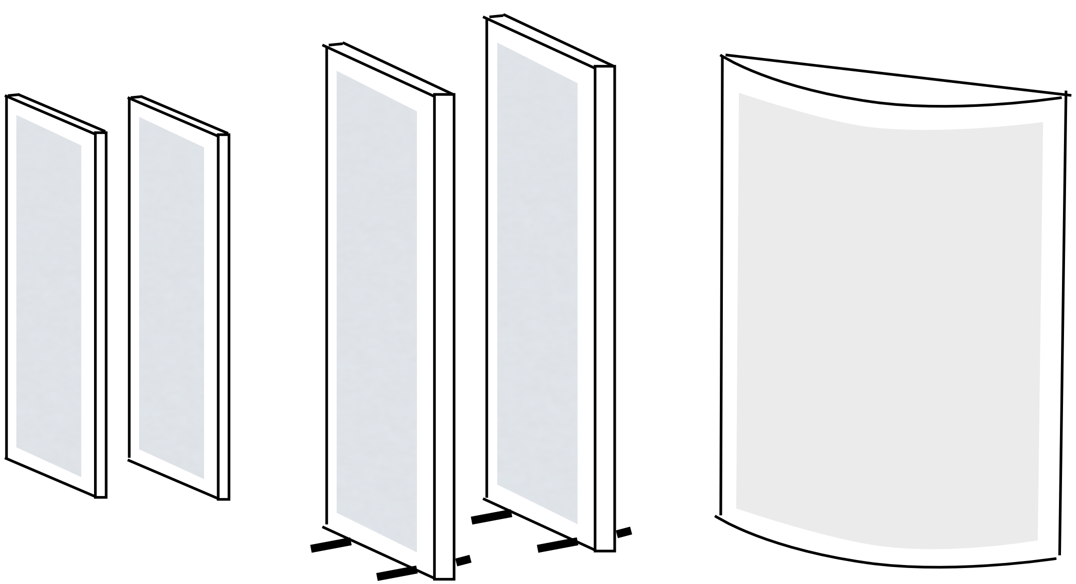
May 2012. LeadingEdge Tech Sheet 3 – Room Acoustic treatment with'D' Panels, flat panels and spline diffusers.

This interim tech sheet is issued in order to get important technical information out about the first tranche of LE products.

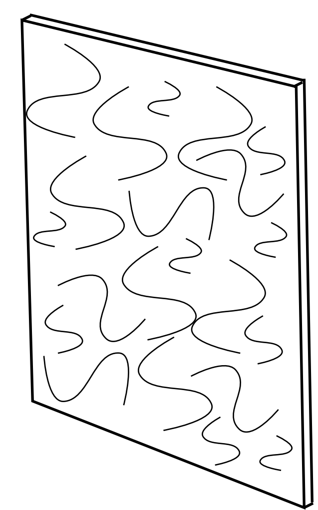
Please use the current LE marketing brochure in general for customers, but if necessary use this document for direct one-to-one advice to customers.

