ARCS®

THE INCREDIBLE INNOVATION OF
WAVEFRONT SCULPTURE TECHNOLOGY®

APPLICATIONS

L-ACOUSTICS® ARCS® provides the same performance benefits as V-DOSC® and dV-DOSC™ in a highly compact format suitable for both fixed installation and touring. By satisfying Wavefront Sculpture Technology® (WST) criteria, ARCS provides remarkable clarity and perfect coherence along with powerful, smooth, predictable coverage.

ARCS is designed for tightly-wrapped arraying in single or double row configurations or for horizontal arraying of up to 4 enclosures. The internationally patented DOSC waveguide designed exclusively for ARCS radiates a wavefront that has a radius of curvature matching the enclosure's 22.5° trapezoidal angle. When arrayed, the radiated constant curvature wavefront is continuous with an arc's shape with horizontal directivity equal to N x 22.5° (where N is the number of ARCS). Vertically, the exit of the DOSC waveguide is loaded by a cylindrical waveguide that provides an asymmetrical coverage angle of +40° by -20°. Modular horizontal coverage, combined with 60° vertical directivity, makes ARCS highly-suited to the overall coverage and throw distance requirements for typical medium-sized venues.

As a full range, two-way system ARCS can be used for front-of-house (FOH) sound reinforcement in corporate, television or theatrical applications. Due to its optimum speech reproduction and small physical footprint, ARCS is also highly effective as a flown center cluster for theatrical installations. For large-scale fixed installation, distributed arrays can be employed for stadium and arena sound reinforcement. In these applications, ARCS can be installed either single or arrayed, vertically or horizontally, and the precise, modular 22.5° horizontal directivity combined with the generous 60° vertical coverage allows for cost-effective coverage.

For touring applications, as a complementary 2-way fill enclosure ARCS is ideal for sidefill monitoring due to its tight, well-defined directivity pattern. When used in conjunction with V-DOSC or dV-DOSC FOH systems, ARCS is highly suitable for flown or stacked centre fill, stereo front fill, offstage fill or delay system applications.

When combined with L-ACOUSTICS SB218 or dV-SUB subwoofers, ARCS delivers powerful, extended bandwidth reproduction with additional low frequency impact that is perfect for FOH use in medium-sized venues. For FOH applications, the modular horizontal directivity of ARCS allows for excellent stereo imaging in the standard left-right format while the flexibility provided by asymmetrical vertical coverage allows the sound designer to cover virtually any room geometry.

For more demanding FOH applications, ARCS can be used in a double row configuration with top row cabinets oriented in the normal position for up-fill and bottom row cabinets inverted for down-fill. When arrayed in this manner, all 15" loudspeakers satisfy WST criteria and couple over their entire operating bandwidth, providing maximum low frequency impact and throw due to enhanced directivity control at lower frequencies.

ARCS - an "Arrayable Radial Coherent System".

L-ACOUSTICS PROFESSIONAL SOUND SYSTEM

- **Active 2-way enclosure (15" LF, 1.4" HF)**
- **WST-based line source design**
- **Perfect coupling, predictable coverage**
- **Excellent for medium throw applications**
- **Modular 22.5° horizontal directivity**
- **Asymmetrical vertical directivity (+40°/-20°)**
- **Designed for high performance touring and fixed installation**
- **Easy set-up - quick and secure rigging system**
- **OEM factory presets for approved digital processors**

SPECIFICATIONS

L-ACOUSTICS specifications are based on measurement procedures which produce unbiased results and allow for realistic performance prediction and simulation. Some of these specifications will appear very conservative when compared with other manufacturer's specifications. All measurements are conducted under free field conditions and scaled to a 1 m reference distance unless otherwise indicated.

