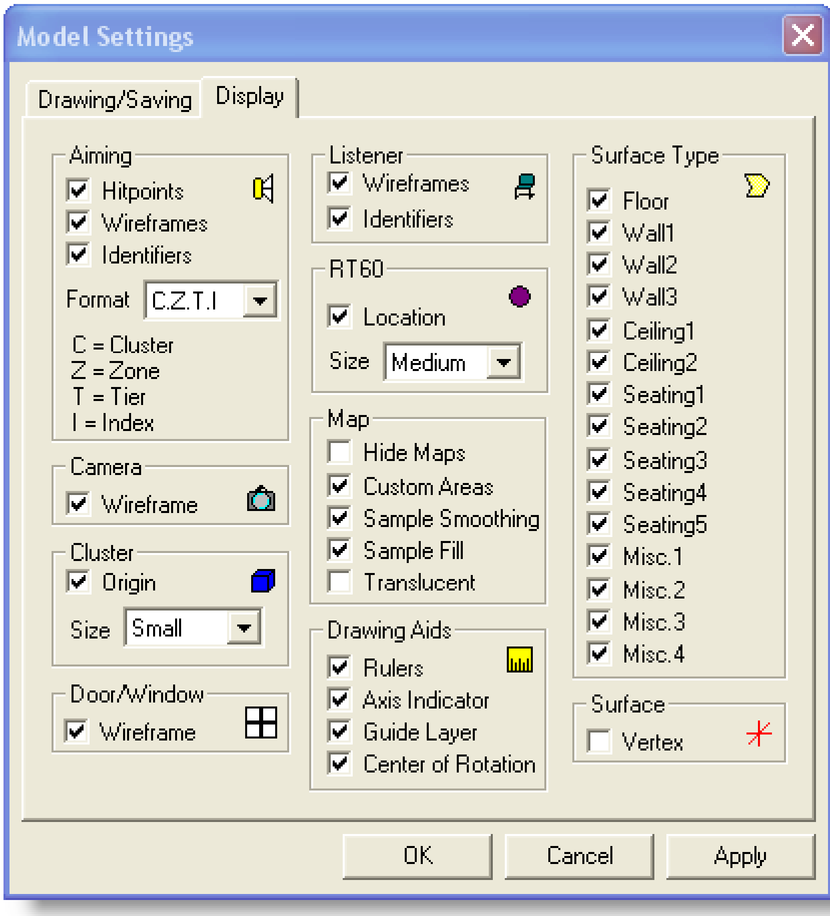
File Contents - Allows you to control what data is saved with your model.

Room Attributes - Selects the options to snap to the nearest Vertex or grid subdivision. Set the Room View Grid as a visual aid.

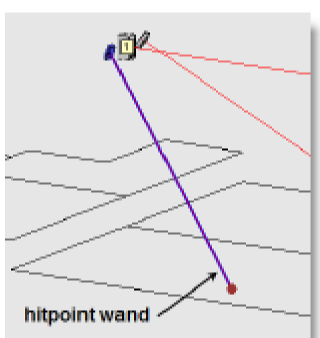
Cluster Attributes - Selects the options to snap to the nearest grid subdivision and angular increment (for curved surfaces).

Curved Surface Attributes - Defines the angular increment used to draw the curve. At each angular increment, a new surface is created, so the angular increment dictates how many flat surfaces are used to simulate the curved surface.

3. Click the Display tab to review display settings:

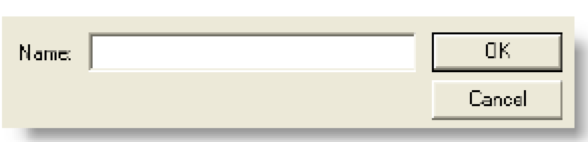


The following describes the settings in the Display tab:

Aiming (Check the loudspeakers)	**Hitpoints** - Show or hide the "hitpoint wand", which is the red line (or purple when selected) indicating the location at which the loudspeaker is aimed.  Click and drag the sphere at the end of the wand to aim a loudspeaker in your model. **Wireframes -** Show or hide the wireframe representation of the loudspeakers in your model. **Identifiers -** Show or hide the identifier numbers displayed at each loud-speaker in your model. **Format -** Select the format of the identifier from a range of different com-binations of the following numbers, for Cluster, Zone, Tier, and Index, separated by a period.
Camera (Check	**Wireframe** - Show or hide the wireframe that represents the camera in the

the camera)	Model View.
Cluster (Set the origin of a cluster)	**Origin** - Show or hide the cluster origin. **Size** - Choose the size of cluster origin from the drop-down list.
Listener (Check the listeners)	The Listener check boxes control how listeners are displayed in the model. **Wireframe** - Show or hide the wireframe that represent listener locations in the model. **Identifiers** - Show or hide the identifier numbers displayed at each listener location in your model.
RT60 (Set the origin of the RT60 source)	The RT60 source represents the location where sound comes from when measuring the reverberant decay curve for the room. The RT60 source is represented by a purple sphere in the model, and it should be located near the primary source of sound in your room model. **Location** - Show or hide the purple sphere that represents the RT60 source. **Size** - Choose the size of the RT60 source from the drop-down list.
Map (Check the coverage maps)	**Hide Maps** - When checked, all coverage maps are hidden and cannot be viewed. This is useful in situations such as a client presentation when you might not want coverage maps to be visible. **Custom areas** - Allows you to quickly map a section of a surface (or parts of multiple surfaces) to evaluate coverage for the selected area. **Sample Smoothing** - When checked, the gradient between areas of a different coverage is smoothed to provide a more continuous looking coverage map. **Sample fill** - Uncheck to show only the coverage mesh. **Translucent** - Displays a softer translucent color for coverage map views.
Drawing Aids (Check which drawing aids are displayed)	Rulers or Axis Indicators. Axis Indicators display the orientation of the three major axes. **Rulers** - Rulers appear on the top and left edges of the Model View in Plan View, Elevation View, and Section View to outline the Room View Grid. Use the check box to toggle the rulers between show and hide. **Axis Indicator** - Appears in the lower left corner of the Model View and displays the orientation of the three major axes. The axis pointers are highlighted according to the selected constraint plane. This a useful tool for orienting yourself in three-dimensional space as well as when using constraint planes.
Surface Type	Check which surface types are to be displayed. Surfaces are not removed from the model and will still be considered in all calculations, but are no longer visible in the model.
Surface	Check Vertex to provide red 3D crosshairs on surface vertices. **Vertex** - Show or hide the red markers that highlight each vertex in the model.

4. When finished, click **OK**.
   The **Name Model** window will automatically appear.
5. Name your new model, and click **OK**.

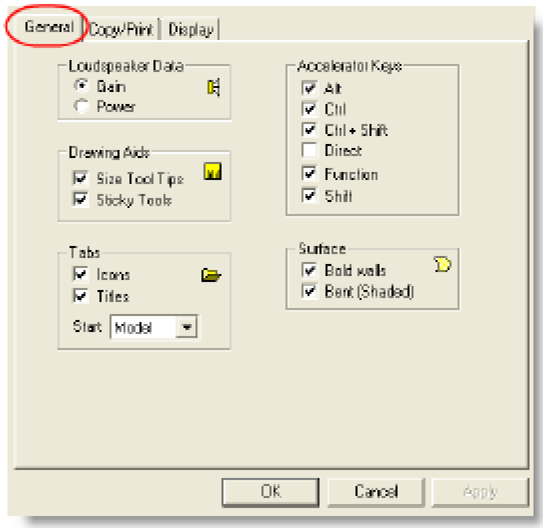


Name Model window

Adjusting Application Preferences

Direct keys allow you to access certain tools and functions in Modeler software with a single keystroke. Follow these steps to turn on direct keys in the **Application Preferences**:

1. Click **Edit > Application Preferences** (or Ctrl+E). The **Application Preferences** dialog box opens with the **General** tab selected by default.



Application Preferences, General tab

2. Under **Accelerator Keys** (in the top-right corner), place a checkmark next to **Direct** to turn on Direct Keys on the keyboard.

Note: With Direct keys on, you may not be able to enter text in certain situations. If you find you are unable to enter text into a field, turn off direct keys in the General tab of the Application Preferences dialog box by removing the checkmark next to Direct or use the 'Edit Cells' function to enter text.

3. Click **OK** to close the **Application Preferences** dialog box.

Note: As soon as you click on OK, the current Application Settings are applied to all models.

Working with the Material Database

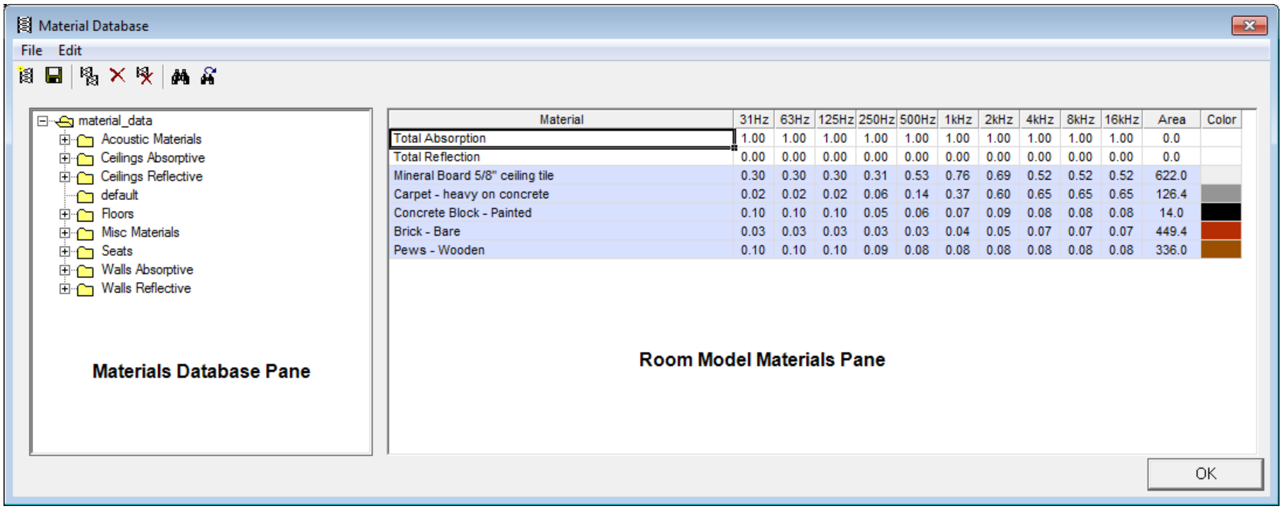
Before creating the room model, it is recommended to assemble a list of materials that will be used to build the room.

Opening the Material Database

Click the **Material Database** button in the **Database** toolbar (or press Ctrl + M):

Material Database button

The Material Database opens:



Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area	Color
Total Absorption	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.0	
Total Reflection	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	
Mineral Board 5/8" ceiling tile	0.30	0.30	0.30	0.31	0.53	0.76	0.69	0.52	0.52	0.52	622.0	
Carpet - heavy on concrete	0.02	0.02	0.02	0.06	0.14	0.37	0.60	0.65	0.65	0.65	126.4	
Concrete Block - Painted	0.10	0.10	0.10	0.05	0.06	0.07	0.09	0.08	0.08	0.08	14.0	
Brick - Bare	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.07	0.07	0.07	449.4	
Pews - Wooden	0.10	0.10	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.08	336.0	

You create a list of materials that you will use to build your model in the Material Database. You can select, modify, add, and delete materials, and save your own materials list. **Total Absorption** and **Total Reflection** simulation materials are displayed in the default Material list. You should always create a list of materials that match the actual room construction materials as closely as possible.

Each material file contains sound absorption coefficient data for 10 different octave bands, with center frequencies from 31 Hz to 16 kHz.

Creating a materials list

The list of folders on the left side of the window is similar to Windows Explorer. To create a list of materials for your project, drag the material from a folder on the left, to the Material list on the right side of the window.

1. Click the plus (+) sign next to the Floors folder to open it, then click on Carpet – heavy on concrete and drag it into the right side of the window. The material and its absorption coefficient information is added to the Material list.

   Tip: Materials are listed in alphabetical order inside each folder.
2. Add the following additional materials to the Material list:
   A. From the **Ceilings Reflective** folder, add **Plaster on Lath 1" thick**.
   B. From the **Walls Reflective** folder, add **Brick-Bare.**
3. Close the Material Database by clicking **OK**. The three materials that you added will now be available when you build the model.

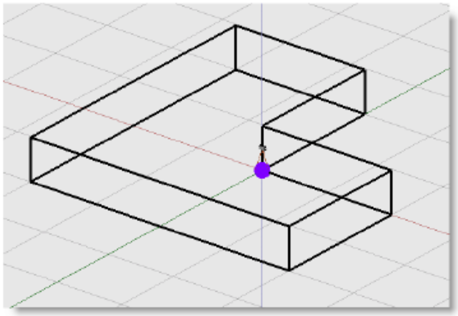
Saving your project

Now that you have set your preferences and compiled a Material list, you should save your project.

Click **File > Save Project** to save the project.

Building the L-shaped room

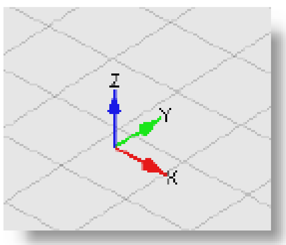
To help you understand the basics of modeling, this section will show you how to build the following L-shaped room.



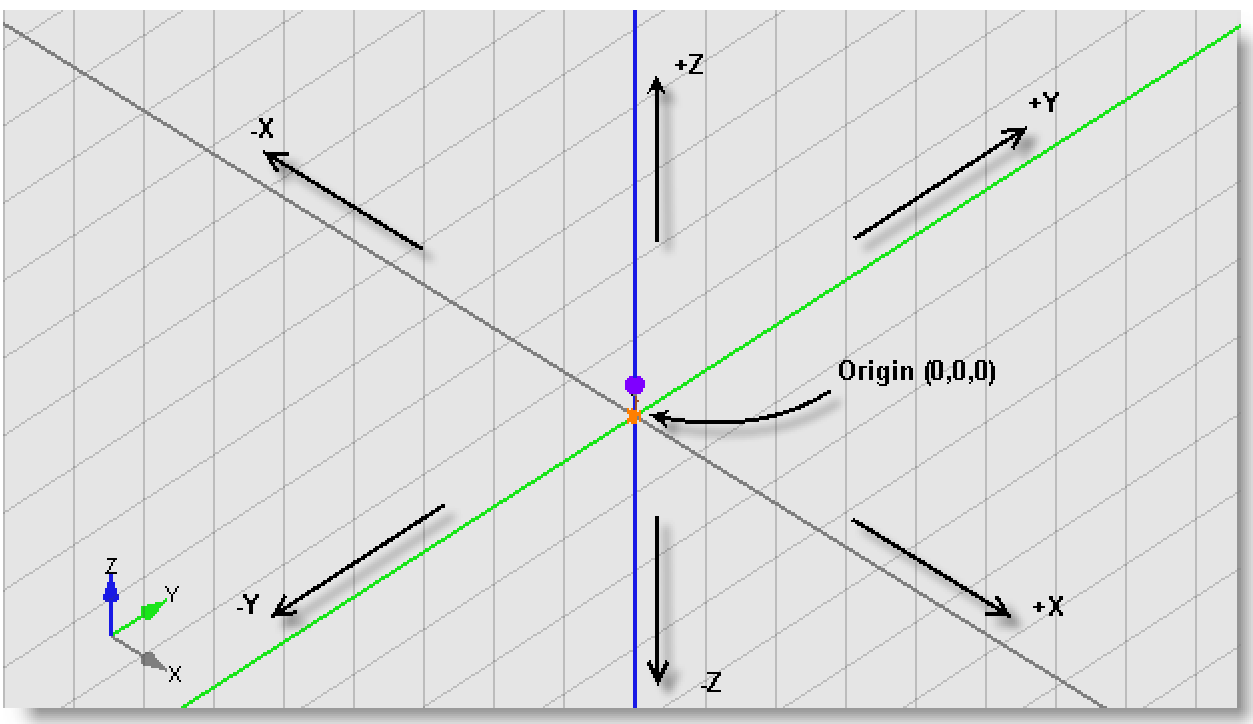
L-shaped room model

Modeler Coordinate System

The coordinate system in Modeler software is a standard Cartesian coordinate system in three dimensions: X (red axis), Y (green axis) and Z (blue axis). The same colors are shown in the axis indicator in the lower left-hand corner of theModel View.



Axis indicator



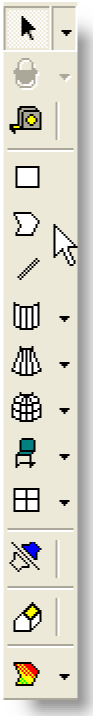
Cartesian coordinate system

In**Plan View**, the Z axis is oriented straight up toward your point of view, so it is not visible.

Creating the floor surface

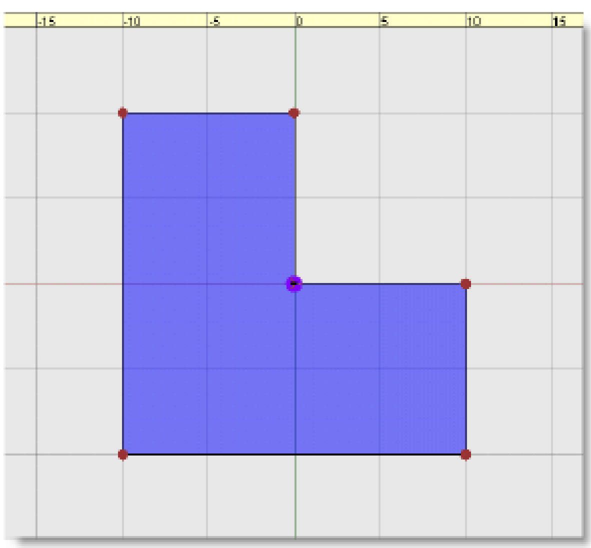
The first step in building the model is to create the floor surface.
Follow these steps to create the L-shaped floor:

1. Select the Draw Polygonal Surface tool in the Draw toolbar.



Draw Polygonal Surface tool

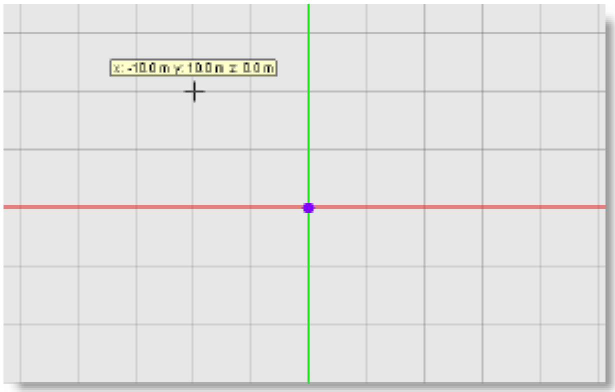
This is the surface you will create:



The floor surface

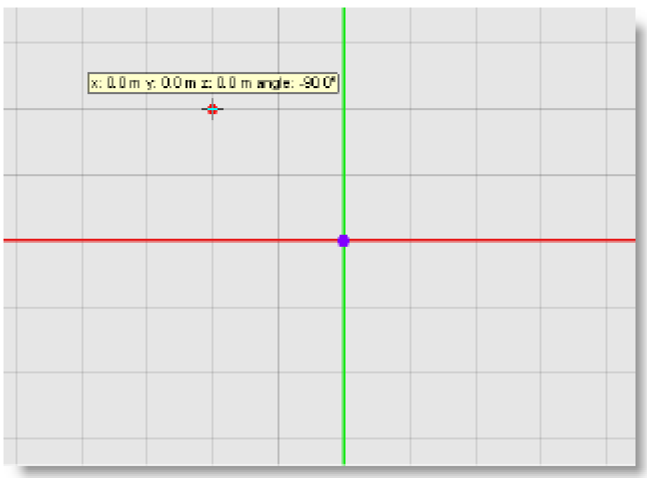
2. Move the drawing crosshairs to **x: - 10.0 y: 10.0 z: 0.0**, then click.

Note: Before you click to begin drawing a surface, the coordinates at the cursor display its location relative to the origin.



Before clicking

Once you click to start drawing a shape, the coordinates at the cursor reset to **0**and display distances relative to your last click. At each click, the coordinates reset to **x: 0.0 y: 0.0 z: 0.0**.



After clicking

3. Move the cross-hair cursor and click at the following locations to outline the floor surface as shown in Step 1. Note that at each click, the coordinates at the mouse pointer reset to **x: 0.0 y: 0.0 z: 0.0**.
   A. Click at **x: 0.0 y:-20.0**
   B. Click at **x: 20.0 y: 0.0**
   C. Click at **x: 0.0 y: 10.0**
   D. Click at **x: -10.0 y: 0.0** (at the origin)
   E. Click at **x: 0.0 y: 10.0**
   F. Click at **x: -10.0 y: 0.0** (which is the red dot indicating the starting point)

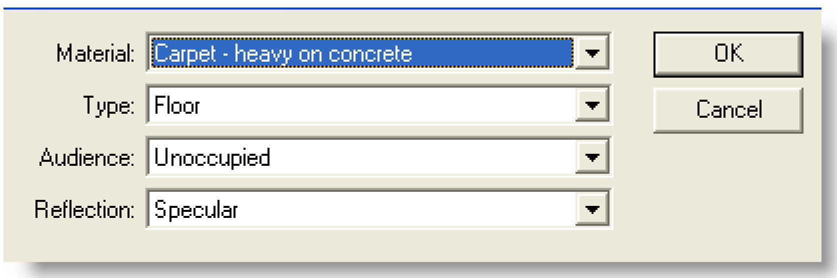
Tip: If you make a mistake while creating a shape, press Esc (or Shift + Esc) to cancel your work.

When you complete the shape, the Z-Coordinate bar opens at the top of the window. This is where you define the height for each corner vertex of your shape.

Z-coordinates

4. Enter the following properties for this shape:
   A. Leave **0 m** as the surface height to establish the floor, or ground level at Z = 0.
   B. Click **Next** five times, leaving the same properties for each vertex.
   C. Click **Finish** to complete the shape. The Surface Properties dialogue will open.

5. When you complete entering the z-coordinates, the Surface Properties window opens at the top of the Model Window. This is where you assign acoustical properties to the shape by entering information such as material, surface type, audience and reflection.



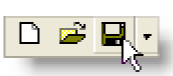
Shape Properties bar

Enter the following properties for this surface:

Note: It is recommended that you select the appropriate material type when you enter properties for the first vertex. Although you could assign a different material type at each vertex of your shape, Modeler software will use the material chosen at the final vertex as the material for the entire surface.

   A. Select **Carpet -** heavy on concrete as the surface material.
   B. Select **Floor**as the surface type.
   C. Select **Unoccupied** and **Specular**, with this being a large smooth area.

6. Click the **Save**button to save your work.



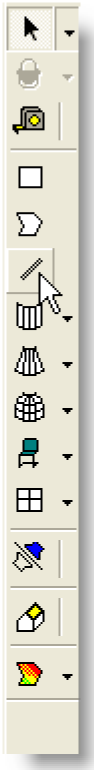
Save button

Creating the walls

Next, you will create walls on each side of the floor surface.

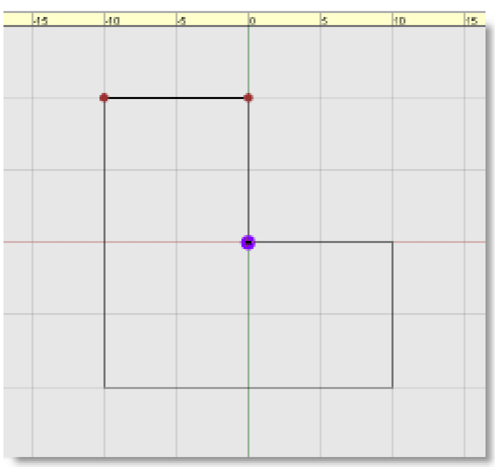
To create the first wall:

1. Select the**Draw Wall Surface**tool in the**Draw**toolbar.



Draw Wall Surface tool

This is the first wall you will draw:



First wall

2. Move the cross-hair cursor to **x: - 10.0 y: 10.0 z: 0.0** and click.
3. Move the cross-hair cursor to **x: 10.0 y: 0.0** and click.

The Z-coordinate bar opens.

Z-coordinatebar

4. Enter the following data for this wall surface:
   A. For the **first bottom corner**, leave 0 m in the **Bottom** field because the bottom of the wall meets the floor at zero.
   B. For the **second bottom corner**, click **Next** and leave the same values for the second bottom corner.
   C. For the **first top corner**, click **Next**, leave 3 m in the **Top** field, and leave the other values the same.
   D. For the **second top corner**, click **Next**, leave the values the same and click **Finish**. The Surface Properties window will open.

5. In the **Surface Properties** window, make the following adjustments:
   A. Select **Brick -** Bareas the surface material.
   B. Leave the surface type as **Wall1**.
   C. Leave **Unoccupied** and **Specular** as is.

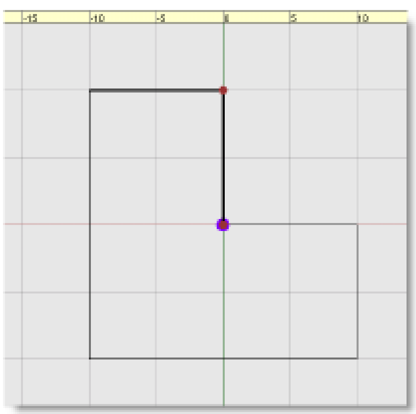
   The first wall is created in your model.

6. Click the **Save** button to save your work, or press **Ctrl + S**.

To create the second wall surface:

1. Make sure**Draw Wall Surface**tool is still selected.

   This is the second wall you will draw:



Second wall

2. Move the cross-hair cursor to **x: 0.0 y: 10.0 z: 0.0** and click.
3. Move the cross-hair cursor to **x: 0.0 y: - 10.0** and click.

   TheZ-coordinatesbar opens.

   Confirm that the following values are entered (you should not have to change any values):

First bottom corner	Leave 0 m in the **Bottom** field.
Second bottom corner	Click **Next** and leave the same values for the second bottom corner.
First top corner	Click **Next**, leave**3 m** in the **Top** field and leave the other values the same.
Second top corner	Click **Next**, leave the values the same and click **Finish**. The Surface Properties window will open.

   A. Leave **Brick -** Bare as the surface material.
   B. Leave the surface type as **Wall1**.

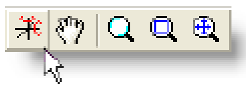
C. Leave **Unoccupied** and **Specular** as is.

The second wall is created in your model.

4. Click the**Save**button to save your work.

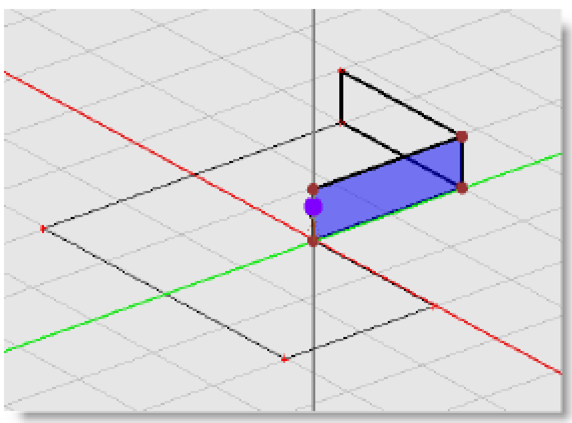
   You now have created two of the six walls for the room model. To ensure that everything lines up, look at the model from a different perspective.

5. Click on the**Rotate View**tool, and then click and drag in theModel View to view your model from different perspectives.



Rotate View tool

At this point, the model should look like this:

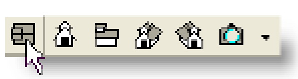


Model with two walls in Rotate View

The remaining walls will be built in the same manner as the first two, and will have the same material and surface type properties.

To build the third wall in the L-shaped room:

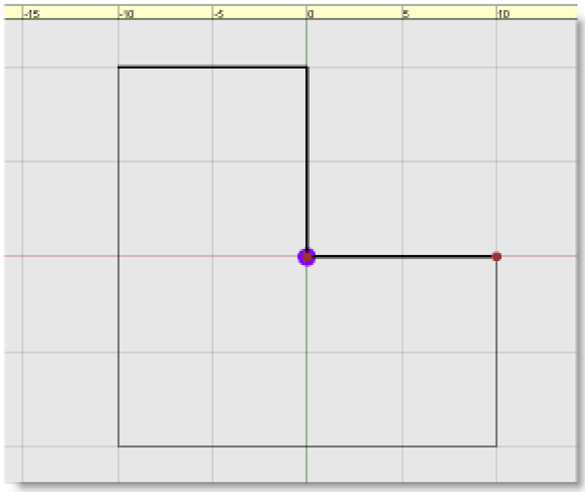
1. Switch back to Plan View by clicking the **Plan View** button, or use the direct key shortcut: press the **H** key.Plan View



Plan View button

2. Select the**Draw Wall Surface**tool.

   This is the third wall you will draw:



Third wall

3. Move the cross-hair cursor to the origin,**x: 0.0 y: 0.0 z: 0.0**, and click.
4. Move the cross-hair cursor to **x: 10.0 y: 0.0 z: 0.0** and click.
   The Z-coordinates bar opens.

   Confirm that the following values are entered (you should not have to change any values):

First bottom corner	Leave 0 m in the **Bottom** field.
Second bottom corner	Click **Next** and leave the same values for the second bottom corner.
First top corner	Click **Next**, leave**3 m** in the **Top** field and leave the other values the same.
Second top corner	Click **Next**, leave the values the same and click **Finish**. The Surface Properties window will open.

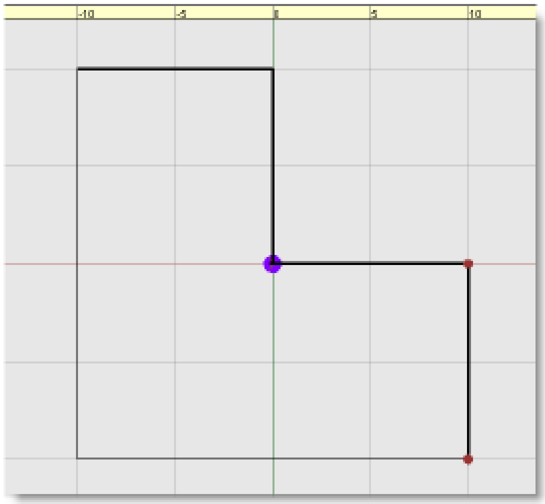
   A. Leave **Brick - Bare** as the surface material.
   B. Leave the surface type as**Wall1**.
   C. Leave **Unoccupied** and **Specular** as is.

   The third wall is created in your model.

5. Click the **Save** button to save your work.

To build the fourth wall in the L-shaped room:

1. Make sure **Draw Wall Surface** tool is still selected.
   This is the fourth wall you will draw:



Fourth wall

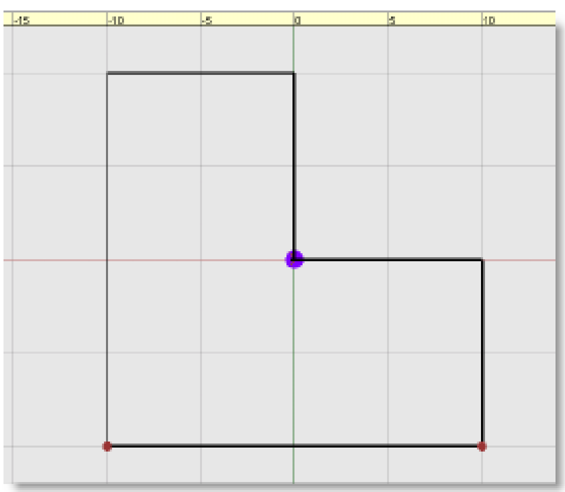
2. Move the cross-hair cursor to **x: 10.0 y: 0.0 z: 0.0,**and click.
3. Move the cross-hair cursor to **x: 0.0 y: - 10.0** and click. TheZ-coordinatesbar opens.

   Leave all the same data for these walls as for the first three. Notice that you will only be required to click on the **Next**button 3 times and then the **Finish** button as Modeler software defaults all setting based on the last wall surface you drew.
4. Click the **Save** button to save your work.

To build the fifth wall in the L-shaped room:

1. Make sure**Draw Wall Surface**tool is still selected.

   This is the fifth wall you will draw:



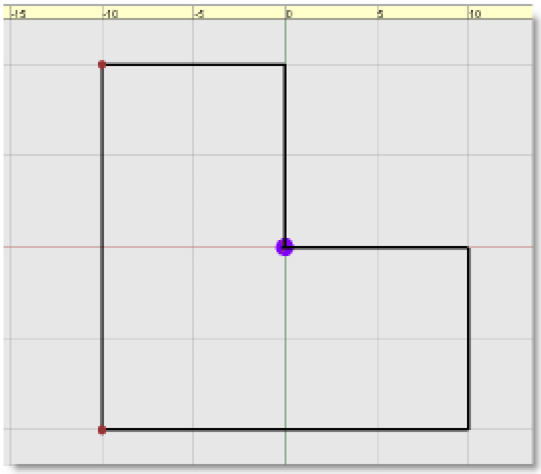
Fifth wall

2. Move the cross-hair cursor to **x: 10.0 y: - 10.0 z: 0.0** and click.
3. Move the cross-hair cursor to **x: - 20.0y: 0.0** and click. TheZ-coordinatesbar opens.

   Leave all the same data for these walls as for the first four. Notice that you will only be required to click on the **Next** button three times and then the **Finish** button as Modeler software defaults all setting based on the last wall surface you drew.
4. Click the **Save** button to save your work.

To build the sixth and final wall:

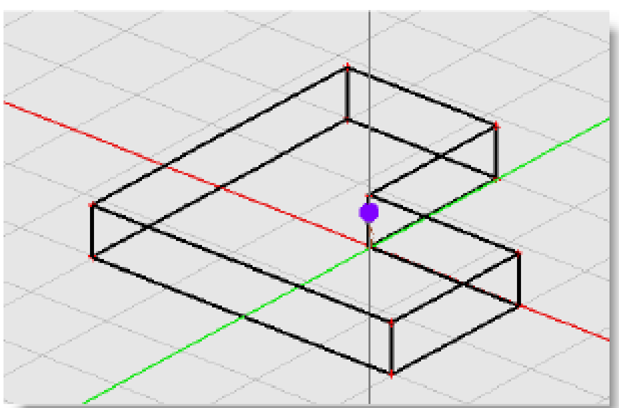
The sixth wall connects the fifth wall with the first wall that you drew.



Sixth wall

5. Use the**Draw Wall Surface**tool to define the position of the wall, then leave the same wall properties as the other walls.
6. When you are finished, view the model in Rotate View. Try using the direct key shortcut for theRotate Viewtool: press the**D**key.

   The room will look like the following figure:

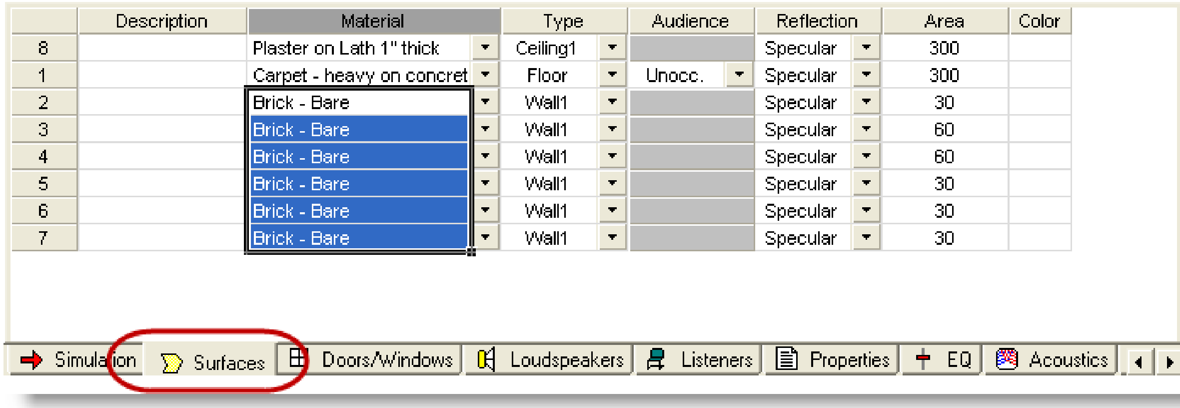


Model with completed walls

Using the Extrude Walls tool

In this section, you will learn how to model the same structure using the**Extrude Walls**tool. The process that you used in the previous section to build the floor and walls of the L-shaped room is an important lesson in basic modeling. You will now learn how to quickly and easily achieve the same results. Follow these steps to build the walls and ceiling of the L-shaped room using the**Extrude Walls**tool:

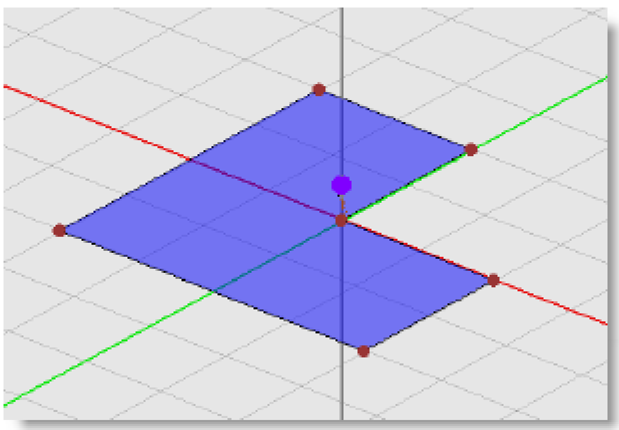
1. Delete the walls that you previously created: Select them in the **Surfaces** tab in the **Detail** window, then press the **Delete** key:



Detail window Surfaces tab

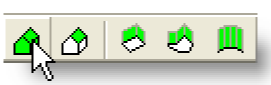
After deleting the walls, your model should only contain the floor surface.

2. Select the floor surface by clicking on it in the **Surfaces** tab in theDetail View. The surface is highlighted in blue in the Modeling View, indicating that it is selected:



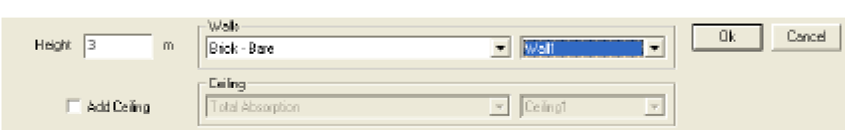
Floor surface, selected

3. Select the **Extrude Walls** tool in the **Extrusions** toolbar.



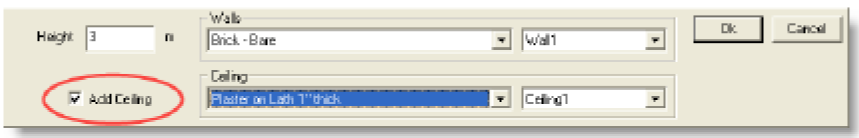
Extrude Walls tool

The **Extrude Walls** dialog box opens:



***Extrude Walls** dialog box*

4. The **Extrude Walls** tool adds walls to the outer perimeter of the selected surface, with the option to also add a ceiling. You can specify how high you want the walls to be in the **Height** field in the **Extrude Walls** dialog box. Because the L-shaped room model has 3 meter walls, leave the default value of **3m** in the **Height** field.
5. In the **Surface Material** drop-down menu, leave **Brick -** Bare as the surface material for the walls. Leave the default Surface Type (**Wall1**).
6. To add a ceiling, place a check mark next to **Add Ceiling**.

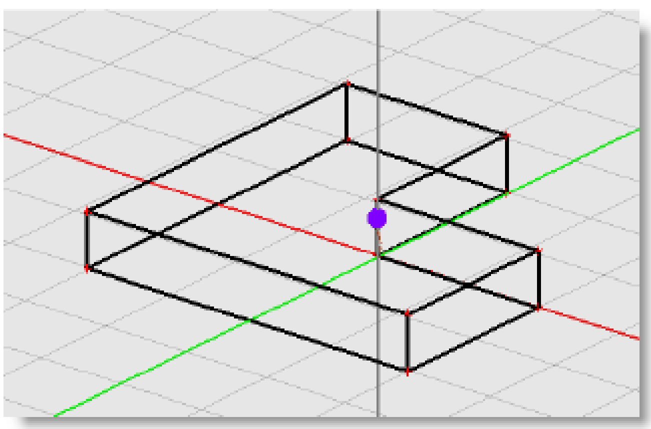


Adding a ceiling

7. Select **Plaster on Lath 1" thick** as the surface material, and leave **Ceiling1** as the surface type.
8. Click **OK**.

   The walls and ceiling are extruded from the floor surface.
9. Use the Rotate View tool to look at the model in perspective.

   The finished room model looks like this:



Finished room model

10. Click the **Save** button to save your work.

Note: When using the Extruded tool, the Reflection and Audience properties must be set manually by adjusting the properties of each surface in the Surface tab.

Close the model by clicking on the X in the upper right-hand corner of the **Modeling** window. Close the project by choosing **File**>**Close Project**.

You are now familiar with how to build a basic model, including setting preferences and assembling a material list using the Materials Database.

Advanced Modeling Concepts

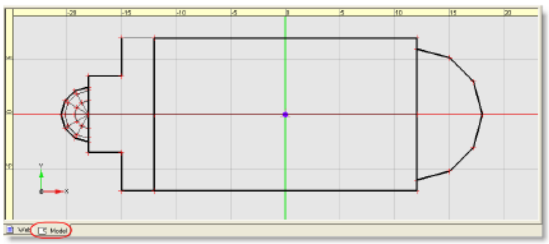
This section goes beyond the basics and presents more advanced modeling concepts. Using the First Street Church project, you will be guided through the process of creating the last two missing surfaces of a nearly complete model of the church. Then you will learn to set surface colors and view the structure in Camera View.

Opening a model

1. Follow these steps to open the nearly complete church model:

2. Click **File > Open Project...**
3. In the Look in: drop-down menu, click on the desktop.
4. Open the Tutorial folder, then open the First Street Church folder.
5. Open the file named First Street Church.pjt
6. In the Project View, double-click on the Design 3 model.
7. After the Design 3 model opens, close the Project window.

The Design 3 model looks like this:

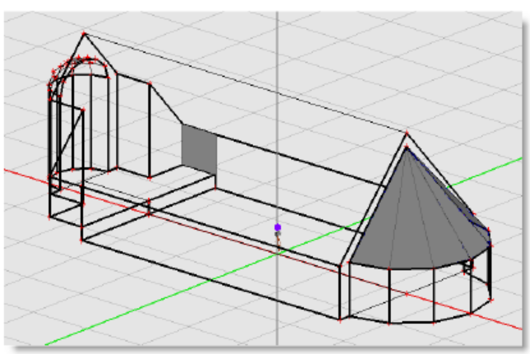


Design 3 model

8. Use the Rotate View tool on the View toolbar to look at the model from different perspectives.

Rotate View tool

Notice that there are two missing surfaces in the model shown in the following figure; one wall section and the conical ceiling surface over the rounded alcove at the end of the church. These are the final two surfaces that you will create to complete the church model.

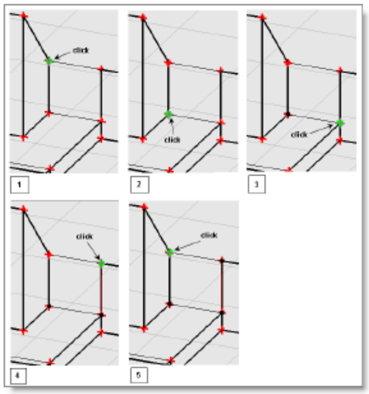


Missing surfaces in the model

Creating a missing surface

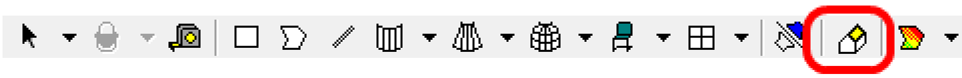
The **Insert Face** tool can be used to create a surface by defining the outer boundaries of the surface. Follow these steps to create the missing square wall section using the **Insert Face** tool:

1. Rotate the view using the Rotate View tool until it matches the following figure. Define the shape of the new surface by clicking on the vertices that outline the missing wall section. Notice that a vertex will highlight in green when the crosshair cursor is moved over it.



*Outlining the missing surface with the **Insert Face** tool*

2. Select the Insert Face tool in the Draw toolbar.



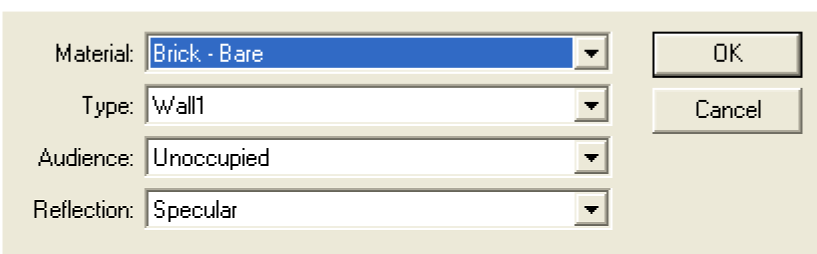
Insert Face tool

When using the **Insert Face** tool, the starting point is highlighted red after clicking, and each subsequent click is highlighted with a black dot. The shape is finished when you click on the red starting point.

Note: After three vertices have been placed, additional vertices can only be created at locations within the plane defined by the first three vertices.

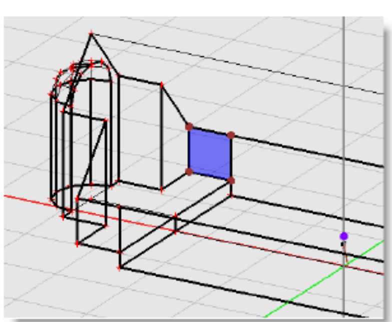
Tip: If you make a mistake while creating a shape, press Esc (or Shift + Esc) to cancel your work.

3. When you complete the shape, the **Insert Face** properties box opens. Here you define the material and surface type for the new surface. Choose **Brick - Bare** for the material, and **Wall1** for the surface type. Leave Audience and Reflection as is.



***Insert Face** properties box*

4. Click **OK.** The new surface is created in the model.



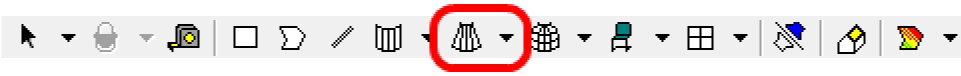
New wall surface

5. Click the **Save** button to save your work.

Creating a conical ceiling surface

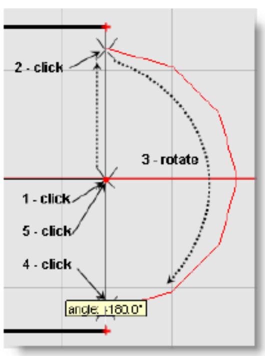
To finish the model, follow these steps to create the conical ceiling surface:

1. Switch to Plan View by clicking on the Plan View button in the View toolbar. You will be creating a ceiling surface on the larger rounded alcove of the church (in the positive X direction).
2. Select the Draw Conical Surfaces tool.



Draw Conical Surfaces tool, with wing menu

3. Define the shape as follows:



Creating the conical ceiling surface

A. Click at x: 12.0 y: 0.0 z: 0.0.
B. Move the cursor in the positive Y direction until the radius is 6 m and click.
C. Rotate the cursor clockwise until the angle is -180.0° and click.
D. Move the cross-hair in towards your starting point until the second radius is equal to 0 m and click

4. When you finish the surface, the Z-coordinates bar appears at the top of the window. Enter the following properties for this shape:

A. Enter 4 m for Elevation 1 (Z1), since the bottom of this ceiling meets the rounded wall at Z1 = 4 meters.

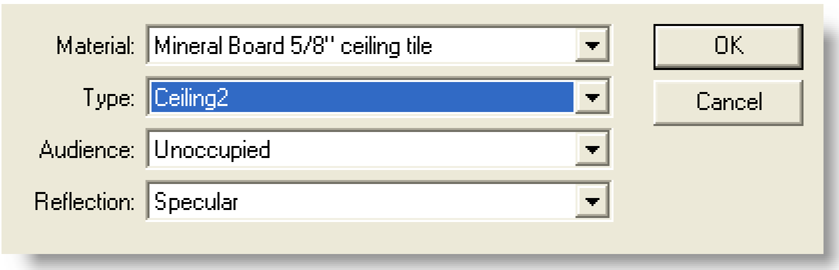
Z-coordinates bar (Z1)

B. Click **Next** and set Elevation 2 (Z2) to 11 m to place the point of the conical roof section just below the peak of the church ceiling.

Z-coordinates bar (Z2)

C. Click **Finish**.

5. In the Surface Properties window, make the following adjustments:
   A. Choose Mineral Board 5/8" ceiling tile as the surface material.
   B. Select **Ceiling 2** as the surface type.
   C. Leave **Unoccupied** and **Specular** as is.
   D. Click **OK**. The conical ceiling is created over the church alcove.



Surface Properties window

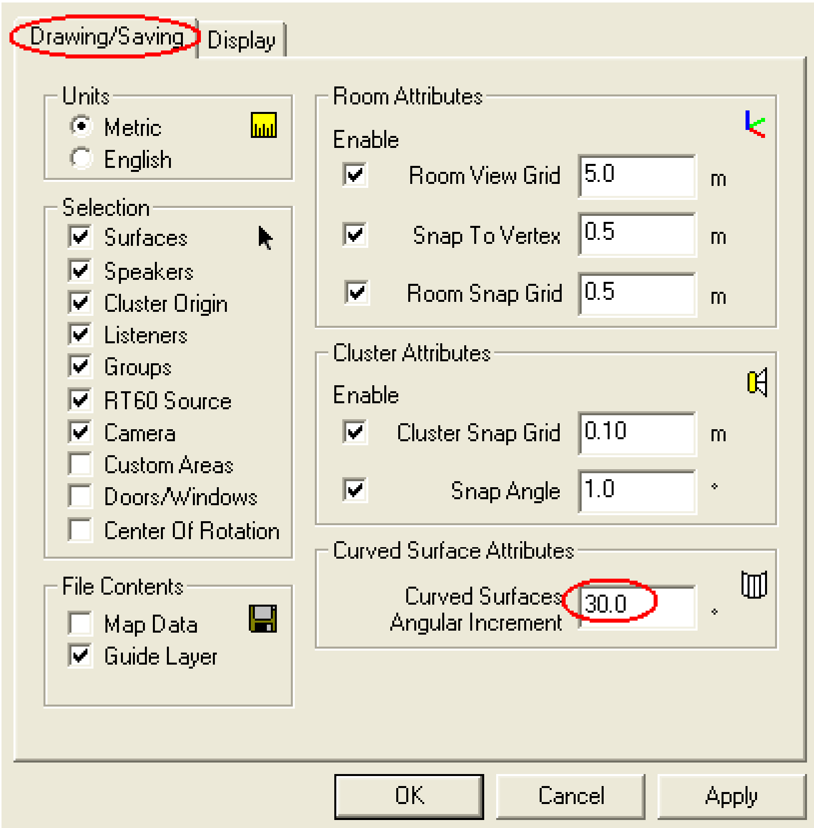
6. Click the **Save** button to save your work.

Creating a curved surface

Curved surfaces in Modeler software are simulated as numerous flat surfaces joined together to form a curve. The Curved Surfaces Attributes allow you to specify the angular increment that is used to draw the curve. At each angular increment, a new surface is created, so the angular increment dictates how many flat surfaces are used to approximate the curved surface.

Follow these steps to set the preferences for the curved surface:

1. Click Edit > Model Settings (or simply click **Ctrl+R**). The Model Settings dialog box opens with the Drawing/Saving tab selected by default.

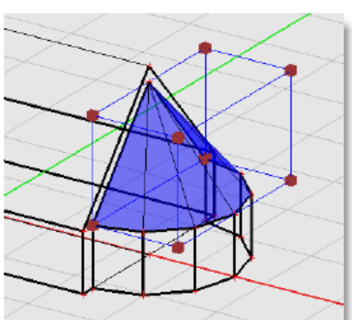


Drawing/Saving tab

2. Under Curved Surface Attributes (bottom-right corner), enter a value of 30° for the Angular Increment.

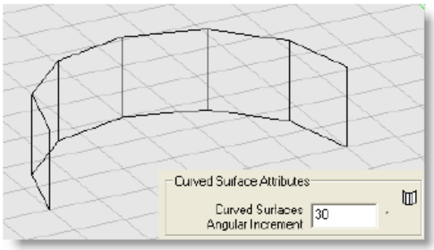
Tip: Rather than going to the Model Settings, simply click on the Wing Menu icon  next to the Draw Conical Surfaces tool, and enter a value of 30°.

The conical ceiling should look like this:

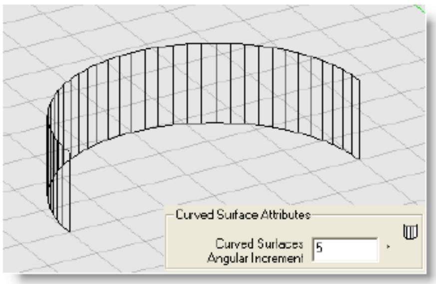


New conical ceiling surface

Examples of different angular increments:



A cylindrical wall created with an angular increment of 30°



A similar cylindrical wall created with an angular increment of 5°.

You now have completed the church structure. For an in-depth workshop on creating this church model from the beginning, please see Modeling Workshop.

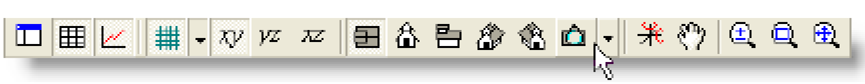
Using Camera View

The Camera View feature in Modeler software allows you to view the model as though you are looking through a camera that can be placed anywhere inside or outside of the model.

Camera View is useful for:

- Gaining perspective of your model.
- Delivering a presentations.
- Ensuring that your model is closed and complete.

To activate, select the Camera View tool in the View toolbar.



Camera View tool

The Model View changes to a view of the model through the camera inside the church. The default camera position is at the origin (**x: 0.0 y: 0.0 z: 0.0**) facing in the positive Y direction, at a height of Z = 1.5 m.

It is possible to move the camera into other positions using the following methods:

Keyboard + mouse scroll-wheel commands:	If you have a mouse with a scroll-wheel, you can use your keyboard and mouse to manipulate the camera.
The Properties tab:	Click the Properties tab while in Camera View. Adjust the different properties and notice the result in the Model View. **Note: In the Properties Tab you can adjust the camera loc-**

	ation, snap the camera to a listener, or add a listener at the camera location. You can also adjust the lighting and coloring.
Keyboard arrow commands:	Use the 4 arrows on your keyboard to move the camera in the X - Y plane.
Select tool:	Exit Camera View and select the camera with the Select tool in the Model View. You can rotate and drag the camera to reposition it, then re-enter Camera View to view the model.

The following chart outlines how to control the camera using a scroll-wheel mouse. You must place your mouse over the Modeling window for these commands to work.

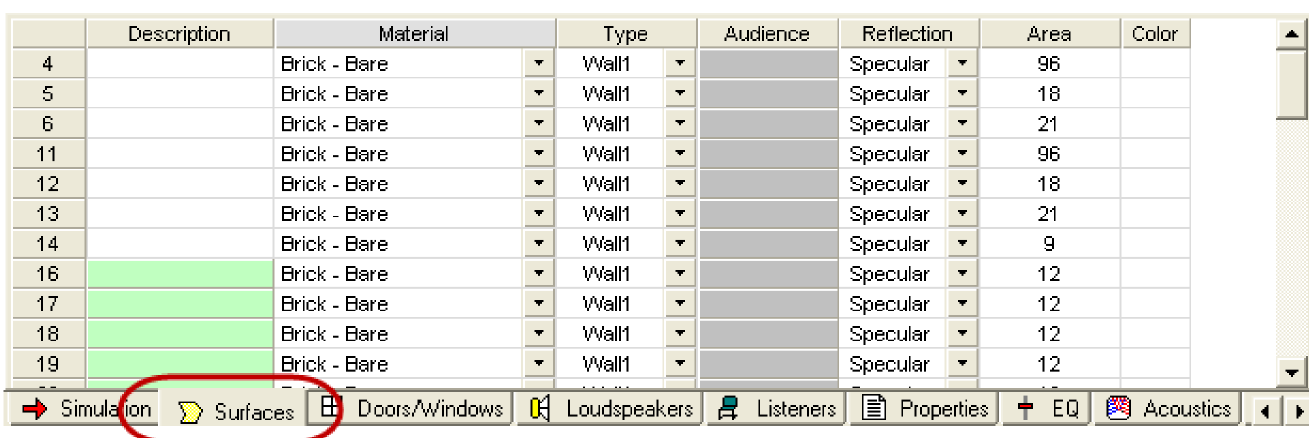
Move forward or backward:	Roll the scroll-wheel on your mouse: Up moves forward, down moves backward.
Adjust camera yaw (rotation):	Hold Shift, then roll the scroll-wheel on your mouse: Up rotates left, down rotates right.
Adjust camera pitch:	Press Ctrl, then roll the scroll-wheel on your mouse to adjust the camera’s pitch: Up rotates the camera upwards and down rotates the camera downwards.
Adjust lens focal length (zoom):	Press Shift + Ctrl then roll the scroll-wheel on your mouse to adjust the camera’s focal length: Up zooms in, down zooms out.
Move along the Z-axis:	Left-click on your mouse and hold: Roll the scroll-wheel forward to move up, roll the scroll-wheel backward to move down.

Setting surface colors

Modeler software provides the ability to add color to the surfaces in your model in order to represent the actual colors of the materials used in the room. The colors will then be displayed in the camera view. Each surface type in Modeler software is assigned the color white by default. You can assign a color to each material type, and all surfaces with that material type will display in the selected color in Camera View.

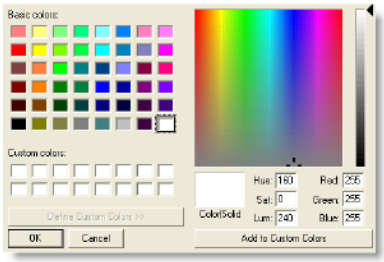
Follow these steps to assign new colors to surfaces:

1. Select the Surfaces tab in the Detail View, then click on the **Material** column header to sort by material name.



Surfaces tab

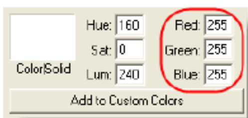
2. Scroll to the right and double-click a cell in the Color column for any of the Brick - Bare surfaces. The Windows Color Picker opens:



Color dialog box

A. Choose a shade of dark red and the selected color appears in the Color window.
B. Click OK and the cells in the color column turn dark red along with all Brick - Bare surfaces.

Note: If you know the Red/Green/Blue color number, simply enter them.

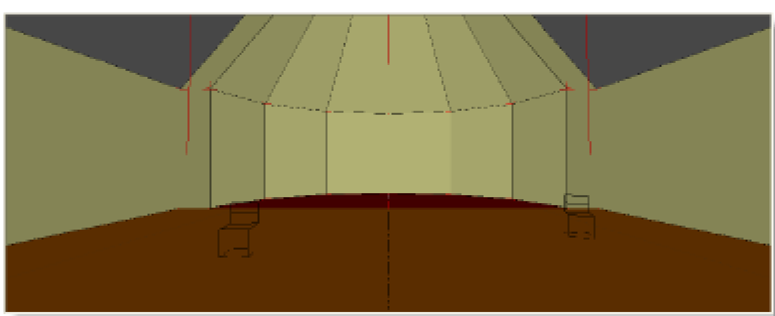


3. Repeat the same process for each surface material, and assign the following colors:

Carpet - heavy on concrete:	Dark gray
Concrete Block - Painted:	Black
Mineral Board 5/8' ceiling tile:	Off white
Pews - Wooden:	Brown

4. Click the **Save** button to save your work.

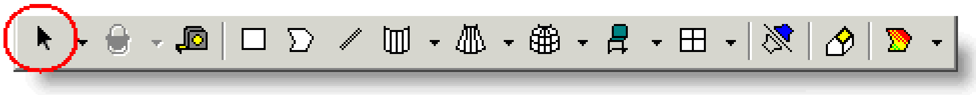
After setting surface colors, the view from the camera in the positive X direction looks like the following figure (color shades may look different on your monitor).



Camera view with colors

Working With Vertices

You may need to adjust the location or shape of a surface after it has been created. Use the **Select** tool to move an entire surface or to move a single vertex.



Select tool

This section covers the mechanisms that Modeler software uses to help you work with a single vertex on a surface. These mechanisms apply to moving vertices and snapping vertices to other objects, and creating and deleting vertices on a surface.

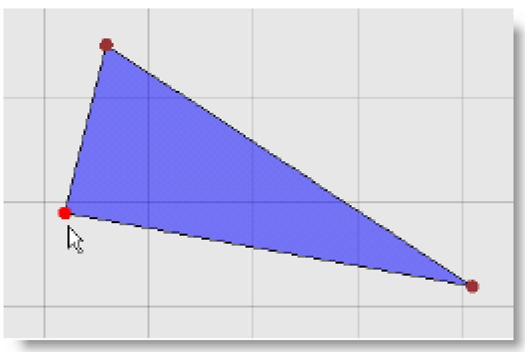
Vertex proximity indicator

When using any of the drawing or extrusion tools, the vertex indicator will turn green when the mouse is within the Snap to Vertex distance.

This function only works when the room model is displayed in an orthogonal view, or when the vertex has an elevation of zero.

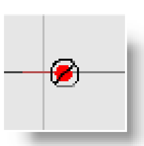
Snapping Vertices

To move a vertex on a surface, select it with the Select tool until it highlights in bright red. You can now drag this vertex with the cursor to change the shape of the surface. You will only be able to drag the vertex within the selected constraint plane, so choose a constraint plane that will allow you to move the vertex to the desired location. For example, if the YZ constraint plane is selected, you will only be able to move the vertex in the Y and Z dimensions.



A selected vertex

Note: In a surface with more than three vertices, all vertices must be in the same plane. You will not be able to move a vertex out of the plane of the surface in this situation.

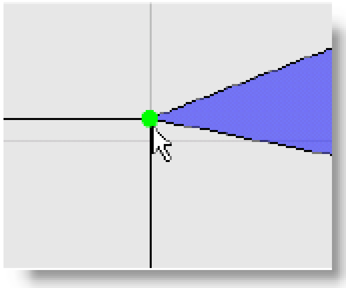
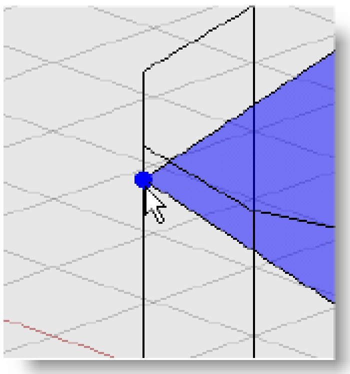
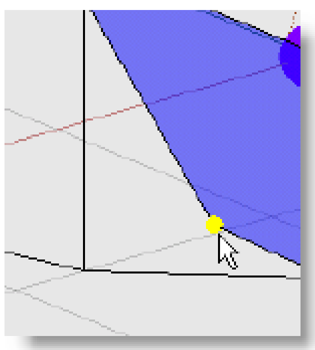
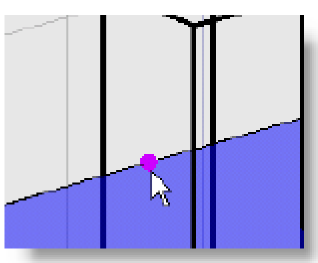


A vertex that is unable to be moved

Modeler software has a **Snap To Vertex** feature to help you line up surfaces in your model. This feature causes a vertex that you are moving to snap to other vertices, edges and planes in the model, just like two magnets might snap together.

Note: The Snap To Vertex feature is enabled in the Drawing/Saving tab of the Model Settings dialog box.

When you drag a vertex, it will change to a different color depending on what it snaps to:

Color	Snap to
Vertex highlights green:	The vertex is snapped to another vertex. 
Vertex highlights blue:	The vertex is snapped to an edge. 
Vertex highlights yellow:	The vertex is snapped to the face of a plane. 
Vertex highlights purple:	The vertex is snapped to the intersection of two planes.* 

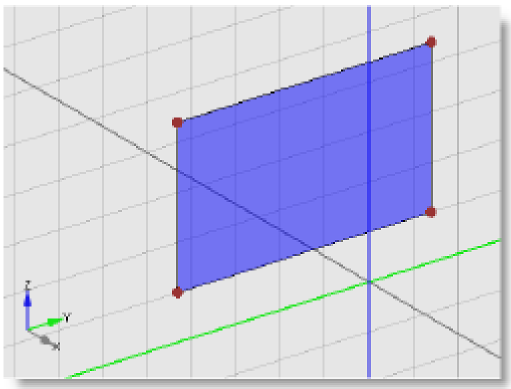
**The intersection of two planes refers to the point at which the edge of one plane passes through another.*

Adding and deleting vertices

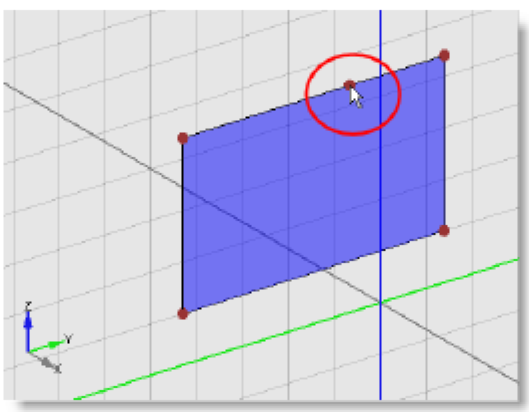
You can add a vertex to a surface by holding down the Ctrl key while clicking on a point on the edge of the surface. The new vertex can then be dragged to change the shape of the surface. This is useful, for example, when lining up and matching surfaces to close a room model, or to join a flat edge to a curved surface.

To add a vertex:

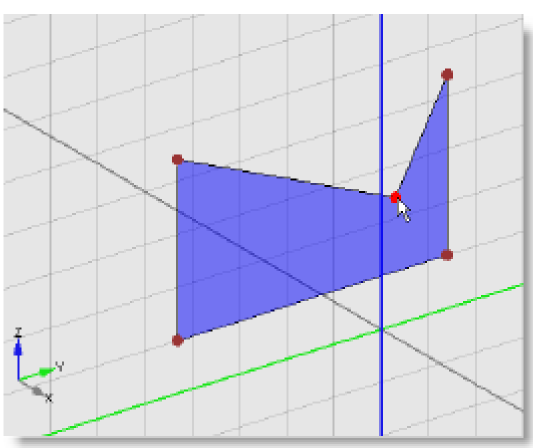
1. Select the surface.



2. While holding down the Ctrl key, click on the edge of the surface.



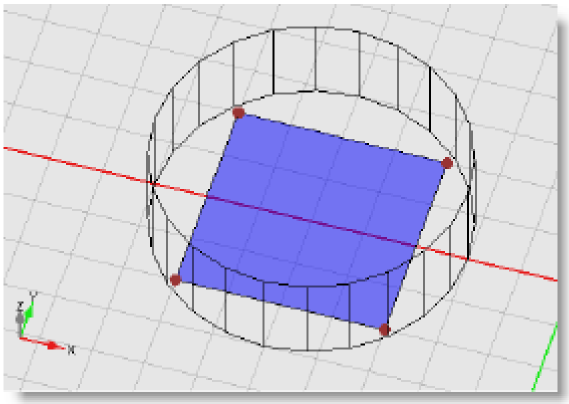
3. Drag the new vertex to change the shape of the surface.



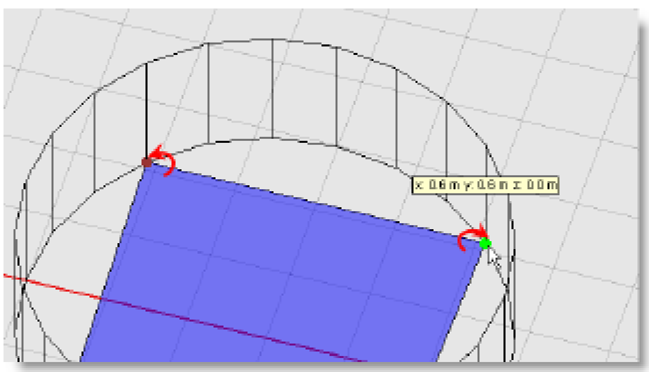
You also can delete a vertex by holding down Ctrl and clicking on the vertex. A surface must have a minimum of 3 vertices, so you will not be able to delete a vertex if the shape only has three vertices.

To add vertices to join a flat edge to a curved surface:

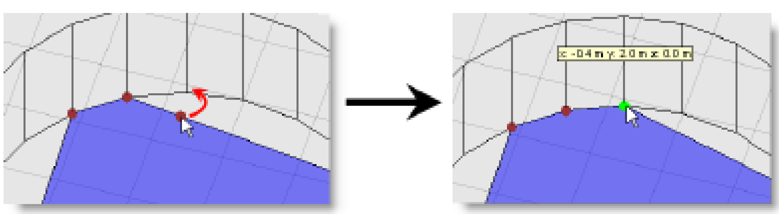
1. Select the surface.



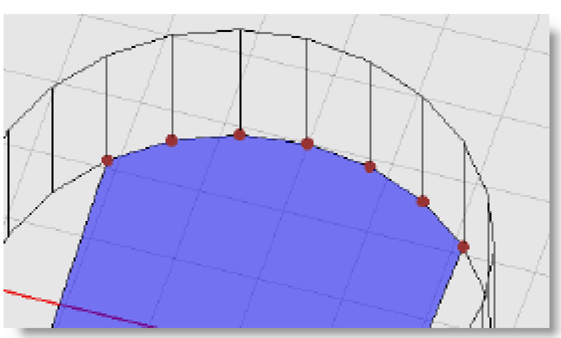
2. Snap two corners to the curved wall



3. Ctrl + click to add a vertex, then snap it to a corner of the curved wall

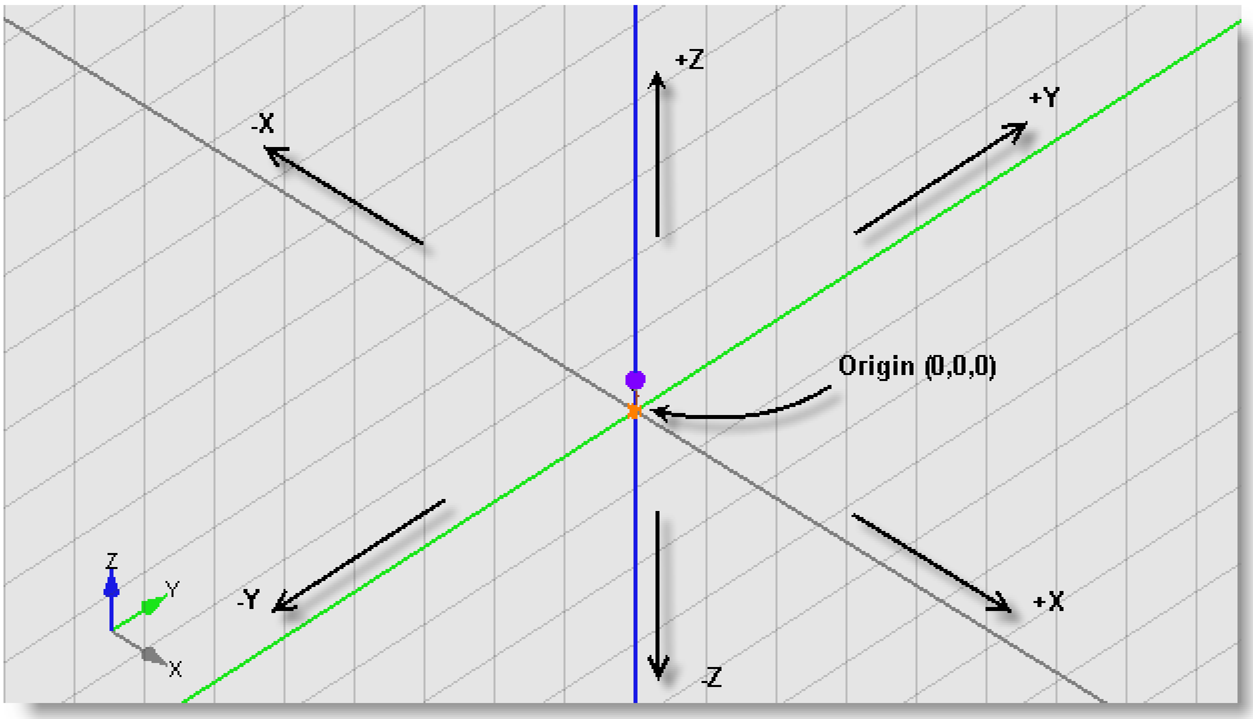


4. Repeat and continue around the perimeter as desired.



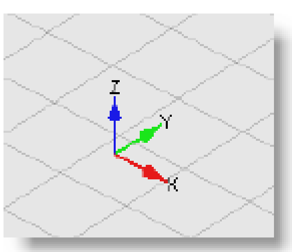
Working With Constraint Planes

This section covers constraint planes and how they are used in Modeler software. The coordinate system in Modeler software is a standard Cartesian coordinate system in three dimensions: **X** (red axis), **Y** (green axis) and **Z** (blue axis).



Cartesian coordinate system

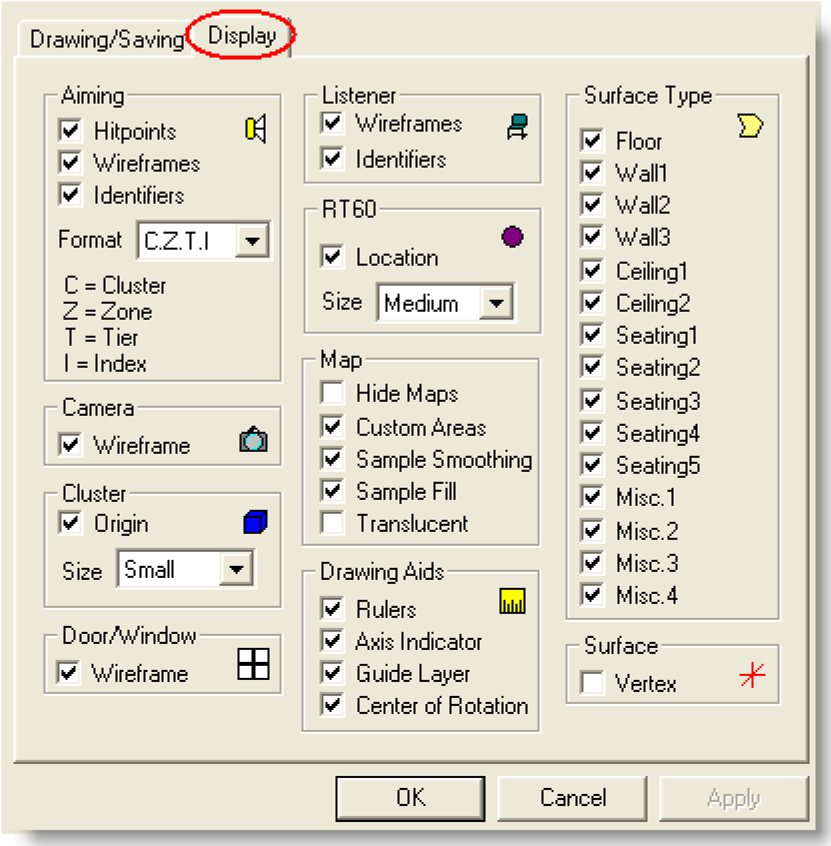
The three major axes and their respective colors are also illustrated by the axis indicator in the lower left-hand corner of the Model View:



Axis indicator

You can use the axis indicator to orient yourself in the three dimensions.

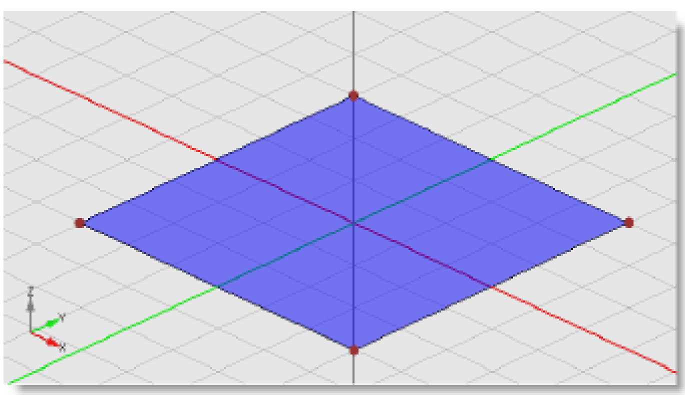
Tip: If you cannot see the axis indicator, open the Model Settings dialog box, by choosing **Edit > Model Settings**, or by pressing Ctrl+R. Click on the **Display** tab, and place a check mark next to **Axis Indicator** under **Drawing Aids** (located on the bottom middle area of the tab).



Display tab in Model Settings (Drawing Aids section)

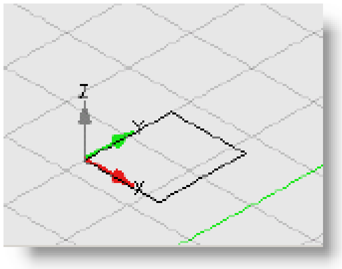
XY, YZ and XZ planes

There are three inherent planes in the Cartesian coordinate system: the XY plane, the YZ plane and the XZ plane. The XY plane is defined by the X and Y axes. For example, the surface in the following figure resides entirely within the XY plane. All points in this plane have the same Z coordinate:



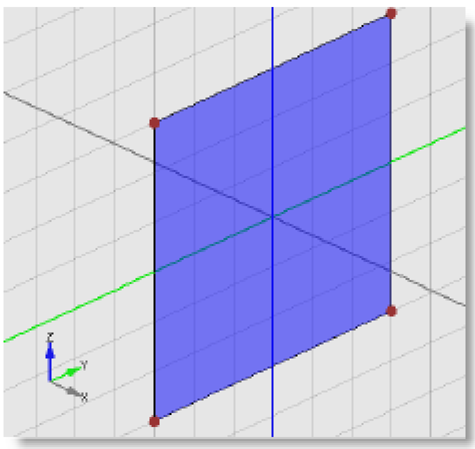
Example of a surface within the XY plane

The axis indicator can be used to help you visualize the XY plane. Picture a surface that connects the X and Y pointers on the axis indicator:



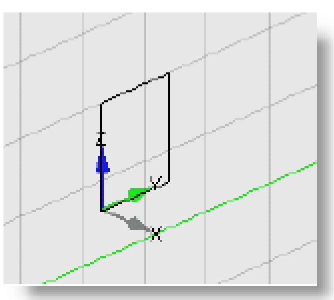
Visualizing a surface in the XY plane

The YZ plane is defined by the Y and Z axes as illustrated in the following example. All points in this surface have the same X coordinate:



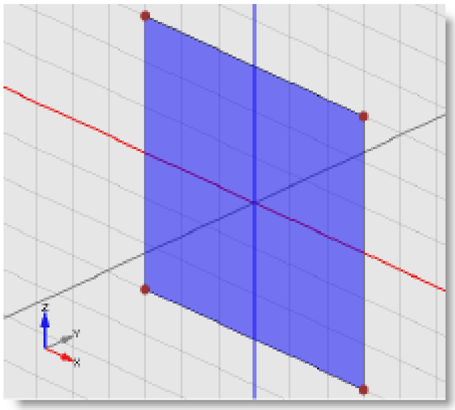
Example of a surface within the YZ plane

The axis indicator can be used to help you visualize the YZ plane: picture a surface that connects the Y and Z pointers on the axis indicator:



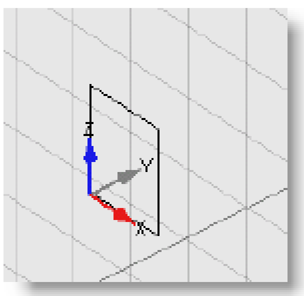
Visualizing a surface in the YZ plane

The XZ plane is defined by the X and Z axes. All points in this surface have the same Y coordinate:



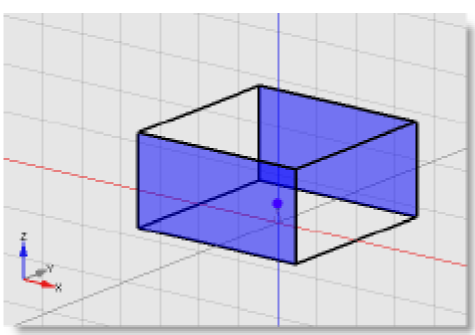
Example of a surface within the XZ plane

The axis indicator can be used to help you visualize the XZ plane: picture a surface that connects the X and Z pointers on the axis indicator:



Visualizing a surface in the XZ plane

A surface that is in the XY, YZ or XZ plane does not necessarily pass through the origin. These terms describe any plane that is parallel to those shown in the previous figures. For example, both of the selected surfaces in the following example can be described as being in the XZ plane:



Example of two surfaces in the XZ plane

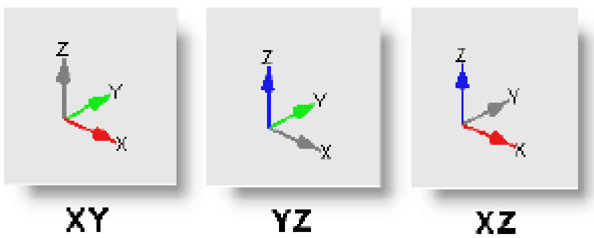
Selecting constraint planes

The **Constraint Plane** buttons in the **View** toolbar allow you to specify which of these planes you would like to work in:

Constraint Plane buttons

Use these buttons when you draw or move surfaces and objects in Modeler software. When you select one of the constraint plane buttons, your movement is constrained to the chosen plane. For example, when you select the XY constraint plane and create a rectangular surface, it will be drawn in the XY plane. Likewise, any surface that you move will only move in the X and Y dimensions.

Tip: When you select a constraint plane, the corresponding axis pointers are highlighted in the axis indicator to help you visualize which plane you are working in:



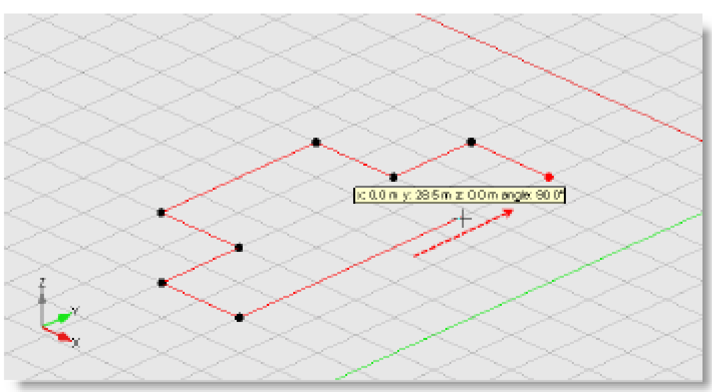
Constraint planes are most often used when viewing your model at an angle, such as in an isometric view.

Tip: When you are in Plan View, Elevation View or Section View, the constraint planes XY, YZ, and XZ (respectively) are selected by default. Note that the constraint plane button is automatically selected when you are in these views.

