

openEMS

An affordable EM simulator

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FDTD

- Finite Differences in the Time Domain
 - Solves Maxwell's equations in the time domain.
- Created by Dr Allen Taflove WA9JLV
 - Dr. Taflove is one of two principal pioneers of numerical solutions of Maxwell's equations.
 - First Fellow of the IEEE in the FDTD area.
- Other simulators use FEM (HFSS) and MOM (Momentum, Axiem & Sonnet)
- FDTD uses less memory and is more parallelable. All GPU code today uses FDTD

Adoption

- While the first paper Yee's was published in 1966
- Tafloves first paper published in 1975
 - Ignored for a decade!
- Goes to prove: The world isn't looking to steal your ideas, you have to cram them down its throat.

Computer Power

- 1994 100 Gflops
 - Intel Paragon
 - Cray Research T3D
 - Think Machines CM-5

- 2016
 - Intel Xeon Phi 1.2Tflops 61 GPU cores \$2k-5K
 - Nvidia Tesla GPU 1.9Tflops 4992 cores \$5k
 - Nvidia GeForce GT 640 346 Gflops?? 384 cores was~\$150 now on bargain PC's
 - Nvidia GeForce GTX1080 9Tflops 2560 cores \$599 new
 - I7 3.4 GHz 12Gflops
 - Raspbery Pi 4.8 Gflops \$30

- Computers have changed!

openEMS

- A FDTD simulator which can solve Maxwells Equations in a 3D environment.
- 3D Cartesian or cylindrical coordinates
- Multi-threading for speed
- Available for Windows & Linux

What can you use openEMS for?

- Distributed circuit analysis
 - Microstrip and Waveguide Filters
 - EMI simulation of circuit boards and IC's
- Antenna Analysis
 - Planar Antennas.....Patches
 - Horns.

