Subject: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 18 Jul 2011 00:02:02 GMT
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Greetings! I am maintaining a build thread for a new Dinner Theater at our family's winery in Iowa. We are completely remodeling a 5,000 sq ft church build in 1930 into our new winery location. I will post a link to my build thread on the AVS Forum later (I'm typing this on my phone). If you want to see a photo album of our progress on the overall project see "Van Wijk Winery" on Facebook.

Anyway, thought I would keep a diary of my 4pi builds here so that I might get some feedback from the man himself or other enthusiasts better equipped to answer questions specific to the pi speakers.

I started my first 4pi speaker using a 7ply 23/32 Arauco found at Lowes. After making a few errors, such as putting in the rear panel and bracing before putting in the port, I decided to start from scratch and use that first speaker as my learning curve. After sifting through 20 sheets of 13ply North American Birch at Lowes I finally became frustrated and finally did some research on other local lumber stores. I found a woodsmith store literally 4 blocks from my house that sells the Baltic Birch in 5' x 5' sheets for $60/sheet (among other quality varieties). All of this time I thought those knocking Lowes' and HD's plywood selection were just being snobs. But after just a little experience working with some of them, I realize that those other 'big box' lumber stores'lumber isn't even in the same league as the Baltic Birch. So, either I was wrong before, or I am a snob now too

I will post a few pics later, but in the mean time a couple of questions I hope to find quick answers to:

1. I have read a few posts from Wayne about making the center channel sealed. I wanted to see about feedback for our specific application. In addition to the three 4pi speakers being used for LCR duty behind a 180" acoustically transparent screen, four F20 horned subs of lilmike's design using the Reference HF driver will be integrated behind the wall under the creen pointing at the audience. While I will mirror the right channel with the port left of the horn, is there ANY advantage to making our center channel sealed?

2. I notice that the space above the port is 3/4 inch. Is that space supposed to be there? More to the point, is there any disadvantage to sandwiching another piece of 10" x 5" above the port so that it may have extra support by being able to screw into the port from the top as well as the side?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by petew on Mon, 18 Jul 2011 00:49:46 GMT
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Hey glad to see you checking in here. I've been watching your progress over at AVS. I've got the drivers and other odds and ends on hand to build four of Lilmikes F-20's. Then I plan to build 4 two Pi's for surround duty and eventually build a trio of four Pi's.

As my drunk friend Marvin says: "Ain't life fun?"

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 18 Jul 2011 02:04:52 GMT
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Also, should I screw in the bracing from the outside, or is the PL and preload enough?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Mon, 18 Jul 2011 03:14:52 GMT
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The sealed center channel offers no advantage - It's done purely for aesthetics. It actually reduces LF extension; however, having the extra extension in the left and right channels is probably enough overlap for the subs. So while the sealed centar channel provides no advantage, I don't see it causing any real disadvantage either, provided the right and left channels are vented as designed.

As for the braces, glue and a small amount of preload is enough. I actually prefer not to use screws except in places where clamping force is needed and a removable brace is impossible or

holding/clamping force on some panels and internal structures.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 18 Jul 2011 03:53:16 GMT
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Thanks for the reply Wayne.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Dave_S on Mon, 18 Jul 2011 04:40:59 GMT
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I have made some mistakes with buying plywood from big box lumber stores myself. My TV stand that I will post in my build thread in the future was a disappointment to me. The veneer was rotary cut (made like a pencil sharpener), so I ended up with a plywood veneer that soaked up way too much stain and the grain pattern was a blotchy mess. For my last project, I opted to pay 3 times as much for cabinet grade lumber. I haven't seen anything that comes close to baltic birch in

terms of structural quality.

Maybe I will get to hear your system a few years down the road. My nephew is starting college in Ames this fall, so it may be a side trip. I don't know much about wine, but I am an all grain beer brewer. The thought of working in a winery sounds nice. There is always the voice in my head telling me to start a brewery, but it would probably be tough.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 18 Jul 2011 04:48:40 GMT
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We are thinking about dabbling in a couple of beers. We already have 18 varieties of wine. Ames is only about an hour from the winery. I got my bachelors and Masters from ISU.

Subject: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by dutchswan0311 on Mon, 18 Jul 2011 14:03:09 GMT
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Wayne, may I please have the plans for the 1pi and 2pi? I am considering using one of these for our surrounds in the Winery's dinner theater. How does the 1pi compare to the JBL 8320? How does the 2pi compare to the JBL 8340A? Building either of these models will certainly offer a cost benefit over $500 for a pair of 8320s or $750 for a pair of 8340As.

