# DASaim™ White paper

# Digital Steering Technology

V1.0 – March 2018

## Contents

## 1 – What is DASaim?

DASaim is a high-tech digital steering solution that provides new and powerful features for the AERO-40A, AERO-20A and AERO-20A-120 DAS AUDIO line-array systems.

DASaim has been developed to achieve the desired goals in sound installations or live events:

- Controlled dBspl distribution with distance (level uniformity).
- Frequency response uniformity at the listening areas (tonal uniformity).
- Adaptation of the vertical dispersion pattern of the arrays to the audience zones.
- Improved intelligibility.
- Decrease the dBSpl in no audience zones.
- Fast design, short set-up times, and efficient workflow.

DASaim is based on FIRmaker technology from AFMG. It is now integrated within the V3.52 GLL library of the AERO-40A, AERO-20A and AERO-20A-120 systems used in EASE Focus V3, the acoustic simulation and modelling tool used by DAS AUDIO.

DASaim designs custom FIR filters for each cabinet in an array, allowing unprecedent control of the global behavior of the array to achieve the desired goals.

See the introductory video at this link.

## 2- How does it work?

The use of FIR filters in professional audio loudspeakers is common nowadays. Both AERO-20A and AERO-40A systems use them in their internal DSP processing for linear-phase brick-wall crossovers and for precise equalization of the transducers for a smooth frequency and phase responses.

DASaim adds a **custom FIR filter per cabinet** that is designed for controlling the **interaction** between the different cabinets of the array in the listening areas.

Why FIR filters? With FIR filters, the magnitude and the phase response of each frequency can be acted upon individually, achieving a degree of freedom impossible with conventional IIR filters in which magnitude and phase responses are related. So not only the magnitude (equalization) can be modified, but also its phase (its virtual position) individually. It can be seen as the shape of the array varies with the frequency to fulfill the desired objectives.

Figure 1 shows an array of 8 cabinets aimed to cover two audience areas. DASaim evaluates the response at discrete listening points over the audience areas as the complex interaction of the contribution of each loudspeaker in the array (cabinets 5 and 8 shown only for clarity). Applying advanced optimization algorithms, DASaim designs in seconds a custom FIR filter per cabinet, specifying for each frequency its magnitude and phase values looking to accomplish in the listening areas the desired goals like constant or controlled level with distance, frequency response uniformity, maximum gain, or a combination of them. These FIR filters modify the interaction of the cabinets and hence the radiation pattern of the array with frequency. This way, it is possible to re-direct the energy where it is needed.

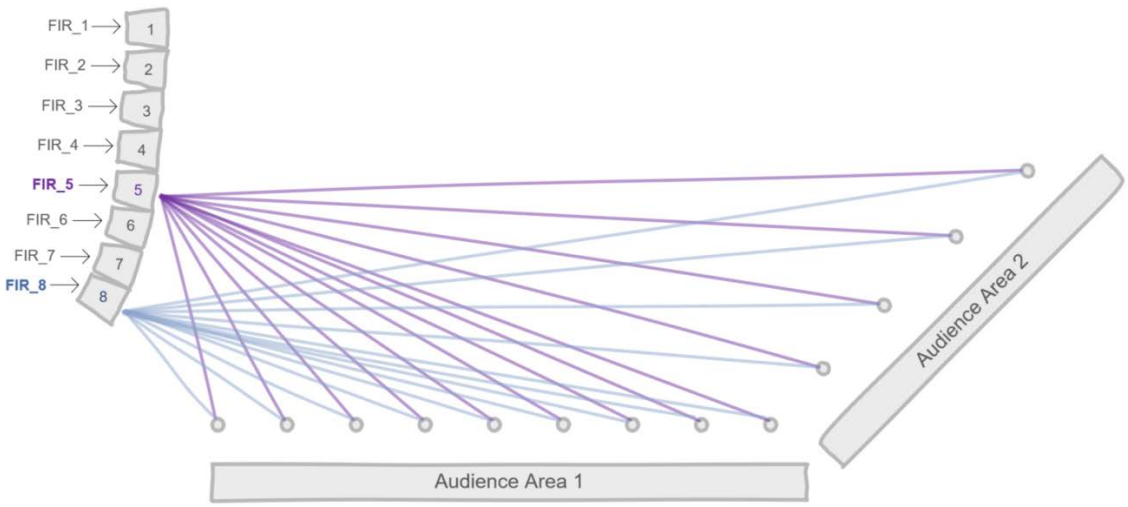



*Figure 1 – Interaction of the sound source*

To achieve satisfactory results, it is mandatory that the GLLs library files of the loudspeakers include all the detailed information about the loudspeaker response and how it radiates in all directions (the balloon) in a realistic way. DAS AUDIO invests both time and internal resources to provide GLL files that mimic the real behavior of the systems.

Using one FIR filter per cabinet gives DASaim the maximum performance:

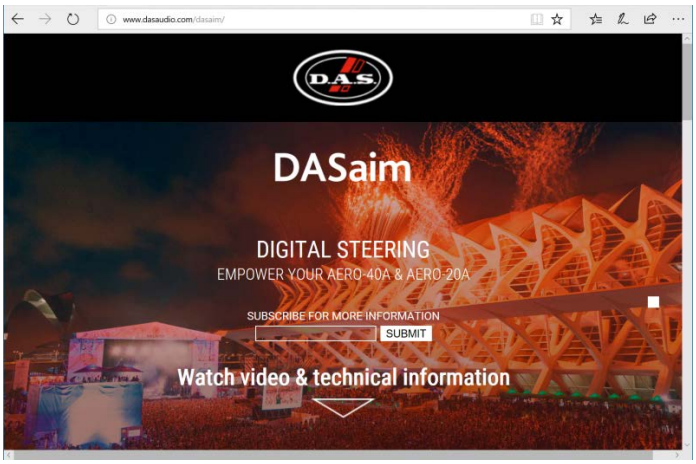
- Better magnitude and phase control for impressive results.
- Better spatial resolution and more uniform results over the audience areas.
- Useful control of the radiation pattern up to higher frequencies due to minimizing the distance between the sound sources with different filtering.

Other similar solutions on the market require customers to use an individual processed amplifier channel per cabinet (for passive systems), increasing the total cost, the number of cables and the connection error possibilities, and even then, do not take advantage of the total available power from the amplifier channels. For active systems with internal DSPs without sufficient processing power, one channel from an external processor per cabinet is needed, increasing also the system cost and cabling.

## 3 - What do I need?

All the information and software needed for using DASaim can be found at its site at the DAS AUDIO web page:

http://www.dasaudio.com/dasaim/



### 3.1 Firmware Update

First, for already purchased AERO-40A and AERO-20A, its internal firmware must be updated to incorporate the DASaim support with firmware version V3.5 or greater. For that, you will need the firmware update software DASLoader V1.7. Follow the instructions of the DASaim Firmware Update Manual document.

