Subject: 4 Pi Design Questions
Posted by Nichol1997 on Mon, 18 Jan 2010 04:09:58 GMT
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Wayne,
I have been modeling the bass response of your 4 Pi design using the JBL 2226H drivers in WinISD. I have calculated the net volume of the enclosure to be approximately 2.74 cubic feet. Given your port dimensions and the net volume of the enclosure, the tuning frequency appears to be 27 Hertz.

I would like to alter the response curve by making a slightly larger enclosure (3.6 cu ft) and raising the tuning frequency to 40 Hertz. This can be achieved by increasing the height of the enclosure by 7 inches. I would like to keep the port on the front baffle but move it to the bottom of the enclosure. From your previous posts it seems that standing waves may become an issue, is this correct?

Do I also need to worry about midrange frequencies escaping from the port and canceling with the front-wave of the speaker?

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Mon, 18 Jan 2010 12:36:32 GMT
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I just realized that I made a mistake in the port dimensions. It appears that you have the original design tuned to 38 Hertz.

I would still like to make a larger enclosure since I like its response better.

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Mon, 18 Jan 2010 14:46:01 GMT
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Sure, you can make the cabinet larger, up to about 5.0ft3. In any loudspeakers with cabinets this large, you should always measure impedance and response to make sure you don't see any big blips from internal standing waves.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Thu, 21 Jan 2010 02:59:49 GMT

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I have two different port designs (see attached). Is the slot port design better at attenuating midrange frequencies from the backwave of the bass driver?

File Attachments
1) Port Options.JPG, downloaded 774 times

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Thu, 21 Jan 2010 03:09:45 GMT
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Generally, ducts that are long and thin tend to develop internal standing waves and those can be a problem. Then again, you can get around them with the right placement and just being long and thin isn't always a problem. In the end, you'll have to measure the cabinet to know for sure.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Fri, 02 Apr 2010 02:15:49 GMT
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Just thought I would post a link to my build thread:
http://www.avsforum.com/avs-vb/showthread.php?t=1238362

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Fri, 02 Apr 2010 14:25:51 GMT
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Good work so far! Thanks for the link, and please keep us posted with your progress.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Sat, 03 Apr 2010 01:58:32 GMT
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Thanks for the compliment. The build is going pretty easy so far except for routing the recessed area for the horn driver. It was a little tricky but I think I am just rusty with my speaker building.

I noticed on your website that you can upgrade to the Jantzen Z-capacitors but you don't specify if they are the Standard, Superior, Silver, or Silver Gold type. Which ones do you provide?

Also, Jantzen doesn't appear to offer 20uF capacitors according to their cut sheet:
http://www.jantzen-audio.com/download/Z-caps%20series%20list.pdf

Are you substituting a Dayton Audio capacitor for this one?

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Sat, 03 Apr 2010 14:32:42 GMT
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I use Dayton capacitors sometimes, yes. If a person orders a standard crossover with no upgrade options, they will have Jantzen, Erse, Solen or Dayton polypropylene caps.

But as for the Jantzen 22uF capacitor, you can use it where the schematic calls for 20uF. If we get an order for Z-Caps, that's what we use. We use Z-Standard caps in all positions except for the 0.47uF part, which is a Z-Superior. Not because I think it needs this, but because the 0.47uF size isn't available in the standard line. If someone was interested, we would be happy to use Z-Superior parts in all positions for a little extra cost, but we don't stock them. Most people that want the high-end caps want Auricaps.

the standard option, Mills 12 watters for upgrades. The Zobel resistor is a non-inductive 100 watt,

used in the 0.5mH position is actually a Jantzen air-core 0.47mH part. No other substitutions are required for any values, in any options or lines. All coils are Jantzen air-cores, whether 18 guage (standard) or 15 guage (upgrade), but the large 5mH coil used on the cornerhorns is an Erse Super-Q. All capacitors are poly caps.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Thu, 08 Apr 2010 02:17:00 GMT
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Wayne,
Thanks for your help. That answered a lot of my questions in regards to crossover components. However, I am trying to find a source for the 8-Ohm, 100 Watt non-inductive resistor. I found one that Parts Express offers but I am not sure if it is what I need because they call it a "dummy load resistor". Here is the link:
http://www.parts-express.com/pe/showdetl.cfm?Partnumber=019-020

Is this the correct one to use?
Is there a better brand that I should be considering since I will be upgrading all the other crossover components?

