Ansys High Frequency Structure Simulator (HFSS) Tutorial

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EE 3407
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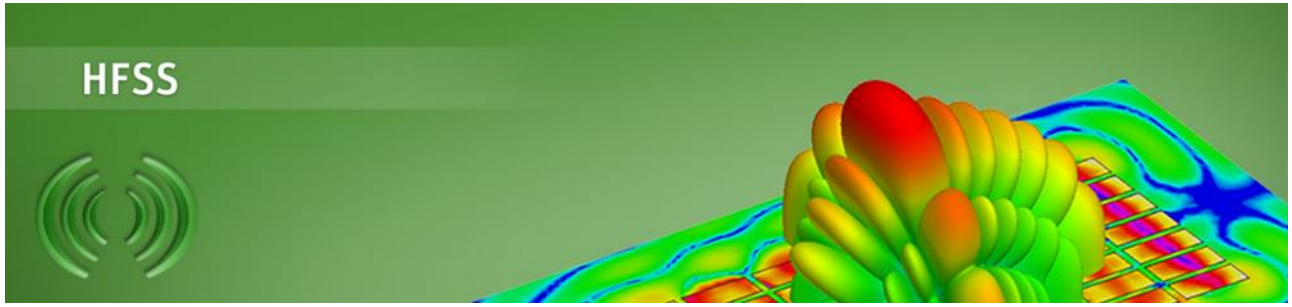
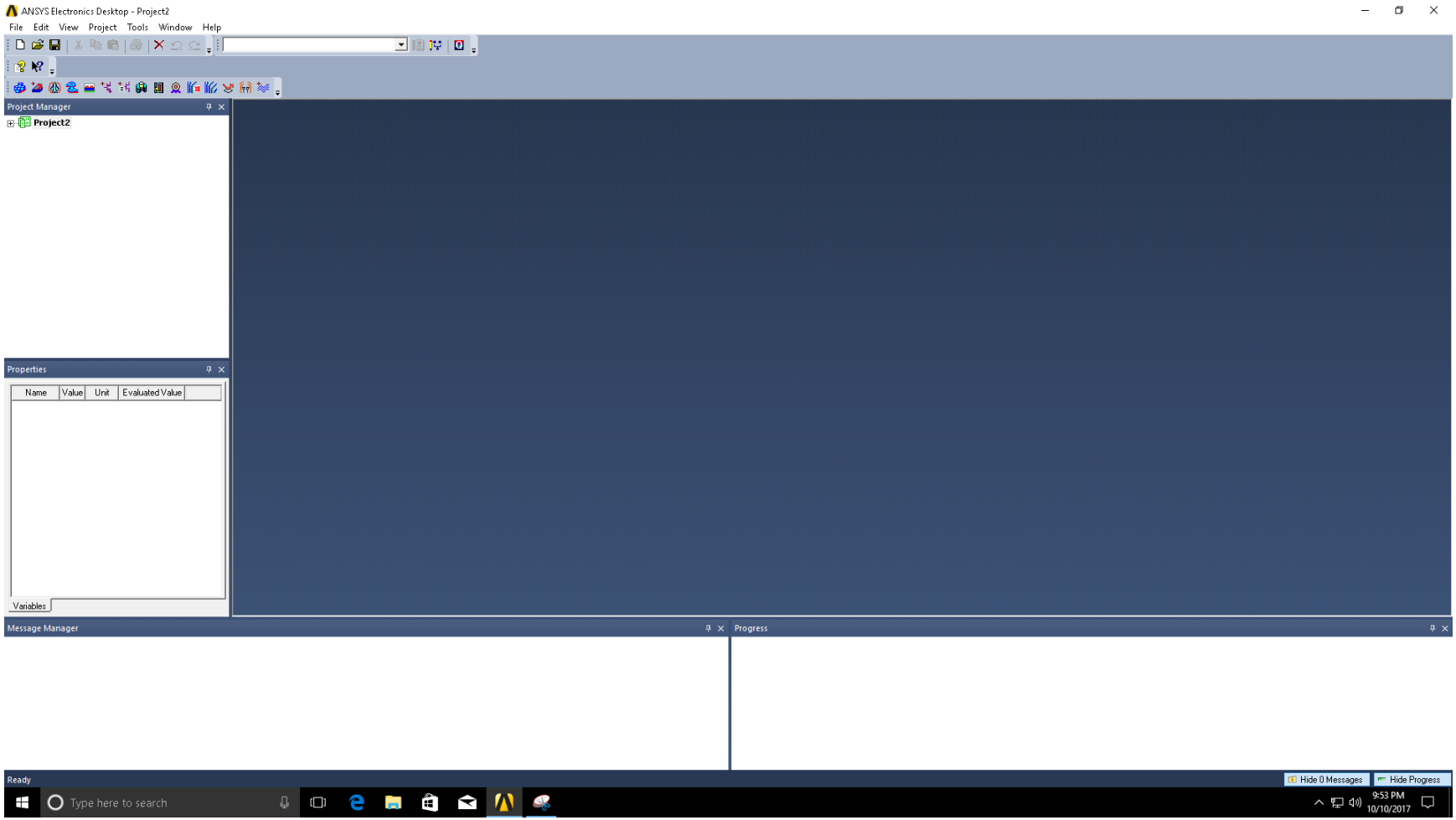
How to solve this ?

$$
\begin{aligned}
I &\equiv \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\int_{-\infty}^{\infty} \mathbf{e}_\mu \varepsilon_{\mu\alpha}(\omega) E_\alpha(\mathbf{r},\omega)\exp(-i\omega t)\,d\omega \\
&= -\int_{-\infty}^{\infty} \frac{\omega^2 n^2(\omega)}{c^2}\underbrace{\frac{1}{2}\sum_{\omega_\sigma \geq 0}\left[\mathbf{E}_{\omega_\sigma}(\mathbf{r},\omega-\omega_\sigma)+\mathbf{E}^*_{\omega_\sigma}(\mathbf{r},-\omega-\omega_\sigma)\right]}_{\text{quasimonochromatic form of } \mathbf{E}(\mathbf{r},\omega)}\exp(-i\omega t)\,d\omega \\
&= \{\text{denote } \omega^2\varepsilon(\omega)/c^2 \equiv \omega^2 n_0^2(\omega)/c^2 \equiv k^2(\omega)\} \\
&= -\frac{1}{2}\sum_{\omega_\sigma \geq 0}\int_{-\infty}^{\infty} k^2(\omega)\left[\mathbf{E}_{\omega_\sigma}(\mathbf{r},\omega-\omega_\sigma)+\mathbf{E}^*_{\omega_\sigma}(\mathbf{r},-\omega-\omega_\sigma)\right]\exp(-i\omega t)\,d\omega. \\
&= -\frac{1}{2}\sum_{\omega_\sigma \geq 0}\int_{-\infty}^{\infty} k^2(\omega)\mathbf{E}_{\omega_\sigma}(\mathbf{r},\omega-\omega_\sigma)\exp(-i\omega t)\,d\omega + \text{c. c.}
\end{aligned}
$$