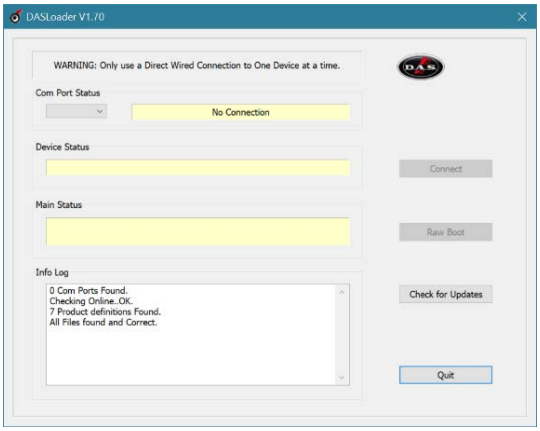



*Figure 2 - DASLoader V1.7*

In minutes, thanks to the powerful DSPs employed, your AERO-40A and AERO-20A will be empowered to a new level.

For new systems, this firmware will be included from factory, so you can skip this step. The new firmware V3.5 comes with DASaim capability and with improvements on the systems frequency response and array size compensation. We have listened to our valuable customers and learned from their day by day experience.

*"Thanks to the powerful DSP built into the amplifiers of each AERO system, no external multi-channel processors or processed amplifier channels are needed in order to have one FIR filter per cabinet. This means greater simplicity and a significant reduction in investment and set up time when compared to other solutions on the market"*

***Javier Navarro, Head of Engineering DAS Audio***

### 3.2 New GLL V3.52 and EASE Focus V3.1

For preparing live events and installations with EASE Focus V3.1 (or greater) using DASaim you need to use the new GLL version V3.52 for the AERO-40A and AERO-20A. The GLL (Generic Loudspeaker Library) files contain all the mechanical, radiation pattern and signal processing information for loudspeakers and arrays. This is the file format created and used by AFMG in EASE Focus and EASE. This new GLL incorporates the new system's frequency responses and DASaim support. The new AERO-20.120A loudspeaker, a modified AER0-20A with wider horizontal dispersion (120°) has been also included.

Then you will be ready to prepare your project with EASE Focus V3 defining the audience areas, selecting the systems to be used, their height and splay angles for proper coverage and SPL level, with the new opportunities and options that DASaim brings to DAS AUDIO customers.

As a result, DASaim produces a custom FIR filter per cabinet that is saved in a separated csv text file that will be sent to the cabinets using DASnet V1.7.

### 3.3 DASnet V1.7

DASnet is the control and monitoring software for DAS AUDIO systems. It has been updated to version DASnet V1.7 incorporating DASaim capabilities and new models. For more information about DASnet, follow the user manual and videos.

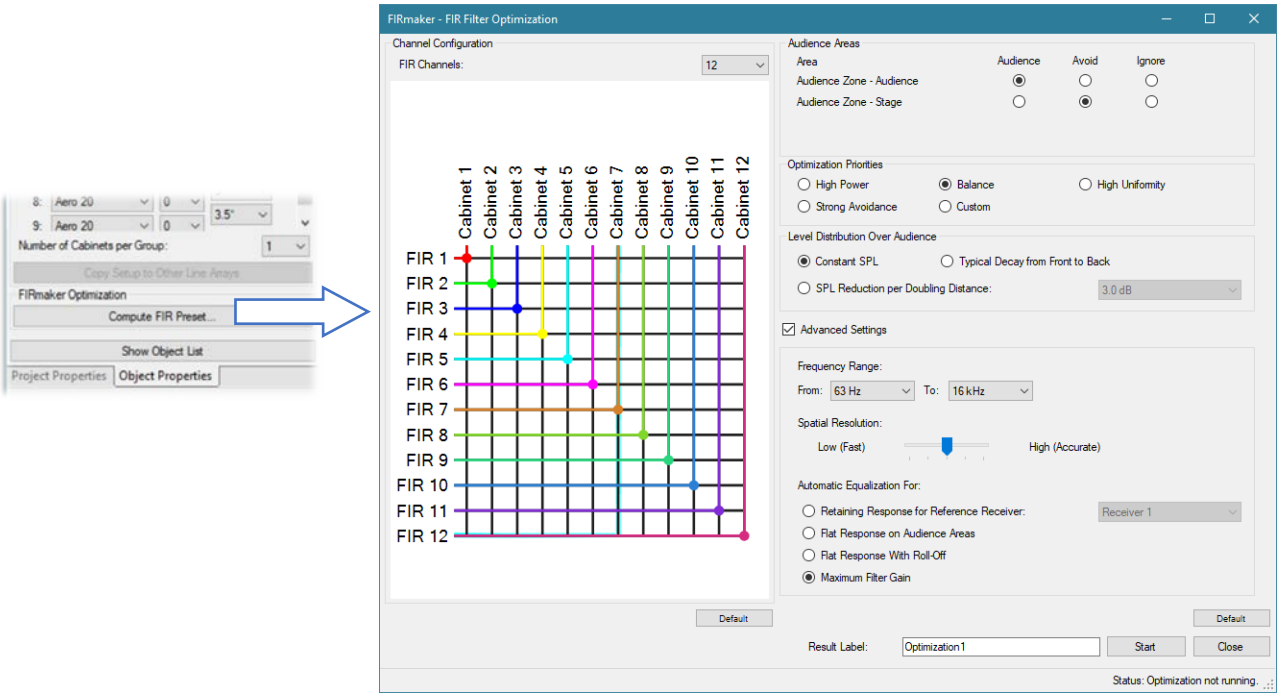
### 3.4 Firmaker License

As mentioned previously, DASaim is based on AFGM's FIRmaker technology. To be able to export the custom FIR filters from EASE Focus, a FIRmaker License for DAS AUDIO products must be purchased and installed in the computer that executes EASE Focus. This license allows DASaim use for present and future products from DAS AUDIO. For purchasing and installation information contact us at DASaim@dasaudio.com.

## 4 - DASaim Design Options

All users of the new GLL V3.52 can start designing audio venues and installations using AERO-40A, AERO-20A and AERO-20.120A with the possibilities of DASaim.

On the *Object Properties* Tab in EASE Focus V3, a new button *Compute FIR Preset...* is available that gives access to the FIRmaker design window:




The scheme on the left at *Channel Configuration*, represents the assignment of the FIR filters (*FIR Channel number*) to cabinets. As the FIR filters are executed at the internal DSP of the cabinets, the default settings are valid: one FIR per cabinet. For flown arrays, Cabinet 1 represents the first one from the top and it will receive FIR 1 filter. The dots on the matrix configure the filter-to-channel assignment.

The DASaim design options appear in the right part of the window. A brief description of them is below. More information could be found at the EASE Focus V3 User's Guide.

### *Audience Areas*

All the areas created in the EASE Focus V3 project will appear. They can be configured as

- *Audience*: Areas where the high SPL and/or uniform SPL will be optimized.
- *Avoid*: Zones where the ration will be minimized, like the stage or unoccupied balconies.
- *Ignore*: Areas that the optimization algorithm will ignore.

