Getting started with Display 3

For technical support contact D3@martin-audio.com

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Introducing Display 3

Support for Windows & macOS

Display 3 is available for Windows & macOS. This release has been tested successfully on Windows 10, Windows 11 and the following macOS versions, on both x86_64 (Intel) and arm64 (silicon M1, M2, etc.) processor types:

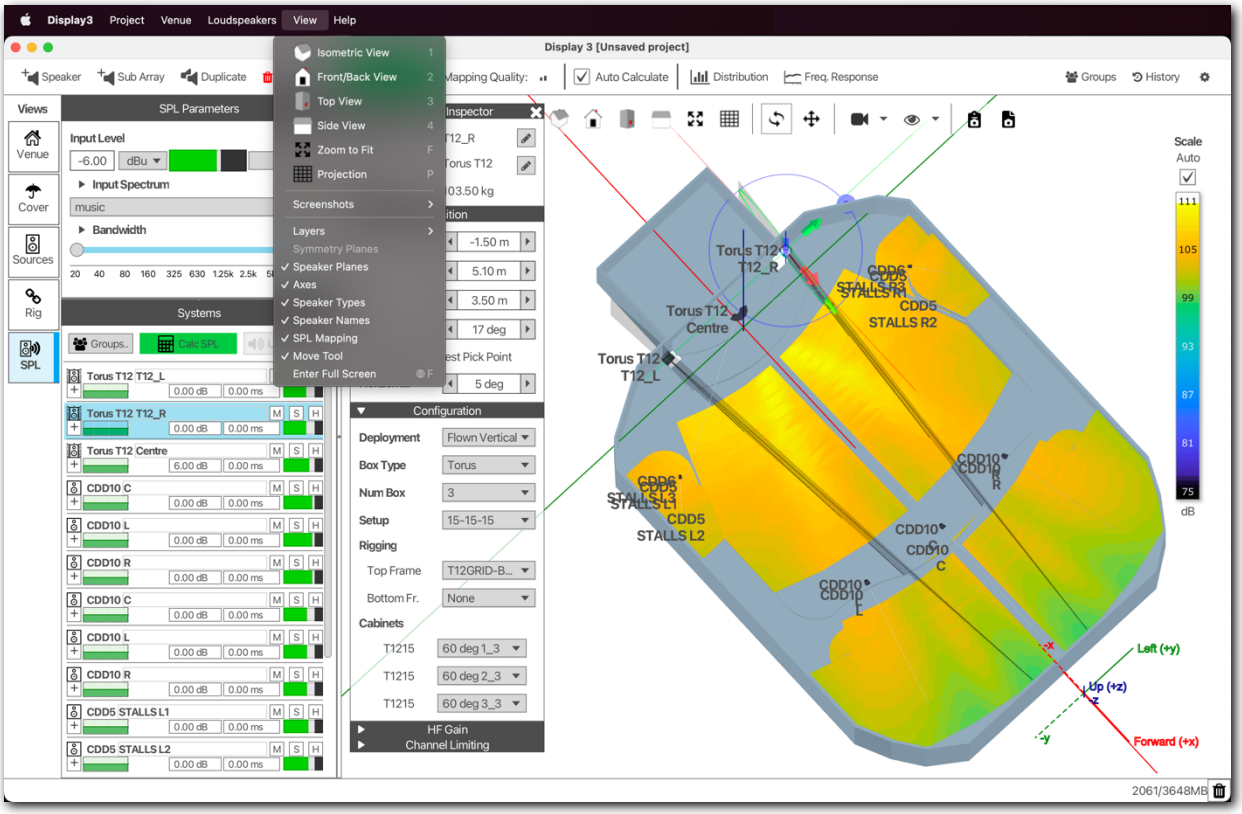
- Big Sur (11.7)
- Monterey (12.7)
- Ventura (13.7)
- Sonoma (14.7)

The following older versions of macOS are not supported:

- Catalina (10.15) and older

macOS App menus

When running on macOS, the Display 3 Menu Bar can be found under the macOS ‘App’ Menu location, at the top of the screen, next to the Apple menu. This should greatly facilitate the workflow for macOS users and help them locate operations more quickly & easily.

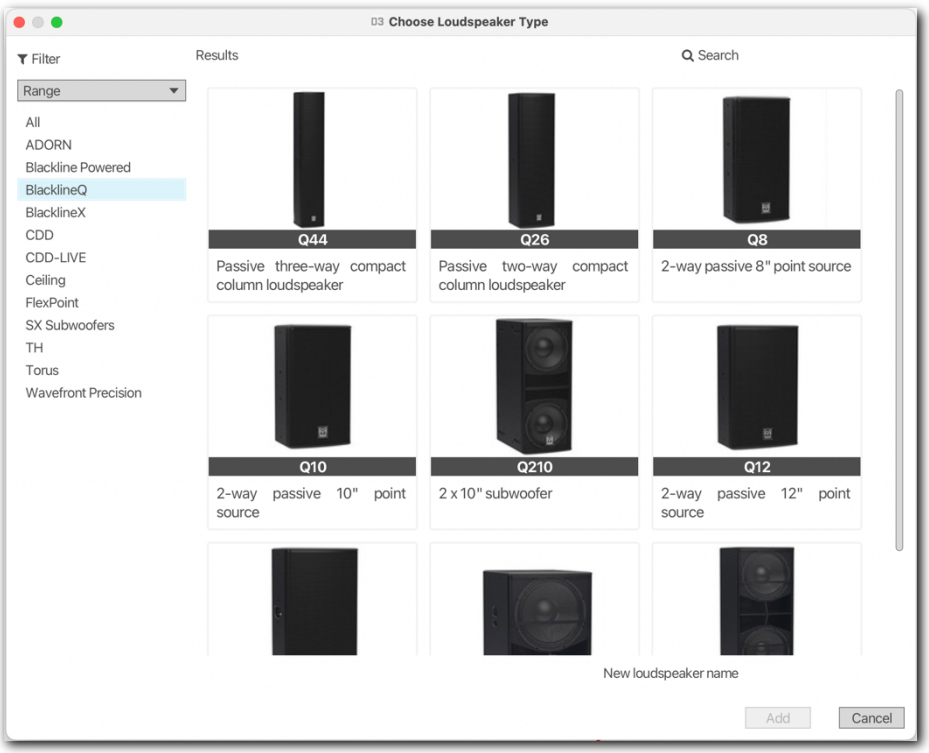


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Supported Martin Audio products

The following Martin Audio product series are supported in Display 3:

- ADORN
- Blackline Powered
- BlacklineQ
- BlacklineX
- CDD
- CDD-LIVE
- Ceiling Series
- FlexPoint
- SX Subwoofers
- TH Series
- Torus constant curvature arrays
- Wavefront Precision line arrays

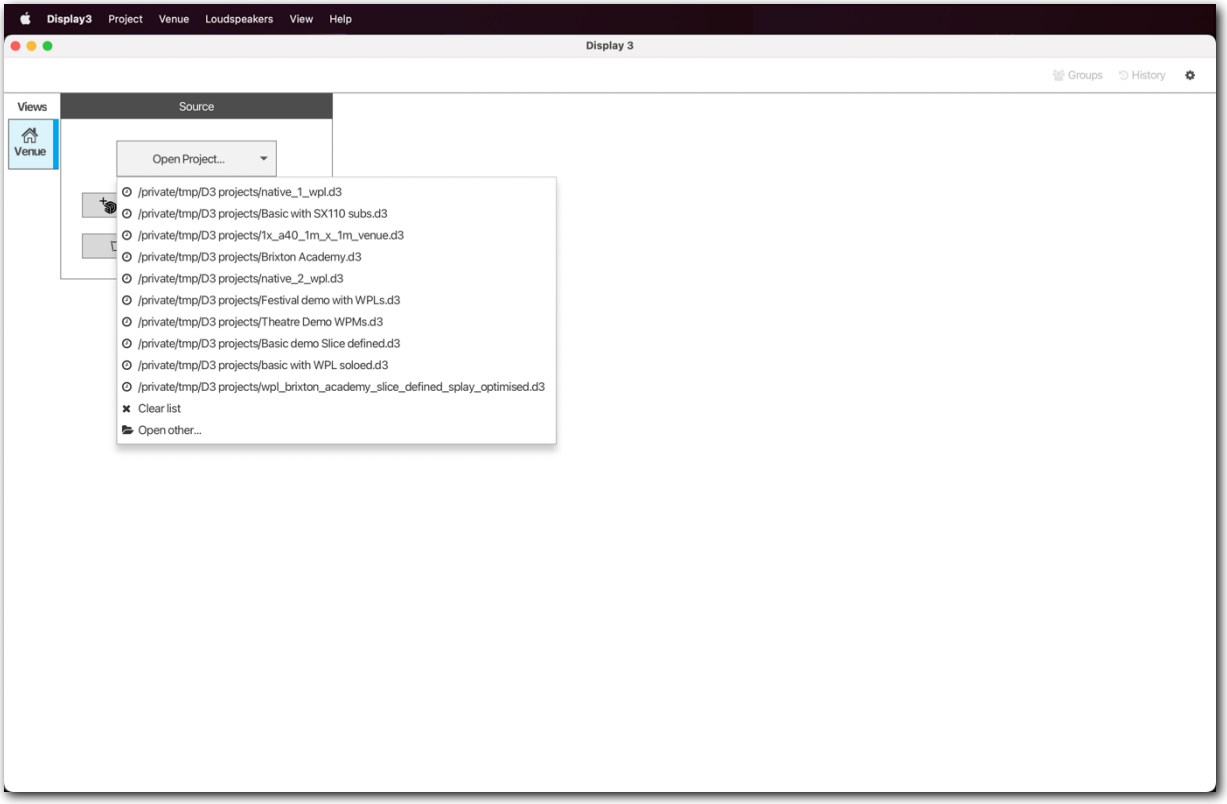


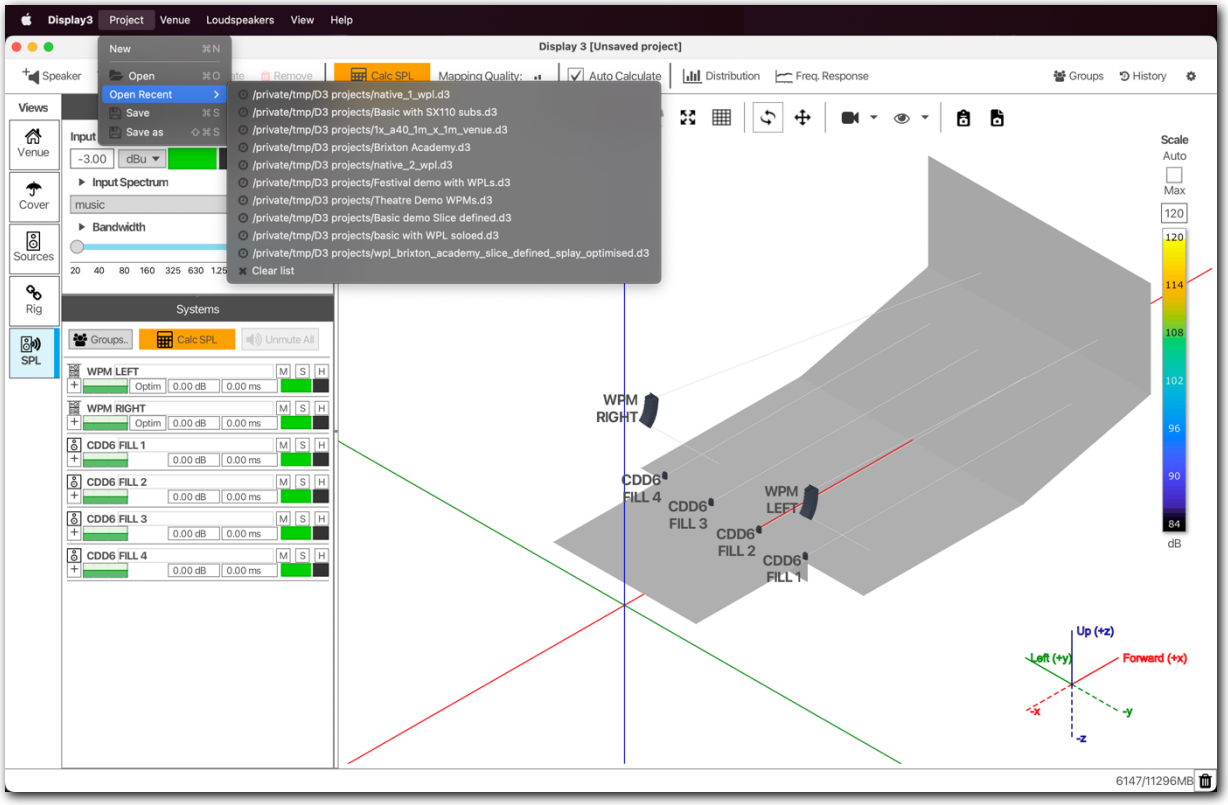
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Main features

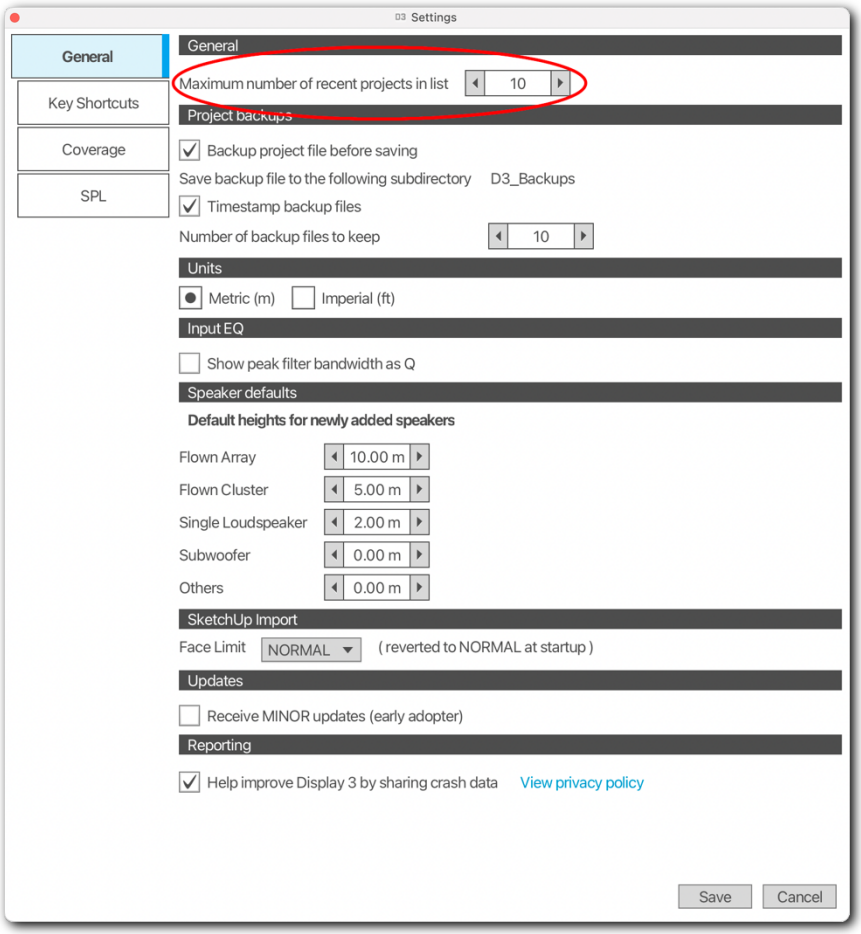
Recently opened projects

Recently opening projects are stored and shown in the Projects Menu and when first opening D3:





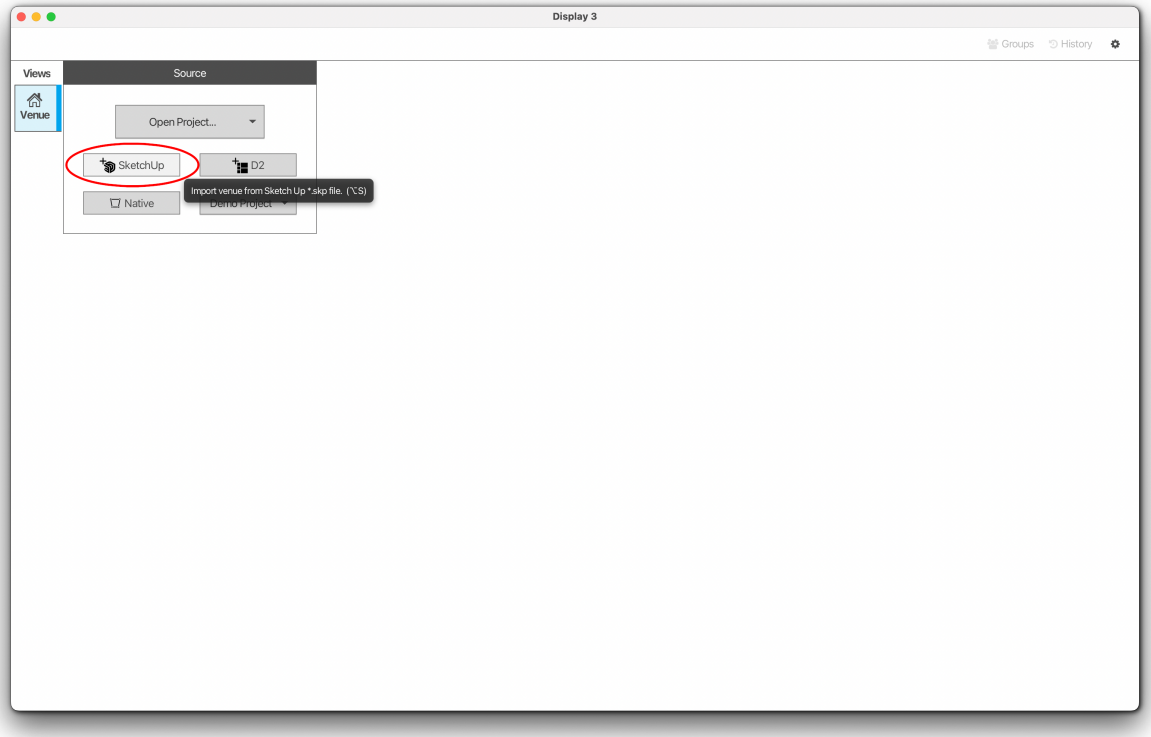
You can clear the list if desired. It's also possible to configure how many recently opened projects you want to appear in the list, in the General Tab of the Settings dialog:



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Importing SketchUp models

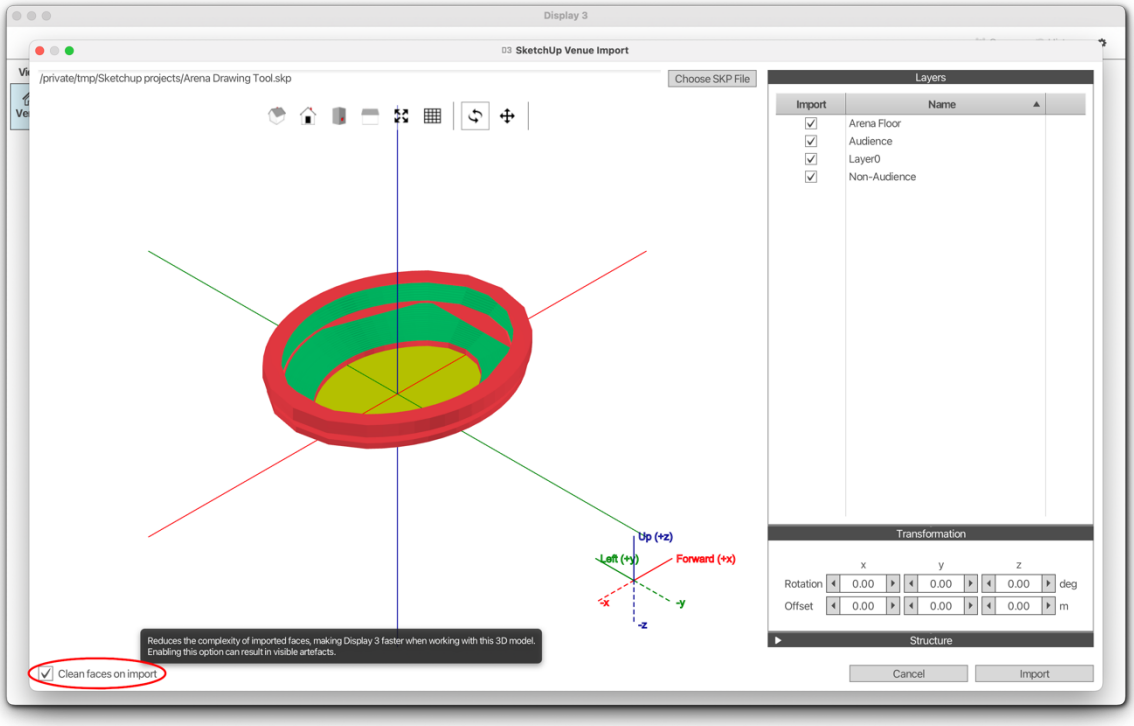
3D venues created in SketchUp can be imported into Display 3. To do this, select the option **SketchUp** in the Display 3 startup screen: You will be asked to select a SketchUp model (files with a .skp extension) to import:

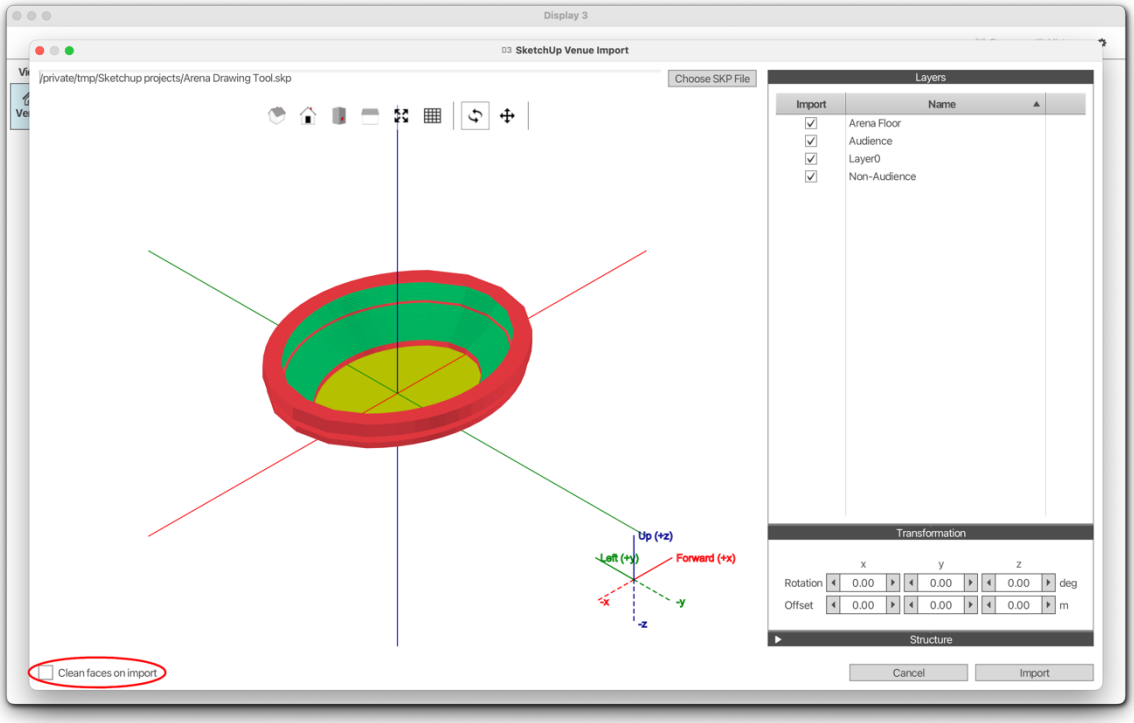


Once the SketchUp model to be imported has been selected, the *SketchUp Venue Import* dialog is shown. In the dialog, various options can be selected - layers which you don't wish to import can be deselected. These become immediately hidden once they've been deselected, allowing a visual check that only the required layers are selected. The venue can also be moved & rotated to align correctly with the axes, should this be required.

Another useful option is *Clean faces on import* - enabled by default, this option reduces the complexity of the imported faces, which can speed up operations when working with this venue in Display 3. Reducing the complexity of imported venue faces can however result in visible artefacts; for example, circular surfaces can appear less smooth. Changing this option will cause the model to be reloaded, so you will be able to immediate verify how the imported venue shell will look before committing and performing the actual import:

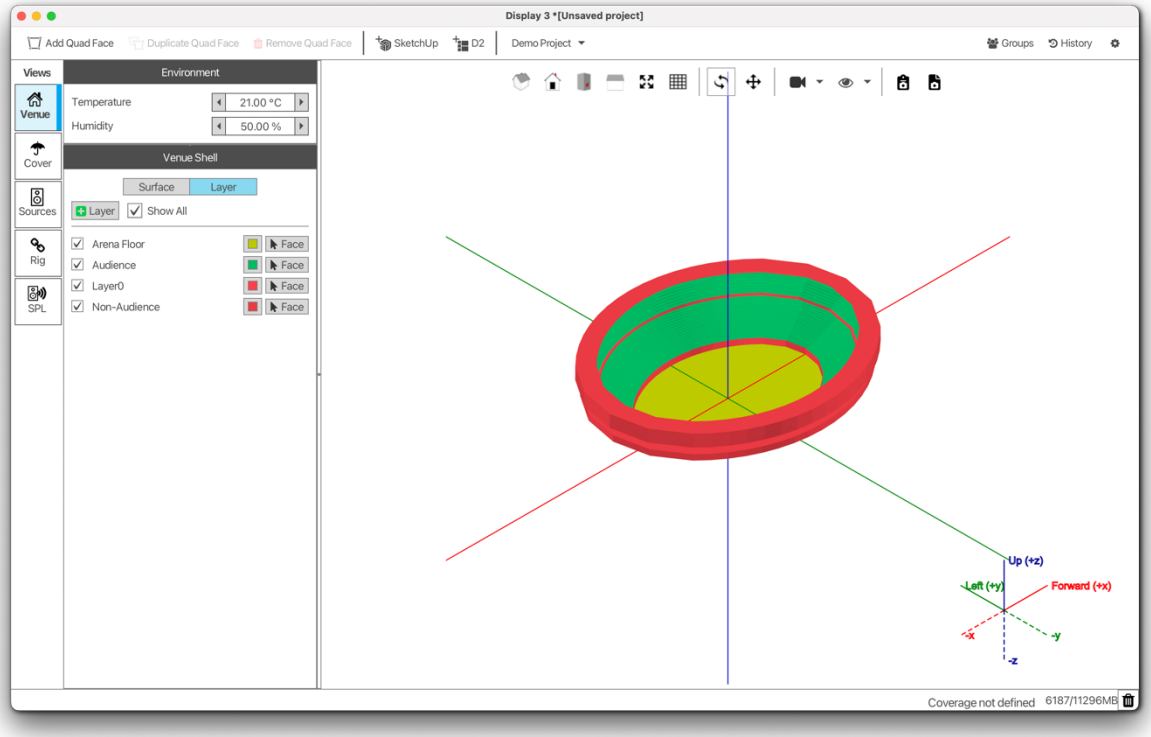
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Once you're happy with the selected options, click on **Import** to import the SketchUp model as a venue shell into a new project in Display 3:

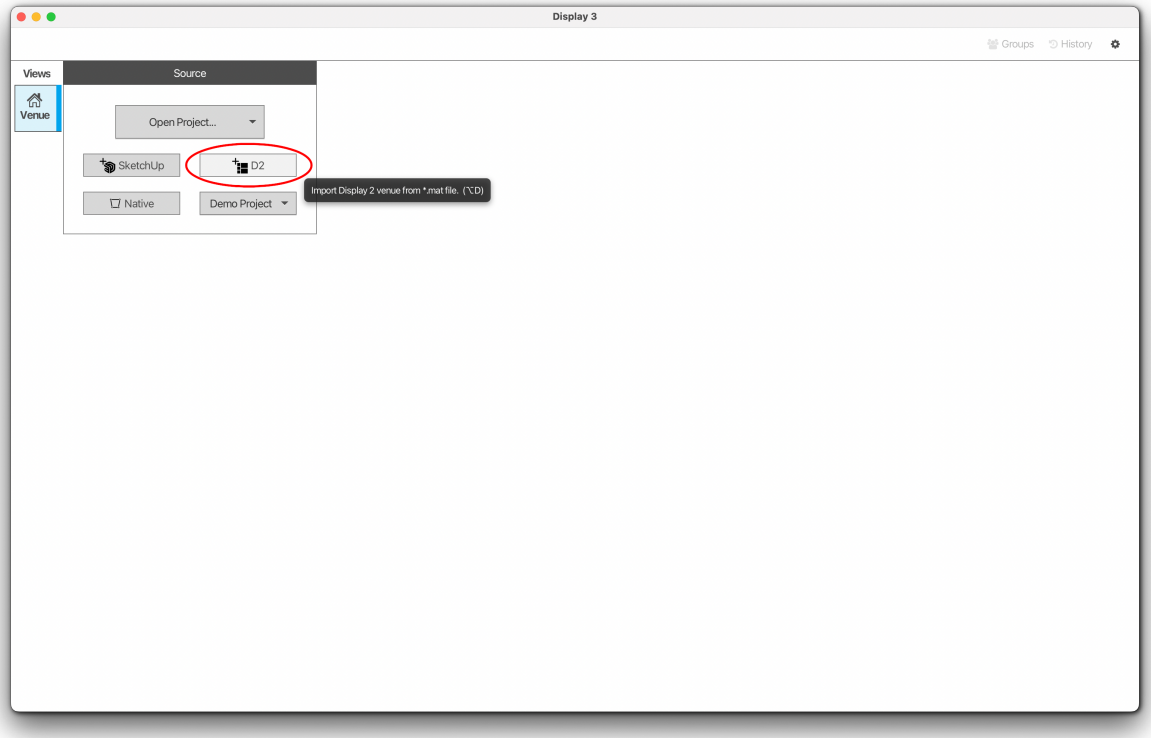
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Importing Display 2 projects

Existing Display 2 projects can be imported into Display 3. Display 2 projects define a distinct Slice for each line array in a project. When importing these Slices into a 3D venue

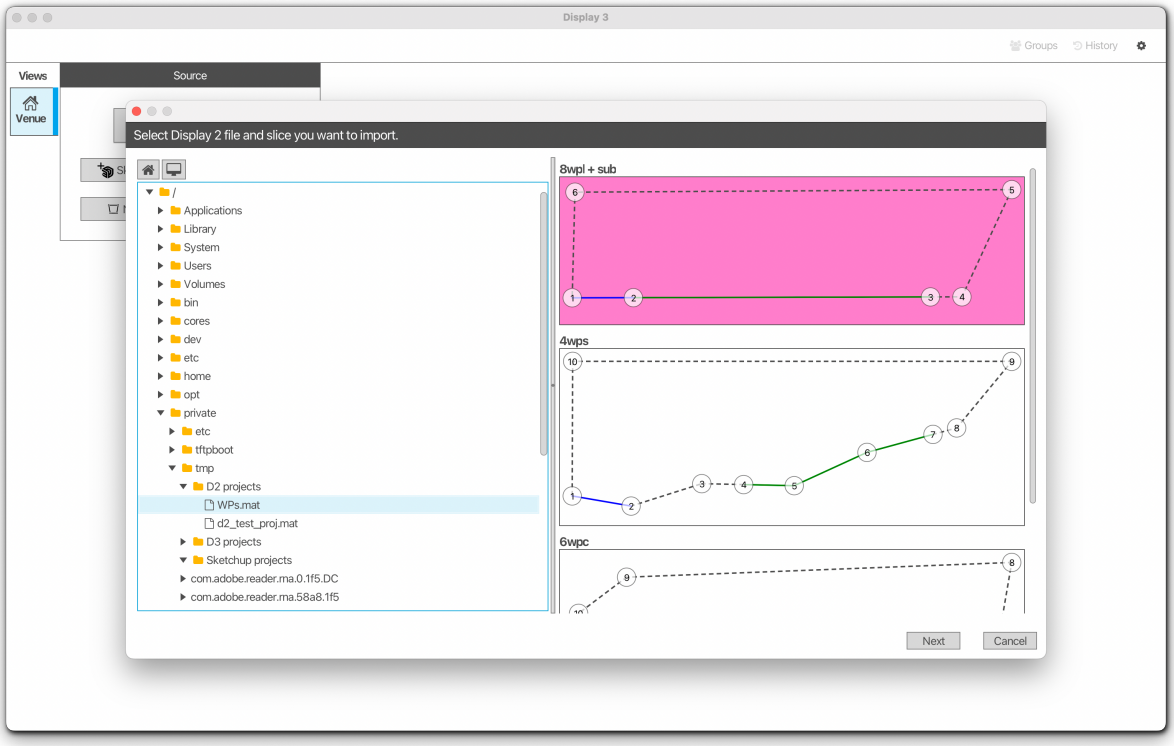
Click on **D2** to select a Display 2 project to import:



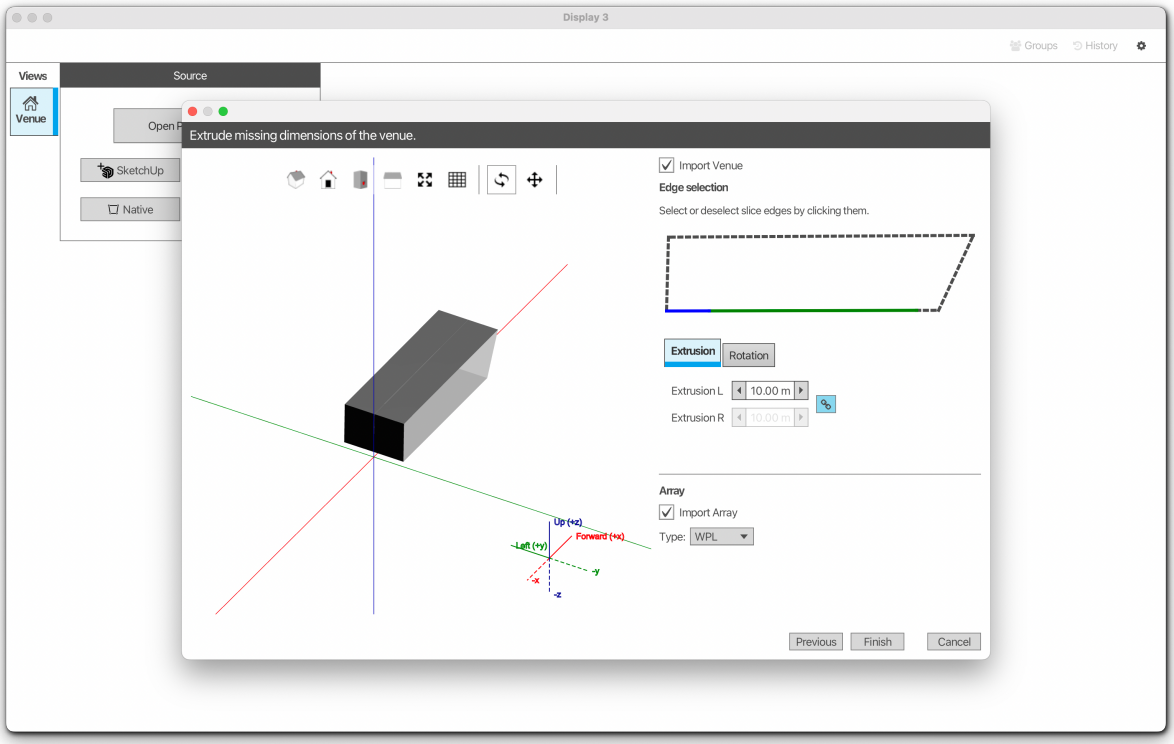
The wizard to import a Display 2 project will be displayed. On the first page of the wizard, you will be asked to select a Display 2 project (files with a .mat extension) to import. Once the Display 2 project

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to be imported has been selected, the wizard will display all the Slices present in the Display 2 project. Select a Slice to import and click **Next**. Each Slice in the Display 2 project pertains to a given array in the project:



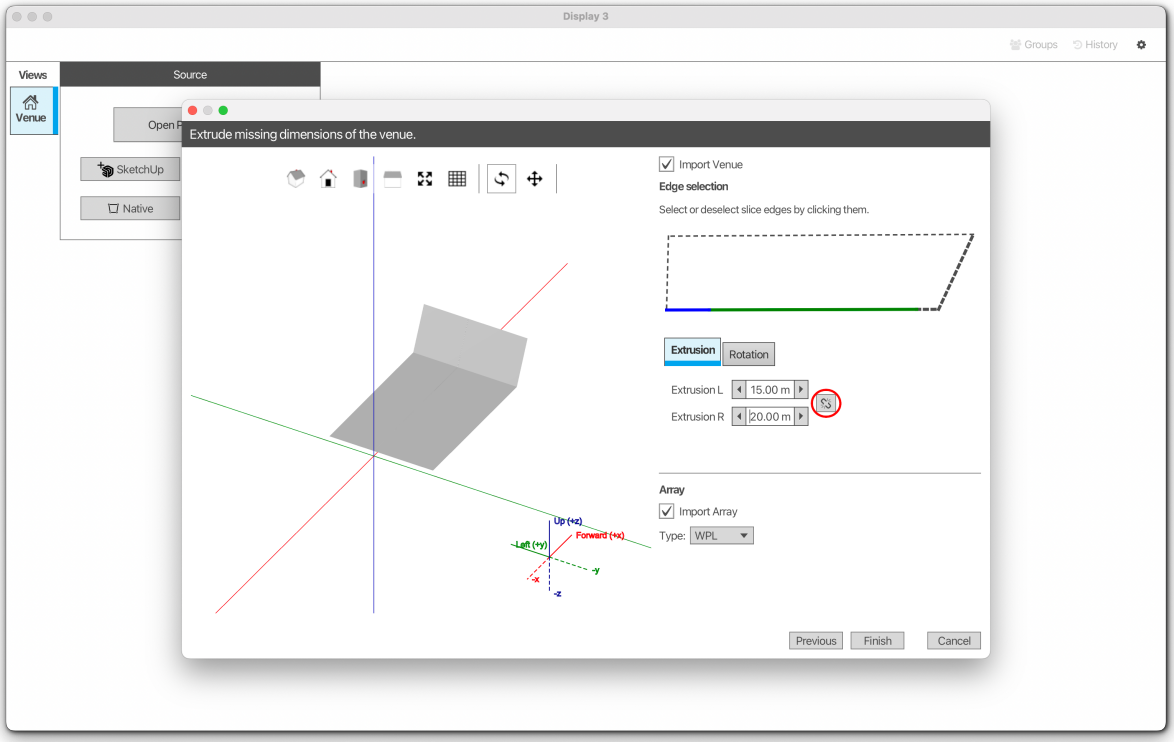
In the second page of the wizard, the import options are displayed:



If you wish to import the Slice Edges as your venue shell, then keep *Import Venue* checked. It's possible to select which Slice Edges we wish to import. It can for example be helpful later if the ceiling is deselected, as well as possibly the rear wall, which may or may not represent an actual physical wall in the venue. Since we're importing a 2D Slice as a 3D venue shell, the wizard provides options to extrude the dimensions of the Slice into 3D. For many venues, this could involve extruding

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the dimensions to the left and to the right. By default, the extrusion to the left and right are coupled, so the extrusion to the left is mirrored on the right. Extrusion to the right can be decoupled by clicking on the button, in which case the extrusion to the right can be entered independently of the extrusion to the left. We can see below that the ceiling and rear wall have been deselected, and *Extrusion R* has been decoupled from *Extrusion L*, allowing it to be entered independently of *Extrusion R*:



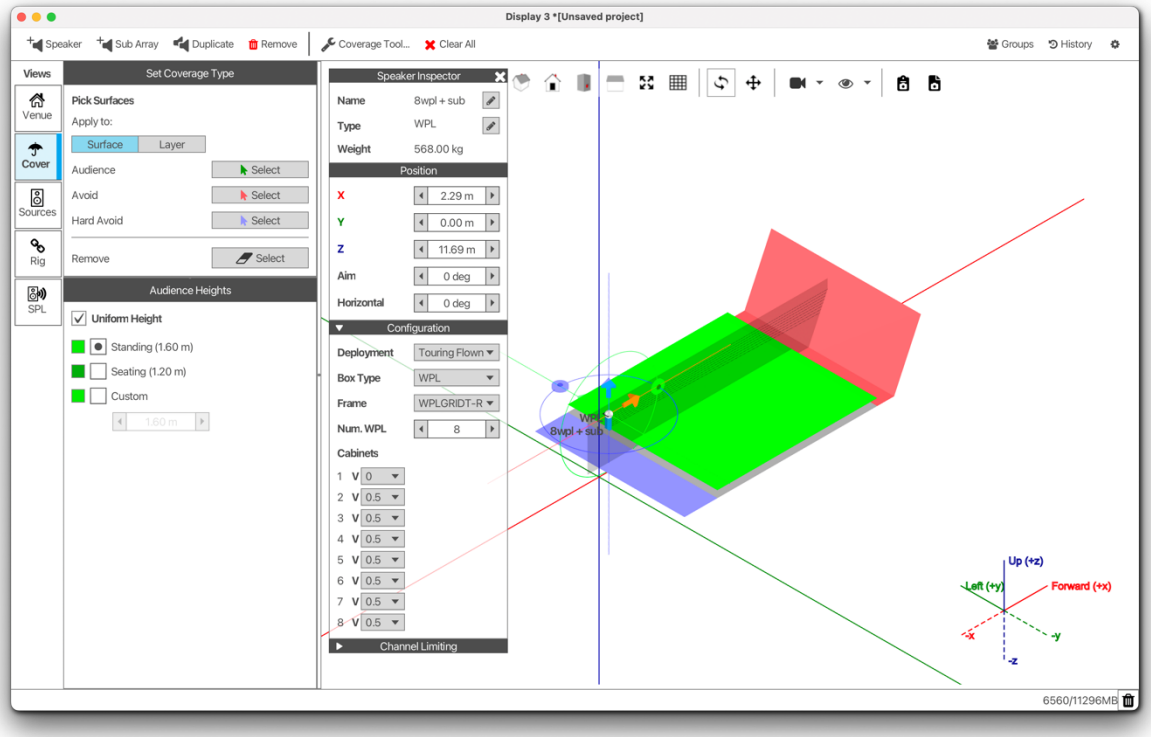
It is possible to just import the Slice as a new venue shell into Display 3. If this is desired, then *Import Array* should be unchecked. In most cases though, you'll likely wish to import the array, in which case *Import Array* should remain checked. The wizard will determine the array type based on the configuration in the Display 2 project, but the option to override this is available; simply click on the *Type* drop-down and select a different array type from the list. Once you're happy with the selected options, click on **Finish**. The venue shell and/or the array are imported into a new Display 3 project.

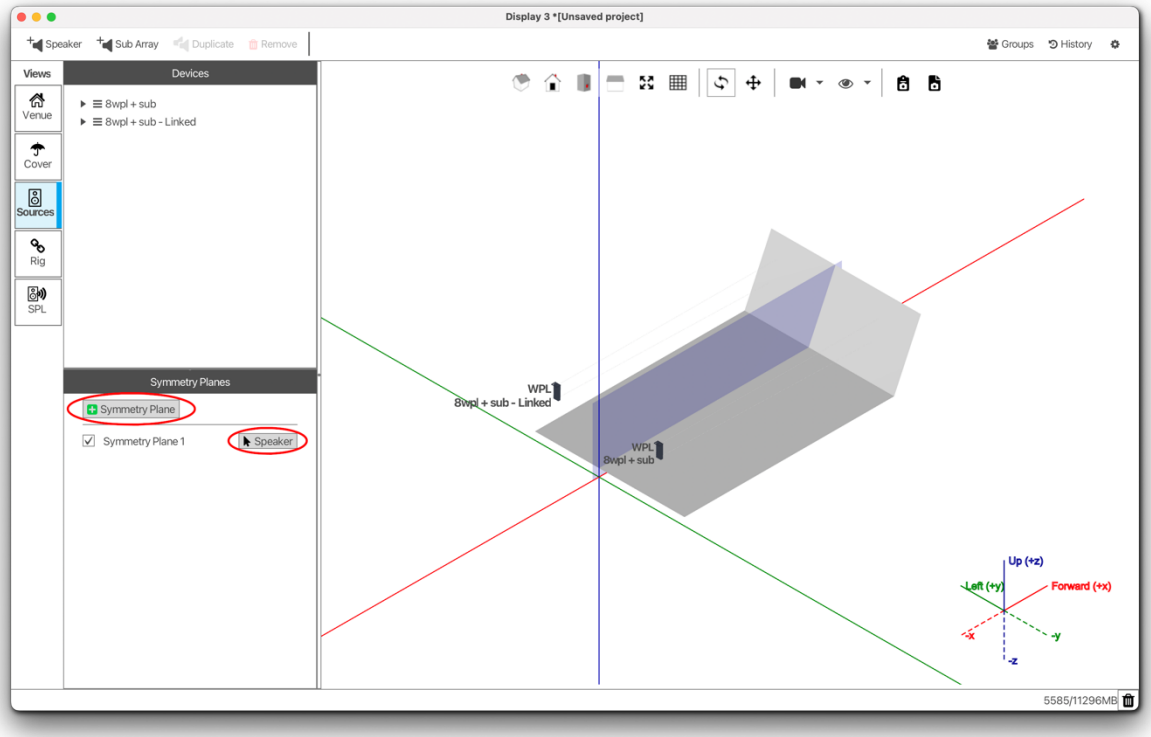
The Coverage Zones defined in the Display 2 Slice are replicated across the extruded 3D venue, as can be seen below.

The array's position along the X- and Z-axes, as well as the number of cabinets, are both preserved and applied to the newly imported array. Cabinet angles aren't preserved, as it the intention that a 2D Slice be drawn in Display 3 and the array optimised in Display 3. Optimisation will result in the array's cabinet splay angles being optimised for the audience zone in the 2D Slice, as well as a snapshot with an optimised EQ filter set being created and applied to the array. This snapshot can be exported to VU-NET, to be uploaded to the array. For further details concerning the 2D Slice functionality in Display 3, please see section *2D Slice* below.

Since we're importing a Slice, the Y-coordinate of the array's position in the 3D venue will always be 0.00. The array can easily be moved to a different location, along any of the three axes. A Symmetry Plane can also be added, and the array mirrored across the Symmetry Plane. The buttons used to achieve this, in the Sources context (tab) are highlighted below:

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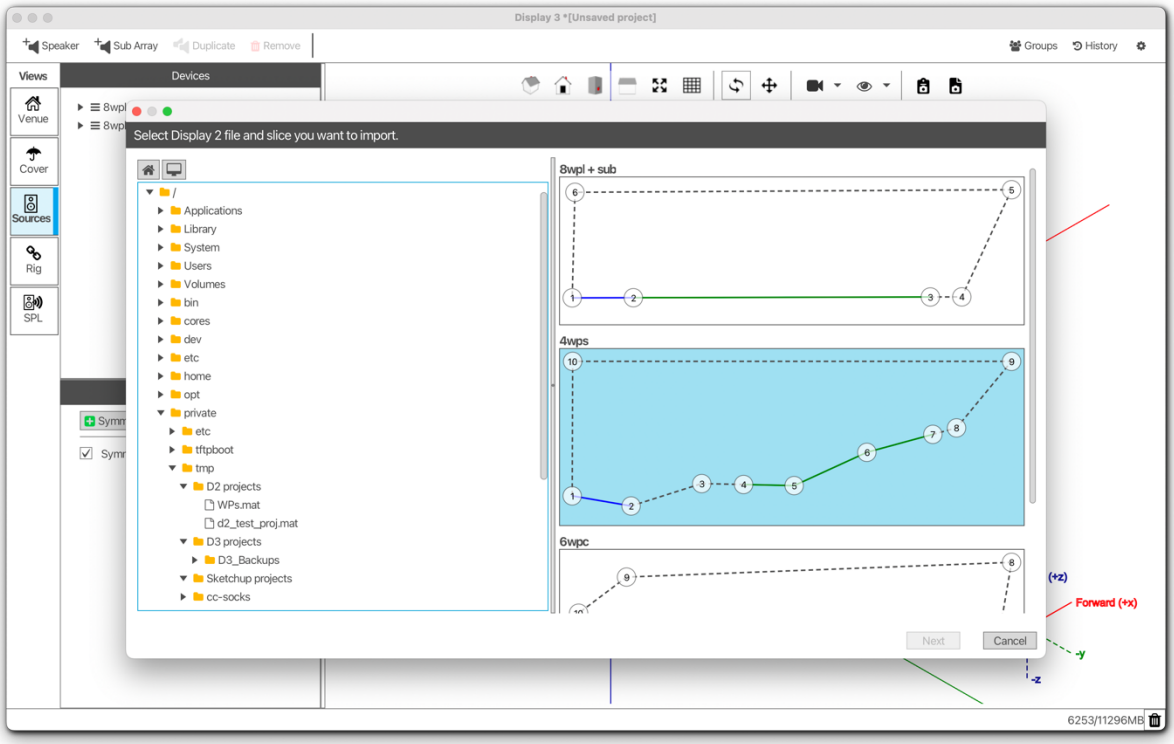


Importing multiple Slices

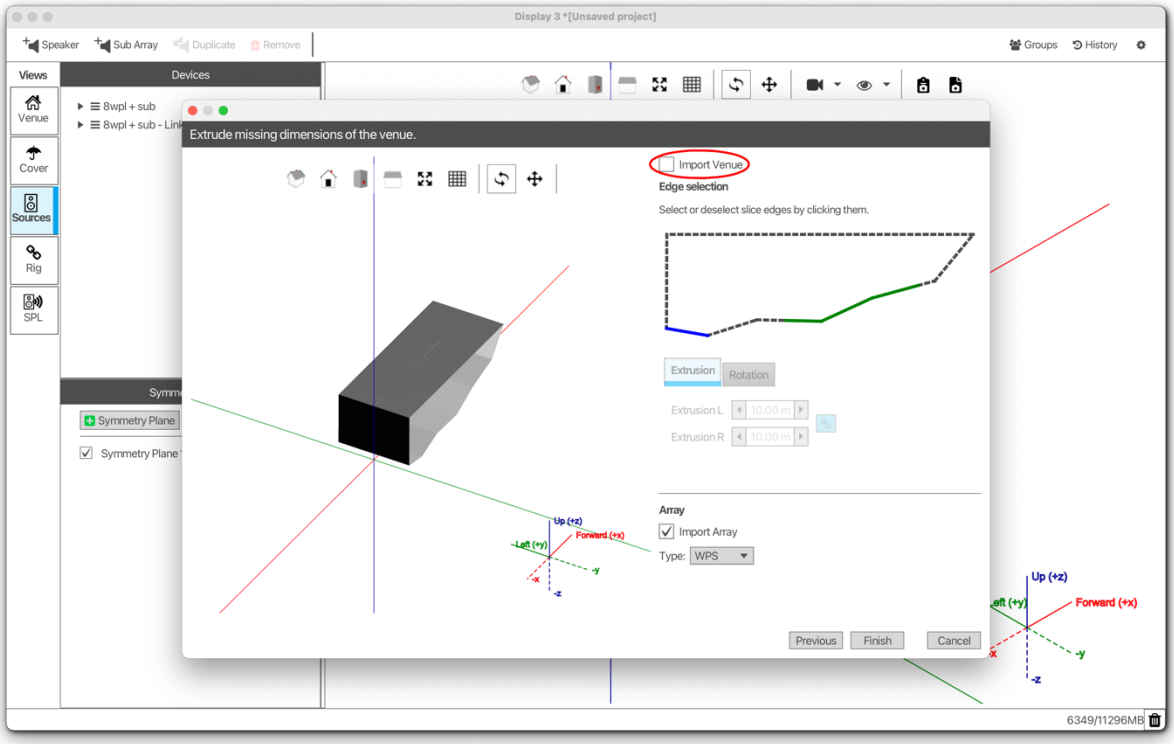
As is the case with the above example, Display 2 projects can contain the Slices for multiple arrays, and these can also be imported into the same Display 3 project. One should however be aware of the following constraints:

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The menu Item *Venue | Import Display 2* will open the wizard to import a Display 2 project. The wizard appears identical to when it's called from the Display 3 startup screen. You can select a different Slice, then click on **Next**.



Again, on the next page of the wizard, the options look identical to when it was previously used. When importing into an existing project with a venue shell, leaving the option *Import Venue* checked will result in the existing venue shell being overwritten by the newly imported venue shell. In the case where we're importing additional arrays from a Display 2 project, we'd usually opt to uncheck the *Import Venue* option:



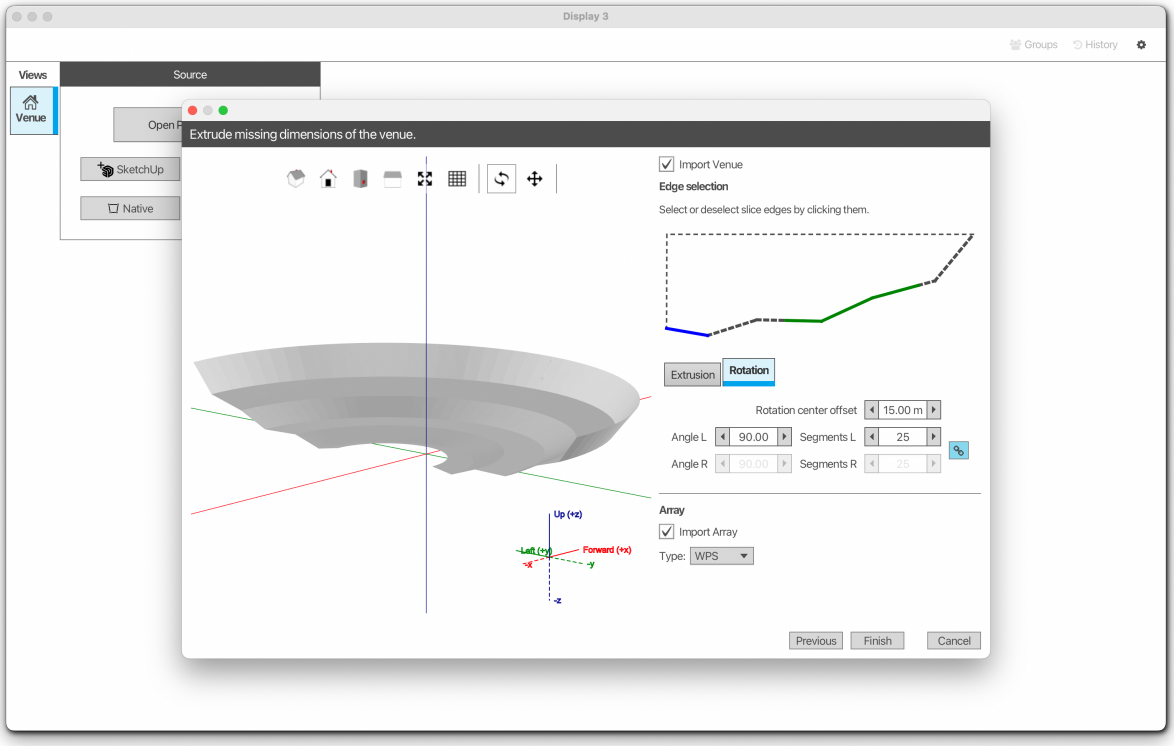
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Clicking on **Finish** will import the array into the existing Display 3 project. As noted above, the Y-coordinate of the newly imported array's position in the 3D venue will always be 0.00. The array can easily be moved, and the array mirrored across a Symmetry Plane, just as with the initially imported array.

Importing venues with circular plans

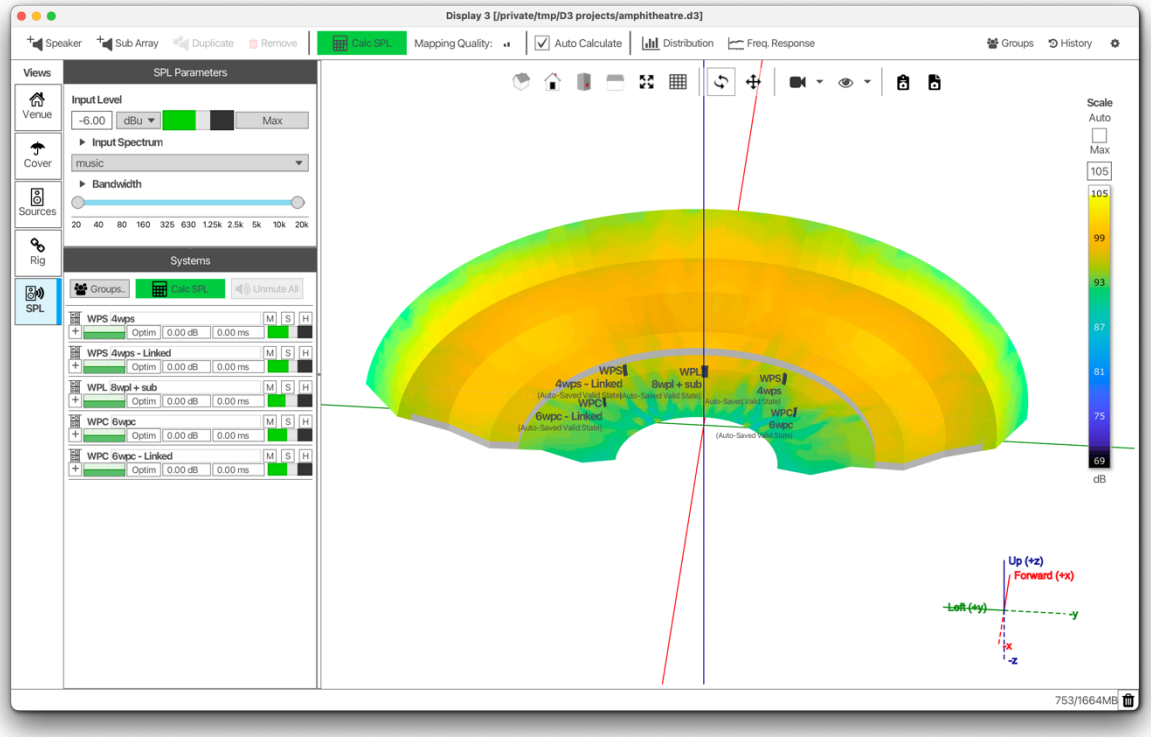
In addition to the extrusion of a Slice to the left and right, a rotation can also be given, to help create arenas or amphitheatres from the Display 2 Slice. Starting with a new project and importing Slice *4wps* from the above example again, deselecting the ceiling and rear wall, we can opt to use the controls under the *Rotation* tab. Giving a rotation *Angle L* of 90˚, with *Angle R* tracking *Angle L*, we're able to create a venue in the form of an amphitheatre. Increasing the number of segments help create a smoother curve. We can see below that *Segments L*, with *Segments R* tracking *Segments L*, has been increased from its default value of 5 to 25, resulting in a smooth circular form. Increasing this value beyond what is necessary may result in the performance of Display 3 being adversely impacted when working with this venue.

The final option to discuss is *Rotation center offset*. This parameter determines the area of the stage at the centre of the arena or amphitheatre. This value denotes the radius of the stage area, so in this case, with *Rotation center offset* set to 15m, the stage area (a semi-circle) of the amphitheatre has a diameter of 30m. Click on **Finish** to import the venue shell and/or the array into a new Display 3 project:



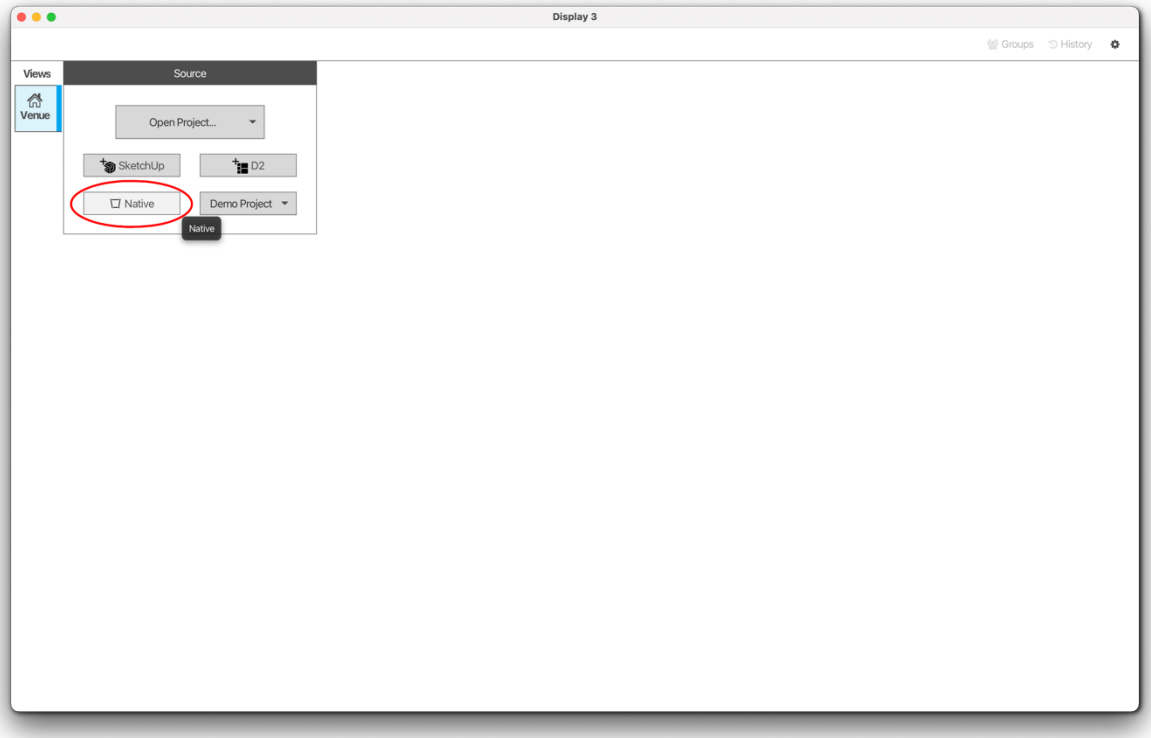
After importing the other Slices from this Display 2 project, taking care to just import the arrays, and not to overwrite the newly created venue shell, then following some rearrangement, i.e. moving & rotating these three arrays and duplicating two across the Symmetry Plane running along the X-axis, as well as some further tweaks to the numbers of cabinets, followed by the optimisation of the arrays in the Display 3 Slice view (please see section *2D Slice* below for details), we arrive at the following venue & sound system configuration, with the SPL projected across the venue:

