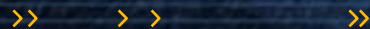


# Ku-Band Diplexer Simulation Using HFSS

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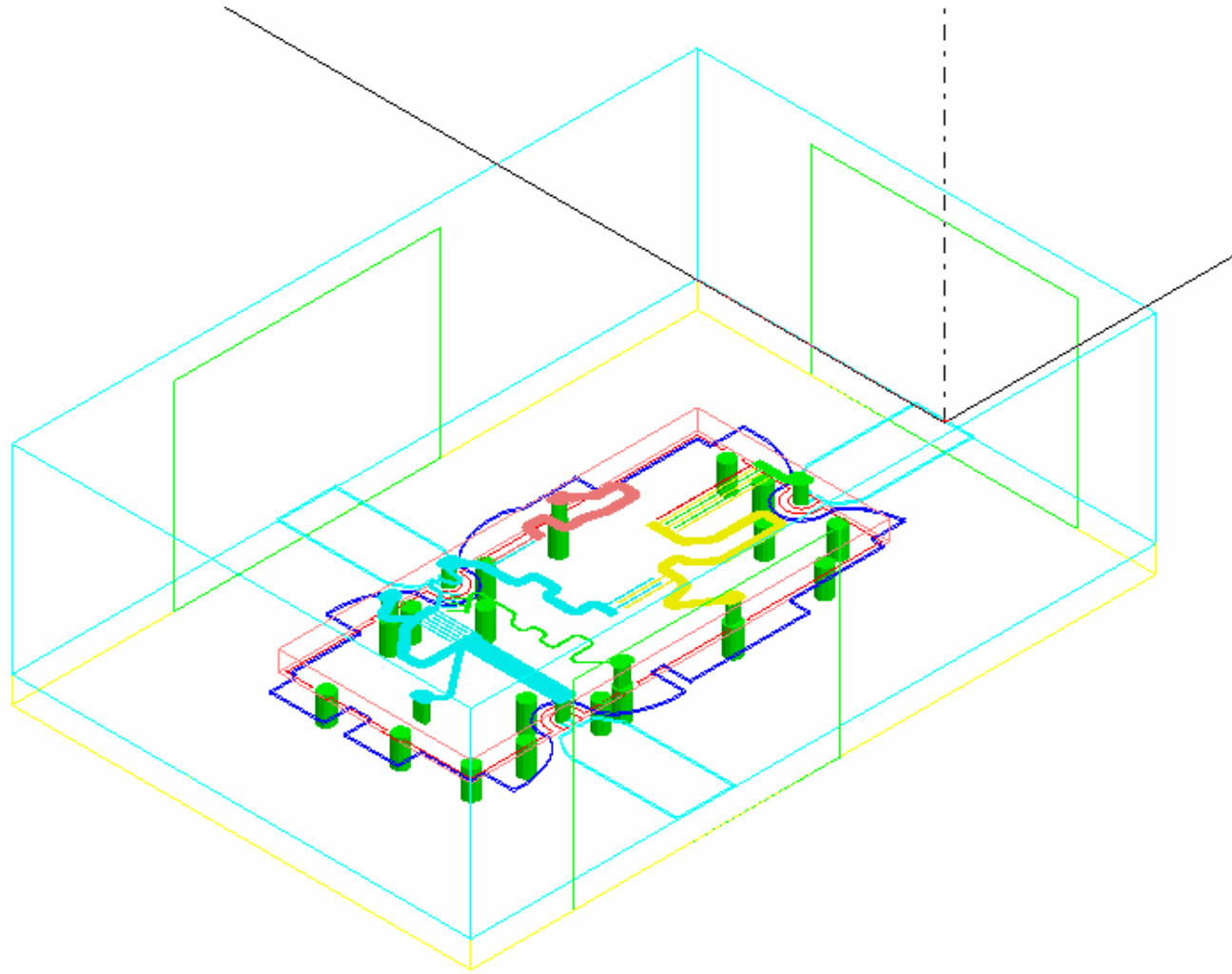
## Goals of the HFSS Simulation

- **Predict the actual performance of the diplexer**
- **Compare the results with other planar EM tools**
- **Compare the results with the measured data**
- **Understand and resolve the differences**

## HFSS Version & Computer Resources Used

- HFSS v8.5 with Service Pack 1
- Pentium 4, 1.80 GHz PC with Windows XP Professional
- RAM: 1.5 GB
- Prefs.ini file modified to increase the Soft Memory Limit
  - » `DIRECT_SOLVER MemLimitSoft 1280000`

