PMC Loudspeakers and the National Physical Laboratory, Teddington

Wednesday 04/07/2013: PMC at the NPL. NPL and PMC hosted a press event to show the latest work using a scanning laser interferometer to map the acoustic output, the spatial sound radiation, of loudspeakers over the mid and treble frequency range. This is a key region encompassing the crossover frequencies and is also where the radiation from the drivers becomes more complex due to phase effects from the driver and diffraction interfence from the enclosure. By visualising the radiation patterns, somewhat like ripples in a pond, abberations may be analysed and corrected. This work goes hand in hand with listening tests to establish the degree of corellation possible with sound quality.

Oliver Thomas (PMC) and Richard Jackett (NPL) explaining the technique

Richard Jackett and the £45,000 NPL laser scanner

In respect of the new PMC ‘fact.12’ (meaning ‘twelve’, not ‘point one two’) loudspeaker launched at Munich this three way design has a new PMC made, 50mm soft dome mid driver where the subtle shaping of the mounting plate materially affects the way the sound waves lift cleanly away from the driver. The NPL laser analysis resulted in the particular shaping at the edge of the diaphragm plate in order to optimise this design.

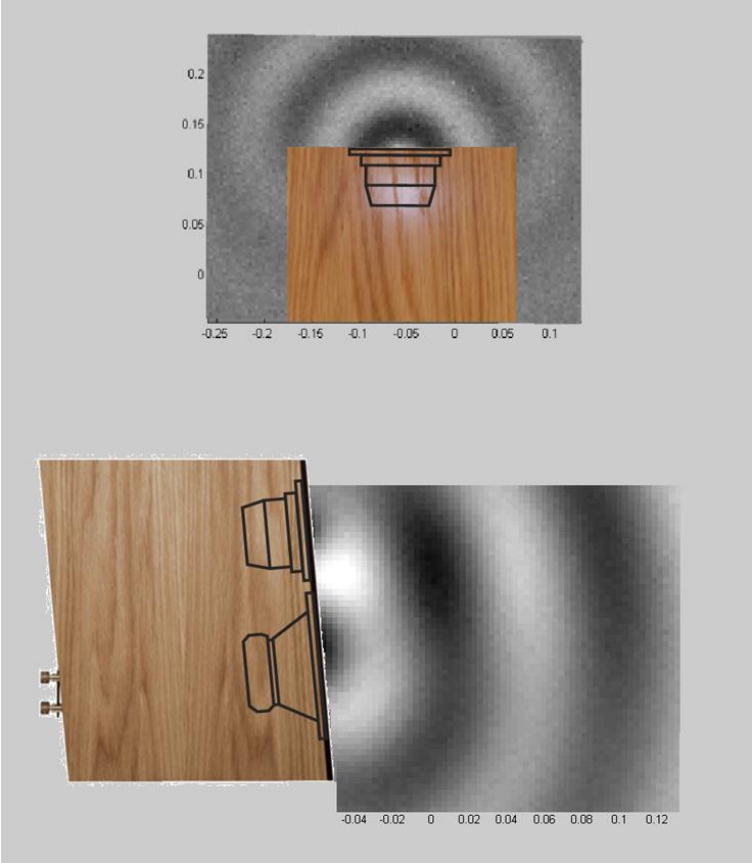
The analysis is carried out in very low ambient noise conditions in the ‘hemi anechoic chamber’, this where one plane of this echoless, reveberation free room is reflective, a so called ‘ground plane’ where this plane is has proved essential to allow for the critical setup of the equipment. The scaning laser fires across the emitted soundwaves, is exactly reflected back from a curtain coated with spherical glass beads behind the speaker, and the reflected wave delay is then computed to high precision to reveal data about the intensity of the sound radiation coming from the speaker.