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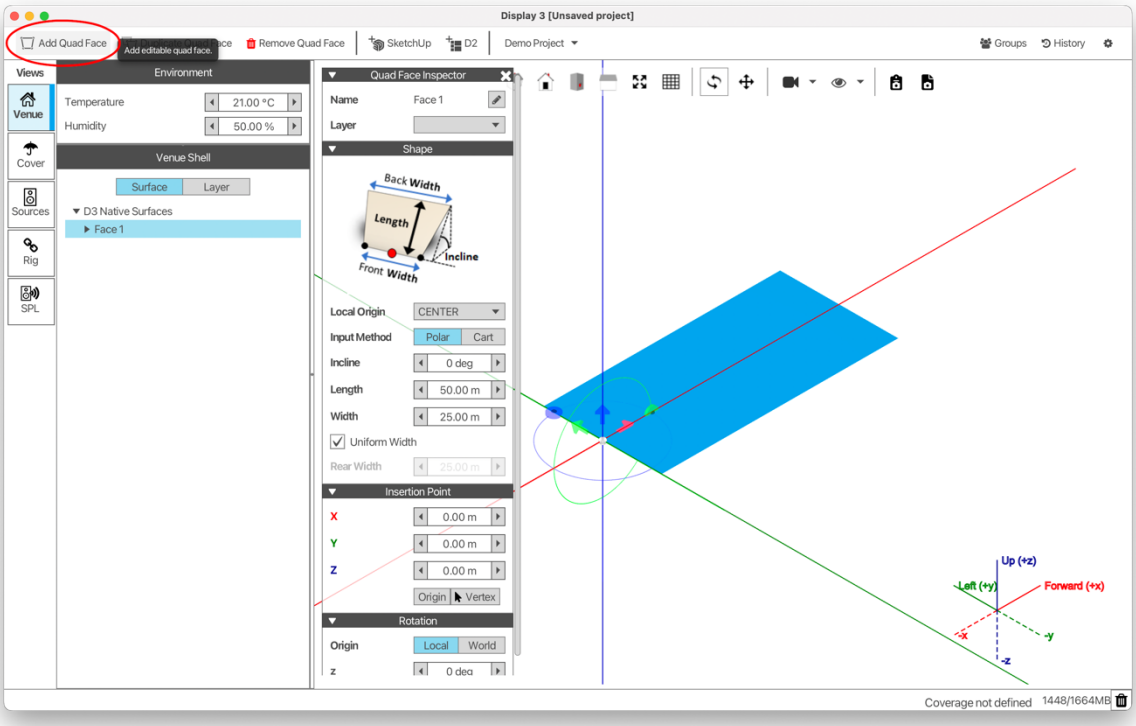


Creating *Native* Display 3 projects

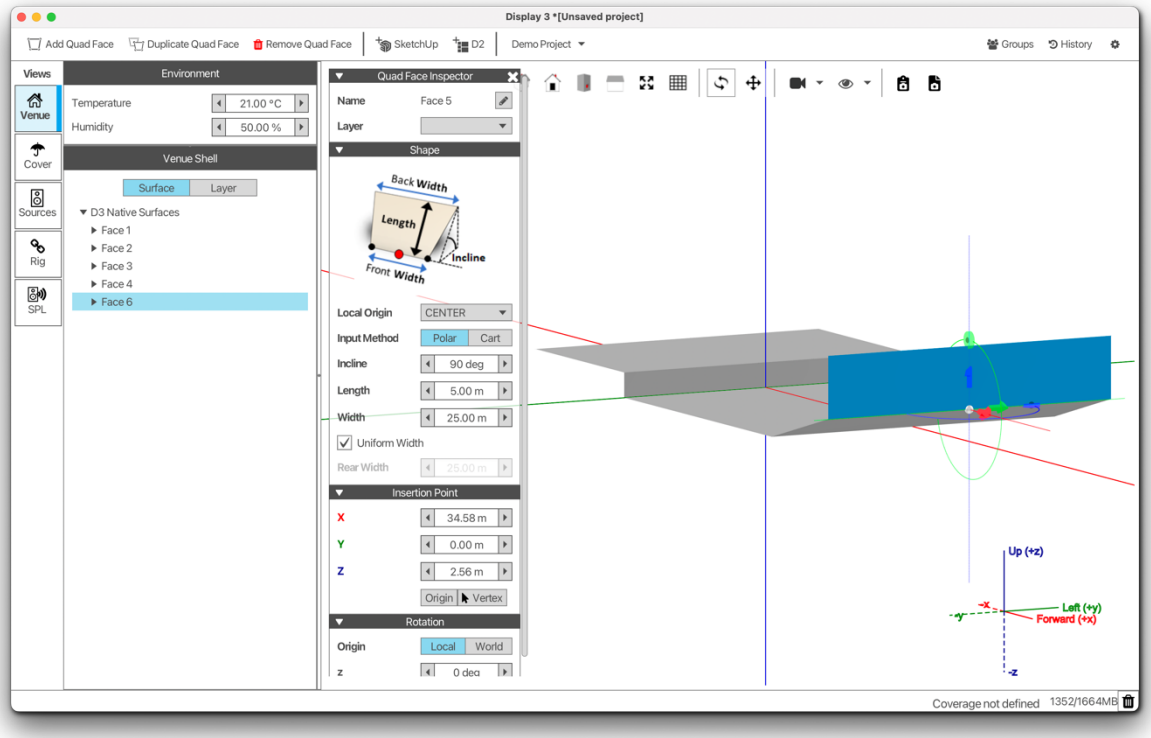
In addition to the possibilities of importing a 3D Venue from SketchUp and importing existing Display 2 projects, Display 3 also facilitates creating a 3D Venue within the application itself. To do this, select the option ▽ **Native** in the Display 3 startup screen. A new project is created with a single native *QuadFace*:



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This QuadFace can be resized, moved & rotated around the y- and z-axes; see below in the section *Moving & rotating native venue faces* for further details on how to change the geometry of individual QuadFaces. Additional Quadfaces can also be added to the Venue, then resized, moved & rotated, allowing the creation of more complex venue shells. The *Basic Demo Venue*, supplied with Display 3 as one of the Demo Venues, was created from native Display 3 QuadFaces. In the images below we show how a native Display 3 venue, similar in appearance to the Basic Demo Venue, is built up using native Display 3 QuadFaces:



Saving projects

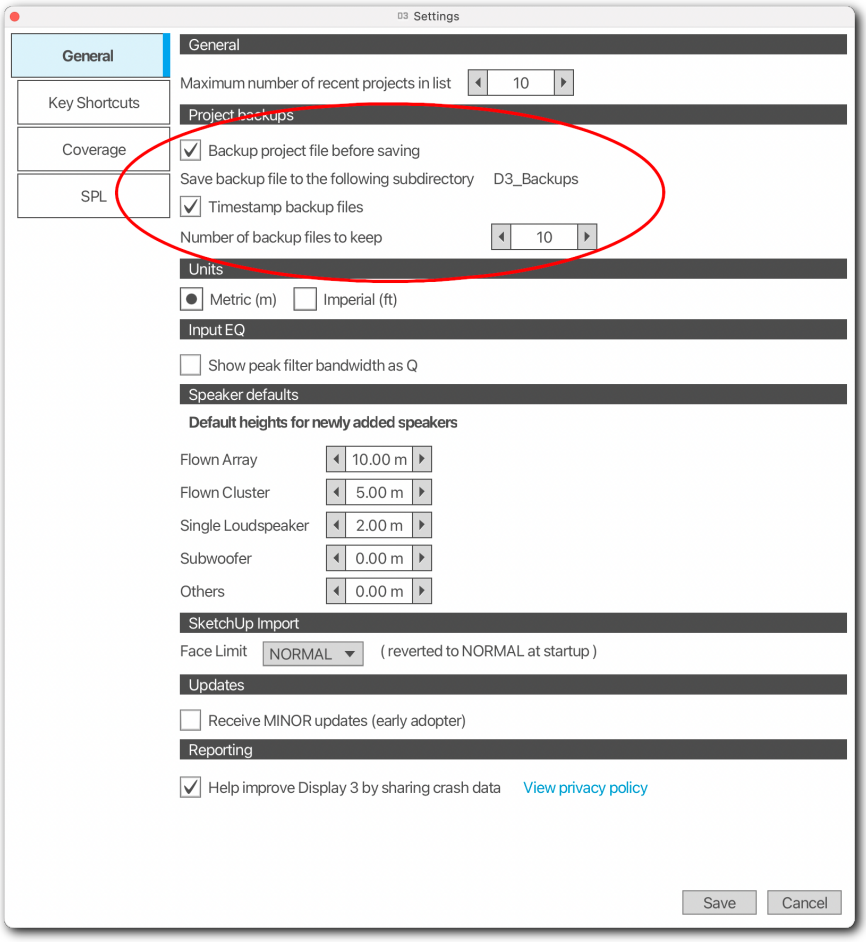
A Display 3 project can be saved at any time, such as once the work on a project is completed, although it's also a good idea to save a project regularly when making changes. The menu item *Project | Save* will overwrite the current project file, if the current project already existed and was opened from disk.

In the case that a project is new and hasn't been saved yet, the user will be asked to provide a filename. The user will also always be asked to provide a filename if the menu item *Project | Save As* was chosen instead of *Project | Save*. If the Display 3 project file (files with a `.d3` extension) already exists, the user will be asked to confirm whether they wish to overwrite the existing file.

Project backups

Before overwriting any project, Display 3 will by default create a backup of the existing project file. This is done by copying the original file to a subdirectory `D3_Backups` then appending *_BAK_yyyy-mm-dd_hhmmss* to the filename, where *yyyy-mm-dd_hhmmss* is the timestamp of when the original file was last modified.

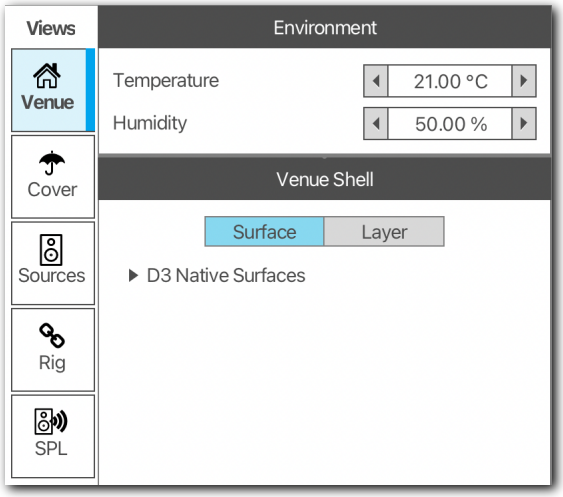
Whether to create a backup before overwriting a file, whether to add the timestamp to backup filenames, and how many backups of a given project should be saved before discarding the oldest one, are all configurable in the Display 3 Preferences Dialog, under the General tab. The directory where the backup is saved (always a subdirectory of where the existing project file was saved) is listed here too, for completeness' sake, but can't be changed:



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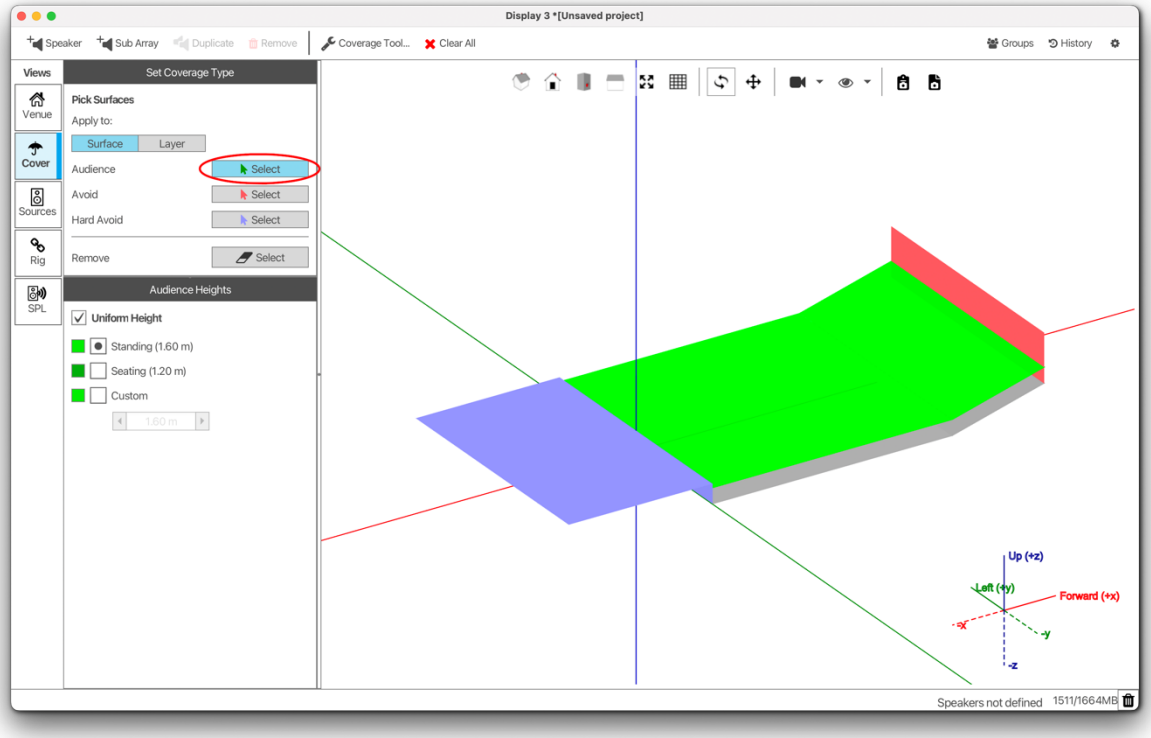
3D venue

After a new or existing project has been loaded, we're presented with Display 3's 3D venue view. This consists of a tab pane with 5 tabs, known as 'Views' or 'Contexts', running along the left-hand side of the application window. These 5 tabs also define the workflow:



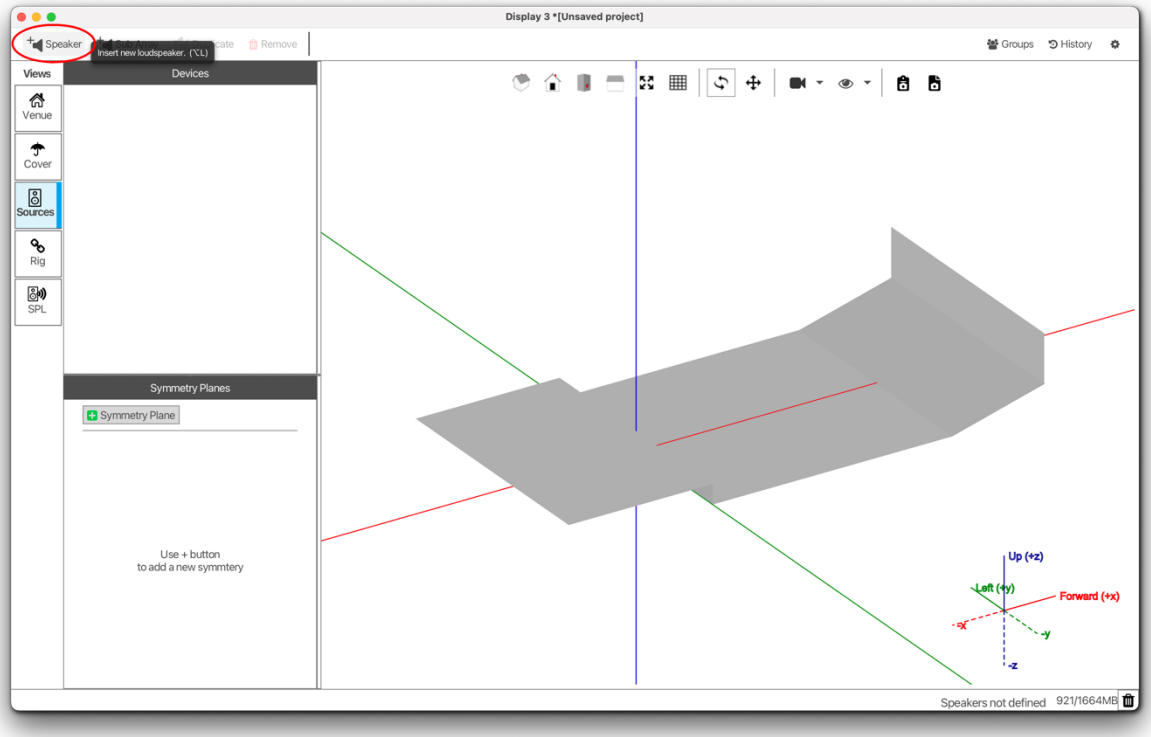
Coverage Zones

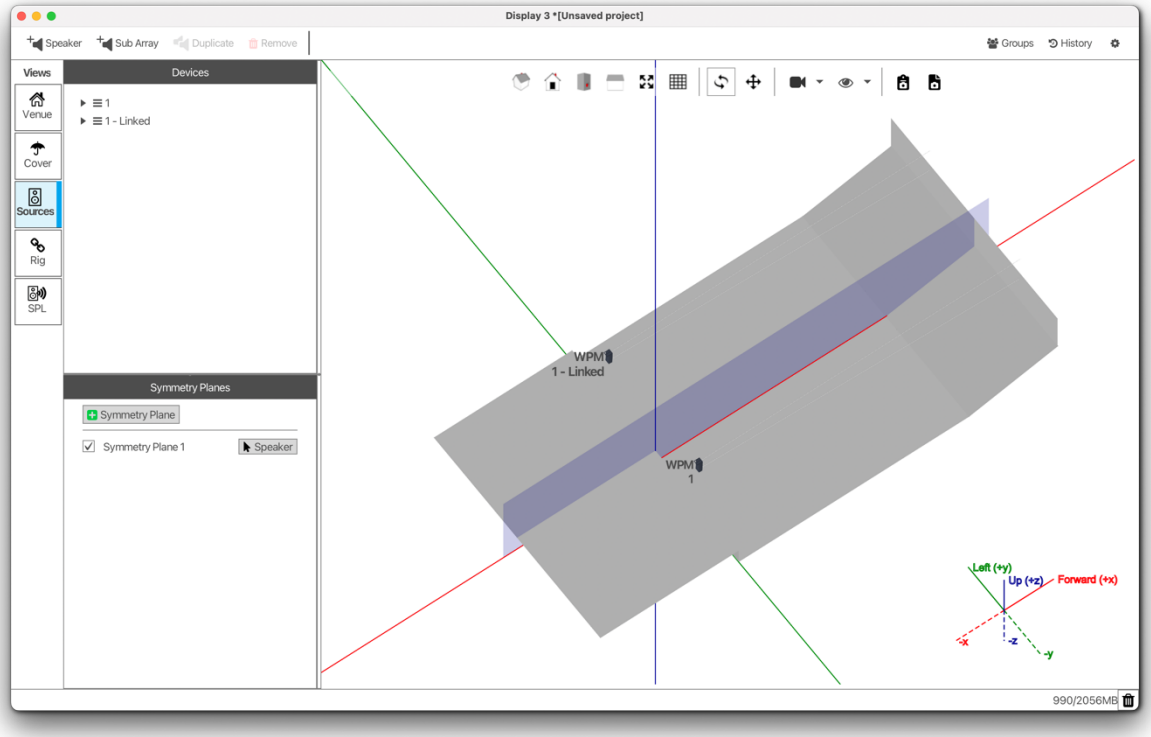
If we've imported a Display 2 project, then the Coverage Zones should already be defined. If we imported a SketchUp model or have created a Display 3 Native venue shell from QuadFaces, then we should define the Coverage Zones next. This is done in the **Cover** (Coverage) view. The *Select* buttons with the different coloured arrows are used to define Coverage Zones. You'll need at least one Audience Zone to calculate the SPL across the venue. Simply click on one of these buttons, then click on one or more venue faces sequentially to assign these to the selected Coverage Zone type. *Remove* will reset a Coverage Zone to "None", or "Don't care". All 4 of these buttons act as a *toggle*; in other words, they remain active until the button is clicked a second time, or until the mouse is moved out of the 3D venue area:



Sources

The next step is to add speakers to the project. Unless you imported a Display 2 project, including at least one array, you'll need to add some loudspeakers to the venue. To do this, activate the **Sources** view, then click on **Speaker**. A list of available speakers will be presented, from which you can select a speaker to add. Once a speaker has been selected, it will be placed at its *default position*. See section *Default Speaker Insertion Heights* below for further details. The newly added speaker can be moved, rotated or tilted and duplicated across a Symmetry Plane:

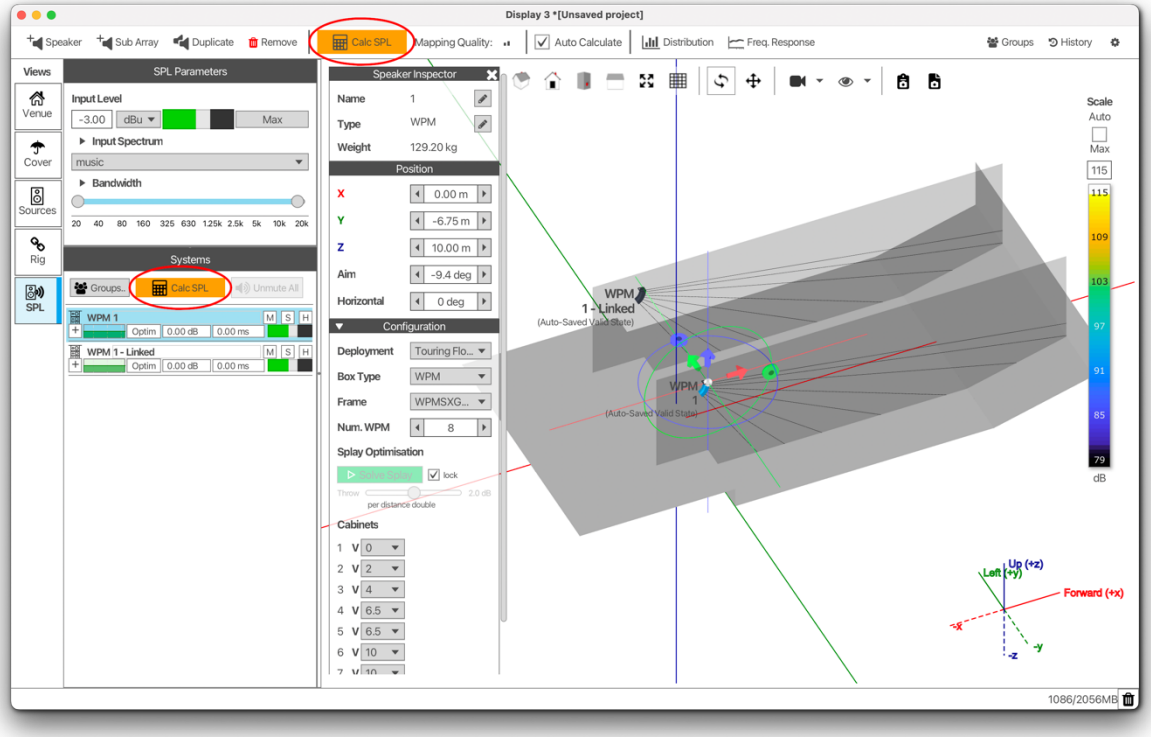




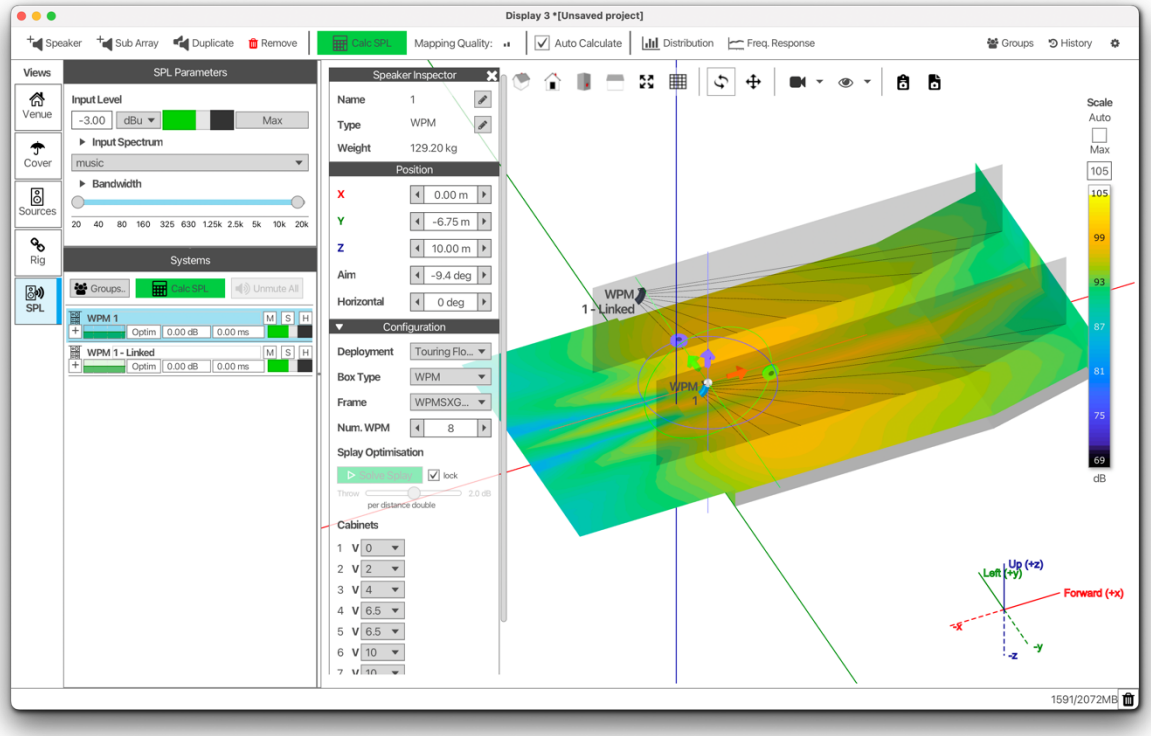
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SPL

Before calculating the SPL, it's advisable to first draw a Slice in the 2D Slice view and optimise the splay angles and EQ filter set for each line array. Mirrored speakers only need optimising once – their mirror (across a Symmetry Plane) is automatically kept in sync. For details, please review section *2D Slice* below. One all the arrays in the sound system have been optimised, you can move to the **SPL** view and click on the **Calc SPL** button, available in the main toolbar as well as in the *Sources* pane:

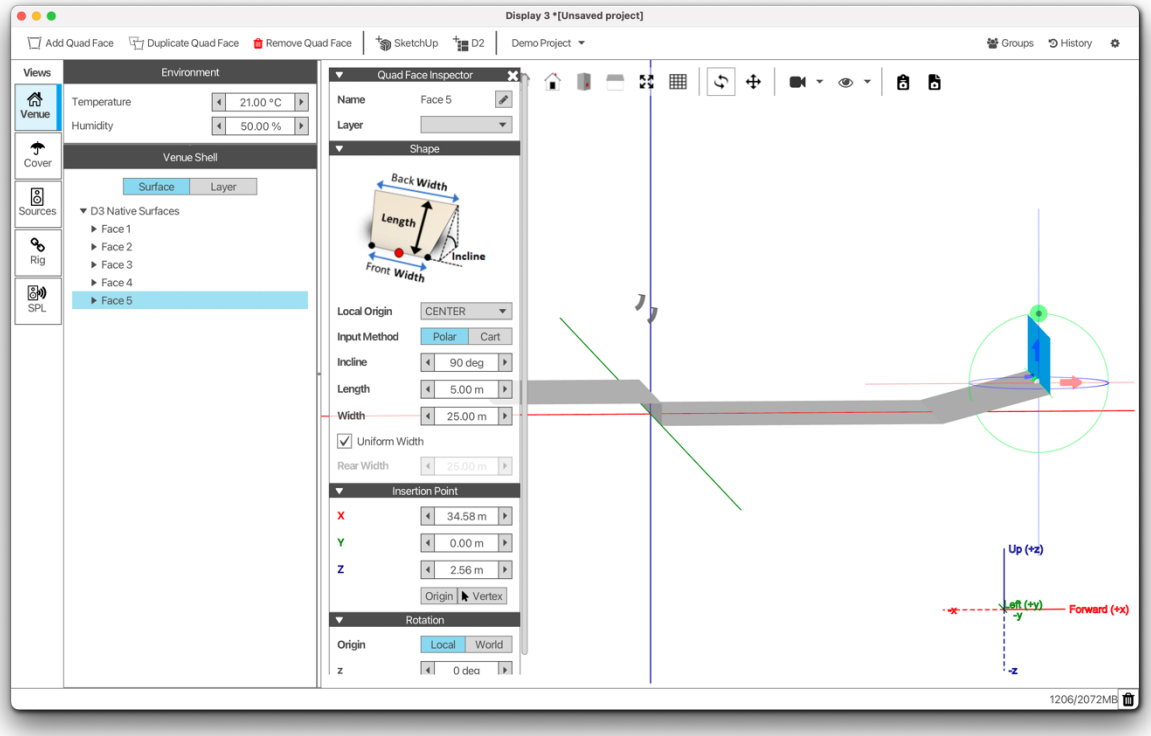


The SPL will be calculated and displayed as a *heat map* across the 3D venue:



Moving & rotating native venue faces

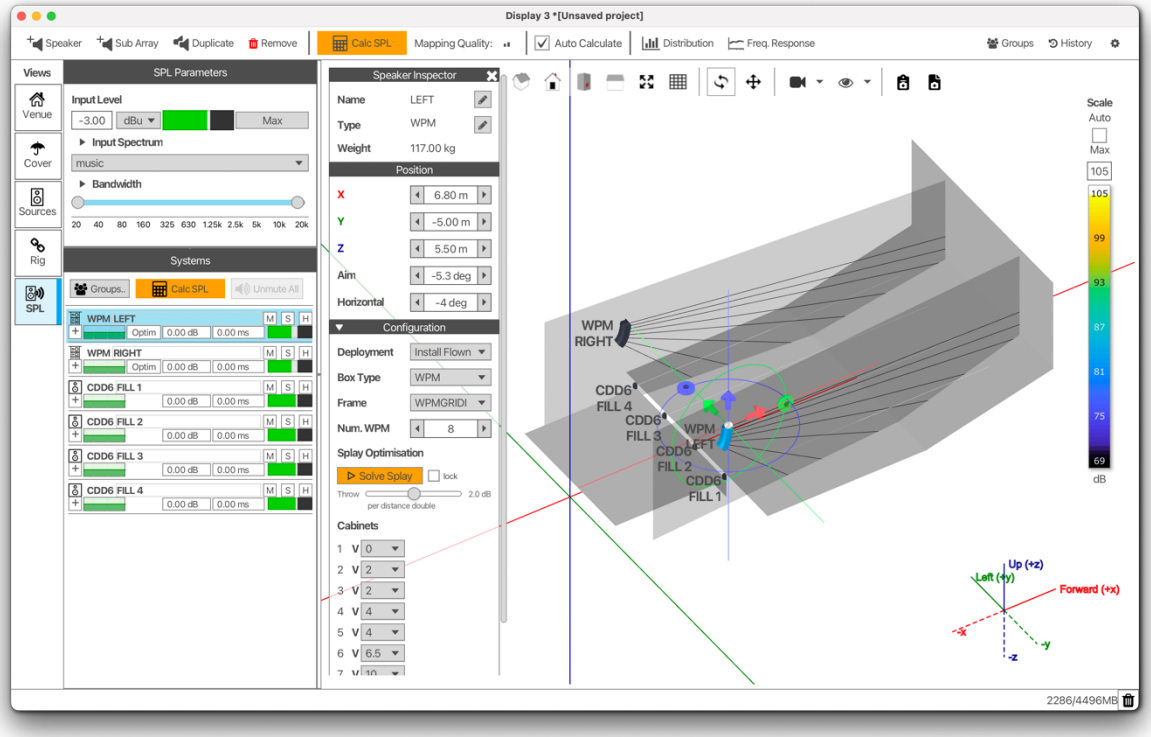
When creating a venue shell using native Display 3 QuadFaces, these QuadFaces can be easily & quickly moved and rotated using the 3D Move Tool, a colour-coded draggable object, which allows the attached QuadFace to be moved along the venue's X, Y & Z-axes, and rotated around the Y and Z-axes. The 3D Move Tool consists of 3 arrows, colour-coded to match the axis along which each arrow moves the QuadFace, and 2 discs, similarly colour-code to indicate the axis around which each disc allows the QuadFace to be rotated. Please note that the Move Tool is not available on SketchUp imported surfaces:



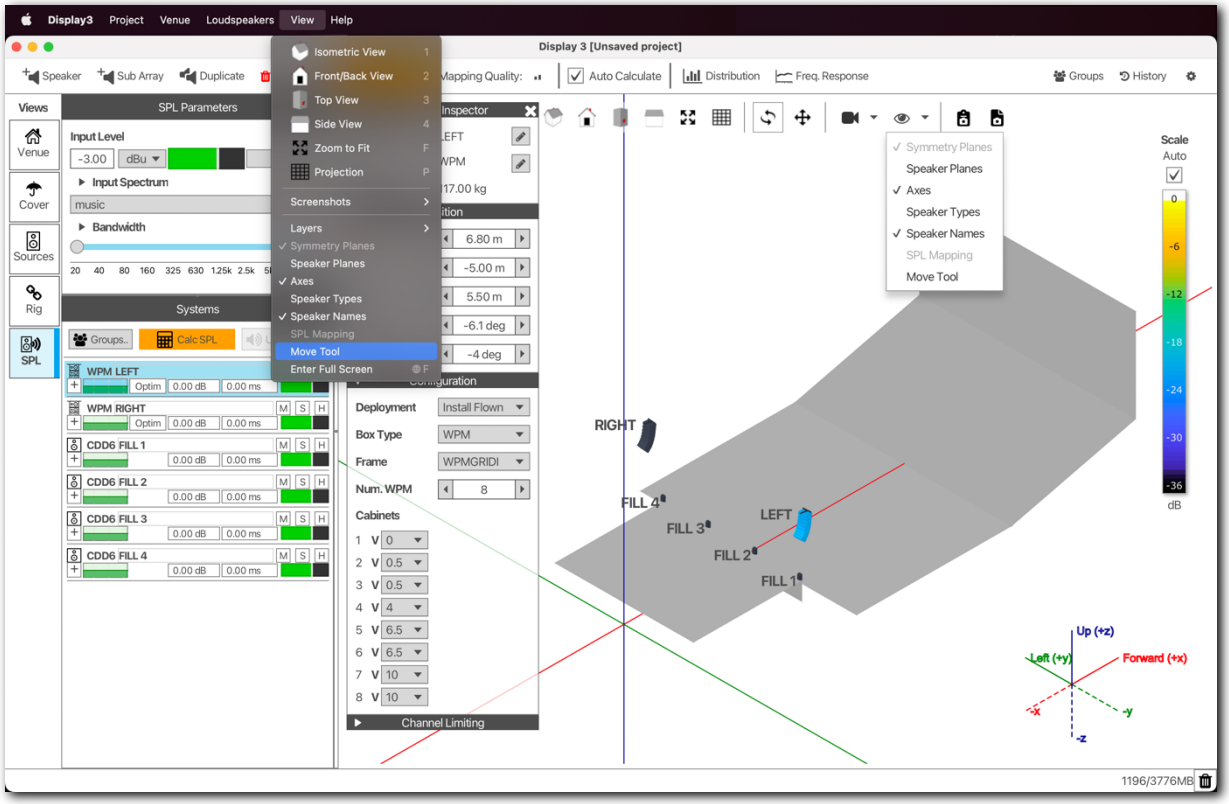
Moving & rotating speakers

Every speaker in a project also has a 3D Move Tool attached, allowing easy movement along the X, Y and Z-axes, as well as rotation around the Y and Z-axes, in a similar fashion to the 3D Move Tool available on QuadFace objects. Do note however, that if the 'Snap to Nearest Pick Point' (see section *Snap to Nearest Pick Point* below) option is checked, then the Aim angle is constrained to those angles which align with a pick point (i.e. pinpoint):

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The 3D Move Tool can be hidden by unchecking the option ‘Move Tool’ from the View menu, or the list of hideable objects in the toolbar:

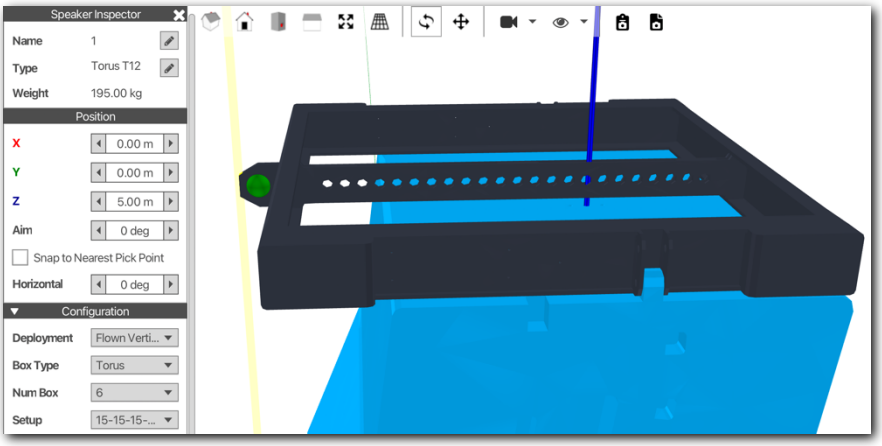


Snap to Nearest Pick Point

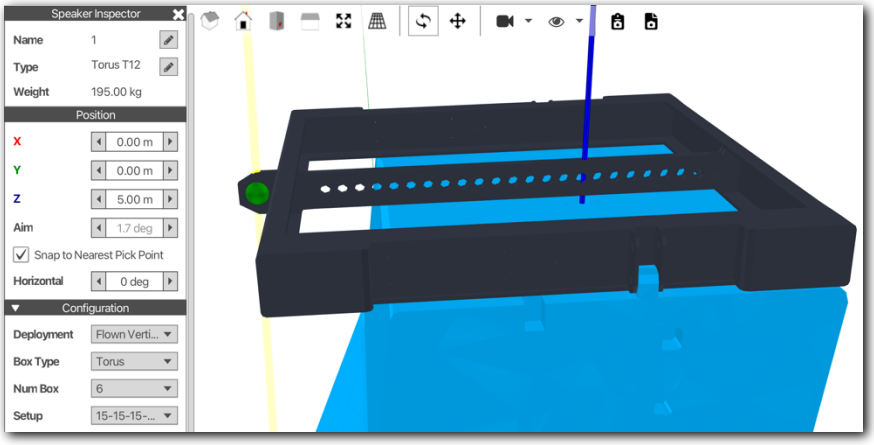
An option is available to optionally constrain aiming angles of line arrays & clusters (Torus) to those available for the pin locations (‘pick point’ or ‘pinpoint’) in the lift bar. This option is available in the Speaker Inspector for clusters. For line arrays, this option is available in Slice view only.

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COG line (yellow) not passing through pick point:



Aim now snapped to nearest pick point:

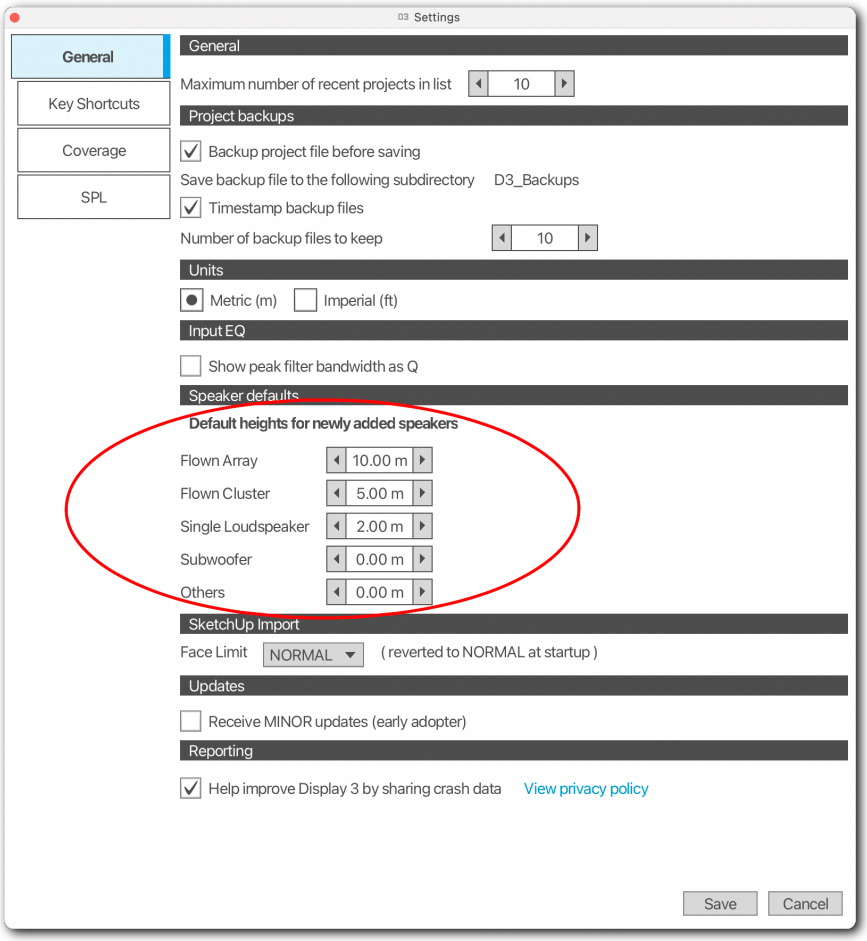


Any change to Aim (with spinner arrows or the 3D Move Tool, see *Moving & rotating speakers* above) will now advance to the next pick point.

Default Speaker Insertion Heights

Depending on the type of loudspeaker, a user definable default height can be configured in the General Tab of the Settings dialog:

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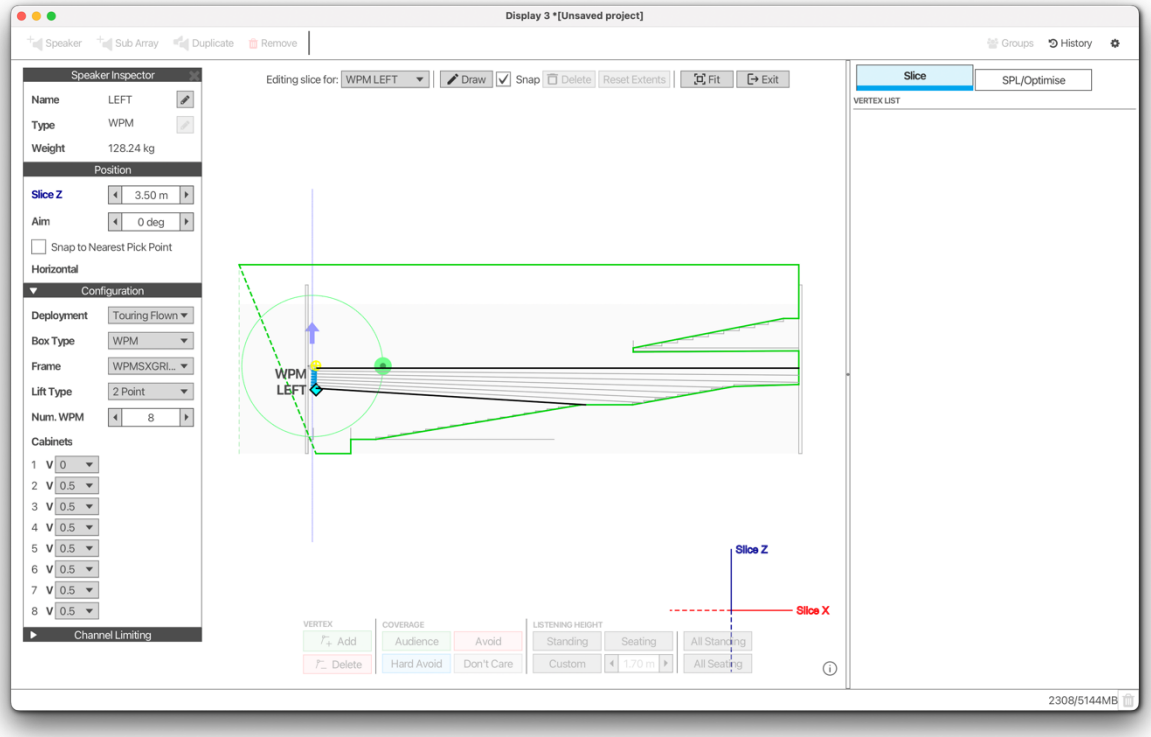


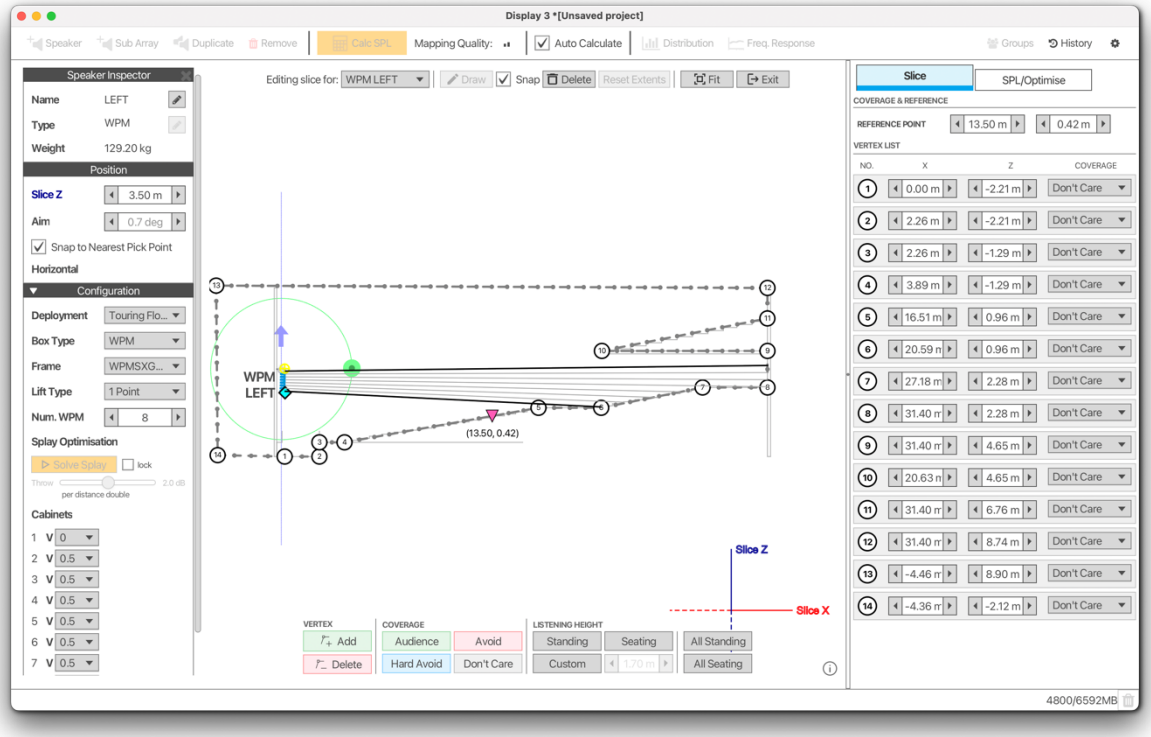
2D Slice

Display 3 offers a 2D Slice feature, with both Splay and EQ Optimisation, for Wavefront Precision line arrays. Simply double-click on an array to open the Slice view. A section plane of the venue is displayed. The Slice can be drawn in this 2D section plane by clicking on the **Draw** button.

Drawing the Slice is aided by snapping to the venue section plane and the four corners of the line array's plane. Further assistance in drawing horizontal & vertical lines correctly is available, while drawing a slice, or moving a vertex in an existing slice, by pressing and holding down the ⌘ Command key on macOS or the ^ Ctrl key on Windows while dragging. While this key is held down, only perfectly horizontal or vertical likes can be drawn. Enhanced snapping is also available in this mode, where guidelines running from venue objects to the current line are displayed, and drawing is snapped to these guidelines, as can be seen below, where the horizontal line at the top of the slice can be perfectly aligned with the speaker plane, even though the horizontal line runs above the speaker plane:

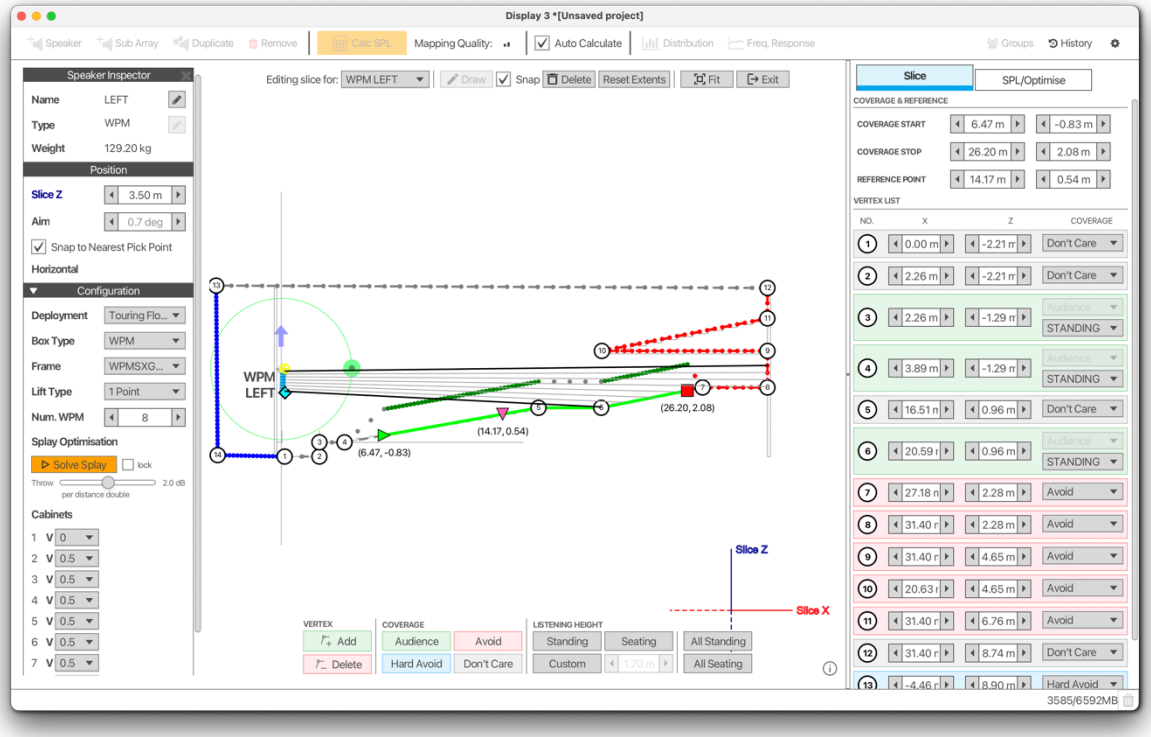
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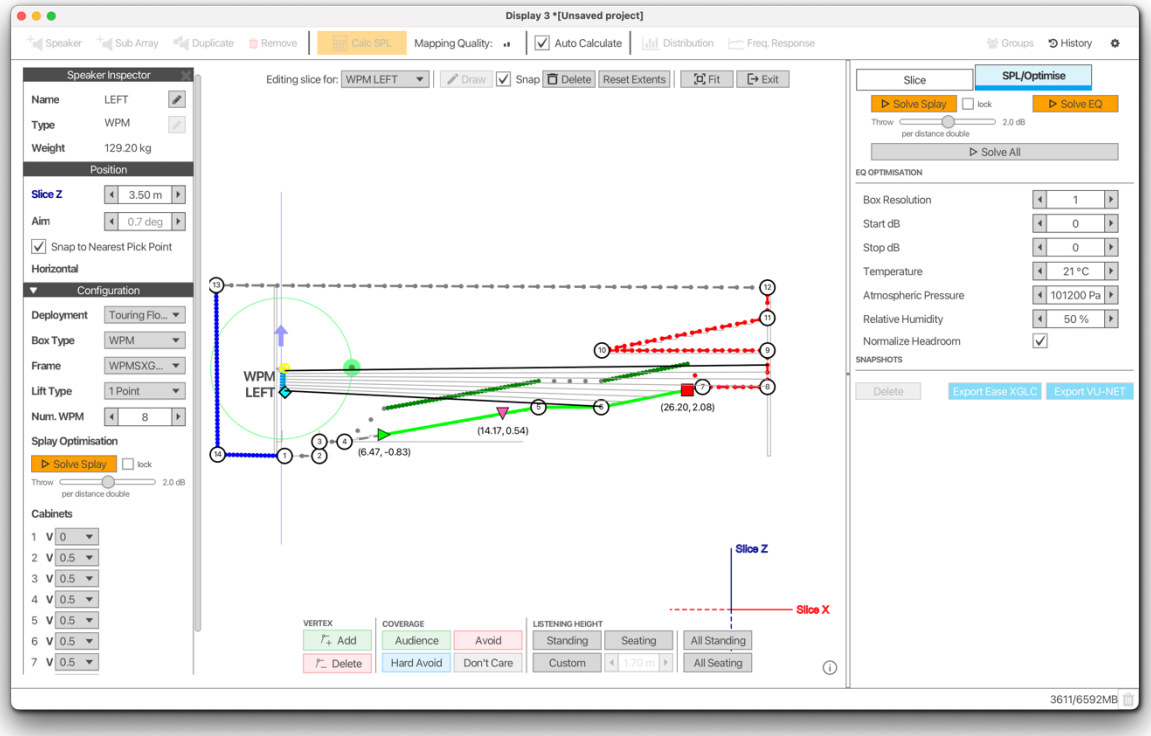
Once the Slice is drawn, segments can be assigned Coverage types. The Slice can only be solved if at least one Audience Zone is defined. Audience height (Standing, Seated, Custom) can be set for each individual Slice Segment. In addition, the Coverage Markers can be moved to extend or shrink the Coverage Zone:

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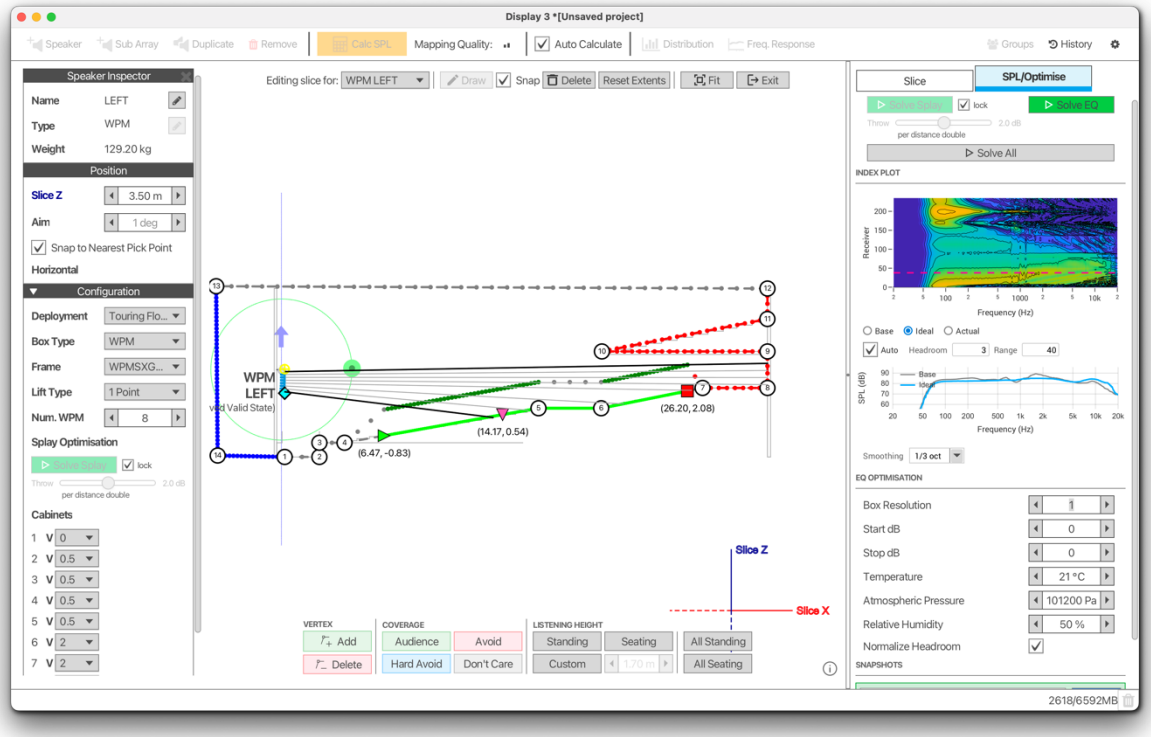
Array Optimisation

Once the Slice is defined, you can solve the Slice – there are three buttons in the right-hand SPL/Optimise pane, **Solve Splay**, **Solve EQ** and **Solve All**. **Solve Splay** will optimise the array aim angle and the individual cabinet splay angles, based on the defined audience area. The *Snap to Nearest Pick Point* option is respected when tilting the array (the aim angle). **Solve EQ** will produce an optimised filter set and **Solve All** will first optimise the Splay, then create an optimised filter set, thereby performing both functions with one mouse click:



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On clicking the **Solve All** button, the Slice is solved, optimising the Splay angles, then creating and applying an optimised filter set. After the Splay angles have been optimised, you can opt to lock the **Solve Splay** button by clicking the *lock* option next to the button. When **Solve Splay** is locked, the Splay angles won't be optimised again when clicking **Solve All**. This lock will be released if the speaker position, aim angle, or any of the cabinet splay angles are changed. The lock can always be manually released by unchecking the *lock* option to the right of the **Solve Splay** button. Upon completing the EQ optimisation, the SPL is displayed as a contour map above a frequency response plot, and the optimised filter set's snapshot for the array is loaded with a default name. The name of any currently active snapshot is displayed next to the array, under the speaker name:



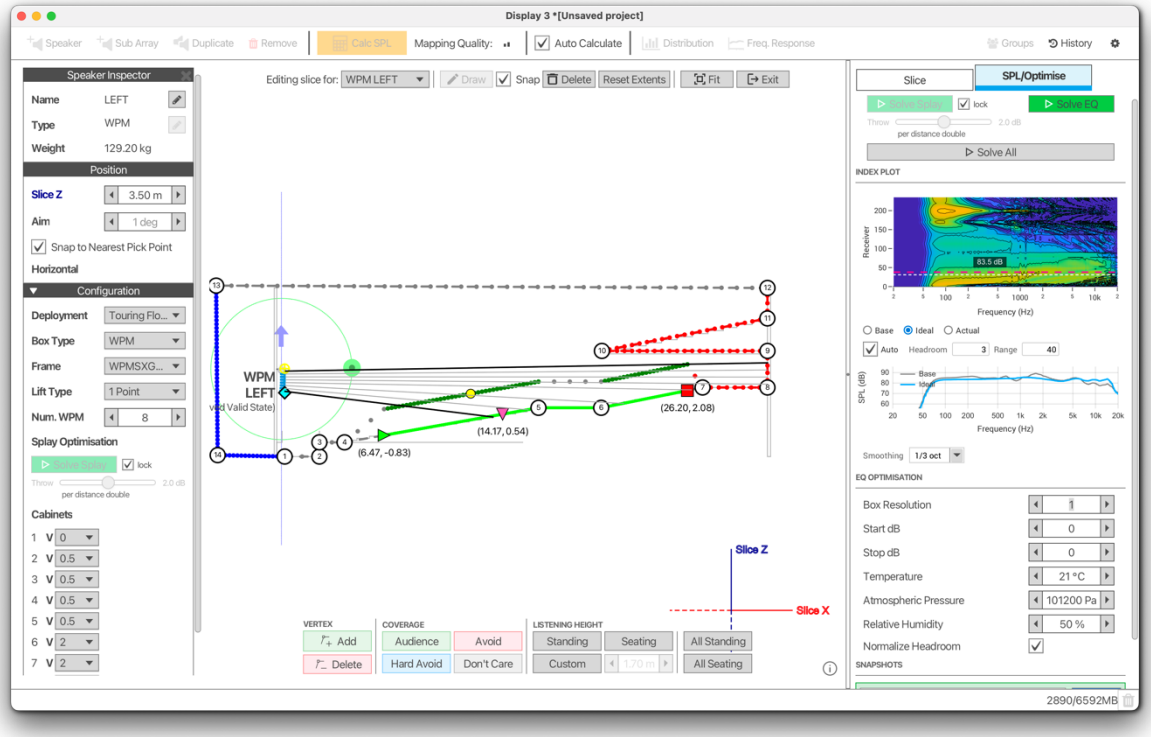
On the SPL contour map, the mix point (the pink triangle) is given by the dashed pink line. The frequency response plot displays the base and ideal frequency responses for this point by default. The mix point can be moved by dragging it. Alternatively, moving the mouse over the SPL contour map displays the frequency response for any other calculation point on the Slice. The currently displayed calculation point is highlighted by a yellow disc in the Slice:

EQ Optimisation Parameters

The EQ Optimisation Parameters can be tweaked before clicking the **Solve EQ** button again.

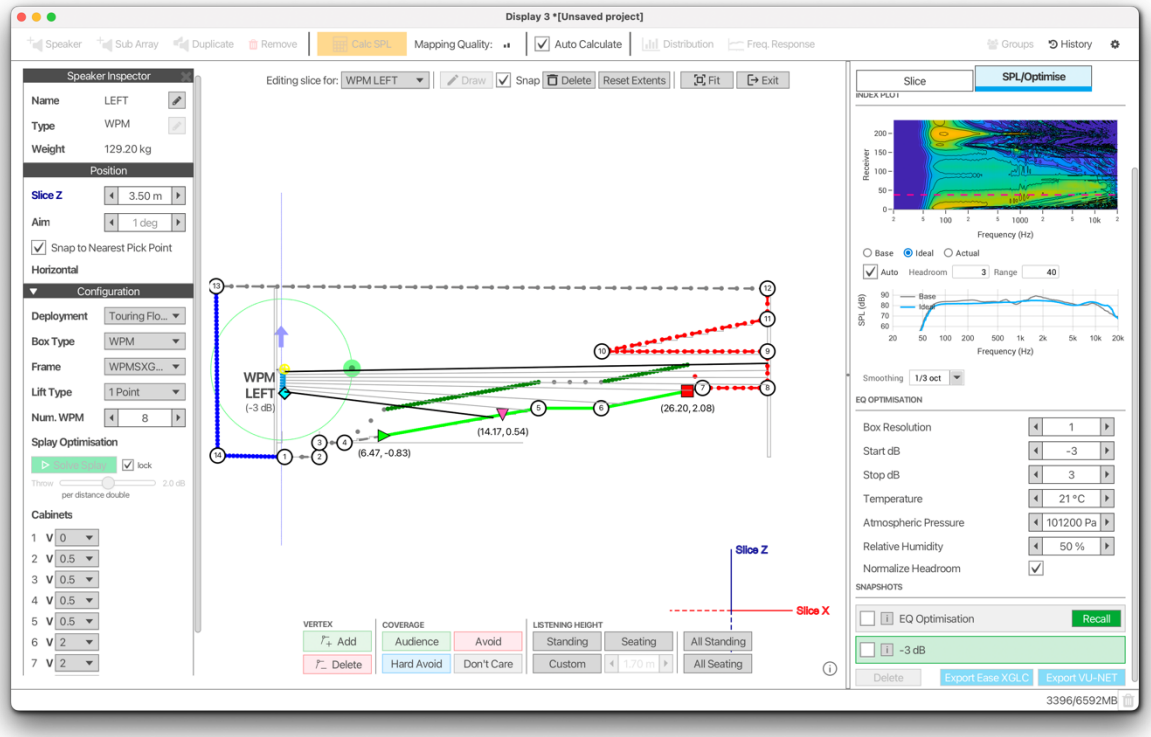
The *Normalise Headroom* option, checked by default, ensures that the output gains are optimised so the output is precisely -6dB. The normalisation does not take account of any input, group or output gains, nor the global Input Gain, accessible from the *SPL Parameters* pane in the 3D venue's SPL tab. If the output of an optimised array is not -6dB, check these gain controls to investigate where other gain values might have been adjusted.