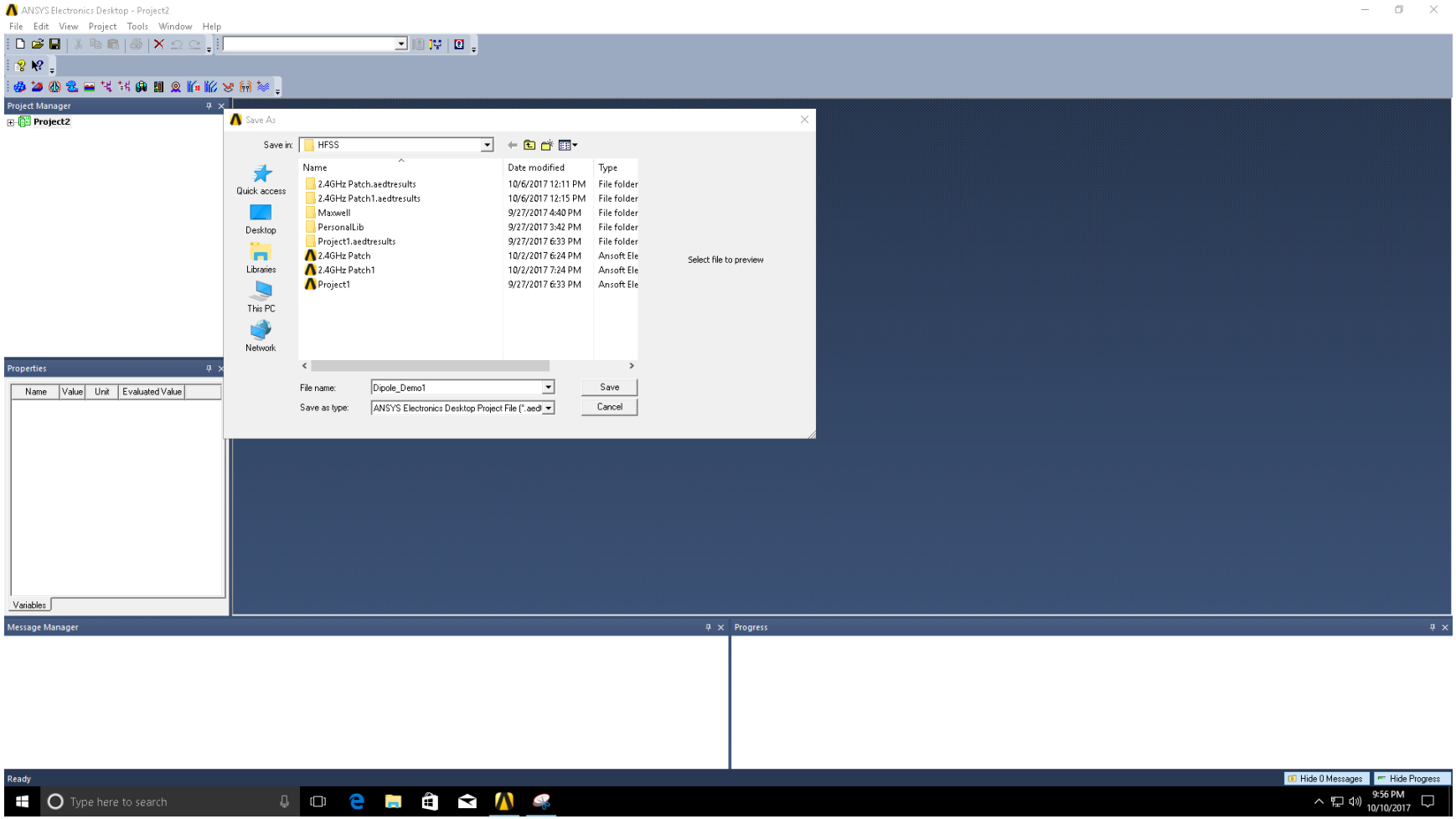


ANSYS Electronics Desktop

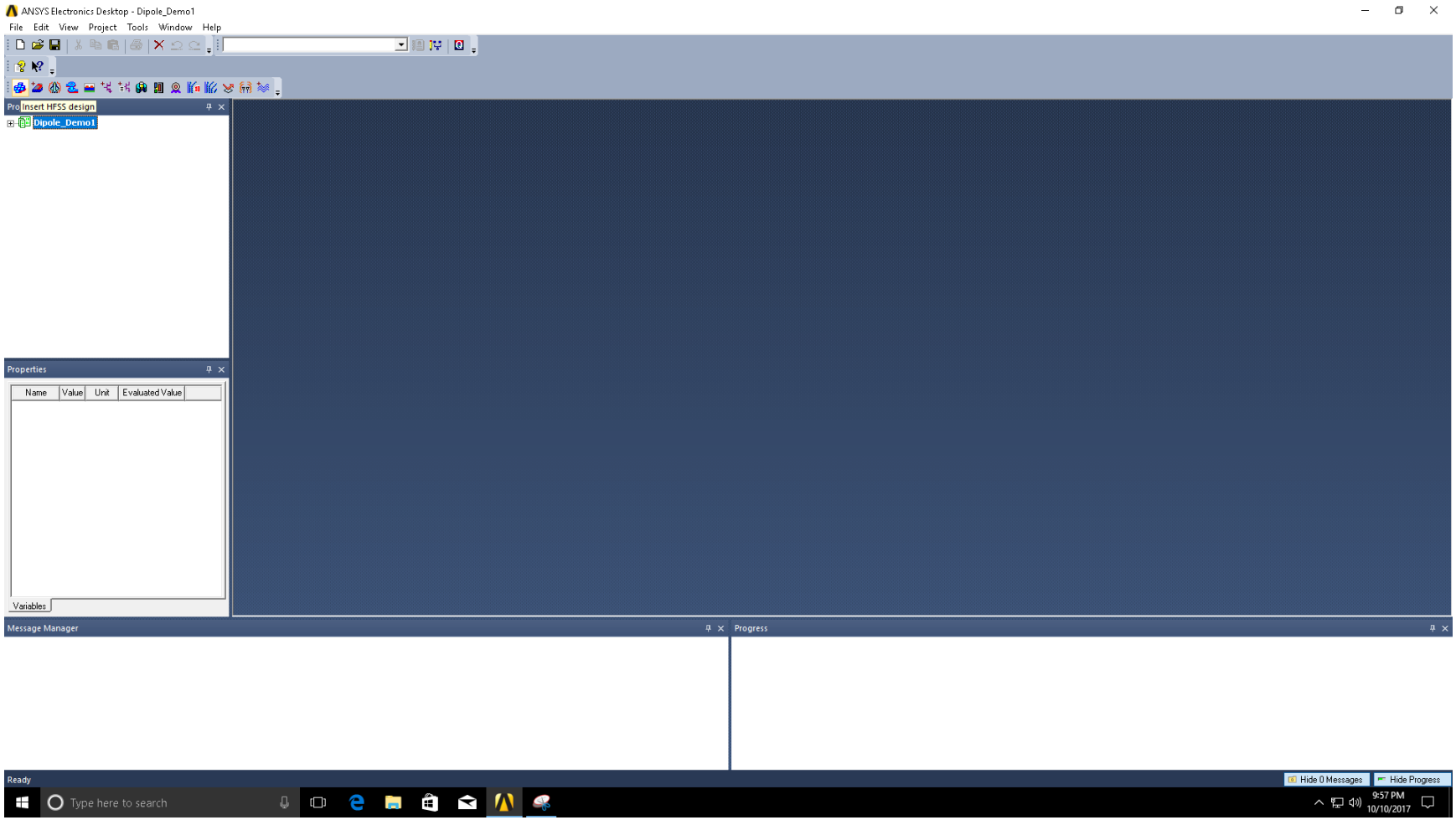
ANSYS Electronics User Interface



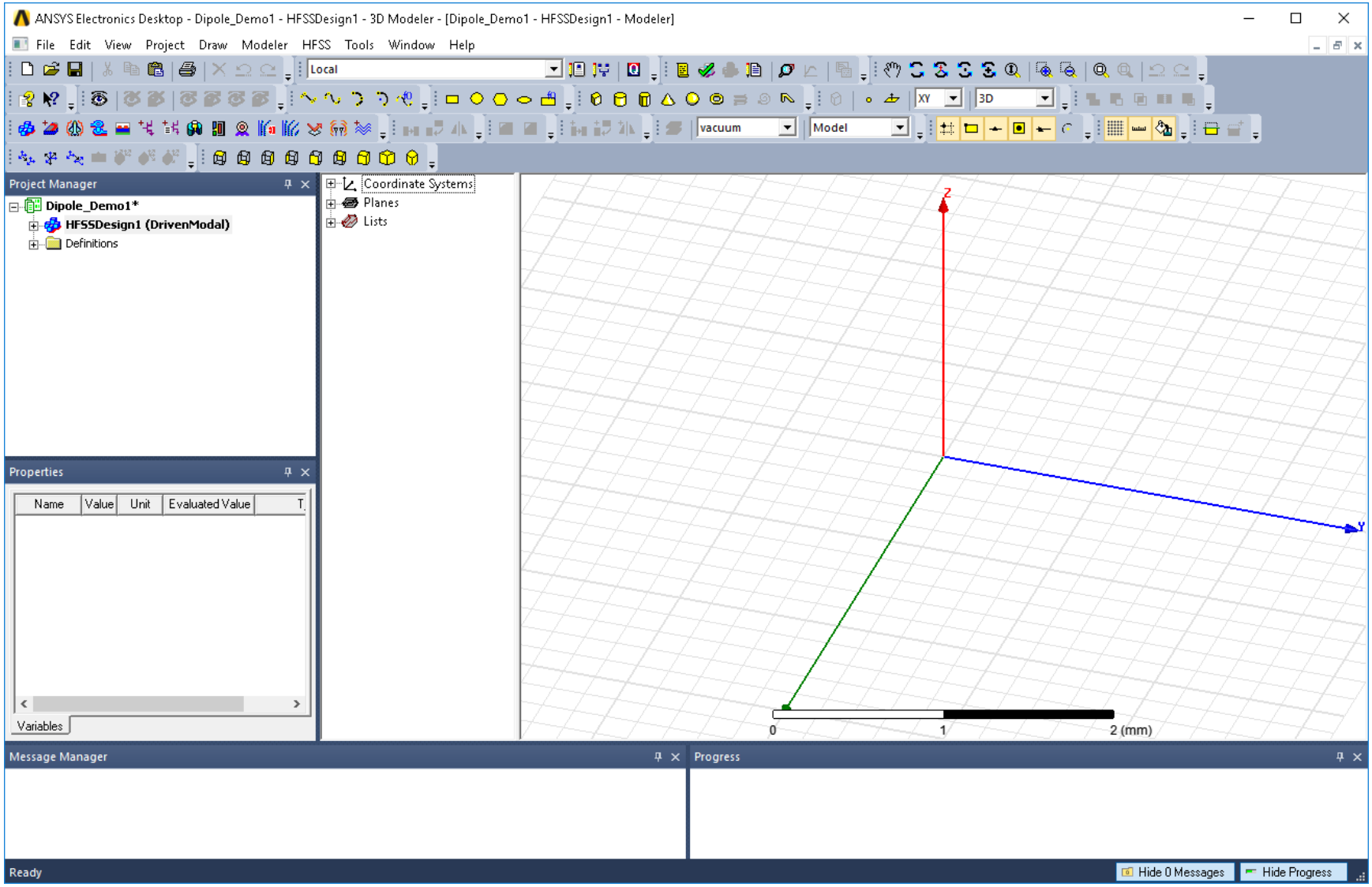
Save As Dipole_Demo1



Insert HFSS Design



HFSS Modeler



Solution Type Selection : HFSS > Solution Type

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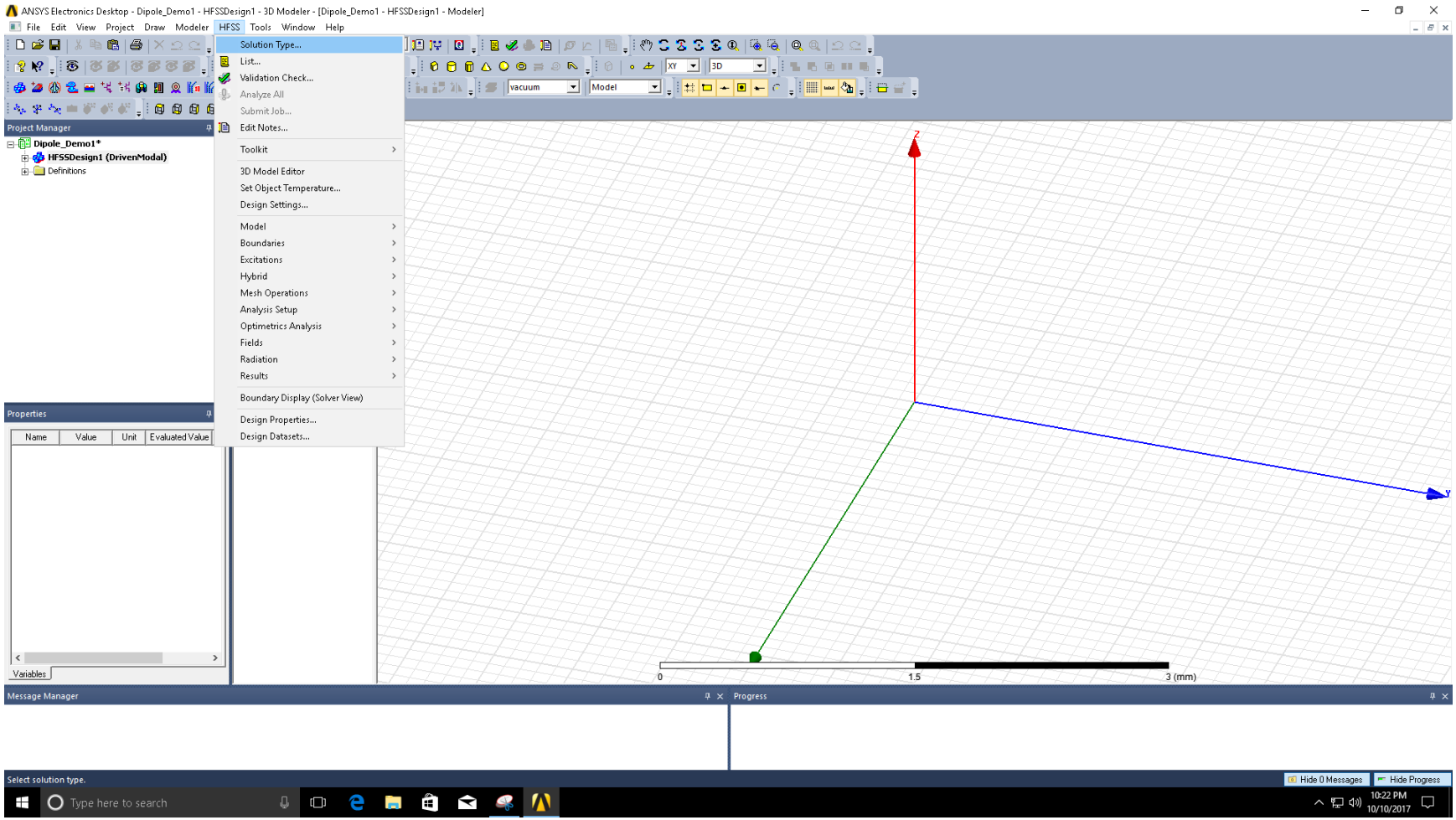
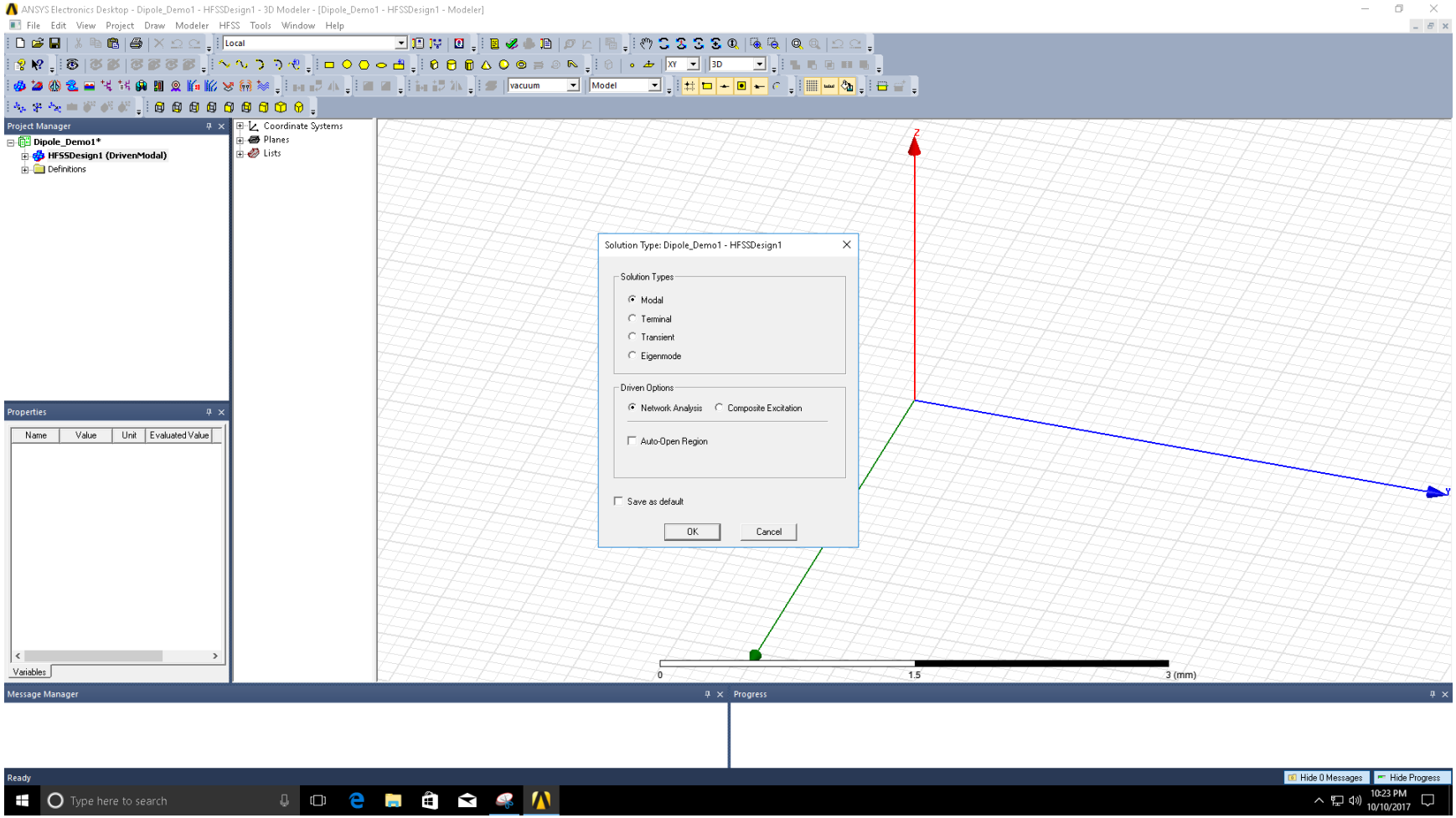
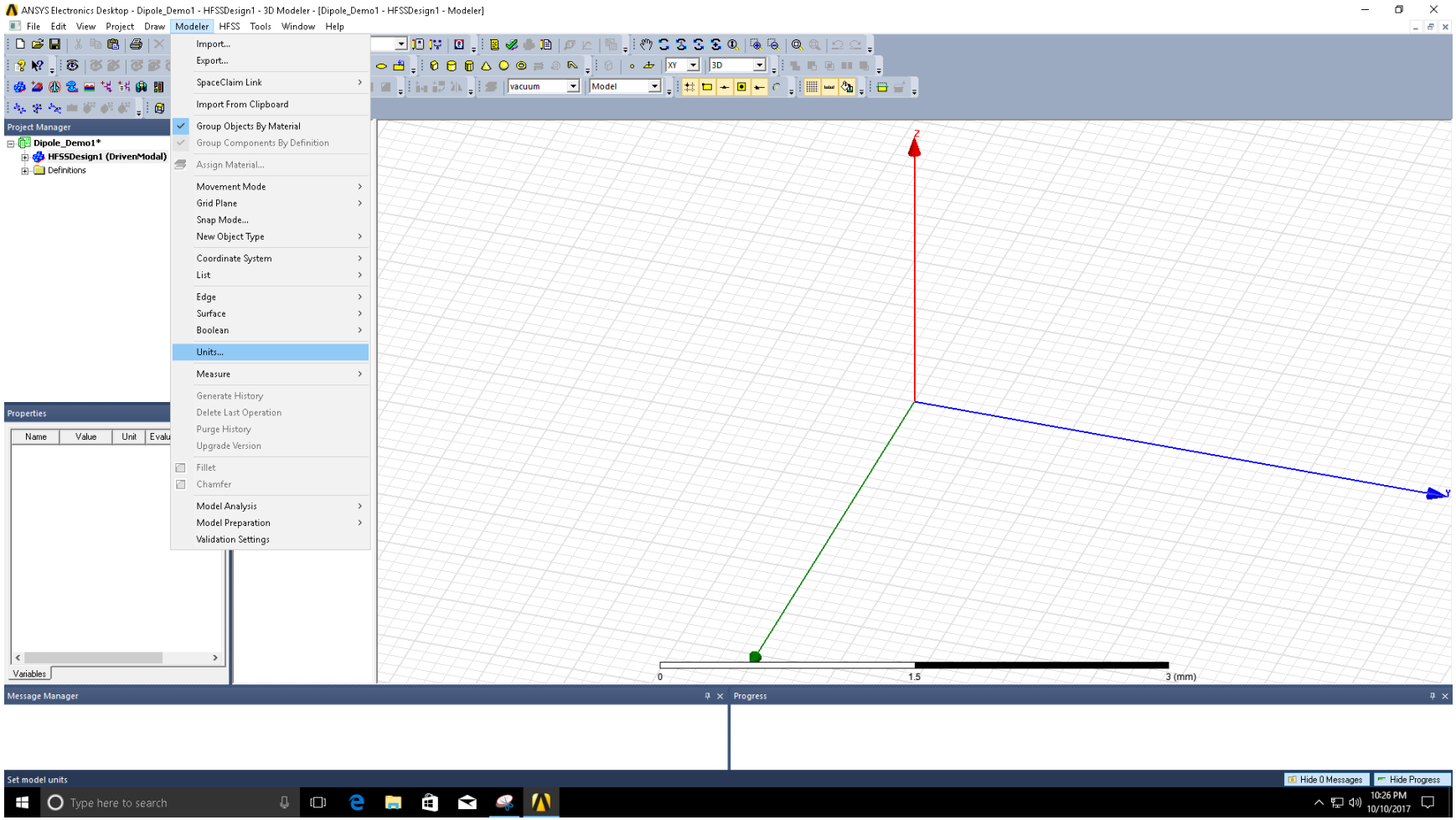