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Thu, 08 Apr 2010 02:55:42 GMT
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That's it!

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Sun, 20 Jun 2010 13:18:08 GMT
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Wayne,
It has been brought to my attention that I did not use the latest crossover design for my 4 Pi build. Specifically, C4 is labeled as 10uF in the plans dated January 30, 2008.

I used a 20uF capacitor. I am wondering if I need to change it to correspond with the latest design. Can you tell me the impacts of this change?

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Sun, 20 Jun 2010 13:54:58 GMT
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I would swap it, yes. It's an easy change worth doing. The position of the forward lobe is shifted up slightly, more aligned with the baffle normal, i.e. straightforward. With the 20uF cap, it points slightly downward but with the 10uF cap, it's almost perfectly centered.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Fri, 12 Nov 2010 03:11:16 GMT
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I thought I would post some pictures now that I finally finished putting the finish on them.

By the way, I swapped the 20uF caps to the 10uF caps and I haven't noticed much difference. Of course it has been 5 months since I heard them with the old caps so that could be part of the reason.

Subject: Re: 4 Pi Design Questions
Posted by Psychoacoustic on Fri, 12 Nov 2010 04:06:41 GMT
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They look great! Well done on finishing them.
I've still got 7 Pis in beautiful MDF!

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Fri, 12 Nov 2010 13:52:00 GMT
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Nichol1997 wrote on Thu, 11 November 2010 21:11By the way, I swapped the 10uF caps to the 20uF caps and I haven't noticed much difference. Of course it has been 5 months since I heard them with the old caps so that could be part of the reason.
It's very subtle, in fact, I'm not sure that even describes it. In some listening positions, it does nothing at all. The only thing that's changed is the position of the forward lobe, shifted slightly upward.

The original cap had the forward lobe pointing down about 5°. The pattern was good from about -30° to +20°. The new cap centers the forward lobe, so the pattern is good from -25° to +25°. If you're not listening way above or way below the speaker, it sounds the same.

Subject: Re: 4 Pi Design Questions
Posted by Doc Jr 8156 on Fri, 12 Nov 2010 15:41:07 GMT
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Great looking speakers! Wayne, what is the consequence of not having R3 installed? My

crossover (from a kit) has none of this. Is it imperative to use a 100 watter 8 ohm resistor or could I get away with a 15 watt non inductive 8ohm resistor? Thanks and sorry for asking these here.

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Fri, 12 Nov 2010 20:44:22 GMT
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on all other models, you do. If you omit this resistor on any of the models that call for it, you'll have a pretty nasty peak in the upper midrange, near the crossover frequency. This is true for all

You can derate any component, provided power input is reduced accordingly. That said, I would not suggest derating any of them because it never hurts to keep things cool.

See the Speaker Crossover document for more information. An example of the peak you'll get if you remove R3 is shown on page 43 and the power transfer curve for this component is shown on page 66.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Fri, 18 May 2012 00:38:11 GMT
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I finally got around to measuring my modified Pi4 speakers. Attached is the nearfield frequency response using Room Eq Wizard version 5.

I am still learning how to use the software and hardware so I am not sure if I am measuring it correctly. I had the mic mounted on a stand that was 16" from the baffle and just a little bit below the throat of the compression driver on the vertical.

My measurement gear consists of:
HP laptop w/ Windows XP
MobilePre USB external soundcard
Behringer ECM8000 mic
Behringer EP2500 (ran the MobilePre USB directly to the amp)

To me, the measurement makes it look like my woofers are out of phase. I only measured the right speaker. I will have to wait until it is quiet in the house again before I can measure the left speaker.

File Attachments
1) Pi4 Measurement.jpg, downloaded 462 times

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Fri, 18 May 2012 03:46:14 GMT
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You may have the woofer or tweeter leads reversed. But redo your measurement first, because measurements made like you are doing always create notches from boundary reflections.

Lay the speaker on it's back and position the microphone one meter (or more) above it, facing the upper half of the midwoofer cone. This orientation will prevent a floor bounce notch, and it puts the microphone in the center of the forward lobe. You can usually get away with indoors measurements when done this way, if all you care about is response in the crossover region, but you'll have no visibility below a few hundred Hertz. It will be peaky if ungated, or meaningless if gated. Of course, it never hurts to take the speakers outdoors, which is truly anechoic. You'll still want to lay the speaker on it's back, or you can put the microphone on the ground and angle the speaker down to face it.

