11.9 Beam blockers, diffusers, and such

In a loudspeaker, beaming effects increase with increasing frequency (Chapter 11.4). The treble, i.e. frequency range upwards of about 1 kHz, is predominantly radiated on-axis, while the lows propagate spherically in all directions. If the loudspeaker (e.g. a 1x12") is set on the floor, the guitarist standing right in front of it or next to it gets to hear too little treble. If the guitar player positions the speaker at the level of his head, the treble will be unbearably shrill (and dangerously loud, potentially damaging the hearing system). Therefore, beam blockers are available that are supposed to distribute the treble within the room, working similar to a diffuser lens.

The concept of the acoustical lens has in fact been around for quite a while – it is already mentioned by Olson [1957]. Similarly to an optical lens, the peripheral sections of a wave need to be delayed if divergence is called for (**Fig. 11.104**). To achieve that, the peripheral sound rays are run through an array of slanted sheets bent in serpentine fashion, creating a longer, indirect path and therefore a phase-shift. JBL has introduced these acoustical lenses in the early 1970's, but they vanished again from the market as horns were further developed.

Fig. 11.104: Acoustical diffuser lenses; pictures from: www.jblpro.com

Today, not lenses but massive scattering bodies are deployed in order to reduce beaming effects in guitar loudspeakers. The **Weber Beam Blocker** (**Fig. 11.105**) is supposed to scatter the treble coming from the speaker-center via a spherical cap of convex shape. However, theoretical acoustics teach that beaming will occur the stronger, the larger the (uniformly) radiating source is – a ring-shaped emitter therefore does not have less beaming compared to the membrane centre thought to be the source of the treble. Reality is even more complex because it's not only the centre of the membrane that can radiate treble but the fringe areas as well, and because the beam blocker will reflect sound back to the membrane, too.

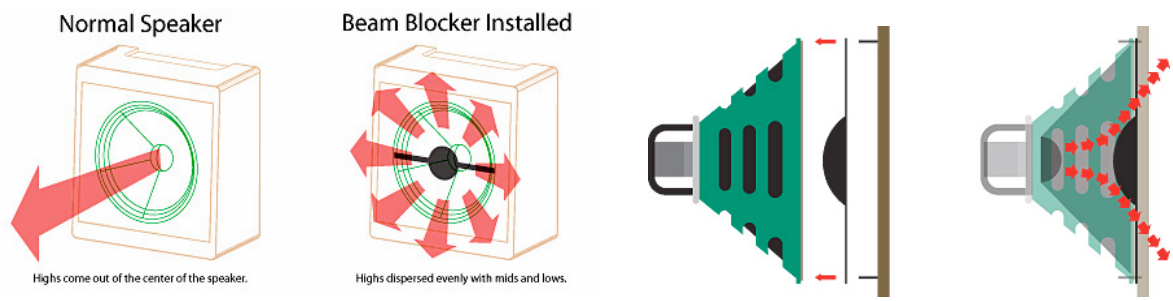

Fig. 11.105: Weber Beam Blocker, www.webervst.com/blocker.html

To obtain quantitative data, a **Tubetown-diffuser** was fitted to a 12"-loudspeaker mounted in the cabinet of an 18-W-Marshall. Measurements were done in the anechoic chamber with the loudspeaker box positioned on a turntable (B&K 3922), and the microphone (B&K 4165) located at the elevation of the speaker axis. Distance was 3 m. To obtain the colored directional spectrograms, pink noise was analyzed using overlapping 1/3rd-octave filters. The results are shown in **Fig. 11.107** (level dynamic = 40 dB) as a function of turn-angle (abscissa) and frequency (ordinate). The directional diagrams pictured below this are horizontal cuts through the color-diagrams.