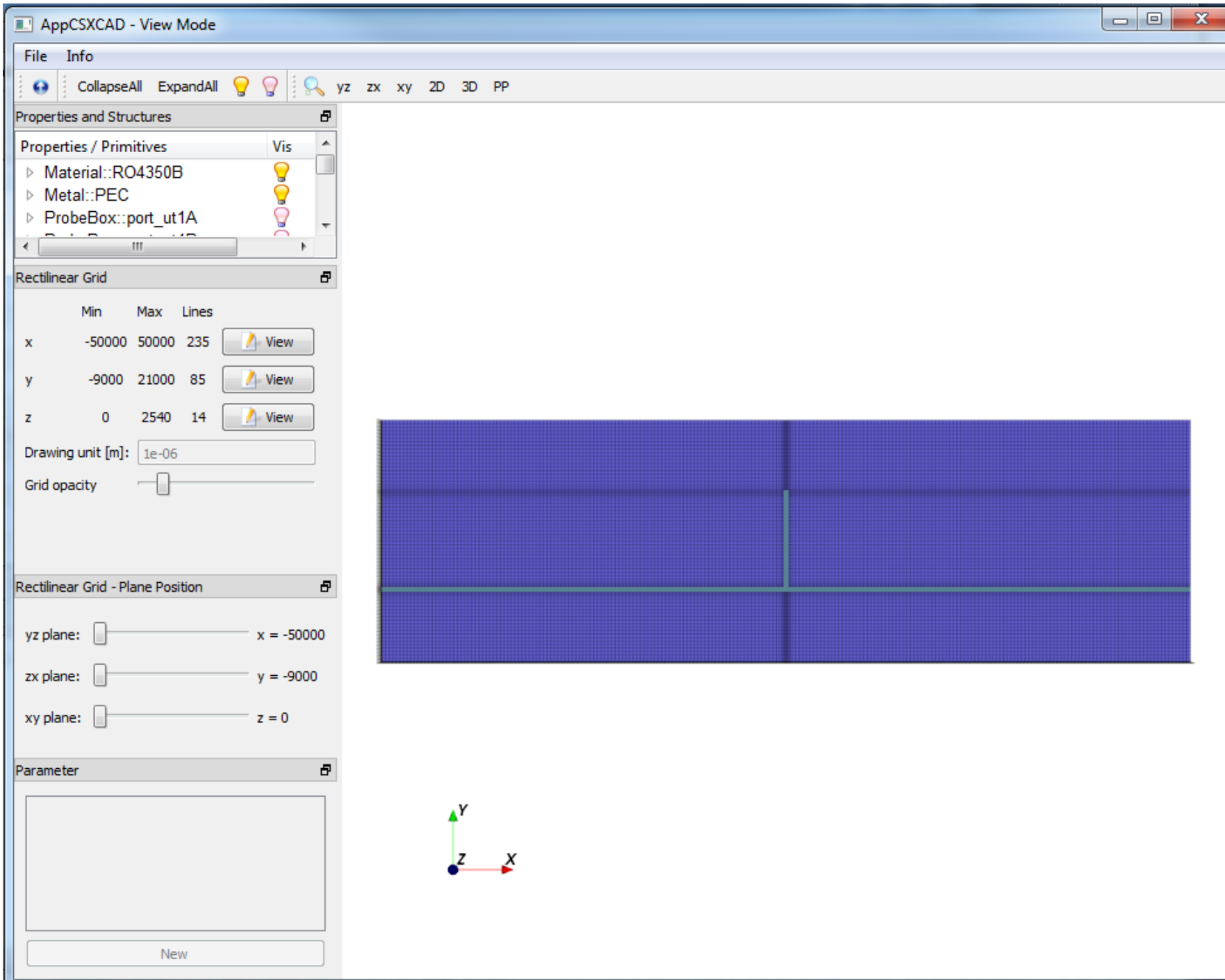
openEMS

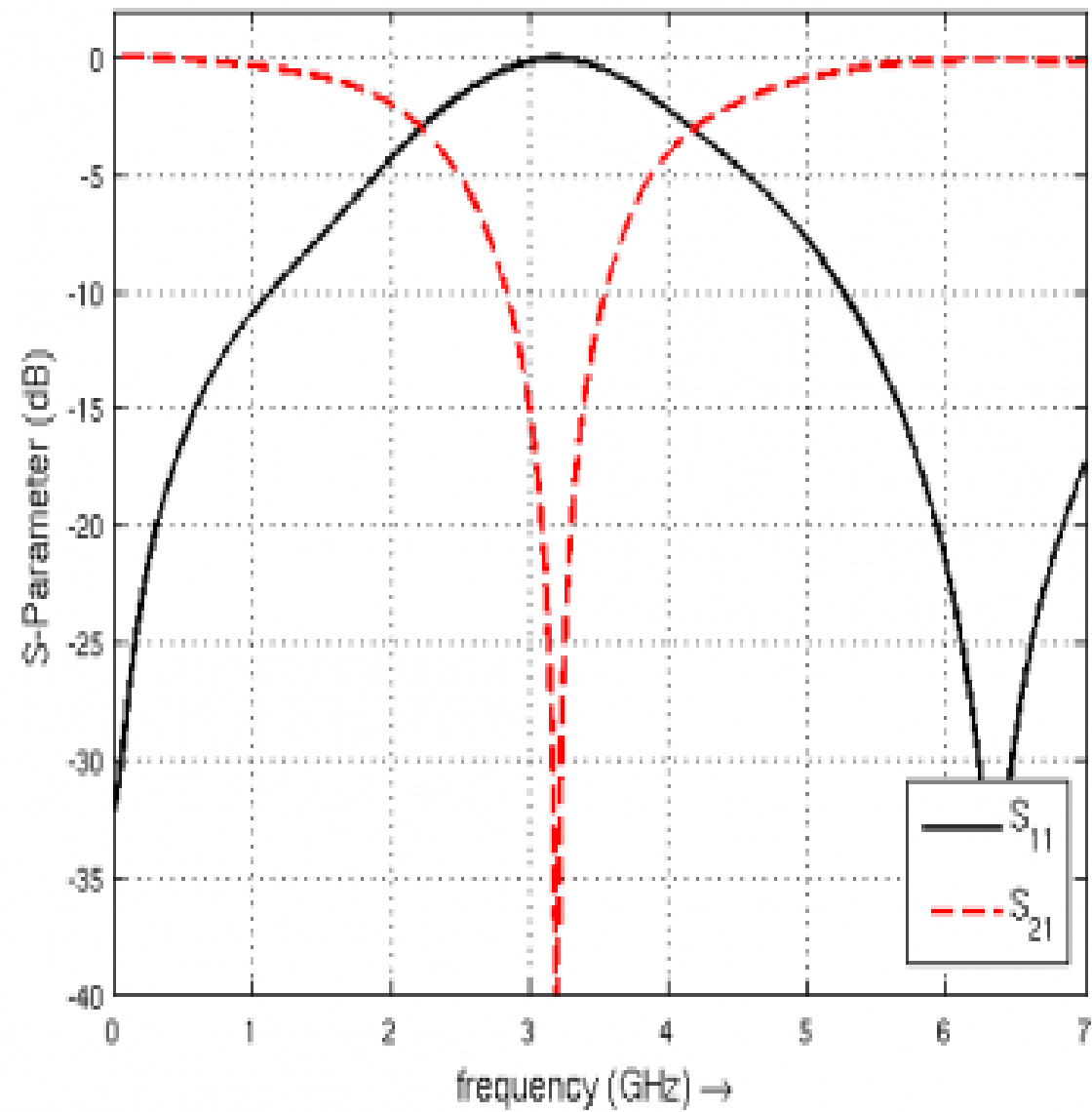
- Price is right.....FREE
- Download from openems.de
 - Three components
 - Octave
 - Scripting language to do matrix math.
 - Similar to MatLab(which is not free)
 - OpenEMS
 - FDTD engine
 - Paraview
 - Display the EM fields.
 - Links for all at openems.de