This is what you should expect to see, measurements from two different people using two different measurement systems:

a modded version, but if the only difference is box size, then I would expect most changes to be below 200Hz. So setup your measurement as described above, and if you don't see a chart like this, check your connections and crossover.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Sat, 02 Jun 2012 00:30:50 GMT
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I went ahead and remeasured them based on your instructions (see attached). I took the measurements in my family room and I think that the mic is picking up room reflections. To verify this, I also measured a MTM speaker and one can see how it almost matches the Pi4 response in certain areas (see 2nd attachment, MTM is labeled as BAMTM on the graph).

I also attached a picture of the mic position along with the mic stand that I had to make. The mic is 36" from the baffle and centered on the top half of the JBL 2226 cone.

Thanks for taking the time to explain where to place the mic when taking measurements. On the graph that you posted of your Pi4 measurements, what type of smoothing did you use (1/12)?

File Attachments
1) lr pi4 lay dwn 36in centered baffle near top half of 2226.jpg, downloaded 7691 times
2) pi4 ylw, bamtm blu 36, 38 from baffle.jpg, downloaded 7741 times
3) Pi4 Mic Location.jpg, downloaded 7494 times

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Sat, 02 Jun 2012 02:35:54 GMT
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Yes, now you're getting good measurements. You still see room modes down low, like the one around 120Hz. This is a vertical mode, and is part of what flanking subs fix. Below that, the response is dominated by room modes - both speakers look the same in the modal region - proving that what you measure down low is not the speaker, but the room. But the response up high shows up pretty clearly. This is a useful setup when you just want to see the crossover region, for example.

I don't use any smoothing at all. The difference is mostly due to my measurement being outdoors. Inside, on its back, my measurements look very close to what you have. I have an eight foot ceiling, and I'm guessing you do too.

You can kind of see the similarity in my indoor measurements and yours in the "Vertical Nulls" video in the "Crossover Optimization" thread. See the wiggles down in the ~100Hz region? Those are room modes.

I think the Omnimic measurements made by BigmouthinDC do have some smoothing applied. I'd say probably 1/12 octave. It actually looks less like smoothing and more like the sampling resolution is a little bit lower than my LMS system.

As an aside, there is a difference between reduced resolution and smoothing, but the end result is similar: Detail is lost.

The biggest difference is smoothing will actually reduce the amplitude of peaks and increase the amplitude of troughs. Reduced resolution simply misses some data points, so a sharp spike may be missed. But where a point is recorded, its amplitude is left intact, and the system just connects the dots to make the SPL chart.

Smoothing really takes the edge off a graph and can make a peaky response curve look pretty smooth. Huge spikes just get knocked off. Then again, it isn't necessarily a bad thing, since most published curves are smoothed, sometimes as much as 1/3 octave. That was pretty common in the 1970s and 1980s - if you could find a chart at all, it was likely smoothed to 1/3 octave

resolution.

Subject: Re: 4 Pi Design Questions
Posted by mantha3 on Sat, 02 Jun 2012 13:56:43 GMT
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Sorry, newbie here.

So are these readings good/desirable compared to what you'd see with the readings on a standard build of a 4 Pi when built to the exact physical dimensions of the design?

I'm following this as I'm thinking of building a set of 4 Pi speakers with the same 7 inch extra height of the cabinet and dual vents on the bottom.

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Sat, 02 Jun 2012 15:30:06 GMT
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measured in this manner. And yes, frankly, that's a very good chart. But below 200Hz, it's ambiguous because only room modes can be seen. That's where you would expect most changes due to the box modification to manifest themselves.

This brings us to the hypothetical question, which is, "How much does it matter?" My concern about box mods is always that they might make ripples in the midrange due to internal standing waves. But as long as they're all below the modal range, one might question how much they matter. If we use flanking subs to mitigate midbass and lower midrange anomalies, they'll tend to smooth that range, whether caused by standing waves inside the box or reflections outside, in the room. Still, my take is the less anomalies we can introduce, the better. Less problems to mitigate.

And of course, if we're using subs, we don't need the extra extension the larger box gives, and leaving it stock eliminates the possibility of introducing midrange ripple. The room is dominant below 200Hz, and the biggest peaks and valleys are from standing waves in the room, not in the loudspeaker box. So truly, the best approach is to use multisubs (flanking and distributed) to smooth this range, which will provide both extension and modal smoothing.

