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Subject: Two PI: A Little Bright OR Light in the Bass?  
Posted by [themilford](#) on Sat, 30 Mar 2013 19:04:56 GMT  
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Hey,

I've been living with a pair of 2PIs on and off, in and out of my system for the past few years now.

While the tonal balance is a tad on the "middy" or "vintage" side which I like, I think overall they are lacking in bass... or maybe it's just a tad that they are a tad bright?

I've only ever really compared them to my Audio Note Js and I'm running them with a pair of Bottlehead Paramours... the Js are flatter sounding... not a ton more bass... but they have it where it counts for most rock records... and although some folks think they are a tad on the bright side as well, when they listen at my house... the PIs are surely brighter still. It is particularly egregious when playing music with prominent jangly or distorted guitars and bashy cymbals. Basically around 2-3k...

I've got 14 gauge wire throughout, 0.51mH 14 AWG Perfect Layer Inductors, Solen 10uf caps and a 20ohm wirewound across the tweeter like the older design called for. lightly stuffed with polyfil.

I read one tweak might be to swap the film caps for oil-filled motor run caps... But I really feel it's more a lack of bass.

Any thoughts?

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [Wayne Parham](#) on Sat, 30 Mar 2013 21:50:04 GMT  
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tower had deep full bass though, so if subs are out of the question, you might consider building tower enclosures.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [themilford](#) on Sun, 31 Mar 2013 15:14:06 GMT  
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Thanks wayne.

I dunno though... I just wonder if I did something wrong. Because I made a pair some years ago

(w/ the CTS tweeter so no cap) but don't remember them being so bass shy.

Did I make the port too short or something? Do I need more stuffing? Should I have used R13 instead of Polyfil? Should I have used different coils or caps? is the resistor the wrong value? Do they just need more break in time?

I haven't really put many hours in on them over the years. Just a few sessions here or there...

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [Wayne Parham](#) on Sun, 31 Mar 2013 16:19:39 GMT  
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You could always check your cabinet to see if the port is too short, I suppose. The plans call for 1-7/8" length. R13 insulation should line the rear, bottom and side nearest the port. So check everything, if you think you might have done something wrong. You might even want to have the woofer checked, if you think they used to sound differently.

To my ears, they sound very powerful and not "bass shy" but they do lack the deepest bass. Like most of my designs, you really need to augment them with subs for the bottom octave (20-40Hz).

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [themilford](#) on Sun, 31 Mar 2013 17:52:22 GMT  
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DUH, DUH, DUH!

How the heck did I manage to make the port a 1/4" too short!

Hmmm... how much of a difference would that make in the bass?

Also, what's an elegant solution to elongating it without tearing the things apart?

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [themilford](#) on Sun, 31 Mar 2013 18:09:47 GMT  
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Also, is there any meaningful difference between the R13 and the polyfil?

I mean the polyfil just sorta gets stuffed in there and the R13 lines the walls... I don't really like working with R13 in the house... but if you feel it's essential I'll grab some this week and try it out.

Also, as a tangent... any thoughts on playing with the crossover a little in terms of fine-tuning? I have parts on hand to try a "solen split" 1st order... I feel like most of the bright energy is focused in this x-over region.

In any case, I'll try the port first... then the stuffing... and report back.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Sun, 31 Mar 2013 19:19:40 GMT

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Ahhh, THERE'S Neil Peart's kick drum!

I just glued & taped little port extensions in there... seems to help a little bit with the very lowest bit of bass.

Wondering if a little more stuffing might help tame the high upper mids a tad and fill out the upper bass a tad more...

I'll report back in a few more...

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Sun, 31 Mar 2013 20:22:07 GMT

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Yeah, having the port too short will make the speaker lack bass in the 60Hz region and overexaggerate midbass and lower midrange in the 80Hz to 120Hz region. Then not having the right damping material will make matters worse, tending to make the speaker be hollow sounding. The insulation attenuates internal standing waves, and in this speaker, those occur in the upper midrange. So I'd say the two accidental modifications probably tended to make the speaker sound kind of "thrummy", having an unnatural over-emphasis of the midrange.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Mon, 01 Apr 2013 15:23:48 GMT

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Ok,

Some pics for yous guys:

Cork-lined front baffle, Finland birch plywood, rear panel is particleboard. Finished with about a bazillion coats of tung oil and paste-wax-buffed to a shine.

FWIW: I love the utilitarian, mid-century modern look of birch plywood. I'll take it over fancy-schmantzy veneers any day.

So the tweaking continues...

So, I swapped the .51mH, 14ga coil for a .60mh, 20ga coil I had on hand. It's getting closer to what I remember the older pair of these I made years ago sounded like? Why is that? What is happening here?

Also, added more polyfil just before this swap and that seemed to help a little too... but minimally so...

What is the resistor on the tweeter doing btw? I have a 20ohm there... is that the correct value?