### *Optimization Priorities*

This option selects how the optimization algorithm will treat the target frequency response of the array and its uniformity.

- *High Power* aims to maximize the total SPL of the system.
- *High Uniformity* seeks uniform SPL level and frequency response at the configured listening areas at the expense of some SPL loss.
- *Balance* is in between *High Power* and *High Uniformity*.
- *String Avoidance* puts its effort in decreasing the level at the areas configured as *Avoid*, and finally *Custom* brings the user into play with the weight of the parameters.

Normally, a good starting point are *Balance* or *High Uniformity*, and then compare the results with modified options as it will be seen later with several examples of use. The final application is the one that determines the main objective: maximum SPL, maximum frequency response and/or level uniformity, avoidance….

### *Level Distribution over Audience*

This function allows defining how the SPL varies with distance respect to the array location.

- *Constant SPL* equates to a homogeneous pressure distribution over the entire audience, from front to back.
- *Typical Decay from Front to Back* is defined as an average level reduction of 4.5 dB per doubling distance.
- *SPL Reduction per Doubling Distance* let the user to select between 1.5dB, 3dB, or 6dB.

As it will be seen later with examples of use, DASaim will adapt the radiation pattern of the array to the audience areas. The excess energy at the first meters could be redirected in part to the far field (mainly in the mid and mid-high frequencies) without increasing the electrical filter's gain, just improving the interaction of the cabinet responses.

Bear in mind that there are physical limits. If you are looking for constant SPL over a long distance, DASaim may decrease the SPL in the first meters to make it equal to the SPL at the last meters, and not the other way around

### *Advanced Settings*

When the user enables *Advance Setting*, new configuration options appear:

*Frequency Range*

Selection of the lowest and highest frequencies where DASaim will optimize the array behavior.

Again, there are physical limitations. For achieving control at low frequencies, the length of the array (and hence, the number of cabinets) must be high. The more cabinets, the lower the controllable low frequency will be.

The effective high frequency limit will depend on the distance of the high frequency units between cabinets and their waveguide design. DASaim will optimize the interaction between sources up to a frequency where radiation overlap between sources still exits and work as a magnitude equalizer above those frequencies.

A good starting point to work are the default values and expecting an effective low frequency control depending on the array size.

*Spatial Resolution*

It configures the physical distance between the virtual microphones that DASaim automatically adds at the listening areas. The desired design goals are evaluated at these points and in seconds, the optimization algorithm iteratively designs the best possible FIR filter per cabinet to fulfill them. It can be configured from *Low (Fast)* with less microphones to *High (Accurate)* with more microphones. With more microphones, a more uniform solution could be achieved at the expense of increasing the filter design time and computer memory use. An intermediate value will be enough in most cases.

*Automatic Equalization For*

This option configures how to equalize the average filter response at the audience areas.

*Retaining Response for Reference Receiver* selects the response of one of the receivers added by the user as the target response. With this approach, the user can select the response of the preferred receiver (like FOH) and then let DASaim make this response global for the rest of the places. The response at the selected receiver will not be modified.

*Flat Response on Audience Areas* looks for a flat curve in all the listening areas, usually at the expense of decreasing the global level. To maintain the system's headroom, the flat response is achieved making the

levels at the listening areas as the ones at the further positions. It is strongly recommended to limit the frequency range to 8kHz or less to avoid excessive level penalty. Otherwise, atmospheric attenuation comes into the play and penalizes the overall level too much.

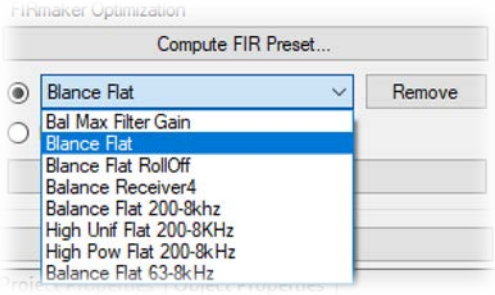
*Flat Response With Roll-Off* is similar to the previous, but limiting by default the frequency range from 125Hz using a 4th order Butterworth filter, to 8kHz with an 8th order Butterworth filter.

*Maximum Filter Gain* looks to achieve the maximum filter gain at each frequency band. This option penalizes the least, the overall SPL level and the one to use if you cannot allow a global SPL reduction greater than 2-3 decibels in your application. This must be your starting point.

**RECOMENDED STARTING POINT**

- *Optimization Priorities*: *Balance* or *High Uniformity*
- *Level Distribution Over Audience: Constant SPL*
- *Advanced Settings:*
  - *Frequency Range*: *63Hz* to *16kHz*
  - *Spatial Resolution:* 50%
  - *Automatic Equalization For: Maximum Filter Gain*

Once the configurations settings are selected, the user can give it an identifiable name at the *Result Label* edit box and design the FIR filters in seconds pressing the *Start* button. It is possible to design different configurations into the EASE Focus V3 project, and later change between them in the *Object Properties* pane to compare the results between them and select the proper configuration for the application. We recommend giving a self-descriptive name to each configuration to have more information when performing later comparisons.




Each installation or venue will require different DASaim configurations because of different types and numbers of cabinets, array heights and aiming, and of course final use (conference, theater, jazz, rock, techno…). As it only takes seconds to test a new set-up, the best way to face a design is to simulate different options and compare the achieved SPL and frequency responses at the listening areas. And of course, it is possible to design different FIR filters sets and then later hear them loaded in the AERO systems to do the final selection. Let's go now with some examples of use to see the possibilities of DASaim.

# 5 - Examples of use

## 5.1 Auditorium

As an example of DASaim use, at Figure 3 we have a real auditorium of 45 meters length with a principal audience area and a balcony as shown. A stage has also been included.

