Subject: Time Alignment
Posted by jgoodd8050 on Fri, 25 Jun 2021 21:25:40 GMT
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Wayne - I'm curious if you can help me better understand time alignment in loudspeakers. I see a people that go to great lengths to get voice coils aligned with sloped baffles or mounting systems that vary the the depth of the drivers. Are these measures helpful? Can time alignment be achieved with a passive crossover? I'm using your 7pi's so you understand my frame of reference. Thanks so much!

Subject: Re: Time Alignment
Posted by Wayne Parham on Sat, 26 Jun 2021 14:02:26 GMT
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When you have a forward lobe that's centered with equally-spaced upper and lower vertical nulls, then your system is "time-aligned."

I personally never liked the phrase "time-aligned" because there are so many phase shifts in the system. Even with voice coils physically aligned, this doesn't ensure "time alignment" and, in fact, usually ensures that the acoustic phase is not aligned. Voice coils aren't always coincident with acoustic centers, so the positions of the voice coils aren't really significant. It's pretty close for direct radiators - disregarding phase shifts in the crossover - so that's what some people focus upon. But read the last link included below, and you'll learn that the actual acoustic center of a driver in its cabinet is sometimes not even located within the box, but somewhere in front or behind it, and that it moves with respect to frequency.

Anyway, the thing that does matter is the position of the forward lobe. That's something you can easily see in measurements. It's useful to also measure impulse response, looking for a single spike rather than a spike followed by a hump or a hump followed by a spike, indicating a multi-cycle shift. Then look at the vertical off-axis response and find the upper and lower vertical nulls. If they're equally spaced, then the system is aligned.

See the links below for specific information how to adjust the crossover to achieve this kind of alignment. I do this for all my loudspeaker designs as a standard part of their development. Check out the video, which shows exactly how its done.
DI-matched two-way loudspeakers
Crossover optimization for DI-matched two-way speakers
The Acoustic Center: How it applies to Loudspeaker Measurements

Subject: Re: Time Alignment
Posted by jgoodd8050 on Mon, 28 Jun 2021 00:01:07 GMT
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This helps a lot. Especially, the video. I really enjoy my 7pi's. One of the best parts of owning building/owning them is how much I have learned along the way. On thing is certain - I have a lot to learn about crossovers. I probably need to design/build one before some of the concepts really make sense!