Frequency Response

Frequency response	63 - 18k Hz (±3 dB)	(2W HI preset)
Usable bandwidth	50 - 20k Hz (-10 dB)	

Sensitivity[1]

LF (2.83 Vrms @ 1m)	98 dB SPL	63 - 800 Hz
HF(2.83 Vrms @ 1m)	109 dB SPL	800 - 18k Hz

Power Rating[2] (Long Term)		**Amplification** (Recommended)	**Impedance** (Nominal)
LF 54 Vrms 375 Wrms	1500 Wpeak	750 W	8 ohms
HF 29 Vrms 100 Wrms	400 Wpeak	400 W	8 ohms

Nominal Directivity (-6dB)[3]

Horizontal	symmetrical	22.5°
Vertical	asymmetrical	20° down 40° up

System Output[4]	**SPL**		**Coverage (-6dB)**	
One enclosure	128 dB (cont)	134 dB (peak)	22.5°	H x 60° V
Two enclosures	133 dB (cont)	139 dB (peak)	45°	H x 50° V
Four enclosures	137 dB (cont)	143 dB (peak)	90°	H x 50° V

Components

LF	1 x 15" weatherproof loudspeaker (bass reflex-loaded, 3" voice coil)
HF	1 x 1.4" compression driver mounted on DOSC waveguide and lens

[1] Sensitivity is the average SPL measured over the component's rated bandwidth

[2] Power rating displays the long term RMS power handling capacity using pink noise with a 6 dB crest factor over the component's rated bandwidth

[3] Directivity is averaged over the 1-10 kHz range

[4] System Output gives the unweighted SPL output of the system referenced to 1 m, including preset equalization and band leveling adjustment as measured under freefield conditions using the 2W LO preset

Enclosure

• Height	820 mm	32.3 in
• Front width	440 mm	17.3 in
• Rear width	190 mm	7.5 in
• Depth	652 mm	25.7 in
• Weight (net)	57 kg	125.7 lbs
Shipping weight	63 kg	138.9 lbs
• Shipping dims	860 x 480 x 730 mm	33.9 x 18.9 x 28.7 in

- Connectors : 2x 4-pin Neutrik speakon
- Material : 15mm, 18 mm and 24 mm Baltic birch plywood
- Finish : Maroon-gray™
- Grill : Black epoxy perforated steel with acoustically transparent foam
- Rigging : Integrated flying hardware and handles

Additional Equipment

- OEM factory presets available for approved digital processors
- L-ACOUSTICS SB218 or dV-SUB subwoofers
- L-ACOUSTICS LA24a or LA48a power amplifier

ARCHITECT SPECIFICATIONS

The enclosure shall be an active, 2-way loudspeaker containing one direct radiating, bass reflex-loaded 15-inch low frequency transducer and one 1.4" exit, titanium diaphragm compression driver that is coupled to a waveguide which is then loaded by a cylindrical horn that provides an asymmetrical vertical coverage angle of +40°, -20° (-6 dB points). As a full range system, the frequency response shall be 63 Hz to 18 kHz with less than ± 3 dB variation and the usable bandwidth shall be 50 Hz to 20 kHz (-10 dB).

The waveguide employed in the loudspeaker shall generate a pre-curved, isophasic wavefront for the high frequency section that provides 22.5 degree horizontal coverage (-6 dB points) and is matched to the trapezoidal angle of the enclosure. When arrayed horizontally or vertically, multiple loudspeakers shall function according to the principles of Wavefront Sculpture Technology whereby the separation between acoustic centers of individual sound sources shall be less than the size of half the wavelength at the highest frequency of their operating bandwidth or the sum of the individual areas of the isophasic radiating elements shall be greater than 80 percent of the target radiating area.

Crossover points shall be 800 Hz between low and high frequency sections with 24 dB per octave Linkwitz-Riley characteristics. Long term power handling shall be 375 Wrms and 100 Wrms for low and high sections, respectively. The low frequency transducer shall have a nominal 8-ohm impedance and the high frequency transducer shall have a nominal 8-ohm impedance. Connection to the loudspeaker shall be made via two parallel 4-pin Neutrik Speakon connectors.