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EQ Optimisation Snapshots

By clicking the **Solve EQ** button again, a newly optimised filter set snapshot for the current parameters will be created and assigned to the array. Each snapshot can be saved under a unique name. The currently active snapshot's name is always displayed below the speaker name:

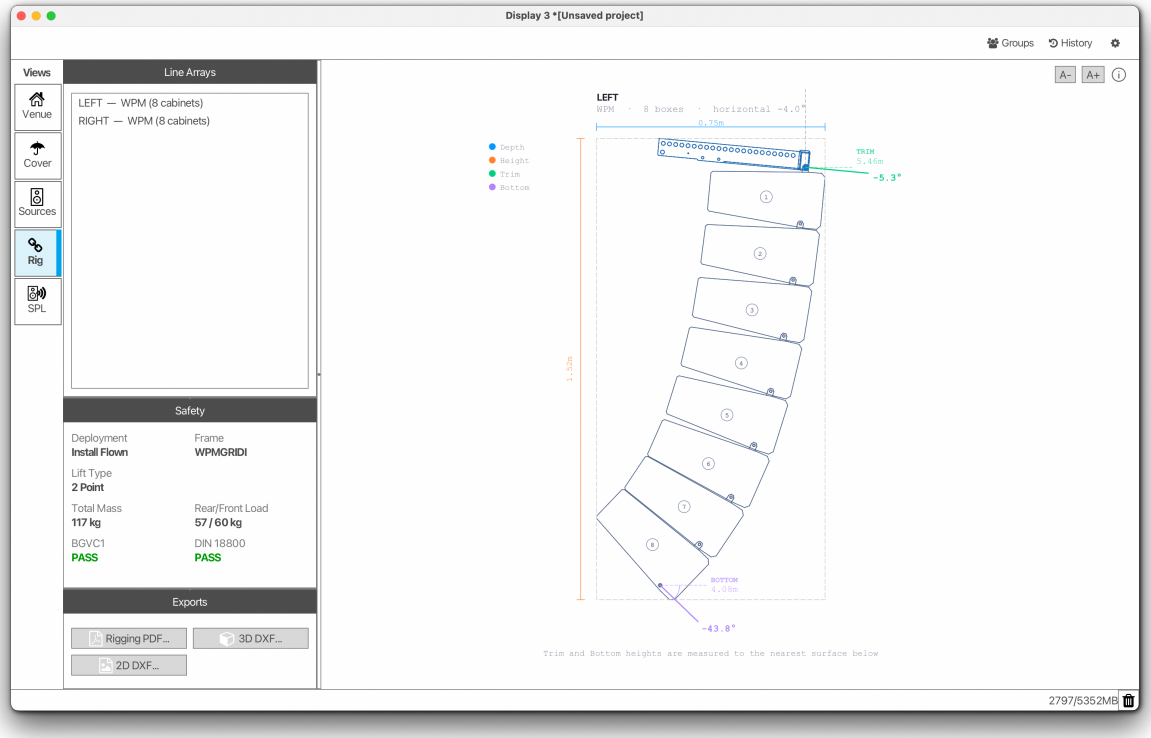


The filter set of the active snapshot is applied whenever calculating SPL, also in the 3D venue. The active snapshot can also be swapped in the 3D venue by right-clicking on the speaker and selecting from the Snapshots > context submenu. The optimised filter set can then be exported to VUNET.

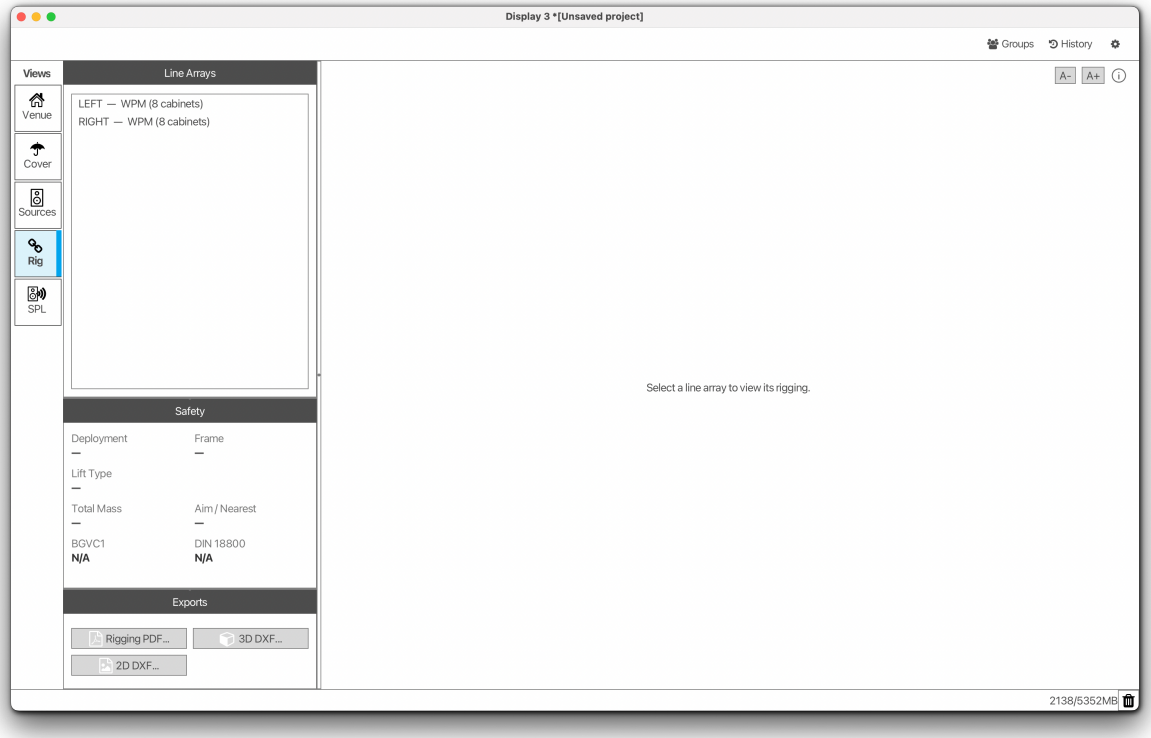
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Rigging

Once a line array's splay angles have been optimised, the rigging can be reviewed and verified against the safety standards BGV C1 and DIN 18800:

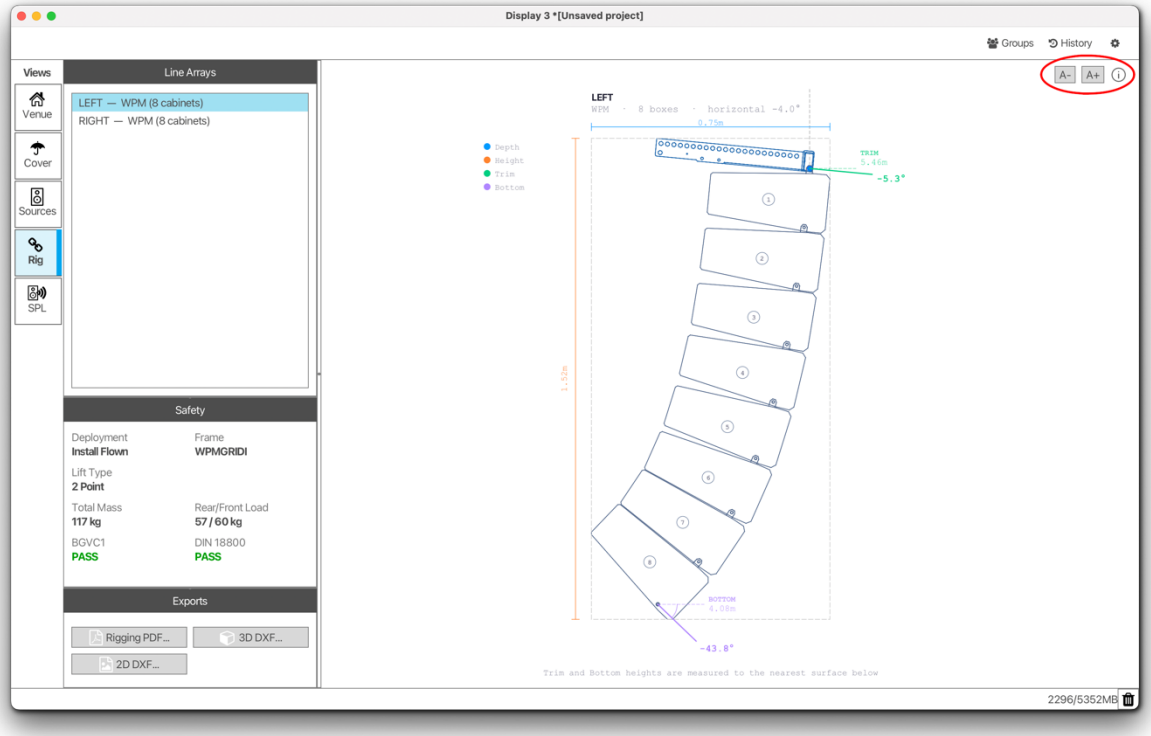


Moving to the **Rig** view when a line array is currently selected displays a 2D cross-section of the selected line array, as can be seen above. If no array is currently selected when the **Rig** view is entered, a message is displayed informing the user that a line array should be selected in order to view its rigging:

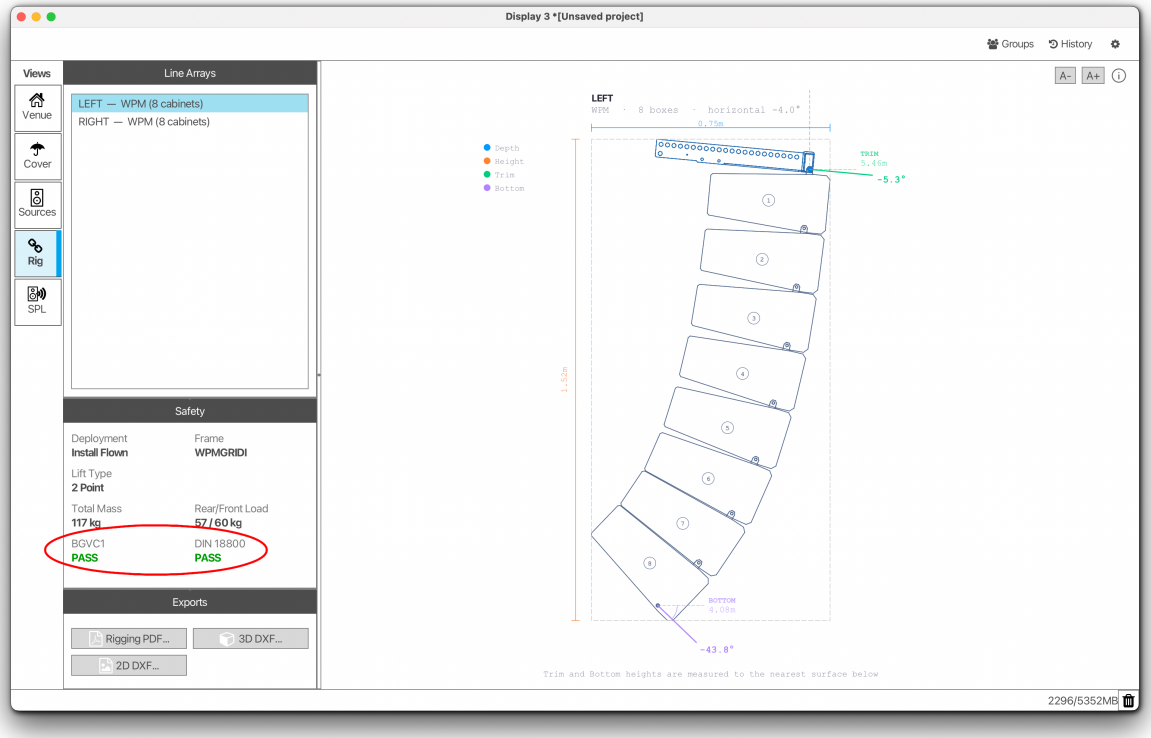


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Once the desired array has been selected, the rigging details for that array can be reviewed:



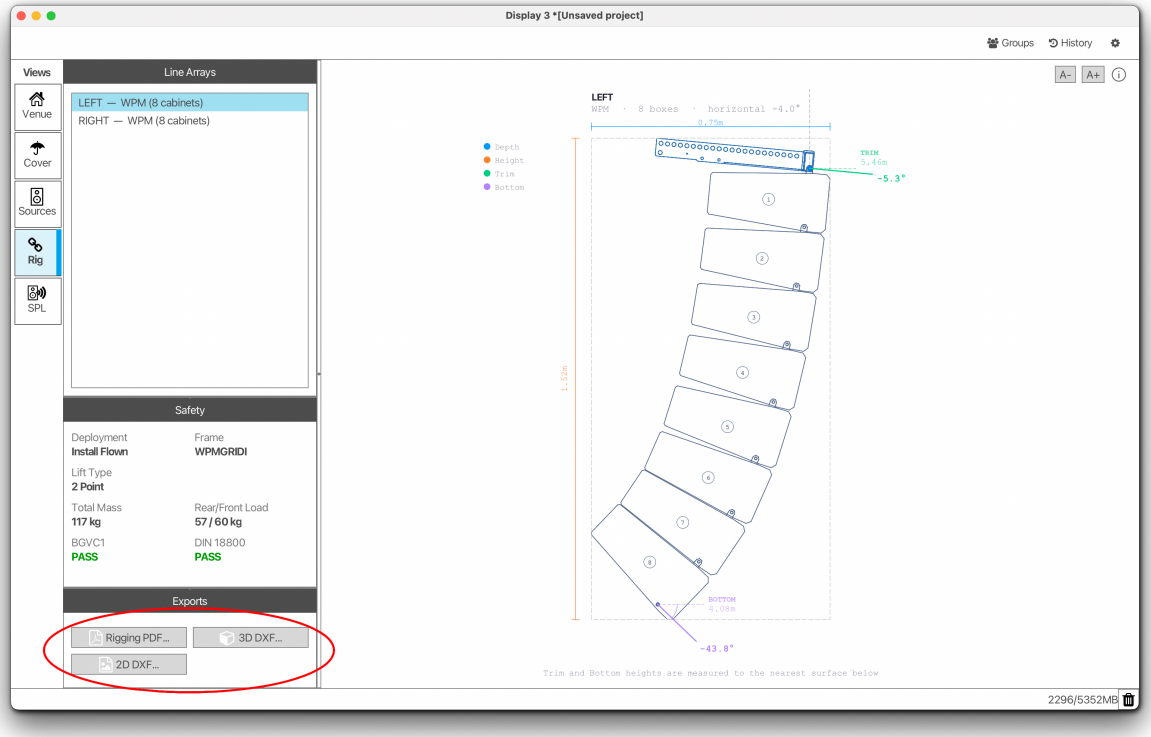
The buttons at the top-right, highlighted above, provide ways the change the view: the font size can be increased or decreased by clicking on the **[A-]** and **[A+]** buttons, and clicking the Info ⓘ button displays a tooltip with the required shortcuts to zoom the 2D rigging cross-section in and out.
In the Safety section, the results of two safety calculations, against both safety standards BGV C1 and DIN 18800, can be seen. Both results must show Pass to be confident that the array in its current rigging configuration can be flown safely:



Once you're ready to deploy the line arrays using this rigging configuration, a PDF report can be produced, which can be taken on-site to aid deployment. The report will contain the rigging details

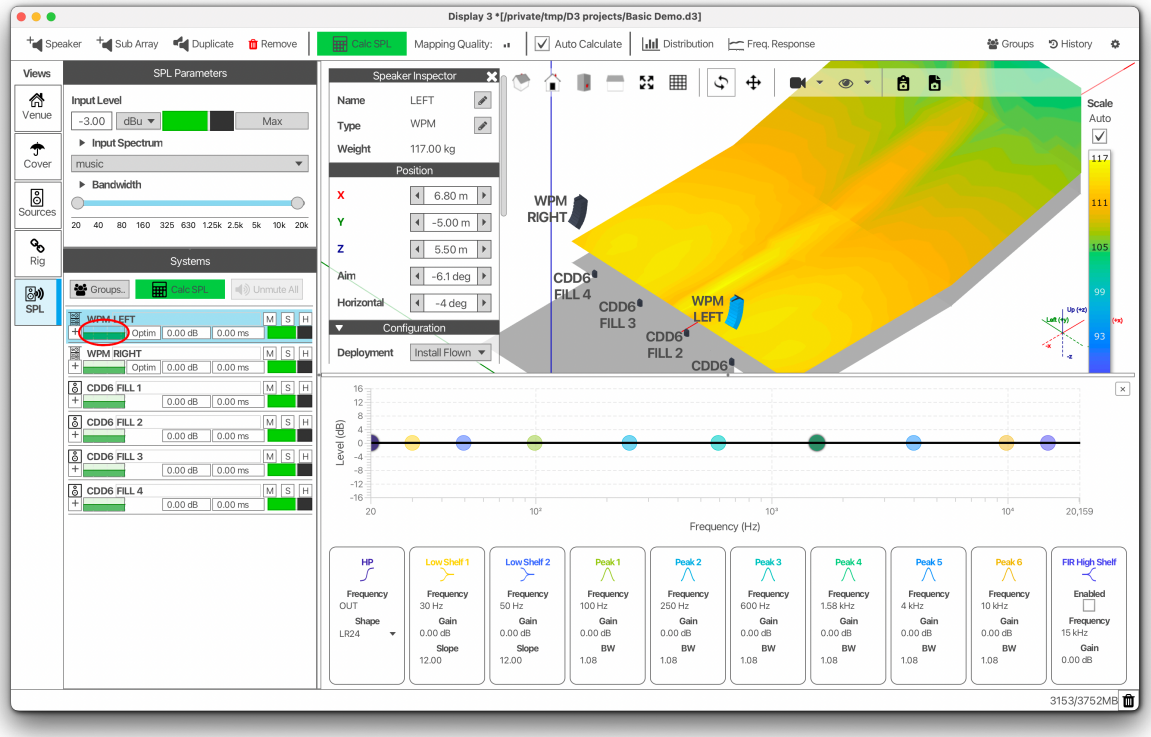
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for every line array in the project, plus other details for other loudspeakers in the project. Export options for both 2D and 3D AutoCAD DXF format are also available:



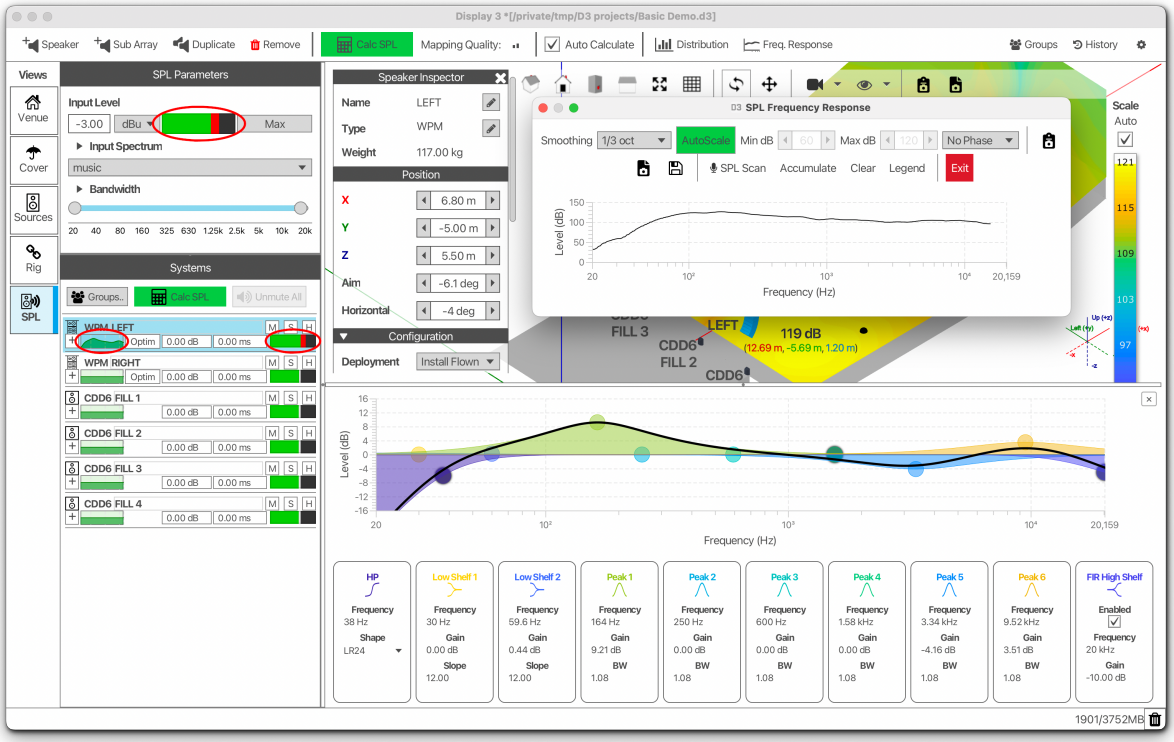
Input EQ Filter Parameters

Display 3 offers the possibility to adjust Input EQ filter parameters. These filter parameters are internal to Display 3 only and won't be exported to VU-NET. They serve only to help visualise what the effect would be when changing these values on the device itself after the device has been deployed and synchronised with VU-NET. To display the Input EQ Filter Parameters, click on the button showing the EQ curve (always flat by default) in the *Systems* pane:



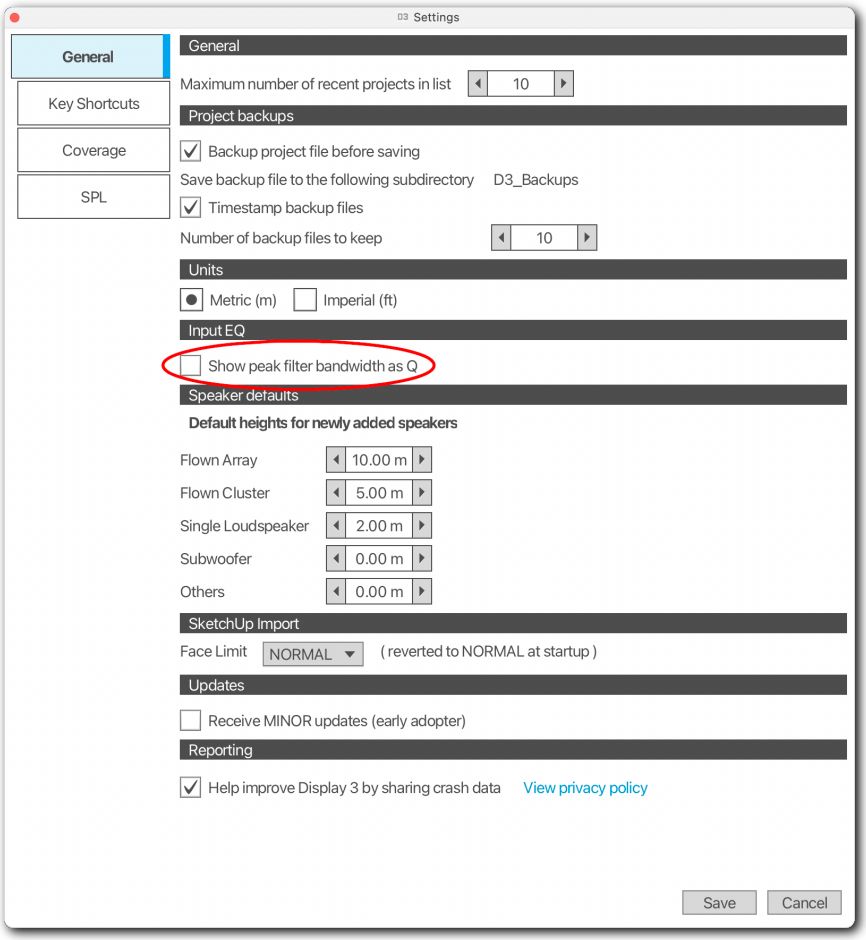
Hover over the discs representing a filter in the Graphic EQ pane to highlight the corresponding Channel Strip below. Equally, hovering over the channel strips highlights the disc in the Graphic EQ pane. Drag one of the discs horizontally to adjust the frequency of filter. Dragging the disc vertically adjusts the filter's gain value. Scrolling with the mouse wheel or dragging the disc vertically when the Shift key is pressed adjusts the filter's bandwidth. The Input EQ Filter Parameters can also be modified directly in the Channel Strip, if you prefer to enter exact values.

After making changes, the EQ curve on the button will be updated to reflect the current state. Changing any of these values is also likely to affect the headroom, so pay attention to these meters when adjusting Input EQ Filter Parameters (highlighted in the image below). The SPL will also be updated whenever these parameters are changed when *Auto Calculate* (see section *Fast SPL Calculation on the GPU* below for details) is on. You can use the *SPL Frequency Response Tool* (see section *Frequency Response Tool* below for details) to review the frequency response of the SPL at a given receiver point:



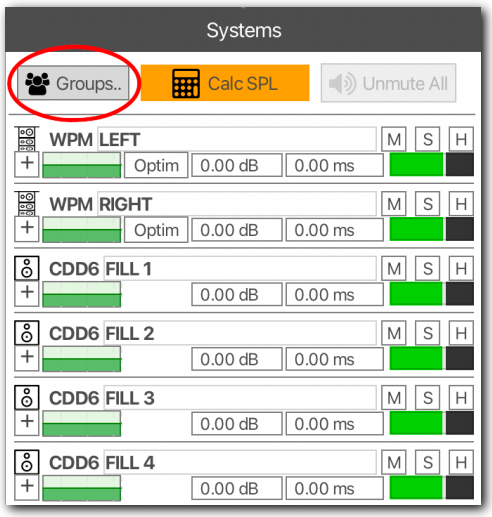
If you prefer to work with *Q* values rather than *Bandwidth*, you can opt to use *Q* in the Display 3 Preferences Dialog, under the General tab. Bandwidth values will automatically be converted to Q values and vice versa, depending on how this option is set:

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Input Groups

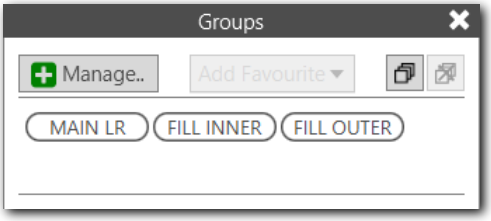
Display 3 facilitates the 'ganging' of Input EQ parameters *Gain*, *Delay* and *Phase inverted*. In the SPL Context, the *Systems* pane displays each speaker in the project's sound system. Each speaker has its own Gain, Delay and Phase inversion (the **[+]** or **[-]** buttons) properties, which can be adjusted individually:



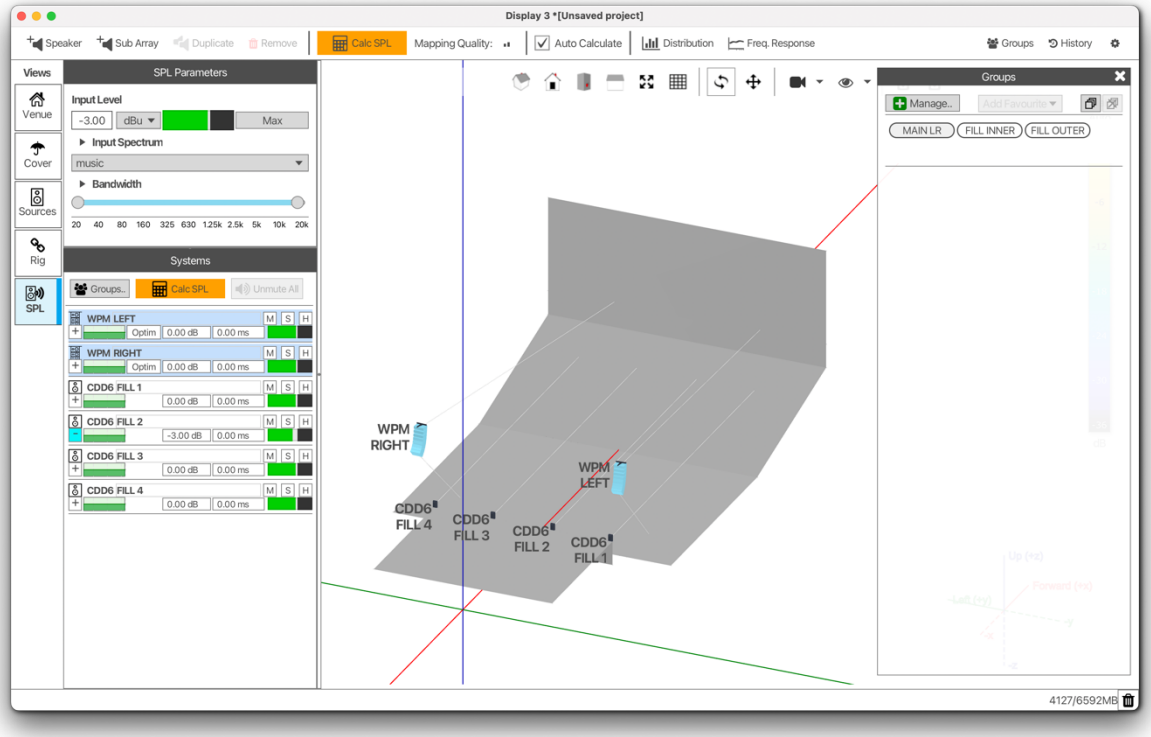
We see above that the speaker FILL 2 has had an individual Gain of -3.00 dB, and Delay of 0.20 milliseconds as well as Phase inversion applied.

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Input Groups are accessible from the *Groups* button, circled in red above. Clicking this button displays the *Groups* pane to the right of the Display 3 window. 'Favourite' groups are displayed below the Toolbar:

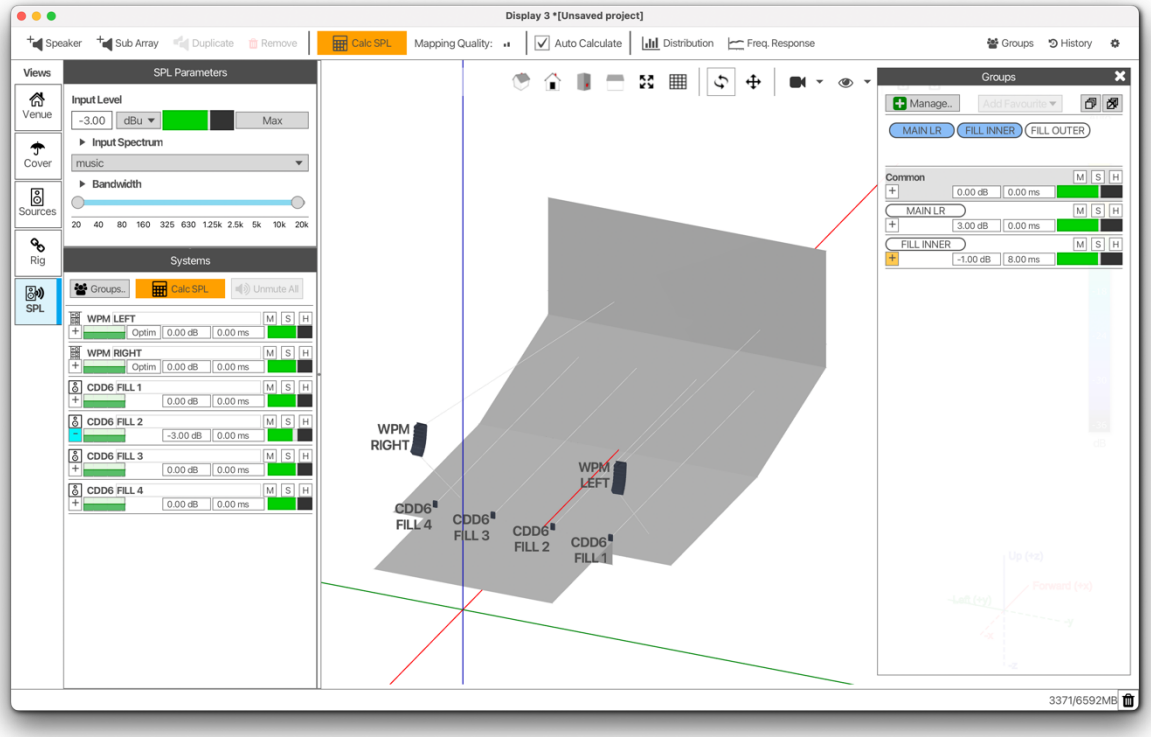


Hovering over any the group buttons (MAIN LR, FILL INNER & FILL OUTER in the above case) will highlight the speakers which are a member of the group, in the 3D venue and the *Systems* pane:



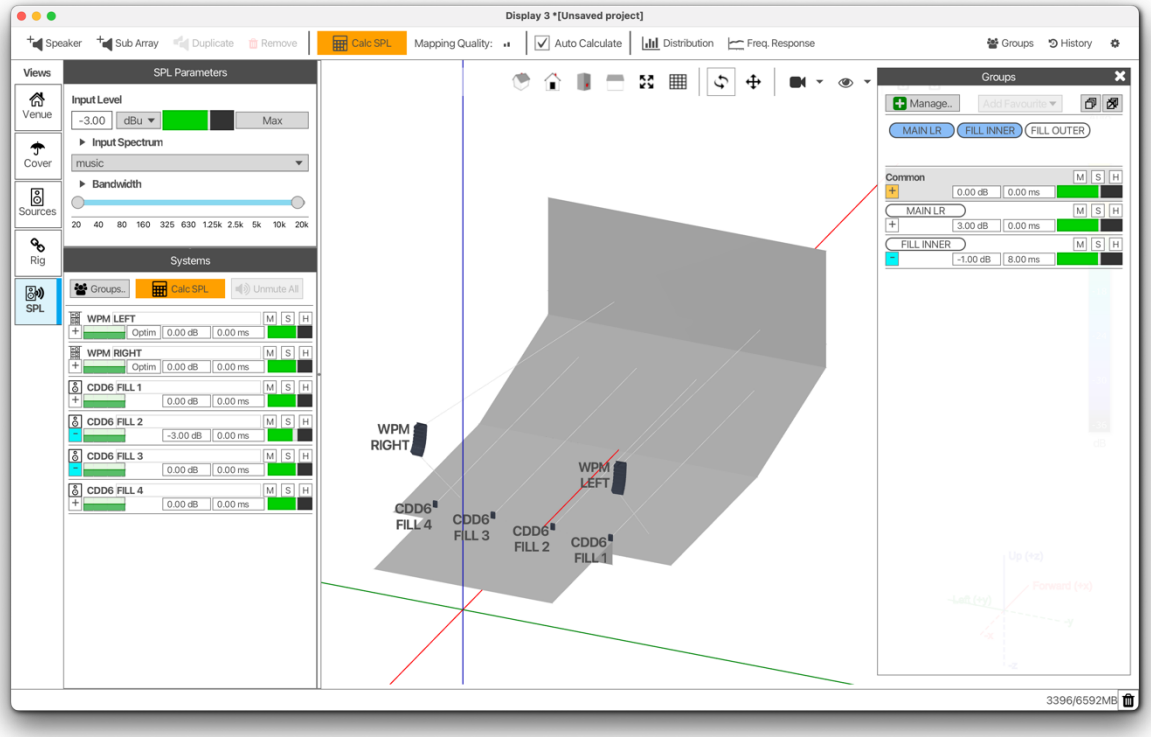
Selecting one or Input Groups, by clicking on the respective group buttons will display the Input EQ parameters for this group. When multiple groups are displayed, a *Common* group is also displayed, which allows changes to be made across all displayed groups:

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We see above that the Phase inversion for Input Group FILL INNER is coloured orange, indicating that this property is applied to an individual speaker (FILL 2) and so this group's Phase inversion property hasn't been synchronised across all speakers in the group.