Two technology groups

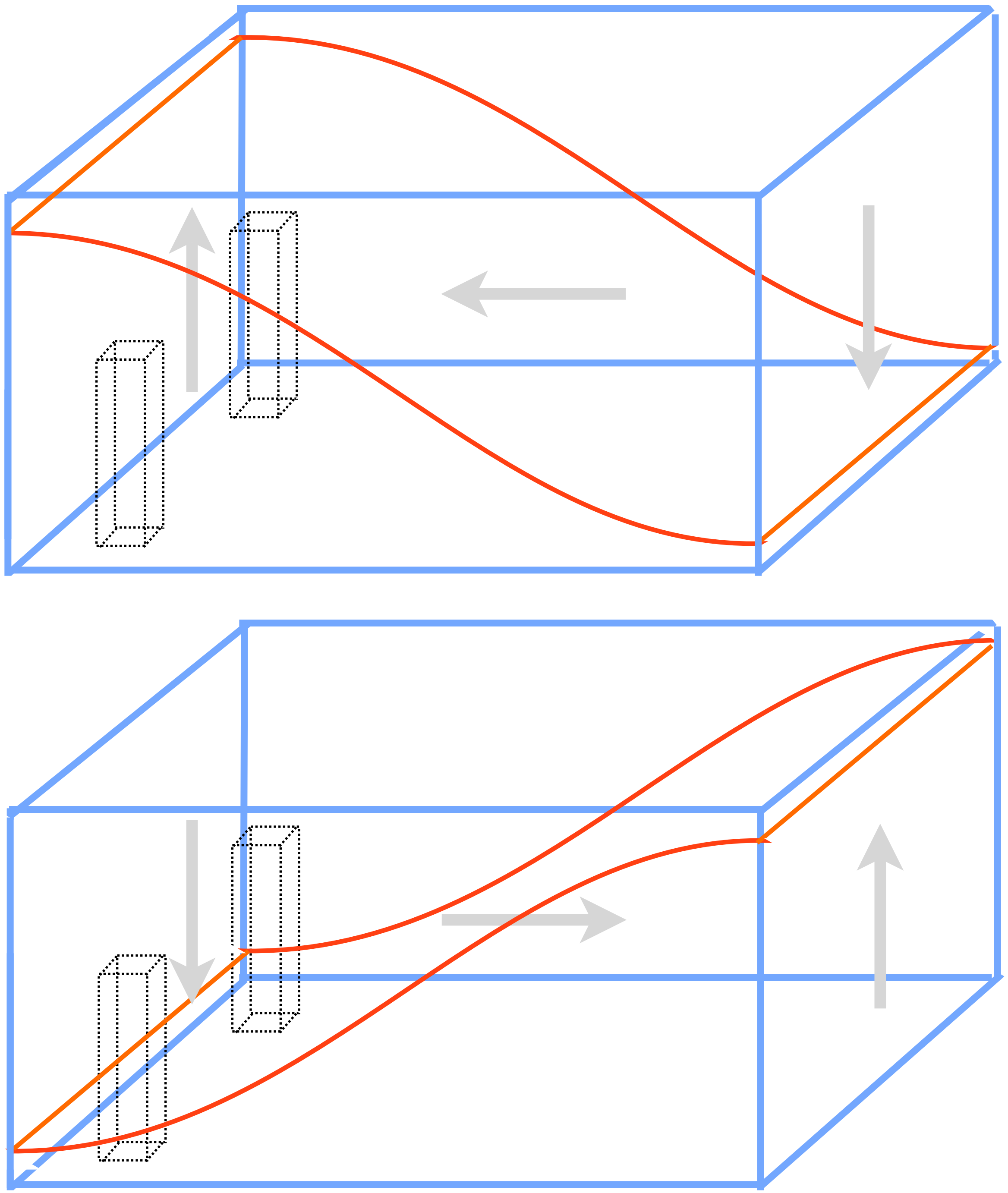
Flat panels and curved 'D' panels using micro-perforation technology



3-dimensional diffusers based on spline mathematics



Micro-perforation technology, 'velocity choking' principles, and the problem of standing waves

