
Subject: Widerange midwoofers, specs, and x-o pts...

Posted by [darkmoebius2](#) on Tue, 22 Sep 2009 02:17:54 GMT

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I just wanted to open a general discussion about widerange mid drivers(3" & 4") and the most desired aspects from a specs POV.

In a perfect world, we could easily find and affordable driver capable of 80-6,500Hz FR with a nice, smooth, curve and rolloff at both ends of the spectrum. But, this isn't a perfect world.

Seeing how, in most cases, one has to crossover to both the LF and HF drivers at 1/2 to a full octave before the actual crossover point, one likely has to trade off one end of the FR against the other.

So, let me ask which is a better trait in a world of compromises (assuming one starts an array from the mids out) - extension below 120Hz or smooth highs above 3.5kHz? taking into account that comb filtering effects likely kick in above that point?

Is this a too simplistic view?

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [selahaudio](#) on Wed, 23 Sep 2009 00:37:22 GMT

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darkmoebius2 wrote on Mon, 21 September 2009 21:17: I just wanted to open a general discussion about widerange mid drivers(3" & 4") and the most desired aspects from a specs POV.

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So, let me ask which is a better trait in a world of compromises (assuming one starts an array from the mids out) - extension below 120Hz or smooth highs above 3.5kHz? taking into account that comb filtering effects likely kick in above that point?

Is this a too simplistic view?

Comb filtering doesn't remove everything so you still have to pay attention to the transfer function of your filter. There may be still be peaks and dips along the line depending on where you place your crossover and how steep the slope is.

Depending on the location and bandwidth of your subwoofer you may want to go lower than 120hz. A steeper crossover slope on the sub will also allow you more flexibility. There are more choices at say 80hz for subs but also Dayton RS / Seas 10"-12" that will easily handle a 120hz crossover point. The really long excursion drivers (15mm+ xmax) tend to be more limited because of their inductive voicecoils.

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Wed, 23 Sep 2009 01:05:25 GMT

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Rick,

RE: "Comb filtering doesn't remove everything so you still have to pay attention to the transfer function of your filter."

I'm sorry. Where does comb filtering come in here? Maybe I'm the only one who doesn't understand this, but I would like to know what you are talking about here.

I'm not assuming that its inaccurate, just that I don't know where this came into the discussion.

Thanks,

Marlboro

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [darkmoebius2](#) on Wed, 23 Sep 2009 06:16:59 GMT

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selahaudio wrote on Tue, 22 September 2009 19:37Comb filtering doesn't remove everything so you still have to pay attention to the transfer function of your filter. Do you know of a good website that explains comb filtering? I guess I don't really have a full grasp of what is going on with it beyond that it causes an increasing decline in output above certain frequencies. Is it a matter of cancellation? Are there formulas for quantifying how much cancellation there is at certain frequency ranges?

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Wed, 23 Sep 2009 11:27:41 GMT

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If we are taling about comb filter distortion, this is what Jim Griffin said on PE back in 2006:

"Comb lining will dull the highs and will be most noticeable in the lack of air (dull highs) especially as you move off axis. Essentially, the high frequencies are rolled off as the ensemble of the tweeter outputs don't add up but start to cancel. Now the ear is less sensitive in the upper octave (10-20 kHz) you may not observe the full impact of this effect. But if you compare to an array that is properly designed, then there is no comparison as the proper array will yield a more airy (and accurate) sound."

Jim Griffin on PE 11-21-06

If you look at a frequency chart, it looks like you put your hand over it and drew around your fingers. However if you use the proper spacing of the speakers and match the correct crossover as described in the white paper, you can avoid the issue. And if you don't move but sit still when you listen, you may not be able to hear it at all even if you have a difficult problem. Pipedreams have comb filter distortion but because people sit still, its not audible.

But I'm not sure where this subject cam up in your original discussion.

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [selahaudio](#) on Wed, 23 Sep 2009 14:19:19 GMT

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darkmoebius2 wrote on Wed, 23 September 2009 01:16selahaudio wrote on Tue, 22 September 2009 19:37Comb filtering doesn't remove everything so you still have to pay attention to the transfer function of your filter. Do you know of a good website that explains comb filtering? I guess I don't really have a full grasp of what is going on with it beyond that it causes an increasing decline in output above certain frequencies. Is it a matter of cancellation? Are there formulas for quantifying how much cancellation there is at certain frequency ranges?

There are some formulas but in reality the measured response can vary from the theory. Comb filtering is basically a phase issue where the drivers don't sum correctly and this creates dips in the response.