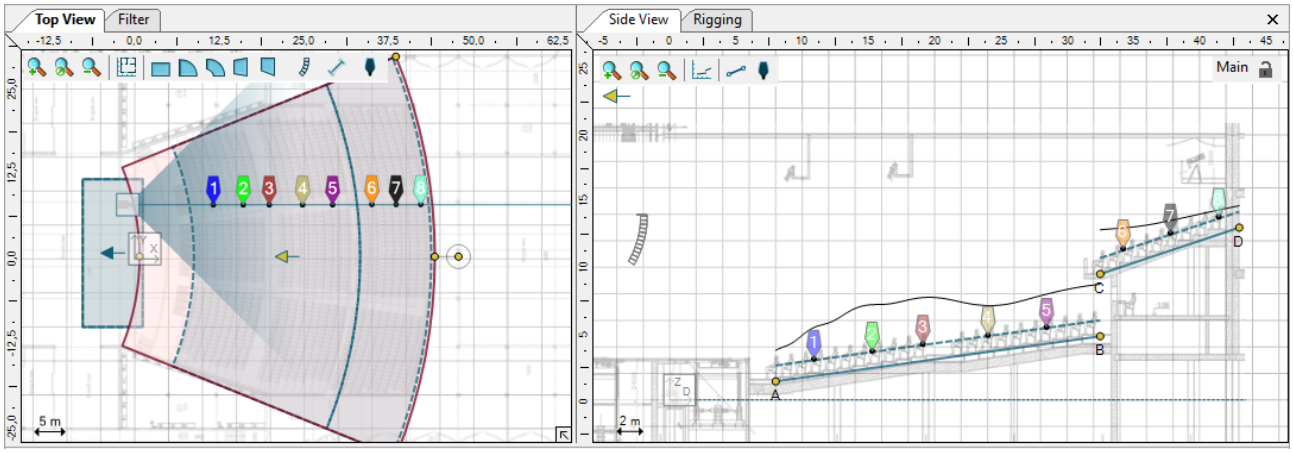



*Figure 3 - Auditorium example*

12 units of AERO-40A will be used per side with an array height of 11 meters. The splay angles have been designed using *Auto Splay* with *Spiral Strategy* with a posterior hand modifications. 8 receivers have been included over the audience to observe the level and frequency response from front (1) to back (8).

First, let's evaluate the performance of the array without DASaim. Configuring the *Filter Settings* of the cabinets to *12 Units (12 U)*, and the *THROW* to *Long Throw (LT)* for the first 3 cabinets (the ones that point to the balcony), and *Mid Throw (MT)* for the rest. The predicted frequency response at the 8 receivers and broadband level with distance are:

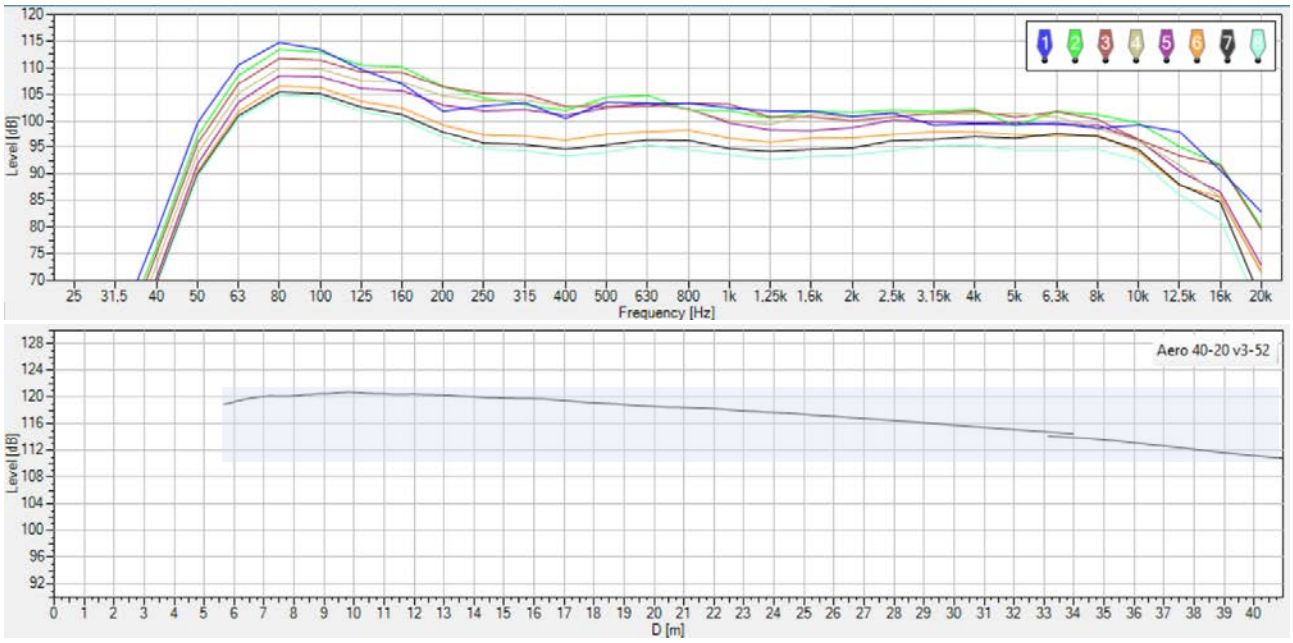



*Figure 4 - Response without DASaim*

The achieved performance in level and frequency response is quite good for a line-array system. We can see a level drop front-to-rear greater than 10 dB and a tonal variation mainly in the mid frequencies with excessive level at the near and mid distances and a lack of them at long distances. High frequencies at far distances (receivers 6 and above) are also attenuated due to atmospheric absorption. With this set-up. The mean SPL level over the audience areas is 114,2 dBspl with a variance of 3,5 dBs.

Let's use DASaim with this configuration: *Balance*, *Constant SPL*, and *Maximum Filter Gain*. Figure 7 displays the new frequency responses at the same 8 receivers and broadband level with distance:

