MLAS™ TECHNIQUE

Modular Line Array System™ Technique

A White Paper

By Jon Risch

Crest Audio® MLAS™ technique, or the Modular Line Array System™ is a method of building up a line array configuration using basic building blocks of EQ packages and line array segments.

What is the MLAS technique, or the Modular Line Array System?

It is a line array configuration design technique that rests on over 15 years of research into line array behavior, and the ensuing field feedback and experiences that have occurred in that time frame as well. Rather than just take some of the well worn myths about line arrays at face value, or accept rules of thumb as gospel, the full range and gamut of line array behavior was examined, measured, tested and refined to the point where the implementation of typical line array geometries was able to be simplified and codified.

The end user now has the option of selecting pre-engineered EQ settings that match with specific modular line array sections, and using these modules to build a line array geometry that is most applicable to their particular situation, without the requirement to delve into time consuming and difficult simulations or modeling software. In fact, if the user so desires, they can still perform their modeling and simulations, and still reap the benefits of well engineered EQ settings ready to use for any given set of line array modular segmented "paste-ups".

The Crest Audio MLAS technique, specifically is a method of breaking any line array vertical geometrical configuration down into defined segments of line array EQ that are appropriate for that segments contribution to the overall array output. Rather than treat each line array geometry as a singularly unique set of cabinet angles and EQ for each individual cabinet (or for the system as a whole), line array segments that share a common trait, such as all the same angle between cabinets, all being used in a Long Throw mode, etc., are broken out as a cluster of cabinets separated from the other differing segments of the array. An EQ package is created that addresses specifically that cluster or segment of cabinets, and the conditions they are operating under. This provides a set of typical line array vertical geometry configurations that can be assembled with several different operational modules consisting of that cluster of cabinets, and the specific EQ needed for their correct operation.

The Versarray™ 112 Mk III system can hang as many as 15 cabinets, and if a separate EQ was generated for all the variations that 15 cabinets with 7 different vertical angles between cabinets can have, it would amount to thousands of possible array geometry configurations. By breaking the vertical array geometry down into the fundamental geometry segments most likely to be used and implemented, we now limit the number of EQ packages to about 40 or so for the MLAS technique. About half of those are variations on the primary EQ modules, that provide either a Bass Boost mode of operation, or some Long Throw EQ for those geometries that would actually be used for Long Throw purposes.

Note that the Horizontal coverage of the Versarray 112 Mk III is nominally 90 degrees, and thus, the array should be aimed horizontally using the rotation of the Halo to cover the 90 degrees desired. Front to back location as well as height can be used to help tune this horizontal coverage, as well as allow for adjustment of the vertical coverage as well.

The module categories we have provided cover all the typical, traditional and advanced line array geometries that would be used in the real world.

Those categories are:

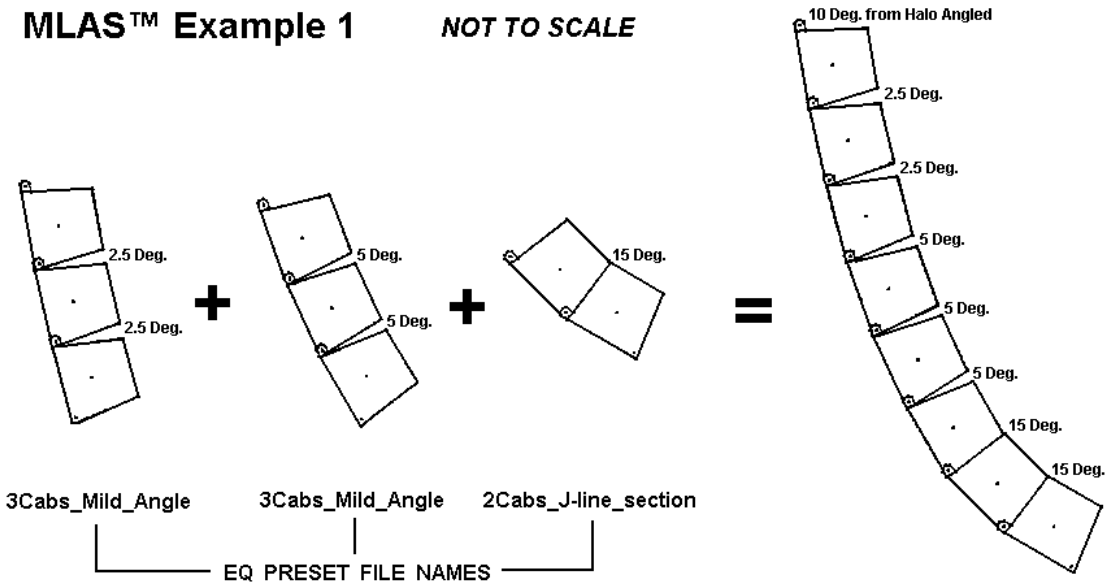
Straight line geometry - used primarily for Long Throw purposes, thus these EQ packages don't need a separate LT version. 0 degrees between cabinets.

