Getting Started with AWR Design Environment (part 2)

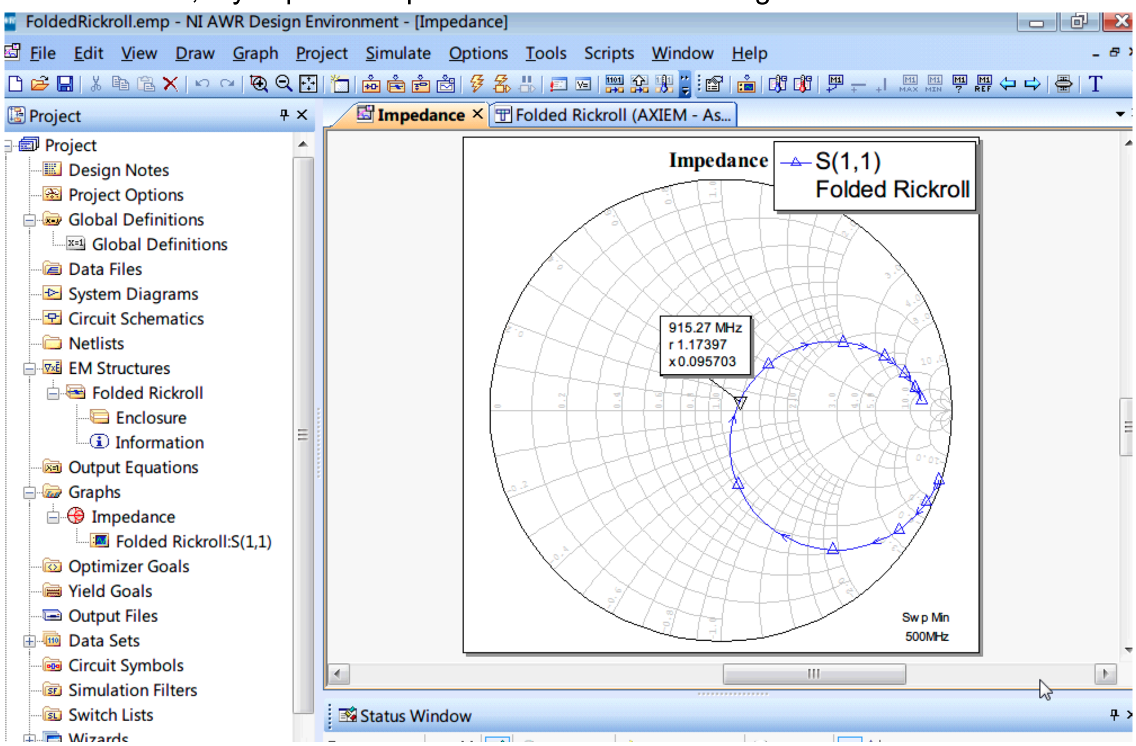
Last class, we got to see the basics of simulation using AWRDE and the AXIEM engine. Today, we will see how to produce 3D plots and graphs and extract parameters from our circuits.

In this tutorial, we will continue going over the basics of electromagnetic simulations using the AXIEM engine to simulate a planar antenna.

Away we go!

1) Launch AWR again and either open your Folded Rickroll project, or re-create the tutorial from last lecture. It shouldn't take too long if you forgot to save.

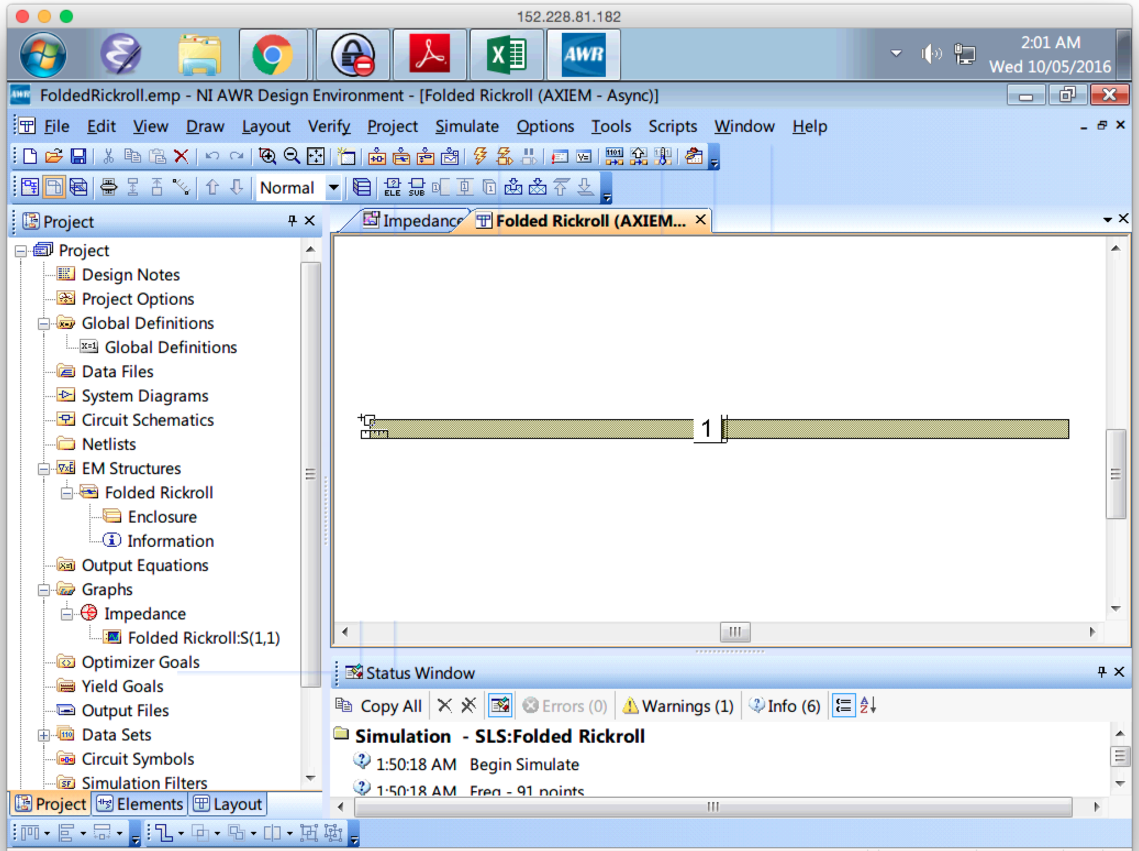
2) Where I left off, my impedance plot looked like the following:



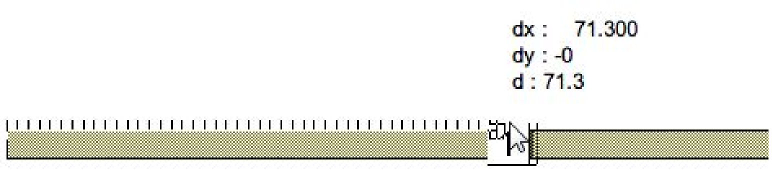
A nice looking match near 915 MHz.

3) Going back to the view of the EM Structure, I can use a measure tool to see the total distance of the traces.

Push CTRL + D to bring up the ruler icon in the layout. Place it at the top left corner of one of your traces. The icon should turn to a square.



4) Click the mouse and then drag to the other end of the trace.

