



Application Note

Using the LS6593v2

The LS6593v2:

The LS6593v2 represents a break-through in high quality live sound solutions. This application note is formatted to provide designers a working understanding of line array physics, allowing them to properly incorporate the LS6593v2 into their designs. It will also identify specific product features in the LS6593v2 and discuss how to use them to further advance design solutions.

The Engineering staff at SLS

Point Source vs Line Source

A point source can be defined as a single point in space from which the measured sound "seems" to emanate or expand equally in all directions, i.e. spherically. (see Figure 1) A line array can be defined as an array of loudspeakers acting in unison to create the measured sound that expands in only a single plane. (see Figure 2)

An advantage of a line array (over a point source loudspeaker) is the resultant Sound Pressure Level (SPL) at distance. The line array only reduces SPL by 3 dB for each doubling of the distance from the loudspeaker, as opposed to a point source loudspeaker that loses 6 dB per doubling of distance.

A group of "stacked up" loudspeakers will display the properties of both a point source and a line array. The wave propagation characteristic will depend upon the frequency being measured and the height of the array. Figure 1 and Figure 2 are both LS6593v2 units, only the measured frequency and the array height have changed. Therefore, not all "stacked up" loudspeakers can be considered true line arrays at the frequency where the characteristic is needed.

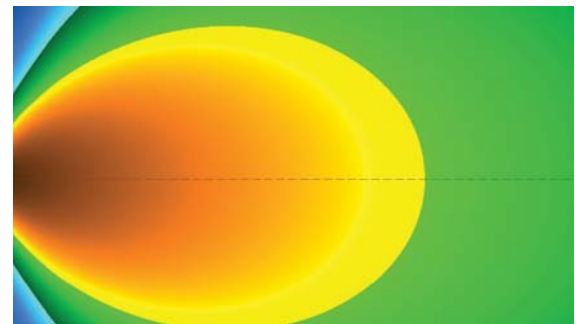
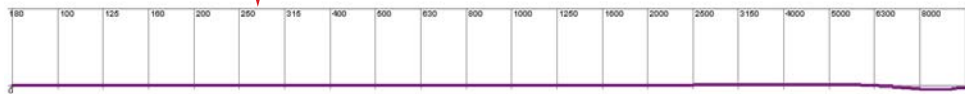
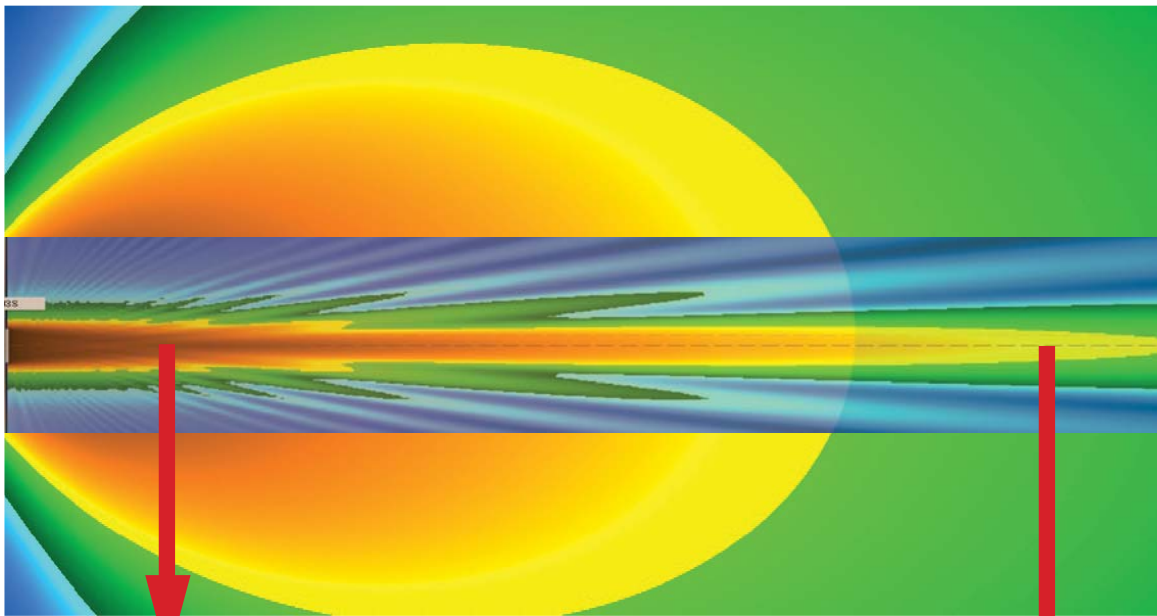


Figure 1:
Vertical Energy Dispersion of a point source (1)
LS6593v2 @ 500Hz 119 dB at 1 meter

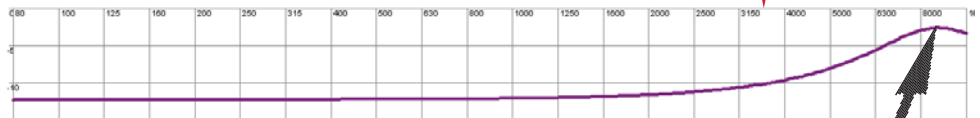


The Problem - Maintaining Frequency Response at Distance

The “plot” below is an overlay of individual energy dispersion plots from a single LS6593v2 loudspeaker measured at two frequencies. It graphically shows what happens to the frequency response as the measuring point is moved farther from the loudspeaker. The single LS6593v2 is acting as a point source at 630Hz but acting as a line source at 8000Hz. The further away from the source, the less low frequency will be measured relative to the high frequencies. **All line arrays will exhibit this behavior at some frequency.** The length of the line will determine how low in frequency this behavior starts. Therefore, a single LS6593v2 would only rarely be used as it only becomes a line source starting at a very high frequency (about 5000Hz).