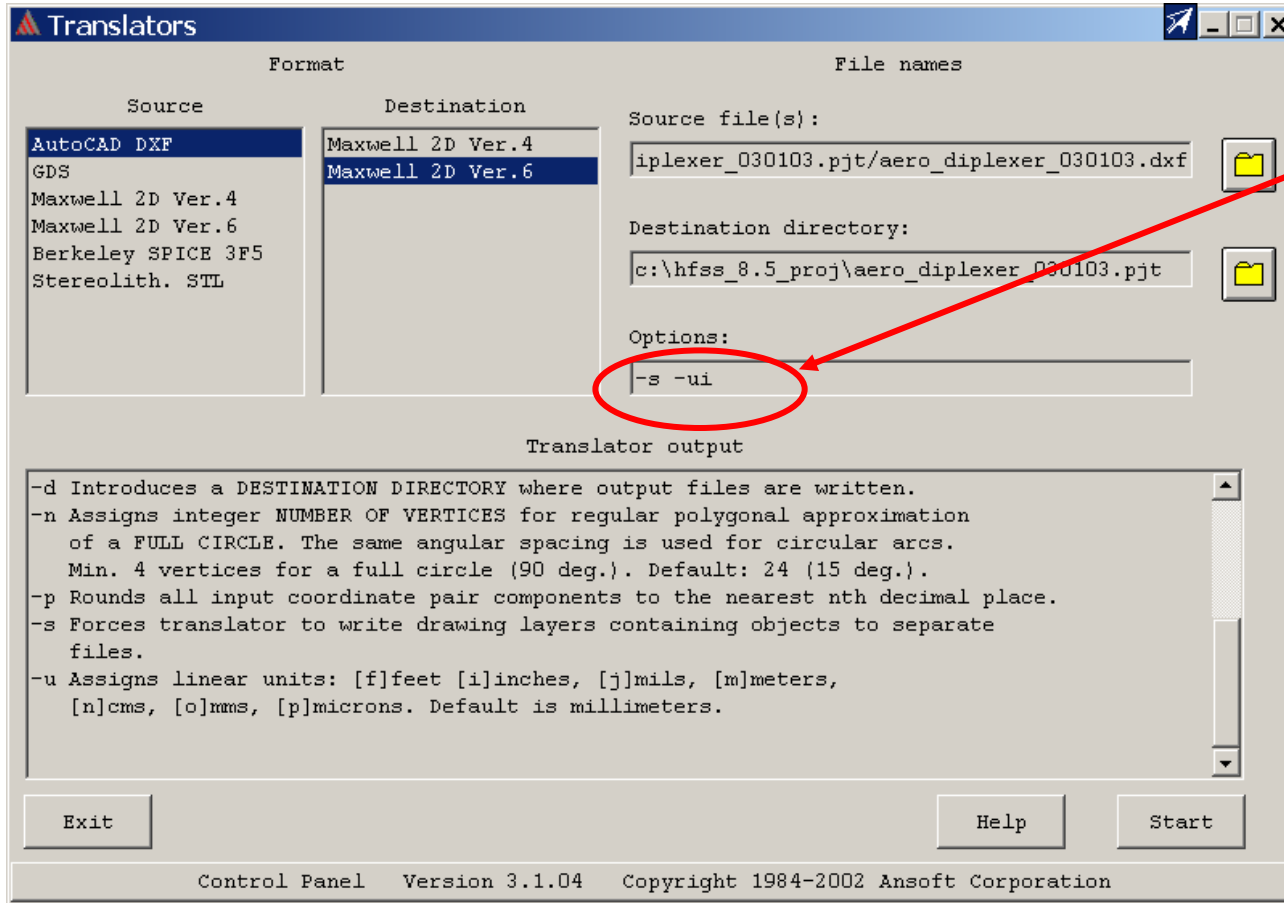
## Ku-Band Diplexer 3D Model in HFSS



## Diplexer Modeling Procedure in HFSS

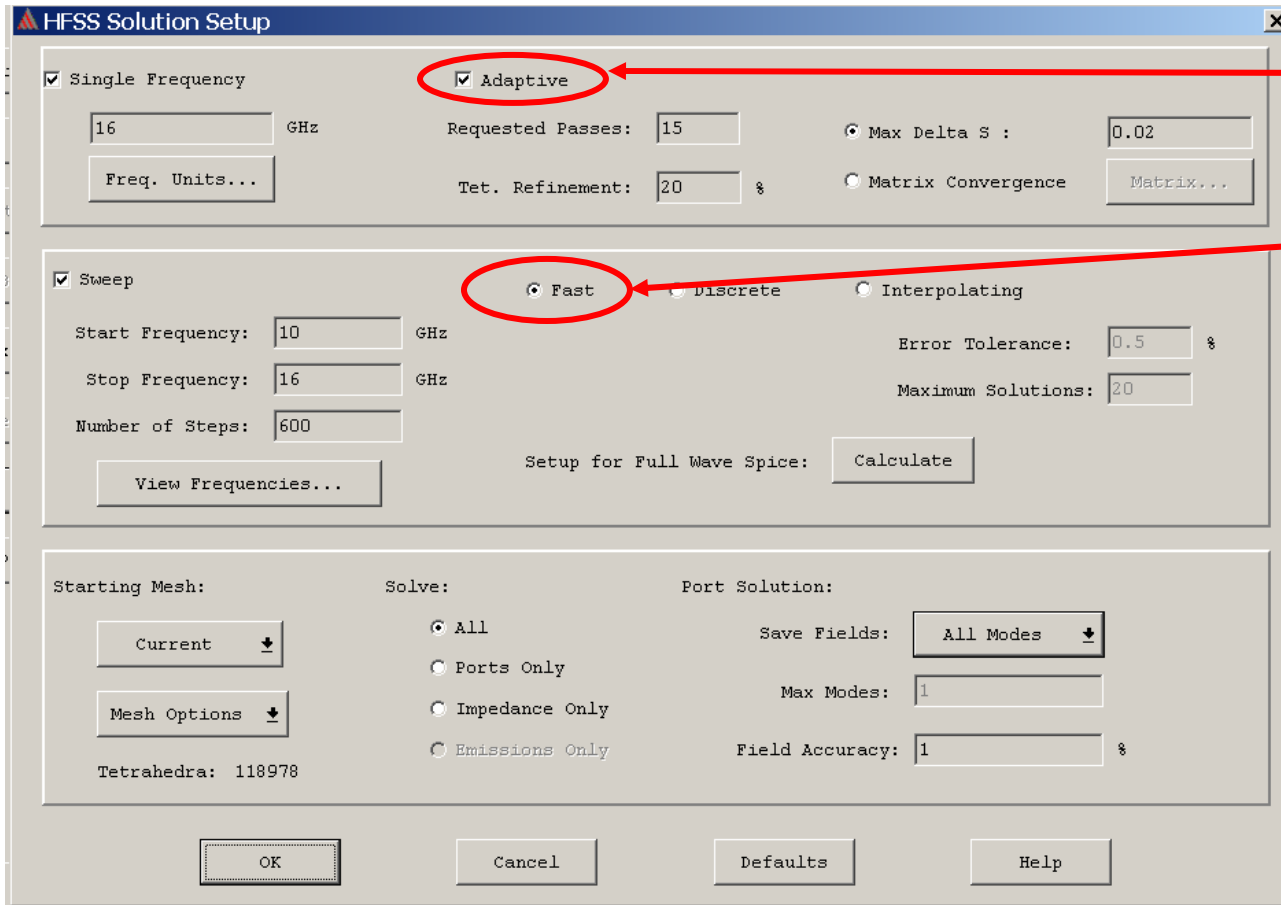
- Diplexer geometry existed in DXF format including the test fixture
- DXF file was converted to 2D (.sm2) Maxwell files
- Imported the .sm2 files, one by one, and changed the attributes as needed
- Used Solids, Sweep, Along Vector commands to create 3D objects
- Created the “Airbox” and the “Port Faces”
- Assigned Materials, Ports and Boundaries
- Setup Solution

## DXF to .sm2 Translation



- Options (-s -ui) was used.
- It was found that the import into 3D Modeler didn't quite work well without the "-ui" option even though the units were set to inches in the original DXF file as well as in 3D Modeler

