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Subject: Re: 4Pi speaker tweek

Posted by [Wayne Parham](#) on Mon, 07 May 2012 17:15:59 GMT

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I talked to Nick while he was contemplating this build. I told him the same thing I tell everyone that approaches me with a mod like this.

First, if you change the physical relationship between midwoofer and tweeter, the crossover has to be redesigned and all bets are off. That's a deal breaker. One exception - Nick could have centered the tweeter since his box was larger. That would have been OK. But the tweeter can't be placed further from the midwoofer. So let's take that off the table, and consider box size only, assuming the woofer and tweeter will be mounted the same distance relative to one another.

The biggest vulnerability in changing box size/shape is it changes the internal standing waves. These cabinets are tuned with Helmholtz resonance, but that doesn't prevent transmission line effects from inadvertently coming into play. We don't want that.

It isn't that transmission lines are bad, it's just that isn't the tuning mechanism we chose. So any standing waves that line up to create a pressure node at the driver or port will cause anomalies in the response.

A smaller box can be shaped almost arbitrarily because the internal standing waves line up in the midrange where they can be effectively attenuated with insulation. But as boxes become larger, standing wave frequencies drop. Once you get to about three cubic feet, the standing wave frequencies have dropped low enough that insulation isn't as effective anymore. So driver and port position become more important.

As an aside, this isn't an issue for subswoofers. They are used at frequencies where wavelengths are small compared to box dimensions. So internal standing waves don't become an issue. It's full-range speakers with midwoofers that we have to be mindful about, and evaluate carefully using good mathematical models and verifying by acoustic measurements.

Another thing to consider is the fact that all my speakers are designed to be used with flanking subs. This approach both adds extension and smoothes room modes. So to add box volume to increase extension on the mains isn't all that important. I mean, as long as the builder has taken steps to ensure internal standing wave modes don't create response anomalies in the lower midrange, the extra extension doesn't hurt anything. But if it's done to gain extension in lieu of using flanking subs, performance won't be as good. Flanking subs are really important for high-fidelity in the upper midbass and lower midrange.