Subject: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 10 Jul 2010 04:06:34 GMT
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OK, so I've jumped in with both feet and ordered/received my 2226's and Horns for three speakers.

They will be going in this theater space and this is both the before and after picture as the speakers will be behind an SMX acoustically transparent screen.

So the first question as I start to work on the baffles is I notice that although the horns have a textured surface they still have a considerable shine which I am going to need to abate otherwise the screen which has a 5% openness factor will create reflections off both the horns and the shiny metal flanges on the woofer.

Have there been any proven techniques for dulling the shine on either?

Here is a look under the hood of the area for the speakers. For size reference the center speaker is sitting on a 15 inch sub.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sat, 10 Jul 2010 13:15:38 GMT
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The horns are very easy to dull. Lightly sand them with some 220 grit sandpaper and you'll take the shine right off.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 10 Jul 2010 23:32:22 GMT
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I tried the sanding and it was just knocking down the high spots but the shine remained. So I grabbed some solvent (Goof off) and wiped the horn which I knew would dull it (and it did) but it

looked like crap when it dried. So I shot a coat of Krylon Ultra Matt black and I have the result I was looking for.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sun, 11 Jul 2010 13:37:53 GMT
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There you go, that's perfect! I've sanded those horns and dulled them, the trick is to remove the finish, not just the high spots. Tried sandblasting them too, which may work if the flow pressure is reduced but the place I go to sandblast stuff has a pretty strong feed that just cuts into 'em like butter.

Sometimes I think it would be worth refinishing these H290 horns, sanding them to remove casting marks and the like. They could be made much more attractive. I never was as concerned with dulling the finish as I was with removing the riser marks. But I can see how a dull finish is important to prevent them from reflecting a glare in an HT setup like yours, where the speakers will be behind the screen.

At any rate, I love the looks of your finish. Good job! It looks great! Will you paint the brushed edge of the 2226 woofers too?

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 11 Jul 2010 16:45:11 GMT
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Wayne Parham wrote on Sun, 11 July 2010 08:37
Will you paint the brushed edge of the 2226 woofers too?

I think it would be a good plan, any ideas how to pull it off without risking damaging anything?

Just a note about the refection problems, In the picture I posted above I had to hang some black GOM fabric over the speakers to cut the reflections of the semi-gloss black painted cabinets that were very visible without the fabric covers. I am trying to do everything to avoid adding any additional material between the speakers and the listeners. I know the screen has some attenuation on the upper frequencies that may need some equalization.

This is from the SMX web site, blue line is speaker, the pink is with the screen in place.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 12 Jul 2010 14:51:54 GMT
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Oh my, it looks like the screen has introduced ripple of about 5dB between 3kHz and 10kHz, as much as 10dB between 4kHz and 5kHz. From that, I would guess the screen is fairly reflective, not fully transparent acoustically. Those peaks and dips look like self-interference from the reflection.

I think I would almost prefer a slightly more absorbent material because even though it would attenuate the sound, perhaps needing a smidge of EQ, it may not introduce that much ripple. Any other options? Have you measured other materials? I might be inclined to even try various fabrics to see what I could come up with.

As for the brushed edge on the 2226, I'd just use some flat black enamel and apply it with a small paint brush. You can get it at any hobby shop, the little bottles of paint used by model builders would work great.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 12 Jul 2010 17:17:11 GMT
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Thank you for your brutal honesty. Actually this is a brand new screen that I purchased for my 2.35:1 remodel after looking at various alternatives. It has earned high reviews from HT enthusiasts and professionals. The published test results for perforated screens (Stewart Screen) are much worse.

So that is the screen I'm going with unless someone comes up with a magic fabric as a replacement.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 12 Jul 2010 19:18:51 GMT
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Sorry. I didn't mean to be brutally honest. I don't really like coming across that way. But I guess it probably did sound like that.

In truth, there are a lot of things in the environment that cause 10dB swings in what would be an otherwise perfectly flat response curve in an anechoic environment. Heck, just the reflections off the walls do that in the region below 200Hz or so.

Then again, I'm not sure I would be willing to accept response swings so large in that frequency range, right where our hearing is most sensitive. Here are a couple things I'd try:

First, angling the speakers might help because the much of the reflected energy would be directed away from the speaker instead of back towards the source. The self-interference ripple is caused by a reflection that combines with the source, and is therefore strongest when it is straight on.

When a boundary is a quarter-wave away from the source, the reflection is a half-wavelength late, which forms destructive interference. When the boundary is a half-wavelength away, the reflection is a full-wavelength late, which forms constructive interference. The relationship between source and reflection changes with wavelength i.e. frequency, so the resulting response curve develops ripples, as some frequencies combine constructively and others combine destructively.

If the reflection isn't directed back towards the source, the ripple would be reduced. So angling them inward should help. On-axis sound is at an incident angle that reflects away from the source. Far side off-axis is even further angled away from the source. Only near side off-axis sound is reflected back towards the source. Of course, that's the problem with this approach. These speakers generate sufficient output off-axis that there will be a fairly significant reflection back to the source even with a lot of toe-in. But it's worth trying. Try the recommended 45° toe-in to see if it helps reduce screen ripple.