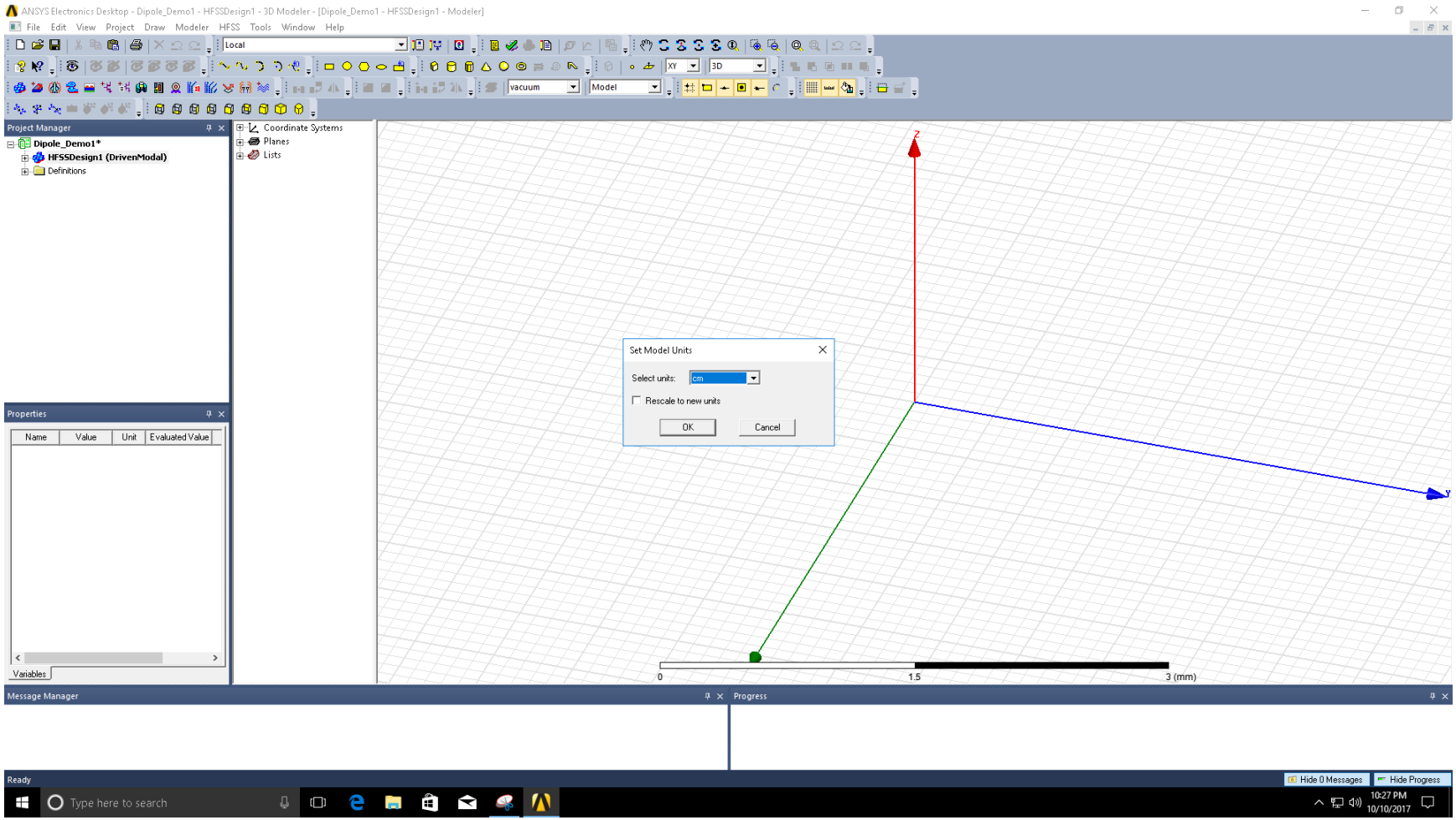
Select Modal > Press OK



Select Model Unit: Modeler>Units



Select Model Unit: Modeler>Units>cm>ok



Set Dialog Data Entry Mode

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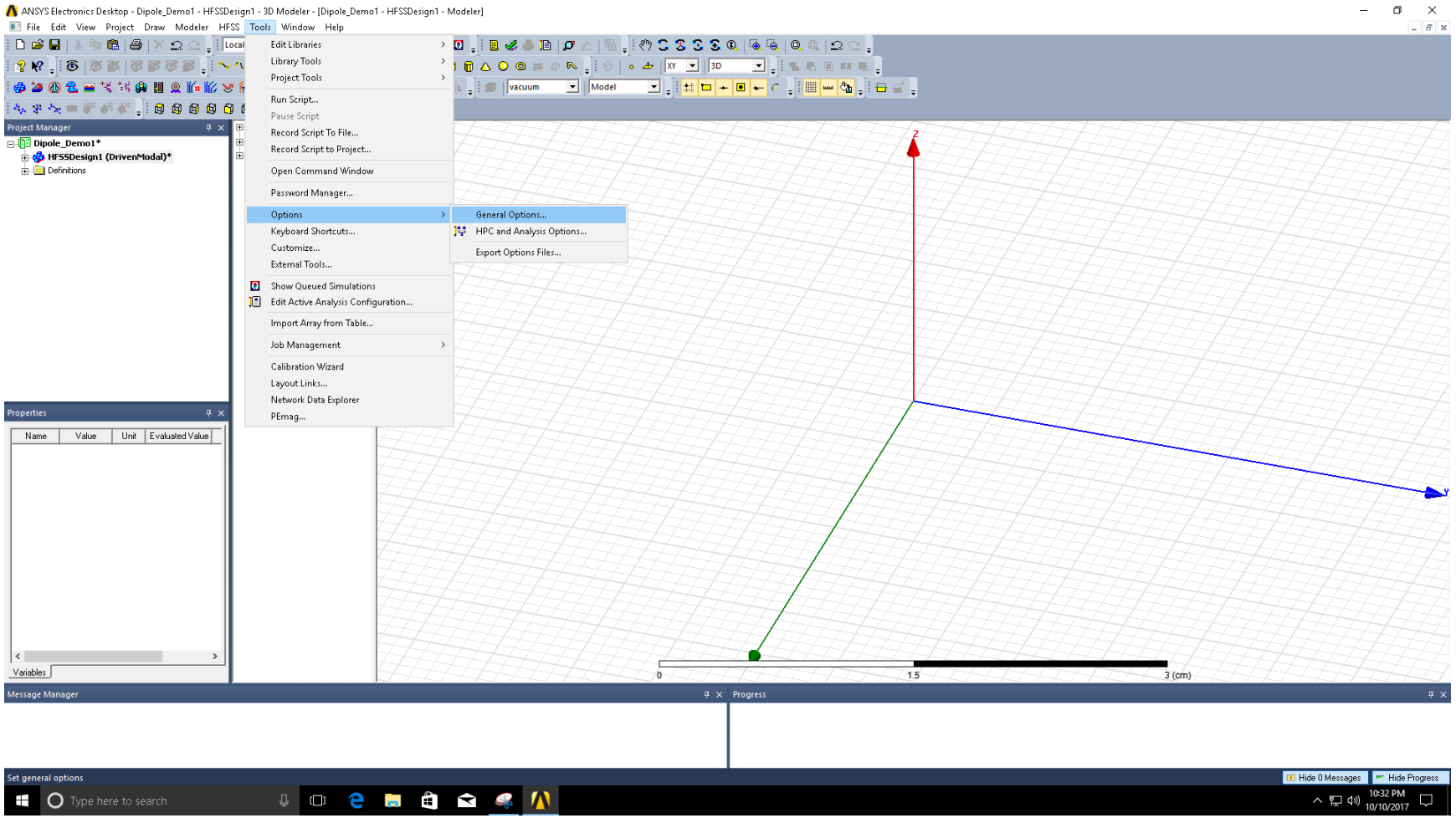
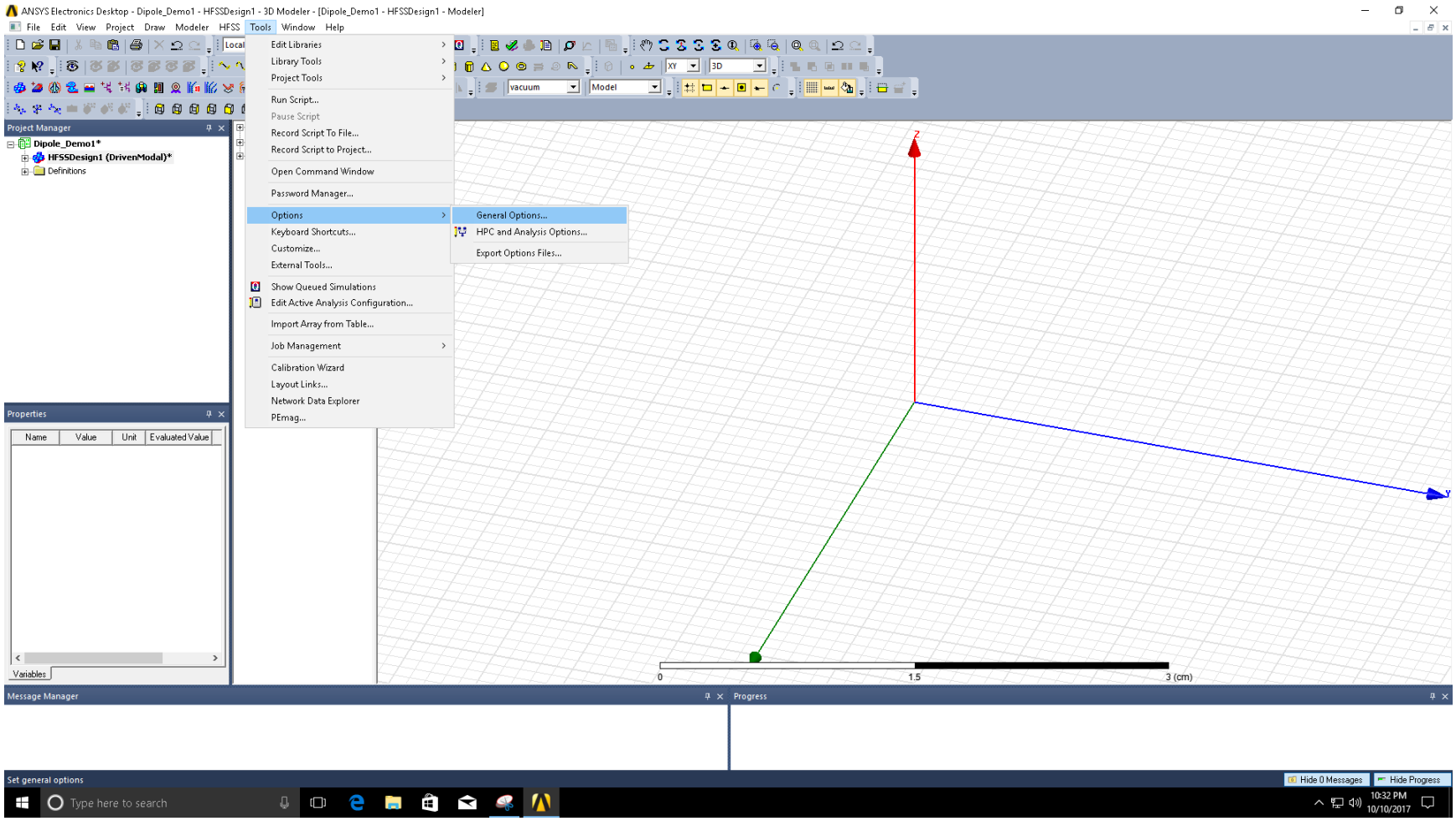
Tools > Options > General Options



Set Dialog Data Entry Mode

The University of Texas ARLINGTON

Tools > Options > General Options



Set Dialog Data Entry Mode

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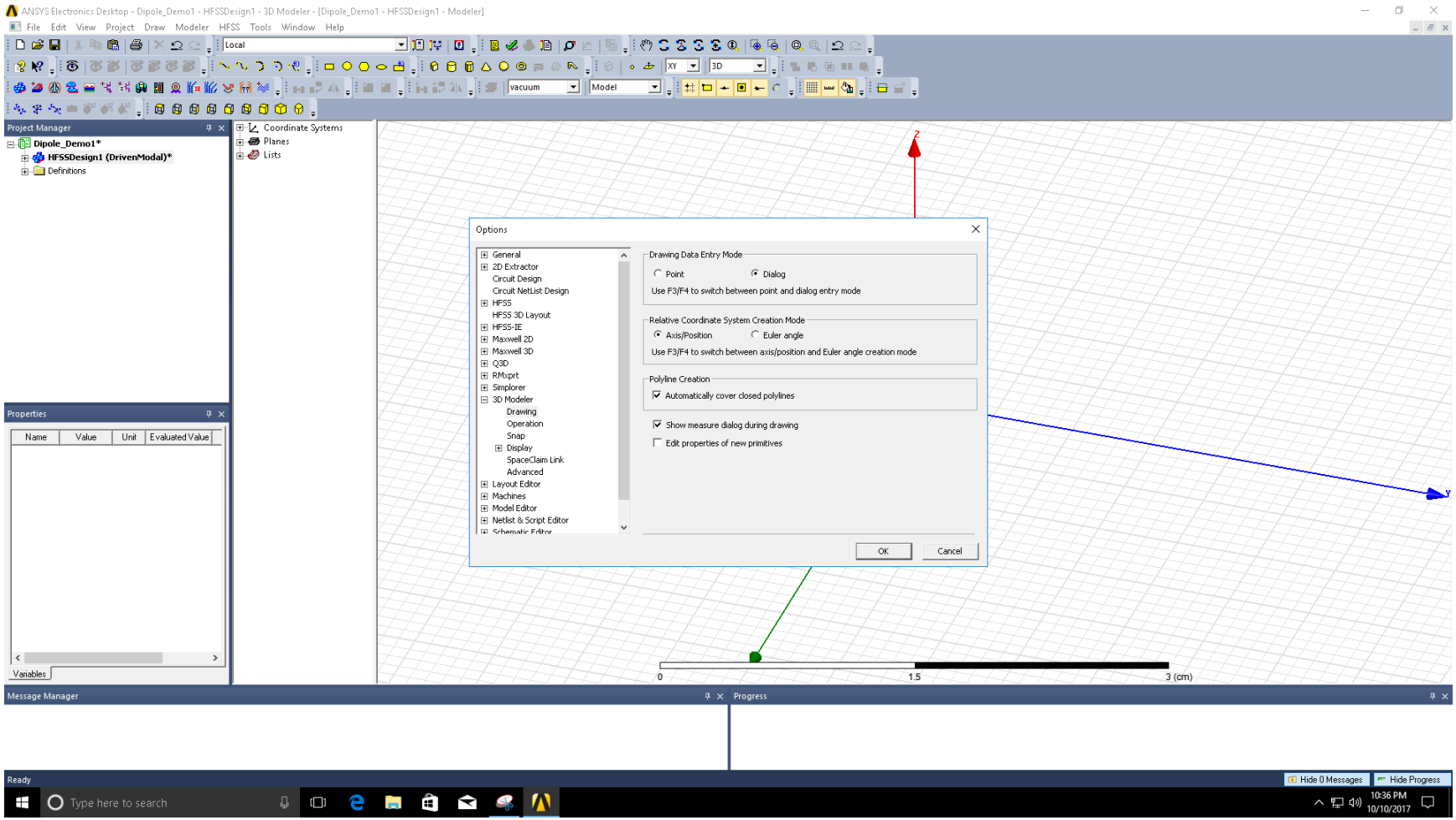
3D Modeler > Drawing > Dialog



Set Default Transparency to 0.7

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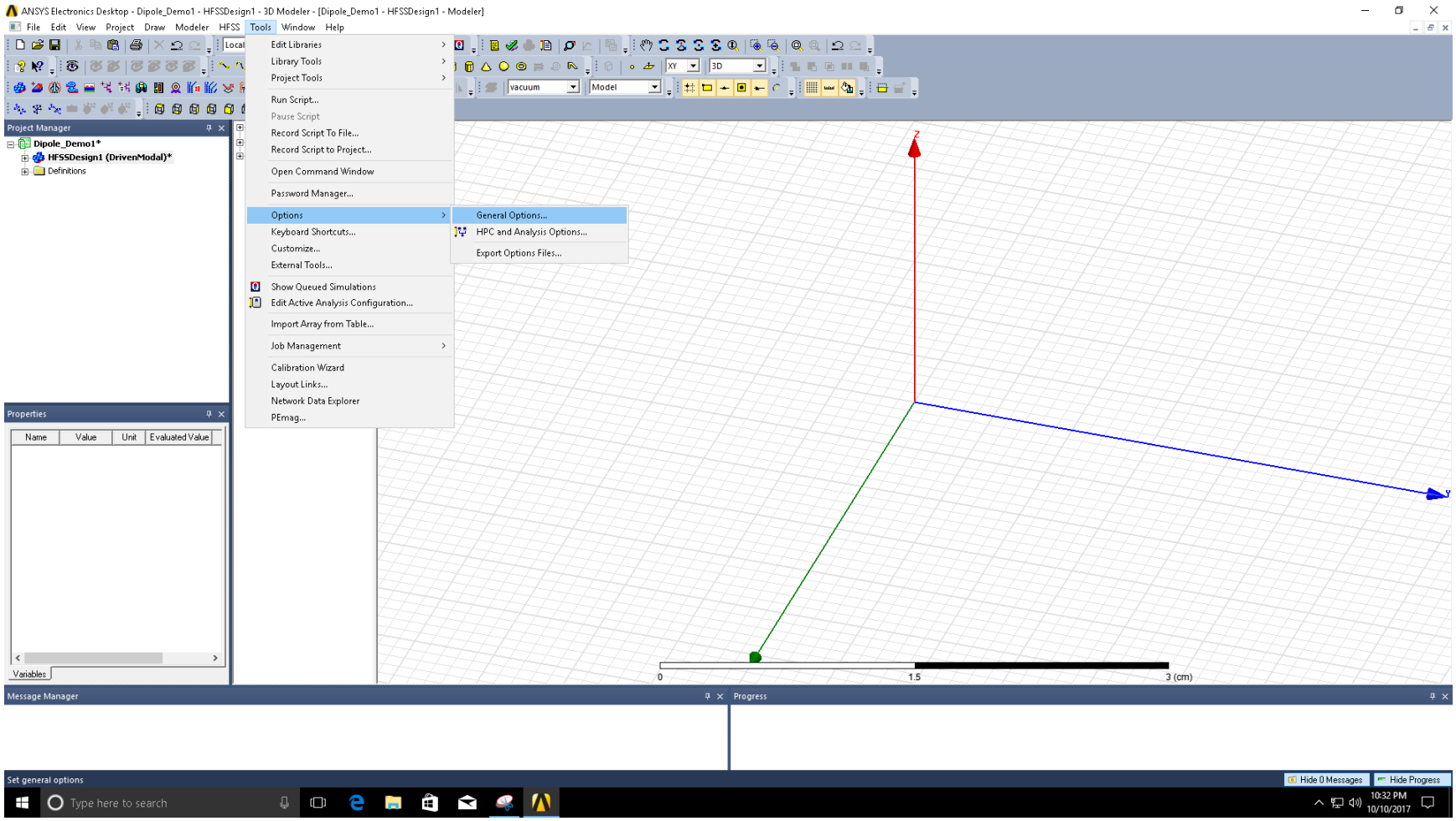
Tools > Options > General Options



Set Default Transparency to 0.7

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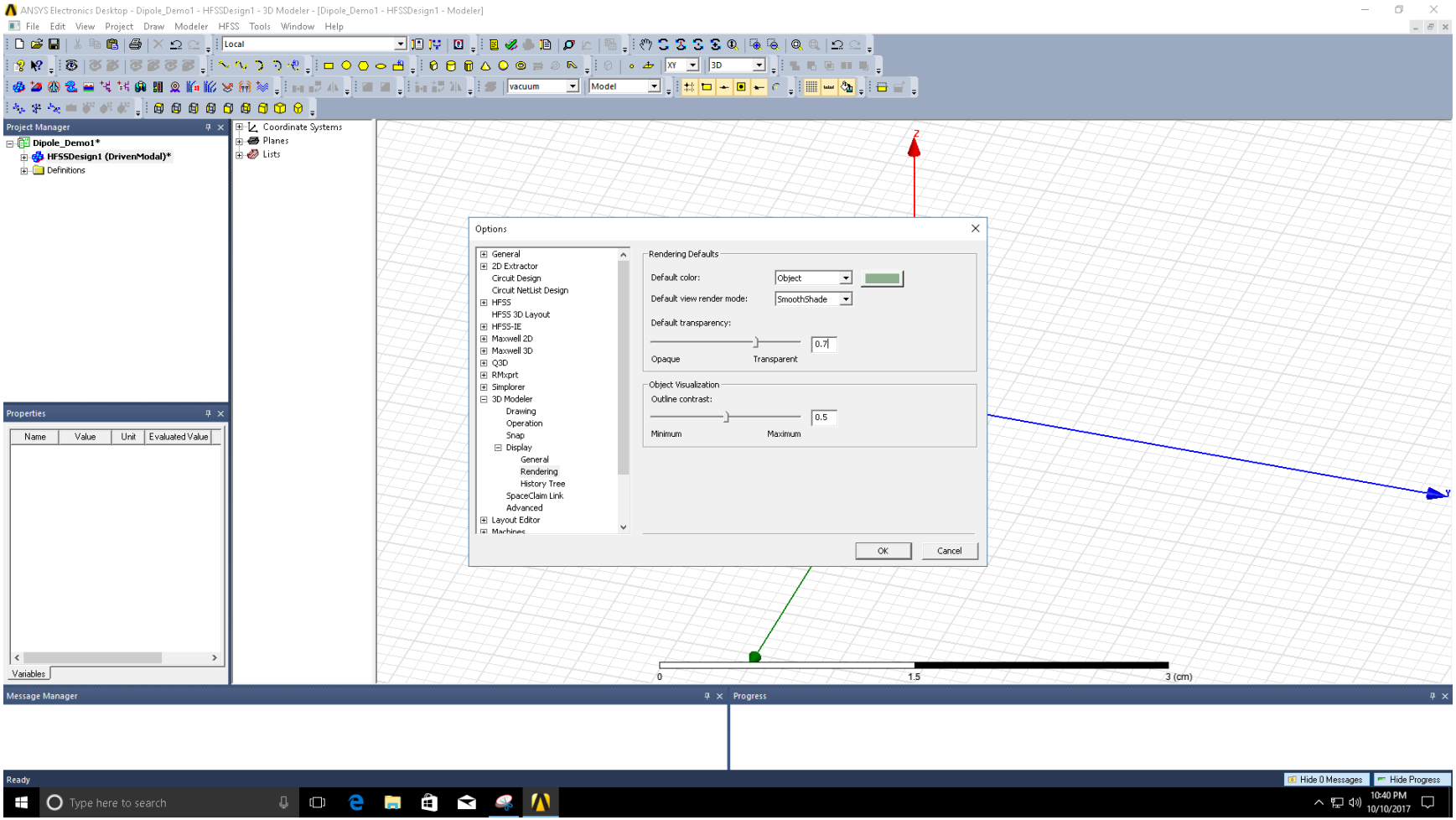
3D Modeler > Display > Rendering



Drawing 3D Model

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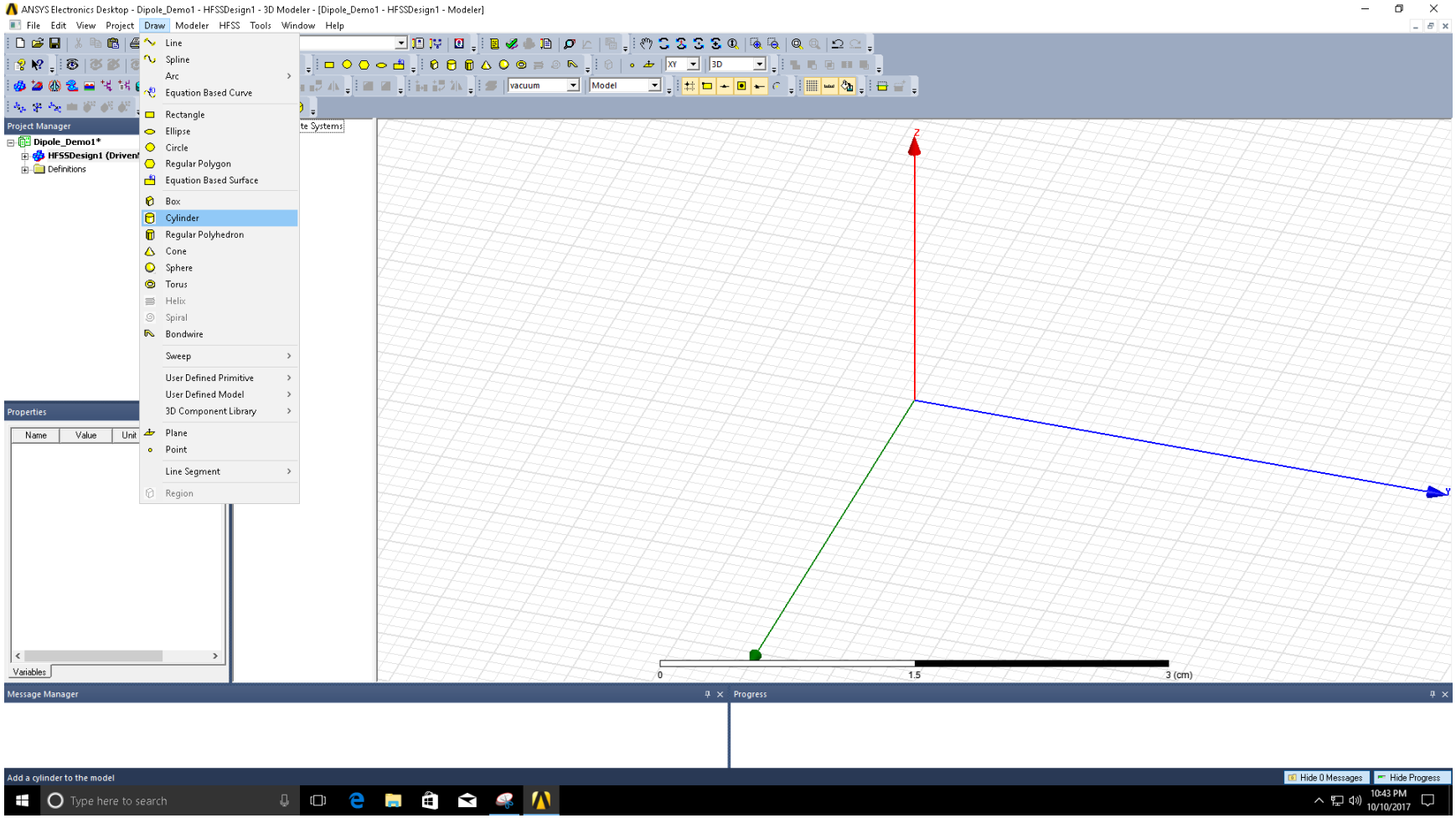
Draw > Cylinder