Mild Angle - used for Long to Medium Throw coverage or specific angles of closer coverage. 2.5 to 5 degrees between cabinets.

More Angled - used for Medium to Short Throw coverage or specific angles of closer coverage. 7.5 to 10 degrees between cabinets.

J-line section - used for acute angled segments, as typically implemented in the bottom portion of classic J-line geometry. 12.5 to 15 degrees between cabinets.

See MLAS Example 1 diagram



Part 1

Selecting the Line Array Geometry

Classic line arrays used a simple straight line geometry, this provides the classic “laser beam” vertical coverage pattern that has become associated with line arrays today. However, many do not realize that the vertical coverage pattern is extremely tight and limited, typically not extending vertically past the ends of the array at a distance.

Laboratory measurements of the amount of angular coverage are not that accurate with straight line arrays, because the effective coverage angle keeps getting smaller as you get further and further away, until it may be just a fraction of a degree at some very far distance.

The upshot of this is that unless you truly need the extremely tight vertical coverage pattern AND can successfully aim the entire array at the exact spot you wish to cover, a classic straight line geometry is not going to be the best choice. A more useful and general-purpose geometry is a gentle and continuous curve, with the angle between each cabinet a total of 2.5 degrees. This would provide approximately 16 degrees of seamless vertical coverage with a 6 cabinet array, and maintain a fairly smooth frequency response. With the Versarray PRO 112, this creates a system with a coverage pattern of approximately 90 degrees horizontal and 16 degrees vertical.

If the venue is smaller or needs a more open vertical pattern for coverage, then there are several options that can address this. You can increase the angle between all the 6 cabinets to 5 degrees total, providing a vertical coverage of approx. 30 degrees.

If that is too much vertical coverage, but there are still some seats up front that need to be covered, then there are two other recommended geometries to use. One is a dual radius, as pioneered by Peavey® on the Peavey SSE™-LA. The upper three cabinets would be set to a total angle between cabinets of 2.5 degrees, while the bottom three would be set to 5 degrees. This arrangement provides a smooth, seamless vertical coverage pattern of approximately 22 degrees.

The other geometry is a modification of the classic “J” line, using a continuously curved array for the top section instead of a straight line, and then an abruptly curved section for the bottom few cabinets. This might consist of the top four or five cabinets angled at 2.5 and 5 degrees, with the bottom one or two each angled more drastically at 12.5 or 15 degrees. Up till now, we have been talking about a relatively smooth vertical coverage, with no gaps or suck-outs in the vertical pattern. However, the use of the “J” precludes this due to the sharper angles between the individual bottom cabinets. Anything over about 5 degrees total angle between cabinets will tend to cause a “gap' or a “hole” in the response at certain frequencies, and while it is not too bad, the sharper the angle, the worse it gets.

Why not use a classic “J” line geometry? This combines the narrow “laser beam” pattern with a “gaps in the coverage” pattern, sort of the worst of both worlds. This is why we recommend one form or another of a gentle and continuous curve, to avoid these common problems, and provide maximum performance.

Note that this behavior of a “gap" or a “hole” in the response at certain frequencies is not exclusive to the Versarray 112 Mk III system, this occurs with many other brands and models of line array cabinets. If special attention is paid to the vertical behavior of the individual cabinets and how they interface as an array, then this kind of behavior can be minimized. Certain "fixed curve" line array modules are on the market, and while they do provide a relatively smooth coverage for their intended angle, the geometry is fixed, and does not allow any adjustment past the fixed angle in use.

