Simplified Polar Data Generation in VituixCAD

Reid Towsley - Revision 1 - Aug 7, 2021

When measuring data for VituixCAD, one may skip the vertical data set in a lot of cases as doesn't contribute to the overall power to a great extent. That is, the difference in simulated result is not great enough to warrant the extra work involved in measuring the driver on both horizontal and vertical axis. This is true for round drivers such as dome tweeters at least, for ribbons and AMTs where the diaphragm dimensions are different horizontally and vertically, the polar data will also be different so vertical polar data must be included for accurate simulation.

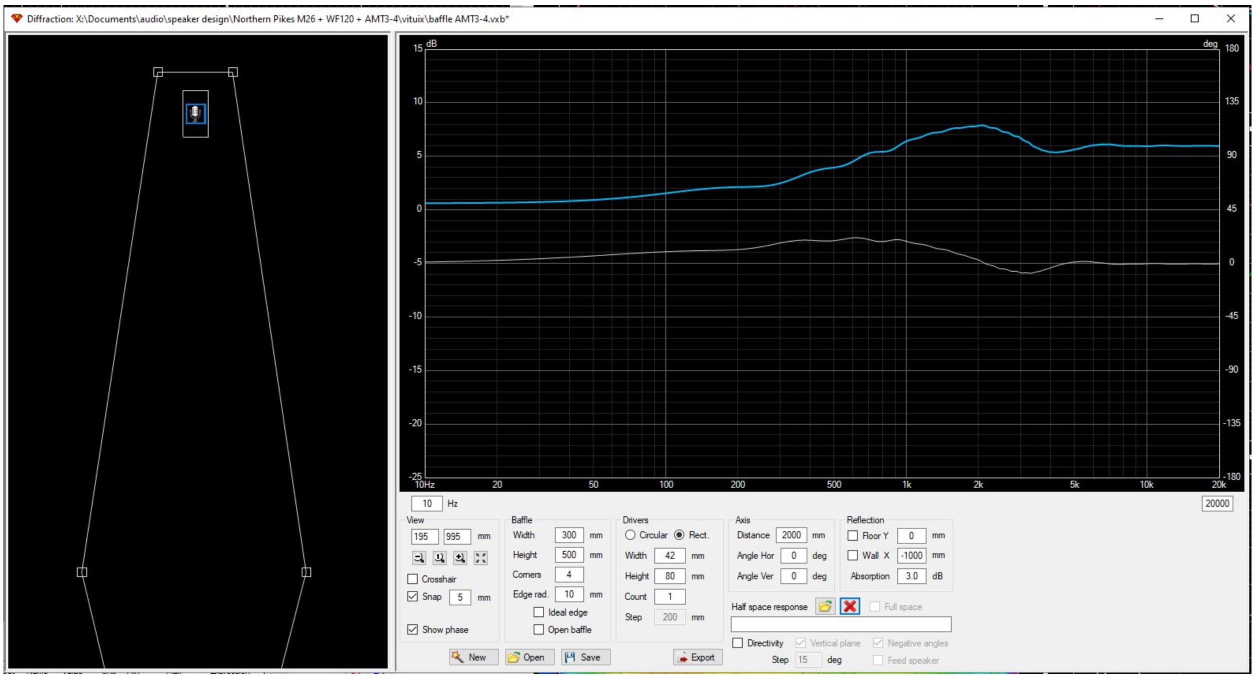
When designing a large tower speaker, measuring this vertical data can be fairly labour intensive. This document describes a simplified method to generate the vertical polar data without measurement.

This is the speaker that is being used for this demonstration. It's a large tower speaker with complex angles and a Dayton AMT3-4 tweeter. This AMT diaphragm has a vertical dimension nearly double that of the horizontal dimension.