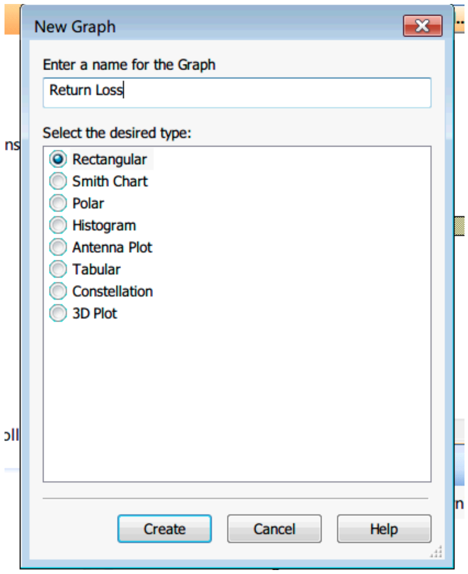


Here we see that for my dipole structure, one leg is 71.3 mm. From the theory, one leg of a dipole should be approximately ¼ wavelength. Multiplying 71.3 by 4, we find that the wavelength is 285.2 mm, or .285 m. This is _very_ close to one of our earlier calculations for the freespace wavelength of 915 MHz.

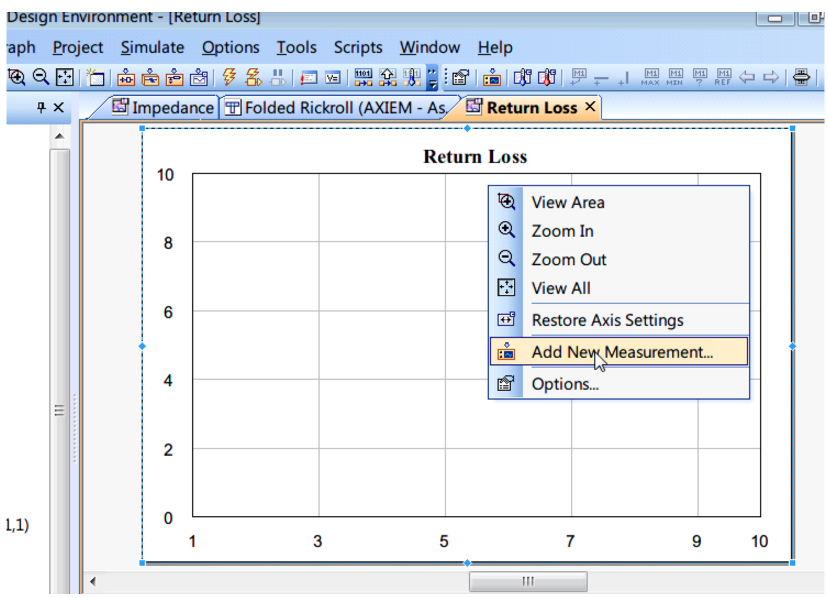
How close did you get with your design?

5) Let's add some new measurements.

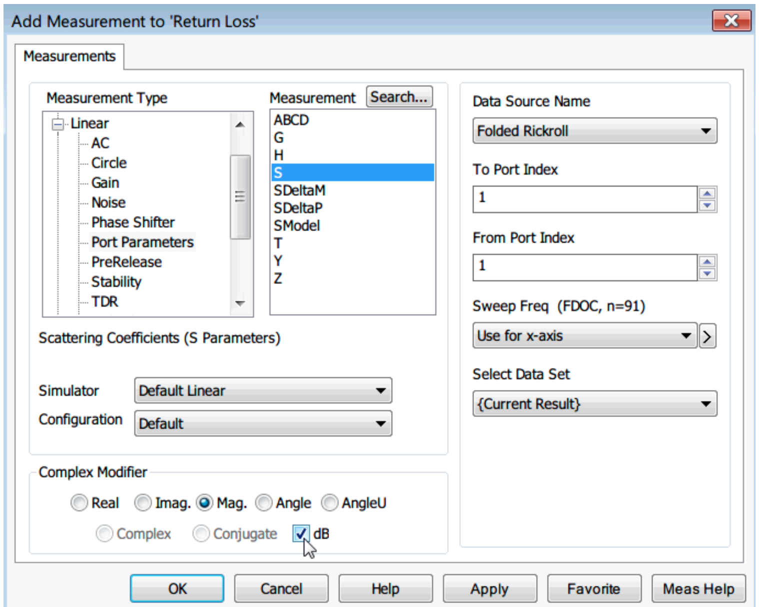
Create a new graph of type Rectangular and name it "Return Loss."



6) Add a New measurement…



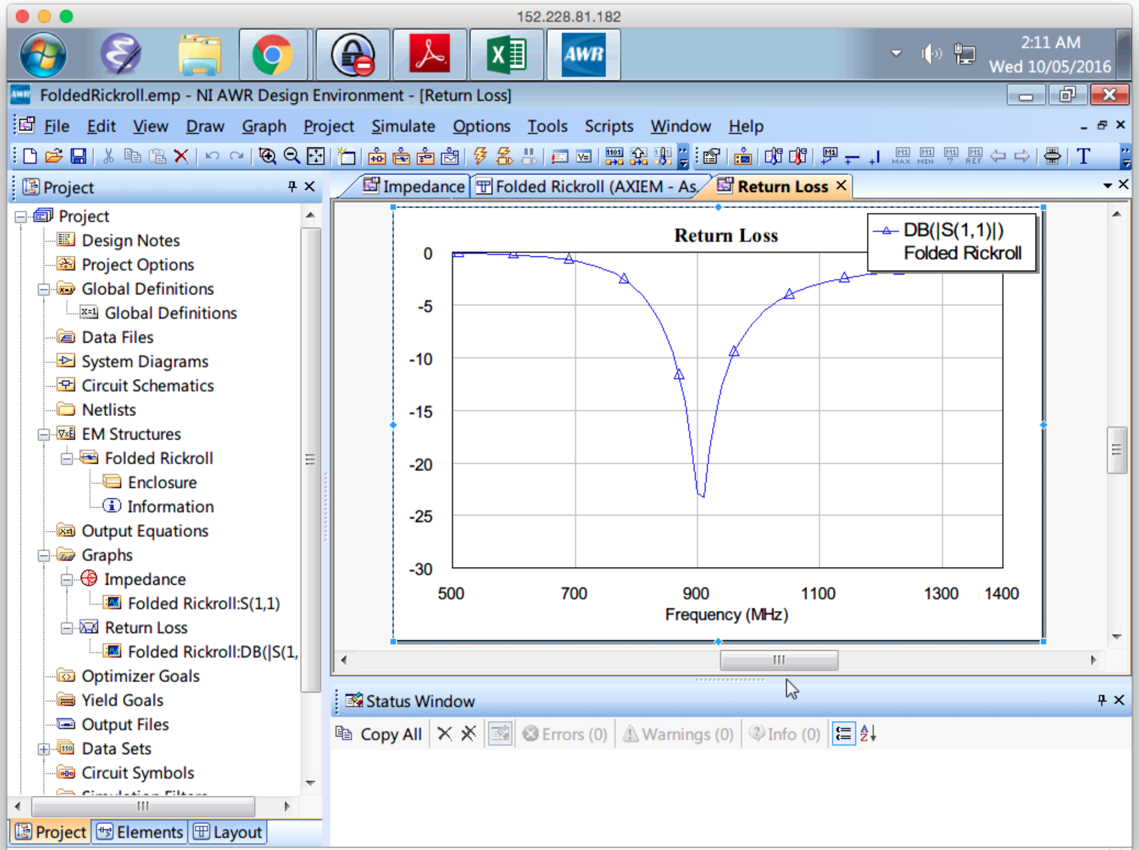
7) Set it to be Port Parameters for the Measurement Type, "S" for the Measurement, and Folded Rickroll for your data source. The complex modifier should already be "Mag." for magnitude. Check the dB box.



Once these are set, hit OK to add Return Loss to a rectangular plot.

8) The plot is now set up, but we need to run a simulation so that AWR will generate the correct data. Click the Lightning icon to begin a simulation.