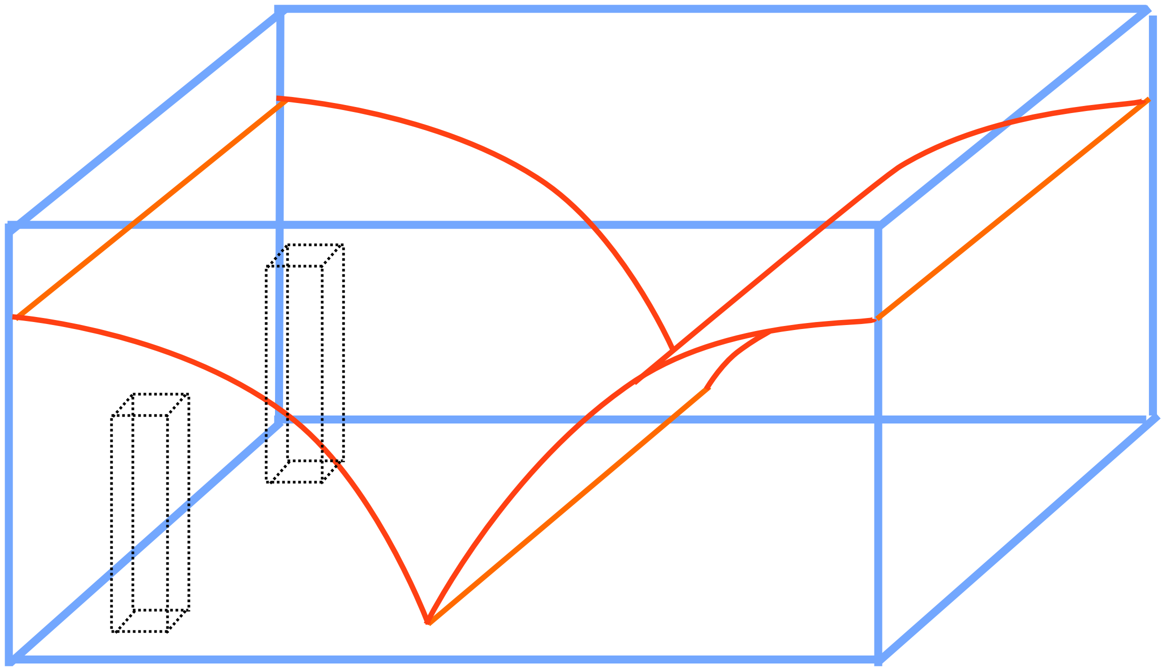


wave diagram

In this simple diagram our room is energised by a pair of speakers positioned symmetrically on the short wall

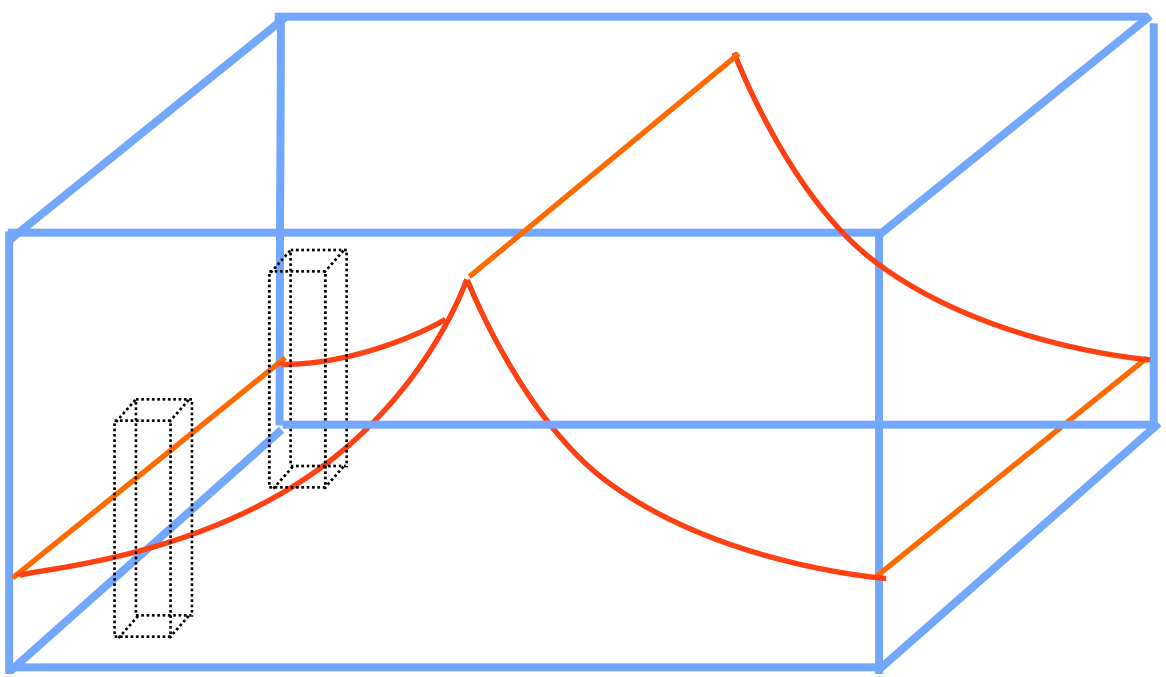
When resonating at the rooms fundamental frequency (a standing wave) the air pressure goes slightly positive and then slightly negative at each end of the room as the air mass 'sloshes' from one end to the other. Half way along the length of the room, the sound wave is working completely in the velocity mode - there is no pressure change here, and we cannot hear the sound at this point. We tend to assume there is no bass problem here, because we cannot here it at this location. But it is there of course, in its velocity component, transmitting its energy to the other end of the room, where we can hear it again.