As can be seen without much difficulty, this diffuser has practically no effect at low and middle frequencies – this indeed being purposeful. Around 3.5 kHz for the G12H, and around 5 kHz for the P12R, a slight broadening of the radiation is achieved. The effect is moderate – as is the price. “I’d rather invest those 15 Euro in a few beers – that will change my sound, too” … this assessment would not seem unreasonable. For those who want to experiment themselves (with the diffuser, not with beer): fasten a cardboard disc (∅ 8 cm) to the outside of the speaker cloth, and if you like what you hear, then buy the professional diffuser and mount inside of the cloth to the loudspeaker frame. Or make one yourself from cardboard.

Jay Mitchell proposes another solution in the "*Manufacturers' and Retailers' Forum*": a doughnut of foamed plastic is positioned within the circular cutout in the baffle board that however must not touch the membrane. The thickness of the doughnut is just under the thickness of the baffle board (about 15 mm), its outer diameter corresponds to the speaker-cutout in the baffle (about 28 cm for a 12”-speaker). The hole in the centre of the foam doughnut measures about 7 cm. Supposedly this arrangement will also distribute the treble better within the room. Our measurements cannot confirm this assumption: the main effect is a dampening of the treble. Which may in fact be a solution for the original problem, too.

Hoovi offers a rather more expensive solution: a *handsomely* styled reflector panel that is intended to deflect the sound to the side and to the top. Indeed, this works, and you can join the fun for the stately sum of around 350 Euro per speaker. Don’t stumble over the thing, though, and make sure you don’t leave it behind during the load-out. That would be rather aggravating considering the price. Also, you will not want the precious device to be scratched – but then you won’t let your roadie throw your prewar-Adirondack on the truck without a case, either; so: take along a tailor-made transport case. And don’t you dare set, instead of the Hoovi, a slantwise cut detergent-drum in front of the amp! That does work as well – but looks decidedly less noble♣.

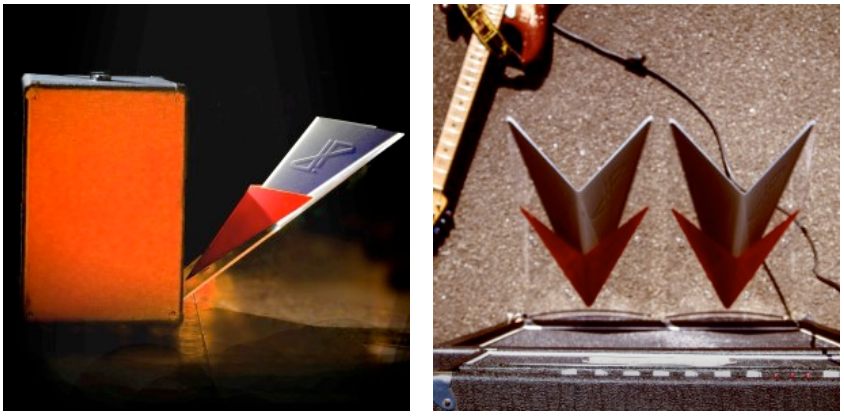

Fig. 11.106: Deeflexx, Donar's missile. [www.hoovi.at] Particularly interesting is the solution for 2 speakers: the sound deflected towards the right from the speaker on the left … where does that in fact go? Yep, exactly – that’s where it goes!

♣ Cited from the depths of the www: “if the guitar player doesn’t cut it, at least his rig should look cool…” Opposing view: “no way I’m going to let such a shitty-looking thing ruin my vintage AC-30-appeal”.

The following measurements were done, at a distance of 3 m in the AEC, with a Tube-Town diffuser attached to a G12H that was mounted in a Marshall-18-W-cabinet.

