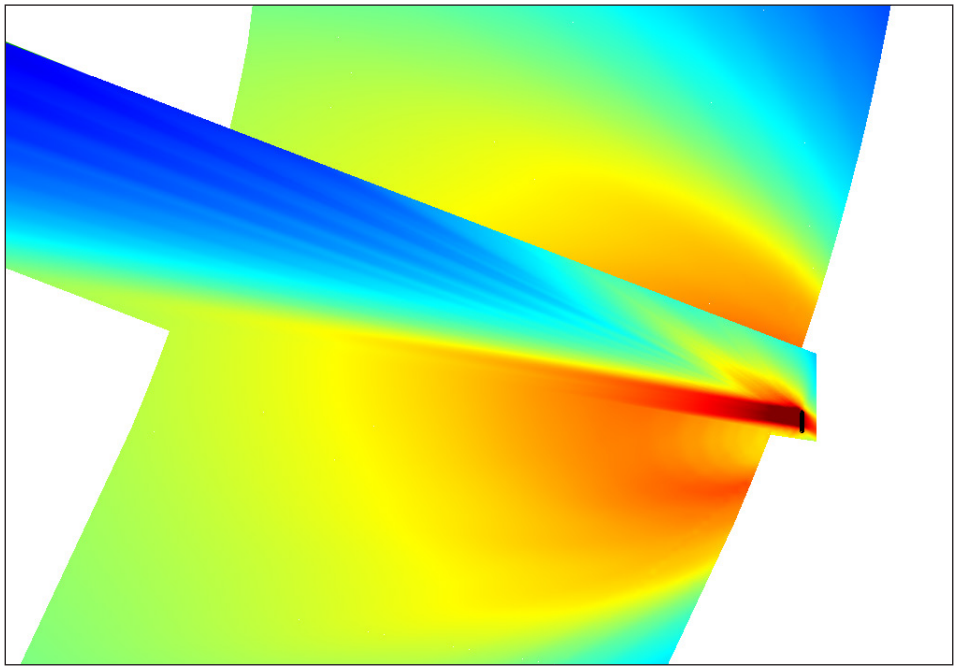
# CAL™ Column Array Loudspeaker

thinking sound Meyer Sound



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## Overview - Description

Providing horizontal coverage of 120 degrees and the flexibility of digital beam steering for the vertical coverage, a single, unobtrusive CAL loudspeaker can provide clear vocal reproduction over a large area while minimizing undesirable reflections.

CAL achieves this by using a separate onboard Class D power amplifier for every driver and tweeter, controlled by extremely sophisticated algorithms. Controlling each element individually yields greater flexibility and precision than other beam steering systems that control modules consisting of several drivers.

The amplitude and phase response of each driver are engineered to produce interactions with the other drivers that result in the desired vertical coverage pattern. While this involves a large number of sophisticated mathematical computations, Meyer Sound makes it easy with intuitive control software that communicates with each CAL loudspeaker over Ethernet.

Flexible mounting options allow users to mount CAL loudspeakers against walls or columns, and custom colors ensure they will blend into any background. Weather protection permits outdoor installations, making it easy to integrate CAL loudspeakers into any environment.

The three models produce average SPL of 87.5dB (Peak SPL of 104dB) at: 90 meters for CAL 96, 60 meters for CAL 64, and 30 meters for CAL 32. The longer columns also steer effectively to lower frequencies, approximately 350Hz for CAL 96, 500Hz for CAL 64, and 1,000Hz for CAL 32.

*Image 1 – CAL 32, 64, and 96 Column Array Loudspeakers*

## Overview - GLLs in EASE

CAL GLL files are generally used as any other GLL file in EASE, so this manual will not cover the general use of GLLs in EASE. It will instead overview the more unique aspects of the CAL Column Array Loudspeaker GLLs and how to predict split beam CAL configurations.

Note that when reading prediction results, the SPL shown will be analogous to continuous average level as shown in MAPP Online Pro, (Multipurpose Acoustical Prediction Program). Continuous peak levels will be 12.5 dB louder than levels shown, and Max peak levels slightly higher than those. Levels shown in EASE are those that would be seen when using real measurement instruments with a loudspeaker driven to limit, using pink noise having a crest of 12.5 dB.

The version 1.0.6 GLL's were created for use in EASE 4.3 and accuracy of Direct SPL has only been confirmed in EASE 4.3. Their use in predictions of Total SPL, STI, AURA, or other EASE predictions have not been confirmed by Meyer Sound.

While Meyer sound provides EASE data for the CAL loudspeaker series, we do not support the use of the program. For any inquiries regarding the use of EASE, please contact EASE support at: http://ease.afmg.eu/index.php/ea-support-en.html.