#### File Attachments

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- 1) [TheMilford\\_twoPi\\_01.jpg](#), downloaded 8085 times
  - 2) [TheMilford\\_twoPi\\_02.jpg](#), downloaded 7815 times
  - 3) [TheMilford\\_twoPi\\_03.jpg](#), downloaded 7989 times
  - 4) [TheMilford\\_twoPi\\_04.jpg](#), downloaded 7915 times
  - 5) [TheMilford\\_twoPi\\_05.jpg](#), downloaded 8012 times
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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Mon, 01 Apr 2013 18:38:27 GMT

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I love the looks of that cabinet. The cork front is a nice touch, as is the rabbet edge. Good work!

Looks like a nice little Bottlehead system too.

prevents excessive energy way down low. You can't really tell it's there, it's just a snubber, an impedance control device. Again, it just protects the tweeter from getting excessive energy down low.

Now for the cabinet. I see that you installed the port on the back. This change, paired with the change of stuffing material is probably what has caused the differences. Could be that the polyfill has settled over time, and has become less effective at absorbing midrange standing waves.

I suggest installing fiberglass insulation before evaluating any other changes, like the larger coil. Your 0.6mH coil is not so much bigger that I would expect to make a huge difference, but still, let's get back to a baseline. You can't really do that since the port is in a different position, but I don't think that will be a problem if you use R11/R13 lining the walls. Might want to cut a hole in the insulation where the port is though, or perhaps line the front instead of the back. But definitely go with fiberglass insulation, and then see where you're at.

I've tried other damping materials over the years and find most to be lacking, some really bad. What I often find in other padding materials is they are less effective at attenuating midrange. Sometimes not only that but they can also modify cavity resonance and detune the box. I'm not sure if the problems with other materials are that the fibers are too heavy and/or rigid to vibrate and absorb energy or if it's more of a bulk/mass thing where the sheets just acts like a solid block. Could be a little bit of both. But whatever the case, I find good old fiberglass insulation works best.

Fiberglass insulation may be a little irritating to your skin when you install it, but once it's there it doesn't enter the air. The sound of the loudspeaker may vibrate the fibers, but they don't break free. And glass is a quite benign, really. It does not cause cancer, and is probably one of the safest fibrous materials to use. It's not like asbestos, but probably gets associated with that in some people's minds because it looks similar. So I think it is probably the best, safest and most effective material to use for this purpose. I find no downside to using the stuff.

Beyond that, I often tell people not to make cabinet mods without testing. The reason is you don't want a port to be in a pressure node of a standing wave. All cabinets have internal standing waves, and that's why we use insulation inside, to attenuate the standing waves.

Large cabinets are particularly sensitive to cabinet mods because internal standing waves are at low enough frequency the insulation is only partially effective. So the positions of the midwoofer enough that the standing waves are in the upper midrange where insulation usually does a very good job. So they tend to be a little less sensitive to cabinet mods, provided the insulation is effective.

That's why I suggest using fiberglass insulation - It could be that you've put the port in a pressure node that causes a midrange peak, and the polyfill you are using is unable to attenuate it. But once you use fiberglass insulation, I think the port position will matter less. Should get you back to where you want to be and sounding good.

Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [my0x](#) on Sat, 06 Apr 2013 05:07:42 GMT

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Nice build...I like the rabbeted joinery with te Finnish ply & cork!

m@

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Mon, 08 Apr 2013 01:00:12 GMT

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Thanks! I'm really happy with the way they look too.

So, today I got around to restuffing these with proper fiberglass insulation. I got equivalent to R11 sans the paper backing.

I ended up covering the bottom, one side and the front. I made cutouts for the drivers and used some spray tack to make sure the stuff stayed on the walls... The rear wall already had a sheet of felt glued to it. For giggles I also put one more slice of fiberglass on the top wall as well... so two short walls, a long wall and the front with cutouts...

And woah! Pretty deep bass on par with my Audio Notes. I realized now that I sized these cabinets just ever so slightly smaller than the plans specified... so I bet some of the issue is coming from there... I built these a while ago, I'm not sure what I was thinking at the time why I made those changes... I should have kept my notes... but I remember doing some figuring with the various box calculators online. Who knows... All I know is the next pair I do will probably be towers... or something in between.

BTW: I like the sound of these with the smaller gauge, .60mH coils over the 14ga .50mh I had in there... it's for sure a smallish difference but it seems to tame that vintage upper midrange (low treble?) a tad and possibly bring out a little more of a bump around 100hz... not sure why, but I can hear that.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Mon, 08 Apr 2013 01:39:56 GMT

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Ouch, yeah, I hate to say this 'cause they look so good. But the box as designed is pretty much as small as you want to go with those drivers. With the port too short and the box too small, the alignment shifts even further, de-emphasizing the bass and over-emphasizing the lower midrange...

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Tue, 09 Apr 2013 13:05:56 GMT

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I just measured my box out and I ended up building mine at approximately .02 ft<sup>3</sup> smaller... I think this was an accident. As you can see I made them slightly narrower but I made them deeper to make up the volume... I think I must have fudged it a little when I started assembling them.

Either way, fixing the port length and swapping the stuffing made a HUGE difference.