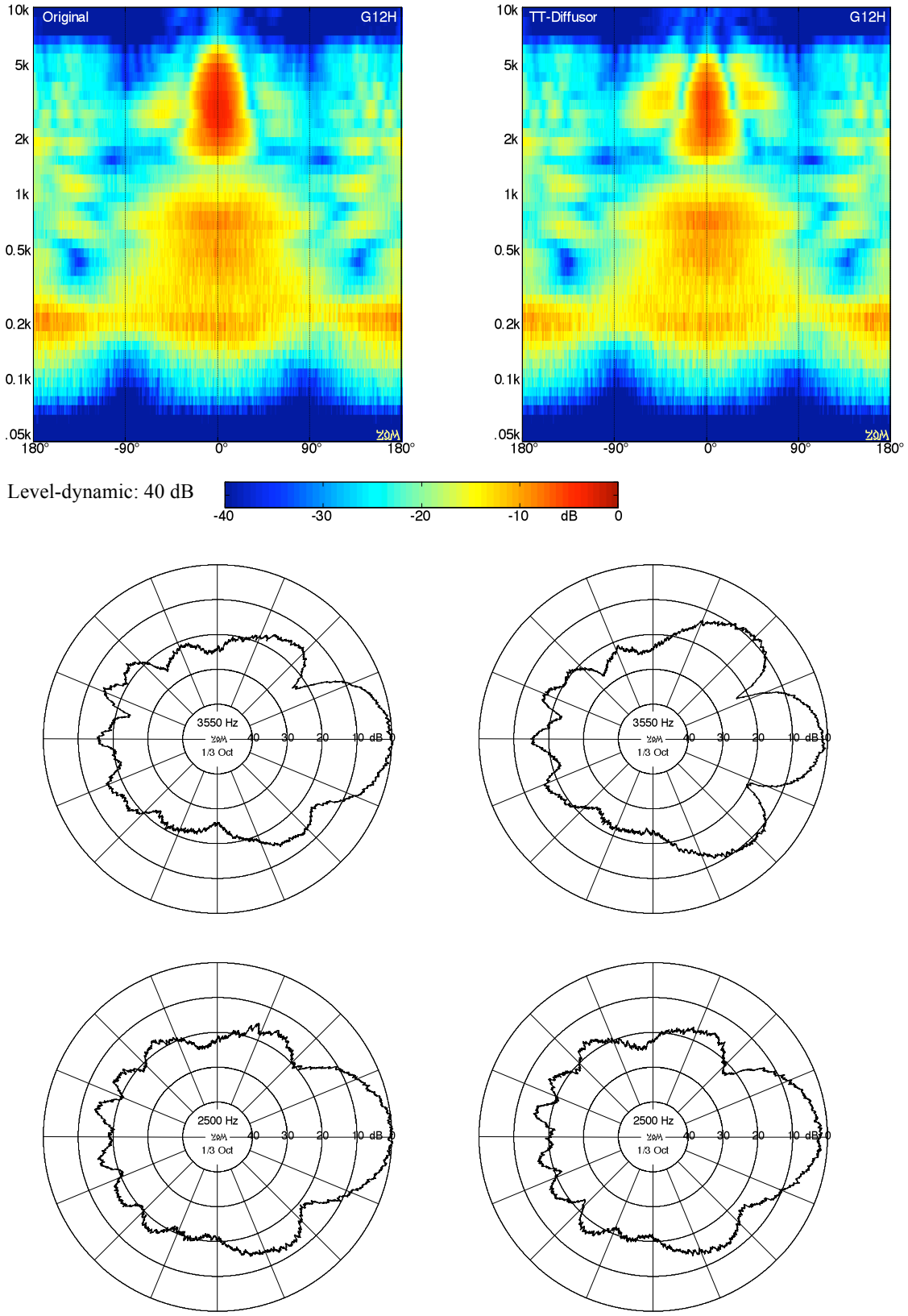

Fig. 11.107a: Celestion G12H; without (left) and with (right) Tubetown diffuser.

The effect of the diffuser shifts to higher frequencies for the P12R (which radiates somewhat more treble than the G12H).

