# Designing a Speaker Enclosure with a Digital Crossover

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MMI501 Transducer Theory

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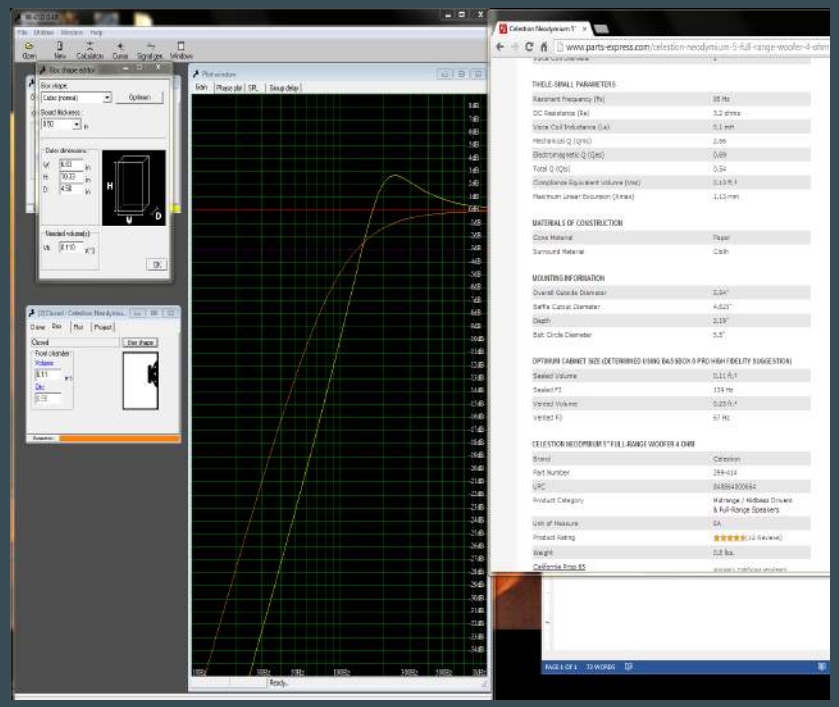
# Components Used

- 5” Celestion mid-range woofer (4ohm)
- 2.5” Bose woofer (6.5ohm)
- ½” MDF Particle Board was cut to create the panels of the speaker
- Various wood screws were used to hold parts of the speaker together
- Gorilla Glue to seal the enclosure
- Black Spray Paint for the exterior
- x2 speaker cup terminals
- Speaker cable
- External Amplifier

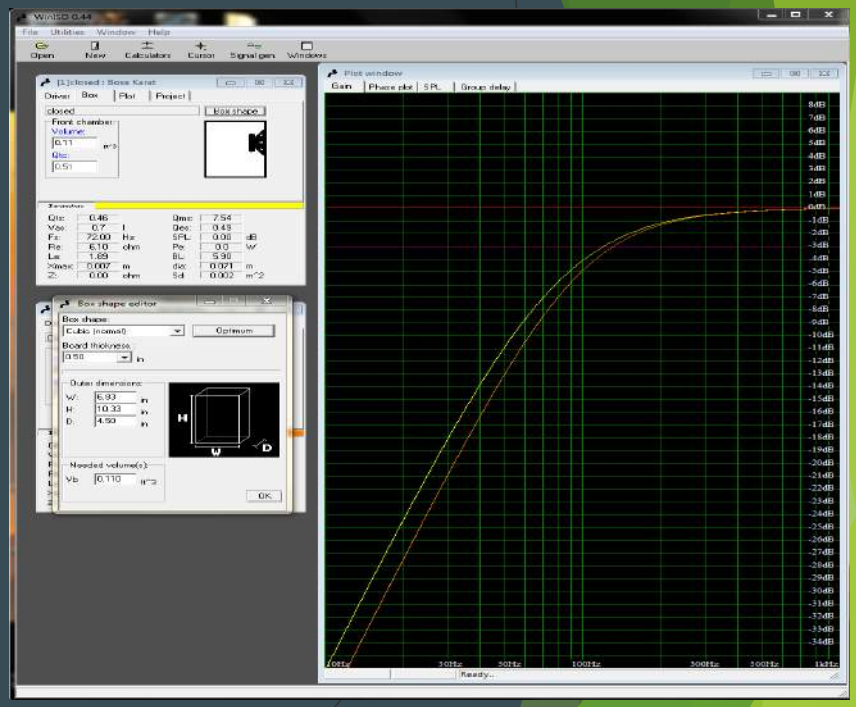
# Designing the Enclosure

- WinISD was used to obtain approximate enclosure dimensions
  - Used both the Standard and Pro versions to get the correct dimensions
- Program was fairly easy to use, once the correct drivers were entered into the database
  - Had to enter the parameters for the two drivers into the program for it to correctly calculate the proper dimensions
- Celestion speaker data sheet gave .11$ft^3$ as the ideal volume
  - Mounted the Celestion driver on the lower half of the Enclosure
  - Simply placed the Bose driver in a typical tweeter position on the front panel
- Decided to use a closed box design as opposed to vented port