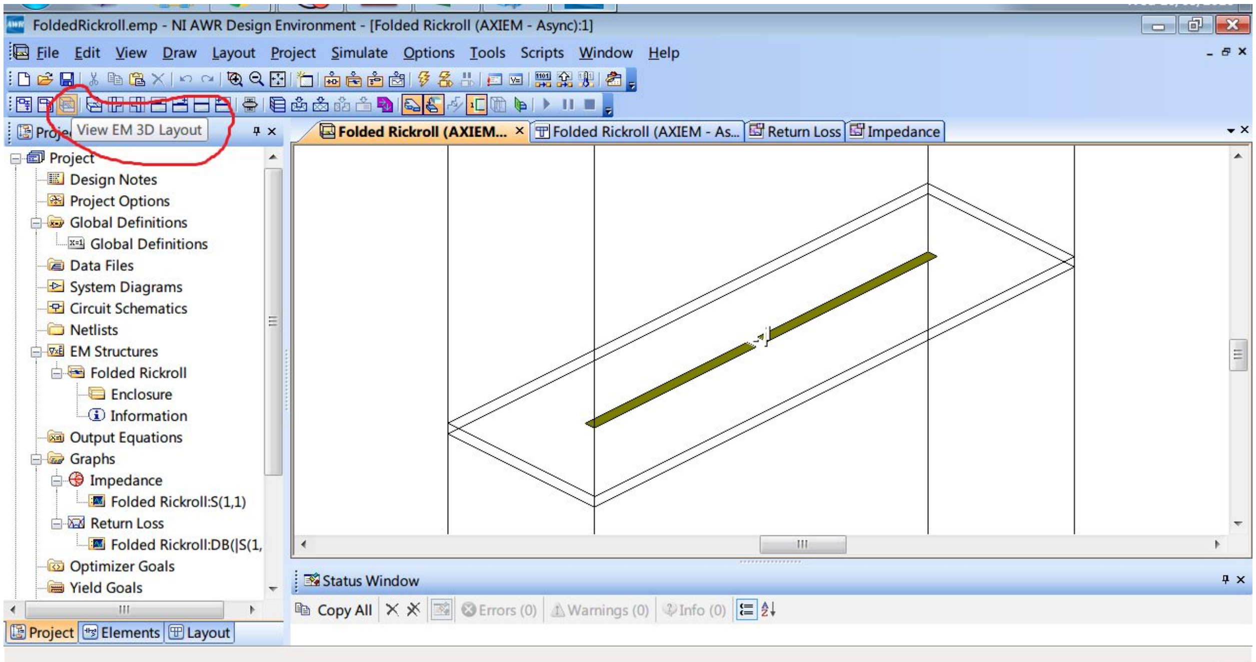
9) You should now see a lovely plot of return loss showing the big dip meaning we are resonant at approximately 915 MHz.



Give yourself a pat on the back!

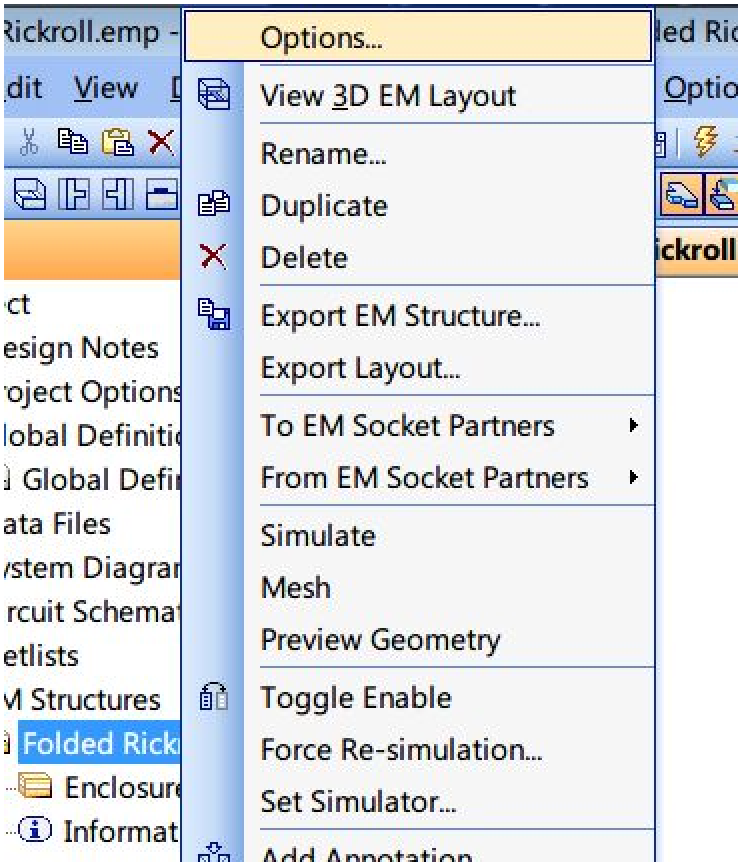
10) And then keep going.

11) Go to the 3D view of the antenna.

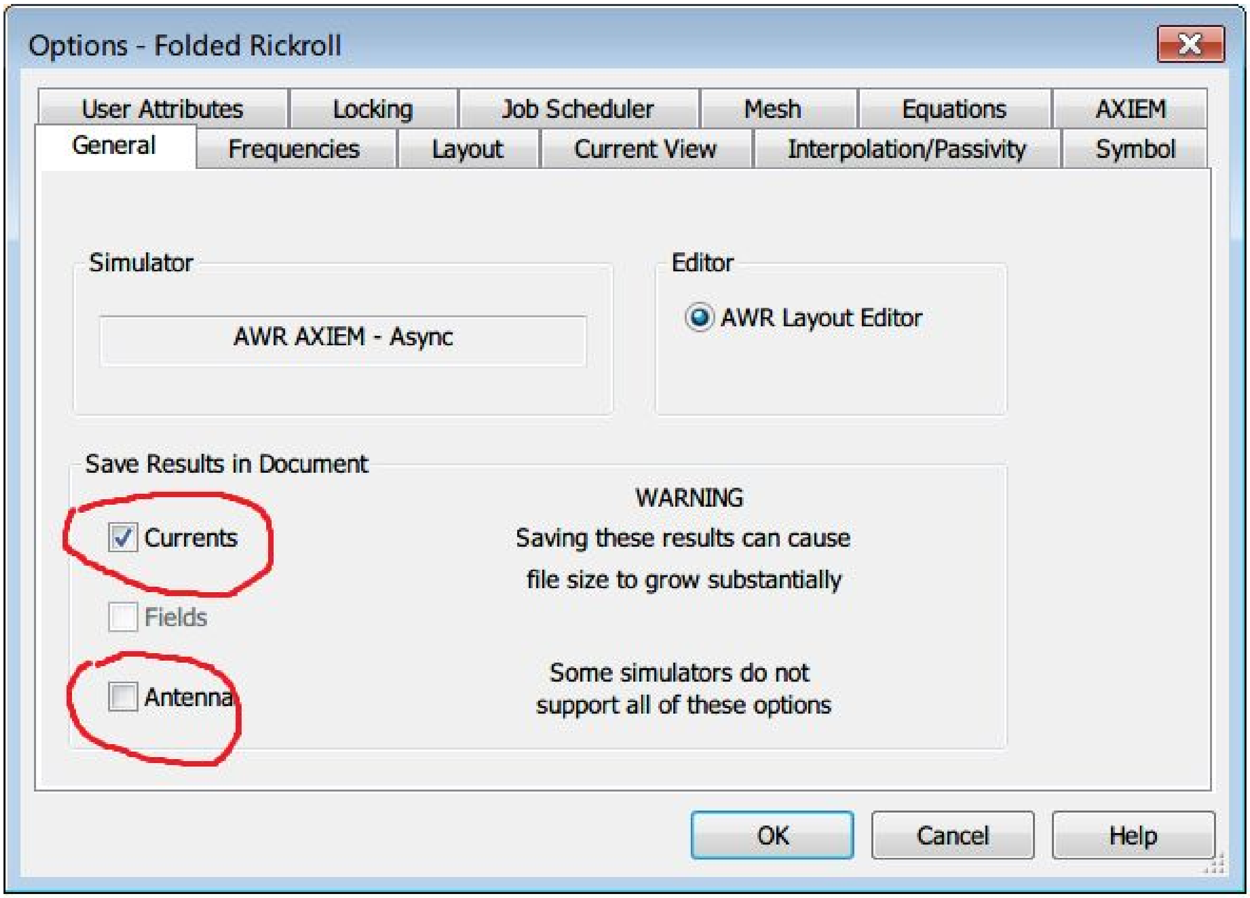


12) Wouldn't it be nice to actually see the electromagnetic currents on the antenna? Yeah, it totally would! So, we'll add one.