Keep in mind I am using 4pis for LCR, and four F20s for sub duty. The room is 1,200 sqft with a 300sqft balcony. Total room volume is about 20,000 cubic feet. I want the best bang for my buck, but also want to keep my surrounds as small as possible. The winery will have a 17th century castle feel with stonework, etc. The LCRs and subs will be completely concealed behind a AT screen, so the idea is to walk into the ballroom and NOT think "wow, there sure are a lot of speakers in here."

I will be needing 8 surronds I think.

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by justphil on Mon, 18 Jul 2011 14:31:18 GMT
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Supposedly the 1pis have a smoother response than the 2pis so I would lean in that direction but I am sure Wayne will offer his thoughts =) I would think in an effort to keep the "sound" the same using 1 or 2 pis would be the better way to go. But I know little to nothing except what I have read about speakers.

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by Wayne Parham on Mon, 18 Jul 2011 14:43:24 GMT
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Each has the same spectral balance, and so they preserve the illusion of seamless, fluid movement when sounds pan from surround to mains or vice versa.

them to be equivalent speakers, certainly above 100Hz. The only real difference is below 100Hz,

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by dutchswan0311 on Mon, 18 Jul 2011 15:43:15 GMT
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If they are.that similar, then their sizes will probably play a big part in my decision. if you will send me the plans, I will take a look at their dimensions and decide. thanks again Wayne!

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by Wayne Parham on Mon, 18 Jul 2011 19:09:09 GMT
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Outside dimensions for each model are shown at the following page:

and let me know - I'll send the plans right out.

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by dutchswan0311 on Mon, 18 Jul 2011 19:17:58 GMT
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I think 1pi definitely. The dimensions will actually allow me to put them between 2x6 studs and actually conceal 5.5" of that 8 inch depth. They will only stick out 2" after Sheetrock is hung.

Subject: Re: 1pi or 2pi for surrounds? (Please send me plans) vs JBL 8320 or 8340A
Posted by Wayne Parham on Mon, 18 Jul 2011 19:37:18 GMT
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Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Tue, 19 Jul 2011 17:59:34 GMT
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Please forgive me if these questions have been asked and answered;

1. What kind of screws do you recommend for the 1pi cabinet? I have been using a combination of 1 1/2" and 1 1/4" #8 wood screws for the 4pi builds, but fear these are to big for 5/8" plywood.

2. As long as the internal dimensions are kept the same, would it be okay to use 3/4" Baltic Birch for the 1pi cabinets?

3. I did not see any mention of cross bracing for the 1pi in the instructions. May I assume this is not necessary with this cabinet?

4. I see the port is round with a diameter of 2 1/2". The schematic shows the port is to be 3 1/2" deep. Is there a round port insert that comes with the kit, or is the depth of the port square while the entrance to the port is round? I am just a little confused how to make a round port with a depth of 3 1/2".

Thanks in advance for any assistance anyone can offer!

Jon Michael

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Tue, 19 Jul 2011 19:38:17 GMT
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Answers by numbers:

1. Screws - Don't use them, use clamps instead. I only use screws in cabinets where removable

internal structures and panels that must be clamped, so we use screws to provide clamping pressure while the glue sets. We predrill the holes and put PL adhesive in the holes before inserting the screws. That makes sure the screws don't vibrate loose and that no internal void,

split or chip is formed that might start buzzing later.

2. Baltic birch is fine.

3. No bracing is necessary, the cabinet is small and very rigid.

4. The kit contains port material. It's a thick cardboard tube that you cut to 3.5". Cut the port hole to match the OD of the duct and glue it in. Some people use plastic ducts, and that's fine, I suppose, but I prefer cardboard. It's wood pulp, just like the cabinet. I like to paint the inside of the duct black.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Tue, 19 Jul 2011 19:50:49 GMT
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As I mentioned in my previous post, for my first 4pi build I glued all joints using PL, and then screwed them together using 1 1/2" #8 brass wood screws. I guess I didn't realize the cabinet could be completely held together by PL alone. Actually, I suppose I should even ask if PL is the right glue to use. I assumed so since it is what the instructions called for with my F20 builds. (At least I didn't use sheetrock screws)

Am I going to run into issues with my 4pi, or is it supposed to have screws used? After screwing up on my first 4pi build in which I used Arauco, I was happy with the results of my second one (which is now really the first one) using the baltic birch.