# WinISD -½” Board Thickness



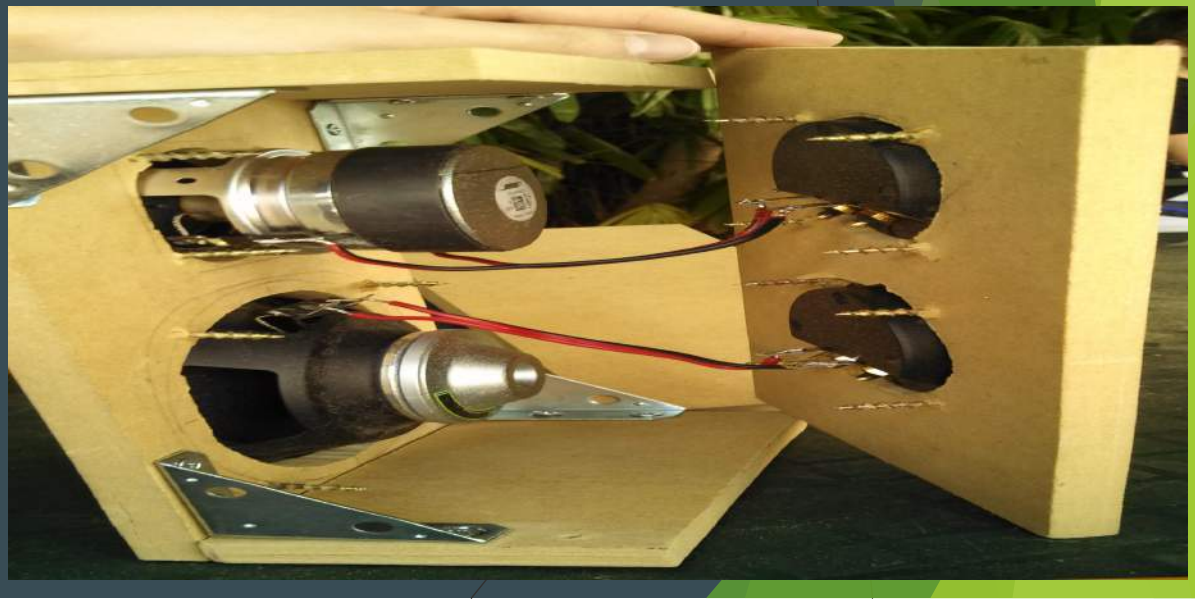
Celestion



Bose

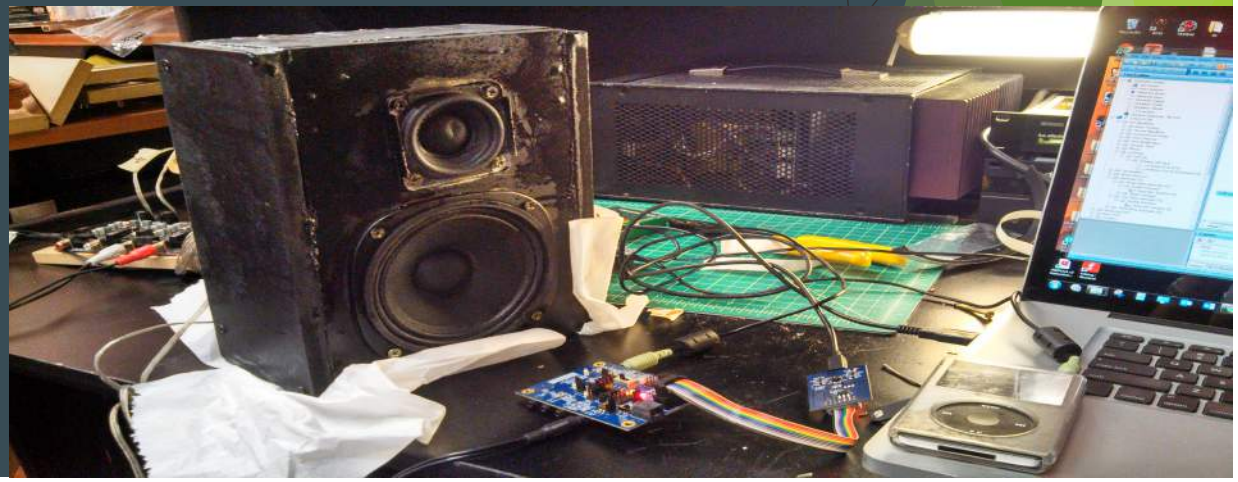
# Assembling the Speaker

- Handsaws and Dremel tools were used to cut the MDF board
- Challenging to cut the wood exactly to measurements
- Spent about $25 out of pocket