Furthermore, when the air is moving back and forth in this velocity 'zone', the movement will move all the higher frequency travelling waves back and forth too. This causes significant intermodulation of all the musical bandwidth, blurring image and detail and adding coloration to tonal content.



pressure diagram

In this diagram we show how the pressure changes are greatest at the ends of the room, and effectively zero at the mid-point of the room. And this is how we naturally 'sense' the behaviour of the bass resonance in the room.

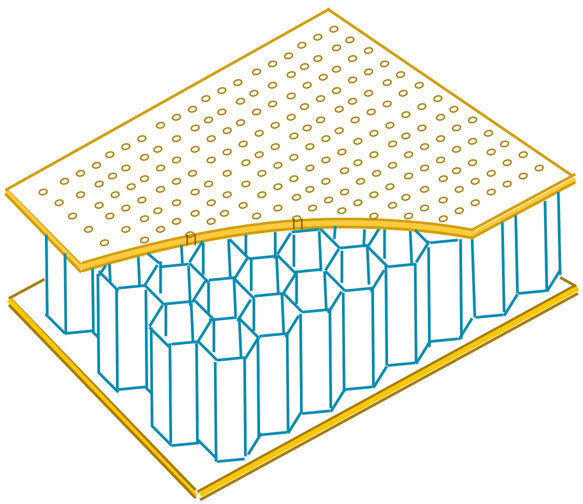


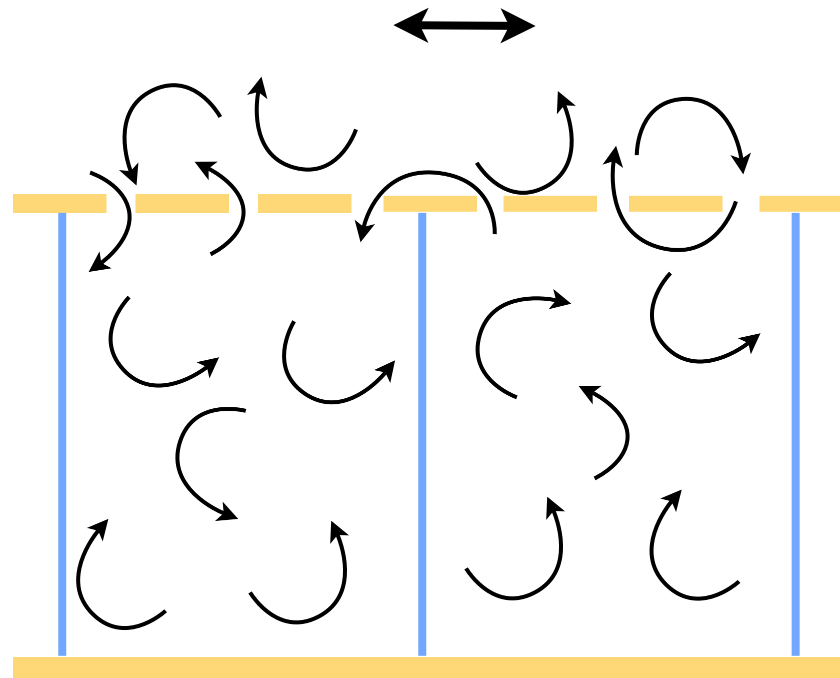
velocity diagram

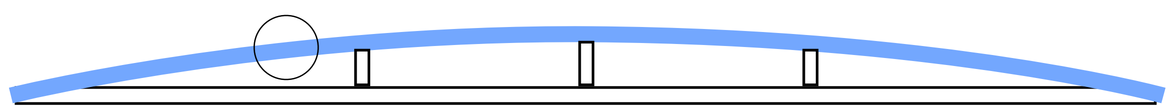
But in this diagram we are representing the acoustics in its velocity component, showing that it is at its maximum at the mid-point of the room. It is in this region of the room that we can create a velocity choke using 'D' panels.