Octave

- Octave is a free scripting language
- Recently added a gui resembling Matlab and runs Matlab m files
- Used to call openEMS
- Generates s-parameter plots

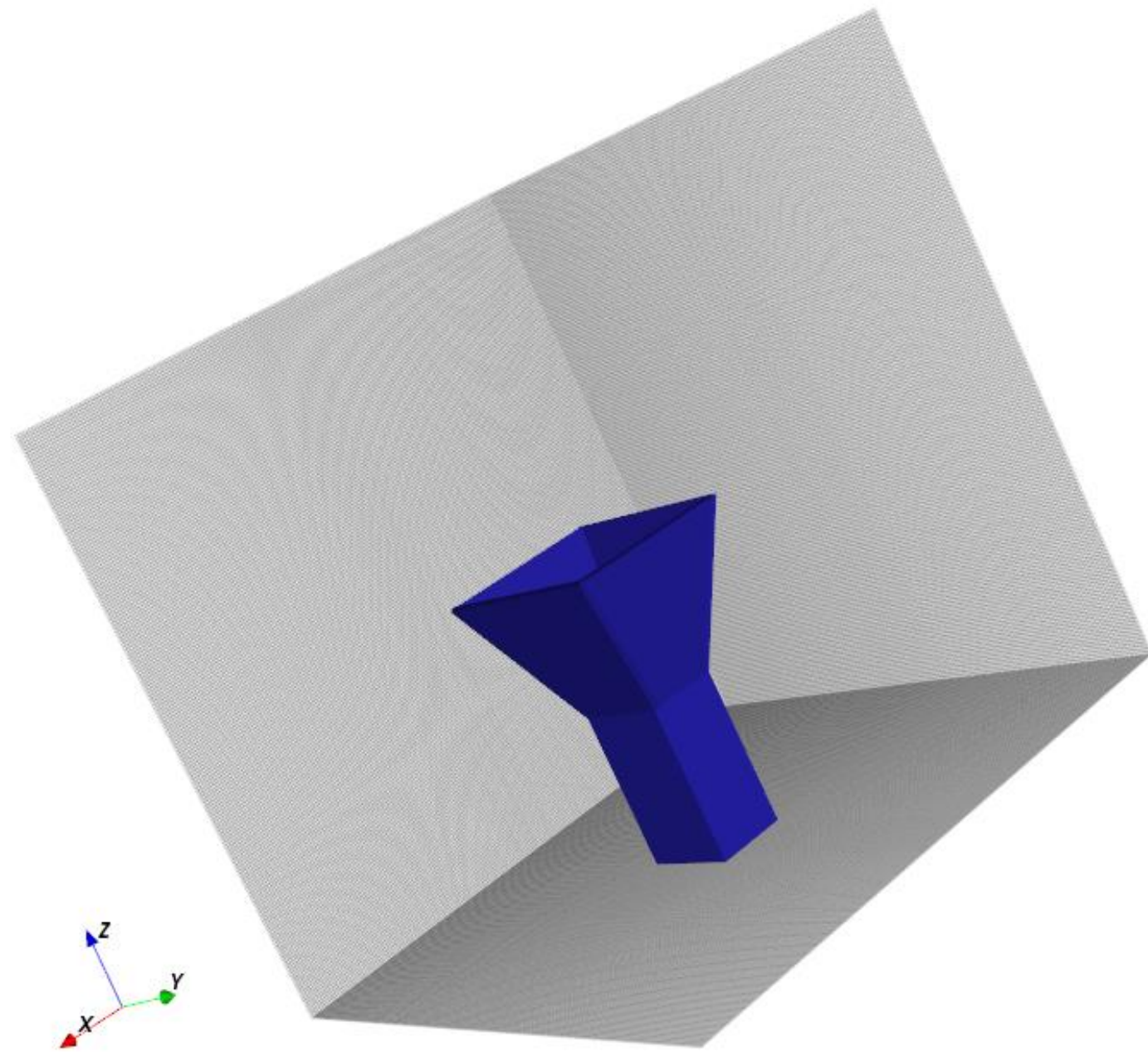
- Can be quirky on install.
- A complete manual exists....All 1000 pages.