It relies on the emitted sound wave changing the properies of the air in the radiation space, its velocity, density and temperature which will subtly alter the laser beam velocity, so revealing itself under post processing. The data is stacked to create maps

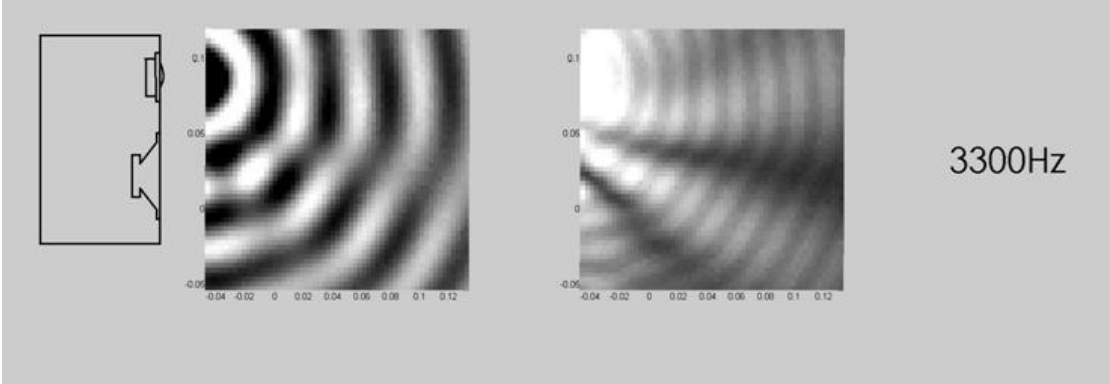
of intensity and the input stimulus is a broad band impulse allowing radiation maps to be produced over a useful frequency range.

Oliver Thomas led the design of this new loudspeaker which employs Peter Thomas' trademark ATL transmission line technology. At the NPL do, it was Oliver Thomas and NPL staff member Richard Jackett who took us through the theory and ran the demonstrations in real time on a small PMC active monitor.
In addition to the in-cabinet radiation from drivers, the performance of the crossover between two drivers can be seen in disturbed and changing patterns in the overall region. Already work has begun to learn the steps required to smooth and integrate the acoustic outputs to a higher precision than previously obtained.
Alternative methods of exploring the three dimensional radiation performance exist, such as sound field partially disturbing arrays of multiple microphones, or the laborious but effective methods using a motorised turntable for the speaker combined with multiple microphone locations. The laser approach lends itself to animation where the relative changes in behaviour can readily be observed over frequency and angle in a short video. There is a running scale for frequency and it may be paused as required for more detailed inspection.

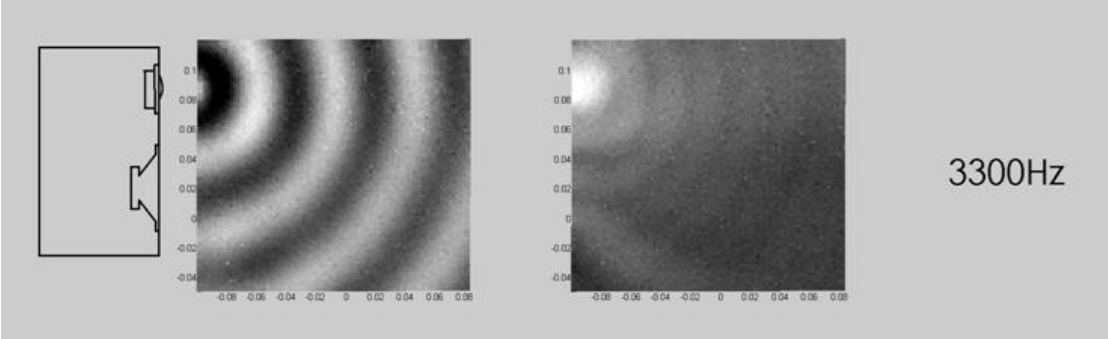
Oliver Thomas (left) in the NPL 'Hemi' anechoic chamber, the latter augmented by a scattering of floor wedges.



Here is a top view and side view of the wave propagated output, near crossover of a two way ‘fact’ loudspeaker



A trial two way system with a passive second order crossover showing some interference between the driver outputs, ie not ideally integrated



The sane system but in active form proving tighter driver control plus a steeper rolloff fourth order filter. The same crossover frequency now shows improved radiated wave coherence.


Oliver explaining to the press

The facility may also be used to measure the absorption of acoustical material such as felt or foam applied to loudspeaker front panels and the laser scan can reveal how the radiation is affected by such additions.
We were also shown the NPL reverberation chamber, a large and irregular hard walled room, which when unencumbered by visitors has an extended reverberation time of no less than 15 seconds and is useful for generating uniform sound power for measuring loudspeakers and sources, and for the reciprocal calibration of precision microphones, here to a world class accuracy of 0.02dB. The absorption represented by the visiting group present in the chamber shortened the reverb by 2/3 but it was still possible for Richard sing a note, and then harmonise with that still decaying note.

MartinColloms