Creating surfaces using constraint planes

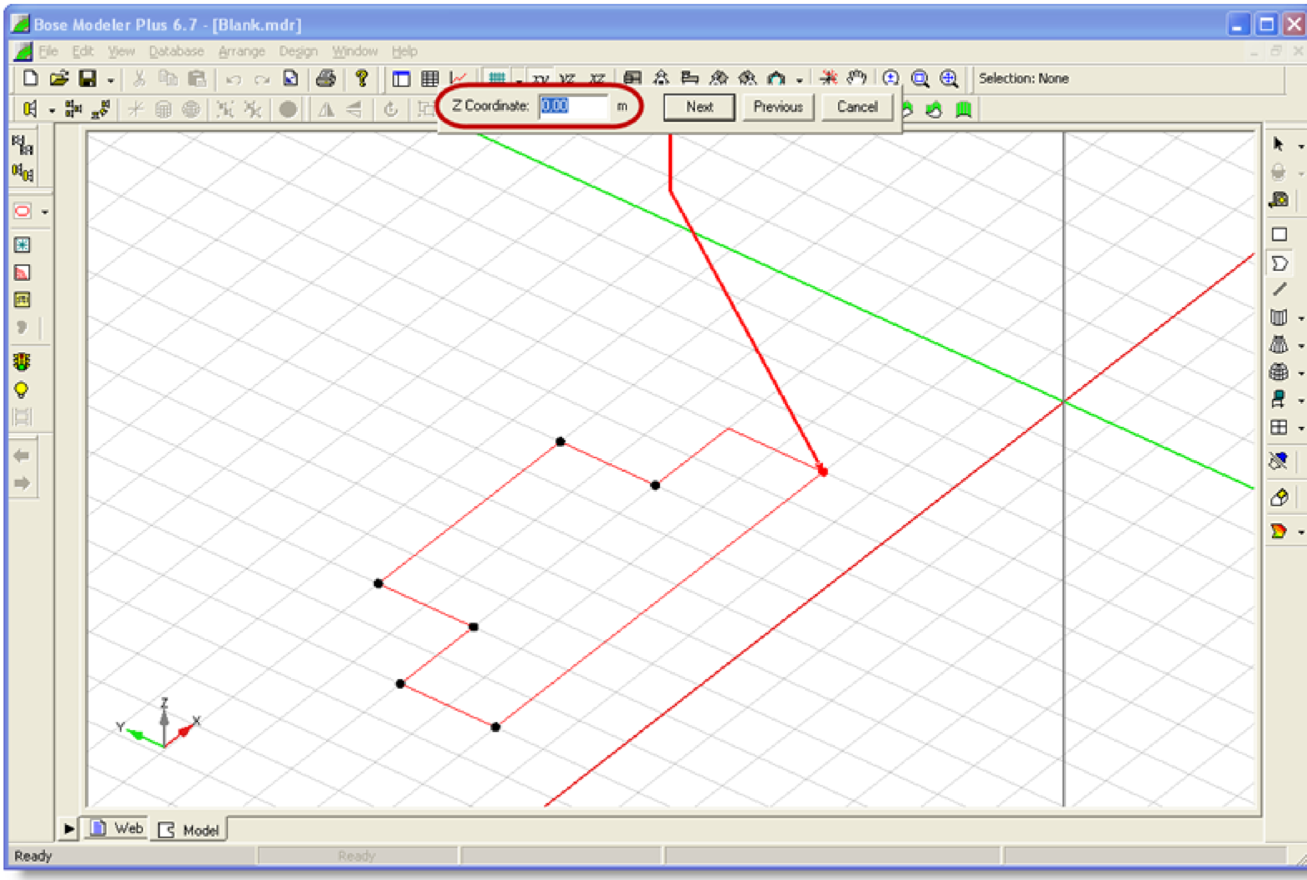
Constraint planes allow you to specify the location of a surface or object in two of the three dimensions (the two dimensions that define the constraint plane). When you are drawing a new surface, you can specify measurements in the third dimension using the Shape Properties bar.

For example, when you create a floor surface in the XY constraint plane, you first outline the shape of the polygon in the X and Y dimensions using the Draw Polygonal Surface tool and then specify the third dimension using the Shape Properties bar:



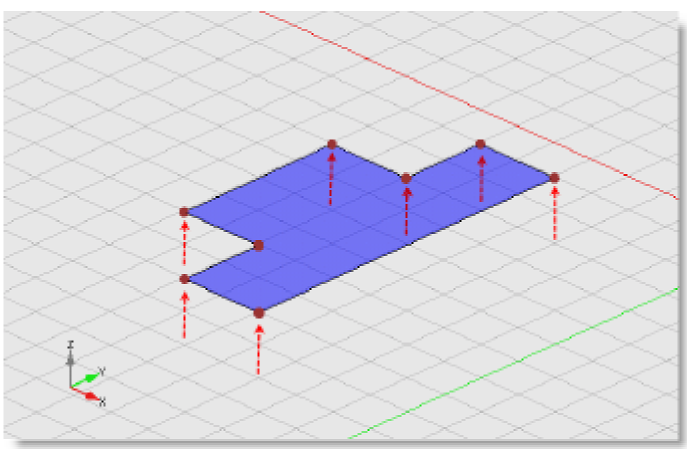
Drawing a floor surface in the XY constraint plane

Notice that the outline of the surface is drawn at Z=0 by default. You will need to specify the location of the surface in the third (Z) dimension. This is done in the Z-coordinates bar, which opens when you complete the shape:



Specifying the Z coordinate in the Z-coordinates bar

Enter the Z coordinate for each vertex to locate the shape in the Z dimension. For example, you may want the floor surface to exist at Z=8. Enter 8 for the Z coordinate at each vertex, and the completed surface is located 8 meters in the positive Z direction:



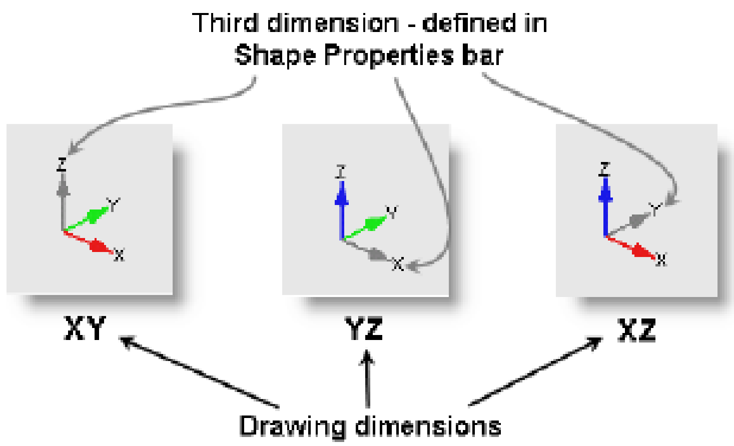
The surface created at Z=8

Although this example involved the XY constraint plane, the same method is used when creating new rectangular and polygonal surfaces in the YZ and XZ constraint planes:

Constraint plane	Drawing dimensions	Third dimension specified in Z coordinates bar
XY	X and Y	Z
YZ	Y and Z	X
XZ	X and Z	Y

For cylindrical, conical, and spherical surfaces you must enter values for two measurements in the third dimension in the Z-coordinates bar: Z1 and Z2. These values adhere to the same principles regarding constraint plane and the third dimension.

Tip: The axis indicator is useful in visualizing the relationship between constraint plane, drawing dimensions and the third undefined dimension. When you select a constraint plane, two axis pointers will highlight in color to show you the plane that you will draw the shape in. The grayed out pointer indicates the third dimension that you define in the Shape Properties bar:



Wall surfaces

Wall surfaces are created perpendicular to the constraint plane in Modeler software. The same principles regarding constraint plane and the third dimension apply to creating wall surfaces, although you will almost always create walls in the XY constraint plane, in Plan View. Modeler software is designed to treat walls as though they extrude from the XY plane. Although you could create walls in a different constraint plane, it is easier to use the Draw Rectangular Surface tool in these cases.

A method for creating surfaces using constraint planes

When you create a surface in Modeler software, you should follow three general steps:

1. Determine the plane in which to create the surface.
2. Create the surface.
3. Specify the location of the surface in the third dimension.

These three steps correspond to the following actions in Modeler software:

1. Determine the plane in which the surface should be created:

   View your model in perspective and use the axis indicator to visualize which plane the new surface should exist in. Select the corresponding constraint plane button.

   OR

   Use Plan View, Elevation View, or Section View which automatically selects a constraint plane.
2. Create the surface:

Use the drawing tools such as **Draw Rectangular Surface** or **Draw Cylindrical Surface**, then draw the surface in the Model View.

3. Specify the location of the surface in the third dimension:

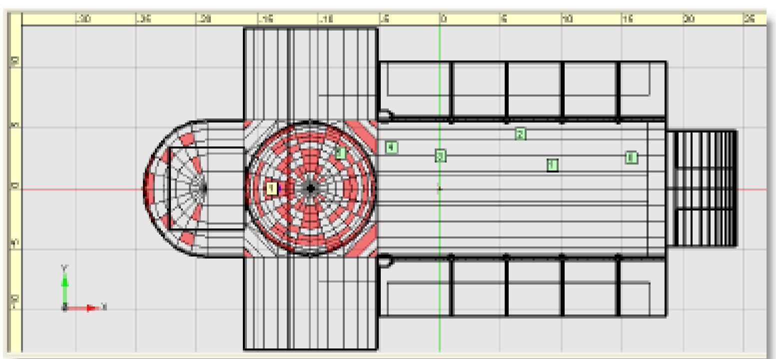
   Once the surface is completed, use the Z-coordinates bar to indicate the surface location in the third dimension.

Bent surfaces

A surface in Modeler software is defined by a minimum of three vertices. For all surfaces, Modeler software requires that all of its vertices lie in the same plane. If one vertex exists out of the plane of the others, the result is a condition known as a bent plane. Modeler software cannot draw bent planes, so it will un-bend the plane and highlight the surface pink to indicate that it has been modified.

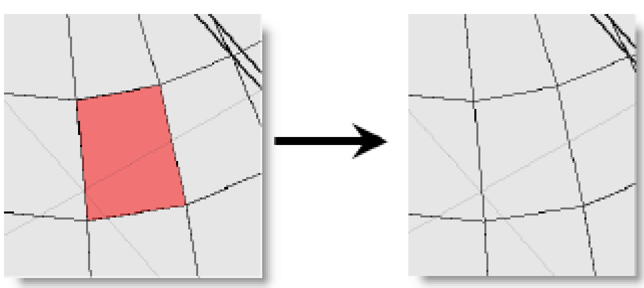
The bottom line is that you will only see bent planes when you import a room model that has bent planes.

For example, a Mac Modeler software file might have selected bent surfaces before import. Modeler software will un-bend these surfaces upon import and highlight them pink to indicate that they have been modified, as shown in the following figure:

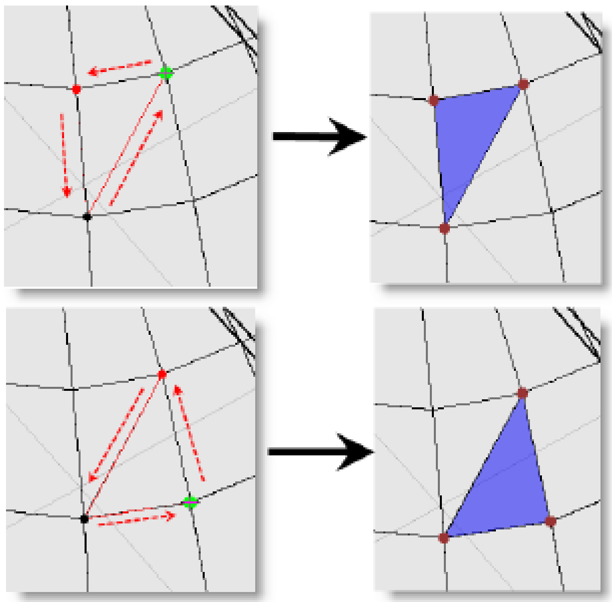


Imported model with modified planes highlighted in pink

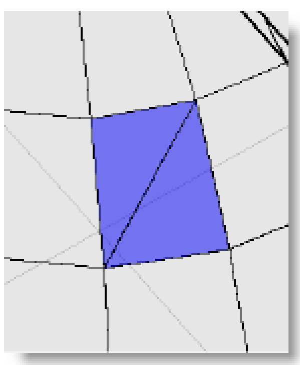
To remove a modified surface, delete the surface and then reinsert a new, non-bent surface. Often you will have to create two or more triangular surfaces to replace the bent surface, as illustrated in the following figures:



Deleting the bent surface



Creating two new triangular surfaces



Finished surfaces

Tip: Triangular surfaces cannot be bent because three vertices always lie in the same plane.

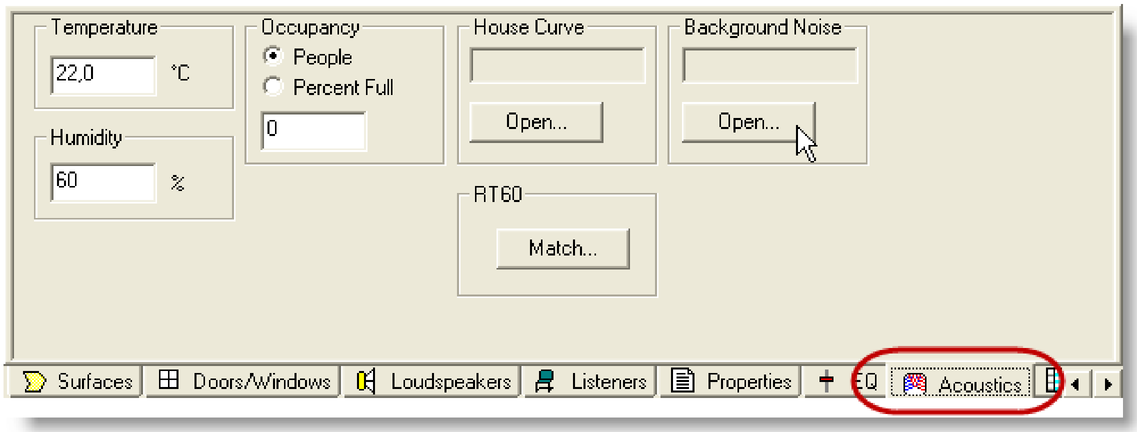
Room Acoustic Predictions

All of the predictions within the Modeler software are affected by certain physical acoustic properties. These properties are defined within the Acoustics Tab. It is recommended that you review the settings within the Acoustics Tab before you take advantage of the powerful acoustic simulation capabilities of Modeler software.

This section provides an overview of the functions within the Acoustics Tab and their impact on the sound system design. The Acoustics Tab, shown below, contains two primary sets of functions, acoustic prediction parameters, and system design parameters.

Acoustic Design Parameters

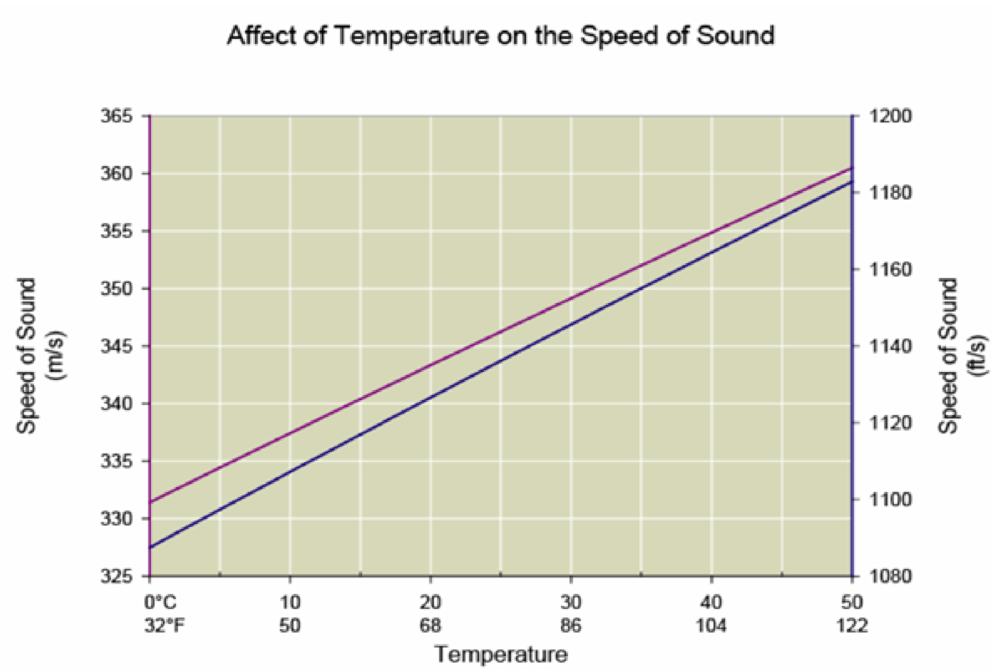
The properties of Temperature, Humidity, Occupancy and RT60 directly affect the acoustic characteristics of the model. Ideally, these parameters are based upon measurements made within the room, and used to match the acoustic signature of the model to that of the real room.



Acoustics tab

Temperature - describes the temperature used for all predictions. If you are using a measured reverberation time this item should be set to the temperature measured in the room at the time reverberation time measurements were made. Otherwise, set the temperature to a representative value for the venue.

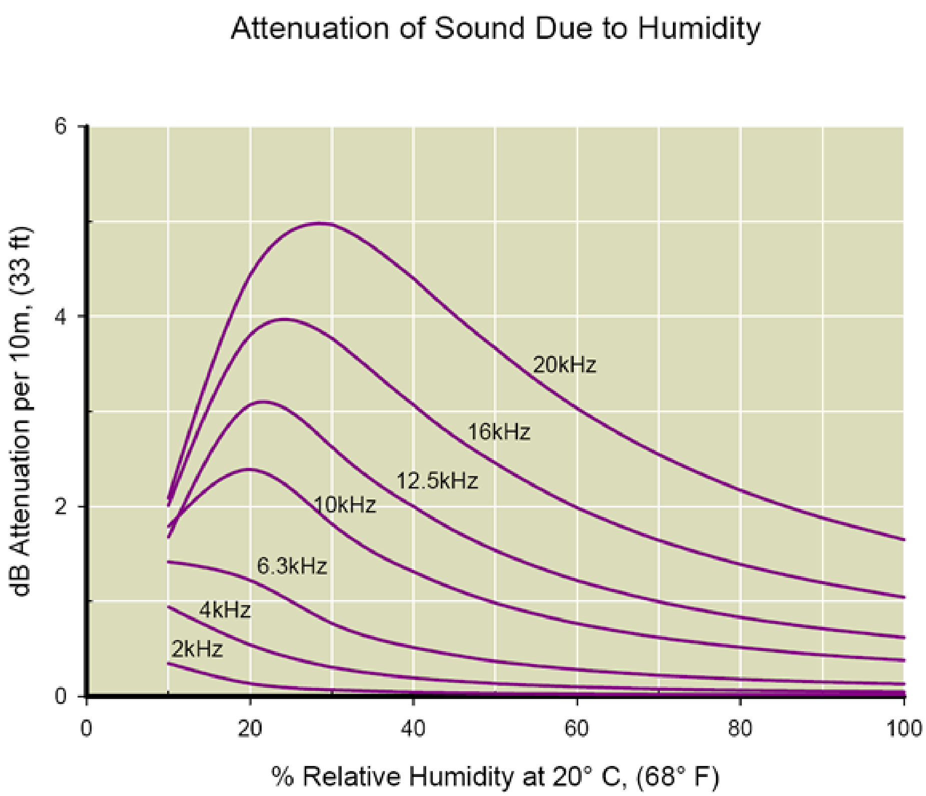
The temperature value is correlated to the speed of sound in air. See the following chart for an illustration of how temperature affects the speed of sound.



The influence of temperature on the speed of sound

Humidity - describes the relative humidity used for all predictions. If you are using a measured reverberation time this item should be set to the relative humidity measured in the room at the time reverberation time measurements were made. Otherwise, set the humidity to a representative value for the venue.

The humidity value directly affects the amount of high frequency air absorption you can expect to see in predictions. See the following chart for an illustration of how the relative humidity affects the air absorption of high frequency energy.



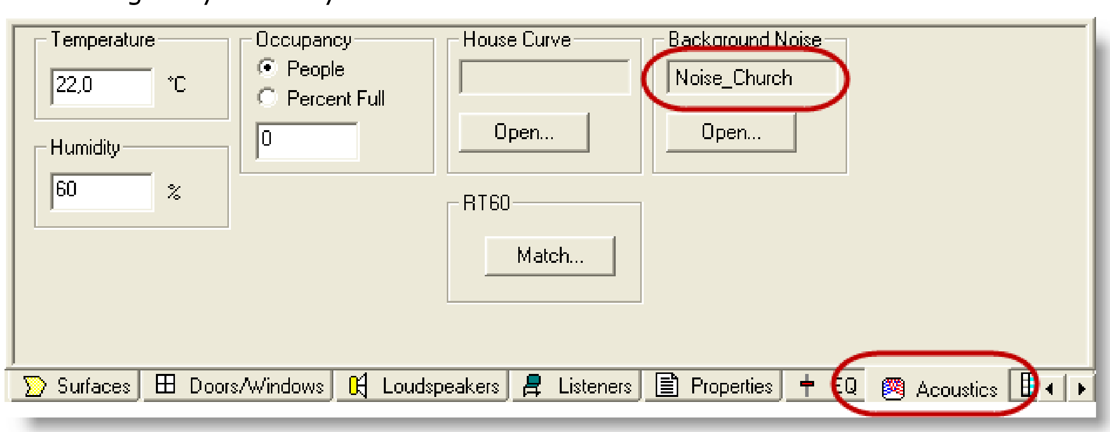
The influence of humidity on the absorption of air

Occupancy - describes the amount of people within the room, and is limited to those surfaces identified as “Seating” or "Floor," and may be defined by either entering a total quantity of audience members, or by using a calculation to determine the percentage occupancy.

House Curve - defines a target equalization curve, and can be used to speed the process of system equalization.

RT60 - is used to match the measured and predicted reverberation times of the room model. Select the **Match...** function to launch the RT60 matching Design Assistant.

Background Noise - is used to describe the level and spectrum of any background, or ambient, noise. Background Noise is displayed within the System SPL tab for reference, and directly impacts the speech intelligibility of the system.



Acoustics tab - Background Noise setting

Matching Predicted and Measured Reverberation Times

The reverberation time of the room has a significant impact on predictions and on acoustic performance in a real space. Because it is difficult to match the materials of the surfaces in the model with those in the real construction, there often can be discrepancies between the predicted reverberation times and those measured in the room.

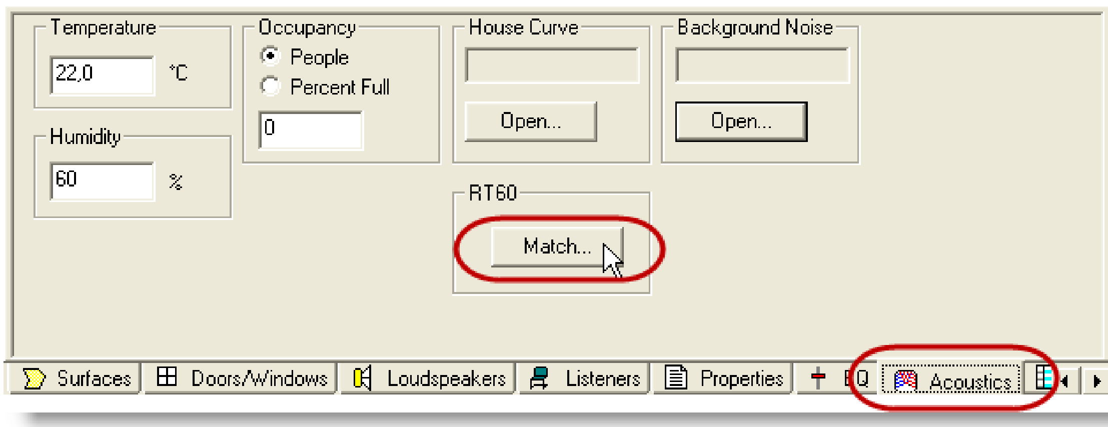
The RT60 matching Design Assistant within the Modeler software helps match the measured and predicted reverberation times by modifying the absorption coefficients of materials, effectively extending the materials database as needed.

NOTE: Before beginning the RT60 matching process you should first make sure that the RT60 source is placed within the model at the same location that was used to excite the reverberant field when the RT60 measurements were made.

TIP: Before matching the reverberation times, the following is recommended:

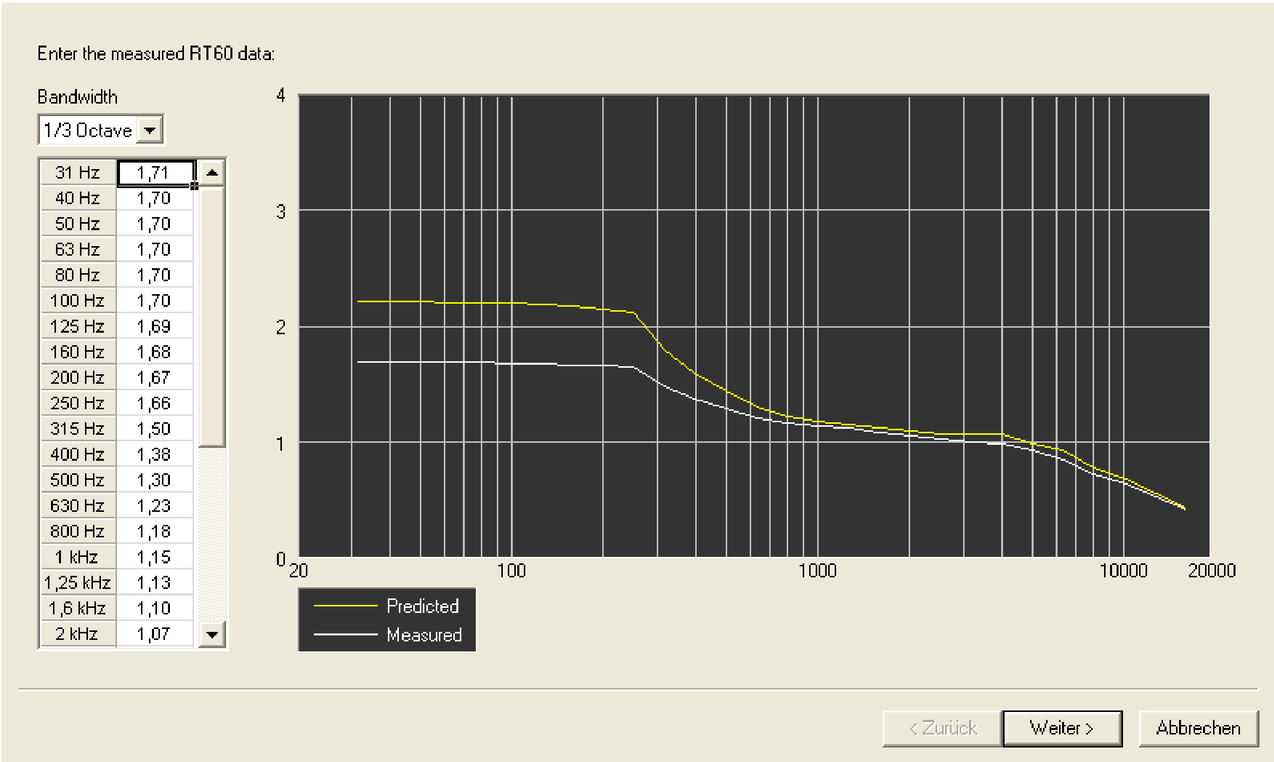
- Save the room model file.
- Delete any unused materials that are in the materials database.
- Use the Save As... function to create a new version of the room model file. This will become your “matched” room model file.

1. Open the modified "Design 3.mdr" model (with closed openings) from the "Advanced Modeling Concepts" section.
2. Click on the **Match** button in the RT60 section.



RT60 Match button

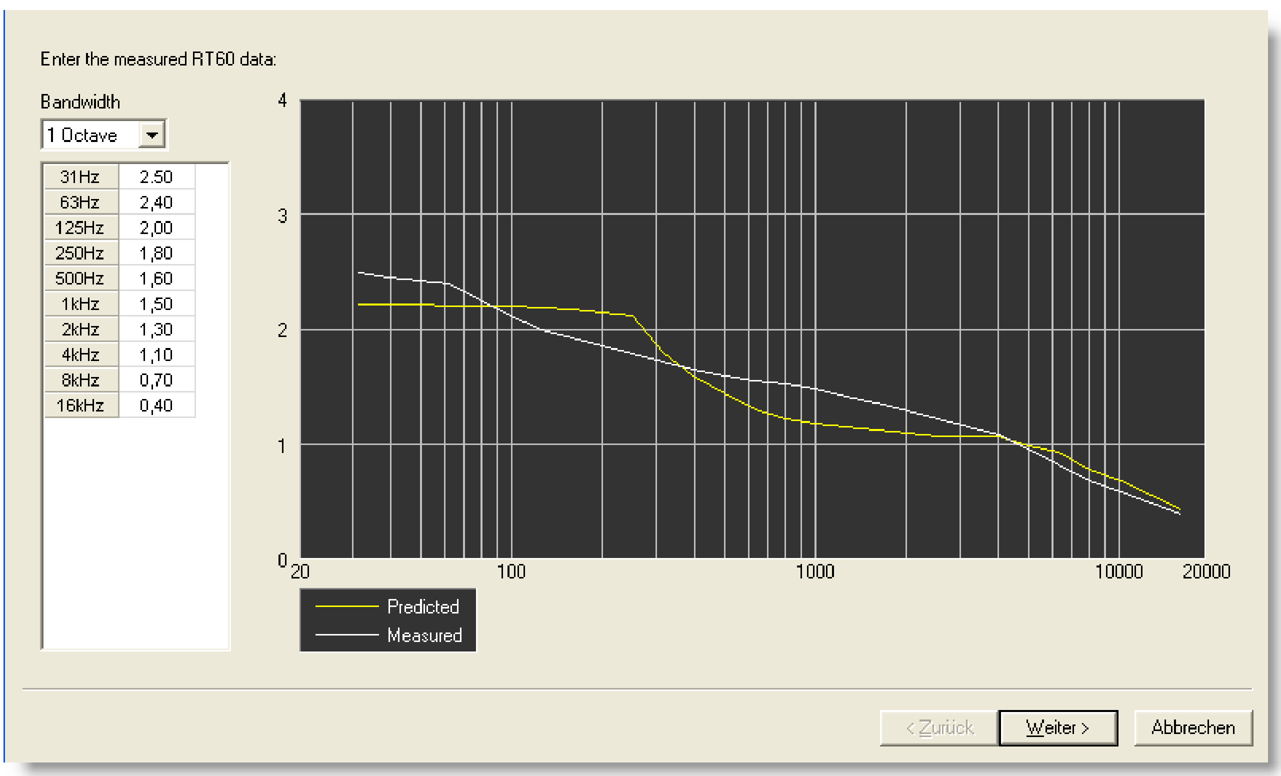
The following window opens:



*RT60 **Data** window*

This graph shows the measured and the predicted reverberation times. Currently the two are almost identical.

3. Enter the measured reverberation times. Set the **Bandwidth** to **1 octave band** and enter the following values seen below:

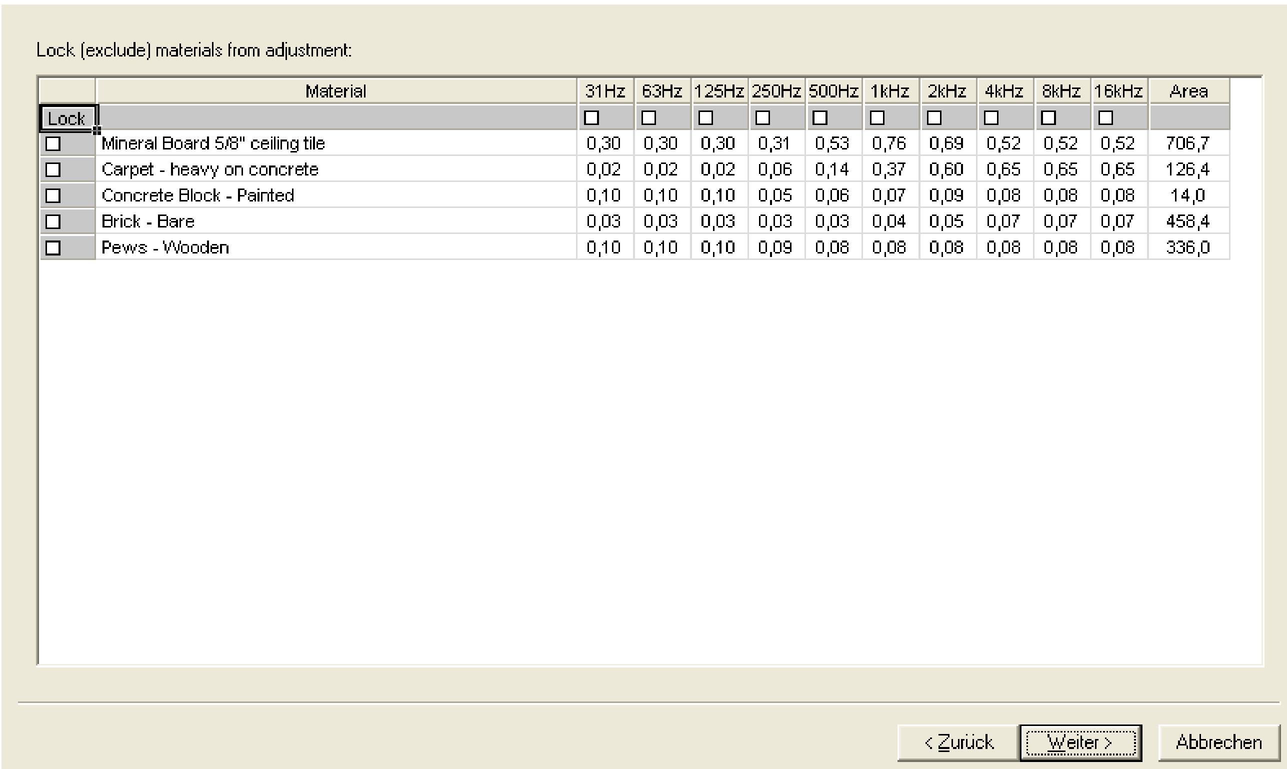


Measured and Predicted Reverberation times

Note: If the measured and predicted reverberation times differ by more than 0.5 seconds, or so, we recommend that you revisit the choices you made in material selections for the various room surfaces.

4. Click on **Next**.

   The following window opens:



	Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area
Lock		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
☐	Mineral Board 5/8" ceiling tile	0,30	0,30	0,30	0,31	0,53	0,76	0,69	0,52	0,52	0,52	706,7
☐	Carpet - heavy on concrete	0,02	0,02	0,02	0,06	0,14	0,37	0,60	0,65	0,65	0,65	126,4
☐	Concrete Block - Painted	0,10	0,10	0,10	0,05	0,06	0,07	0,09	0,08	0,08	0,08	14,0
☐	Brick - Bare	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,07	0,07	0,07	458,4
☐	Pews - Wooden	0,10	0,10	0,10	0,09	0,08	0,08	0,08	0,08	0,08	0,08	336,0

Material Data window

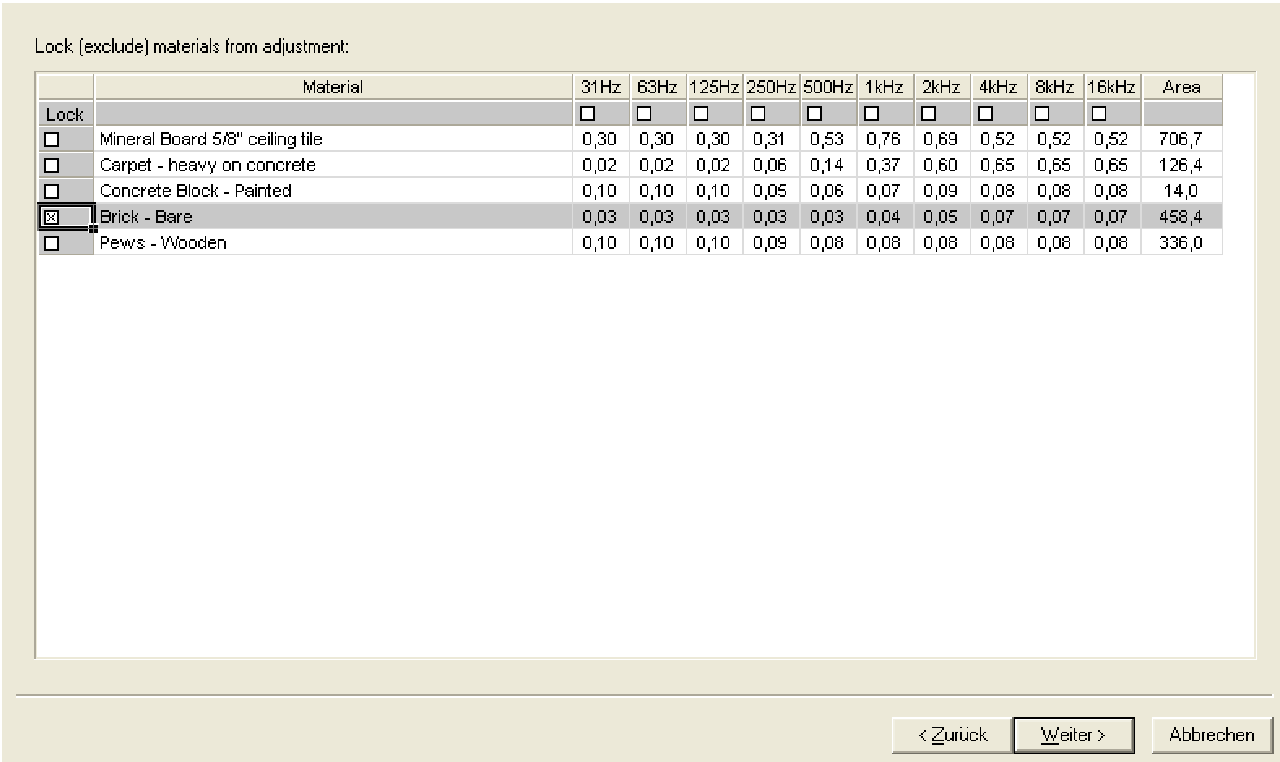
This window shows only the materials currently used in this model. We are very confident that other certain materials used in this model are accurate. For example, you may have included an absorber that has been measured by a reputable laboratory and the real mounting is equivalent to the measurement.

The algorithm allows you to prevent certain materials from being modified. We refer to this as “locking” the material. You can lock either entire materials or selected frequency bands.

In this example, we assume that the absorption coefficients of **Brick - Bare** are accurate because they have been measured by a laboratory.

5. Select the box to the left of **Brick - Bare**.

   The entire material is selected, indicating that it will not be modified:



Lock (exclude) materials from adjustment:

Lock	Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area
☐	Mineral Board 5/8" ceiling tile	0,30	0,30	0,30	0,31	0,53	0,76	0,69	0,52	0,52	0,52	706,7
☐	Carpet - heavy on concrete	0,02	0,02	0,02	0,06	0,14	0,37	0,60	0,65	0,65	0,65	126,4
☐	Concrete Block - Painted	0,10	0,10	0,10	0,05	0,06	0,07	0,09	0,08	0,08	0,08	14,0
☒	Brick - Bare	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,07	0,07	0,07	458,4
☐	Pews - Wooden	0,10	0,10	0,10	0,09	0,08	0,08	0,08	0,08	0,08	0,08	336,0

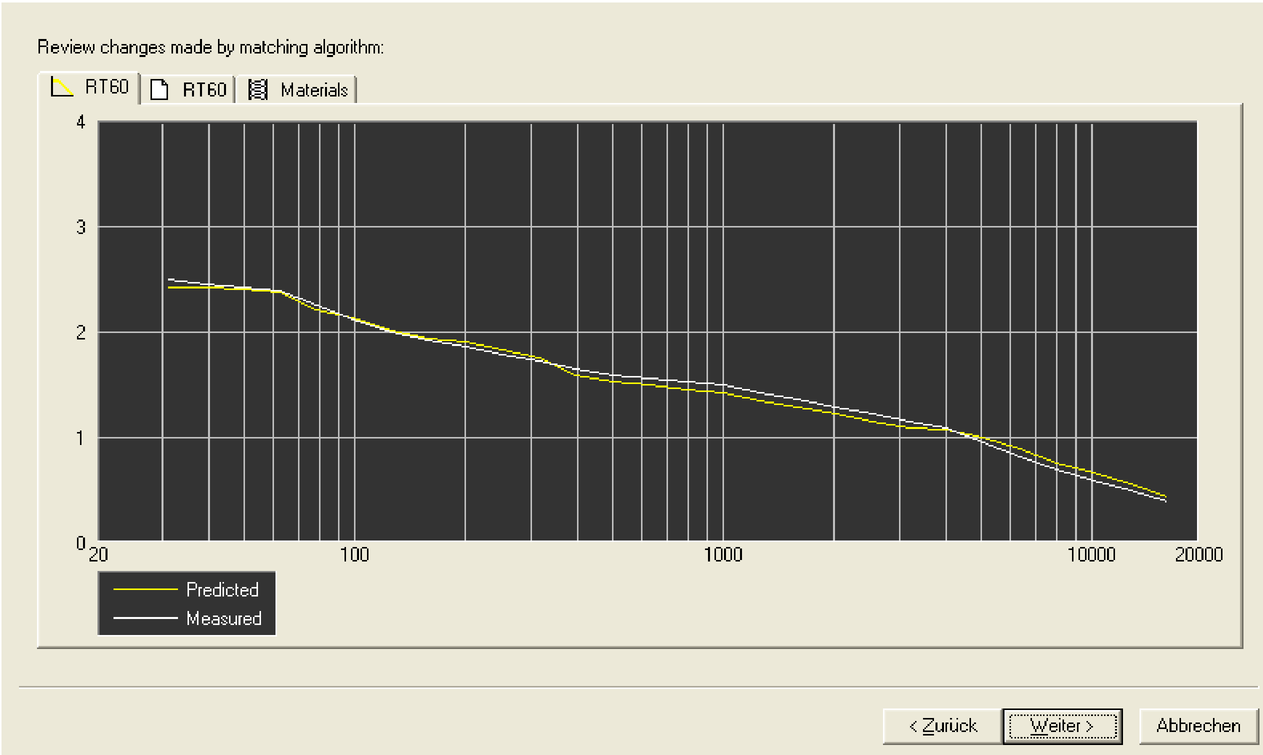
< Zurück | Weiter > | Abbrechen

Selected material

6. Click **Next**.
   The program will automatically adjust absorption coefficients.

Note: The algorithm assumes that the reverberation is measured with the room empty. If you had specified a number of people in the model when entering the wizard, Modeler would set it to 0 and post a warning.

Once the matching is completed, the following window will appear:

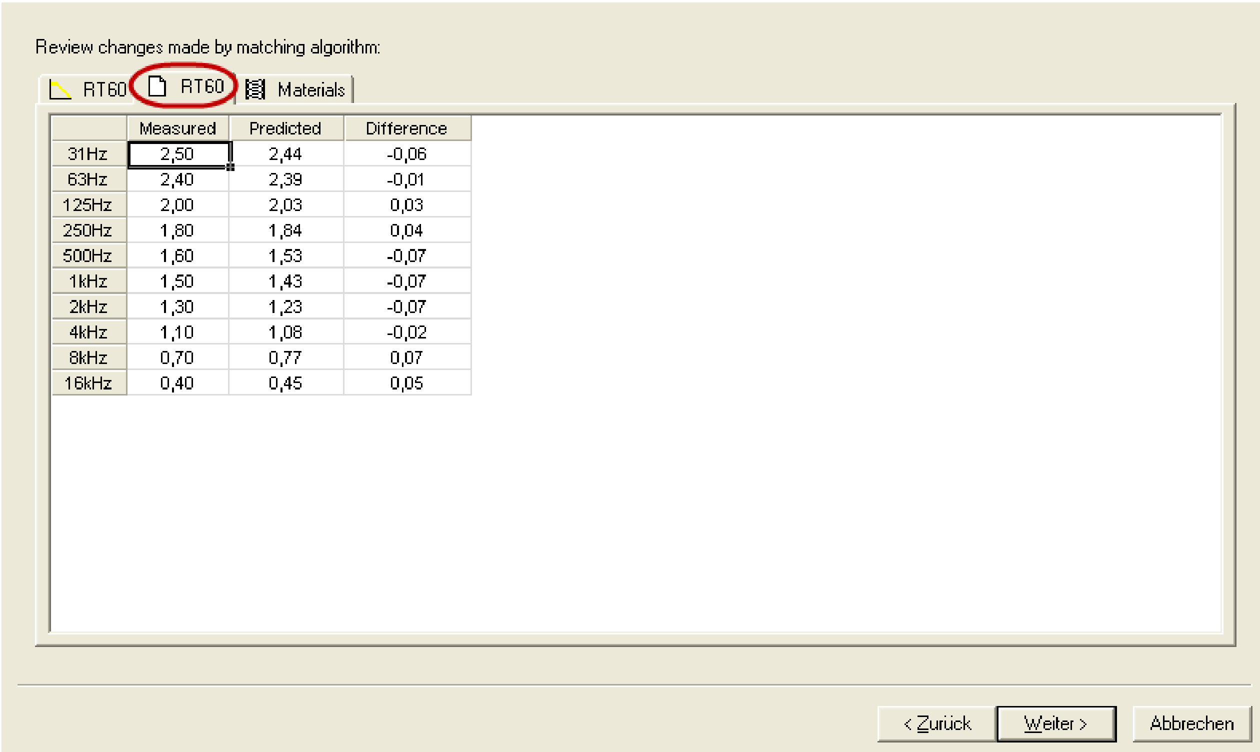


RT60 Match

The first tab shows the measured and predicted reverberation times. In this case, you can see that the algorithm closely matched (to within +/- 0.05 s), measured with predicted reverberation times.

Note: It may be that there still are differences between measured and predicted reverberation time. This tells you that the differences were initially too large to overcome without making unrealistically large changes to absorption coefficients. If this happens, please click the Cancel button and review you material selections.

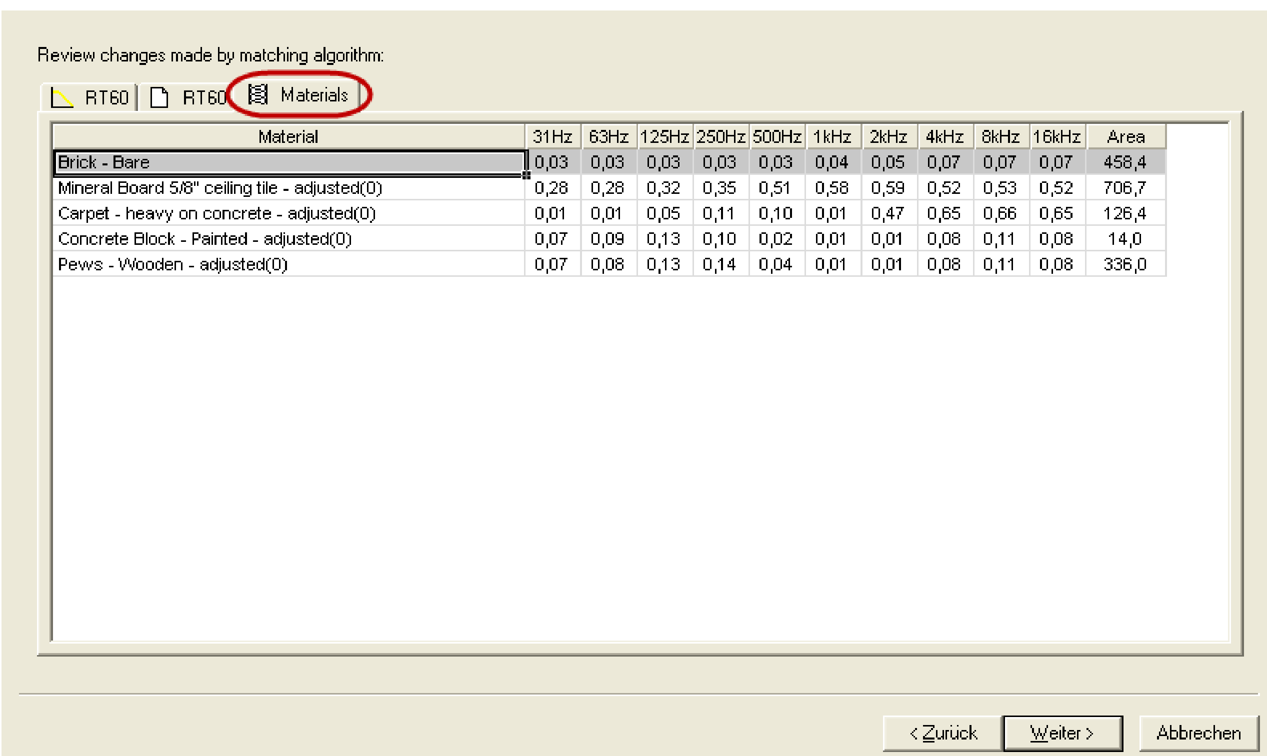
7. Click on the second tab, and the data will appear in tabular format:



	Measured	Predicted	Difference
31Hz	2,50	2,44	-0,06
63Hz	2,40	2,39	-0,01
125Hz	2,00	2,03	0,03
250Hz	1,80	1,84	0,04
500Hz	1,60	1,53	-0,07
1kHz	1,50	1,43	-0,07
2kHz	1,30	1,23	-0,07
4kHz	1,10	1,08	-0,02
8kHz	0,70	0,77	0,07
16kHz	0,40	0,45	0,05

RT60 Match in tabular format

8. Click on the **Materials** tab for list of materials.
   The following window will appear:

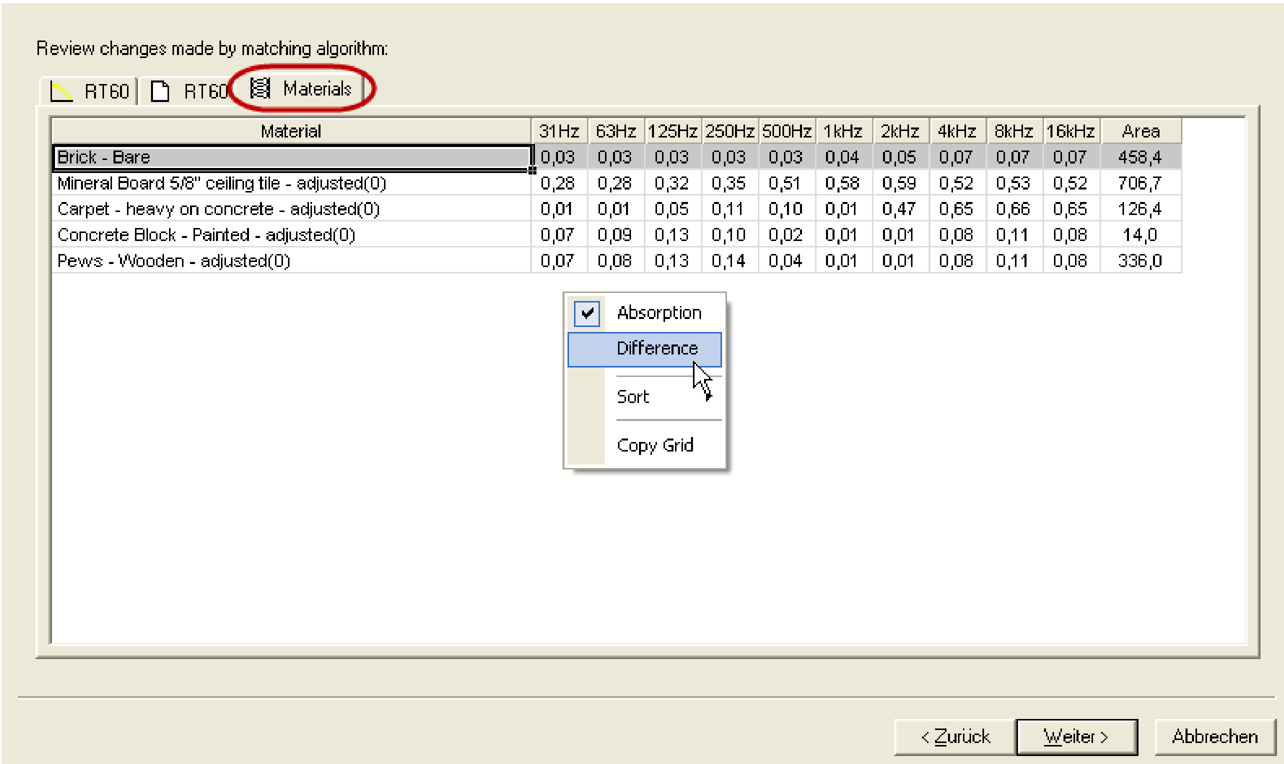


Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area
Brick - Bare	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,07	0,07	0,07	458,4
Mineral Board 5/8" ceiling tile - adjusted(0)	0,28	0,28	0,32	0,35	0,51	0,58	0,59	0,52	0,53	0,52	706,7
Carpet - heavy on concrete - adjusted(0)	0,01	0,01	0,05	0,11	0,10	0,01	0,47	0,65	0,66	0,65	126,4
Concrete Block - Painted - adjusted(0)	0,07	0,09	0,13	0,10	0,02	0,01	0,01	0,08	0,11	0,08	14,0
Pews - Wooden - adjusted(0)	0,07	0,08	0,13	0,14	0,04	0,01	0,01	0,08	0,11	0,08	336,0

RT60 Match, Materials tab

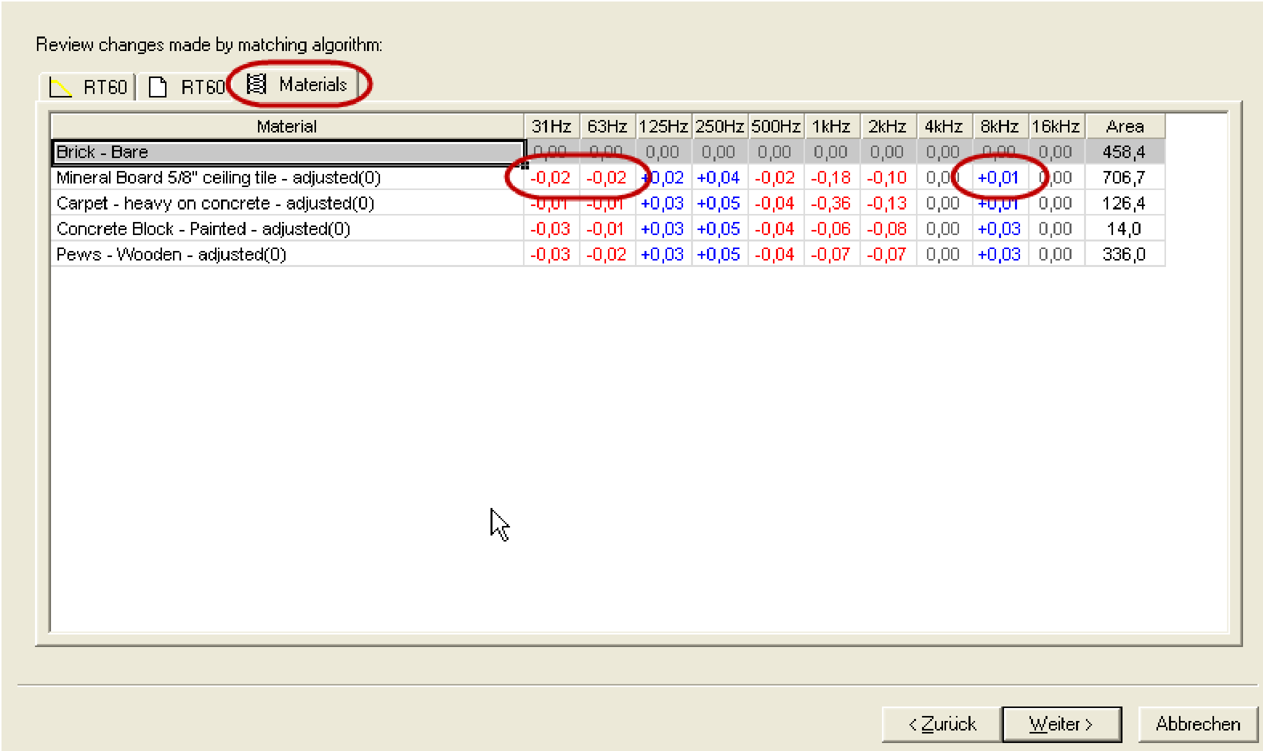
Here you will see the list of materials and their associated absorption coefficients.

Note: Materials that have been modified appear with "adjusted(0)" appended to their names. Original materials are not deleted. If you go through the algorithm again and they are changed again, they will be appended with "adjusted(1)" and so on.



Right-click menu on a material

9. Right-click in the window and select **Difference**
The following window appears:



Material	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Area
Brick - Bare	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	458,4
Mineral Board 5/8" ceiling tile - adjusted(0)	-0,02	-0,02	+0,02	+0,04	-0,02	-0,18	-0,10	0,00	+0,01	0,00	706,7
Carpet - heavy on concrete - adjusted(0)	-0,01	-0,01	+0,03	+0,05	-0,04	-0,36	-0,13	0,00	+0,01	0,00	126,4
Concrete Block - Painted - adjusted(0)	-0,03	-0,01	+0,03	+0,05	-0,04	-0,06	-0,08	0,00	+0,03	0,00	14,0
Pews - Wooden - adjusted(0)	-0,03	-0,02	+0,03	+0,05	-0,04	-0,07	-0,07	0,00	+0,03	0,00	336,0

Absorption coefficient reductions and increases

This window shows the changes that have been made for each of the materials. Reductions are shown in red; increases are shown in blue.

Note: Brick-Bare is unchanged, as it was locked. Mineral Board had its absorption coefficient reduced by 0.02 (Red) in the 63 Hz band and increased by 0.01 (Blue) in the 8 kHz band.

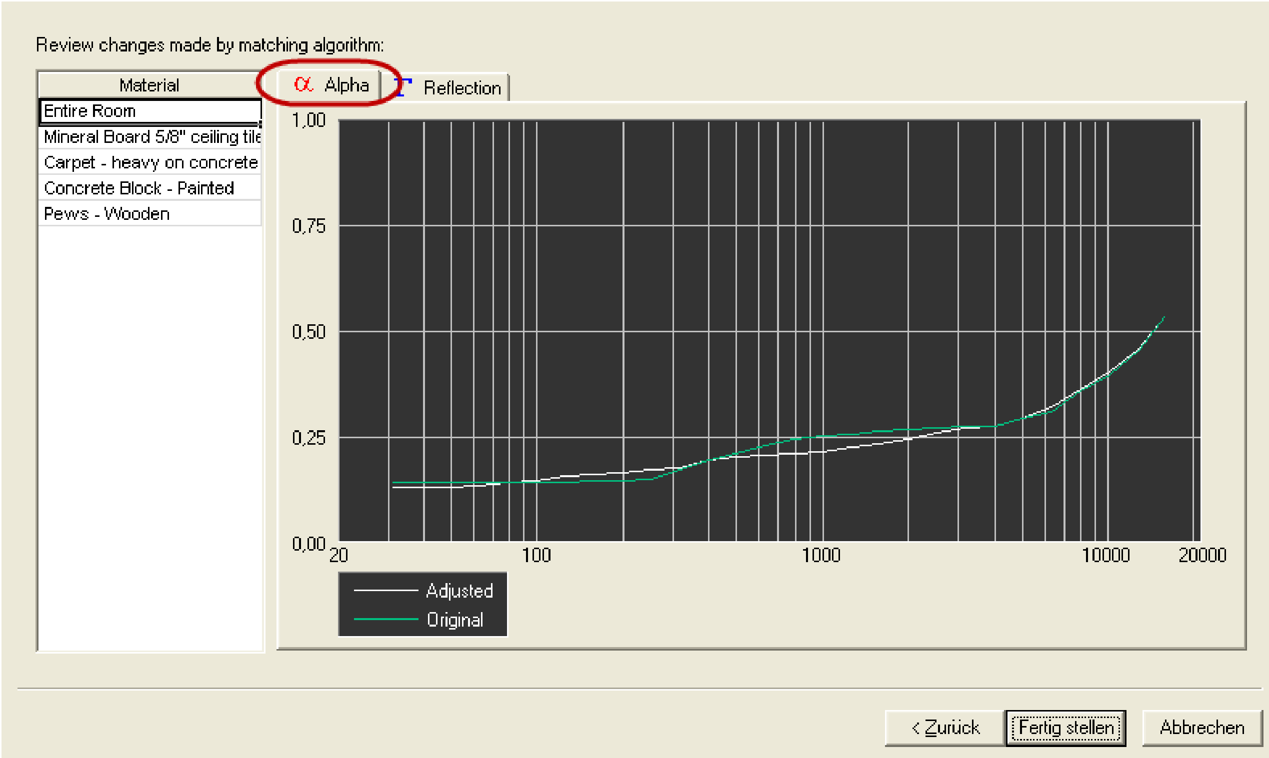
Tip: Click on Cancel to return to the acoustics tab and restore the original materials. Or click on "Back" to change the material locking settings.

10. Click on **Next**, and you can do a more detailed analysis of the changes.

    In this window, you can do a more detailed analysis of the changes made to materials. This window shows the changes that have been made in terms of absolute change in absorption coefficients, and in change in reflection strength.

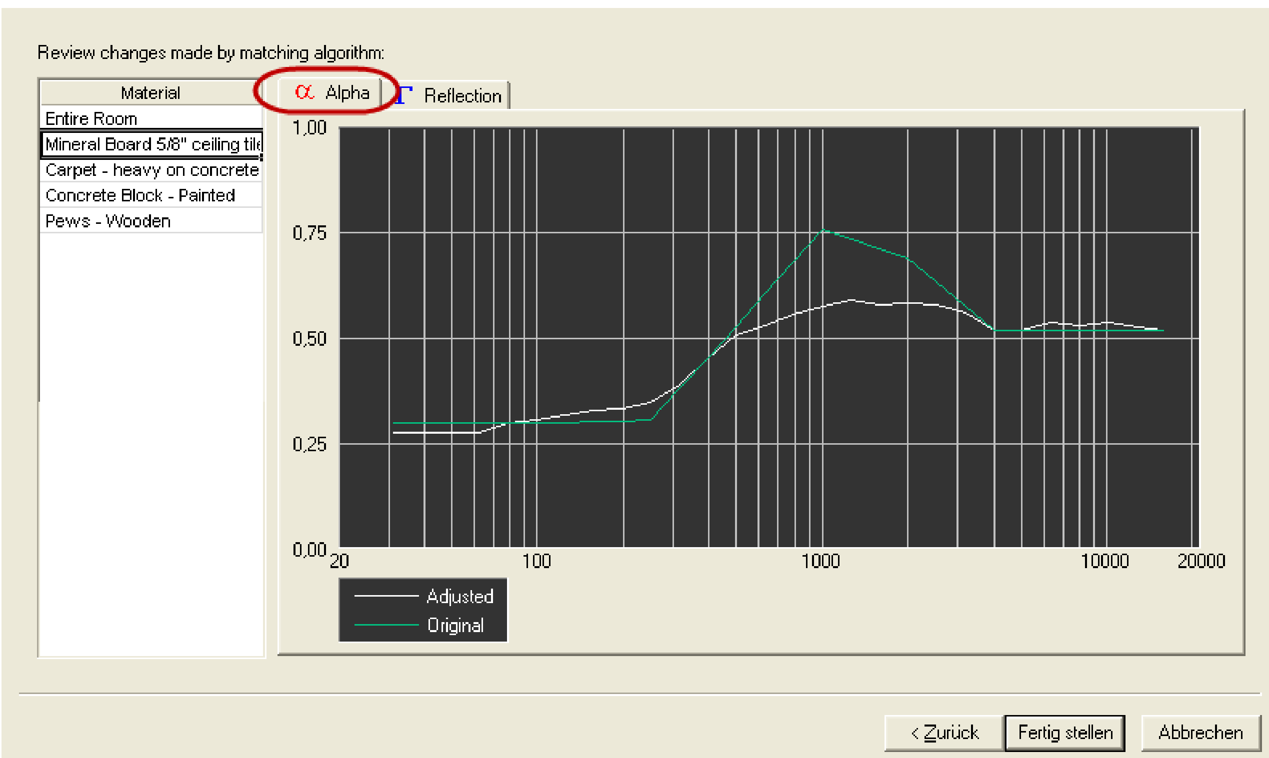
11. Select the Alpha tab.

    This graph shows the original and adjusted absorption coefficients for the entire room or for each material, individually, you select the materials to the left. By highlighting selecting the entire room, you will see the original and adjusted average absorption coefficients for the entire room.



RT60 Results - Alpha tab

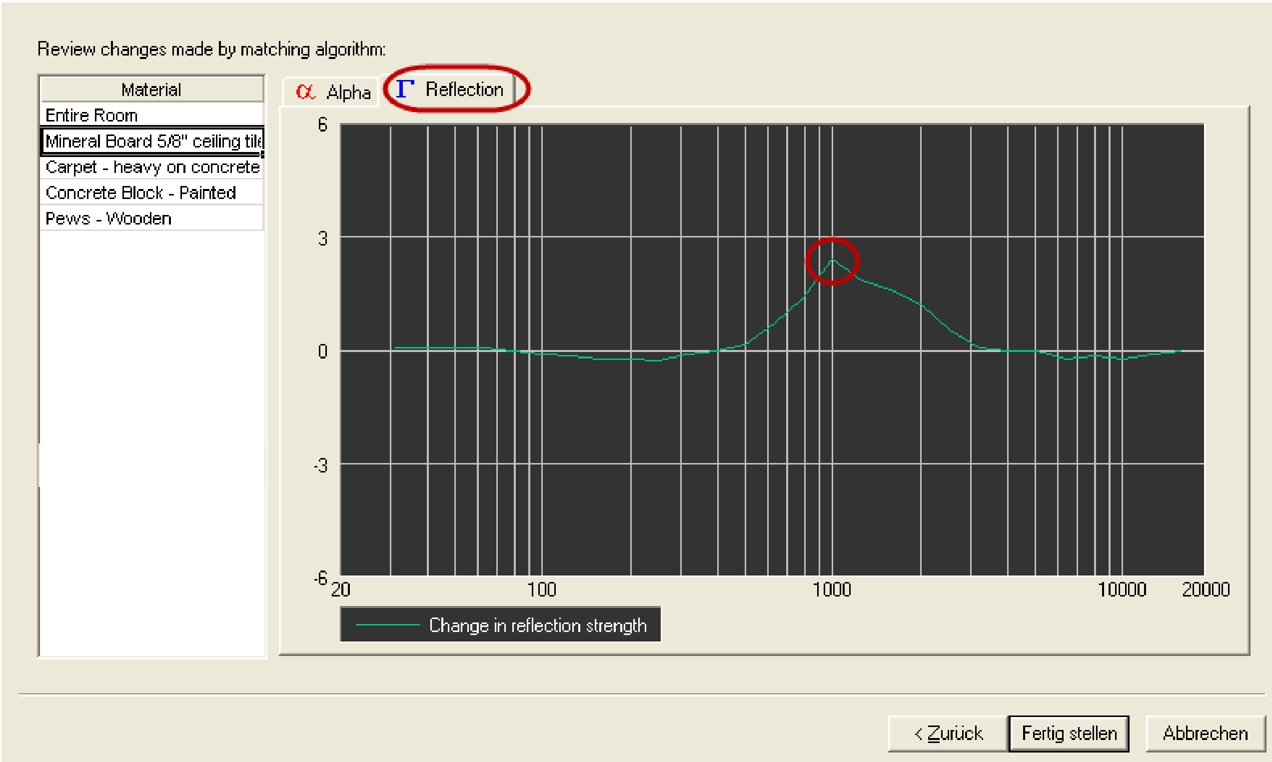
12. Now click and select **Mineral Board 5/8**".
    The following window will appear:



RT60 Results - Mineral Board 5/8"

This figure shows the Mineral Board's original absorption coefficients and the adjusted coefficients. In this case, at 1000 Hz, the original material absorption coefficient was 0.76, and the adjusted is 0.58, a reduction of 0.18.

13. Click on the **Reflection** tab, the following window appears:



RT60 Results, Reflection tab

This figure shows the change in reflection strength of a ray hitting the adjusted material, compared with the original material. In this case, the reflection at 1 kHz is 2.2 dB stronger from the adjusted material than the original material.

The change is calculated as:

$$\Gamma = 10 \times \log\left(\frac{1-\alpha_{adjusted}}{1-\alpha_{original}}\right)$$

Tip: The maximum change in reflection strength allowed by the algorithm is 3 dB.

14. Click **Finish** to accept them, or click on **Cancel** to reject the new absorption coefficients. You will be returned to the **Acoustics** tab.

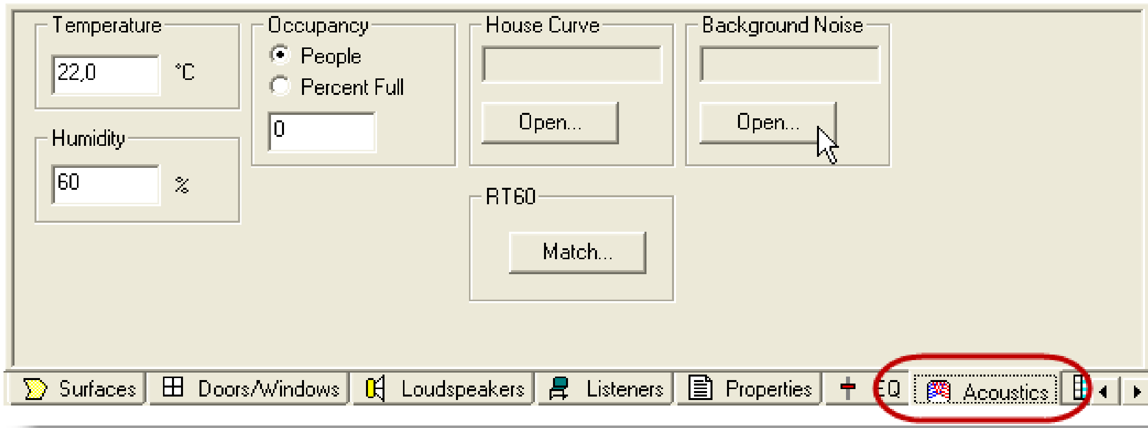
Note: When you click Finish you are committing to the new absorption coefficients, and there is no undo. If you change your mind you can close and reopen the model, but all changes made since the last time you saved will be lost.

For information on Matching RT60, see "Matching the Measured and Predicted Reverberation Time."

Defining Background Noise Levels

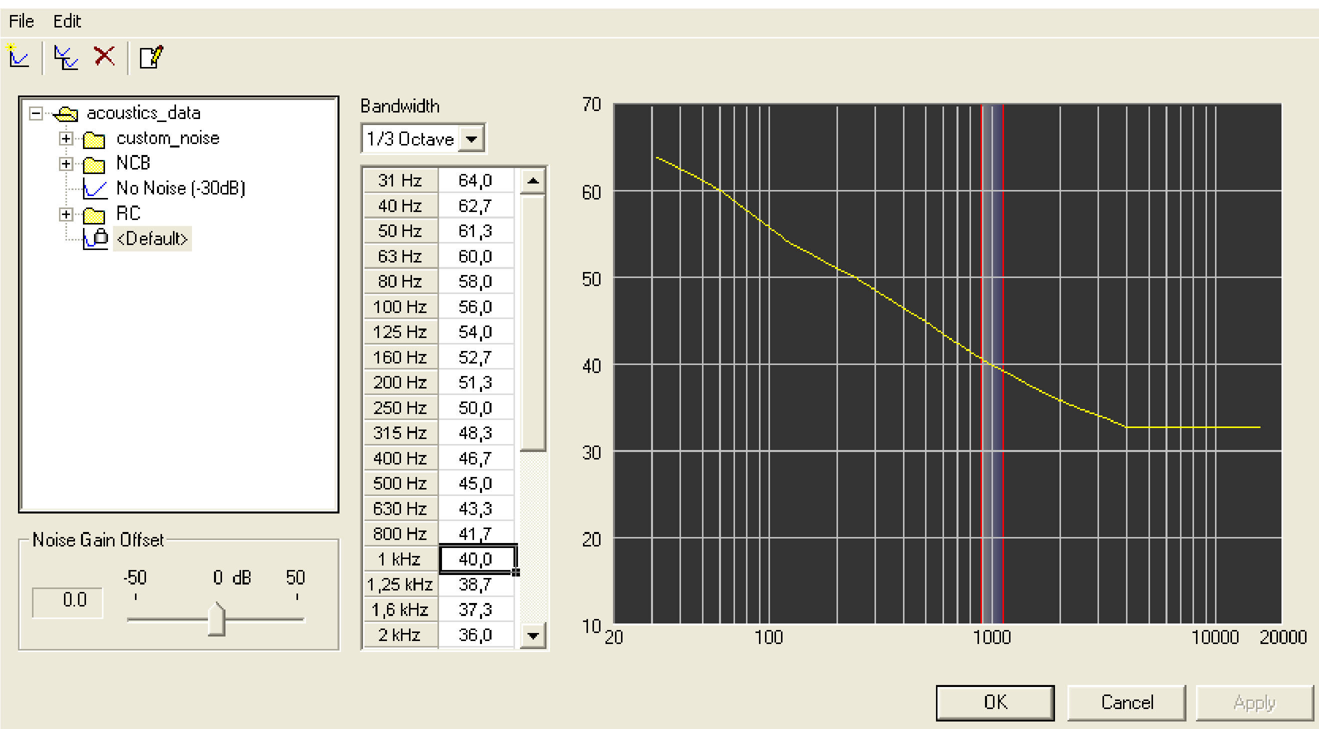
The background noise level used within the Modeler software predictions may be one of the standard noise levels provided in the Background Noise database, or may be a custom background noise created specifically for the design.

Click on the Background Noise **Open** button.



Background Noise Open button

The following window appears:



Background Noise window

Note: Background noise can have a significant impact on predictors such as speech intelligibility and echoes. Background noise can reduce intelligibility, and it can help mask a late strong reflection that may otherwise have appeared as an echo.

In this window, you can either use one of the predefined noise curves, or if you have actual measurements from the space, simply create your own noise files.

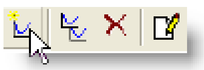
Click on a few of the different noise files to get familiar with the format. You can duplicate files, rename them, and delete some of them.

Note: The standard files (BNC - Balanced Noise Criteria and RC - Room Criteria) are pre-defined and locked. They cannot be changed unless you duplicate them first. See American National Standard *Criteria for Evaluation Room Noise* ANSI S12.2-1995 (ASA 115-1995)

Creating your own Background Noise

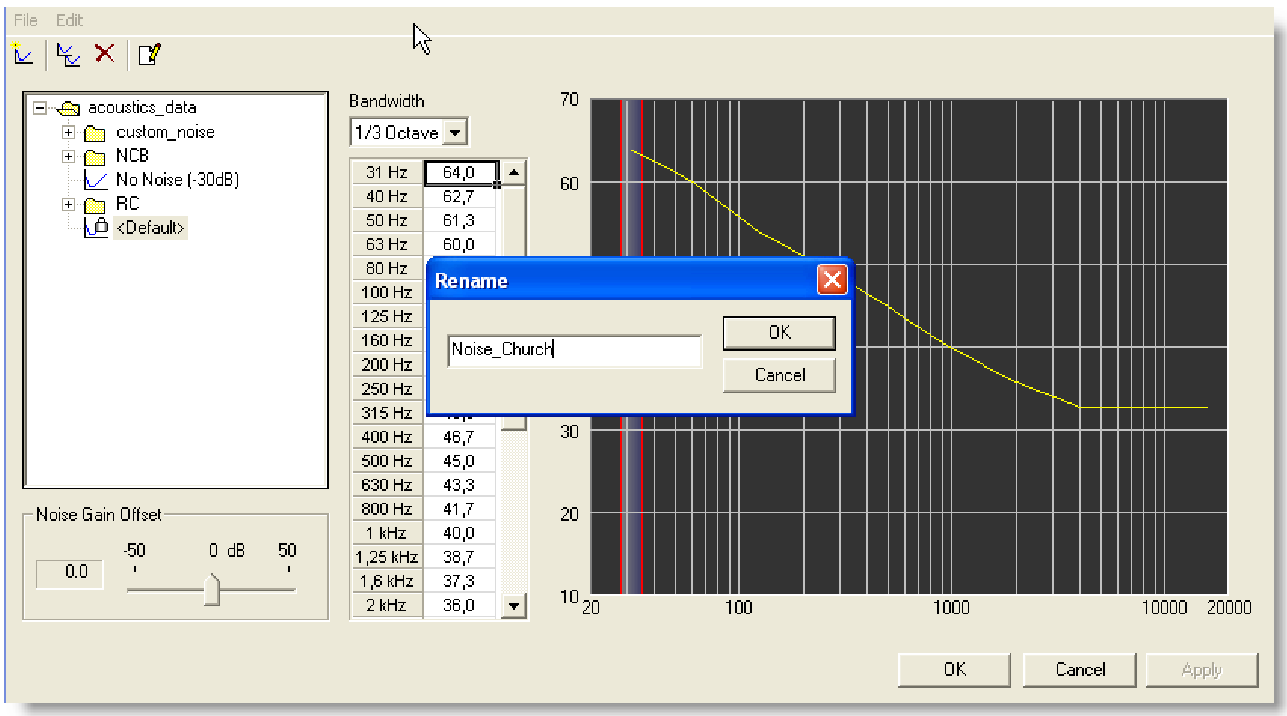
For this example, we have measured the actual background noise in a room. We will now create a custom noise file with this data:

1. Click on the **New Noise Curve** button (or select New from the File menu).



New Noise Curve button

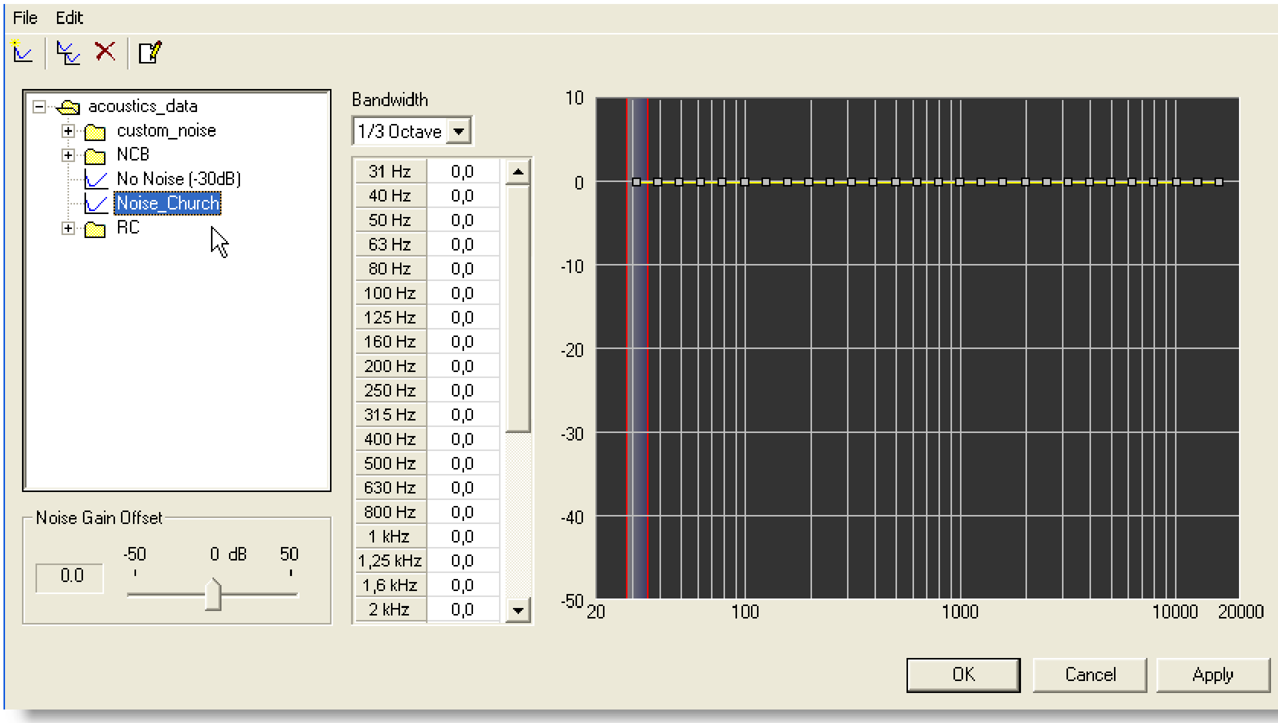
2. Name the file **Noise_Church**, then click on **OK**.



Adding a New Noise Curve

The file appears at the root of the acoustics data folder.

3. Select the **Noise_Church** file by clicking on it.



New Noise Curve file

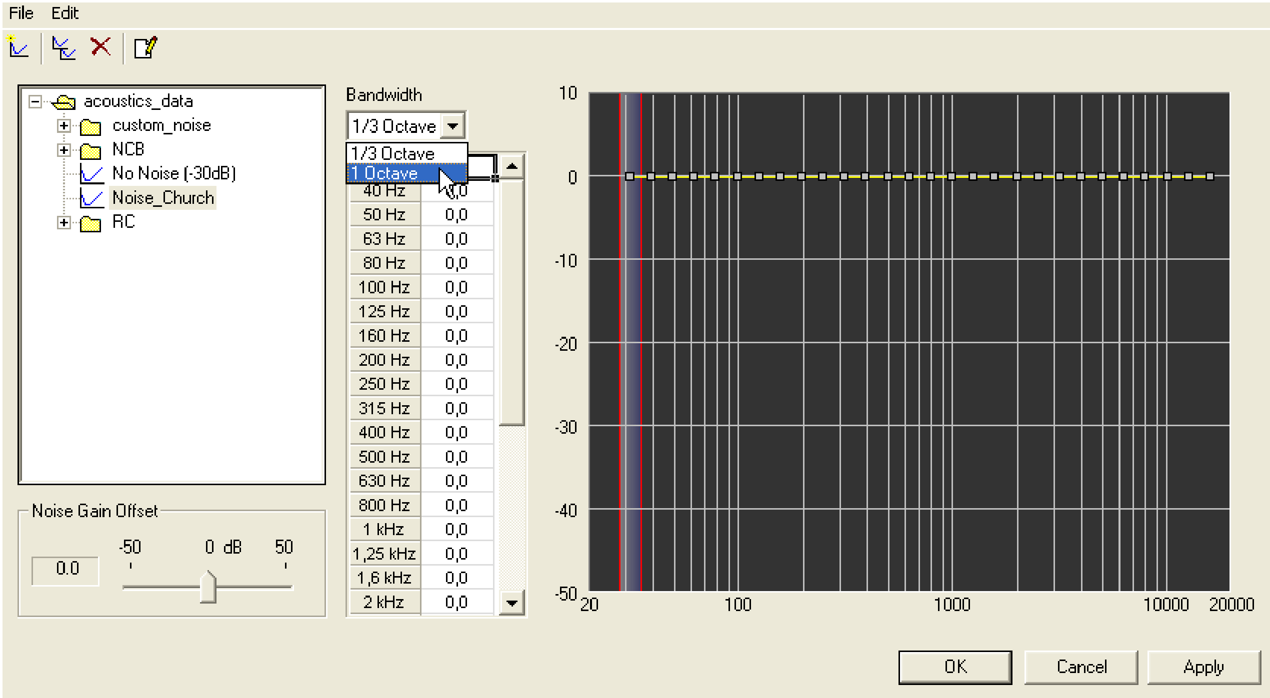
Storing a Gain Offset for the Background Noise File

In some cases you may need to increase or decrease the gain of a background noise file. One possible way to do this is to create multiple copies with different levels. Modeler provides an easier way by using a Gain Offset function that allows you to specify a gain offset per room model.

To access the Gain Offset function, open the Background Noise Database, and preview the background noise file using the steps described earlier. While previewing the background noise file, you can use the Gain Offset function to increase or decrease the initial level of the background noise.

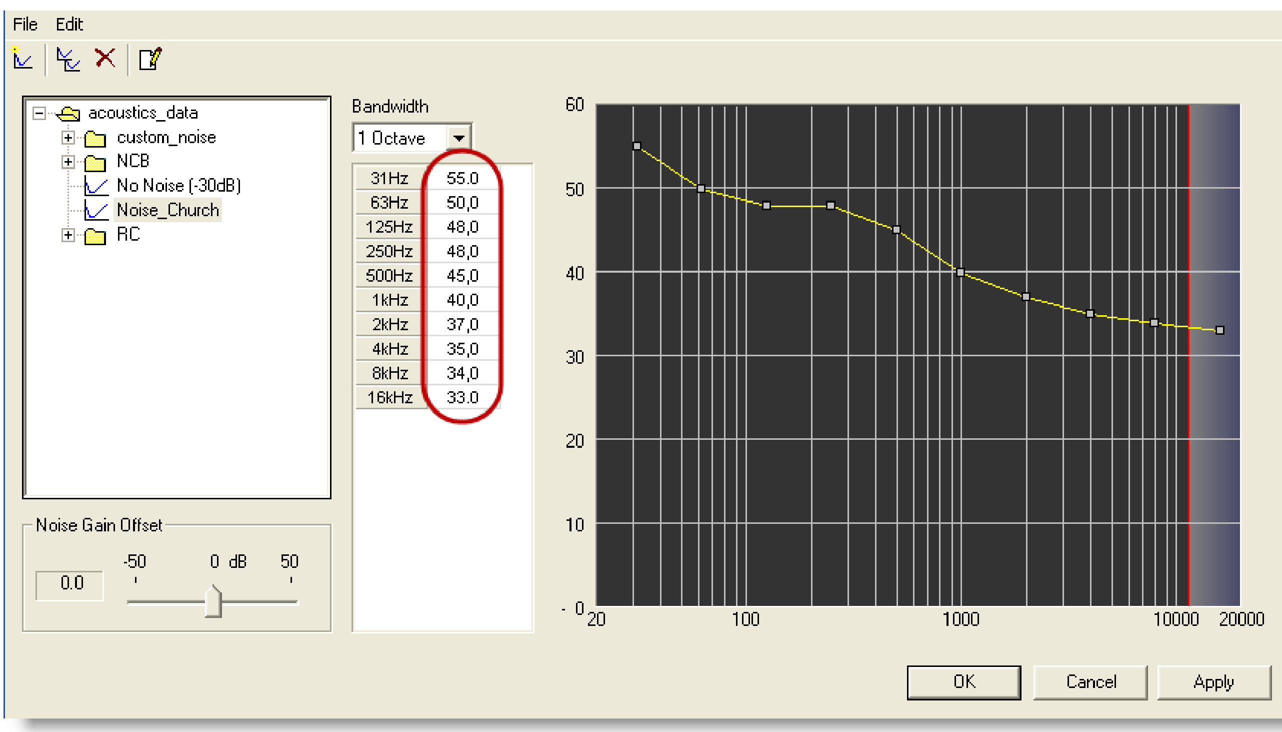
A Gain Offset can be defined for each room model where this particular background noise file is used. The Gain Offset information is stored with the room model, and is recalled the next time the room model is opened.