Second, putting some open cell foam or other semi-absorbant material between the speaker and the screen may smooth the ripple. It would probably only be required in front of the tweeter if the screen is placed close enough. Increase tweeter output slightly to compensate. It would make the reflective "boundary" formed by the screen be somewhat "fuzzy". Instead of having a partially reflective boundary that is at a single distance from the source, you'll have a region of semi-transparent, semi-reflective material for the sound to pass through. The self-interference reflection could not line up with well-defined quarter-wave nodes.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 13 Jul 2010 01:14:34 GMT
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I want the brutal honesty even if I can't or won't follow all of your ideas. I've got some problems with the toe in as I'm pinched for space on the left side. Also not sure how it would help the center channel.

I like the idea of experimenting with the open cell foam. How about a sheet of foam over the horn area (or horn and port) How about the stuff that the Geddes disciples are using to stuff their horns with?

I obviously like the black version.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Tue, 13 Jul 2010 01:37:07 GMT
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I think this is a good application for this open cell foam. I'd place it between the horn mouth and the screen, perhaps attaching it to the screen in front of the horn so sound has to travel through the span, not just the screen. Don't leave a gap because we're trying to eliminate transitions, having only one, where the sound leaves the screen towards the listeners. You can fill the horn with it as Geddes prescribes too, which will cause the sound to travel through the same sort of space all the way from the phase plug to the screen.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 13 Jul 2010 13:57:37 GMT
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Time for less talk and more building as I need to first get some speakers made. Then I can give them a listen and maybe convince a friend to come over with his calibrated mic and software to test them in place.

If you have any interest in furthering the "Science" of making Pi speakers more AT screen friendly I could drop some fabric remnants in the mail.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Tue, 13 Jul 2010 14:34:14 GMT
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Well, sure, if you have some of the screen material and the open cell foam, I'll measure the speakers with and without the screen in front (at various positions and angles) and with and without the open cell foam sandwiched between screen and speaker. I'd like to also try it with a piece cut to fill the horn like Geddes does, because if the foam is just put in front of the speaker,

then we have an abrupt transition at the mouth. Kinda trying to make a "medium" for sound to pass through that is relatively constant from phase plug to screen face.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 13 Jul 2010 20:51:08 GMT
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Sounds like a deal, I'm going to do some more reading on sources for the foam an how to fashion a plug in between sawdust sessions.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Tue, 13 Jul 2010 22:06:24 GMT
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Very good, keep us posted.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Psychoacoustic on Fri, 16 Jul 2010 10:35:20 GMT
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Let the woodchips fly! Hope to see some finished photos soon.
And your home theatre looks sensational, BTW.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by skywave-rider on Sat, 17 Jul 2010 01:26:01 GMT
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Ditto.

Interesting about the perf screen.
Beautiful theater!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 02 Aug 2010 21:25:11 GMT
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Progress has been slow, not for complexity only a time allocation issue.

So I decided to go with a two layer front baffle consisting of 3/4 MDF and 1/2 MDF. Using the 1/2 inch MDF as an easy method of flush mounting the woofer and horn. I also decided to use Green Glue dampening goo between the layers. The baffle turned out to be remarkably quiet once assembled.

I originally planned to use the leftover 1/2 scraps to make the ports but once I had them glued up I didn't like how they responded to a knuckle test so I glued up some 3/4 versions and they sounded better.

Here is the front baffles and ports glued up. When the sides are all glued up I will be removing those screws and washers you see in the picture. I used the washers to keep the 1 1/4 inch screws from going through the front.

Next, item is the horn isn't quite 1/2 so I cut some gaskets out of some rubber foam I had sitting around.

Then test fitted everything. When I screw the horn in it will flatten the gaskets a bit and sit flush.

I will probably cut a little more out of the woofer recess.

Couple of questions. I'm planning on rounding over the cabinet edges but what about that port opening? can I take a little off?

On mounting the woofer I've used putty caulk in the past to seal woofers yet make them removable for service and did note that you mentioned shower liner in another thread, any other thoughts? Guess I could cut some more gaskets out of the foam rubber. I've got some 10-24 T-nuts and bolts for the mechanical attachment.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Tue, 03 Aug 2010 14:40:51 GMT
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I definitely emphasize with you on the time crunch and having a hard time scheduling projects.

But it looks like you're making good progress. Getting close now!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 03 Aug 2010 15:21:10 GMT
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Can I round over the port opening a little bit?

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Tue, 03 Aug 2010 17:39:43 GMT
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Sure, no problem. They're large enough port velocity is real low even at full power. But radiusing the edge won't change tuning by any appreciable amount so it can't hurt.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Wed, 04 Aug 2010 19:53:48 GMT
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Some more progress. Three boxes less bracing and backs completed.