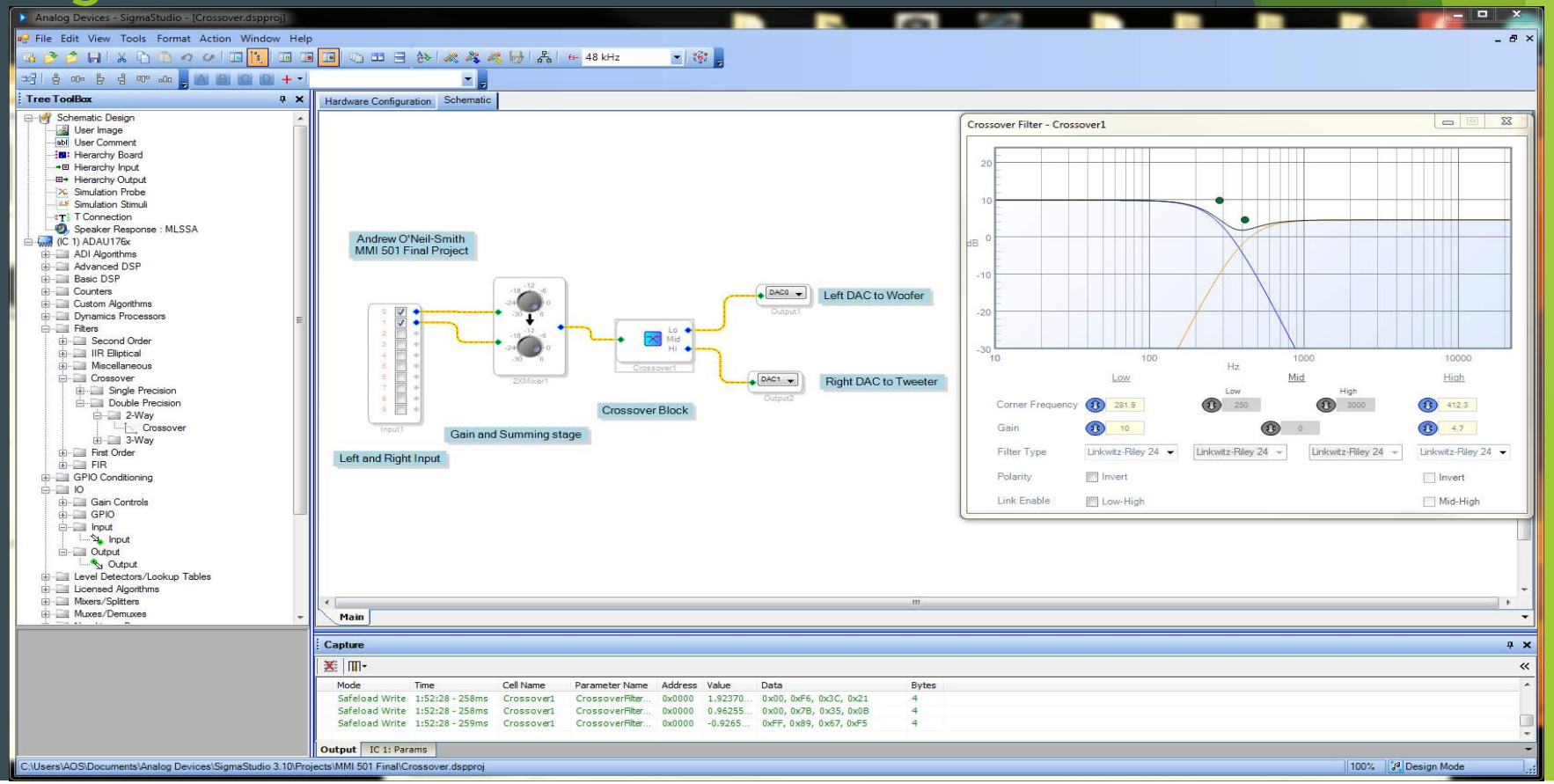


# Designing the Crossover

- The crossover was an Analog Devices, Inc. evaluation board
- The DSP chip was the ADAU1761
  - It has two DACs – one for the woofer and one for the tweeter
- Setting up the schematic was very easy in Sigma Studio
  - I/O, gain, crossover, output