I hope I don't have to start all over again. :-/

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Tue, 19 Jul 2011 20:59:42 GMT
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I prefer Titebond or Elmer's Wood glue for MDF. But for my larger hornsub cabinets that use Baltic Birch, I prefer PL adhesive. I have also used it in smaller cabinets and it works just fine. It just isn't as easy to clean up. So for the "furniture" aspect of the speakers that have real wood veneer finishes, I think probably the wood glues are probably better. Once that PL gets on the wood, it's really hard to get it off, so the finish can be blotchy.

Now please understand I usually have a cabinetmaker do the woodworking, so I'll defer to some of them here to give other opinions. There are some really good cabinetmakers here on the forum. What I'm telling you is what I've come across on the cabinets I've helped build. I tend to be hands-on from time to time with my cabinetmaker buddies, and have learned some from them.

As for the structural stuff, I've found good clamped joints are usually stronger than the wood when using either glue. If you break a box, it usually breaks the fibers next to the glue joint, not directly on the seam. So I'm pretty happy with both adhesives in this respect. As for acoustics, both are fine too.

About the screws, I wouldn't get too worried since they are all exposed and easy to access. You can always remove them, run a drop of glue down in the hole and retighten. The glue can then press into any layers that may have split when tightening the screws.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Tue, 19 Jul 2011 22:32:43 GMT
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Another question on the port:

If the internal diameter of the 1pi port is 2 1/2", and the cutout for the port is 2 1/2", then I assume the 3 1/2" tube (minus the thickness of the front panel) is glued to the back of the front panel? I know it sounds like a dumb question, but just want to be absolutely sure of what I am doing before I begin.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Tue, 19 Jul 2011 23:24:46 GMT
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If I understand your questions correctlly this is my answer. You cut the port material to the length needed IE: 3 1/2". The actual port cut out is just a hair bigger than the 2 1/2 diameter. I cut a 2 1/2 hole and then when I got the port material I used my dremel with a sander tip and opened it up just enough to get the port in. I then coated the end edge of the port with some PL (I used PL on all my 2pi and 1pi cabs) and slid it in even with the baffles front.

So long story short cut the port to 3 1/2" and slid it in all the way through the front/baffle until it reaches the outside edge.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Tue, 19 Jul 2011 23:36:57 GMT
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That is different than how I read the instructions, but is consistent with how I thought it should work. So if the "cardboard" tube is inserted into the cutout and is flush with the front edge of the panel, how do you finish it to make it look seamless?

I wish I had realized sooner that the 4pis were not intended to be screwed. I had just finished researching F20 build threads and for those i was told that clamping was not necessary and that it just held the panels together more effectively while one screwed them together. Since I don't own more than 2 4" clamps, I did not clamp anything on the F20. I wrongfully assumed the same applied to all speaker cabinet builds. While you can barely notice the screws on my first 4pi build with everything painted black, my slight case of OCD will always make me a little bothered that one is screwed while all of the others are not.

Note: I just spent $135 on eight 24" clamps. All of the surrounds will be seen to a certain degree, so I thought I better follow Wayne's instructions.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Wed, 20 Jul 2011 01:06:15 GMT
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What I like to do is to attach the carboard tube in the cabinet and apply veneer over the face, covering the edge of the tube.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Wed, 20 Jul 2011 01:06:17 GMT
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I asked the same question =) He usually veneers the cabs so it isnt a problem. As he stated you can get plastic tubes that are more cosmetic perhaps for your build as long as they match the dimensions.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Wed, 20 Jul 2011 01:10:41 GMT
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Stopped at Lowes to buy clamps and stopped in pluming to see if they had pvc that was the right size to no avail. They only had 1 1/2", 2", 3", etc.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Wed, 20 Jul 2011 01:52:04 GMT
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Personally, I think I'd rather have the cardboard tube. It's thick and strong, not flimsy like a toilet

roll tube.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Wed, 20 Jul 2011 02:34:50 GMT
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I am pretty sure when Wayne refered to the plastic ports he meant something like this. I think it is pretty close to his dimensions and can be trimmed to length.
http://www.parts-express.com/pe/showdetl.cfm?Partnumber=260-478

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Thu, 21 Jul 2011 12:21:40 GMT
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Thanks for the info!

