Subject: 4pi: floor mount or stand mount? / plans needed
Posted by Rocketmail on Tue, 06 Jan 2009 21:59:09 GMT
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Hello, New voice here. I am considering building a set of 4pi speakers, and wonder if they are intended to be used sitting directly on the floor, or could they be mounted on a low stand to raise the center of the 290 horn to ear level? I will be using them near corners (within a foot or so). Thanks. Also, Wayne, if you would be kind enough to send me a set of 4pi plans, I would appreciate it. I will be using the 2226, DE250, and Eminence 290 setup with your crossovers.
Mark

Subject: Positioning and subs
Posted by Wayne Parham on Wed, 07 Jan 2009 01:17:33 GMT
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I like to use a small riser that angles the speakers back about 5°. Not much, just enough to tilt the forward axis up slightly, to put the pattern at ear level a few feet back. This keeps the midwoofers low enough that there is no floor bounce notch. This is a placement that almost always works in just about any room.

Remember that the goal of placement for a speaker like this isn't to point the speaker directly at the listener but rather to make the pattern cover the listening area. The spectral balance is quite good within its 90° x 40° pattern.
Imaging, placement and orientation

as floor standers on little angled risers, the tweeters are still about two feet up, which is very nearly ear level when seated. However, it is sometimes desirable to have the speakers a little higher than that. Obstruction from furniture or integration with screens mounted high on the wall make it attractive to elevate the speakers off the ground.

Another configuration that works well is to put the speakers on 12" to 18" stands, used in conjunction with flanking subs blended with the mains. The idea is to low-pass the subs a little bit high, overlapping them with the mains to mitigate self-interference from the reflections off the nearest boundaries, the floor and the wall behind the speakers. It's really better to add subs anyway as they'll smooth room modes as well as those those self-interference notches.

The idea is to position the subs a few feet away from the mains, usually at a different position in all three planes. The subs provide extension to 20Hz and they overlap with the mains, filling in any notches from reflections and averaging room modes. The low-pass frequency can be adjusted to provide the desired range of smoothing, because the optimum frequency is largely determined by the position and distance to the mains. Low-pass is typically set between 90Hz and 120Hz, but sometimes as high as 150Hz. Best results are obtained with a relatively gentle rolloff slope, smoothing the transition from blended multiple sources to a single point source above the Schroeder frequency.

Multi-sub configurationsI suggest building the speakers and trying a few placements in your room using books, milk crates or other temporary stands. This will let you find the positions and orientations that work best in your room. Once you've found it, have the appropriate size stands made. My experience has been that the little angled risers almost always work well, and if you use subs, you can get them up a little higher than that. But using books of different heights, you can angle the speakers and set their levels for trial runs and find the optimum placements before committing to a riser or stand type.

Subject: Re: Positioning and subs
Posted by Rocketmail on Wed, 07 Jan 2009 07:14:45 GMT
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Thanks, Wayne, for the informative answer and suggestions. The tilted base is similar to the Klipsch Heresy bases available when I used those speakers, although I actually mounted the Heresys on boxes and placed them in corners. Experimentation is the key-- and as you say, the speakers must be built first.I am definitely going to try multiple subs, having followed the discussion concerning them by both you and Earl Geddes. I have assumed that corner mounted woofers with a time-aligned playback above 250hz or so was the best possible (ala TacT/Lyngdorf)-- but that may not be the case below Schroder frequencies. Thanks also for the various plans. I admire your approach to bringing good sound to the non-engineers (includes me)-- and your "good value" approach. Time to get some enclosures built. Mark

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Subject: Re: Positioning and subs
Posted by Wayne Parham on Wed, 07 Jan 2009 18:15:46 GMT
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I have always liked corner placement where possible. It sets the radiation angle at frequencies above the Schroeder frequency. If a sound source would radiate omnidirectionally otherwise,

horizontal pattern to 90°. It is one of the best ways to create a uniform reverberent field, because the boundaries define the pattern at relatively low frequencies, below what most horns are able to do on their own.Of course, corner placement is not always possible. I think probably most homes do not have ideal corners. Often times either they don't have two useful adjacent corners of if they do, they're too far apart. In that case, it makes sense to angle the speakers inward, just like cornerhorns, but you lose the corner loading. When you have the right room,

frequency as is possible. The walls essentially form a very large waveguide.One of the places where I differ with Earl Geddes is on this point. His position is that since room modes dominate the response below the Schroeder frequency, you cannot talk about directivity at those frequencies without considering the room. Of course, this is a true statement but it overlooks the

fact that all rooms are different.Just like you usually design a speaker to be flat in an anechoic environment, I believe it makes sense to strive for uniform directivity in an anechoic environment.