The enclosure shall have a trapezoidal shape with a 22.5-degree angle terminated in an arc-shaped front baffle. Dimensions shall be 44.0 cm (17.3-in) wide at the front, 19.0 cm (7.5-in) wide at the rear, 82.0 cm (32.3-in) high and 65.2 cm (25.7-in) deep. Enclosure weight shall be 57 kg (125.7 lbs). Cabinet construction shall consist of 15 mm (0.59-in), 18 mm (0.71-in) and 24 mm (0.94-in) Baltic birch plywood with sealed internal bracing and joints that are sealed, screwed and rabbeted. The finish shall be maroon-gray, high-resilient paint. The front of the enclosure shall be protected by a black epoxy-coated, 1.5 mm (0.06-in) thick steel grille that is covered with 10 mm (0.4-in) thick acoustically transparent open cell foam.

The enclosure shall include internal and external hardware for rigging and shall be used in conjunction with dedicated rigging accessories including aluminum coupling bars for edge-to-edge arraying, a flying bumper and liftbar assembly for vertical arraying or a flying grid for horizontal arraying.

The loudspeaker shall be used with an approved digital processor with OEM factory presets for active 2-way or 3-way operation in conjunction with additional subwoofer enclosures.

The loudspeaker system shall be the L-ACOUSTICS ARCS.

The subwoofer system shall be the L-ACOUSTICS dV-SUB or SB218.

ACCESSORIES

ARCOUPL: Pair of coupling bars for physical attachment of adjacent ARCS enclosures

BUMP3: Flying bumper for rigging an ARCS array. One BUMP3 is required to fly 2 or 4 cabinets. Two BUMP3 and one LIFTBAR are required to fly 1, 3, or more than 4 enclosures.

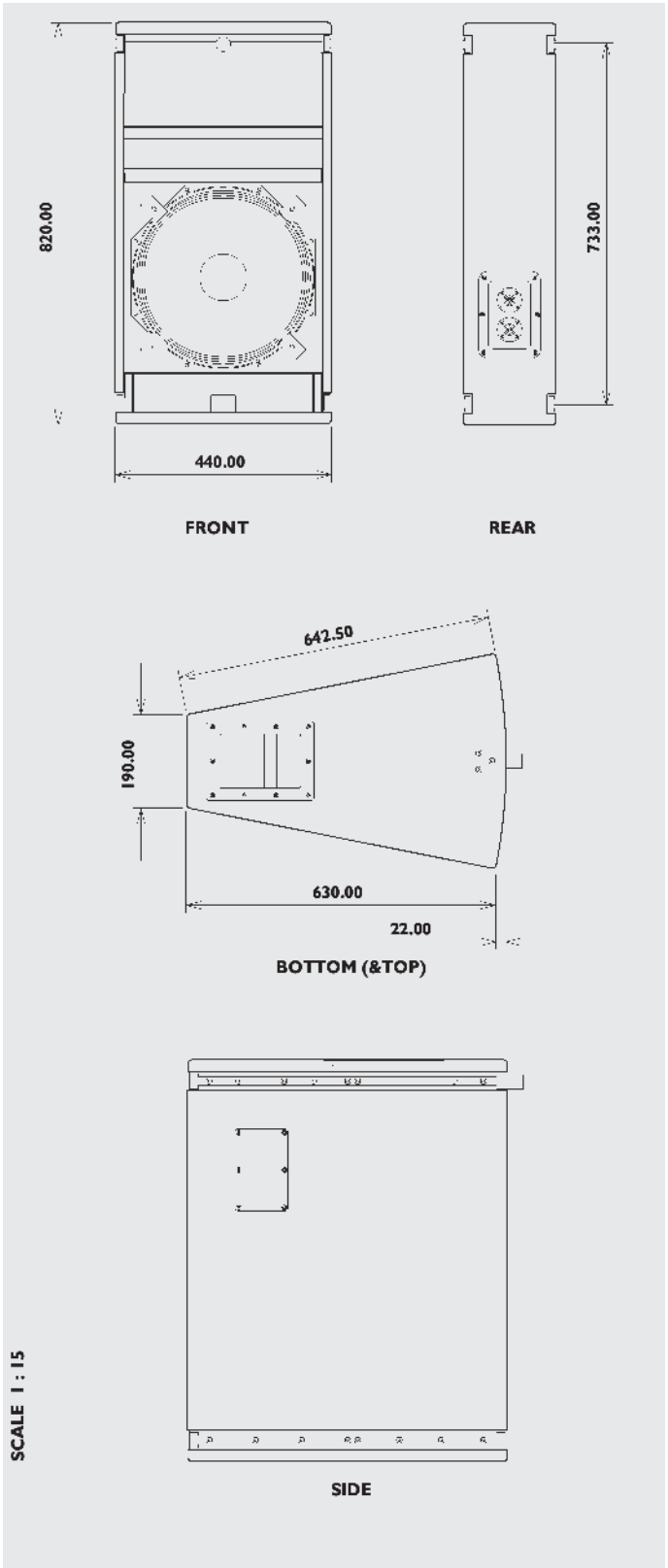
LIFTBAR: Rigging bar for use with 2 x BUMP3