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Fri, 22 Jul 2011 12:44:11 GMT
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@justphil...I did end up purchasing those exact tubes that you linked to. While Wayne's opinion is well received, I do not think I will be veneering the 1pis, and think I will like the look of the flared port. If only I could find a 3 3/4" hole saw locally! It seems like they have everything but. It literally goes from 3 1/2, 3 5/8, 4, 4 1/8, 4 1/4. It's almost like the universe knew I was coming to buy the 3 3/4 and plotted against me.

On a different note: I did my first ever clamp and glue job. I must say this is much different than screwing things together. It went...poorly. Here is what I learned on my 1st 1pi:

1. Tightbond dries much faster than I expected

2. Tightbond is much runnier than PL Premium. I think I do not need to apply quite as much. I had the stuff dripping everywhere.

3. Even though the cabinet is small, 8 clamps is not enough. One needs at least 12 clamps. I will be purchasing 4 more tonight.

4. For some reason I am able to cut completely straight panels for larger cabinets, but smaller cabinets are harder to make exact. This point is still a mystery to me. Perhaps I was just having a bad day.

5. You cannot glue it together on a flat surface, as your clamps need space to hang. Another

obvious point, but not so obvous until I started putting things together. I had to quickly figure out where to put the cabinet and balancing on a saw horse seemed like the best answer at the time.

6. When drilling the 1/2" holes before the tweeter cutout, make sure to have the back of the panel against another piece of wood that you do not care about. I found that the last layer of ply likes to break off instead of being drilled, even if you are careful. Drilling against another piece of wood should prevent that.

In the end, my first 1pi should be okay, I just have a lot of sanding in my immediate future. I used 3/4" Baltic Birch. Since the 3/4" Baltic Birch is actually 11/16", I adapted the extra thickness to Wayne's deisgn by making the width 12 5/8" and the height 18 5/8". The depth is unaffected by the thicker wood, as the side panels need only remain at 7 1/4". Overall, these measurements (unless I am wrong) should maintain the same internal dimensions as the original design.

One last point. At first I could not figure out why the instructions did not identify the center of the port like it did for the tweeter cutout. Instead it showed the edges of the port 1" from each the right side and bottom of the cabinet. When I decided to go with a flared plastic port, I realized the reason for this, as the cut-out diameter increases from 2 1/2" to 3 3/4". If there were a fixed center for the port, the larger cutout would take me off the side of the panel. These points may seem immediately obvious to those of you who build these on a regular basis, but for the first timer they are not.

File Attachments

1) 1pi01.jpg, downloaded 6689 times

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Fri, 22 Jul 2011 13:10:47 GMT
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@Wayne...

It is my intent to recess the 1pi speakers 5 1/2 inches into the wall between 2x6 studs. As a result, someone on a different forum suggested that I ask you the following question:

"Does the 1pi have baffle step compensation? Up against the wall might give it a rising bottom. You should ask him if the crossover needs tweaking for in-wall duty."

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Fri, 22 Jul 2011 14:37:10 GMT
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Why not use your router to cut the hole for the 3 3/4? I used a home made router jig for making circles and just marked it accordingly for the port size.

How are you now going to put in the insulation with the baffle/face on the 1pi now?
I built my 1 and 2pis leaving the baffle/front off the box. I also cut the baffle about a 1/2" larger so I could flush cut it with a router when I was done in case I was a tad out of square. I then did all the insulating and such. I also used a drill press and used "T-nuts" for holding the woofers in. Are you just going to screw them to the wood? I am sure its fine perhaps I am just anal =P Once that was all done I glued on the baffle and was ready to rock =)

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Fri, 22 Jul 2011 15:40:16 GMT
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I will be using T-nuts. On my first F20 build, I accidently stripped one of my T-nuts when installing the driver. If you know anything about that cabinet you know that there is NO space for hammering a T-nut after it is built. After removing the driver to replace the damaged T-nut, I found that vice grips worked at replacing the T-nut very well. As a matter of fact, it worked better than hammering it in since you can apply even pressure to seat it properly, as opposed to trying to hammer the edge of a baffle cut-out.

I am not certain how the front panel being installed is going to hinder the installation of the insulation? I used a jig saw to cut my circles. Can you post a picture of the router you are talking about?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Fri, 22 Jul 2011 19:09:20 GMT
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dutchswan0311 wrote on Fri, 22 July 2011 08:10It is my intent to recess the 1pi speakers 5 1/2 inches into the wall between 2x6 studs. As a result, someone on a different forum suggested that I ask you the following question:

"Does the 1pi have baffle step compensation? Up against the wall might give it a rising bottom. You should ask him if the crossover needs tweaking for in-wall duty."
The quick answer is the speaker was designed to be used in locations where it will be radiating into half-space to quarter-space, so wall mounting or placement near the wall is preferred.