## Overview - Coverage

CAL column array loudspeakers have a fixed horizontal coverage of 120-degrees. The two coverage parameters that can be modified are vertical beam spread and vertical beam steering.

Vertical beam spread can be adjusted in 5-degree increments, from 5-degree spread to 30-degree spread. Vertical beam steering can be adjusted in 1-degree increments, from 30-degrees upward to 30-degrees downward.

CAL GLLs, in every combination of vertical beam spread and vertical beam steering, can be individually inserted into projects to demonstrate coverage and predict Direct SPL in the project.

Below at left are images showing the vertical coverage pattern of a CAL 32 at 4kHz with a bandwidth of one octave. At right are the corresponding configuration as would be seen in CAL Compass software. The plan view horizontal coverage will vary, depending on rake of seating, vertical beam spread, and vertical beam steering angle, but will always be 120-degrees in width.

**EASE Section View**

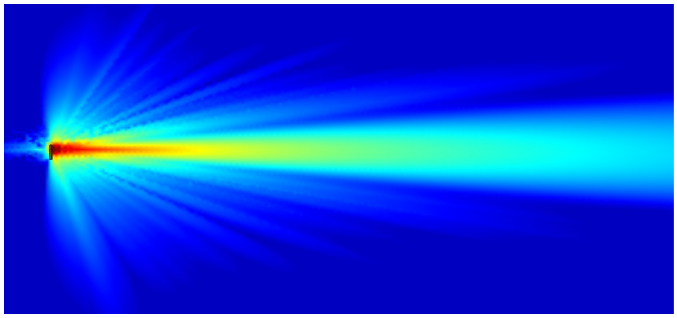


*Image 2 – EASE Section View– CAL32sprd05dwn00.gll*
*CAL 32 (Beam Spread 05deg, Steering 00deg)*

**CAL Compass Software View**

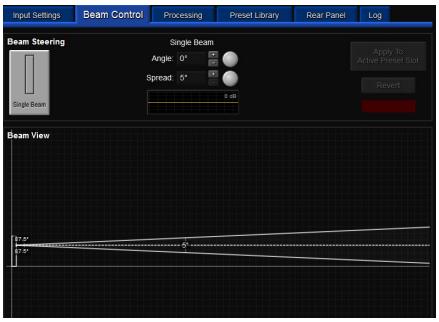



*Image 3 – Compass Software –*
*CAL 32 (Beam Spread 05deg, Steering 00deg)*

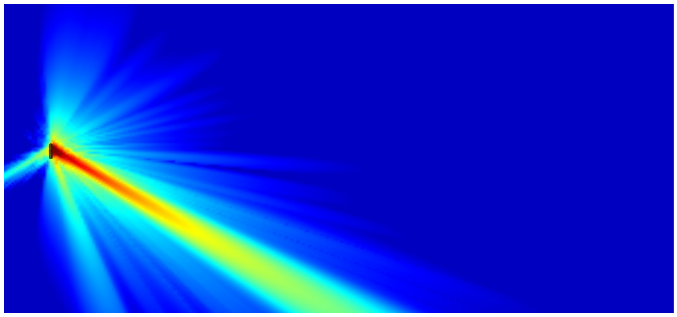


*Image 4 – EASE Section View– CAL32sprd05dwn30.gll*
*CAL 32 (Beam Spread 05deg, Steering Down 30deg)*

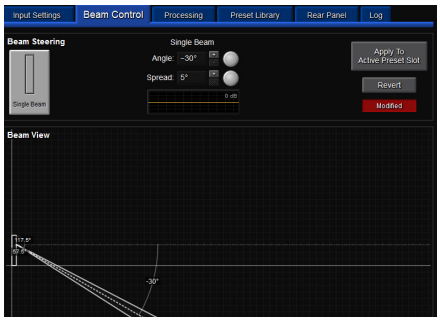



*Image 5 – Compass Software –*
*CAL 32 (Beam Spread 05deg, Steering Down 30deg)*

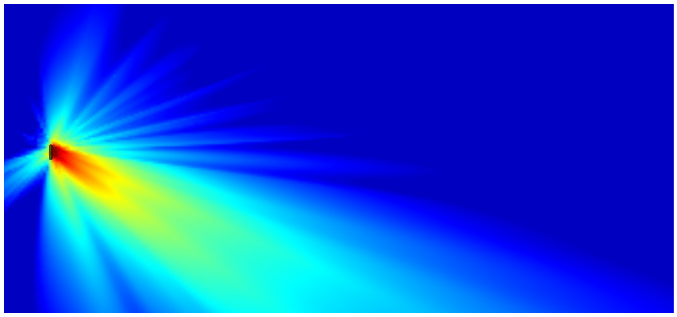


*Image 6 – EASE Section View– CAL32sprd30dwn30.gll*
*CAL 32 (Beam Spread 30deg, Steering Down 30deg)*