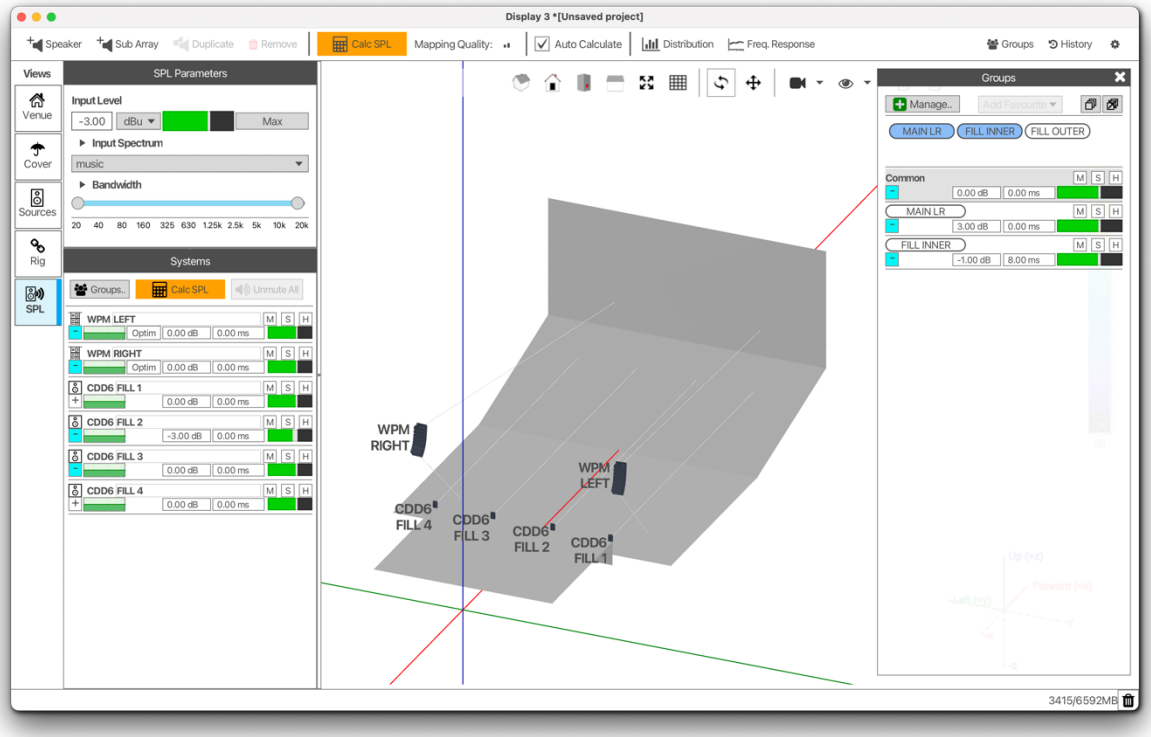
Applying Phase inversion to the group will apply this property equally to all member speakers:



We see above that the *Phase inversion* button for the FILL INNER group is now coloured cyan to indicate that this property has been applied equally to all speakers in this group. The *Phase inversion* button for the *Common* group is now coloured orange, indicating that the Phase inversion is applied to some groups only.

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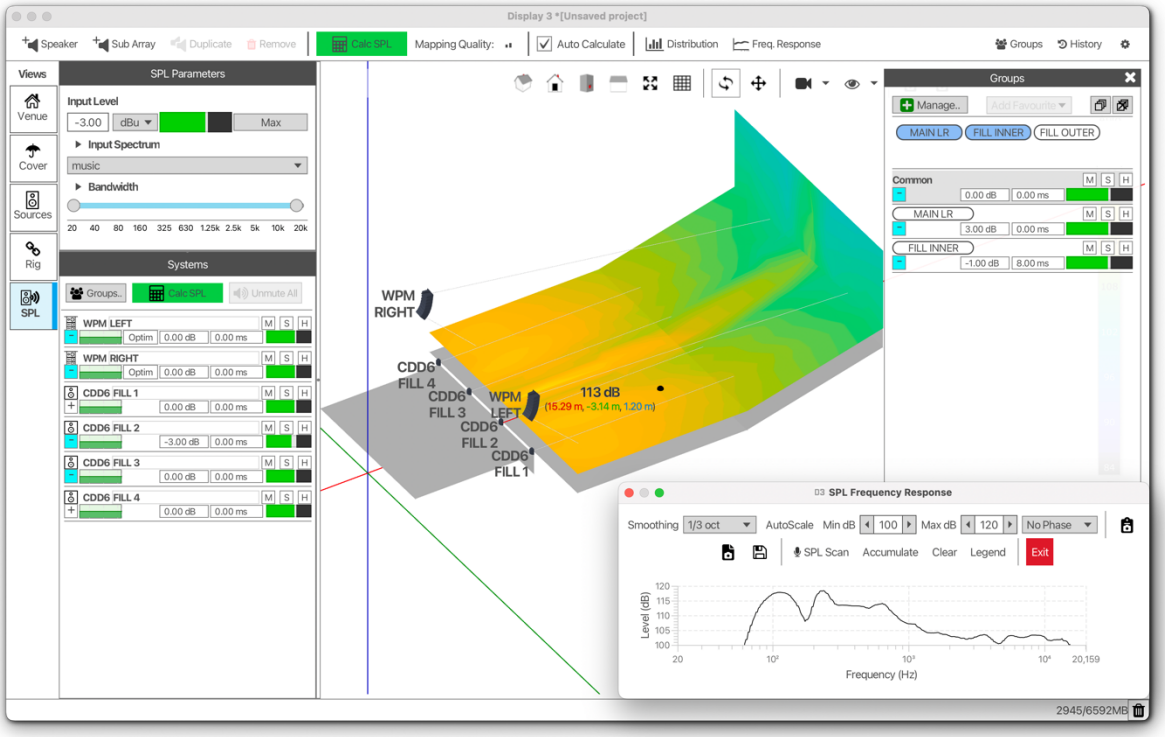
Clicking the *Phase inversion* button for the *Common* group results in the *Phase inversion* buttons for all the selected groups being coloured cyan, indicating that the Phase inversion property has been applied equally to all speakers in every selected group:



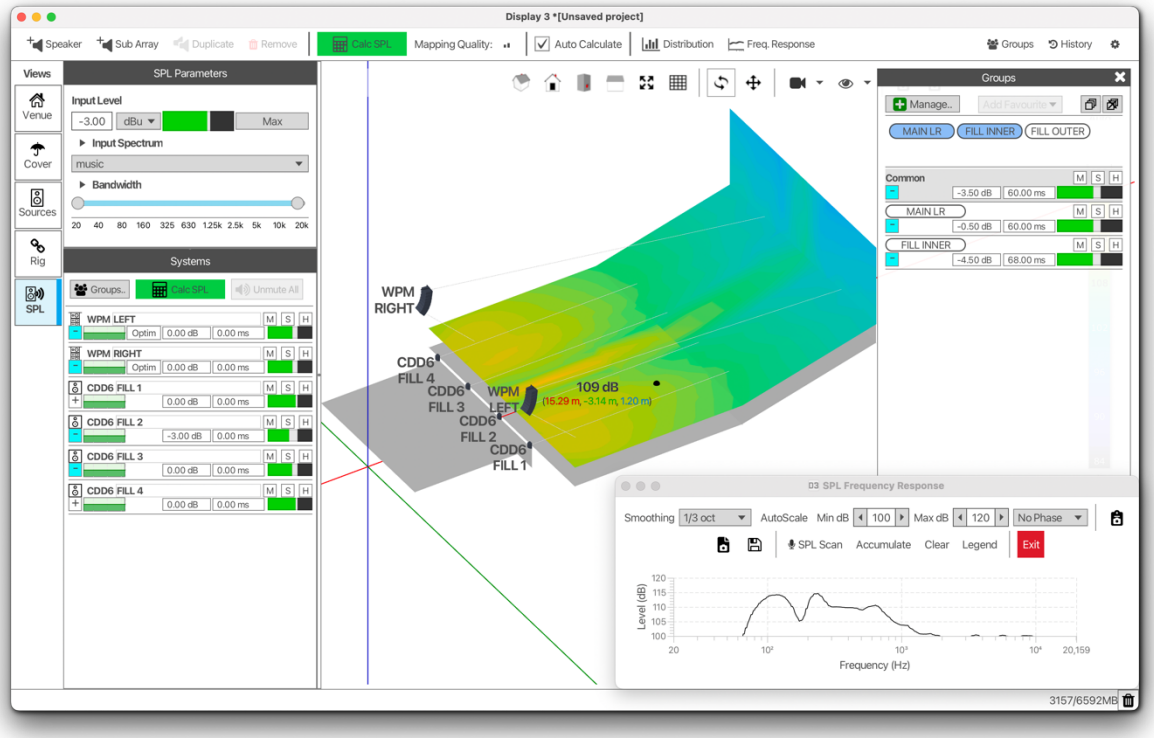
The *Mute*, *Solo* and *Hide* buttons (the **[M]**, **[S]** and **[H]** buttons) all work in a similar fashion to the *Phase inversion* button; any change to an individual member speaker will result in the group's button being coloured orange, and any change to a group's property will result in the property being applied equally to all speakers in the group.

The Gain and Delay properties work in an *additive* manner, meaning that any adjustment made to these properties, on a group, results in the Gain or Delay being added to all the speakers in the group. Gain can take positive or negative dB values, whereas Delay must always be a positive value notating milliseconds delay. Note that Gain or Delay values added to the groups aren't added to each individual speaker's Gain or Delay fields in the Systems pane – these continue to display the Gain & Delay values entered for each speaker; when calculating the SPL however, these group Gain and Delay properties are included in the calculation:

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Adding -3.50 dB Gain (attenuation) and 60 ms Delay to the *Common* group adds these values to each speaker's Gain & Delay values (SPL Scale is set to Manual):

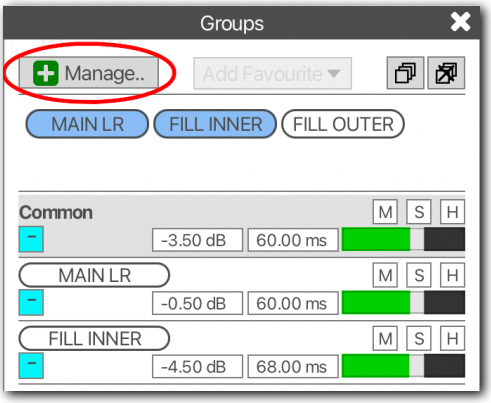


As can be seen above, the speaker output has been attenuated, resulting in a lower SPL, and the phase shift visible in the Frequency Response is indicative of the Delay having been applied.

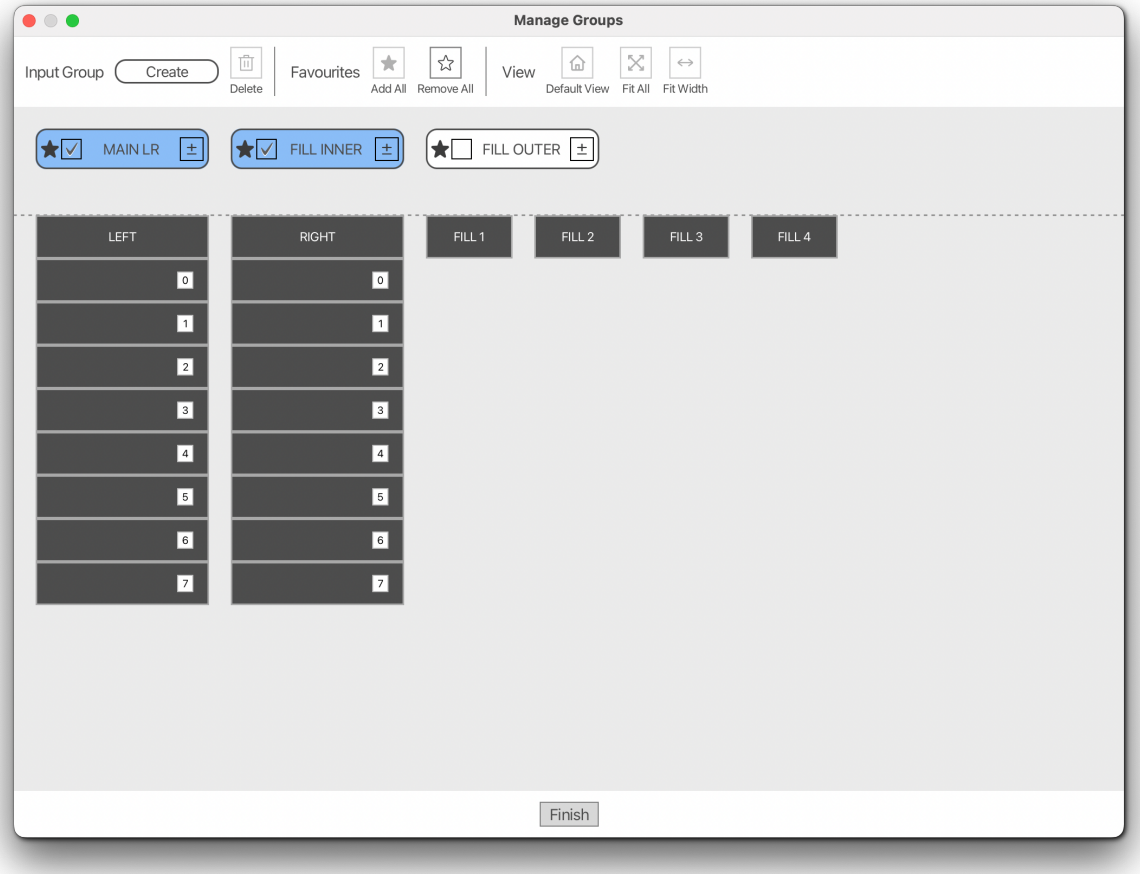
Input Group Management

Input Groups can be added or deleted, and added to or removed from the list of Favourites in the *Manage Groups* window, accessible via the *Manage* button in the *Groups* pane:

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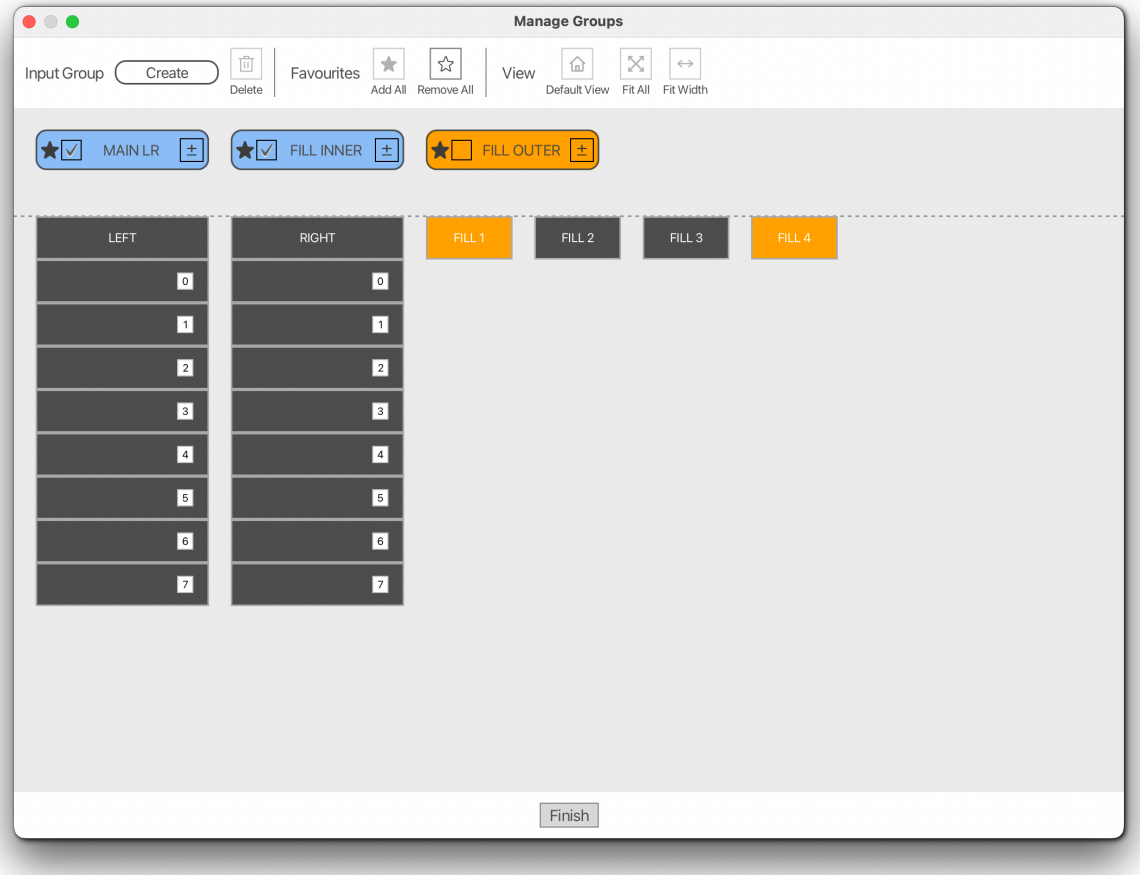
The *Manage Groups* window is displayed:



The buttons in the Toolbar provide options to create and delete Input Groups. Further options are available to add or remove all groups to or from the Favourites, as well as to arrange the boxes representing the sound system's speakers in the *Manage Groups* window. An individual group can be added to or removed or from the Favourites by checking or unchecking the check box next to the star in the rounded rectangles representing the group, as highlighted above. Favourite groups are coloured blue in the *Manage Groups* window.

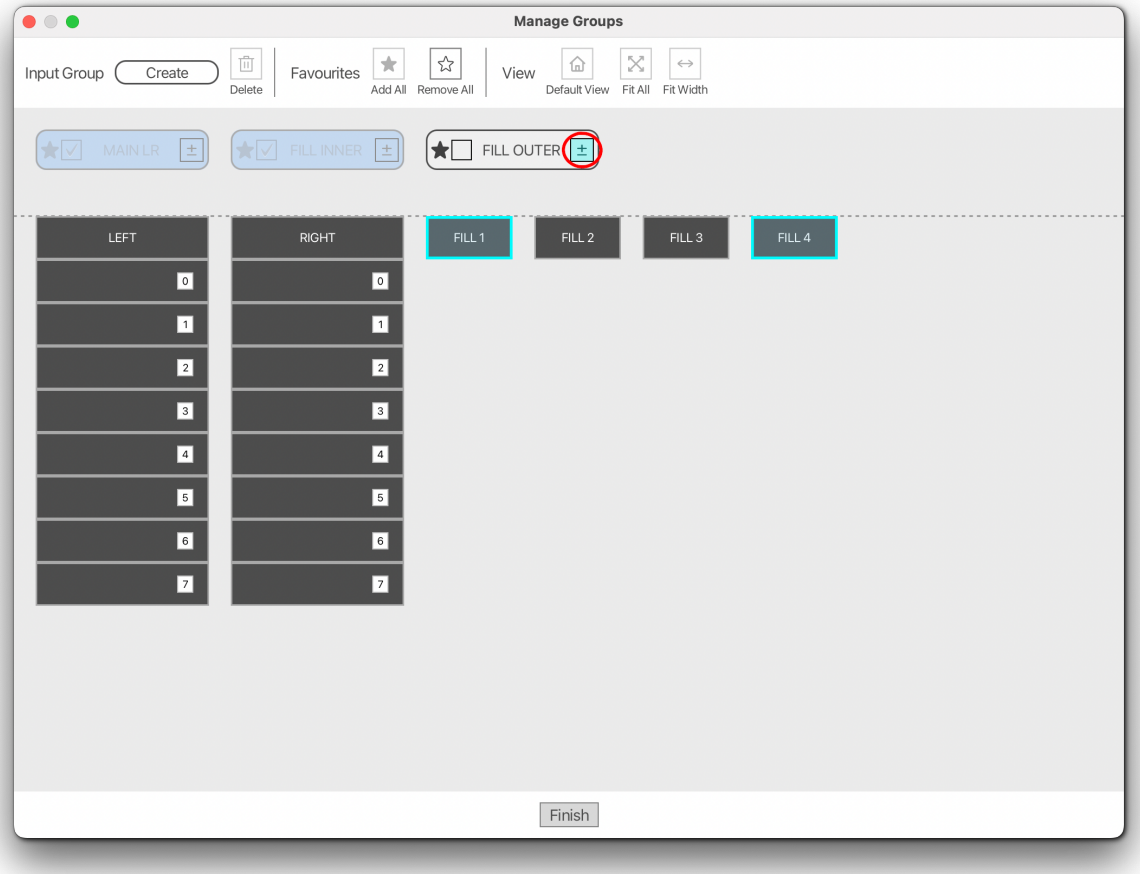
Group membership can be easily visualised by hovering over a group and pressing & holding the right mouse button. The group and its member speaker are coloured orange while the right mouse button remains pressed:

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Speakers can be added to or removed from a group by first clicking the **[±]** button to the right of the rounded rectangle representing the group, as highlighted below:

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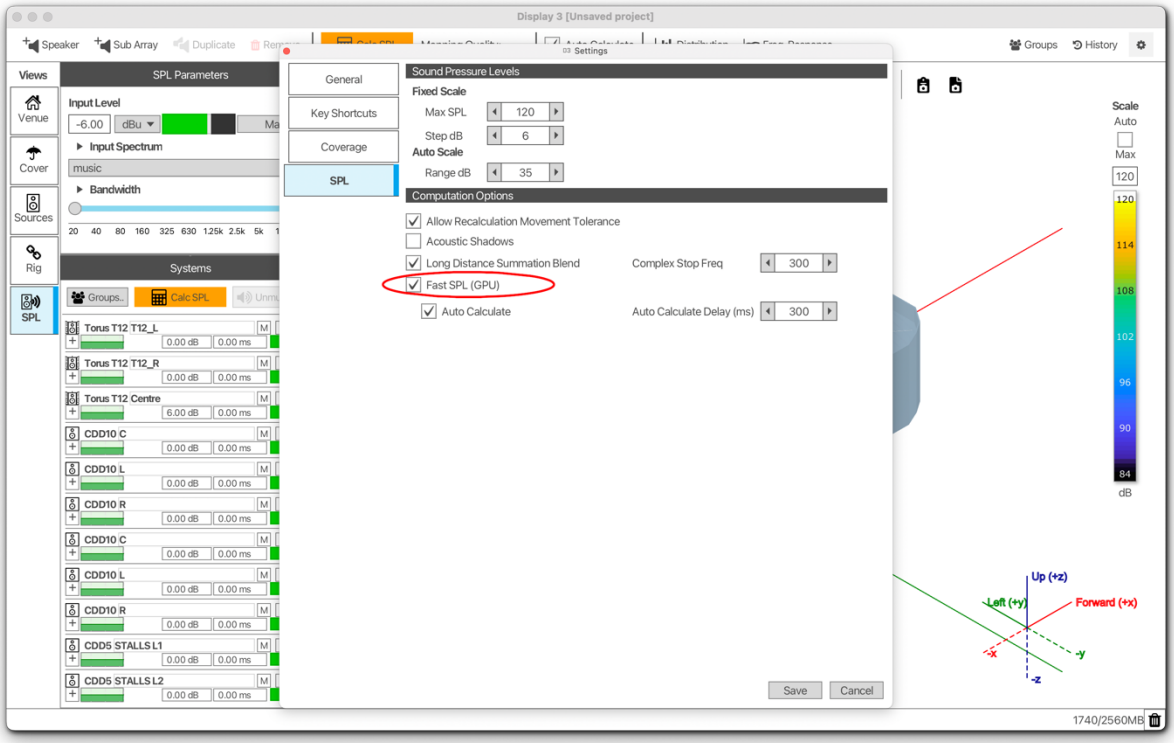
The button is subsequently coloured cyan and the boxes representing the speakers which are currently a member of this group are highlighted in cyan. To remove a speaker from the group, click the box representing this speaker. You will see that the cyan highlight is removed, indicating that the speaker is no longer a member of this group. Similarly, to add a speaker to the group, click the box representing this speaker. You will see that this speaker is now highlighted in cyan, indicating that the speaker is now a member of this group. Essentially the action to add or remove a speaker to or from a group acts as a *toggle* function.

Once you have completed assigning speakers to groups, click the *Finish* button the close the *Manage Groups* window and return to the Display 3 main window.

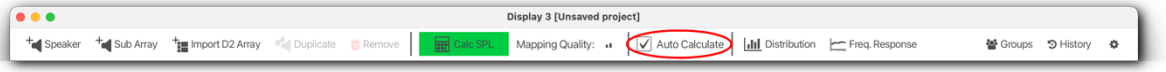
Fast SPL Calculation on the GPU

Display 3 is able to leverage Graphics Processing Unit (GPU) processing capabilities to calculate the SPL across the 3D venue at a significantly faster rate than that achieved by more traditional CPU processing methods. Fast (GPU) SPL calculation is enabled by default. Thanks to this increased performance, Display 3 is also able to perform incremental updates to the venue's SPL results on small changes to a speaker's position, tilt angle, or other properties. These options can be turned on or off in the Display 3 Preferences Dialog. The option *Fast SPL (GPU)* enables or disables Fast SPL computation on the GPU, *Auto Calculate* enables or disables incremental updates to the SPL, and *Auto Calculate Delay (ms)* determine the delay between the user making changes and the triggering of the automatic calculation of incremental updates to the SPL. The *Auto Calculate Delay* can vary from 0 milliseconds (instantaneous) to 1000 milliseconds (1 second). A longer delay allows the user to make more changes before the SPL is auto calculated:

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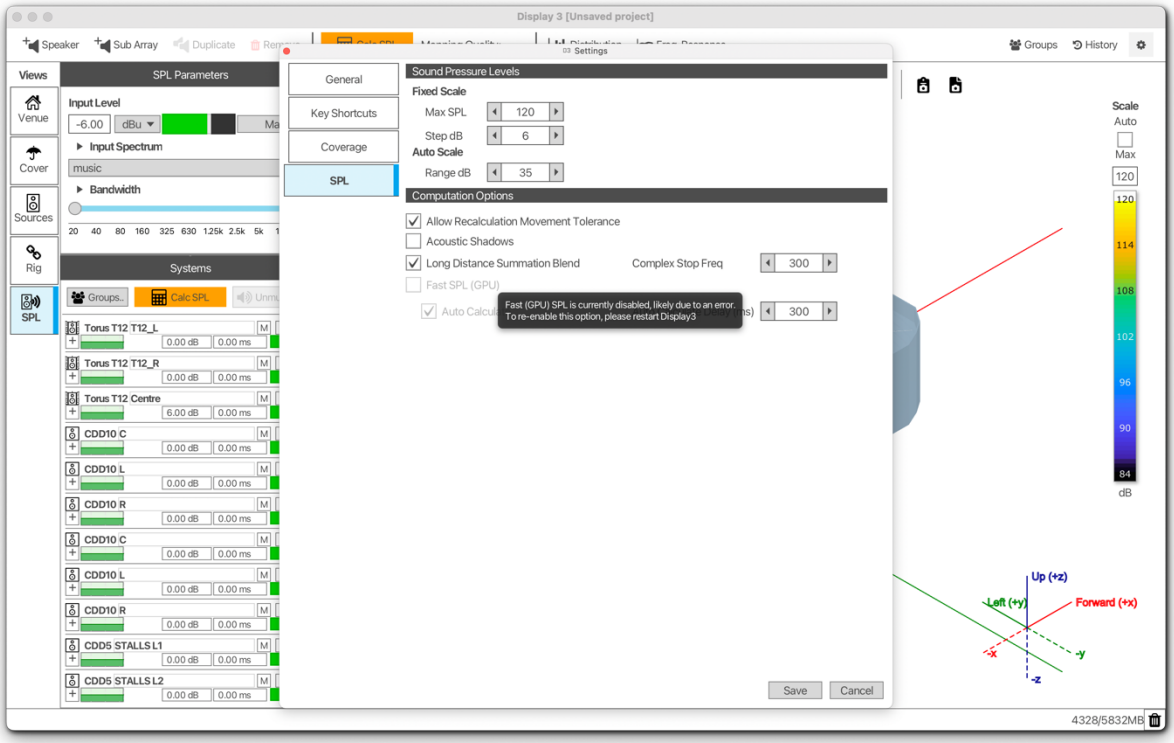


The *Auto Calculate* option is also easily accessible in the 3D venue, in the SPL Context Toolbar which is displayed at the top of the Display 3 window. This option is only made visible when the *Fast SPL (GPU)* option is enabled:



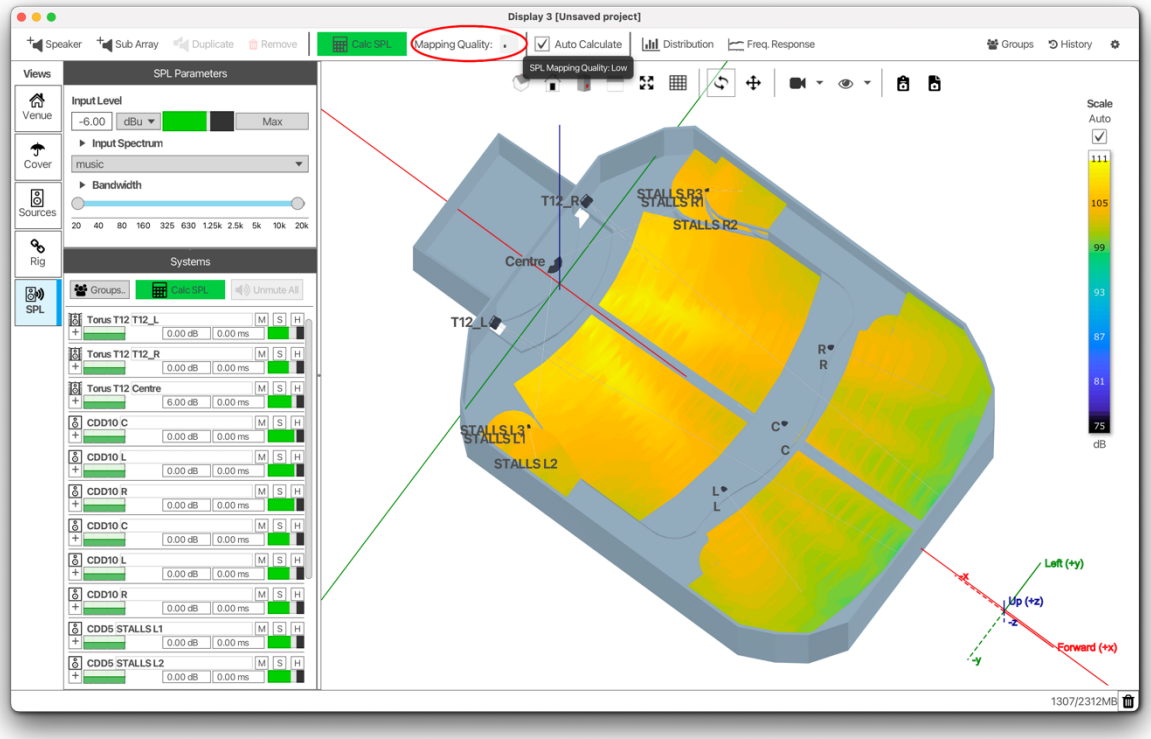
Most modern computers are able to support GPU computation of the SPL across large venues with many speakers. If however the data for any given venue exceeds the capabilities of the computer on which Display 3 is running, SPL calculation will gracefully downgrade to the slower CPU computation. In this case, a notification is displayed in the Display 3 Progress Bar. Fast SPL computation on the GPU is then disabled for the duration of the Display 3 session, and a tooltip is displayed over the disabled GPU option, to explain why this option is no longer available:

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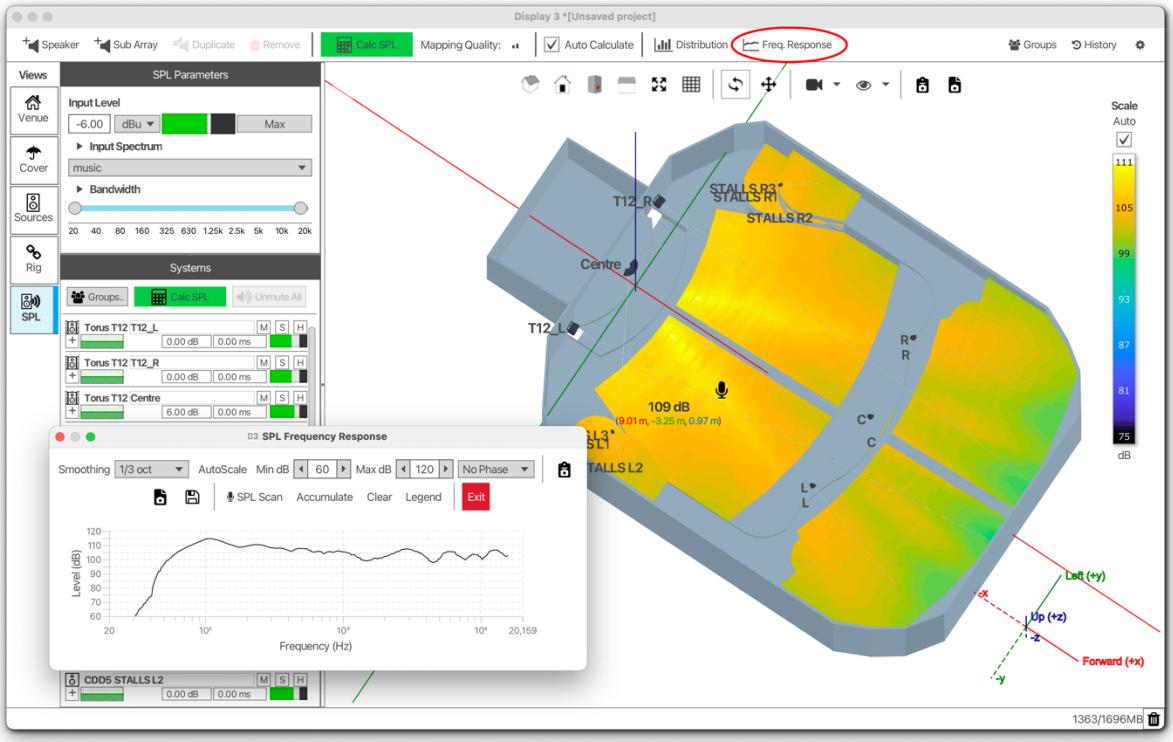
This option will become available again the next time Display 3 is started.

If you need to calculate the SPL for more complex venues, which trigger a downgrade to the slower CPU SPL computation, then reducing the *SPL Mapping Quality* can help. This option determines the density of calculation points in the venue and selecting the *Low* option can reduce the number of calculation points across the venue significantly, increasing the probability that the GPU will be able to compute the SPL across the whole venue within the time constraints defined by your computer's operating system:



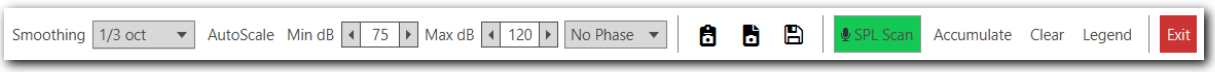
Frequency Response Tool

A tool to display the frequency response at any position on a surface is available on the main Toolbar:



When the SPL Frequency Response dialog is opened, SPL Scan mode is active by default. In this mode the nearest calculation point to the mouse position is highlighted by a black microphone symbol with the coordinates and total SPL value displayed. When the mouse is moved the position and frequency response are updated.

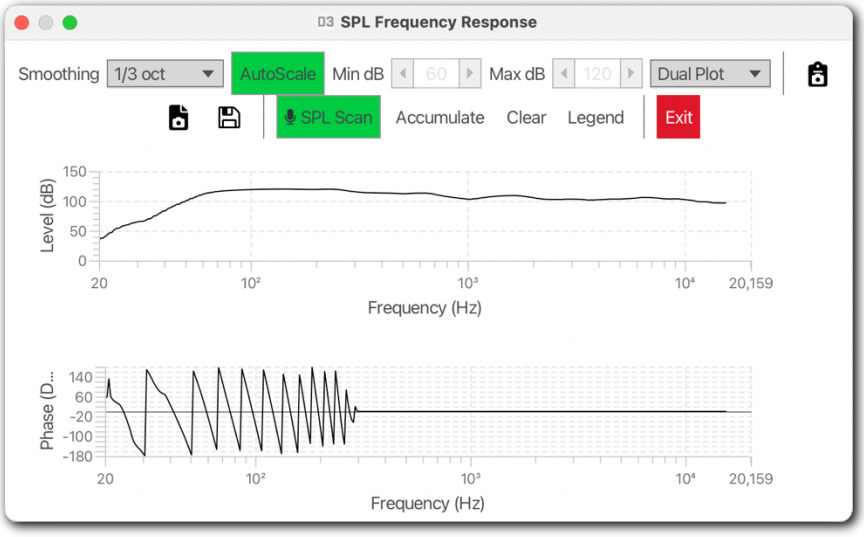
Clicking near the currently highlighted position will fix it there and SPL Scan mode becomes deactivated. To select a new point, click the **SPL Scan** button and move the mouse back to the venue – the state of SPL Scan mode is indicated by the colour of the button.



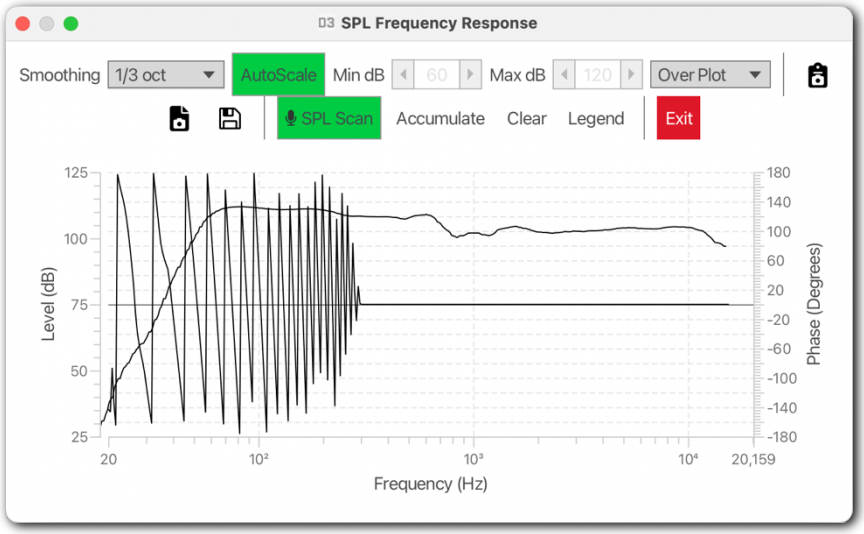
The graph Toolbar contains the expected controls for smoothing, scaling (AutoScale by default) and exporting graphics or data.

The plot type controls whether phase is displayed, either underneath in a separate plot:

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or overplotted with a right-hand axis:

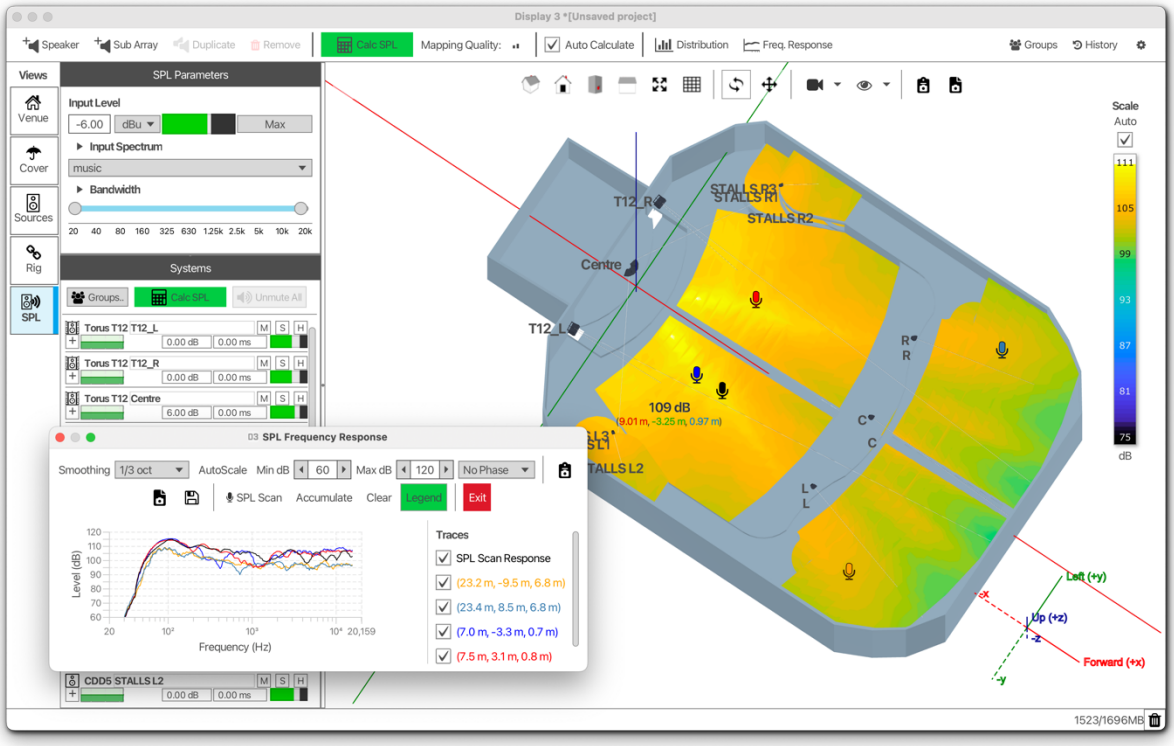


The SPL Frequency Response window can remain open while you make changes to speaker properties or SPL Parameters and the plots will be updated whenever the SPL is recalculated.

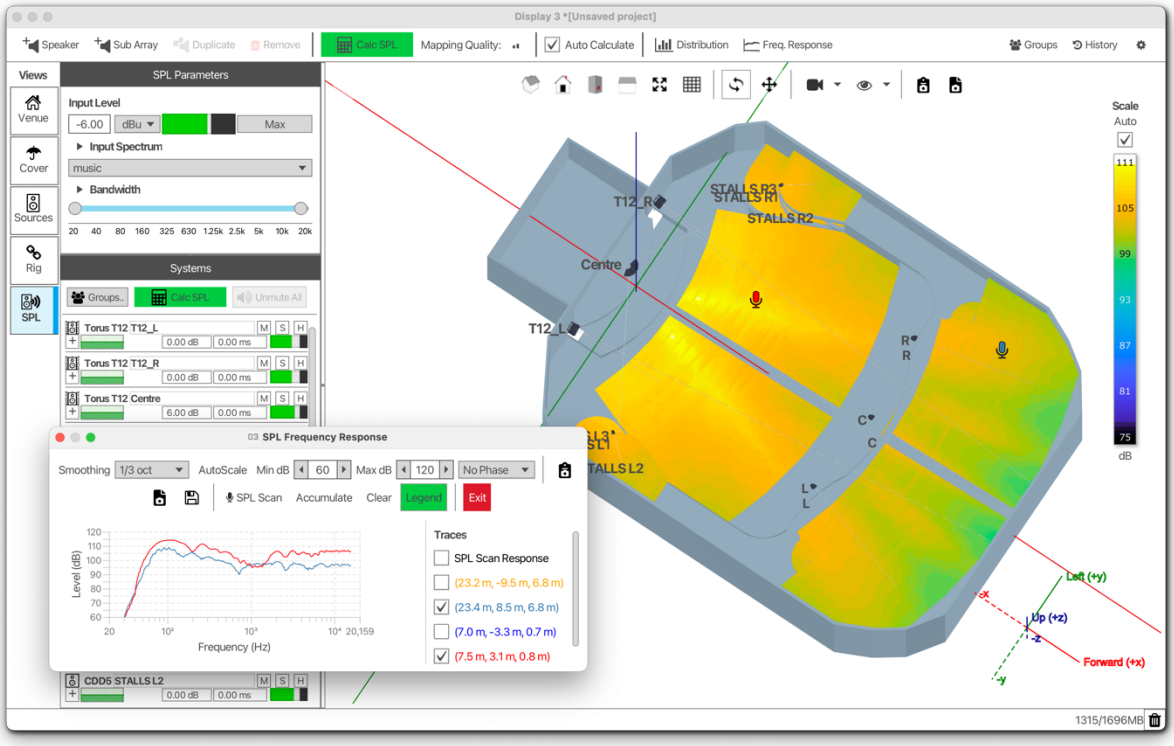
Comparing various SPL Scan Responses

It's possible to compare the SPL Scan Responses from different locations in your venue. To achieve this, click the **Accumulate** button. The button will remain highlighted in green, indicating that this function is active, until it is clicked again. Once this button is activated, clicking near the currently highlighted position will add this location to the list of 'traces', assigning the microphone symbol which has been placed in the venue a unique colour. When accumulating traces, SPL Scan mode remains active. To add an additional point, simply click again elsewhere in the venue. When you've finished adding points to the Frequency Response, click again on the **Accumulate** button to deactivate this function. The SPL Frequency Response can be easily compared across different parts of the venue using this functionality. Clicking on the **Legend** button reveals a colour-coded legend of trace points, with their location in the venue:

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If the SPL Frequency Response plot becomes too cluttered, individual trace plots can be hidden simply be unchecking the checkbox next to the colour-coded coordinates of the trace point in the Legend:



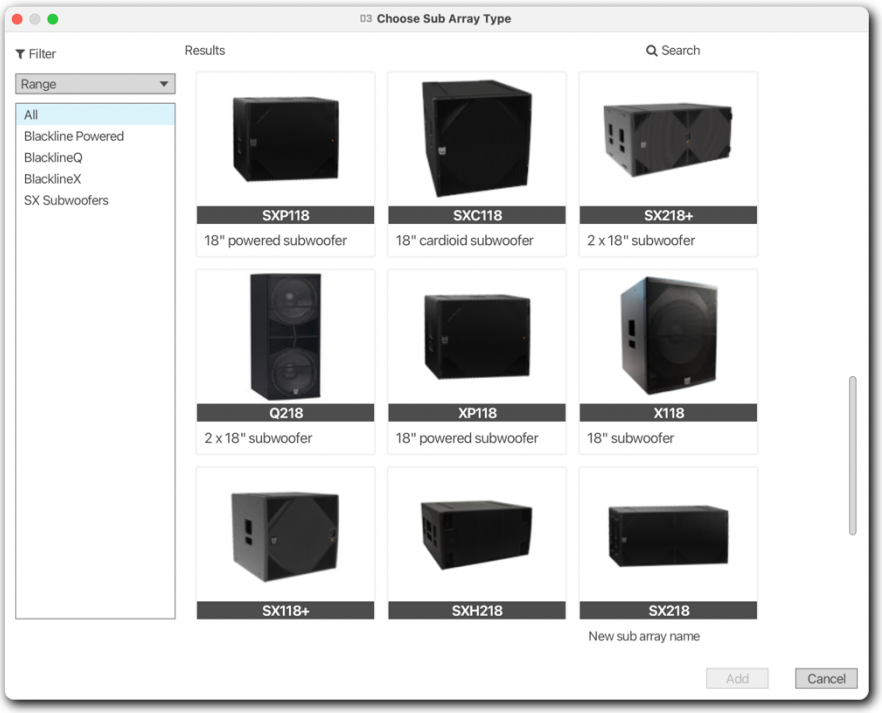
If you wish to remove all the trace points, click the **Clear** button the SPL Frequency Response dialog. If, however, you wish to keep these in place across sessions, simply leave them – the trace points will be stored with the project next time you save it.

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Subwoofer Array Tool

Subwoofer Arrays can be added using the **Sub Array** button, available from the main Toolbar whilst in the Coverage, Loudspeaker or SPL context (tab). The Subwoofer Array Tool's options enable rapid design of ground deployed linear arrays of subwoofers. Traditional techniques have been employed to determine the EQ required to approximate and steer far-field beams. Emphasis has been placed on the speed of design using a handful of parameters, rather than requiring manipulation of individual loudspeakers and associated EQ elements.

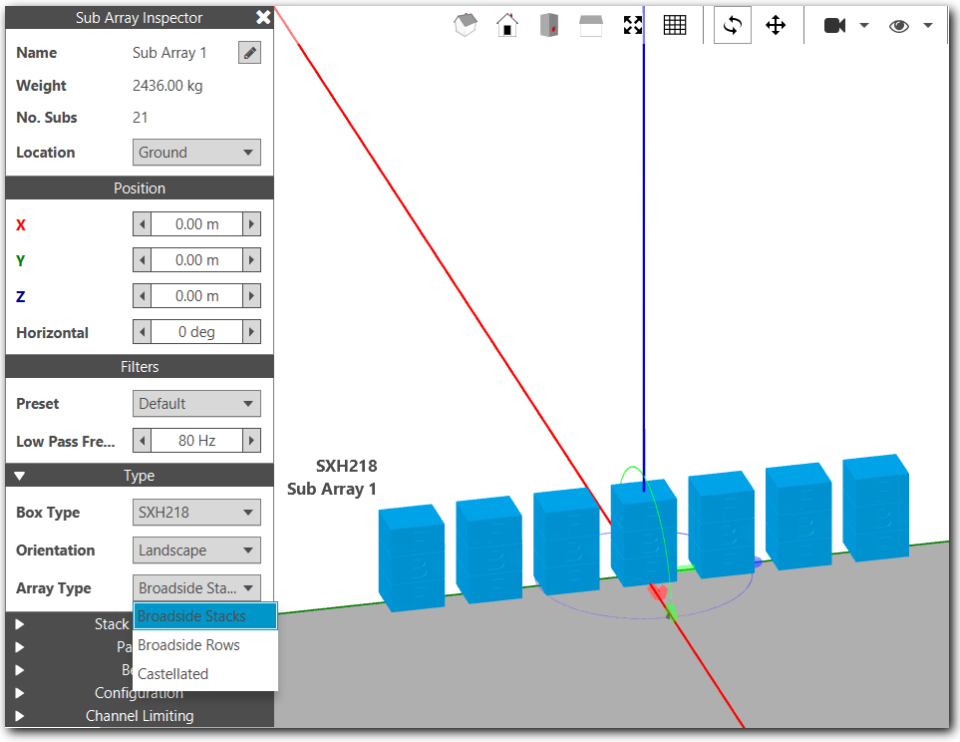
Clicking **Sub Array** or selecting the menu option *Loudspeakers | Insert Sub Array…* will open a window for you to choose which sub to use. A list of all available subs is presented:



Select and **Add** or **double click** on the one you want and the default array will be created. You can easily change the box type later in the Property Editor.
Click on any box in the sub array (or in any list of Devices/Systems in the Loudspeaker or SPL context) and the Property Inspector will be displayed. The array can be renamed and positioned just like any other loudspeaker, except of course that there is no Aim angle property available for sub arrays.

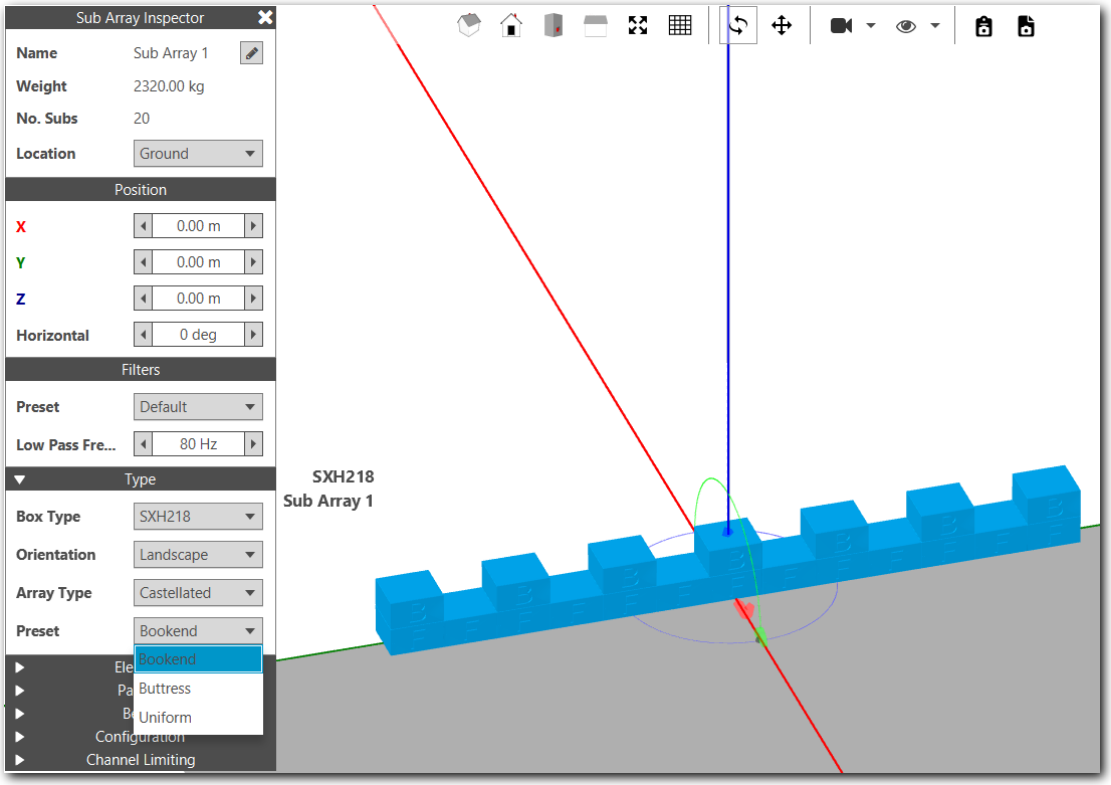
Types
Three **Array Types** - 'Broadside Stacks', 'Broadside Rows' and 'Castellated' are available:

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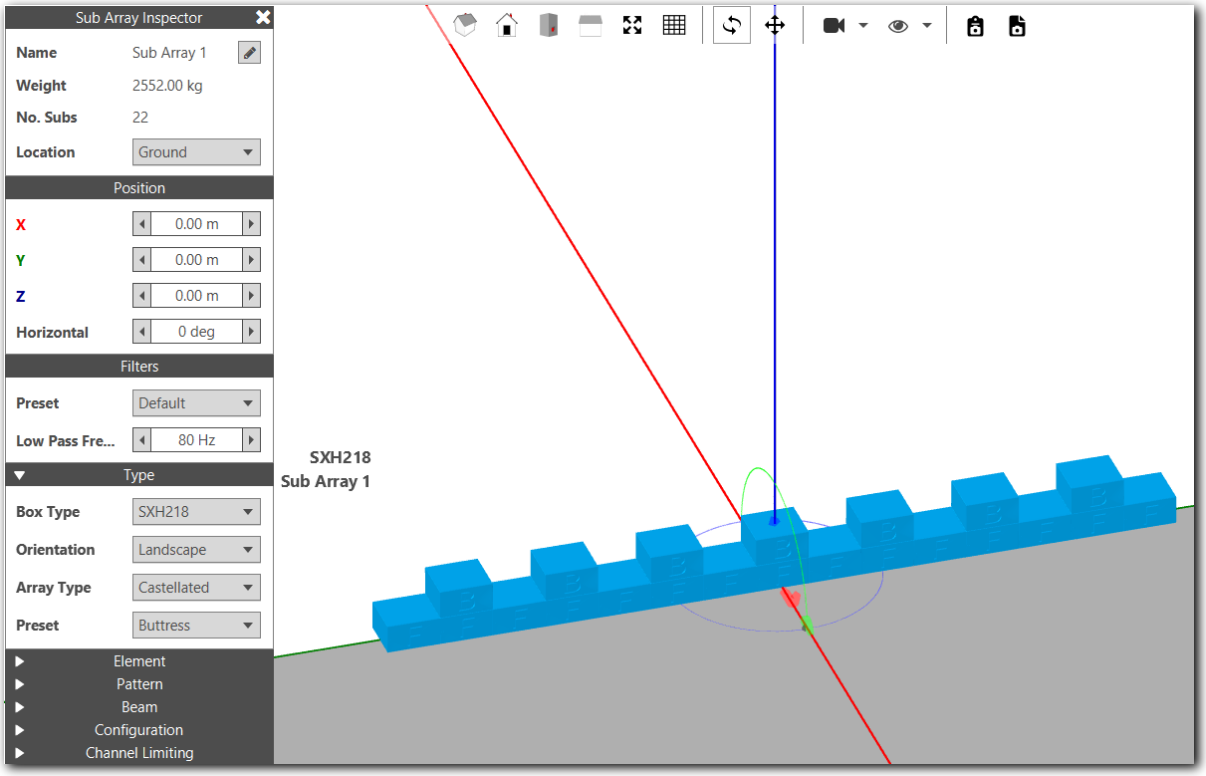


For **Broadside Stacks** and **Broadside Rows**, any sub loudspeaker Box Type can be selected, for Castellated only subs which have cardioid settings available can be selected (email us if you want to use a sub in cardioid mode that currently has no cardioid configuration).

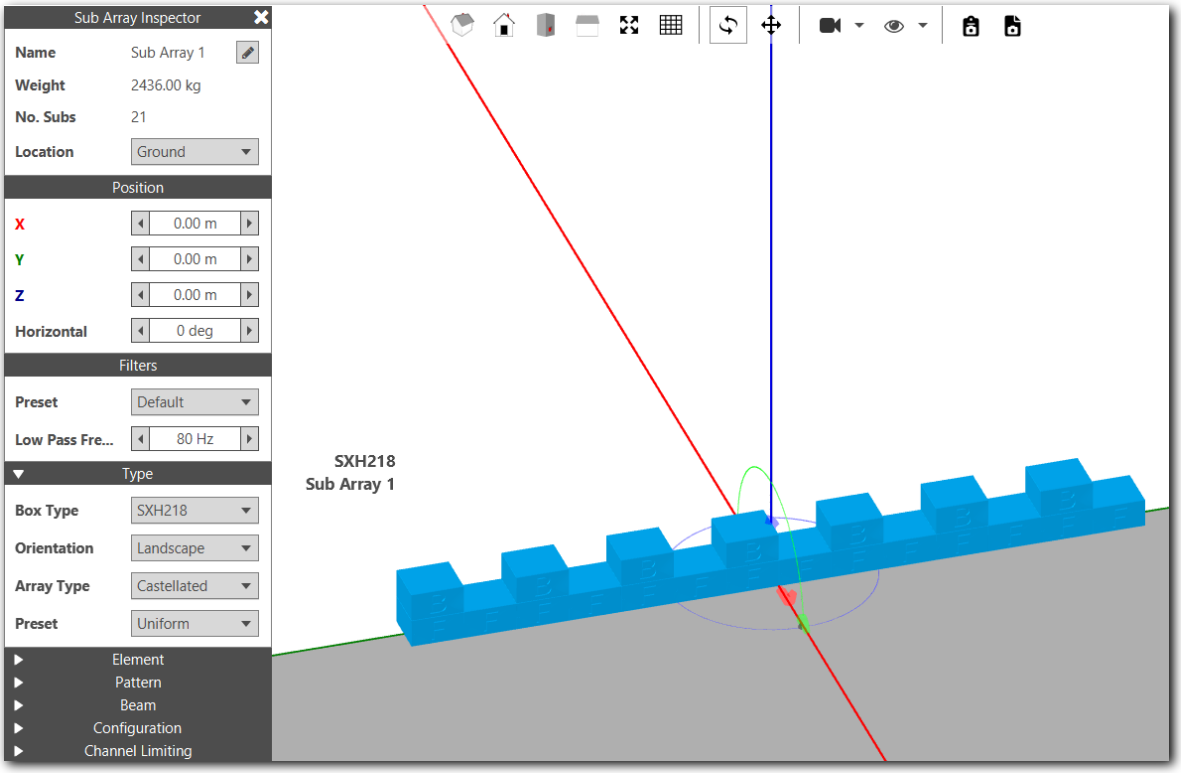
Castellated arrays have 3 styles defined as **Presets**, the above is '**Bookend'** where the end parts of the array are two high.



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'**Buttress'** is one box high at the ends and '**Uniform'** consists of an array of L shaped elements.