Frequency response curve referenced at a position close to the speaker (front row seating) It projects even energy across the spectrum

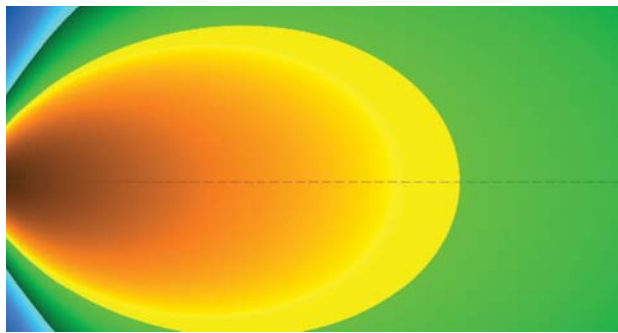


Frequency response curve referenced at a position far from the speaker (back row seating) Note that the higher frequencies peak **11 dB higher** than the low frequencies. This is a non-correctable situation. Any EQ done at the back position will cause an equal error to be created at the front position. **This is a result of not using enough LS6593v2 in the design.** More units are needed to extend low frequencies to the desired distance.

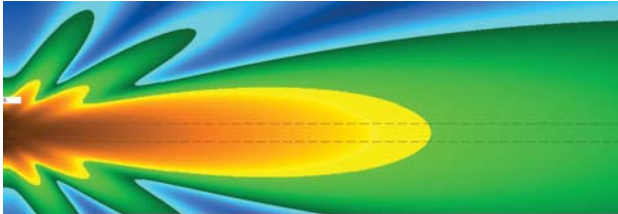


Growing Your Array

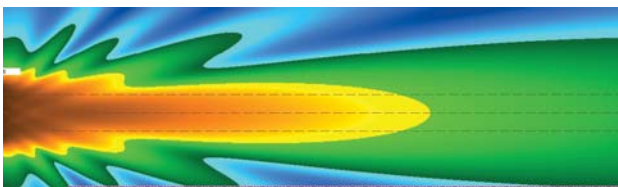
Below are energy dispersion plots measured at the same lower frequency of 630Hz used on the previous page. These show how the number of LS6593v2 modules used starts to control the lower midrange. Notice that it takes a minimum of five modules at the measured frequency to truly become a line source. However, even using just two modules offers a substantial improvement over just one. **For this reason the minimum recommended LS6593v2 modules are two per location to minimize frequency response errors and providing vertical control at distance.**



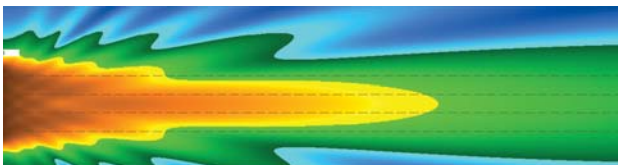
(1) LS6593v2 @ 630Hz



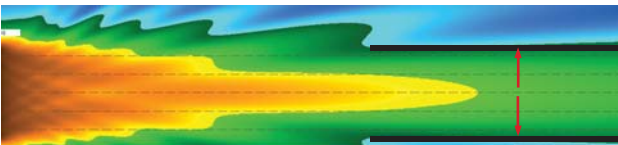
(2) LS6593v2 @ 630Hz



(3) LS6593v2 @ 630Hz



(4) LS6593v2 @ 630Hz



(5) LS6593v2 @ 630Hz

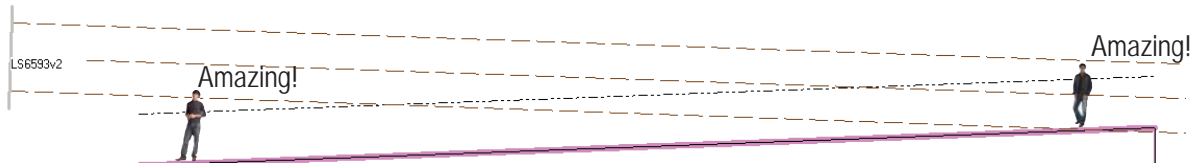
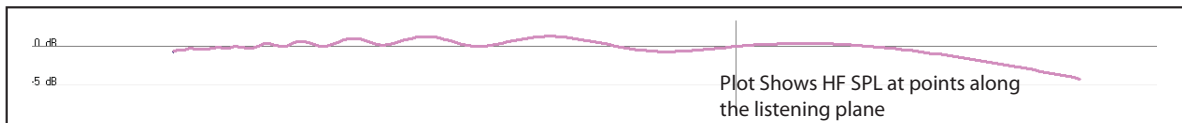


(5) LS6593v2 loudspeakers are needed for the onset of True Line Source Performance @ 630Hz



Typical Application Example

This venue's throw distance is 90 feet to the back row and the vertical coverage required is 3 feet. Using LASS, the coverage area (throw distance and elevation) and array information is entered. By rotating the three LS6593v2 modules 2 degrees down and carefully adjusting the overall height, astonishing results can be achieved.



Conclusion

We at SLS are excited about the potential of your success with our LS6593v2 modules. With the basic understanding available in this application note you are well on your way to a great variety of designs that can exceed your customer's expectations.

SLS maintains a full time staff to assist you with your specific applications and we encourage your use of this resource. There are many situations where the LS6593v2 modules can be implemented that are beyond the scope of this application note so e-mail or give us a call whenever practical. We will be glad to assist you.