Due to the wider vertical coverage, you are often limited to using only two of these modules, before the third module is pointing nearly straight down. Thus, the number of array elements is severely limited, and the ability to use a gentler angle or a straight line segment is not an option.

What Constitutes a "Real" Line Array?

Even though the individual Versarray 112 Mk III cabinets have a line array tweeter section, one Versarray 112 Mk III cabinet is not a line array all by itself. In order to benefit from a significant amount of line array behavior, you need at least 4 cabinets arrayed together vertically. This is not to say that the use of just two or three Versarray 112 Mk III cabinets is not possible, but the unique strengths of a line array don't come into play until you get enough cabinets to work together to create that line array wave launch across a wide band of frequencies, all the way down into the mid-bass. It is strongly recommended that four or more Versarray 112 Mk III cabinets be used together in a single array hang for this reason.

Aiming the Line Array

If a classic straight line array geometry is used, then aiming becomes critical; the coverage pattern at high frequencies is only going to be about 10 feet tall for a set of eight Versarray 112 cabinets at a very long distance. You will have to pick the 10 feet or so of vertical space you want covered very carefully, and aim the array precisely. Here, use of an inexpensive laser pointer temporarily taped to the top and/or bottom of the array can be an invaluable aiming aid.

If you have chosen one of the geometries that provide a smooth curvature and a relatively narrow vertical coverage, then aiming will be more in line with the kinds of concerns and methods used for high Q point sources when looked at in one dimension, but you still have to pay attention to assuring that seating areas of primary concern are within that pattern.

If you have chosen one of the dual radius curvatures, the top section will be handling the long throw vertical coverage, and the bottom section will be providing the medium/short throw vertical coverage. Once again, use of the familiar tools for aiming point sources and clusters will be helpful here, as long as you realize that you have two different coverage zones.

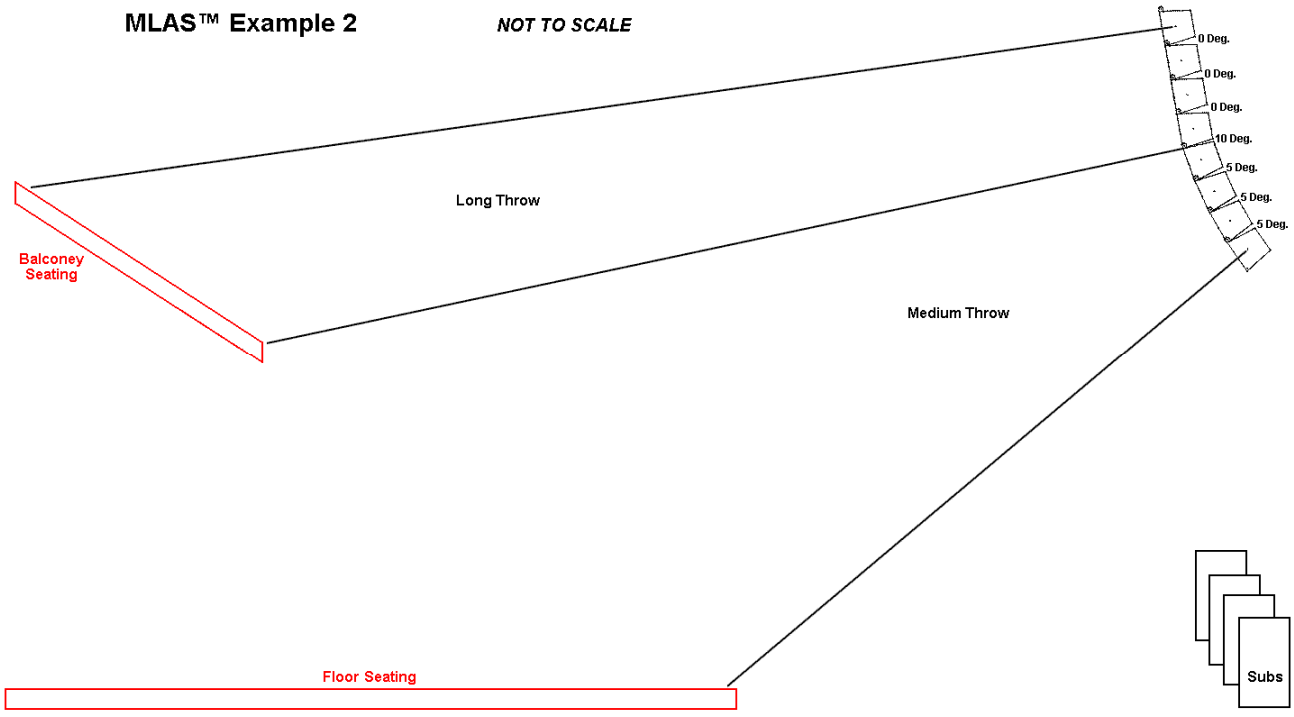
Crest Audio has teamed with EASE® Focus 3 software to bring you line array aiming software with the Versarray 112 system included in the database. Check with your Crest Audio representative, or visit the Crest Audio website for more information. https://peaveycommercialaudio.com/versarray