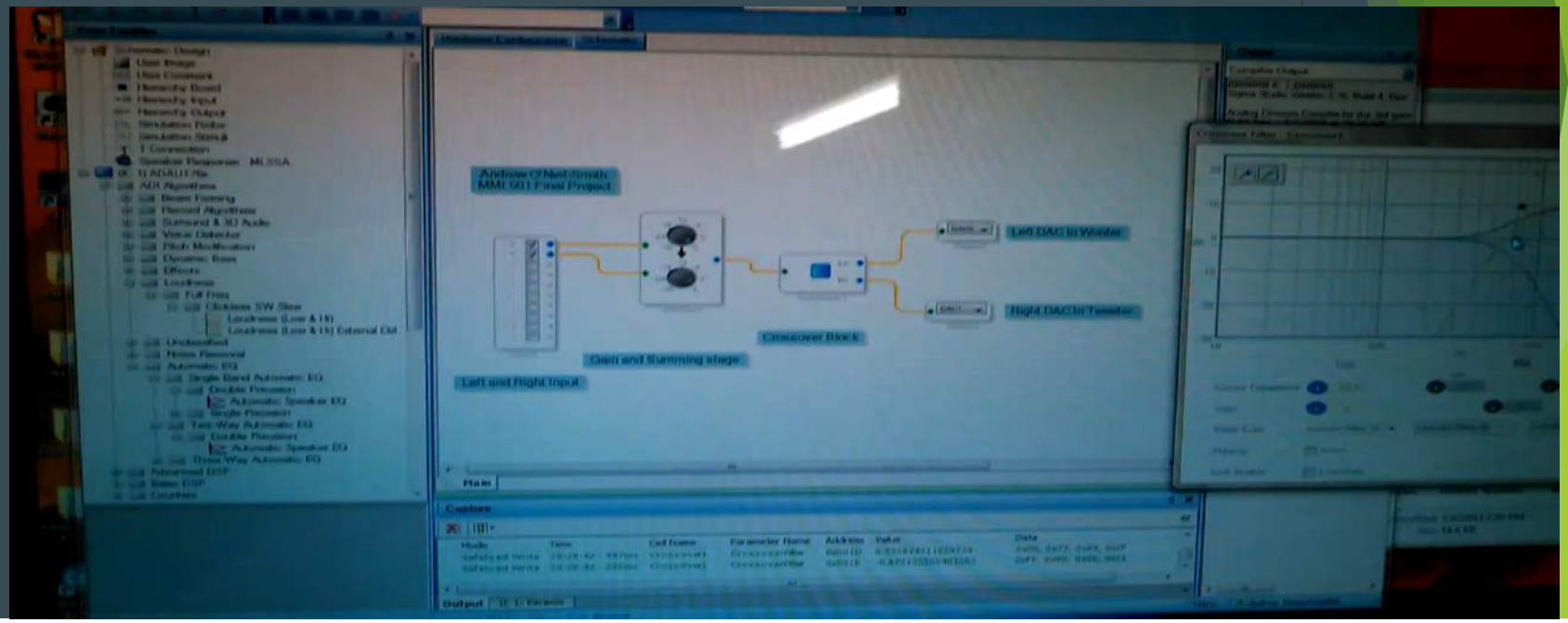


# Sigma Studio Schematic



# Results

- Won class award for 1st place in technical design category



# Future Considerations

- Would like to take frequency response of speaker without the crossover to obtain the response of the two drivers within the enclosure
- MLSSA file can be imported into Sigma Studio for the program to automatically design filters for a flat frequency response with a crossover
- Would like to design an enclosure with 3 drivers, all with matching impedance
  - This would call for a different DSP chip- one with 3 or more DACs
- Would like to compare closed and vented responses with the Digital Crossover
- Probably should have filled the enclosure with fiberglass insulation

# Acknowledgements


- Bill Jahn at Analog Devices for providing the Evaluation Board
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- Will Pirkle – author of course textbook
- Michael Tonry – class TA