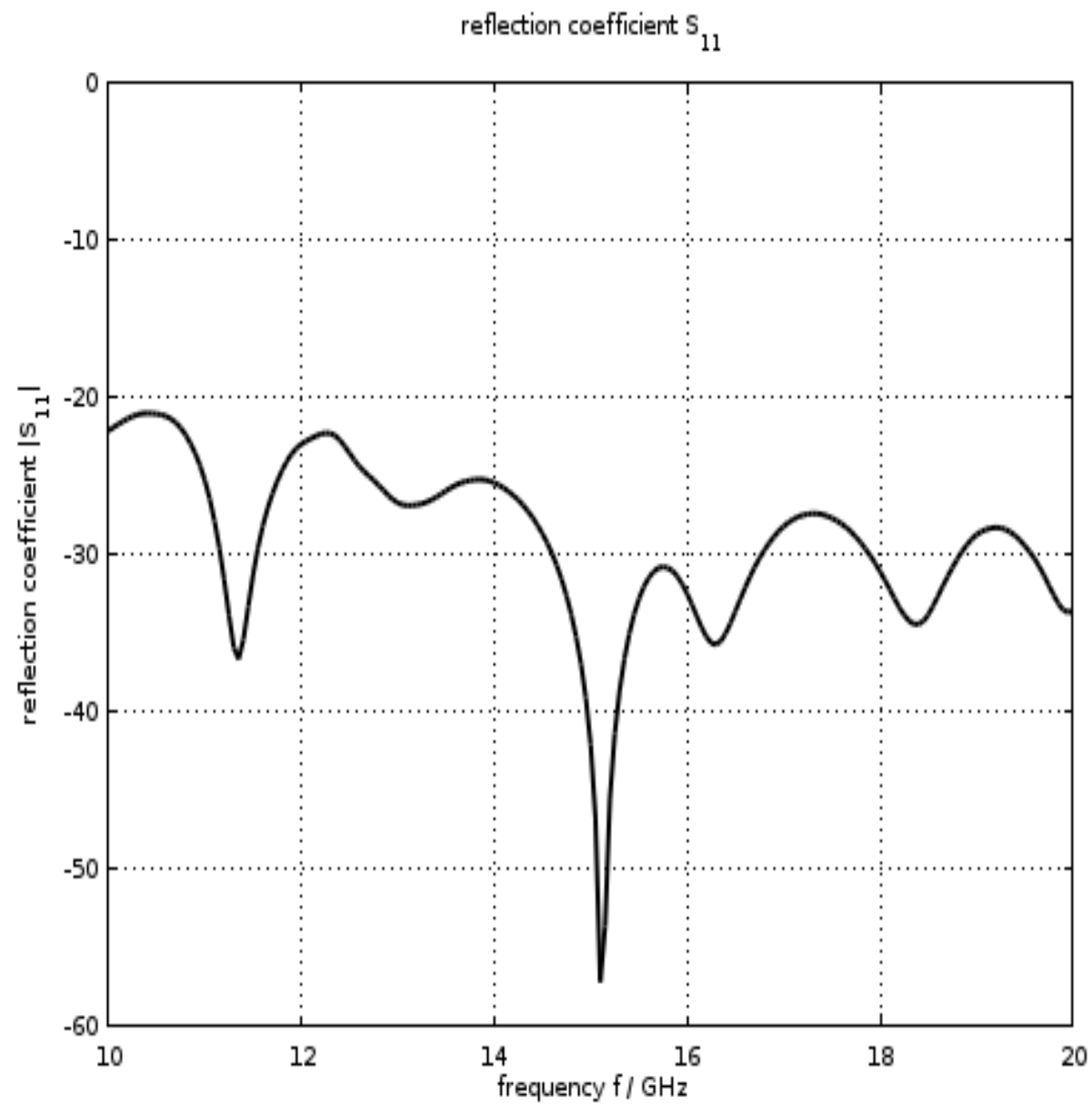


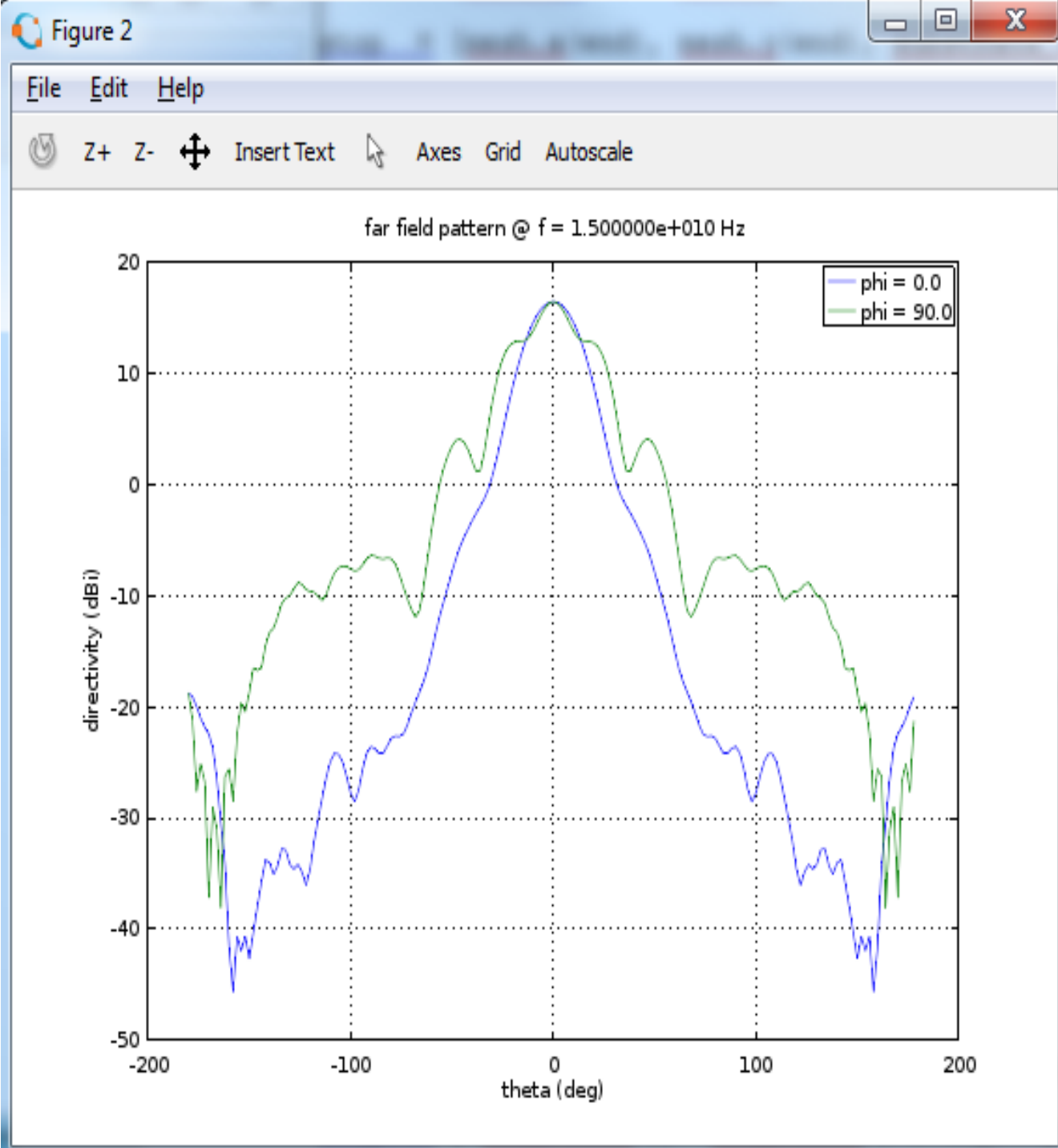


MSL Notch Filter S-Parameter



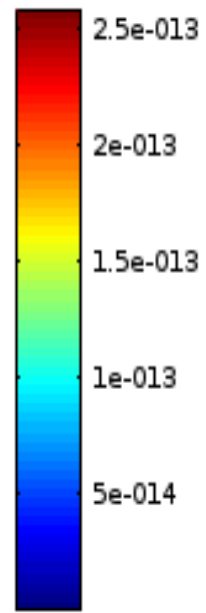
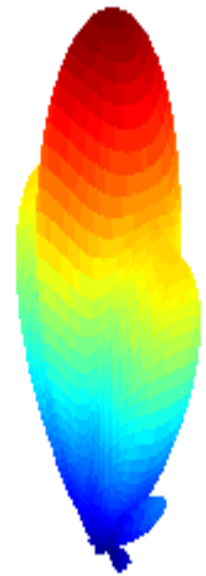








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