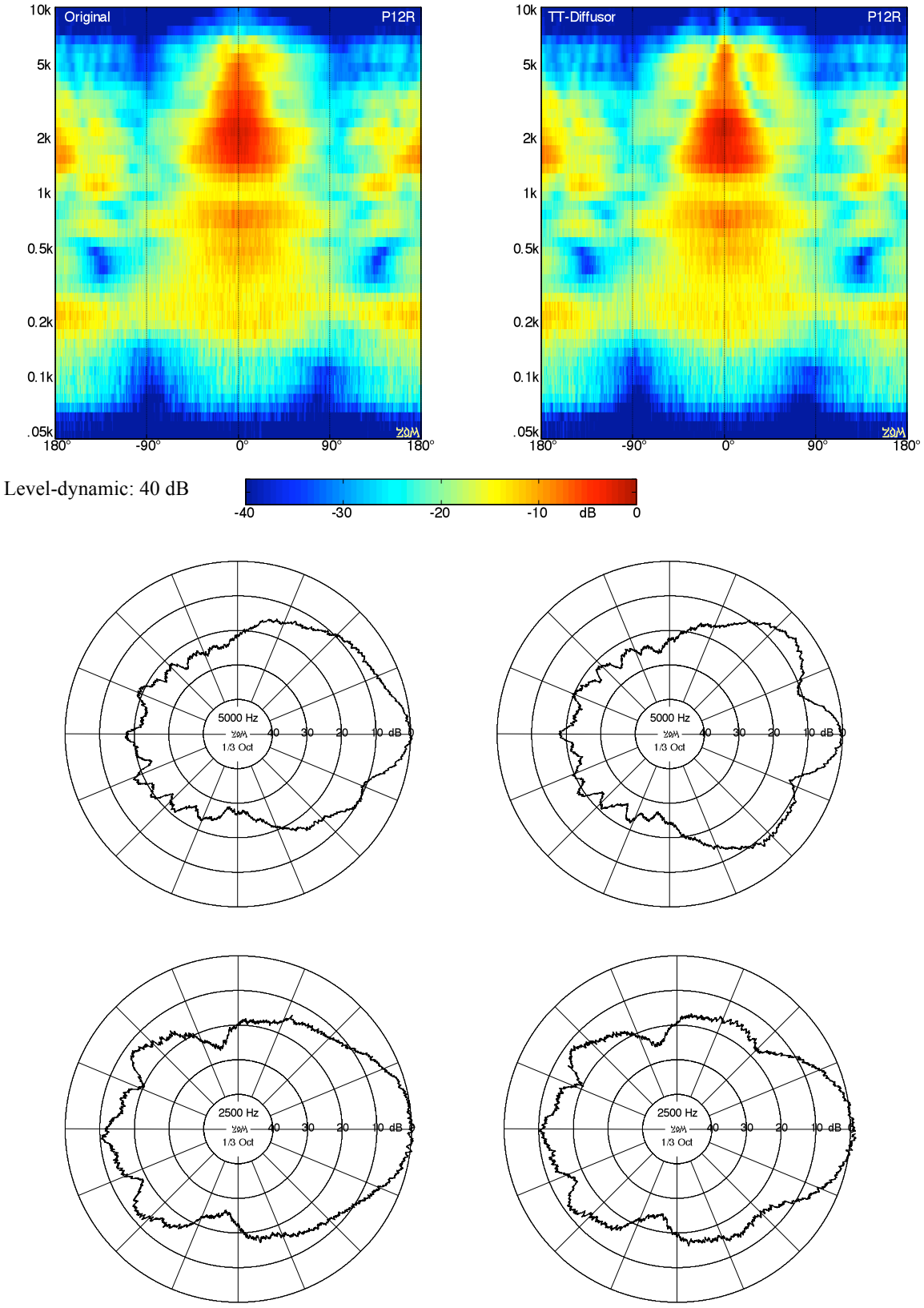

Fig. 11.107b: Jensen P12R; without (left) and with (right) Tubetown diffuser (left).

For the angled diffuser (construction similar to the Deeflexx), the effect is more brute, the distribution is broader, and there is a total treble-loss on axis.