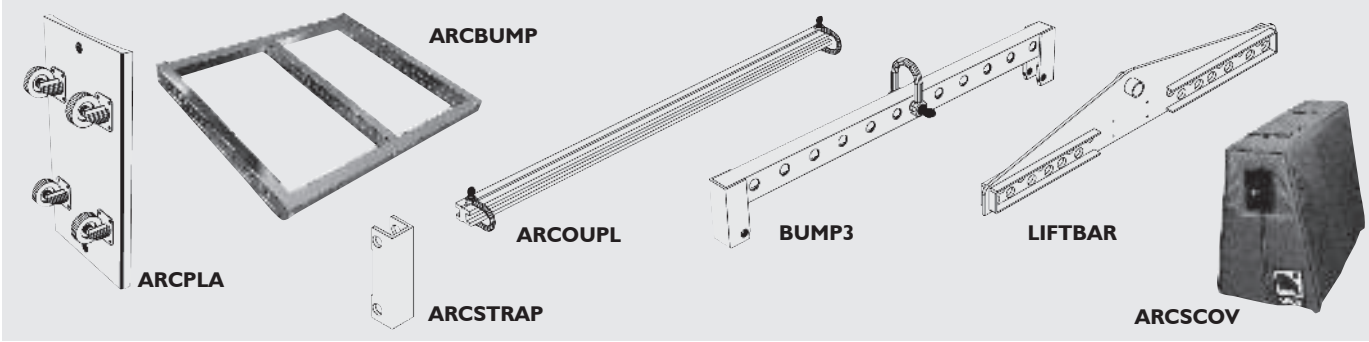
ARCSTRAP: Vertical linking elements for flying a double row ARCS configuration (provided in pairs, for front and rear attachment)