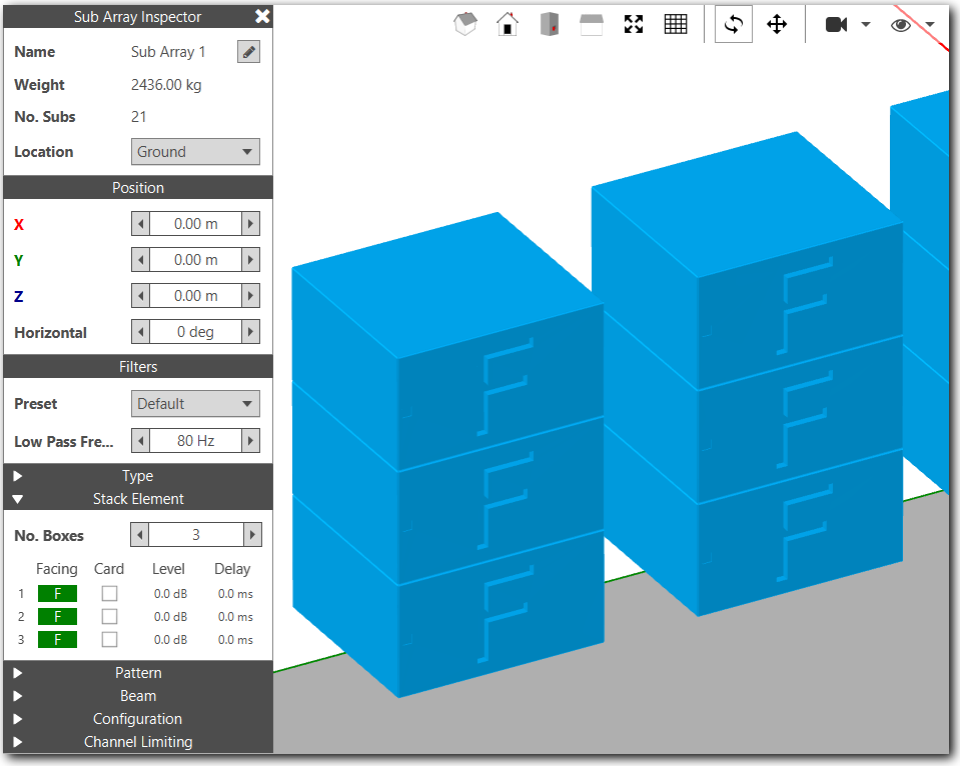


The **Orientation** (Portrait or Landscape) of all boxes in the array can also be set in the Type Section.

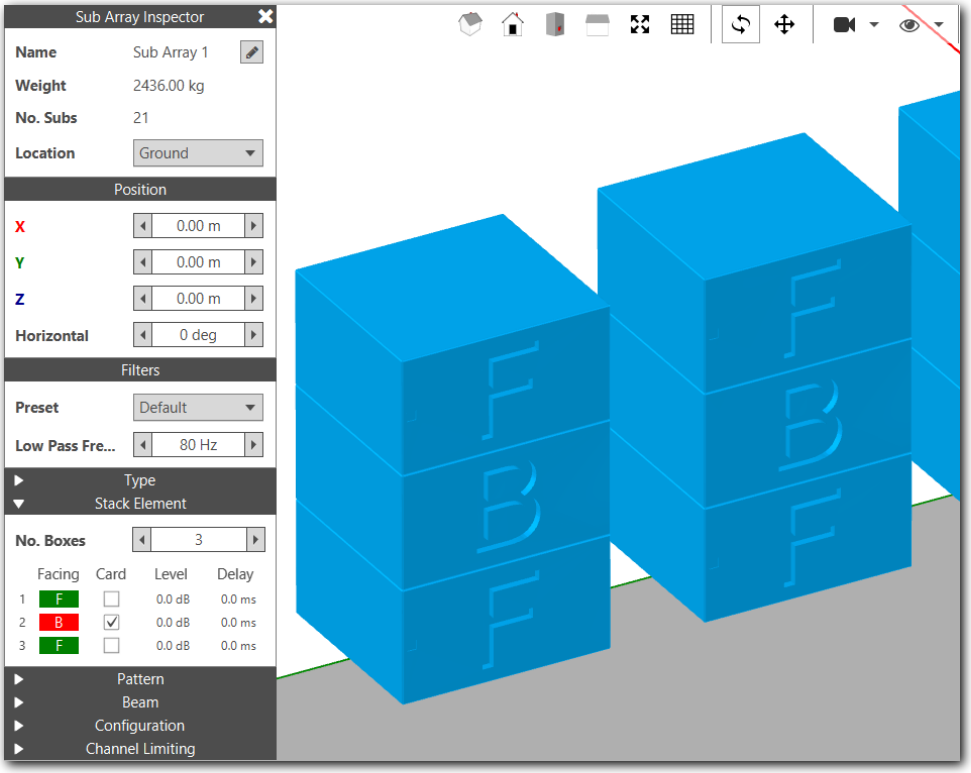
Array Elements

An **Element** can be a single sub **or** group of subs and is the entity which is replicated in a linear **Pattern**. Each array type generally has a different 'patternable' element. For Broadside Stacks for example, the element is the Stack which can consist of one or more sub boxes:

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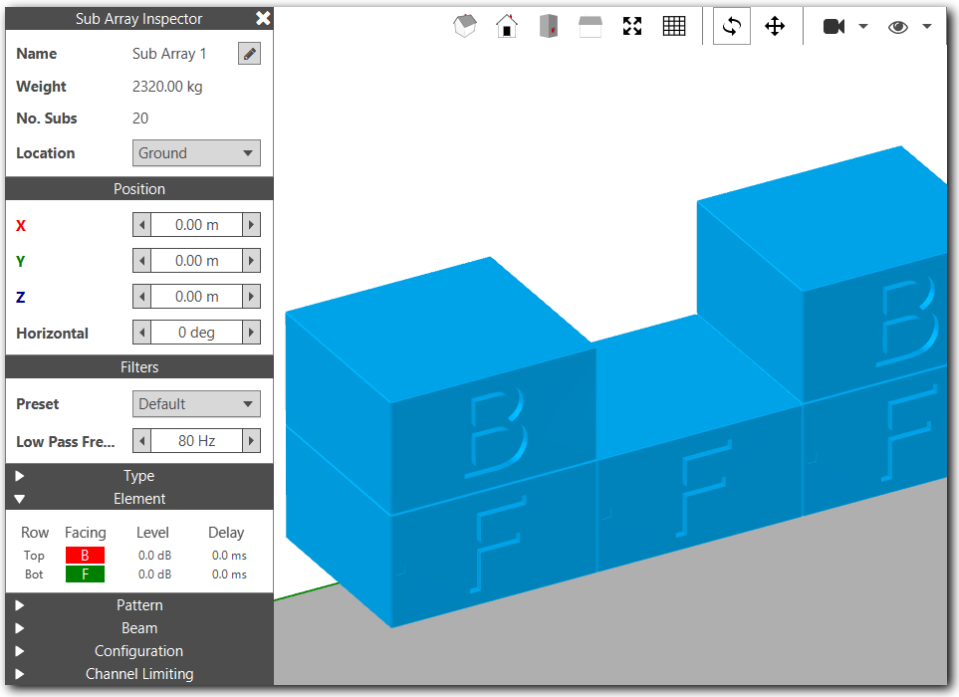


You can change the **number of subs** (No. Boxes) in the Stack and **Level**./ **Delay** (positive values only for Delay) for each of those subs. The number of subs can't be changed for Castellated Array Types. These values are copied across all Stacks in the **Sub Array**.



For subs with a cardioid configuration then you can assign that property with the **Card** checkbox – the sub will automatically re-orient and internally select cardioid filter EQ.

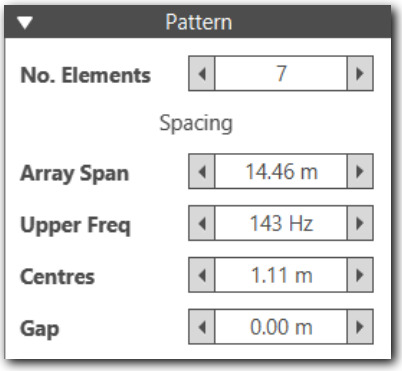
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Castellated Elements consist of whole or partial L shaped groups of subs that have cardioid configurations defined. Here, you can change the **Level** and additional **Delay** on a **row** basis – each sub in that row will be affected by the values you set.

Pattern

Properties of the linear pattern:



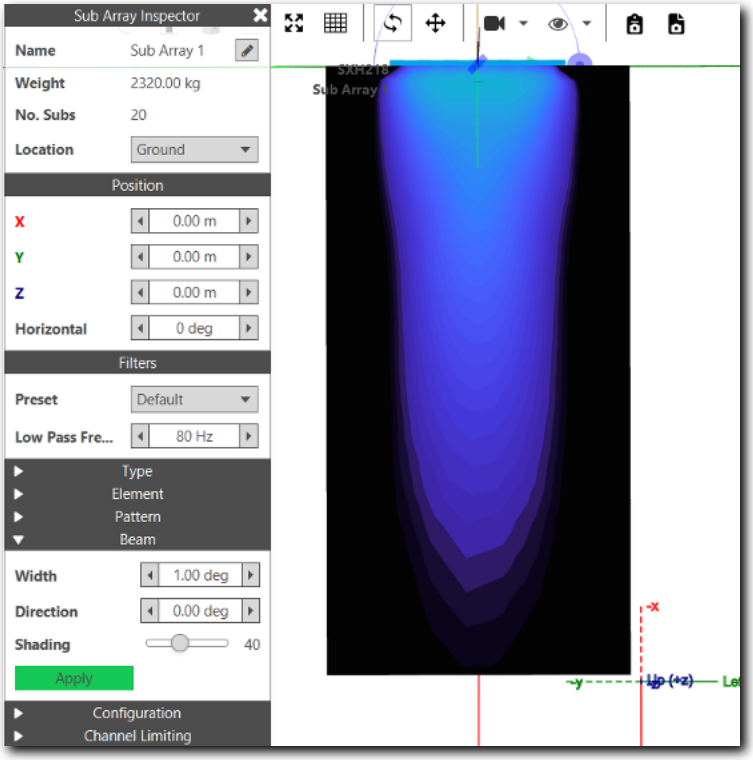
You can set the total number of **Elements**.

All **Spacing** properties are linked together – changing one will update the rest. The minimum distances are constrained to when subs are touching each other, i.e. **Gap** = 0. The **Upper Freq** depends on spacing, the number of boxes and any steering applied. The often used half wavelength constraint applies to infinite arrays and ensures no aliasing when steered 90°, for modest steering angles this constraint can be relaxed. Also, the more columns you have the higher the upper frequency.

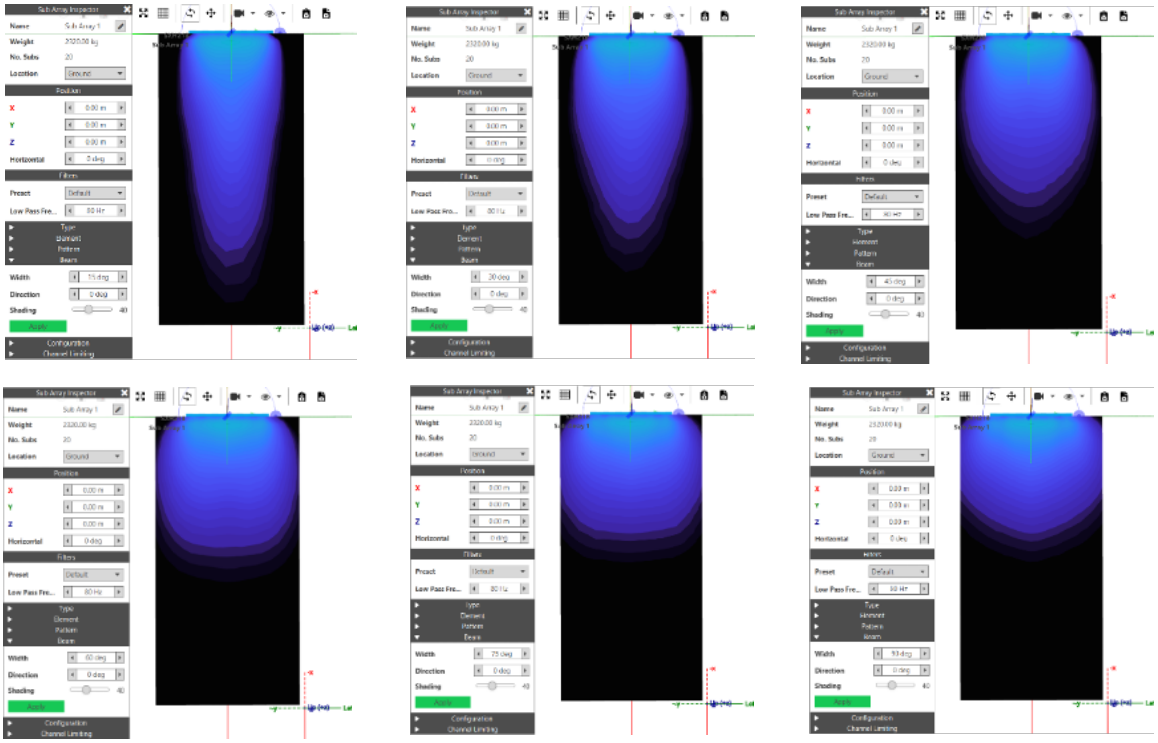
Beam

Beam **Width** can be set from 1° to 180°, although extreme values like this are unlikely to provide useful results. Setting to 1° will generate the narrowest beam possible from the array:

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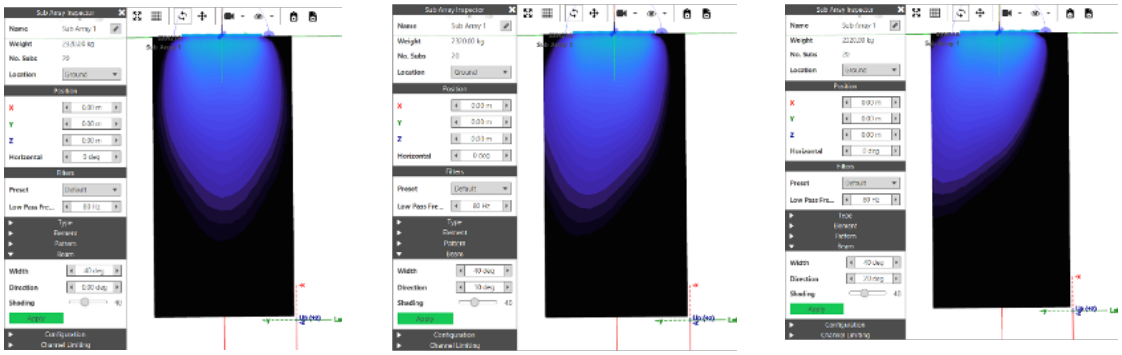
By incrementing the **Width** you can get closer to the coverage required:



Above from 15° in 15° steps.

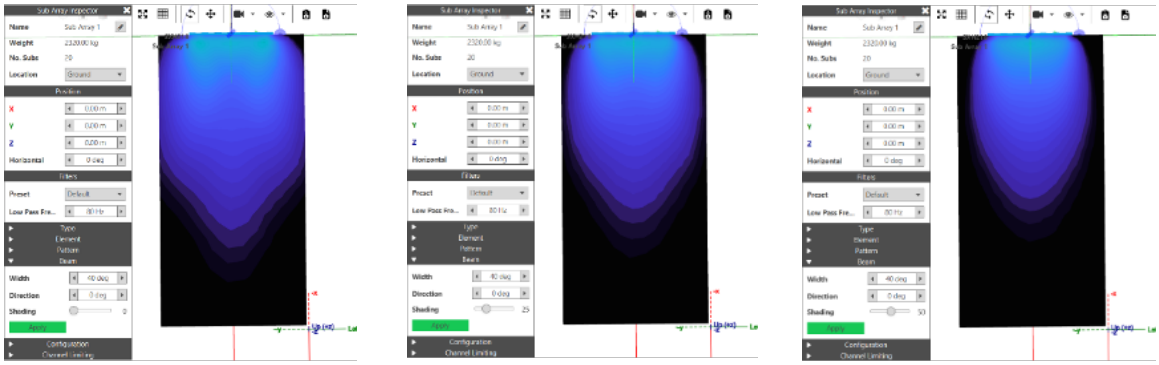
The Beam can be steered either side by a modest amount by changing the **Direction**:

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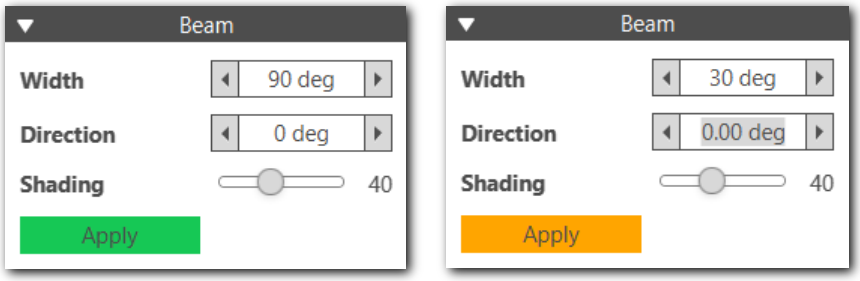
Above 0°, 10° and 20°.

Gain **Shading** controls how well the Beam conforms to an ideal Beam. The degree of shading is expressed as a percentage of the maximum, allowing you fine control over pattern shape vs max output. The default value is 40 % and has been used in all the plots so far:



Above gain Shading 0 %, 25 % and 50 % and a 40° Beam.

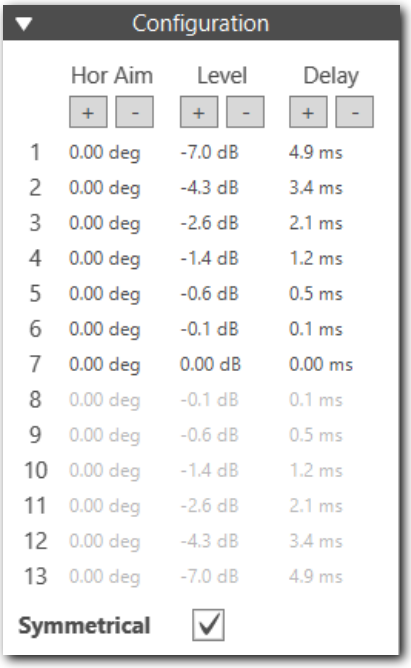
The **Apply** button will update the Configuration with the Beam parameters and if the Auto-Calculate option is enabled together with the Fast (GPU) SPL computation option, then the SPL plot will be automatically updated. If you change some Beam parameters, the Apply button will be coloured orange to indicate these changes have yet to be applied:



If either the Auto-Calculate option or the Fast (GPU) SPL computation option are not enabled, then after applying the changes, the main Calc SPL buttons will appear orange indicating that an SPL Update is required. Often you may want to see the effect of power distribution in the array with changes you make to the Beam, unchecking the *Auto Calculate* option in the Toolbar, then re-checking this prior to making your final change allows you to do this quickly & easily.

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Configuration



The **Configuration** allows you to see the **Level** and **delay** applied from the Pattern and allows you to manually change these values to iterate to an improved coverage. You can also change the **Horizontal** rotation each Element. Each row represents an **Element** (above for a definition).

When the Beam Direction is 0° then a symmetrical application of EQ is applied. You can override this by either setting a non-zero direction or unchecking the **Symmetrical** box at the end of the list.

When you change the values manually then both the Apply button in the Beam section and the main D3 Calc SPL buttons go orange. Applying the Beam will overwrite any manual changes.

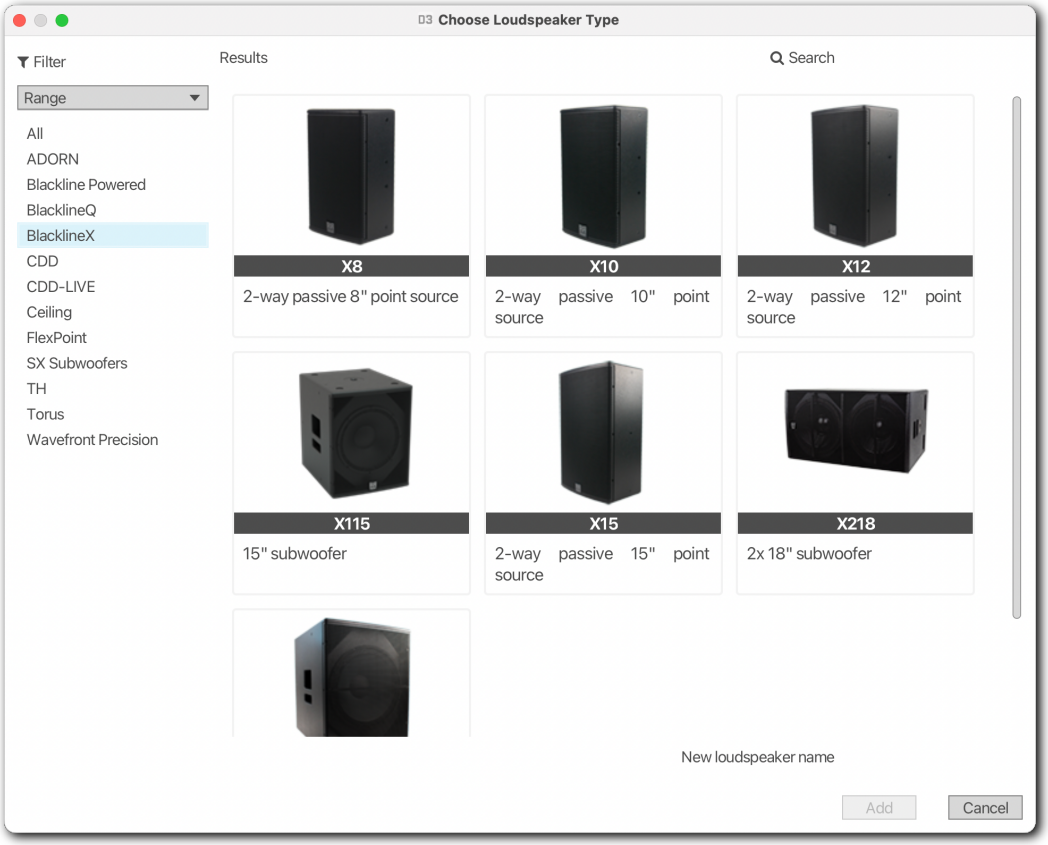
Export

The loudspeakers in a Display 3 project can be exported to VU-NET via the menu option – *Loudspeakers | Export WP Presets to VU-NET…*

Freely Assigned Subwoofers

All SX and Blackline subs are available using high accuracy BEM derived data and can, in addition to being deployed as part of a sub array, also be deployed as a single speaker, using the *Insert Loudspeaker…* (rather than *Insert Sub Array…*) menu item (in the *Loudspeakers* menu) or the corresponding **Sub Array** button in the Toolbar:

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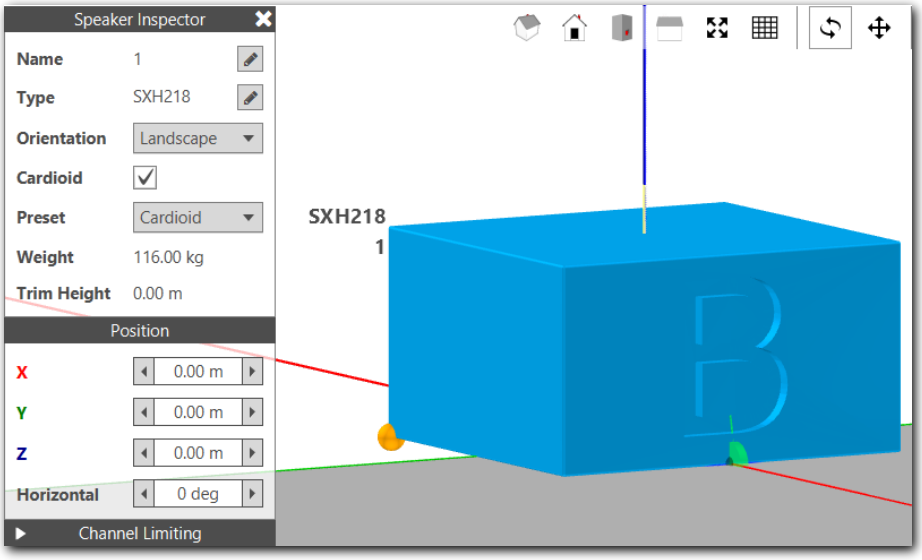
All subs are marked with Front (F) and Back(B) identifiers to help with arrays and have no aiming lines.

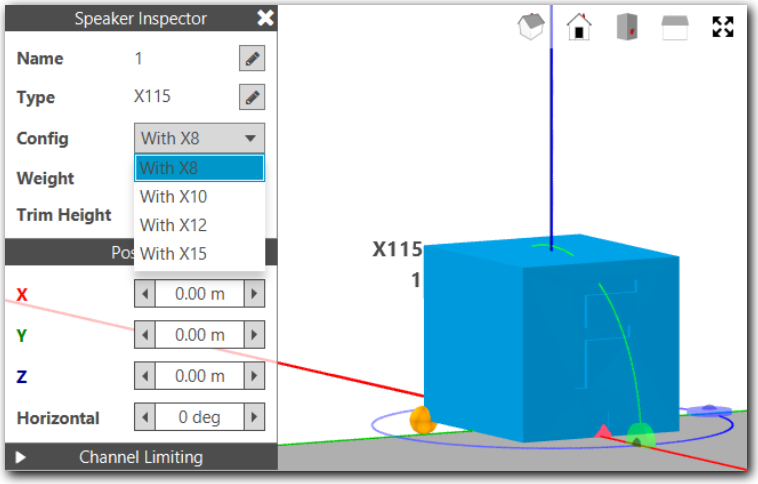
Speaker properties

Configurations

Properties are available in the Speaker Inspector to quickly set the configuration of boxes. This can include orientation, and for subs both the orientation and filtering so that a cardioid setup can be quickly created. For BlacklineX, the configuration changes the Input EQ for partnering with specific top boxes:

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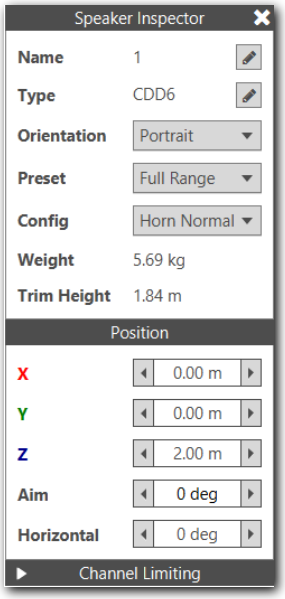
The configurations follow from the familiar 'Settings' spreadsheet on the Martin Audio Website

<u>Horn orientation (CDD, FlexPoint, BlacklineX)</u>

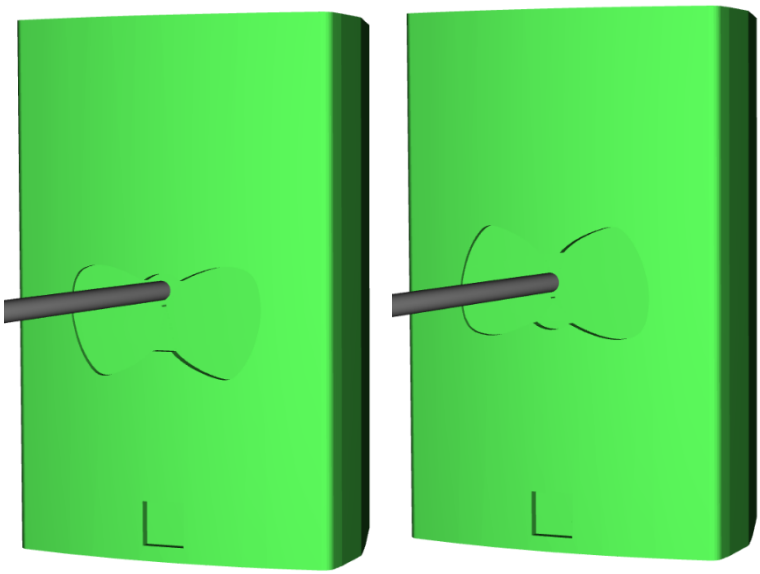
- Three properties *Orientation*, *Preset* & *Config* appear in the Speaker Inspector, for the following products:
  - CDD5
  - CDD6
  - CDD8
  - CDD10
  - CDD12
  - CDD15
  - FP6
  - FP8
  - FP12
  - FP15
  - X8
  - X10
  - X12

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- X15



Visual indication of horn orientation

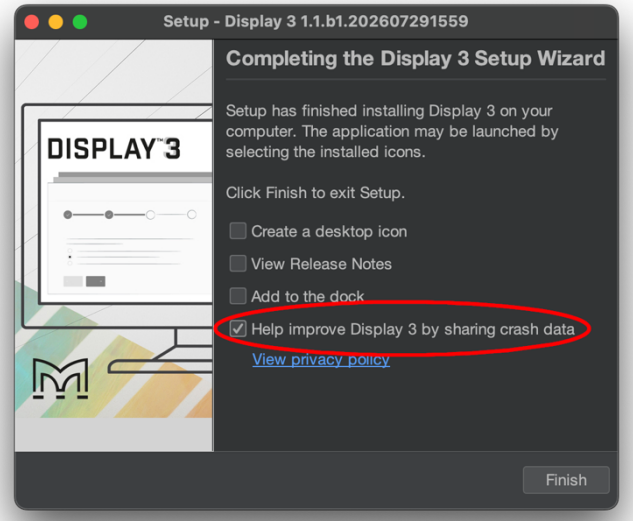


Automatic Crash Reporting

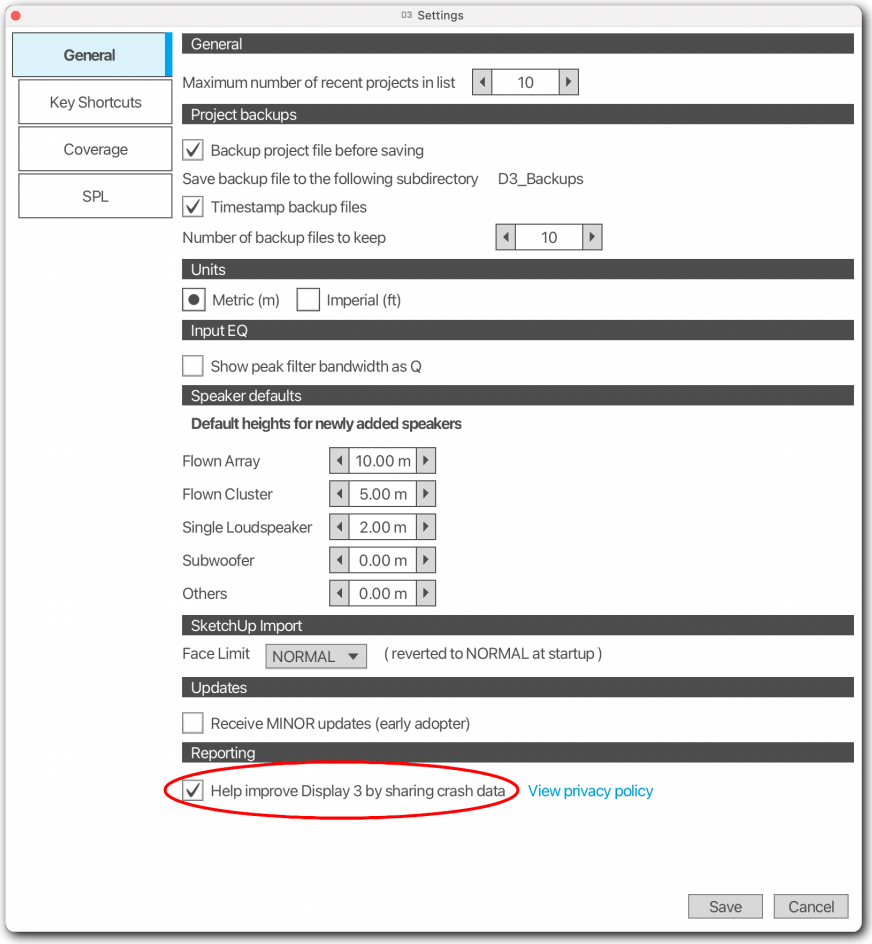
To help continually improve the quality of Display 3, an option is available to automatically submit crash logs – these are the long lists of text which are displayed when an error in the application occurs. These crash logs contain a hierarchy of function calls and events that led to an error, called the *Stack Trace*. The crash logs which are submitted are reviewed on a regular basis and can aid in fixing issues at the earliest opportunity.

The crash logs are anonymised before being submitted, meaning that individual users can't be identified; only what build and operating system the crash occurred on. The option to turn this feature on or off is available in the Display 3 installer:

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The option to submit anonymised crash logs can also be turned on or off in the Display 3 Preferences Dialog, under the General tab:



A link to the privacy policy is provided with both methods and here - [Privacy Notice | Focusrite]

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