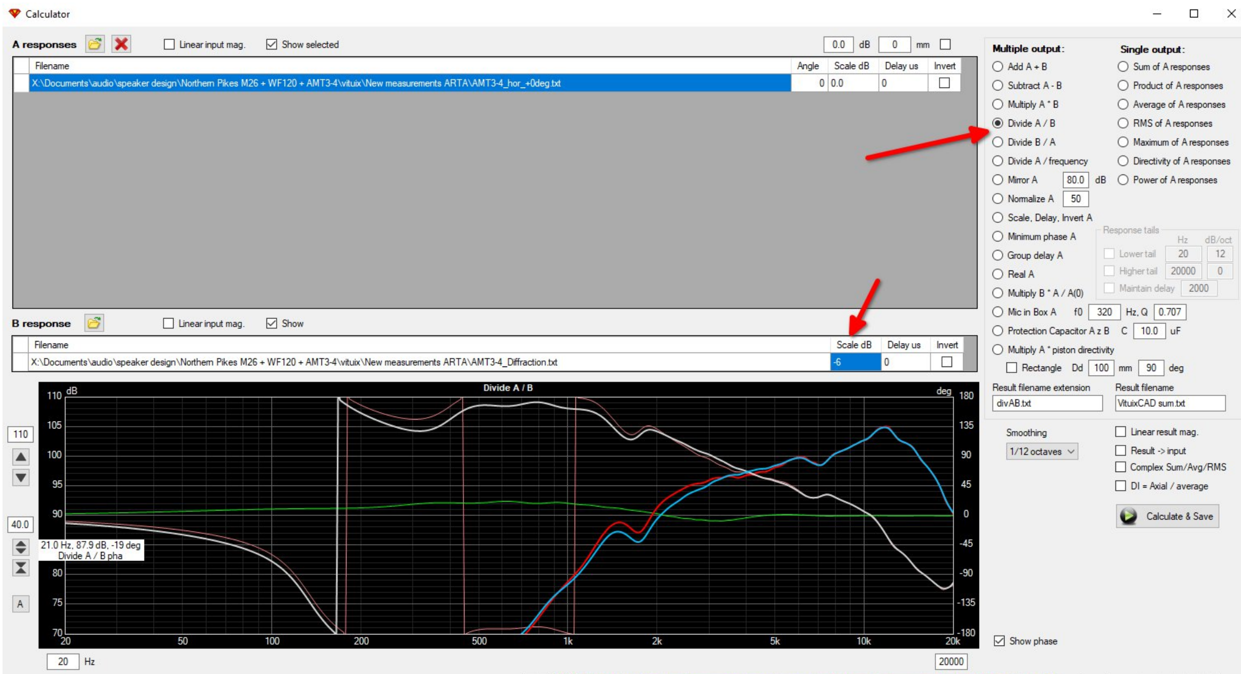
The process is simply to use existing measured data and simulate the off-axis result with enough accuracy to result in accurate power response simulation. Since the horizontal data has already been measured following the process outlines in VituixCAD measurement guide for ARTA, we will first compare the result of simulated data against real world measurements.

To simulate full-space response of a driver, we must start with half-space data. To obtain half-space data from the far-field measurement, the diffraction response must be “subtracted” from the measured data. Mathematically, it will be divided.

Start by drawing the baffle in the diffraction simulator, locate the mic in front of the driver as it was measured, and expor the diffraction response on-axis. The following result is achieved.