My conclusion is this: Since the mods have not introduced any additional ripple above 200Hz, I'd call it "verified". That's the main thing we're looking for here. We don't want any midrange ripple from internal standing waves. Of course, we can't see what it might be doing below 200Hz, but

indoors, that almost doesn't matter.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Tue, 19 Jun 2012 00:50:55 GMT
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I took the Pi4 outside to take some measurements (see attached). I used the same microphone stand that you see in my previous post (two-by-four A-frame), laid the speaker on its back and placed the mic at 38 inches from the baffle. The mic was centered and directly above the top half of the JBL 2226 driver. I ran the test a little louder since I was outside and there were birds chirping in the background.

All of the measurement graphs that I posted have 1/12 smoothing. I can post the raw data response if you want to see it.

First time taking measurements outside and I was surprised to see the overall bass level louder than the higher frequencies. I assume this is normal for outdoor sweeps?

File Attachments
1) pi4 outside vs inside.jpg, downloaded 531 times

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Tue, 19 Jun 2012 02:12:43 GMT
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No, that's not normal. Something is wrong. Check your settings.

The spectral balance is the same inside and outside, there just aren't any reflections outside so there aren't any self-intereference notches. The outdoor response curve is much smoother, especially down low. But you won't see any difference in the overall trend, the basic balance between bass, midrange and treble. They are all equal in volume.

Subject: Re: 4 Pi Design Questions
Posted by mantha3 on Tue, 19 Jun 2012 12:52:57 GMT
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Is it possible that the Bass levels are higher due to the larger cabinet making bass more pronounced?

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Tue, 19 Jun 2012 12:55:58 GMT
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No, a larger box won't make the bass louder, at least not broadly like that. It can make the cutoff frequency lower, or if mistuned, it can create a peak. But nothing like that.

That outdoor curve is the result of a measurement problem of some sort.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Wed, 20 Jun 2012 00:08:28 GMT
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I found my setting mistake in REW. I will have to do the outside measurements again. Wife is not happy about helping me carry the speaker outside again.

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Wed, 20 Jun 2012 02:34:45 GMT
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Boy do I understand. I've lugged a lot of speakers around to make measurements over the years. And some of them have been pretty damn big.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Mon, 25 Jun 2012 01:04:14 GMT
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My back hurts just looking at those horns. I bet they are close to 250 lbs each.

Subject: Re: 4 Pi Design Questions
Posted by Nichol1997 on Mon, 25 Jun 2012 01:08:59 GMT
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I ran a few more sweeps outside and I think that I got some good measurements...

File Attachments
1) pi4 inside vs outside measurements.jpg, downloaded 12024 times

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Mon, 25 Jun 2012 12:48:37 GMT
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Yes, that looks much better. I still see some reflections (mostly above 1kHz) - probably from nearby structures - but this chart has captured the basic trend very well. You have the measurement system configured properly, and have recorded an accurate response curve. Good job!

Subject: Re: 4 Pi Design Questions
Posted by mantha3 on Mon, 25 Jun 2012 22:15:17 GMT
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Wayne,

How does this look in comparison to a more standard build of a 4pi? Does this curver differ much? I was guessing it may have more difference in the bass side of the curve maybe? Just curious on this thread as I'm thinking of building to this 7" taller box size and interested in hearing from you on any difference observations for good or bad from ya.

Thanks,
Andy

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Mon, 25 Jun 2012 23:12:08 GMT
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initially concerned that his box might have introduced anomalies in the lower midrange. But his measurements tell me that his box is ripple-free in the lower midrange, which is a very important thing to consider when building a two-way loudspeaker that is physically large.

Since Nick kept the woofer/tweeter spacing relationship the same and used the same crossover, I was pretty sure it would act right in the crossover region. So from 500Hz upward, I would have expected the same response.

We all would expect bass to change, but the thing I often point out is that a box this size also needs attention paid to the midrange, since standing waves can line up inside. That's why modeling and measurements are really important in a large two-way loudspeaker like this. So many DIYers use a box modeling program to determine bass response, but fail to look at the midrange. That's an extremely important thing to consider in a large two-way speaker, because of the matter of standing waves.

Nick's speaker looks like it probably sounds pretty darn good. There is no midrange ripple, and that's what we wanted to see.