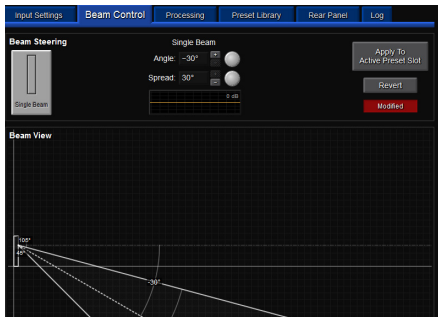



*Image 7 – Compass Software –*
*CAL 32 (Beam Spread 30deg, Steering Down 30deg)*

## Setup - File Download and Install

GLL files for CAL 32, 64, and 96 column array loudspeakers are available for download as 3 ZIP files that contain all the available vertical beam spread and beam steering combinations. The ZIP files contain a total of 1,116 separate files, totalling 9.9 GB of data. Please allow for sufficient hard drive space.

Before downloading, you must sign up for EASE file access at:

http://www.meyersound.com/forms/ease_form.php

Once the form is completed and a login and password are obtained, you may retrieve the CAL, and other Meyer Sound loudspeaker, GLLs at:

http://www.meyersound.com/products/ease/index.php

After the CAL 32, 64, and 96 zip files are downloaded, they should be unzipped to the default loudspeaker folder you have specified in EASE. This folder is typically located at:

C:\Users\Public\Documents\EASE40Data\Global Speakers40

Once unzipped, the folder containing the CAL GLLs should look something like this:

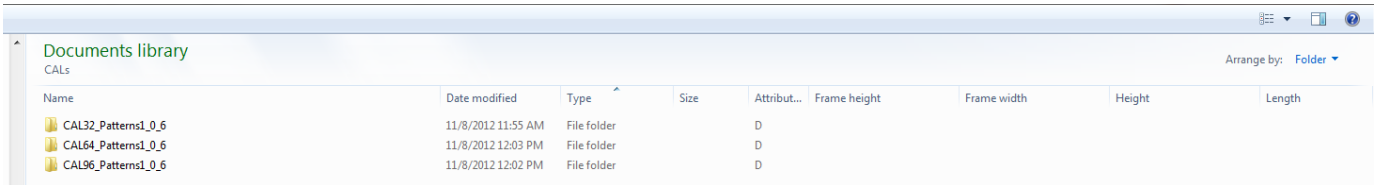
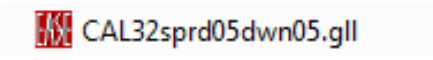



*Image 8 – CAL GLL folder in Windows Explorer*

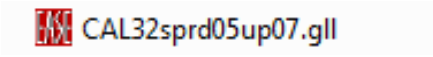
The CAL GLL files for each loudspeaker are located inside their respective folder. These folders can be organized per each user's preference. The naming convention is as follows:

[Loudspeaker Model] [Vertical Beam Spread] [Down or Up Vertical Beam Steering angle].gll

For example, the file below will predict a CAL 32 loudspeaker with a vertical beam spread of 5-degrees and a downward vertical beam steering angle of 5-degrees.




The file below will predict a CAL 32 loudspeaker with a vertical beam spread of 5-degrees and an upward vertical beam steering angle of 7-degrees.



## Split Beam Use - Placement

CAL 64 and CAL 96 Column Array Loudspeakers allow for split beam configuration modes. CAL 32 loudspeakers do not allow for a split beam mode. If using a CAL 64, the 64 available drivers can be split into two sets of 32 drivers each, with any combination of vertical beam spread and steering available for each set of 32 drivers. Similarly, a CAL 96 will allow the 96 available drivers to be split into an upper set of 32 and a lower set of 64, or an upper set of 64 and a lower set of 32. Each set of drivers in a CAL 96 split beam configuration can also use any combination of vertical beam spread and steering.

When using EASE to predict split beam configurations, one needs to use two separate GLL files that are appropriately spaced, depending on the model used and the type of split beam configuration desired. The X,Y,Z origin of the loudspeaker in EASE will be the top, front of the loudspeaker, regardless of model type. Remember that the base of each loudspeaker contains the input and control electronics, so the height of those components (referred to here as the "Electronics Offset") will need to be considered. The height of the Electronics Offset is the same for each model of loudspeaker. Below is an illustration showing the heights of each model of CAL loudspeaker.