Drawing 3D Model

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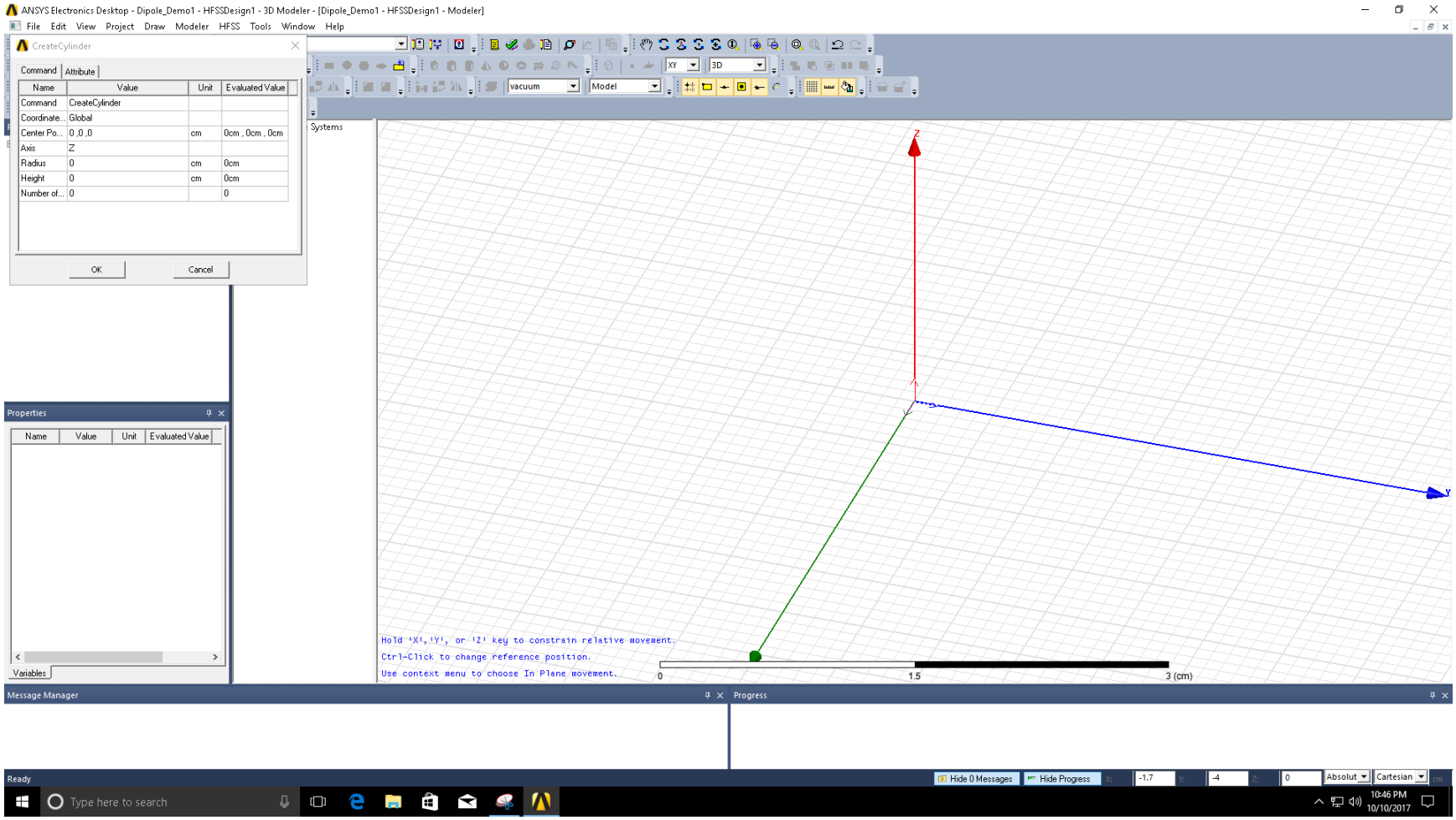
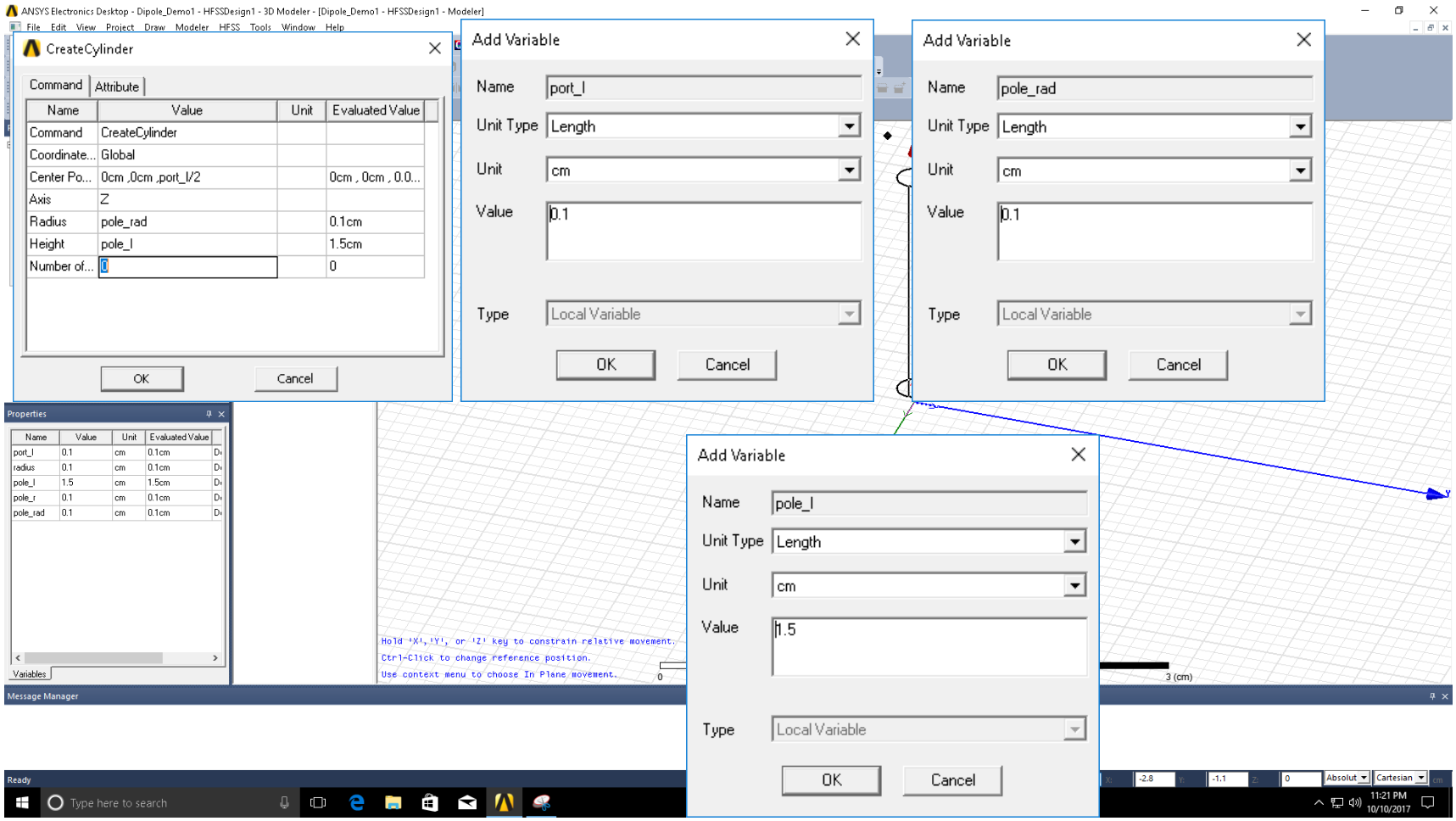
Create Cylinder Dialog Box Opens



Drawing 3D Model

Create Variables



Drawing 3D Model

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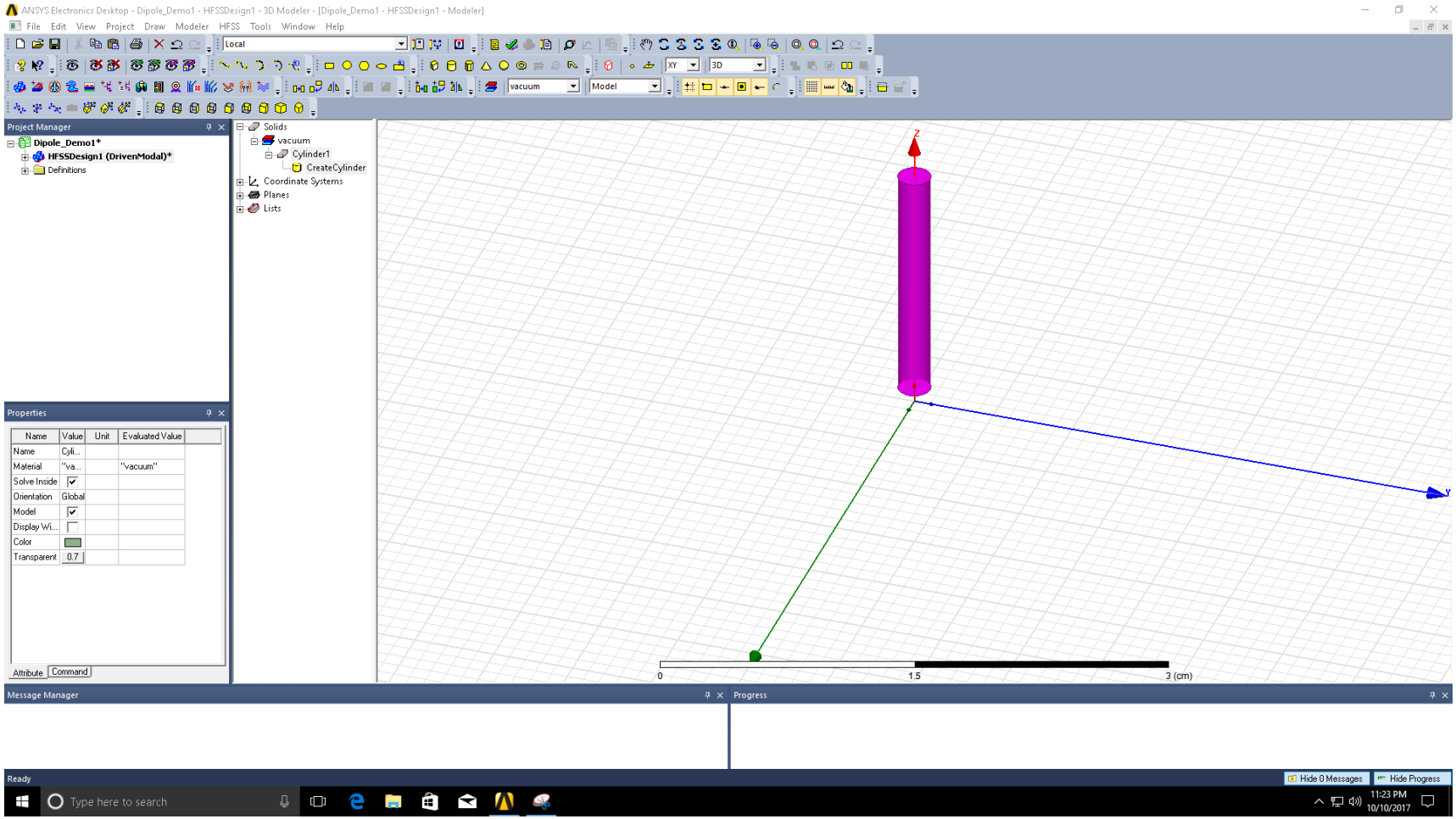
Cylinder1 Created



Drawing 3D Model

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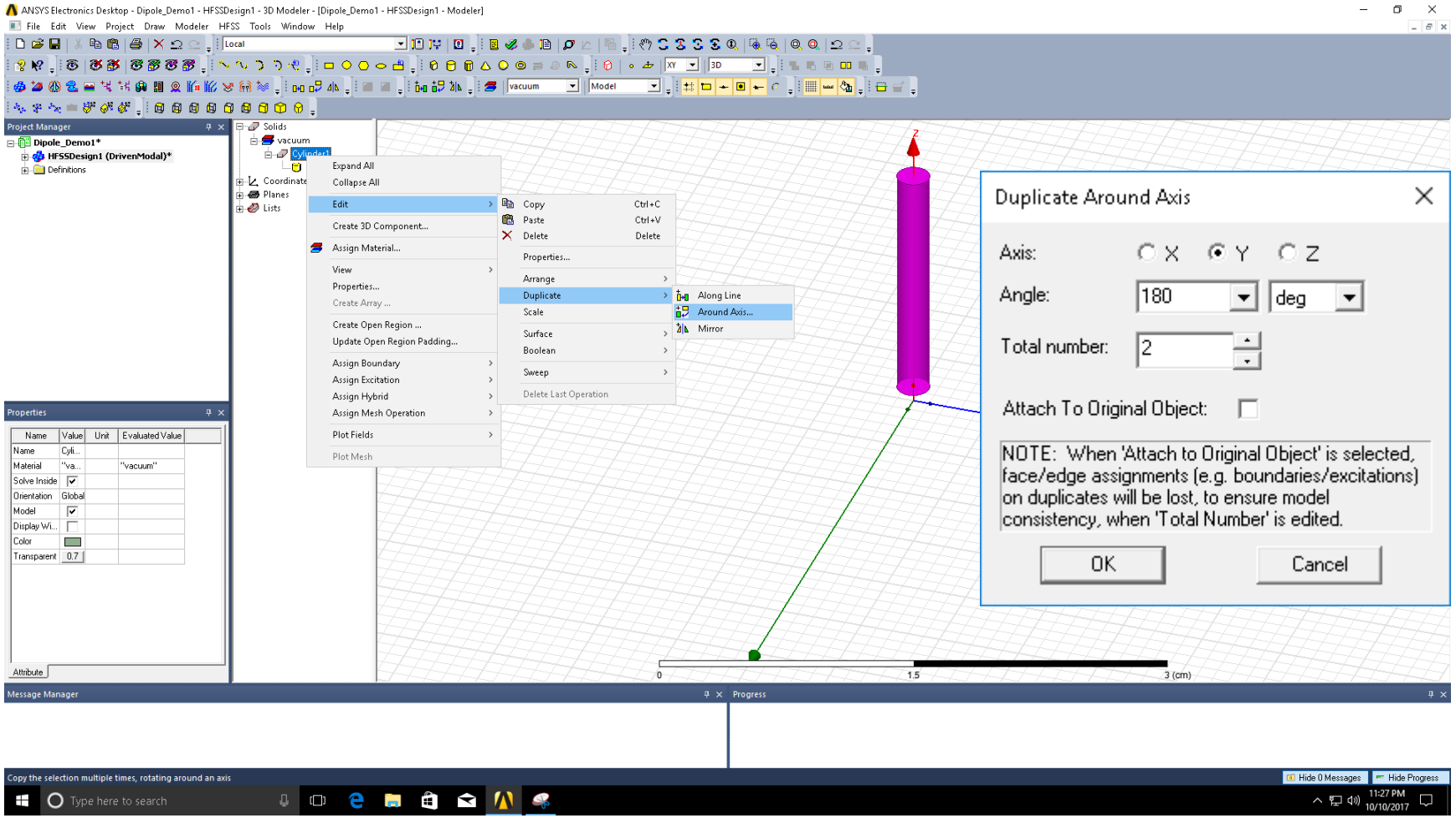
Duplicate Cylinder 1 to create second pole