Subject: Re: 4 Pi Design Questions
Posted by mantha3 on Fri, 31 Aug 2012 20:13:37 GMT
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Wayne,

I'm planning to build some 4 PI "Tall" speakers like Nichol1997 did here in this thread. Basically, I'd build exactly like your plan but add 7" in height to the cabinet as Nick did. I'd center the horn but have it spaced exactly the same distance from the woofer as you have outlined in the plan.

I'm planning to use a lower brace where the bottom panel would be on your normal 4PI. I'd basically stuff the entire cabinet below this lower brace with the damping material you outline in the plan. I'd stuff around the ports and behind the port like you advise on the normal 4 PI

Here is the face of the speaker I drew up. I'd use 4" Internal Dia ports that are flared to 7" on the face. The 4" run of the Port would be 9.25" in length. This is what Nick said he did with his build.

I'm a little worried on the Port part.

You run an internal size of 3.5" X 6" for an Area of 21.5"
Two ports at 4" would be a lager area. 1 port at 4" would be pi × r2 at 12.5" so two would be 25" of area

I think if I used two of the 4" ports I'd need to run them at least the 10" you run your 3.5" X 6" rectangle ports or more given the extra area.. Or is this somewhat larger port area not such a big deal.. Or if it was we would see something in the test Nick did? I was hoping that this test Nick did shows this port idea of Nick at two 4" ports at 9.25" is good to go.

Sorry for all the questions.. Maybe I'm over-thinking this all

PS I have an plunging head router and the round ports would be easier for me... I like the look of the round ports too... And the 7" extra height is cool as the speaker will look a bit more like a tower and not need a stand perhaps.

File Attachments
1) 4PI_Face_Mod.png, downloaded 11374 times

Subject: Cabinet design, port placement and internal standing waves
Posted by Wayne Parham on Fri, 31 Aug 2012 23:28:13 GMT
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There are three things that come into play with the cabinet geometry and the arrangement of the woofer and port(s).

First is the Helmholtz frequency, which is something pretty much all DIYers think about. When you run a T/S simulation, this is primarily what it is showing. Cabinet volume and Helmholtz frequency set the response in the bottom octave or two, and most hobbyists are aware of that part.

Second is the port airspeed, which is not an issue below 50MPH, and probably not even at 100MPH. It's only an issue at extreme excursion levels, meaning it's being played very loudly (or is being pushed too low, below its passband).

Truly, we don't want the excursion anyway, since it increases intermodulation distortion. So if extreme SPL is needed, high-pass the speaker to limit the signals sent to the speaker below the Helmholtz frequency.

I only say this because I think port airspeed is sometimes over-analyzed by DIYers. We don't want the ports to be too small, but they don't have to be huge either, especially in a speaker like this. The midwoofer in a matched-directivity two-way is really a midrange driver that digs deep, and it shouldn't be pressed hard in the subwoofer range, because that will increase IMD and make vocals less pure. These should really be seen as three-way speakers with detached woofers in the form of flanking subs.

The third thing is the frequency and position of standing wave modes that line up inside the cabinet. This is what most DIYers overlook. But it is a very important consideration in speakers like these, as it directly influences sound quality, particularly in the midrange.

When people complain about the "box sound", it's usually this anomaly that causes it. In fact, I'd go so far as to say the only reason open-baffle speakers are ever considered is the fact that so many speakers suffer from midrange anomalies caused by standing waves. But with careful cabinet layout, they can be perfectly mitigated.

If we were making subs, it almost wouldn't matter what size and shape the box was or where the woofer and port were. The wavelengths presented to the box would be very long compared to box dimensions, so standing waves would not form. Don't even need acoustic damping material inside a subwoofer.

Similarly, when the cabinet is small, standing waves aren't too bad because even though they will line up in the passband, the frequency range where they do is high enough that the stuffing

damps the standing wave modes very effectively.

But larger cabinets used for mains can be kind of tricky, because the standing waves often line up in the lower midrange. This is a tough frequency range to deal with because acoustic insulation lining the walls doesn't do anything at all. There is no absorption at midrange frequencies, so any standing waves inside will cause response ripple, and sometimes it can be pretty bad.

The best thing you can do is to put the midwoofer and port(s) in positions where standing waves don't develop a high-pressure node. It also helps to put a sheet of insulation in the middle of the cabinet, spanning the cross-section. The insulation can attenuate midrange if spaced away from the walls. That's why we put a sheet on the brace between woofer and tweeter, in addition to the sheets that line the walls. It sort of breaks the cabinet into two sections, and traps the midrange while allowing the bass to pass right through.