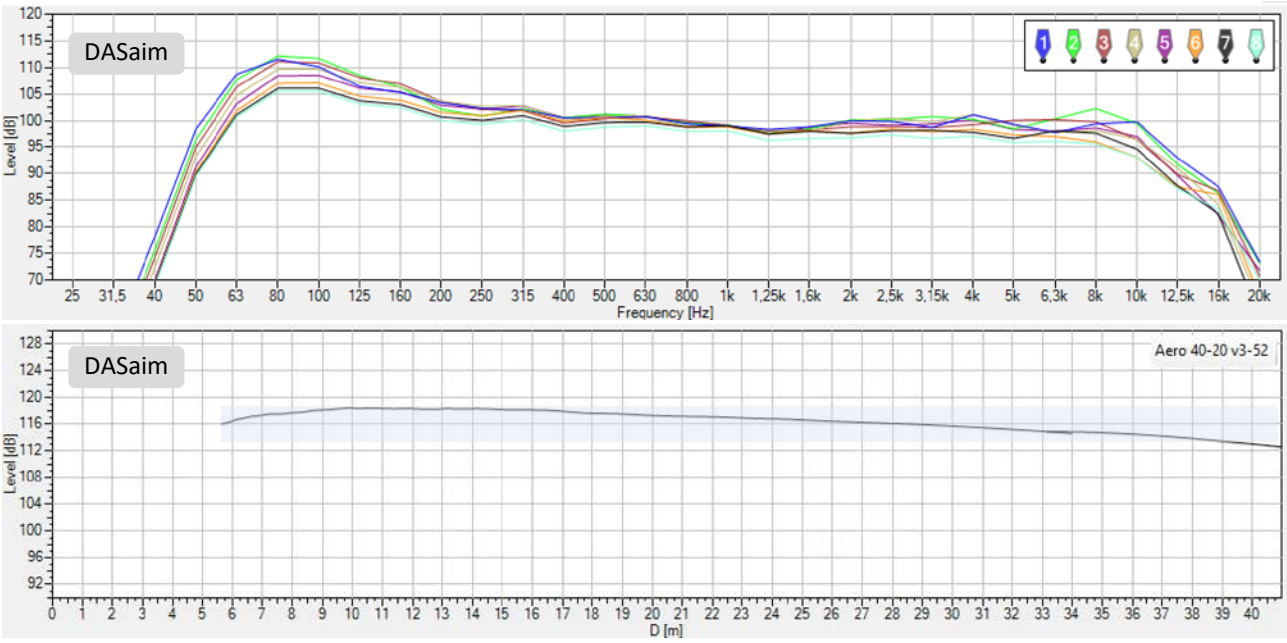



*Figure 5 - Response with DASaim: Balance, Constant SPL, Maximum Filter Gain*

We can observe now how the frequency responses and level are almost identical from 350 Hz to 6kHz, and the level difference front-to-rear has been reduced to less than 4 dB, with most of the audience area within ±1 dB. In this situation, what is really relevant is that now, the global equalization of the system becomes global in space and that is fantastic. No more worries about near, mid, and far field equalization. It is GLOBAL.
There is an energy translation from the first meters, where normally there is too much level (and it is not healthy), to the mid and long distances, where it is needed. And this is done without filter gains, just improving the interaction between the sources. The level at the balcony has been increased by free more than 2 dBs. Now, the mean SPL at the listening areas is 113,2 dBspl with a lower variance of only 2dBs. In this case, the mean SPL loss for the complete audience is only of 1 dB.

DASaim modifies the vertical radiation pattern of the array to properly cover the audience areas with a wider useful frequency range than other techniques. If we observe at Figure 6 the vertical mapping and SPL at mid frequencies (630 Hz, 1/3 octave), we can see at the pictures of the left how the direction of the main lobe is perpendicular to the array, not covering the balcony properly. The SPL with distance is quite irregular with 10 dB difference from front to back. Turning on DASaim we achieve the results of right graphs. Now the lobe is tilted-up adapting itself to the audience areas, thanks to the digital steering capabilities of DASaim. Also, the SPL is much more uniform within the complete audience areas with a deviation of only 1 dB from front to back.

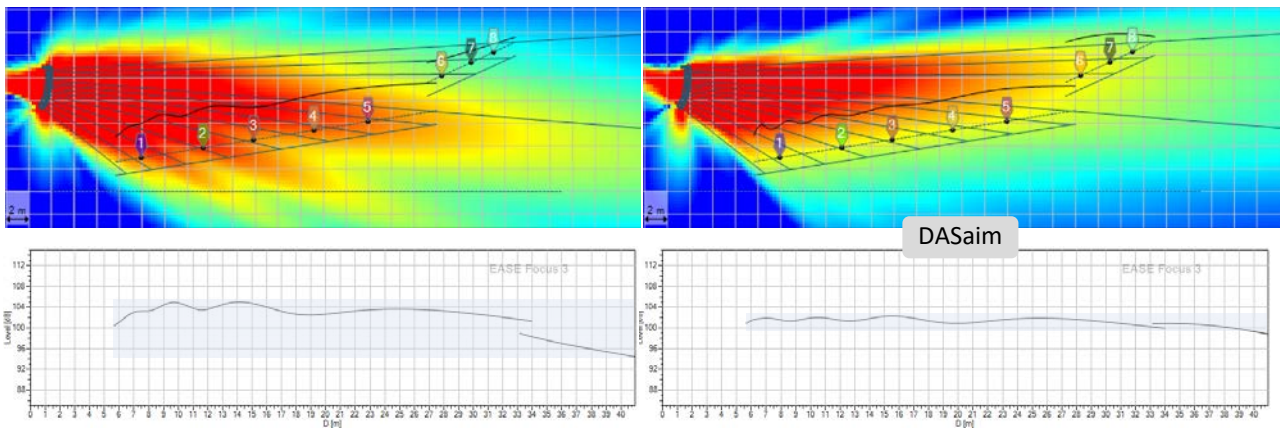



*Figure 6 - Vertical radiation pattern at 630 Hz*

Although there are complex and risky all-pass techniques for tilting-up the lobe at low and mid frequencies, DASaim solves this problem while it uniformizes SPL and frequency response for the complete audience, in a fast and safe way.

This is a common problem in line-array systems. The array position, its inclination, and the splay angles of the cabinets, are configured to achieve complete coverage at the listening areas at high frequencies due to the directivity of the high frequency units. But the coverage at low and mid frequencies is determined by the mean array inclination, and in general, there is a lack of low-mid frequencies at mid and long distances, losing the tonal balance uniformity from-to-back, and SPL with distance. DASaim solves this, something impossible to achieve with pure equalization techniques.

It is possible to achieve more uniformity changing the design options. For example, with *High Uniformity, Constant SPL and Maximum Filter Gain* we obtain the results shown on the left graphs of Figure 7. As seen, the frequency responses are almost identical at all the receivers, as happens with the SPL, with less than 2 dBs from front-to back. In this case the mean SPL is 111,2 dB, a decrease of 3 dBs from the system without DASaim. In general, the price for achieving more uniformity is SPL reduction.

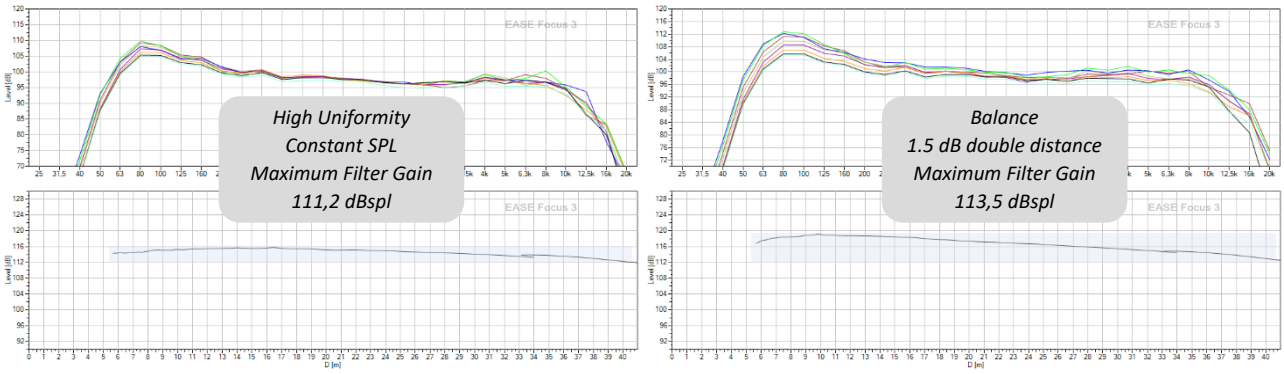



*Figure 7 - DASaim configurations*

DASaim is flexible enough to adapt its behavior to the specific requirements of each installation or venue. If the maximum SPL must be maintained, or some level drop with distance is desired, other design strategies could be used. The results shown on the right graphs of Figure 7 are obtained with *Balance*, *1.5 dB attenuation with distance*, and *Maximum Filter Gain*. As lower level uniformity is required, the mean SPL is increased to 113,5 dBspl, only 0,7 dB below the original one, with a maintained tonal uniformity. In this case, the power headroom of the AERO-40A will be enough to recover almost the original SPL.

