Subject: Pi Speakers!
Posted by Adrian Mack on Sat, 05 Jul 2003 08:34:57 GMT
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Hey Wayne,I am now interested in the bass reflex Pi Speakers. I had originally intended to go with my other design, which was actually pretty good, but it costs heaps for what it does. So at the moment I have two JBL 2370A horns and P.Audio PA-D45 compression drivers on them sitting around. I think using them in a Pi Speaker would be very nice :-). The Eminence stuff doesn't cost too much here at all in Australia, so getting an Eminence woofer seems good. Very low distortion and linear response is important to me. I can actually get some JBL 2225 baskets and then recone them with some aftermarket recone kits and it will cost about AU$580 including postage costs for a pair. A pair of new Eminence Delta 15's would be a little less than that, but not by much. Do you think the 2225 will have lower distortion than say, Eminence Delta or Omega series? Which would you reccomend?I dont want a box massivly large either - actually, I would prefer a tower. This is of course for HiFi use - which out of the Studio, Thermionic, and Theater series would you reccomend? The Pi Speakers website states 126db maximum SPL for the Theater series 4pi bass reflex using the 15" motor. At this 126db level (very very loud of course!) how are the distortion levels like? Dont want to go any of the Pi Horn designs - way to big :P. Whats the external dimensions on the Theater 4pi? I hope its not TOO big! (as you see I've heard a lot of stuff about Pi Speakers sounding very nice, but are massive!). I realize the bass reflex pi speakers dont use high freq horns.... but I assume they can be used in them anyway with a different crossover (Have not actually built my 1KHz crossover yet, because I planned to build the enclosures first). What sorta crossover would you reccomend then for this setup? *Gets excited about Pi's* Thanks!Adrian

Subject: Re: Pi Speakers!
Posted by Wayne Parham on Sat, 05 Jul 2003 11:53:34 GMT
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Both the JBL 22xx series and the Eminence Omega Series are personal favorites of mine. You won't go wrong with either. But JBL 2205, 2225 and 2226 woofers have shorting rings, which greatly reduce distortion. They sound cleaner and less fatiguing.<p>As for the tweeters and

101" seminar. These papers go through some of the "how's and why's" and are applicable to all crossover designs.

Subject: Re: Pi Speakers!
Posted by Adrian Mack on Sat, 05 Jul 2003 13:10:44 GMT
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Hey Wayne,Thanks for th like a 4pi. Specs are as follows:Fs=42HzRe=5ohmQms=5.36Qes=0.28Qts=0.27Vas=131LMms=125gSd=900cm^2BL=24.2 TmLe=2.15mHXmax= 5.5mm (length - gap height /2 method). Pe= 700Wrms (pink noise tested). Has 4" VC. Its designed for use from 30Hz to 2Khz, but they have reccomended max frequency of 800Hz (probably because of cone breakup modes). The graph provided by them with the driver in a 125L box tuned to 50Hz shows response flat to about 1.5Khz then drops off heaps, and on the other end it shows flat down to about 200Hz then gradually goes to -8db at 50Hz. A better box would give more bass extension of course. There are other models like the 15W1200 with actual reccomended max limit of like 1.8KHz, but have smaller xmax, ~3mm, but other t/s specs essentially pretty similar. It has two copper rings (DDR, Doudble Demodulating Rings) for decreased harmonic and intermodulation distortion, and also DSS (double silicone spider) for increased linearity. Power compression is 3.4db @ 700w. It has heaps of cooling through channels between the basket and magnetic faceplate, and also more air vents in the back plate. I actually use the 18" 18LW1400 Eighteen Sound driver in a bass reflex box for my sub, and it is very good. Do you think the 15LW1401 or 15W1200 above is suitable for something like the Professional Series 4pi speakers? The great thing is I can get these Eighteen Sound parts for great prices from Active Audio, less than what an Omega costs here in Australia (then again 99% of US-made speakers cost HEAPS more in Australia). Wouldn't crossing at, for example 1.6KHz present rather severe cone breakup modes on the 15" woofer? Like, I know these high quality parts present less of a problem, but the fact would still remain. So I guess my qustion is, is there an audible artifact of cone breakup near the crossover frequency using these sorts of 15" drivers, or is it not noticable? BTW: I've heard the word "parallax" being thrown around heaps. What does it actually mean?Thanks!Adrian

