

Guesstimation of Z offsets/Acoustic Center:

1. Always bias the dimensions of the woofer and mid AC off that of the tweeter physical AC. If the tweeter VC or ribbon chip is 10mm behind the baffle, subtract that from the woofer estimate.
2. Jeff Long said about 25mm is average for the 6-7" woofer and 1" dome tweeter. You can base it off of that, and likely not be too far off. Just scale it a bit.
3. The other methods I use include where is the voice coil in dome tweeters or diaphragm position in ribbons/AMTs/planars. Usually this can be close to the thickness of the tweeter faceplate for flat-faced domes, to the front-plate for others, as that is the center of the voice-coil operation. The 'chip' or housing of the ribbon to the front of the faceplate is the standard measurement on those.

I have stated 'to the front-plate' on woofers and mids for AC estimation prior, but more often than not, I fudge it forward of there, usually setting it for the spider/cone junction, or even the rear-most physical spot on the cone.

If you want to know how it typically goes when measured, it varies a lot.

Also from <https://www.diyaudio.com/forums/multi-way/357334-setting-approximate-driver-delay-sim-help-please.html>:

Be advised that the rule of thumb for 'guesstimating' the drivers' acoustic centers is frequently inaccurate, sometimes by just a little and sometimes significant enough that the difference in the drivers' phase relationship could alter the FR a little bit too.

Nevertheless, for a typical dome tweeter as xrk971 suggested, the acoustic center is considered to usually be about 4 to 6mm below its face plate, or at about the bottom of the face plate in other words. For coned drivers, Jeff Bagby's best guess is where the voice coil former attaches to the cone, which very often is where the spider is attached as well.

If you do not have the drivers in hand, you can download the driver's spec sheet and then enlarge the pdf until it measures as the actual size on your screen and then you can measure where the acoustic center is located as best as the diagram allows. And yes, I mean take a ruler up to your screen and physically make the measurement.

Now if you are using PCD or VituixCAD (I think) knowing the difference in acoustic centers is enough and can be directly entered into the program along with the drivers' x and y coordinates and your listening position too. XSim however doesn't have this feature so for accuracy's sake you have to do an additional calculation. Because what you are really trying to tell the program is the difference in path lengths from your ears to each drivers' acoustic centers not just the difference in the acoustic center positions. So if your ears are on the tweeter axis, because the woofer is lower than the tweeter (or sometimes higher too) the path length to the woofer is going to be longer than the path length to the tweeter even before you add in the acoustic center difference.

If that isn't clear in words, I've attached a pic below. For a 2-way, just ignore the extra woofer. Also included is the necessary math which is just simply working with right angle triangles and Pythagoras' theory where the square of the

hypotenuse is equal to the sum of the other sides squared, so  $h^2 = a^2 + b^2$ . In the eg, I used a listening distance, X, of 1m but you are better off using your actual intended listening distance, so usually between 2 and 3m. I have put the formula into a little spreadsheet program (Excel) to make it as simple as possible to work with for me and suggest the same for anyone else if they know how to do so. So to be clear, in PCD and VCAD, you are entering all of the variables and the program will calculate the path length differences but in XSim it's left up to you.

The upshot is that the XSim delay for woofers is always going to be greater than just the simple difference in the acoustic centers between the tweeter and woofer if you are listening on the tweeter axis. By habit this delay is usually a positive value entered in the woofer's "Tune" window as ericsquires has said. But if I'm not mistaken you could enter the value in the tweeter delay if you wanted to but it will need to be a negative value. Should be the same difference.

So here's an example. If you are listening on the tweeter axis about 2.5m away and the woofer acoustic center is 12mm back and the woofer center is 125mm below the tweeter center, the XSim delay for the woofer will be 15.11mm or .595". Not that much different than the acoustic center difference in this eg but the variable will start to get much larger as the woofer to tweeter distance on the baffle starts to get larger too or in other words for the lower woofers in a floor standing speaker.

That's about as basic as I can put it. Let me know if anything isn't clear.