4. Select 1 octave band for the bandwidth.



New Noise Curve file with 1 Octave selected in Bandwidth

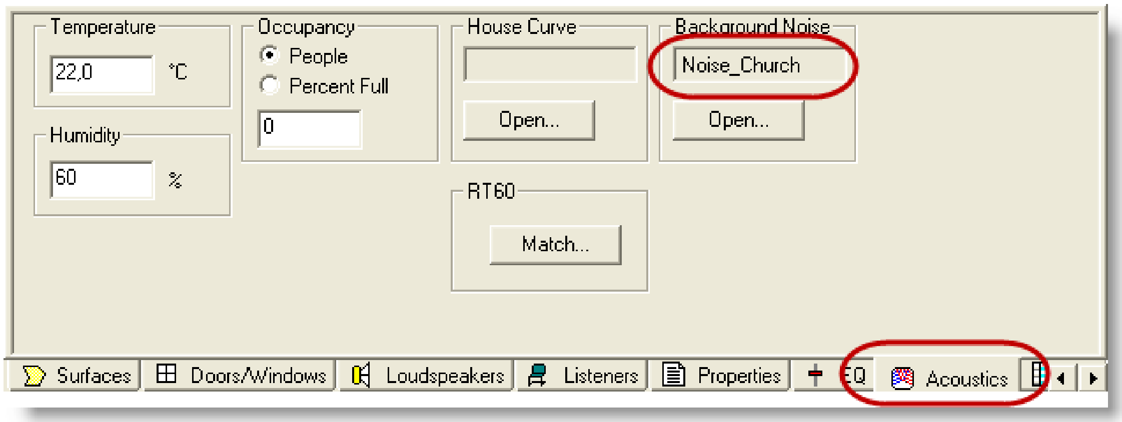
5. Enter the numbers as follows:



Added numbers for New Noise Curve file

We have now entered the background noise.

6. Click on **OK**. You will then return to the **Acoustic tab**. You will see the name **Noise_Church** in the **Background Noise** section.



Noise_Church in Background Noise field

Note: With the calculation engine enabled, just selecting a new noise file will not update calculations. Instead, clicking "Apply", "OK" or adjusting the Noise Gain Offset slider will trigger a recalculation.

Tip: To clear a previously selected background noise file, simply replace it with another background noise file. Note that there is a file "No Noise (-30 dB)". When this file is selected, the room model is simulated with no background noise.

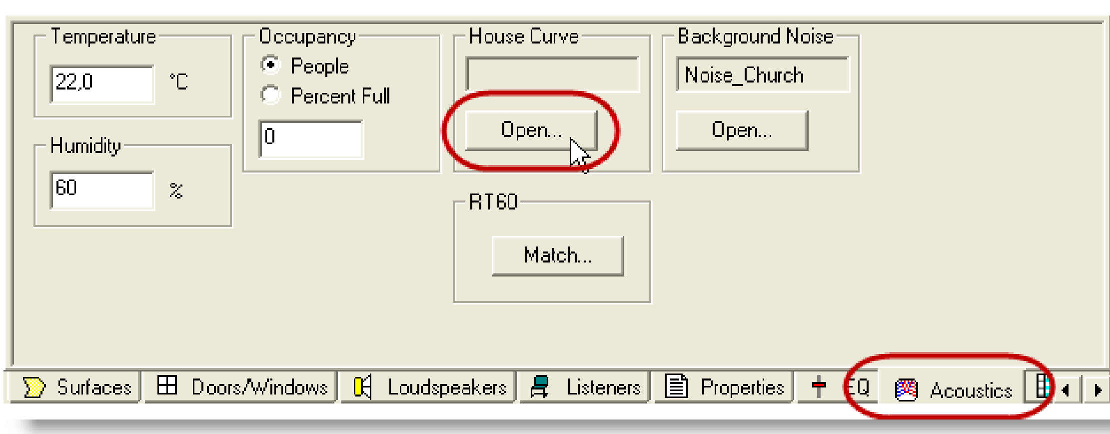
Defining A House Curve

The House Curve function is used by the Apply House Curve function within the right-click menu of the EQ Tab. One of the standard house curves provided in the House Curves database may be used, or a new, custom House Curve created specifically for the design may be created.

By setting the House Curve, you may quickly modify the rooms average response to match your preferred shape (House Curve).

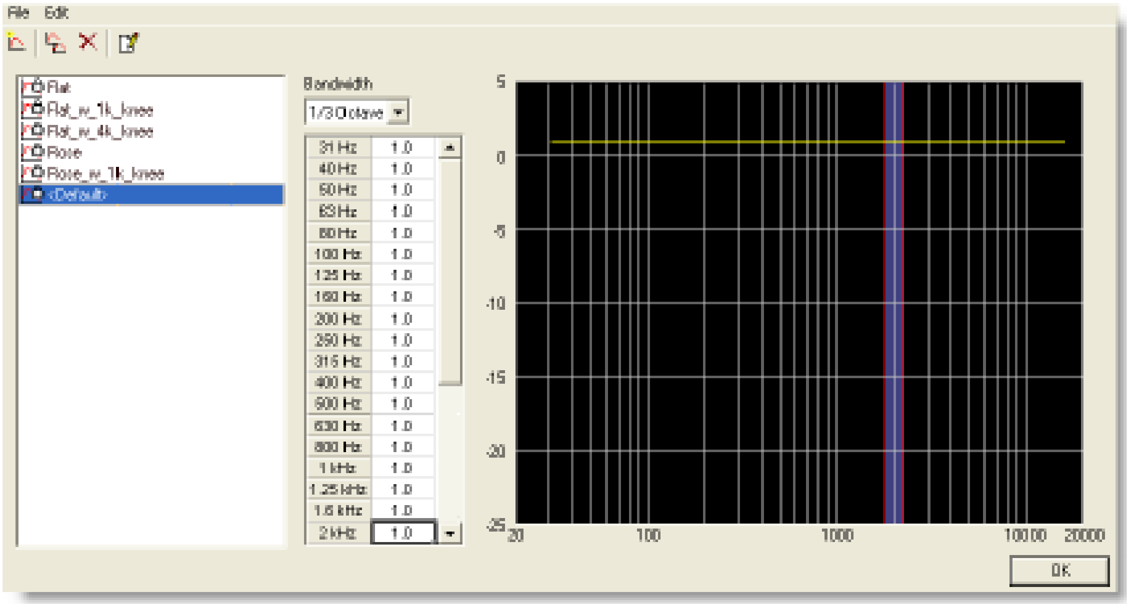
To set the House Curve.:

1. Click on the House Curve **Open** button.



House Curve, Open button

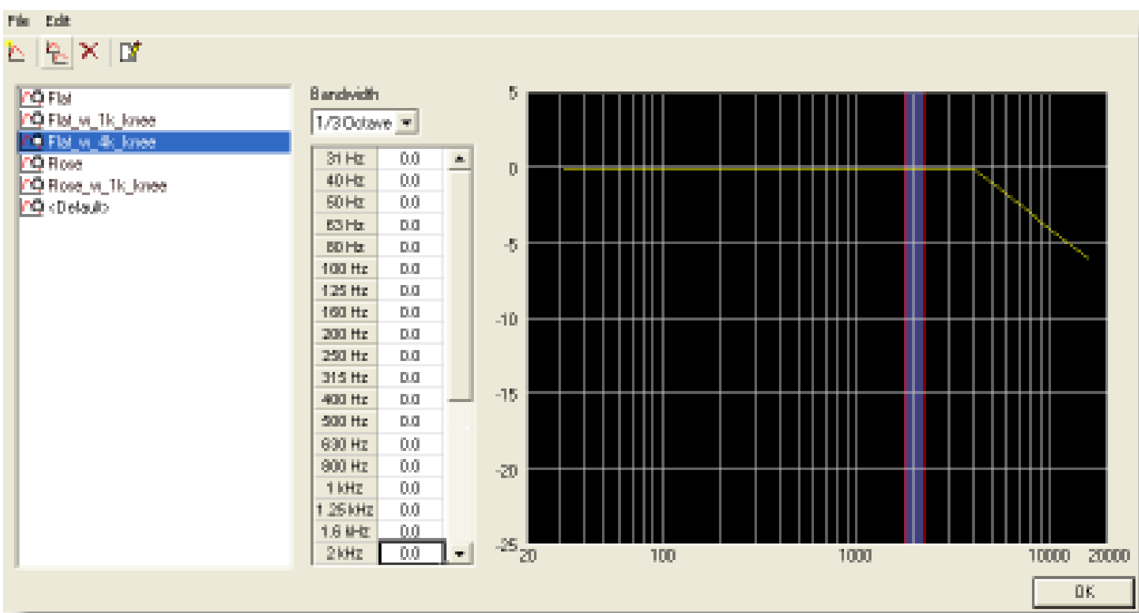
The following window appears:



House Curve window

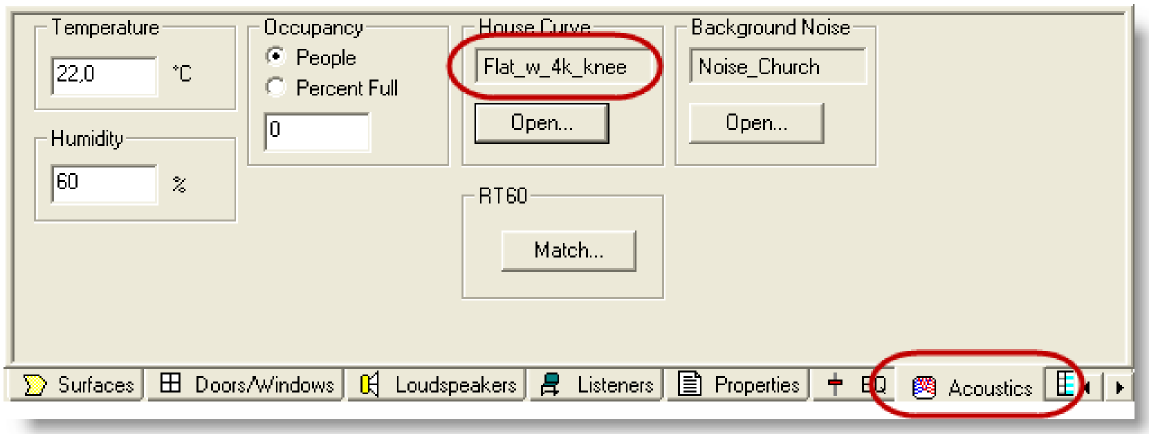
This window works similarly to the Background Noise window. Click around to get familiar with the functionality.

2. Select the curve labelled Flat_w_4k_knee, which is flat to 4 kHz, and then rolls off by 3 dB per octave band.



House Curve

3. Click on **OK**, and you will return to the **Acoustics** tab. Notice that the House Curve name appears in the House Curve section.



Acoustics tab, showing House Curve name

Creating a System Design

Introduction

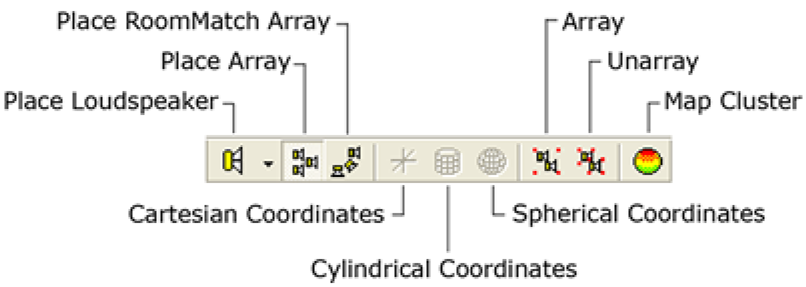
Once the room model is created, a system design may be implemented using the various loudspeaker and array tools within the Modeler software.

See the following topics:

- Placing and Aiming Loudspeakers
- Working with Arrays
- Working with RoomMatch® Arrays

Placing and Aiming Loudspeakers

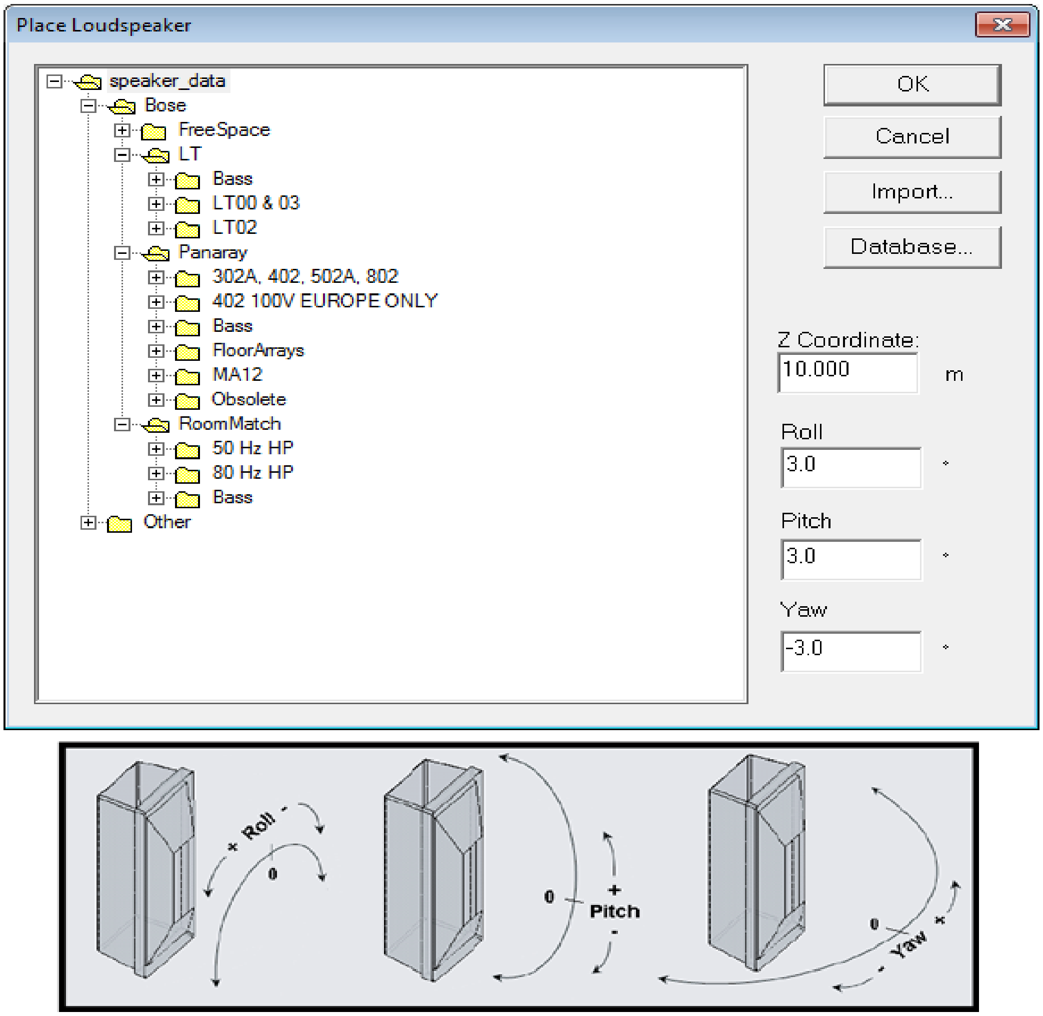
The Cluster toolbar contains tools for placing and viewing loudspeakers.



Cluster toolbar

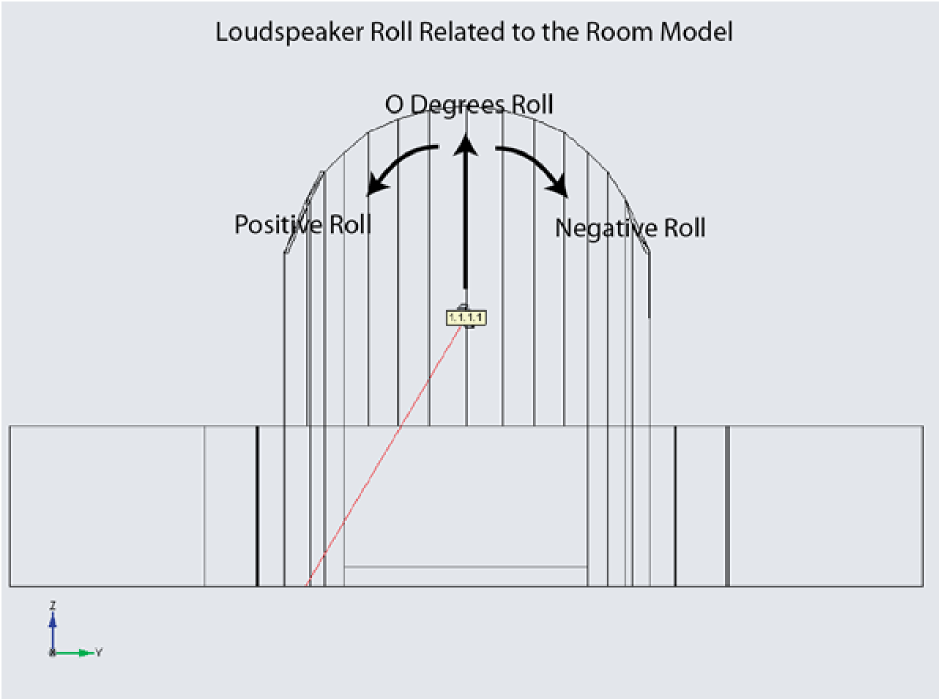
- **Place Loudspeaker** - Places a loudspeaker in your model.
- **Place Array** - Places an array in your model.
- **Place RoomMatch™ Array** - Places a RoomMatch array in your model.

When placing speakers within the room model using the **Place Loudspeaker** tool you are asked to specify the elevation, Roll, Pitch and Yaw of the loudspeaker.

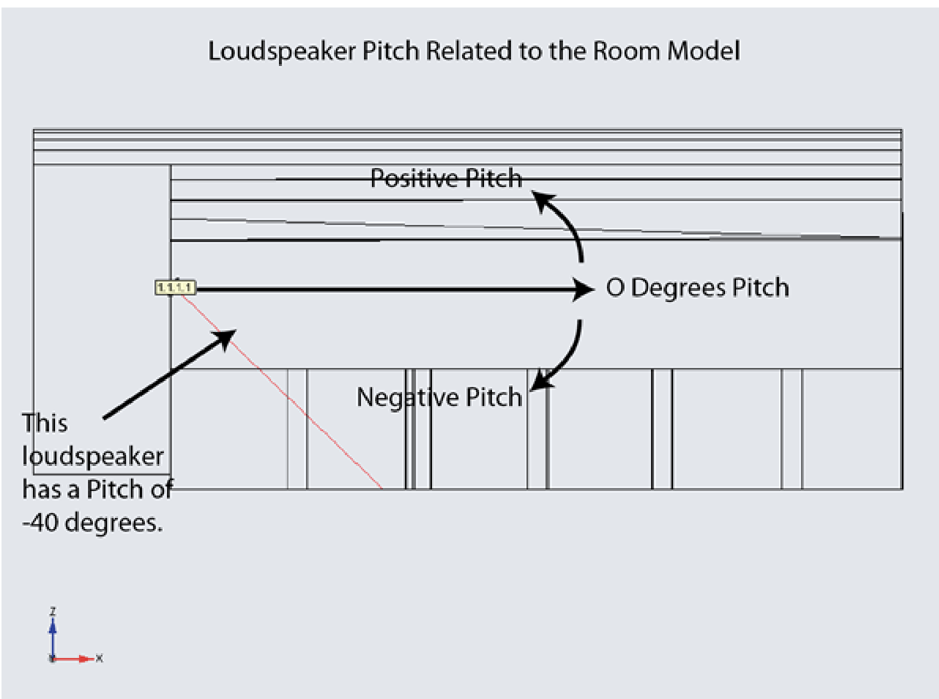


Entering elevation, Roll, Pitch, and Yaw when placing a loudspeaker

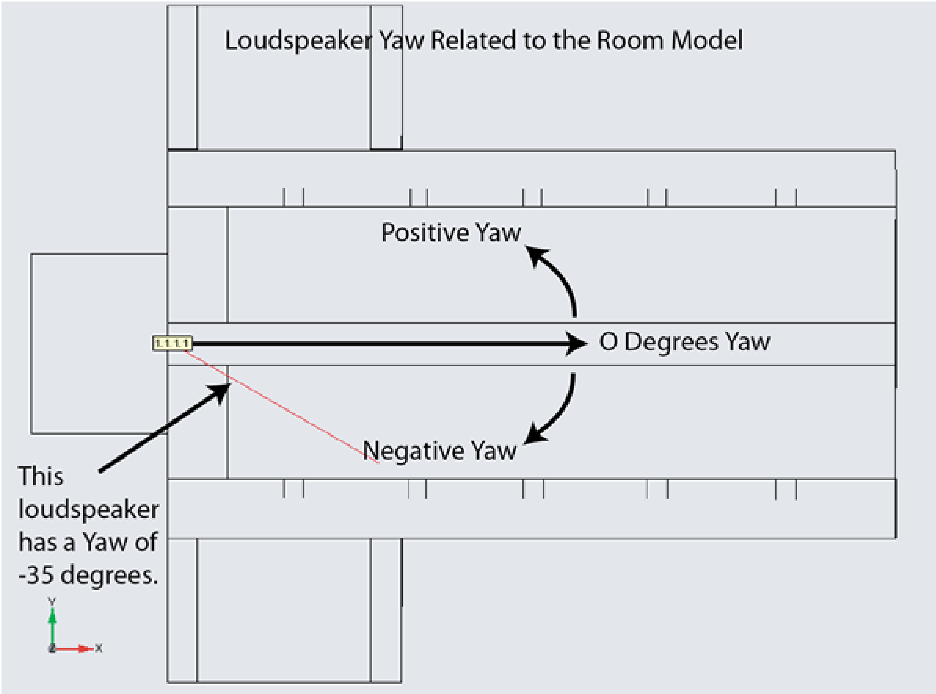
The Roll, Pitch and Yaw you choose will determine how the loudspeaker is aimed within the room model. If you wish you can just click the **OK** button and the loudspeaker will be placed using the default settings. You can then move the hit point directly within the room model, or you can edit the Roll, Pitch and Yaw angles in the loudspeaker spreadsheet.



Elevation View



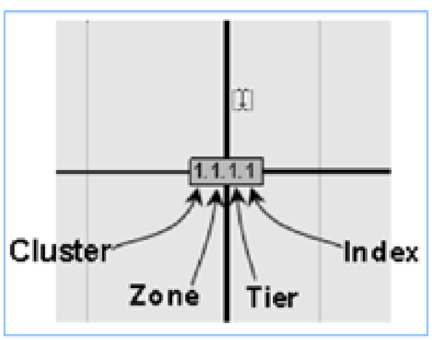
Section View



Plan View

Working with Clusters

Once you have placed a loudspeaker in the room model it is automatically assigned to a cluster. Modeler uses a Zone.Cluster.Tier.Index labeling system for all loudspeakers within the design. This is a hierarchical system that offers a great deal of flexibility for the organization of loudspeakers. Many systems, however only require a Zone.Cluster organization. It is possible to turn off the display of Tier and Index settings in the Loudspeaker Tab when they are not being used. In the Model Settings, you can adjust the appearance of the Cluster Identifier.

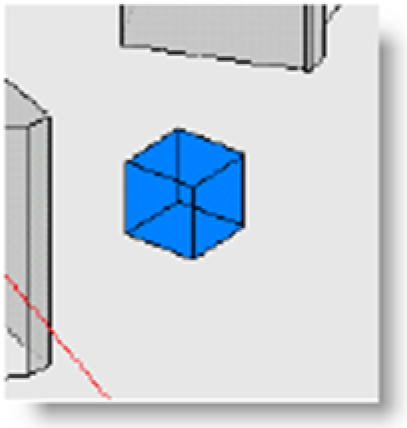


	Cluster	Zone	Tier	Index	Desc.	Speaker
1	1	1	1	1		Bose 402-II FR 6_0

Loudspeaker labeling system

Cluster Origin

The cluster origin represents the point at which measurements are made when arranging loudspeakers in Cluster View. It is displayed in Modeler software as a blue cube, and is created when you place the first loudspeaker of a new cluster. Even if you only have one loudspeaker, there will still be a cluster origin).



Cluster Origin (blue cube)

It is (unless hidden within a loudspeaker) displayed as a blue box, which then appears as a gray box. When selected, the cluster origin is red, unless it is hidden within a loudspeaker, which then appears as a purple box).

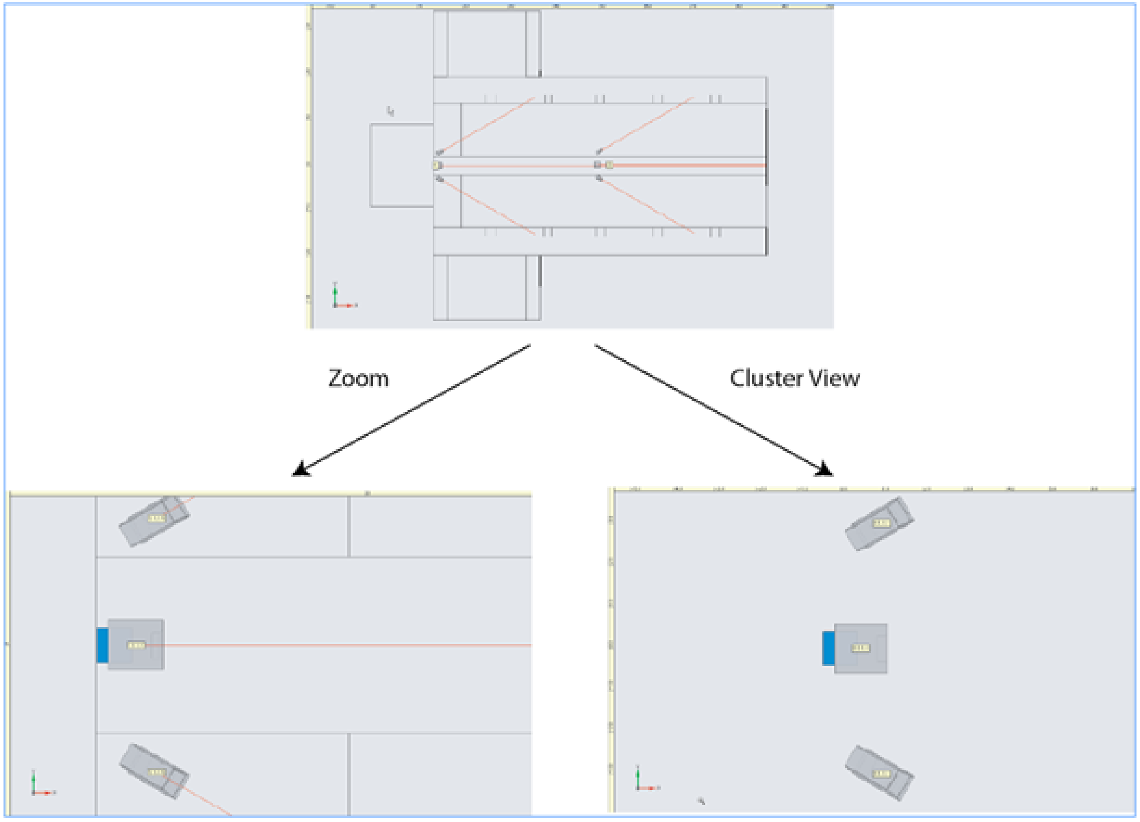
The cluster origin is used as follows:

- For moving the entire cluster (click and drag the cluster origin).
- As a point of reference for arranging loudspeakers within the cluster.
- For selecting and duplicating the cluster

Editing a Loudspeaker Cluster

There are two ways that you can work with a cluster within the Modeler program. The first is to use the zoom tool to “zoom in” on the cluster position from within the Room View. Using this method you can select, move or nudge individual elements within the loudspeaker cluster.

The second method is to use the Cluster View. The Cluster View allows you to work within a single cluster, and provides additional controls for orienting loudspeakers, and building arrays.



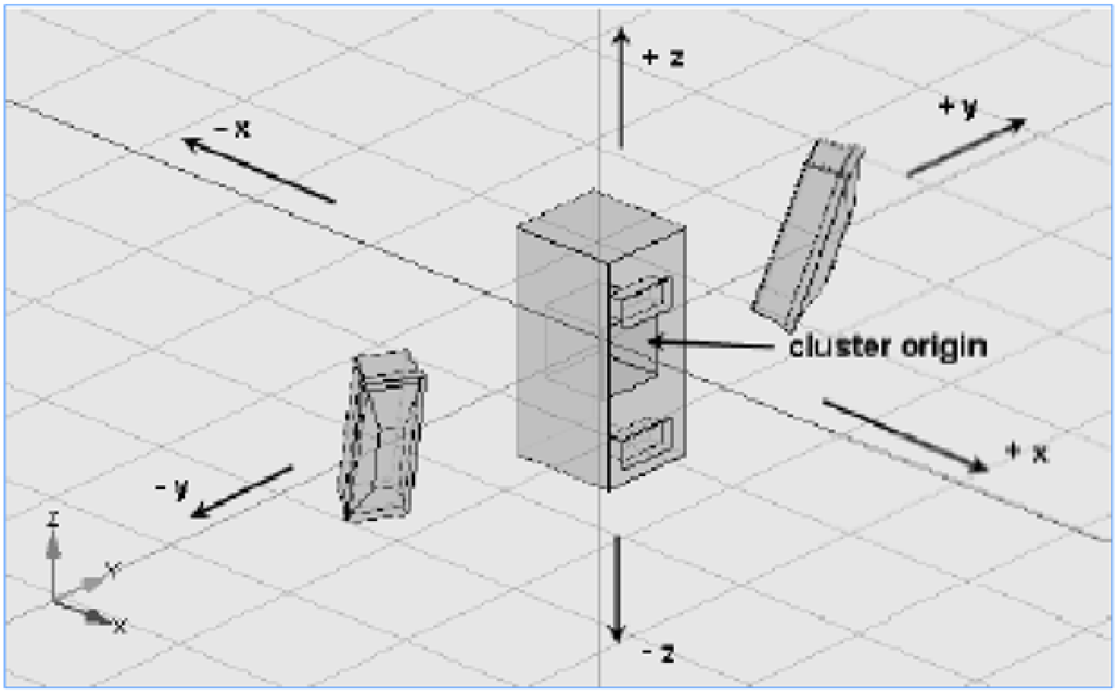
Using the Zoom tool and Cluster View to edit a Cluster

When working within the Cluster View you notice the following changes:

- The rulers along the edge of the model are relative to the Cluster Origin.
- The X, Y, Z coordinates in the Loudspeaker Tab now adjust the loudspeakers position relative to the Cluster Origin.
- The Cluster Snap grid will apply to any changes you make.

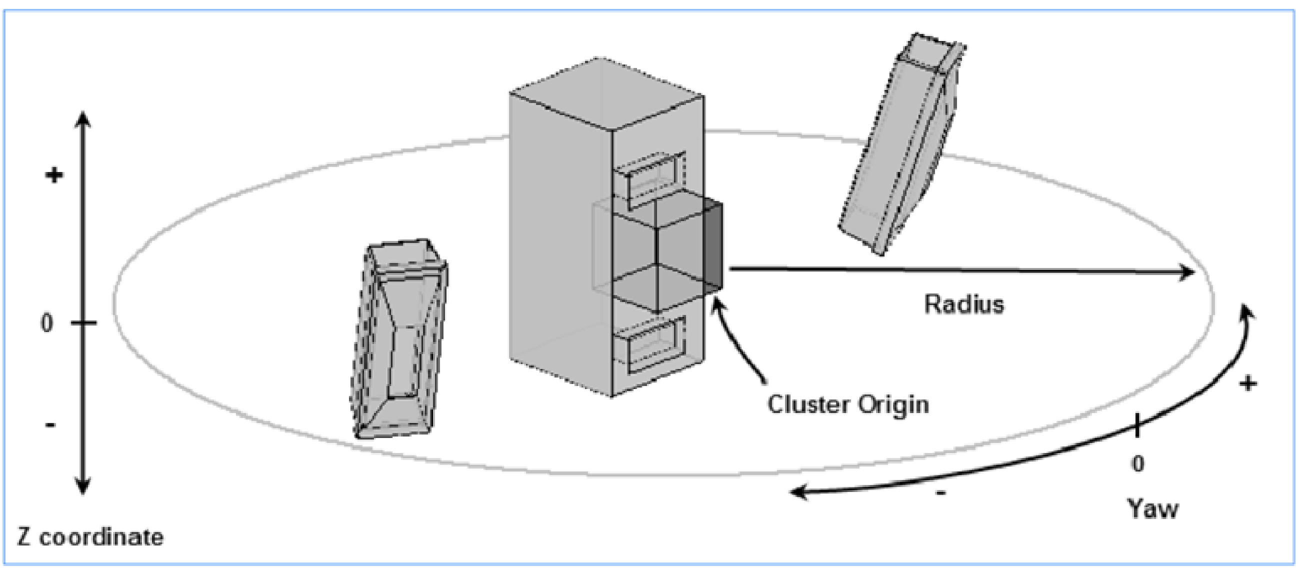
When working within the Cluster View you have access to three methods of arraying loudspeakers: Cartesian coordinates, cylindrical coordinates or spherical coordinates.

- **Cartesian coordinates** is the default coordinate system when working in the Cluster View. When working in Cartesian coordinates loudspeakers snap to the nearest X, Y, Z value when being selected and moved.



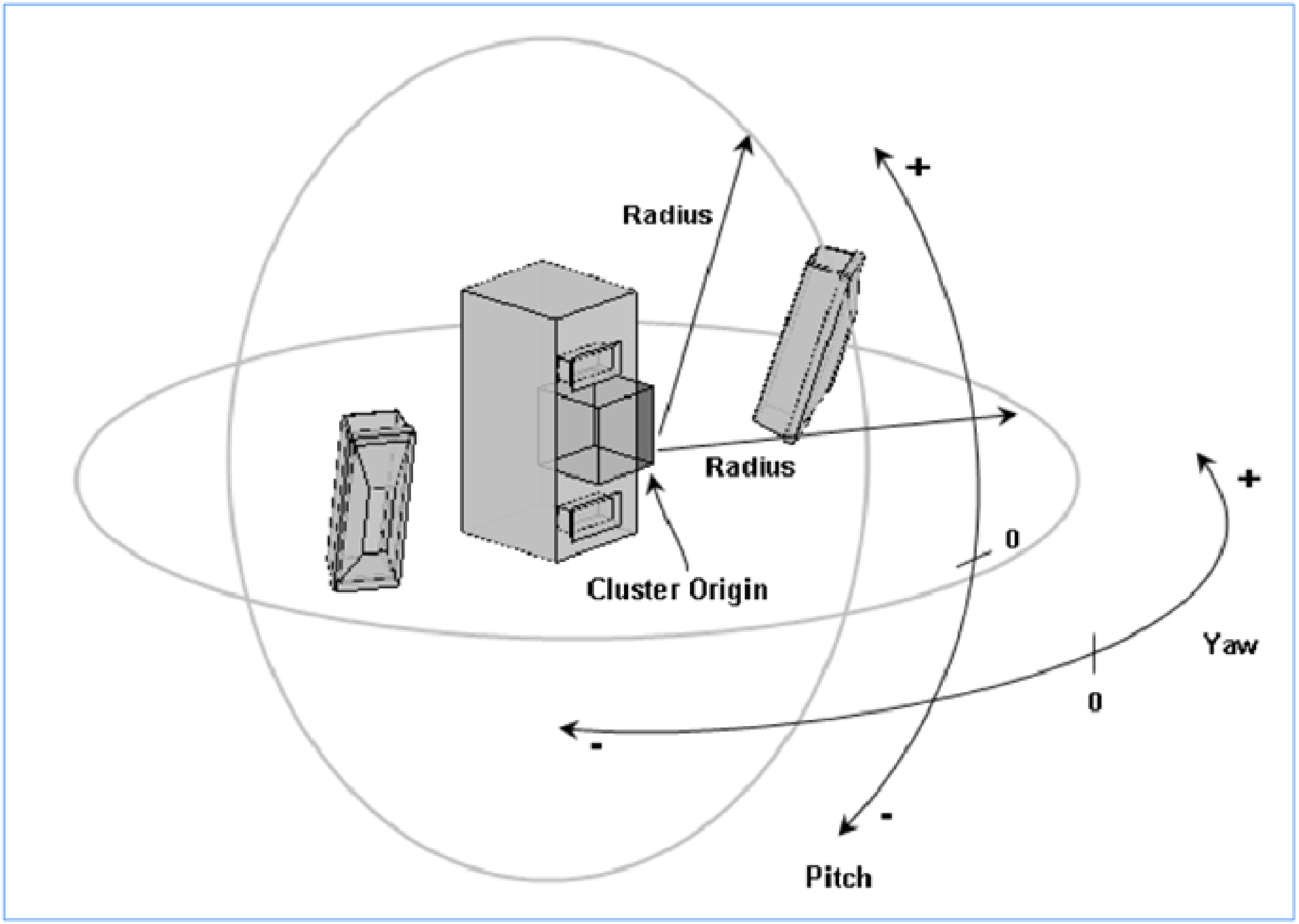
Example of Cartesian coordinates

- **Cylindrical coordinates** will allow you to array loudspeakers according to a radius. For each loudspeaker a radius length, Yaw angle and Z offset value is specified. The Array Radius determines the distance from the Cluster Origin to the geometric center of the loudspeaker. The Yaw determines the location of the loudspeaker along the edge of the cylinder, and the Z value determines the location of the loudspeaker along the height of the cylinder.



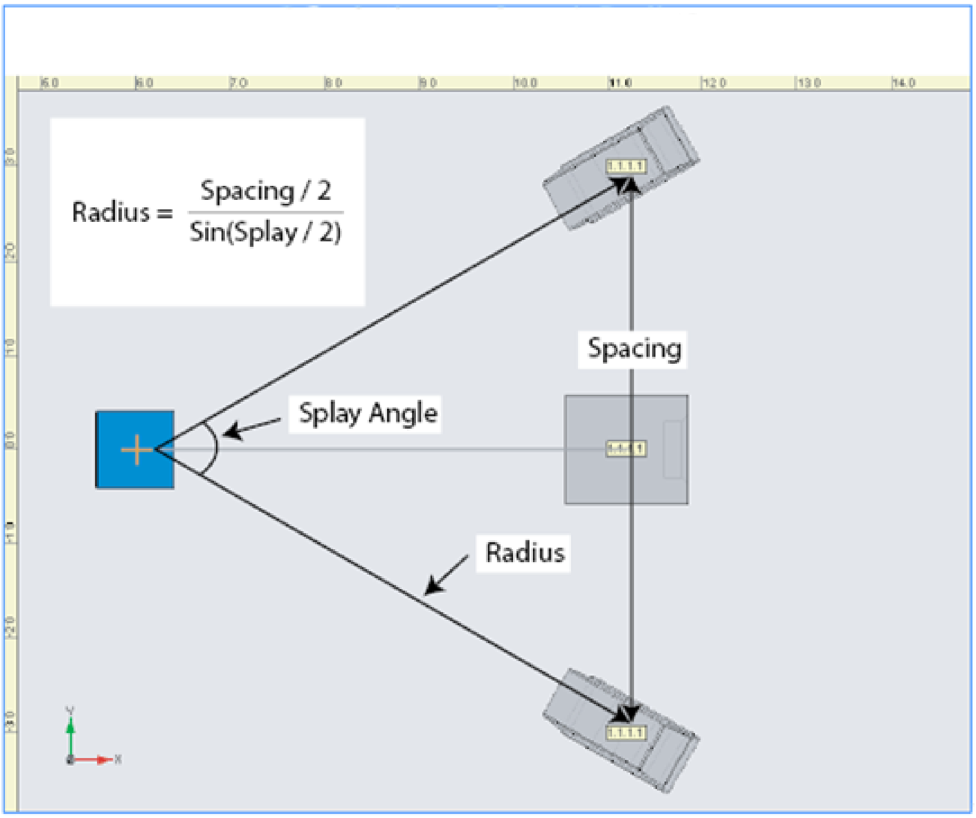
Example of Cylindrical coordinates

- **Spherical coordinates** array the loudspeakers on the edge of a sphere. In this case you will specify an Array Radius, Pitch and Yaw. The Array Radius determines the distance from the Cluster Origin to the geometric center of the loudspeaker. The Yaw determines the location of the loudspeaker along the edge of the sphere, and Pitch value determines the location of the loudspeaker along the height of the sphere.



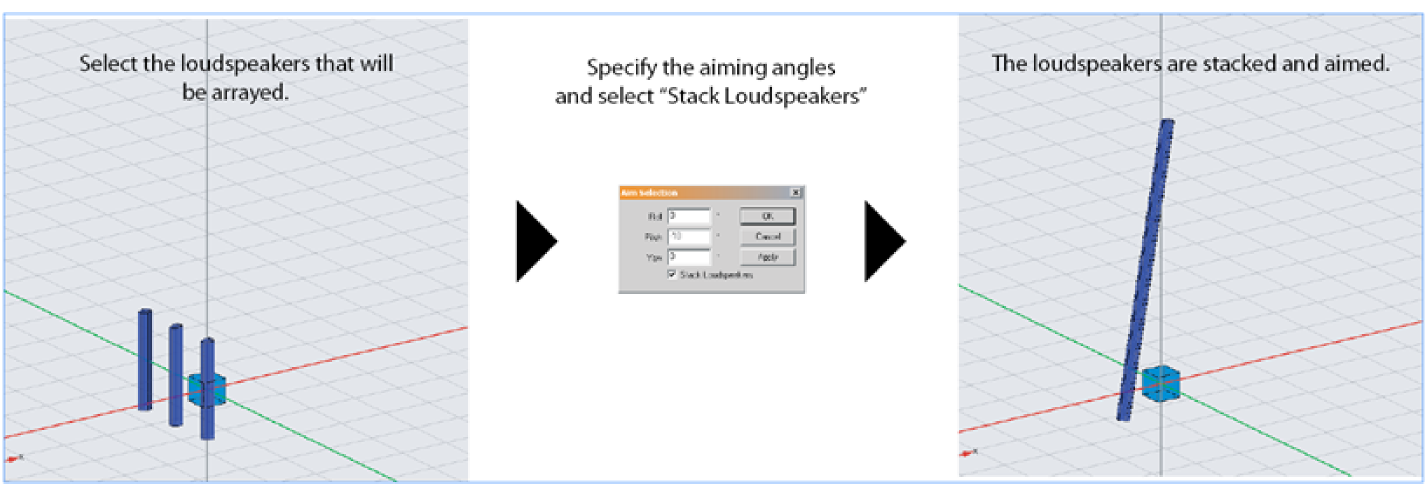
Example of Spherical coordinates

When you are working with Spherical and Cylindrical arrays you will need to know the Spacing and Splay in order to calculate the appropriate radius for the array. Doing this will simplify cluster layout, and will precisely position the loudspeakers.



Calculating the radius of an Array

Additionally, when working with multiple loudspeakers in a cluster you can use the "Aim Selection" feature to stack, aim or stack and aim the loudspeakers in the array. The Aim Selection tool is available from the Right-Click menu of the Model View. This feature is very useful for creating a stacked MA12 array. To create a stacked MA12 array you simply select all of the MA12 loudspeakers in the cluster, and using the Aim Selection feature specify the amount of Yaw, Pitch and Roll, and select the "Stack Loudspeakers"

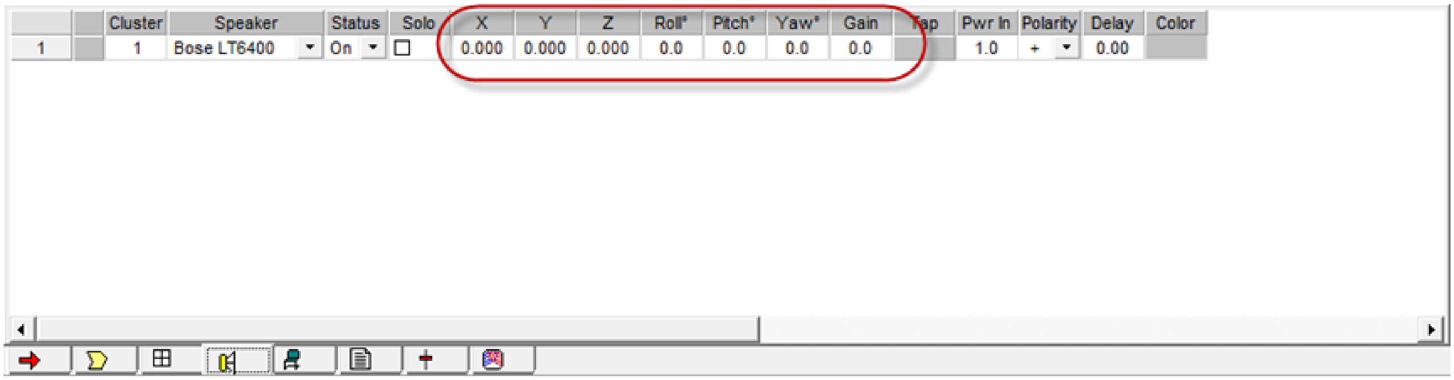


Note: The Stack feature always stacks the loudspeakers on top of each other using the top surface of the loudspeaker. If you use Roll + Stack you will create a horizontal array with the loudspeakers "stacked" end to end.

Editing Loudspeaker Placement and Aiming

The aiming of loudspeakers within the room model may be modified using either the loudspeaker properties of the individual loudspeaker, or the Loudspeaker Tab.

Within the Loudspeaker Tab all of the aiming properties of the loudspeaker are shown.

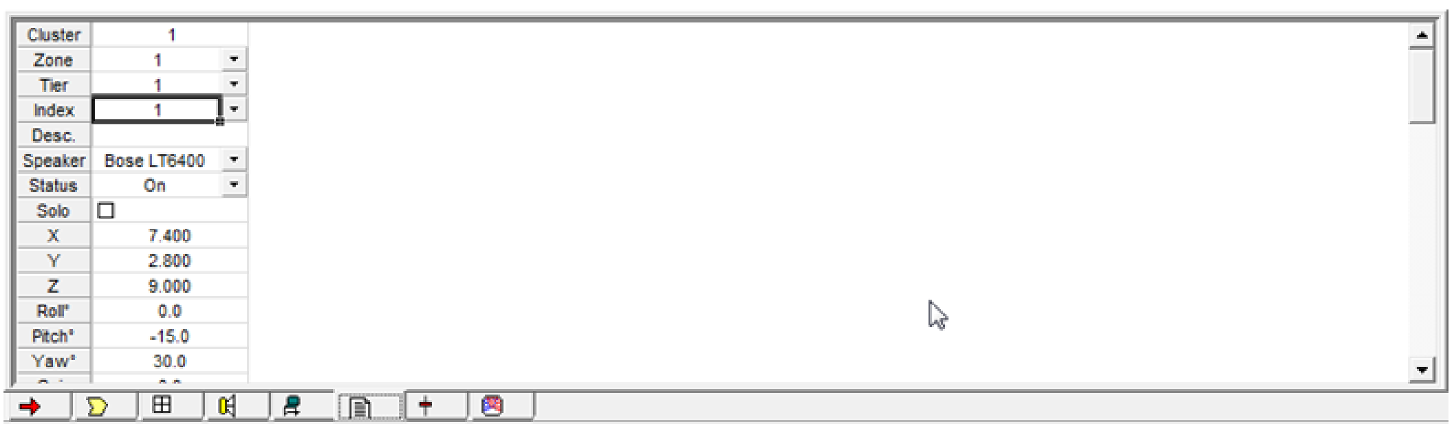


Loudspeaker aiming properties

From this location you may change the loudspeaker's position within the model using the X,Y and Z properties, and its aiming using the Roll, Pitch and Yaw items.

It is important to note that the X, Y and Z items are view dependent. When the room model is displayed the coordinates refer to the loudspeaker's position using the room model coordinates. When the Cluster View is displayed the X, Y and Z items are relative to the 0, 0, 0 point of the cluster.

Selecting a loudspeaker within the Model View, and displaying the Properties Tab will display the properties for the selected loudspeaker.



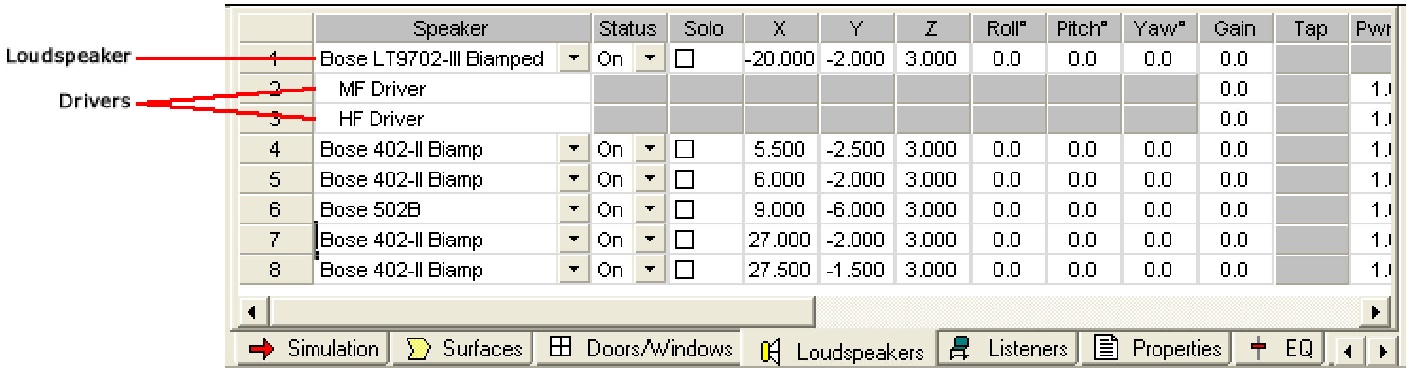
Properties for the selected loudspeaker

Like the Loudspeaker Tab the X, Y and Z items are view dependent. When the room model is displayed the coordinates refer to the loudspeaker's position using the room model coordinates. When the Cluster View is displayed the X, Y and Z items are relative to the 0, 0, 0 point of the cluster.

Loudspeakers with multiple drivers

Multi-way loudspeakers use master properties for the loudspeaker, and driver properties for control of individual driver components. This functionality allows you to independently adjust parameters such as EQ settings, delay and gain for each driver in many multi-way loudspeakers.

Separate drivers are displayed individually in the Loudspeakers and Properties tabs. For example, a biamped Bose Panaray® LT 9702® loudspeaker, has two independently adjustable drivers: a high frequency section and a mid frequency section. The drivers are displayed as “child” rows (MF9702, HF9702) underneath the “parent” entry (Bose LT 9702®-III Biamp) in the Loudspeakers tab.

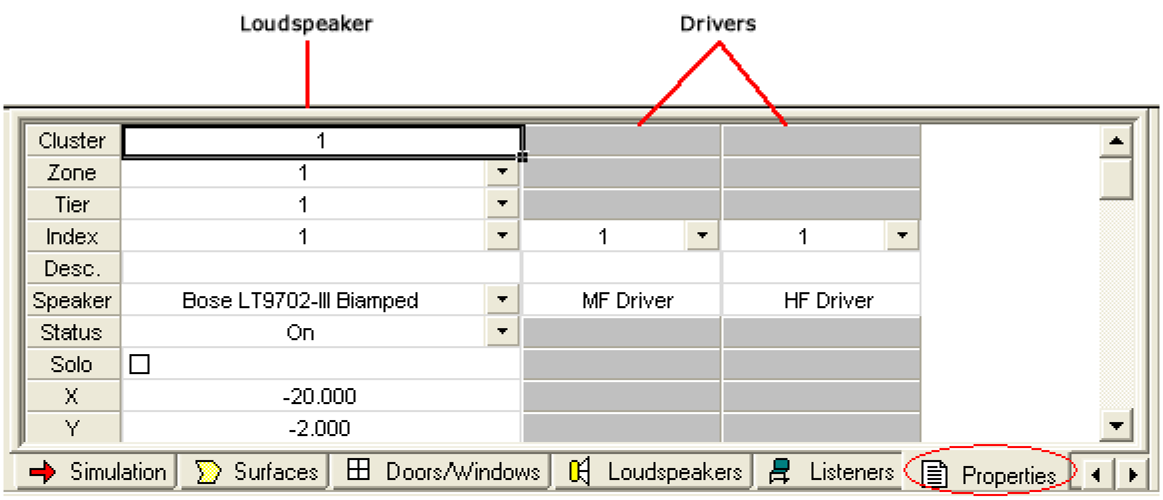


Multiple drivers shown in Loudspeakers tab

A Bose Panaray® LT 9702® loudspeaker with independently adjustable mid-frequency and high frequency drivers

Use the parent entry to delete the loudspeaker or change its position. Use the child entry to adjust settings for the individual drivers. You may also use the parent entry to apply a master gain or delay to the loudspeaker which maintains the relative differences applied to the individual drivers.

Loudspeakers with independently adjustable drivers are displayed in a similar manner in the Properties tab:



A Bose Panaray® LT 9702® loudspeaker with independently adjustable mid-frequency and high frequency drivers as seen in the Properties tab

Working With Arrays

An array is a special collection of loudspeakers that have been specifically arranged, oriented, and potentially steered to achieve a desired pattern of coverage across multiple frequency bands. Like all speakers, they are assigned to a cluster.

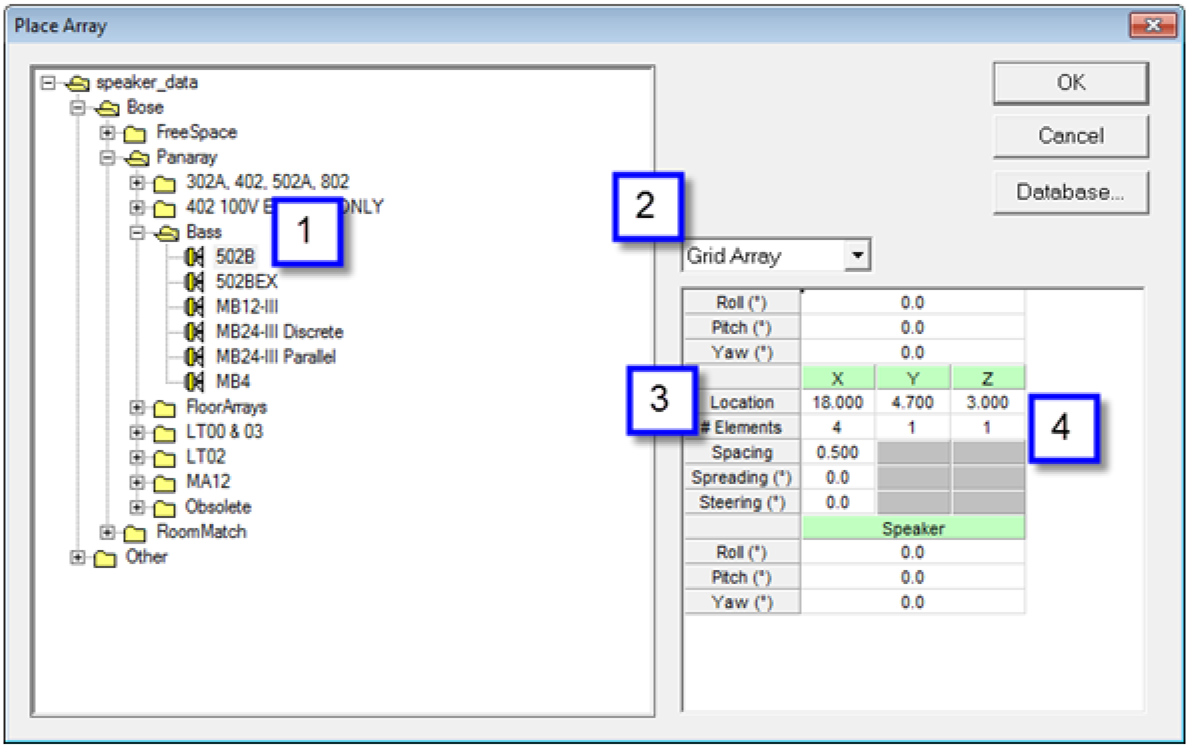
The array is described by a set of rules. For example, the arrangement is determined by specifying dimension and spacing. You define what direction in space you want to steer the array, and the software automatically assigns to each of the loudspeakers a delay time that steers it in the desired direction, and so on.

This chapter illustrates the process of designing with arrays, starting with how to define them, following by a description of array properties. It concludes with a survey of the most common array types.

Creating an Array

A typical application for the Array tool is the creation of bass arrays. Because of this the remaining examples in this section focus on the creation of four bass array types: broadside, endfire, compound, and ring arrays.

To place an array, select the Place Array tool, located next to the Place Loudspeaker tool, and click within the room model at the desired array location. Doing so will cause the Place Array window to be displayed:

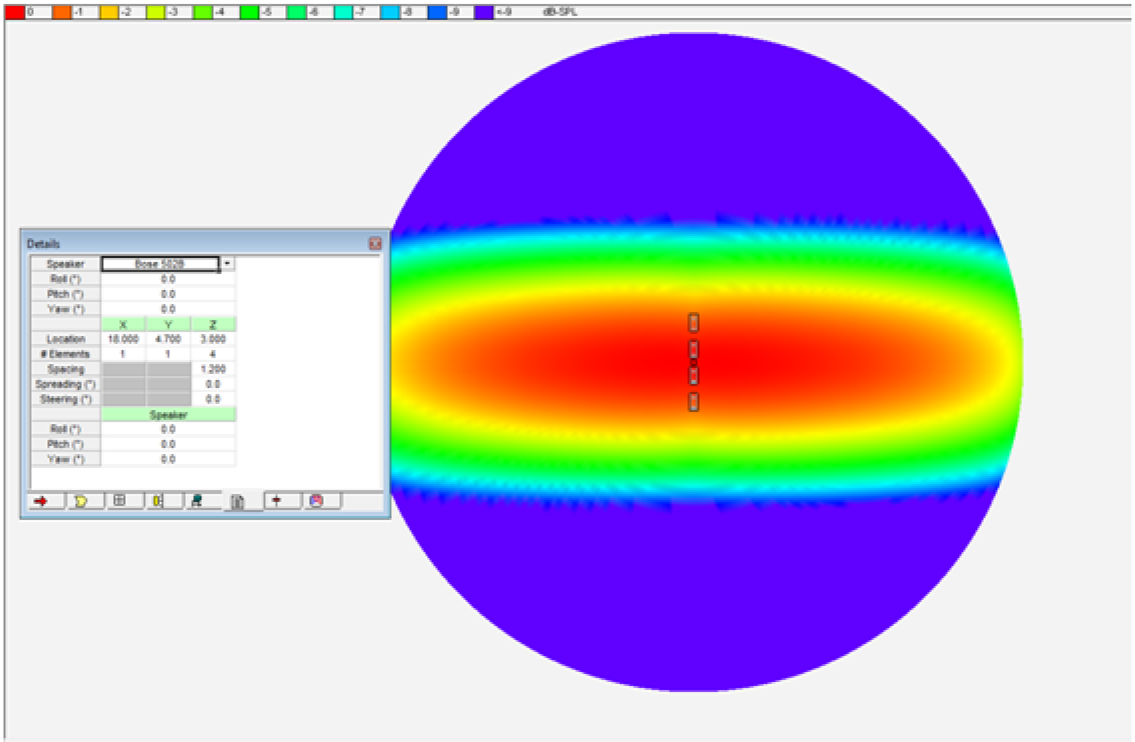


Place Array window

1. Select the desired loudspeaker to be used within the array.
2. Select the type of array to be created: Grid Array (broadside, endfire, or compound) or Ring Array.
3. Define the physical location of the array within the room model.
4. Define the quantity of elements to be included within the array.
5. Once the array parameters are defined select OK to place the array.

Broadside Arrays

A broadside array is the simplest of the array types. In this array the sources are equally spaced, and energy is radiated to the sides of the array, and cancels at the ends of the array. A broadside array relies solely upon the spacing of the array elements to create its radiation pattern, and does not employ any advanced signal processing.



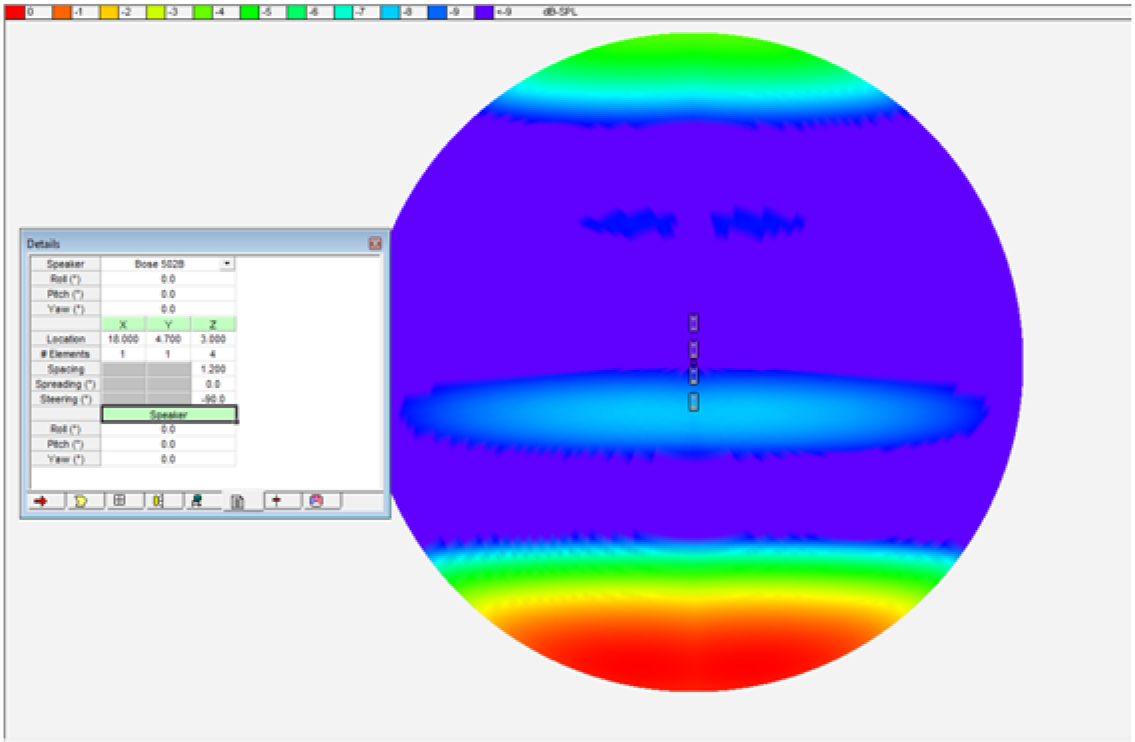
Broadside array example

In this example, the array is stretched in the Z dimension resulting in significant radiation pattern control.

Endfire Arrays

Endfire arrays are used to direct, or focus, the array’s energy in a single direction. In this array spaces are equally spaced, but a linear signal delay is applied to the array in the direction of the desired radiation.

The steering of the energy is accomplished using the Steering function in the Array properties. The main beam of the array may be steered between +/- 90 degrees, where 90 degrees corresponds to the positive direction of the selected array dimension (and equivalent to 'Full Endfire').

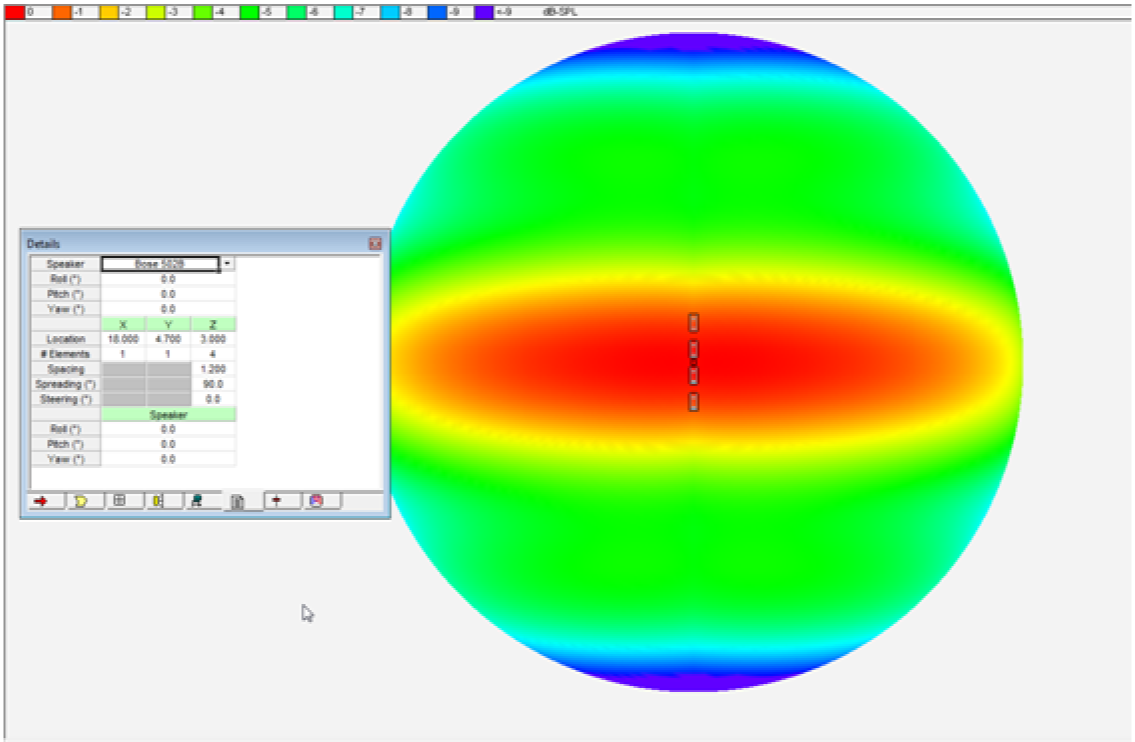


Endfire array example

In this example, the energy of a broadside array is now steered downward by 90 degrees to create an end-fire array.

Array Spreading

The concept of spreading may be used in conjunction with steering or by itself. Spreading the array’s energy effectively “softens” the edge of the array’s coverage pattern. Spreading applies a non-linearly increasing delay across the array with the 0 point being the center of the array, and the signal delay time increasing along the length of the array.

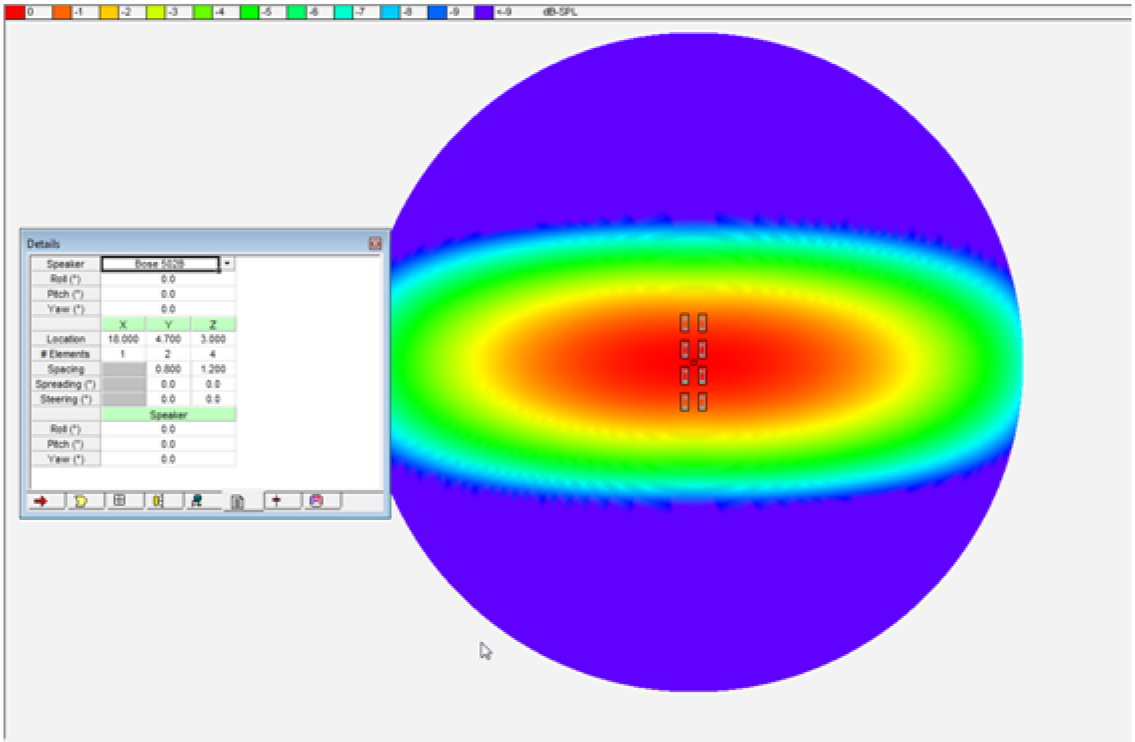


Array spreading example

In the example above 90 degrees of spreading has been applied to the array. Notice that the coverage is not as “sharp” in this application as compared to the standard broadside array.

Compound Arrays

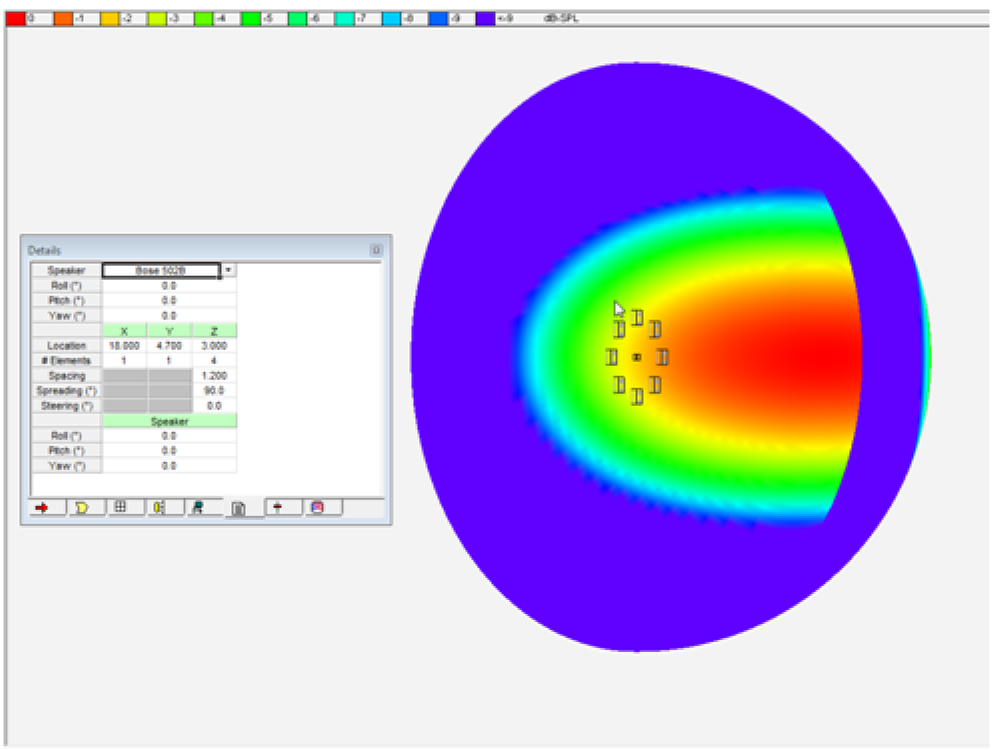
Compound arrays employ multiple rows and/or columns of loudspeakers. Compound arrays incorporate more complex spacing, but are capable of delivering a higher SPL at the listener. Compound arrays employ the same steering, spacing and spreading concepts as the basic endfire and broadside arrays, but applied to two (or three) dimensions. In compound arrays, steering and spreading may be independently adjusted for each of the dimensions of the array.



Compound array example

Ring Arrays

A ring array is a unique type of compound array which uses spacing, steering and spreading to focus the array's energy in a single location. Physically the array looks like an oval, or circle depending on the amount of vertical pattern control that is required.



Ring array example

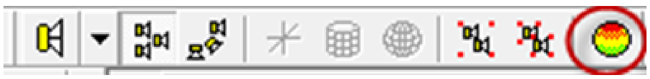
In the above example the ring array is steering the energy in the positive X direction while providing the desired vertical pattern control of a broadside array, and low frequency directivity of a compound array.

Note: The orientation of the individual array elements may be adjusted by editing the aiming angles in the 'Speaker' section of the properties of the array.

Viewing the Anechoic Array Performance

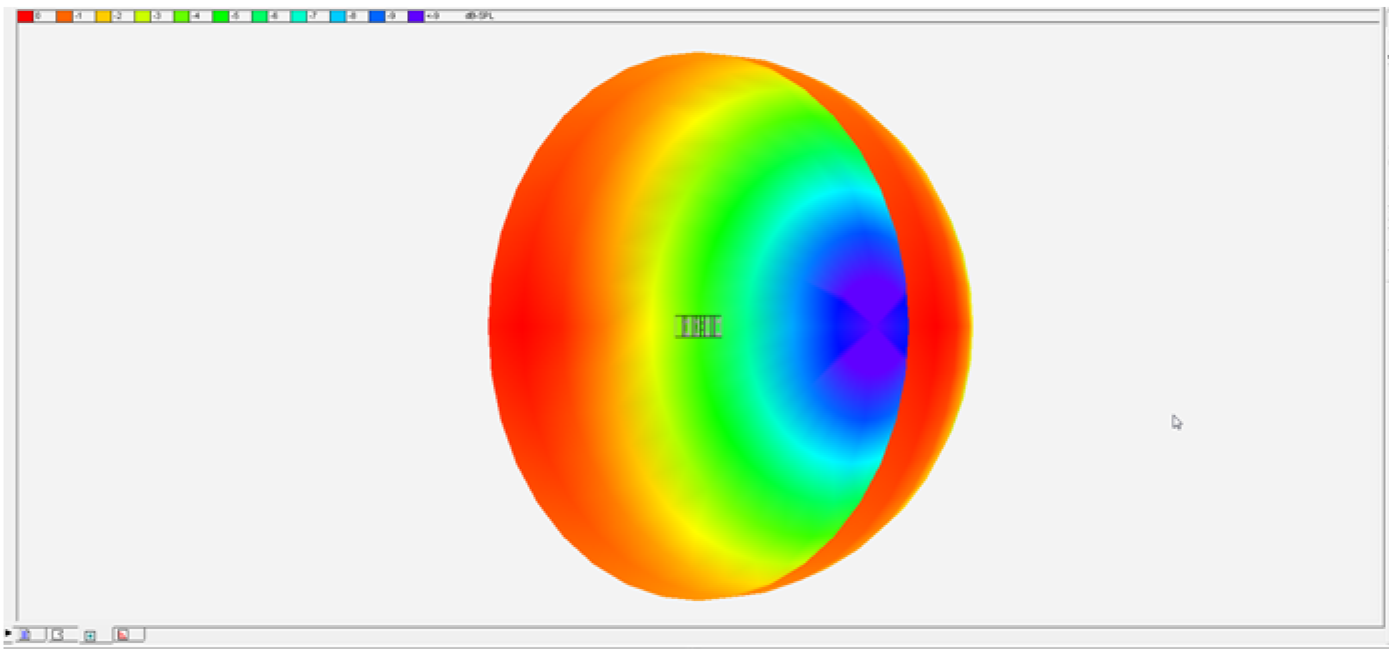
Once you have created an array, it is possible to view its performance independent of the room model, and simultaneously modify its properties to achieve the desired radiation pattern. The array's performance is viewed using the Map Cluster function within Modeler.

To view the array's performance, select the Map Cluster tool within the Cluster toolbar:



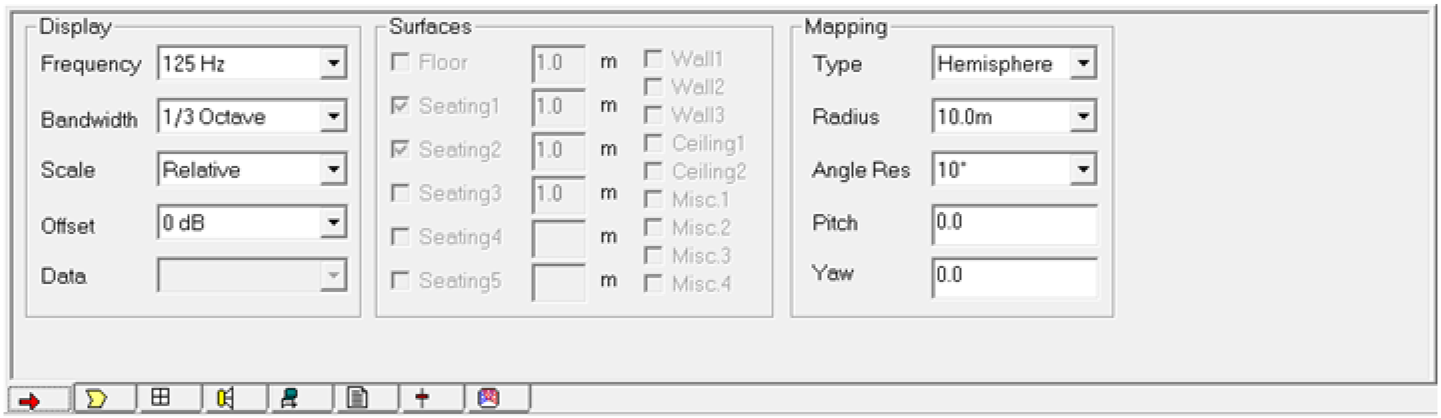
Selecting the Map Cluster tool

Once the map cluster is selected, the cluster's anechoic response is displayed upon a hemisphere:



Anechoic response example

The Simulation tab may be used to define how the coverage of the array is mapped:



Simulation tab - mapping array coverage

These additional mapping options are shown in the **Mapping** section of the Simulation Tab:

Type - Defines how to display the array performance; select from None, Hemisphere, Full sphere, or Plane.

Radius - Defines the radius of the sphere; select from 1 to 100 m.

Angle Res - The angular resolution of the display; select between 2°, 5°, 10° and 20°. A higher resolution results in longer computation times.

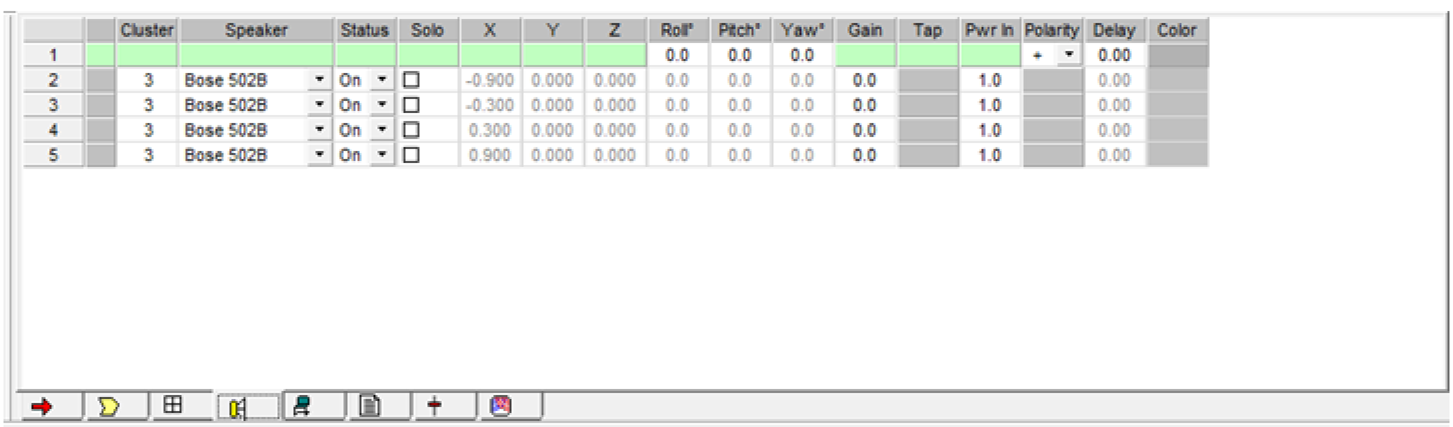
Pitch - Pitches the mapped surface.

Yaw - Yaws the mapped surface.

Editing Array Placement and Aiming

The aiming of loudspeakers within the room model may be modified using either the loudspeaker properties of the individual array, or the Loudspeaker tab.

Within the Loudspeaker tab, all of the aiming properties arrays are indicated using a green header line which includes properties that are common to the array, and the individual array elements underneath.



Loudspeaker tab - aiming properties of arrays indicated by green header

Note: Some of the array element properties are disabled within the loudspeaker tab. These properties can be edited only from within the Array Properties.

To view an array's properties, select the array within the room model, and then select the Properties Tab. From within the array properties you may modify the array's aiming, position within the model, number of elements and steering.

Viewing an array's properties

Unarray and Array Tools

In some situations it may be necessary to “break apart” an array into its component elements, or to create a new array consisting of all the devices within a loudspeaker cluster. To accomplish this, use the Array and Unarray tools found in the Clusters Toolbar.

Clusters toolbar - Array/Unarray tools

Unarray Tool

Using the Unarray tool will break the array into its component elements. Using this function will not change any performance predictions, but will affect your ability to easily modify the array’s configuration.

Once an array is un-arrayed, all array properties are lost. If the elements are re-arrayed, the following properties cannot be adjusted:

- Number of array elements
- Spacing of array elements.

Array Tool

The Array tool is used to combine a number of individual loudspeaker elements into a single group, or array. This function is useful when you wish to create a large cluster, and then aim the cluster as a single element within the room model. Once the items are arrayed they appear in the Loudspeaker Tab as an array.

Working With RoomMatch® Arrays

Within Modeler software the creation, editing and optimization of Bose RoomMatch® Arrays is greatly simplified when using the RoomMatch Array tools. Each RoomMatch array is treated as a single entity within the room model. RoomMatch properties define the type and quantity of modules and subwoofers that comprise the array.

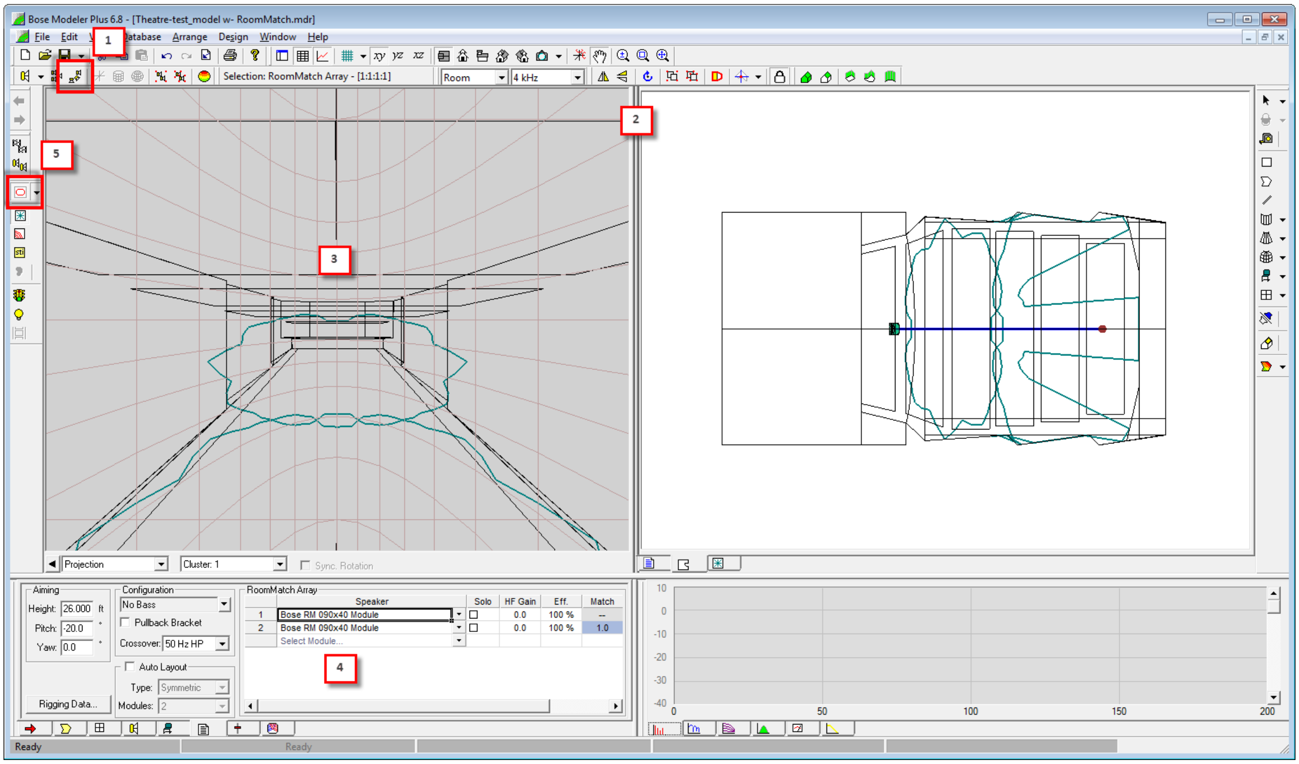
Arrays may be designed using the Auto Layout function, or manually by selecting individual module types. Metrics around the modules acoustic efficiency and the presence of audible seams is provided for both design methods. Once the design is complete a single page rigging data sheet can be generated which describes the necessary hardware and installation details to realize the array.

