Subject: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Wed, 02 Oct 2019 19:22:16 GMT
View Forum Message <> Reply to Message

Hi, Wayne.

Firstly, thanks for sharing all of this fantastic information and for providing your products to the DIY community!

Secondly, I purchased a pair of your H290C waveguides yesterday to go with a pair of DE250s I have (thanks for shipping those so quickly, by the way), and would love a copy of your plans for the Three Pi and the Three Pi Subwoofer to look over. Could you also please point me toward the appropriate crossover schematics/layouts?

Lastly, when I decide which woofer I'd like to use in my builds, is that something I could purchase from you a-la-carte, or do you only sell those packaged within the kits?

Thanks again,

Tim

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Thu, 03 Oct 2019 14:03:05 GMT
View Forum Message <> Reply to Message

We don't sell partial kits or raw drivers. But we do well the crossovers individually (assembled or unstuffed) for those that want to source their own drivers.

I'll send plans directly to your email address. The plans include the crossover schematic.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Sat, 12 Oct 2019 21:49:16 GMT
View Forum Message <> Reply to Message

Wayne,

Thanks for sending those over!

The 3Pi design is really elegant, and, I'm convinced, would perform incredibly well. Unfortunately, after much consideration, I just don't think it will shoehorn into my space due to the cabinet size.

I started modeling alternative boxes in WinISD, and think I found a good compromise: Using the B&C 12PLB100 woofer you've identified, I tried B&C's recommended box size of 1.41 cuft tuned to 52HZ, and came up with a ruler-flat response to 60HZ that then slopes quickly to -3db at 50HZ. This seems like acceptable low frequency cutoff to me, especially if used with flanking woofers.

However, after reading your thinking behind the larger box with the EBS alignment, and how it's meant to play lower and integrate better with flanking woofers, I'm wondering if I'd lose more than just a little low end extension using this smaller box. I'm also wondering if I were to change the box alignment, if a substantial redesign of the crossover will also be required.

Having already gotten so much great information from you and this site, I feel bad asking for more. But, if you would be willing to share your thoughts on this, or point me toward further reading, I'd sure appreciate it.

Thanks again,

Tim

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 14 Oct 2019 15:37:12 GMT
View Forum Message <> Reply to Message

What you propose sounds like it would work pretty well. You would lose a couple synergies that

with acoustic measurements, paying special attention to the lower midrange. I think you'd be alright there though, because your cabinet is small enough that it would have relatively high-frequency standing waves inside, and those would be attenuated the fiberglass stuffing material. The standing waves are potentially problematic in larger cabinets.

The synergies I'm talking about are matching the baffle step with the flanking sub rolloff, which both conjugates baffle step and mitigates higher-frequency room modes and self-interference

designs when used with flanking subs.

A smaller baffle will have baffle step higher in frequency, and you wouldn't want to run flanking subs high enough to fill in that gap. So there will be a little bit of a droop between the flanking sub upper frequency and the baffle step frequency.

But you might still give it a go. I wouldn't try to compensate for baffle step with an electronic filter, I'd just live with the droop and see if it was objectionable. My guess is it would sound just fine.

Subject: Re: Three Pi and Three Pi Sub Plans

Posted by timothyeyster on Mon, 14 Oct 2019 19:33:15 GMT
View Forum Message <> Reply to Message

Thanks for the great response; that's exactly what I was trying to understand. Again, the design seems very elegant, and I wish I could accommodate the cabinets in my room.

I have been thinking about building a baffle wall, however, as I already have an AT projector screen, but am unhappy with the in-wall speakers installed behind it currently. If I understand correctly, these proposed shrunken Three Pis set into that baffle would not suffer from baffle step loss, so should perform quite evenly down to their roll off frequency excepting interference from room modes. Is that correct?

Then, at that point, would you still recommend the flanking subs, or would it make more sense to just run several distributed subs crossed at a lower frequency?

Again, thanks for all of the great info!

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 14 Oct 2019 22:13:34 GMT
View Forum Message <> Reply to Message

If you can mount the speakers in the wall, that's perfect because it removes self-interference from the wall as well as removing any baffle step. It really is the best option. You can setup the subs as distributed multisubs rather than flanking subs.

However, you will lose the left/right self-correcting imaging if you don't toe them in so that their forward axes cross in front of the listeners. Is it possible to do that to the left and right speakers? Can you provide a wedge-shaped baffle that connects to the wall and still offers toe-in?