Found some scrap 1x2 oak in my scrap pile for the braces as specified in the plans and threads.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Wed, 04 Aug 2010 21:44:08 GMT
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Looking good. Don't forget to put insulation on the top brace, spanning the cross-section of the cabinet. It kind of forms a pseudo-transparent separator between woofer and port. I say pseudo-transparent because it is completely transparent at low frequencies where the bass tuning

works, but attenuates midrange frequencies to damp internal standing waves. This is done in addition to lining three internal panels, the bottom, one side and the back.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by krikor on Thu, 05 Aug 2010 13:36:53 GMT
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Seeing this makes me want to find the time to build a pair of these cabinets as well... and soon! I've got all the parts including the JBL drivers just sitting in a closet. So many projects, so little time this summer.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Thu, 05 Aug 2010 14:26:49 GMT
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Wayne is this what the Doctor ordered for bracing?
I found some 3/4 x 1 1/2 and 3/4 x 2 Oak in my scrap pile. I positioned it about as low as I can go to create the "shelf" for the recommended insulation installation separating the woofer from the port.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by krikor on Thu, 05 Aug 2010 15:33:13 GMT
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Wayne,

Something I've been wondering about with regards to the 4Pi port that is evident in this photo... since the port is so close to the cabinet side wall, could you just build a three-sided port and use the cab sidewall as the fourth side?

It would mean moving the port over slightly, or narrowing the cab a bit and making adjusting in height/depth to keep the same volume.

Any reason you wouldn't want to do this?

Just thinking about how I can streamline my (eventual) build.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Thu, 05 Aug 2010 15:54:07 GMT
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When you look at the front of the speaker and the size of the woofer I can't imagine it being much narrower. I applied a copious amount of Green Glue between that side wall and the port to act as another constrained layer dampening surface to tame vibration and resonances.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by krikor on Thu, 05 Aug 2010 16:01:25 GMT
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Ah yes, I forgot about the diameter of that big JBL woofer. Actually, your approach makes more sense using the port wall as additional stiffening agent/vibration sink for the cabinet.

I like what you did with the baffles, especially the rounded over port, and I am now planning to do similar. Will probably use baltic birch or a veneer for the front layer since my speakers won't be hidden.

Thanks for the photos and details.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Thu, 05 Aug 2010 16:23:38 GMT
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BigmouthinDC wrote on Thu, 05 August 2010 09:26Wayne is this what the Doctor ordered for bracing?
Yes, that's good. That's exactly how I do the braces.

BigmouthinDC wrote on Thu, 05 August 2010 09:26I found some 3/4 x 1 1/2 and 3/4 x 2 Oak in my scrap pile. I positioned it about as low as I can go to create the "shelf" for the recommended insulation installation separating the woofer from the port.

That's perfect.

krikor wrote on Thu, 05 August 2010 10:33Something I've been wondering about with regards to the 4Pi port that is evident in this photo... since the port is so close to the cabinet side wall, could you just build a three-sided port and use the cab sidewall as the fourth side?

You could, and that's actually how I modeled the cabinet when I first started assessing the impact of internal standing waves. But I didn't like the looks of the cabinet with the port that close to the edge, so I shifted it inwards about an inch by adding the extra material.

As you guys have discussed, the cabinet dimensions can't be reduced, and really, you don't have a lot of choices with port position either. But there is some wiggle room, I suppose. You could put

it right out at the edge. Still, with the extra cost of a couple pieces of wood, I think you'll be happier with the port where it is drawn in the plans. It looks really funny to me when it's placed higher than the tweeter and shifted outward. Where it is now, it's even with the tweeter.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Fri, 06 Aug 2010 12:45:52 GMT
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Wayne, Design question of the day.

As I mentioned earlier I need to avoid any direct reflections back to the screen. The JM white R13 fiberglass I picked up for insulation will definitely reflect light at the back of the port. I've thought of 4 solutions.

1) Staple some black acoustically transparent fabric to the back of the port. I have some black GOM FR701 fabric on hand but could easily run and grab some Joannes speaker cover fabric

2) Use the same fabric and instead of stapling to the back of the port drape over the offending insulation leaving a gap between the port and the fabric. Since the side of the cabinet with the port is supposed to also get insulation this isn't going to be real easy as there will be two surfaces to cover.

3) Get out a spray can of black flat and put a light coat on the visible fiberglass

4) I have some Linacoustic duct liner which is one inch thick compressed fiberglass insulation with a black coating. I could cut a little pocket in the R13 and position behind the port.

My preference is #1 but I'm not sure whether or not even a little air movement resistance may affect the tuning.

Thanks for the assistance so far!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Fri, 06 Aug 2010 13:00:00 GMT
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Don't use a screen on the port because it will be too restrictive.

Use a can of black spray paint and lightly mist the insulation in the area behind the port. Don't saturate it, or the fibers will become stiff and lose effectiveness. Test it with your hand after it's dry and make sure it's still the same consistency as the untreated fibers. I've done this before and it works very well.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 09 Aug 2010 12:43:42 GMT
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I did manage to get the the braces glued in place and the backs on all three boxes this weekend, Started to Bondo the seams and do the first sanding. However now I need to shift gears this week for a kitchen counter top installation and then do a subway tile back-splash so the cabinets will be aging for a week. Crossover parts should be delivered today but one of the caps is back-ordered for later this week.