The EASE® Focus 3 program can be found at: http://focus.afmg.eu/index.php/fc-downloads-en.html

Example of Using the MLAS Technique

As a working example of the MLAS technique, let's construct a line array configuration that has a specific use. The venue we need to cover has a significant amount of balcony seating further away from the line, and then, more conventional seating nearer to the line on a floor plan. Eight Versarray 112 Mk III cabinets are to be used for this line array.

See MLAS Example 2 (NOTE: Diagram is not to scale, used for example only)



This line array could consist of a vertical coverage arrangement including a **Straight line** segment to cover the balcony, and a **Mild Angle** segment for the floor seating.

In this instance, a segment consisting of 4 cabinets EQ'd with the **4cabs_Straight-line** EQ package is used to cover the balcony, and a segment consisting of 4 cabinets ED'q with **4Cabs_Mild_Angle** EQ package is used to cover the floor.

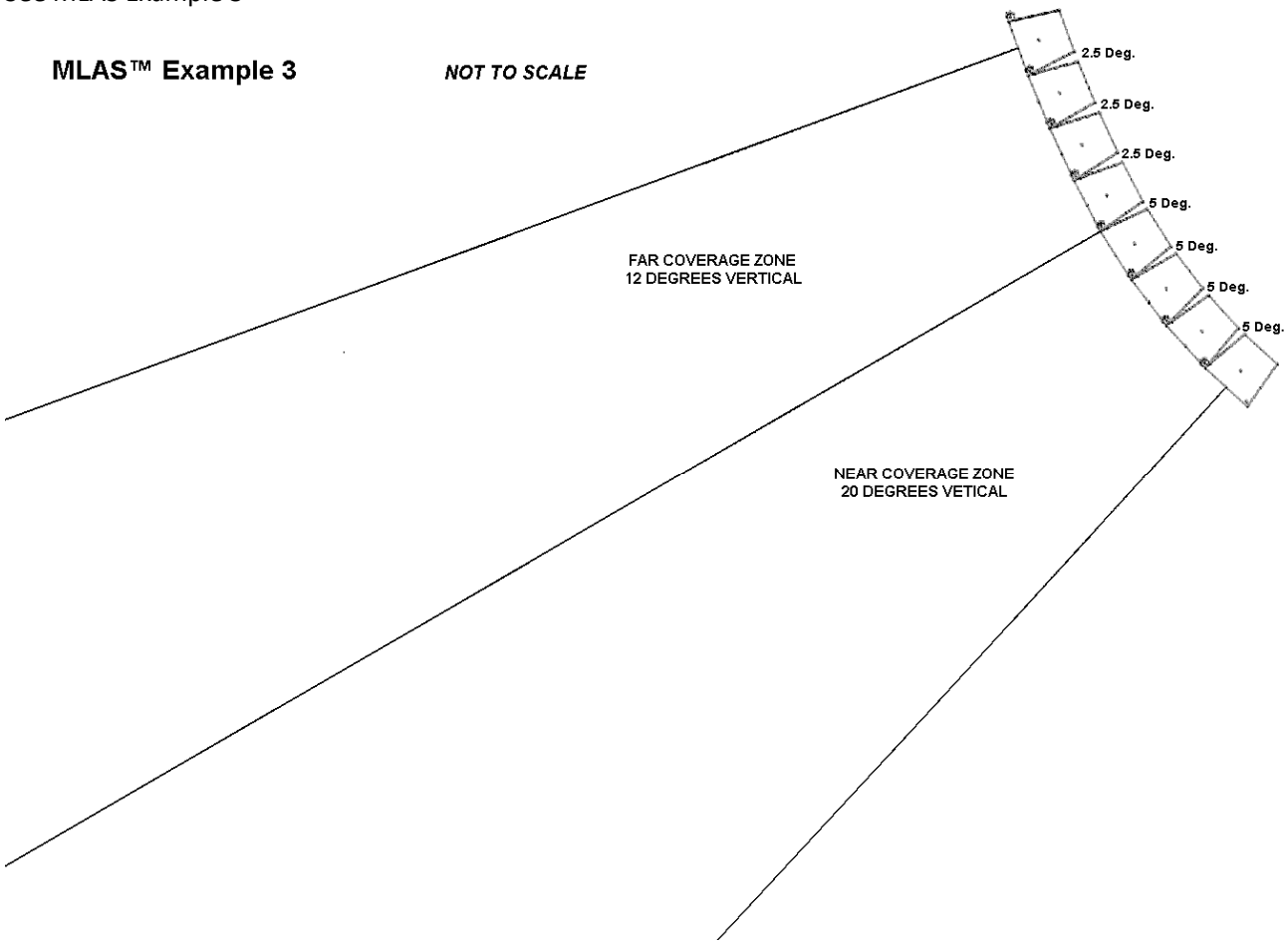
In another example, we create a dual-radius curvature line array using 8 Versarray 112 Mk III cabinets. This configuration is a very useful and somewhat universal line array configuration, and so, makes a good example to use to explain the MLAS process and the end results.

If we look down at the list of coverage angles provided by the various EQ packages available to be used (See list below this section), we are going to use the **LT_4Cabs_Mild_Angle** EQ package for the top 4 cabinets, and use the **4Cabs_Mild_Angle** EQ package for the bottom 4 cabinets.