If a user wishes to predict a CAL 64 with a split beam, they need insert one CAL 32 loudspeaker at the height of the full CAL 64 loudspeaker and one 2.78' (848mm) lower (Height of CAL 32 – Electronics Offset and Loudspeaker Endcap). All X, Y, and rotation parameters should be identical between the upper and lower loudspeakers. Any available combination of vertical beam spread and vertical beam steering can be used for any split beam configuration.

Example CAL Split Beam Configurations:

A CAL 64 with a split beam of 32 drivers each at a height of Z=20.00'. Place one CAL 32 loudspeaker at Z=20.00' and one CAL 32 loudspeaker at Z=17.06'. (20.00' – 2.78'.)

A CAL 96 with a split beam of 32 drivers on top and 64 drivers on bottom, at a height of Z=20.00'. Place one CAL 32 loudspeaker at Z=20.00' and one CAL 64 loudspeaker at Z=17.06'. (20.00' – 2.78'.)

A CAL 96 with a split beam of 64 drivers on top and 32 drivers on bottom, at a height of Z=20.00'. Place one CAL 64 loudspeaker at Z=20.00' and one CAL 32 loudspeaker at Z=14.28'. (20.00' – 5.56'.)

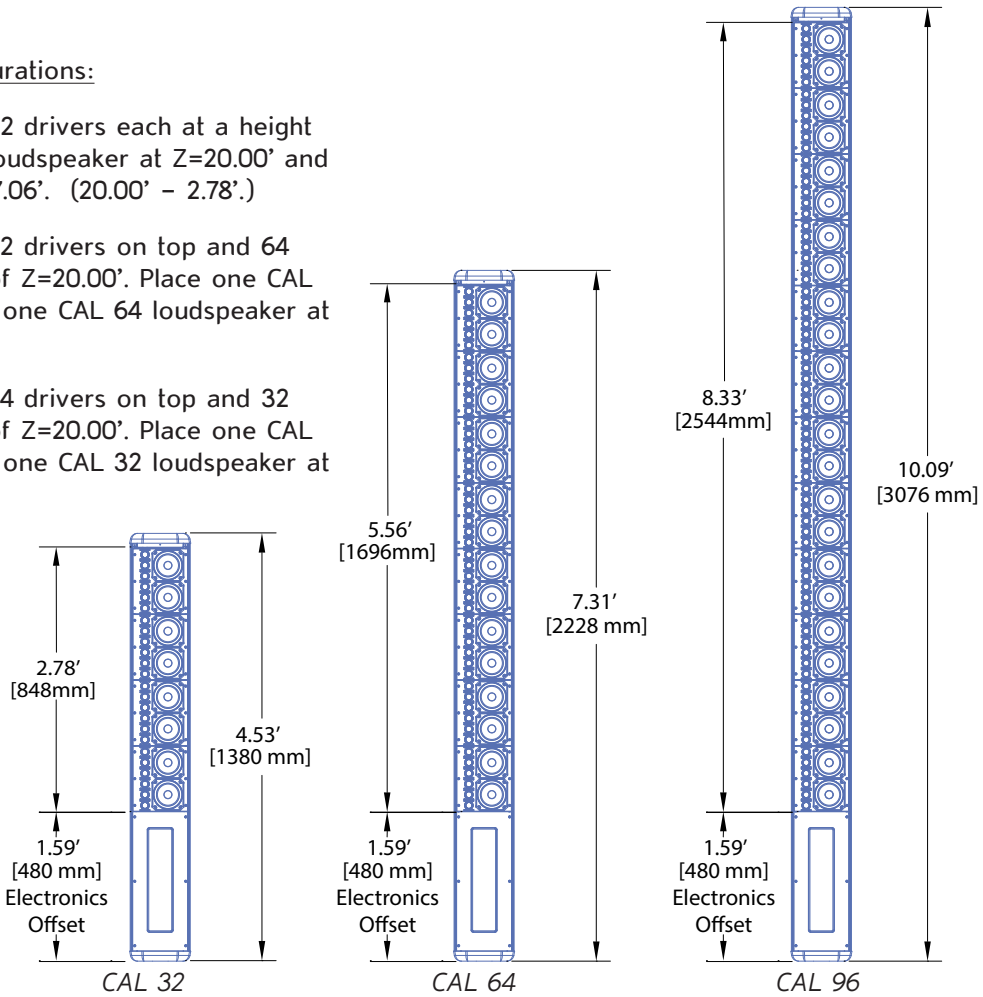



*Image 9 – CAL Loudspeaker Heights (Electronics offset at left)*

## Split Beam Use - Prediction

To illustrate a split beam configuration, the images below show a CAL 96 loudspeaker at a height of 16.82' with 32 drivers on the top portion of the beam split and 64 drivers on the lower portion of the beam split. Images on the left show 4kHz coverage with a one band octave sum, and the images on right show a broadband A-weighted sum.