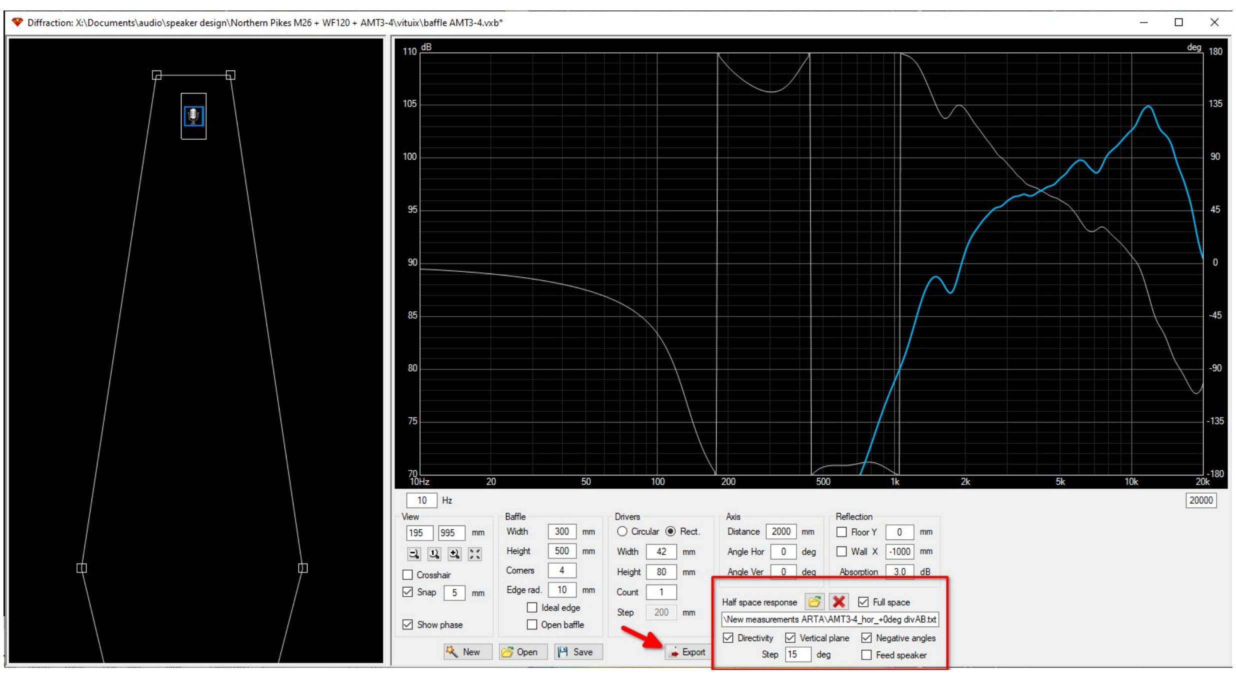


Next, use the calculator to remove the diffraction from the measured response. The measured response is loaded into response A, and the diffraction result is loaded into response B, and the “Divide A / B” function will be used. In order to retain the measured SPL, the diffraction response must be shifted by -6dB.

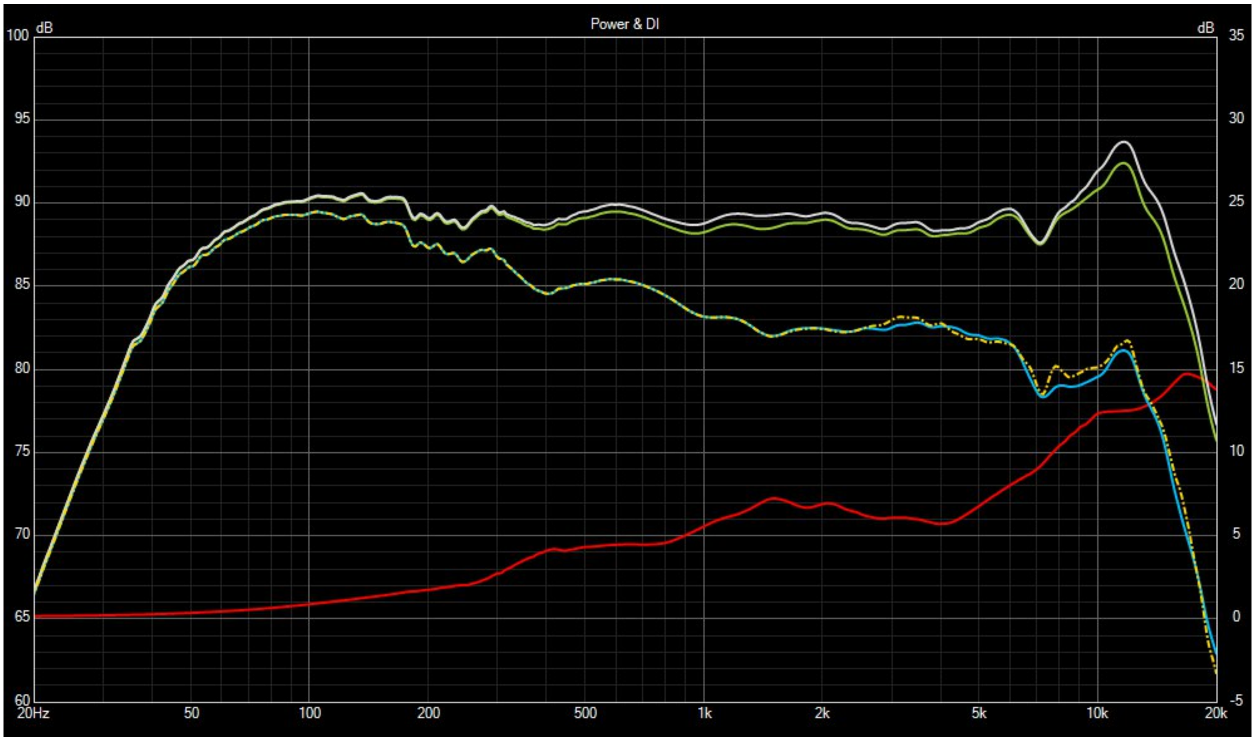


The result of this calculation is the half space response of the tweeter. Now, we can load this response back into the diffraction simulation to generate the vertical off-axis response. Horizontal response will be generated as well, which we will compare to the real off-axis measurements to see how well this simulation process matches real-world data.