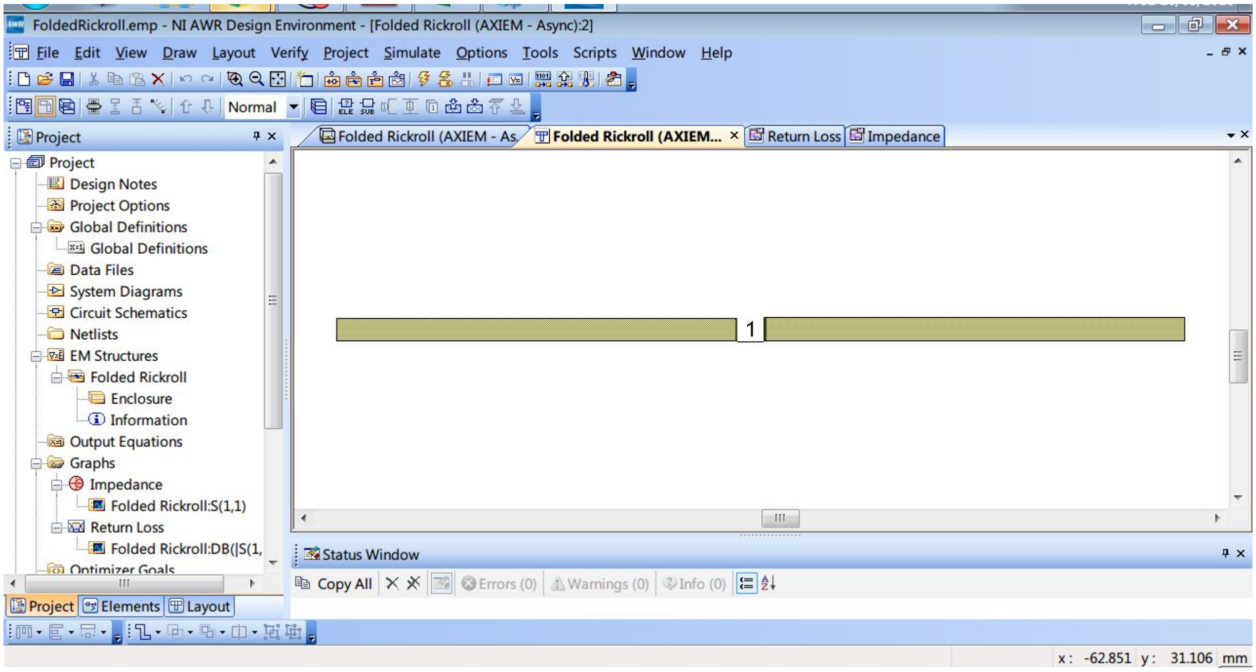
13) Go to the Folded Rickroll options



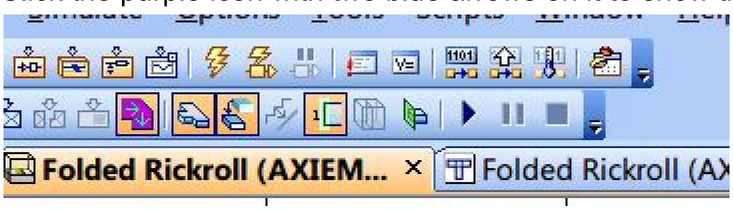
14) In the general options, click to save “Currents” and “Antenna”



15) Go back to the main view of the antenna (the non-3D view) and click the lightning bolt to simulate everything. I’m not sure why, but you have to simulate (“analyze”) from the 2D view of the antenna.

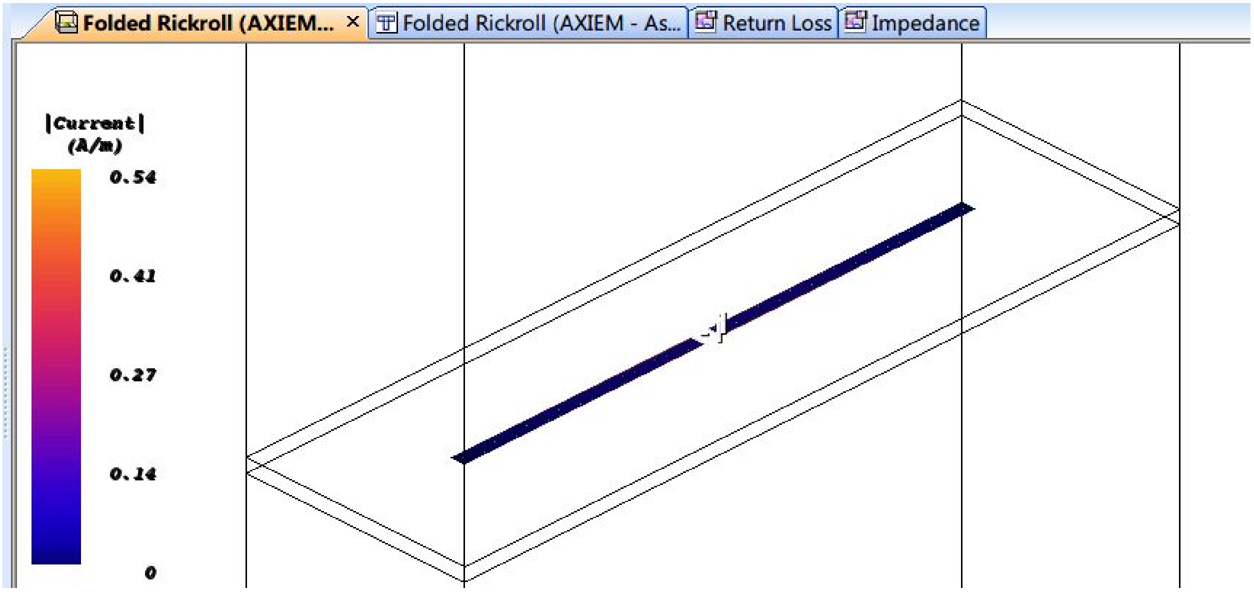


16) But now, we can go BACK to the 3D view and do something amazing. Just amazing. Click the purple icon with two blue arrows on it to show the antenna currents.



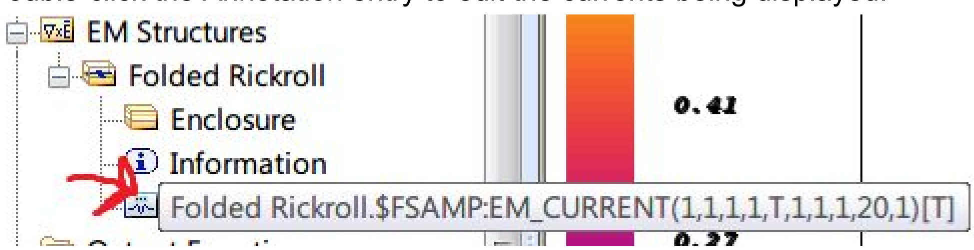
And like magic,

17) Bask in the awe of your antenna currents.