In this section we will review the steps necessary to create a RoomMatch array, and discuss the performance metrics used in the creation of the RoomMatch array.

RoomMatch Design Interface

To support the design of RoomMatch arrays, a specific design interface has been created within the Modeler software. The RoomMatch Design interface is automatically opened when a RoomMatch array is placed within the room model, and may be easily accessed whenever a RoomMatch array is selected.

The RoomMatch design interface is comprised of five components as shown below:



RoomMatch Design Interface

1 - Place RoomMatch Array Tool for placing a new RoomMatch array within the model.

2 - The Split View shows a Projection View from the array's perspective next to the model view. Both can be controlled and sized independently.

3 - The Projection View displays the interior wireframe of the room model to assist with aiming of the array.

4 - RoomMatch Array Properties control the type and configuration of the RoomMatch array.

5 - Isobar mapping displays the isobar contour of each module within the array.

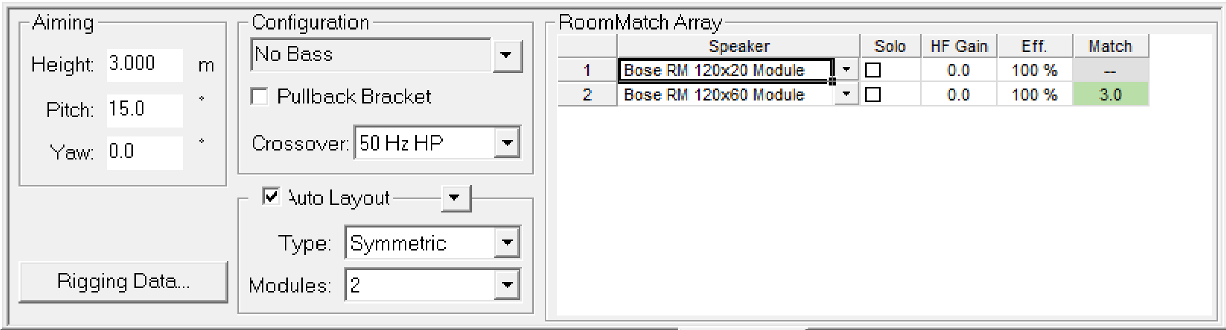
RoomMatch Array Properties

The RoomMatch Array properties provide immediate access to the type, configuration, and aiming of the RoomMatch Array.

From within the properties display it is possible to:

- Create a RoomMatch array using the manual or automated array layout tools
- Define the array crossover to operate as a full range array, or with subwoofers
- Define the aiming of the array within the room model
- Access a detailed rigging report which describes what is required to implement the RoomMatch array

The RoomMatch array properties are shown and described below:



RoomMatch Array properties display

Aiming describes the orientation of the array within the room model. All items in this section are dimensioned relative to the topmost full range module within the array. When subwoofers are added to the array, the height, pitch and yaw remain constant. Note that the subwoofers are added above the topmost module.

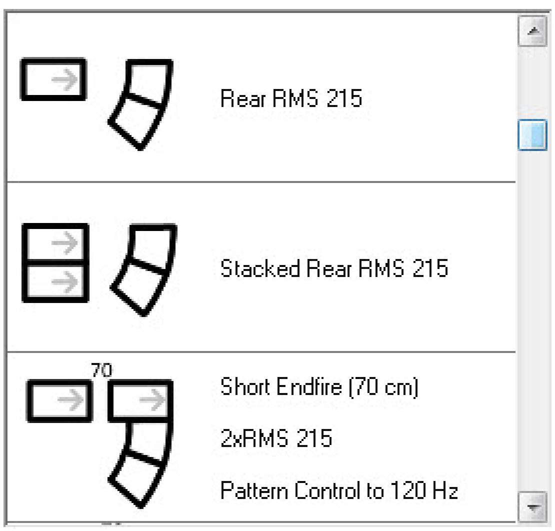
Height defines the overall pitch of the array oriented around the topmost module of the array.

Pitch defines the overall pitch of the array oriented around the topmost module of the array.

Yaw defines the yaw (left/right aiming) of the array.

Configuration defines the type of array being created within the RoomMatch array tool and includes the following options:

Configuration Selection defines the type of array that will be constructed. A total of 38 unique configurations are available. Each includes an iconographic depiction of the array, and a short text description of the configuration.



RoomMatch Array Configuration Selection

Array configurations are available in the following categories:

Standard Configurations employ full range RoomMatch modules, or RoomMatch modules integrated with RoomMatch subwoofers.

Endfire + Array Configurations integrate an endfire array of two or more RoomMatch RMS215 subwoofers.

Endfire Arrays do not include any RoomMatch full range modules, but only RoomMatch RMS215 subwoofers.

RMS215 Configurations allow for the creation of RMS215 subwoofer arrays.

RMS218 Configurations allow for the creation of RMS218 subwoofer arrays.

Available selections include arrays consisting of RoomMatch modules only, arrays with modules and integrated subwoofers, and flown subwoofer only configurations.

Pullback Bracket, when selected, will include a pullback bracket on the bottom module of the array. A pullback bracket is recommended for use when the desired array pitch cannot be achieved with the main grid frame mounting points.

Crossover defines the high pass crossover point of the array. Available selections are 50 and 80 Hz. Based on the array crossover point the corresponding subwoofer low pass crossover settings are applied.

Auto Layout contains the control necessary for generating a RoomMatch array solution based on user defined target coverage area.

Auto Layout Activation enables/disables the auto layout function.

Auto Layout Wing Menu displays the values which define the target coverage area. While the target coverage area can be directly defined within the Projection View, values can be edited here for fine tuning.

Type defines the type of modules to be used for the array – symmetric or asymmetric.

Modules defines the quantity of modules to be used in the array. Based on the target coverage area definition the auto layout function will determine the best module choices based on the number of modules selected.

RoomMatch Array includes the modules within the array, and provides the ability to modify the modules to create a new RoomMatch array manually.

Speaker identifies each RoomMatch module within the array. Each row in the table represents a module position within the array. An array may have up to eight devices, subwoofer or speaker. Use the drop down selection to choose the module type for that position in the array.

Solo activates the solo function for the selected module.

HF Gain allows adjustment of the high frequency gain for each module within the array. All modules default to 0 dB of gain adjustment, but can accommodate +18.8 / -50 dB of gain adjustment.

Eff. (Efficiency) displays the calculated module efficiency for each RoomMatch module in the array. Efficiency is a key metric for determining if modules can be split or combined. For example, two 20 degree vertical modules operating at 30% efficiency can be combined to a single 40 degree vertical module.

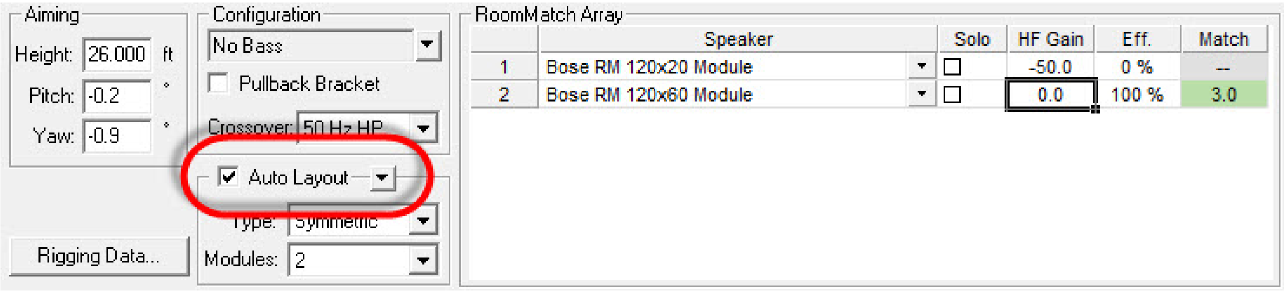
Match displays the quality of the match between two adjacent modules. Modules that are well matched will exhibit seamless vertical coverage. Modules that are not well matched will exhibit the presence of an audible seam between the two devices.

Rigging Data... displays the RoomMatch rigging data for the selected array.

Using the RoomMatch Array Auto Layout Function

The automated layout function for a RoomMatch array creates a Progressive Directivity Array based on the target coverage area and module quantity requirements.

Once a RoomMatch array has been placed within the room model, the Auto Layout function is enabled by selecting the Auto Layout checkbox within the RoomMatch array properties



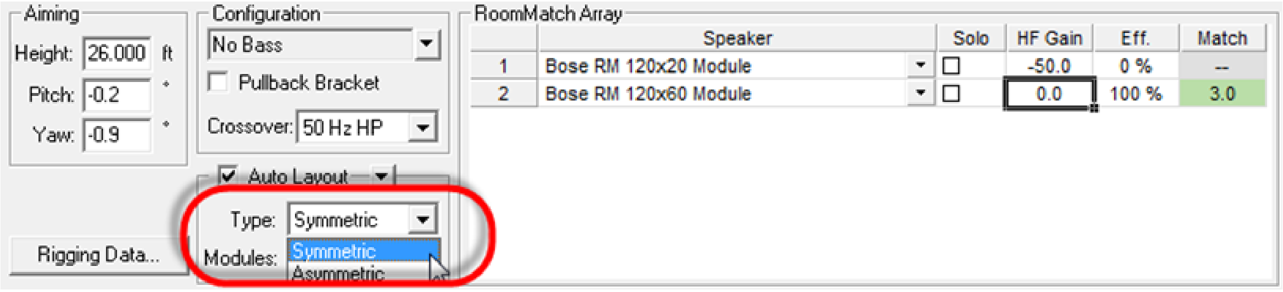
Once Auto Layout is enabled the following steps are recommended for creating a RoomMatch array:

1. Select the type of array you will create.
2. Define the target coverage area using auto array functions.
3. Evaluate the performance of different module quantities.
4. Adjust horizontal coverage of modules as needed.
5. Add bass reinforcement to the array.

Step 1: Select the Array Type

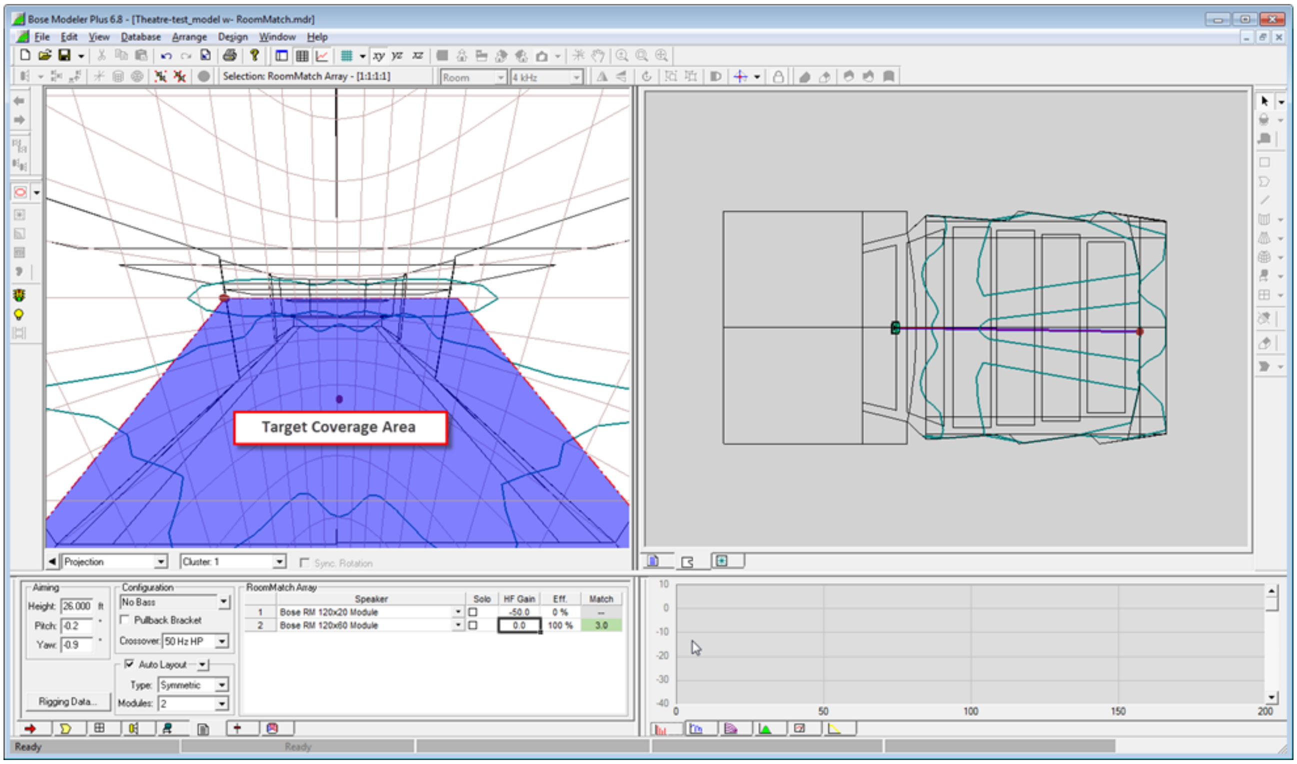
Auto Layout supports the design of arrays using Symmetric or Asymmetric modules. In most of the cases, your choice of array type determines the module type that will be used. In some cases, however, an asymmetric array will use a symmetric module when no asymmetric module is available to provide coverage to the target area.

The choice of array type is made using the Type drop down within the Auto Layout section.



Step 2: Define the Target Coverage Area

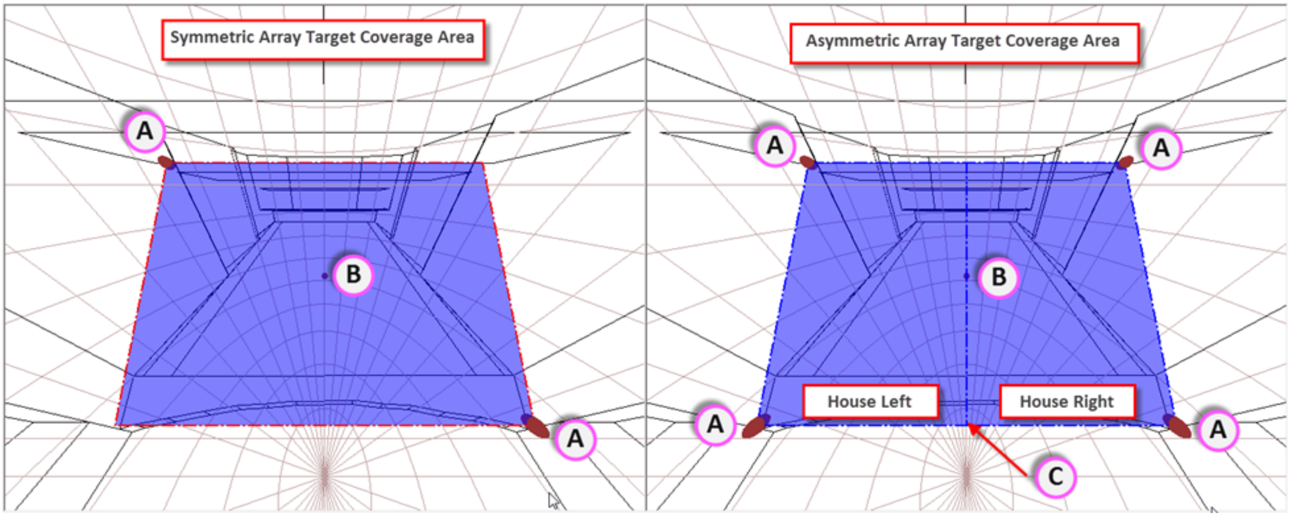
The target coverage area is only shown in the Projection View when the Auto Layout function is active as shown below:



Target Coverage Area

The target coverage area is used to define five key requirements for the creation of the RoomMatch array: Total Vertical Angle, Far Horizontal Angle, Near Horizontal Angle, Array Pitch, and Array Yaw. The auto layout uses this information, with the required module quantity to determine the set of modules that will comprise the RoomMatch array. Each of these items are adjustable from directly within the Projection View, or may be accessed within the Auto Layout Wing Menu.

The following diagram describes the controls for both array types within the Project View:



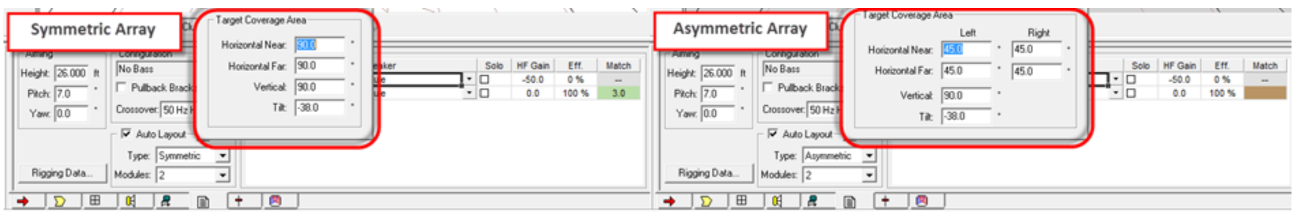
A – Adjust Horizontal/Vertical Coverage: Use the grab handles and move within the target coverage area to define the target coverage areas near and far horizontal coverage, and the total vertical coverage for the array.

Symmetric arrays provide two grab handles and the symmetric corner adjusts automatically, in asymmetric arrays you may adjust each corner of the target coverage area.

B – Cluster Hit Point: Adjust Pitch and Yaw by moving the cluster's hit point within the target coverage area.

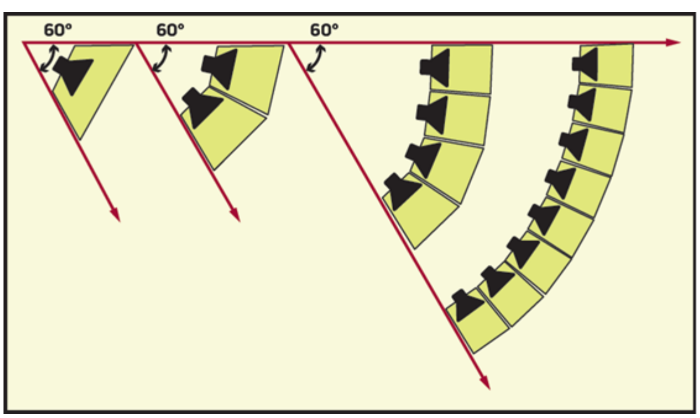
C – Indication of the mechanical center line of modules, asymmetric arrays only.

Fine control of each of these parameters is also available within the Wing Menu of the Auto Layout section of the RoomMatch properties window.

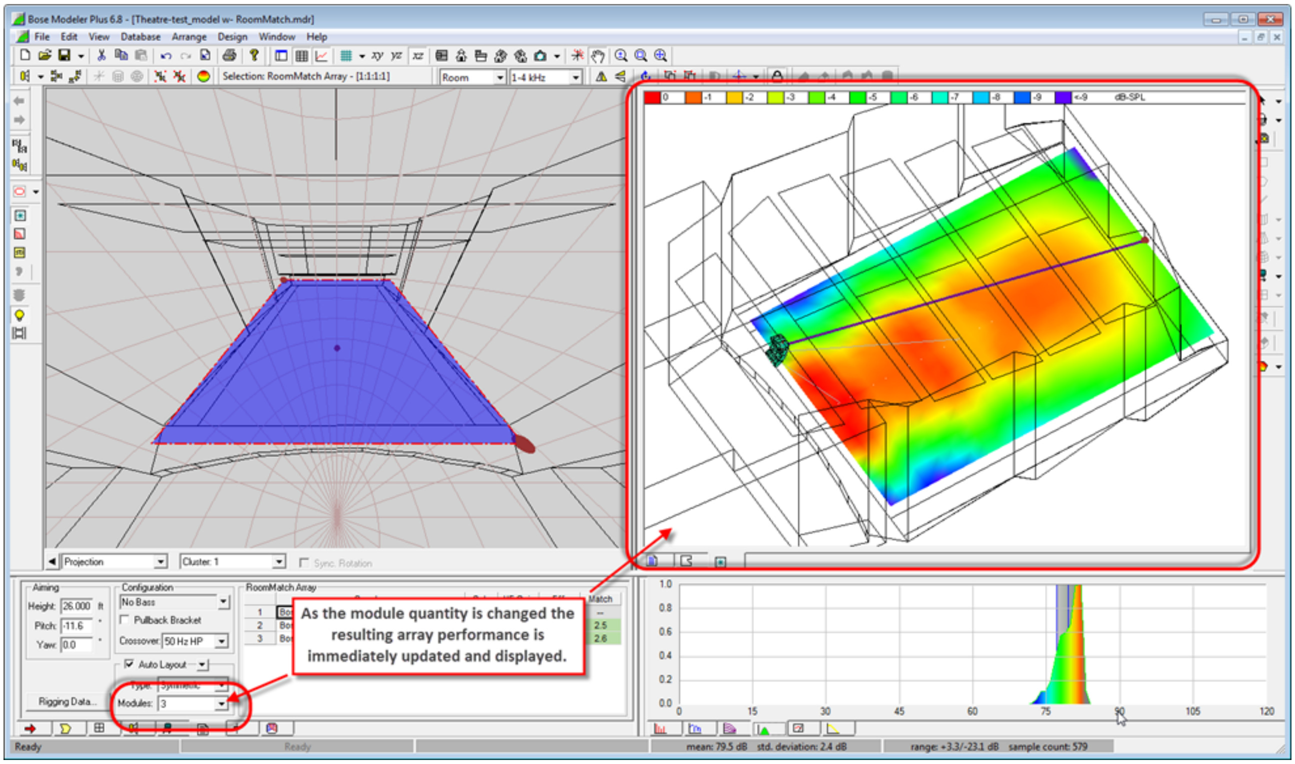


Step 3: Select Module Quantity

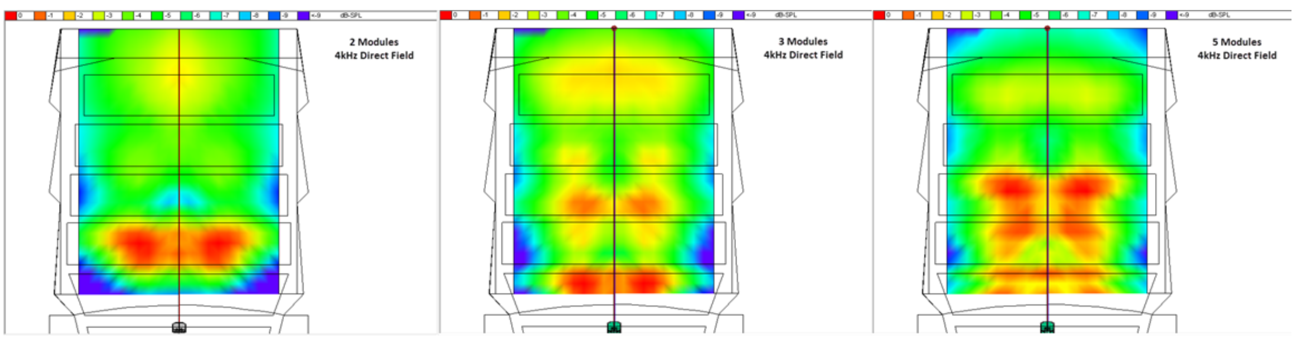
RoomMatch Array modules are designed such that it is possible to scale the performance of the array in three areas of performance: seamless coverage, SPL output, and vertical pattern control. These parameters are adjusted by 'splitting' or 'combining' modules for a given vertical angle. For example, to increase the SPL a single 40° module can be split into two 20° modules – this also results in increasing the length of the array, and its vertical pattern control in the lower frequencies. Likewise two modules can be combined to reduce the overall size and cost of the array, provided it still meets the SPL requirements for the project. The following image illustrates how it is possible to create four unique array configurations for a single vertical coverage angle:



All calculations within Modeler software are performed in real time allowing you to immediately evaluate the coverage for RoomMatch arrays of various sizes. The Auto Layout function will automatically generate an array based on the target coverage area and the selected number of vertical modules. When mapping is enabled the coverage for the array is immediately available for viewing within the room model.

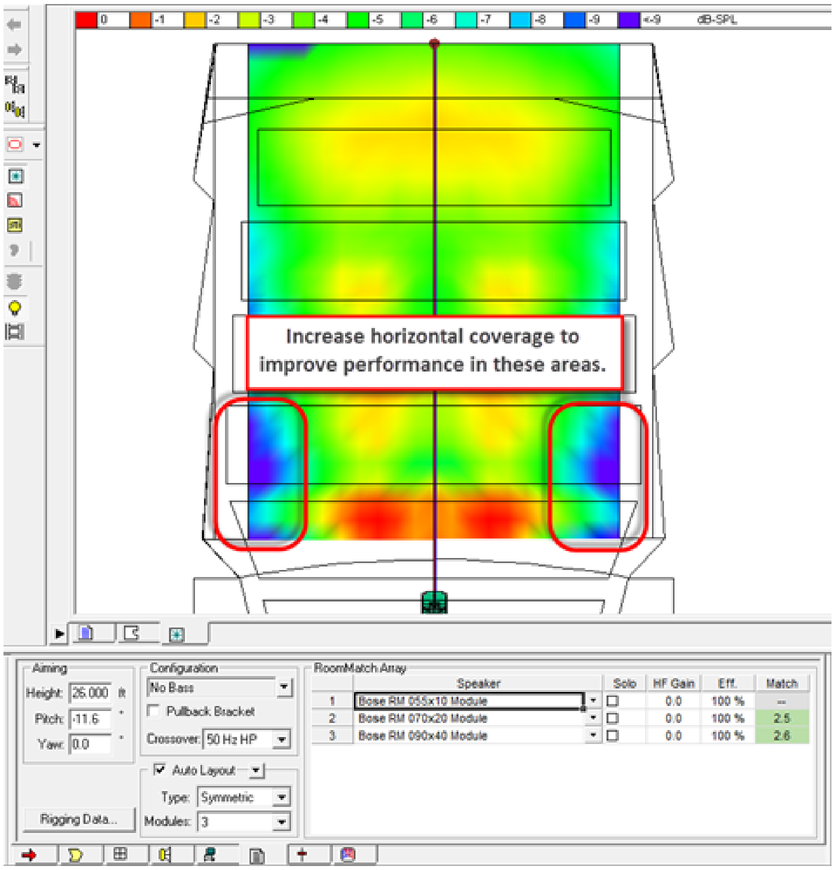


We recommend you evaluate several array configurations to determine the one which provides the best balance of the three array criteria for your project. The following illustration compares three arrays for a given vertical coverage angle. Each array provides the same coverage, but it can be seen that the seamless coverage improves as the array size increases, as does the overall SPL output.



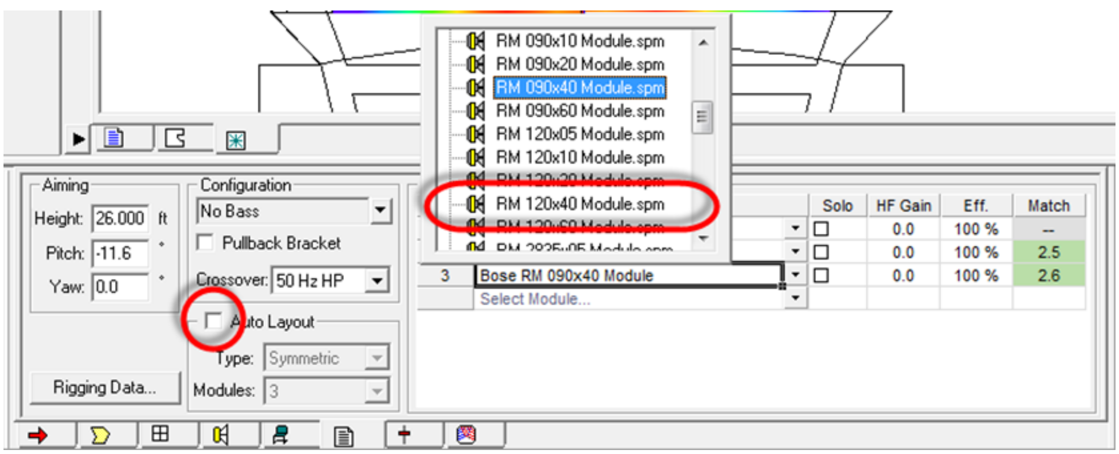
Step 4: Adjust Horizontal Coverage

The horizontal coverage of the array can be ‘fine-tuned’ within the RoomMatch Array section of the RoomMatch properties. In the following example the coverage for the near throw modules could be increased to better cover the far edges of the seating area.

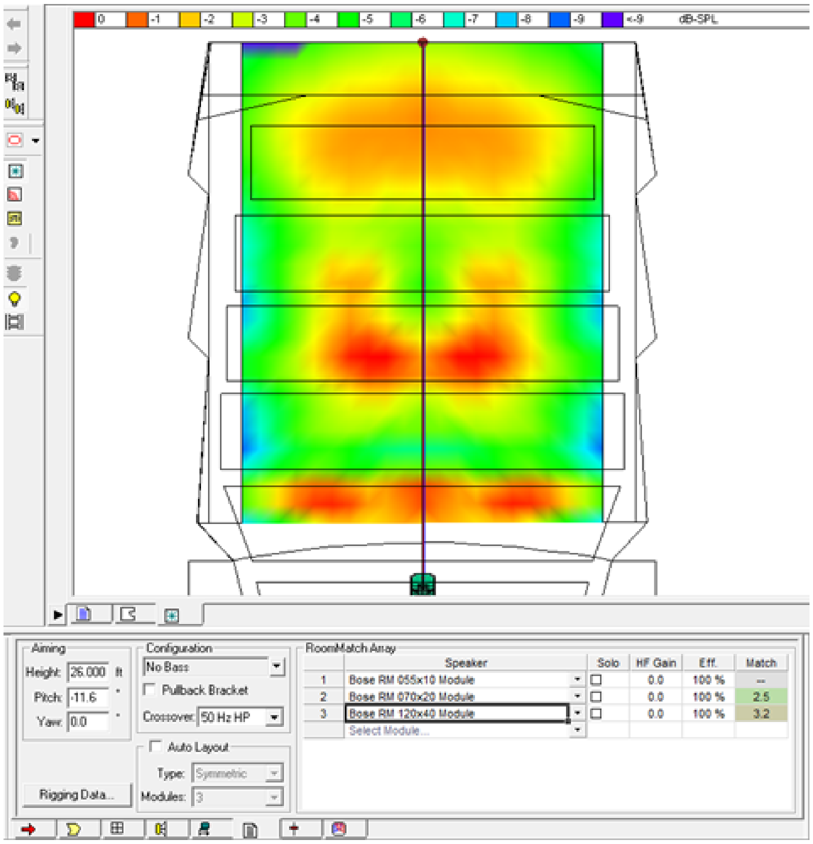


Improving the coverage in this situation can be as easy as selecting module of the same vertical angle with a wider horizontal angle. In this example a 90x40 (HxV) is proposed, but a 120x40 may perform slightly better.

To accomplish this first turn off the Auto Layout function and then select the new module from within the Speaker column in the RoomMatch Array section of the properties window as shown below:



Once the adjustment is made the resulting coverage pattern is displayed in the model view, and it can be evaluated.

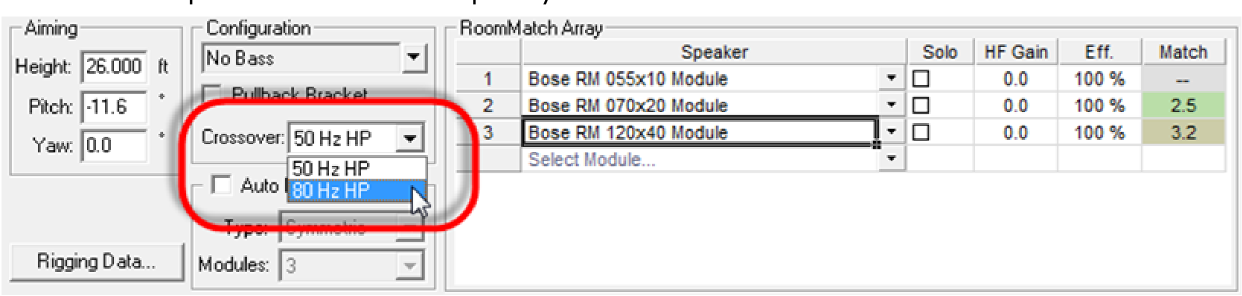


In this example the change to wider horizontal coverage pattern provided two benefits. First, the coverage has been extended to the edge of the seating area. Secondly, because a wider coverage angle is used the total acoustic energy for this module is distributed across a wider area resulting in an improved level balance for the entire array.

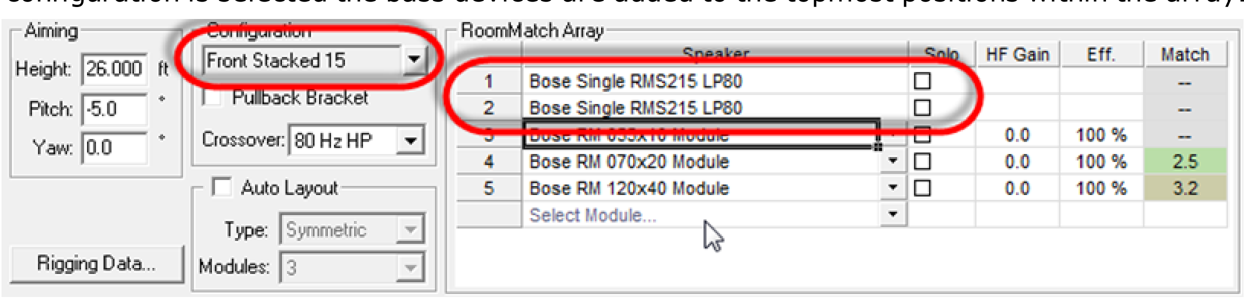
Step 5: Add Bass Reinforcement

A variety of low frequency options are available for use with RoomMatch arrays. In situations where the low frequency elements will be flown with the modules in a single array use the following steps:

1. Select the 50Hz high pass within the array configuration. This will adjust the crossover of the full range modules for operation with low frequency devices.



2. Select the desired bass configuration from within the array configuration selection tool. Once the new configuration is selected the bass devices are added to the topmost positions within the array.



It is important to note that when adding bass devices to an array the following rules are enforced:

- The maximum number of devices within an array is eight, which can be any combination of modules or bass loudspeakers.
- The Aiming of the array does not change as a result of adding bass devices.

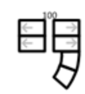
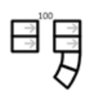
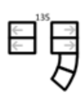
3. Verify that the bass devices are properly located within the room model. Since the array height is referenced to the top module, it is possible that the bass is placed outside of the room model when added – if the array was in close proximity to the ceiling.

RoomMatch Bass Array Configurations

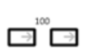
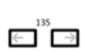
The RoomMatch product line supports a total of 8 unique bass array configurations that may be suspended as part of an array with RoomMatch modules, or in a stand-alone configuration. When one of these configurations is added to an array all of the necessary signal delay is automatically added to achieve the desired bass steering for the specific configuration.

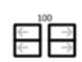
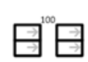
RoomMatch Endfire Bass + Array Configurations

Icon	Description	Configuration Details
	Short Endfire (70 cm) 2xRMS 215 Maximum of 7 Modules Pattern Control to 120 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.03 ms Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: Out
	Short Endfire (100 cm) 2xRMS 215 Maximum of 7 Modules Pattern Control to 100 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: In
	Deep Endfire (100 cm) 2xRMS 215 Maximum of 7 Modules Pattern Control to 85 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.91 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: Out
	Deep Endfire (135 cm) 2xRMS 215 Maximum of 7 Modules Pattern Control to 63 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 3.92 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: In

Icon	Description	Configuration Details
	Short Endfire (100 cm) 4xRMS 215 Maximum of 6 Modules Pattern Control to 100 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: Out
	Short Endfire (100 cm) 4xRMS 215 - No Array Maximum of 6 Modules Pattern Control to 100 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: In
	Deep Endfire (100 cm) 4xRMS 215 Maximum of 6 Modules Pattern Control to 85 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: Out
	Deep Endfire (135 cm) 4xRMS 215 Maximum of 6 Modules Pattern Control to 63 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 3.92 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: In

RoomMatch Endfire Bass Only Configurations

Icon	Description	Configuration Details
	Short Endfire (70 cm) 2xRMS 215 - No Array Pattern Control to 120 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.03 ms Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: Out
	Short Endfire (100 cm) 2xRMS 215 - No Array Pattern Control to 100 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: In
	Deep Endfire (100 cm) 2xRMS 215 - No Array Pattern Control to 85 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 2.91 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: Out
	Deep Endfire (135 cm) 2xRMS 215 - No Array Pattern Control to 63 Hz	Sub Qty: 2 Sub Type: RMS 215 Front Box Delay: 3.92 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: In

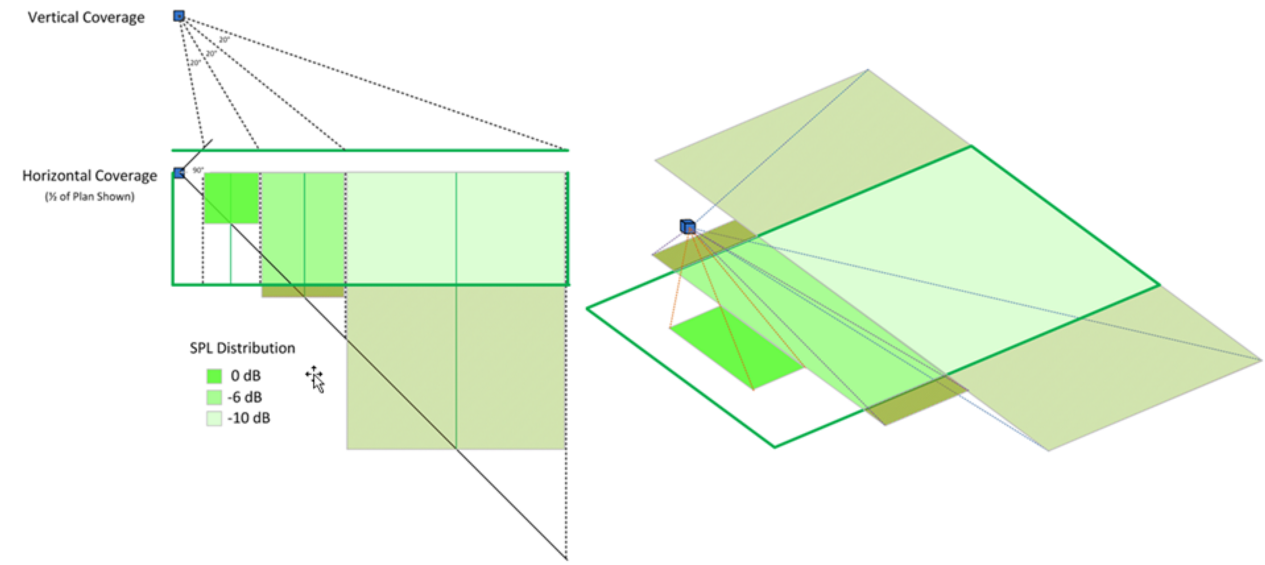
Icon	Description	Configuration Details
	Short Endfire (100 cm) 4xRMS 215 - No Array Pattern Control to 100 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: Out
	Short Endfire (100 cm) 4xRMS 215 - No Array Pattern Control to 100 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 Frame Type: large frame Ext. Bar Type: Short Ext. Bar Position: In
	Deep Endfire (100 cm) 4xRMS 215 - No Array Pattern Control to 85 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 2.91 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: Out
	Deep Endfire (135 cm) 4xRMS 215 - No Array Pattern Control to 63 Hz	Sub Qty: 4 Sub Type: RMS 215 Front Box Delay: 3.92 ms Frame Type: large frame Ext. Bar Type: Long Ext. Bar Position: In

RoomMatch Array Metrics

RoomMatch Array modules are designed such that it is possible to scale the performance of the array in three areas of performance: seamless coverage, SPL output, and vertical pattern control. These parameters are adjusted by 'splitting' or 'combining' modules for a given vertical angle. The decision to split or add modules is guided by two key metrics – Efficiency and the quality of Match between modules.

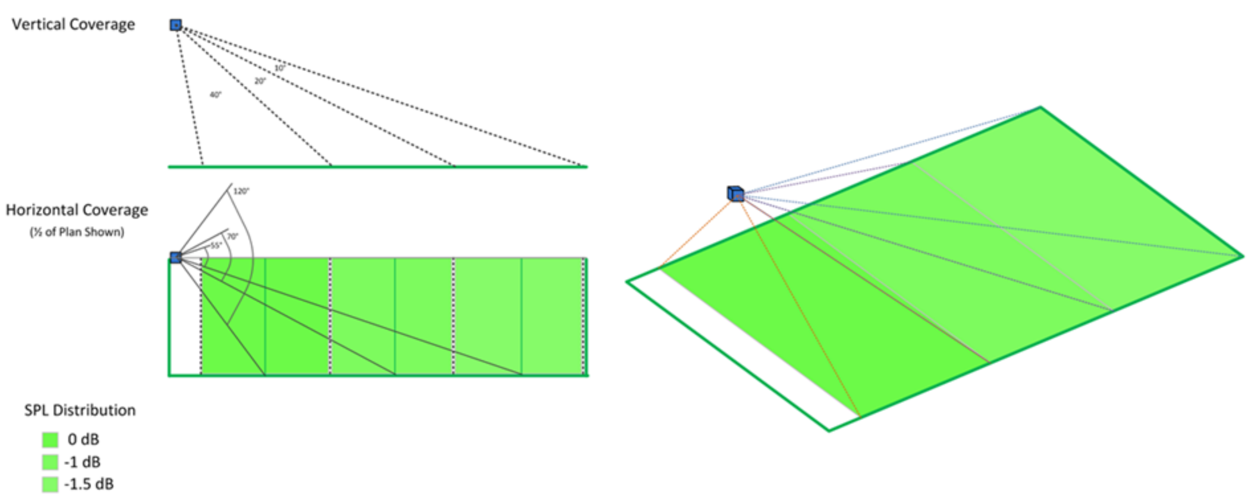
Efficiency

Ideally a RoomMatch array will have all modules operating at an equal gain level. Traditional line arrays use the same coverage pattern for all modules within the array. In this configuration the projection area of each module is different which results in varying SPL levels across the vertical axis of the array – as shown in the following illustration.



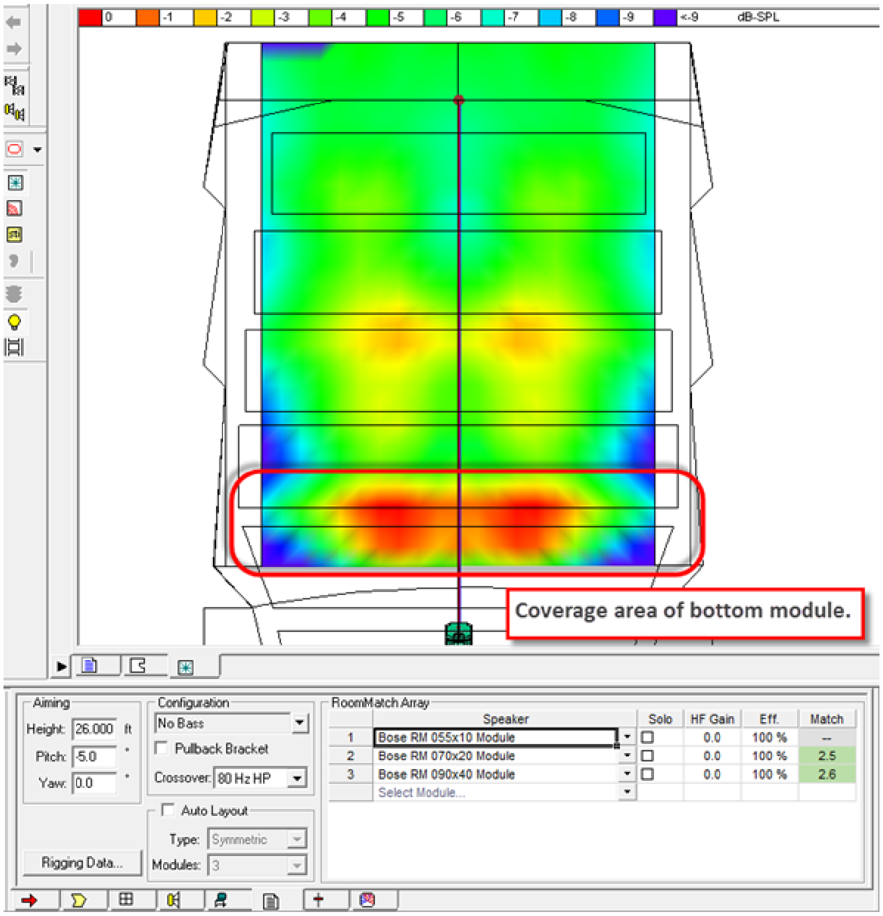
The solution to this problem is typically to reduce the drive level to modules across the length of the array to balance the SPL level at the audience area.

RoomMatch systems achieve a consistent SPL balance across the seating area by adjusting the directivity index of modules within the array – achieving the same effect, by adjusting the acoustic gain of the modules within the array. The result is that narrower, higher directivity index modules are used for the far throw, and wider, lower directivity index are used for the near throw. This results in a balanced SPL response, and keeps the coverage within the target coverage area – as illustrated below:

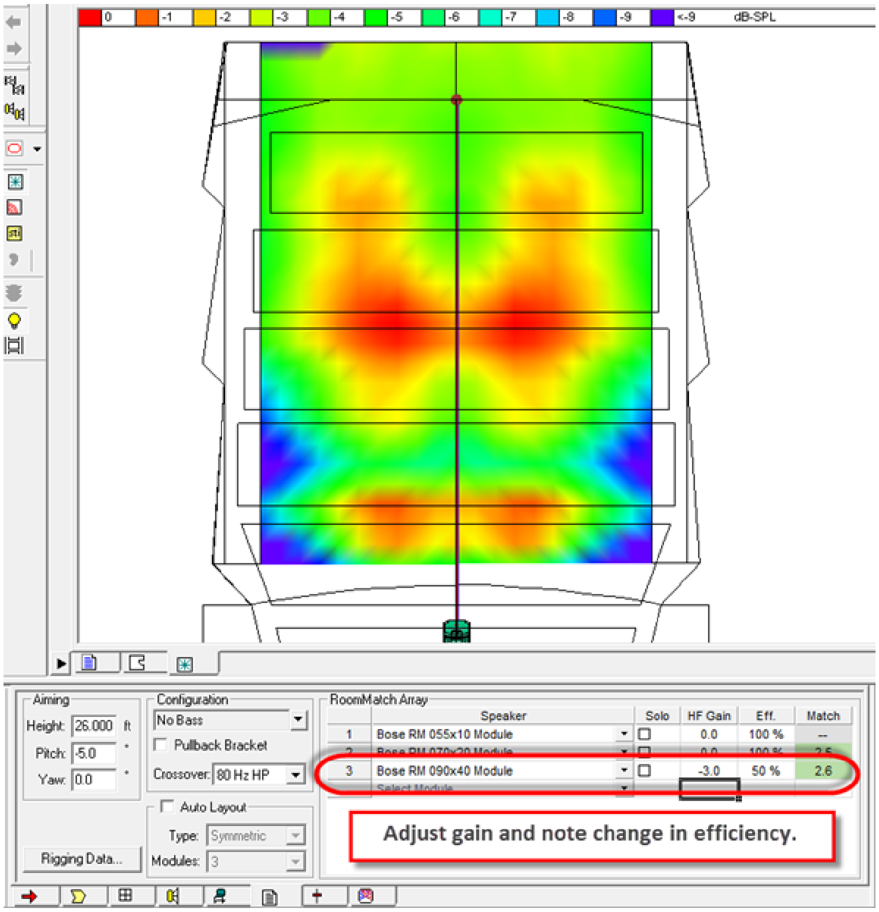


A properly designed RoomMatch array will have all modules operating at the same drive level, with little or no 'gain shading' applied. The Efficiency metric indicates how well a given module's acoustic output is being utilized – relative to other modules within the array. Ideally all modules within the array are operating at 100% efficiency. To achieve this, the efficiency metric can be used – in conjunction with module gain to develop an insight into when modules should be split or joined to achieve 100% efficiency.

In the following example the energy from the bottom module in the array is 3-6 dB more than in the coverage area of the upper two modules.

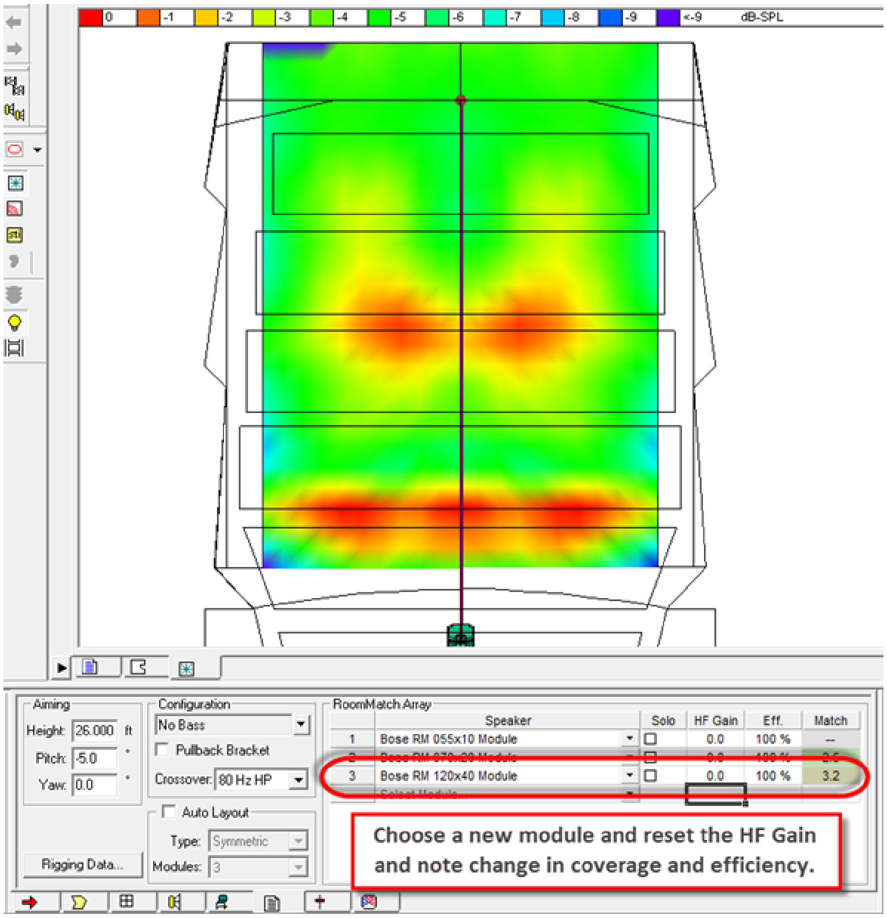


To balance the energy across the array you can reduce the gain of the bottom module by 3 dB, but note that the efficiency for this module is now at 50%. This provides a better level balance across the length of the array, but the Efficiency metric indicates that this particular module is only utilizing 50% of its capabilities.

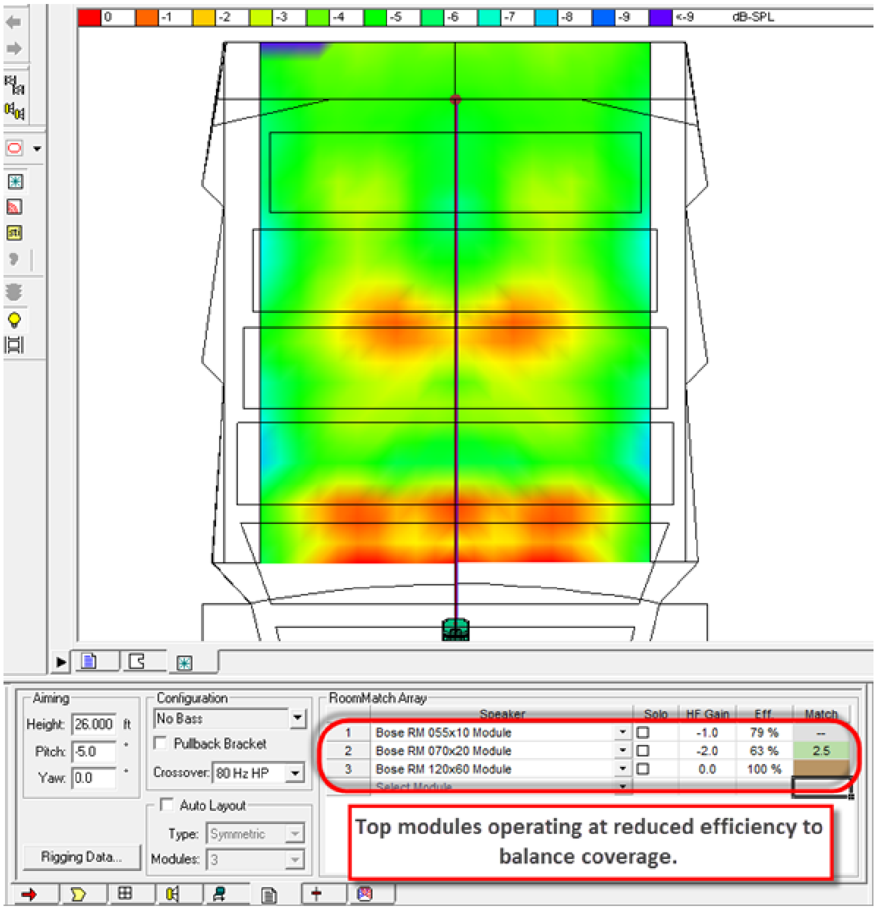


Efficiency is calculated by first calculating the efficiency of the individual module's high frequency devices, (Actual Power Applied/Power Handling), which is then displayed. In general when the module efficiency drops below 50% you should consider choosing a wider coverage angle.

In this example, changing to a module with wider horizontal coverage will not only improve the horizontal coverage of the array, but will also improve the overall array efficiency as all modules will be operating at 100% efficiency.



In some cases the opposite may occur, which can lead you to choose to split modules. In this example too wide of a module was chosen for the near coverage, which led to reducing the gain of the two topmost modules in an attempt to balance the level across the array.



In this situation you may choose to use a narrower module at the bottom of the array, or you may choose to split the wide module into two narrower modules with the equivalent vertical angle. In this example we have chosen to split the bottom 120x60 module into two modules, a 90x20 and 120x40 module for example as they achieve the same vertical angle, but will better balance the energy level across the array.

As you continue to work with the Efficiency metric you will develop an intuitive sense of when to split, join or replace modules within an array based on the overall balance of level within the coverage area.

To balance the energy across the array you can reduce the gain of the bottom module by 3 dB, but note that the efficiency for this module is now at 50%. This provides a better level balance across the length of the array, but the Efficiency metric indicates that this particular module is only utilizing 50% of its capabilities.

Module Match

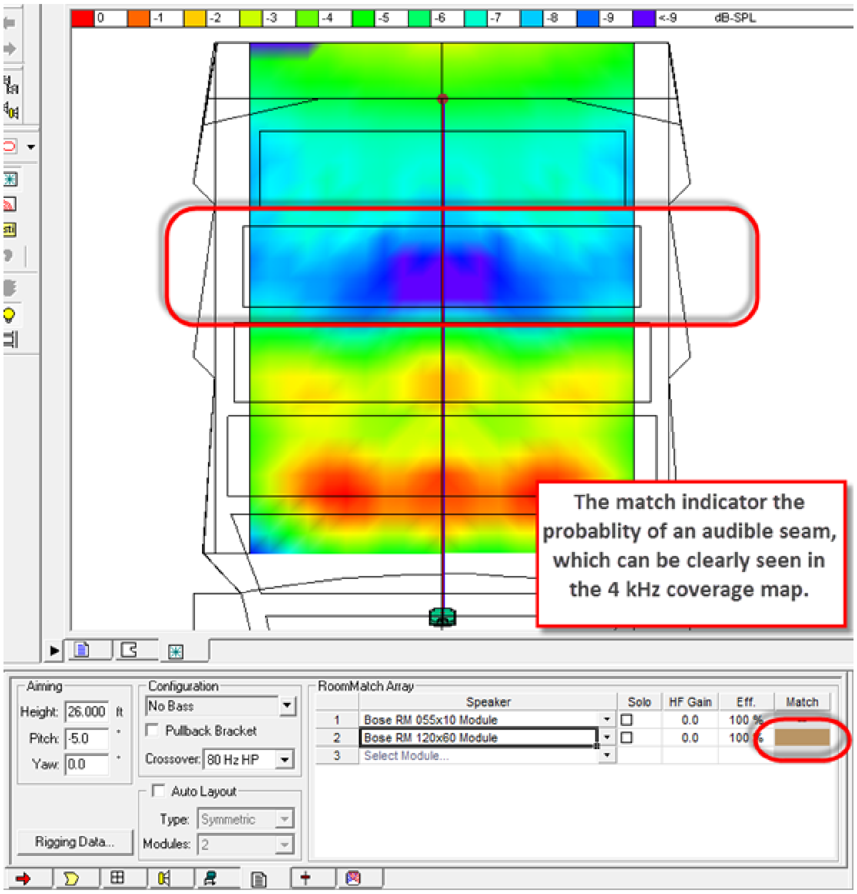
RoomMatch arrays are comprised of multiple modules with varying horizontal and vertical coverage patterns. While the Continuous-Arc Diffraction-Slot (CADS) manifold technology enables a seamless vertical coverage for most all applications, it is possible to create an array which will exhibit less than ideal performance in the vertical transition area between adjacent modules. The Module Match metric is intended to help prevent this situation, by providing feedback during the design process of when two adjacent modules may deliver less than ideal seam performance.

The Module match metric compares the projected solid angle of two adjacent modules. If the change in the projected solid angle is too great, there is a probability of an audible seam at the transition between the two modules. This is represented within the RoomMatch array properties using a color, and numeric value. The change between modules can be evaluated using the following scale:

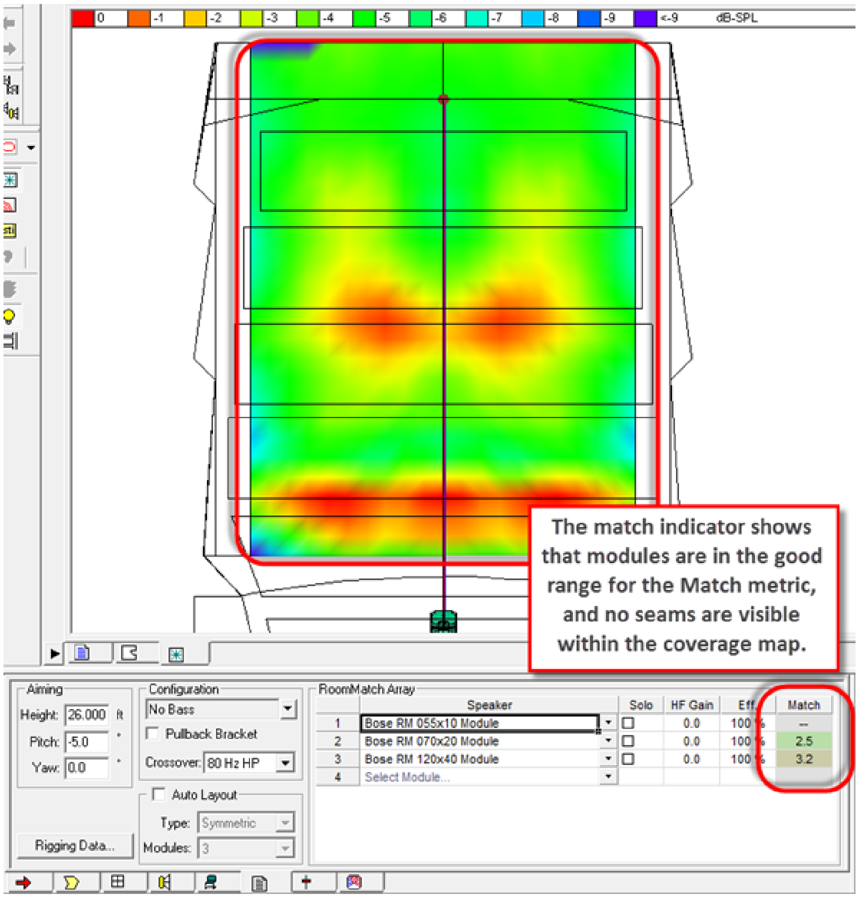
Match Score Scale

EXCLNT	VGOOD	GOOD	ACCPT	NR
≤ 1.5	≥ 1.6 ≤ 2.0	≥ 2.1 ≤ 3.0	≥ 3.1 ≤ 4.0	≥ 4.1

In the following example two modules are used to achieve the required 70 vertical coverage angle. However the Module Match metric indicates that it is a not recommended (NR) module pairing.



To address this situation it is recommended that the module with the poor match indication be split into two modules which will provide a much better seam performance in the module transition area of the array. In the following example the 120x60 module is replaced with a 70x20 and 120x40 modules.



The following table shows the Module Match metric for all possible symmetric module pairings.

RoomMatch Module Pairing for Optimal Seam Performance

H		55	55	55	55	55	70	70	70	70	70	90	90	90	90	90	120	120	120	120	120
	V	5	10	20	40	40	5	10	20	40	60	5	10	20	40	60	5	10	20	40	60
55	5	1.0	2.0	4.0			1.3	2.5				1.6	3.3				2.2				
55	10	2.0	1.0	2.0	4.0	4.0	1.6	1.3	2.5			1.2	1.6	3.3			1.1	2.2			
55	20	4.0	2.0	1.0	2.0	2.0	3.1	1.6	1.3	2.5	3.8	2.4	1.2	1.6	3.3		1.8	1.1	2.2		
55	40		4.0	2.0	1.0	1.0		3.1	1.6	1.3	1.9	4.9	2.4	1.2	1.6	2.5	3.7	1.8	1.1	2.2	3.3
55	60			3.0	1.5	1.5		4.7	2.4	1.2	1.3		3.7	1.8	1.1	1.6		2.8	1.4	1.5	2.2
70	5	1.3	1.6	3.1			1.0	2.0	4.0			1.3	2.6				1.7	3.4			
70	10	2.5	1.3	1.6	3.1	3.1	2.0	1.0	2.0	4.0		1.6	1.3	2.6			1.2	1.7	3.4		
70	20		2.5	1.3	1.6	1.6	4.0	2.0	1.0	2.0	3.0	3.1	1.6	1.3	2.6	3.9	2.3	1.2	1.7	3.4	
70	40			2.5	1.3	1.3		4.0	2.0	1.0	1.5		3.1	1.6	1.3	1.9	4.7	2.3	1.2	1.7	2.6
70	60			3.8	1.9	1.9			3.0	1.5	1.0		4.7	2.3	1.2	1.3		3.5	1.8	1.1	1.7
90	5	1.6	1.2	2.4			1.3	1.6	3.1			1.0	2.0	4.0			1.3	2.7			
90	10	3.3	1.6	1.2	2.4	2.4	2.6	1.3	1.6	3.1		2.0	1.0	2.0	4.0		1.5	1.3	2.7		
90	20		3.3	1.6	1.2	1.2		2.6	1.3	1.6	2.3	4.0	2.0	1.0	2.0	3.0	3.0	1.5	1.3	2.7	4.0
90	40			3.3	1.6	1.6			2.6	1.3	1.2		4.0	2.0	1.0	1.5		3.0	1.5	1.3	2.0
90	60			4.9	2.5	2.5			3.9	1.9	1.3			3.0	1.5	1.0		4.5	2.3	1.1	1.3
120	5	2.2	1.1	1.8	3.7	3.7	1.7	1.2	2.3			1.3	1.5	3.0			1.0	2.0	4.0		
120	10	4.4	2.2	1.1	1.8	1.8	3.4	1.7	1.2	2.3	3.5	2.7	1.3	1.5	3.0		2.0	1.0	2.0	4.0	
120	20		4.4	2.2	1.1	1.1		3.4	1.7	1.2	1.8		2.7	1.3	1.5	2.3	4.0	2.0	1.0	2.0	3.0
120	40			4.4	2.2	2.2			3.4	1.7	1.1			2.7	1.3	1.1		4.0	2.0	1.0	1.5
120	60				3.3	3.3				2.6	1.7			4.0	2.0	1.3			3.0	1.5	1.0

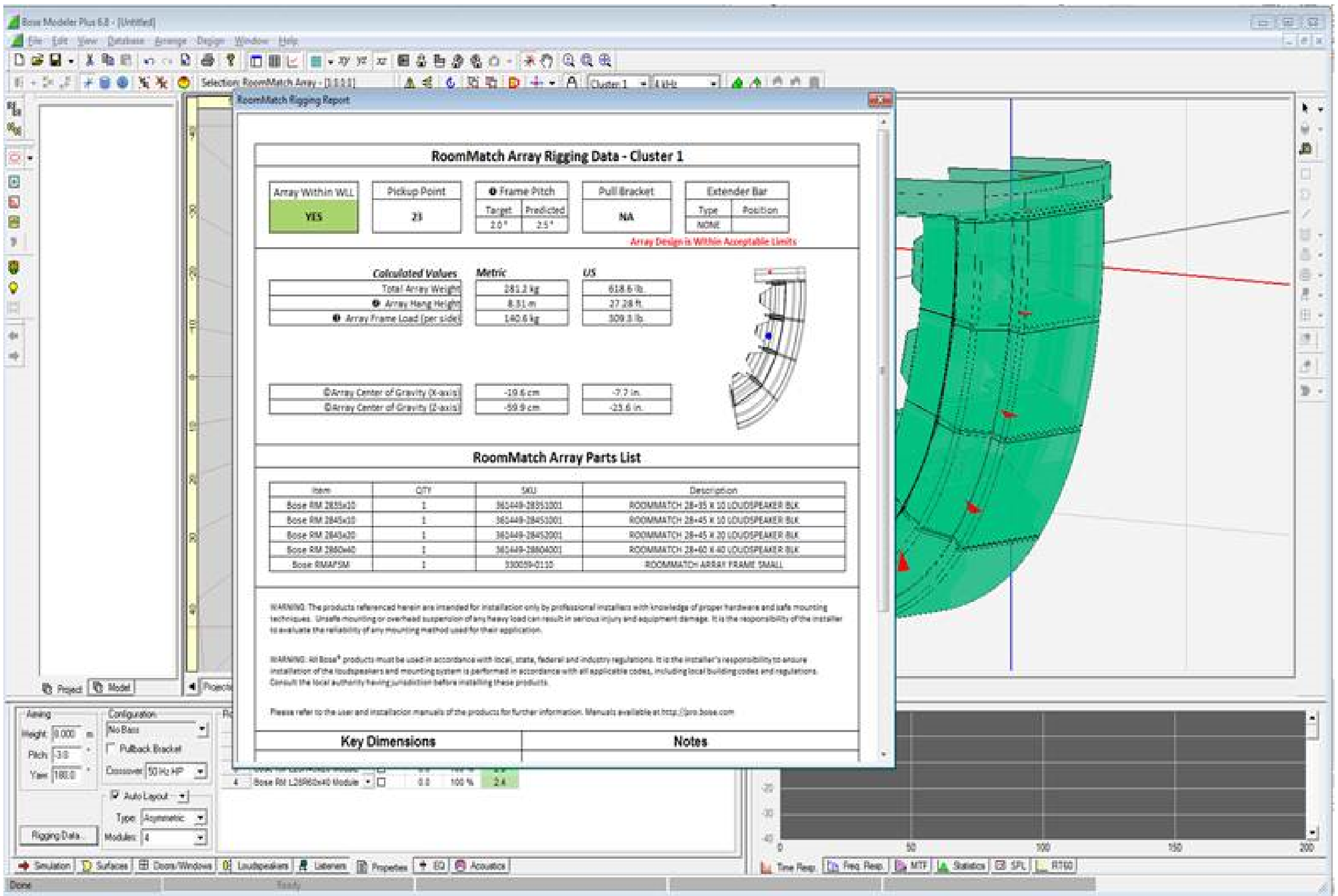
As you continue to work with the Module Match metric you will find that it is a very helpful guide in determining when it is necessary to ‘split’ a module into multiple vertical sections.

RoomMatch Rigging Data

Information related to the rigging of RoomMatch arrays is now calculated and displayed directly within the Modeler software interface. The information found in the original Excel based RoomMatch rigging calculator is provided, along with additional information specific to the type of RoomMatch array.

The RoomMatch rigging data is displayed on a cluster by cluster basis, and is accessed from within the RoomMatch array properties.

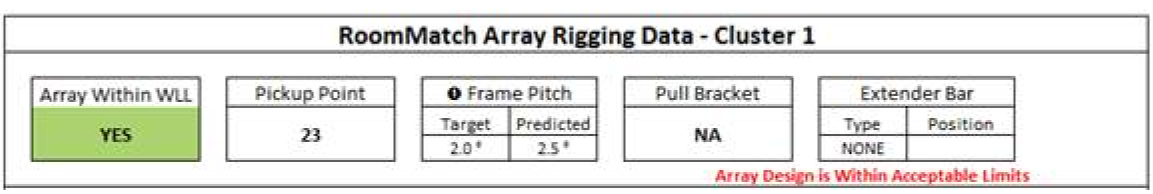
Click **Rigging Data...** within the RoomMatch Array Properties to view detailed rigging information:



Rigging Data Window

The calculated values information displayed within the RoomMatch Rigging Data is based upon configuration of the RoomMatch array, and whether a pull bracket has been included in the design.

Rigging Report - Summary Data



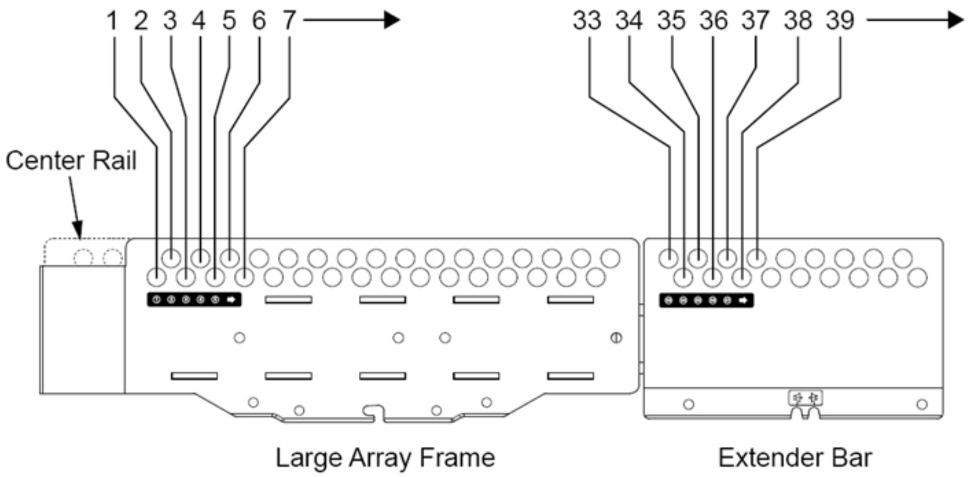
Array Within WLL displays either YES or NO based on calculated values. All calculations are based on a 10:1 Safety Factor (design factor) and cannot be changed by the user.

Pickup Point displays the estimated pickup position using the array frame numbering system for the Left and Right array frame rails. The pickup point for array frames is always referenced to the shackle holes for the left and right rails. The center rail of the array frames is intended only for temporary attachment and has a different hole pattern as compared to the left and right rails.

Shackle holes on each rail have a top and bottom position. However, the pickup point positions are numbered sequentially from 1 to 32 for the Large Frame and 1 to 33 for the Small Frame, without reference to the top or bottom positions. Both left and right rails have a label that identifies the starting point of the pickup position numbering and direction of increment. The label does not contain numbering for every single position.

Note: Do not use pickup point reference numbering for center rail!

The pickup point reference for the Extender Bars starts with 1 number greater than the last number of the Large Array Frame. Thus, the first pickup point reference number for the Extender Bars is 33.



Frame Pitch displays the calculated array frame pitch, as referenced from the top of the array frame relative to the horizon. Downward pitch is indicated by negative numbers while upward pitch is indicated by positive numbers. This section contains two values – Target and Predicted.

Target Pitch displays the desired array pitch angle based on the aiming of the RoomMatch array within the RoomMatch properties. The target pitch is the difference between the Pitch item and ½ the vertical angle of the topmost module in the array.

Predicted Pitch displays the predicted array pitch angle based on the proposed pickup point. When the difference between the target and predicted frame pitch exceeds (xxx) a message is displayed recommending the use of a pullback bracket.

It is recommended that you always compare the predicted frame pitch value to that of the target frame pitch value, to confirm you have not exceeded the pitch angle possible using the available pickup points of the array frame.

Note on Prediction Accuracy: To confirm the accuracy of the predicted pitch angles, both the Small Array Frame and Large Array Frame were tested to compare actual constructed array pitch angles versus the predicted values. The testing revealed an accuracy of 96% using a tolerance of 2.0 degrees from predicted value. Many factors contribute to the variation including manufacturing tolerance Therefore, we always recommend confirming the array pitch during installation with an inclinometer, and making adjustments in the predicted pickup point as required

Pull Bracket displays YES when pull bracket is incorporated into the array configuration and NA when a pull bracket is not used.

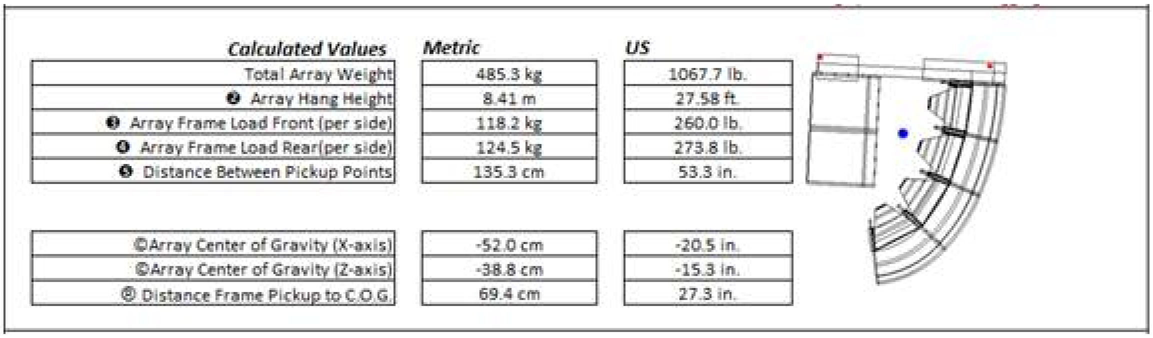
Extender Bar Is comprised of two sections – Type and Position.

Extension Bar Type displays the type – SHORT or LONG – of extender bar used to achieve the desired array configuration. Extension bars are used for specific subwoofer/array configurations, and in cases if steeply pitched arrays which require a multi-point dead or gravity hang.

Extension Bar Position displays the position – IN or OUT – of the extension bars. The position of the extension bars allows for the creation of different end-fire bass array configurations, and accommodated the mounting of RMS 215 subwoofers directly behind the RoomMatch array.

For information regarding the advantages for each of these options, please refer to the detailed instructions contained in the document "RoomMatch Array Rigging Frames and Accessories Installation and Safety Guidelines," which is available for download at pro.Bose.com.

Rigging Report - Calculated Values



Calculated Values	Metric	US
Total Array Weight	485.3 kg	1067.7 lb.
❷ Array Hang Height	8.41 m	27.58 ft.
❸ Array Frame Load Front (per side)	118.2 kg	260.0 lb.
❹ Array Frame Load Rear(per side)	124.5 kg	273.8 lb.
❺ Distance Between Pickup Points	135.3 cm	53.3 in.
⑥Array Center of Gravity (X-axis)	-52.0 cm	-20.5 in.
⑦Array Center of Gravity (Z-axis)	-38.8 cm	-15.3 in.
⑧ Distance Frame Pickup to C.O.G.	69.4 cm	27.3 in.

Calculated Values are displayed in both kilograms (Metric) and pounds (US) and include the total weight of all modules and frame accessories as specified in the Array Parts List. The information displayed here is specific to the selected RoomMatch array and its suspension method.

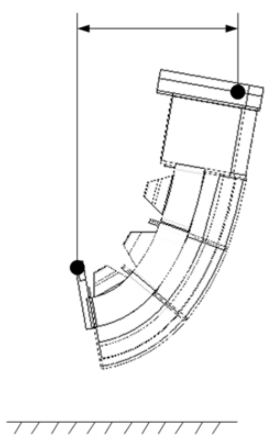
Total Array Weight is the total weight of all modules and frame accessories as specified in the Array Parts List.

Array Hang Height is the height of the array at the indicated pickup point on the array frame. This hanging height is relative to the z=0 elevation within the room model.

Array Frame Load (per side) is the total loaded weight of each pickup point for a 2 point suspension.

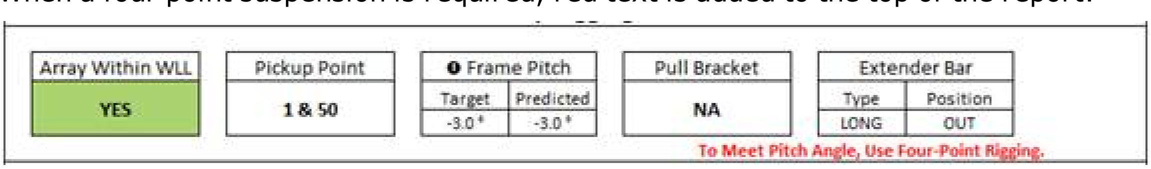
RMPULL Load (per side) is the total loaded weight of each pickup point for the Pull Bracket. This is only displayed when a pull bracket is included in the configuration.

Distance from Frame Pickup to RMPULL Load is the distance from the pickup point on the array frame to the Pull Bracket as shown in the illustration below. This is only displayed when a pull bracket is included in the configuration.



Four Point Load (per side) is the total loaded weight of each pickup point for a 4 point suspension. This is only shown when a four point suspension is required.

When a four point suspension is required, red text is added to the top of the report:

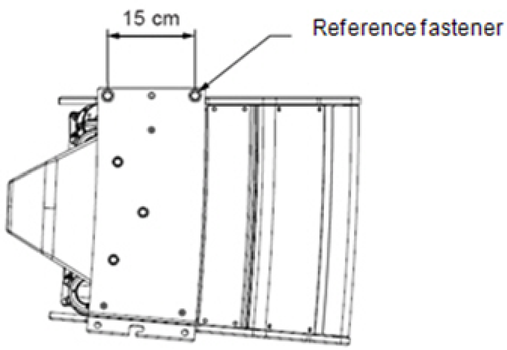


Array Within WLL	Pickup Point	❶ Frame Pitch		Pull Bracket	Extender Bar	
		Target	Predicted		Type	Position
YES	1 & 50	-3.0°	-3.0°	NA	LONG	OUT

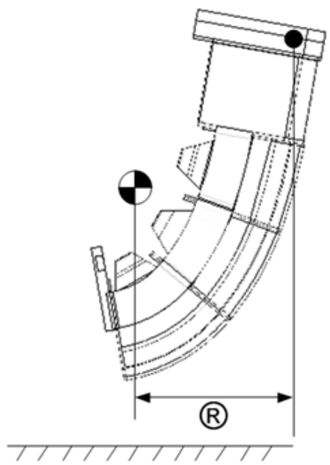
To Meet Pitch Angle, Use Four-Point Rigging.

Array Center of Gravity (X/Z-axis) is the distance from the forward most connection point to the array frame of the top module to the Array’s center of gravity.

The Center of Gravity dimensions are referenced to the side-plate forward-most fastener position of the topmost module of the array as shown below:



Distance Frame Pickup to C.O.G. is the distance from the pickup point on the array frame to the array's center of gravity as shown in the illustration below:



Rigging Report – Array Parts List

The array parts list includes all of the RoomMatch components – modules, subwoofers and rigging hardware necessary to realize the array as it is designed.

RoomMatch Array Parts List

Item	QTY	SKU	Description
Bose RMS215	2	330034-0110	ROOMMATCH DUAL-15 SUBWOOFER LDSPKR BLK
Bose RMSFLY	2	343856-0120	ROOMMATCH RMS215 FLY KIT BLK
Bose RM 2835x10	1	361449-28351001	ROOMMATCH 28+35 X 10 LOUDSPEAKER BLK
Bose RM 2845x10	1	361449-28451001	ROOMMATCH 28+45 X 10 LOUDSPEAKER BLK
Bose RM 2845x20	1	361449-28452001	ROOMMATCH 28+45 X 20 LOUDSPEAKER BLK
Bose RM 2860x40	1	361449-28604001	ROOMMATCH 28+60 X 40 LOUDSPEAKER BLK
Bose RMAFLG	1	330038-0110	ROOMMATCH ARRAY FRAME LARGE
Bose RMXLNG	1	344056-0110	ROOMMATCH ARRAY FRAME EXTENDER LONG

Rigging Report – Warnings

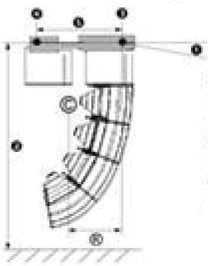
Legal disclaimer for rigging data:

WARNING: The products referenced herein are intended for installation only by professional installers with knowledge of proper hardware and safe mounting techniques. Unsafe mounting or overhead suspension of any heavy load can result in serious injury and equipment damage. It is the responsibility of the installer to evaluate the reliability of any mounting method used for their application.

WARNING: All Bose® products must be used in accordance with local, state, federal and industry regulations. It is the installer's responsibility to ensure installation of the loudspeakers and mounting system is performed in accordance with all applicable codes, including local building codes and regulations. Consult the local authority having jurisdiction before installing these products.

Please refer to the user manuals of the products for further information. Manuals available at http://pro.bose.com

Rigging Report – Key Dimensions & Notes



Key Dimensions	Notes
❶ Frame Pitch ❷ Array Hang Height* ❸ Array Frame Load Front (per side) ❹ Array Frame Load Rear (per side) ❺ Distance Between Pickup Points © Center of Gravity ® Distance from Frame Pickup to C.O.G. * relative to z=0 in room model	1) Allowed pitch is +30° to -45°; depending upon configuration these limits may be reduced 2) The design safety factor for all RoomMatch array rigging hardware is 10:1 3) The Center of Gravity dimensions are referenced to the side-plate forward-most fastener position of the first (top) module of the array.

Key Dimensions displays a reference diagram showing key dimensions for the array configuration. Each item is indicated using a letter or number which corresponds to items within the Calculated Values section.