The long answer goes into a little more detail, but if you're interested, see these three links:
Baffle Step
Constant directivity verses on-axis EQ for non-uniform directivity (aka baffle step filters)
High-Fidelity Uniform-Directivity Loudspeakers

Subject: Re: 4pi Commercial Dinner Theater Build

Posted by dutchswan0311 on Fri, 22 Jul 2011 19:50:30 GMT
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Would it really make a difference being mounted on the wall, or being mounted 6" into the wall?

At the end of the day, do you recommend against installing it into the wall with the front 2" of the cabinet sticking out? I just thought this would be a very non-intrusive look with very nice sound.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Fri, 22 Jul 2011 20:12:03 GMT
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It will actually be a little better when recessed 6" into the wall. Do it!
Soffit (Flush Mount) Reference Speakers

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Fri, 22 Jul 2011 22:59:55 GMT
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As for my DIY circle jig.
All I did was remove the base plate from my dads plunge router. I then got a piece of 1/4" plexi the width of the base plate and about 15"long. You then mark the holes for the base plate onto the plexi and drill and countersink them so they dont scratch the surface of your project. You then take your bit that you will be using to cut the circles with and install it in the router. Attach the base plate. Then on a scrap piece of material cut though your new baseplate.
You now have a circle jig.

So say you need to cut an 8" hole. You take your tape measure and mark a spot 4" from the outside edge of the hole the bit cut through the plexi. Drill an 1/8" hole through the plexi at that point.

Go to your project mark your center and drill an 1/8 hole.
Leave the bit in the hole you drill and get your router. Put it in the 1/8 hole you drilled in the plate and your on your way. Its really easy.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Sat, 23 Jul 2011 02:57:24 GMT
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The first of twelve 1pi speaker enclosures is finished. It did take a lot of sanding, but it turned out well. FedEx shows my terminals and port tubes will arrive tomorrow.

File Attachments
1) IMAG0553.jpg, downloaded 4490 times

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by justphil on Sat, 23 Jul 2011 03:43:01 GMT
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Very Nice!

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Sun, 24 Jul 2011 08:10:57 GMT
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I tried staining my first 1pi (red mahogany) after some extensive standing with very fine sandpaper. Parts of it looked good, parts looked "splotchy" as a result of inconsistent standing. I see why most people veneer them. I don't have that kind of time on my hands to do this with twelve 1pis; especially if only 2" of it will be seen. I instead painted it black with the concrete epoxy. It is not elegant, but it looks professional and does not look homemade.

I am thinking about making two 4pis for live music on the stage. These I will make last, as I will have had a lot of practice making speaker cabinets by then. These two 4pis I will take extra care in making, and will veneer them as well as do whatever else I can to make them look more like an expensive piece of furniture than a high efficiency speaker.

I see a "modified 4pi" speaker build thread out there. I like the look of the taller speaker with the two round ports at the bottom. Are there any disadvantages of this configuration when compared to the original design?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Sun, 24 Jul 2011 13:55:59 GMT
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system.

throws all that design and testing out the window. It's not that the larger cabinet would not work - it would - but unless you have test equipment and a lot of time to make measurements, it might end up with ripple from standing waves and turn out to not work as well. So if it were me, I would go with the stock design.

I also suggest that you use multisubs. That's the best approach because it provides the deep

doesn't give you anything. You don't need the extra extension.

High-Fidelity Uniform-Directivity Loudspeakers

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Sun, 24 Jul 2011 14:52:14 GMT
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Wayne...

As of right now, our plans to create a cinema experience in our.dinner theater call for the use of the following:

LCR - 4pi speakers with all of the upgrades x3
L/R Surrounds - 1pi speakers x8
L/R Rear Surrounds - 1pi speakers x 4 (2 in balcony, 2 under balcony)
Subs - F20 horned subs x4 (lilmike's design, but using the 15" Reference HF driver instead of the MFW-15)

As a sound expert, do you see any issues with this setup? Do my.subs not.qualify as "multi-subs, as you put it?