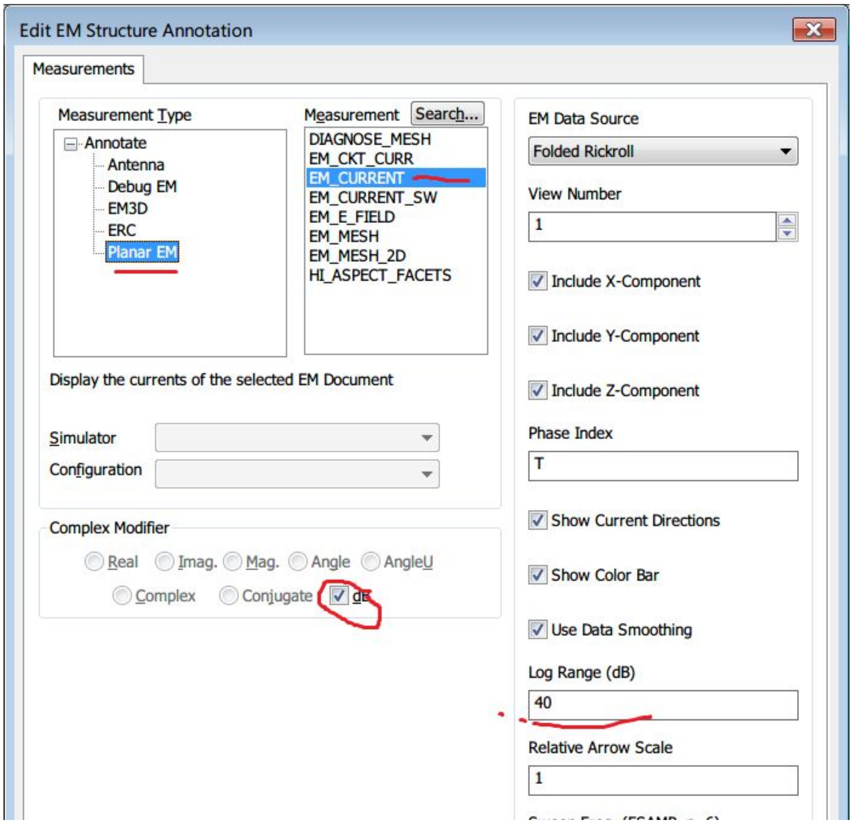


18) Now we can't see much, but we can change the view to be in deciBels and animate everything.

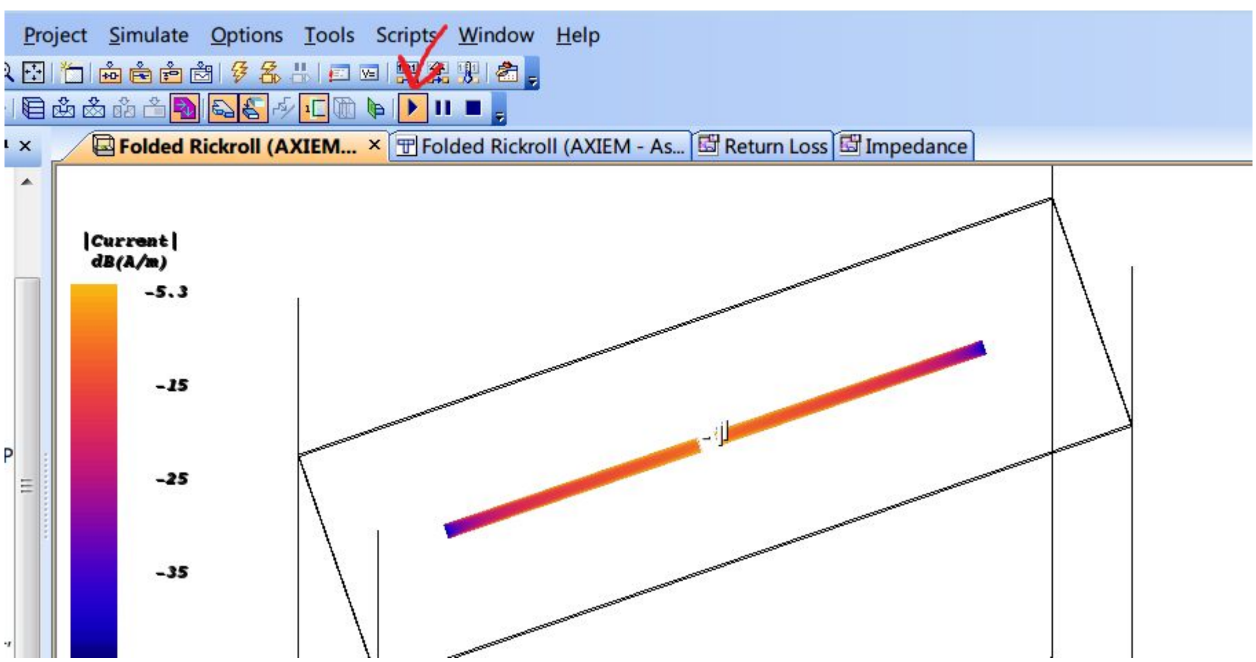
19) Double-click the Annotation entry to edit the currents being displayed.



And select dB for the Complex Modifier and a Log Range of 40. Everything else should be set, but frequency will be on FSAMP.



20) Now we can make our antenna dance for us. Hit the “Play” button and watch the currents move.



This shows current magnitude and animates as a function of the phase angle (0 to 2 PI). Notice that at the ends, the current stays very low --- meaning there’s no current at the end. Why? It’s an open circuit!

In the middle, the current oscillates between orange, purple, and orange. This means that there is a large amount of current, zero current, and then a large amount as the current goes the other direction. But since this is displaying magnitude, if it is a strong positive current or a strong negative current, they will both appear orange.

This should match exactly our discussion of dipole antennas from a previous lecture. Currents are maximised in the middle and voltages are maximized at the end points, where current is zero.

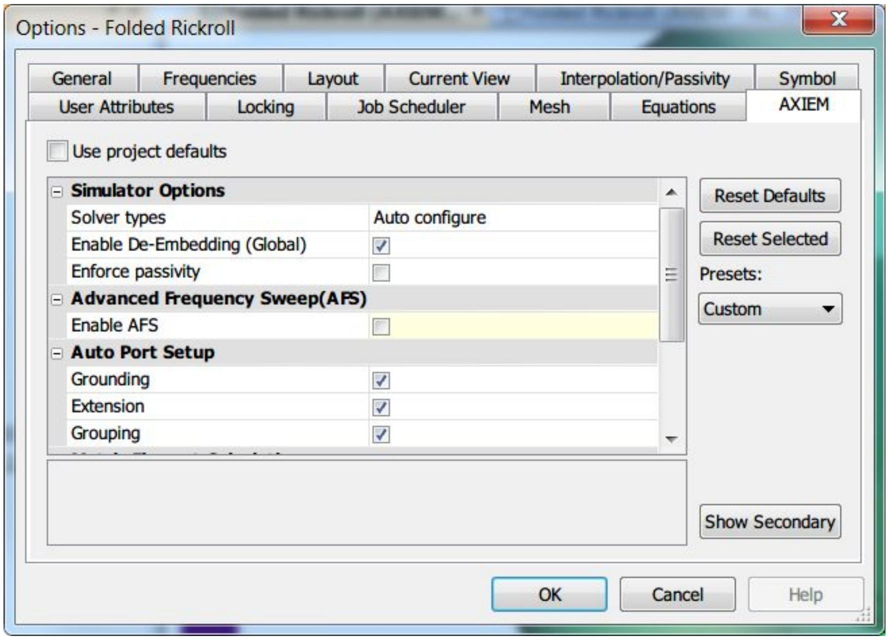
21) We will now view the 3D fields from the antenna.

22) First we need to fiddle with the frequencies a bit. AWR defaults to using an adaptive frequency selection. For the most part this is fine, but for antennas, we would like to take measurements at very specific frequencies.

    Go to the project options and change your frequency sweep to be about 10 points from 500 MHz to 1.4 GHz.