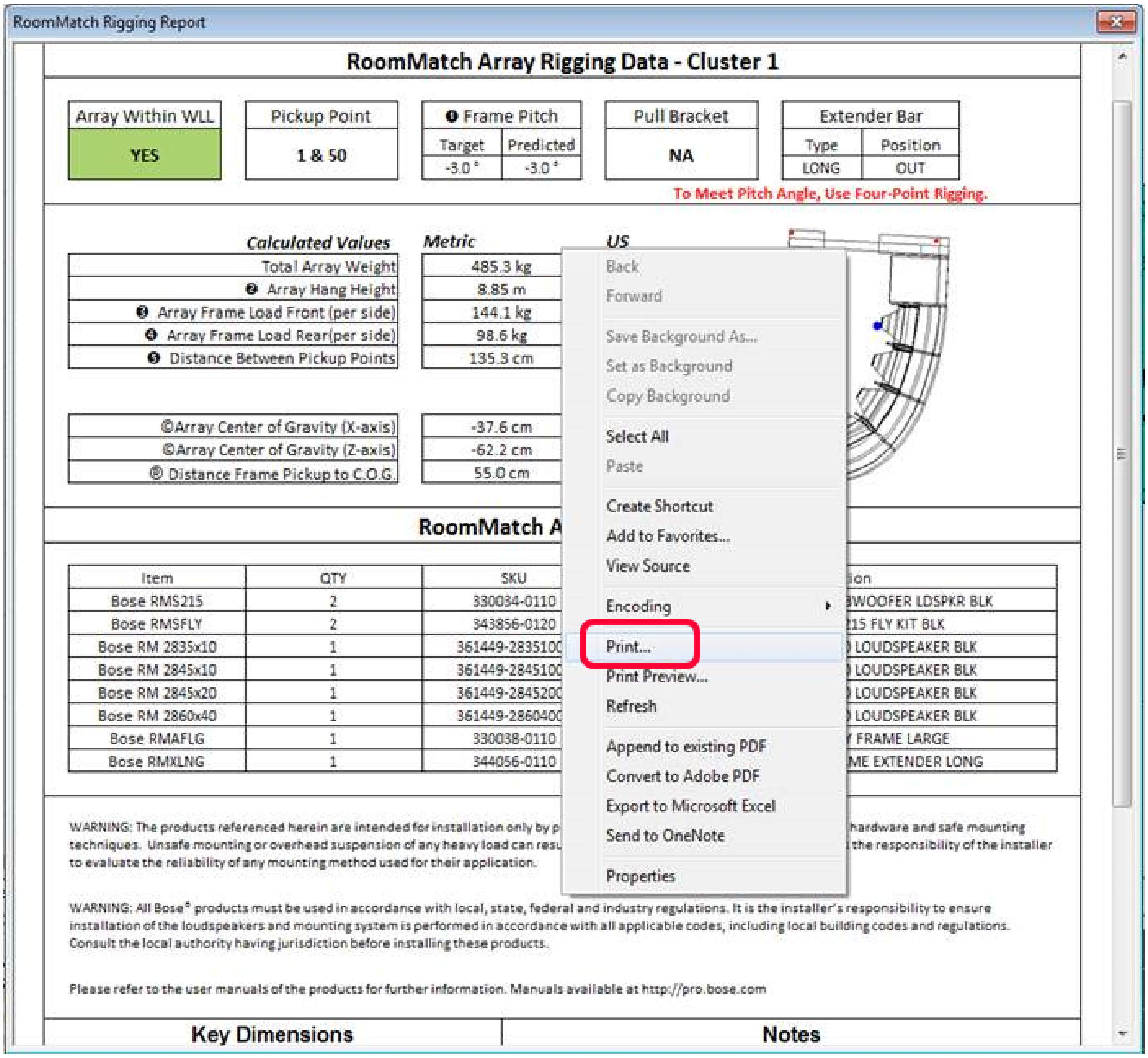
Notes displays additional notes related to the information contained within the rigging data report.

Printing the Rigging Report

The RoomMatch array rigging report may be printed using the right-click menu function.

To include all colors in the printed Rigging Data Report, take the following steps:

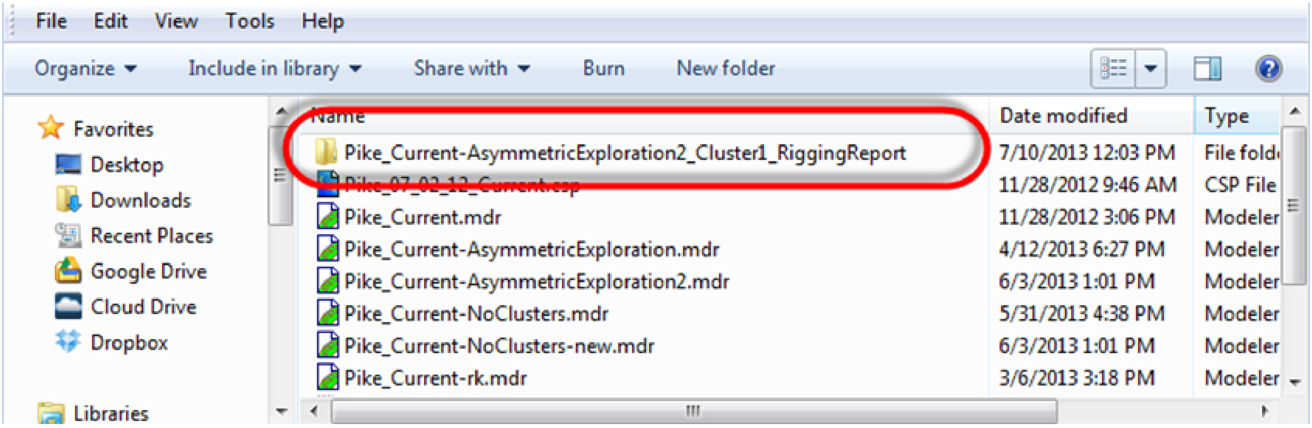
1. Right mouse-click on the report.
2. Select Print Preview.
3. Select Page Setup, Enable the "Print Background and Images" check box.
4. Select OK.
5. Proceed to Print the report.



Opening the Rigging Report in a Web Browser

Once a RoomMatch rigging report is created the original files are stored within a single directory, in the same directory as the room model file. The Rigging Report will only open correctly in Internet Explorer. Mozilla Firefox, Google Chrome, Apple Safari, and Opera are unable to display the enhanced Windows metafile (.emf) that is generated by Modeler.

To open the rigging report, locate the room model directory. Within the room model directory you will see a folder named for the room model, cluster name, and rigging report as shown below:



Within the rigging report folder you will find the original HTML file, and image elements.

Predicting System Performance

Introduction

Once the room model is created and a system design is implemented its performance in the room may be evaluated.

See the following topics:

- Coverage Maps
- Defining A Custom Mapping Area
- Time Response
- Frequency Response
- System SPL
- Working With Listeners
  - Listener Locations
  - Adding Listeners
  - Setting Listener Preferences
  - Listener Properties
  - Using Listeners and the Sample Tool
  - Using Listeners to Reduce Calculation Time
- Including the Absorption of an Audience
- Including Background Noise

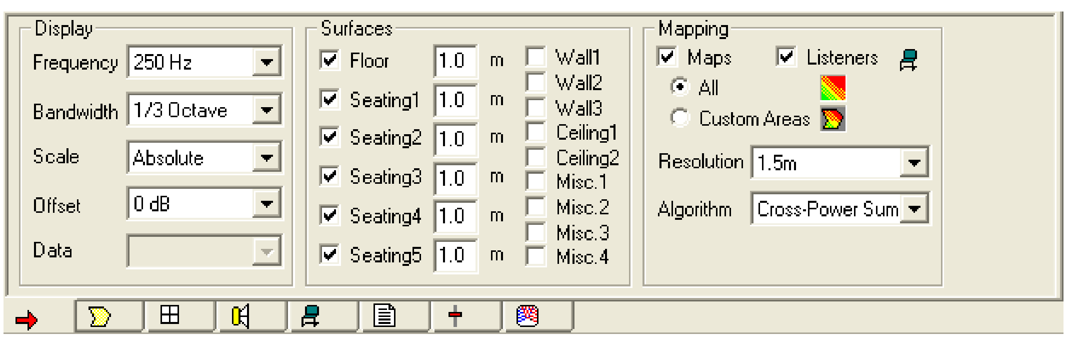
Coverage Maps

The Modeler program uses three primary coverage maps to demonstrate the performance of the system design: Direct Field, Direct+Reverberant Field, and Speech Intelligibility. Each of these maps may be invoked from the D2RASTIc toolbar, or by using their associated quick keys.

Direct Field Coverage

Direct Field coverage describes the direct path between the listener and loudspeaker, and does not include the effects of reflections or reverberation.

The default settings for Direct Field Coverage in the Simulation Tab are shown below:



Things to remember when evaluating Direct Field Coverage:

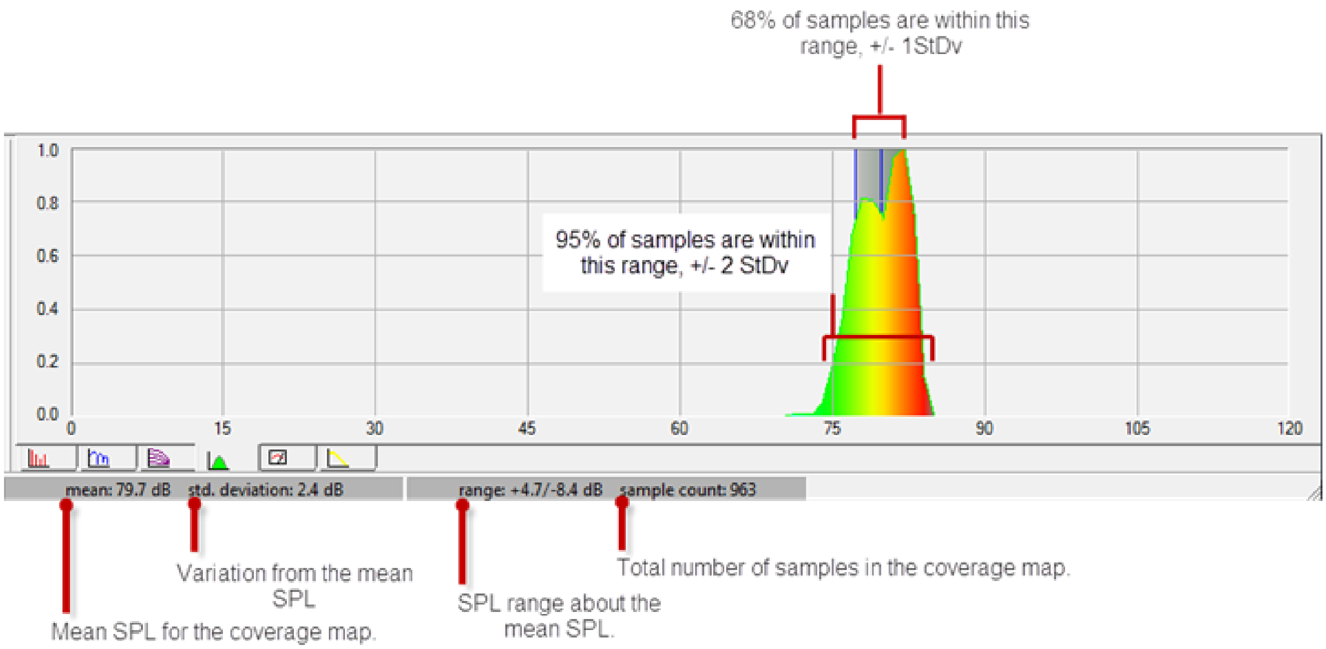
- **Coverage is independent of power** - Changing the gain of the loudspeakers will not change the coverage, it will only increase the Direct Field Level. Because of this it is easier to look at your direct field coverage using a Relative scale.

- **Obstructing Planes** are included in the calculation. If you have obstructing planes you will see shadowed areas of coverage.
- **Increasing the Resolution** does not necessarily lead to a better analysis of the coverage. Increasing the resolution can lead to the wrong decision. If you are working in a fine resolution you may see, and try to correct problems in your model that you cannot address in the real world.
- **Likewise, it is possible to have resolution that is too large** - This can also lead to the wrong decision as you may not see the effect of obstructing surfaces. We recommend using a Resolution of 3 feet, 1 meter for most coverage maps.

The Direct Field coverage map will show you the areas where you are providing sound (red to green), and those areas where there is little or no coverage (blues and purples). Using visual representation of the distribution of sound throughout the coverage area, you can easily see the areas where additional sound coverage is needed.

While the coverage map is an ideal visual tool for viewing this information it does not provide a single number that describes the overall coverage quality. The Standard Deviation, however, provides a single number to describe the quality of coverage.

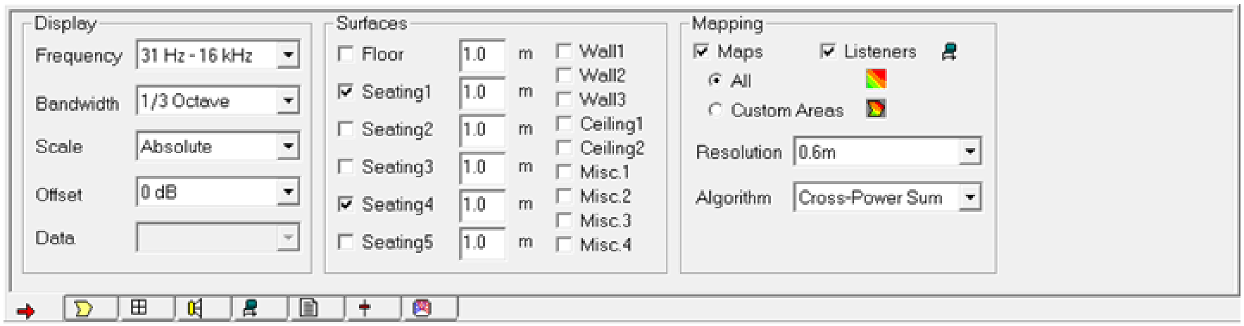
The Statistics Tab provides a coverage histogram that plots SPL along the horizontal axis, and normalized occurrence of each SPL along the vertical axis. You can think of the vertical axis as the probability that a given sample in the coverage area will have the corresponding SPL.



Direct+Reverberant Field Coverage

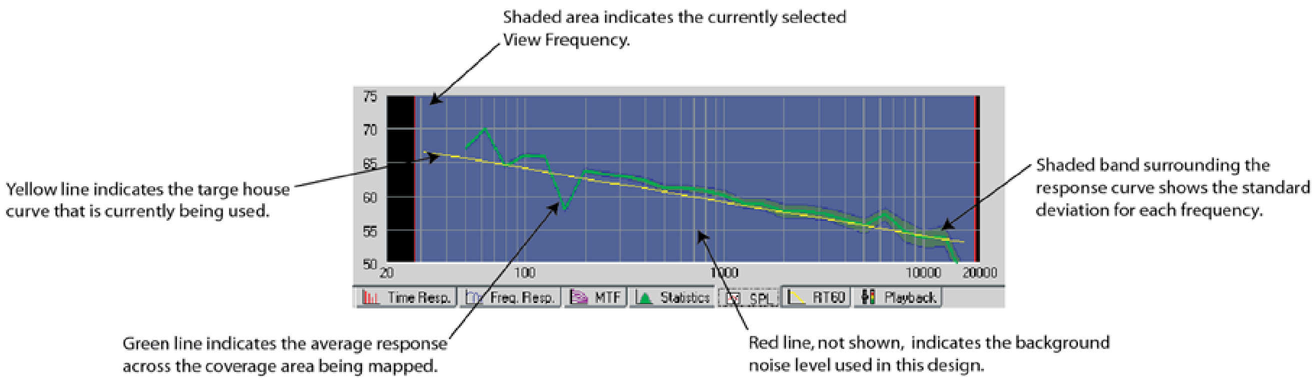
The Direct+Reverberant field calculation includes the effects of the direct sound, and reverberant field energy to predict the total system SPL throughout the coverage area. This calculation is performed for the full audio spectrum from 31Hz to 16kHz.

The default settings for the Direct+Reverberant field coverage map are shown below:



Note: You will want to change the scale to Absolute when using Direct+Reverberant Field Coverage.

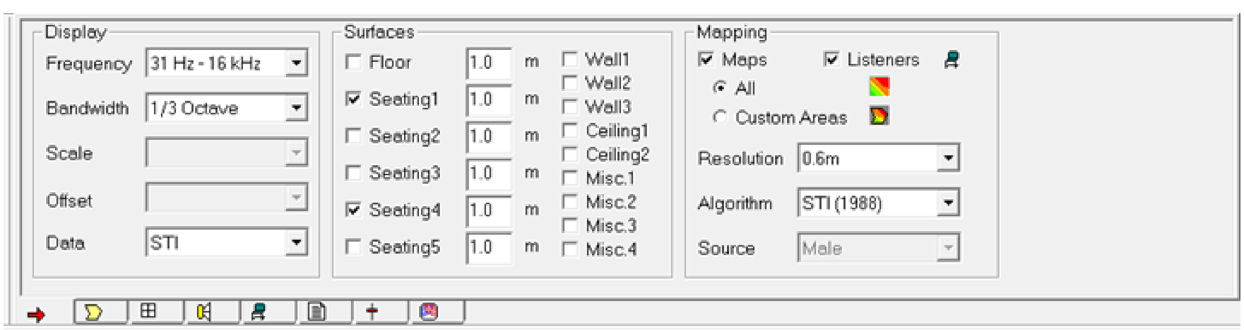
When working with the Direct+Reverberant Field map you will want to finalize system gain settings, and the level balance between mid high and bass devices. When viewing the Direct+Reverberant Field map you can view the average system response using the SPL Tab. This tab represents the average of all samples in the coverage map.



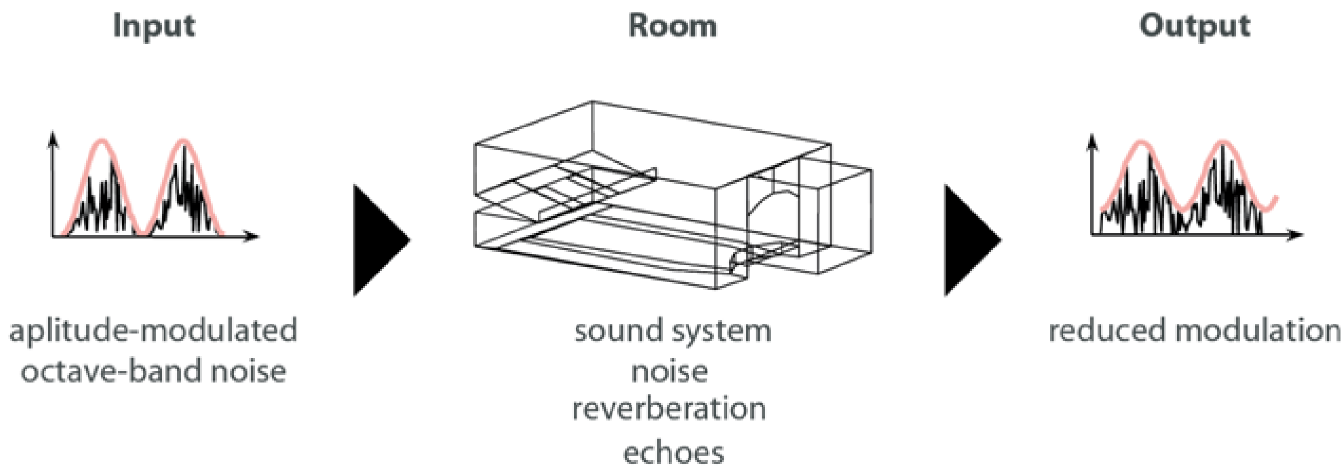
Speech Intelligibility, (STI), Map

The STI field calculation incorporates all acoustic and sound system performance attributes within the room model including, direct field level, reverberant field level, background noise, and reflections.

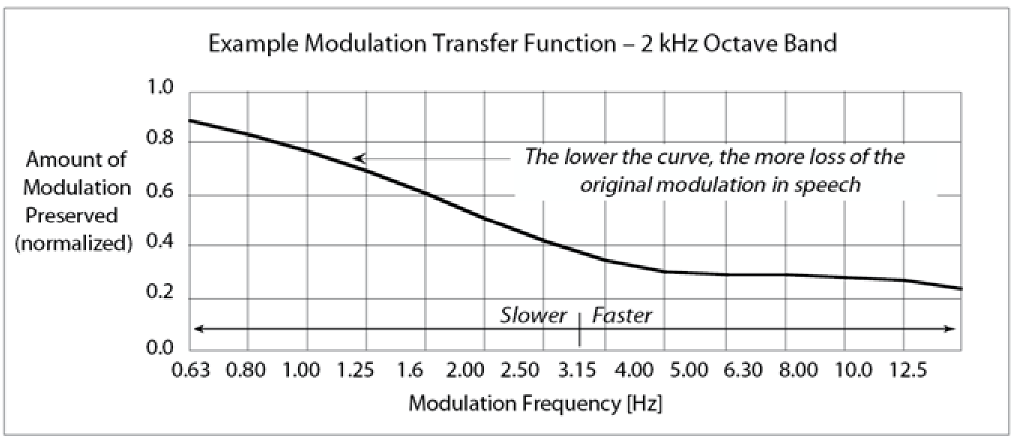
The default settings for the Speech Intelligibility coverage map are shown below:



The STI method assumes that for the original modulation of speech to be preserved it must pass unchanged through the sound system, and acoustic environment. Background noise, reverberation and late arriving reflections all have the effect of reducing this modulation. The resulting reduction in modulation is what we use to predict the speech intelligibility of the system.



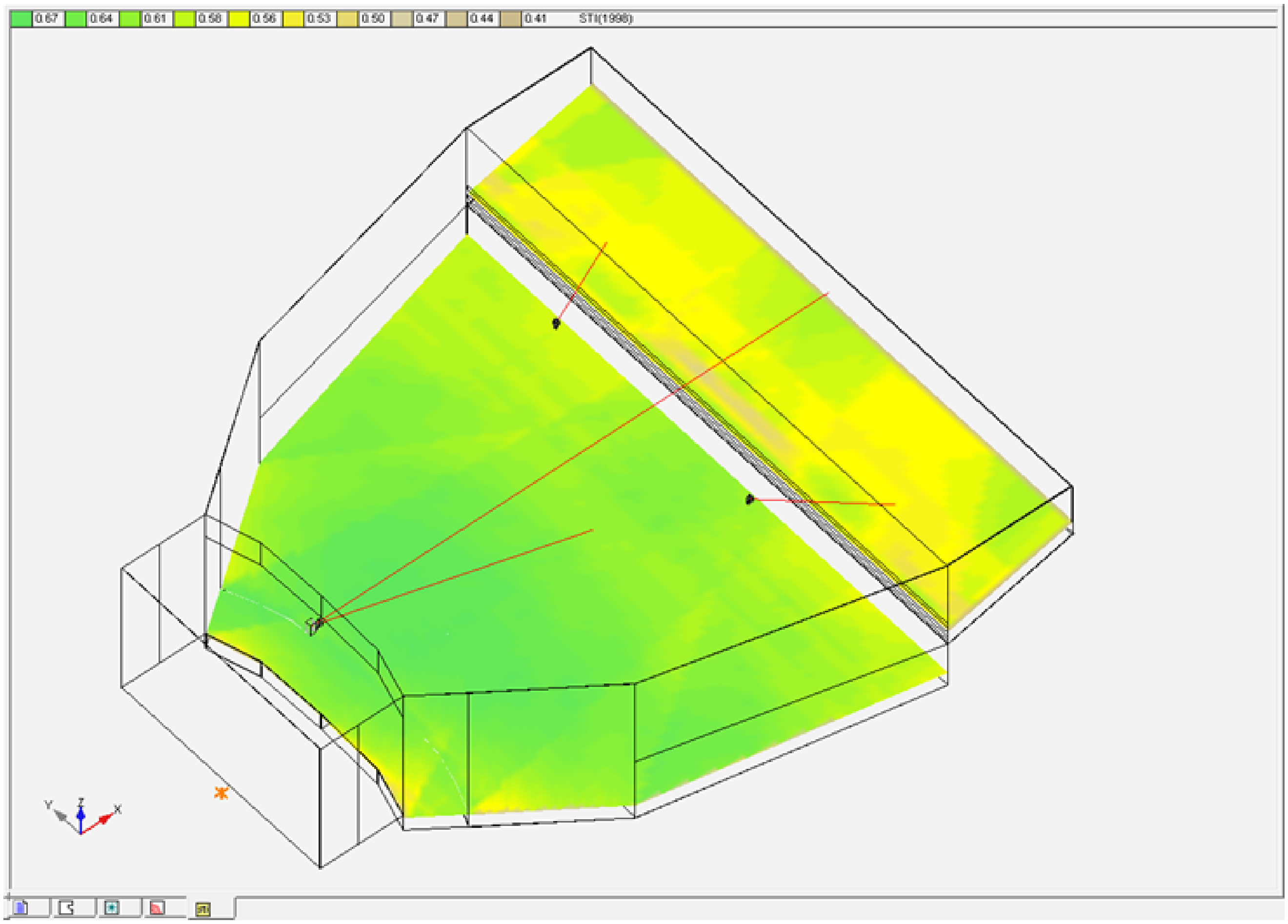
Seven octave-bands of noise between 125Hz and 8kHz are used to predict the STI. Each of the octave-bands is modulated at fourteen different frequencies between 0.63Hz and 12.5Hz. The resulting modulation transfer function, MTF, shows the reduction in the octave-band due to background noise, reverberation and late arriving reflections.



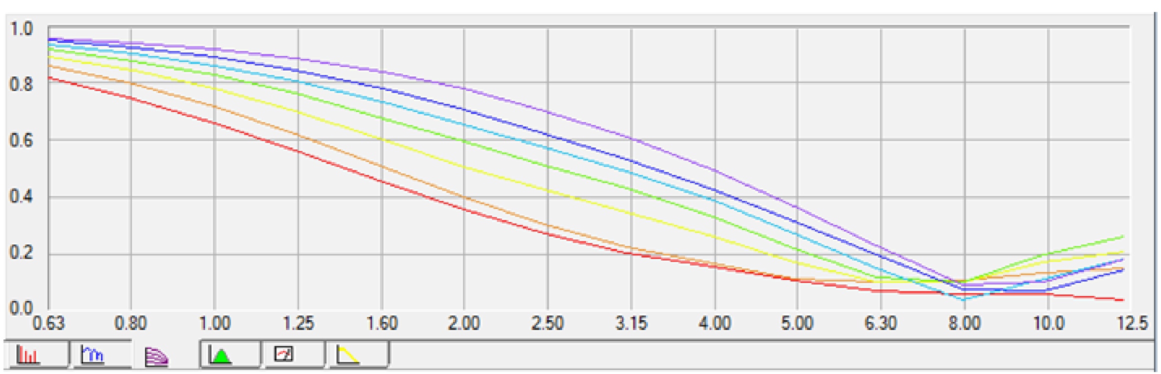
Once the modulation transfer function has been calculated for each of the seven octave-bands they are weighted and averaged to derive a single Speech Transmission Index score. The weighting factors emphasize the 2, 4 and 8kHz bands as these carry the important consonant sounds for required for understanding speech.

When predicting speech intelligibility the Modeler program uses the Hybrid Energy Decay Curve™ to predict the impulse response of the system, which is then used to calculate the STI score. This method has been shown to equivalent to directly calculating the reduction in modulation for each amplitude-modulated octave-band noise test signal.

When the HEDC/STI calculation is invoked, this calculation is performed for each sample point across the seating areas being mapped, and is then displayed as a speech intelligibility coverage map.



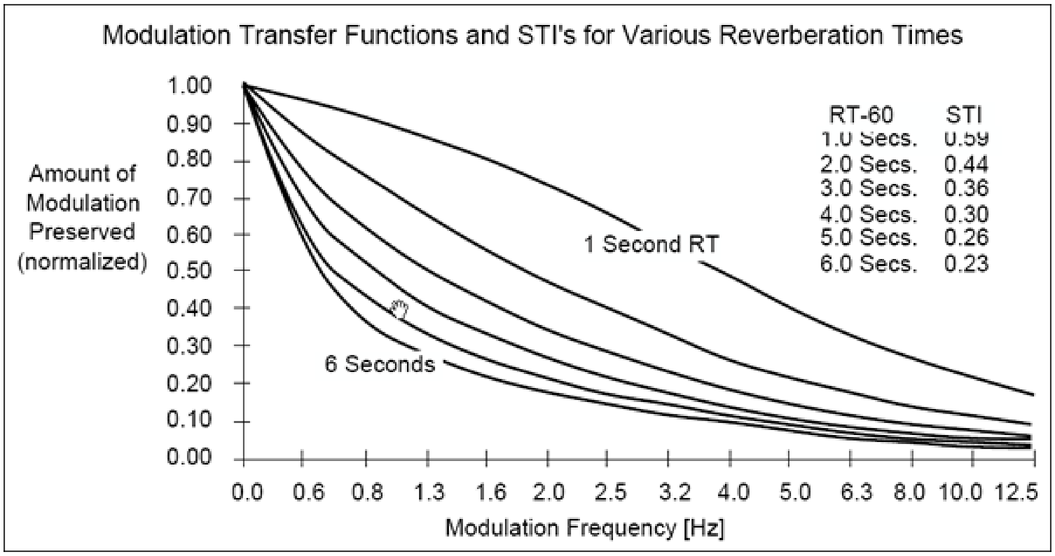
Using the STI map as a guide, you can identify areas with reduced intelligibility for further analysis. The Sample Tool is used to select an individual listener position. Once you have selected a position is selected you can use the MTF graph to identify the cause of the reduced intelligibility.



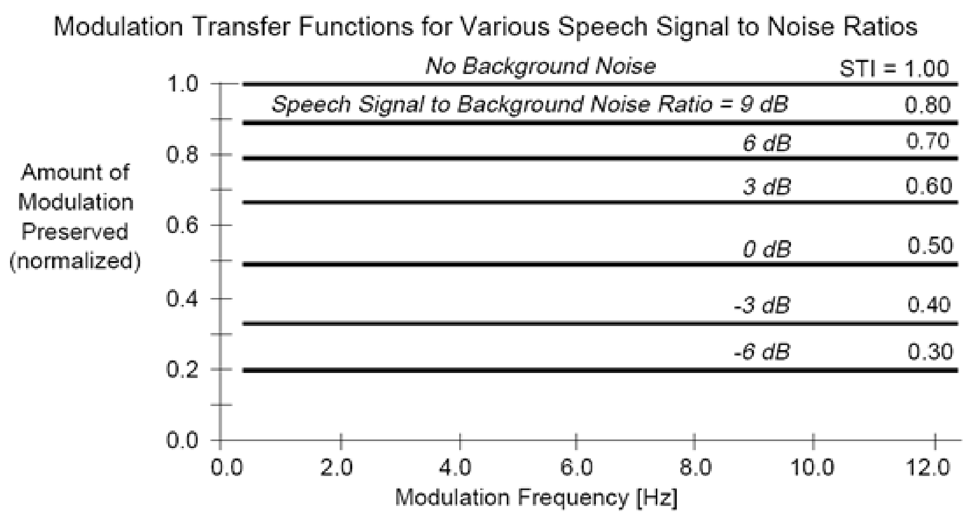
The MTF tab displays the modulation transfer function for each of the seven octave-bands. The octave-bands are displayed in a ROY G BIV color coded pattern. Red corresponds to the 125Hz MTF, and Violet corresponds to the 8kHz MTF.

When viewing the MTF graph the shape of the individual octave-band MTF graphs reveals the nature of reduction in modulation. The shape of the MTF curve will be affected by one or more of the following:

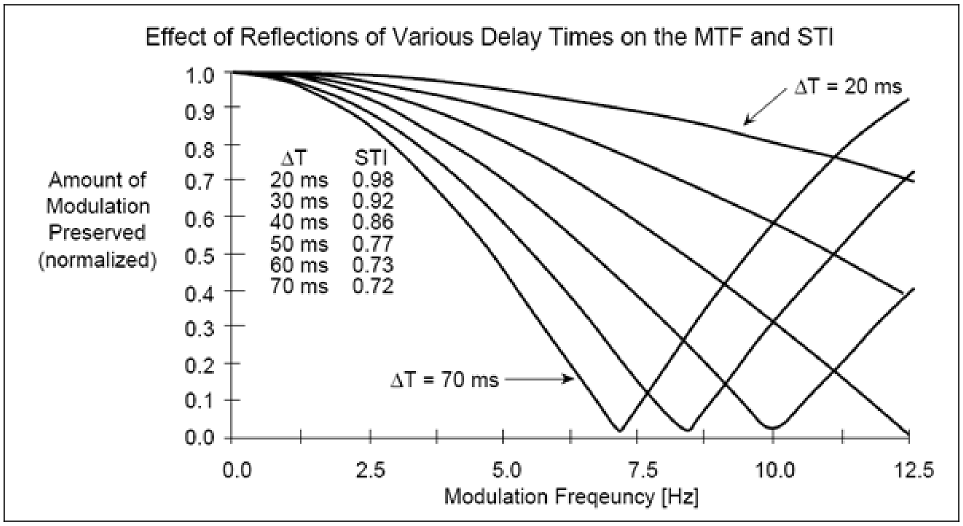
Reverberation - affects higher modulation frequencies more than lower modulation frequencies, as a result you will see that the preserved modulation will decrease as the modulation frequency increases.



Background Noise - affects all modulation frequencies equally, as a result background noise will have the effect of reducing the overall MTF curve.



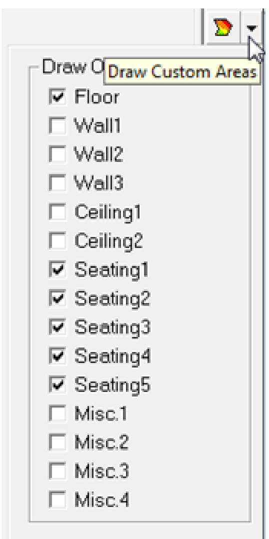
Late Arriving Reflections - will produce a visible “notch” in the MTF curve. It is important to note that these late arriving reflections can be caused by a variety of factors, improperly aimed loudspeakers, discrete reflections from a room surface, or even a group of reflections that have summed to produce an audible reflection.



Defining a Custom Mapping Area

If you do not want to map the entire audience area, you can use the Custom Mapping Area tool to draw a virtual surface on the specific area within the room you wish to map. This surface has no impact on the acoustics of the room, it is simply a surface for mapping.

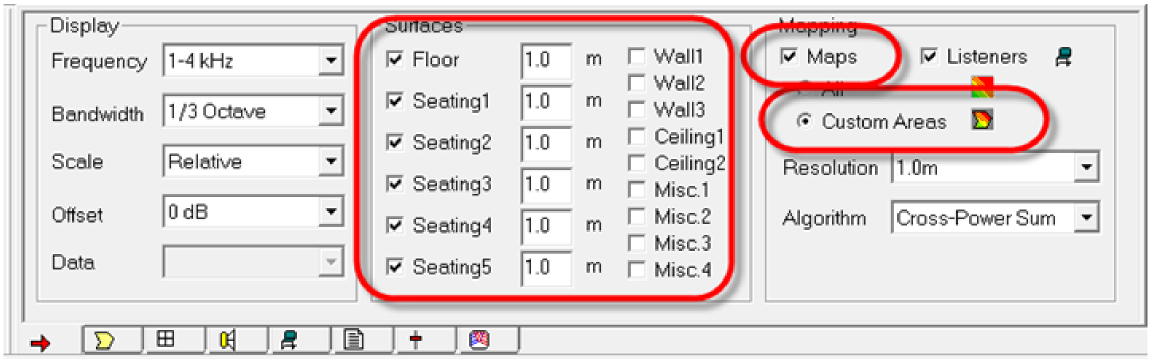
To create a custom mapping area, click on the Draw Custom Areas tool wing menu and select the surface types upon which the custom area will be drawn.



You can create a Custom Area that spans multiple surface types. For example, you can create one that covers the seating area and parts of a wall. Simply make sure that the surface types you want to include are checked in the Custom Areas wing menu list.

To display a coverage map for a custom mapping area, the following items need to be selected within the Simulation Tab:

- **Surfaces** - The surface types you are mapping (Floor, Seating1, etc.)
- **Mapping** - The Maps check box and the Custom Areas radio button.



Time Response

Time arrival data for direct and reflected energy is displayed within the Time Arrival tab. Information displayed within the Time Arrival tab is dependent on the active coverage map.

- Direct Field Coverage – displays only direct arrivals for the selected frequency band.
- Direct+Reverberant Field Coverage – Time Response tab is disabled.
- Speech Intelligibility Coverage – displays direct arrivals, first and second order reflections and the Reverberant Field Envelope Function.

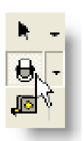
The information displayed is based on a single sample or listener position. To view the time response for a single point the Sample Tool must be active, and a point within the room must be selected, or a listener position must be selected from within the Listeners tab.

The following describes how to generate time-arrival data in the Time Resp. tab and how to use the Time Resp. tab to set loudspeaker delays.

Generating time-arrival data

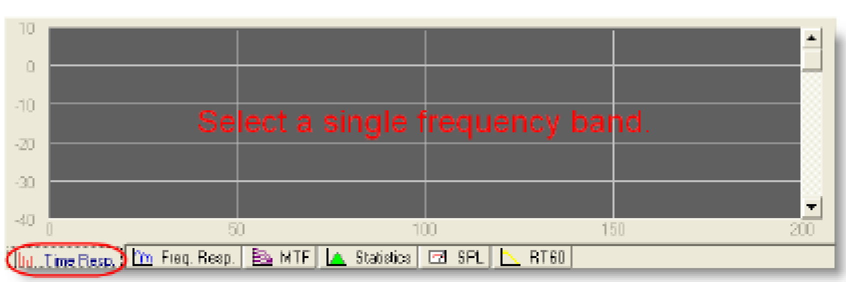
Data in the **Time Resp.** tab is location dependent, and therefore can only be seen when the Sample tool is placed in your coverage map. The **Sample** tool allows you to specify an exact location from which to generate acoustic prediction data. Follow these steps to use the **Sample** tool to generate time-arrival data:

1. Make sure that the D2RΔSTIc engine has been enabled, and that the **Direct, Direct + Reverberant**, and **Speech Intelligibility** coverage maps have been turned on.
2. Select the **Sample** tool in the **Draw** toolbar.



Sample tool

3. Click in the **Speech Intelligibility** coverage map to place the **Sample** tool. Time-arrival data for that location will populate in the **Time Resp.** tab.

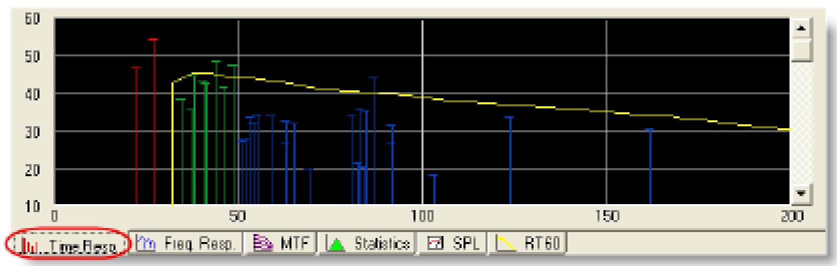


Note: Time-arrival is only displayed for a single-frequency band. The Time Resp tab will be grayed out and a warning will be displayed in the graph indicating that you need to pick a single-frequency band from the Frequency drop-down menu.

Frequency band warning

The **Time Resp.** tab displays elapsed time on the horizontal axis and dB SPL on the vertical axis. Each pin in the graph represents an arrival of sound at the exact location where you placed the **Sample** tool. The colors of the pins have the following meanings:

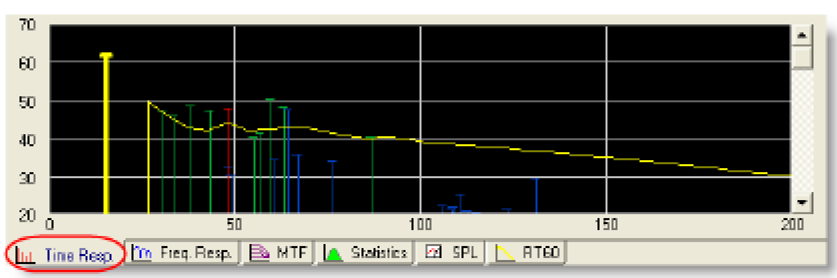
Red pins:	Direct arrivals from the sound source.
Green pins:	First order reflections. They have reflected off of one surface.
Blue pins:	Second order reflections. They are arriving at the sample point after reflecting off of two surfaces.
Yellow line:	Reverberant Field Envelope Function (RFEF), which shows the build-up and decay of reverberant energy at the particular location.



Time Resp. tab

Note: In the HEDC™ Time Resp window, the direct arrival from each cluster is represented by a single pin. Its level is calculated using x-power sum on all individual arrivals from that cluster. Its time is set equal to the time of arrival of the first individual arrival time.

Click on a pin in the graph to generate the path from the source to the listener location, which is viewed in the **Modeling** window. You can scroll through the pins sequentially using the scroll bar to the right of the **Time Resp.** graph.

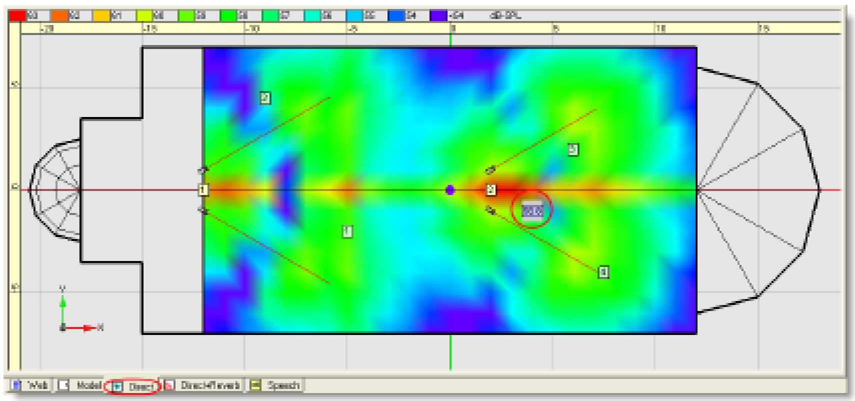


Time Resp. tab, first pin highlighted

Setting loudspeaker delays

In a decentralized sound system, the signal to certain loudspeakers can be delayed by a fraction of a second to ensure proper signal localization. Follow these steps to use the **Time Resp.** tab to set loudspeaker delays:

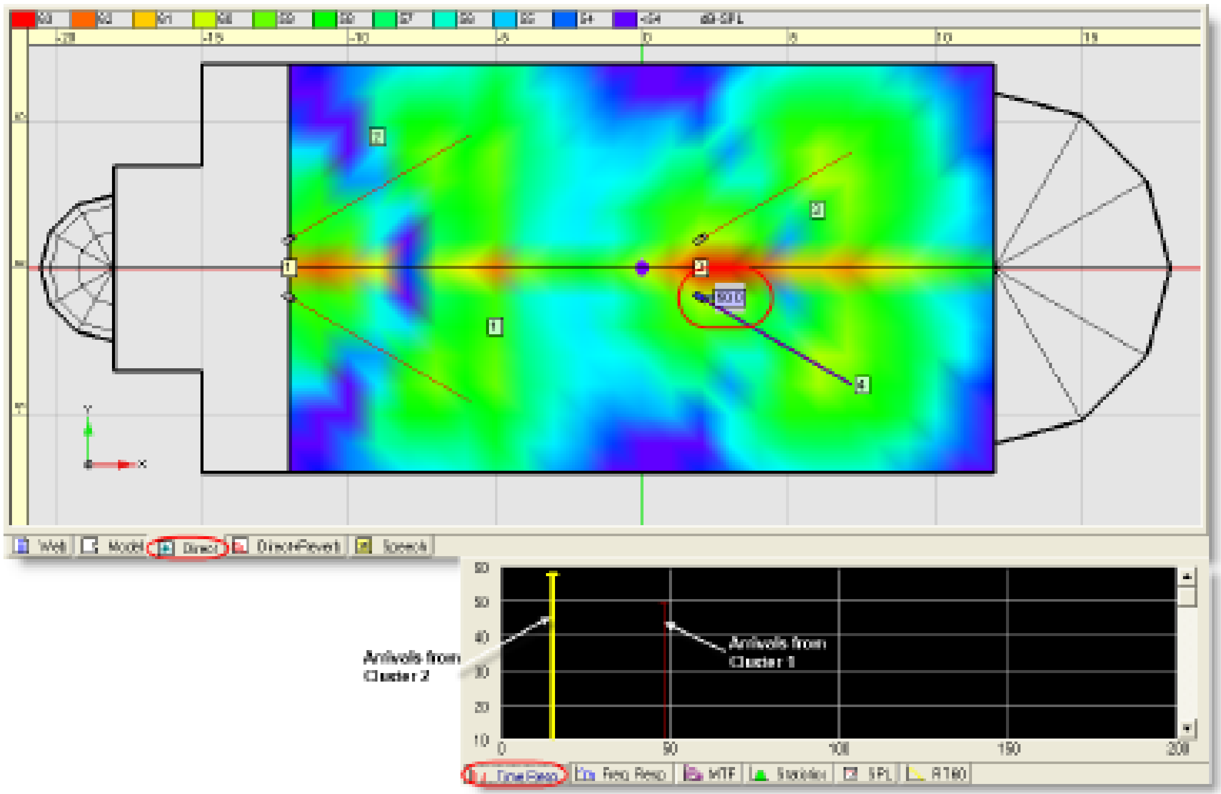
1. Select the **Direct** tab in the **Modeling** window.
2. Place the **Sample** tool in the model to the right of Cluster 2, as shown in the following figure:



Sample tool placed behind Cluster 2 (with 1 kHz selected)

Loudspeaker delays are set using direct arrival information. When the **Sample** tool is placed in the Direct Field coverage map, the **Time Resp.** tab shows only the direct sound arrivals (red pins).

3. Scroll through the arrival pins in the **Time Resp.** tab and take note of which arrivals come from which cluster.

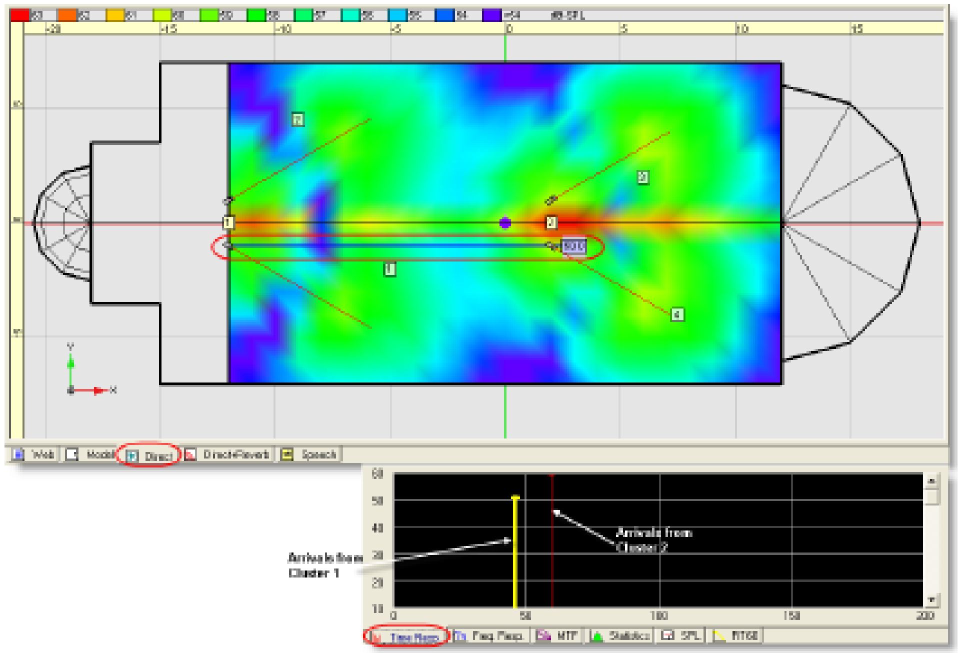


Matching arrivals with clusters

As you can see, sound is arriving at the **Sample** tool location from Cluster 2 first (notice the selected pin and its corresponding trace on the coverage map).

Humans localize sound based on the first arrival that they hear. Cluster 1 is closest to where a talker or music presentation would be located, so the audience should hear their first sound arrivals from Cluster 1, not Cluster 2. Because listeners in the back of the church are closer to Cluster 2, sound from these loudspeakers would normally reach them first. To prevent this, a signal delay should be set on the loudspeakers in Cluster 2 so that all listeners in the church receive sound from Cluster 1 first.

4. Click the **Loudspeakers** tab in the **Detail** window and scroll to the right until you can see the **Delay** column.
5. Enter a delay of **45** (ms) for the three loudspeakers in Cluster 2.
6. Notice that the time-arrivals in the **Time Resp.** tab have changed, and the first sound arriving at the **Sample** tool location is now from Cluster 1.



After a delay of 45 (ms) is set, sound arrives from Cluster 1 first

Frequency Response

The frequency response for a selected point within the room model, or a specific listener position is displayed within the Frequency Response tab. Information displayed within the Frequency Response tab is dependent on the active coverage map.

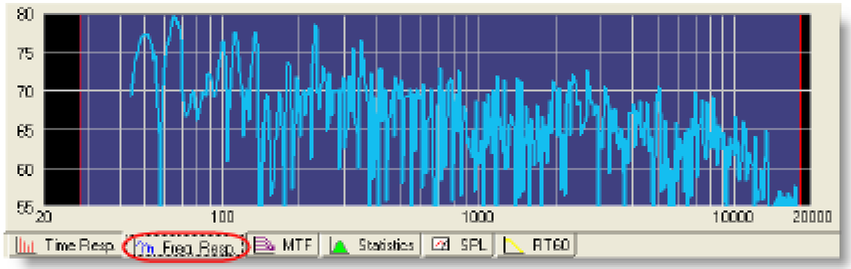
- Direct Field Coverage – displays the direct field frequency response at the selected position.
- Direct+Reverberant Field Coverage – displays the Direct+Reverberant field frequency response at the selected position.
- Speech Intelligibility Coverage – frequency response tab is disabled.

The information displayed is based on a single sample or listener position. To view the frequency response for a single point, the Sample Tool must be active, and a point within the room must be selected, or a listener position must be selected from within the Listeners Tab.

The **Freq. Resp.** tab displays dB SPL on the vertical axis, and the frequency spectrum on the horizontal axis. The frequency response at a specific location in the coverage map can be displayed by placing the **Sample** tool at the desired location.

Follow these steps to display a frequency response:

1. Click the **Freq. Resp.** tab.
2. Select the Sample tool in the **Draw** toolbar.
3. Click inside the Speech Intelligibility coverage map in the **Model** view. Notice that data appears in the **Freq. Resp.** tab.
4. Drag the **Sample** tool around the model. Because frequency response is position-dependent, the data changes as you change the location of the **Sample** tool.
5. Drag the **Sample** tool over each of the listener locations in the model. The **Sample** tool snaps to the listener location when you drag the tool near a listener. As you make changes to your sound system, these listener locations allow you to return to a specific and consistent location in the model to evaluate acoustic prediction.



Freq. Resp. tab

Note: You can change the smoothing of the frequency response curve by right-clicking in the Freq. Resp. tab and choosing a different octave value. Lower values produce finer resolution.

System SPL

The System SPL tab displays the average frequency response for all samples within the selected coverage map. Also included is the total system SPL, based on a Pink Noise stimulus.

When viewing the System SPL tab the information displayed is dependent on the active coverage map.

- Direct Field Coverage – displays the average direct field frequency response of all samples within the coverage map.
- Direct+Reverberant Field Coverage – displays the average Direct+Reverberant field frequency response of all samples within the coverage map.
- Speech Intelligibility Coverage – System SPL tab is disabled.

When working with the System SPL tab additional SPL weighting scales, (A, B, C, and Flat) are available. In addition a total SPL with program material display is available – which predicts the total system SPL based upon an IEC shaped Pink Noise input source.

Note: All SPL predictions within the Modeler program assume an input noise source with a 6 dB Crest Factor.

Working with Listeners

Listener Locations

Modeler software provides the ability to specify persistent reference points, or “Listener” locations, at which acoustic performance is predicted. As you change the sound system design, these listeners make it easy to compare prediction data.

Listeners vs. audience

It is important to note the difference between listeners and surfaces occupied by an audience.

- **Listeners** are placed in a model as reference locations for generating acoustic predictions.

  Listeners are objects placed within the model at precise locations. They provide points of reference when using the Sample tool to view acoustic predictions at different areas in the model.

- **Audience** is a surface attribute that causes Modeler software to simulate the presence of an audience.

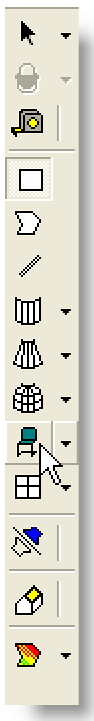
  Audience refers to a specific acoustic characteristic across a particular surface in the model. Surfaces in Modeler software can be designated as occupied by an audience. When you designate a surface as occupied by an audience, Modeler software will simulate the effect that an audience has on the acoustics on the surface.

Adding Listeners

Modeler software enables you to establish listener positions throughout your model using the Place Listener tool. Listeners provide reference points in your model from which to analyze acoustic predictions.

Follow these steps to place a listener location in your model:

1. Select the Place Listener tool in the Draw toolbar

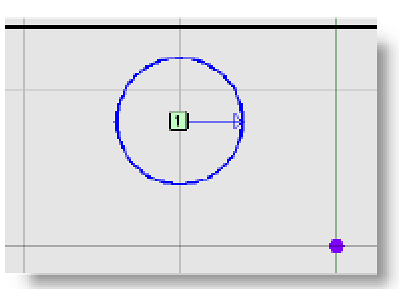


Place Listener tool

Note: Listener locations can only be specified on Floor and Seating surfaces.

2. Click at the desired location in your model to place a listener.

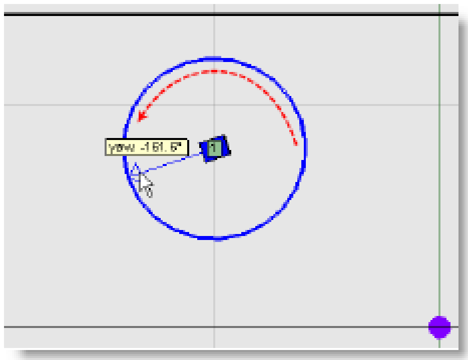
   The number in the green box is the listener identifier. The arrow indicates the direction in which the listener is facing (the yaw). By default, the listener faces in the positive X direction.



A listener location

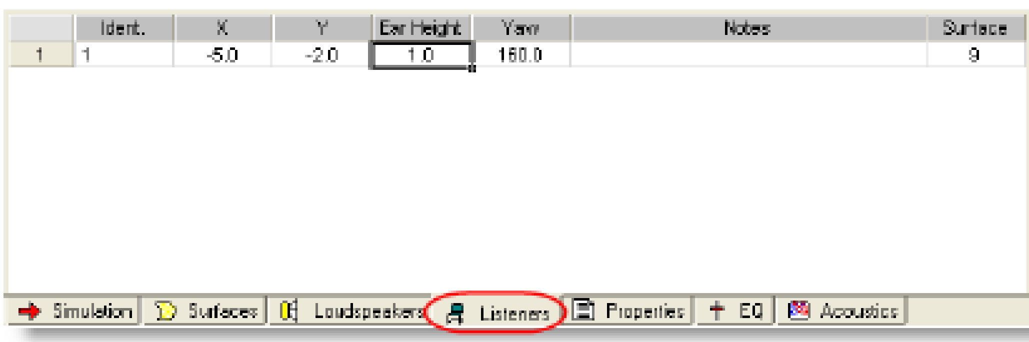
Note: The orientation of listeners have no impact on calculations in Modeler, only in Modeler Plus.

3. Adjust the direction the listener is facing by dragging the blue yaw arrow in the listener circle. Click near the tip of the arrow and drag it around the circle. The listener should face in the direction that a listener would face in the venue.



Adjusting the yaw of a listener

4. Move the listener location by clicking and dragging the icon in the center of the circle.
5. Select the Listeners tab in the Detail window and enter a value in the Ear Height field to specify that the listener’s ears are located off off the ground, or that they are sitting down. The typical Ear Height default is at 1 m. If the listeners were standing up, or sitting on the floor, you could enter a higher or lower value for **Ear Height** to best represent the height of the listeners.



Ear Height column in Listeners tab

Note: Typical ear height: 3 ft (1m) Seated; 6 ft (2m) Standing.

6. Click the **Save** button to save your work.

Note: Use the Place Listener wing menu to show/hide listener Identities and Wireframes.

Tip: To deselect items such as listeners, use the Esc (or SHIFT+Esc) command.

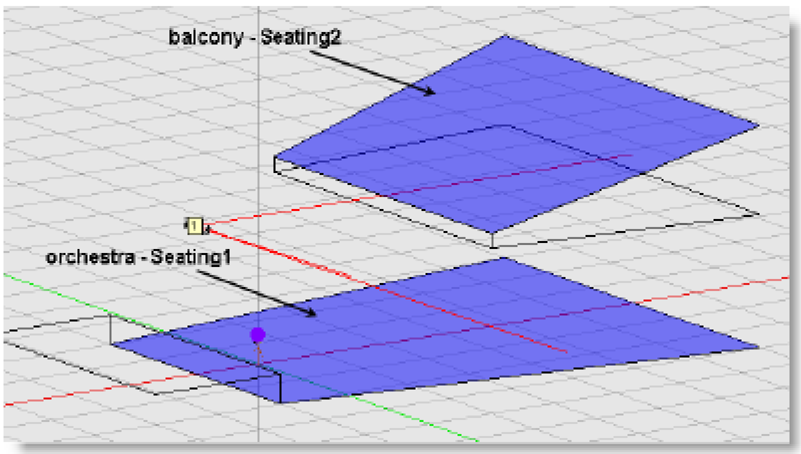
Copy and paste listeners

Listener locations can be copied and pasted between different models. To do this, select the listeners you would like to copy and choose Edit > Copy (or press Ctrl + C). Open or create the model that you would like to add these listener locations to, and select Edit > Paste (or press Ctrl + V). The listener locations are added to the model and appear in the same location relative to the origin.

Note: Listener locations that are copied and pasted will have the same X and Y coordinates relative to the origin in both the original and new models. This feature is most useful when copying and pasting between two models with similar geometry and layout.

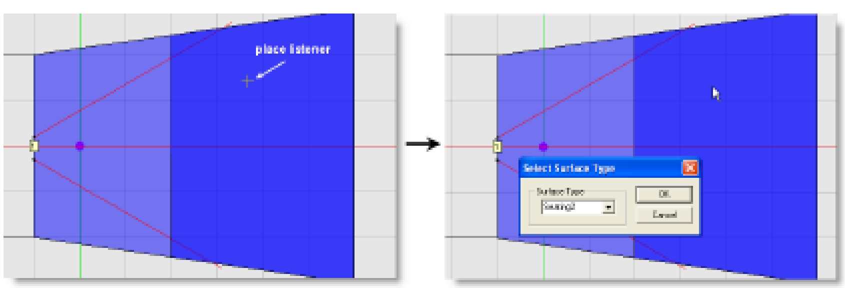
Placing listeners on overlapping surfaces

It may be helpful to place listeners in acoustically challenging locations, such as underneath a balcony. If you try to place a listener on a surface that overlaps another surface, Modeler software will prompt you to choose which surface you would like the listener placed on. For example, the theater in the following figure has an orchestra seating area (Seating1) and a balcony seating area (Seating2).



A theater with two overlapping seating areas

When you place a listener in a region where surfaces overlap, Modeler software will prompt you to choose which surface the listener is sitting on.



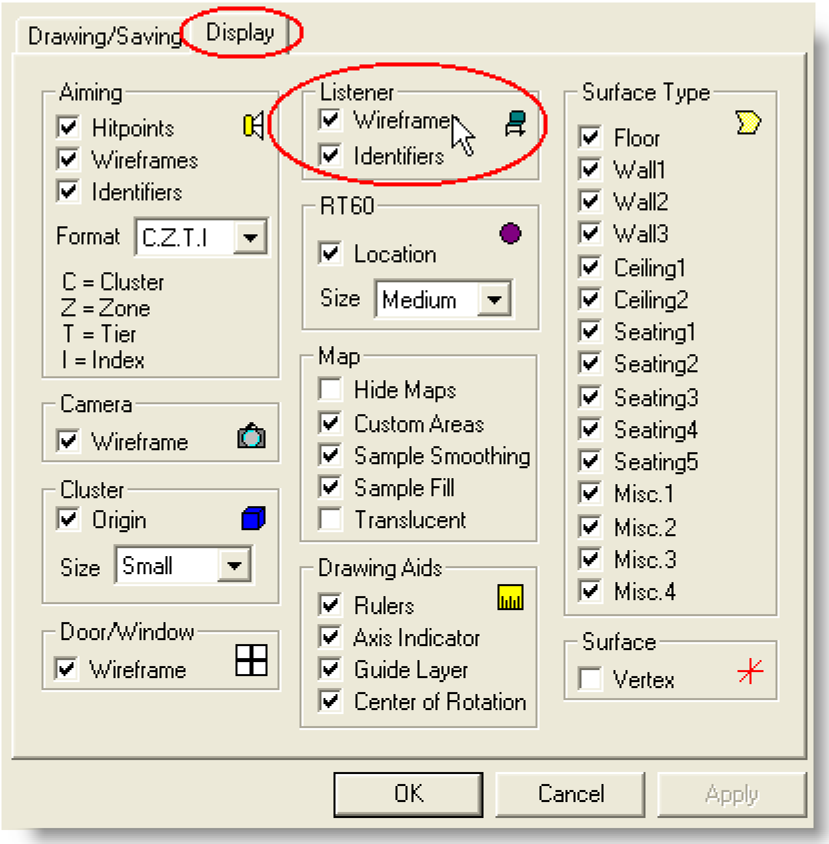
Placing a listener on two overlapping surfaces

Choose the desired surface type to place the listener location.

Setting Listener Preferences

Follow these steps to change the way listeners are displayed in Modeler software:

1. If **Model Settings** is not already displayed: Click **Edit** > **Model Settings**. The **Model Settings** dialog box opens with the **Display** tab selected by default.



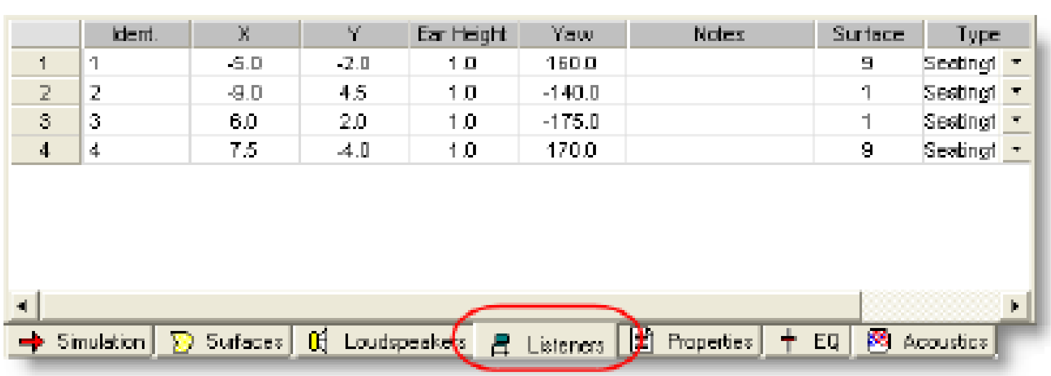
Display tab

2. To hide the wireframe representation of the listener, remove the checkmark from the **Wireframes** box.
3. To hide the listener identifier number, remove the checkmark from the **Identifiers** box.

Tip: You can click on the Listeners wing menu to check how listeners are to be displayed in the model, as a wireframe chair and/or identifier number.

Listener Properties

You can view and modify characteristics of the listeners in your model using the **Listeners** tab:

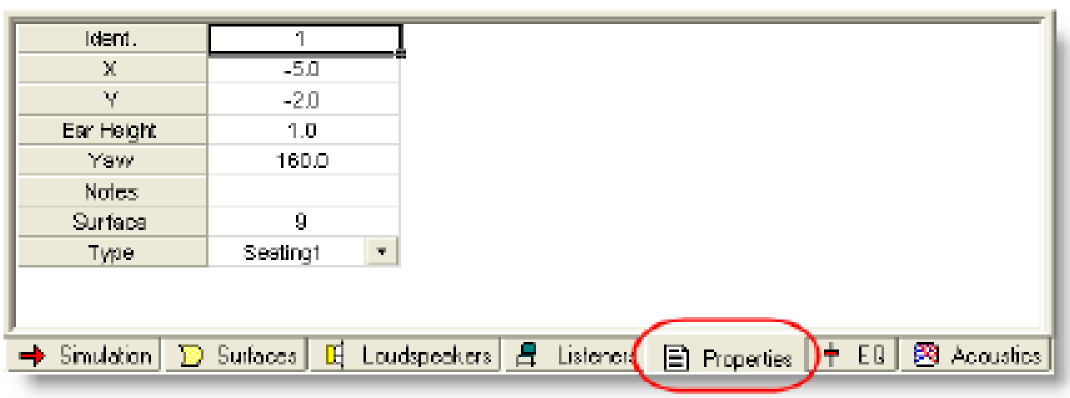


Listeners tab

See the table below for information on each column in the **Listeners** tab.

Ident.:	The listener identifier number is generated automatically when you place a listener. After you place a new listener, or copy and paste a listener, you can change this number using the Listeners tab.
X:	The distance of the listener location from the origin along the X Axis.
Y:	The distance of the listener location from the origin along the Y Axis.
Ear Height:	The height above the surface of a listener's ears. This number should be chosen based on whether the listeners are sitting or standing. The default value is 1.0 m (3.3 ft) above the ground. Ear height must be between 0 and 2.13 m (7 ft).
Yaw:	The direction that the listener is facing. The default position is 0° (positive X direction).
Notes:	A text field that can be used for notes about the listener location. For example, you may want to note specific acoustic prediction characteristics for a given listener location.
Surface:	The identifier number of the surface that the listener location is on. Use this number to easily locate the surface in the Surfaces tab.
Type:	Indicates whether the listener location is on a Floor or Seating surface.

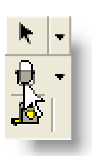
You also can view the same information for a selected listener in the Properties tab:



Properties tab for a selected listener

Using Listeners and the Sample Tool

The **Sample** tool is used to measure acoustic predictions for a particular location in your model.

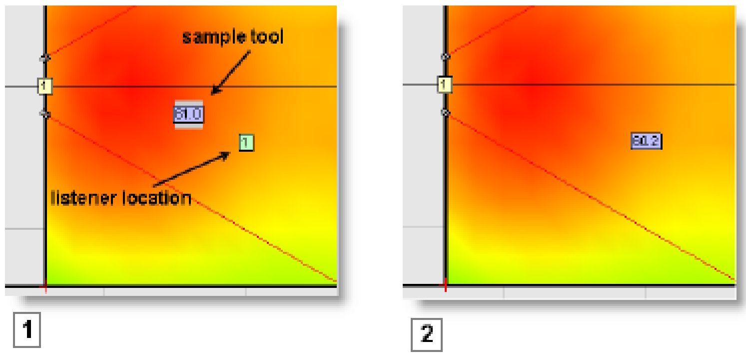


Sample tool

For more information on the Sample tool, see the DRASTIC Design Process.

The **Sample** tool allows you to view the predictions at any location in the room model including the predefined listener locations. While listener locations are fixed in space, the sample tool can be moved in real time and immediately provide the data at the sample point.

Note: When the tool is placed over a listener location, it will "snap to" the listener, and generate data for this precise location.



Snapping the Sample tool to a listener location in a Direct Field coverage map

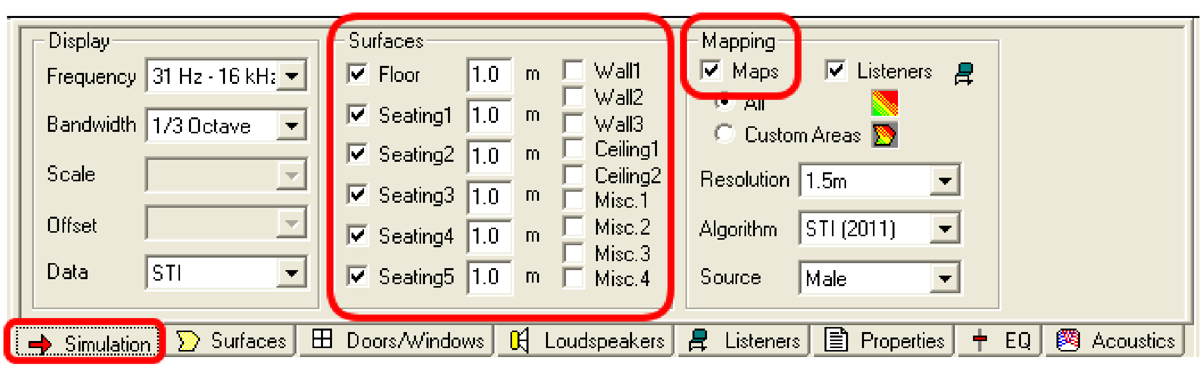
As you change the sound system design, the listener locations provide reference points from which you can measure the effects of your design changes. Snap the Sample tool to a listener location before and after a design change, to see how it affects acoustic prediction data from the exact location.

Tip: In order to de-select a sample in a map, click the wing menu of the Sample Tool and click on the 'Clear' button.

Using Listeners to Reduce Calculation Time

You can greatly reduce calculation time by generating acoustic prediction data exclusively at listener locations. The calculation will be significantly faster because Modeler software will not calculate an entire coverage map. It is strongly recommended that you use this method when working with complex sound system designs and/or large and complex models. Follow these steps to generate acoustic prediction data exclusively at listener locations:

1. Open a model that contains listener locations and loudspeakers.
2. With the D²RΔSTIc engine off, click on the Simulation tab in the Detail window and uncheck Maps to turn off the coverage maps. Modeler software will only draw the coverage map on the surface types that are checked (with Maps checked and All selected).



Simulation tab settings

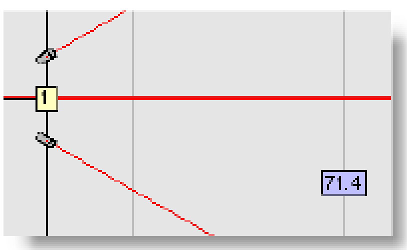
3. Enable the D2RΔSTIc engine by clicking on the Enable **D2RΔSTIc** Engine button in the Map toolbar:

Enable D²RDSTIc Engine button

4. Click the Direct button on the Map toolbar.

Direct button

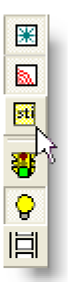
5. Select the Sample tool and snap it to a listener location.



The Sample tool snapped to a listener location

Although there is no coverage map, Modeler software will generate acoustic prediction data at the listener locations. The Sample tool cannot be placed on other parts of the Seating1 surface, but it can be snapped to a listener location to generate acoustic prediction data.

6. Click on the Speech Intelligibility button in the Map toolbar to generate Speech Intelligibility data at the listener locations.

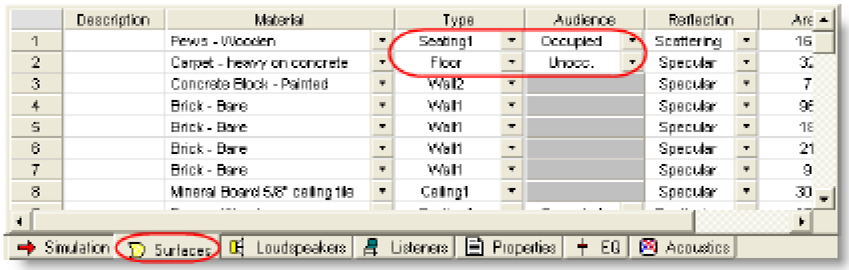


Speech Intelligibility button

7. Select the Sample tool and snap it to a listener location in the model. Notice that acoustic prediction data for the listener location is generated in the Time Resp. and MTF tab.

Including the Absorption of an Audience

Surfaces of the type Floor, Seating, and Misc. can be designated as occupied or unoccupied by an audience using the Surfaces tab.

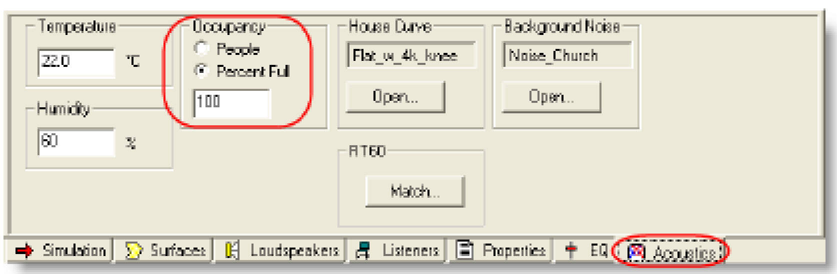


Floor and Seating type surfaces in the Surfaces tab

When surfaces are occupied by an audience, Modeler software will simulate the effect that an audience has on the acoustics in the room.

Note: Remember, audience and listeners are two separate concepts in Modeler software. Whether or not a surface is occupied by an audience is unrelated to whether or not there are listener locations on that surface.

The effect an audience has on the acoustics in a room depends on the number of people in the audience. The size of the audience can be set in the **Acoustics** tab.



Occupancy settings in the Acoustics tab

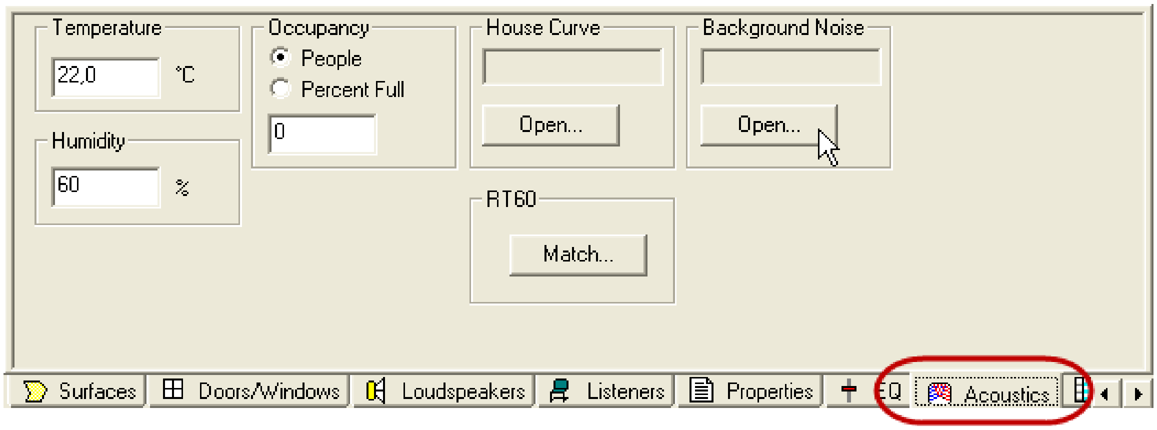
The audience size can be specified in either number of People, or Percent Full. Enter a value to specify a number of people or a percentage. If you have not specified any surfaces as occupied, these fields will be grayed out.

Note: Modeler software determines the maximum occupancy of a room based on a density of 1.8 persons per one square meter. An easy way to view your room's maximum occupancy is to enter 100 in the Percent Full field and then click the radio button next to People. Modeler software will calculate the number of people that can occupy your room model.

Including Background Noise

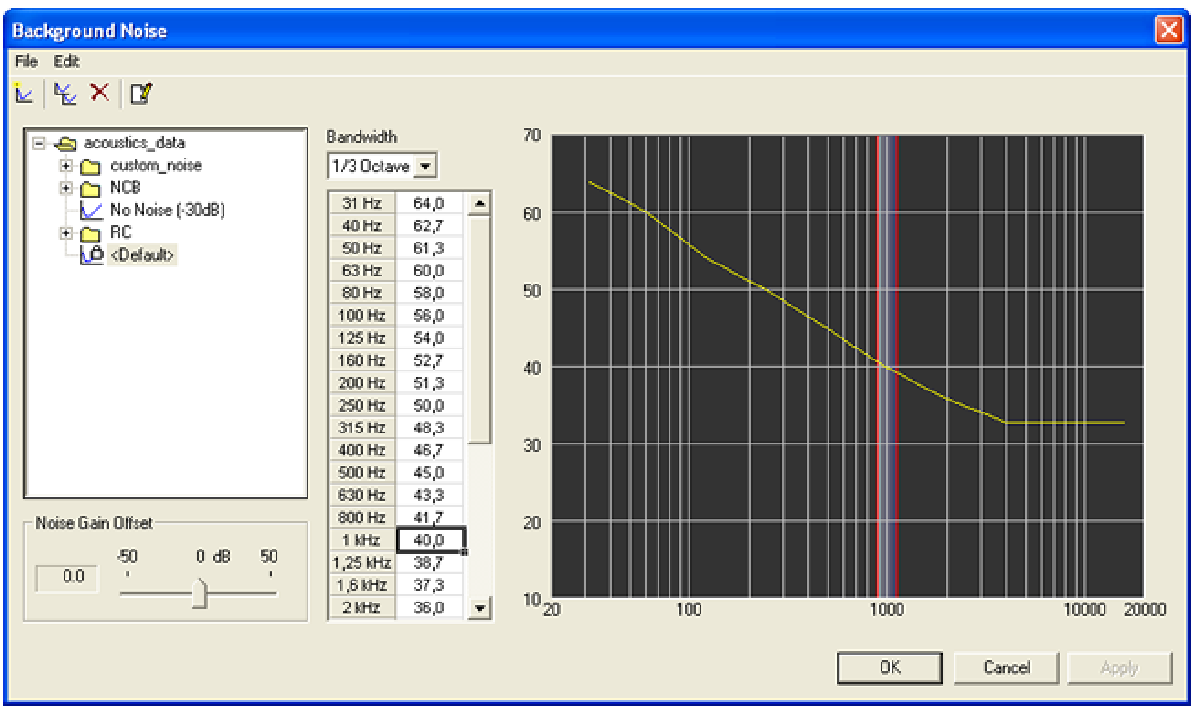
To assign a background noise profile to a model:

1. Click on the Acoustics tab in the Detail window.



Acoustics tab

2. Under Background Noise, click on the "**Open...**" button. The following screen appears:



Background noise window

3. Select an existing noise curve from the library on the left window frame, or create/duplicate/modify noise curves.

Note: You may create a new noise curve, or duplicate and rename an existing noise curve. If you do so, there will be no corresponding audio (.wav) file, and therefore no noise will be played for listeners in models with this noise assigned.

There are three types of noise files: standard, custom, and user created noise files. The audio (.wav) files associated with standard noise files are locked binaural files of shaped white noise. Custom noise files are recordings of real environments that have been processed for playback on Auditioner®. Unlike standard noise files, these files are unlocked and the level may be adjusted as needed for a given model. A user created noise file will have no associated audio (.wav) file.

When playing a listener in Auditioner®, the selected background noise will be played (unless muted). When you use the noise volume slider in the Playback tab to adjust the noise volume, the STI map is recalculated and redrawn if visible. When changing listeners the noise gain offset is set to 0, and the change is retained in the model.

Tip: If you mute the noise, the room level will be the same as the signal level. If you mute the signal by pressing pause/stop in the Bose Media Player, the room level will be the same as the noise level.

Simulating System Performance (Plus only)

Getting Started

The Modeler Plus software provides an auralization function for use with the Auditioner playback system. When active, dry audio, typically a music or speech .wav file, is convolved with the system's predicted impulse response at a selected listener location. The audio reproduced on the Auditioner playback system is an accurate reproduction of the sound system's performance in the room.

Note: For the simulation to be accurate the room model must be both geometrically and acoustically accurate.

Before you begin with the Auditioner technology you should first make sure that the following has been performed:

- The Auditioner Playback System is connected and powered on.
- Source material is loaded and playing.

See the following topics for simulating system performance using Modeler Plus software:

- Projects
- Auditioner Playback System Connection
- Bose Media Player
- The Playlist Tab
- The Playback Tab
- Relative and Absolute Level Playback
- Including Background Noise in the Auralization
- Recording and Playing Auditioner Audio Output

Projects

The auralization functions within the Modeler Plus software are only enabled when a Project file is open. Much of the power of this tool is derived from the ability to listen to and compare multiple design variations in a single session. To facilitate this feature, the Modeler software uses the concept of a Project which may contain one or more Models that represent different design variations. The project object contains many of the attributes and settings models used by the Modeler Plus application. While the designer may open and interact with a model outside of a project, the model must be in a project in order to activate the Auditioner® features.

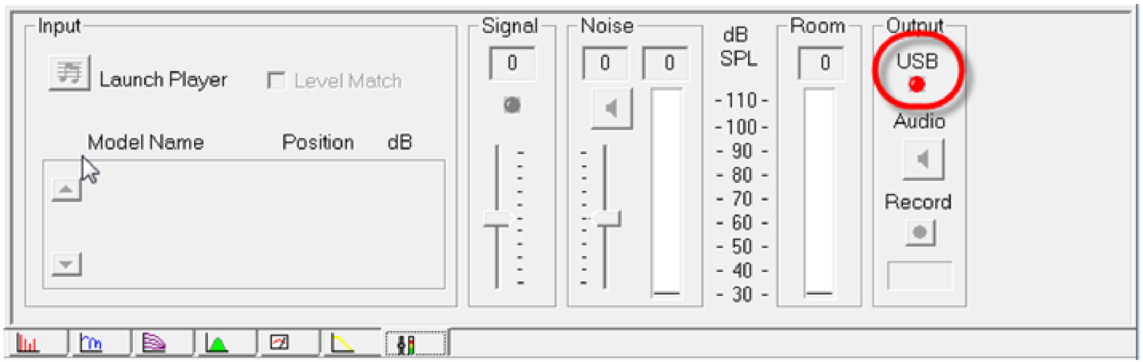
Before you begin working with the Auditioner features within Modeler Plus make sure of the following:

- A Modeler project file is open, and the project file contains at least one room model.
- The model to which you will listen contains a sound system, composed of at least one loudspeaker.
- At least one listener location within the model is selected and enabled within the Playlist Tab.

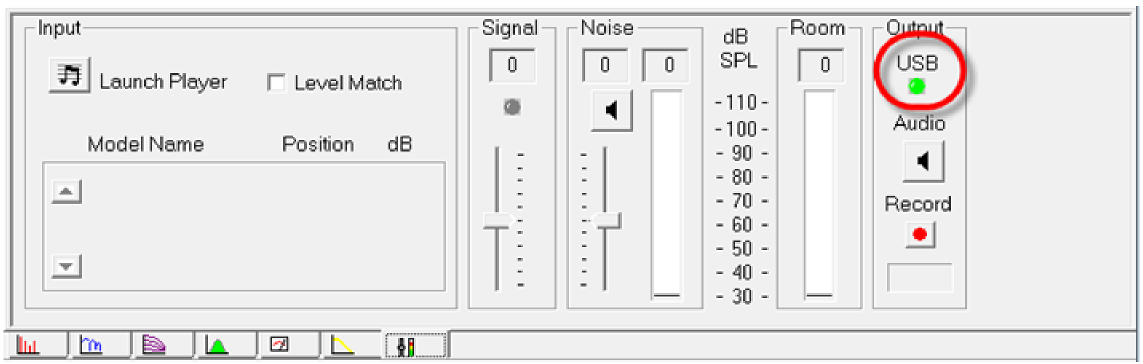
Auditioner® Playback System Connection

To enable the filter playback functions within the Modeler Plus software, the Auditioner Playback System must be connected to your PC through an active USB port, and the unit must be powered ON.

When a playback unit is not connected to the PC the Playback Tab will be inactive, and the USB indicator in the output section will be red, as shown below:



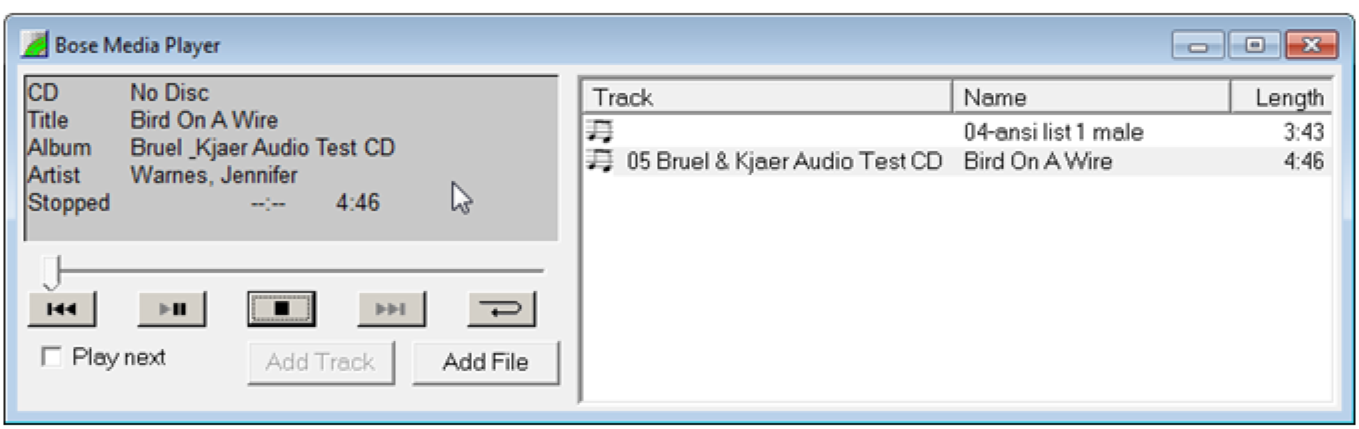
Once the Auditioner playback system is connected to the PC, and powered ON, the Playback tab will be active, and the USB indicator will be green, as shown below:



Bose Media Player

Modeler Plus software includes a dedicated media player to control the audio source program material during listening sessions. The Bose Media Player runs as a separate program (it shows up as a separate item in the taskbar) but it opens and closes from within Modeler Plus software.