In free space our acoustic energy moves back and forward in the velocity domain completely unimpeded. Local flat surfaces, even if covered with acoustic foam ect. have no significant effect.

In the vicinity of the micro-hole surface, as the velocity component builds, there is a corresponding rise in aerodynamic drag, absorbing energy from the velocity part of the wave.







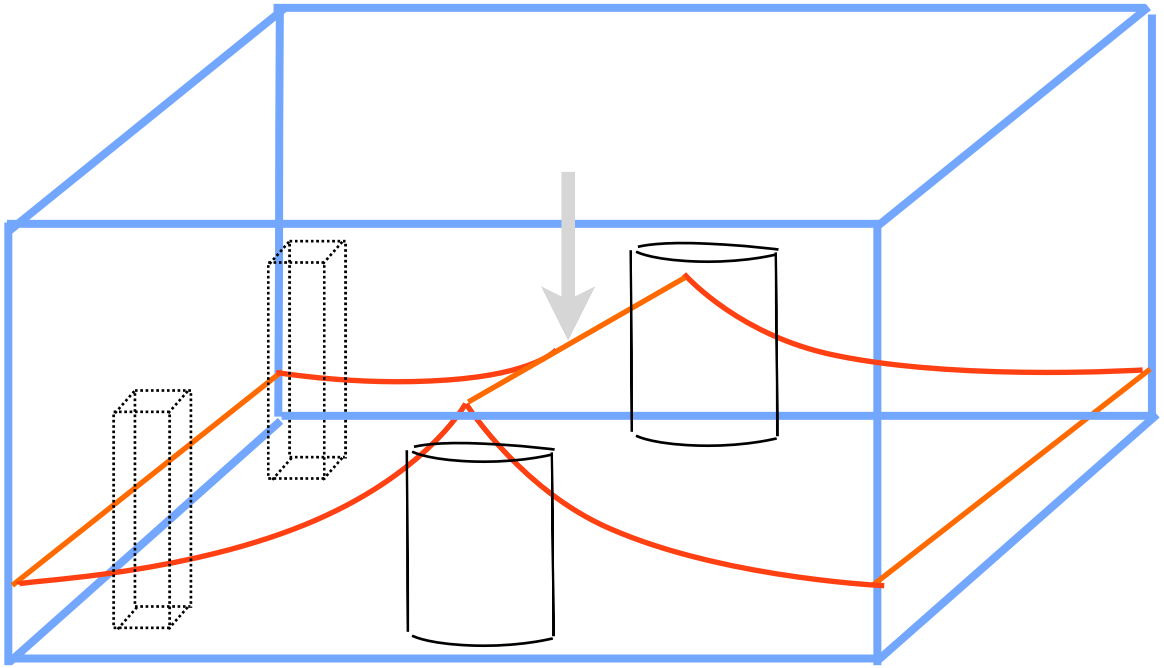
This is how the micro-hole acoustic panels are constructed internally. They work in a completely different way to foam, and are far more effective than foam, therefore requiring less surface area in a room to have a great effect.

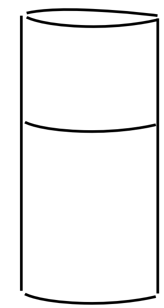
These panels are used on the underside of the platforms, on the mini-panels and on the large D panels

The perforations, and the cells below, create lots of little turbulent 'eddys' as the sound passes over the surface in the velocity part of the wave - adding a lot of drag which stops the wave. This is known as a viscus loss technique.