ARCPLA: Removable front dolly with castors for ARCS

ARCBUMP: Rigging accessory for flying up to 4 ARCS in the horizontal orientation

ARCSCOV: Protective cover for ARCS enclosures

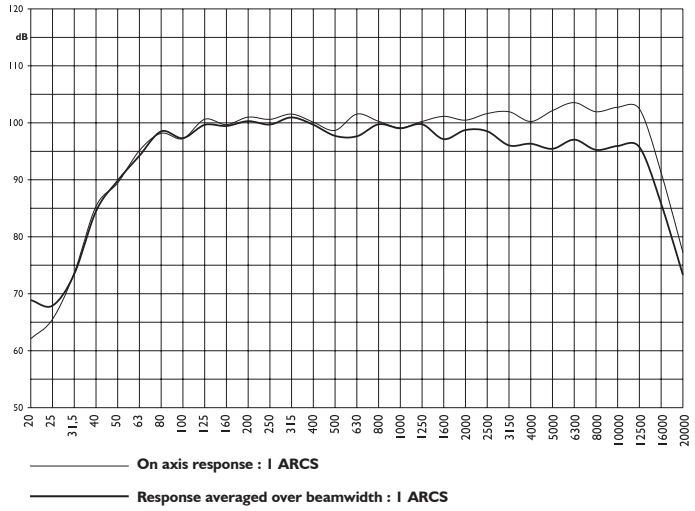




ARCS®

PERFORMANCE DATA

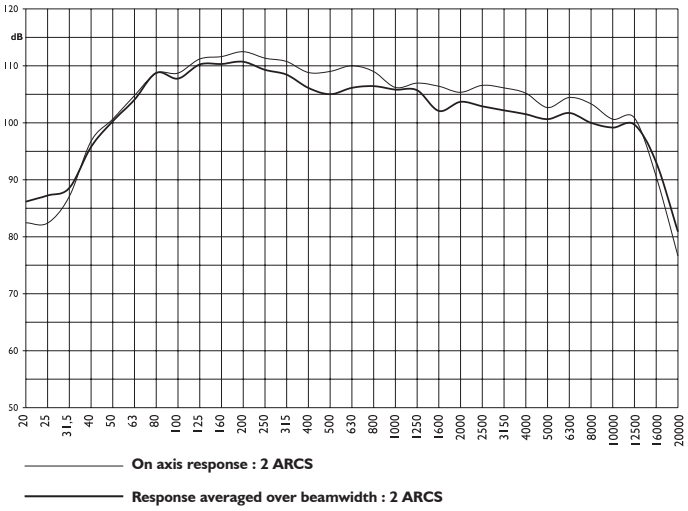
FREQUENCY RESPONSE: 1 ARCS



On axis response : 1 ARCS

Response averaged over beamwidth : 1 ARCS

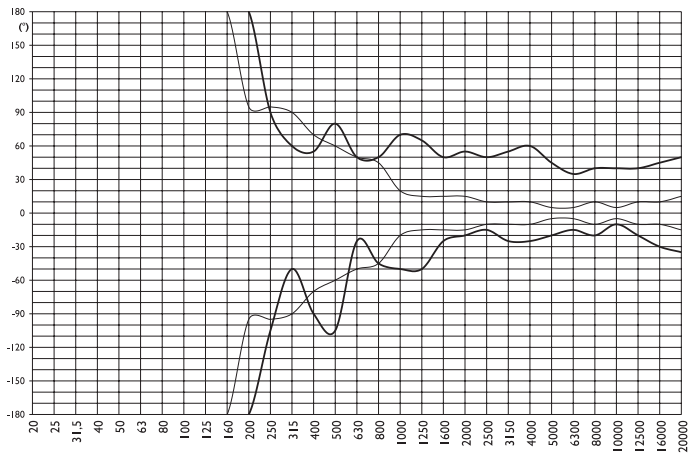
FREQUENCY RESPONSE: 2 ARCS



On axis response : 2 ARCS

Response averaged over beamwidth : 2 ARCS

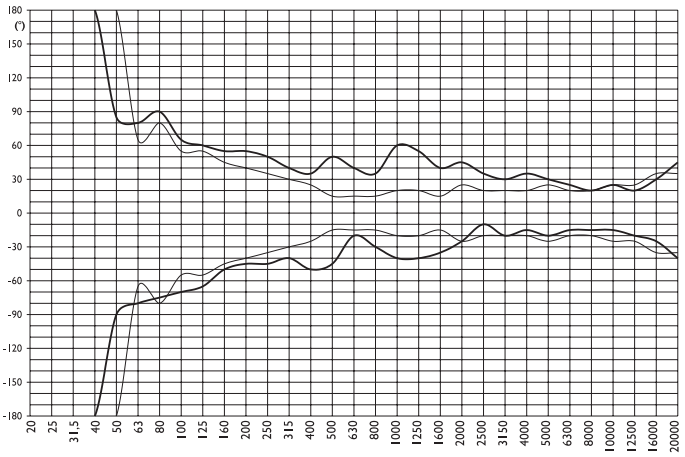
BEAMWIDTH (-6dB): 1 ARCS



Horizontal

Vertical

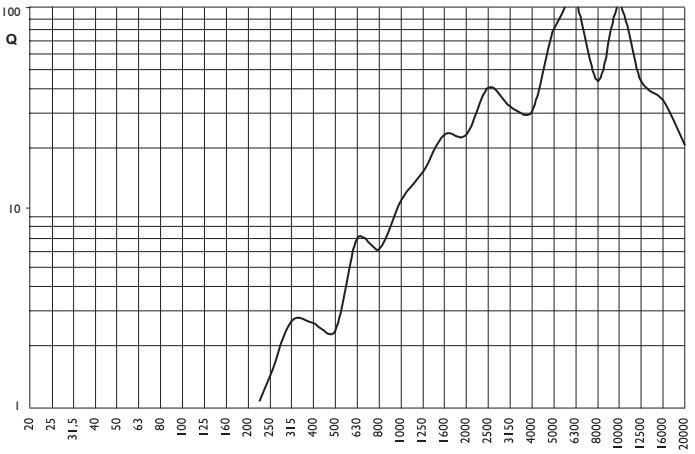
BEAMWIDTH (-6dB): 2 ARCS



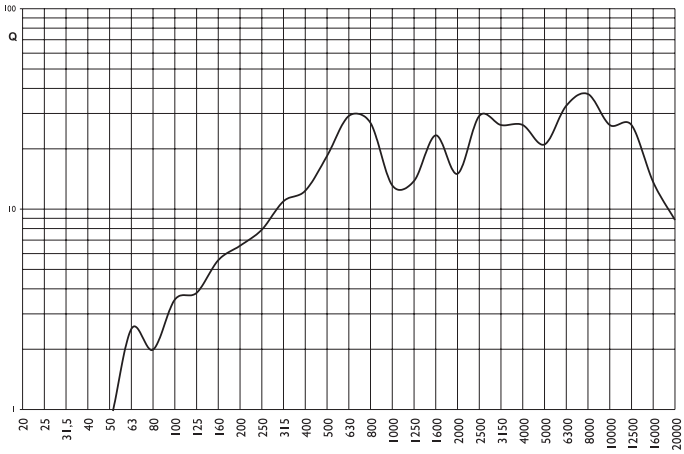
Horizontal

Vertical

DIRECTIVITY FACTOR Q: 1 ARCS



DIRECTIVITY FACTOR Q: 2 ARCS



WAVEFRONT SCULPTURE TECHNOLOGY®

The first task of sound engineers and audio consultants is to design sound reinforcement systems for a predefined audience area. Performance expectations in terms of clarity, coherence, sound pressure level (SPL) and coverage consistency have progressively increased over the years while at the same time the size of the audience has grown, inevitably leading to an increase in the number of loudspeakers.

In the past, conventional horn-loaded trapezoidal loudspeakers were typically assembled in fan-shaped arrays according to the nominal horizontal coverage angle of each enclosure in an attempt to reduce coverage overlap that causes destructive interference. With this type of arrangement, the optimum clarity available in one direction could only be provided by the individual enclosure facing in this direction. Attempts at "flattening the array" to achieve greater throw and higher SPLs resulted in severe interference in an uncontrolled way, affecting coverage, pattern control, intelligibility and overall sound quality. Even when arrayed according to specification (always an "optimum" compromise since the polar response of individual horns varies with frequency), the sound waves radiated by individual horn-loaded loudspeakers do not couple coherently thus the conventional system approach is fundamentally flawed. Furthermore, the chaotic sound fields created by interfering sound sources waste acoustic energy, thus requiring more power than a single, coherent source would in order to achieve the same SPL.

As an illustration of this principle, imagine throwing some pebbles into a pool of water. If one pebble is thrown into the water, circular waves will expand concentrically from the point where it entered. If a handful of pebbles are thrown into the water, we observe the equivalent of a chaotic wavefield. If we throw in a single larger stone, having total size and weight equal to the handful of pebbles, then we again see circular waves as for the case of the single pebble - only now with a much larger amplitude.