The vertical off-axis frequency response of the driver plays a role as well which is why planars and ribbons function better as tweeters in an array. Domes have more interference because they radiate sound the same at all angles. If you ever listen to an array with domes you'll notice the top octave sounds partially missing and that's the result of comb filtering. The same is true for arrays with small drivers operating full-range. Ribbons/planars aren't totally immune to it but they have lower interference due to the longer radiating element and in most cases the quasi-horn loading of the front faceplate.

With woofers and mids the combing starts at a lower frequency and is affected by the center-to-center spacing as well as the off-axis response. After several years of working with different woofers I have concluded that 3"-5" woofers work best with the planars and ribbons that are available. A DSP crossover with steep slopes (48db or more) is a big advantage if you want to use a 6"-7" woofer because it will handle the comb filtering better than a passive crossover.

Subject: Re: Widerange midwoofers, specs, and x-o pts...
Posted by [darkmoebius2](#) on Wed, 23 Sep 2009 20:07:16 GMT
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Thanks for the responses, guys. Having read so much stuff about crossovers, bi/tri-amping, etc. I forgot that I had a fairly good idea of comb filter effects from a white paper by one of the commercial array manufacturers(or was it an AES paper?) that I cam across.

Subject: Re: Widerange midwoofers, specs, and x-o pts...
Posted by [Marlboro](#) on Wed, 23 Sep 2009 20:56:12 GMT
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RE: "Domes have more interference because they radiate sound the same at all angles. If you ever listen to an array with domes you'll notice the top octave sounds partially missing and that's the result of comb filtering. The same is true for arrays with small drivers operating full-range."

You have to understand here that the only line array that Rick Craig has PROBABLY listened to that is commercially available is the PipeDreams. This may be the only line array that he has listened to with domes in it.

My research has shown that 1 inch domes are too big and 1/2 inch domes are too small. Only 3/4 inch domes will work due to comb filter distortion issues and crossover issues. And even these have to have their edges truncated so that they are literally silk to silk.

I can assure you, and everyone who has listened to my array can assure you, that there is not a hint of loss of high frequencies using my method. However, no commercial builder could possibly do it due to the labor intensiveness.

Rick has brought this up numerous times about domes, and specifically mine. Here is what Jim Griffin had to say about SPECIFICALLY ABOUT MY LINE ARRAY on April 28, 2007, when Rick Craig commented that my line array with the domes and the 3 inch midranges was very poorly executed:

"Perhaps not as bad as you are thinking. He is using 3" diameter mid-woofs with 4" pipe loading for each one. It would have been better to locate these drivers closer together so that the center to center spacing was smaller (I'm guessing about 5" c-t-c in his design[ACTUALLY 4.75 inches-marlboro]). While with his crossover at 2650 Hz would create some potential combing issues for a

low slope crossover, his active crossover likely has a high enough slope to minimize the crossover overlap region between the mid-woofs and tweeters. He does trim the flanges on the dome tweeters so that their c-t-c spacing is reduced. Hence, he pushes the coherent frequency coverage for the tweeters higher than you would have without those trimmed flanges.[START OF COMB FILTER DISTORTION IS 16.5 khz--- quite a bite above my hearing and most people above 25 years old- Marlboro]

"He is a student of my white paper....."

Since I consulted with Jim every step of the way, I want to assure you that you can use domes, but you will be limited to using Dayton Neo20FA's only. Although if you can believe Zaph's reports, the little Dayton neo's charts beat all the ribbons except the B&G.

So I have to conclude that Rick's statement about domes has to be with the ones where the edges are not cut to make the center to center distance about .78. Its too bad that he lives in NC and can't hear a decent line array using domes.

Marlboro.

P.S.: If I was unable to use domes, or Dayton changed the style of their neos, i would most certainly use a ribbon. But it would be the B&G model. Until I see tests somewhere that compare all three testing graphs that John Krutke uses, I will have to use his measurements.

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Wed, 23 Sep 2009 23:31:29 GMT

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Back to the original question.....

I believe that distortion is the most significant measurement.

FR is so dependent on so many things from the speakers to the room to actual hearing of the individual to almost everything.

But distortion is pretty steady: IT INCREASES AS THE VOLUME INCREASES.

