Subject: On axis measurements in nearfield listening
Posted by Marlboro on Tue, 15 Sep 2009 23:22:51 GMT
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On the PE Tech forum, I asked a question as to whether when one is listening in the nearfield, and when the speakers are facing a central listening couch, whether there is any issue with speakers being off axis at all? Its a big measurement question that is always brought up.

Many people seemed confused that I would bring up a question about something that I didn't actually experience, I guess because asking questions just to find something out is not done. I'm not sure. Other people told me all about how I could fix the problem, even though I had already indicated that I could hear no issues with off axis response. Other people assured me that my line array was clearly wrongly placed against the wall, and other things.

I was told by someone I respect immensely that my system clearly had bad smearing of the sound stage(meaning I couldn't tell what instrument was placed where), and that combfilter distortion was rampant cutting out my highs. He's never heard the system, and I know both of these things are so wrong that I'm on the other side of the universe with them.

Nobody confirmed my listening tests that in the nearfield with the speakers angled directly toward the listening, that there is essentially no hearing observable effect of off axis response issues.

I'm really not sure what any of this means. But I have suspected for years, and Jim Griffin has taken many professional engineers to task many times to try to explain that the whole listening experience in a full line array is fundamentally different from point source speakers, and that line arrays aren't just big point source speakers.

Marlboro

p.s.: when I get 43 more posts, I graduate from Grandmaster to Illuminati 1st degree. Wayne is Illuminati 33rd degree, but he has 12000+ posts, and I'm sure I'll never get that many posts for the rest of my life. Does this qualify me to be in the Movie?

Subject: Re: On axis measurements in nearfield listening
Posted by Wayne Parham on Wed, 16 Sep 2009 00:20:38 GMT
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I have found that most folks on the PE forum rarely (or never) do measurements. They trust their models instead. I'm not against models by any means, using them extensively. In fact, I think most people have better results with models than they would with measurements because making good measurements is not trivial and requires good equipment. But still, a good measurement trumps a good model any day. And off-axis stuff is harder to accurately model because there are complexities that aren't included in the simplifying assumptions.

To me, off-axis performance is as important as on-axis response. The total power is radiated in

all directions, not just on-axis. In a room, much of this energy is reflected back, so it really is what sets the tonality of the sound field. A uniform reverberent field is just as important as a uniform on-axis response curve. Most experts agree with that, and I think a few minutes with a speaker that generates good polars will convince most any audiophile.

Subject: Re: On axis measurements in nearfield listening
Posted by Marlboro on Wed, 16 Sep 2009 01:52:52 GMT
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Wayne,

Asking questions about line arrays on PE invariably sends the various university trained electrical and audio engineers into some kind of joyful excursion of audio engineer language, which almost always excludes those of us who are not engineers. I think they do it on purpose so they don't have to answer questions in a way that a normal person can understand. Usually they get kind of angry when I ask for an explanation in laymen terms, like who do I think I am asking a question that I can't understand their answers for.

I'm sure what you said makes good sense to an audio or electrical engineer. Unfortunately, you lost me near the beginning.

Could you respond to my question about my listening to my line array in the nearfield with the speakers slightly angled so that they are essentially facing the listening couch, and whether in that circumstance, off axis performance is actually hearable. As someone suggested who has always been a voice of reason on PE stated, I should have smearing of sound stage and loss of highs, but I most clearly DO NOT. Later in their discussion they started a technical argument as to what smearing actually means, and then lost me completely.

Are you suggesting that I have a uniform reverberant field? I was under the impression that that was a characteristic of listening in the nearfield. Also that the brain ignores any reflection that comes in under 38 milisecs, and listening in the nearfield pretty much eliminates any sound reflections that would be interpreted as anything other than the primary information.

As to the polars, doesn't a line array listened to in the nearfield produce a fundamentally different pattern that has less to do with polars?

Thanks so Much.

