Mirror EQ with VituixCAD

Reid Towsley – Feb 6, 2022

Revision History:

Date	Description
Jan 19, 2022	Initial Release
Jan 20, 2022	Rewrite for better work based on Kimmo Saunisto's process
Feb 6, 2022	Updated to reflect frequency limitation capability for the TF export. Requires at last VituixCAD 2.0.83 (2022-02-06)

Bodzio Ultimate Equalizer is not your standard software DSP solution. This software allows the user to load in a speaker frequency response, define a target "textbook" type of response, and the EQ system will generate a mirror EQ to conform the speaker response exactly to the target. Essentially the driver response is normalized to the target slope.

There are some limitations to this type of compensation, one being that EQ to perfectly flat only works completely on a single axis. Loudspeakers have complex directivity, cone breakup, diffraction, etc that may make a perfect conformance to a target slope not the best solution for overall performance.

With VituixCAD, we have the ability to provide a similar mirror EQ function, that can then be passed to APO EQ for active processing. Using in-room response or power response as a target is not yet supported, so directivity index should be very smooth in order to make a flat power response with a normalized very flat on-axis response.

VituixCAD Process

1) Load all driver responses in the drivers tab. Set smoothing for each driver at 1/12 oct to avoid unnecessarily detailed correction with FIR EQ.

2) Connect each driver and EQ blocks in the crossover section as shown. Ensure that the active peak/notch filters are "shorted" so that only the G(f) block is directly connected to the driver. Three PEQ blocks are show, you may include as many or as few as are needed.