23) Make sure that the same frequency settings are being used in your Folded Rick roll options. These need to match up.

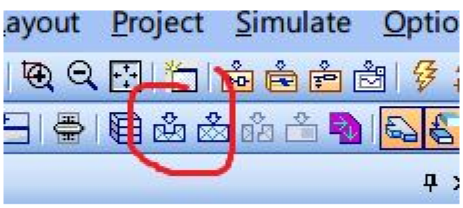
24) From the Folded Rockroll options, click the AXIEM tab. Make sure that “Enable AFS” is NOT clicked. This will disable the adaptive frequency selection and only simulate at the frequencies we request. It takes a bit longer, though.



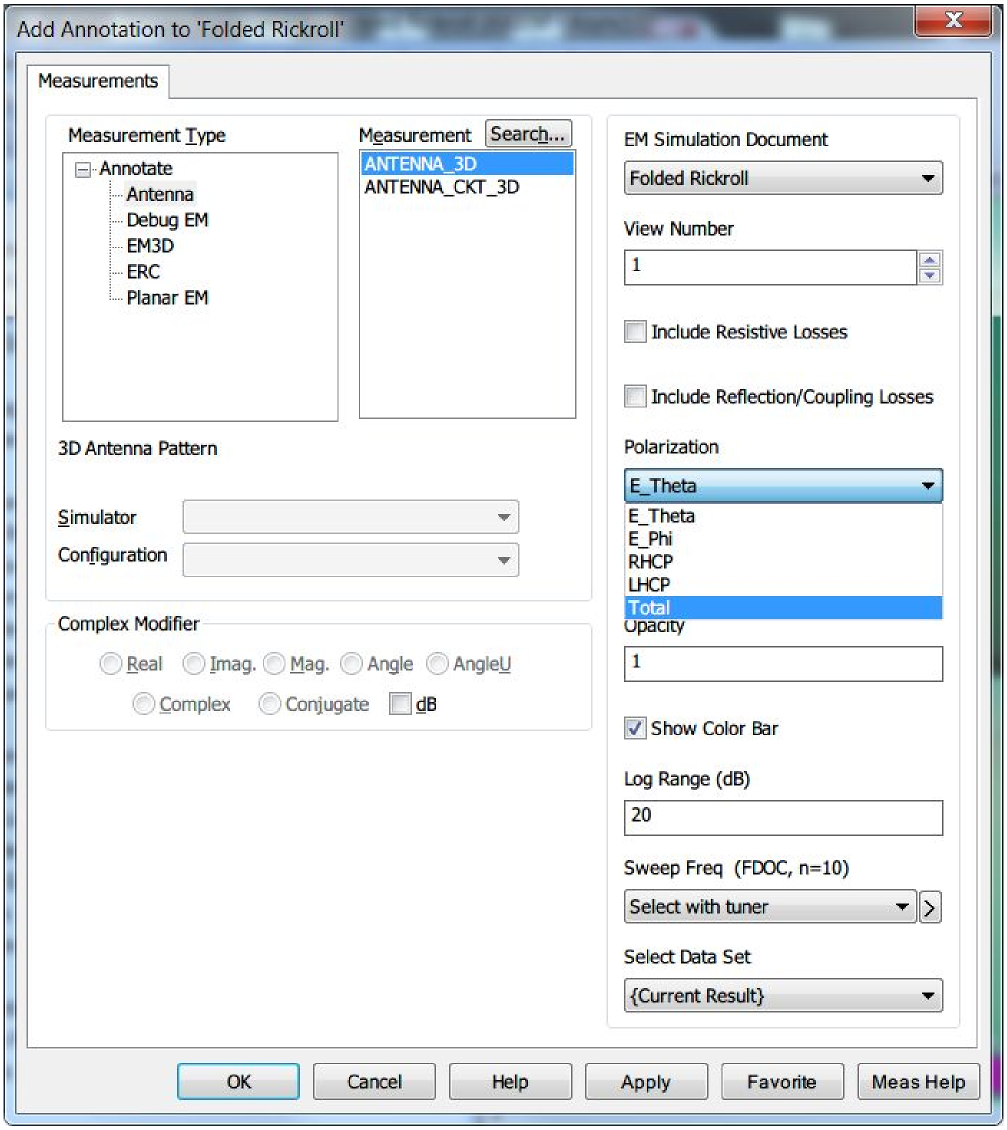
25) Go back to your 2D layout view and re-simulate your antenna. You may have to Right-click on the "Folded Rickroll" Em structure and select "Force Re-simulation."

26) Once the simulation is complete, go to the 3D view.

27) You will need to click "Add EM Annotation" from the top menu bar.



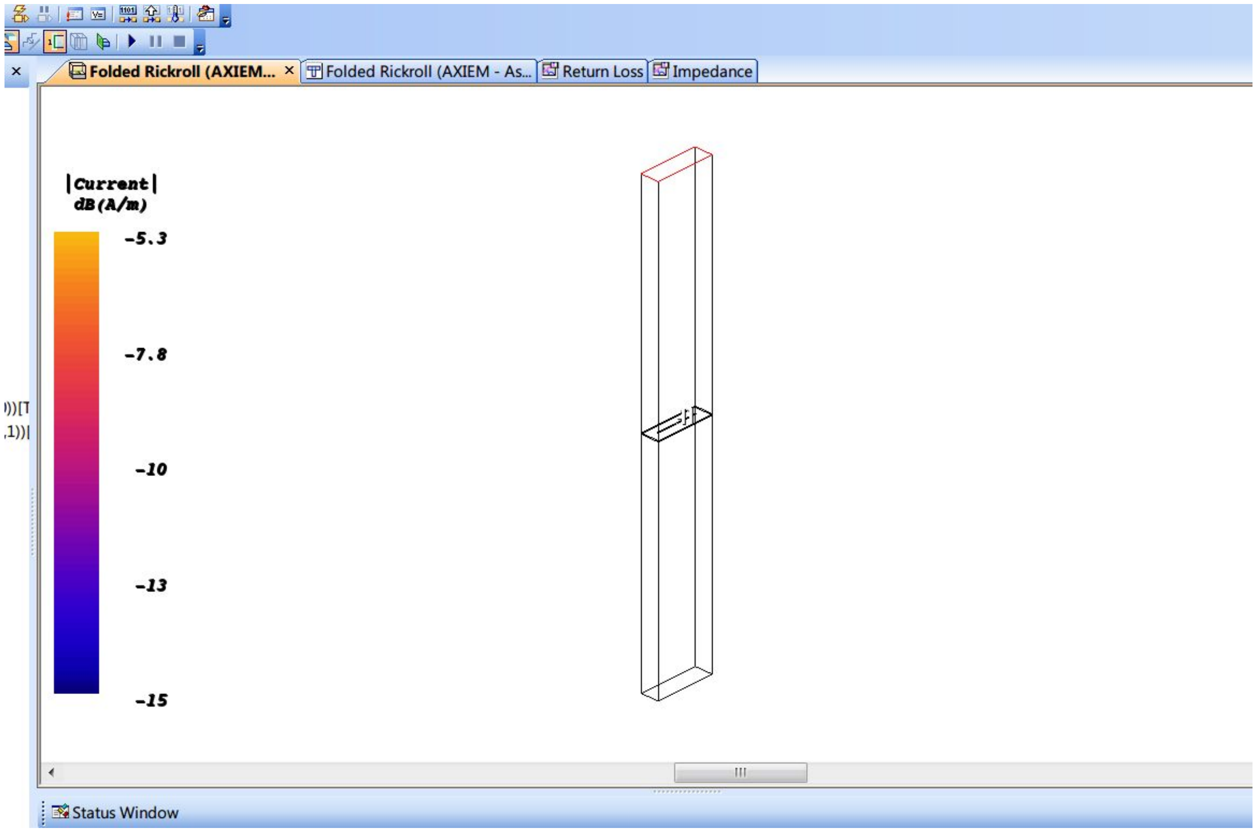
To bring up the Add Annotation window.