We will designate the top cabinet at zero degrees relative to the Halo. The Halo can be angled up to 25 degrees, so as to aim the array at the target audience.

Then the next three cabinets get angled at 2.5 degrees relative to each other, and the bottom four angled at 5 degrees relative to each other.

See MLAS Example 3



Vertical Coverage Angles of Various Section EQ packages

EQ package: **Single_Cab_Flat**
One Versarray 112 Mk III Cabinet - 15 degrees nominal, but narrows down as the distance from the cabinet gets greater. Used as a reference point, as well as for use of an isolated Versarray 112 Mk III Cabinet without arraying a number of cabinets.

EQ package: **2cabs_Straight-line**
Two VR112 Cabinets Straight - 8 degrees nominal, but narrows down as the distance from the cabinet gets greater.
EQ package: **2Cabs_Mild_Angle**
Two VR112 Cabinets @ 2.5 degrees total angle between cabinets - 7 degrees, but tends to stay the same as distance increases.
EQ package: **2Cabs_Mild_Angle**
Two VR112 Cabinets @ 5 degrees - 9 degrees, but tends to stay the same as distance increases.

Note 1: Vertical High Frequency coverage is no longer a continuous spread when the angle between cabinets exceeds 5 degrees. Angles of more than 5 degrees between cabinets are considered special cases.

EQ package: **3cabs_Straight-line**
Three VR112 Cabinets Straight - 5 degrees, but narrows down as the distance from the cabinets gets greater.