The Bose Media Player automatically opens when a project is open and the Auditioner® Playback System III is connected to your computer and powered on. When the project is closed, or the Auditioner® Playback System III is disconnected, the Bose Media Player is automatically closed.



Launching the Media Player

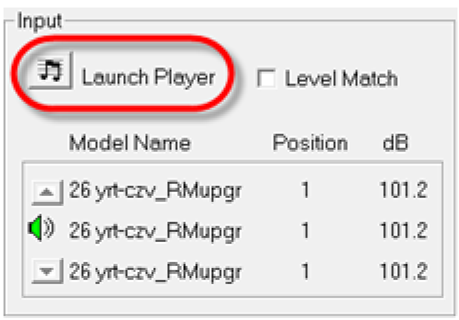
The Bose Media Player will only launch if all the following conditions are met:

- A project is open.
- The Auditioner® Playback System III is connected to your computer.
- The Auditioner® Playback System III is powered on.

The Bose Media Player will automatically close under any of the following conditions:

- The project is closed.
- The Auditioner® Playback System III is disconnected.
- The Auditioner® Playback System III is powered down.

If you close the Bose Media Player by clicking on the "X" in the upper right hand corner of the Bose Media Player window, it can be re-launched from the Playback tab. Click on the Launch Player button to launch the Bose Media Player:

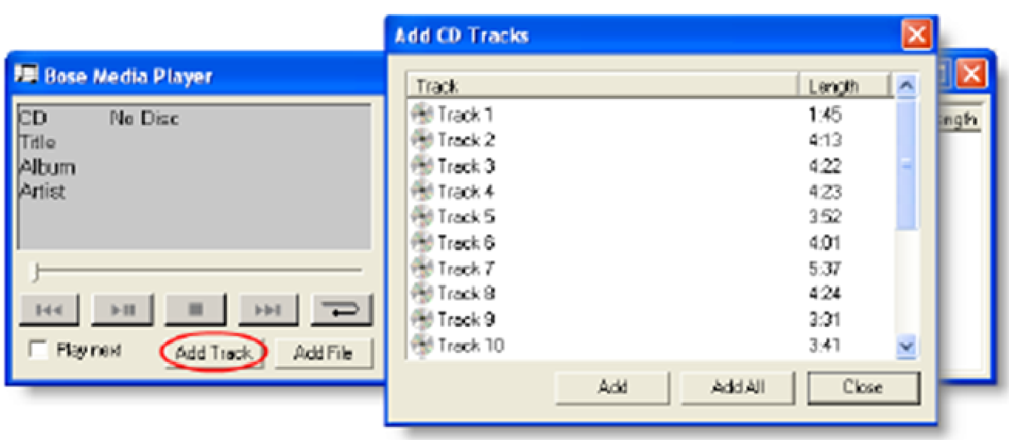


Media Player launch button

Tip: You can also re-launch the Bose Media Player by pressing Shift + Ctrl + P.

Adding CD Audio

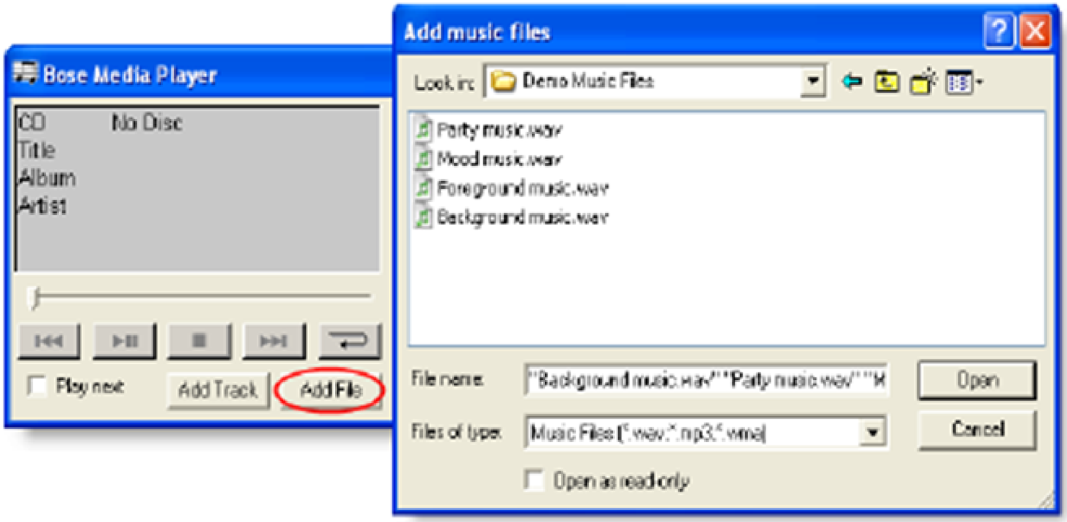
To add audio tracks from an audio CD, insert the CD into a drive on your computer and click the Add Track button on the Bose Media Player. Select tracks from the CD and click Add, or click Add All to load all tracks from the CD.



If you eject the CD from your computer, the tracks are automatically removed from the Bose Media Player.

Adding Audio Files

To add audio files that are on your hard drive or on an external drive, click the Add File button on the Bose Media Player. Navigate to the location of the audio tracks and click Open:

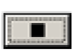


If you move or delete an audio file from the hard drive, it will not play in the Bose Media Player. When you close and reopen the Bose Media Player, the file is removed.

Note: The playlist you create is available every time the Bose Media Player opens; it is not associated with the project.

Playing Audio Files

Use the following transport controls to control the Bose Media Player:

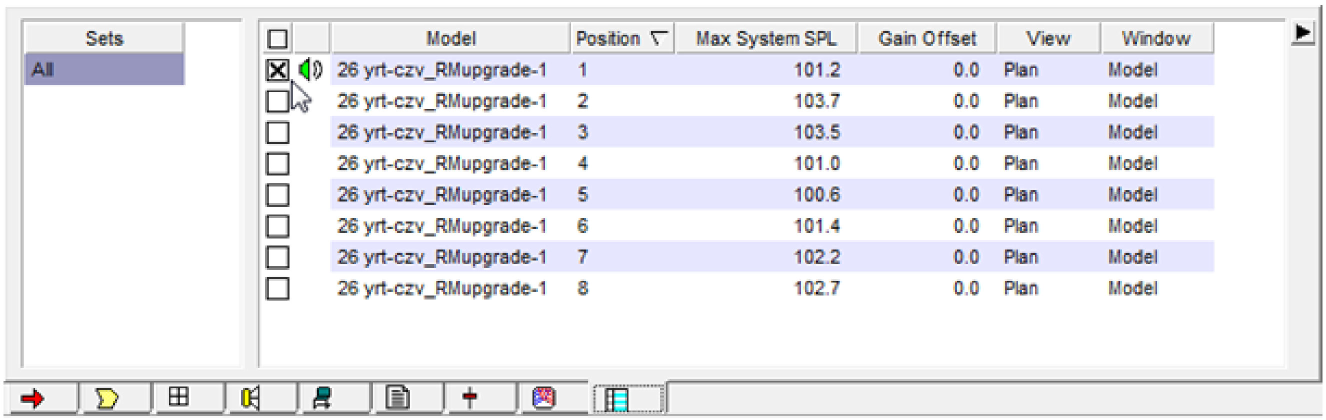
Play/Pause 	Press once to begin playing the selected track. Press while a track is playing to pause the track.
Stop 	Press to stop the track and rewind to the beginning.
Previous 	Play the previous track if within 3 seconds of the beginning, otherwise go to the beginning of the current track.
Next 	Play the next track.
Repeat 	Press to repeat the current track. Press again to disable repeat. Repeat is particularly useful when you are comparing listener positions or presenting a design. With repeat on, the track will automatically start over each time it reaches the end.
Play Next 	When checked, the next track in the playlist is played when the current track is finished. When unchecked, play is stopped when the current track is finished.
Seek	Drag the slider to skip to a desired location in the track.

Playlist Tab

A Playlist is a collection of listener positions from one or more of the room models within the Project. Multiple playlists, called Sets, may be created within the project file, and the various sets are used to organize comparisons and demonstrations. For example, a set comparing the same listener positions in an empty and full occupancy condition.

The left hand side of the Playlist Tab contains all of the Sets that have been created for the project. The right hand side displays the listener positions, and their status, for the active Set. The default set, named "All", contains all listener positions within all open models.

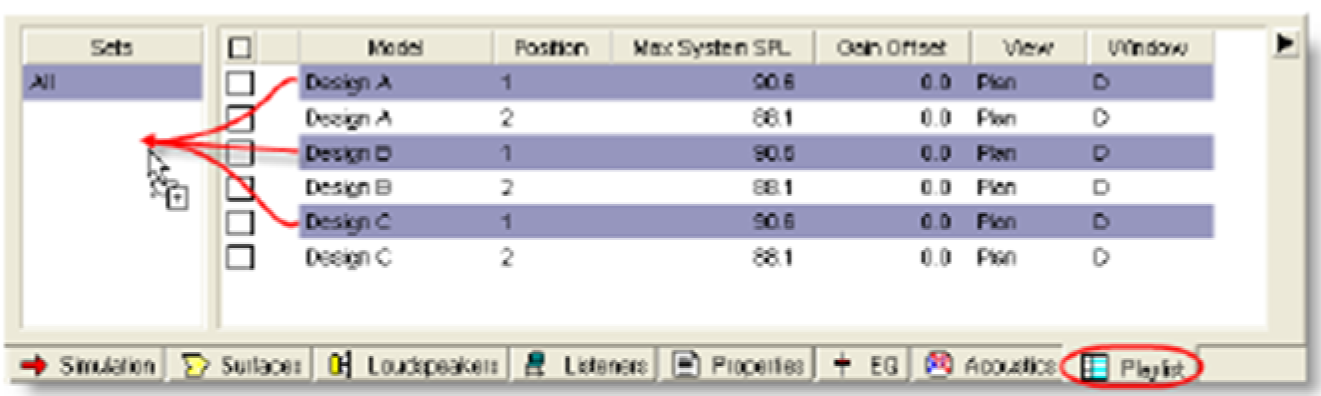


Creating A New Set

You can create a set that contains a selected subset of listeners. This is especially useful when comparing two models.

The following steps describe how to create a new set by clicking and dragging:

1. Select one or more listeners from the playlist panel by clicking on the listener name (hold Shift or Ctrl to select multiple listeners). Click once, and then drag the selected listeners to a blank area in the Sets list on the left. A new set is automatically created.

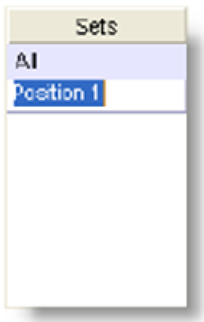


Selecting and dragging listeners to create a new set

The new set appears in the Sets panel and is named Untitled 1:

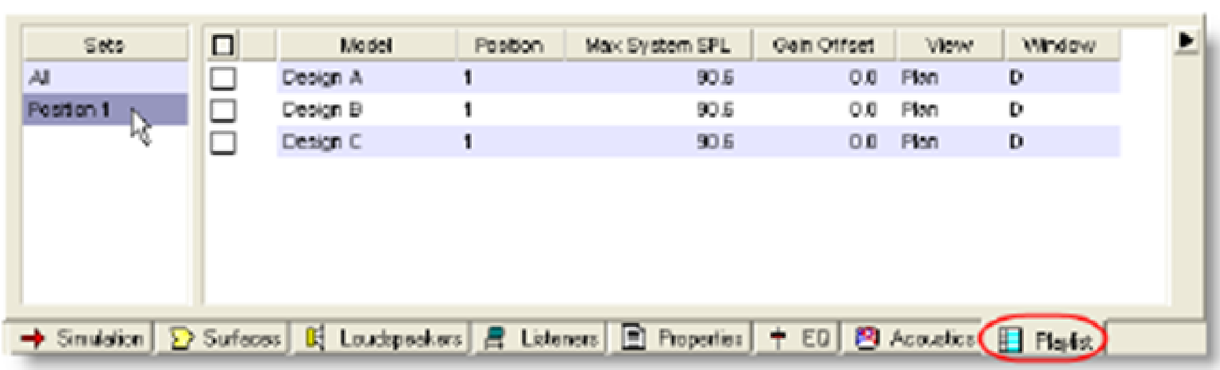
The new Untitled 1 Set

2. Rename the new set by double-clicking on the name (Untitled 1) in the Sets panel:



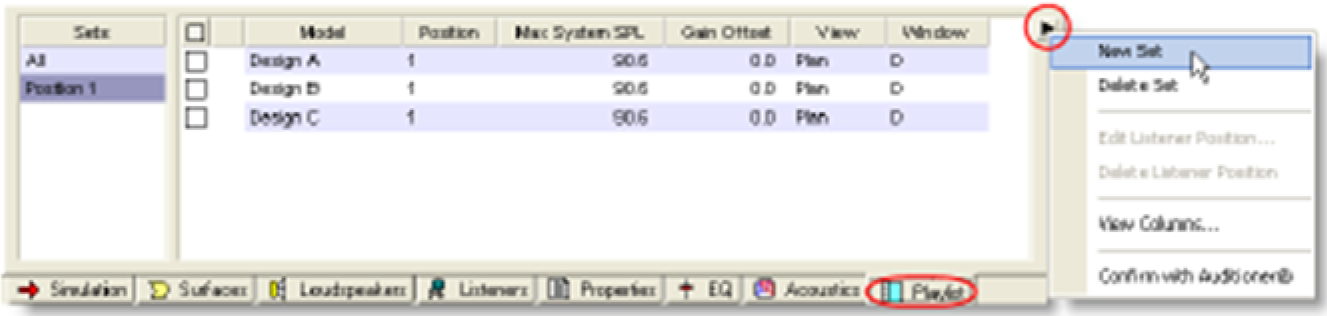
Renamed Set list

3. When you click on the new set to select it, the Playlist panel displays the listeners that belong to the set:



Follow these steps to create a new set using a different method:

1. Open the Playlist wing menu by clicking on the arrow in the upper-right corner of the tab:



2. Choose New Set. A new set is created in the Sets panel. You can rename the set by double-clicking on it. To add a listener to the new set, simply click to select, then click, drag and drop them into the new set.

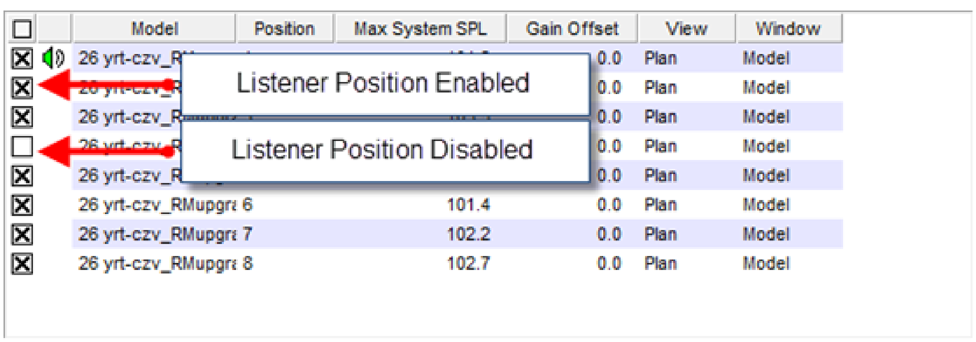
   To delete a set, select the set and choose Delete Set from the Playlist wing menu. The deletion of a set cannot be undone.

Adding Listeners To An Existing Set

Listeners can be dragged into existing sets at any time. For example, if you want to add another listener to the new set you created, select the desired listener from the All list by clicking once. Click again and drag the row into the new set.

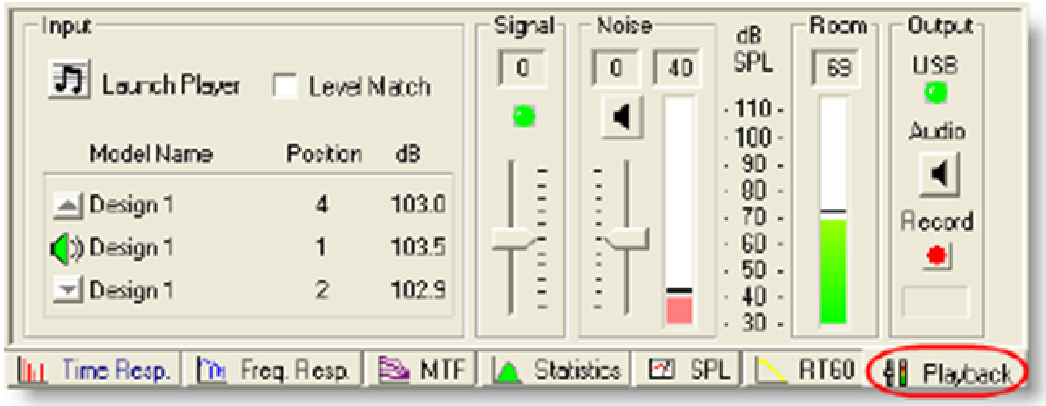
Enabling Listener Positions for Simulation

While a playlist includes a number of listener positions it is possible to exclude positions from the simulation. To include a position in the simulation, place an "x" in the Activate Listener checkbox.



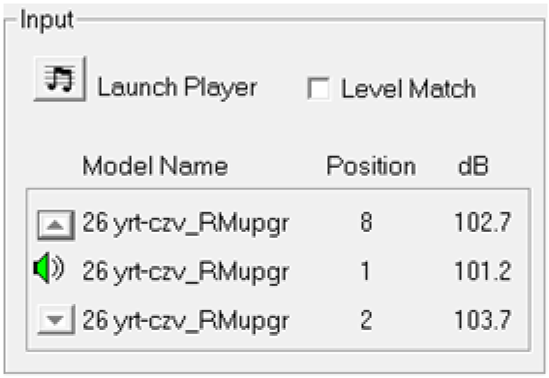
Playback Tab

The Playback tab allows you to control the playback of the listener positions within the playback queue. The panel layout is partitioned into five blocks: Input, Signal, Noise, Room, and Output.



Input

The Input section indicates what listener positions are being simulated, and contains controls to access the Bose Media Player and determine the type of simulation to be performed, relative or absolute.



Launch Player – selecting this item launches the Bose Media Player.

Level Match – select this item to level match listener positions for relative level playback.

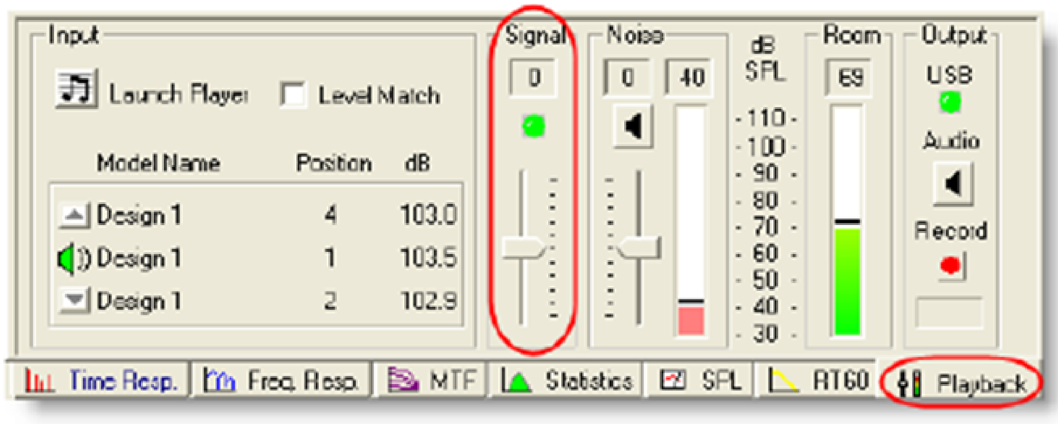
Playback Queue – Displays the previous, current and next listener position to be simulated. Items in the playback queue are loaded from those enabled listener positions within the active Set in the Playlist Tab.

The first two columns display the model name and listener position label for each listener. The third column displays either the maximum system SPL for the listener position, or, when level match is selected, the gain offset for the listener position.

Scroll through the listeners using the arrows in the Controls group. You can also use the keyboard shortcuts to scroll through listeners: Ctrl+f and Ctrl+g. Alternatively, you can use Ctrl and the left and right arrow keys.

Signal

Conceptually, the signal gain slider allows you to control the volume of your program material on a mixer. As the slider is adjusted, the sound level changes accordingly. The signal gain field reflects the current value of this adjustment.



It is possible to raise the signal gain slider above the level that the installed system is capable of reproducing at a given listener location. The system clip indicator (above the Signal slide control) is used to indicate this state.

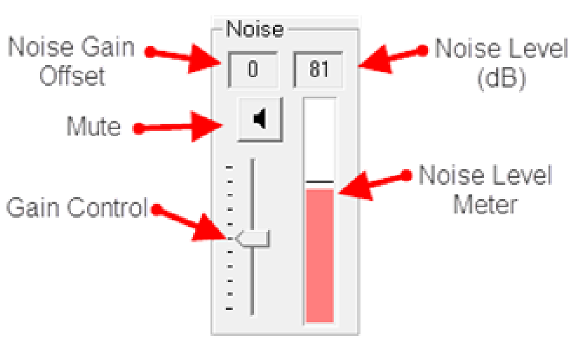
The system clip indicator has three states: No signal present (gray), signal present and not clipping (green), and signal present and clipping (red). Only the sound system signal is used to set the state of this indicator. In other words, the background noise cannot cause system clipping.

Noise

The Noise control allows you to include background noise in the simulation. Typically the simulation is performed without background noise, but including this in the simulation provides a more representative demonstration of system performance, and can aid in judging the intelligibility of the system.

Noise control is only active when a background noise file has been specified from within the Acoustics Tab. When working with standard noise files, NCB or RC, a noise source with a spectrum shaped to the selected curve is mixed into the simulation, and the Noise Gain control is locked.

When working with a custom noise file, either one of the provided files, or a custom binaural recording, the noise gain control is enabled, and the noise level, in dB is calculated, and mixed into the simulation. When the noise level is changed, the new value is used to calculate STI. If the map is visible, it will be updated automatically.



Noise Gain – displays the current amount of gain applied to the original noise file. Only available for custom noise files.

Mute – mutes the background noise

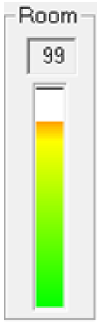
Gain Control – adjusts the background noise level

Noise Level – the current background noise level in dB SPL.

Noise Level Meter – displays the current noise level, relative to the level scale.

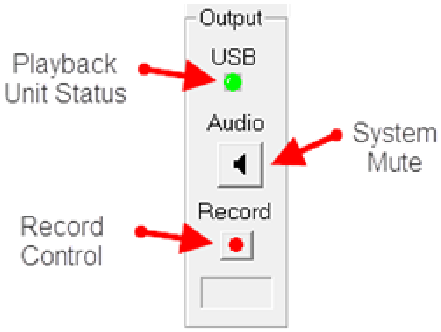
Room Level

The room level meter combines both the signal and the noise in the room as predicted at the current listening location. The room level is displayed in dB SPL on the meter shown below. The room level field above the meter bar is updated every 1.25 seconds, while the meter bar is updated every 250 milliseconds.



Output

The output section displays the status of the playback system, and provides a system mute and recording control.



Playback Unit Status – The USB detection indicator is green when the Auditioner® playback unit is detected. When the playback unit is not detected, or gets disconnected, the indicator is red and no audio can be processed.

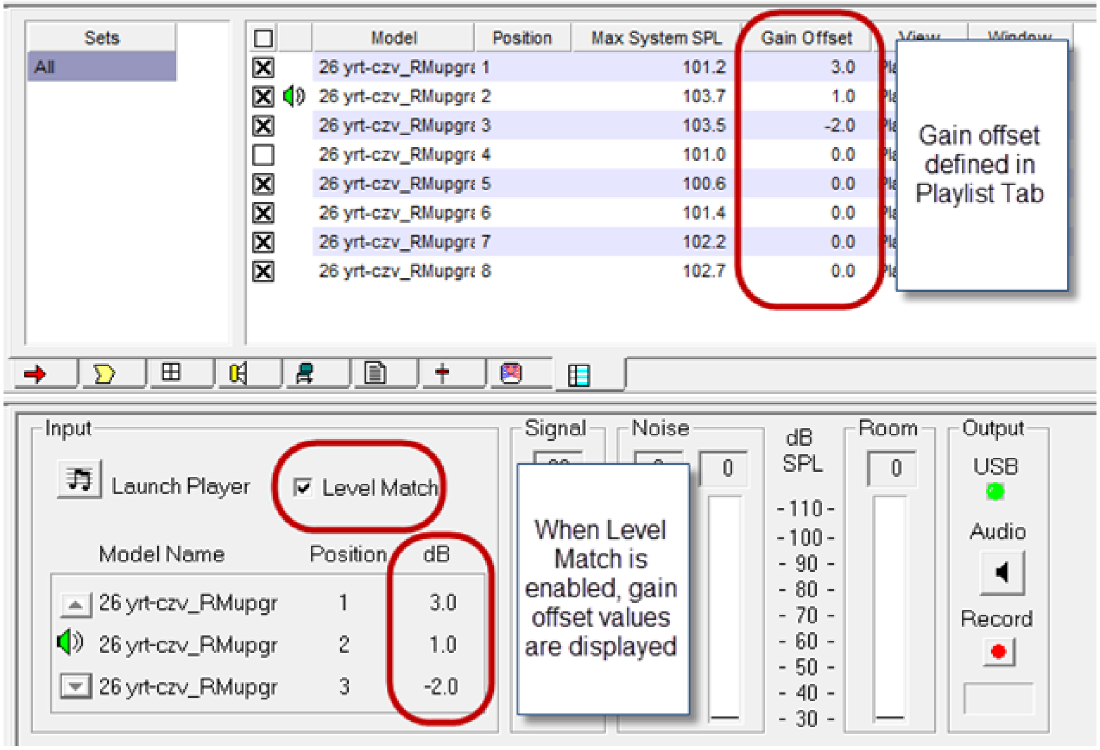
System Mute - Use the System Mute button to mute the playback. When you press the button again to unmute, there is a short ramp-up time before full volume is restored. The ramp-up time cannot be adjusted.

Tip: If you have enabled Direct keys, you can use the direct key shortcut to mute the sound: the M key. You can enable Direct keys in the General tab of the Application Preferences dialog box. To mute the signal, press pause in Media Player.

Record Control – Processed audio can be recorded and saved to a (.wav) file for future playback. When recording, the current recording duration is displayed in the elapsed time field located below the record toggle button. To stop recording, click on the toggle a second time.

Relative and Absolute Level Playback

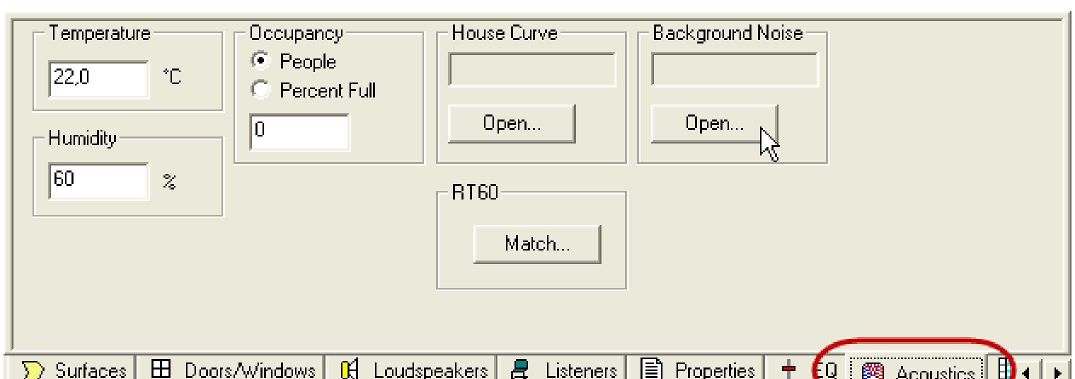
The default playback mode for an Auditioner simulation is absolute level. In this mode the absolute level differences between listener positions are maintained; a filter with a maximum SPL of 90 dB will be played back louder than a filter with a maximum SPL of 80 dB. In some cases it is easier to make spectral comparisons between listener locations if the playback levels are similar. The Level Match feature automatically adjusts the level of each listener by the relative difference, or gain offset, for each filter as defined within the Playlist Tab. In this mode a filter with +1 dB gain offiset will only be 1 dB louder than a filter with 0 dB gain offset, even though their absolute level differences may be much greater.



Including Background Noise in Auralization

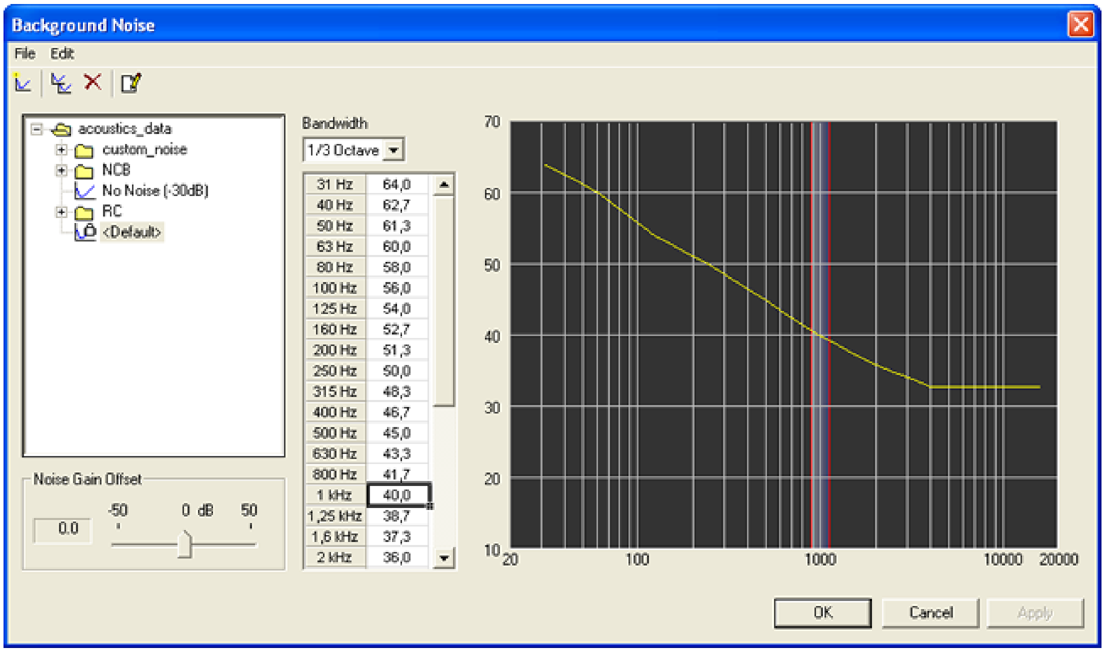
To assign a background noise profile to a model:

1. Click on the Acoustics tab in the Detail window.



Acoustics tab

2. Under Background Noise, click on the "**Open**..." button. The following screen appears:



Background noise window

3. Select an existing noise curve from the library on the left window frame, or create/duplicate/modify noise curves.

Note: You may create a new noise curve, or duplicate and rename an existing noise curve. If you do so, there will be no corresponding audio (.wav) file, and therefore no noise will be played for listeners in models with this noise assigned.

There are three types of noise files: standard, custom, and user created noise files. The audio (.wav) files associated with standard noise files are locked binaural files of shaped white noise. Custom noise files are recordings of real environments that have been processed for playback on Auditioner®. Unlike standard noise files, these files are unlocked and the level may be adjusted as needed for a given model. A user created noise file will have no associated audio (.wav) file.

When playing a listener in Auditioner®, the selected background noise will be played (unless muted). When you use the noise volume slider in the Playback tab to adjust the noise volume, the STI map is recalculated and redrawn if visible. When changing listeners the noise gain offset is set to 0, and the change is retained in the model.

Tip: If you mute the noise, the room level will be the same as the signal level. If you mute the signal by pressing pause/stop in the Bose Media Player, the room level will be the same as the noise level.

Recording and Playing Auditioner® Audio Output

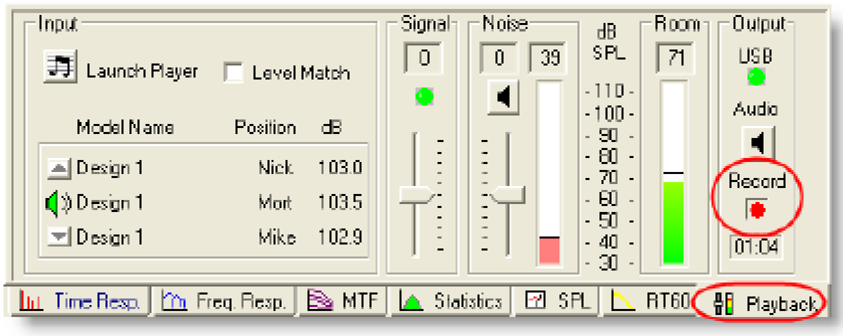
Recording audio output

The processed audio output from Auditioner can be recorded to a (.wav) file. You can then burn the (.wav) file or files onto a CD along with a calibration tone. This allows you to use the Auditioner Playback System III to play pre-recorded audio from outside Modeler, which is helpful in the following situations:

- If a client or field engineer wants to listen to a sound system without a computer.
- If you want to create a copy of the audio files to use as a backup for a demonstration.

Follow these steps to record processed audio output:

1. During listener playback, press the **Record** button in the **Playback** tab. When recording, the button will be displayed in a depressed mode and the display of elapsed time will be shown:



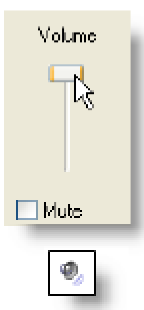
Record button

2. While pressing the **Record** button, Modeler Plus software records the output of any listener being played, including any volume changes. As you record, the elapsed time is updated.
3. To stop recording, press the **Record** button again.
4. The **Save As** dialog box opens where you can name the file and specify a location in which to save it.
5. When burning a CD of the (.wav) file output, you should include the calibration tone for calibrating the Auditioner® Playback System III. The calibration tone can be found in the **Extras** folder on the Modeler Plus software installation CD.

Calibrating playback of Auditioner® recordings

You can ensure that your recordings are played at the intended level by taking the following steps to calibrate playback from a CD or (.wav) file player:

1. Place the CD with the calibration tone into a CD player, or load the calibration tone into a media player on your computer.
2. If you are using a media player on your computer, make sure your system volume is set to maximum.



Setting system volume to maximum

3. Connect the CD player to the Auditioner® Playback System III using the supplied cable, or use a USB cable to connect the Auditioner® Playback System III to your computer.
4. Toggle the **Calibrate** button on the front of the Auditioner® Playback System III to the up position to engage calibration mode.
5. Play the calibration tone.
6. The LED read-out on the front of the Auditioner® Playback System III provides the following information:

LED Color	Status	Meaning
Red	Calibration High	Incoming signal is too high. Decrease the volume level on the CD player or media player
Green	Calibration Reference	Unit is calibrated within ±1 dB SPL.
Yellow	Calibration Low	Incoming signal is too low. Increase the volume level on the CD player or media player.

7. Adjust the volume level on the CD player or media player until the calibrate LED is green.
8. After setting the volume level on the CD player or media player, do not change the volume for the duration of the playback session.
9. Toggle the **Calibrate** button on the Auditioner® Playback System III to the down position to engage the SPL meter.

Integrating Auditioner® recordings into Microsoft PowerPoint presentations

Recorded output can be used to make effective and dynamic PowerPoint presentations.

1. Make a PowerPoint slide that shows a coverage map by using the Copy/Paste functionality.
2. Insert a (.wav) file recorded from the model into the PowerPoint slide.
3. Play the (.wav) file during the presentation.
4. For more information on Copy/Paste functionality, see Copying and Pasting Data.

Documenting System Performance

Summary of Functions

The Modeler software provides basic print functionality for the creation of printed documentation. In addition, all windows within the application include a copy function so that charts, graphs and model views may be copied/pasted into other applications, such as Microsoft Word, for use in documentation and reports.

For instructions on using these functions, see:

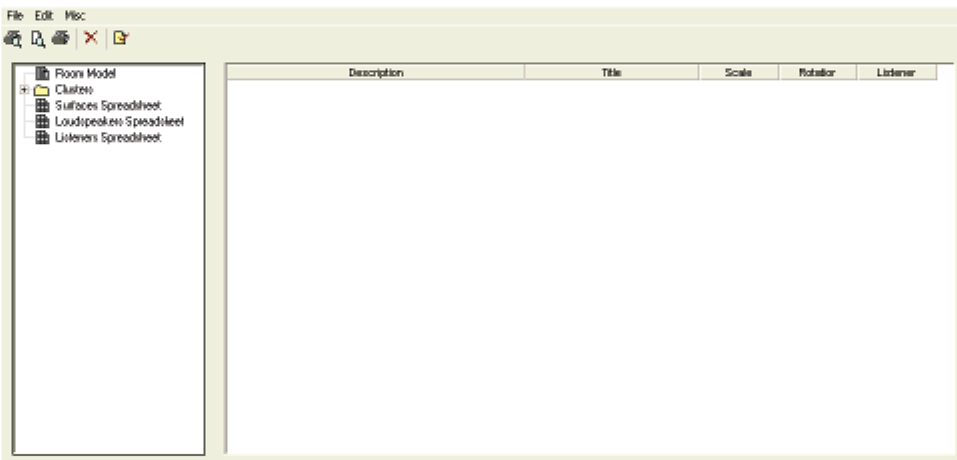
- Printing Documents
- Copying and Pasting Data
- Copy/Print Preferences

Printing Documents

To print directly from Modeler software:

1. Go to File > Print.

   The Print window opens:



Print window

2. Create a list of documents to be printed by dragging items from the left window into the print list on the right.

   You can open folders and select items in the left window as you would in Windows Explorer.

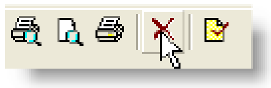
   You have the option to print:

   - The room model
   - Individual clusters
   - Surfaces, Listeners, and Loudspeakers spreadsheets
   - Coverage maps

The documents that are available to print depend on the state of your model. For example, you will not have the option to print coverage maps unless they have been generated in your model.

Keep the following things in mind when you create a print list:

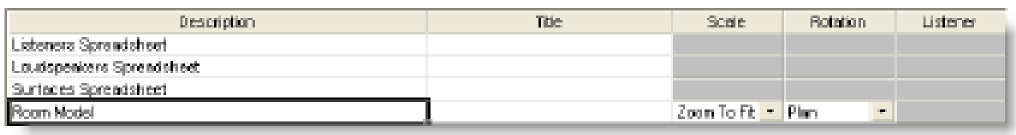
- Folders cannot be dragged into the list, only individual items.
- To drag more than one item at a time, hold down Ctrl to select multiple separate items or Shift to select a range of items.
- To delete an item from the print list select the item and click the delete button:



Delete button

- You cannot re-arrange the order of documents in the print list. Print them out and re-order the documents by hand.

The print window provides the ability to change the format of your printout:



Fields in the print list

- Add a Title to your printout which appears in the heading bar with the Bose logo.
- Change the Scale of the model display in the printout.
- Change the view (Rotation) of the model display in your printout. Choosing Custom allows the user to specify rotation about the X and Z axes. Choosing Camera enables a view from one of the listener positions.

Print preview and print setup

Access the Print Setup window from the Print window by clicking on the Print Setup button:

Print Setup button

Use the Print Setup to change printing options such as printer selection, paper options, and paper orientation.
To preview what your printout will look like before you print, click the Print Preview button:

Print Preview button

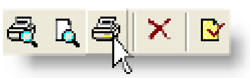
Print Preview window toolbar

Use the following features in the Print Preview toolbar:

Print...:	Open the print dialog box.
Next Page:	Preview the next page in the printout.

Prev Page:	Go back one page in the printout.
Two Page/One Page:	Switch between viewing one page at a time, and two pages at a time.
Zoom In:	Zoom in on the printout.
Zoom Out:	Zoom out on the printout.
Close:	Close the Print Preview window.

When you are ready to print, click the **Print** button from the Print Preview window, or click the **Print** button in the **Print** window:



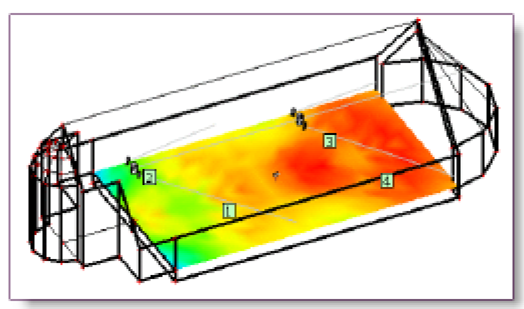
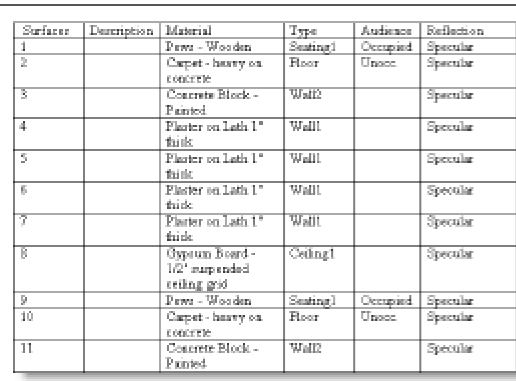
Print button

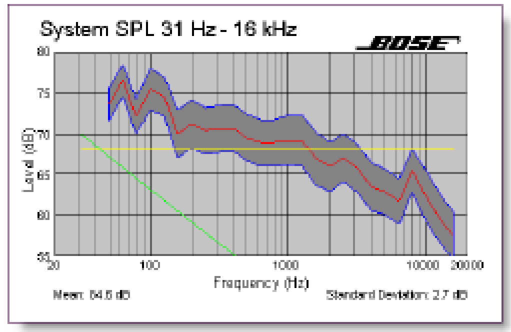
Copying and Pasting Data

Graphs, charts, and data can be transferred from Modeler software into a report or presentation using the Microsoft Windows copy/paste functionality. You can copy graphs and information from the tabs in the Data window and the Detail window, and paste into Microsoft Word or Microsoft PowerPoint.

Note: The Copy/Paste functionality in Modeler software was designed to work with Microsoft Word and Microsoft PowerPoint. You may experience problems when attempting to paste into other applications. You also can Copy Grid/Paste into Microsoft Excel.

The following table outlines the copy/paste functionality in the Modeler software interface:

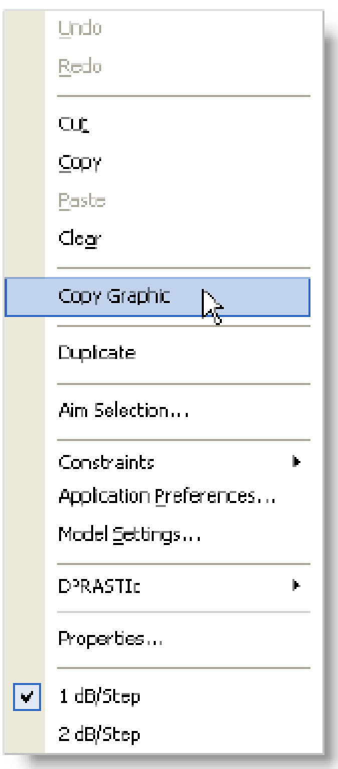
<table>
<tr><th>Window</th><th>Action</th><th>Pasted Example</th></tr>
<tr><td>Modeling Window:</td><td>Right-click to Copy Graphic</td><td>
</td></tr>
<tr><td>Detail Window:</td><td>Right-click to Copy Grid</td><td>
<table>
<tr><th>Surfaces</th><th>Description</th><th>Material</th><th>Type</th><th>Audience</th><th>Reflection</th></tr>
<tr><td>1</td><td></td><td>Pews - Wooden</td><td>Seating1</td><td>Occupied</td><td>Specular</td></tr>
<tr><td>2</td><td></td><td>Carpet - heavy on concrete</td><td>Floor</td><td>Unocc</td><td>Specular</td></tr>
<tr><td>3</td><td></td><td>Concrete Block - Painted</td><td>Wall2</td><td></td><td>Specular</td></tr>
<tr><td>4</td><td></td><td>Plaster on Lath 1" thick</td><td>Wall1</td><td></td><td>Specular</td></tr>
<tr><td>5</td><td></td><td>Plaster on Lath 1" thick</td><td>Wall1</td><td></td><td>Specular</td></tr>
<tr><td>6</td><td></td><td>Plaster on Lath 1" thick</td><td>Wall1</td><td></td><td>Specular</td></tr>
<tr><td>7</td><td></td><td>Plaster on Lath 1" thick</td><td>Wall1</td><td></td><td>Specular</td></tr>
<tr><td>8</td><td></td><td>Gypsum Board - 1/2" suspended ceiling grid</td><td>Ceiling1</td><td></td><td>Specular</td></tr>
<tr><td>9</td><td></td><td>Pews - Wooden</td><td>Seating1</td><td>Occupied</td><td>Specular</td></tr>
<tr><td>10</td><td></td><td>Carpet - heavy on concrete</td><td>Floor</td><td>Unocc</td><td>Specular</td></tr>
<tr><td>11</td><td></td><td>Concrete Block - Painted</td><td>Wall2</td><td></td><td>Specular</td></tr>
</table>
*Note - table shown after converting text to table (see Copying and pasting grids).</td></tr>
</table>

Window	Action	Pasted Example
Data Window:	Right-click to Copy Graph	

Copying and pasting graphics

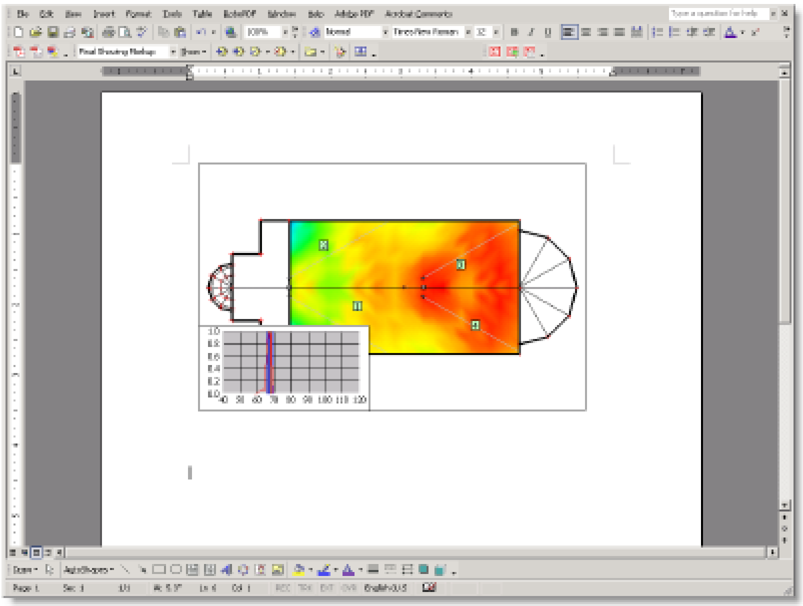
Follow these steps to copy and paste a coverage map from Modeler software into another program.

1. Open the program where you wish to paste the graphic, in this case Microsoft Word.
2. Right-click in the **Modeling** window and select Copy Graphic.



Right-click to copy graphic

3. Switch to Microsoft Word, and press Ctrl + V to paste the graphic (or click Edit > Paste). The map is pasted into Word:



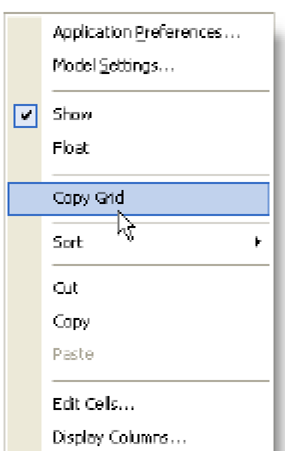
Pasting into word

Note: To turn off the histogram when pasting, go to Edit > Application Preferences and click on the Copy/Print tab. Under Model/Map, turn Histogram to Off.

Copying and pasting grids

When you copy and paste a grid from the **Detail** window (except for the **EQ** tab), the output is in spreadsheet format. When you paste this output into Microsoft Excel, you will find that the data is automatically pasted into rows and columns. When you paste into Microsoft Word, you will need to format the data by putting it into a table. Follow these steps to copy and paste data from the **Detail** window into Microsoft Word. This example uses the Surfaces tab:

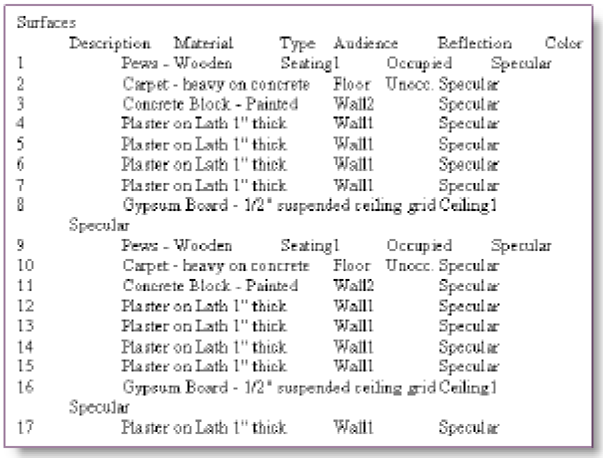
1. Select the **Surfaces** tab, right-click and choose **Copy Grid**.



Copy grid

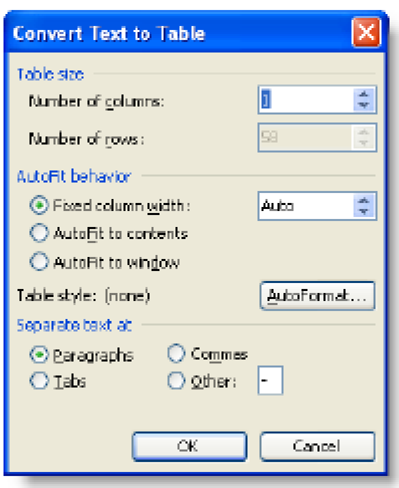
2. Paste into Microsoft Word.

3. The data is pasted as text, separated by tabs.


Surfaces
Description Material Type Audience Reflection Color
1 Pews - Wooden Seating1 Occupied Specular
2 Carpet - heavy on concrete Floor Unocc. Specular
3 Concrete Block - Painted Wall2 Specular
4 Plaster on Lath 1" thick Wall1 Specular
5 Plaster on Lath 1" thick Wall1 Specular
6 Plaster on Lath 1" thick Wall1 Specular
7 Plaster on Lath 1" thick Wall1 Specular
8 Gypsum Board - 1/2" suspended ceiling grid Ceiling1
Specular
9 Pews - Wooden Seating1 Occupied Specular
10 Carpet - heavy on concrete Floor Unocc. Specular
11 Concrete Block - Painted Wall2 Specular
12 Plaster on Lath 1" thick Wall1 Specular
13 Plaster on Lath 1" thick Wall1 Specular
14 Plaster on Lath 1" thick Wall1 Specular
15 Plaster on Lath 1" thick Wall1 Specular
16 Gypsum Board - 1/2" suspended ceiling grid Ceiling1
Specular
17 Plaster on Lath 1" thick Wall1 Specular

Grid data pasted into Microsoft Word

To format the data you will need to put it into a table. One way to do this is to select all the data in the Word document that you just pasted, and choose **Table** > **Convert** > **Text to Table....**
The **Text to Table** dialog box will open in Word, allowing you to specify how the data is put into a table:



Text to Table dialog box

4. Choose **Tabs** under **Separate text at**. Click **OK**.
5. The data is placed into columns and rows, allowing you to more easily customize its appearance.

Surfaces						
	Description	Material	Type	Audience	Reflection	Color
1		Pews - Wooden	Seating1	Occupied	Specular	
2		Carpet - heavy on concrete	Floor	Unocc.	Specular	
3		Concrete Block - Painted	Wall2		Specular	
4		Plaster on Lath 1" thick	Wall1		Specular	
5		Plaster on Lath 1" thick	Wall1		Specular	
6		Plaster on Lath 1" thick	Wall1		Specular	
7		Plaster on Lath 1"	Wall1		Specular	

Grid data after being placed in a table

Copy/Print Preferences

The appearance of graphs and tables can be customized when copying/pasting and printing. These options can be changed in the Application Preferences dialog box.

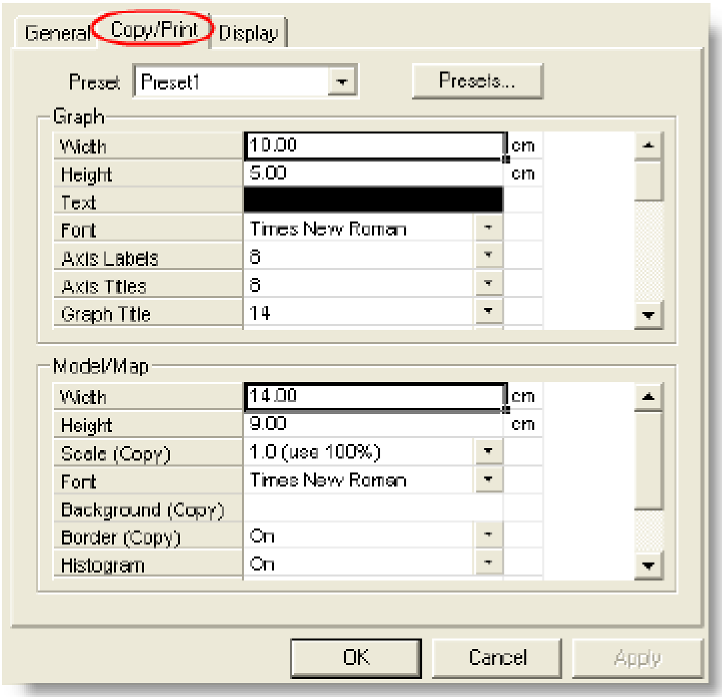
To access the copy/print preferences:

1. Click on the Application Preferences button in the Print window toolbar:

Application Preferences button

The **Application**Preferences dialog box opens.

2. Click on the **Copy/Print** tab.



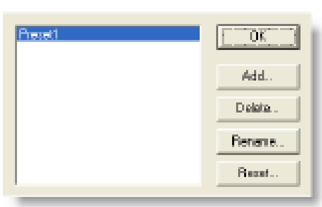
Copy/Print preferences

Copy/Print Presets

You can create, save, and load customized Copy/Print preferences using the Presets feature. Follow these steps to create a new preset:

1. Set your desired Copy/Print preferences.
2. Click the Presets... button.

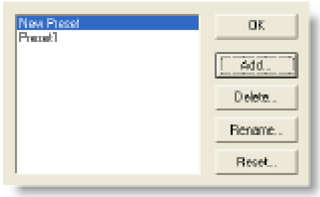
   The Presets dialog box opens:



Presets dialog box

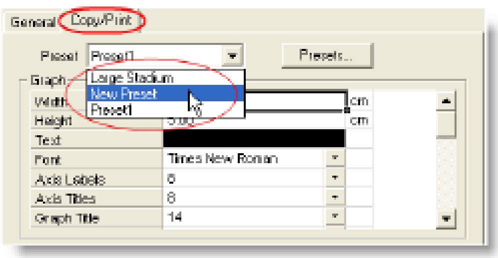
3. Click the **Add...** button.
4. Name your new preset and click **OK**.

   Your new preset is added to the list of presets.



Adding a new preset

5. Choose your new preset from the Preset drop-down menu in the Copy/Print tab of the Application Preference dialog box to load your Copy/Print preferences.



Loading a customized preset

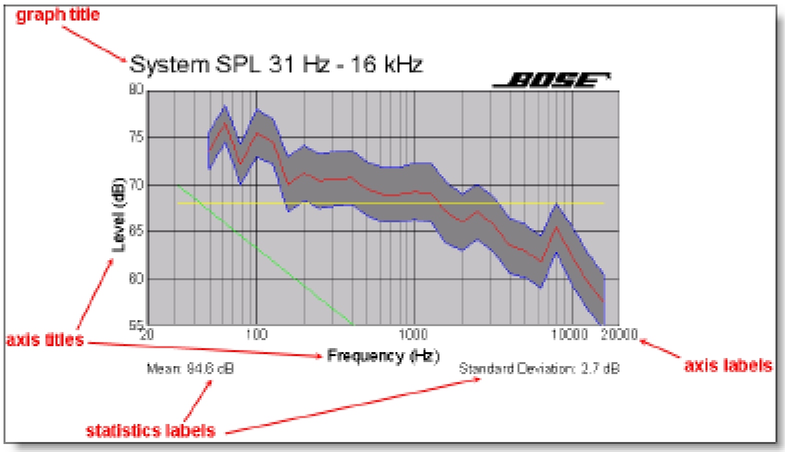
Graph Preferences

The Graph settings control how graphs from the Data window are copied and pasted. The following explains each function:

Width:	The width of your graph when pasted into another application, displayed in English or Metric values depending on which is selected in the Drawing/Saving tab in the Model Settings dialog box.
Height:	The height of your graph when pasted into another application, displayed in English or Metric values depending on which is selected in the Drawing/Saving tab in the Model Settings dialog box.
Text:	The text color for your graph when pasted. Double-click to open the color picker.
Font:	The font used for text in your pasted graph. Click the drop-down to choose a font.
Axis Labels:	The font size for your graph axis labels (numbers). Click the drop-down to choose a font size.
Axis Titles:	The font size for your graph axis titles. To turn off axis titles, select “None” from the drop-down.
Graph Title:	The font size for your graph title. To turn off the graph title, select “None” from the drop-down.
Statistics Labels:	The font size for the statistics text displayed below the graph. To turn off statistics labels select “None” from the drop-down (Statistics, MTF, and SPL tab only).
Background:	Background color for the graph. Double-click to open the color picker.
Opaque:	If set to “Off”, the background color selected in the Background will be displayed. If set to “on”, the background will be opaque, with no color.
Major Divi-	The color of major division lines in the graph grid. Double-click to open the color picker.

sion:	
Minor Division:	The color of the minor division lines in the graph grid. Double-click to open the color picker. (Applies only to Freq. Resp. tab, RT_{60} tab, SPL tab and EQ tab).
Shading:	The color for the shaded area representing standard deviation. (Applies only to the SPL tab and the Statistics tab).

Use the following figure for a reference to the graph elements.



Graph elements

Model/Map preferences

The Model/Map section controls how models and coverage maps are copied, pasted, and printed. The following explains the function of each field:

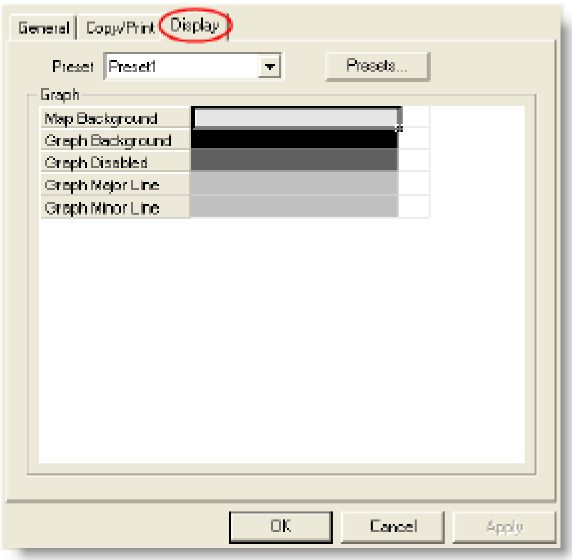
Width:	The width of your model or coverage map when pasted into another application or printed, displayed in English or Metric values depending on which is selected in the Drawing/Saving tab in the Model Settings dialog box.
Height:	The height of your model or coverage map when pasted into another application or printed, displayed in English or Metric values depending on which is selected in the Drawing/Saving tab in the Model Settings dialog box.
Scale (Copy):	The resolution of the image when copying a graphic. 1.0 is the lowest resolution; 3.0 is the highest resolution. Only available for Copy/Paste.
Font:	The type of font used for text in your graph.
Background (Copy):	The background color of the map. Only available for Copy/Paste.
Border (Copy):	Turning “On” adds a border to the map. Only available for Copy/Paste.
Histogram:	Turning “On” adds the coverage histogram inset into the coverage map display.
Hist. Width (Copy):	The width of the histogram inset in the coverage map display. Only available for Copy/Paste.
Hist. Height (Copy):	The height of the histogram inset in the coverage map display. Only available for Copy/Paste.

Modeler for presentations

When giving presentations using a projector, or when copying to a file, sometimes you may wish to change the background colors of displays to make them clearer.

You can do this in the **Display** tab:

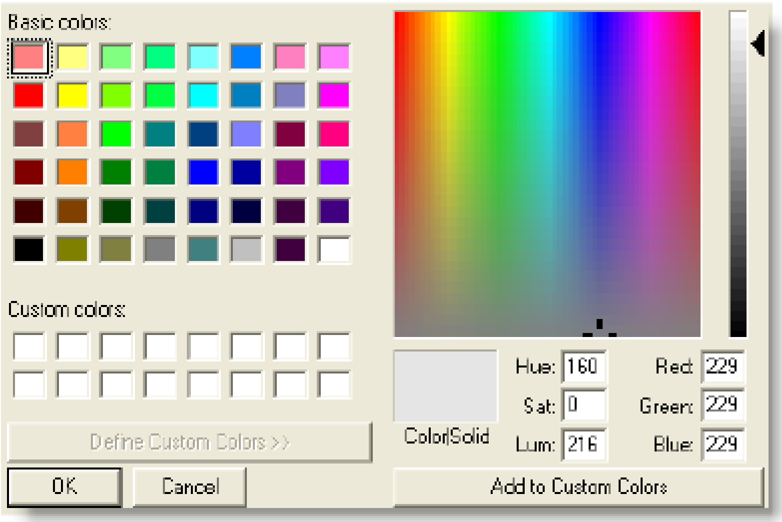
1. Click on **Edit**, and select **Application Preferences** (or simply click**Ctrl+E**).
2. Click on the **Display** tab.



*Application Preferences, **Display** tab*

Map Background:	Background color for the Model windows.
Graph Background:	Background color for the Data window (when there is data displayed).
Graph Disabled:	Background color for the Data window (when there is no data displayed).
Graph Major Line:	Line color for major increments in the Data window (e.g., 100 Hz, 1,000 Hz, 10,000 Hz).
Graph Minor Line:	Line color for minor increments in the Data window (e.g., 200 Hz, 300 Hz, 400 Hz).

3. Double-click on a color and the following color dialog box will automatically appear:



Color dialog box

4. After choosing a color, the selected color appears in the Color window.
5. Click OK.

Tutorials

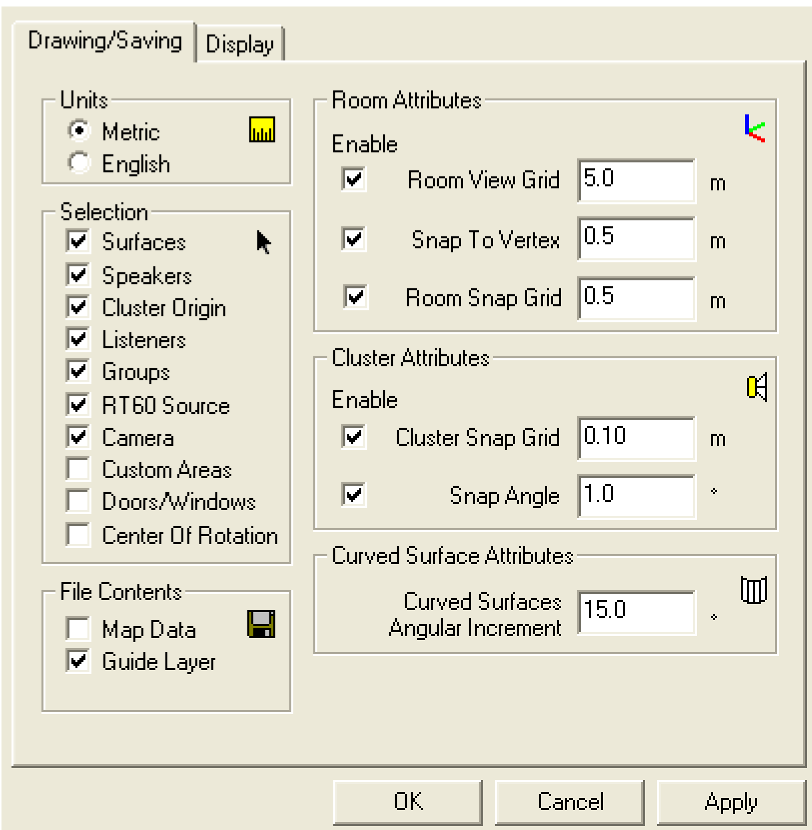
Modeling Workshop

Before you start

Before you start, create a new project and a new model by following these steps:

1. Launch Modeler software.
2. Choose File > New Project.
3. Name the new project “Workshop” and navigate to an appropriate folder to save the project in, or just choose the desktop. Click Save.
4. When the New Project window opens, choose New to create a new model.

The Model Settings window automatically opens by default:



Model Settings dialog box

Selecting model settings for the workshop

You have the ability to specify how numerous features in Modeler software will act based on the require-ments of your project.

In the **Model Settings** dialog box with the **Drawing/Saving** tab selected by default, follow these steps to set the Model Settings for the modeling workshop:

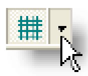
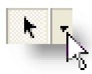
1. Make the following changes in the Drawing/Saving tab:
   A. Under **Room Attributes** (in the top-right corner), place a check mark next to **Snap to Vertex** to enable and make it 1.0 m. The vertices of each surface will now be highlighted in the model.

B. Under **Room Attributes** (in the top-right corner), place a check mark to enable **Room Snap Grid**, make sure the sensitivity is set to 0.5 m. This means that all objects will snap to half-meter sub-divisions of the grid.

C. Make sure there is a check mark in all the check boxes under **Selection**.

D. Under **Curved Surface Attributes**, enter a value of 30° for the Angular Increment. Curved surfaces in Modeler software are simulated as numerous flat surfaces joined together to form a curve. Under Curved Surface Attributes you specify the angular increment that is used to draw the curve. At each angular increment, a new surface is created, so the angular increment dictates how many flat surfaces are used to simulate the curved surface.

Tip: Wing menus are a convenient way to quickly change model settings as you work through a model.

	In the case above, the **Room View Grid** wing menu can be used to set the **Snap to Vertex** and **Room Snap Grid**.
	The **Select** tool wing menu can be used to select the types of objects you want to select with the mouse. In a complicated or cluttered model, you can remove the check mark from types of objects that you do not want to select with the mouse.

2. Click on **Apply**.
3. Select the **Display** tab.
4. Under **RT60** (located in the middle of Display tab window), click the **Size** drop-down menu and select Small.

This reduces the display size of the purple sphere representing the location of the RT60 source.

Note: The RT60 source represents the location where sound comes from when measuring the reverberant decay curve for the room.

5. Click on **OK**.

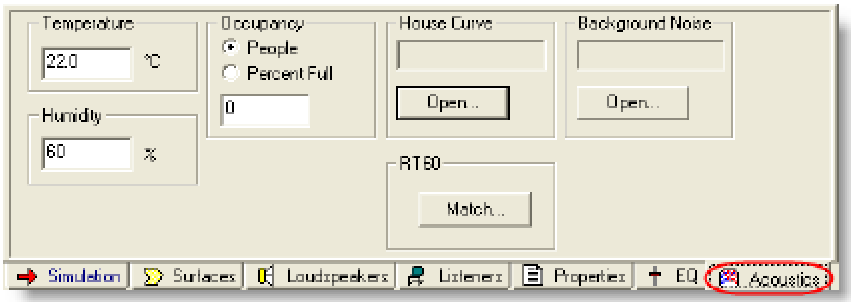
The **Name Model** window will automatically appear.

6. Name your new model "**Workshop Model.mdr**" and click OK.

Name Model window

7. Before you start modeling, set the acoustic parameters for the room and gain materials to be used in the model: Select the Acoustics tab in the **Detail** Window.

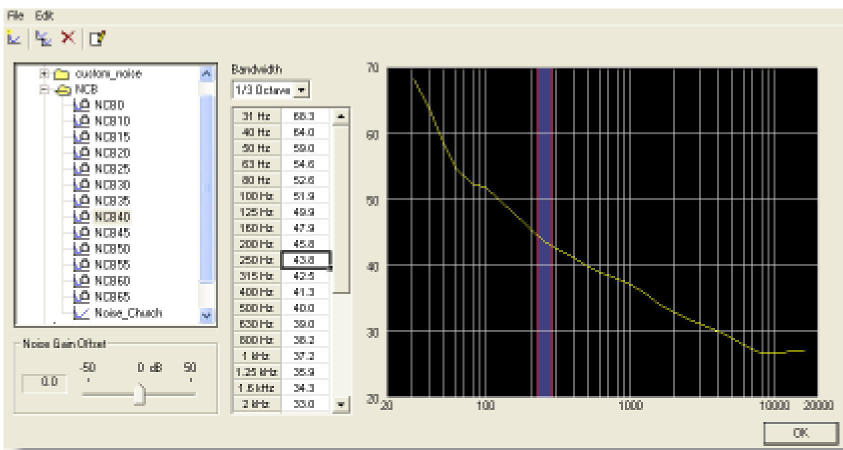
Here you can specify conditions that affect the room acoustics.



Acoustics tab

A. Enter 22 (°C) in the Temperature field.
B. Enter 60 (%) in the Humidity field.

8. Click **Open** under **Background Noise** and select **NCB 40.**
   This selection represents minimal background noise.

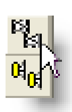


Background Noise

9. Click **OK**.
10. Leave the **Acoustics** tab open, and proceed to the next section.

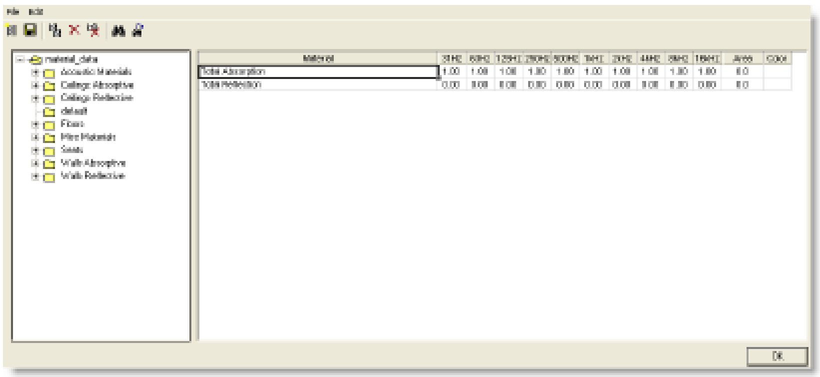
Working with the Material Database

Click the Material Database button in the Database toolbar (or press Ctrl + M):



Material Database button

The MaterialDatabase window opens:



Material Database window

Using this window, create a list of materials that you will use to build your model in the Material Database. You can select, modify, add, and delete materials, and save your own materials list. Total Absorption and Total Reflection simulation materials are displayed in the default Material list. You should always create a list of materials that match the actual room construction materials as closely as possible.

Each material file contains sound absorption coefficient data for the different octave bands from 31 Hz - 16 kHz.

Since most manufacturers only specify data from 125 Hz - 4 kHz. Models automatically duplicate data to low and higher bands.

Creating a materials list

The list of folders on the left side of the Material Database window is similar to Windows Explorer. To create a list of materials for your project, drag the material from the left pane to the Material list in the right pane.

The material database files can be found on your hard drive in:

(*Your*Local Drive) > Program Files > Bose > Bose Modeler 6.8 > data > material_data

Follow these steps to add new materials to the Material list:

1. Click the plus (+) sign next to the **Ceilings Absorptive** folder and select Mineral Board 5/8" ceiling tile and drag it into the right side of the window. The material and all of its absorption coefficient information is added to the Material list.

Tip: Materials are listed in alphabetical order inside each folder.

2. Add the following additional materials to the Material list:
   - From the Floors folder add Carpet **-** heavy on concrete.
   - From the Misc Materials folder add Glass **-** large pane, heavy glass.
   - From the Walls Reflective folder add Concrete Block **-** Painted and Brick **-** Bare.

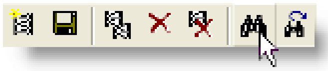
Finding a material

If you know the name or part of the name of a material, but you are unsure what folder it is in, you can search for it.

Follow these steps to search for a material:

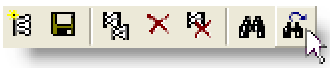
1. Click the **Find Material** button in the Material Database window.

   The Find dialog box opens:



Find Material button

2. Type "Wood" in the Search field.
3. Click **Find** and the first instance of Wood, Wood Roof Deck - tongue - in - groove, is highlighted in the left pane.
4. Click the **Find Next** button in the Material Database window until Pews - Wooden is highlighted in the left pane:



Find Next Material button

5. Add Pews - Wooden to your Material list.

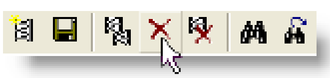
Leave the Material Database open and proceed to the next section.

Deleting a material

Deleting a material in the Material list only removes the material from the list. It is not permanently removed from the data base.

Follow these steps to delete a material from your list:

1. Select Glass - large pane, heavy glass in your materials list.
2. Click the **Delete** Material button to remove it from the Material list.



Delete Material button

Your materials list should look like this:

Material	31 Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	Color
Total Absorption	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Total Reflection	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mineral Board 5/8" ceiling tile	0.30	0.30	0.30	0.31	0.53	0.76	0.69	0.52	0.52	0.52	
Carpet - heavy on concrete	0.02	0.02	0.02	0.06	0.14	0.37	0.60	0.65	0.65	0.65	
Concrete Block - Painted	0.10	0.10	0.10	0.05	0.06	0.07	0.09	0.08	0.08	0.08	
Brick - Bare	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.07	0.07	0.07	
Pews - Wooden	0.10	0.10	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.08	

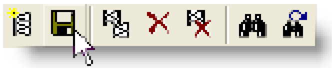
Materials list for the workshop

Saving your materials list

After you compile your Material list, you can save it in its own folder in the Material Database for easy future access.

Follow these steps to save your Material list:

1. Click the **Save Material List** button in the Material Database window and the Save As dialog box opens.



Save Material List button

2. Type “**Workshop Materials**” in the File name field.
3. Click **Save**.
   Notice that your new folder now appears in the folders list on the left side of the window.

Tip: When you start a new model, the Material list contains the contents of the “default” folder (Total Absorption and Total Reflection). To change this to your own default list, add the desired materials to the Materials list and save it as “default.mat”. When prompted to replace the existing default.mat file, click yes. When you create a new model, the material database will now contain your customized default list of materials.

4. Click **OK** to close the Material Database.

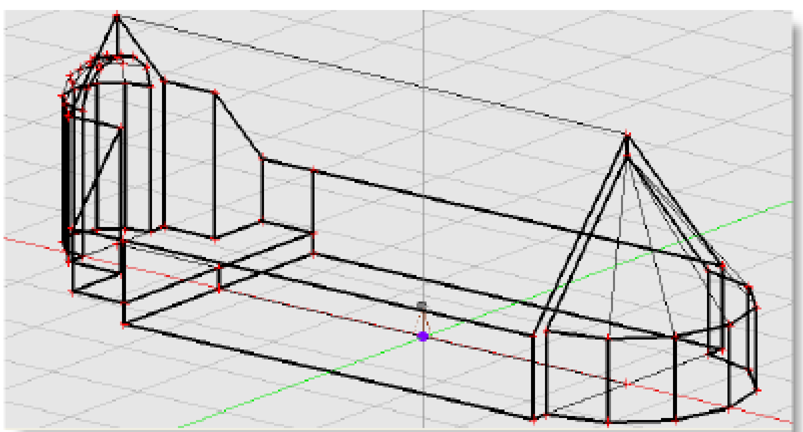
Saving your model

Now that you have set your preferences and compiled a Material list you should save your project.

Click **File > Save Project** to save the project, and click **Yes** when prompted to save changes to the Workshop model.

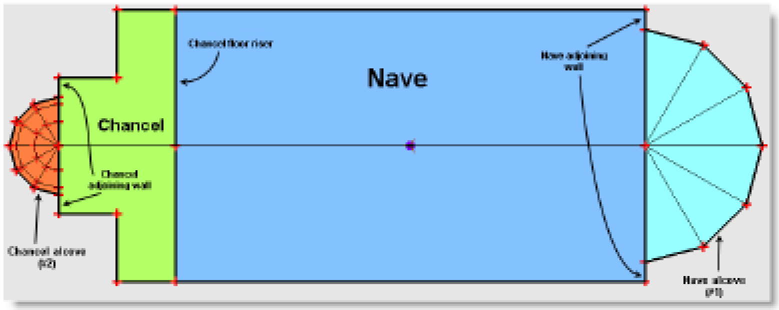
Building the Workshop Model

This section of the modeling workshop shows you how to build the First Street Church model. When you are finished, you will be familiar with many of Modeler software’s tools for modeling. The final model will look like the following figure:



Completed church model

Use the following as a reference to the names of areas and surfaces in the church model.



Names of areas and surfaces in the church model

Creating a room model

One way to approach the creation of a model is as though you are actually building a room from the ground up. It is also a good idea to complete the basic structure of the room and then add more complex shapes afterwards. In this workshop, you will begin by creating simple floor surfaces. You will first build half of the church and then use the mirror tool to create the other half. Finally, you will add more complex architectural shapes to complete the model.

Constructing the nave floor

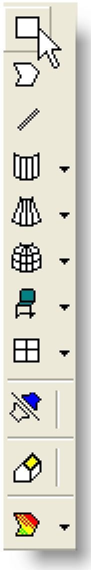
1. Close the Project window by clicking on the Project View button:

Project View button

2. Make sure that Plan View is selected in the View toolbar. This view enables you to look down at the model from a "bird's-eye view".

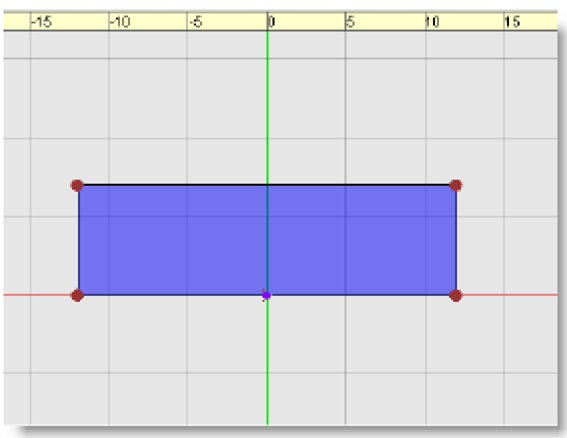
Plan View button

3. Select the Draw Rectangular Surface tool in the Draw toolbar.



Draw Rectangular Surface tool

This is the surface you will draw:



Half of nave floor

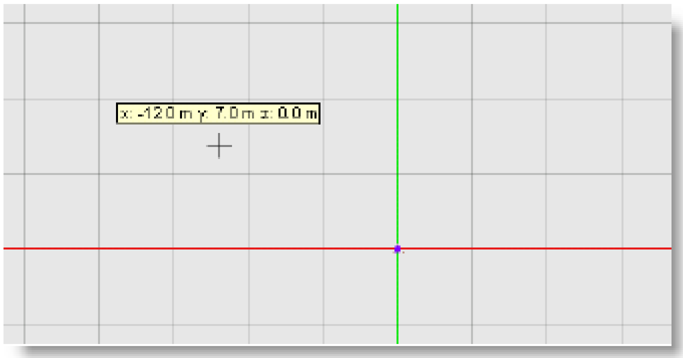
Note: All values in this workshop are in meters. Units of measure are specified in the Drawing/Saving tab in the Model Settings dialog box.

4. Move the drawing crosshairs to x: - 12.0 y: 7.0 z: 0.0, then click.

Note: To cancel unfinished surface drawings such as when you are using the Draw Rectangular Surface, use the Esc (or SHIFT + ESC) command.

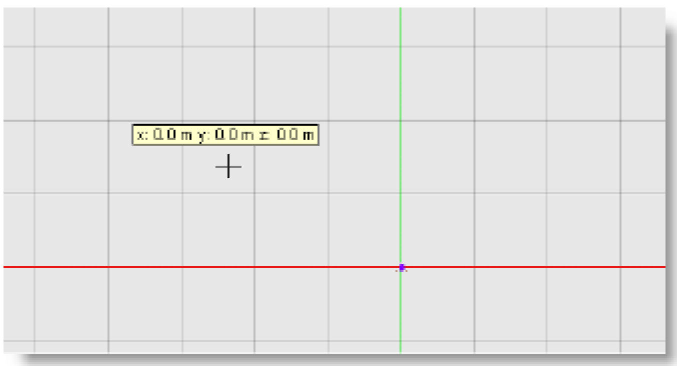
Note: Before you click to begin drawing a surface, the coordinates at the cursor display its location relative to the origin.

Before clicking:



Once you click to start drawing a shape, the coordinates at the cursor reset to 0 (zero) and display distances relative to your last click. At each click, the coordinates reset to x:0.0 y:0.0 z:0.0.

After clicking:

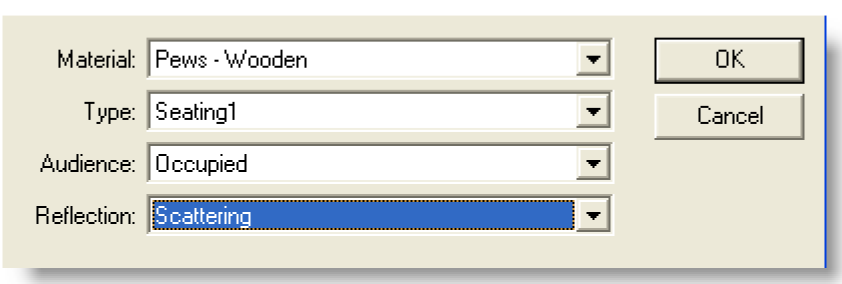


5. Now move the cursor to x: 24.0 y:-7.0 z: 0.0, and click.
   The Z Coordinate bar opens at the top of the window. This is where you assign the height of the surface.

Z Coordinate bar

The Z Coordinate is the location of this vertex in the Z axis (height). Leave this height at 0 meters for each vertex.(the seating area has a height of 0 meters). Click **Next** to proceed.

6. When you reach the fourth corner, click **Finish**.
   The Z Coordinate bar closes and the Surface Properties window opens:



Surface Properties window

This is where you assign properties to the shape such as material type, and surface type:

A. Click the **Material** type drop-down and choose Pews - Wooden as the surface material.

B. Click the surface **Type** drop-down and choose Seating1. This indicates that this surface can be occupied by an audience.

C. Click the **Audience** drop-down and choose Occupied to indicate that this surface will be occupied by an audience.

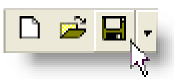
D. Click the **Reflection** drop-down and select Scattering.

E. Click **OK** to closes the Surface Properties window and the new seating surface is highlighted in blue in the modeling window.

Note: Only Seating, Floor, and Misc type surfaces can be occupied by an audience.

Tip: If you want to go back and replace a value, you can click Previous to return to the previous vertex.

7. Click the **Save** button to save your work.

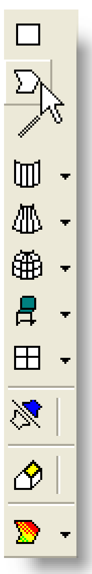


Save button

Constructing the chancel floor

In this section, you will create half of the chancel floor surface. This floor surface is 1 m higher than the nave surface you created in the previous section. The chancel is where a presenter would stand to address the audience, so think of the chancel as a stage that is elevated 1 m higher than the seating area.

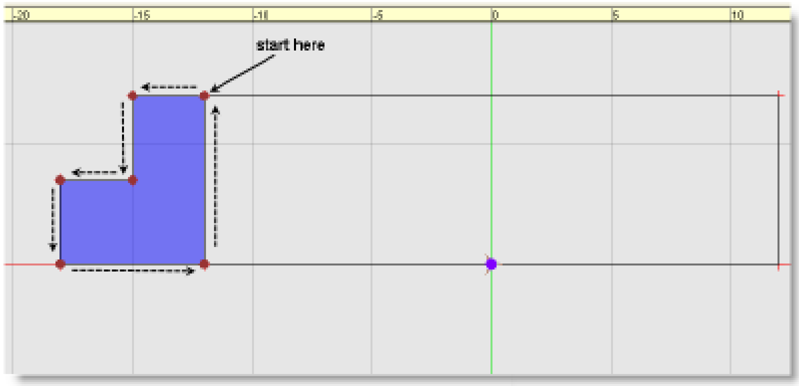
1. Select the Draw Polygonal Surface tool in the Draw toolbar.