MARLBORO

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [darkmoebius2](#) on Thu, 24 Sep 2009 00:10:34 GMT

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Marlboro wrote on Wed, 23 September 2009 15:56

You have to understand here that the only line array that Rick Craig has PROBABLY listened to

that is commercially available is the PipeDreams. This may be the only line array that he has listened to with domes in it. Marlboro, you cannot lambaste Rick for supposedly making an assumption, then turn around and make an assumption yourself about what he has, and has not, heard without seeming slightly hypocritical. Quote: My research has shown that 1 inch domes are too big and 1/2 inch domes are too small. And what do the majority of line arrays using dome tweeters utilize? So, in general, Rick's statement might be true about a lot of arrays using dome tweeters - maybe even a majority. Quote: I can assure you, and everyone who has listened to my array can assure you, that there is not a hint of loss of high frequencies using my method. However, no commercial builder could possibly do it due to the labor intensiveness. I have a feeling that you are taking every statement Rick makes too personally, as if it is intentionally directed at you. That does not seem to be the case, to me, and I think others might agree. Quote: Rick has brought this up numerous times about domes, and specifically mine. But, he did not mention you, or your array, this time. Quote: So I have to conclude that Rick's statement about domes has to be with the ones where the edges are not cut to make the center to center distance about .78 How many other arrays do you know of where someone has done this? This only goes to buttress that, outside of your speakers, any array using domes the rest of us are likely to hear will be using tweeters that are not close enough together and will experience some noticeable loss in HF response.

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Thu, 24 Sep 2009 00:38:22 GMT

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You're getting too excited here, Dark Moebius.

I was simply describing how dome tweeters can work if you do some special gyrations to make them happen. They are special gyrations, but I seem to be the only one who has taken the time to make them happen.

Newbies here need to know that this is possible, though difficult. While Rick is not directly responding to me, everyone on both here and PE, knows that I have used domes with my line array, and everyone that I know or ever saw, except for the PipeDream people's 81,000 buck devices, have used ribbons.

While I have a short trigger sometimes, and Rick is really good at pressing my buttons when I'm not paying attention, my only purpose is to correct any fallacies that I see in terms of line array building.

You or anyone else has that right also. You, or Rick or Fred, can disagree with the use of domes in line arrays. I don't have a problem with that. But you cannot tell all the newbies that using them will cause unacceptable comb filter distortion, without me stepping in and, as politely as I can, saying, "No, that's not correct, if, and only IF, you do it this way." And I've described the way.

I do have to apologize for flipping out before. I really don't like to be letting my buttons be pressed.

Everyone here has specific biases. Rick has made it pretty clear that he thinks Krutke's

measurements of Fountek tweeters are wrong, but he's not been will to offer any counter measures to show that other than his own viewpoint.

I maintain my right to explain when someone has made an incorrect statement and my way to fix it. Except for Fred and I (and I hope I am wrong), we may be the only DIY people (meaning we don't offer finished items or kits for sale) who have actually built line arrays from scratch using Jim Griffin's white paper that have a tweeter array as part of the system. I believe everyone else may have built one of Rick's kits. This is great, and I encourage everyone to build what they feel comfortable with doing. But when you do it completely yourself, you've learned things that you won't learn in any other way.

Kind regards and thanks for sharing,

Marlboro

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [darkmoebius2](#) on Thu, 24 Sep 2009 07:30:00 GMT

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Aaaah, sorry about that, Marlboro. I mistakenly assumed that you were really pissed off by that post.

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [darkmoebius2](#) on Fri, 25 Sep 2009 00:38:58 GMT

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Quote: I believe that distortion is the most significant measurement...FR is so dependent on so many things from the speakers to the room to actual hearing of the individual to almost everything...But distortion is pretty steady: IT INCREASES AS THE VOLUME INCREASES. Certainly a logical deduction, but...

I wonder if the levels (and types/orders) of distortion between the best of applicable ribbons and domes are as audible as the numbers seem to suggest.

Not to mention, there are other factors in how things ultimately sound. Horizontal and vertical dispersion characteristics seem to favor ribbons in array circumstances i.e. ribbons have limited vertical dispersion and much greater horizontal dispersion giving a greater sense of space and size.

Also, Zaph's tests were done 4 years ago and I wonder if ribbon/planar designs have progressed much since then. Or, at least, manufacturing has evolved to higher tolerances thereby improving performance.

I did find this comment on DiyAudio regarding one person's comment that ribbons tended to sound "light", "bodyless", "boring/no kick": Quote: btw, *most* of the problems kea posed are likely

due to an overdamped output because of amplifier pairing with very low output impedance. Match OR almost double the ribbon's impedance (i.e. for an 8 ohm ribbon either 8 ohm output or up to 16 ohm output for the amplifier), and you should find that the sound changes rather dramatically in favor of the low mass driver. The tangible air compression (or "kick") IS a product of the driver's mass and its transfer impedance to the air. The less mass, the less "kick". This is a subjective valuation, BUT generally the lower in freq. you go the more mass your diaphragm should have - otherwise it does indeed provide a "lifeless" character (..which incidentally is more accurate to the source but likely less accurate to the event - but this is definitely an art in balancing these two aspects, not a science).