In order to predict this in EASE, a CAL 32 is placed at a height of Z=16.82' and a CAL 64 at a height of Z=14.04 (16.82'-2.78'). The upper beam uses the file CAL32sprd05up10.gll, which provides a vertical beam spread of 05 degrees and upward vertical beam steering angle of 10 degrees. The lower beam uses the file CAL64sprd30dwn04.gll, which provides a vertical beam spread of 30 degrees and downward vertical beam steering angle of 04 degrees.

4kHz 1-Octave Bandwidth SPL

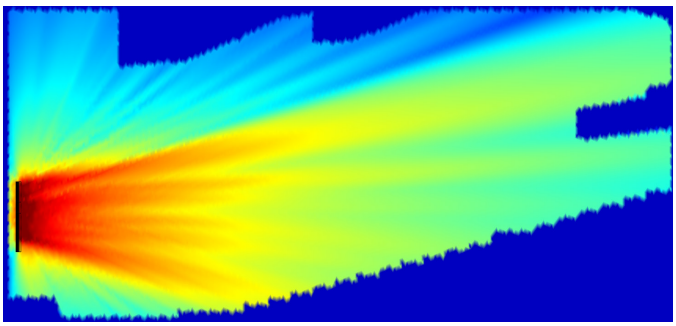


*Image 10 – EASE Section View– CAL 96 Split Beam*

Broadband A-weighted SPL

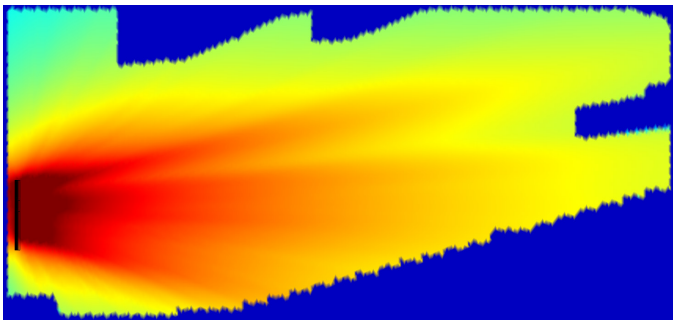


*Image 11 – EASE Section View– CAL 96 Split Beam*

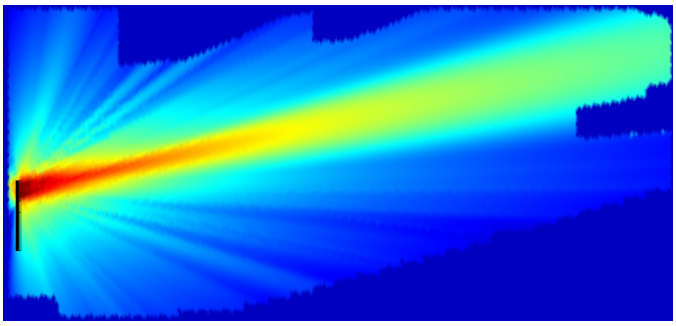


*Image 12 – EASE Section View– CAL32sprd05up10.gll*
*CAL 32 (Beam Spread 05deg, Steering Up 10deg)*

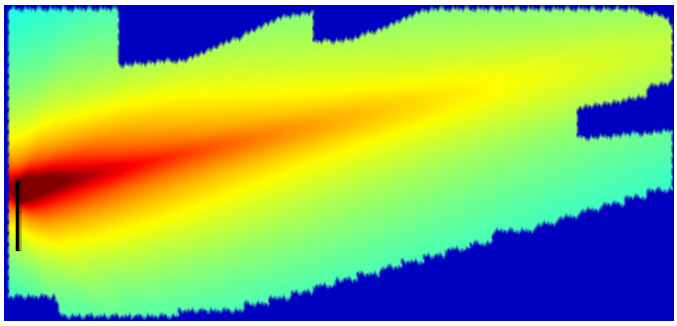


*Image 13 – EASE Section View– CAL32sprd05up10.gll*
*CAL 32 (Beam Spread 05deg, Steering Up 10deg)*

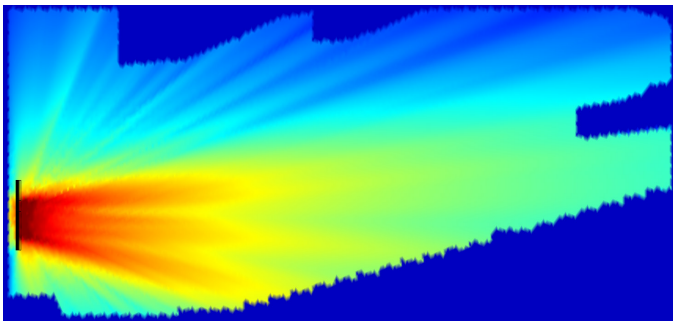


*Image 14 – EASE Section View– CAL64sprd30dwn04.gll*
*CAL 64 (Beam Spread 30deg, Steering Down 04deg)*