Cylineder1 >(right click) Edit > Duplicate > Around Axis



Drawing 3D Model

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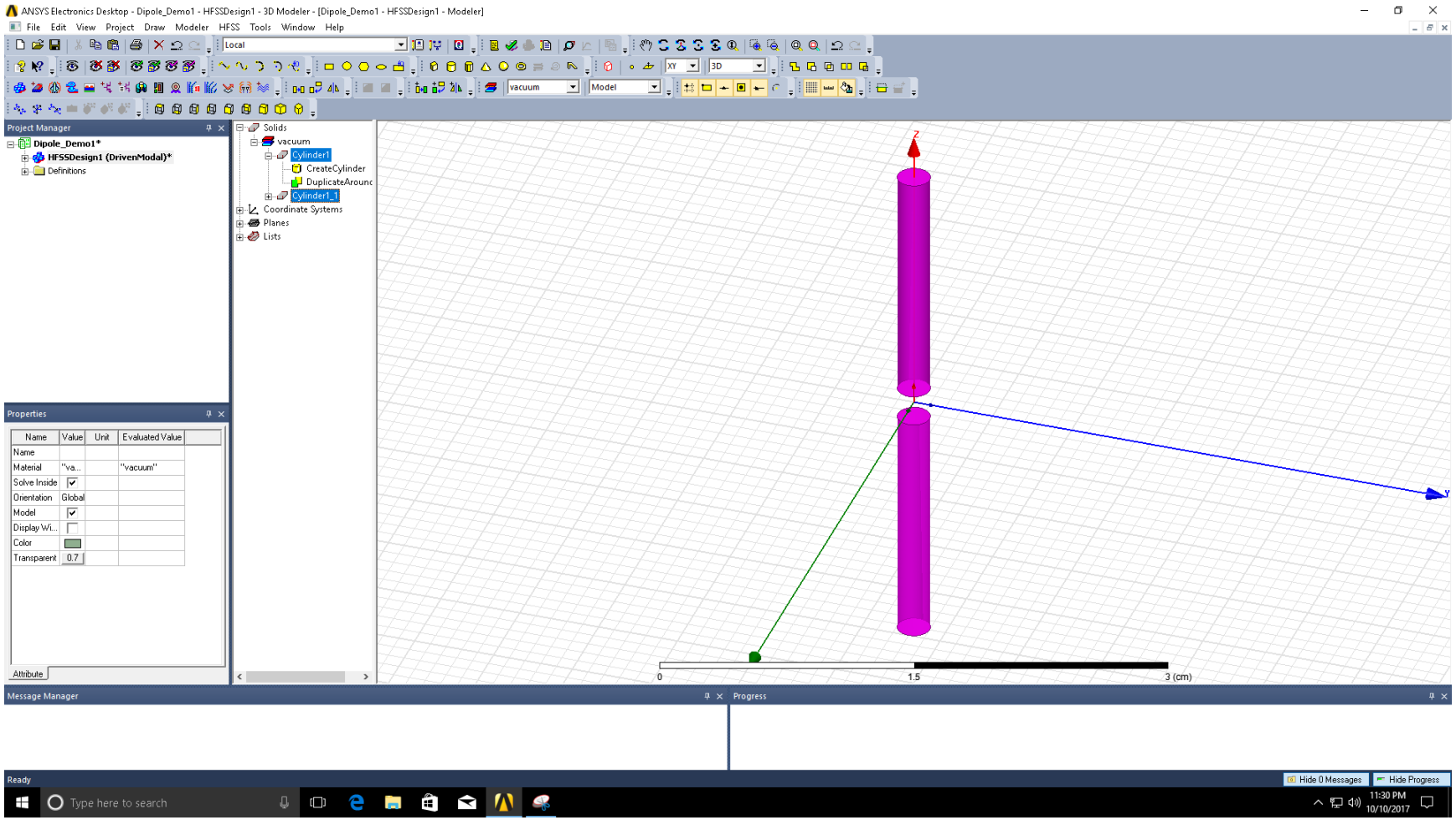
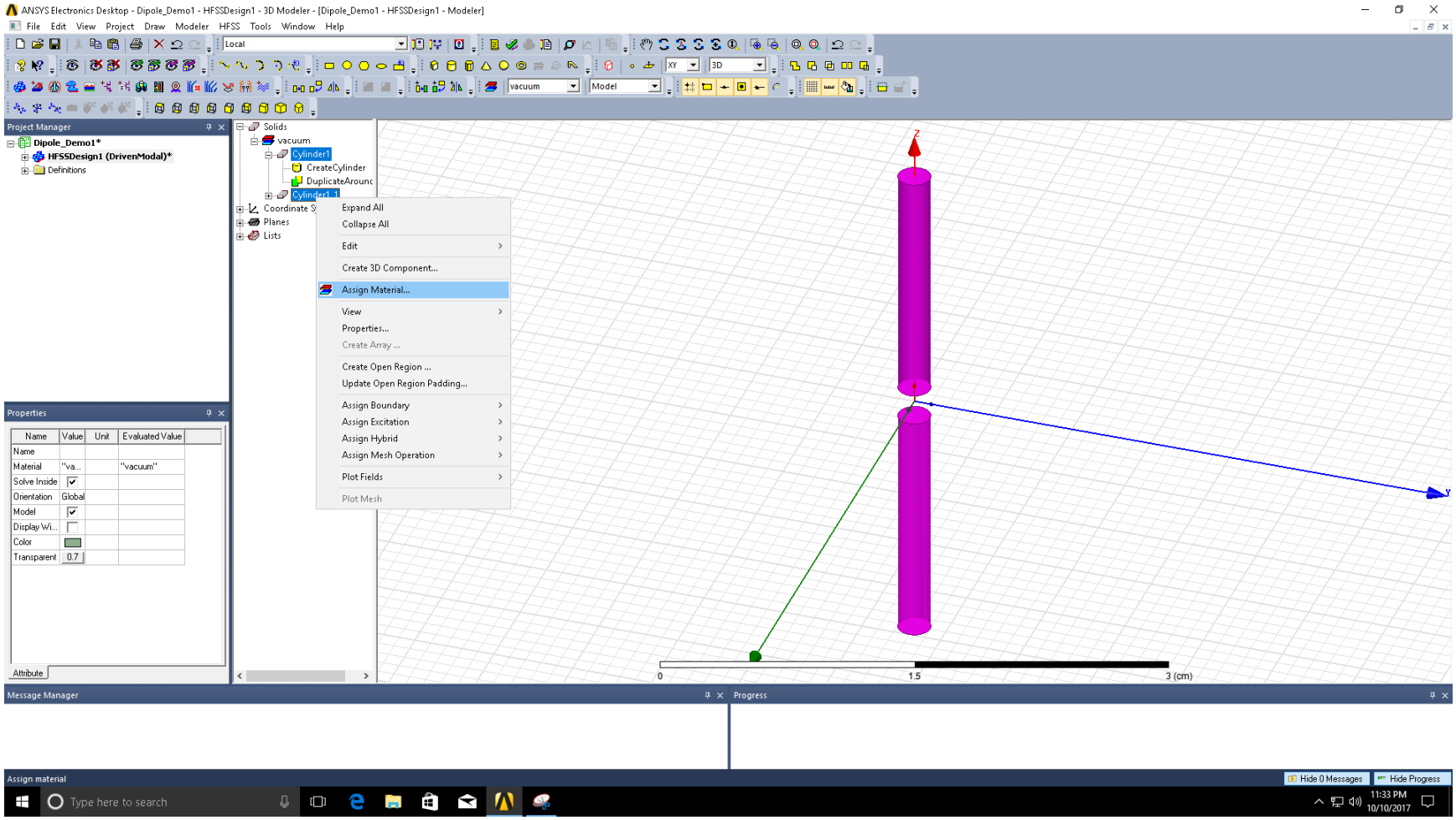
Cylinder1_1 created



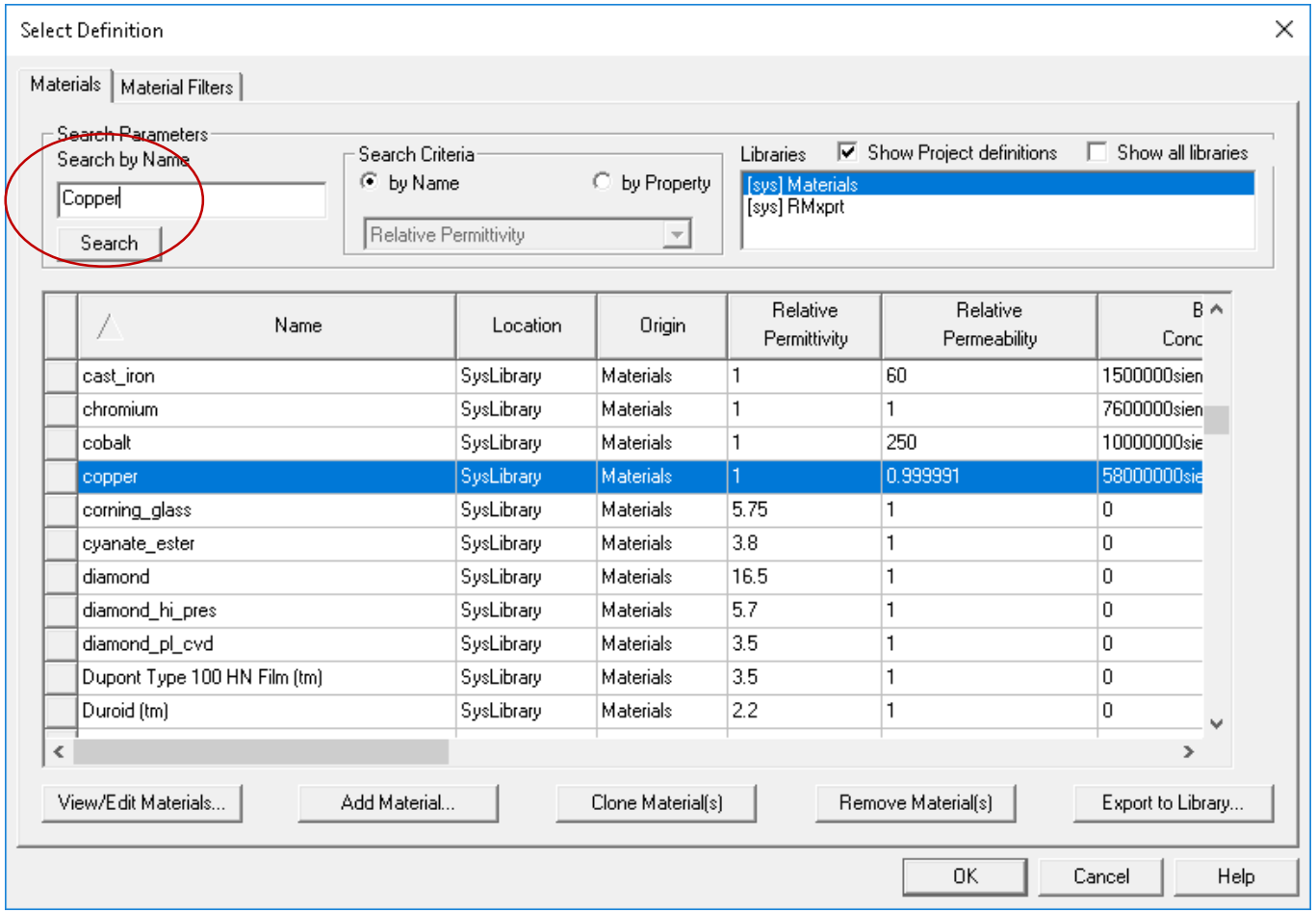
Assigning Materials

Select Cylinder1 and Cylinder1_1 > (Right Click) > Assign Materials



Assigning Materials

Search Copper > Select > OK



Create Port

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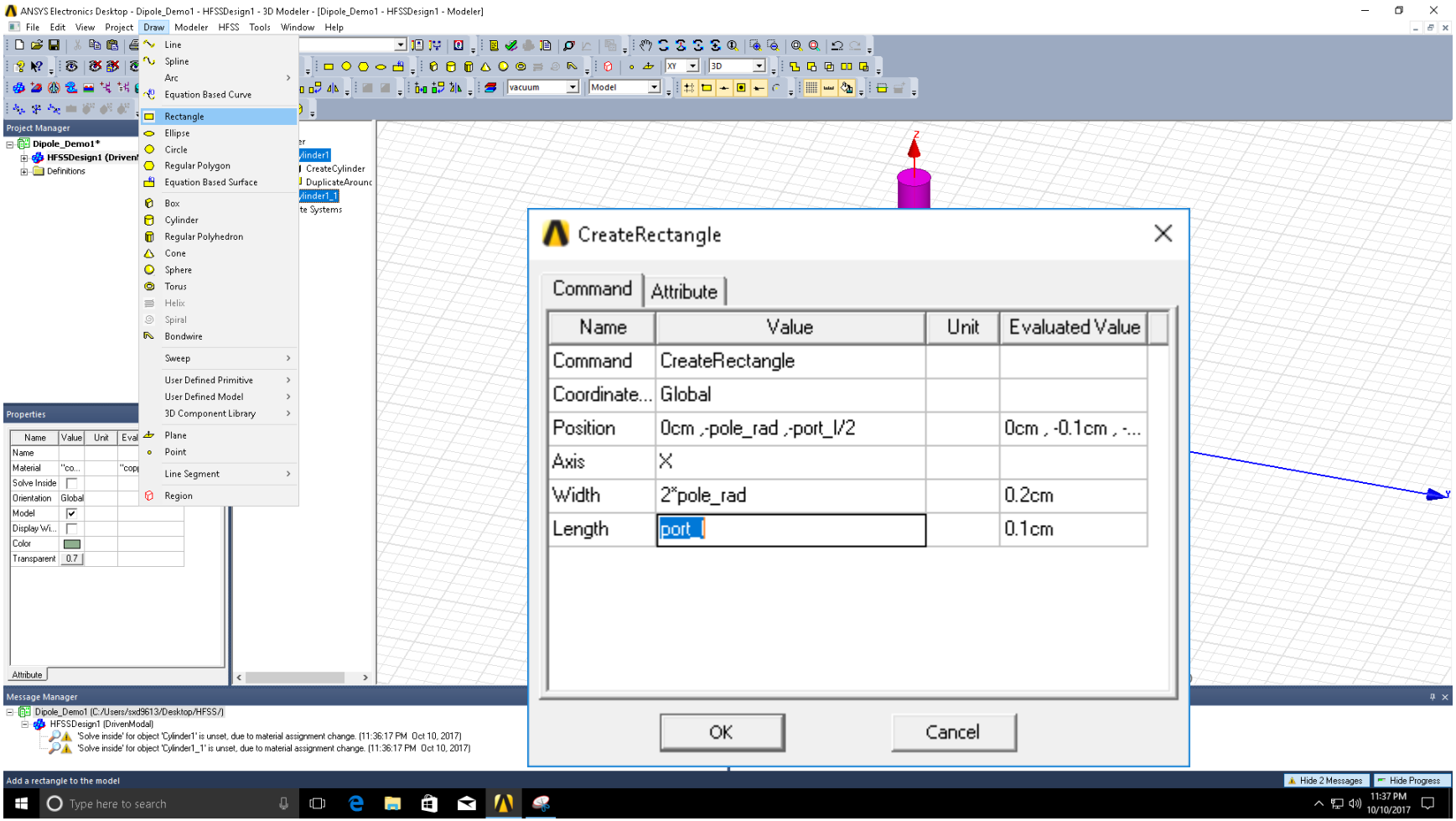
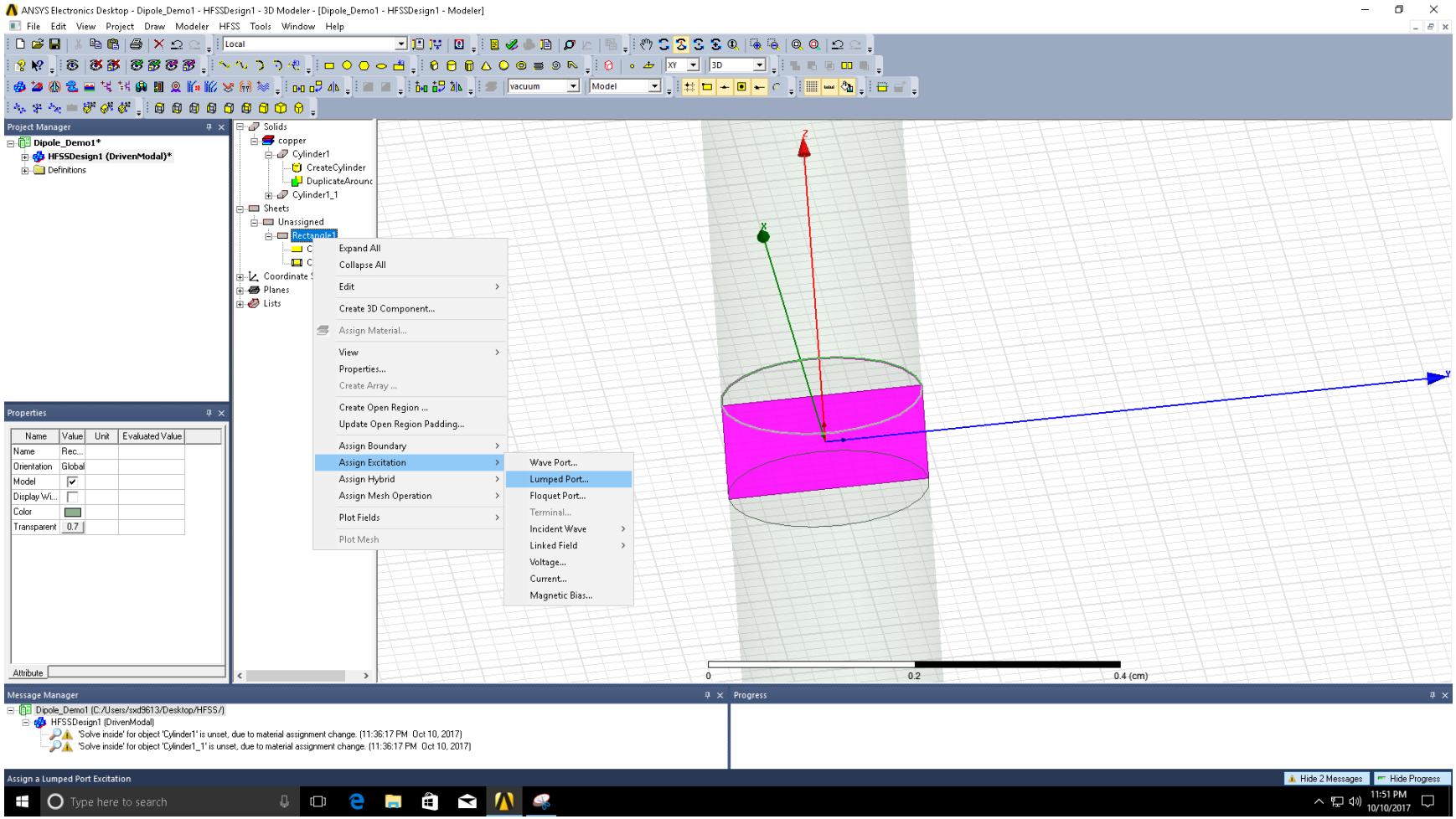
Draw > Rectangle > OK



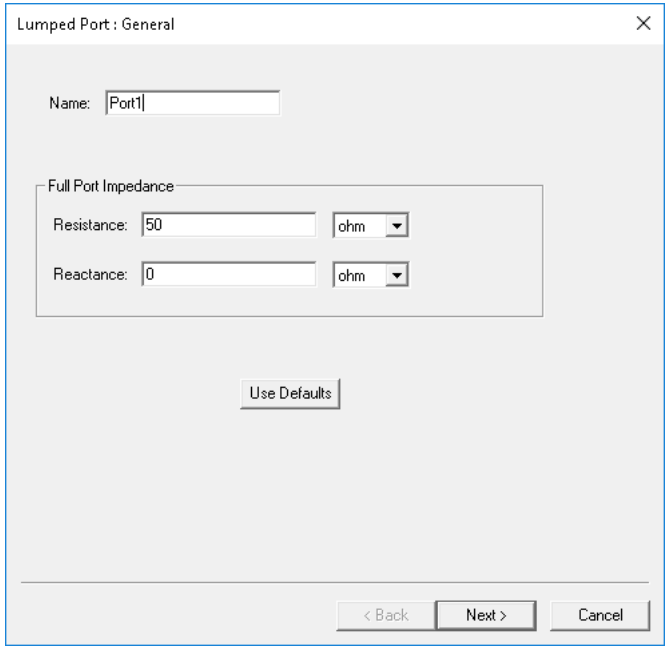
Create Port

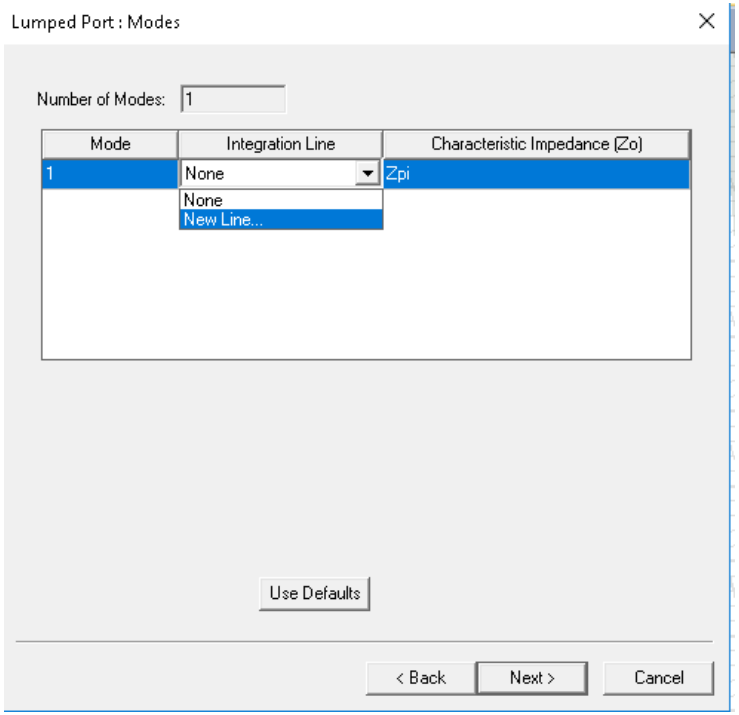
Select Rectangle1 > (right click) > Assign Excitation > Lumped Port