I've been reading a number of sources on painting the cabinets and haven't quite decided. Some of the favorite finishes like duratex look a little to shining for the front baffle. I may end up with putting one finish on the whole cabinet and then shooting some flat black on just the front.

Anyone, Any suggestions? I like a little bit of texture (like vinyl) and I dislike the rough feel of the truck bed liner solutions.

Rubberized black bumper paint has come up on some thread.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 09 Aug 2010 16:12:05 GMT
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I've used truck bed liner and I've also used black formica. Both are excellent. The truck bed liner is easier to apply, in my opinion, and not as shiny. You can also spray over it with flat black to make it even more dull.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by rkeman on Tue, 10 Aug 2010 19:22:40 GMT
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Duratex and LSS Aligator finishes are both excellent choices and can provide a fairly matte

appearance while still having some life and body. Both are very tough when dry. If cost is an issue, Valspar satin acrylic latex in Kettle Black can be found at Lowes and produces a mild orange peel finish with a smooth roller. At least two coats are necessary over unprimed MDF and plan for about 10 days before the finish is fully dry before monting the drivers.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Thu, 12 Aug 2010 21:26:30 GMT
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Thanks Rkeman for the LSS lead.

I can find plenty of pictures of Duratex painted speaker projects including this one which shows exactly what I DON'T want:

Too shiny and I'd like a much more subtle texture.

I haven't found a single LSS painted project with a Google images search.

I did find this documented project that used a foam roller with the Duratex. This is close to what I want and I bet I could hit the front baffle with a coat of flat if needed.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Nichol1997 on Fri, 13 Aug 2010 00:27:05 GMT
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Take a look at the pictures in this thread:
http://www.avsforum.com/avs-vb/showthread.php?t=1015331&highlight=bedliner

and this one:
http://www.avsforum.com/avs-vb/showthread.php?t=1265019&highlight=qsc

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Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Fri, 13 Aug 2010 21:35:25 GMT
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Update: I ordered a gallon of Duratex.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sat, 14 Aug 2010 05:13:33 GMT
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and the finish holds up well even under massive abuse. They've taken everything from summer sun (105° in the shade) to load-in/load-out on semi trucks to rowdy crowds and they rarely even need touch up. At 285lbs, rolling them up the truck ramps and then sliding them across the bed, you would expect the bottoms to wear through but they really don't. It's good stuff.

I know your application won't need any of that but I'm just sayin'.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 17 Aug 2010 17:36:06 GMT
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UPDATE:

I put on two coats of Bulls-Eye sanding sealer and sanded. The MDF soaked it up like a sponge.

Sprayed on a coat of sanding primer. While not required for the Duratex it will help in finding any remaining voids and rough spots that need some attention before putting on the Duratex.

Also pics of the recesses for the banana binding posts.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Psychoacoustic on Fri, 20 Aug 2010 10:30:33 GMT
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Thanks for posting the pics. Great to see other builder's work- yours appears exceptional. Looking forward to reading your listening impressions. BTW- do you have a dedicated two channel system in addition to your HT?

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 21 Aug 2010 01:27:23 GMT

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Thanks for the feedback. As for two channel listening, I do enjoy music, I tend to enjoy it mostly as a sound track for my life while I am either on the move or taking an exercise class. I'm afraid a dedicated two channel listening set up would get little use in my house.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Nichol1997 on Sat, 21 Aug 2010 23:25:14 GMT
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Looking good. You are in the home stretch now. All of the time consuming parts are finished.

The recessed portion for the horns look perfect. Did you take the time to make a template for the router?

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 22 Aug 2010 02:08:59 GMT
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Nichol1997 wrote on Sat, 21 August 2010 18:25
The recessed portion for the horns look perfect. Did you take the time to make a template for the router?

Thanks Nick, I know I talked about it but I tried cutting the cutout for the horn with a jig saw and I had pretty good luck. If I was setting up to crank out the cabinets on a volume basis I would have a template for sure.

So here is what I did. I started with a two piece front baffle. 3/4 and 1/2.

I cut the horn and port cuts with a jig saw with the two pieces separate. I cleaned up the cuts with a file and sandpaper. I also used two different blades one blade that had a much longer profile and a blade intended for tight radius cuts for just the horn corners on the 1/2. I first cut the two top cut-outs in the 1/2 then I screwed the two pieces together from the back. I then marked where the holes were on the 3/4 and drilled the 1/8 center pivot hole for the woofer through both layers.

I took the two layers apart and finished all the holes with the jig and router. Then I put the two layers back together using green glue between the layers. I used the previous screw holes to align the two layers.

The one last step was to take a little more out of the woofer recess and I used a dado guided clean-out bit to make quick work of that. (Woodline)

I made the outer 1/2 inch layer over-sized 1/8 inch all around so that I had some margin for error and after assembly I trimmed it off with a flush cut bit (Just like you showed me!)

The one thing I would do differently would be to intentionally undercut the port hole in the outer 1/2 baffle and then finish it off once the port was glued in behind it. That would make the area where they are joined a little cleaner and you could work a little faster if you just need a rough cut.