If you cannot, it isn't terrible for movies, especially if you have a center dialog channel. But it is really nice because the left and right speakers are balanced over a wider range of positions. When the axes cross, people sitting nearer the left speaker will still hear the right channel very well, and vice versa.

As I said, it isn't terrible to forego the axes-crossing for home theater if you have a center channel. But it is better to have both a center channel and left/right axes crossing. And if you don't have a center channel, like when you are listening to stereo, or if you are attempting to create a phantom center, you'll really benefit from the toe-in that crosses the axes in front of the listeners.

Subject: Re: Three Pi and Three Pi Sub Plans

Posted by timothyeyster on Sun, 24 Nov 2019 22:36:52 GMT
View Forum Message <> Reply to Message

Wayne,

After much consideration, I ended up building a pair of Three Pis per your plans. They are a bit dominating in my current room, but will eventually go behind an AT projector screen (hopefully with enough space to cross their forward axes properly). In terms of the sound, I'm very happy with the dynamics, detail, and imaging- really nice sounding speakers. I noticed right away that the high-end balance is very depressed compared to most other speakers I've had. Running an Audyssey auto setup brought them much more in line with my preference, but shelved the high end nearly 10db. Does that seem normal with these, or might I have made a mistake building the crossovers? I'm using the DE250, and the B&C 12PLB100 woofer.

Also, though the bass is quite good, I'm eager to add the Three Pi flanking subs to complete the picture. I ordered a pair of kits from your site last week, and look forward to building the boxes shortly. Could you please clarify for me how best to accomplish the port on these? Is there something included in the kit, or do I use PVC pipe?

Thanks again for all of the great information!

Tim

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Sun, 24 Nov 2019 22:47:49 GMT
View Forum Message <> Reply to Message

Glad you got the mains done! I'm sorry you're having trouble with the tweeter circuit though. Do check your connections - The treble SPL should be equal to the bass SPL. Without R1/R2 attenuation/compensation, the tweeter would be 10dB higher than the midwoofer, so something is amiss. Could be that you've effectively shorted R1 in some way.

The sub kits have port material included, so wait until they arrive and cut the port hole to match the duct material. The hole diameter shown in the plans is accurate, but having the duct in your hand might help you get it exactly right.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Mon, 16 Dec 2019 03:28:17 GMT
View Forum Message <> Reply to Message

Wayne,

After experimenting a bit with placement of the Three Pis, and particularly with tilt-back, I'm much happier with the treble balance. Audyssey still assigned about 6db of high-shelving, but I think that

may be baked into their reference curve. In any case, they're sounding great now!

I received my Three Pi sub kits last weekend, and plan to cut and assemble boxes for them this week sometime. It's looking like I'll have no option but to place them inboard of the mains which are shoved in the corners, but I imagine I'll still gain some advantage configuring them as flanking woofers (namely, crossed at 100hz, 2nd order and fed discrete copies of their respective left and right signals) versus just running them as mono LFEs, right?

Also, I'm thinking of rounding out my surround system with a pair of One Pis; could I trouble you to share those plans with me? Does the kit you offer include the crossover parts?

Thanks again!

Tim

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 16 Dec 2019 15:38:39 GMT
View Forum Message <> Reply to Message

Flanking subs work just as well when placed inside as they do when set outside the mains. They just need to be a couple feet beside, behind and below the mains.

I'll send plans for the surrounds, and yes, kits include the crossovers.

Sounds like you're getting you system setup and dialed-in nicely.

Congratulations!

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Sat, 15 Feb 2020 18:36:41 GMT
View Forum Message <> Reply to Message

Hi, Wayne.

After trying a few positions, I just couldn't get my subs far enough behind or below my 3Pis and ended up with a huge hump in the 80-120hz region using a 12db/octave 100 hz crossover on the sub. Ultimately I decided to just stack the mains on top of the subs, cross them over at 60hz 24db/octave, and push them into the corners. They seem to be integrating pretty well now, with only a minor slump due to the lack of baffle step compensation. I expect this will be mitigated once

I build out the screen wall, but, until then, I'm really happy with the results; By far the best low end I've had in my room!

I'm still wringing my hands a bit over the top end response, though; They still sound like the highest octave is rolled off.