Marlboro

Subject: Re: On axis measurements in nearfield listening

Posted by Wayne Parham on Wed, 16 Sep 2009 03:34:12 GMT
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What I'm saying is that a loudspeaker produces sound eminating all directions from it, not just straight forward. This goes without saying, I suppose, and you're aware of it or you wouldn't have brought it up here. What I'm also saying is that I believe (as do many others in the field) that the off-axis response is as important as the on-axis response, especially when used indoors. The reason is pretty simple - the sound going straight in front of the speaker is only a tiny fraction of the total sound radiated by the speaker (in all directions). You don't just hear the sound coming straight at you, but also you're enveloped by the sound reflected back at you from the walls. This is called the reverberent field, and it makes up a great deal of what each listener hears.

Off-axis sound also plays a part in the width of the sweet spot. If you have a speaker that only sounds good on-axis, then it has to be pointed directly at the listener. That doesn't leave much room for guests. If you want good seat-to-seat coverage, you have to use a speaker that generates a sound field that is spectrally balanced over a wide range of listening positions. What that means is it should sound pretty much the same 20° or 30° on each side as it does straight on. This allows a much wider range of listening positions.

I don't know what kind of spectral balance your speakers have off-axis, but I do know that arrays generally provide a pretty wide coverage area. If the speakers are spectrally balanced over a wide enough arc, I've found you can improve the speaker's imaging with toe-in. The idea is to cross the speakers in front of the listening area so that the stereo image is self-balancing. This requires reasonably uniform off-axis coverage to work. Here's a post about the technique: Imaging, placement and orientation

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Subject: Re: On axis measurements in nearfield listening
Posted by AudioFred on Fri, 18 Sep 2009 20:36:04 GMT
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Marlboro wrote on Tue, 15 September 2009 18:22
I was told by someone I respect immensely that my system clearly had bad smearing of the sound stage meaning I couldn't tell what instrument was placed where...

I've often been told something will sound terrible, yet when I do it anyway I find, as your have, that there's little of no difference. A good example is whether to position a tweeter at the center of the baffle or slightly offset to reduce diffraction. Maybe some people can hear a huge difference, but I can't.

In the case of your speakers, I notice they are positioned almost against the side walls of the room and pointed straight ahead. Their closeness to the side walls means the timing of the reflected sound will not be much different from the direct sound, but with highly reflective walls your ears will perceive the sound of each speaker is eminating from two positions, the speaker's position and the position where the refleced sound off the wall seems to be coming from. This may cause some smearing, but not so much as your first date's lipstick after you kissed her good nite on her

dad's front porch.

I've found that corner-placed speakers often soundstage best when they are angled at 45 degrees, with the axis crossing in front of the listener's head. This extreme toe-in seems way too much, and I actually have to use a carpenter's angle thingee to force myself to position them this way, but it does work, at least with speakers whose tweeter is positioned directly above the mid or the woofer. I don't know if a line array with tweeters alongside the mids will do the same thing, but it shouldn't be too hard to try it.

Some people are fascinated with a precise soundstage, where each instrument's position can be exactly located. To me this sounds nothing like live music, and what I look for instead is a more convincing soundstage, where breadth and depth sound real to me based on the live music I hear at least three times a week.

If it's not too hard to move your speakers, try the 45 degree thing and let us know what differences you hear.

Subject: Re: On axis measurements in nearfield listening
Posted by selahaudio on Mon, 21 Sep 2009 16:28:33 GMT
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Wayne Parham wrote on Tue, 15 September 2009 19:20
I have found that most folks on the PE forum rarely (or never) do measurements. They trust their models instead. I'm not against models by any means, using them extensively. In fact, I think most people have better results with models than they would with measurements because making good measurements is not trivial and requires good equipment. But still, a good measurement trumps a good model any day. And off-axis stuff is harder to accurately model because there are complexities that aren't included in the simplifying assumptions.

To me, off-axis performance is as important as on-axis response. The total power is radiated in all directions, not just on-axis. In a room, much of this energy is reflected back, so it really is what sets the tonality of the sound field. A uniform reverberent field is just as important as a uniform on-axis response curve. Most experts agree with that, and I think a few minutes with a speaker that generates good polars will convince most any audiophile.