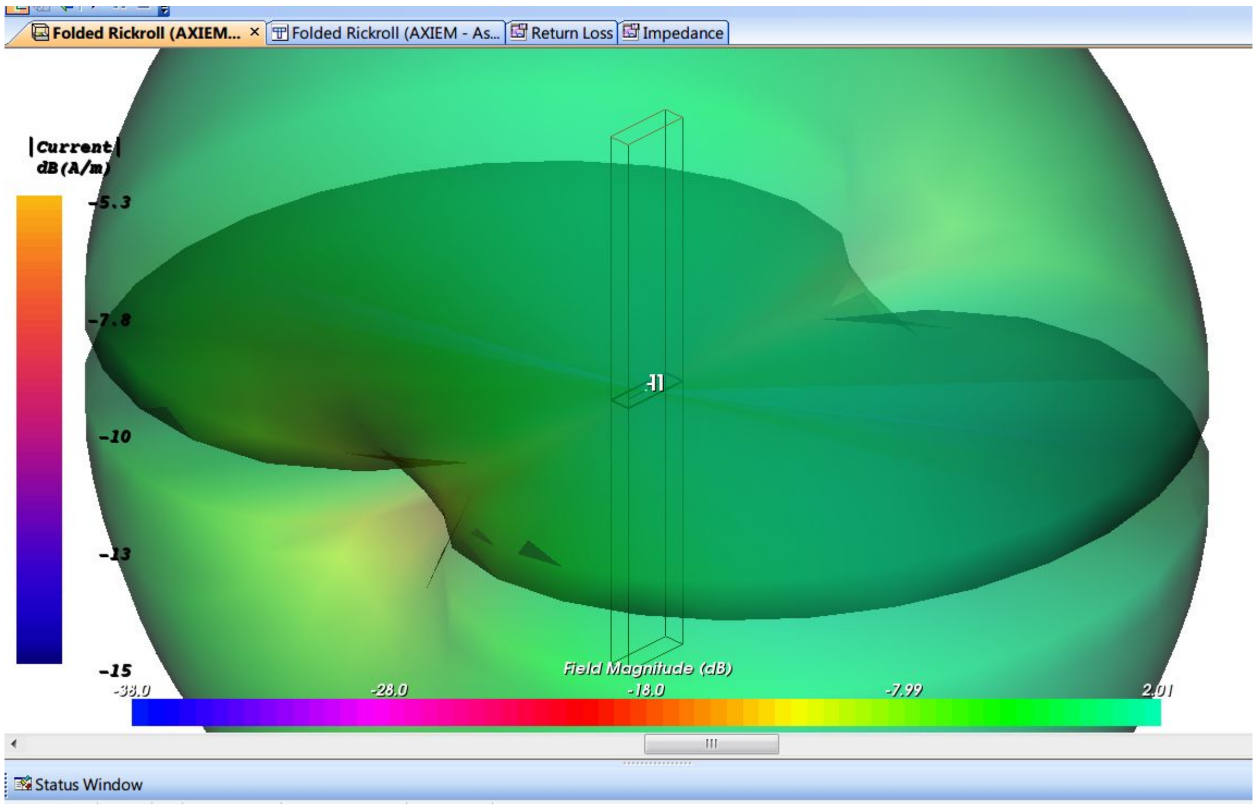
Be sure to select Antenna for measurement type, ANTENNA_3D for Measurement, and choose “Total” for Polarization. Select dB for the complex modifier and you may keep the log range at 40 dB. For Swee Freq, this should be set to be “FDOC” and Select with Tuner. If not, choose the right arrow to select the correct data set.

After you get these settings, hit OK.

28) If its not appeared yet, hit the Analyze button one more time and ...



29) Now, hit the Simulate/Analyze button one more time, and Voila!



I changed my Opacity to be about 0.5 so that I could also see the antenna structure.

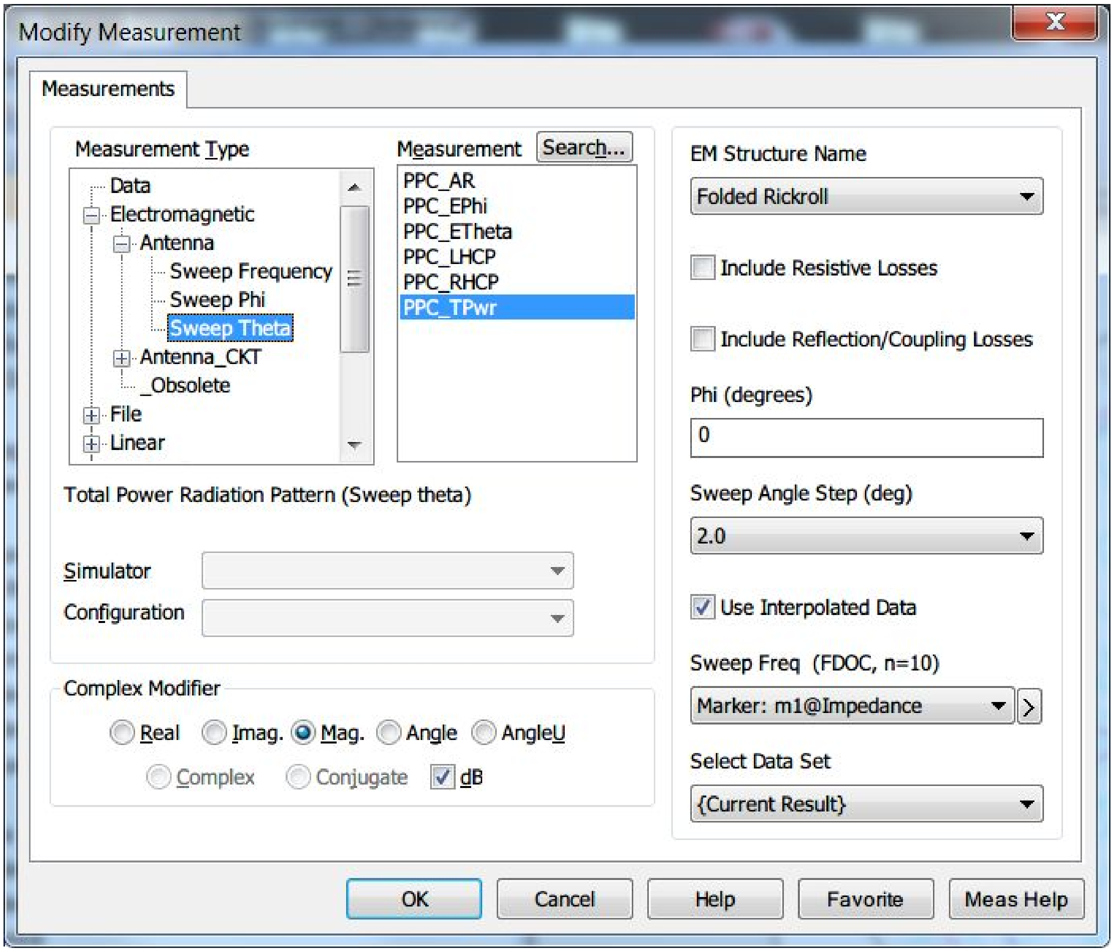
This plot shows the 3D pattern from the antenna. Clearly there are maximums when we are facing head-on into the antenna and nulls when we are looking directly into one of the ends.

Use the mouse and play around and look at the pattern. Double click the new dataset under "Folded Rickroll" to change any settings you want. You may need to go back to your 2D view and re-simulate before any changes appear.