I decided to take some nearfield measurements to try to confirm what I was hearing. After reading this article on the miniDSP website on speaker measurements using my Umik1 and REW

https://www.minidsp.com/applications/acoustic-measurements/loudspeaker-measurements

I made this measurement:

Per the miniDSP article, I placed the 3Pi in the corner, turned it in 45 degrees and raised it up until it was roughly centered between the floor and ceiling. I placed the mic at a 1m distance from the speaker baffle and pointed it directly between the bottom of the horn and top of the woofer. I then gated the measurement to eliminate the floor bounce.

The measurement seems to indicate that the response starts to rolloff at 10khz, and that comports with what I'm hearing. Does this still seem likely to be a malfunctioning crossover to you? I triple and quadruple checked the schematic against my wiring and verified each connection with a multimeter. Although it's not impossible, I would be really surprised if I still had a wiring error at this point.

If this response looks correct to you, could you suggest a way I might be able to raise the top octave response a bit to better suit my tastes? For example, would it help to install a cap at the C1 position?

Meanwhile, I'm really enjoying my setup! So much so that I've built boxes for a 3Pi center and third 3Pi sub and am in the process of finishing them with black laminate. I also have a CNC router file ready to roll for a pair of 1Pi rears as soon as I get a little more free time.

Thanks again for all of your great help!

File Attachments

1) 3PI Nearfield Measurement.jpg, downloaded 828 times

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Sat, 15 Feb 2020 20:15:35 GMT
View Forum Message <> Reply to Message

Here's a picture of my finished 3Pi mains and 3Pi subs, by the way.

File Attachments
1) Media Room.jpg, downloaded 682 times

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Sun, 16 Feb 2020 16:43:04 GMT
View Forum Message <> Reply to Message

Your setup looks really nice! Response looks good too. There is some rolloff above 10kHz, which is to be expected from compression drivers. You can add the 0.47uF C1 capacitor if you want - which will add a little sparkle - but I removed that part about ten years ago because I thought it was too much. I'd rather have a little droop above 15kHz than a spike there.

I can see how hard it was to try and get flanking subs setup in there. Just no room. They have to be offset in all three planes to get them to do their thing. To do that in your room would have required pulling the mains out enough from the wall they probably seem to be intrusive. So I can see why you took the more traditional subwoofer approach. Looks like it worked out very well though.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Sun, 16 Feb 2020 20:04:43 GMT
View Forum Message <> Reply to Message

It's good to hear that it looks like my crossovers are working correctly- I'll stop sweating that now.

I was raised mainly on digital and I've spent the last ten years with various ribbons and, most recently, electrostats, so I think I've developed an affinity for a hot high end. So, I'll plan to grab a couple of .47uF caps and give them a try in the circuit at C1 to see if that works better for me.

Thanks again for all of the great input, Wayne!

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 17 Feb 2020 17:19:50 GMT
View Forum Message <> Reply to Message

I've always loved ribbon tweeters too. Back in the 1970s, the EMIT tweeters in Infinity speakers were oh-so sweet to me. They offered much greater extension than compression drivers of that era. But they lacked dynamic range. They were relatively fragile, and couldn't handle a lot of power. So that was the trade-off.

Most compression drivers don't have the above-20kHz output that ribbon tweeters do. Most don't even hit 20kHz. There was a time when I wouldn't have used compression drivers for hifi because

they didn't even hit 10kHz. But since the late 1990s, you could expect to reach nearly 20kHz with a relatively inexpensive titanium or polyimide 1" exit compression driver. That combined with their superior dynamic range and their ability to be used on a waveguide to set directivity are the advantages of a compression driver tweeter.

I wanted to mention a few thoughts about your subs too. I neglected to say this on my last post, so I thought I would add it here.

Subs should always be set at an amplitude that almost makes them invisible. When a subwoofer is set right, you shouldn't even know it is on. About the only thing that should be noticeable is the deepest bass, and that shouldn't be glaring. There should only be a very subtle difference in the sound when you switch the subs on and off when they're setup right.

If you can hear noticeably louder bass or midbass with the subs on, then they're set too loud. Thus is true no matter if they're set as multisubs, flanking subs or traditional subs.

Since flanking subs are run to relatively high frequency, the system will sound throaty if they're set too loud. That's an obvious sign that the subwoofer SPL is set too high. If you can measure a hump in the 80Hz to 120Hz region, then the flanking sub volume is set too high. That's the region where we expect the mains and the subs to blend transparently. There should be virtually no SPL increase in this region. It should be the same SPL level as the 200-300Hz region. If it's too loud around 100Hz, then the SPL of the flanking subs needs to be reduced.