The best way to configure DASaim is to study with virtual receivers the evolution of the frequency response and level with distance and play with the design options to find the optimum tradeoff in any situation. Each iteration design takes only seconds, so the user could find the best solution for each case in minutes.

## 5.2 Auditorium without balcony

Imagine now that in a show, the balcony is empty. We can configure DASaim to avoid it and do not send sound to it. That will improve also the voice intelligibility because the room is less excited. With *High Uniformity, Constant SPL and Maximum Filter Gain*, but now avoiding the balcony we achieve the frequency responses at the receivers shown on the top graph of Figure 8. The level for the mid and high frequencies for the three receivers of the balcony (6-7-8) has decreased considerably, about 15 dBs. Similar results are obtained if the balcony is configured as *Ignore* instead of *Avoid*. In fact, this attenuation value will in reality be lower due to the reverberation

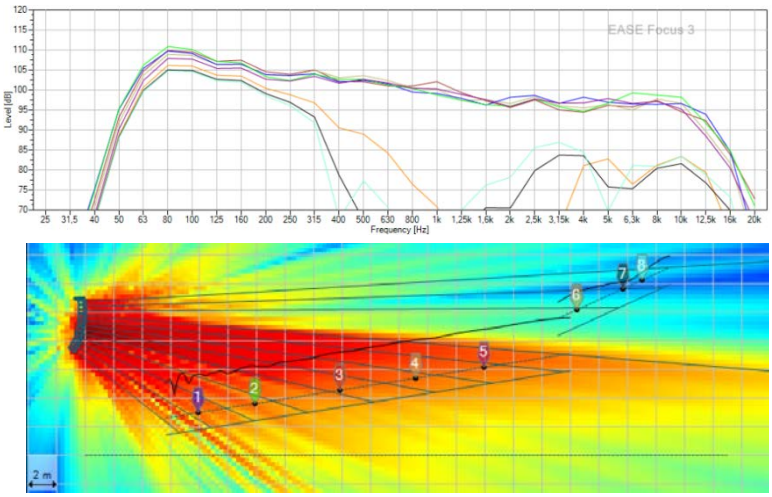



*Figure 8 - Auditorium - Avoiding the balcony*

effect not considered in EASE Focus, but still considerable and useful. And, finally, the array has not been moved or its splay angles modified. The vertical coverage has been adapted with digital steering using the designed FIR filters. The bottom graph shows the adapted vertical coverage at 4kHz. The user can change from one scenario to the other just with a few clicks of the computer mouse in seconds.

## 5.3 Avoiding the stage

As we did before avoiding the balcony, we can now try to clean the stage and do it at the same time a specific configuration of DASaim is done. Let's start again with *High Uniformity, Constant SPL* and *Maximum Filter Gain*, and configuring the stage as *Ignore* in the design. A new receiver (9 in magenta) is added at the stage 2 meters back the array. Figure 9a shows the frequency responses and broadband SPL with distance including the stage. As expected, there is contamination at the stage, about 7 dB below the level of the audience, and mainly at low frequencies.

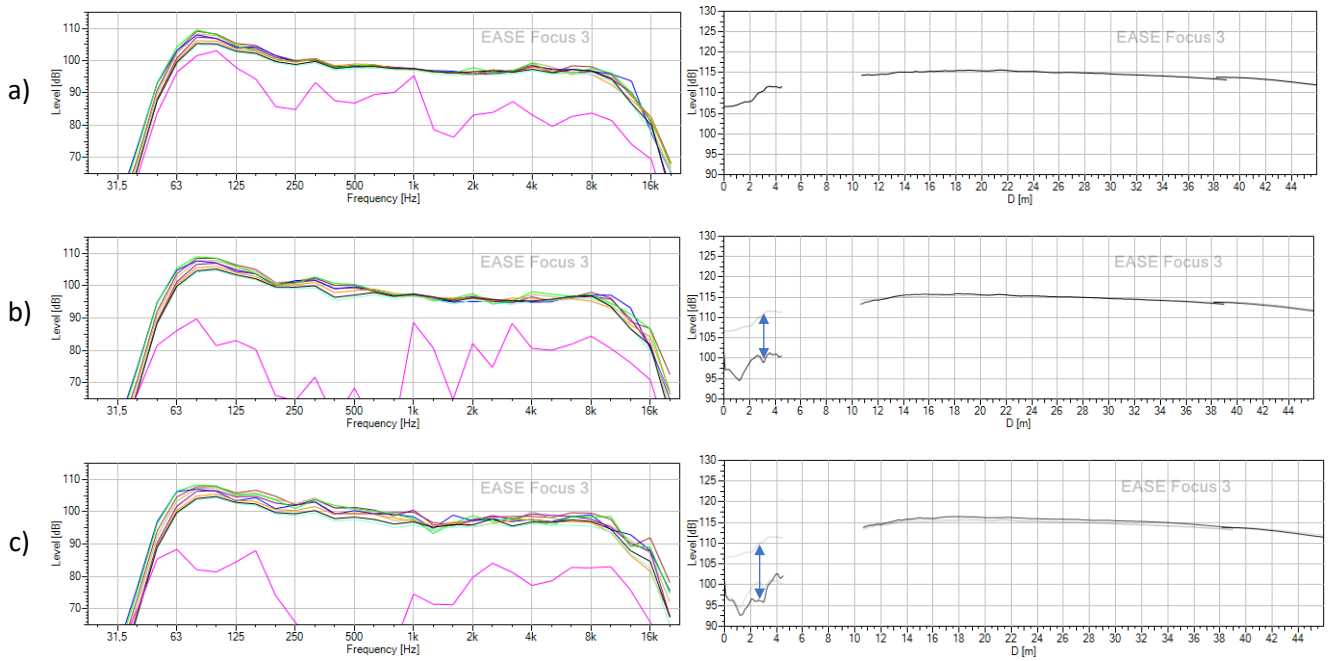



*Figure 9 - a) Initial response at the stage; b) Avoiding the stage; c) Avoiding the stage with Strong Avoidance strategy*

Configuring now the Stage as *Avoid*, we get the results of Figure 9b. The SPL and frequency response at the listening areas remains almost the same, but the SPL at the stage has been reduced more than 10 dBs. The gray curve is the previous level. From 125Hz to 1kHz, the reduction is even greater, close to 20 dBs.

Changing the configuration to *Strong Avoidance*, *Constant SPL* and *Maximum Filter Gain*, we can even get more reduction. Now the FIR filters design method put more emphasis in the reduction at the expense of losing some uniformity on the frequency response and SPL. The results are at Figure 9c.

We can see at the next pictures how the radiation at 500Hz is modified from the case 10a to 10b.