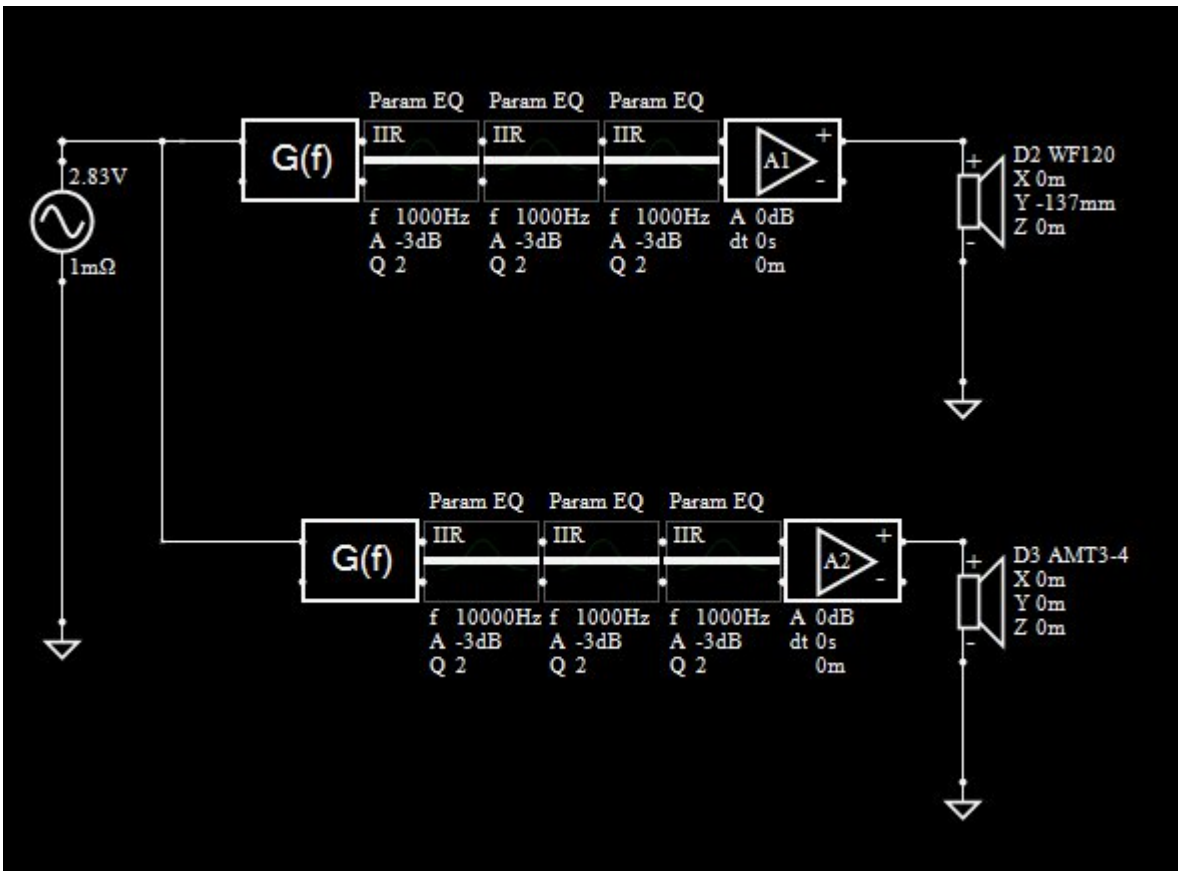

Figure 1 Schematic connections

3) Using the Optimizer window, select “axial response of driver”, then select the driver to be optimized in the drop down menu top the right. Define the target slope and high pass or low pass function as desired.

   Some care of the target slope is necessary to avoid extreme gain requirement for the mirror filter. For example, a flat to 20kHz response for a 12” woofer will result in extreme gain requirement at high frequency. As well, target response at low frequency should be similar to driver low end roll-off as any EQ in the sub range requires many taps for a DSP system.

   In order to prevent over-correction of the EQ or compensation for measurement noise floor, selecting the frequency range in the optimizer will limit the range that is to have EQ applied. Uncheck “Free LF” and “Free HF” to have the EQ follow the slope of the response beyond the EQ limits. Checking either of these boxes will apply a flat 0dB/oct slope beyond the frequency limits.

4) Select the G(f) block for the driver, then press the “->TF” button to export the target transfer function. This will save the target response file and load it to the G(f) block. If the G(f) block hasn’t been selected, you must load the file manually by selecting the block and using the open button at the bottom of the main window.