# HFSS Solution Setup

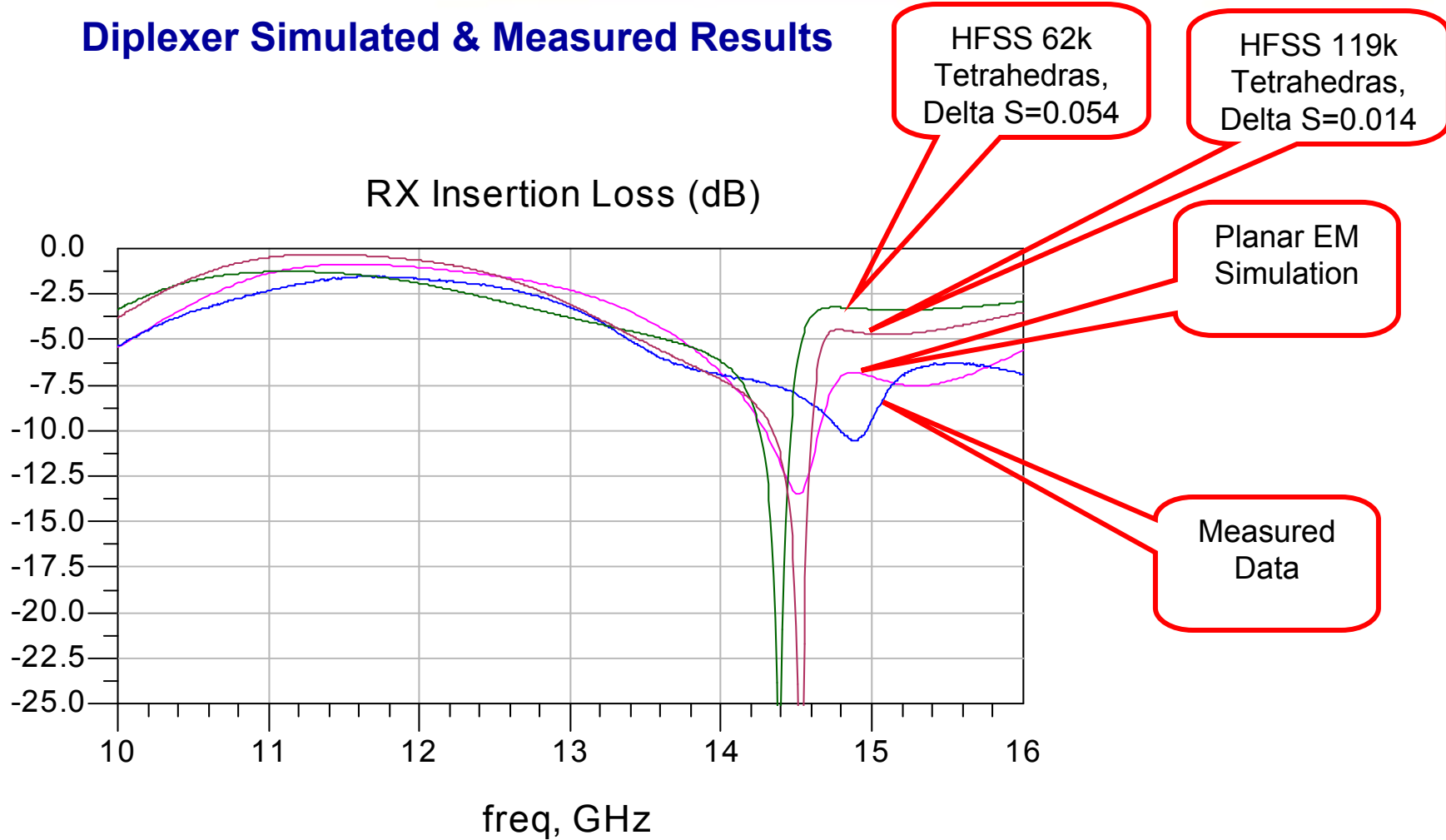


- Adaptive meshing for accuracy
- “Fast” sweep for fast frequency sweep
  - » Eigenvalue problem solved for center frequency
  - » Field solution extrapolated across the frequency range
  - » Allows 3D Post Processor to display fields for all frequency entries in the range

## Some Tips & Guidelines

- DXF Import:
  - » Make sure the objects/polygons in the DXF file are not grouped; ungrouped them using “explode” command if using AutoCAD
  - » Make sure you know the units in the original drawing file
  - » Use the “Options” when translating files to .sm2 format
- Initially model with perfect conductor & zero thickness metals
  - » Thickness of RF/Microwave circuit traces may be critical to give a reasonable initial circuit behavior/response
- Accuracy:
  - » Depending on the circuit adaptive meshing with a low “Max Delta S” may be required to get accurate simulation results. This will lead to a relatively large number of tetrahedras, memory, and disk space
- Always run a quick “Ports Only” solution and check for the desired impedances at the ports

## Diplexer Simulated & Measured Results



HFSS 62k  
Tetrahedras,  
Delta S=0.054

HFSS 119k  
Tetrahedras,  
Delta S=0.014

Planar EM  
Simulation

Measured  
Data

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Measured  
Data

Planar EM  
Simulation

## Simulation Results Observations

- Large number of meshes are needed for accurate simulation
- “sharp dip/resonance” seen around 14.5 GHz in HFSS simulation does not show up in measurements. Further investigation is underway.

## Next Steps

- Include the metal thickness of the circuit traces/metal of the diplexer.
- Remove the metal thickness of the traces for the test fixture. This should help in the memory requirement.
- Check DXF file to see if the polygons have too many vertices. If so remove them. This should help in the memory requirement (less number of edge meshes).
- Check the model carefully and re-run the simulation.
- The center frequency at which the eigenvalue problem is solved needs to be changed?