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Subject: hmmmmm
Posted by Adrian Mack on Sat, 05 Jul 2003 13:14:55 GMT
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LOL! I dont know what happened to the first part of that post, it must have stuffed up or something. Anyway those parameters are for the Eighteen Sound 15LW1401 driver, I was asking if its suitable for use in a 4pi. I also said thanks for the plans, but I guess that didn't show up either :P I hate netscape navigator, so unreliable. :-)

Subject: Design choices
Posted by Wayne Parham on Sat, 05 Jul 2003 14:44:05 GMT
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The Eighteen Sound woofers use shorting rings like the JBL's. They act as a shorted secondary

and decrease harmonic distortion and reduce inductive reactance at high frequencies. JBL has been doing this for about 25 years, starting when they replaced alnico with ferrite. Eminence has introduced this in their Magnum line and others have begun to use this technology as well. It is often referred to as a Faraday ring.

As you've mentioned, good HF performance is another important requirement of a woofer used in a matched-directivity two-way speakers like this. The cone flex must be well damped so that resonances across the cone are controlled. We need the crossover point to be set fairly high in order that the midwoofer's directity matched the tweeter horn's horizontal pattern. So the crossover point cannot be lowered without adversely affecting off-axis response.

Check out the the post called "Coverage angle" and also the paper called "Improvements in Monitor Loudspeaker Systems," published in volume 31, number 6 of the AES Journal by David Smith, Don Keele and John Eargle. This paper illustrates features of two-way horn monitor

speakers and other similar designs. Most notable are the discussions of frequency division between components, passive compensation networks for compression horn tweeters and on-axis and polar response.

Subject: Re: Pi Speakers!
Posted by ToFo on Sat, 05 Jul 2003 15:12:26 GMT
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Adrian,I want to stress something that may not have occured to you (and may or may not be important to you) because it didn't occur to me untill later. If you use a bunch of non-standard parts in you speakers, not only are they not Pi's, but the forum couldn't help you much. We will have no Idea the properties of what you are using, or what it sounds like. The power of this forum and being able to adjust the design to your taste, based on what others have tried is priceless. I have A LOT of money invested in capacitors and resistors I bought for experimenting with the padding and compensation for the 2370. It is non-standrd, but luckily Wayne knows this horn and others were familiar. Had I chosen a part that nobody had a clue about, I could still be ordering this weeks comp and pad parts to solder up and cross my fingers. I already have more in caps and resistors than I paid for compression drivers. So the point is, If you are running non-standard parts, and you have a question, We would all be guessing. You might spend weeks and much money tweaking around to no avail. There may be good substitute parts, but having been one who blazes my own trail, I must admit, if I hadn't started with a known good combination, I would likely still be tweaking my last bad idea. I hope that my intense desire to be helpful shines through, and that this doesn't come off negative. You may have great ideas and be great at figuring what works well. I am pretty smart about this stuff for an amatuer, and lately I have made some great sounding original designs. I just know what it's like when people answer my posts with "well I have never heard that combination before, but try this" or "just order the specified parts, they work well" I didn't think of that untill after it happened. I also didn't get good at speaker building untill I had a popular design and followed the forum A LOT. I got to try all the cool stuff that goes on here and I learned what something on paper sounds like when it gets to my ears. I learned so much from Wayne and the guys. Now, I guess I'm one of the guys.As for the different woofers. I can attest

that even the budget Delta 15 sounds more realistic than my ScanSpeak 8" which is one of the worlds best according to all who covet or own it. You can't really make a bad choice with the 15's. Just bass acording to your taste. But if you like a lot of material with really deep bass the Delta sounds way better than it's graph would let on. My next Pi will use an Omega, I just have to hear this thing. I love the idea that instead or rising respose at breakup range, it just rolls off at crossover. Thats crazy! It is Wayne's favorite Eminence in the midrange and it uses a small box. I will not likely get to own a JBL based Pi for money reasons, but The recone thing can have varying results. It's really down to how good the tech is and with what parts. Hmmm scary.Good luck with themThomas