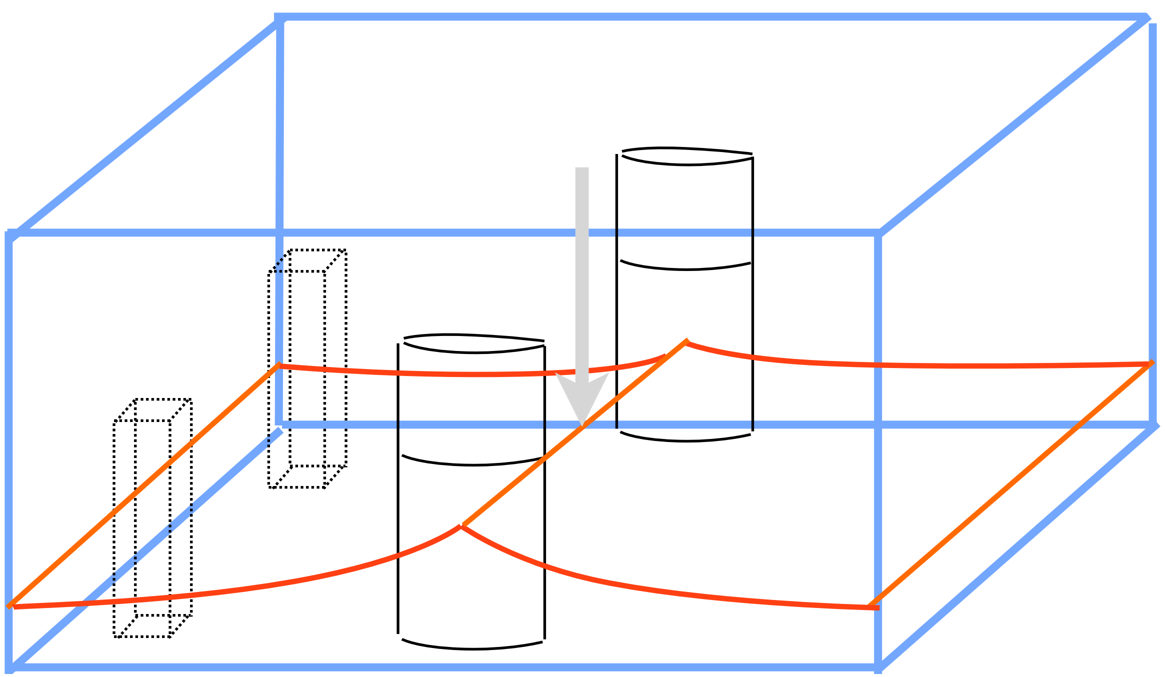
Because of the rotating eddies in the cells below, the air literally blows and sucks through the holes in a random way, but by greater amounts as the local air velocity increases. thus increasing the amount of turbulence over the surface.