facing into an open space, then directivity is uniform all the way down to cutoff. There are no room modes, so directivity is constant even at the lowest bass frequencies. Put the cornerhorns in a very large room, and the same is true, provided the Schroeder frequency is below cutoff. As the room is made smaller, the Schroeder frequency rises, so modes begin to form in the woofer's passband. That's when distributed bass sound sources become attractive.Certainly every home listening room is small enough to have its Schroeder frequency in the passband, usually in the upper bass to lower midrange. So it does make sense to consider the room when discussing energy distribution. But I do think it is important to consider it separately, because every room is different.The problem that happens when failing to do so, is one begins to think of everything as a modal source and then to eventually conclude that uniform amplitude response from individual units is unimportant. While this may be true in some sense, I am not at all confident that it is the best approach. I would rather have several well-behaved sources than several that aren't. Using the idea that averaging will work the kinks out is fine, but I'd rather not have peaky subwoofers to work with.I have always suggested that overdamped alignments be used, because those tend to conjugate the room. If a room is very well damped, its modes may not cause huge amplitude swings. If it is large, the modes may be very low in frequency. But an overdamped curve is always going to have a smooth rolloff that works well in most environments. It shifts gracefully when thermal effects start to come into play, rather than become peaky, it simple becomes less overdamped. I think this is a much better approach than to just assume the room dominates the response, so bass alignments don't matter.In the end, my conclusion is to make bass bins slightly overdamped and to make directivity as uniform as possible in the ideal anechoic environment. Then, you are certain of a good outcome when properly installed in any environment. The gradual rolloff from a slightly overdamped alignment works just fine in a large room or one that is well damped. It is also an appropriate alignment for use in multi-sub setups. Damp the modes as much as possible and add bass sound sources as required to smooth room modes. A couple subs are very useful for doing that, and give extension to below 20Hz in the bargain.

Subject: Re: Positioning and subs
Posted by BtHarris on Thu, 08 Jan 2009 03:38:44 GMT
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Should subwoofers always be put in corners?

Subject: Re: Positioning and subs
Posted by Wayne Parham on Thu, 08 Jan 2009 05:36:01 GMT
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I wouldn't say that subs should always go in corners, but there are some benefits of corner

placement and I think that at least one sub in a multi-sub setup should go in a corner.

main speakers. The spectral balance is uniform throughout the room and imaging is great over a large area.

If the room doesn't have corners that will work well for this setup, then DI-matched two-ways like

As for the multi-sub setup, there are several schools of thought. All share some things in common, and all are in agreement that the more subs used, the more uniform energy distribution is.

When I first started looking at multi-sub configurations, I would have probably suggested four corners for sub placement. It is not a bad arrangement, and it has some advantages. The number of subs ensures a great deal of smoothing. Most agree that once you get to four subs or more, it almost doesn't matter where you put them. If they aren't grouped closely together, you can put them almost anywhere and get good smoothing. Putting all of them in corners tends to also increase SPL.

The first proponent of the multi-sub configuration I saw was Todd Welti. He did a study of several configurations and came to a conclusion that the best placements were (4) corners, (4) wall midpoints or (2) wall midpoints. At that time, I would have probably picked four corners because it smoothed room modes, gave high SPL and coordinated nicely with my cornerhorns.

Later, Earl Geddes proposed what he called a random configuration. We talked about it in person at the 2005 GPAF and later in several online dialogs, both public and private. It made sense to me immediately that he was trying to break up the resonances with random placement, but I was also concerned about a couple of things. For one thing, "random" is not specific and so is vulnerable to what I would consider random results. Some configurations might be good and do what Earl wanted, but others might not. And for another thing, I was concerned about localization.

Earl began to give specificity and perhaps evolved his approach. Instead of being totally random, he proposed that one sub go in a corner, one sub be at mid-height and a third be totally random except that it not be in the same position as either of the other two subs. I began to refer to his proposed setup as a pseudo-random placement. He has recently changed this recipe further to say that the mid-height sub is not always necessary, but that it should be at least midway along a wall or close to it.

This approach sounds reasonable to me, but it still seems vulnerable to not necessarily making the target area have the best balance over the widest area. Then again, since you should "dial in" the placement with measurememts for best performance, I think it is probably as good a starting point as any.

The second point I was always concerned with - localization - is addressed by making sure the furthest subs are low-passed at the lowest frequency. Only the sub placed physically closest to the mains can be low-passed higher, where it can smooth the portion of the modal range closest

to the Schroeder frequency.

two-way loudspeakers. Either Welti or Geddes configurations will prove effective at smoothing room modes, and I would recommend either one. I think it is worthwhile to try both to see what works best in your particular room.