Draw Polygonal Surface tool

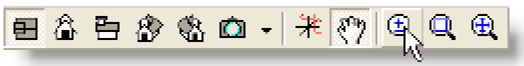
The Draw Polygonal Surface tool is used to create a surface that is a non-rectangular polygon.

This is the surface you will be modeling:



Half of the chancel floor

Tip: Zoom in on the model to make drawing surfaces easier. Select the Zoom tool and click on an area of your model to zoom in on it. To zoom out, hold down Ctrl and then click. You can also use the keyboard shortcuts: **[** (zoom out) and **]** (zoom in). If you have a scroll-wheel mouse, you can zoom in or out by holding the Ctrl key and scrolling up and down.



Zoom tool

2. Move the cross-hair cursor and click at the following locations to create your shape.

   You will be starting at the upper right corner of the highlighted shape in the previous figure of the chancel floor. Note that at each click, the coordinates at the mouse pointer reset to **x: 0.0 y: 0.0 z: 0.0**.

   (red dot indicates the starting point)

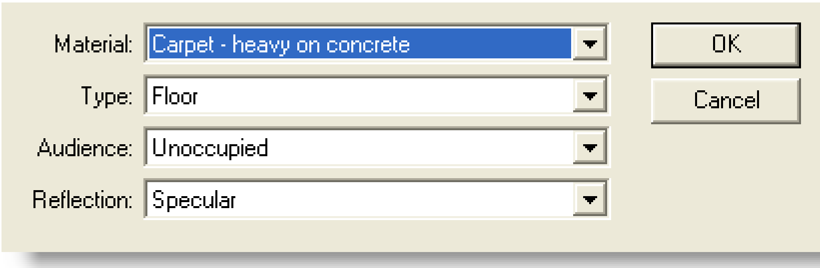
   A. Click at x: -12 y: 7.0
   B. Click at x: -3.0 y: 0.0
   C. Click at x: 0.0 y: -3.5
   D. Click at x: -3.0 y: 0.0
   E. Click at x: 0.0 y: -3.5
   F. Click at x: 6.0 y: 0.0
   G. Click at x: 0.0 y: 7.0

Tip: If you make a mistake while creating a shape, press Esc (or Shift + Esc) to cancel what you have done.

3. When you complete the shape, the Z Coordinate bar opens at the top of the window.

   Enter 1 m for the Z Coordinate and select **Next** for each vertex. When you reach the fourth corner, click **Finish**. The Z Coordinate bar closes and the Surface Properties window opens.

Z Coordinate bar



Surface Properties window

A. Select the **Material** drop-down list and choose Carpet - heavy on concrete as the surface material.
B. Select the **Type** drop-down list and choose Floor as the surface type.
C. Select the **Audience** drop-down list and choose Unoccupied.
D. Select the **Reflection** drop-down list and choose Specular.
E. Click **OK** to complete the shape.

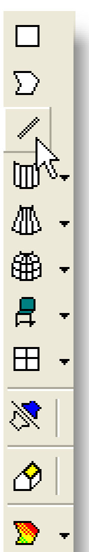
4. Press Ctrl + S to save your work.

You have just drawn half of the chancel floor.

Drawing the chancel floor riser

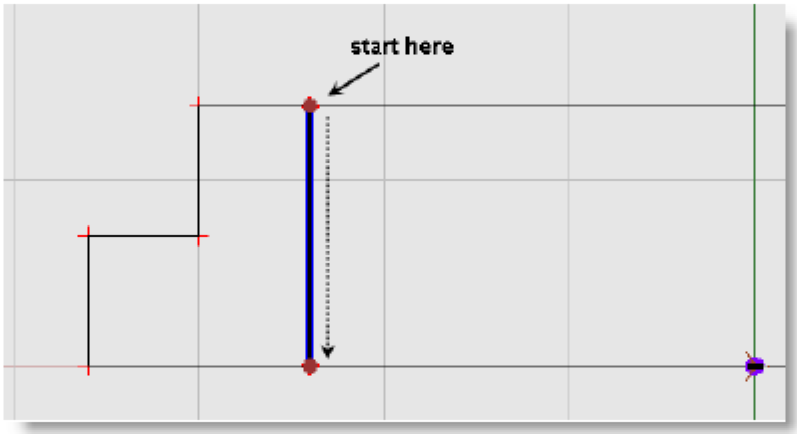
In this lesson, you will build the chancel floor riser, which connects the two surfaces that you just drew. This is a vertical surface, so you will use the Draw Wall Surface tool.

1. Select the Draw Wall Surface tool in the Draw toolbar.



Draw Wall Surface tool

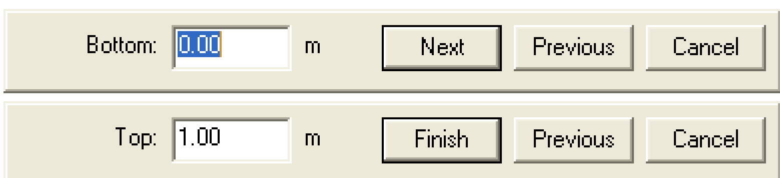
This is the surface you will draw:



Chancel floor riser half

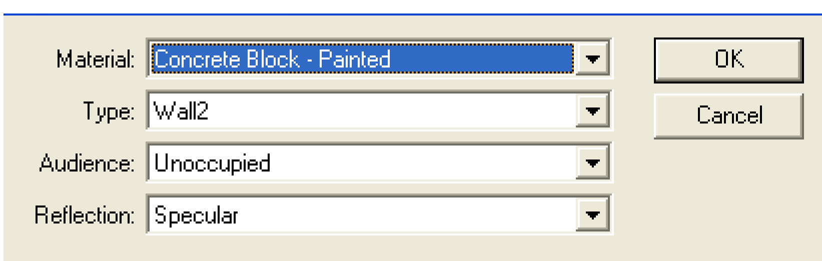
2. Move the cross-hair cursor to x: -12.0 y: 7.0 z: 0.0 and click.
3. Move the cross-hair cursor to x: 0.0 y: - 7.0 and click.

The Wall Z Coordinate bar opens



Wall Z Coordinate bar

4. Leave 0 m in the **Bottom** field vertices and click **Next**. The bottom of the wall meets the floor at zero.
5. Enter 1 m in the **Top** field vertices and click **Finish**. The Surface Properties window opens.



Surface Properties window

6. Enter the following data for this surface:
   A. Select Concrete Block-Painted as the surface material.
   B. Select Wall 2 as the surface type.
   C. Select Unoccupied and Specular
   D. Select **OK**. There will now be a riser between the two floor surfaces.

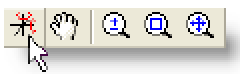
Note: It is suggested that you designate the main surfaces of a structure as "Wall1, Seating1, Ceiling1" etc. While this riser is a wall surface, it is not one of the primary walls of the church, which is why it should be designated "Wall2".

E. Click **Next** and leave the same values for the second bottom corner.

F. Click **Next**, then enter 1 m in the **Top** field and leave the other values the same.

G. Click **Next**, leave the values the same, and click **Finish**. There will now be a riser between the two floor surfaces.

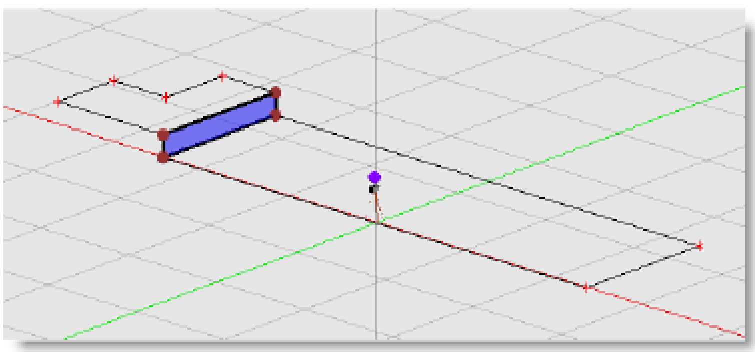
7. Click the **Save** button to save your work. You have just drawn the riser between the two floor surfaces.
8. To ensure that everything lines up, look at the model from a different perspective. Click on the Rotate View tool



Rotate View tool

9. Click and drag in the Modeling window to view your model from different perspectives.

Your model should look like this:



Model in rotate view

To return to the Plan View, click on Plan View in the View toolbar. You also can switch to Plan View using the direct key shortcut: press the H key.

Drawing the nave side wall

Next, you will build the following nave side wall:

Nave side wall

1. Select the Draw Wall Surface tool.

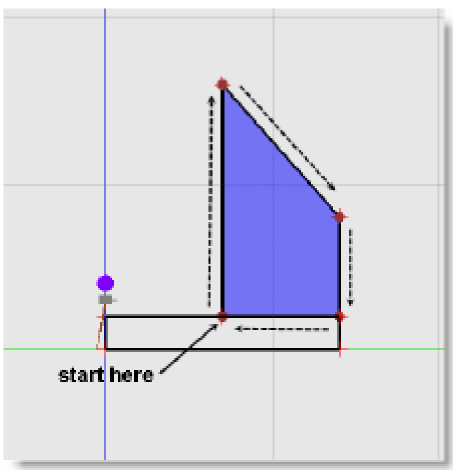
2. Move the cross-hair cursor to x: - 12.0 y: 7.0 z: 0.0, and click.
3. Move the cross-hair cursor to x: 24.0 y: 0.0 and click. The Wall Z Coordinate bar opens.
4. Enter the following Wall Z Coordinates:
   A. Leave 0 m for the bottom field vertices.
   B. Enter 4 m for the **Top** field vertices and click **Finish**. This defines the wall as 4 meters high.
5. Enter the following data for this surface:
   A. Select Brick - Bare as the surface material.
   B. Select Wall 1 for the surface type because this is one of the main walls of the church.
   C. Select Unoccupied and Specular
   D. Select **OK** to create the wall.
6. Click the **Save** button to save your work.

You have completed the nave wall.

Drawing chancel wall #1

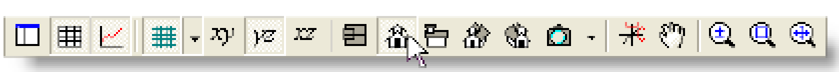
You will now use the Draw Polygonal Surface tool to draw the first chancel wall. Note that you will need to switch to a different view to draw this surface.

This is the surface you will draw:



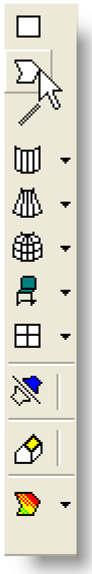
Chancel wall #1

1. Click the Elevation View button in the View toolbar. This view displays the church as if you were standing on the ground next to it.



Elevation View button

2. Select the **Draw Polygonal Surface** tool in the Draw toolbar.

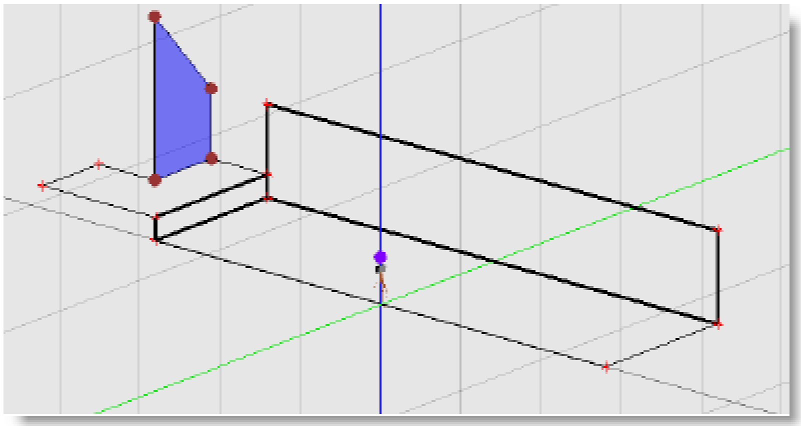


Draw Polygonal Surface tool

3. Click at the following locations to create your shape:
   A. Click at x: 0.0 y: 3.5 z: 1.0.
   B. Click at y: 0.0 z: 7.0.
   C. Click at y: 3.5 z: - 4.0.
   D. Click at y: 0.0 z: - 3.0.
   E. Click at y: -3.5 z: 0.0.

4. When you complete the shape, the Wall X Coordinate bar opens. Enter the following X Coordinates:
   A. Enter - 15 m in the X Coordinate field. This specifies the location of the shape in the X dimension.
   B. Click **Next** for each of the vertices of the surface, leaving the same values for each one. Selecting Finish opens the Surface Properties window.
   C. Leave Brick - Bare as the surface material.
   D. Select Wall 1 as the surface type.
   E. Select Audience = Unoccupied and Reflection = Specular
   F. Select **OK** to create the wall.

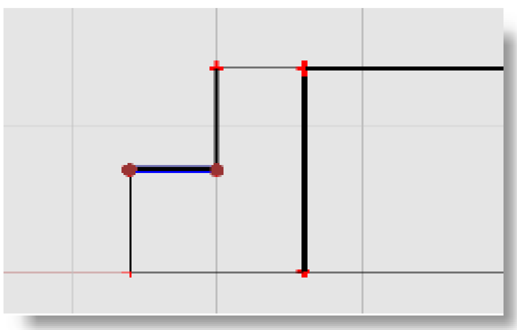
5. Click the Save button to save your work.
   Your model should now look like this:



Chancel wall #1 in rotate view

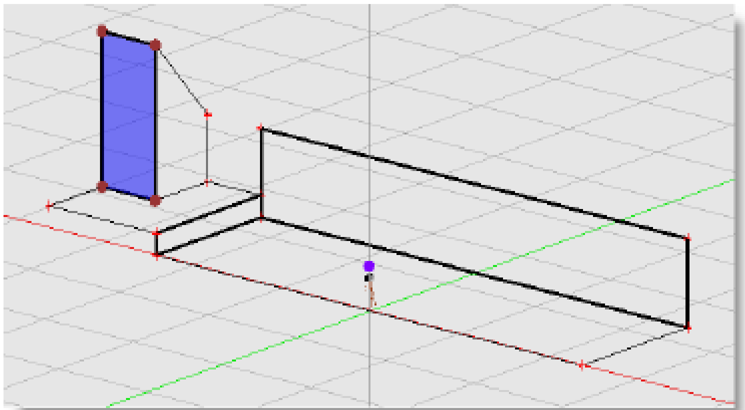
Drawing chancel wall #2

Now, using the Draw Wall Surface tool, you will draw the following second chancel wall:



Chancel wall #2

1. Switch to Plan View (press the H key).
2. Select the Draw Wall Surface tool in the Draw toolbar. You can also select the Draw Wall Surface tool by using the direct key shortcut: press the W key.
3. Click at the following locations to create your shape.
   A. Click at x: - 18.0 y: 3.5 z: 0.0
   B. Click at x: 3.0 y: 0.0
4. The wall Z Coordinate bar opens. Enter the following:
   A. Enter 1 m in the **Bottom** field vertices, click Next.
   B. Enter 8 m in the **Top** field vertices, Click **Finish**. The surface properties window opens. Select the following:
      - Brick - Bare Material type.
      - Wall 1 surface type.
      - Unoccupied and Specular.
      - Select OK to create the wall.
5. Click the **Save** button to save your work. Your model should now look like this:

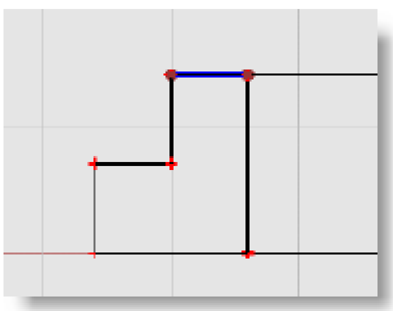


Chancel wall #2 in rotate view

Tip: Use the Direct key shortcut to switch to Rotate View: Press the D key. If this does not work, make sure the Direct Accelerator key is turned on in the Application Preferences.

Drawing chancel wall #3

In this lesson, you will create chancel wall #3, which joins chancel wall #1 with the nave wall.
This is the wall you will draw:



Chancel wall #3

1. Switch to Plan View (press the H key).
2. Select the Draw Wall Surface tool in the Draw toolbar (press the W key).
3. Click at the following locations to create your shape.
   A. Click at x: - 15.0 y: 7.0 z: 0.0
   B. Click at x: 3.0 y: 0.0
4. The wall Z coordinate bar opens. Enter the following:
   A. Enter 1 m in the **Bottom** field vertices, click **Next**.
   B. Enter 4 m in the **Top** field vertices, Click **Finish**. The surface properties window opens.
   C. Select the following:
      - Brick - Bare Material type
      - Wall 1 surface type
      - Unoccupied and Specular

   D. Select **OK** to create the wall
5. Click the **Save** button to save your work.

Creating a ceiling surface

Next, using the Draw Polygonal Surface tool, create the ceiling for the church.
This is the surface you will draw:

Church ceiling surface with vertex heights

1. Make sure you are in Plan View, then select the **Draw Polygonal Surface** tool in the Draw toolbar. You can also select the Draw Polygonal Surfaces tool using the direct key shortcut: Press the Q key.
2. Move the cross-hair cursor and click at the following locations to create your shape.

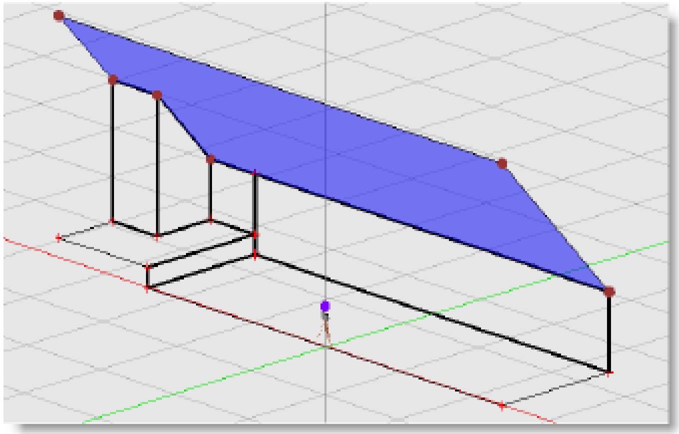
Tip: You will follow the perimeter of the church as you create your ceiling.

A. Click at x: - 18.0 y: 0.0 z: 0.0.
B. Click at x: 0.0 y: 3.5
C. Click at x: 3.0 y: 0.0
D. Click at x: 0.0 y: 3.5
E. Click at x: 27.0 y: 0.0
F. Click at x: 0.0 y: -7.0
G. Click at x: -30.0 y: 0.0

3. After you click the final coordinate, the Surface Properties bar opens.
Enter the following properties for this shape (refer to the previous figure for vertex heights):

A. Enter 12 m in the first field, which represents the height of the ceiling at this corner.
B. Select Mineral Board 5/8" ceiling tile for the surface material.
C. Select Ceiling1 as the surface type because this is the primary ceiling surface in the model.
D. Click the **Next** button, then enter **8 m** in the height field and leave the other values the same.
E. Click **Next** and leave the values the same.
F. Click Next, then enter **4 m** in the height field and leave the other values the same.
G. Click **Next** and leave the values the same.
H. Click Next, enter **12 m** in the height field, leave the other values the same, and click **Finish**.

4. Click the **Save** button to save your work.
Your model should look like this:



Church ceiling in rotate view

Creating the other half of the church

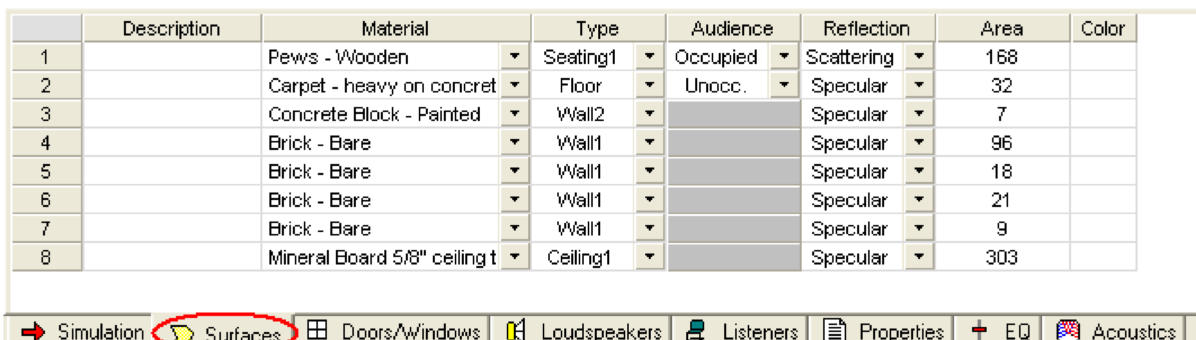
At this point, you have drawn half of your church model. Rather than creating all of these surfaces again on the opposite side, you can take advantage of the symmetry of your model and duplicate the existing surfaces to make the other half of the model.

This can be done using two different methods.

- Using the duplicate, group, and flip surface functions
- Using the Mirror tool

Using duplicate and group functions to create the other half of the church:

1. Switch to Plan View, then click the Surfaces tab in the Detail window.

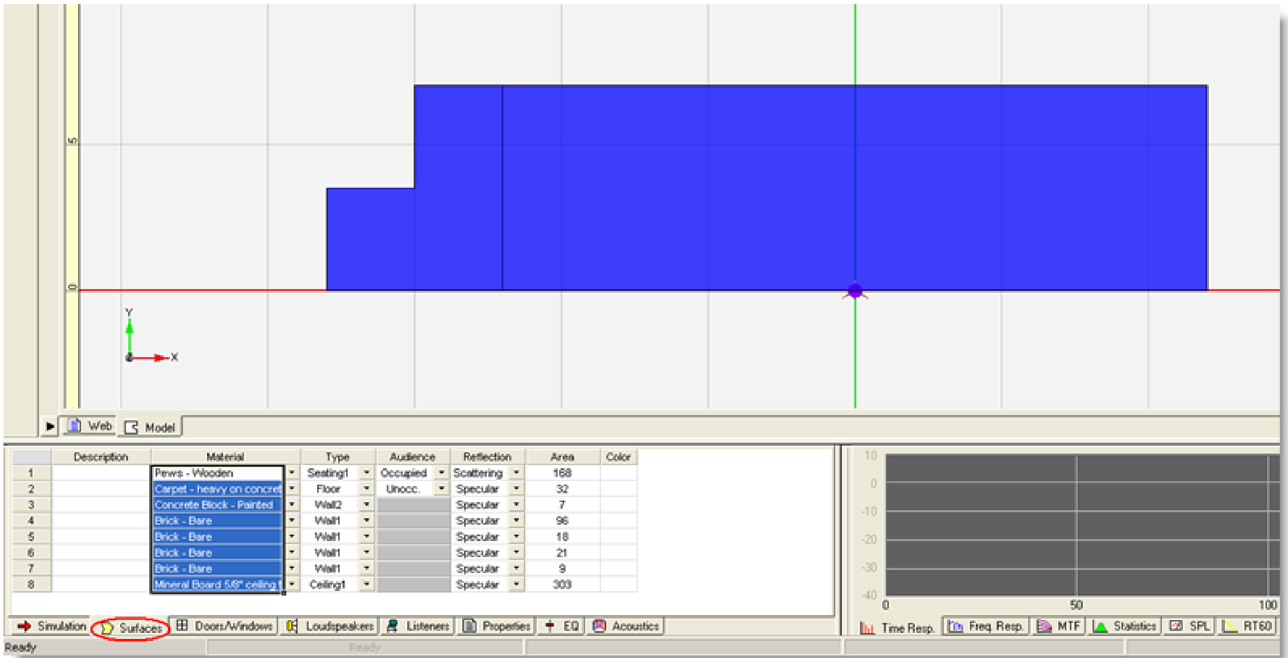


	Description	Material	Type	Audience	Reflection	Area	Color
1		Pews - Wooden	Seating1	Occupied	Scattering	168	
2		Carpet - heavy on concret	Floor	Unocc.	Specular	32	
3		Concrete Block - Painted	Wall2		Specular	7	
4		Brick - Bare	Wall1		Specular	96	
5		Brick - Bare	Wall1		Specular	18	
6		Brick - Bare	Wall1		Specular	21	
7		Brick - Bare	Wall1		Specular	9	
8		Mineral Board 5/8" ceiling t	Ceiling1		Specular	303	

Surfaces tab

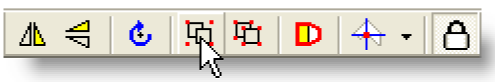
This tab lists each of the surfaces in your model and provides information about each surface. It can also be used to easily select surfaces in the model.

2. Click the first surface in the list, then drag your mouse down until all of the surfaces are highlighted. Notice that all the surfaces in the model become highlighted.

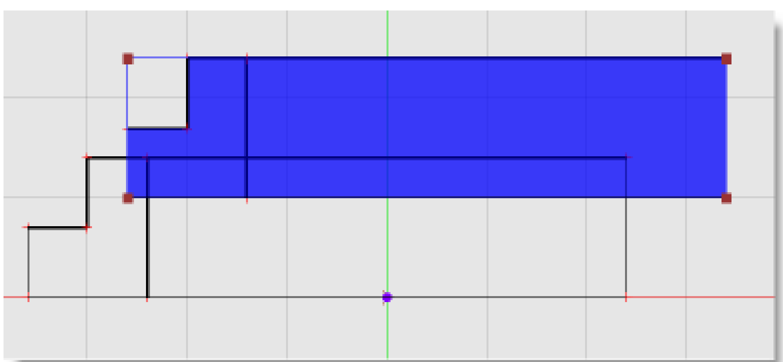


Selecting all surfaces in the Surfaces tab

3. In the Edit menu click **Edit > Duplicate** (or press **Ctrl + D**). An identical set of surfaces appear in the model slightly offset from the first, highlighted in blue.
4. Click the **Group** button in the Arrange toolbar. The new duplicate surfaces are grouped together.

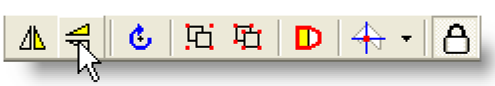


Group button



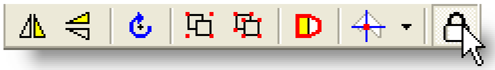
Duplicated, grouped surfaces

5. In the Arrange toolbar, click the Flip Vertical button so that the new surfaces mirror the existing church half.



Flip Vertical button

6. If it is not already unlocked, unlock the model by clicking on the Lock Model button so you can move the duplicate half of the church.

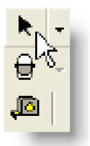


Lock Model button in locked state

Note: When the model is locked, you will not be able to move individual surfaces in the model by clicking and dragging them. Turning Lock Model off allows you to select and drag objects in the model independently.

7. Click on the Select button in the Draw toolbar, then click on and drag the highlighted surface group until you place it on the negative side of the y-axis, opposite the original surfaces.

Make sure **Surfaces** checkbox is checked in the wing menu (click on to the right of the selection arrow for the wing menu).

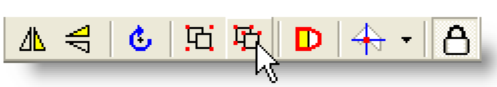


Select tool

The two halves of the church should line up flush against each other:

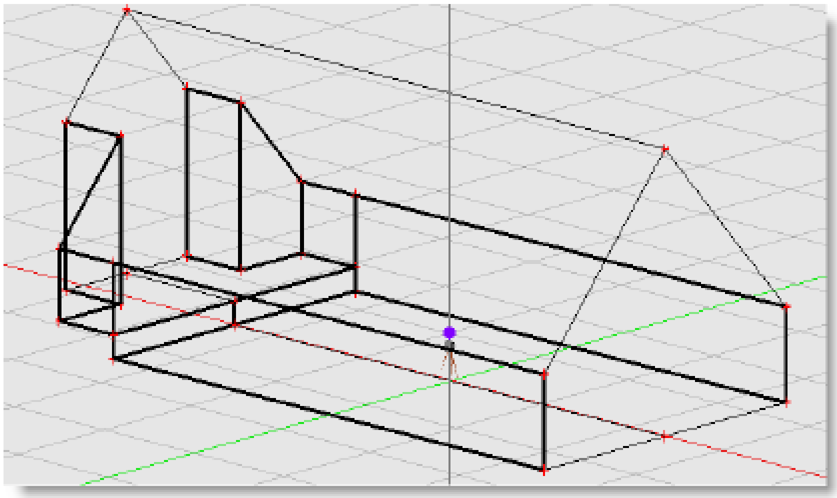
Lining up the church halves

8. Click Ungroup to ungroup the surfaces.



Ungroup button

Your model should now appear almost complete, except for the missing walls on both ends of the church:

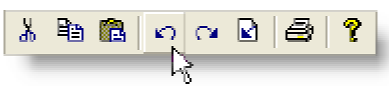


Church after duplicating

Using the Mirror tool to create the other half of the church

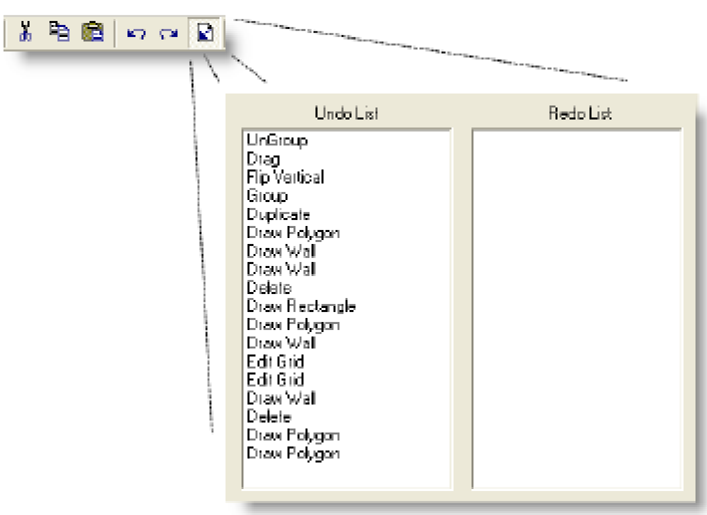
Before using the Mirror tool, you first need to delete the duplicate surfaces you just created. This can be accomplished in numerous ways, three of which are listed below:

- **Surface Deletion Method 1** - Click on the Undo button several times until you reach a state before the duplicate surfaces were created.



Undo button

- **Surface Deletion Method 2** - Click the Undo List button to open the Undo/Redo window.



Opening the Undo/Redo window

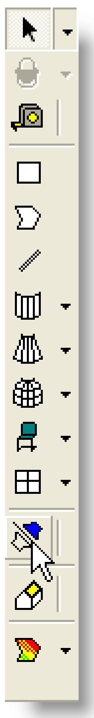
Double-click an item in the Undo List to undo your actions to that point. In this example, double-click on "duplicate" to remove the duplicate surfaces.

- **Surface Deletion Method 3** - Select the duplicate surfaces in the Surfaces tab and press the Delete key.

After the duplicate surfaces are removed, click the **Lock** Model button in the Arrange toolbar to lock the model. It is recommended that you keep the model locked to prevent against accidentally moving a surface.

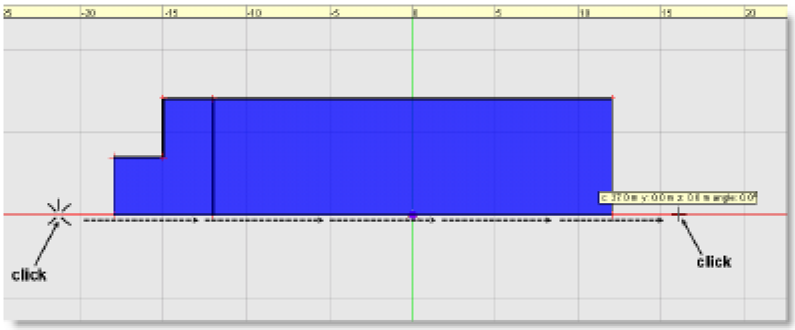
To create the other half of the church using the Mirror tool:

1. Make sure you are in Plan View, then click the Surfaces tab in the Detail window.
2. Click the first surface in the list, then drag your mouse down until all of the surfaces are highlighted, or do **Ctrl + A** to select all. Notice that all the surfaces in the model are highlighted with a blue outline.
3. Select the Mirror tool in the Draw toolbar.



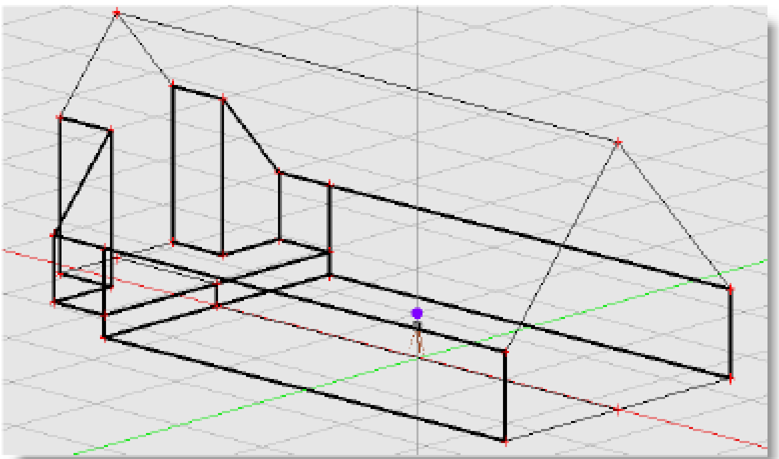
Mirror tool

4. Make sure you are in PlanView. Click once and trace the mirror axis along the bottom edge of the church. Think of this as placing a mirror against the shape you want to duplicate. Click again, and the selected surfaces are duplicated on the other side of your mirror line.



Tracing the mirror axis along the bottom edge of the church

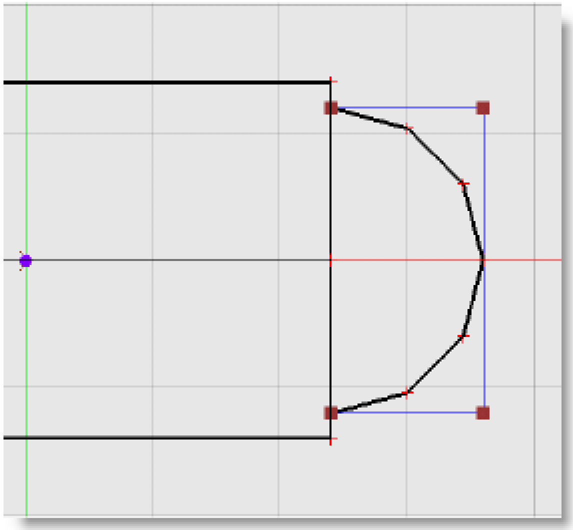
5. Click the **Save** button to save your work.
   Your model should look like the following:



Church after mirroring

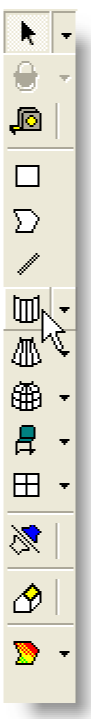
Drawing the cylindrical nave alcove (#1)

The following steps will show you how to place rounded alcoves at either end of your church model. This is the nave alcove surface you will create:



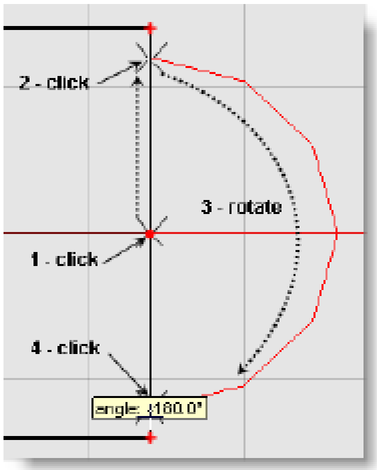
Nave alcove (#1)

1. Make sure you are in PlanView, then select the Draw Cylindrical Surfaces tool:



Draw Cylindrical Surfaces tool

2. Using the cross-hair cursor, define the shape as follows:
   A. Click at x: 12.0 y: 0.0 z: 0.0
   B. Move the cursor in the positive Y direction (up) until the radius is 6.0 m and click.
   C. Rotate the cursor clockwise until the angle measures - 180° and click. Make sure that the angle is negative.

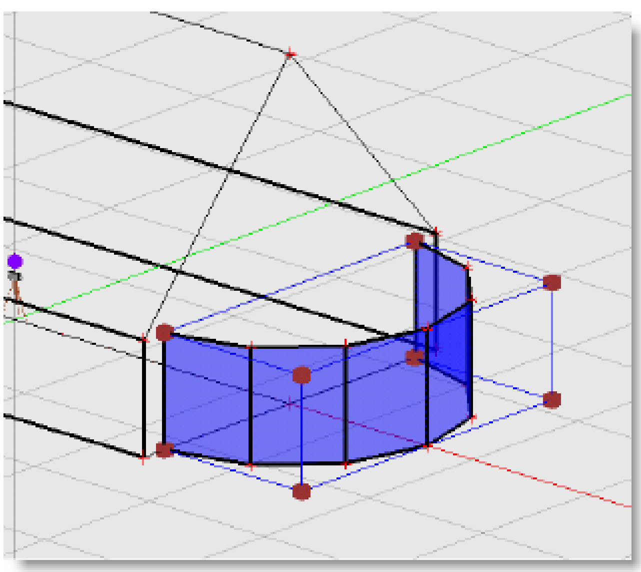


Using the Draw Cylindrical Surfaces tool

3. After you finish the surface, the Z Coordinate bar opens at the top of the window. Enter the following:
   A. Leave 0 m for Elevation 1 (Z1) since the bottom of this surface is at the same level as the nave floor.
   B. Click **Next**, then enter 4 m for Elevation 2 (Z2), leaving the other values the same, then click **Finish**. The Surfaces Properties window opens.
   C. Select Brick - Bare as the surface material.
   D. Select Wall 1 as the surface type.
   E. Select Unoccupied and Specular.
   F. Select **OK** to create the cylindrical wall surface.

4. Click the Save button to save your work.

   The finished alcove should look like this:

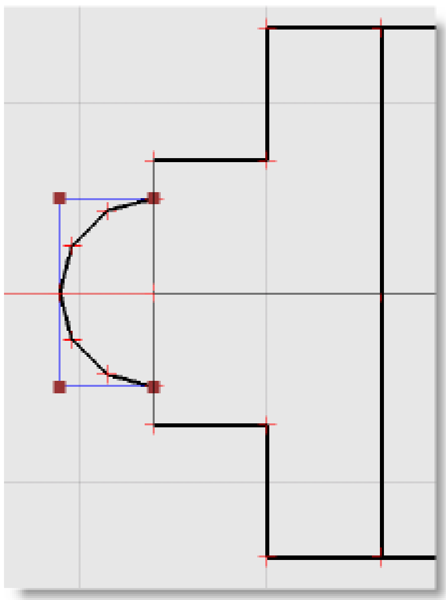


Alcove #1 in rotate view

Note: Curved surfaces are simulated as numerous flat surfaces joined together to form a curve. You specify the angular increment that is used to draw the curve. At each angular increment, a new surface is created, so the angular increment dictates how many flat surfaces are used to simulate the curved surface. In this example 30°, making 6 surfaces.

Drawing the cylindrical chancel alcove (#2)

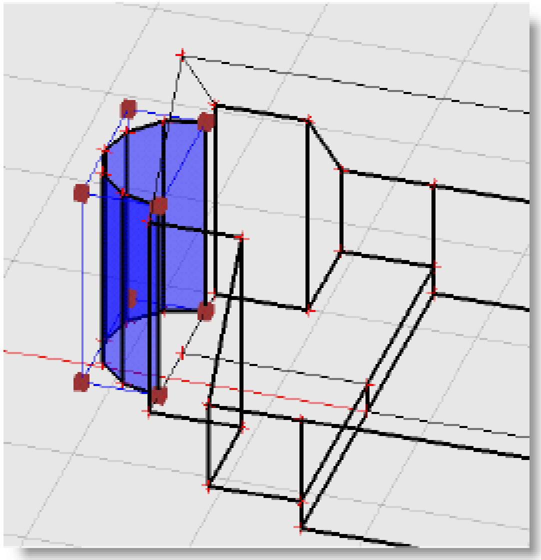
The following steps will show you how to draw the chancel alcove (#2) in the church.
This is the surface you will create:



Alcove #2

1. Switch to Plan View.
2. Select the Draw Cylindrical Surfaces tool (or press the C key) and define the shape as follows:
   A. Click at x: - 18.0 y: 0.0 z: 0.0
   B. Move the cursor in the positive Y direction until the radius is 2.5 m and click.
   C. Rotate the cursor counter clockwise until the angle measures 180° and click. (Make sure that the angle is positive).
3. After you finish the surface, the Shape Properties bar opens at the top of the window. Enter the following properties for this shape:
   A. Enter 1 m for Elevation 1 (Z1)
   B. Click **Next**, then enter 8 m for Elevation 2 (Z2), then click **Finish**. The Surfaces Properties window opens.
   C. Select Brick - Bare as the surface material.
   D. Select Walll 1 as the surface type.
   E. Select Unoccupied and Specular.
   F. Select **OK** to create the cylindrical wall surface.
4. Click the Save button to save your work.

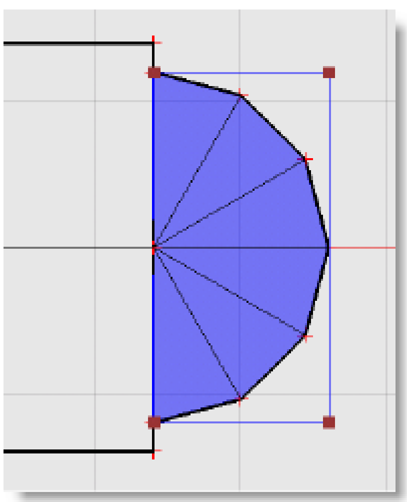
   The finished chancel alcove (#2) should look like this:



Alcove #2 in rotate view

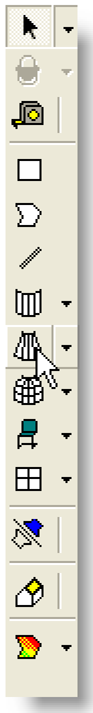
Drawing a conical surface

Next, you will place a conical roof section over the nave alcove (#1) using the Draw Conical Surfaces tool. This is the surface you will create:



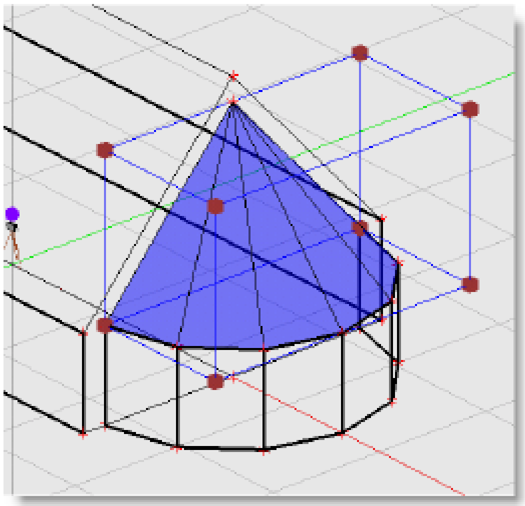
Conical roof over alcove #1

1. In PlanView, select the Draw Conical Surfaces tool:



Draw Conical Surfaces tool

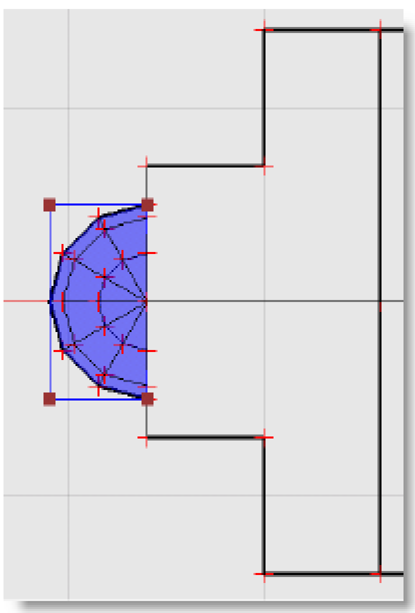
2. Define the shape as follows:
   - Click at x: 12.0 y: 0.0 z: 0.0.
   - Move the cursor in the positive Y direction until the radius is 6 m and click.
   - Rotate the cursor clockwise until the angle is **-** 180.0° and click.
   - Move the cross-hair in towards your starting point until the second radius is equal to 0 m and click.
3. When you finish the surface, the Z Coordinate bar appears at the top of the window. Enter the following:
   - Enter 4 m for Elevation 1 (Z1).
   - Click **Next** and set Elevation 2 (Z2) to 11 m, then click **Finish**. The Surfaces Properties window opens.
   - Select Mineral Board 5/8" ceiling tile as the surface material.
   - Select Ceiling 2 as the surface type because this is not the main ceiling surface in the model.
   - Select Unoccupied and Specular.
   - Select **OK** to create the conical ceiling surface.
4. Click the **Save** button to save your work.
   The conical ceiling over the nave alcove should look like this:



Conical ceiling over nave alcove

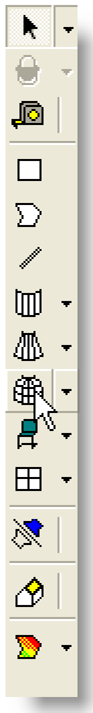
Drawing a spherical surface

The following steps will show you how to place a spherical ceiling over the chancel alcove (#2). This is the surface you will create:



Spherical ceiling over chancel alcove

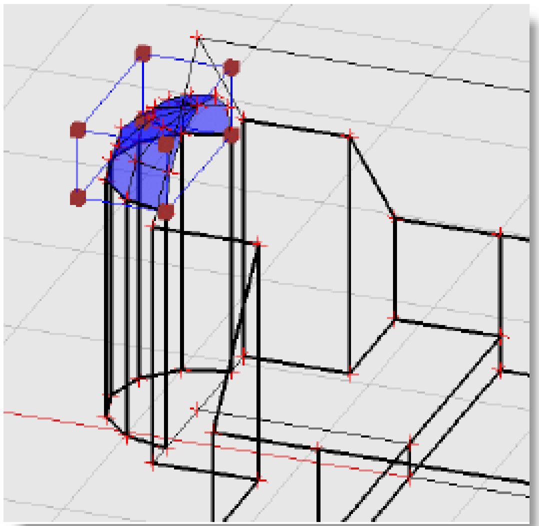
1. In Plan View select the Draw Spherical Surfaces tool:



Draw Spherical Surfaces tool

2. The Draw Spherical Surfaces tool is used in the same fashion as the Draw Conical Surfaces tool. Define the shape as follows:
   A. Click at x: - 18.0 y: 0.0 z: 0.0.
   B. Move the cursor in the positive Y direction, radius is 2.5 m and click.
   C. Rotate counter-clockwise around the center point of the sphere until the angle is 180.0° and click.
3. When you finish the surface, the Z Coordinate bar appears at the top of the window. Enter the following:
   A. Enter 8 m for Elevation 1 (Z1).
   B. Click **Next**, then enter 10 m for Elevation 2 (Z2), then enter **Finish**. The Surfaces Properties window opens.
   C. Select Mineral Board 5/8" ceiling tile as the surface material.
   D. Select Ceiling 2 as the surface type because this is not the main ceiling surface in the model.
   E. Select Unoccupied and Specular.
   F. Select **OK** to create the conical ceiling surface.
4. Click the Save button to save your work.

   The completed chancel alcove ceiling should look like this:

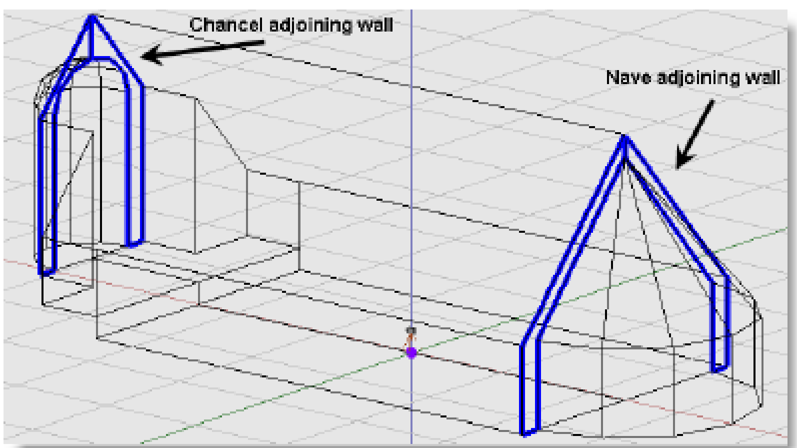


Chancel alcove ceiling in rotate view

Closing the room model

You have created all of the main surfaces of the model. There are still a few open spaces that you will fill in with surfaces in the following lessons. A model that has no open or missing surfaces is called a closed model.

In order to close your room model, you first will create the wall surfaces highlighted below. These are called adjoining walls.



Adjoining walls to create before closing the model

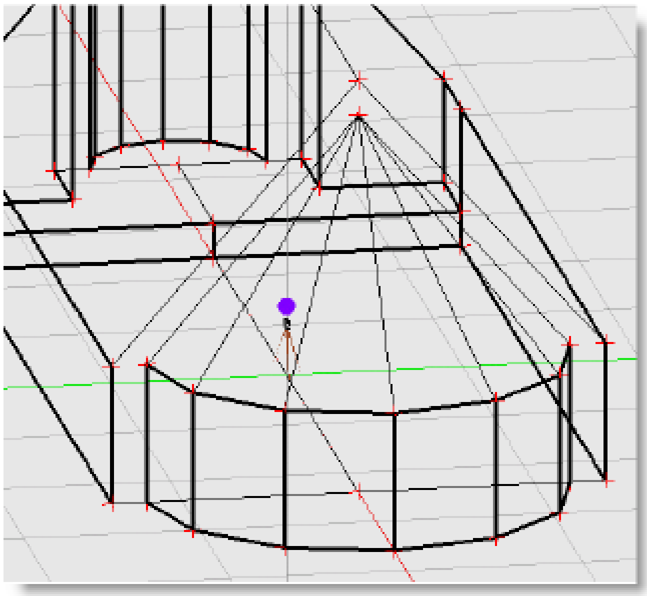
Drawing the nave adjoining walls

The nave adjoining wall joins the nave alcove with the nave. This surface can be created using the **Insert Face** tool. The **Insert Face** tool allows you to create a surface by outlining the vertices that make up the perimeter of the shape.

To create the nave adjoining wall:

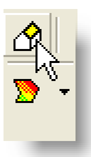
1. Select the **Rotate View** tool (press the D key).
2. Rotate the model until the view closely matches the following figure:

You will click on the vertices that outline the nave adjoining wall, so it is important that you can see all the vertices. Zoom in using the Zoom tool if you need to.



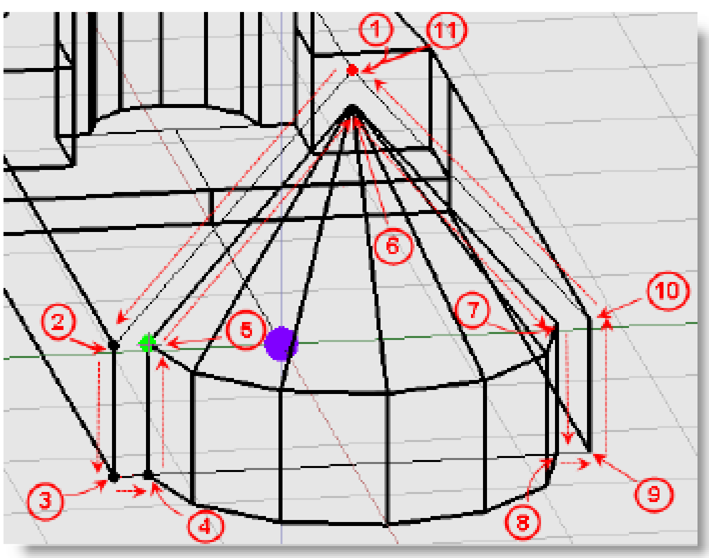
A good viewing angle for creating the nave adjoining wall

3. Select the **Insert Face** tool:



Insert Face tool

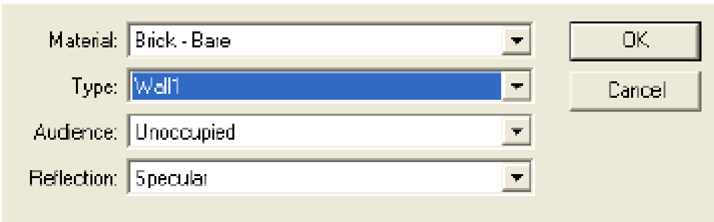
4. To define the nave adjoining wall, click on the vertices that form its perimeter. Each vertex will highlight in green when the cursor is moved over it. The surface is completed when you click on the red dot indicating the starting point.



Outlining the nave adjoining wall with the Insert Face tool

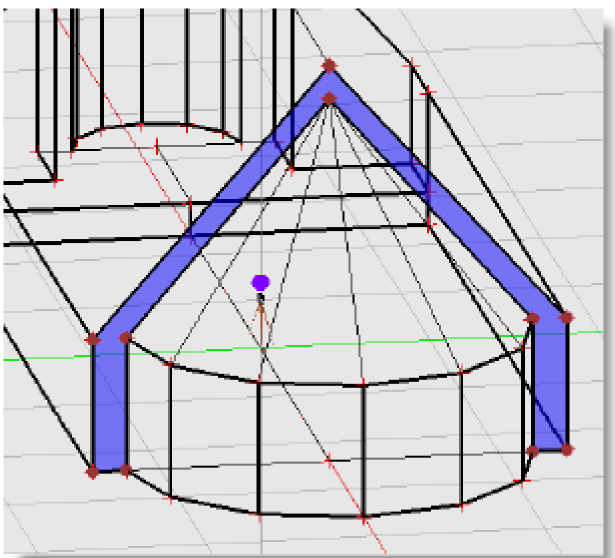
Note that this snapshot was taken on step 5 as you can see the green highlighted vertex at the cursor.

5. When you click on the starting point to finish the shape, the **Insert Face** properties box opens. Here you define the material and surface type for the new surface. Choose **Brick - Bare** for the material, and **Wall 1** for the surface type and click OK.



Insert Face properties box

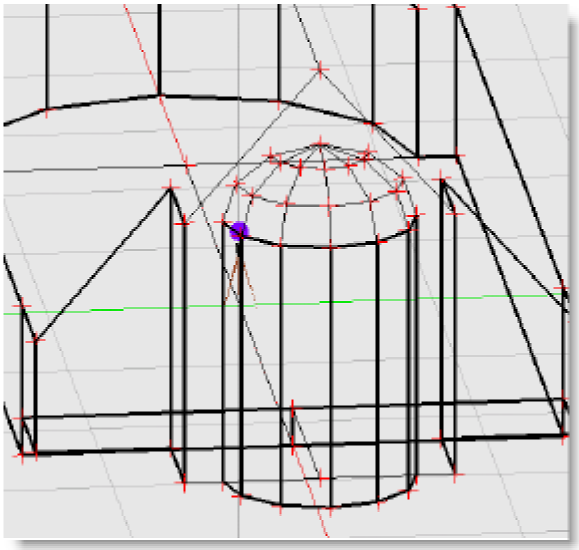
The new surface looks like this:



Completed nave adjoining wall

To create the chancel adjoining wall:

1. Select the **Rotate View** tool (press the D key).
2. Rotate the model until the view closely matches the following figure:



A good viewing angle for creating the chancel adjoining wall

You will click on the vertices that outline the chancel adjoining wall, so it is important that you can see all the vertices in your view of the model.

3. Select the **Insert Face** tool.
4. Define the chancel adjoining wall by clicking on the vertices that form its perimeter, just as you did for the nave adjoining wall. Make sure that each vertex highlights in green before you click.

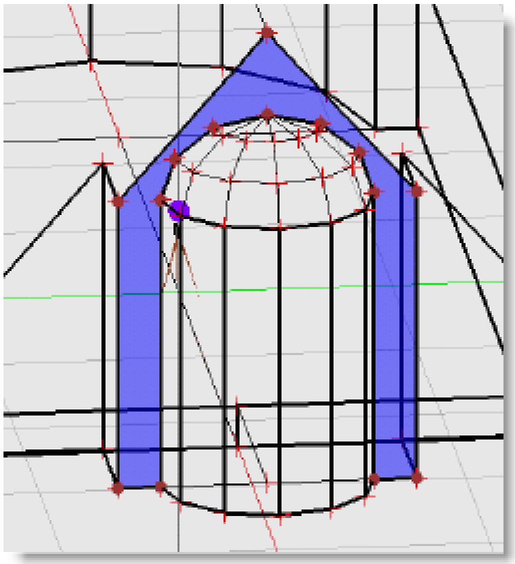
Tip: If you have difficulty finding the vertex highlighted in green, click ESC (or Shift + Esc) to cancel, then you can alter your viewing angle and begin again.

Note: The object "●" is an RT_{60} source in the background and not a vertex

The surface is completed when you click on the red dot indicating your starting point. Use the figure in the next step as a guide to the vertices that define the chancel adjoining wall.

5. When you click on the starting point to finish the shape, the **Insert Face** properties box opens. Leave **Brick - Bare** as the material type, and **Wall1** as the surface type, and click OK.

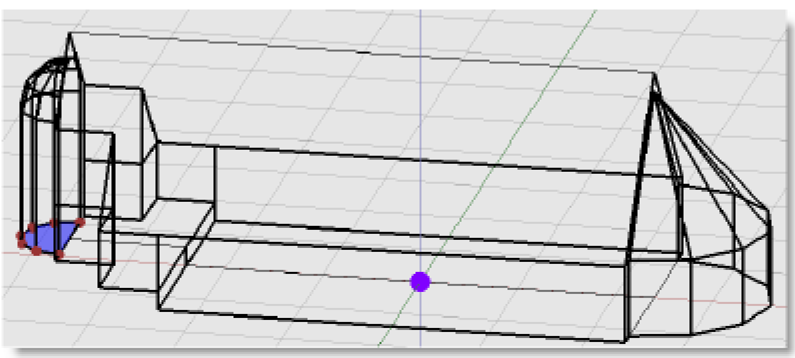
The finished chancel adjoining wall looks like this:



Chancel adjoining wall

Creating the chancel alcove floor surface

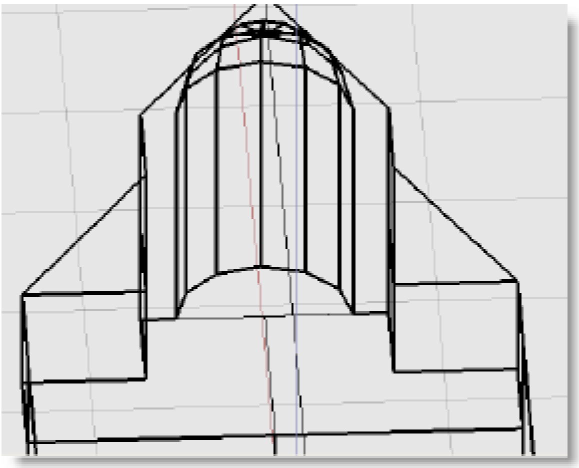
The last surfaces that you will create for the model are the floor surfaces for the two alcoves. As with the adjoining walls, these floor surfaces can be created using the **Insert Face** tool. The first floor surface you will create is the chancel alcove floor, which is highlighted in the following figure:



Chancel alcove floor surface

1. Use the Rotate View tool so that you can more easily see the space where you will create the floor surface. Your view should look similar to the following figure, which is looking down on the chancel alcove. You may find it helpful to use the **Pan** tool along with the **Rotate View** tool.

Tip: You can switch between these Pan and Rotate View tools quickly by using their direct key shortcuts: SPACE BAR for the Pan tool, and D for the Rotate View tool.

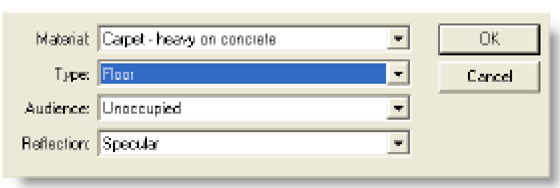


A good viewing angle for creating the chancel floor surface

2. Use the **Insert Face** tool to outline the alcove floor surface, as you did with the adjoining walls.

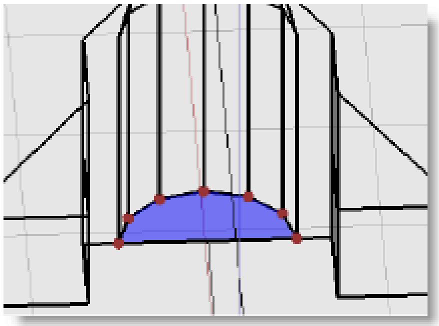
*Creating the chancel alcove floor surface using the **Insert Face** tool*

3. When you click on the starting point to finish the shape, the **Insert Face** properties box opens. Choose **Carpet - heavy on concrete** for the material, and **Floor** for the surface type and click OK.



Insert Face properties box

The surface looks like this when complete:



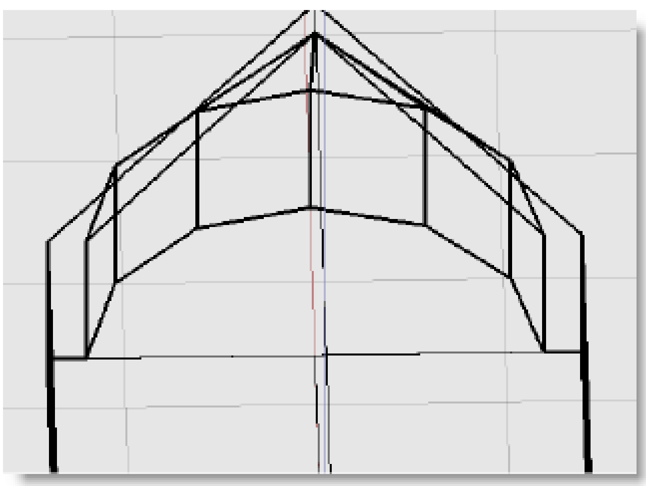
Completed chancel alcove floor surface

Creating the nave alcove floor surface

The nave alcove floor surface can be created with the **Insert Face** tool in the same manner as the chancel alcove floor surface.

1. Use the Rotate View tool so that you can more easily see the space where you will create the floor surface.

   Your view should look similar to the following, which is looking down on the nave alcove:

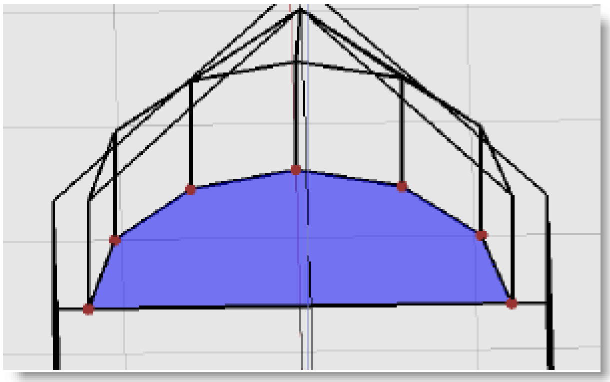


A good viewing angle for creating the nave floor surface

   Again, you may find it helpful to use the **Pan** tool along with the **Rotate View** tool. Remember, you can switch between these tools quickly by using their direct key shortcuts: **SPACE BAR** for the **Pan** tool, and **D** for the **Rotate View** tool.

2. Use the **Insert Face** tool to outline the nave alcove floor surface, exactly as you did with the chancel alcove floor surface. The surface is completed when you click on the red dot indicating your starting point. Use the figure in the next step as a guide to which vertices define the nave alcove floor surface.
3. When you click on the starting point to finish the shape, the **Insert Face** properties box opens. Choose **Carpet - heavy on concrete** for the material, and **Floor** for the surface type and click OK.

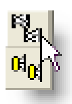
   The floor surface looks like this when complete:



Completed nave alcove floor surface

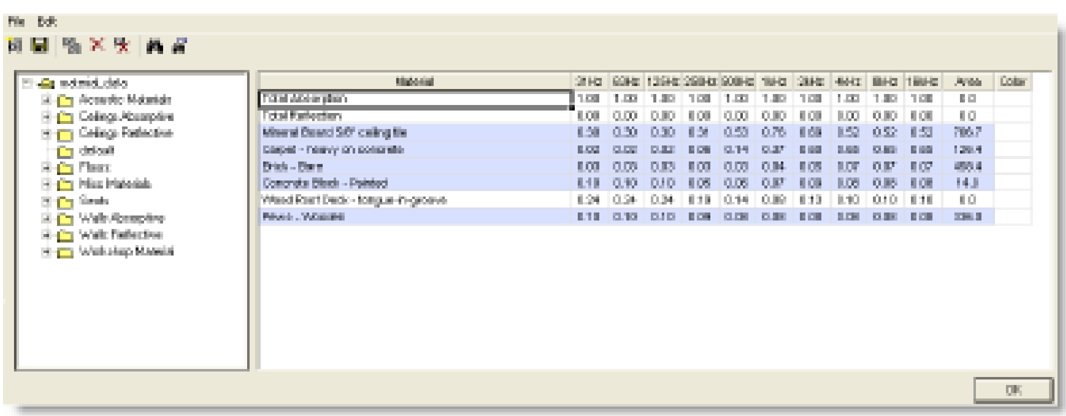
Deleting Unused Material

1. Click the **Material Database** button in the **Database** toolbar (or press**Ctrl + M**):



Material Database button

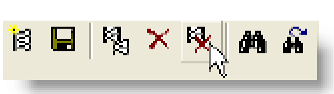
The**MaterialDatabase**window opens:



Material Database Window

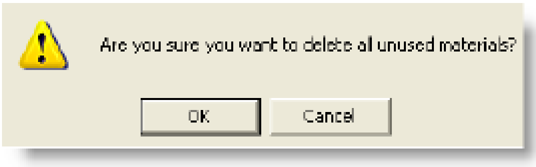
This figure shows materials highlighted in blue that have been used in the model. Materials that are not highlighted are unused.

2. Click on the **Delete Unused Materials** tool.



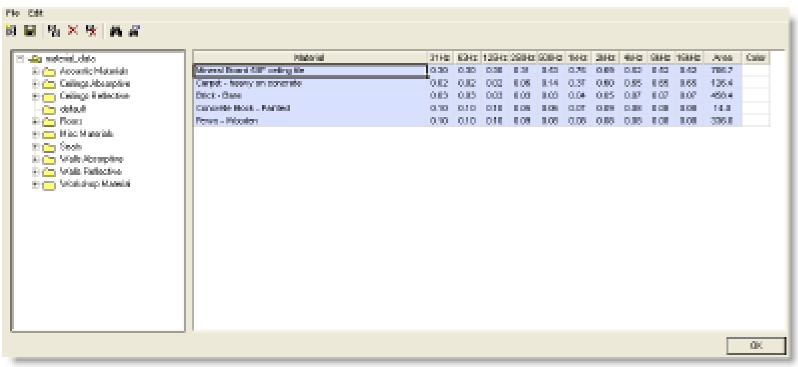
Delete Unused Materials tool

The following Warning window appears:



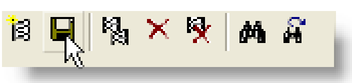
Modeler Warning window

3. Click on **OK**.
   The Materials Data list changes to display only the highlighted used materials, deleting the unused automatically.



Materials Data list (used materials only)

4. Click the **Save Material** tool.



Save Material tool

5. In the Save As dialog, select the **Workshop Materials.mat** file.
6. Click on the **Save** button.
7. Click on the **Yes** button to replace the existing Workshop. Materials.mat file.
8. Click on **OK** to close.

Next steps

To add loudspeakers to your model, see:

- Placing and Aiming Loudspeakers
- Working With Arrays
- Working With RoomMatch Arrays

To add listeners to your model, see:

- Listener Locations
- Adding Listeners
- Setting Listener Preferences
- Listener Properties
- Using Listeners and the Sample Tool
- Using Listeners to Reduce Calculation Time

Working With Projects

The features of the project structure provide an easy way to create a logical and organized work environment. The following covers the use of projects in Modeler software, and it will show you how to manage projects and their associated models as well as how to use the various features of the project structure. We recommend that you use projects in your work whenever possible.

Opening and creating projects

You can have only one project open at a time. If you attempt to open or create a new project while another project is open, you will be asked to close the current project.

To create a new project:

1. Launch Modeler software and choose File > New Project (or press Ctrl+N).
2. The Create New Project dialog box opens and asks you to name the new project and choose a location to save it.
3. Enter a name and choose a location for the file, then click Save.

Note: When you create a project in Modeler software, a folder is generated on your hard drive with the same name as the project. The project (.pjt) and its model (.mdr) files are stored in this folder. Project names must be unique, you cannot create two projects with the same name in the same folder.

4. You are then prompted to either create a new model, open an existing model, import a model or cancel.

New:	A new model is created. You are asked to name it
Open:	Open an existing model. You are prompted to locate the model on your hard drive. The existing model is copied and placed into your new project.
Import:	Import a model that was not created in Bose Modeler software. The model will be added to the currently open project file. Choose to import a Macintosh Modeler software file (.mac), a Modeler Transfer File (.mtf), and EASE faces file (.xfc), or an EASE project file (.ppj). Note that the file must have the appropriate file extension (.mac, .xfc, .ppj, .dxf) to be imported into Bose Modeler software. If a project is not open, the model will be imported without being added to any project.
Cancel:	The project is created, but contains no models.

5. The new project is created with the new, existing or imported model associated to it.

Note: Open the Project window to view a project and its models by choosing View > Window > Project.

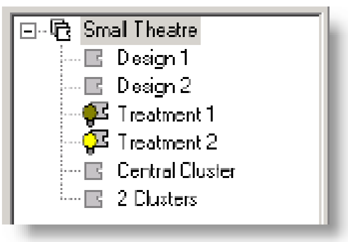
To open an existing project:

1. Choose **File > Open Project...**
2. You will be asked to locate the desired project folder. Locate the folder and click Open (or double-click on the folder name).

3. Click on the project file within the project folder and click Open (or double-click on the project file). Note that all project files end in the file extension .pjt.
4. The new project opens, and it can be viewed in the Project window.

Project window

The project structure creates a "parent/child" relationship between project and model files in Modeler software. A project file can be thought of as the "parent" file, with its associated models being "children". The Project window displays a project in a hierarchical format, allowing you to see all models contained within the project.



A project and its associated models in the Project window

The appearance of the model icon in the Project window corresponds to the state of the model:

 Model closed.

 Model open, D2RΔSTIc Engine off.

 Model open, D2RΔSTIc Engine on.

To open a model, double-click on the model icon in the Project window. The model opens in the Modeling window. When you close a project, the project file keeps track of which models are open or closed as well as which models have the D2RΔSTIc Engine enabled. The next time you open the project, the models will be in the same state.

Select a project or a model and right-click to perform one of many commands such as opening a model, closing a model, and renaming a model or project. For a full explanation of all commands, see File_menu_commands.

Note: You can only have five models open in a project at any time. If you try to open one more model, you will see a dialog box asking you to close a model before opening another.

Comparing multiple designs

You may want to create multiple versions of the same model within a project. These versions might have a different loudspeaker design, different acoustic material treatments or different room geometry.

To create multiple versions of a model:

1. Open or create a project that has at least one model.
2. In the Project window, select the model.
3. Right-click on the model and choose **Duplicate Model**.
4. Modeler software will prompt you to enter a name for the duplicate model. Enter the desired name and click **OK**.

You can now modify the duplicate model. For example, you could add sound absorbing material to certain wall surfaces, or you could create a version that uses different loudspeakers.

To save a version of the model you are working on:

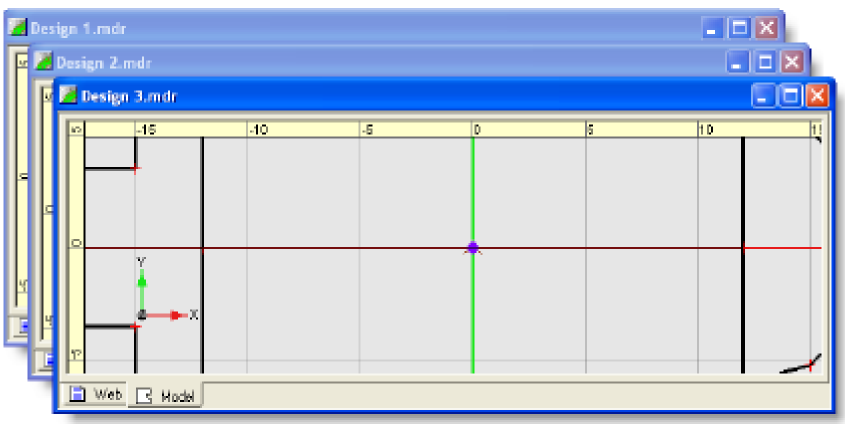
1. Choose **File > Save Model As...**, or right-click on the model in the Project window and choose **Save Model As...**.

2. Enter the name for the new version of the model.

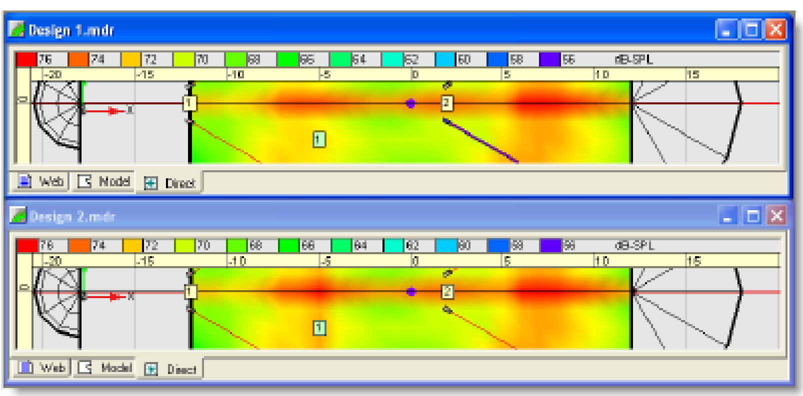
Note: After Save Model As, the newly saved model is open and active, and the original model is closed and remains in the state that it was last saved.

Viewing multiple models

Create multiple versions of the same room model to allow for an easy and quick comparison of the predicted sound quality for different design options. For example, you could create three different designs of the same auditorium using three different materials. Open the models you wish to compare, and choose Window > Cascade, or Window > Tile to view and switch between the designs quickly. Acoustic prediction data is displayed in the Data window as you view each model.



Cascade windows (three models shown)



Tile windows (2 models shown)

File menu commands

The following menu commands can be accessed in the File menu or by right-clicking in the Project window. Many of these commands are only available when working with a project. We recommend that you use projects whenever possible.

New Project:	Create a new project file (.pjt) and project folder and specify its location on the hard drive. You will be prompted to create a new model, add an existing model or import a model into the project. If a project is currently open, you will be prompted to close it before creating a new project.

Open Project...:	Open an existing project by locating it on the hard drive and choosing the .pjt file. If a project is currently open, you will be prompted to close it before opening a new project.
Close Project:	Close the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project:	Save changes to the project. You will be prompted to save changes to models that you have modified, with the option to save all models that have been modified.
Save Project As...:	Create a copy of the project and save it with a different name. All models within the project will be copied. The new saved project will remain open and the original project will be closed.
Rename Project...:	Change the name of the project.
New Model:	Create a new model. You will be prompted to name the new model. If a project is not open, a new model will be created without being added to a project. This model is named “Untitled” by default and can be renamed at any time by choosing Save Model.
Open Model...:	Add an existing model to the project. A copy of the model will be added to the project. If no project is open, the model will be opened without being added to a project.
Close Model:	Close the model.
Save Model:	Save changes to the selected model.
Save Model As...:	Create a copy of the model and save it with a different name. Use this option to save a version of the model you are currently working on. The new saved model remains open and active, and is added to the project. The original model is closed and remains in the state that it was last saved. If no project is open, you will be prompted to choose a location in which to save the model.
Import Model:	Import a model that was not created in Bose Modeler software. The model will be added to the currently open project file. Choose to import a Macintosh Modeler software file (.mac), a Modeler Transfer File (.mtf), and EASE faces file (.xfc), or an EASE project file (.ppj). Note that the file must have the appropriate file extension (.mac, .xfc, .ppj, .dxf) to be imported into Bose Modeler software. If a project is not open, the model will be imported without being added to any project.
Export Model:	**Export loudspeaker data** to a text (.txt) file with tab delimited data for all loudspeakers in the room model. Data includes loudspeaker properties and equalization data for each device. **Export a Modeler Transfer File** (.mtf) which contains all the room model data in a proprietary text format for use in other modeling applications. **Modeler Data Exchange** (.xml) contains all the room model data in Extensible Markup Language (.xml) format for use by ControlSpace® Designer software.
Duplicate Model:	Duplicate the selected model in the project. To select which model to duplicate, click on the model name in the Project window, or click in the Modeling window of the project you wish to duplicate. You will be prompted to name the duplicate model. Modeler software will copy the model and add it to the “parent” project. This option exists only when the model is associated with a project.

Rename Model:	Rename the selected model in the project. This option exists only when the model is associated with a project.
Remove Model:	Remove the selected model from the project. You will be prompted to remove the model from the disk. Choose Yes to delete the model from your hard drive. Choose No to remove the model from the project but not from the hard drive. It is saved in the project folder and can be added back to the project or to another project at a later time. This option exists only when working with a model that is associated with a project.

Project files

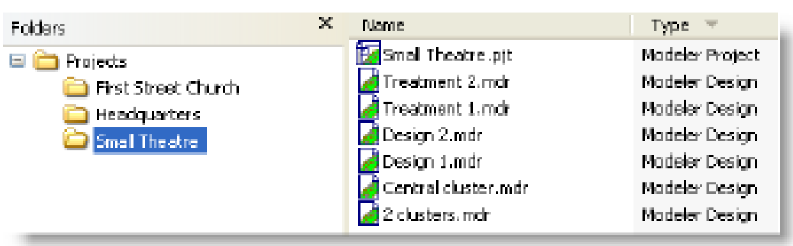
This following covers topics that are related to working with project and model files in the file structure on your hard drive.

Project folders

When you create a project, a project folder is created in the chosen location and a project file (.pjt) is created within the project folder.

Note: When you enter the name of a project in the Create New Project dialog box, the project folder takes on the same name. Changing the project name using the Rename Project function will also change the folder name.

The following figure shows a typical project folder on the hard drive. The folder contains the "parent" project (.pjt) file and the "child" model (.mdr) files.



A project folder and its contents

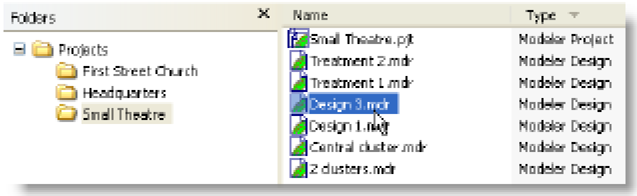
You should use Modeler software to manage projects and models whenever possible. Moving, renaming and deleting project and model files in the file structure on your hard drive is not recommended. For example, to copy a model, use the "Duplicate Model", or "Save Model As..." functions in Modeler software rather than copying the model file on your hard drive.

Renaming, moving, and deleting model files

A project file (.pjt) must be located in the same folder as its "children" models in order for Modeler software to recognize and open the project. Actions carried out in the file structure may cause the project to be "out of sync" in Modeler software. Moving, renaming, or deleting "child" model files (.mdr) in the file structure of your hard drive will cause an error message when opening the "parent" file in Modeler software.

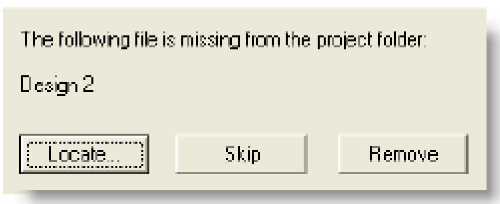
Renaming a file

If you rename a model file (that is associated with a project) on your hard drive, Modeler software will be unable to find the model when you open its "parent" project. You will be prompted to locate, skip, or remove the model file from the project. For example, suppose you renamed the "Design 2" model in the previous figure to "Design 3", as shown:



Renaming the Design 2 model

When you open the "Small Theater" project in Modeler software, you will receive the Project Error message:



Project Error message

Locate...:	Will allow you to search for the model file.
Skip:	Will open the project without the "Design 2" model. (If you select skip, you will receive the same error message every time you open the project until the model is either located or removed).
Remove:	Will remove the model from the project.

Moving a file

If you move a "child" model file from its project folder and then try to open the "parent" project in Modeler software, the program will be unable to locate the model file. You will receive a Project Error message. Clicking Locate... will allow you to find the file on the hard drive. Once located, the model will be added to the project.

Deleting a file

Deleting a model file from a project folder on the hard drive will also cause the Project Error in Modeler software when you try to open the project. You will be prompted to locate, skip, or remove the model from the project. If you select skip, you will receive the same error message every time you open the project until the model is either located or removed.

Renaming, moving, and deleting project files

A project file (.pjt) must be located in the same folder as its "children" models in order for Modeler software to recognize and open the project properly.

Rename:	You can rename a project file in the file structure, but it is recommended that you rename

	projects in Modeler software. If you rename a project file in the file structure of your hard drive, the project will still open properly and all models will remain associated to it. However, the project folder will not be renamed, and will retain the original project name. This may cause confusion when working in Modeler software.
Move:	If you move the project file from its folder to another location, and then open the project, Modeler software will be unable to locate the "child" models because they are no longer in the same folder as the "parent". You will receive an error prompting you to locate, skip, or remove the missing model files. If you select skip, you will receive the same error message every time you open the project until the models are either located or removed.
Delete:	If you delete a project file, you will be unable to open the project. You will need to create a new project and add to it all models previously associated with the deleted project.

Deleting a project

To permanently delete a project, locate the project folder on your hard drive and delete the folder and its contents.

Opening project and model files from the hard drive

You can open a project by double-clicking the project file on the hard drive. If you are running Modeler software and have a project open, you will be asked to close the current project before opening a new one.

You can open a model by double-clicking the model file on the hard drive. If you have a project open in Modeler software, the model will be added to the project. If you do not have a project open or do not have Modeler software running, the model will open in Modeler software without being associated with any project.

Models that are not part of a project

It is possible to work with models that are not associated with any project, although the features of the project structure will be unavailable (such as duplicating the model) as will Auditioner® functions. We recommend that you use projects whenever possible.

Changing model files outside of their project

Using the Open Model... command, it is possible to open any model file on the hard drive, including those that are already associated with a project. If you open a model file that is located in a project folder (i.e. is associated with a project) without opening the parent project and make changes to this model, the changes will be permanently saved to the model. When you open the "parent" project that contains this model, you will see the changes in this model.

Adding models to projects

A model that has been created outside of a project can be added to a project. To add a model to a project, open the project and choose Open Model.... Locate the model on your hard drive and click Open. The model will be added to the project. Note that simply placing a model file into a project folder on your hard drive will not add the model to the project. You must add the model in the Modeler software.

D$_2$R∆STIc Design Process

Bose Professional Systems has developed a process for designing sound systems that ensure good performance in the following five acoustic dimensions:

Consistent tonal balance:	Provide a consistent balance of sound energy in all frequencies throughout the listening area.

Satisfactory loudness:	Achieve the overall loudness that is appropriate for the venue and for the program material.
Proper localization:	Create the perception that sound is originating from its actual source, such as a presenter on stage.
No objectionable sound arrivals:	Eliminate late sound arrivals, such as echoes, that are detrimental to sound quality.
Clear speech:	Provide a system that produces clear and intelligible speech.

The process establishes measurable performance criteria in these acoustic dimensions. The steps in this process are represented by an acronym: **D$_2$R∆STIc**. D$_2$R∆STIc stands for:

D	Direct Field Coverage (first D)
D+R	Direct plus Reverberant (second D, plus R)
∆	Time Arrivals (Greek Delta or change in time)
STI	Speech Transmission Index
c	Confirm using Auditioner® (listen to the design using the Auditioner® Playback System III)

Each step in the D$_2$R∆STIc process corresponds to one of the following dimensions of high quality sound, as illustrated below:

To create consistent tonal balance:	Provide even and consistent **D**irect Field Coverage.	**D**
To achieve satisfactory loudness:	Optimize the total SPL across listening area, by analyzing the **D**irect plus **R**everberant sound.	**D + R**
To eliminate undesirable sound arrivals: **AND** **Establish proper localization:**	Predict and adjust time-arrivals (∆) at all listener locations and set proper signal delays.	∆
To provide clear speech:	Achieve the highest possible **S**peech **T**ransmission **I**ndex.	**STI**

Overview of D^2RΔSTIc Steps

The D_2RΔSTIc steps are meant to be followed in order. Each step is dependent upon the previous step. If a design change causes you to return to a previous step, continue through all steps sequentially.

- **Step 1 - Calculate the Direct Field coverage**

  The Direct Field is the sound that reaches the listener's ears directly from the loudspeakers; it does not include any reflections. In this step, the sound system designer should try to achieve even and consistent tonal balance in the 1 - 4 kHz frequency range.