I think not enough people building line arrays depend on measurements like they should. Measurements are extremely important with arrays if you want the best sound.

Subject: Re: On axis measurements in nearfield listening
Posted by Marlboro on Mon, 21 Sep 2009 17:22:35 GMT
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ONCE again, you are making a blanket statement that implies that if a DIYer does not have access to an extensive and possibly expensive measuring system, s/he he should not even

attempt a line array. You leave nothing open to the DIYer who wants to design something they'd love, and just enjoys doing it.

I would disagree with that statement, from personal experience.

Its what I heard from many people in the manufacturing area: you can't do that because you don't have enough money or you don't have enough skills, or you don't have the right measuring equipment.

The implication again is: Only we have all those things, so don't even try.

I disagree fundamentally.

Subject: Re: On axis measurements in nearfield listening
Posted by selahaudio on Mon, 21 Sep 2009 17:44:46 GMT
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No the idea is that if you want to get the best results then you have to be able to measure it. Why go to all the trouble and not bother to do it right? Good and affordable measurement tools are available to any DIY builder. The margin for error is greater with the complexity of an array if you don't have the right tools.

Subject: Re: On axis measurements in nearfield listening
Posted by darkmoebius2 on Mon, 21 Sep 2009 23:33:20 GMT
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Marlboro wrote on Mon, 21 September 2009 12:22ONCE again, you are making a blanket statement that implies that if a DIYer does not have access to an extensive and possibly expensive measuring system, s/he he should not even attempt a line array.
That's not what he said or implied. He simply said that "Measurements are extremely important with arrays if you want the best sound.". I can't see anything factually incorrect or elitist/condescending about that statement, especially since he added "The margin for error is greater with the complexity of an array if you don't have the right tools"

I suppose Selah's opinion could be invalidated if someone who had designed/built arrays both using testing equipment, and without, came forward to say that they found absolutely no performance difference between the two in the end.

But, as of yet, that hasn't happened, so his is the most qualified opinion we have with regard to that issue.

Subject: Re: On axis measurements in nearfield listening

Posted by Wayne Parham on Tue, 22 Sep 2009 03:16:57 GMT
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I've used computer models (both electro-mechanical and acoustic) to help me design crossovers and loudspeaker systems through the years. I've been using computers to help me design loudspeakers since the 1970's. But I always try to work with their limitations, and to understand what they can and cannot do. Computer models rely on simplifying assumptions so they become less accurate as system complexity increases. Things like diaphragm material and shape aren't included in the models, so there is an assumption of pistonic motion without consideration of breakup modes, and directivity and acoustic summing is over-simplified as well. It would be fairly complicated to include all the detail required to model these kinds of things.

I remember not so long ago when the systems required to do good acoustic measurement was prohibitively expensive for DIYers. Now there's some really good stuff out there for under $1K and some decent systems that work with a PC sound card are even free. I would encourage anyone that doesn't have this capability to get it and study - it isn't as difficult and expensive as it used to be. Still not trivial, by any means, but certainly within reach for the dedicated enthusiast.

Subject: Re: On axis measurements in nearfield listening
Posted by jp on Fri, 25 Sep 2009 20:50:20 GMT
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To all the experts on this forum :
""Testing is very important to be able to get the best of a speaker or array design"" .As a DIY without too much technical knowlege I would be very pleased if I (and probably all the DIY's on this forum)could be easily guided on how and where we could find help for beginners for testing and what are the most important tests one should concentrate on ? Or it would be even better if we could be guided on this same forum .
JP

Subject: Re: On axis measurements in nearfield listening
Posted by selahaudio on Fri, 25 Sep 2009 22:09:42 GMT
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jp wrote on Fri, 25 September 2009 15:50To all the experts on this forum :
""Testing is very important to be able to get the best of a speaker or array design"" .As a DIY without too much technical knowledge I would be very pleased if I (and probably all the DIY's on this forum)could be easily guided on how and where we could find help for beginners for testing and what are the most important tests one should concentrate on ? Or it would be even better if we could be guided on this same forum .
JP

Unfortunately there's not much information for beginners but you might start here

http://www.madisound.com/catalog/index.php?cPath=404_3

Dickason's book is the first one to read followed by D' Appolito's "Testing Loudspeakers". I would also frequent some of DIY sites and ask questions or follow threads about equipment and software. One caveat - testing an array is different than a point source. Most builders will have little or no experience with arrays so they won't be able to help you very much. There are a few that will give opinions based on theory but not experience. Some of the theory applies but is no substitute for measuring the results yourself.

