
Subject: Svelte 3pi

Posted by [go94022](#) on Tue, 30 Sep 2014 04:19:11 GMT

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Hi Wayne,

Been thinking about this for a long time, so apologies if the post gets over-long. Posting this to gather ideas from you and others in this forum, and also hope to get a copy of the 3pi plans/crossover as a starting point.

I would like to build a narrow (and smaller) 3pi tower. Also thinking about making a shallow enclosure with the front of the box slanted, toed-in. In a dual purpose HT setup, the front speakers are typically near the front-wall alongside the screen. Shallow box means the drivers can be closer to the front wall and push front-wall comb filtering above the midrange. No BSC would be needed for this placement, do your crossovers include it?

There were Carlsson speakers that were mounted at an angle adjacent to the front wall to approach 2pi-space loading.

http://www.carlssonplanet.com/downloads_old/uploads/carlsson_ortho.pdf

Willing to trade some efficiency and extension for a smaller box. The SEOS-12 kits are about 2 cu. ft., while the 4pi is almost 3 cu. ft. and the 3pi is almost 4 cu. ft. The SEOS-12 Alpha kit (no longer offered) used the same Eminence Definimax 4012HO in a 2 cu. ft. box.

My svelte version could be a box about 10" deep on average (slanted), 13" wide, and 36" tall. The slant could be 6" on the inner side and 14" on the outer side, about 30 deg. toe-in built-in.

The pipe modes along the long dimension are a big concern. And with a shallow cabinet, the front-to-back modes will be higher frequency and maybe leak through the cone. Any thoughts on how to mitigate bad resonances would be appreciated. Maybe a slanted, perforated resistance panel could divide the interior into 2 long triangular prisms?

Assuming near or against front-wall placement, and assuming a vented cabinet, the port needs to be at the front or side (not rear). Near the bottom will enhance floor boundary reinforcement. Is a slot at the bottom of the cabinet for a port a bad idea?

So why do this when the shape/size and port placement of the 3pi is all worked out? Partially room layout and partially WAF - unfortunately the 3pi box is just too bulky and intrusive.

Some wilder ideas - a typical 2-way CD design sees a fairly rapid loss of directivity below crossover. A more radical approach would be to create a cardioid resistance box and push the woofer directivity an octave (or more) lower. Some very solid results from Kimmo Saunisto. <http://kimmosaunisto.net/KS-1804/KS-1804mk2.html>

Kimmo's design does cardioid bass, and needs significant equalization and power to make that fly. It would be interesting to get cardioid behavior only to just above Schroeder, say 300-400Hz. Maybe smaller resistance panels? Below that, let the speaker go omni and work like a standard sealed/vented enclosure. Though enclosure Q will be hurt with resistance panels.

I saw the thread on H290C vs. SEOS-12 and understand the concerns you have about the depth of the WG and HOMs. The PE PH612 JBL PT clone is ~1" deeper than the SEOS-12 at 4.4". The PE clone of the QSC HPR152i is 5.5" deep. I don't see dimensions for the H290C on the Web site, but the Eminence H290B is 5.9" deep, assume the H290C similar? At any rate, is the PH612 still too short to keep HOMs at bay? The QSC clone may be similar to the H290C in depth, but it is physically quite large. So it seems the H290C still wins.

Not directly related to these project ideas, but was wondering that the 4pi has a bigger driver, so for directivity matching the crossover frequency should be lower based on $\sqrt{S_d}$. Yet a lower crossover frequency for a 1" CD would work against the higher headroom of the 15 in. driver in the 4pi. So how does the xover frequency compare for 3pi vs. 4pi?

Finally, I realize that Pi Speakers is both a business and a labor of love. If you feel that any of this would not be appropriate to discuss in public, that is fine. I am nonetheless very glad there is so much material available from you.

And so, would love to get a copy of the DE250 version of the 3pi crossover with Definimax and Delta 12LF as options. Leaning towards the Definimax, but not sure the price/performance is there. From everything I have seen, though, the DE250 is a great driver and worth the upgrade.

Thanks, Glen

Subject: Re: Svelte 3pi
Posted by [tubemax](#) on Tue, 30 Sep 2014 11:14:35 GMT
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" So why do this when the shape/size and port placement of the 3pi is all worked out? Partially room layout and partially WAF - unfortunately the 3pi box is just too bulky and intrusive."

Hi, I find 3 Pi quite opposite - they are very nice speakers to look at if done properly... like the one from Wayne!

Max

File Attachments

1) [Pi 3.jpg](#), downloaded 6044 times

Subject: Re: Svelte 3pi
Posted by [Wayne Parham](#) on Tue, 30 Sep 2014 16:13:31 GMT

You are focused on the right things.

One main thing you have to watch out for in these larger full-range cabinets with midwoofers run high is the internal standing wave modes. You can't put a sound source where a pressure node lies or it will manifest as a nasty blip in the response curve. And it sounds even worse than it looks on a response chart - They seem to always make the speaker sound really hollow or nasal. So driver and port placement are important, as is the position of the damping material. A sheet of insulation that spans the cross-section often works wonders.