Ordering the Crossover parts from PE was a bit of a challenge.

The superior cap was on back-order and I took the last 8 (of the 9 I needed) of another. They also ommitted slipping the dummy load resister in the box. So it took a 20 minute phone call and I should have everything I need when I get home next week. I am using your design for the hook-ups.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Fri, 27 Aug 2010 00:25:07 GMT
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They're BLACK.

Used two coats of Duratex with some light sanding with 400 grit after coats. Used a foam cigar roller intended for smooth finish. The result is a subtle texture. Just what I wanted. Now on to the crossovers.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Fri, 27 Aug 2010 02:18:00 GMT
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Those look really great. Not long now...

I love your stage lettering, by the way. Very cool!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Fri, 27 Aug 2010 03:39:02 GMT
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Thanks, Stage?

It is the bar at the back of my theater space. I'm still working on some concepts for the back-splash design. I get a lot of feed back on the lettering. They are basically metal laminate

faced 1 inch thick gator foam letters. Most commercial sign shops can get them. I have some LED strips mounted behind some molding on the ceiling that light up the letters.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Fri, 27 Aug 2010 04:29:54 GMT
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Oh, I see now, that's a bar at the back. Now I visualize what your theater room layout looks like. I just was picturing your room wrong and thought we were looking at the screen area in the photo from a few posts back. I remember now, the screen area was shown in your first post, shown again below.

Really diggin' your theater room. Looks great, really great. It's getting ready to sound great too.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 28 Aug 2010 18:18:05 GMT
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So I wired up the three crossovers, used some scrap flooring and split the High and Low sections. Not pretty, I hope they work. Tested them all with the drivers attached and they measured 5.8 ohms.

One little detail, those bright shiny edges on the JBL speakers weren't going to cut it behind the screen. So I masked them and painted them. Cut some strips from a file folder and inserted in the slot that existed between the felt gasket and the metal rim. Taped the sides and laid paper towels on the cone.

Gave it a shot of Krylon ultra flat black.

here is a comparison before and after

Hopefully my next post will be the finished speakers.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sat, 28 Aug 2010 23:01:05 GMT
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Yeah, I was wondering what you were going to do about those shiny edges. I expected you would want to paint them.

A word of warning, if you really put the power to these, the resistors in the tweeter circuit can get pretty warm to the touch. I saw that you used what appears to be an adhesive. It's probably OK, and even if it got hot enough to melt the adhesive, that probably wouldn't do anything bad. But I did want to put a bug in your ear about it. I've had the resistors melt plastic nearby when used at high power levels for extended periods of time. It will burn right through a wire tie, for example.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 28 Aug 2010 23:14:12 GMT
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Thanks for the tip on the resisters. When I install the crossovers I'll make sure that if they come loose that nothing bad can come from it. I was planning to mount them on the bottom, so gravity will pretty much not be a factor. Will it be a problem to put the insulation in contact with the resistors?

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sun, 29 Aug 2010 14:57:09 GMT
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No, I haven't had any trouble with fiberglass insulation. I've layed it right on the resistors for years without having any problems. I've never tried to burn the stuff to see how it acts but it is made of recycled glass and sand so I wouldn't expect it to burn.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 29 Aug 2010 15:41:56 GMT
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I got one assembled last night and I lugged it over to my stage area and ran the center channel wires to it. The thing is so efficient that I couldn't turn my system up to my normal setting which meant I also couldn't really hear any of the other speakers.

Walking around the seating area I was very pleased with respect to the clarity of the dialog at all the positions. I only had a crappy made for TV movie on so not a real test.

More to come.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sun, 29 Aug 2010 19:41:22 GMT
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That's excellent. Now the adrenaline really starts to flow...

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 29 Aug 2010 21:30:25 GMT
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Just carried them in from the workshop, still some dust I see in the picture. All three work. Now to fish out the other wires, and give a run.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 29 Aug 2010 22:04:32 GMT
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First report. I turned on some Satellite Smooth Jazz and set my Receiver to stereo. When sitting in the masters chair, 3 times I had to get up and put my ear to the center channel because that was were most of the sound was located but of course it was turned off. These things would be phenomenal for anyone needing to run a phantom center channel.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sun, 29 Aug 2010 23:33:06 GMT

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A close up (Speaker Porn)

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 30 Aug 2010 00:20:55 GMT
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A few more under the hood shots of the construction process.

It seemed like dampening the horn would be a good idea or at least couldn't hurt.

So first a little log cabin style:

Then a barbershop up and down with the remainder of the roll:

Then I got to thinking about what happens in ten years when the caulk dries so I gave it a gorilla brand duct tape safety net:

screwed the crossovers in on a 1/8 inch rubber pad.

Added some gold plated bling banana plug binding posts.

Then the recommended insulation on the bottom, back, a cross section at the brace and the side by the port

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 30 Aug 2010 02:40:49 GMT

Nice report! Your speakers look great and it sounds like they're sounding good too. Very good, must've wired 'em all up correctly.

Thanks for all the photos, by the way, I think they're interesting and very helpful for future builders reading this thread.