A Single Sound Source From Many Speakers

The initial specification for the Wavefront Sculpture Technology® (WST) research and development program was the design of a single acoustic source that is completely modular and adjustable while providing a totally coherent, predictable wavefield. In 1988, an early L-ACOUSTICS system called "Incremental" proved the project's feasibility. Based on this experimental concept, Professor Marcel Urban and Dr. Christian Heil began theoretical research and presented their findings at the 92nd AES Convention in Vienna in 1992 (Preprint #3269). The theory that was developed defines the acoustic coupling conditions for successfully arraying individual sound sources - including wavelength, the shape of each source, their surface areas and their relative separation.

Briefly, the coupling conditions can be summarized as follows:

An assembly of individual sound sources arrayed following a regular step distance on a planar or curved continuous surface is equivalent to a single sound source having the same dimensions as the total assembly if one or both of the following two conditions are fulfilled :

1) Frequency: The step distance (distance between the acoustic centers of individual sources) is smaller than half the wavelength over the operating bandwidth.

2) Shape: The wavefronts generated by individual sources are planar and together fill at least 80 percent of the total radiating surface area.

Additional conditions were published in the Audio Engineering Society journal paper "Wavefront Sculpture Technology", JAES Vol. 51, No. 10, October 2003. The first two WST conditions were re-derived (based on an intuitive approach using Fresnel analysis) and in addition it was shown that:

3) Deviation from the ideal, target wavefront (flat or curved) must be less than a quarter wavelength at the highest operating frequency (this corresponds to less than 5 mm curvature at 16 kHz)

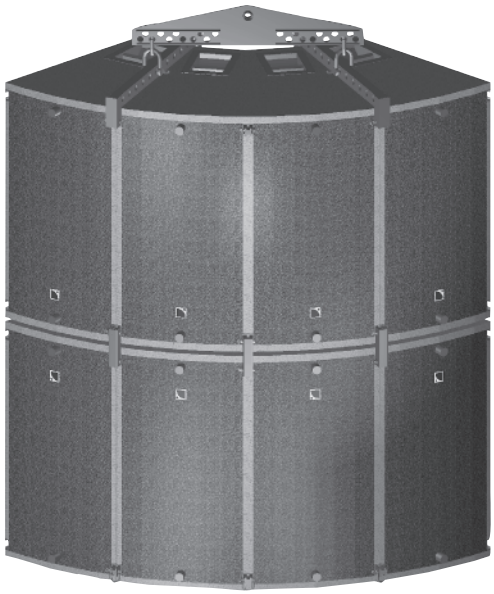
4) For curved arrays, enclosure tilt angles should vary in inverse proportion to the listener distance (geometrically this is equivalent to shaping variable curvature arrays to provide equal spacing of individual enclosure impacts on the audience listening plane)

5) Limits exist concerning the size of each enclosure, the minimum allowed listener distance and the relative angles that are allowed between enclosures.

L-ACOUSTICS defines the practical implications of these conditions as Wavefront Sculpture Technology. The first WST condition dictates the design constraints for achieving single sound source performance at lower frequencies. By loading high-frequency compression drivers with the L-ACOUSTICS "DOSC" waveguide it is possible to meet the second WST condition at higher frequencies. Since WST conditions are satisfied over the entire audio bandwidth, the sound engineer or designer is provided with a "single" loudspeaker with well-defined coverage and wavefront shape, thus allowing the geometrical distribution of energy to be precisely installed to match the geometry of the audience seating area.

L-ACOUSTICS KUDO™, ARCS®, dV-DOSC and V-DOSC® are true line source arrays. KUDO, dV-DOSC and V-DOSC are designed for large audiences and long-throw applications while ARCS is suitable for medium-throw needs. All use the heart of Wavefront Sculpture Technology - the patented DOSC Waveguide - to achieve remarkable results.

Single-row ARCS array



Double-row ARCS array

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