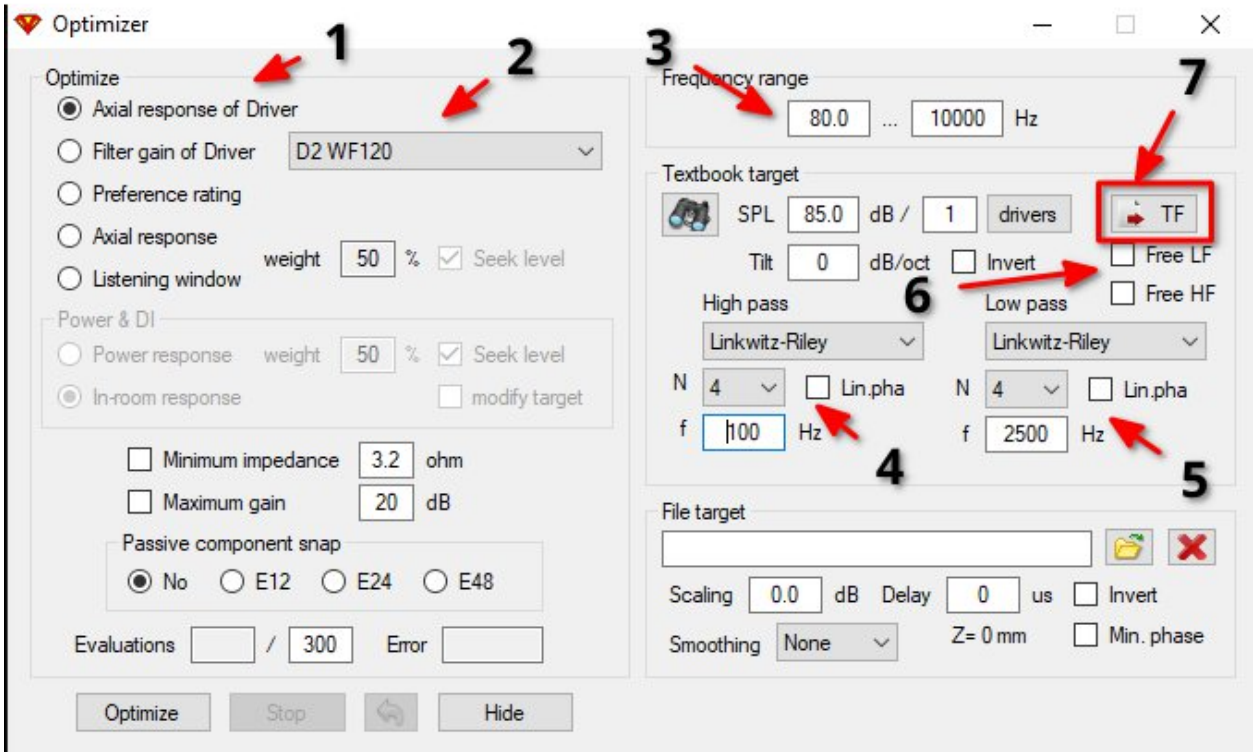

Figure 2 Optimizer Window

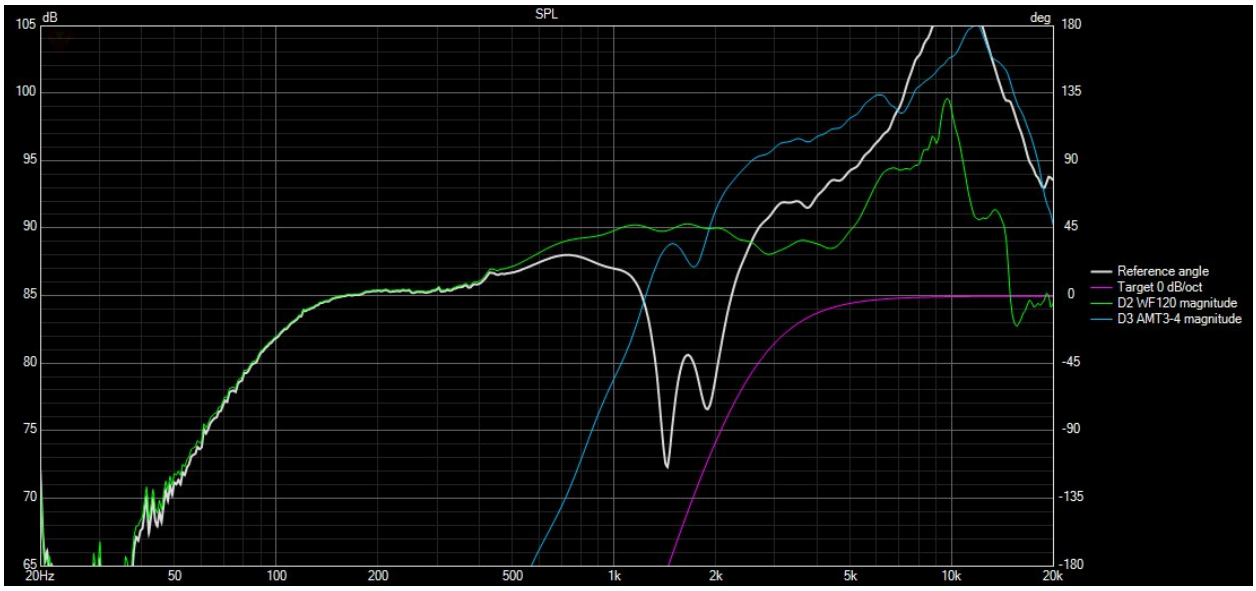

Figure 3 High Pass Target

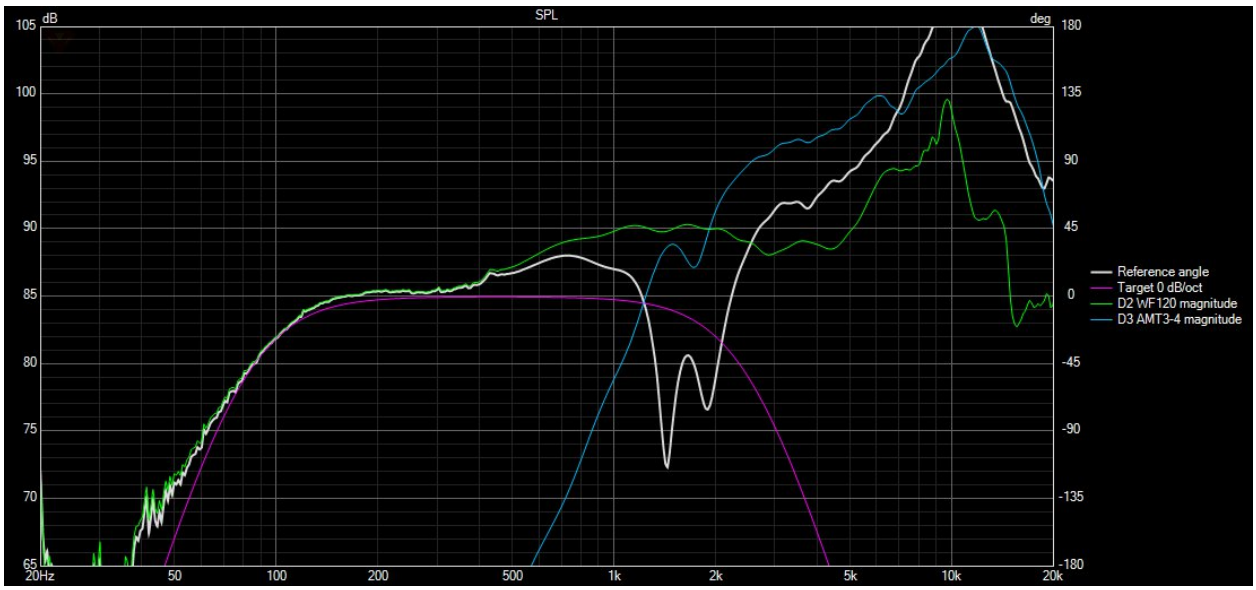

Figure 4 Low Pass Target

5) Repeat Steps 3 and 4 for each driver in the system.

6) Enable active peak/notch filters and optimize the system for listening window, in-room response, power response as needed.