BigmouthinDC wrote on Sun, 29 August 2010 17:04First report. I turned on some Satellite Smooth Jazz and set my Receiver to stereo. When sitting in the masters chair, 3 times I had to get up and put my ear to the center channel because that was were most of the sound was located but of course it was turned off. These things would be phenomenal for anyone needing to run a phantom center channel.
That's how I run mine, left and right axes crossed in front of the listeners, phantom center. I use

BigmouthinDC wrote on Sun, 29 August 2010 19:20It seemed like dampening the horn would be a good idea or at least couldn't hurt.
I don't damp mine with the caulk, although I have tried it. Bill Epstein, a good friend of mine, recommended it at one time but I personally could not hear or measure any difference. These H290's have a thick body and are dead to the tap. I will say I found it to be helpful on other horns with thinner bodies. I've even had some horns that rang like a bell, at a frequency in the passband. Yikes! But the H290 just isn't like that.

BigmouthinDC wrote on Sun, 29 August 2010 19:20screwed the crossovers in on a 1/8 inch rubber pad.
Very good, nice touch. I think it is potentially important to put gaskets under the crossovers, to prevent them from buzzing. I mean, I've tried lots of mounting configurations from mounting on standoffs to wired in line (hanging) to mounting directly to the panel inside. I like this last approach best, because it is sturdy and rigid. The gasket makes sure the board doesn't buzz. I use silicon to tack down the components on the board as well.

BigmouthinDC wrote on Sun, 29 August 2010 19:20Then the recommended insulation on the bottom, back, a cross section at the brace and the side by the port
Excellent. I noticed you didn't forget the cross-section piece, which is very important to ensure smooth midrange.

All-in-all, your speakers look like they are very well built and should give years (decades) of good sound.

Please report back when you've watched a few movies and also when you've lived with them a while, to let us know how you're liking them as time passes.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread

Posted by BigmouthinDC on Mon, 30 Aug 2010 02:55:04 GMT
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Thanks for the positive comments and thanks for making your plans available. Without the plans this effort wouldn't have happened.

I haven't forgot our discussion about the use of foam. When the horns were loose I made a cardboard template of the inside profiles of the horns so that I could attempt to fashion a foam plug. My plans are to make a plug, but to also send you a larger sheet of foam along with a piece of the screen fabric so that you can do some measurements of what might be the best strategy for behind screen placement. This assumes you still have an interest.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Infrasonic on Mon, 30 Aug 2010 07:15:54 GMT
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Impressive work, DC.

Please keep us updated on your thoughts on these. I, for one, am very interested in their performance with movies.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Psychoacoustic on Mon, 30 Aug 2010 07:58:31 GMT
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Congratulations on finishing your fabulous build. 4 Pi's performance will surely compliment that amazing theatre.
Always interesting to see: A) Speaker Porn... and B) The Porn Star in the making.
Efficient- spit out a few decibels, don't they!
Enjoy.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by addictedtosound on Mon, 30 Aug 2010 12:01:44 GMT
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Great looking project, how much did the whole build cost in the end, so I can see how many pennies I have to save up

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 30 Aug 2010 12:26:06 GMT
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addictedtosound wrote on Mon, 30 August 2010 07:01Great looking project, how much did the whole build cost in the end, so I can see how many pennies I have to save up
Check out the bare bones kit prices on Wayne's site. IMHO He adds a very modest mark-up for doing all the leg work and providing an assembled crossover on a real circuit board.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 30 Aug 2010 23:28:59 GMT
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BigmouthinDC wrote on Sun, 29 August 2010 21:55Thanks for the positive comments and thanks for making your plans available. Without the plans this effort wouldn't have happened.

I haven't forgot our discussion about the use of foam. When the horns were loose I made a cardboard template of the inside profiles of the horns so that I could attempt to fashion a foam plug. My plans are to make a plug, but to also send you a larger sheet of foam along with a piece of the screen fabric so that you can do some measurements of what might be the best strategy for behind screen placement. This assumes you still have an interest.
Absolutely. Send me some of the screen material and foam and I'll make some measurements. It will be an interesting study.

My gut feeling is we want to span the gap between source and screen with a material that is as close to the same acoustic resistance as the screen as possible. The idea is to prevent an acoustic transitions from source to freespace to screen. To achieve this goal, we will want foam filling the entire horn, all the way back to the phase plug at the entrance of the throat. This should extend out past the horn to reach the screen.

The midwoofer won't need quite as much attention as the wavelengths are longer, but it does reach up high in the midrange into the overtone area where wavelengths are just a few inches. So I would place a block of foam that spans the distance from the baffle to the screen, covering the woofer. You don't want the woofer to rub the foam, naturally, but you do want the foam to be as close to the woofer as possible, without actually touching it.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Tue, 31 Aug 2010 14:16:56 GMT
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Wayne another technical question. I wonder if you have any experience with the 4PIs in a baffle wall mounting.