Subject: Re: On axis measurements in nearfield listening
Posted by Marlboro on Sat, 26 Sep 2009 00:56:32 GMT
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But Rick,

YOU have the experience that no one else has. And you're right. I've done extensive internet research on how to measure line arrays and have come up almost completely empty. I have a minimal testing system (Apex mic, stand, Fuzzmeasure for my Powerbook).

How about if YOU share a few tidbits about the way you measrue your systems?

Marlboro

Subject: Measurement Information
Posted by Wayne Parham on Sat, 26 Sep 2009 01:33:49 GMT
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Do some searches here. You'll find lots of good information on everything from systems and equipment available to technical discussions and principles and processes, advantages and disadvantages to different methods and stimulus signal types, etc. There are also online tutorials and experts frequently check there for posts with questions. Ask anything you want and it'll get answered.

By the way, the inventor of the Smith & Larson measurement systems is an array enthusiast and he is one of the experts that regularly checks in here.

Subject: Re: Measurement Information
Posted by jp on Sat, 26 Sep 2009 07:29:56 GMT
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I support Marlboro with his request ! Rick, Wayne , Jim, Danny , just hints that will help us as a

start with array testing because as you mentioned Rick it is very rare to find info on that subject .
I also have TRUE RTA and a Bahringer ECM 8000 mic .
I will also go to Wayne's suggested forum but I'm sure all of us DIY's appreciate your guidelines , and be sure not to be afraid we wont be your competitors not even in 2 decades time ,ha ha ha .In the case some of you will help be sure you will attract more DIY and that can only be beneficial to all of you at the end of the road .You scratch my back I'll become your client , Hahahaha again .
JP

Subject: Re: Measurement Information
Posted by selahaudio on Mon, 28 Sep 2009 19:49:00 GMT
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jp wrote on Sat, 26 September 2009 02:29I support Marlboro with his request ! Rick, Wayne , Jim, Danny , just hints that will help us as a start with array testing because as you mentioned Rick it is very rare to find info on that subject .
I also have TRUE RTA and a Bahringer ECM 8000 mic .
I will also go to Wayne's suggested forum but I'm sure all of us DIY's appreciate your guidelines , and be sure not to be afraid we wont be your competitors not even in 2 decades time ,ha ha ha .In the case some of you will help be sure you will attract more DIY and that can only be beneficial to all of you at the end of the road .You scratch my back I'll become your client , Hahahaha again .
JP

Start with the books I suggested. You need a good foundation in order to be able to understand the more advanced concepts. There's also no substitution for doing your own investigation - trial and error is part of learning the trade. I basically taught myself because I had the same limited resources that you do.

Subject: Re: Measurement Information
Posted by Marlboro on Mon, 28 Sep 2009 21:16:04 GMT
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So I guess this means that you aren't planning on sharing any of the tidbits that you've learned along the way on line arrays, huh, Rick?

Subject: Re: Measurement Information
Posted by Wayne Parham on Mon, 28 Sep 2009 21:36:34 GMT
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Like I said, do some searches here 'cause there's a ton of stuff there for everyone from novice to expert. You can find general tips, specific advice and even philosophical discussions about what should be measured and what shouldn't, what matters and what doesn't and how to know which from which. Doesn't cost a penny to search the archives or to to ask questions.