Check the boxes to export directivity at 15 degree increments, and include the vertical plane, as well to calculate diffraction for both positive and negative angles. 15 degree increments was used to match the increment of the measured data.



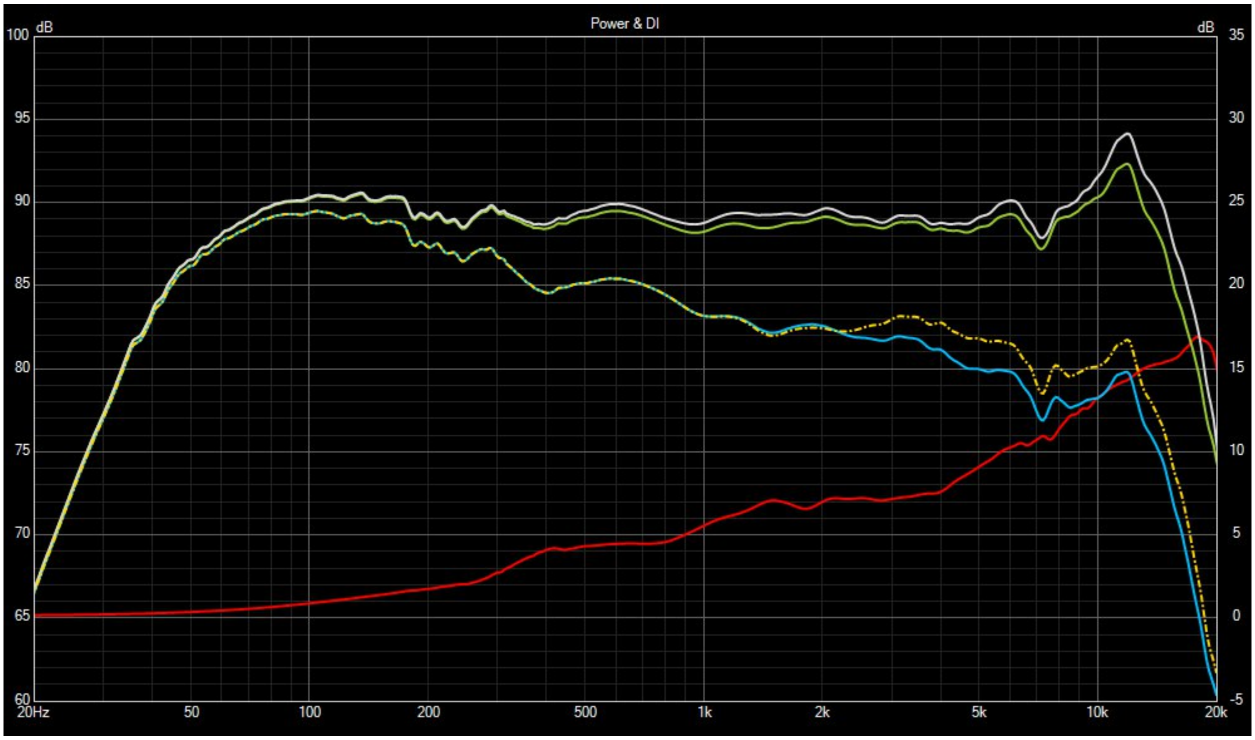
Now, a crossover for this speaker has been designed. Observe the system power response result of the complete speaker using only horizontal data for the AMT tweeter, compared to the power response using simulated horizontal data.



Yellow Dash - Measured Data
Blue - Simulated data

It is observed that there are some minor difference, but overall the result is rather similar, but equally inaccurate as the vertical plane has not been included. The question to ask yourself is if it's worth it to measure the off-axis angles manually to gain the difference shown in the result here. At least for obtaining the vertical axis data for the speaker in question, I will accept the slight difference to save a lot of time and work obtaining accurate real-world measurements.

Moving on to the last step, simply load in the driver data for the AMT tweeter into the project. For this demonstration, measured data for on-axis and horizontal measurements was used, and simulated data for the vertical plane. Sine this AMT is twice as tall as it is wide, including the vertical data is crucial to accurate power response measurement, and the result below shows that. The following is a comparison of power response for this driver using only horizontal measurements, versus the inclusion of simulated vertical data.



Yellow Dash - Measured Data horizontal only
Blue - Measured data horizontal plane, simulated data vertical plane

It is observed, that the difference in simulation result from including the vertical plane is significant. Hopefully this has provided some time saving to your next project, and illustrated the importance of including both horizontal and vertical polar data for non-round drivers.