Currently my front wall behind the screen is entirely treated with linacoustic but I could also build a baffle wall flush with the fronts of the speaker the same size as the screen.

http://www.thx.com/professional/cinema-certification/speaker-layout-and-baffle-wall/

In my research I found this quote in a JBL manual:

Baffle loading
For optimal results, JBL Professional recommends the installation of screen channel speakers in a full
baffle wall, such as recommended by Lucasfilm/THXÒ and others. Good results can also be achieved using
reinforced baffle "wings" on either side of the speaker system stacks, as long as they are constructed using
high quality materials and are free of resonances and vibrations.
The preferred baffle wall design extends from interior theatre wall-to-wall, and floor to ceiling, essentially
creating a room behind the screen, into which the speakers are flush mounted, firing into the auditorium.
For practical and budgetary reasons, this concept can be modified, still yielding good results, but optimal
performance is typically achieved in a full baffle wall condition.
Full Baffle Wall
The speakers should be located in the baffle wall so that the front of the LF cabinet is flush with the front of
the baffle wall acoustical treatment material (typically black faced duct-liner).

Another post on a discussion of baffle walls had this qoute from Dennis Erskine (well respected theater designer, board member CEDIA)

"A baffle wall should:
run stage to ceiling, wall to wall
be very rigid
allow no resonances in the cavity behind the wall
be covered with 1" (sometimes more depending on speaker) of a black absorptive material (reduces reflections between the screen and the wall.
have the speakers resiliently mounted to the baffle
have no air gaps between the speaker body and the baffle wall
have all front speakers including the front subs in the same continuous baffle.

The speakers themselves should be covered with the black absorptive material with cut outs for the drivers.

Problems. You best have your speaker placement exact for proper listening and sound stage creation ... you're not moving them later. Understand, speaker frequency response will change (partially why the baffle is treated with absorption).

Do a search on 2 pi speaker response or spatial loading to get started. I believe QSC Audio has a paper on their website about this. Really good speaker companies will have FR plots and data

available for their speakers for 2 pi installations."

Any thoughts?

Subject: In-wall flush mounting
Posted by Wayne Parham on Tue, 31 Aug 2010 22:08:38 GMT
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All of my speakers respond well to this kind of placement. They are all designed to be used in quarter-space or eighth-space, and I don't use baffle step compensation filters. My thinking has always been that the baffles are rather large, so the transition happens in the lower midrange, close to where room modes take over. That's not where you really want to bump up the power, but then again, you don't want it to be lean down low either. So instead of including baffle step filters, I've suggested placements that reduce the problem acoustically. And as for room modes, a different but related matter, they can be effectively mitigated using a multisub approach.

Placing the speaker close to the boundary reduces baffle step, among other things. The closer the speaker baffle is to the back wall, the less the baffle step. If you can recess the speaker in the wall flush, the baffle step goes to zero. It also makes the reflection off the back wall go to zero too. Those are both important goals.

Some people try to reduce the negative influence of the back wall reflection by moving their speakers out away from the back wall. That's reasonable, a good idea, I suppose. It reduces the amplitude of the rear reflection because of distance. It increases the delay of the reflection too. There's a window of time where reflections are most troublesome, and by moving the speakers away from the back wall, they hope to decrease the early reflections, and to delay them out of that window.

But I go the other way, for several reasons. It is hard to space the speakers far enough away from the back wall to do much good in most living spaces. Most rooms in peoples' homes aren't big enough. So I use another approach. I prefer to use directional speakers that limit the rear wave in the first place, which decreases the amplitude of the rear wave by virtue of directivity. Instead of trying to make the rear reflection late, I try to make it so early it is indistinguishable from the direct wave. As you decrease the distance from baffle to boundary, when the distance becomes zero, so does the reflection delay. So that's the direction I go.

That's why I like using directional speakers designed to mount right up against the rear wall or in corners. The rear wave reflection becomes less of a problem and baffle step is nearly eliminated, because there is so little transition region. If the speakers are mounted with their baffles

completely flush with the walls, or their drivers mounted at the apex of the corners, baffle step and rear reflection are completely eliminated.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Mon, 06 Sep 2010 11:24:29 GMT
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Got them into position. While not what I expect to do forever it is good enough for now. I'm leaving the L/R sitting on 10 inch subs and I found that I like letting the subs add a little to the very bottom of the L/R soundtrack. You notice it most on full orchestra passages. I have a doohickey that allows me to mix in a little of the LFE and send to the L/R subs as well.

I'm loving the dynamics of the speakers. They were made for action films.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Mon, 06 Sep 2010 14:54:48 GMT
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Multiple subwoofers - that's definitely the way to go!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by morphlaugh on Wed, 08 Sep 2010 06:03:17 GMT
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Big,
Your theater looks amazing! What amp are you using to drive these 4pi's? What are you using for your surround speakers to timbre match these, if you're using these for your mains?

Wayne, thanks!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Wed, 08 Sep 2010 15:15:00 GMT
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Thanks for the feedback

My amp it the Outlaw 770

http://www.outlawaudio.com/products/770.html

Right now I have the Audax HT kit surrounds in side columns and in custom DIY angled front baffle ceiling speakers for the rears. The lack of exact timbre matching hasn't bothered me yet but I will admit that I have given some thought to doing a tall slim version of the 3PI for the side surrounds, Something that is just deep enough to hold the drivers. Not that I feel I need to right now but just because it is something I could do.