pressure diagram

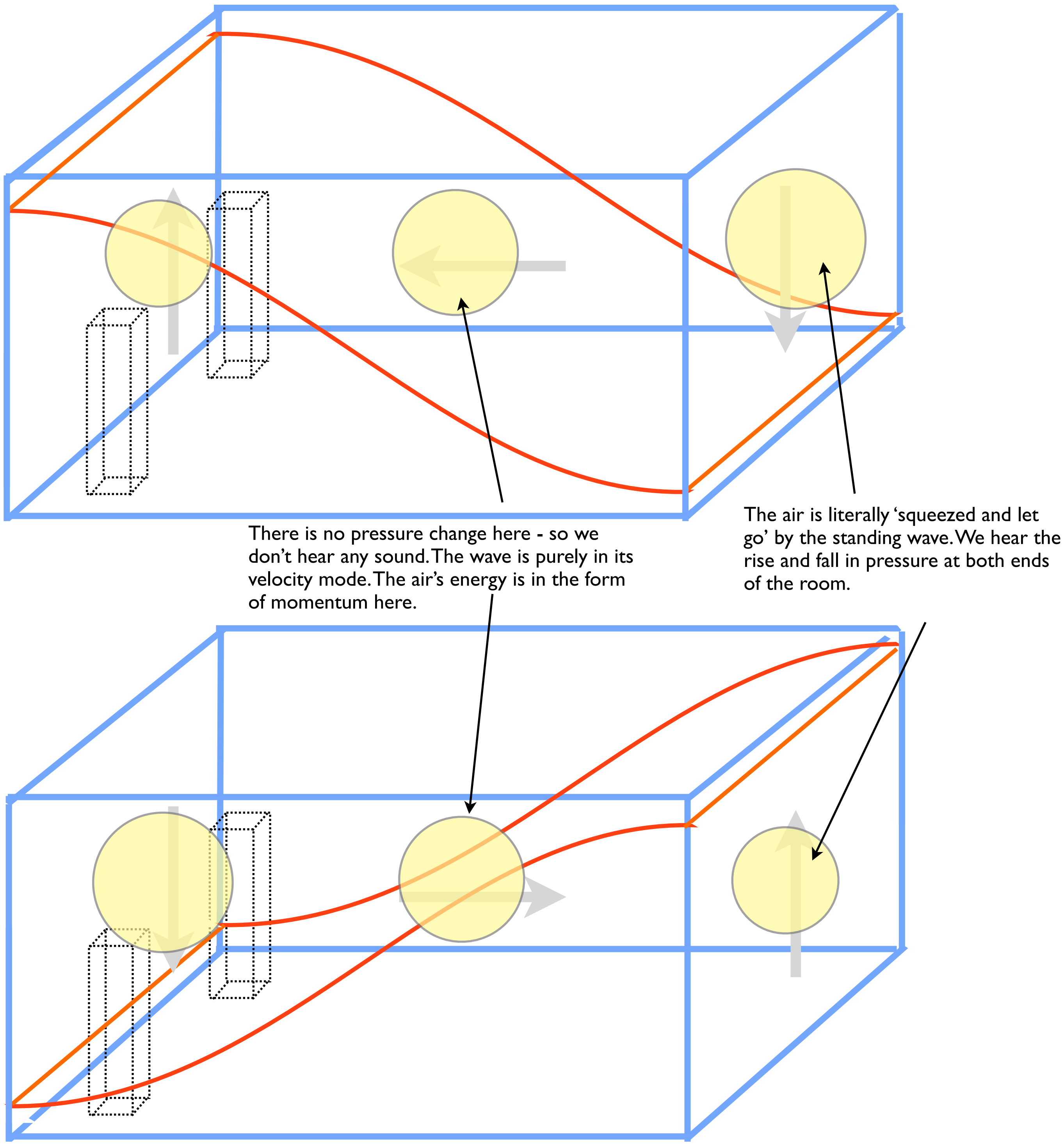




velocity diagram



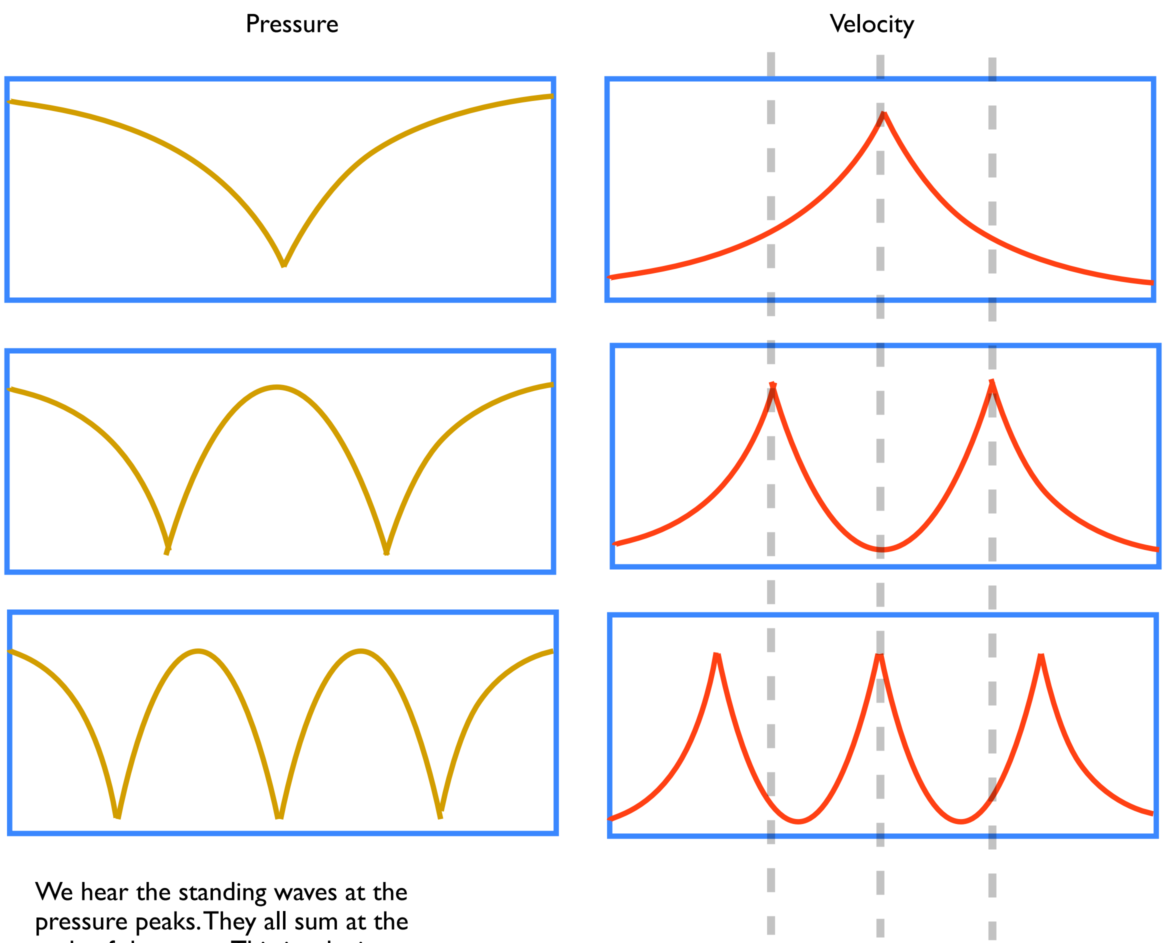
As the velocity decreases, the damping effect of the panel decreases also, because its not generating as much turbulence. So there is a natural self-controlling property to this principle and it won't over-damp. It will attenuate to a moderate extent and you will notice a reduction in splashiness and echo in the room, and the room will seem quieter and more comfortable for conversation. But it's when there is excessive velocity at the room resonances during music playback that the real 'choking' effect occurs. The effective control in the behaviour of the room when listening is profound.



The pressure component of sound is referred to by scientists as a 'scalar', which means it only has a single parameter to define it. Pressure has a magnitude but no direction. Sound pressure level is the variation above and below atmospheric pressure.

The velocity component of sound is a vector and has two parameters to define it. For sound it has speed and direction.

In modern acoustics management, products like the velocity microphones from Microflown Technologies have 3 orthogonal acoustic particle velocity sensors, and one pressure microphone mounted on a single sensor head. This is the only way to get a true representation of acoustics at any specific point



We hear the standing waves at the pressure peaks. They all sum at the ends of the room. This is why its worst to put the electronics at the end of the room, but we cannot assume its fine to place the electronics where we cannot hear the sound.

Best to place the velocity chokes at the half and third points along the room.

The micro-hole panels are very efficient at lowering the velocity component. Drag increases witht the square of velocity. Because the standing waves buid up with resonant tendencies we will get an uneven velocity profile within the room.

Whilst these diagrams show the principles longitudinally down the length of the room, they also apply across the width, and vertically too, although the longitudinal effect is generally the primary issue to treat. By fitting panels to a ceiling, in the centre area of the room, they will function both with longitudinal standing waves, and standing waves across the width of the room.

Using Spline Diffusers and flat panels