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Subject: Re: Pi Speakers!
Posted by Adrian Mack on Sat, 05 Jul 2003 21:00:25 GMT
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Hey Tofo,Thats ok, you dont sound negative at all :-) And yes, if I do decide to go the Pi route, then I'll be using mostly different parts, except for the crossover and JBL horns I guess. But I do think the Eighteen Sound drivers are very good, and I enjoy the 18LW1400 a lot which I have. As for knowing my stuff... I can say that for subwoofers anyway. Not so much multi-way designs, but hey, I'm gettin there! I've had my share of crappy subs from bad designs of my own, but not anymore (not to say I'm a complete expert of course!). If the Pi speaker I build does sound real bad, then at least theres stuff to be learned :-) But I dont think I could go too wrong choosing parts that I know are good. Besides, I wont cut or purchase a thing until I am certain that it will perform well. I know one person who uses the 15LW1401 from 70-300Hz, William Cowan uses this in with his Unity Horns, and apparantly they work very well too. Then again... I might indeed go the Eminence Delta route. The 15LW1401 I think costs about AU$420... but the Eminence Delta 15 costs just AU$225. So thats quite a saving, especailly because I'd be needing a pair. Do you think I would be disappointed with the Delta's? I have scanspeak 8's too, so I am looking for an good/noticable improvement over these. Not sure if I'd go the reconed 2225 way. I know they say specs of aftermarket recones are very similar, but thats just taking the manufactures word for it, which most of the time isn't a good thing to do :P Thanks!Adrian

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Subject: you wanted the short reply? too bad!
Posted by ToFo on Sun, 06 Jul 2003 00:16:26 GMT
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Sounds like you've got the right attitude and expectations for whatever you decide, so, cool!The delta is a great woofer, especially factoring in cost. Since you have a Scan-Speak 8" we share a similar reference. I will say that the delta sounds similar at low volumes, and they both have a full midbass when up against a wall or corner. but since the delta is so much bigger and has to move

so little even at high volumes, the phrase that comes to mind is effortless slam. The 8's that I have are the stiff paper woofers so they break up terribly in the mids. It is impossible to compare the two above 500 Hz as the deltas sound great even at crossover. Oh! and believe it or not, the delta is only about 50 % heavier.(not bad when you are 4 times bigger) If I had your sub I might aim for something with less bass than a delta, something more for high output midbass/midrange.The omega still looks good for you, but I understand about the cost. The woofer you spec'd in another post also looks real strong, but I can't see how they get it in a box larger than 2 cubic feet.(as per BoxPlot) It looks like a great driver to use with your sub crossed around 60 to 90Hz, because it starts rolling off fast at 50 Hz. It looks to be a real high power midbass, and it does seem similar to an omega 15, but lower Q and higher gauss (not a bad thing). Thats a big bad motor. It looks good in a small box too, 2 cubic feet and a port 4" by 3.5" long. Does Eighteen Sound make a hot 15" with similar specs, but without the double spider? That adds a lot of moving mass and is likely the reason they say to cross at 800. (mass rolloff) Might save you some money too. It isn't really necessary for midbass duty unless you will really pound these things HARD. If your compression driver can do 800 or 1000, it might be ok though. It does appear from the specs and the presence of copper shorting rings that they are doing quality stuff. (just a guess since I havent ever even seen or heard one, but makes sense) If you get the double spider ones, break them in like you are trying to blow them up! I use to sell some double spider car woofers, and most of the customers amps were not capable of moving all that spring tension real well. (I was the service guy so It became my problem, 1 hour on the 1200 watt mono block usually freed them right up)As for break-up on big drivers, it varies a lot. All drivers break up, It's just where and how bad. Paper is usually friendly and it generally sounds even better than it measures. If you were using kevlar, carbon or glass you would want to cross an 8" about 1000Hz 3rd order. any higher and you would need a notch filter also. Paper self damping, and some drivers like the omega do not show ragged or rising response before mass rolloff. I am not saying that it doesn't have break up, but it has a strong motor and it doesn't have spikey or rising response above 1000Hz (or anwhere else for that matter). How often do you see that? Thats got to tell you something. It seems very controlled in all of the usual behaviors. It's a shame about trade laws and tariffs really. It appears you will have good parts from Eighteen Sound though.P.S. If you find more info online (graphs, pictures) for eighteen sound let me know. I am not getting much from what I have found.P.P.S. Take all the Omega stuff with a grain of salt. I have the hots for them right now, and I do not even own any yet. You must admit they have insanely well behaved frequency response in the crossover area compared to just about anything else period.Let me know how it goes,Thomas

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Subject: Re: you wanted the short reply? too bad!
Posted by Adrian Mack on Sun, 06 Jul 2003 04:08:52 GMT
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Hey Thomas,

The Eminence Delta sounds like it could perform pretty well then. I noticed on the Pi Speakers website, it says max SPL of 126db from the Theater 4pi series that use the Delta 15. When I do a T/S simulation, it shows about 114db SPL in a PiAligned cabinet before it runs out of its 2.7mm excursion. Then again, thats only the length - gap height/2 way for xmax, and it might go further

than that without objectionable distortion (low distortion is a major goal of mine though). I didn't think it could hit 126db anyway, or am I missing something?

