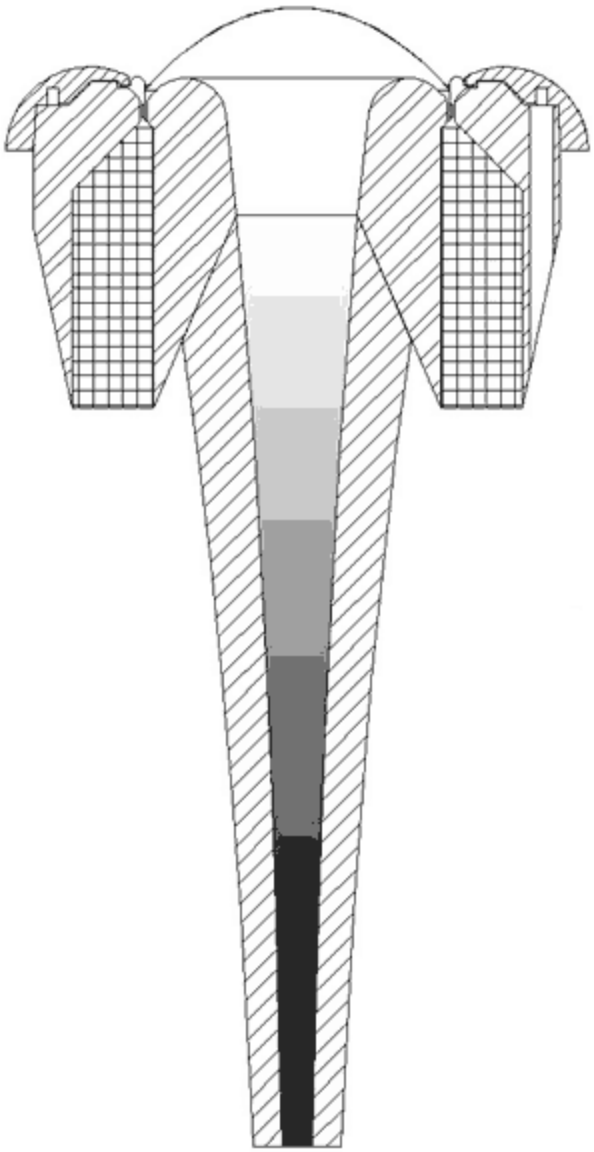
## *Tapered Tube Loading*



In the early days of the quest for resonance and reflection free drivers it became abundantly clear that in order to fully complement the transparency of reproduction from a well designed dome transducer something had to be done to remove any hint of cabinet colouration. Colouration which could usually be traced back to resonant air pockets, the eigentones of the main cavity or structural modes in the enclosure walls

Mounting the drivers in the side of a large cylinder proved a very effective way of smoothing the path for the forward radiation but this did nothing for the sound coming out of the driver rear which has to be confined or dissipated in some way.

Initial results, using a ring magnet within the voice coil diameter and a small central hole to connect the rear of the dome to the outside world, suffered from a strong Helmholtz resonance problem which imposed a severe peak and dip in the forward response. Replacing the magnet with an external ring and opening out the hole in the pole to the greatest diameter possible allowed the rear radiation to emerge unhindered but when attached to any sort of enclosure this performance was inevitably compromised by the resonant modes of the enclosed air space. Adding damping can improve this greatly but there had to be a better way.

. Coupling the driver instead to the end of a long tube excited a classic series of resonances but these were rather easier to damp out with a fibrous filling than with a short wide enclosure but it required rather a long tube to get good results. Serendipity came to the rescue however, and, while searching for a way of reducing the overall volume of the tube for use at lower frequencies, it was decided to try an exponentially tapered tube. Above its 'cut-off' frequency such a device behaves pretty much like one of constant area but occupies about a third of the volume. That wasn't really the issue for a mid-range unit where size was not a problem but, when adding the damping material it was found that simply dragging a length of fibre mat into the tube and letting the taper of the tube naturally increase the density of the filling towards the narrow end resulted in a performance which actually exceeded that of the parallel tube in terms of freedom from reflection. And it proved remarkably insensitive to changes in fibre density.

This principle has now been applied to both the high frequency and mid-range units in various Vivid systems and ensures the best performance from both.