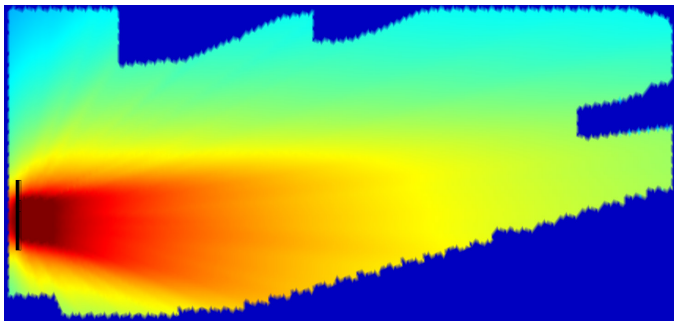


*Image 15 – EASE Section View– CAL64sprd30dwn04.gll*
*CAL 64 (Beam Spread 30deg, Steering Down 04deg)*

## Split Beam Use - Compass

If a user wishes to install a CAL 96 loudspeaker with the settings on the previous page (page 7) they would insert the values below into Compass software and upload the corresponding settings to the loudspeaker. For details on CAL installation and configuration with Compass, refer to the CAL and Compass webpages at:

http://www.meyersound.com/products/industrialseries/cal/

http://www.meyersound.com/software/compass

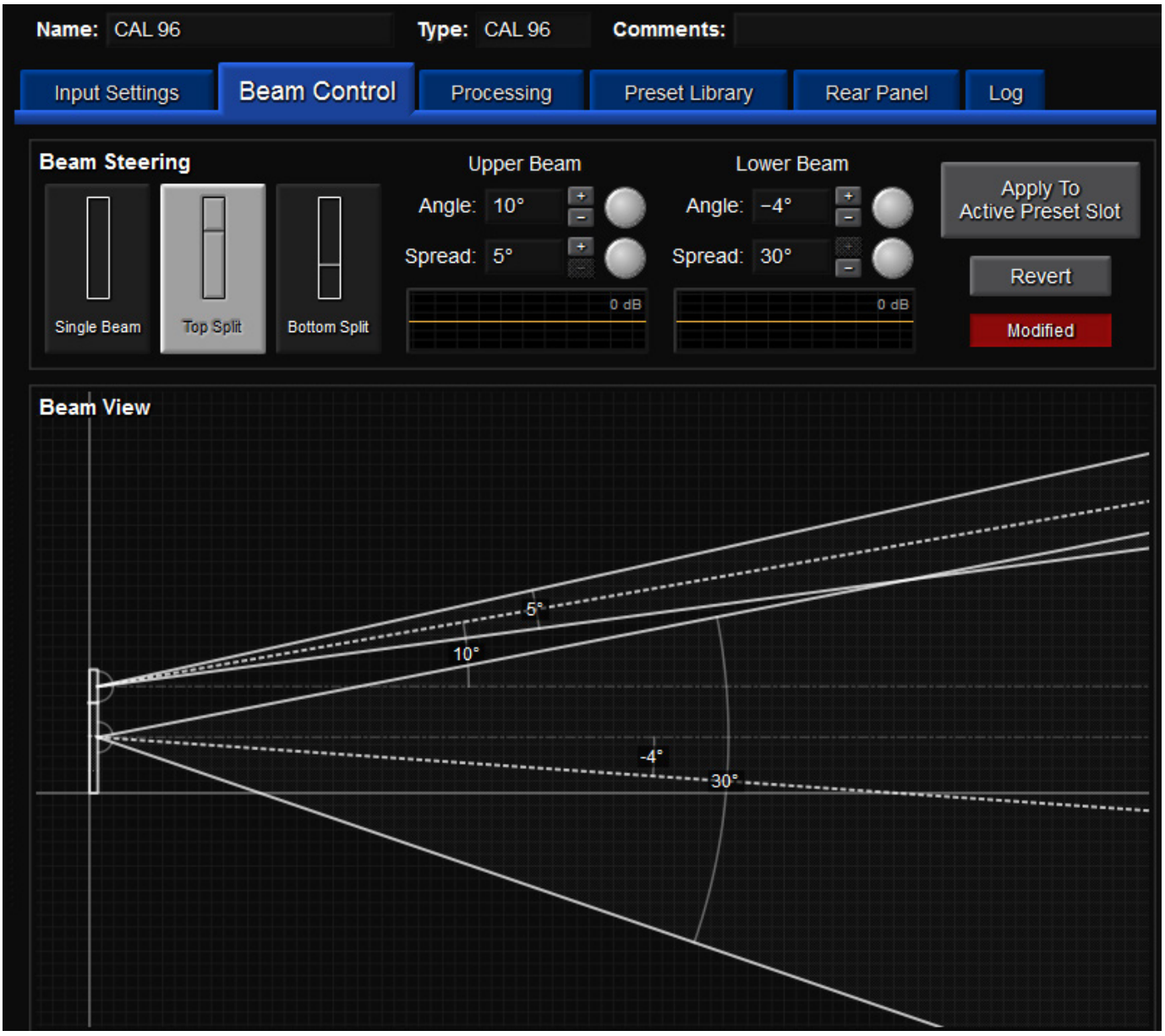



*Image 16 – Compass Software – CAL96 with split beam configuration*

## Split Beam Use - Case Study

As a case study for split beam coverage, an auditorium with a Left / Right CAL 96 loudspeaker system is shown below. Each CAL 96 is configured with 64 drivers on the top portion of the beam split and 32 drivers on the lower portion of the beam split. In order to predict this in EASE, a CAL 64 is placed at a height of Z=20' and a CAL 32 at a height of Z=14.44 (20'-5.56'). The upper beam uses the CAL64sprd20dwn00.gll, which provides a vertical beam spread of 20 degrees and no vertical beam steering. The lower beam uses the CAL32sprd30dwn13.gll, which provides a vertical beam spread of 30 degrees and downward vertical beam steering of 13 degrees.