- **Step 2 - Calculate the Direct plus Reverberant Field coverage**

  The Direct plus Reverberant field represents all of the sound energy arriving to the listener, both directly and after first and second order reflections. To determine the loudness of the sound system, the sound system designer calculates the Direct plus Reverberant field for the full frequency range from 31 Hz to 16 kHz.

  NOTE: In this step the overall tonal balance of the system is set by applying EQ.

- **Step 3 - Predict Time-Arrivals**

  Time-arrivals describe how and when sound reaches the listener. Arrivals that are later than 100 ms of the direct arrival, and 10 dB or more above the reverberant field, can be perceived as an echo.

  Loudspeaker delays should also be set to establish proper localization of sound.

- **Step 4 - Determine Speech Intelligibility**

  To determine whether the sound system produces clear and intelligible speech, Modeler software predicts the Speech Transmission Index (STI) using a proprietary algorithm known as the Hybrid Energy Decay Curve™ (HEDC™).

The steps in the D_2RΔSTIc process can be used to create a sound system that delivers high quality sound. Modeler software is designed to facilitate the use of the D_2RΔSTIc process in your project. Use the method outlined in this chapter as a guide to creating a successful sound system installation.

The following information covers how to view sound prediction data in Modeler software, with an emphasis on the steps of D_2RΔSTIc. For each step in D_2RΔSTIc, this information covers:

- How to generate the sound prediction data.
- How to evaluate the sound prediction data.

If you are not already familiar with the basic interface of Modeler software, please refer to the Modeler Software Interface, to become acquainted with the basic features of the program.

Opening the Sample Model

The sample project, **First Street Church.pjt**, is used for D_2RΔSTIc examples.

Follow these steps to open this project and model:

1. Click File > Open Project...
2. In the Look in: drop-down, choose your desktop.
3. Open the Tutorial folder, then open the First Street Church folder.
4. Open the file named First Street Church.pjt

   You will see this in the Project window:

First Street Church project in Project window

NOTE: If you cannot see the Project window, go to View > Window > Project.

5. Double-click on the Design 1 model in the Project window. The Design 1 model opens.
6. Close the Project window.

Performing the D_2R∆STIc Process

Step 1 - Calculate the Direct Field Coverage

1. Generate the Direct Field coverage map:
   A. Enable the D_2R∆STIc engine by clicking on the Enable **D_2RDSTIc** Engine button in the Map toolbar:

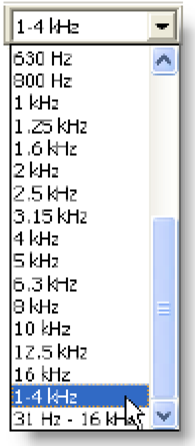
Enable D_2R∆STIc Engine button

   B. Click the Direct button on the Map toolbar.

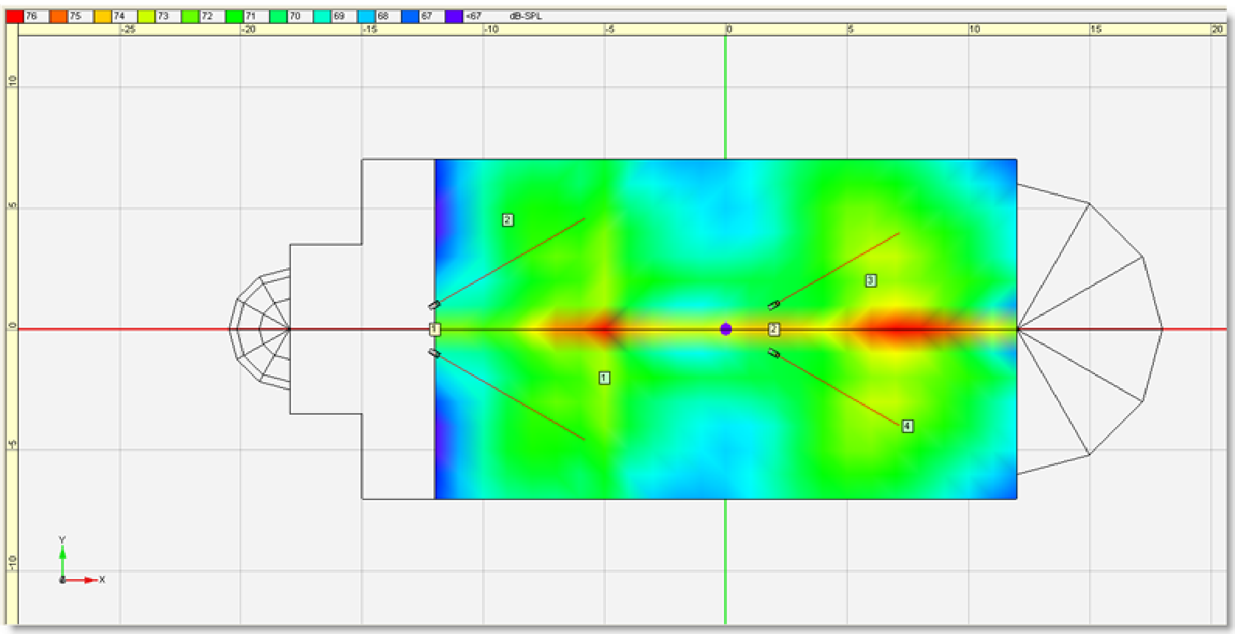
Direct button

   Modeler software calculates the Direct Field coverage for the seating area and displays it in the **Modeling** window.

2. Evaluate your coverage map:
   For D_2R∆STIc, the Direct Field coverage should be evaluated using an average of the 1 - 4 kHz octave bands.
   To display the coverage map for the 1 - 4 kHz average, choose 1 - 4 kHz in the Frequency toolbar:



Choosing 1 - 4 kHz in the Frequency drop-down menu



Direct Field coverage map at 1 - 4 kHz

Tip: The Direct Field coverage map for the 1 - 4 kHz frequency range can be generated in a single step using the Design menu. Go to Design > D^{2}RΔSTIc > Direct (1 - 4 kHz) or press F5.

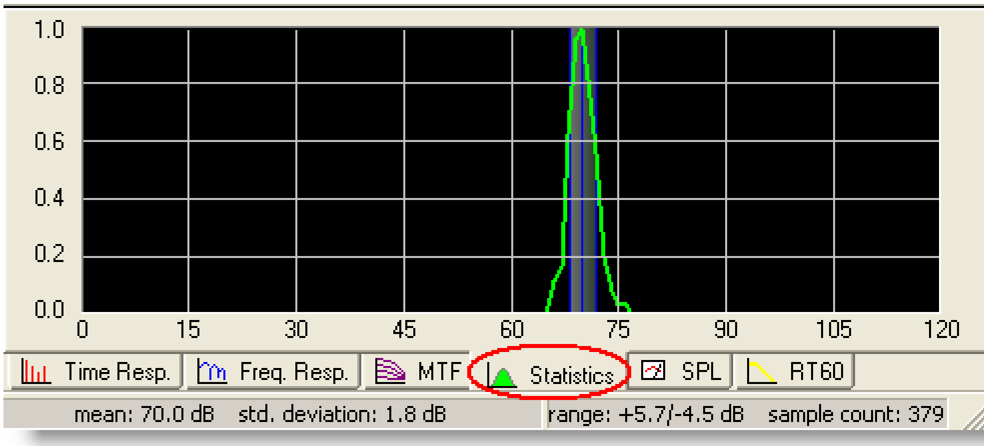
The Direct Field coverage map shows the sound pressure levels as a spectrum of colors. The correlation between SPL levels and color can be found in the map legend at the top of the window.

Inspect the coverage map to gain insight into the regions of coverage for each loudspeaker in the system. The coverage map also provides the visual feedback necessary to re-aim loudspeakers, substitute loudspeakers, or change the gain for various loudspeakers.

3. Evaluate the evenness of coverage:

   The Statistics tab histogram indicates the evenness of coverage in the coverage map. The Statistics tab is a plot of the normalized occurrence of a particular SPL (vertical axis) versus the SPL value (horizontal axis). This can be thought of as the likelihood that a given SPL is being displayed in the map.

   To evaluate the evenness of the coverage, select the **Statistics** tab in the **Data** window.

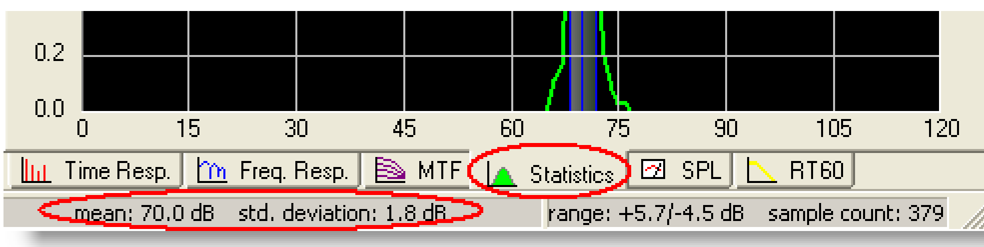


Statistics tab

The Statistics tab displays:

Green Line:	Histogram curve.
Middle Blue Line:	Mean.
Outer Blue Lines:	Standard deviation from the mean.
Shaded Area:	Values within standard deviation.

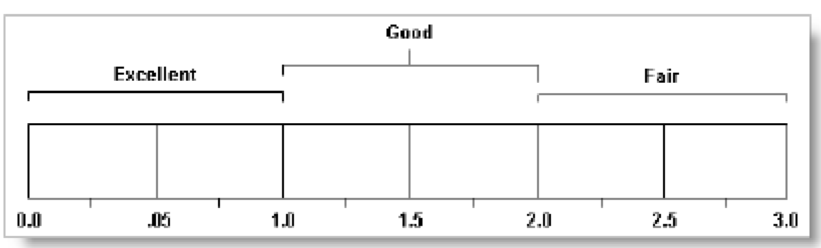
The mean SPL and standard deviation are displayed below the Statistics tab in the Status Bar.



Status bar

Assuming you have established fairly even coverage, the **Statistics** tab shows a normal distribution of samples. This means that 95% of the samples fall within the mean +/- two standard deviations. In this example, as the mean is 69.9 dB and the std. deviations is 1.8 dB, 95% of the listening area is within the 66.3-73.5 dB SPL range.

The standard deviation is a quantitative representation of the evenness of the direct coverage. The following qualitative descriptors can be used in regard to the standard deviation:



Step 2 - Calculate the Direct plus Reverberant Field Coverage

Follow these steps to generate the Direct plus Reverberant Field coverage map:

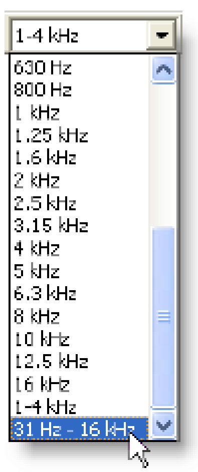
1. Generate the Direct + Reverberant filed coverage map.
   Make sure the D^{2}R∆STIc engine is still on.
   Click the Direct + Reverberant button on the Map Toolbar.

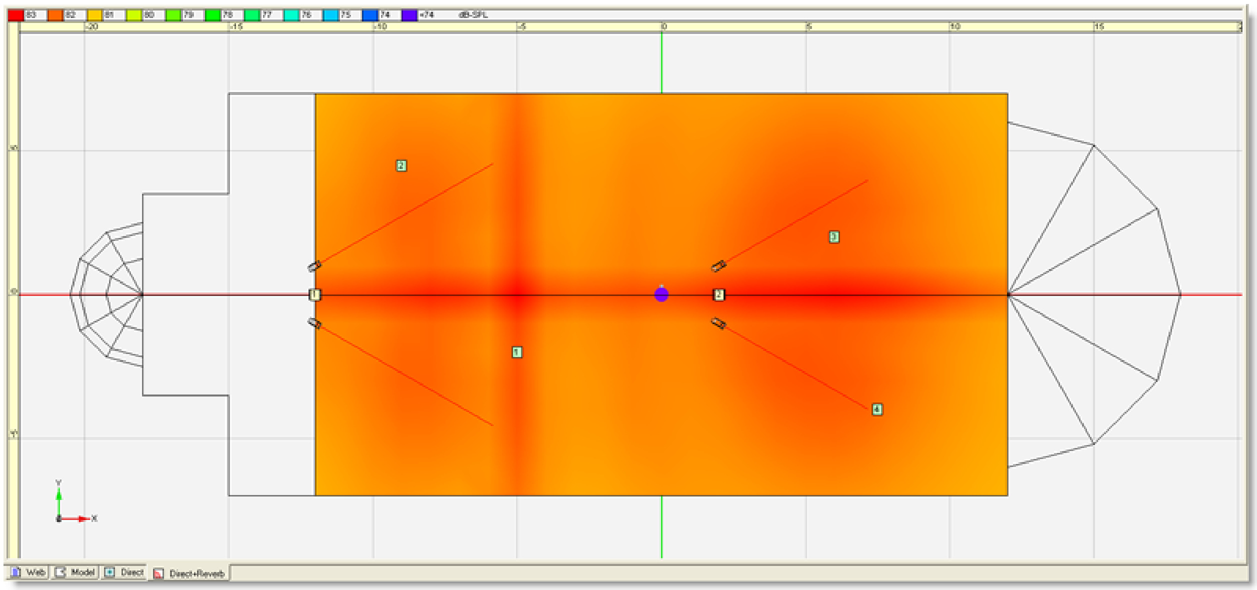
   Direct + Reverberant button

   The D$_{2}$R∆STIc engine predicts the Direct plus Reverberant Field coverage and displays it as a new tab in the Modeling window.

2. Evaluate your D+R coverage map.
   The D+R step in D^{2}R∆STIc is used to equalize the system to a desired response and to determine the sound pressure levels produced by the system. The Direct plus Reverberant coverage should be examined for the full audio spectrum (31 Hz - 16 kHz frequency range).
   To display the coverage map for 31 Hz - 16 kHz:
   A. Choose 31 Hz - 16 kHz in the Frequency toolbar.

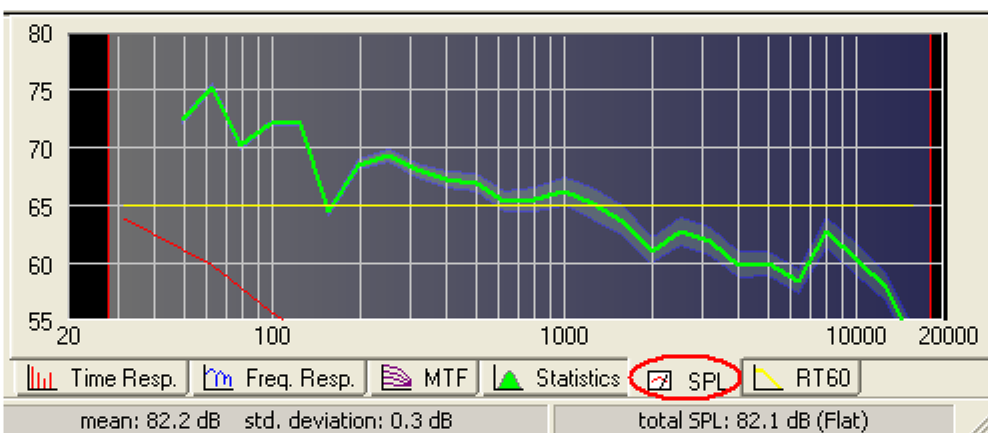
   Choosing 31 Hz - 16 kHz in the Frequency drop-down menu



Direct plus Reverberant coverage map at 31 Hz - 16 kHz

Tip: The Direct plus Reverberant Field coverage map for the 31 Hz - 16 kHz frequency range can be generated in a single step using the Design menu. Go to Design > $D_2R\Delta STIc$ > Direct+Reverberant (31 Hz - 16 kHz) or press F6.

B. Select the SPL tab in the Data window to see room SPL data across the full frequency range:



SPL tab

The SPL tab displays:

Green Line:	The mean SPL at each frequency.
Shaded Area Surrounding Green Line:	The standard deviation from the mean.
Red Line:	The background noise level.
Yellow Line:	The house curve.

The status bar below the graph shows the mean SPL for the selected frequency range, and the standard deviation for the selected frequency range. The right-hand average total SPL for all frequency-range.

3. Adjust the equalization

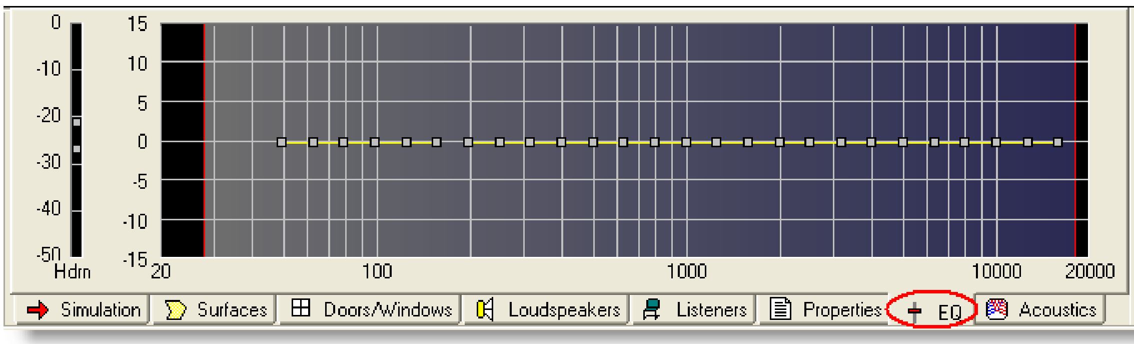
The loudspeaker equalization is adjusted through the EQ tab in the Detail window.

A. Select the **EQ** tab in the **Detail** window.

B. To see the equalization setting for a given loudspeaker or loudspeakers, right-click on the graph and choose Select Speakers... (or press F3).

To see the EQ setting for all loudspeakers that are turned on, right-click on the graph and choose Select Active Speakers (or press F4).

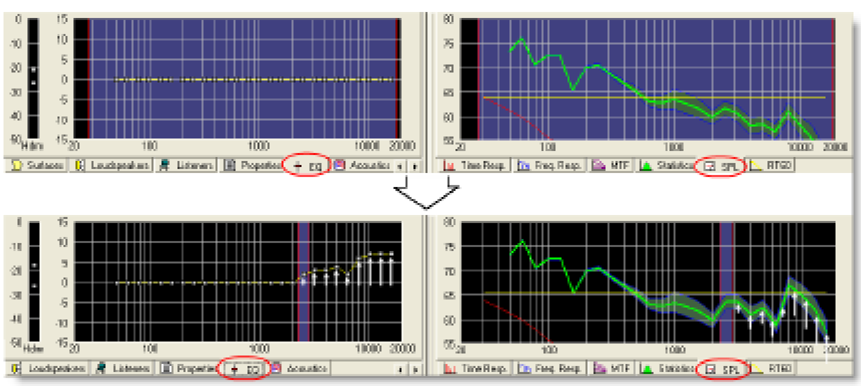
The EQ curve for the selected loudspeaker or loudspeakers is displayed on the EQ tab.



EQ tab displaying loudspeaker EQ curve

C. Adjust the EQ curve by moving the gray boxes on the curve up or down.

The effects of your change can be seen directly on the SPL tab on the Data window, which shows the room-response.



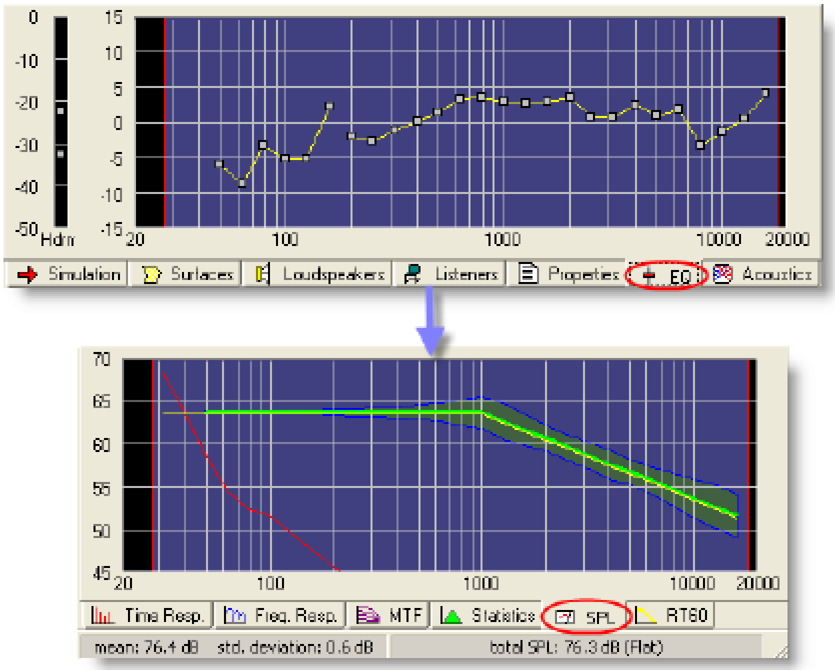
A change in the loudspeaker EQ affecting the room equalization in the SPL tab

D. Right-click in the EQ window and select **Zero Equalizer** to undo the EQ's.

EXAMPLE: Equalizing the sound system to a House Curve

1. Go to Acoustics and click on the **Open** button in the House Curve section.
2. Select **Flat_w_1k_knee**.
3. Click **OK**, you will see the House Curve update in the SPL window.
4. Go to the EQ window.

5. Press **F4** to select all active speakers (or right-click on the graph and select **Select Active Speakers**).
6. Right-click in the EQ window and select **Apply House Curve**. You will see the EQ’s being updated and the room SPL data match the target curve.



Resulting SPL graph via applying House Curve

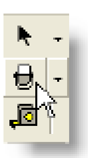
7. Make sure D_2RΔSTIc is turned on.

4. Predict the frequency response

   You can view the frequency response at a particular point in the model.

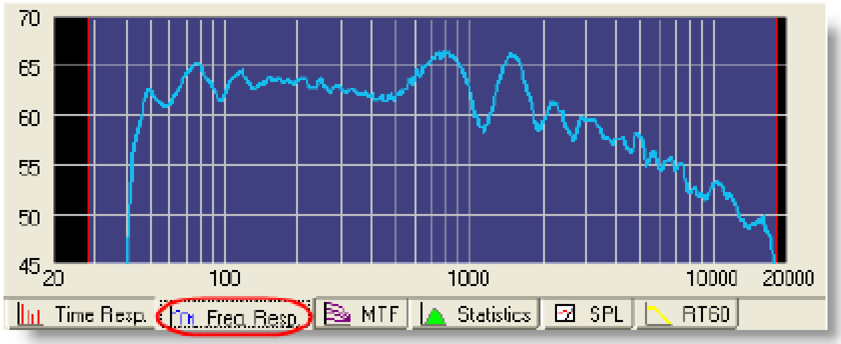
   To view frequency response, use the Freq. Resp. tab in the Data window:

   A. Select the Sample Tool from the Draw Toolbar.

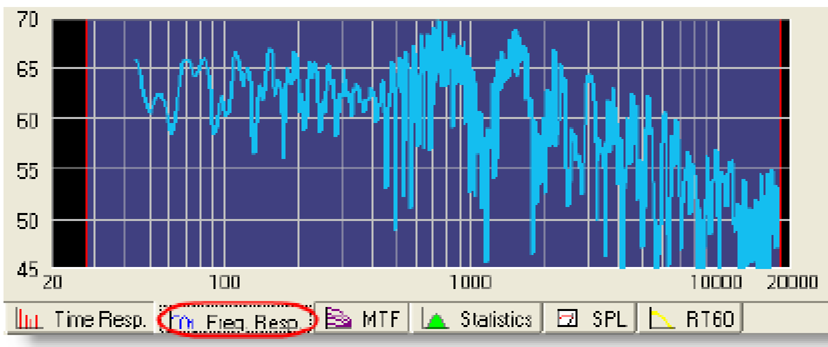
   

   Sample tool

   B. Click at the point on the coverage map where you would like to view the frequency response.
   C. Select the Freq. Resp. tab in the Data window to see the frequency response at the selected location in your model.



Freq. Resp. tab with $^{1}/_{3}$ octave smoothing



Freq. Resp. tab with 0 octave smoothing

A smoothing function is applied to the frequency response curve at the selected bandwidth. Lower values / wider bandwidths result in finer resolution, more smoothing. Select 0 Octave to turn smoothing off.

5. Calculate the maximum SPL of the system

   The last part of Step 2 in the D$_2$RΔSTIc process, is to calculate the maximum SPL of the sound system with program material.

   A. Go to SPL tab.
   B. Right-click in the window and select **Program SPL**.
   C. A dialog box appears, stating that the maximum SPL is 101.1 dB-SPL.

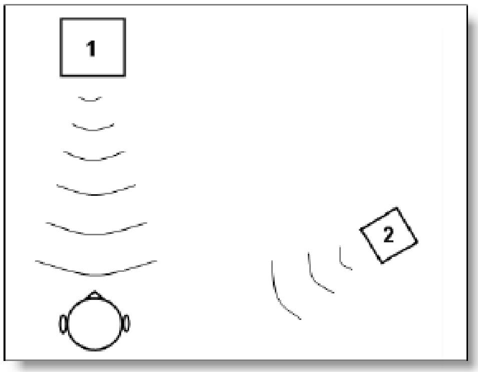
Note: The Program SPL is calculated with the amps turned up until the first speaker reaches its maximum power handling.

Step 3 - Predict Time-Arrivals

Time-arrival predictions in Modeler software are used to establish proper localization and to eliminate any undesirable sound arrivals.

To establish proper localization, it may be necessary to set loudspeaker delays. In a system with multiple loudspeakers, the listener receives time-arrivals from many different loudspeakers located in different parts of the room. It has been shown that listeners localize sound to the source producing the first time-arrival.

In the following figure, sound waves from loudspeaker #1 arrive at the listener first. It will appear to the listener that all sound is coming from the direction of loudspeaker #1, even if loudspeaker #2 is closer and/or slightly louder. In a decentralized or distributed sound system, the designer must set loudspeaker delay times properly so that the listener first receives sound from the loudspeakers nearest to the actual sound source.



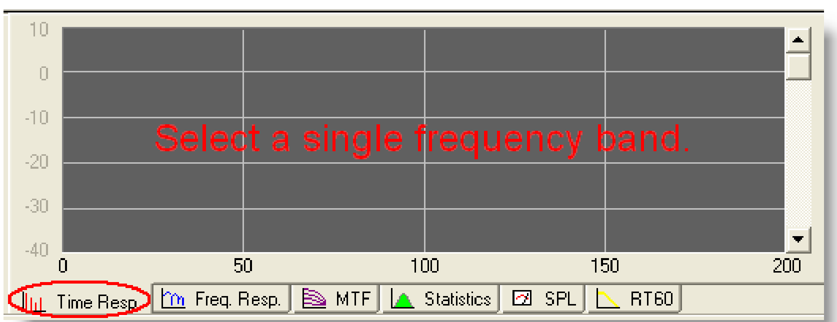
A listener receiving time arrivals from two speakers

Note: For an array you will deal with two delays; one delay to get the array to perform correctly and one for the cluster to be assigned with other clusters in the room model as above.

The following describes how to establish proper localization by setting loudspeaker delays, and then shows how to identify undesirable sound arrivals.

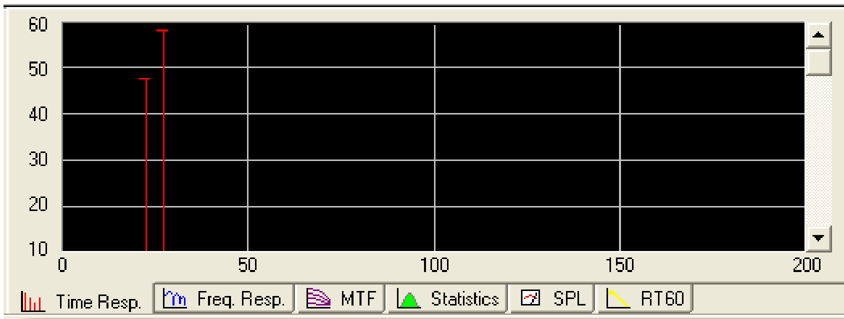
1. Generate direct time-arrival predictions for establishing proper localization:
   A. Make sure the D_2RΔSTIc engine is still on.
   B. Select the Time Resp. tab in the Data window to display time-arrival data.
   C. Select the Direct tab in the Modeling window to view the Direct Field coverage map.

   Note: Time-arrival data cannot be displayed for a range of frequencies, such as 1 - 4 kHz, or 31 Hz - 16 kHz. The Time Resp. tab will be grayed out and a warning will be displayed in the graph, indicating to pick a single frequency band from the Frequency drop-down menu.



Tip: Direct time-arrivals can be generated in a single step using the Design menu. Go to Design > D_2RΔSTIc > Time (2 kHz) or press F7.

   D. Select the Sample tool from the Draw toolbar.
   E. Click anywhere in the seating area to generate direct time-arrivals for that location. Notice that placing the Sample tool generates data in the Time Resp. tab:

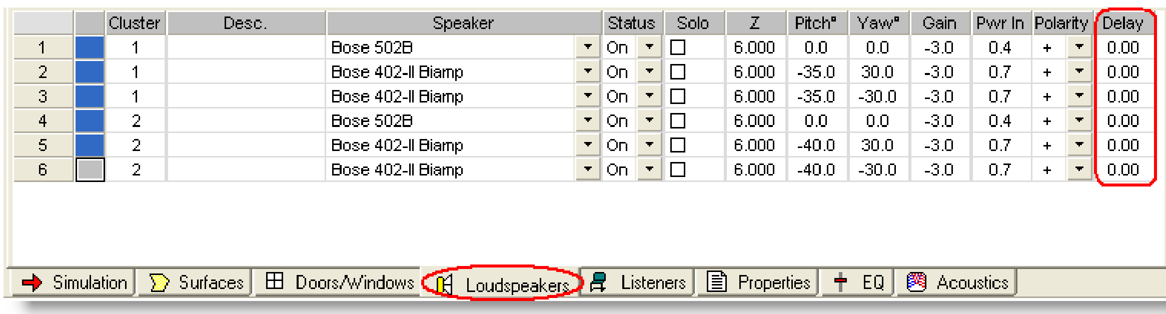


Time Resp. tab showing direct arrivals

The Time Resp. tab displays elapsed time on the horizontal axis and SPL on the vertical axis. The red pins represent direct sound arrivals at the location of the sample tool. By clicking on a pin, or by using the scroll bar to the right of the window, you can see which loudspeaker the direct arrival is coming from in the Modeling window.

For proper localization, the first arrival at any location should be from the loudspeaker closest to the actual sound source or presenter. In this example, Cluster 2 needs to be delayed.

F. Set the necessary loudspeaker delay times in the **Loudspeakers** tab to achieve the appropriate localization for your room. When complete, the loudspeaker tab should look like this:



		Cluster	Desc.	Speaker	Status	Solo	Z	Pitch°	Yaw°	Gain	Pwr In	Polarity	Delay
1		1		Bose 502B	On	☐	6.000	0.0	0.0	-3.0	0.4	+	0.00
2		1		Bose 402-II Biamp	On	☐	6.000	-35.0	30.0	-3.0	0.7	+	0.00
3		1		Bose 402-II Biamp	On	☐	6.000	-35.0	-30.0	-3.0	0.7	+	0.00
4		2		Bose 502B	On	☐	6.000	0.0	0.0	-3.0	0.4	+	0.00
5		2		Bose 402-II Biamp	On	☐	6.000	-40.0	30.0	-3.0	0.7	+	0.00
6		2		Bose 402-II Biamp	On	☐	6.000	-40.0	-30.0	-3.0	0.7	+	0.00

Loudspeakers tab showing Delay column

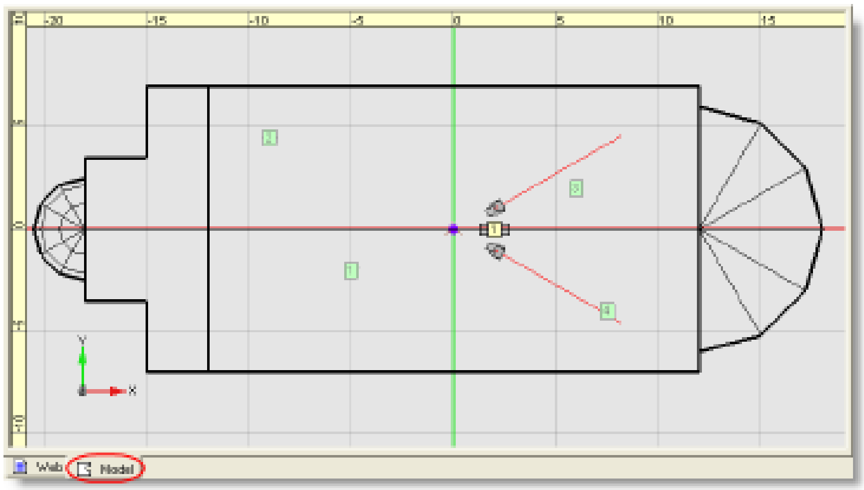
Note: The example below is a delayed cluster with an endfire array of 2xMB12 and 2xLT6400. The cluster has been delayed by 50 ms to provide proper localization. In addition the second MB12 has a 2.32 ms delay to create the endfire bass array. In the real implementation, the following delays would be applied:

6400: 50 ms

6400: 50 ms

MB12: 50 ms

MB12: 52.32 ms



3. Generate all time-arrival predictions

   To identify and eliminate objectionable time-arrivals, do the following to generate all direct, first order, and second order time-arrivals:

   A. Make sure the D^{2}R∆STIc engine is still on.

   B. Click the Speech Intelligibility button on the Map toolbar:

   Speech Intelligibility button

   This enables the calculation of the Hybrid Energy Decay Curve™ (HEDC™), which is required for predicting first and second order reflections.

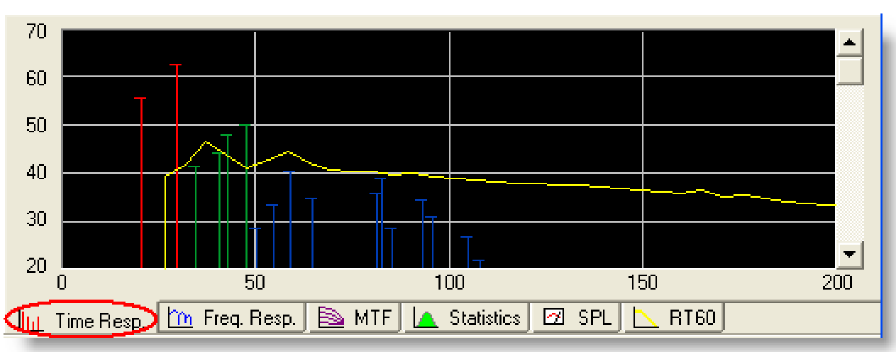
   C. Select the Time Resp. tab in the Data window to display time-arrival data.

   D. In the Simulation tab, choose a single frequency in the Frequency drop-down menu.

   Time-arrivals are not displayed for a range of frequencies, such as 1 - 4 kHz, or 31 Hz - 16 kHz.

   C. Select the Sample tool from the Draw toolbar.

   D. Click anywhere in the seating area to generate time-arrival data for that location. Placing the Sample tool generates data in the Time Resp. tab:



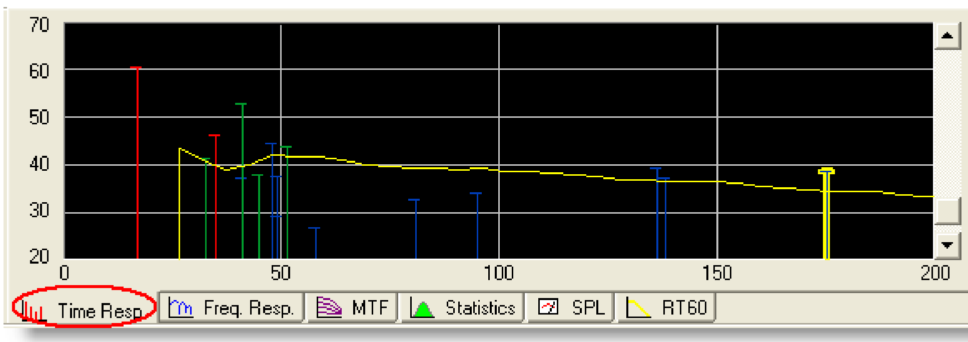
Time Resp. tab showing all time-arrivals

The Time Resp. tab displays all direct, first order, and second order time-arrivals:

Red pins:	Direct arrivals from the sound source.
Green pins:	First order reflections. They have reflected off of one surface.
Blue pins:	Second order reflections. They are arriving at the sample point after reflecting off of two surfaces.
Yellow line:	Reverberant Field Envelope Function (RFEF), which shows the build-up and decay of reverberant energy in the room.

Click on a pin in the graph to generate the path from the source to the listener location, which is viewed in the **Modeling** window. You can scroll through the pins sequentially using the scroll bar to the right of the Time Resp. graph.

Time-arrivals are potentially objectionable if they arrive more later than approximately 100 ms after the direct arrival, and 10 dB or more above the reverberant field.

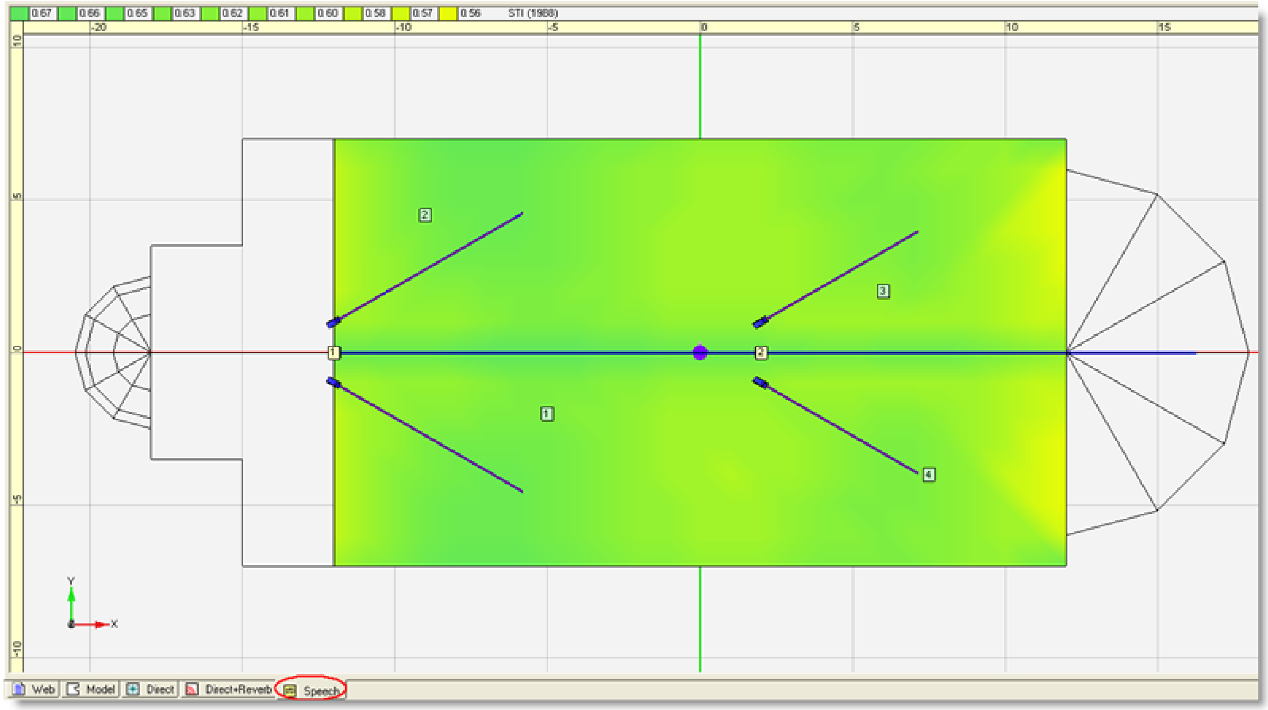


A late and strong arrival

Note: If multiple arrivals over a short interval aggregate to a level of 10 dB more than the reverberant field, an echo may result.

Step 4 - Generate Speech Intelligibility Data

1. Click the Speech Intelligibility button to generate the Speech Intelligibility (STI) coverage map.
   The Speech Intelligibility button is located on the Map toolbar.



STI coverage map

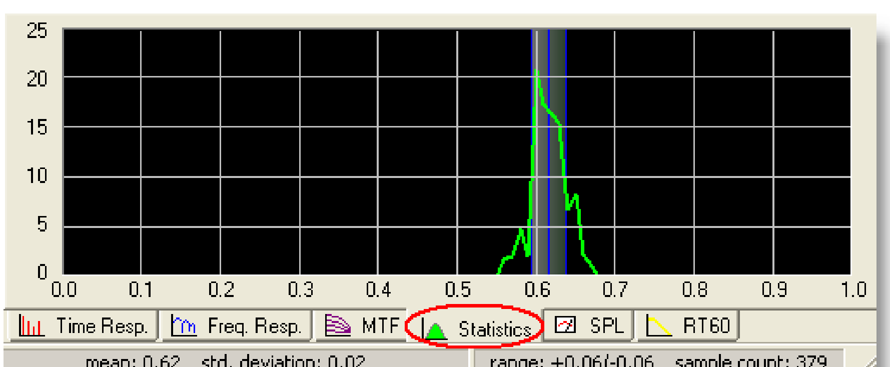
Tip: The Speech Intelligibility coverage map can be generated in a single step using the Design menu. Go to Design > D_2RΔSTIc > Speech (STI) or press F8.

Note: When pressing F8 or simply calculating Speech Intelligibility, Modeler's default algorithm is the STI adhering to the 1988 standard. You can use a different algorithm by changing the algorithm drop-down field in the Simulation tab. For more information, see the Simulation Tab.

2. Evaluate the STI data.

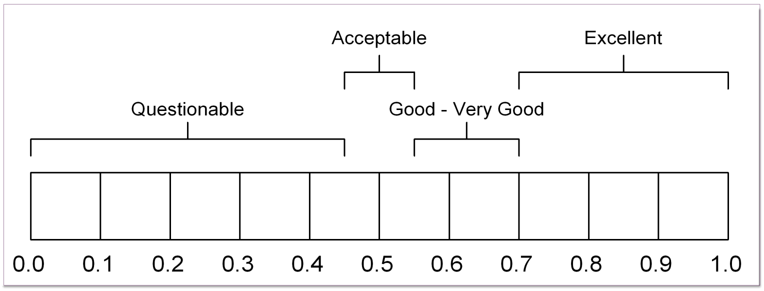
   The STI coverage map shows the landscape of speech intelligibility for your model. The correlation between colors in the map and actual STI numbers is shown in the map legend at the top of the window.
3. Select the Statistics tab

   When displaying STI data, the Statistics tab provides a quantitative display of the level and uniformity of speech intelligibility in your design.



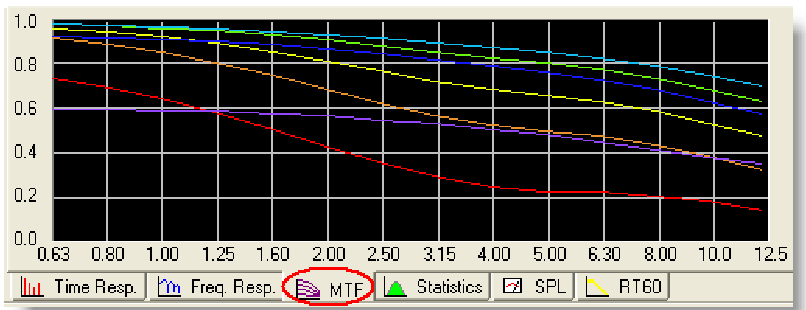
Statistics tab displaying STI data

Use the following scale to assign qualitative descriptors to the STI numbers in your model:



STI number

4. Place the **Sample** tool in your coverage map and select the Modulation Transfer Function (MTF):



The MTF tab display

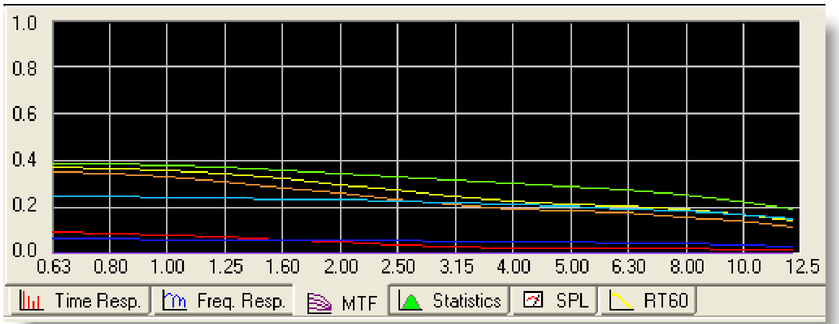
The MTF tab displays the normalized amount of modulation preserved (vertical axis) versus modulation frequency in Hz (horizontal axis) at the location of the **Sample** tool. The 7 lines in the graph correspond with the 7 octave bands:

Red:	125Hz
Orange:	250Hz
Yellow:	500Hz
Green:	1kHz
Blue (light blue):	2kHz
Indigo (dark blue):	4kHz
Violet:	8kHz

Diagnosing and correcting speech intelligibility problems

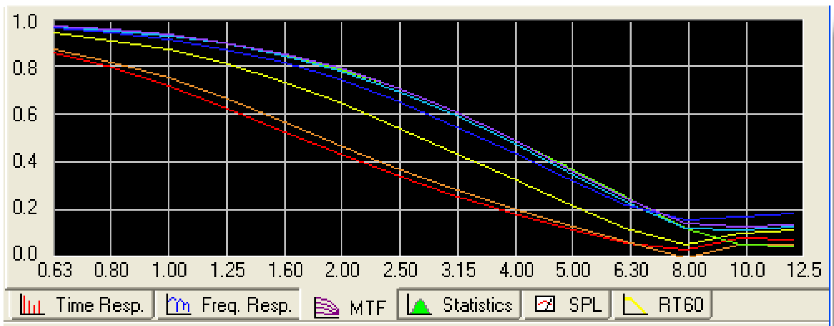
The shape of the MTF contains information that can help to diagnose the cause of speech intelligibility reduction. Use the following guidelines when diagnosing poor speech intelligibility:

Background noise has the effect of reducing the entire MTF, independent of modulation frequency. The lines would both start and end lower on the graph.



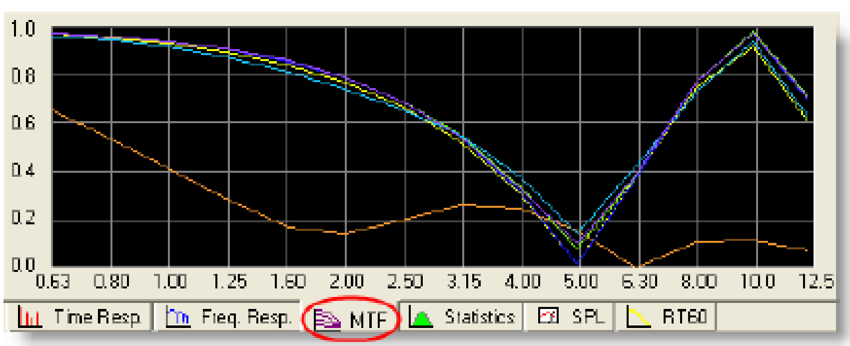
A reduced MTF due to background noise

Reverberation has the effect of gradually decreasing the modulation as the modulation frequency increases. The MTF that results from high reverberation levels will slope continuously downward. Higher reverberation times cause the curve to decrease more rapidly.



A downward sloping MTF caused by reverberation

Late-arriving reflections have the effect of putting a notch in the MTF. The later the reflection, the lower the modulation frequency at which the notch occurs.

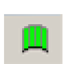


A notched MTF caused by late reflections

Tip: The notch is located at a frequency, f where $f = \frac{1}{2\times\Delta t}$ where Δt is the time difference between the two arrivals causing the echo. If you see a dip at 5 Hz, look at 2 arrivals spaced by roughly $\frac{1}{2\times 5Hz}$ or 100 ms.

Using Extrusion Tools

Modeler software includes five extrusion tools to assist in the creation of room models and complex room features. Found on the Extrusion Toolbar, the extrusion tools include:

Icon	Tool	Description
	**Extrude Walls**	Creates a complete set of walls, capped by a ceiling plane based on a single floor surface. The extrusion will always be along the Z-axis and to the extent is specified by the user. Typically used to either quickly create a room model, or to create the starting point for room modeling which can be edited to create the final model. Extrude Walls can also be used to extrude “downwards” from the floor surface.
	**Extrude Surface**	Extrudes a set of surfaces from a reference surface within the room model. The surfaces will terminate at the specified target surface. Typically used to quickly complete a room model based on a set of two reference surfaces.
	**Extrude Rectangular Surface**	Extrudes a set of walls from a rectangular surface. Typically used to quickly create a room model or a complex room feature.
	**Extrude Polygonal Surface**	Extrudes a set of walls from a polygonal floor surface. Typically used to quickly create a room model or a complex room feature.
	**Extrude Arc**	Extrudes an arc or column from a reference surface. Typically used to create a cylinder or column within the room model which is bounded by a floor and ceiling surface.

When using the extrusion tools there are some terms with which you will want to become familiar.

Extent – the endpoint of the extruded surface. Some surfaces are extruded from a selected surface, so one of the Extents is known, while the other must be specified. In cases where two extents must be defined the minimum extent has the lowest elevation in the model, and the maximum has the highest elevation in the model.

Termination – determines how the end of the extrusion will be handled. It can be left open, closed, or no action can be specified.

Within Modeler® software extrusions fall into two categories:

An **EXISTING** surface is extruded in the direction of three axes: X, Y, Z or the normal of the surface. A surface normal to a flat surface is a vector which is perpendicular to that surface. In this case, the existing surface remains unchanged. The Extrude Walls and Extrude Surface tool perform this operation.

A **VIRTUAL EXTRUSION SHAPE** is drawn in the room model and extruded in the direction of one of the three main axes: X, Y, Z. The virtual plane disappears once the extrusion is completed, and the newly extruded surfaces terminate at two other existing planes (donor planes).

In other words, the extruded shape is limited by features in the room model that intersect with the extruded shape.

The following are several examples of how these tools can be used.

Extrusion Basics

The extrusion tools are intended to help you quickly create room models, and the two tools used most often for this purpose are the Extrude Walls tool and the Extrude Surface tool.

The use of the Extrude Walls tool to create a basic room geometry that can be edited is covered within the Introduction to Modeler training.

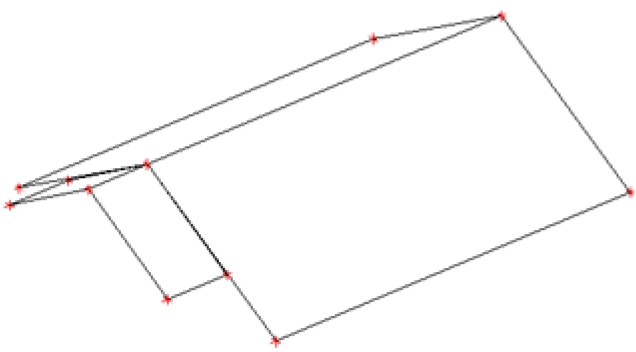
The Extrude Surfaces tool creates a set of surfaces between two surfaces. Using this tool it is possible to quickly create room models from two wall surfaces.

The following examples illustrate of how a model can be quickly created using the extrusion tools.

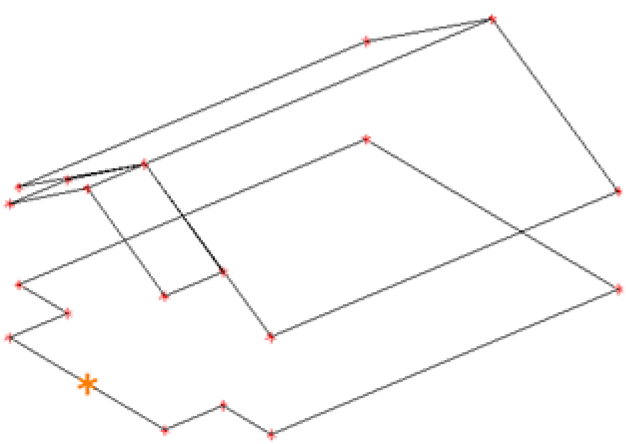
Example #1 - Creating a model using the Extrude Surface tool

1. Model the Ceiling.

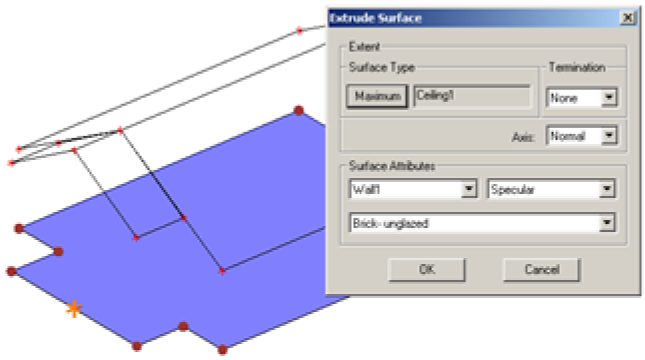
   In this model the ceiling describes the overall shape of the room, and can be quickly modeled.



2. Using the ceiling shape as a template to model the floor using the Polygonal Surface tool.



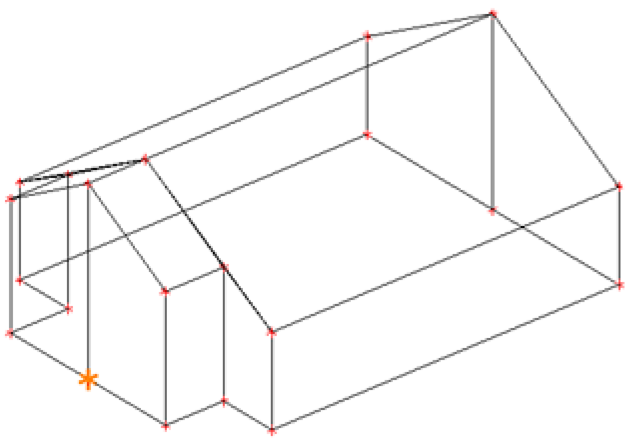
2. You are now ready to extrude the remaining surfaces. After selecting the floor, Select the Extrude Surface tool.



The floor is the one known extent, and you must specify the Ceiling to be the other extent for all extruded surfaces. In this model, since we already have a ceiling, the termination is defined as None.

3. Define the surface attributes and click **OK**.

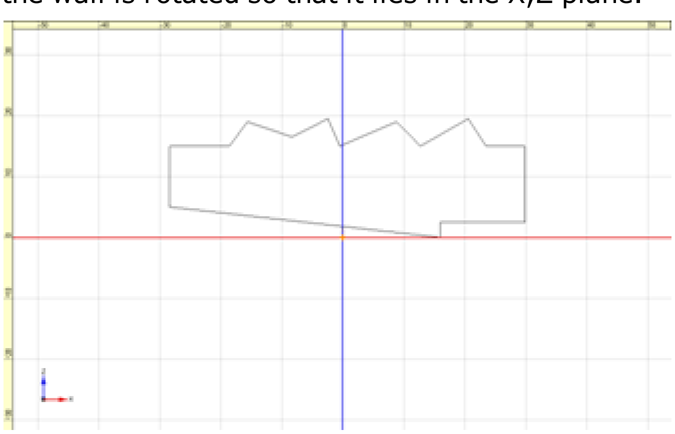
   The basic model is created and is ready for editing, or a basic design can be implemented.



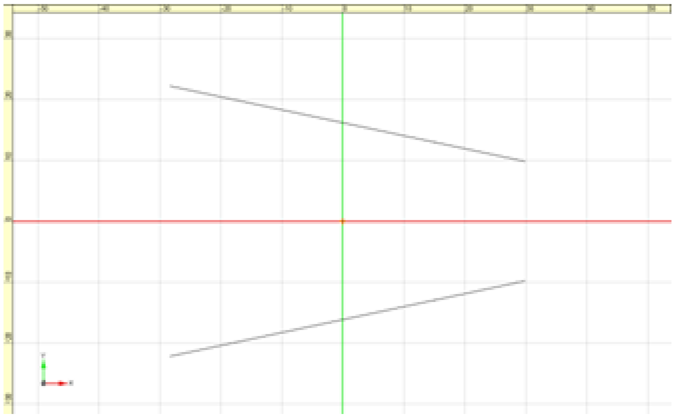
Example #2 - Creating an auditorium model

This second example demonstrates how to create an auditorium room model on a single surface.

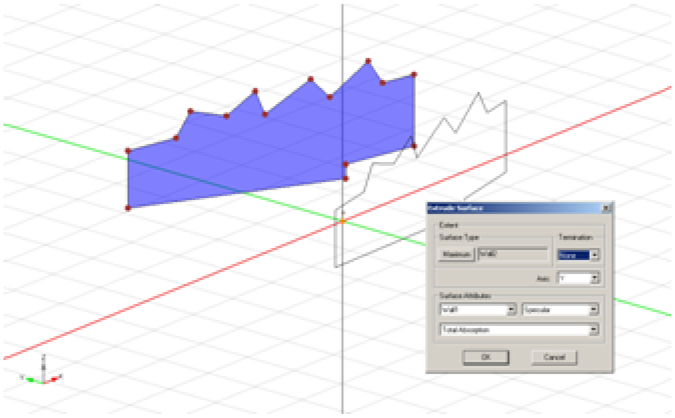
1. In this example the side wall of the auditorium is used to describe the articulated ceiling and raked seating area. The shape of the side wall is drawn using the draw Polygon tool in plan view, and then the wall is rotated so that it lies in the X,Z plane.



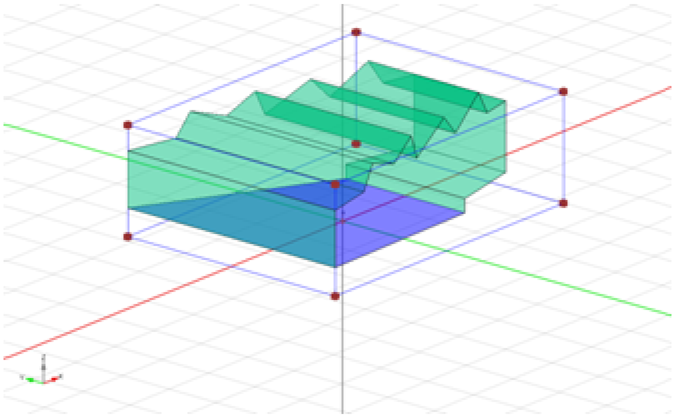
2. Mirror the surface. You now have two side walls.



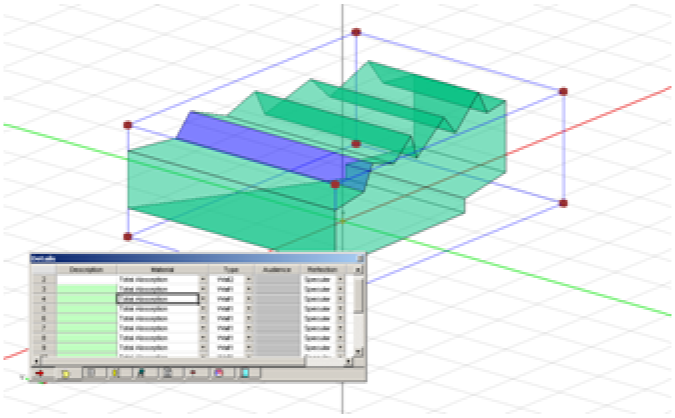
3. Use the Extrude Surface tool to create the complete room model.
   NOTE: This surface must be extruded along the Y (red) axis.



   When a surface is extruded the new surfaces are created as a group:



4. Now that all of the surfaces of the room model exist we will need to manually edit their individual surface properties. This is accomplished using the Surfaces Tab, and stepping through each surface individually.



NOTE: The selected surface is highlighted in blue.

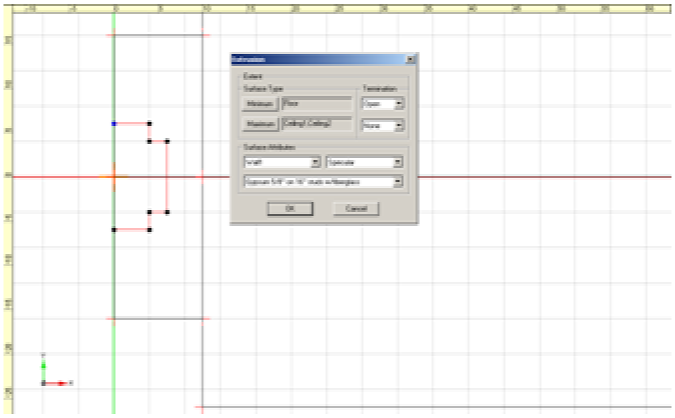
The Extrude Rectangular Surface, Extrude Polygonal Surface and Extrude Arc tools create a set of surfaces from a polygonal, rectangular or arc shape. The new surfaces are extruded between two existing room model surfaces.

Example #3 - Adding a room feature using the Extrude Polygonal tool

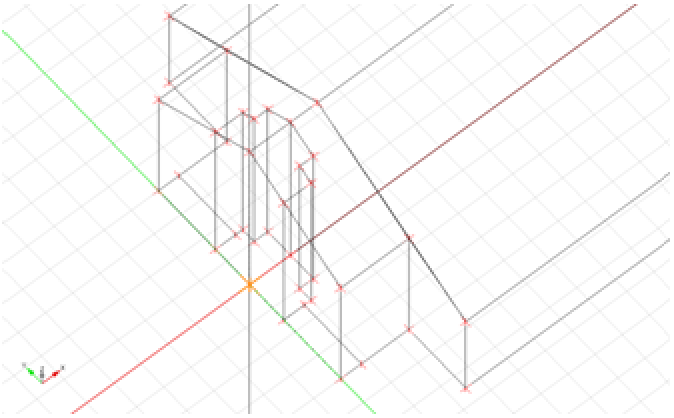
In this example the Extrude Polygon tool is used to add an interior room feature.

1. Define the shape of the new extrusion using the polygonal or rectangular extrusion tool.

   Define the termination for the extents of the new extrusion. In this case the bottom, (Minimum,) extent is open, and the top, (Maximum,) extent is not terminated.



2. View the results of the newly extruded surfaces.

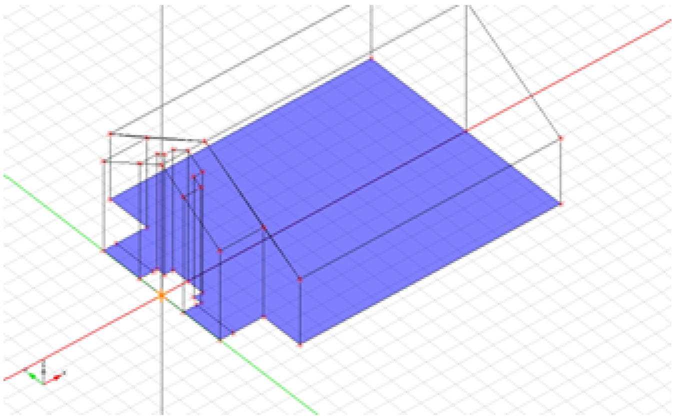


When a new extrusion is created using an open termination, Modeler® software will modify adjacent surfaces such that they properly intersect the newly extruded surfaces, but do not create any bent planes. In some cases this results in a large number of surfaces being created.

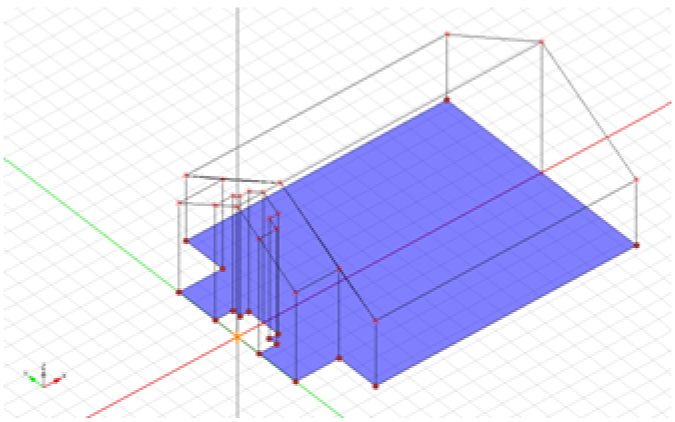
Example #4 - Using the Merge Surfaces tool

The Merge Surfaces tool is used to clean up the room model once an extrusion with an open termination is created and after a model or individual surfaces are mirrored. The following demonstrates how the Merge Surfaces tool can be used to reduce the number of surfaces used in this room model.

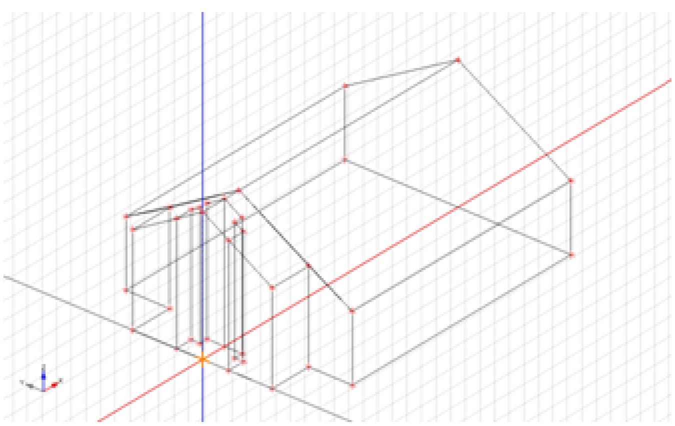
1. Select two or more adjacent surfaces which are coplanar.



2. Select the Merge Surfaces tool and the two surfaces are now merged into a single surface.



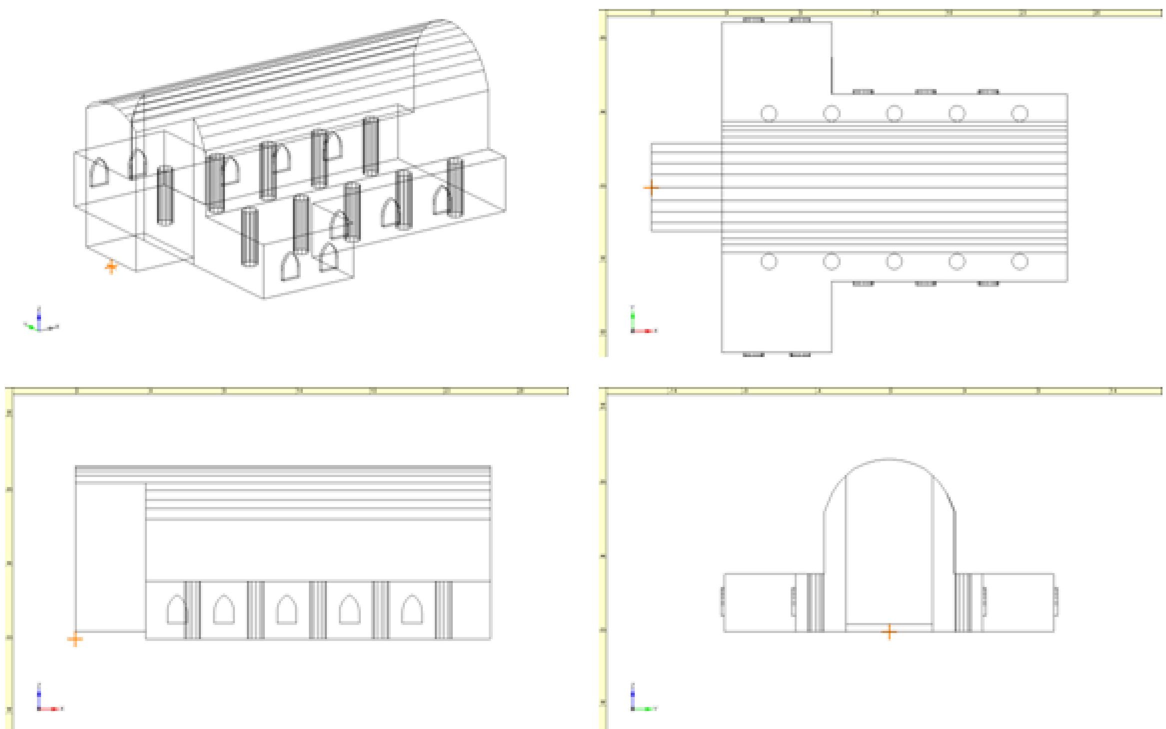
3. Repeat this process for all the coplanar surfaces in the room model.



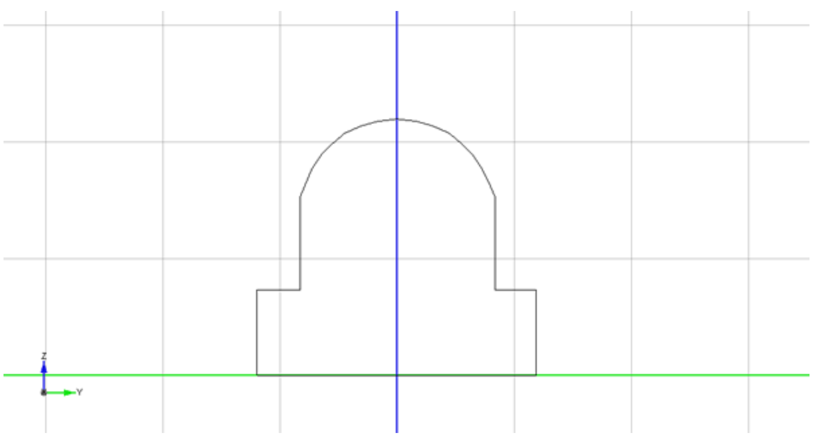
NOTE: Surfaces containing holes are filled (holes eliminated) when they are included in a Merge Surfaces selection set.

Room Model Example

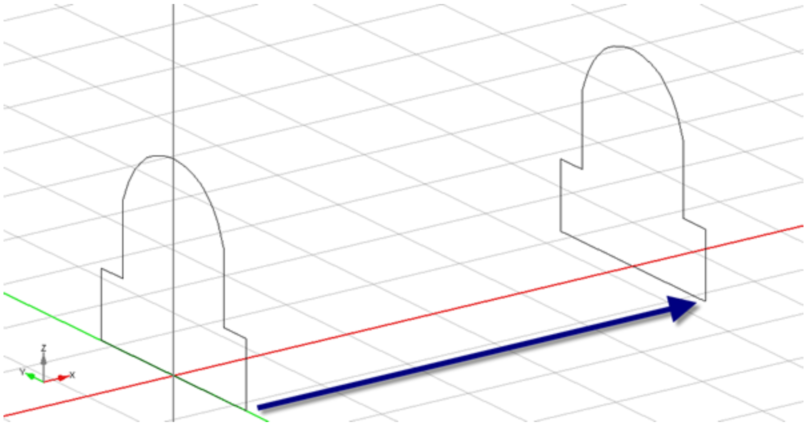
The tools provided within the Modeler® software can greatly simplify the process of room model creation. This example shows how to create a room model using a minimum of drawn surfaces, primarily relying on using the extrusion tools to achieve the overall room geometry and unique room features. This model is a basic cathedral which will look like this:



1. This example starts by modeling the front wall using the Polygonal Surface tool. This surface is constructed in the Elevation view to eliminate unnecessary surface rotations.

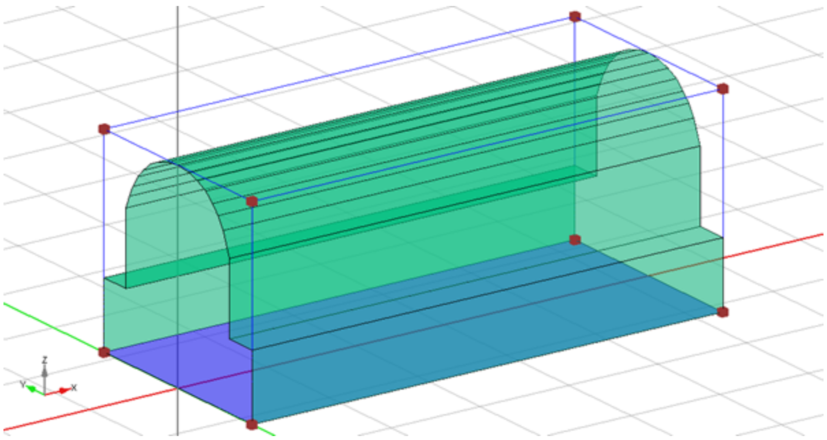


2. In order to extrude this surface, the rear wall needs to be created as a target surface. This is accomplished by copying the front wall and pasting a duplicate surface into the model. Unlock the model and move the newly pasted surface into position.

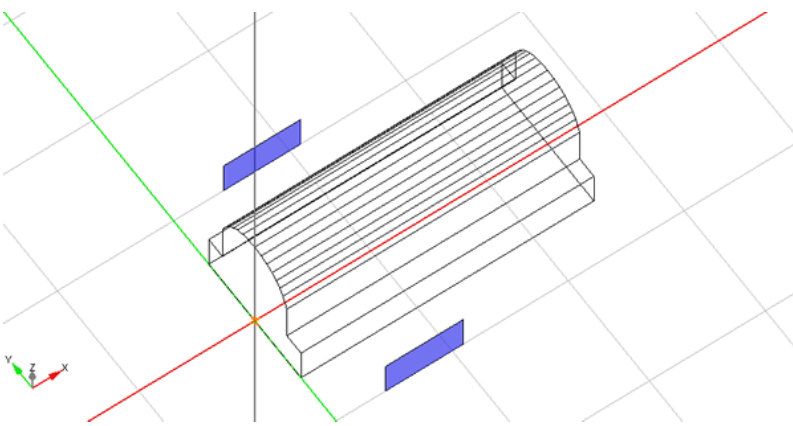


3. Use the Extrude Surface tool to create the basic shape of the nave.

   The newly extruded surfaces are created as a group. At this point it is recommended that you modify their Surface Types, Materials, and Reflection properties.

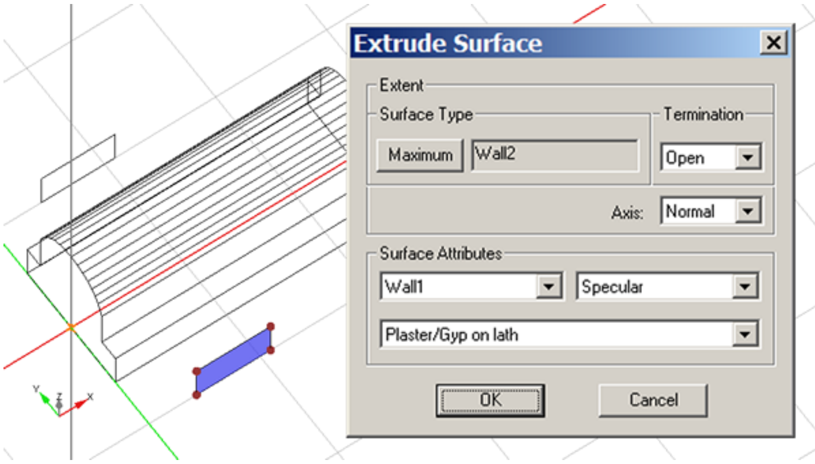


4. Now, the transepts are added. To do this the end wall of the transept is created on either side of the nave.

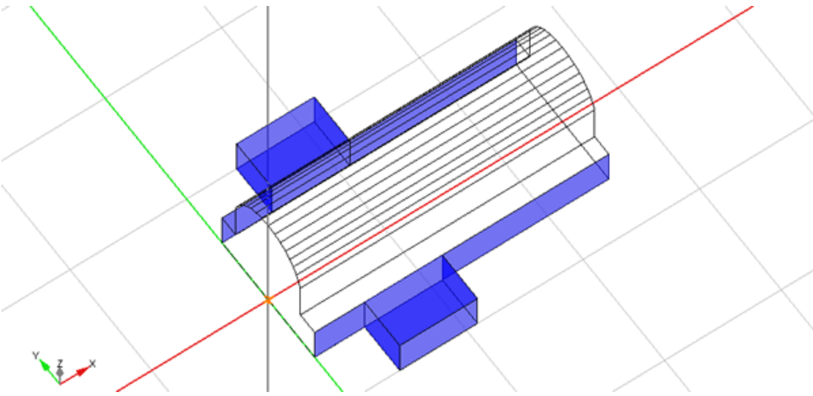


5. The transept end walls need to be extruded to the side wall of the nave. In this case, the termination is set to Open because the transept is open to the room.

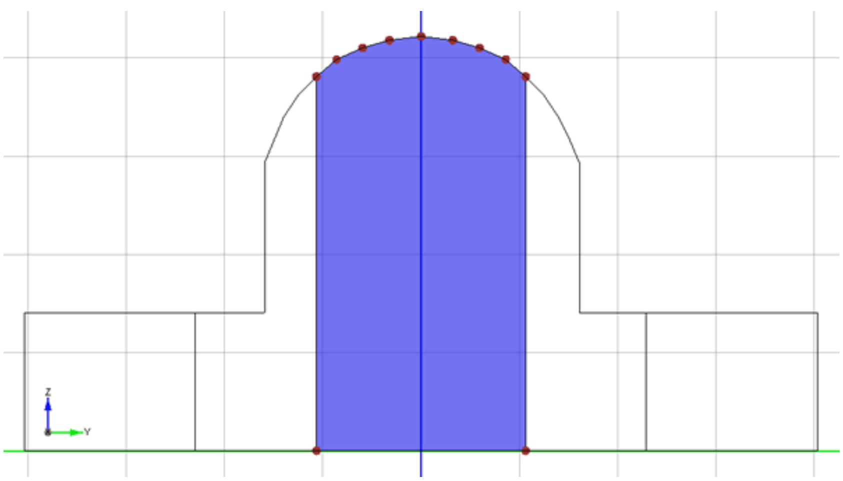
   This process is repeated for the opposite side.



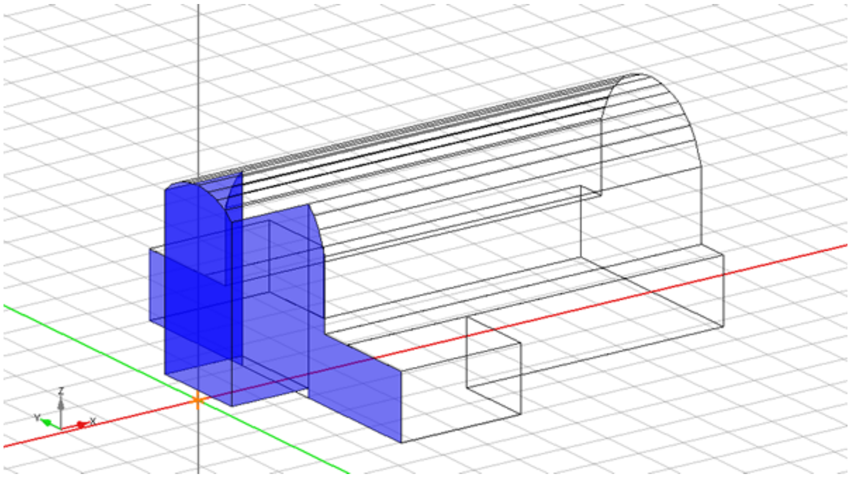
The completed extrusion action yields several new surfaces shown here as highlighted objects.



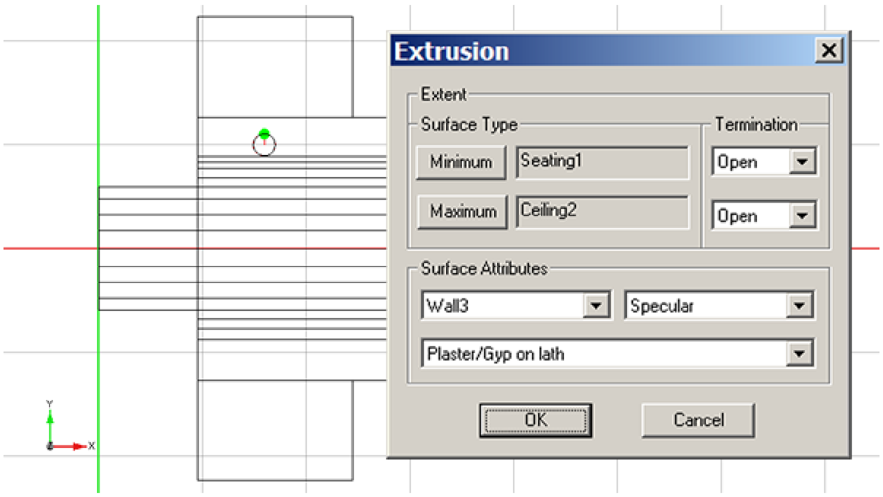
6. Now that the basic shape of the room model is created, the editing tools can be used to form the apse. To accomplish, adjust the vertices of the front wall for a narrower width leaving gaps to fill using the Insert Face tool.



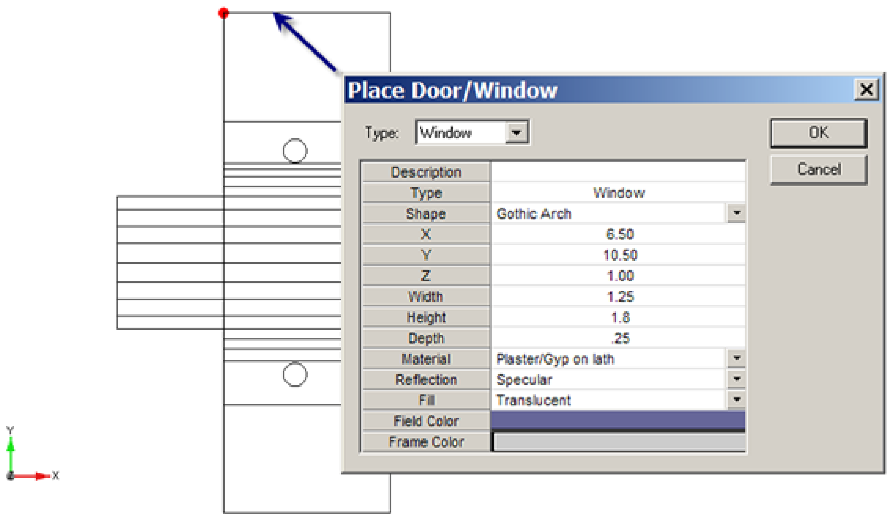
Highlighted objects illustrate new surfaces to add to fill in the gaps around the newly created apse using the Insert Face tool or by adding vertices to existing surfaces and dragging them to their new destinations.



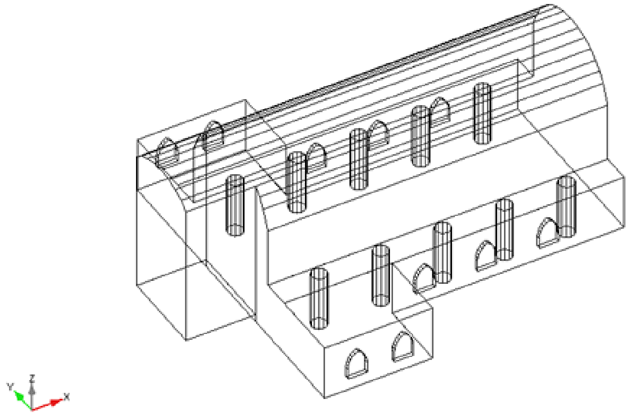
7. The model is now nearly complete and is ready for adding some interior details. Using the Extrude Arc tool the columns will added to the room model. An Open termination is selected to avoid adding enclosed spaces to the room model. This process should be repeated for all remaining columns.



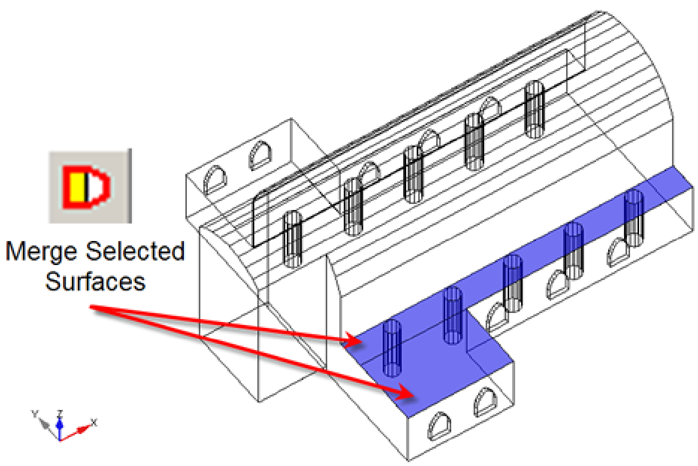
8. Using the Add Doors/Windows tool windows are added along the nave and transept walls.



After adding all remaining windows, the model looks like this:



9. It is possible to simplify the view of this model using the Merge Surfaces tool to merge the nave and transept ceilings into a single plane.



10. Additional room details such as seating areas and doors can also be added at this time as indicated by highlighted objects.

    The model is now complete and ready for a sound system design.