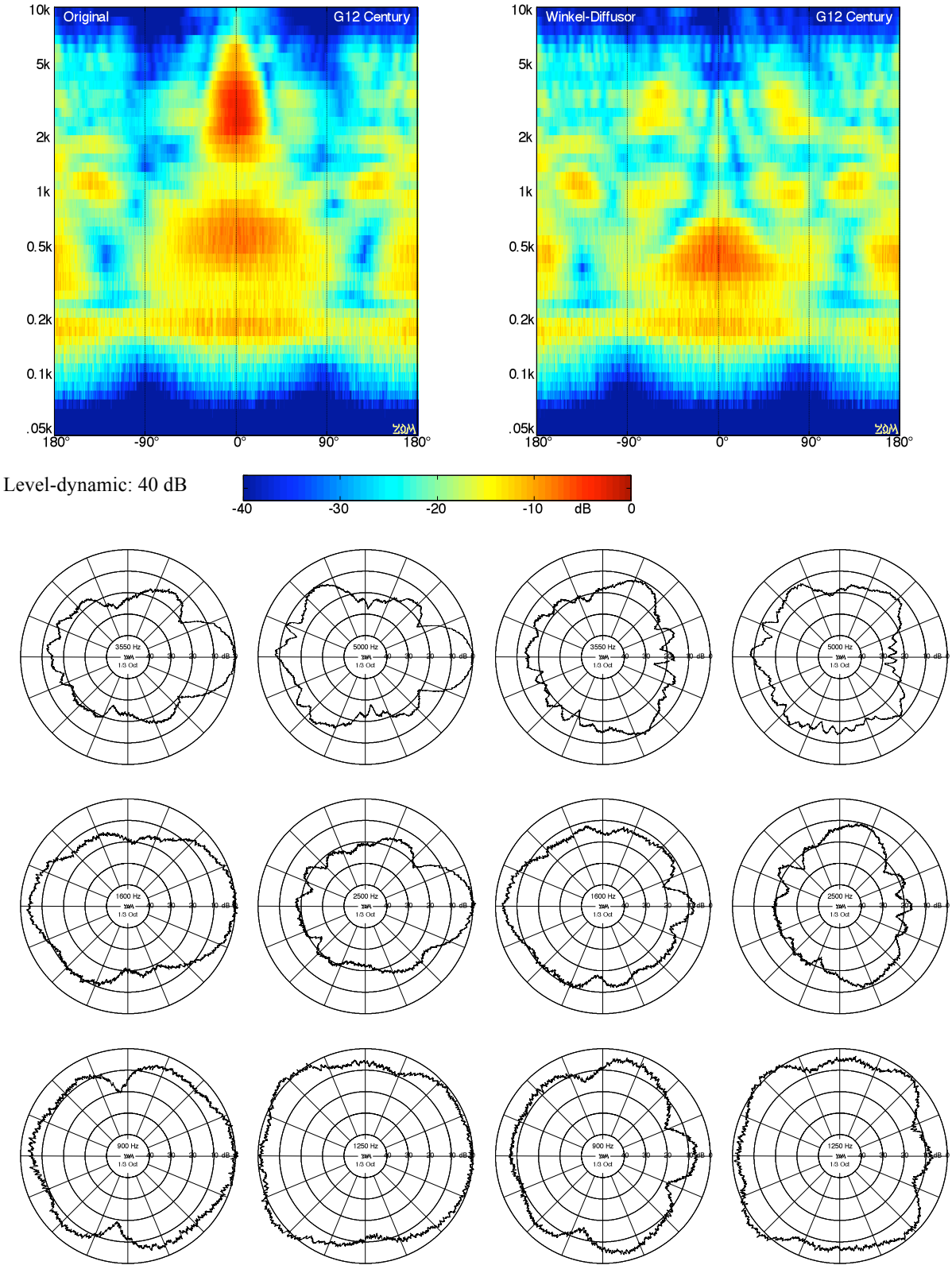

Fig. 11.107c: Angled diffuser in front of a VOX AD60-VT, Celestion G12 Century. It was not the DeeFlexx that was measured but a replica of equal dimensions.