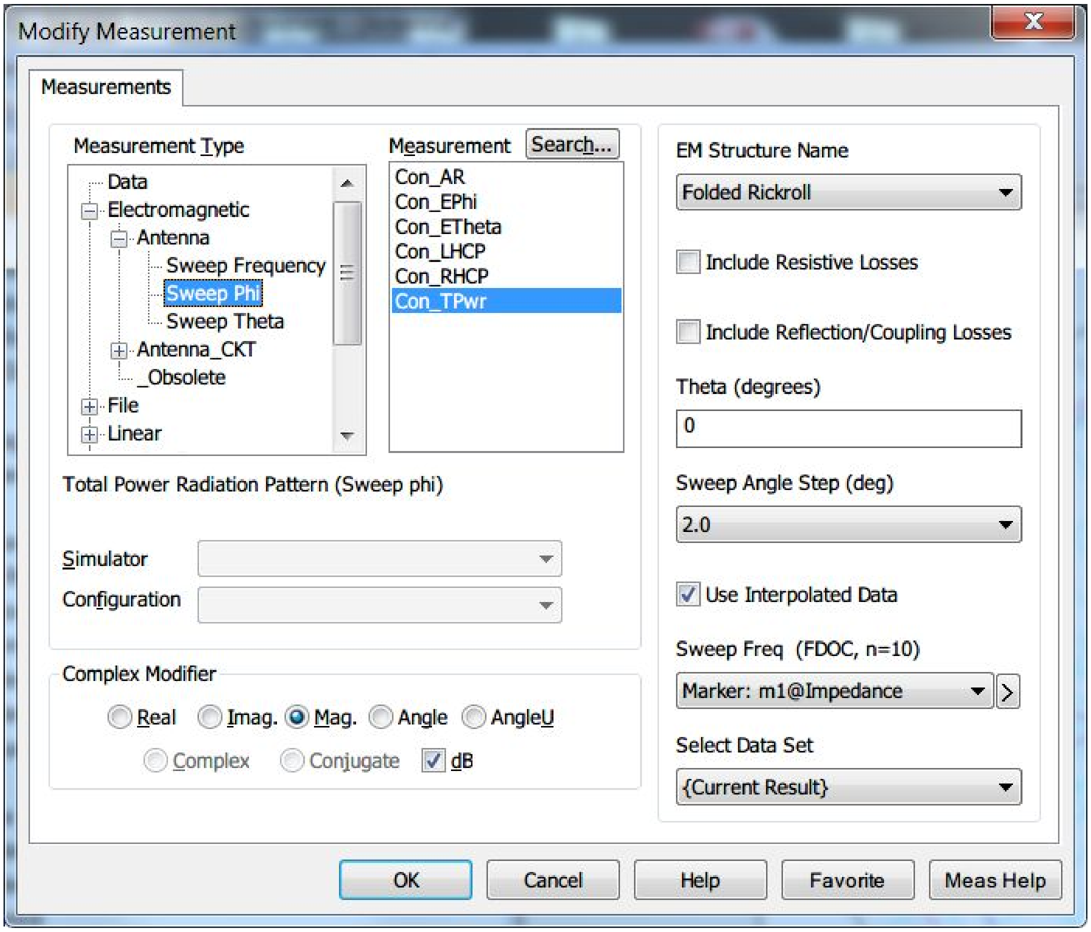
Just so you know, AWR can be finicky. I have had some troubles with datasets not being available. Just keep trying to force re-simulations and change settings until you can see a pattern.

30) Now make a new graph. Select Antenna for the type and name it "Antenna".

31) Add a new measurement as shown.

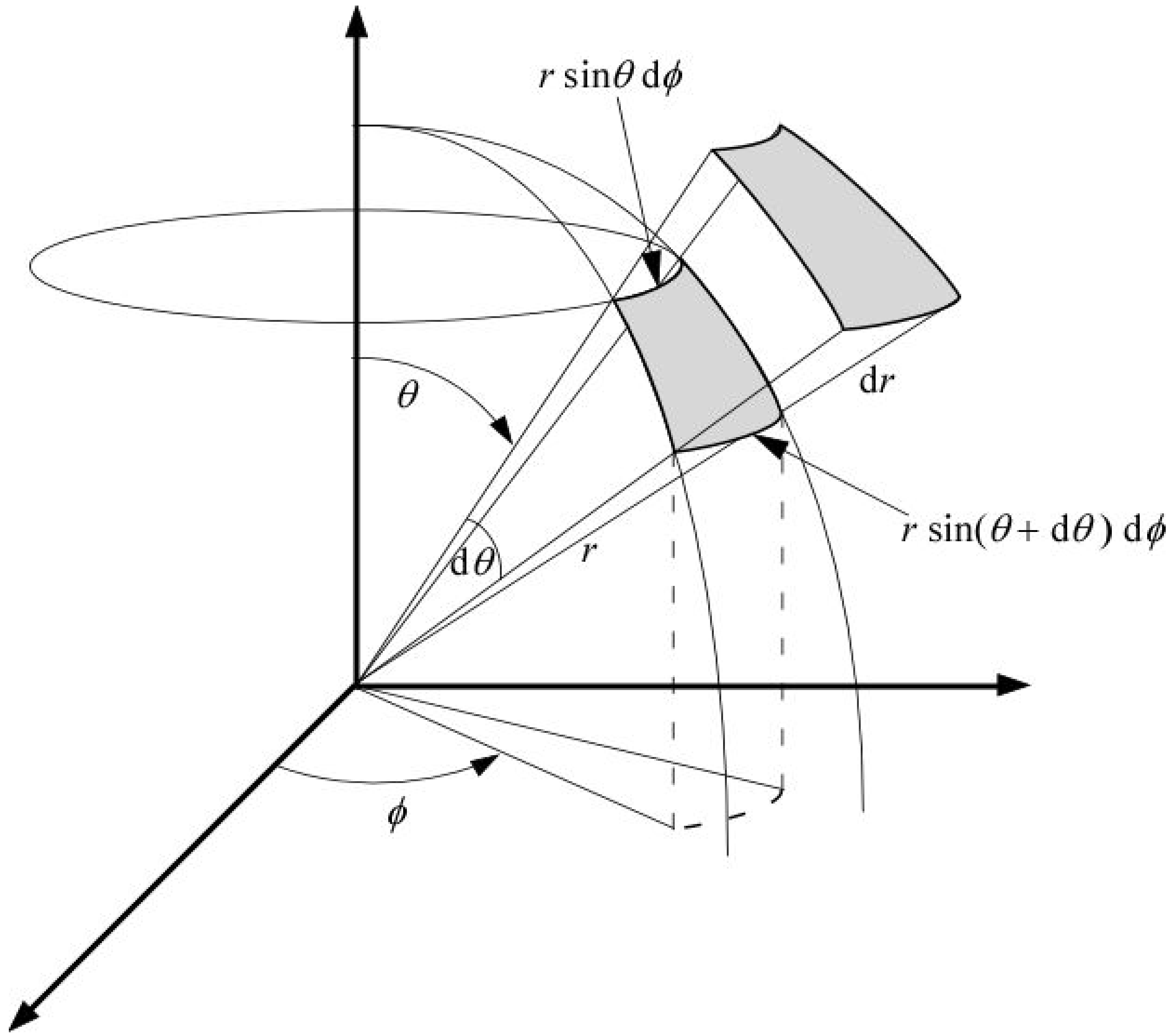


32) Add a second measurement as shown:



33) This will slice the data in two coordinates -- Polar (from pole to pole of the 3D view) and along the equator (called azimuth).

Spherical coordinates a bit odd if you haven't seen them. Just keep in mind which angle is THETA and whcih angle is PHI. You may need to set THETA to 90 when you sweep PHI or set PHI to 90 when you sweep THETA depending on how your antenna is oriented. This plot will show the gain in dBi for your simulated antenna!



34) Get a plot of YOUR antenna that you designed and show the antenna plot showing gain for your antenna. Write down the peak gain. How does this compare to your measured results?