Finally, it seems that everyone is *certain* that the likes or dislikes for ribbons and other low mass drivers are due to harmonic distortion. I find that laughable. Chances are that most people wouldn't even be aware of an increase in 3rd order up to 5% and 2nd order up to 15%. At the lower % levels (below 1%) I would be looking more at 5th order and above to cause any sort of audible problem. So - if you are looking for a problem in most drivers - I wouldn't be too concerned with driver THD unless the higher order (5th+) started moving much past .1%. This doesn't mean that you shouldn't try to minimize THD, but rather that you should be careful in that a reduction in THD may well lead to an increase in distortion that we either cannot measure yet OR can measure, but so far do not understand its importance. The distortion comments are most interesting. But, I wonder what the impedance circumstances of Zaph's tests were, too?

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Fri, 25 Sep 2009 03:14:13 GMT

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Re: "Not to mention, there are other factors in how things ultimately sound. Horizontal and vertical dispersion characteristics seem to favor ribbons in array circumstances i.e. ribbons have limited vertical dispersion and much greater horizontal dispersion giving a greater sense of space and size."

The only problem with this is that the human ears don't have the capability to recognize differences in vertical dispersion.....

Jim Griffin was describing circumstances regarding vertical dispersion in line arrays in June, 2008 on the PE forum:

".....talked about the differences in how a near field line array radiates vs. the spreading radiation which would be observed from point sources or for far field radiation. Another consideration with line arrays is from the psycho-acoustical viewpoint. Our ears and head combination provide an exceptional ability to localize sounds in the horizontal plane. Shadowing by the head helps in the horizontal plane.

"However, the ear has poor spatial resolution in our ability to localize sound in the vertical plane. This poor vertical resolution is attributable to the equal distances from each ear to sources in this plane. Furthermore, the ear will mask signals according to both their time of arrival and the strength of each signal. Thus we observe very little ability to discriminate between signals from different sources in the vertical plane.

"Bottom line is that you should not worry too much about the arrival time differences in the near field because of the ears lack of vertical discrimination."

Apparently in the jungle, early man did not need to hear predators coming from the trees, but only from around on the ground.

I'm not positive, but the reference suggests that the extreme differentiation of the human ear-brain to horizontal dispersion and minimal to vertical, would have some influence on your concern. I would need to see some measured comparison between domes and ribbons in horizontal dispersion. Just looking at the fact that the dome stick out, and the ribbon is flat, it would seem to me that dispersion should be easier for something that sticks up compared to something lies flat. But I've no research at the moment on the dispersion comparison. I'll research it.

What do you think?

Marlboro

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Fri, 25 Sep 2009 03:47:03 GMT

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I don't have time for any more research.

What I've discovered so far is not that the ribbon is inherently wider in dispersion that the dome. What makes some of them have such wide dispersion is a kind of horn loading that you see in the HVRT1C or in the Pioneer ART-55D, but that you don't see in the Eton AR Air motion.

There is another factor. The ribbon may not actually have a wider dispersion than a dome:

The output of a planar ribbon driver is evenly distributed over the entire radiating surface, which results in no wave cancellation, diaphragm break-up or resonances. The flat radiating surface also results in a coherent wavefront with even dispersion.

This may be what is perceived as wider when in fact it is really the coherence with less cancellation.

There is a third factor. Ribbons tend to stay the same in their dispersion characteristics as they move through the different frequencies, However Domes tend to beam and the frequency rises. I would be interesting to put a line of domes together on some kind of rising and falling horizontal angle to the listening area. This would prevent the effect of the beaming from influencing the sound. it owuld be fairly easy to do with a line of 30 dome tweeters.

But the problem remains that even a lowly Dayton Neo20FA will be able to match or beat most ribbons in FR, distortion, and spectrum decay.

Its an interesting discussion. I wish one could say there was an answer hands down. I think it still means what people like:

Heres a comparison quote from a guy on Audiocircles about 3 years ago:

"IMHO, what I noticed immediately between the tweeters was the difference in apparent "air" and "detail". Cymbals seem to have a natural shimmer to them, along with triangles etc.

"The 1" fabric dome seems to have more "body" to the sound and less "air". Between the two, I lean towards the ribbons but have grown to like the fabric dome. "

I'm still researching it.

Marlboro

Subject: Re: Widerange midwoofers, specs, and x-o pts...

Posted by [Marlboro](#) on Fri, 25 Sep 2009 03:49:32 GMT

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Re:

"The distortion comments are most interesting. But, I wonder what the impedance circumstances of Zaph's tests were, too?"

Please correct me if I'm wrong.

I don't think the impedance characteristics make any difference unless you are tied to using passive crossovers. With active crosses various impedance is a non-issue, the amp has direct control of the speaker. Also the spike to infinity that you see at the crossover in passive crosses is either non-existent in active electrical crosses or at least way less.

Maybe this isn't what you were talking about??

Marlboro