Create Port

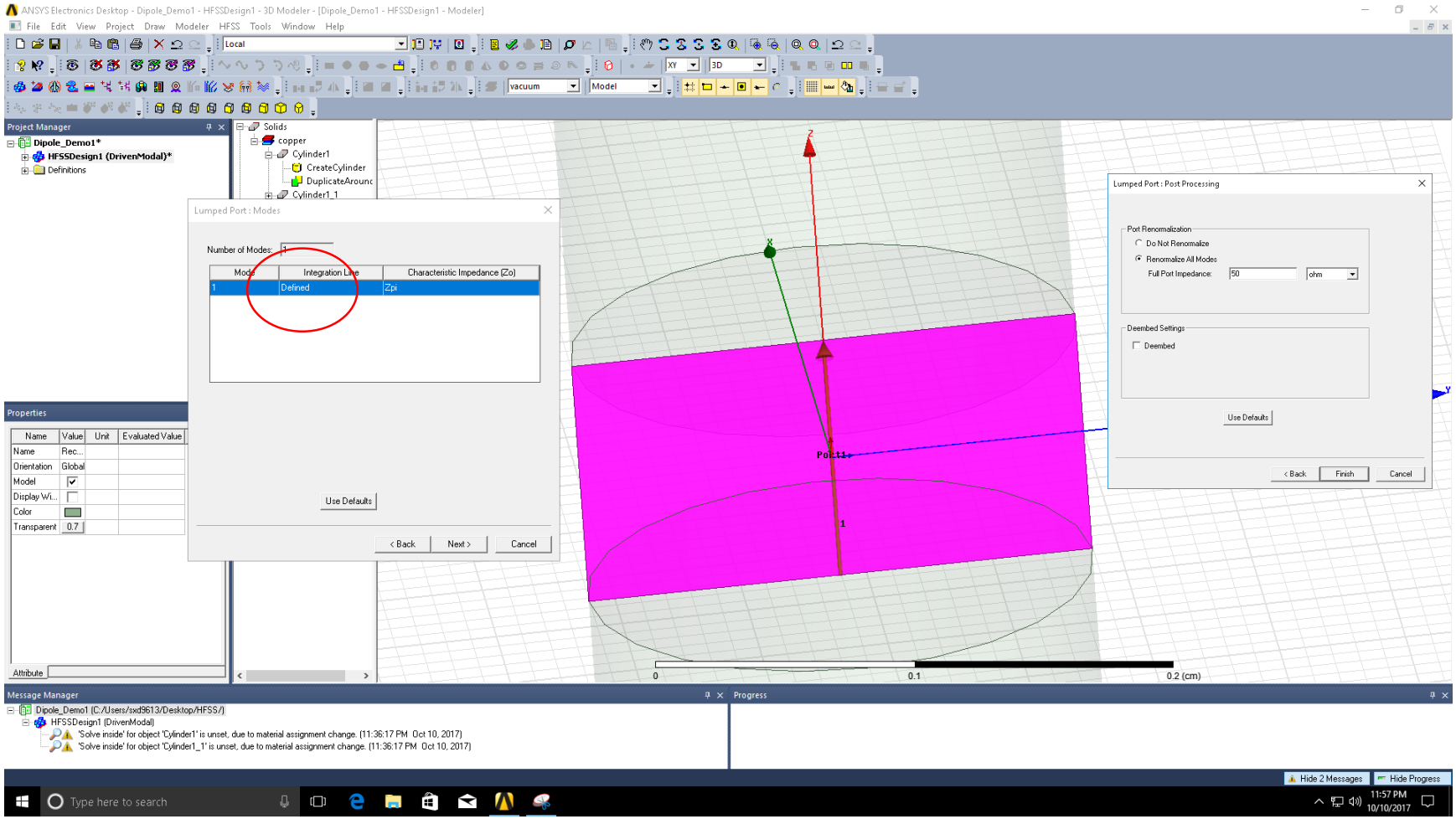
Give Name Port1 > Next > Integration Line > New Line





Create Port

Draw New Integration line along the center of the port between antenna arms > Next > Renormalize all modes to 50 Ohm > Finish



Create Port

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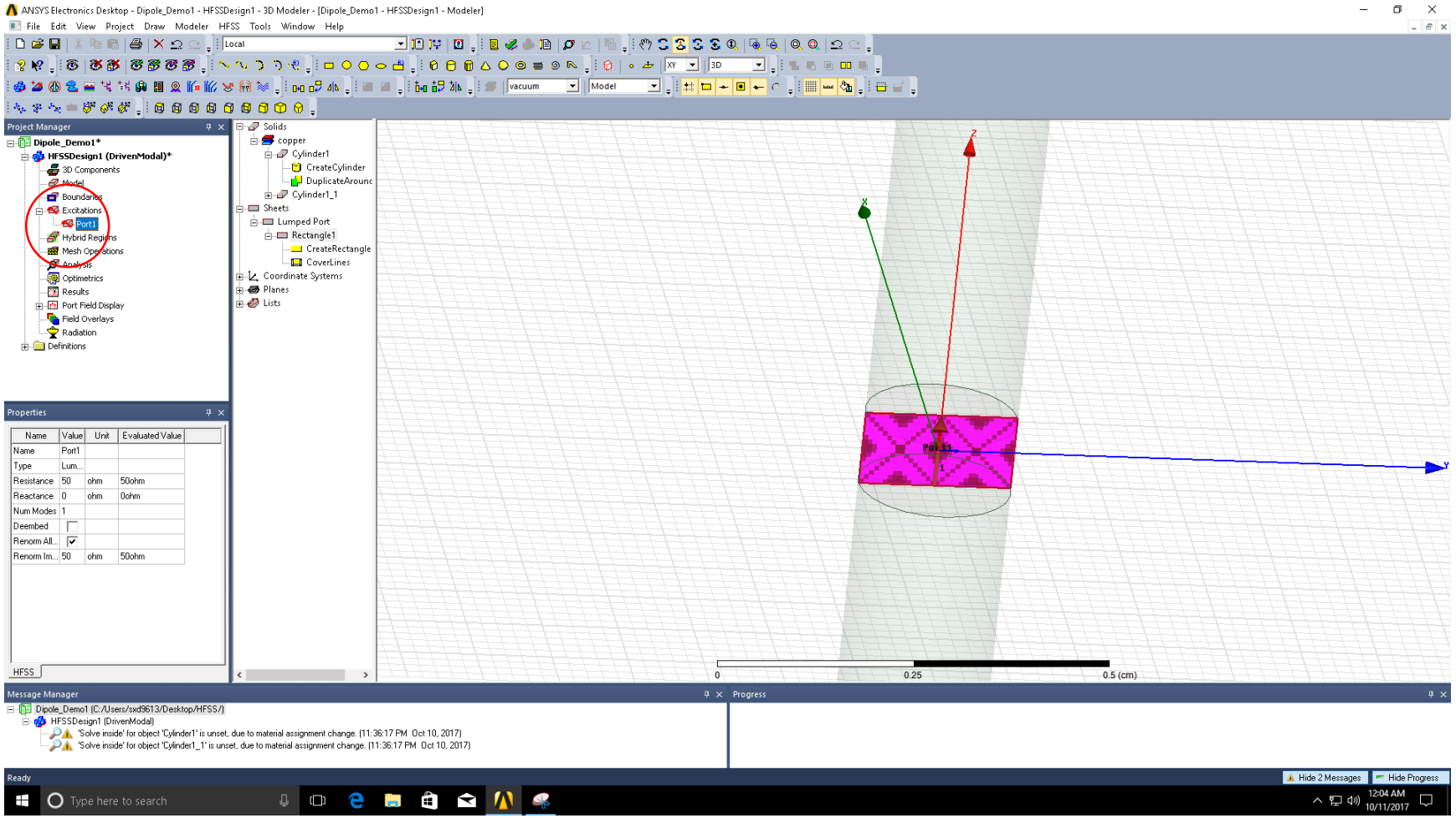
Port assignment should look like this



Create Radiation Boundary

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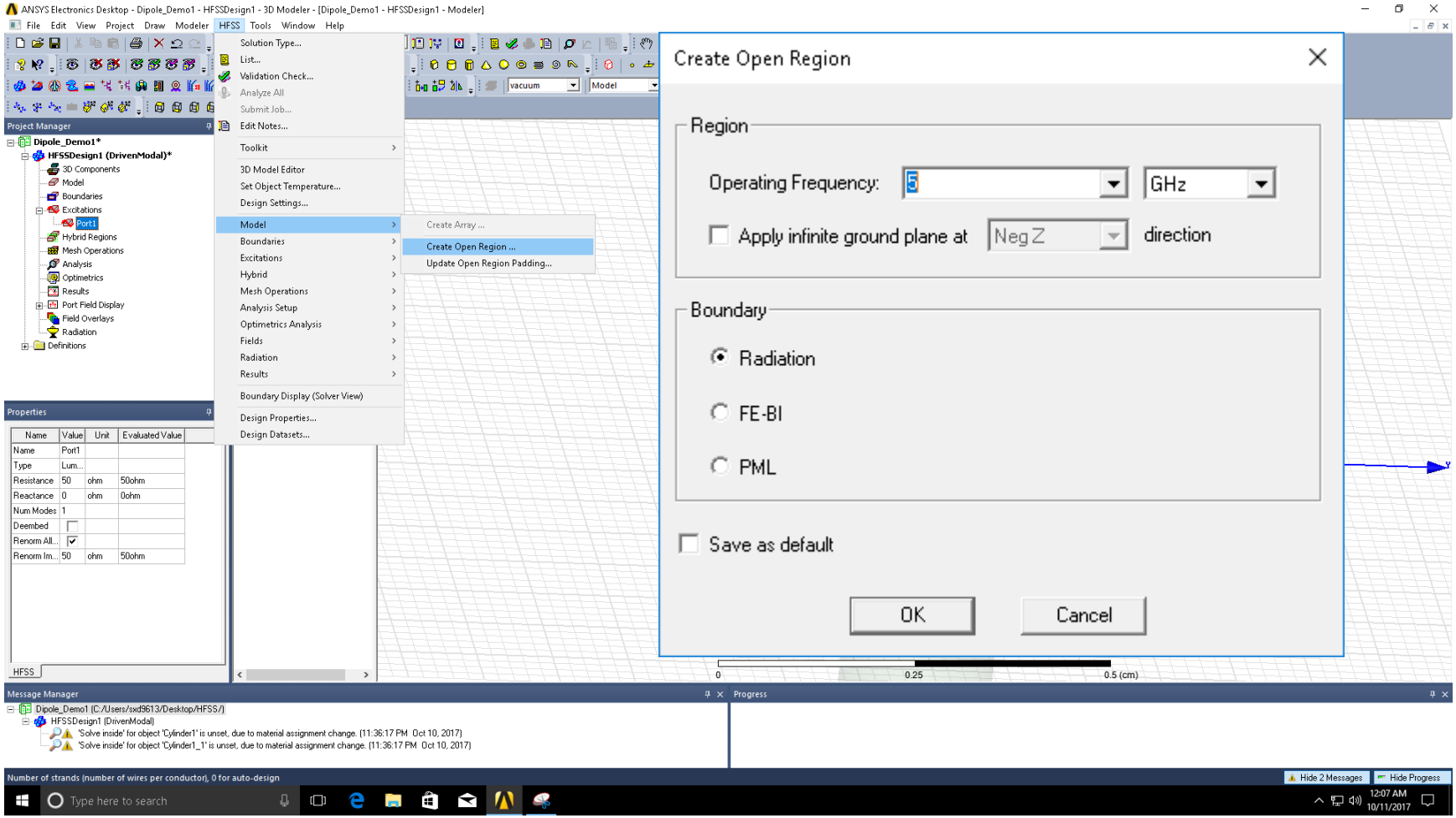
HFSS > Model > Create Open Region

Enter Operation Frequency and select radiation boundary



Create Radiation Boundary

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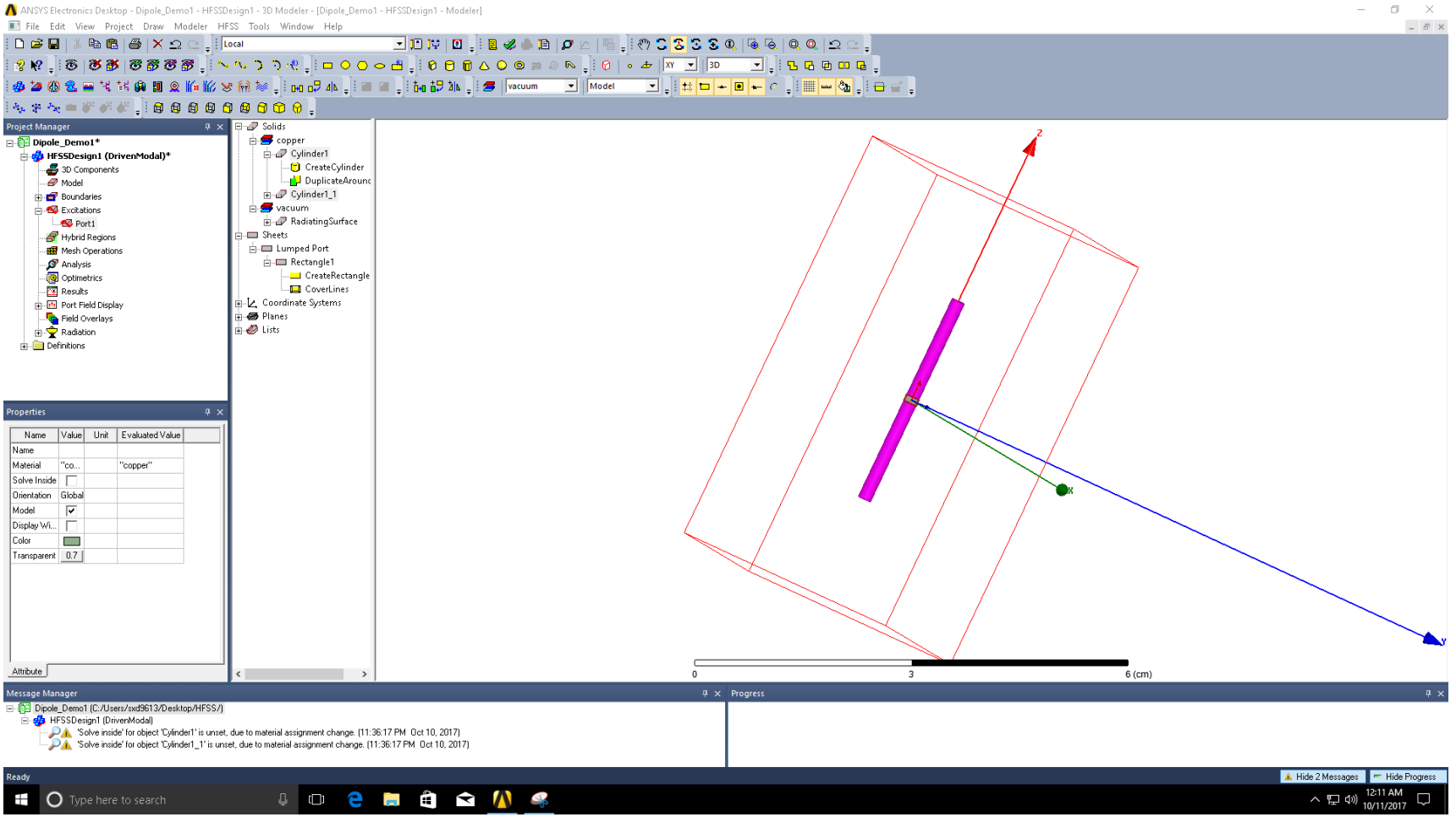
Vacuum Radiating Surface Created