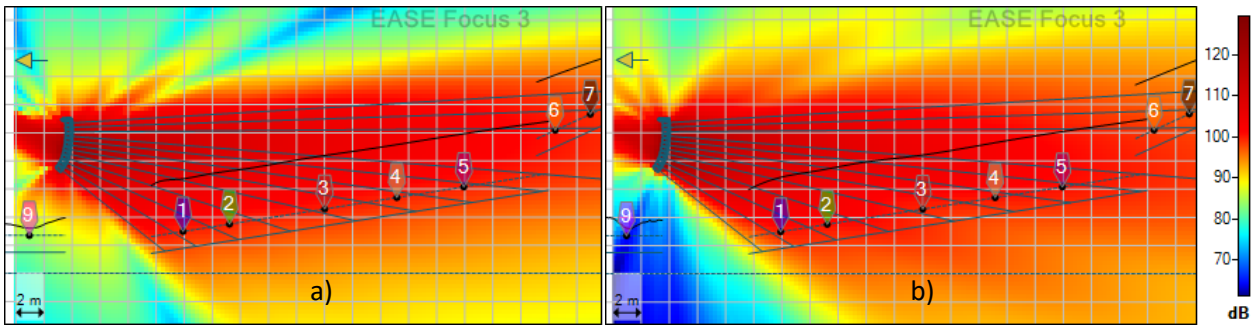



*Figure 10 – Vertical coverage at 500 Hz without avoiding the stage a) vs avoiding it b)*

### 5.4. Real Measurements

To demonstrate the performance of DASaim in a real situation, a similar auditorium with two arrays of 9 AERO-20A was prepared to compare the EASE Focus 3 predicted results with real measurements in an indoor scenario.

Three microphones (*Earthworks M30*) were placed at near (8 meters, receiver 1 in blue), mid (18 meters, receiver 2 in green), and far field (32 meters, receiver 3 in red). A *High Uniformity, Constant SPL* and *Maximum Filter Gain* set-up for DASaim was used.

Figure 11 compares the measured results (using a *Presonus AudioBox 44VSL* interface and *Smaart V7* analyzer) without using DASaim. Observe how accurate are the predictions (and hence the fidelity of the GLL data) even in indoor situation with the room influence.

And Figure 12 is what happens when DASaim is turned on. That is uniformity. Imagine how easy is now to equally equalize and sent your mix to the whole audience.

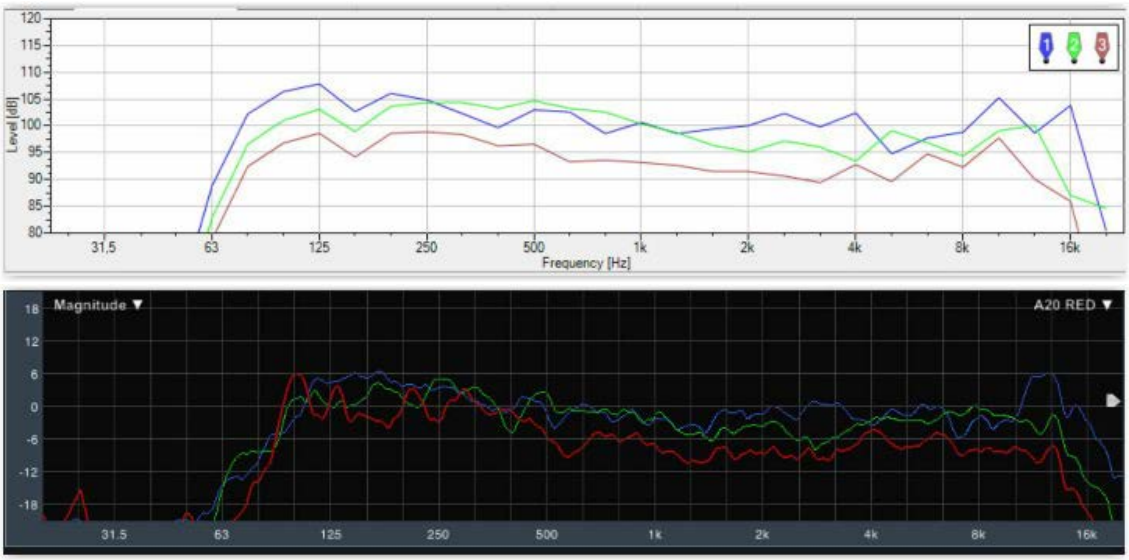



*Figure 11 - Prediction and measured responses without DASaim*

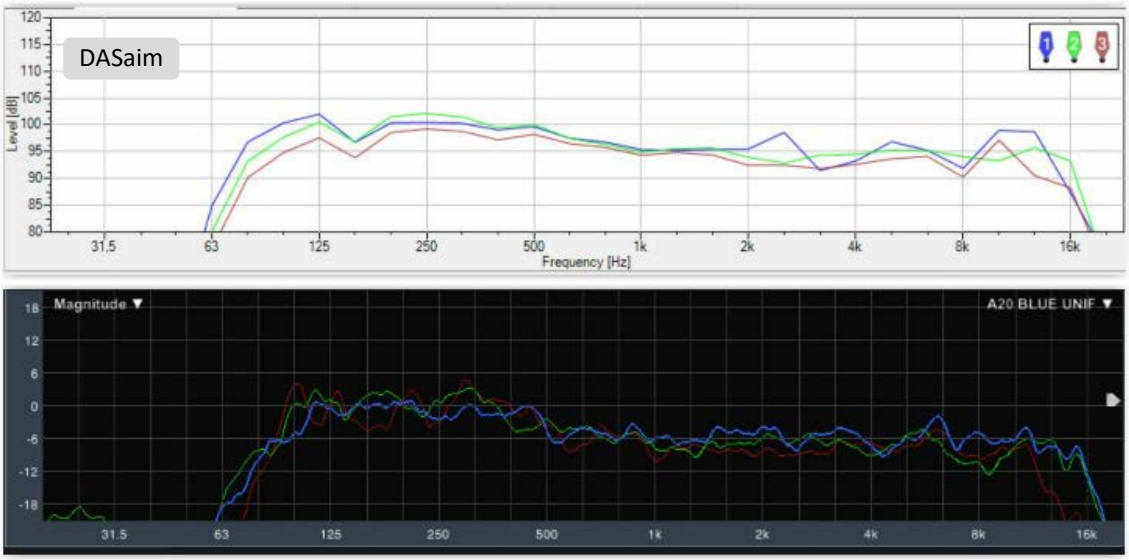



*Figure 12 - Prediction and measured responses with DASaim*

## 6 - Workflow

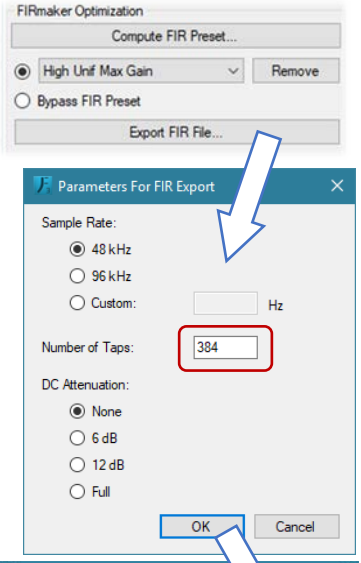
Having seen the possibilities of DASaim, let's have a look to the complete workflow formed by these three steps:

Using EASE Focus V3.1 or greater, and the GLL V3.52 for the AERO-20A, AERO-40A and AERO-20A-120, prepare the venue or installation as always: introduce the precise information; configure the systems (height, splay angles, and internal filter set-ups); and evaluate its performance. Then, as seen with the examples of use, try different configuration options of DASaim to meet your specific requirements. Once selected the configuration you are ready to export the FIR filters.