Also important is the size and shape of the waveguide. Not just for directivity but also for acoustic loading. Seems the quest towards improved directivity sometimes leaves acoustic loading in the dust. A waveguide isn't going to provide as good loading as an exponential horn, but it doesn't have to be bad either. The best waveguides balance these two competing priorities, and provide both uniform directivity and adequate acoustic load. They can be made to have smooth response without notch filters, as is evidenced by the performance of the H290C waveguide.

And of course, the crossover is the heart of the speaker, and ties it all together. The DI-matched two-way approach is a good staple design, in my opinion. It allows uniform directivity in a convenient package. I think it's best used with flanking subs though, which mitigate the anomalies caused by reflections from the nearest boundaries and vertical modes. Sometimes, one or two more distant distributed mutisubs also help, by smoothing lower frequency room modes.

and more is discussed in detail there.

Subject: Re: Svelte 3pi

Posted by [go94022](#) on Thu, 02 Oct 2014 07:43:02 GMT

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Hi Wayne,

Thanks for the comments. I actually had some very specific questions and the long-winded stuff was just context.

So...

Does the 3pi crossover include BSC or not?

Clarification on your comment on pressure nodes... So the common practice of putting a slot/vent at the bottom of a box is really bad because it excites all modes?

Is the depth of the H290C the same as Eminence, 5.9"? Any thoughts on whether the PH612 PT clone is too short at 4.4"? I am pretty much sold the H290C anyway, because it seems smoother

and pattern control holds lower.

Is the crossover frequency for the 4pi lower to match the slightly bigger diaphragm? Doesn't this push the CD harder because it has to play louder and lower?

Do you have any thoughts on feasibility of resistance boxes for (partial) cardioid response?

And please, a copy of the 3pi crossover and plans(?) as a starting point. Still leaning to DE250 and Definimax 4012HO.

More hot air:

Yes, I've read a lot of material on your site. I'm a pretty serious hobbyist. I read the original AES Thiele-Small papers in the late 70s and have been following speaker design informally since then. Familiar with the Econowave, Geddes, SEOS, JBL PT 2-ways. And also the Orion, Gradient/Amphion, Danley Synergy, CBT36, JBL RBI, Kef LS50, and other controlled directivity approaches. Dabbled in Ambiophonics, closely spaced stereo pairs, and other psychoacoustic tricks.

I've been focused on smooth power response and directivity for a long time, and since mid 80s have been running an FFT designed 3-way with graduated driver sizes (8"/4.5"/1"). Similar to the Harman/Revel approach today. With a subwoofer, it has LOTS of headroom without pushing the tweeter.

Have also tried the Behringer B2031, which I think has slightly smoother response than my design (1 fewer crossover). But the dynamics can't match my homebuilt and distortion levels are middling. Amazingly good for the price, though.

Also concerned about pattern flip and vertical polars in 2-way horn/WG designs. Everyone shows horizontal polars, but not vertical pattern, overall power response. I've seen you complain about that as well. Then I saw your design note about using the crossover lobes to modify vertical polars, which is such a great idea.

So now I'm excited to give this a shot. Expect to get smoother response, more headroom, less distortion (even at low levels) than my old 3-way. I also expect that the narrower pattern (compared to the Harman approach) will result in a closer approximation to LEDE and the master mix - without needing much dead-end treatment. But I do have a few 2x4' homebuilt fiberglass/foam 4" thick panels to play with if needed.

I hope to do some cardioid experiments with old 8" drivers first, and if successful that will probably require more crossover adjustments. Juggling a busy job, kids, family so not sure how fast I can go.

Thanks a bunch, Glen

Subject: Re: Svelte 3pi
Posted by [Wayne Parham](#) on Thu, 02 Oct 2014 23:55:28 GMT
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Answers under questions:

"Does the 3pi crossover include BSC or not?"

No. Please see the FAQ page for comments about baffle-step compensation on loudspeakers of this size. In short, the baffle-step occurs near the Schroeder frequency, and there are better ways of increasing bass in that range than EQ. Use flanking subs instead.

"Clarification on your comment on pressure nodes... So the common practice of putting a slot/vent at the bottom of a box is really bad because it excites all modes?"

Not necessarily. But it is important to do the analysis and testing to make sure the pressure nodes aren't located on a sound source, and that they don't create response ripple as a result.

"Is the depth of the H290C the same as Eminence, 5.9"?"

Yes, it's very close to that.

"Any thoughts on whether the PH612 PT clone is too short at 4.4"?"

It's not just the length, but also the acoustic load, and the ratio of resistance to reactance, which sets the phase.

"Is the crossover frequency for the 4pi lower to match the slightly bigger diaphragm? Doesn't this push the CD harder because it has to play louder and lower?"

The frequency and slope are both different. Please see the post in the FAQ called "Crossover Optimization for DI-matched loudspeakers", because it shows the process of setting the crossover region.

"Do you have any thoughts on feasibility of resistance boxes for (partial) cardioid response?"

No, sorry. I'm sure it can be done very well. I've gone a different way, using constant directivity cornerhorns and DI-matched two-ways with flanking subs.

"And please, a copy of the 3pi crossover and plans(?) as a starting point. Still leaning to DE250 and Definimax 4012HO."

You've got mail!