Your right about the breaking in thing! On my 18LW1400 with double spiders, I had to break that thing in like hell before it 'loosened up. More than any other sub I've used. But after it was done, it sounds awesome.

Eighteen Sound has heaps of 15" models. It seems like the ones that dont have the two copper rings also dont have double spiders either. So thats a shame because I'd like to have the copper rings. There is one particular model that doesn't have what they call DSS, the Double Silicone Spider, but rather what they call a "Twin Spider" and is the only model that they have that has it like this (model 15LW1300). It has an Mms of 99g, which is a lot lower than the 15LW1401 - it has maximum reccomended frequnecy of 1KHz. My compression drivers have output to below 1KHz according to the graph on the website, and reccomend xover of 1KHz. On the compression driver itself is a piece of metal with a graph printed on it which shows what I call a "spastic" graph, dropping off at 2Khz or so, so I guess the one printed on the compression driver itself is probably wrong, because the website states 1Khz xover and the graph on website showing output flat to 1KHz and a bit below that too.

I actually have the Eighteen Sound catalogue here, and it has heaps of info and a few graphs on each driver, with pic. Below is a picture of what the 15LW1401 looks like. Its a pretty poor picture cuz its actually a digital photo i took of the magazine, but nonetheless:

http://members.wasp.net.au/~macky888/18Sound/15xxxxxx/Jam001.jpg

Here is a graph of the 15LW1401 in a 125L box with Fb=50Hz. The pic is taken on a bit of an angle but it shows flat to 2Khz despite 800Hz rec. freq:

http://members.wasp.net.au/~macky888/18Sound/15xxxxxx/Jam002.jpg

The 15LW1401 has a cardboard, straight-ribbed corrugated cone, but its carbon fibre reinforced as well for strength.

The 15LW1300 which is the one with TwinSpiders (not DSS) but I guess its still double spiders, with max recc freq. of 1Khz and the specs are:

Fs=46Hz
Re=5.5ohm
Qms=4.9
Qes=0.39
Qts=0.36
Vas=138L
Mms=99g
Sd=900cm^2
BL=20.2
Le=1.55mH
Xmax=3mm

It looks the same physically as the 15LW1401. Here is a graph of 15LW1300 in the same box as above:

http://members.wasp.net.au/~macky888/18Sound/15xxxxxx/Jam003.jpg

As can be seen it has a pretty strong rise in high frequency response. So hmmmm.

Another interesting one is the 15W1200 which does have DSS and DDR, but maximum reccomended frequency of 1.8KHz. Its got smaller xmax though. Specs are:

Fs=45Hz
Re=5.5ohm
Qms=4.1
Qes=0.27
Qts=0.25
Vas=134L
Mms=108g
Sd=900cm^2
BL=25
Le=1.7mH
Xmax=3mm

Picture of 15W1200 below:

http://members.wasp.net.au/~macky888/18Sound/15xxxxxx/Jam007.jpg

And its graph:

http://members.wasp.net.au/~macky888/18Sound/15xxxxxx/Jam008.jpg

This graphs a bit hard to see, but it goes flat to 1.5KHz, and up about 3db at 2Khz, then falls rapidly.

Theres also the 15W700 which has a lower Fs of 38Hz and lighter moving mass, but has no faraday rings so I wont mention the specs here. But it also doesn't have double spiders.

So what I am thinking the 15W1200 with 1.8Khz maximum reccomended crossover frequency is the best bet. The 15LW1401 shows good response above 800Hz, but nonetheless, they must reccomend 800Hz for a reason. And thet 15LW1300 shows the rising response which I dont want, but a different box could probably tame this. Out of these, the 15W1200 I think is the least expensive, and 15LW1401 the most expensive. Any thoughts on these drivers?

> You must admit they have insanely well behaved frequency response in the crossover area compared to just about anything else period.

Now thats something I've heard a lot of - why do people say period?! What does it mean!

Thanks!

Adrian

Subject: Re: you wanted the short reply? too bad!
Posted by Adrian Mack on Sun, 06 Jul 2003 06:05:08 GMT
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Just been playing with the Omega 15 then, and I have to say it looks GREAT on paper! The 15W1200 has a -3db point of about 85Hz in PiAligned cab, which is really a bit too high I guess. The Omega 15 in a PiAligned cab has a -3db point of 65Hz. Both drivers though are capable of over 120db - the Delta seems the only one with less SPL output. Omega costs AU$570 though..... Unless I provided some equalization in the highpass crossover (sallen key) which would bring down the -3db point a bit, but I dont 'really' want to do this. Looks like I got a lot of deciding to do, GRR!