*Export FIR filters*

*csv files*

With the selected configuration active, press the *Export FIR Preset* button. The window shown below will appear. This button will be enabled only if a FIRmaker License has been acquired. For purchasing and installation information contact us at DASaim@dasaudio.com.



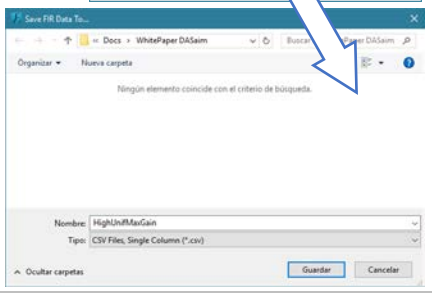

***IT MUST BE CONFIGURED AS DISPLAYED***

*Sample Rate: 48 KHz*
*Number of Taps: **384***
*DC Attenuation: None*

**48 KHz** is the sample rate of the internal DSPs of the AERO systems. **384** is the number of taps (coefficients) employed. It is a good tradeoff between frequency resolution of the filters and the added latency (4ms). **DC Attenuation** configures how the low frequencies are attenuated.

***DASaim adds 4 milliseconds of latency***

Pressing *OK*, let the user identify the FIR filter set with a file name. Select the **CSV format file** (default). Be as explicit as possible to avoid later confusions. If the array has N cabinets, N csv files will be saved in the selected folder, adding a "_x" to the file name identifying the specific FIR filter for the cabinet "x", being x=1 for the most top cabinet.



Using DASnet V1.7, do an Autoscan to discover all cabinets. For each array, a *Zone* must be created.

***CABINETS MUST BE ORDERED TOP-DOWN AS THEY ARE PHYSICALLY IN THE ARRAY***

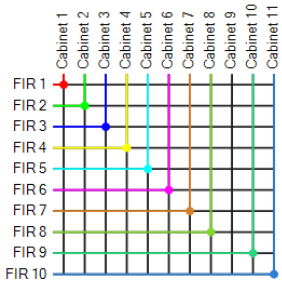

Use the IDs of the cabinets for identify them. By this way, each cabinet will receive its custom FIR filter. A minimum of 6 cabinets is needed for using DASaim.

Do right-click over the Zone pane and a pop-up menu will appear. Select *Load FIR* and navigate to the folder with the csv files. Select any of the csv files with the added "_x". DASnet will check that the number of csv files is the same as the number of cabinets in the array, and that the *Number of Taps* is 384. The name of the csv files will be shown at the *Zone* panel and at each cabinet in red. Select now *Send FIR* and, in seconds all the FIR filters will be sent. The text with the csv names will change to white. Now you are ready to activate them with *Activate FIR* and deactivate with *Bypass FIR* and do fast comparisons. With *Delete FIR* it is possible to delete the stored filters on the cabinets.

For a demonstration of use, see this video.

## 7 - Recommendations

- Configure the EASE Focus project as accurate as possible with the posterior real set-up of the systems.
- Try different DASaim options and compare between them to select the one that better approximates to your design objectives in any case.
- Be careful with the definitions of the *Audience Areas*. Limit their dimensions to the real coverage areas. Leave the first meters just close to the arrays out of the *Audience Areas*. Otherwise we force to DASaim to optimize at the same time the very near field where there is no high frequency coverage, with the mid and far field, with degradation of the global results.
- Utilize self-explaining names for DASaim configurations and csv files.
- Use *Balance* or *High Uniformity* as *Optimization Priorities* for uniform tonal balance with *Maximum Filter Gain* to minimize the mean SPL loss.
- For uniform SPL with distance configure the *Level Distribution Over Audience* as *Constant SPL* at the expense in general, of a mean SPL loss of 1 to 3 dBs. For lower dB losses, select a *SPL Reduction per Doubling Distance* as 1.5 or 3 dBs. Anyway, try different options and compare between them evaluating with Receivers the tonal balance and level distribution front-to-rear.
- If using in *Advanced Settings* the *Flat Response* options, limit the frequency range to 8kHz or lower.
- Understand that there is an energy balance from the near field, where in general there is enough level, to the far field, where there is a lack of energy.
- When using *Avoid* areas, compare the results with *Ignore*, to evaluate how the performance of the array is modified when trying to cancel the radiation to the area to be avoided. Check how is modified the vertical dispersion pattern to avoid undesirable lobes at other directions.
- When using mixed arrays of AERO-40A with AERO-20A or AERO-20A-120, EASE Focus 3 needs the insertion of an AX-Combo that is considered as a "new" cabinet in the array. In that case, identify its position in the array, and change the *Channel Configuration* with one less *FIR Channel*, and rearrange the FIR Channel to Cabinets matrix connections to eliminate the FIR assigned to the AX-Combo. For example, a mixed array of 8 AERO-20A, an AX-Combo, and 2 AERO-20A-120, modify the matrix as shown. Cabinet 9 is the AX-Combo, so no FIR filter must be assigned to it.




- Verify that all the cabling and systems are working properly before using DASaim.
- Try to compare acoustically using similar SPL levels, and using your well-known music pieces.

## 8 - Conclusions

DASaim is a significant step in sound system design. It provides a flexible and powerful tool for digital steering that adapts the performance of the AERO-40A, AER-20A and AERO-20A-120 to your concrete needs every day.

The desired goals in any sound installation or venue like uniform frequency response and controlled SPL with distance can be achieved easily. With uniformity, your posterior equalization is global in space for all the audience. Send your mix and your sound fingerprint to the whole audience.

DASaim simplifies and accelerates set-up times and is able to solve complex acoustic scenarios where controlled radiations to audience areas, or avoiding zones, is needed. It is even possible to modify the vertical radiation pattern without modifying the height and angles of the arrays.

As the custom FIR filters are executed inside the cabinets, no external multi-channel processors or processed amplifier channels are needed in order to have one FIR filter per cabinet. This means greater simplicity and a significant reduction in investment and set up time when compared to other solutions on the market. One FIR per cabinet means better spatial resolution and efficient lobe control up to higher frequencies.

For more information or support contact us at DASaim@dasaudio.com

**DASaim empowers your AERO system - The future is now**