Solution Setup

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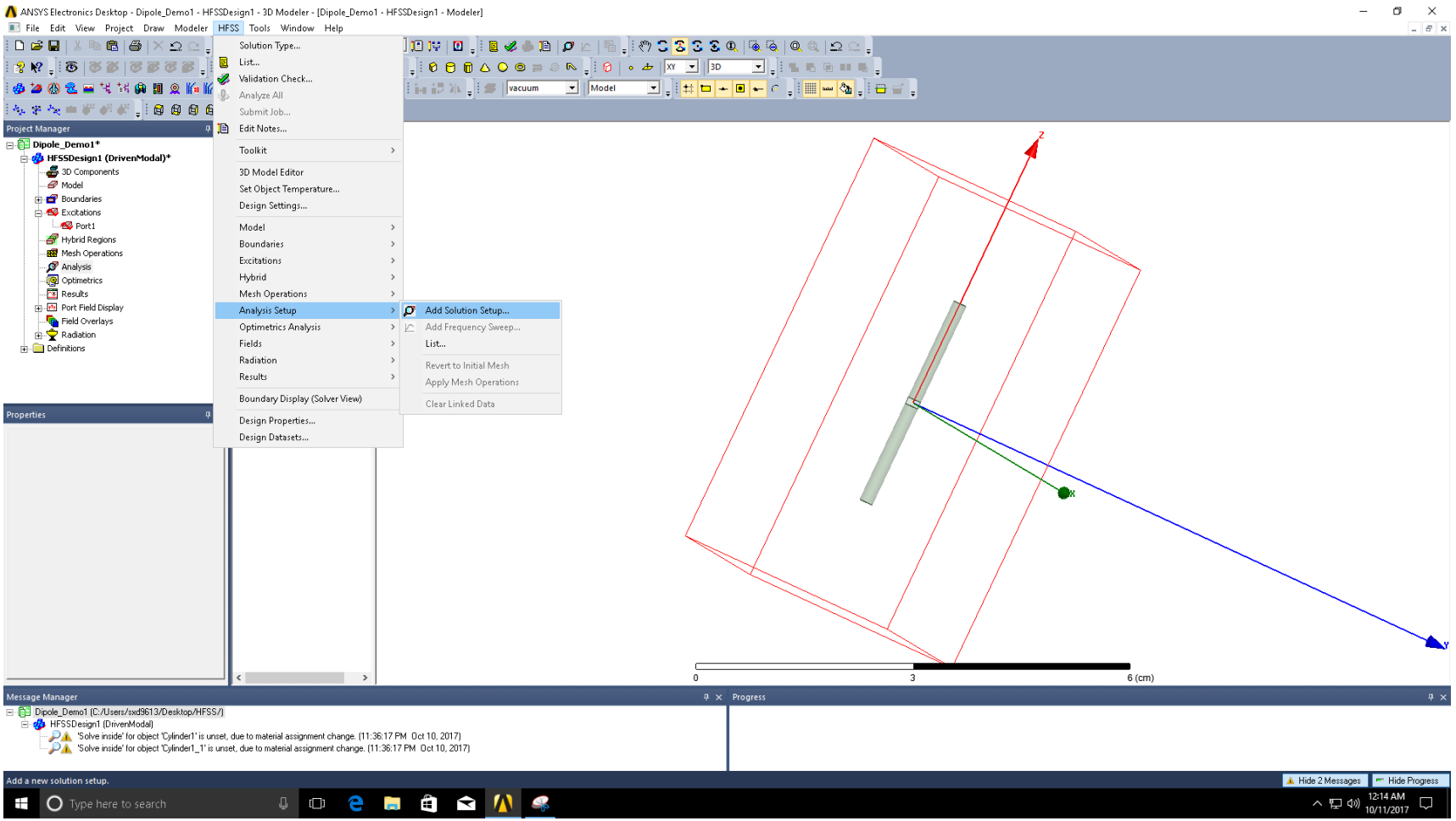
HFSS > Analysis Setup > Add Solution Setup

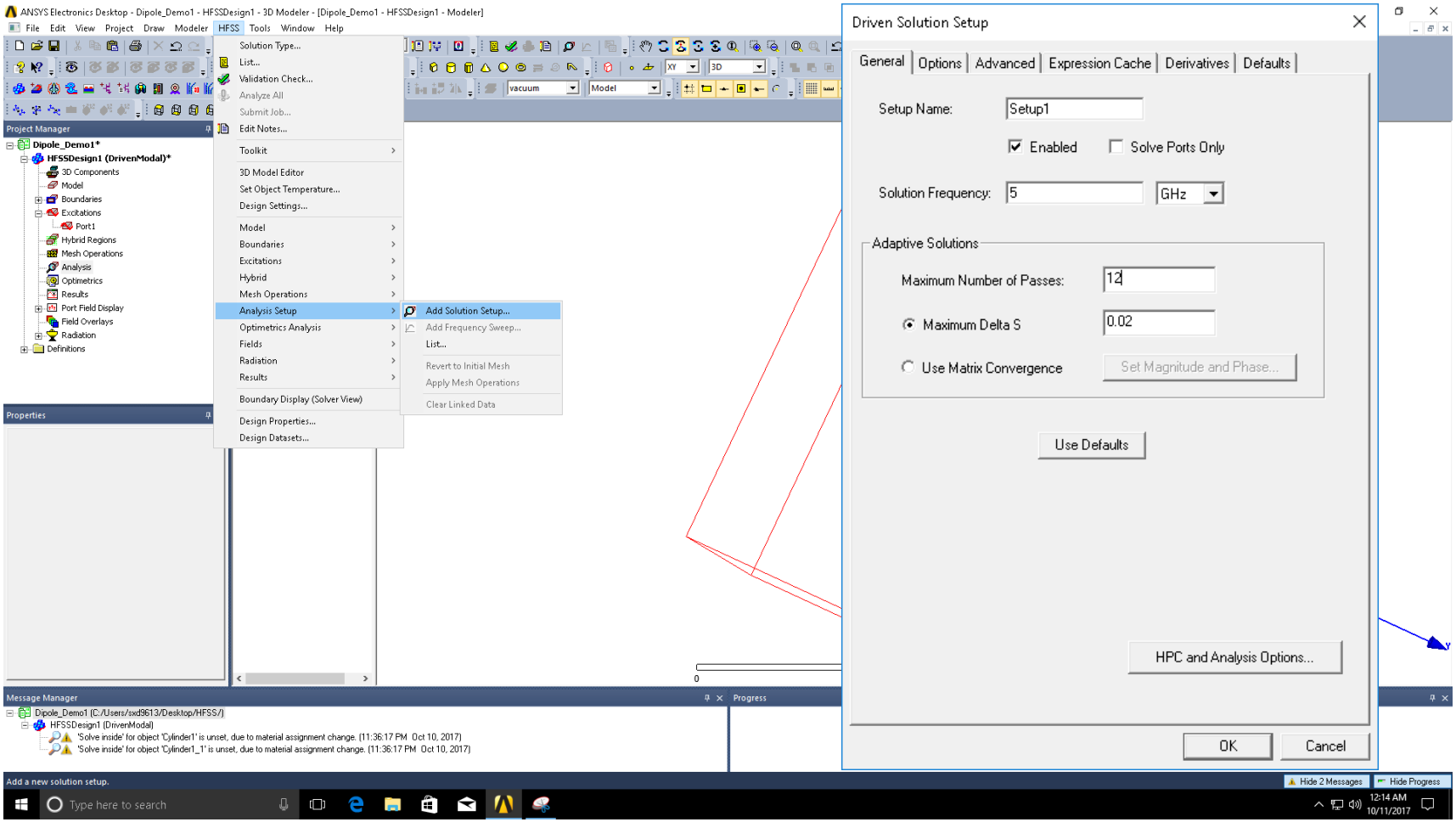


Solution Setup

The University of Texas ARLINGTON

HFSS > Analysis Setup > Add Solution Setup

Select solution frequency , Maximum Number of Passes 12



Solution Setup

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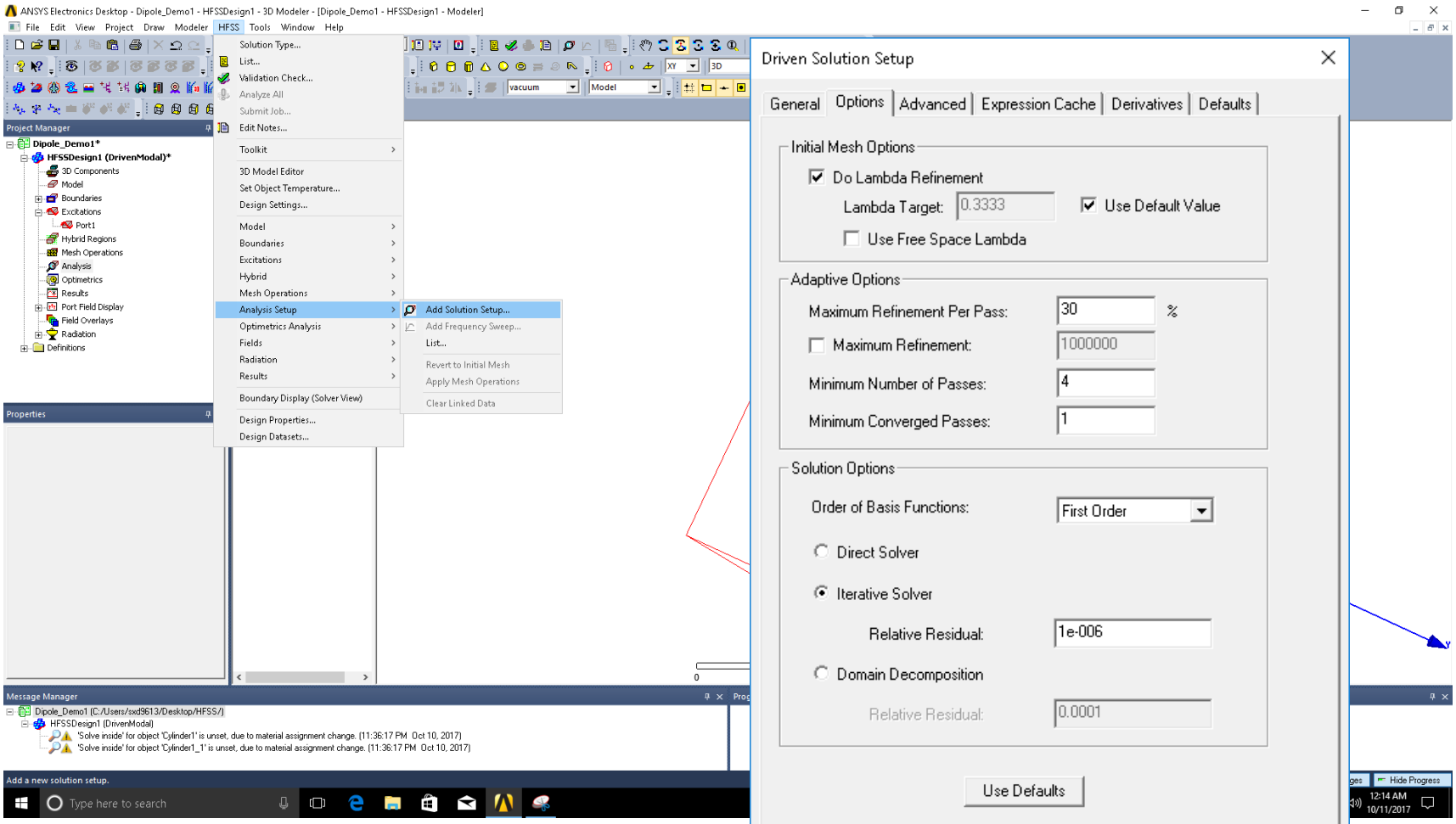
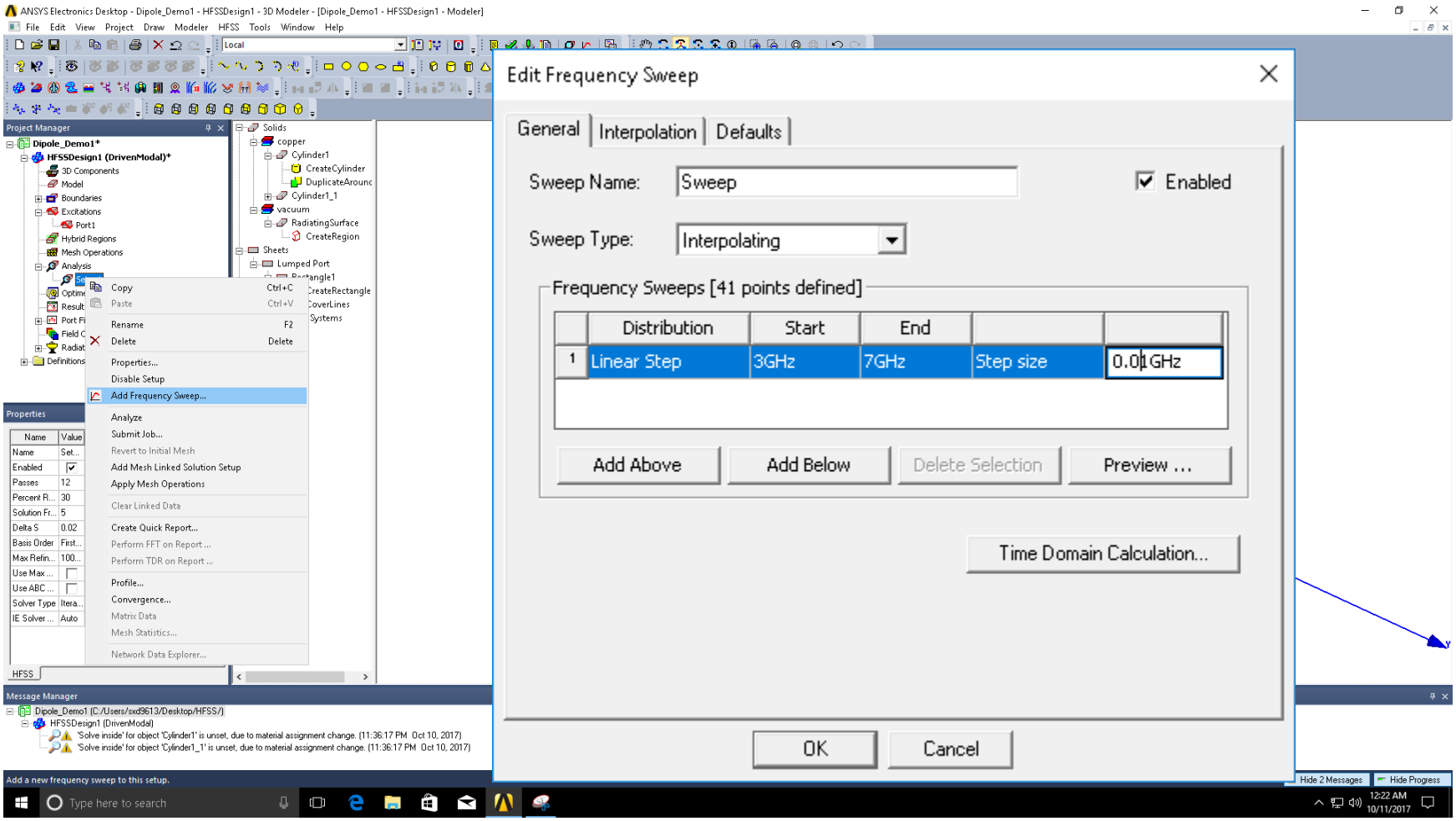
In option tab enter Minimum Number of Passes 4, Solution option Iterative Solver



Add Frequency Sweep

Right click on newly created Setup1 from Analysis tab of project manger and add Frequency Sweep > Provide the start, end and step size as 3, 7 and 0.01 GHz



Save and Validation

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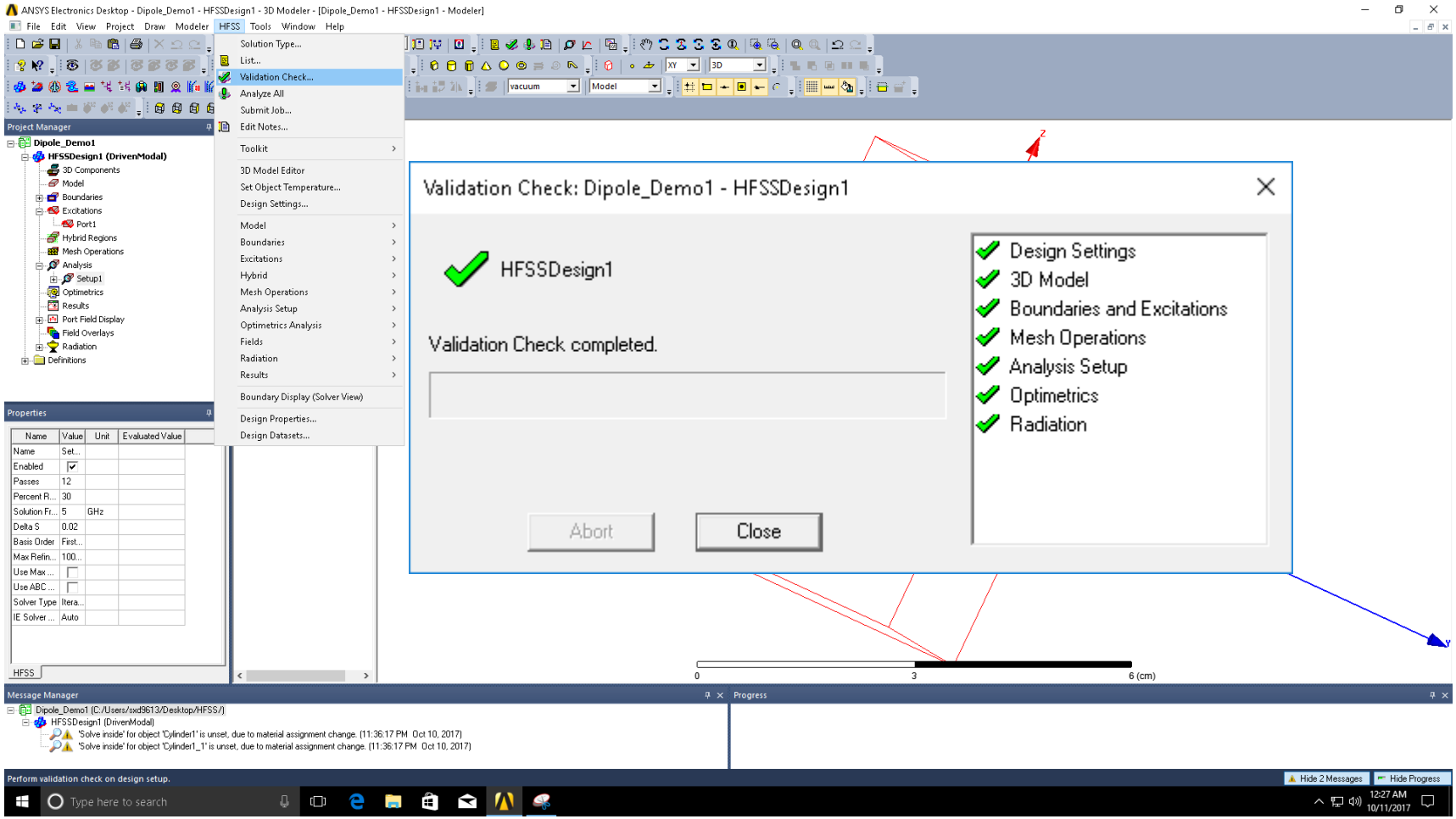
Save the project > HFSS > Validation Check