So if you ever feel like experimenting, please keep these thoughts in mind. If you can dial it in with a traditional sub setup, that's awesome. I would expect a little bit of a dip below baffle step and I would expect some SBIR. But if those aren't troublesome - excellent - enjoy the system. On the other hand, if you notice something lacking in the upper midbass and lower midrange, you might try a flanking sub setup again, but reduce the SPL of the subs to the point where you almost can't even tell they're tuned on.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Mon, 17 Feb 2020 20:22:00 GMT
View Forum Message <> Reply to Message

More great info!

With all of that in mind, I may try implementing the flanking subs again when I install the center channel. If I do, could I check for proper integration using a measurement with REW from the main listening position? Sounds like I'd be looking for a relatively flat response at 100hz, and fewer peaks and nulls below that compared to the 3Pi on its own- correct?

I also had a thought: I'm using a miniDSP for the sub crossover and volume, and could easily implement a delay with respect to the main speakers- could that be used to approximate moving the subs back and beside the mains, or does that just open another can of worms?

Thanks again!

Tim

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by OutOfSpace on Mon, 17 Feb 2020 20:25:15 GMT
View Forum Message <> Reply to Message

"If you can hear noticeably louder bass or midbass with the subs on, then they're set too loud. Thus is true no matter if they're set as multisubs, flanking subs or traditional subs"

I guess most car 'audio' guys that didn't get the memo. Some of them are seriously rude about it, too.

Chris

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 17 Feb 2020 21:13:51 GMT
View Forum Message <> Reply to Message

OutOfSpace wrote on Mon, 17 February 2020 14:25"If you can hear noticeably louder bass or midbass with the subs on, then they're set too loud. Thus is true no matter if they're set as multisubs, flanking subs or traditional subs"

I guess most car 'audio' guys that didn't get the memo. Some of them are seriously rude about it, too.

timothyeyster wrote on Mon, 17 February 2020 14:22With all of that in mind, I may try implementing the flanking subs again when I install the center channel. If I do, could I check for proper integration using a measurement with REW from the main listening position? Sounds like I'd be looking for a relatively flat response at 100hz, and fewer peaks and nulls below that compared to the 3Pi on its own- correct?

That's right, exactly. Set the SPL so that 100Hz is the same level as 200Hz and 300Hz. What you'll also get is a reduction in the amplitude of the dip that results from self-interference from the wall behind the speakers and also reduction of the dip from the interference from the sidewall nearest to the speaker. The subs will provide extension as well.

You won't get much modal smoothing below 80Hz though. To smooth the lowest frequencies, you need one or two multisubs placed far from the mains. They might be placed at the opposite end of the room.

timothyeyster wrote on Mon, 17 February 2020 14:22I also had a thought: I'm using a miniDSP for

the sub crossover and volume, and could easily implement a delay with respect to the main speakers- could that be used to approximate moving the subs back and beside the mains, or does that just open another can of worms?

That's actually an excellent suggestion for your room, since you're kind of limited in fore-aft placement. You could delay the subwoofer signal a smidge to make it act similarly to the fore-aft displacement required by flanking subs. That's what we're looking for - We want the phase difference to not be 180° in the 80Hz to 120Hz region where we normally find it.

The reflection from the wall behind the speakers is usually 180° from the main speaker's direct sound somewhere between 80Hz to 120Hz, depending on the speaker's distance from the wall. Having the flanking sub a different distance makes it not have this same null. So the null is partially filled in.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Mon, 17 Feb 2020 21:33:53 GMT
View Forum Message <> Reply to Message

Perfect!

Looking forward to implementing some of these suggestions and wringing just a little more out of these already incredible speakers!

Speaking of which- one last thing: For those like me who really crave "airiness" in our speakers, do you see any potential in adding something like this to cover the top octave?

http://www.fountek.net/neocd3.5h.html

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by Wayne Parham on Mon, 17 Feb 2020 22:05:48 GMT
View Forum Message <> Reply to Message

I wouldn't add a super-tweeter on top, because it interferes with the speaker's uniform directivity. If you want that last half-octave up-top, I suggest going with a driver that uses a beryllium diaphragm, like the TAD TD-2002. They're pricey though. It's an Nth degree thing.

Subject: Re: Three Pi and Three Pi Sub Plans
Posted by timothyeyster on Tue, 18 Feb 2020 14:53:53 GMT
View Forum Message <> Reply to Message

Got it!

Thanks again!