EQ package: **3Cabs_Mild_Angle**
Three VR112 Cabinets @ 2.5 degrees - 9 degrees, but tends to stay the same as distance increases.
EQ package: **3Cabs_Mild_Angle**
Three VR112 Cabinets @ 5 degrees - 14 degrees, but remains the same as distance increases.
See Note 1

EQ package: **4cabs_Straight-line**
Four VR112 Cabinets Straight - 4 degrees, but narrows down as the distance from the cabinets gets greater.
EQ package: **4Cabs_Mild_Angle**
Four VR112 Cabinets @ 2.5 degrees - 12 degrees, but tends to stay the same as distance increases.
EQ package: **4Cabs_Mild_Angle**
Four VR112 Cabinets @ 5 degrees - 20 degrees, but remains the same as distance increases.
See Note 1

EQ package: **6cabs_Straight-line**
Six VR112 Cabinets Straight - 3 degrees, but narrows down as the distance from the cabinets gets even greater.
EQ package: **6Cabs_Mild_Angle**
Six VR112 Cabinets @ 2.5 degrees - 16 degrees, but tends to stay the same as distance increases.
EQ package: **6Cabs_Mild_Angle**
Six VR112 Cabinets @ 5 degrees - 30 degrees, but remains the same as distance increases.
See Note 1

EQ package: **8cabs_Straight-line**
Eight VR112 Cabinets Straight - 2 degrees, but narrows down as the distance from the cabinets gets much greater.
EQ package: **8Cabs_Mild_Angle**
Eight VR112 Cabinets @ 2.5 degrees - 22 degrees, but tends to stay the same as distance increases.
EQ package: **8Cabs_Mild_Angle**
Eight VR112 Cabinets @ 5 degrees - 40 degrees, but remains the same as distance increases.
See Note 1

Array segments greater than 8 cabinets should use the 8 cabinet EQ packages, as the changes to the EQ are becoming much smaller at this point.

The other EQ packages provided for building an array configuration cover other circumstances of use. The line segments for EQ packages labeled **More_Angled** don't provide smooth continuous vertical coverage due to the cabinets being angled 7.5 or 10 degrees apart from one another.

The total coverage of one of these irregular coverage segments is basically the sum total of the cabinet angles between the group of cabinets, plus one extra cabinets worth, divided in half and counted at each end.

The EQ packages labeled "**LT**" are for **Long Throw** situations, and these boost the upper high frequencies to allow for the absorption of those frequencies by the sheer amount of air that the sound waves have to travel through. These would generally not be used until you were trying to reach areas that were more than 80-100 feet from the array.

The **Straight line** EQ packages have a controlled portion of this long distance EQ dialed in already, as the most typical use for straight line segments is for Long Throw use anyway.

The **J-line section** EQ packages don't have an LT option, because they are angled so much relative to the other cabinets, and each other, that they would not typically be used as a Long Throw line array segment.

Coverage Plotting Using Floor Plans

If it is inconvenient to load and engage the EASE Focus 3 modeling program to map out the coverage of the array, or you just don't have access to the tools to do so, then it is possible to use a floor plan that has dimensions given to plot out the Versarray 112 Mk III system coverage in the horizontal and vertical axis. This is possible because of the MLAS technique of providing for line array modules of cabinets and EQ packages.

Given that the Versarray 112 Mk III has a horizontal coverage of 90 degrees, this makes it easy to use a top down view to see what you can cover when the line array is hung at a given location. You can use the corner of a piece of 8.5" by 11" printer paper to cover the floor plan and see what the coverage will be, rotating the corner, and relocating the apex of the corner in different positions to look at the resulting coverage.

The vertical coverage varies with the line segments and EQ package pairs used, so a protractor can be a useful tool to look at various angles of vertical coverage for each line array segment, and look at a number of "what-if" scenarios. This would utilize the coverage angles given in the listing of EQ package modules as given in the Owner's Manual section **Vertical Coverage Angles of Various Section EQ packages**

This will be a rough approximation of the actual coverage, and you can't really "see" what the bottom of a "J-line" segment will be doing, but you can see where the cabinets are aimed if you project a cone of sound along the central axis of any such J-line segment cabinet to get a feel for the localized coverage they would be providing.