With regards to the two 4pi speakers that will serve stage duty, I will use the unmodified version with all the upgrades. I see most use the 4pi for home theater use. Do you have a better suggestion for live music, or will these perform that function nicely?

As always, thank you for your feedback. I am always in a constant state of learning.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Sun, 24 Jul 2011 16:02:42 GMT
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Wayne...

I just read your paper on Hi-Fi Uniform Directivity Loudspeakers. Facinating. I am not sure what is more scary, the fact that I understood 95% of it, or that I found it facinating. It is good to know that you guys really know your stuff, and we are privileged that you have chosen to share your designs and thoughts with us. Moreover, your availability to answer our questions is not the norm in any industry, and is greatly appreciated.

The gaps in my knowledge on sound wave theory stem around the difference between the different "spaces" (1/4 space, 1/2 space, etc.) I am sure I will read about them in more depth when I can find the time, but in the mean time,; your input and help is invaluable. I look forward to throwing money your way when the time comes to buy the drivers and components for our cinema

project. Lord knows I am saving a ton of money through your generosity.

More on the stage speakers: More forum research leads me to believe that the 3pi may work just as well as the 4pi for a live music application. Based on pictures that I have seen, I think the 3pi is more "sexy" than the 4pi, and wanted to get your opinion on the difference of the two for live music.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Sun, 24 Jul 2011 17:14:56 GMT
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I'd say they're both equally competent. Both have similar characteristics, tonal balance, directivity,

Really, you should make your choice based on the midwoofer family you prefer. If you want AE,

stamped frame Delta 12LF.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Tue, 26 Jul 2011 01:59:23 GMT
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Can I have plans for the 3pi?

Subject: Re: 3pi Commercial Dinner Theater Build
Posted by Wayne Parham on Tue, 26 Jul 2011 03:39:38 GMT
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Subject: Re: 3pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Wed, 27 Jul 2011 01:03:03 GMT
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It seems strange to this novice that the 3pi is actually quite a bit bigger than the 4pi. huh.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 22 Aug 2011 16:12:20 GMT
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I just thought I would give an update on our progress. Click Here to see the build thread in our facebook album.

I know that Wayne has said 3/4" BB is okay for the 1pi that calls for 5/8" as long as the interior dimensions remain unchanged. I do wonder though; will there be any difference in the performance having used a thicker wood?

Also, I notice that the 3/4" BB is actually 11/16", which is only 1/16" thicker than a true 5/8" (for a total of 1/8" when considering both sides). Does that 1/8 really make that much difference? I only ask because I have two panels that I set aside that I accidentally cut too narrow by 1/32, which means the interior space would be 1/16 less than what the instructions call for if I use these panels. Would that 1/16" really make any difference if I use those panels?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Mon, 22 Aug 2011 17:42:56 GMT
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Baltic Birch is metric, so you can get 18mm (0.71") or 19mm (0.75"). Both are common, and either is fine for this application. But if you want true 3/4" (like for panels intended to fit into 3/4" dado slots), then you have to use the 19mm stock.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 22 Aug 2011 19:18:08 GMT
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That is good to know. I will look more closely at that tonight when I go to buy another sheet for some more 1pi enclosures. Are you able to say if there is any difference in performance using a heavier stock of wood?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Mon, 22 Aug 2011 19:33:33 GMT
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No difference at all. That's what I meant when I said "either is fine for this application." It can

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 22 Aug 2011 19:48:04 GMT
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I am trying to figure out exactly what I want to do for our stage sound. I am thinking about stacking a 4pi built with an extra layer of ply on each side to make it the same width as the F20 (60"H,20"W,30"D), and then just stack it on the F20. Would it be okay to (1) flip the F20 over with the horn on top and then (2) stack a 4pi on top of the F20 flush to the front? The reasoning behind this would be to then build 1 cloth mesh grill to cover all of the drivers of the sub and 4pi (well, the drivers of the 4pi and the horn of the sub).

I suppose my question might really be as to whether or not the horn would be too close to the other drivers and if there is any loss of room gain by not having the horn next to the floor.

Thoughts?