So this brings me to the point. It's best to make acoustic measurements to verify response when contemplating cabinet dimension modifications, and/or port or midwoofer position changes. There are very few software modeling tools that will show the response anomalies caused by standing waves, so it has to be measured.

My suggestion would be to either stick with my plans or with the mod described in this thread. These are configurations that have been tested. You can center the tweeter, provided the distance between woofer and tweeter remain the same, but don't deviate from the box dimensions or the placement and size of the port and midwoofer.

Or if you have measurement equipment, by all means, you can find other configurations that work well. But you definitely don't want to just pick a port with a box modeling program and call it good. That isn't good enough for speakers like these.

Subject: Re: 4 Pi Design Questions
Posted by mantha3 on Fri, 31 Aug 2012 23:39:16 GMT
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Wayne,

I am a huge fan of these speakers and the time you take to discuss things on this forum. All you say makes sense and I appreciate the time you take to respond.

I'll post when I build and with some luck the sound will be excellent

Have a good holiday weekend!!!

Andy

Subject: Re: 4 Pi Design Questions
Posted by Wayne Parham on Fri, 31 Aug 2012 23:51:42 GMT
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Thanks, Andy. Hope your Labor Day is good too. And please post back with your build progress!

Subject: Re: Cabinet design, port placement and internal standing waves
Posted by dheflin44 on Wed, 27 Feb 2013 21:16:20 GMT
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Wayne,

Are there any simulators available that would predict where the internal high pressure nodes will be?

Thanks,
Darrell

Subject: Re: Cabinet design, port placement and internal standing waves
Posted by Wayne Parham on Wed, 27 Feb 2013 21:50:02 GMT
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dheflin44 wrote on Wed, 27 February 2013 15:16Are there any simulators available that would predict where the internal high pressure nodes will be?
Yes, Martin King wrote an excellent modeling tool in the form of a series of MathCad spreadsheets. They used to be available for download, but I think he may have pulled them because he felt commercial users were taking advantage of him. I can empathize with him, and respect his IP so naturally paid his commercial licensing fees.

This whole thing is a hobby for me, but it's hobby turned business and that means commercial licensing is appropriate, in my opinion. Darn well worth the fee, and Martin is a nice guy too, by the way, very intelligent. But I digress.

My point is that's the tool I have used and found most effective. Measurements tracked predictions very well. Check the link below, and see if the spreadsheets are available. If not, you might write to Martin and inquire about licensing. For personal use, I think he'll go easy 'cause they were sort of GPL'ed at one time.
Quarter-Wave.com

Subject: Re: Cabinet design, port placement and internal standing waves

Posted by dheflin44 on Wed, 27 Feb 2013 23:06:54 GMT
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Looks like the cost is only $25 for DIYers. Since the main app is modeling transmission lines, it's going to take a little studying to figure out how to model what I'm trying to do.

Thanks,
Darrell

Subject: Re: Cabinet design, port placement and internal standing waves
Posted by Wayne Parham on Wed, 27 Feb 2013 23:25:09 GMT
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He used to supply a spreadsheet for ported cabinets tuned primarily using Helmholtz resonance. While his main focus was transmission lines, he also had a spreadsheet that covered bass-reflex boxes at one time. I'm sure he still does, or perhaps he morphed its functionality into one of the other spreadsheets. It would make sense, because in order to accurately predict response, you have to calculate both pipe mode resonance and cavity resonance.

You know, there is never really any sort of cabinet that is tuned solely by pipe modes or by cavety resonance. Both things are always present. That's kind of the point - It's important to realize that fact when designing cabinets. Most DIYers focus only on the mechanism they are trying to use, and that's fine as long as the other one is shifted out of the pasband. So for example, if the box is small, the pipe modes are high enough they are all attenuated by insulation. You can disregard them. Or if making a transmission line, if the port is sized where the Helmholtz frequency is really high or really low, then the cavity mode can be disregarded. But in the cases where both mechanisms might come into play - like most medium to large boxes and/or tower enclosures - it is important to model both mechanisms when simulating response. Otherwise you don't get the whole picture. Martin's spreadsheets do take these things into account, and that's what makes them so accurate.

So just tell him what you're trying to do when you send him your licensing fee. He'll suggest the spreadsheet that will work best for you.