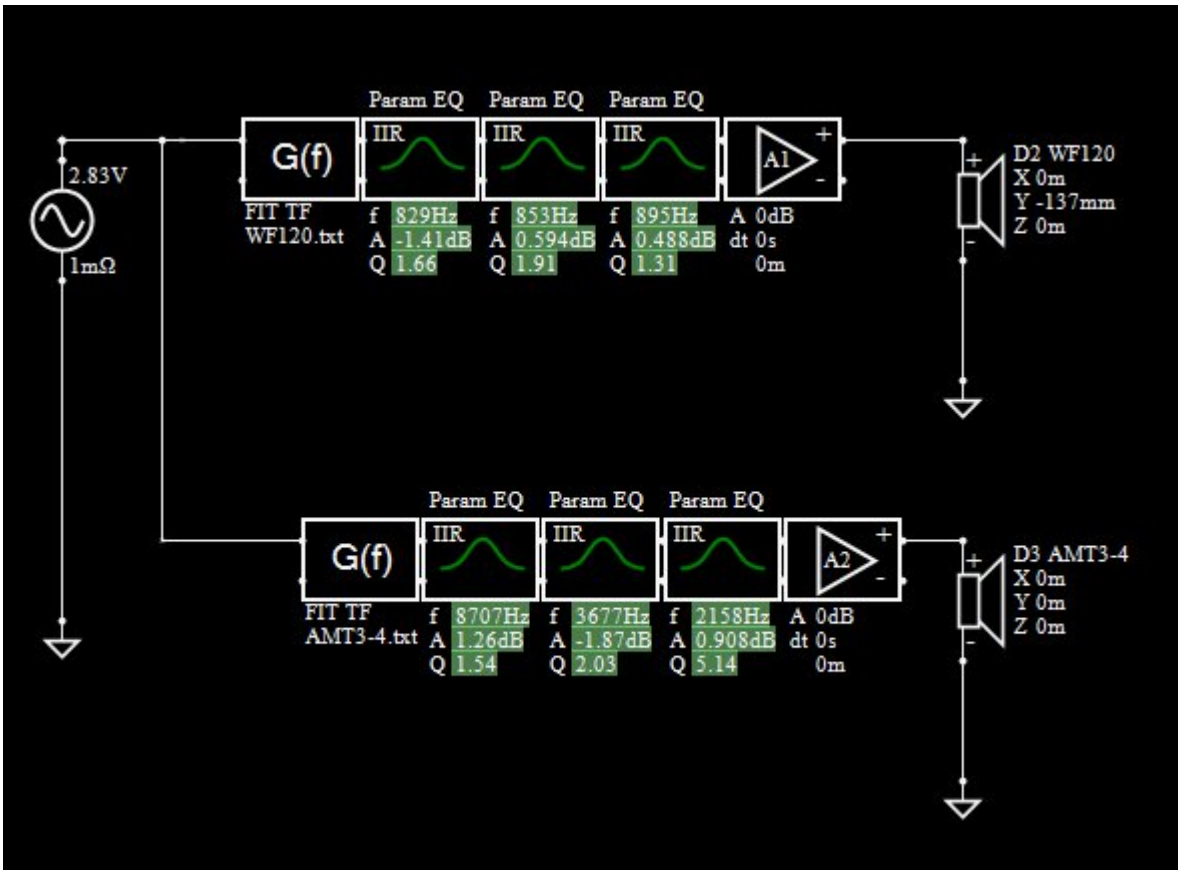

Figure 3 Filter Schematic

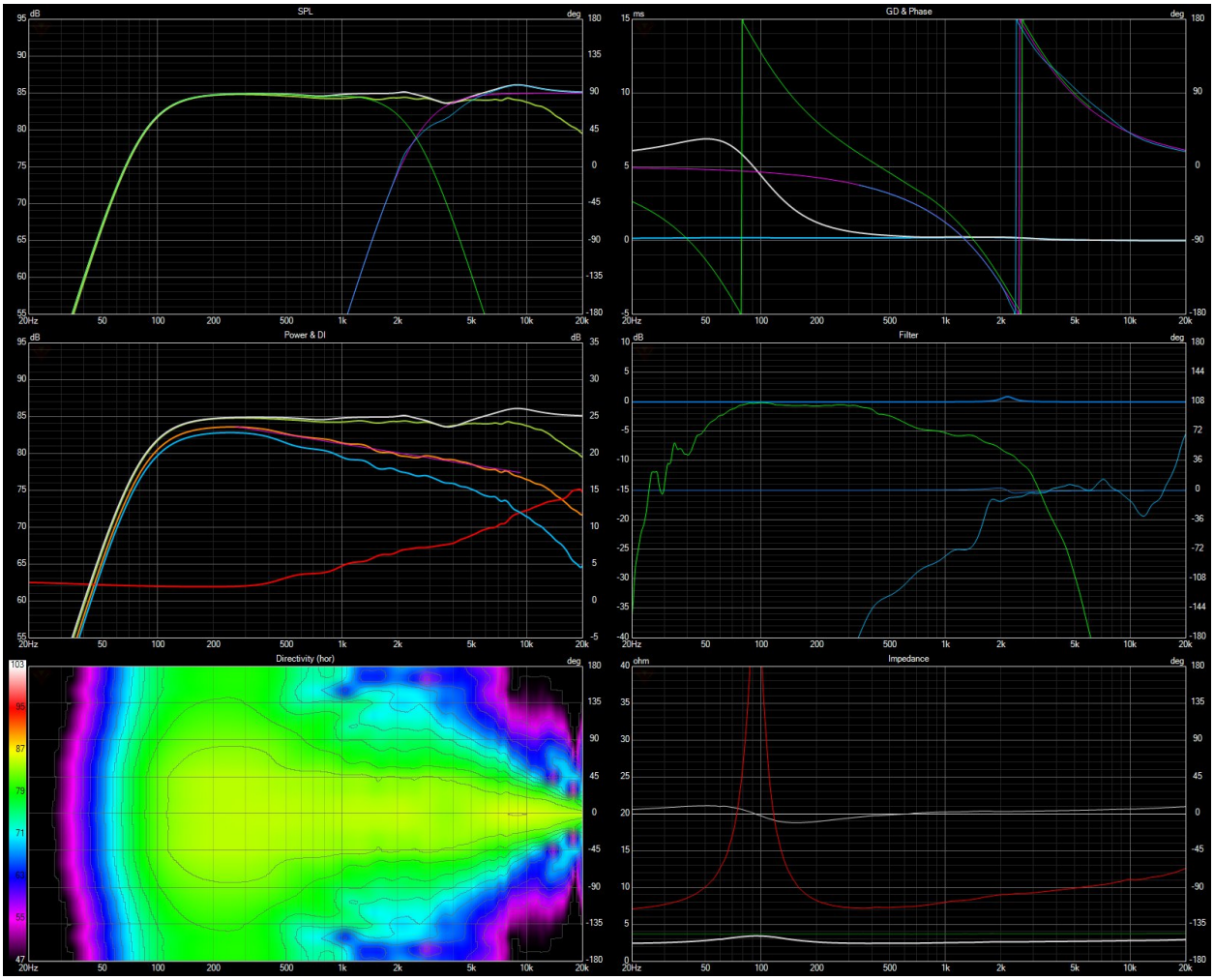

Figure 11 Complete system with optimized responses

7) Complete IR export and utilize within APO EQ for active processing. See my instruction “filter simulation with EQ APO and VituixCAD” for details on this process.