Here is a shot of my DIY rears, I copied the concept from a Triad Speaker. It got covered with fabric.

This was the inspiration for the rears, I also have some acoustical treatment in mine but it is not obvious in the picture.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Wed, 08 Sep 2010 17:29:55 GMT
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I wouldn't want surrounds to be way different, but I don't think matching the surrounds to the mains is nearly as important as matching each of the speakers used as L/C/R front mains.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by morphlaugh on Wed, 08 Sep 2010 18:16:48 GMT
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Wayne,

I think timbre matching the surrounds is quite important. Although I agree that most movies simply

use the surrounds for ambiance, there are some movies where for example, a ship will fly overhead and it'll come from the surrounds and fly to the LCR's when coming onscreen.

I've just found this website and am still trying to find all of the data I can from these forums about the 2pi and 4pi loudspeakers you've designed. I'm thinking of doing what Big has done here and build myself three 4pi for the LCRs of my work-in-progress theater, but two things are holding me back:

1) I am afraid of trying to timbre match to the surrounds. I don't have horn surrounds, and horns definitely add a fair bit of presence to a speaker, in my experience. What I have now are some ported tweet-mids for my surrounds, and I am worried I won't be able to properly adjust my surrounds into the mix. You suggested the 2pi's... what are they? Are they a horn/ported woofer configuration?

2) I haven't had the pleasure of listening to the 4pi's yet... I have just been reading the glowing reviews of how great they sound. Do you ever take them on the road, and more specifically, to Colorado?

Could I get a copy of the 2pi and 4pi designs/specs? I'd love to look em over and see what's involved and what trade-offs I'd be making if I selected the cheaper or more expensive components.

Thanks!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Wed, 08 Sep 2010 19:46:44 GMT
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I would agree generally, that to match surrounds and mains at least in terms of spectral balance is important. In fact, there was a time that I recommended all five speakers in a five channel system should be the same. However, I have backed off this, because my opinion has changed. I now think the fronts should be the same, but that surrounds need not be.

In fact, I think it is probably better that the surrounds not be the same as the mains, at least in terms of directivity. I prefer the fronts to be somewhat directional but the surrounds to have a wider pattern. They are primarily for ambiance. Even though sound effects in the surrounds are occasionally "given focus", it is rare and only for an instant, a transition to the front or as a quick movement away. Their main purpose is ambiance.

I don't think the surrounds should be radically different than the mains though. The spectral balance should be pretty similar. This is important for the times when a particular sound pans from fronts to surrounds or vice versa, like you said, as a fly-by or an approach or something. But even then, we're talking about a sound coming into focus or going out of focus, so a sonic transition is made, just as the visual transition is made. The effect is realistic, provided the speakers are not completely different.

I did some little subjective experiments before coming to this conclusion. I tried various speakers, even including some that were considerably different than the mains. I used bookshelf speakers, unbaffled speakers, car speakers and even some with tweeters removed to see what sonic significance there was in surrounds. I could tell when surrounds lacked a major portion of the spectrum, like if the treble was completely gone. Or if a speaker couldn't "keep up" dynamically, bottomed out or broke up at loud passages, obviously, I could hear that. But as long as the spectral balance was similar and there was sufficient dynamic range, the illusion of realism was

dynamic range.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by BigmouthinDC on Sat, 05 Feb 2011 01:51:09 GMT
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It has been some time since I posted any information in this thread but this week I have been playing with a new measurement system I purchased to test my speakers, some planned sub-woofers, room set-up, and the overall acoustical design of my space. I picked up the OmniMic from Parts Express.

My thoughts relative to the Pi's are to do some of my own measurements of the effect of the SMX screen in the audio path and the impact of adding some foam to the waveguide.

To start this is my first pass at measuring one of the 4Pi's in place in the wall with the microphone about 3 ft away. This is with the screen in place:

I hope Wayne doesn't mind but I'm copying in one of his published graphs:

I'm actually pretty happy that what I built looks to me about what the Master designed. I wonder about that sawtooth uptick in the higher frequencies that I can no longer hear. Maybe some screen interference issues.

When I finish building some new sub-woofers I'll be taking down the screen and at that point I can measure without the screen fabric.

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by Wayne Parham on Sat, 05 Feb 2011 16:04:24 GMT
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Thanks for reporting back. It's always nice to get feedback from people, especially when they've done as much work as you have.

I'm impressed to see this measurement through the screen. It's pretty much the same chart as you get from an anechoic measurement. There is usually more ripple than that when you add a grille or screen.

Your system looks great! All you lack is getting the subs added in.

Great job!

Subject: Re: Three 4Pi's in Basic Black for Home Theater Build Thread
Posted by NWCgrad on Wed, 17 Oct 2012 09:15:08 GMT
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Big,

Did you build your subwoofers? If so, what did you go with. I am about half way through your HT thread on AVSforum, simply awesome work! I followed the link from there to re-visit your speaker build.

This thread was a major inspiration for my building the 4 Pi's.