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Mon, 22 Aug 2011 20:36:05 GMT
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dutchswan0311 wrote on Mon, 22 August 2011 14:48I am trying to figure out exactly what I want to do for our stage sound. I am thinking about stacking a 4pi built with an extra layer of ply on each side to make it the same width as the F20 (60"H,20"W,30"D), and then just stack it on the F20. Would it be okay to (1) flip the F20 over with the horn on top and then (2) stack a 4pi on top of the F20 flush to the front? The reasoning behind this would be to then build 1 cloth mesh grill to cover all of the drivers of the sub and 4pi (well, the drivers of the 4pi and the horn of the sub).
I think they will work well that way, just be sure to delay the mains to match the path length of the subs. Orient the subs with the mouth near the floor. If the F20s sound good in the ~120Hz range, I'd low-pass them with a shallow filter slope, like ~90Hz second-order or ~120Hz third-order. This will make the F20s act as flanking subs, which smooth room modes in the upper modal region.

Run the mains full range or if you're really pushing the power, high-pass them at 60Hz. Having some overlap between mains and flanking subs will smooth the modes in the 70Hz to 140Hz range, usually vertical modes and self-interference off the back wall. More distant subs should be crossed over lower, with multiple sound sources to smooth the lower modes from 30Hz to 70Hz, usually horizontal modes between opposing walls.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Mon, 22 Aug 2011 20:43:51 GMT
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I think most people keep their F20s between 20Hz and 80Hz.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Mon, 22 Aug 2011 20:54:10 GMT
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I'd probably use them as distant subs then, and use a different kind of sub closer to the mains. You really want to take advantage of the flanking sub configuration to smooth the upper modal region. Use your larger, more distant subs with low-pass set at a lower frequency to help smooth the lower frequency modes.

Flanking subs need to sound good in the ~120Hz region. Distant subs should be low-passed below 60Hz, to prevent localization cues.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Fri, 02 Sep 2011 00:22:32 GMT
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I have tried to depict the placement of all of the speakers/subs the best that I can in the floor plan below. Below the floor plan is a key to help you understand what you are looking at.

Wayne: When you talk about me using the horned subs as a "distant flanking sub", do you suggest that I use the four Theater F20s on the west wall in conjunction with the stage sound? Would you then recommend a pair of 3pi Subs to accompany the Stage 4pis? If so, what placement do you suggest for the 3pi subs? I was thinking the bottom of the Stage 4pis could be positioned at a height of approximately 5', as that would (in my opinion) provide the best positioning for a standing audience. Would the 3pi subs (if their use is suggested) then be placed under the 4pis at floor level facing the audience? (It seems to me that the 3pi subs would also double as extra multi-subs for the 7.1 surround when playing movies, filling in any nulls created by our being limited to F20 placement. Thoughts?)

Finally; with the plan for our dinner theater and stage sound coming together, it looks like we might end up with 4pi x 5, 1pi x 12, and 3pi Sub x 2. I have two 4pis and four 1pis constructed, so I am probably at least six weeks out from ordering all of the components. How much lead time are you going to need for all of those components?

P.S. I am open to a critique of our plan below from anyone. Everyone's feedback is always appreciated!

File Attachments
1) key01.jpg, downloaded 4267 times
2) Speaker Placement 02.jpg, downloaded 4532 times

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Fri, 02 Sep 2011 02:36:41 GMT
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Flanking subs and distant subs are two different things, and serve two different purposes. Both provide extension, and beyond that, the main purpose of the flanking subs is to smooth the upper midbass and lower midrange and the main purpose of the distant subs is to smooth the lower bass. Flanking subs are close to the mains and are low-passed sometimes as high as 200Hz but more often between 80Hz and 120Hz, depending on the slope. Distant subs are put further away, and are low-passed below 60Hz.

Flanking subs are in near proximity to the mains, a meter or two away from the mains in all three dimensions. The mains are on stands and the subs are on the floor, the mains are forward of the wall behind them and the subs are pressed back to the wall. They are also both inside or outside the mains, whichever is most convenient. As I said earlier, these smooth the upper midbass and lower midrange modes. There is almost always a strong notch around 120Hz to 140Hz from axial modes between ceiling and floor, and also from self-interference from the wall behind the speakers and floor bounce. The flanking subs main purpose is to smooth these notches.

Distant subs are usually placed somewhere in the opposite side of the room. It almost doesn't matter where the distant subs are placed, as long as they aren't in the same place as the mains or flanking subs. We want diversity of positions for the sound sources in the modal range.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Fri, 02 Sep 2011 14:07:51 GMT
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Wayne: Thank you for your patience as I get past the learning curve. I learn quickly; but there is much to learn. If I understand what you say correctly:

1. The F20 subs on the west wall can function as the "distant subs". I see that you suggest a high pass at 60Hz. Would a high pass at 80Hz be troublesome for the distant subs?