Quick question... I'd like to make a larger box for my next pair but don't wanna go as big as the tower... would there be a benefit to say going with a 2 to 3 ft<sup>3</sup> box? I assume for port length I would just calculate for a 40hz port?

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Sun, 14 Sep 2014 17:55:16 GMT

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Hey Wayne,

I asked this a while back and didn't receive an answer:

"Quick question... I'd like to make a larger box for my next pair but don't wanna go as big as the tower... would there be a benefit to say going with a 2 to 3 ft<sup>3</sup> box? I assume for port length I would just calculate for a 40hz port?"

I'm building a pair of these for a friend and the towers are too big for his space... but he'd like the benefit of floor standers and maybe slightly stronger bass... is there a size/volume in between the regular 2PI and the 2PI tower that will work?

Thanks!

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Mon, 15 Sep 2014 00:30:50 GMT

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The problem with stretching the standard model to form a tower is that standing waves develop inside. Our tower was mathematically modeled to make sure neither the midwoofer nor the port are in a pressure node at lower midrange frequencies, which prevents response ripple. This was verified with measurements, of course. So there's your problem - You probably shouldn't modify the designs unless you can validate them with measurements.

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Subject: Re: Two Pi: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Tue, 09 Dec 2014 18:11:23 GMT

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Ok, making my next pair for a friend.

I'm using 3/4" Finland Birch this time so I'm slightly increasing the size accordingly. will be locating the port on the front this time as well...

One question, I don't have tube stock for the port so figured I can sandwich a 2.25" square of stock to the front baffle making up the 1.875" length of the port and drill a 2" hole through that. This should add some mass and bracing to the front. But I notice that the plans call for the port I.D. to be 1.91" and my bit is exactly 2". how would I adjust the length of the port to make up for this?

Also, is it ok to center the port on the bottom?

And finally, has anybody put in the time to measure out a slightly smaller TwoPi Tower? I would love to simply double the volume of the regular TwoPi but I don't have the software or knowledge to work this out. Having a TwoPi with a tad more bass that that doesn't need a stand but isn't as huge as the TwoPi Tower would be fantastic for me and my WAF.

Cheers,  
DJ

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Subject: Re: Two Pi: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Tue, 09 Dec 2014 21:27:51 GMT

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with Audio Note speakers. The bookshelf version is a little smaller , so has a slightly higher f3 and the tower version is larger, so has lower f3. But both models have the same tonal character as Audio Notes.

I also agree with you on the coil. I don't even offer a larger guage option because I prefer the 18gu coil.

for decades. Even after I moved towards uniform directivity designs, I've always retained the one

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Subject: Re: Two Pi: A Little Bright OR Light in the Bass?



Posted by [themilford](#) on Wed, 10 Dec 2014 14:16:42 GMT

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Hey wayne, thanks for your insight... however I think you may be replying to an earlier post.

Sorry for the zombie thread.

Just trying to ascertain whether I need to make an adjustment to the port on the new pair of Two Pis I'm building. Any of you guys use adding wood/baffle thickness to build up the port depth?

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [Wayne Parham](#) on Wed, 10 Dec 2014 16:21:42 GMT

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You're right. I was replying to the first post in the thread, not the most current one.

I'll respond to your more recent comments this time.

I like using blocks of wood built-up to make a port. Your 2" drill bit is fine. The small difference between that and the 1.91" I.D. of the tube in the kit is inconsequential. There's more difference in other areas - a loudspeaker is a pretty wide-tolerance device with lots of electro-mechanico-acoustic shift in its parameters.

As for re-positioning the port, the bookshelf model is small enough that standing waves line up in the upper midrange where the damping material does a pretty good job attenuating them. So I'd be reasonably comfortable with minor mods, and would expect little change. But we can't know without measurements, of course.

However, the tower model is a different story. The larger the box is made, the lower in frequency the standing waves modes line up. Large boxes tend to have standing wave nodes in the lower midrange, and these lower frequencies start passing through the damping material. It becomes less effective at lower frequencies. So we have to be more careful with placement of driver, port and damping material.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?

Posted by [themilford](#) on Wed, 10 Dec 2014 17:34:40 GMT

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Thanks wayne.

would something like this be useful for calculating such a problem?

[http://vikash.info/audio/standing\\_wave\\_calc/](http://vikash.info/audio/standing_wave_calc/)

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [themilford](#) on Wed, 10 Dec 2014 17:51:18 GMT  
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FWIW: my target size for a larger TwoPi is: 31" x 14" x 10.5"

Of course this can be shifted a little... but I haven't the first idea how to model anything. I'm a little mathematically disinclined.

I've played around with the link from above but I don't even know what I'm looking at or how it relates to what I might be building.

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Subject: Re: Two PI: A Little Bright OR Light in the Bass?  
Posted by [Wayne Parham](#) on Wed, 10 Dec 2014 19:42:26 GMT  
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That kind of tool is useful, but only marginally. It calculates the modes, but it doesn't model the cabinet and tell you the effect of sound source placement on response. This is what the Martin King spreadsheets do, and they're much more useful because of that.  
Martin King's Quarter-Wave.com loudspeaker modeling spreadsheets

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