Subject: Re: Measurement Information
Posted by selahaudio on Tue, 29 Sep 2009 02:34:15 GMT
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jp wrote on Sat, 26 September 2009 02:29I support Marlboro with his request ! Rick, Wayne , Jim, Danny , just hints that will help us as a start with array testing because as you mentioned Rick it is very rare to find info on that subject .
I also have TRUE RTA and a Bahringer ECM 8000 mic .
I will also go to Wayne's suggested forum but I'm sure all of us DIY's appreciate your guidelines , and be sure not to be afraid we wont be your competitors not even in 2 decades time ,ha ha ha .In the case some of you will help be sure you will attract more DIY and that can only be beneficial to all of you at the end of the road .You scratch my back I'll become your client , Hahahaha again .
JP

I would be happy to offer advice but I'm not familiar with True RTA. If you can post your measurements and provide ant other pertinet information (measurement distance, microphone height, etc. that will help. Is your microphone calibrated?

Subject: Re: Measurement Information
Posted by jp on Tue, 29 Sep 2009 05:56:04 GMT
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Ok guys, here is a scenario :
Now I've just finished assembling my line array and here I am connecting them to the system .
I have a Behringer calibrated mic ECM 8000, a Real time analyser on my PC and an external sound card that is better than internal PC cards . At this stage I can generate sine waves , pink noise , white noise etc . Now What is the first crucial measure I should do and how to interpret it ?
Let'g get this first answer cleared and understood by all amateurs interrested then we can pass to the next question !!!!!!!
Thanks

Subject: Re: Measurement Information
Posted by Wayne Parham on Tue, 29 Sep 2009 14:19:51 GMT
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I'd measure outdoors, to get an idea what the speaker's response is without room interactions. I prefer ten meters at 100 watts, but you can go with five meters or even just two or three if the speakers won't handle the power. Results change at different positions, so keep that in mind.

If the listeners won't be ten meters away, it may not make sense to measure at that distance. Might be better to measure close to the distance you think they'll be used. Even better, measure at several distances and positions (on and off axis) to see what the speaker does at several

angles and distances. The ideal speaker is one that produces the same response at all angles within its intended pattern, but every speaker configuration is different in this regard. That's where measurements at various positions and angles can help show you what the capabilities of the speaker are, beyond the basic (almost hypothetical) "1W/1M on-axis response curve."

If outdoors measurements show a problem, then you can work on the speaker to get the kinks out. If not, then you can start making measurements in-room, to find out where to place the speakers and arrange furniture for best results.

I would anticipate your next questions might be what distance is best, what differences are found between measurements at different distances, and whether to stand the speaker upright or facing it on its back, how to position the microphone, i.e. using a boom, centered with respect to the baffle, on the ground, etc. My suggestion would be to try different positons to see what results you get. You'll learn something.

Also try this with a point source - measure the speaker standing upright facing forward or lying on its back facing up, etc. Measure the speaker sitting on the ground facing forward and compare with it being raised on a stand. You'll learn something there too. The response in different positions is usually vastly different, so you'll learn how the environment affects the sound, and so you'll begin to learn how to setup your test to measure various things.

Subject: Re: Measurement Information
Posted by jp on Wed, 30 Sep 2009 05:51:16 GMT
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I presume by saying measure that I should measure SPL with Pink noise ?
Unfortunately I dont have the option to go outdoor , I'll have to do with indoor measurements , wich I am sure is not going to be accuratedue because of room interaction but what should be done to get the best we can in this case ? Maybe use absorbing cushions on both sides of the speaker forming a 1 m corridor in front ? Puttin the Mic at a 1m distance at different heights ?
JP

Subject: Re: Measurement Information
Posted by Wayne Parham on Wed, 30 Sep 2009 14:41:24 GMT
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The biggest influence you'll see from indoors measurements is at low frequencies, and no absorbent material like cushions, wedges or padding will help. You would really need large membranes to absorb sound waves that long, which is how room damping at low frequencies is accomplished. I would assume that your indoor measurements are going to show what the speaker is doing only above about 300Hz, below that it's mostly the room.

As for signal types, I think white noise is probably fine for what you're doing. Pink noise would also work as long as you remember that the signal spectrum is not flat, so the measured spectrum should not be either. You'd hope to see exactly the same spectral balance at the measurement microphone as was presented to the amplifier.

For more informaton about signal types, pros and cons of each, see the post called "Measurement signal types".