I personally prefer a sort of hybrid approach. Even though I agree in principle with both Welti and Geddes arrangements, I like some parts and dislike some parts of both of them. For example, I see the room itself as providing some of the random-ness of the Geddes approach, and so it may be that the subs can be placed in a more ordered arrangement. Welti multi-sub arrangements are always symmetrical between subs, but they aren't necessarily symmetrical with respect to the mains. I think this is a key issue, because integration with the mains is the most important thing we're trying to do.

My approach is a little more empirical. I like to put symmetrical midwoofer/woofer pairs in fairly close proximity with each other to smooth the highest portion of the modal range, nearest the Schroeder frequency. The helper woofer flanks the main woofer, hence the name "flanking subs" that I mentioned earlier. Another subwoofer or pair of subwoofers can be placed further from the mains, if more smoothing is desired at lower frequencies. The distant subwoofer(s) should be low-passed at a lower frequency, so it doesn't betray the mains by exposing its location.

the bass bin and midhorn. They are separated by a couple feet vertically and are also offset in both other axis. This is close enough to allow a relatively high frequency overlap but far enough apart in all three planes to provide smoothing.

In the DI-matched two-way speakers, it can be done by flanking the mains with a pair of subs

midwoofer/subwoofer pair is placed close enough to allow a relatively high low-pass frequency on the subs. This provides smoothing of the upper end of the modal range but does not muddy the mains or betray their imaging because the subs are close enough to integrate well. They should be offset in at least two planes, possibly all three, but should be symmetrical with respect to the mains.

Many times the mains are offset to one side of the room or the other, not exactly centered. That is sometimes why cornerhorns weren't chosen in the first place. If that's the case, one subwoofer may be placed in a corner, say four feet from the main speaker on that side. Then the other one may be also placed four feet away from its corresponding main speaker but instead of being place in a corner, it may be several feet away from the corner, possibly 2/3rds of the way down a wall or maybe even at a midpoint. This kind of arrangement gives what I would call "local symmetry" because the mains and subs are all symmetrical with respect to the listening area. It is not symmetrical in the room though, so is not a Welti configuration. It isn't a Geddes configuration either, but does have two of three bass sources where Geddes suggests. If you consider the woofers in the mains as your "random" placements, this configuration is similar to the Geddes pseudo-random configuration even though it has what I would call local symmetry.

I think the main thing is every room is different. The other main thing is the more bass sound

sources you have, the smoother the bass energy distribution will be. And a third main thing is higher frequency smoothing requires relatively closely spaced sound sources blended high and lower frequency smoothing requires further spaced subs with a deeper low-pass frequency. Sometimes you can strike a balance with a pair of subs augmenting the mains, other times it's better to have three or four.

Subject: Re: Positioning and subs
Posted by jimbop on Tue, 13 Jan 2009 16:38:17 GMT
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When you say "corner placement", can you explain how close to the corners? Is 45-degree angle positioning important?If the cabinet is in the corner, how do you recommend bass trap placement?Thanks

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Subject: Re: Positioning and subs
Posted by Wayne Parham on Tue, 13 Jan 2009 17:35:24 GMT
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close as possible. The idea is to have a point source eminating from the apex.

There is also a distinction betwen subs and mains with respect to forward axis orientation. It's not very important for monopole subs because they are omnidirectional. Where it is good to angle the speakers inward 45° is when using mains that have constant directivity, and this is because it makes a very large "sweet spot".
Imaging, placement and orientationFor room damping in the modal range, I suggest panel dampers. They're easy to build and can be made as false walls.

Subject: Re: Positioning and subs
Posted by jimbop on Thu, 15 Jan 2009 17:11:59 GMT
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Is the Theater 4 considered a corner horn?Jim

Subject: Re: Positioning and subs
Posted by Wayne Parham on Thu, 15 Jan 2009 19:12:41 GMT
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What they are designed to do is to crossover from a direct radiating midwoofer to a horn tweeter where directivity matches. This provides better spectral balance off-axis.
Matching directivity in the vertical and the horizontal planesI like to use a 90°x40° radial horn with constant directivity in the horizontal plane. This provides good room coverage across a wide horizontal arc. It also limits output at large vertical angles, which do nothing but increase unwanted ceiling slap.

Another type of loudspeaker I make takes this one step further, but requires corner placement:

the pattern to 90° even at low frequencies, where radiation would normally be omnidirectional or at least very wide. This arrangement forces radiation to be limited to 90° all the way down to the Schroeder frequency, making the most constant directivity possible. A midrange horn is also used which has 90°x40° coverage and is implemented with a crossover strategy similar to the DI-matched two-ways, providing uniform 90° horizontal coverage and keeping a pure wide forward lobe of 40° with vertical nulls set outside that.