2. If I build two 3pi subs, then I should place them at the back floor of the stage wall slightly offset from the x coordinate in relation to the mains?

3. Are the drivers pointed at the audience in this configuration?

P.S. Did you see my question about how much lead time I should give you for all of the components I will end up needing?

Thanks again!

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Fri, 02 Sep 2011 14:43:45 GMT
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Answers by numbers:

1. If I understood your picture properly, the west wall is on the left, where the mains are. So that would be where you would put flanking subs. Distant subs would be put somewhere else, more distant from the mains. The low-pass frequency is set empirically - if you can't tell they're on, then the crossover frequency and SPL is right. It should provide deep bass foundation but still be subtle, you definitely should not be able to tell where the rumble is coming from. So set the distant sub(s) crossover frequencies empirically. You can even use measurements to find what settings give smoothest response, if you have that capability.

2. Indoors subs should be in a different position in all three coordinates that the mains. It is different than outdoors, where we want to have them acoustically close, acting as a single source. Indoors, we want to spread things around. Wall reflections create multiple virtual sound sources, so we cannot create a point source anyway. It creates course interference, because the number of sources is fairly small, so the spacing between peaks and nulls is wide, and pretty obvious. The goal of the multisub configuration is to actually make even more interference, and by making the interference pattern more dense, it more closely resembles an averaged reverberent field.

3. All drivers should be pointed at the audience. It actually doesn't matter much what direction low frequency sound sources are facing, so if it is more convenient to point subs in another direction, you can do so.

As for lead time, I keep stock of all crossover parts, and many drivers. But I go through a lot of 2226 woofers and DE250 compression drivers. So it seems like every other month, I get backlogged on one or both of those drivers for anywhere from a week to a month. The TD12S often takes several months to fill. Everything else is usually either in stock, or if not, less than a week until the replenishments arrive.

We build the crossovers at time of order. Sometimes I'll have a couple on the shelf, but there are

one for the DE250. Then there are the coil, cap and resistor options. So in most cases, we have to build the crossover at time of order.

All other kits are taking two to four weeks. If you order all of them at once, it will take a little longer to get them all ready for you, but we can ship as we make ready rather than all at once, if that will help.

Subject: Re: 4pi Commercial Dinner Theater Build

Posted by dutchswan0311 on Fri, 02 Sep 2011 16:42:21 GMT
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Thank you for explaining. I thought if I ordered all at once, that I might save on shipping costs. If that is not the case, then I will probably order in three phases.

Back to question 1:

I have two sets of mains. The three 4pi mains for the dinner theater seen in red on the picture, and two 4pi mains on the stage depicted in green. My question about the F20s on the west wall acting as distant subs is in relation to the two mains on the stage.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Fri, 02 Sep 2011 17:40:28 GMT
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It would probably still be best to order all at once, that way I'll know what I need to bring in. I keep stock of a lot of stuff, but if I need something, it would be best to know as soon as possible. The shipping would be the same either way, because the kits are packed the same way even at moderate quantity levels as they are in singles or pairs. The larger kits fit one per 20x20x16 box, smaller kits can fit two per box.

When we send out a large quantity, we palletize drivers and ship them separately, but that usually

shipment of palletized packages most effective. But your order is not so large that palletizing makes sense.

As for the distant subs, yes, I see what you mean now. That's a pretty good idea - the flanking subs for the mains on the north wall could be used as distant subs for the mains on the west wall, and vice versa. Just remember that flanking subs (closer to the mains) get low-passed around 80Hz - 120Hz and distant subs (further from the mains) get low-passed around 50Hz - 60Hz.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by dutchswan0311 on Wed, 09 May 2012 16:33:37 GMT
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I have been maintaining a build thread over at the AVS Forum, but thought I would show some pictures on this old thread showing where I am at in the project.

These will go behind a 190" AT screen in the dinner theater. I plan to build two more to use on our stage.

Eight 1pi speakers are finished. The final four are will be painted tonight for a total of twelve.

I have two horned subs finished and am building the other two right now for a total of four. With 300W to each I should be producing 130dB down to my highpass at 20Hz and a lowpass at 80Hz.

Subject: Re: 4pi Commercial Dinner Theater Build
Posted by Wayne Parham on Thu, 10 May 2012 04:36:15 GMT
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Excellent! Those are great looking speakers. Thanks for the pics!