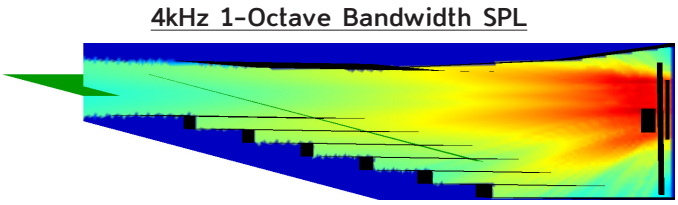



*Image 17 – Section – CAL 96 Split Beam*

The farthest seat covered by the system is about 100 feet from the loudspeaker and the system achieves an average level across all seating areas of 91 dB SPL A-weighted. These levels relate to continuous AVG as shown in MAPP Online Pro, with continuous peak levels 12.5 dB higher, or 103.5 dB.

A loudspeaker Centerline section face has been inserted (shown in red in the plan view at left) to aid in visualizing the beam coverage and aiming. If this Centerline section face is set as "Two-Fold", "Locked", and "No Shadow Cast", it will not affect your predictions in the main EASE model. If predicting in AURA, the Centerline section face must be deleted or moved out of the room, as it will affect AURA predictions, regardless of the face's settings.

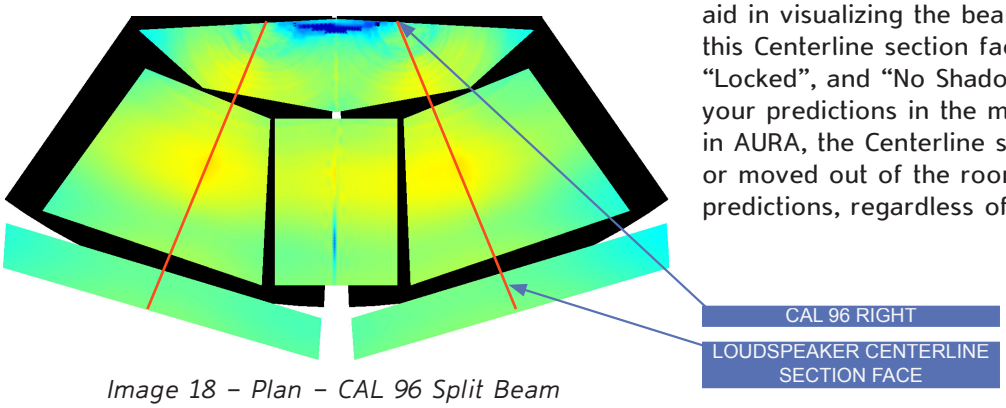



*Image 18 – Plan – CAL 96 Split Beam*

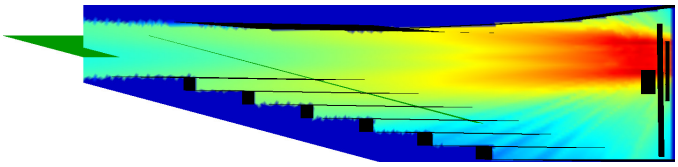


*Image 19 – Section – CAL64sprd20dwn00.gll*
*CAL 64 (Beam Spread 20deg, Steering Down 00deg)*