Subject: Re: you wanted the short reply? too bad!
Posted by ToFo on Sun, 06 Jul 2003 06:35:47 GMT
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Adrian,"Period" I guess it's a US thing, but it is an exagerration for emphasis that signifies there is nothing else to be said on the matter. The final word.I agree that the 15W1200 looks good, and it also has that great behavior in the crossover region like the Omega. As a midbass driver the smaller X-max is not much of an issue. According to box plot this thing will take more than its rated power without the voice coil ever leaving the gap, as long as you cross above 50Hz. Looks really good!As far as 3dB down at 85Hz goes, your using that big sweaty sub with these aren't you. If so, Where are you crossing over? Besides room gain has usually started to kick in around 85 Hz. I think you could use either. That damn Omega is a charmer though. If you could get it for what we pay in the US, it would be a real winner. Is the price you listed for Omega 15 the price for one? If I've got my $AUD right thats almost double what we pay here. OUCH!Anyway, I think you have it narrowed down to where you can't really do bad either way.Later,Thomas

Subject: Re: Design choices
Posted by Adrian Mack on Sun, 06 Jul 2003 08:08:21 GMT
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Hey Wayne,Seems like I've narrowed down my choices pretty well now. I was just wondering why you didn't choose to use a PiAlignment for the Theater series? (havn't checked out the rest). I just

did a quick check of the internal box volume used and it just seems to be very different. Is there any reason for this? The PiAligned Delta 15 and the box used on the Theater series didn't have much change in the transfer function between each other, but its quite a difference in box size though. Thanks!Adrian

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Subject: Re: Design choices
Posted by Wayne Parham on Sun, 06 Jul 2003 12:30:55 GMT
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version of the Delta 15. I noticed it had changed - and has since changed a couple more times - But box tuning was still appropriate for the (then and now) current Delta 15. In fact, I believe one of the older Delta 15 specs are what is in the PiAlign "DAT" file.

Subject: Re: you wanted the short reply? too bad!
Posted by Wayne Parham on Sun, 06 Jul 2003 12:44:56 GMT
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you're using them for maximum output like this, you will probably employ a subwoofer below 100Hz, so I think that's pretty good for this class of speaker and particularly for its cost.Wayne

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Subject: Re: you wanted the short reply? too bad!
Posted by Adrian Mack on Mon, 07 Jul 2003 00:42:50 GMT
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I agree Wayne. I actually did some modelling just then with a highpass filter at 100Hz on the Delta 15, and it still had a -3db point of 80Hz or so, and also high output about 118db along its passband within its excursion. So thats not bad at all :-)

Subject: Re: you wanted the short reply? too bad!
Posted by Wayne Parham on Mon, 07 Jul 2003 01:13:13 GMT
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That's pretty cool, but I think the SPL figure is still a little bit low. Maybe the difference is because you've modeled with a lower cutoff, allowing more subwoofer energies to be presented to the speaker.

Subject: Re: you wanted the short reply? too bad!
Posted by Adrian Mack on Mon, 07 Jul 2003 05:47:56 GMT
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One last thing, you mentioned that the Delta 15 is still nice and flat in the crossover area. On the graph from Eminence, it actually shows greatly rising response from about ~650Hz and up, are you sure the Delta sounds fine in its crossover area?Yea, its gonna be used with the 18LW1400 sub :-)Thanks!Adrian

Subject: Re: you wanted the short reply? too bad!
Posted by ToFo on Mon, 07 Jul 2003 08:09:20 GMT
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I said they sound great all the way up to crossover. There is a little bump about 850 Hz, but the crossover actually brings down all that rising response better than you might expect from the look of the graph. Anyway, You can always cross lower since your compression drivers go down to 1K. Maybe it is the room, or the fact that they are set up in a system with crossover and another driver, but they sound and measure real good in my house. (warning! home measurements! I do not own a high quality meter, but I did calibrate my crappy meter using a good one) The deltas behave better in the real world than they do on paper in my opinion. I do not really know how loud they go at full power, but they are dance club loud with 125 watts pushing them.with that big sub I must admit I wonder why you want such a full range big box main speaker, but if you are contemplating running your mains without the sub sometimes, or you just want to have the option, the Delta would be a good choice. If you will always use the sub then you still have to think about the JBL route too (asuming a good recone job). Way smaller box and from what people say they are super clean and dynamic. I know, I am no help, but the choice is yours alone.Thomas