Tweaking the Array for Best Performance

Amplitude Shading
Once you have decided on a series of line array segment modules to stick together to form the vertical portion of the line array, and have applied the appropriate EQ packages to the relevant processors, then it would be possible to improve the coverage by making minor adjustments to the various cabinets in the array. As an example, amplitude shading is often used to help even out the SPL changes with distance or location due to the line array coverage area. For instance, lowering the drive level to the bottom most cabinet in a line array by several dB can help keep under control the strong output that it has relative to the audience seated just under or near the array.

A "J-line" type line array might have the bottom most cabinet aimed almost straight down at the audience sitting just below that cabinet. Dropping the drive level by 6 dB or more might keep that audience area from experiencing an excessive SPL compared to the rest of the audience.

Along the same lines, a gently curved line or a dual-radius line might have the bottom 3 cabinets progressively lowered in level as you go down the array of cabinets. As an example, perhaps the 3rd cabinet from the bottom was set 2 dB lower in level than the rest of the array, and the second cabinet from the bottom 4 dB lower, and the bottom most cabinet 6 dB lower than the rest of the upper cabinets.

Frequency Shading
Seating close up to just under a line array may need some selective frequency shading for those lower or bottom cabinets, to help account for the much closer listeners. Often, a slight reduction of the upper midrange and lower treble can help balance out the overall tonal result. It may be sufficient to provide the frequency shading, and not have to apply any amplitude shading.

Venue EQ
The Versarray 112 Mk III system has been carefully engineered and designed to provide a nominally flat response using the Factory EQ and crossovers, along with the MLAS tools, and with proper coverage alignment, will provide a very flat and neutral frequency response to the listening areas targeted. With average or typical venue conditions, very little additional EQ will actually be needed to "dial the system in" because of this.

With conventional point source systems, it is standard practice to EQ each instance of system use, as if it were never responding quite right or in a neutral and flat manner under any conditions of use. With properly done line arrays, this is not a necessity, and there should only be a need for some slight EQ that is venue specific, such as a highly reverberant hall or auditorium, or a very dead environment such as outdoors at a festival. With these kinds of venues, the need for EQ should also be minimized. In these cases, the use of a simple shelving filter, such as a High Shelf or a Low Shelf, with less than 6 dB of boost or cut, should suffice to get the sound back on track.

It is strongly advised that only minimal EQ along these lines be applied by ear, rather trying to use an RTA and a microphone, to EQ the system as if it were a typical point source system. This type of approach to venue EQ just doesn't work very well for line arrays. Since the Versarray 112 Mk III system starts out very neutral and, with use of the MLAS tools, stays that way even once an array has been configured to the specific needs of the event. The need for significant amounts of PEQ type alterations is greatly reduced to the point of being just as likely to make things sound worse than they did before the added EQ.

Bass Boost EQ package Use
Since the Versarray 112 Mk III system does start out so neutral in it's reproduction of music, this tends to leave certain types of modern music not presenting with the "over the top" impact as much as the audience has come to expect, such as EDM, Electronica and DJ playback. These genres of music have come to be associated with added levels of bass energy, and to address this, we have come up with a set of EQ settings that are labeled as Bass Boost EQ.

This additional EQ provide that extra bass and mid-bass energy that has come to be expected, while providing for the proper protection of the system components despite the added levels of bass energy. These settings are more sophisticated than just cranking up the levels of the Sub, or adding in a Low Shelf EQ at some arbitrary frequency and amount of boost.

If you use the Factory flat setting EQ packages for a given line array configuration, and the bass seems lacking for your particular application, then try the Bass Boost EQ versions of the EQ packages.

Note that with the flat settings, an acoustic guitar, male vocals or upright bass will sound totally natural, with the Bass Boost EQ versions, these instruments will tend to sound larger than life, and less realistic.

Recommended Number of Subs to match a hang of Versarray 112 Mk III cabinets

The recommended number of Subs is one for every two VR 112's. This is for normal or typical sound reinforcement use of the system. If high energy DJ, EDM or Electronica music is to be the sound source, then additional Subs may be desirable.

As noted above, use of the provided Bass Boost EQ packages will usually provide a better overall result than merely increasing the level of the Subs relative to the level of the VR112 array.

See the Processor Settings section of this Owner's Manual or the Versarray 218 Mk III Owner's Manual for more specifics on the use of the Subs.

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