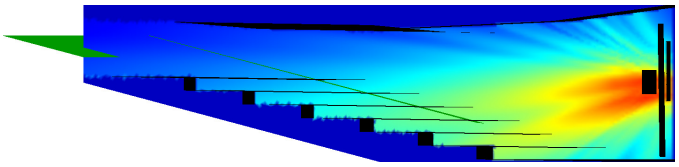


*Image 21 – Section – CAL32sprd30dwn13.gll*
*CAL 32 (Beam Spread 30deg, Steering Down 13deg)*

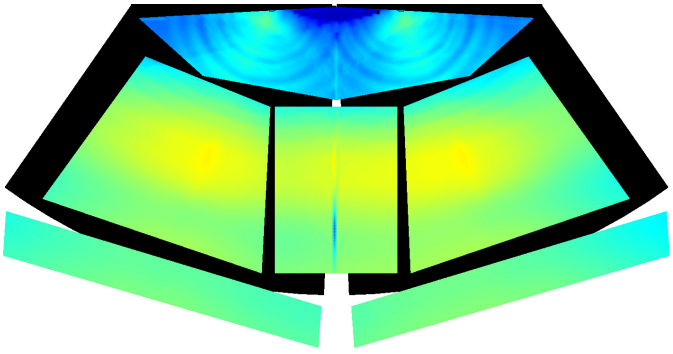


*Image 20 – Plan– CAL64sprd20dwn00.gll*
*CAL 64 (Beam Spread 20deg, Steering Down 00deg)*

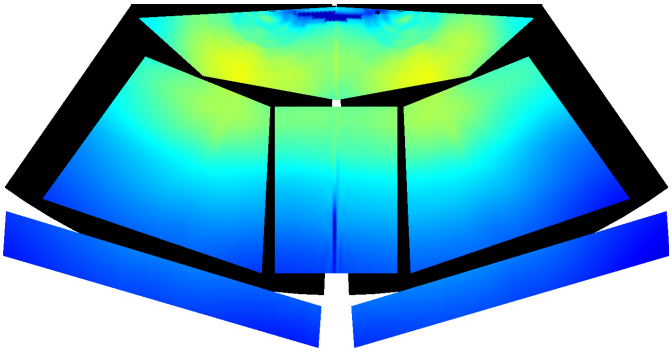


*Image 22 – Plan – CAL32sprd30dwn13.gll*
*CAL 32 (Beam Spread 30deg, Steering Down 13deg)*

## About Meyer Sound

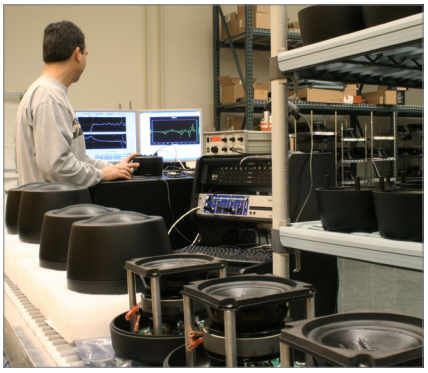
Privately-owned and operated since its founding by John and Helen Meyer in 1979, Meyer Sound has been at the forefront of professional audio for nearly three decades. Technological innovation, rigorous engineering, precision manufacturing and extensive worldwide customer support are the company's hallmarks.

John & Helen Meyer

Meyer Sound products are wholly integrated systems designed for optimal performance and ease of use. Renowned for their pristine sound, reliability, efficiency, and long life, they are the choice of top sound system designers and consultants worldwide.

Meyer Sound's accomplishments have been widely recognized. Within the audio industry, Meyer Sound products have received numerous awards, including seven TEC (Technical Excellence and Creativity) Awards, and John Meyer has been named a Fellow of the Audio Engineering Society. Meyer Sound has also been awarded 40 U.S. and foreign patents, as well as receiving a prestigious R&D 100 Award, presented by R&D Magazine for the top engineering accomplishments in any field worldwide.

The company has manufactured controller-assisted loudspeakers since its inception and, since 1995, self-powered systems that carry integral amplification, complex crossover, driver protection and frequency and phase correction circuitry onboard. In addition to loudspeakers, Meyer Sound makes electroacoustic measurement devices, acoustical prediction software, analog and digital signal processors for sound reinforcement, comprehensive audio show control, and electroacoustic architecture. Transducers and electronics for Meyer Sound products are made under strict quality controls at its Berkeley, Calif., headquarters.



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CAL GLL User Guide - 05.918.001.01_B