Run Simulation

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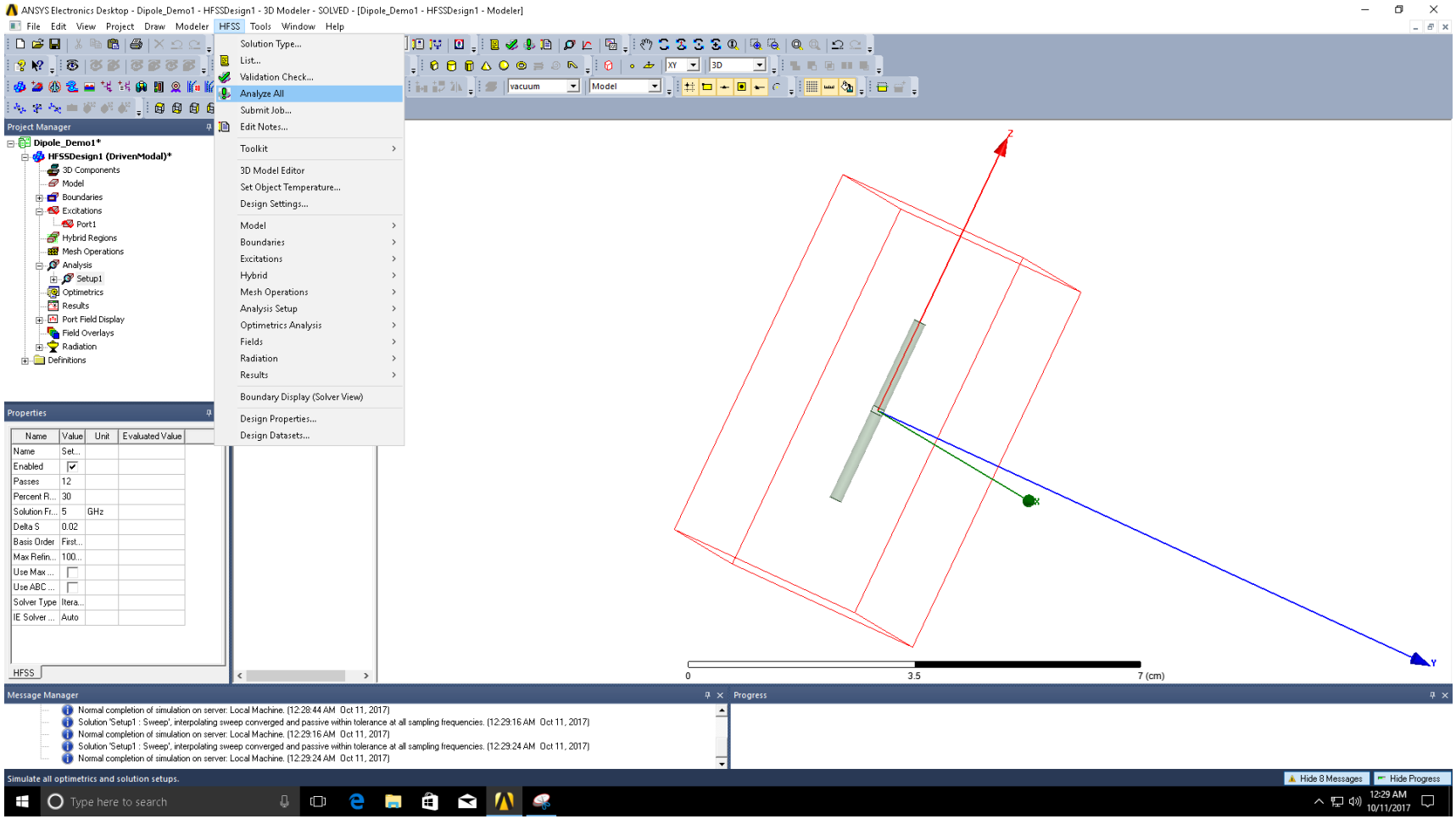
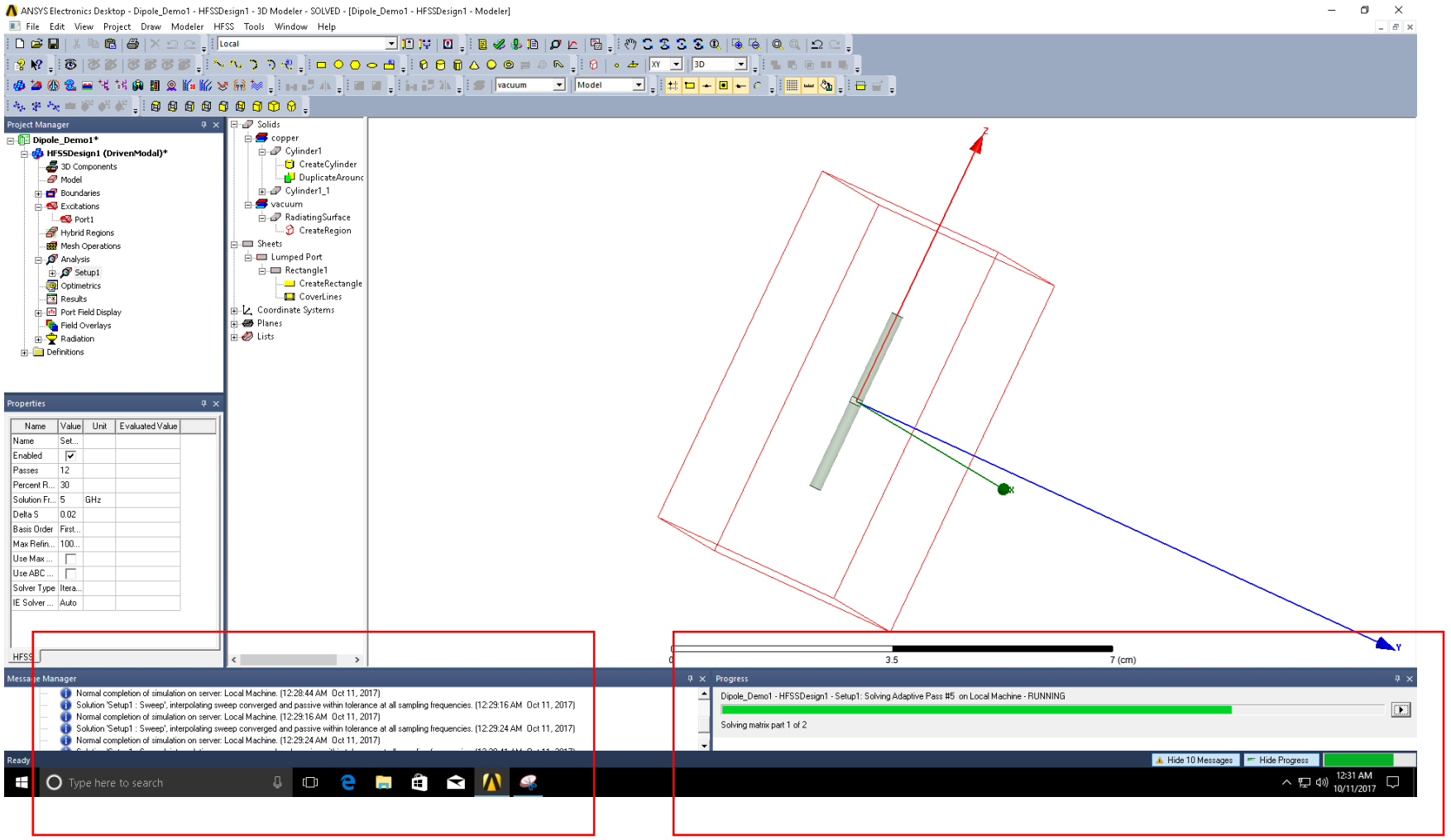
HFSS > Analyze All



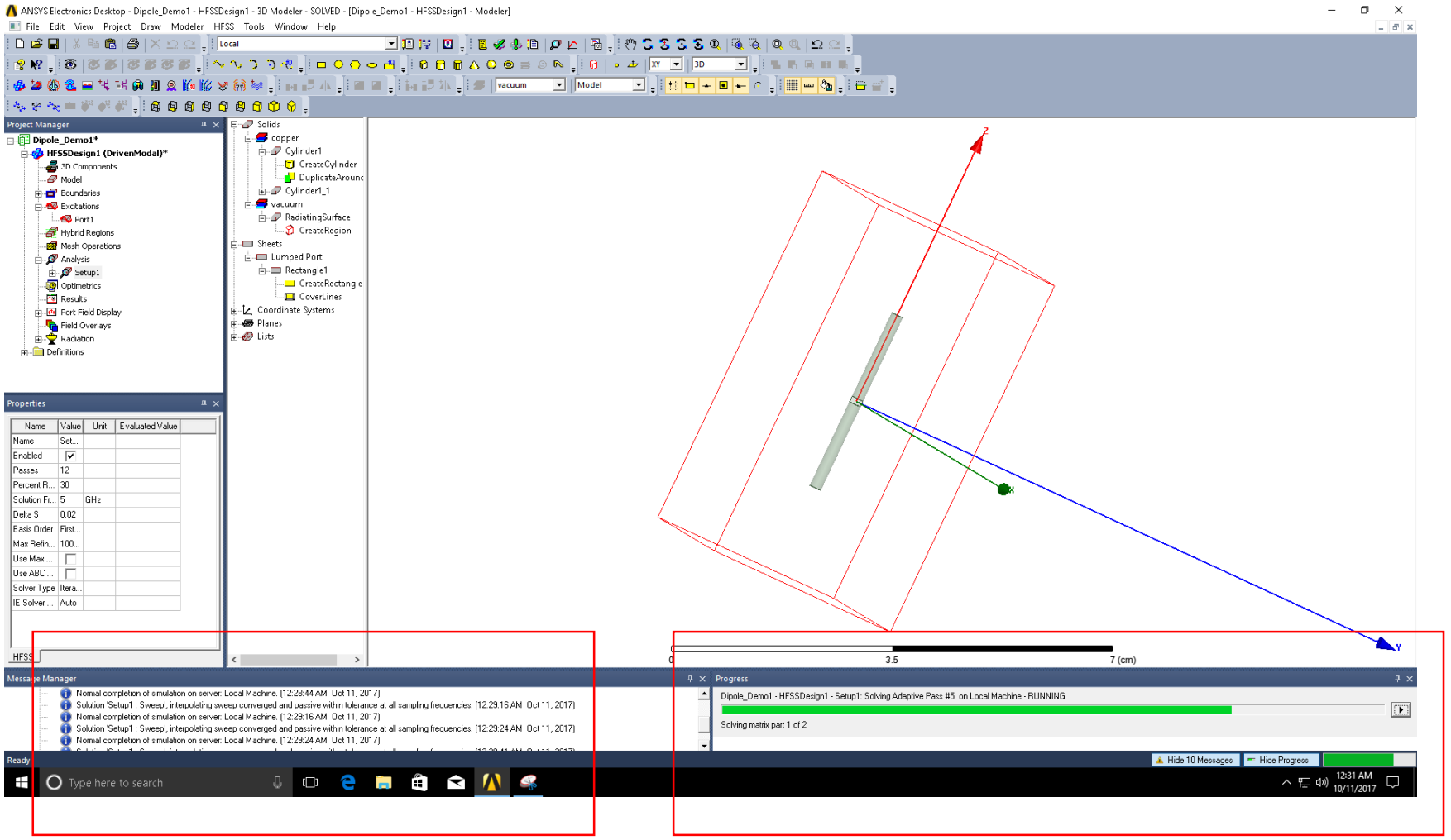
Simulation in Progress



Notifications

Progress Bar

Simulation in Progress



Notifications

Progress Bar

View Results (log magnitude)

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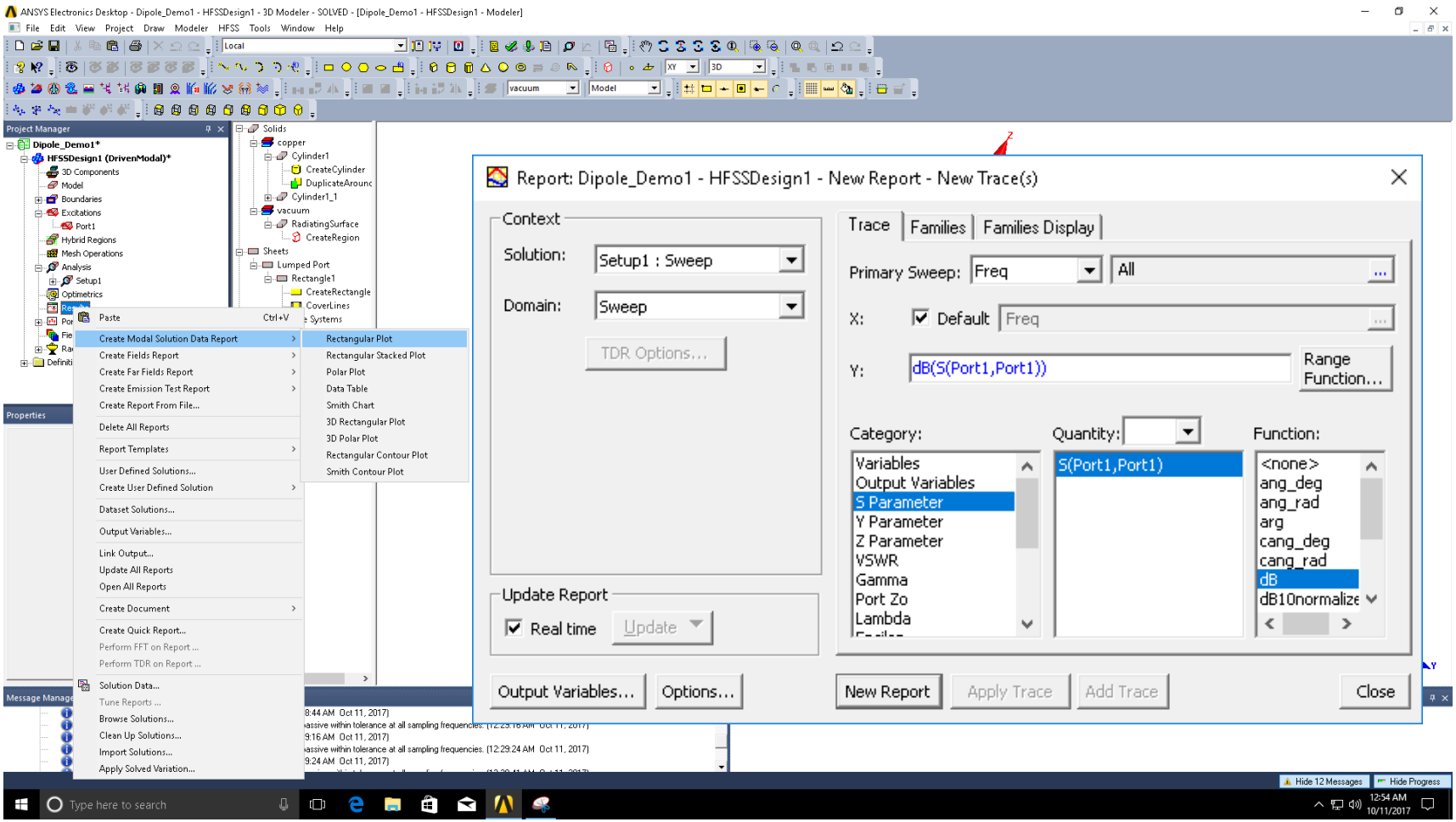
Results (right click) > Create Modal Solution Data Report > Rectangular Plot

S parameter > S(Port1, Port1) > dB > New Report



View Results (log magnitude)

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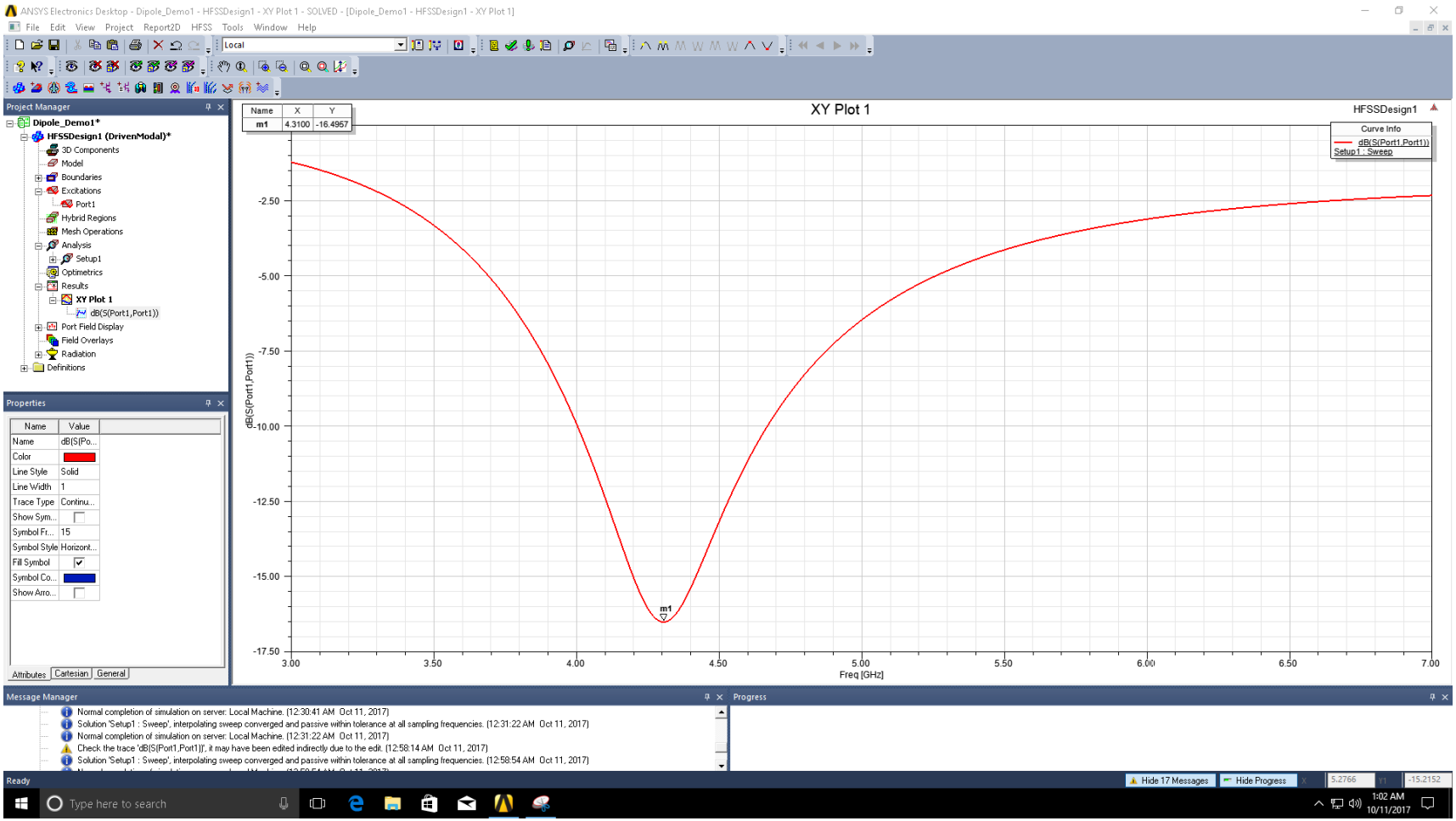
Antenna Resonates at 4.31 GHz

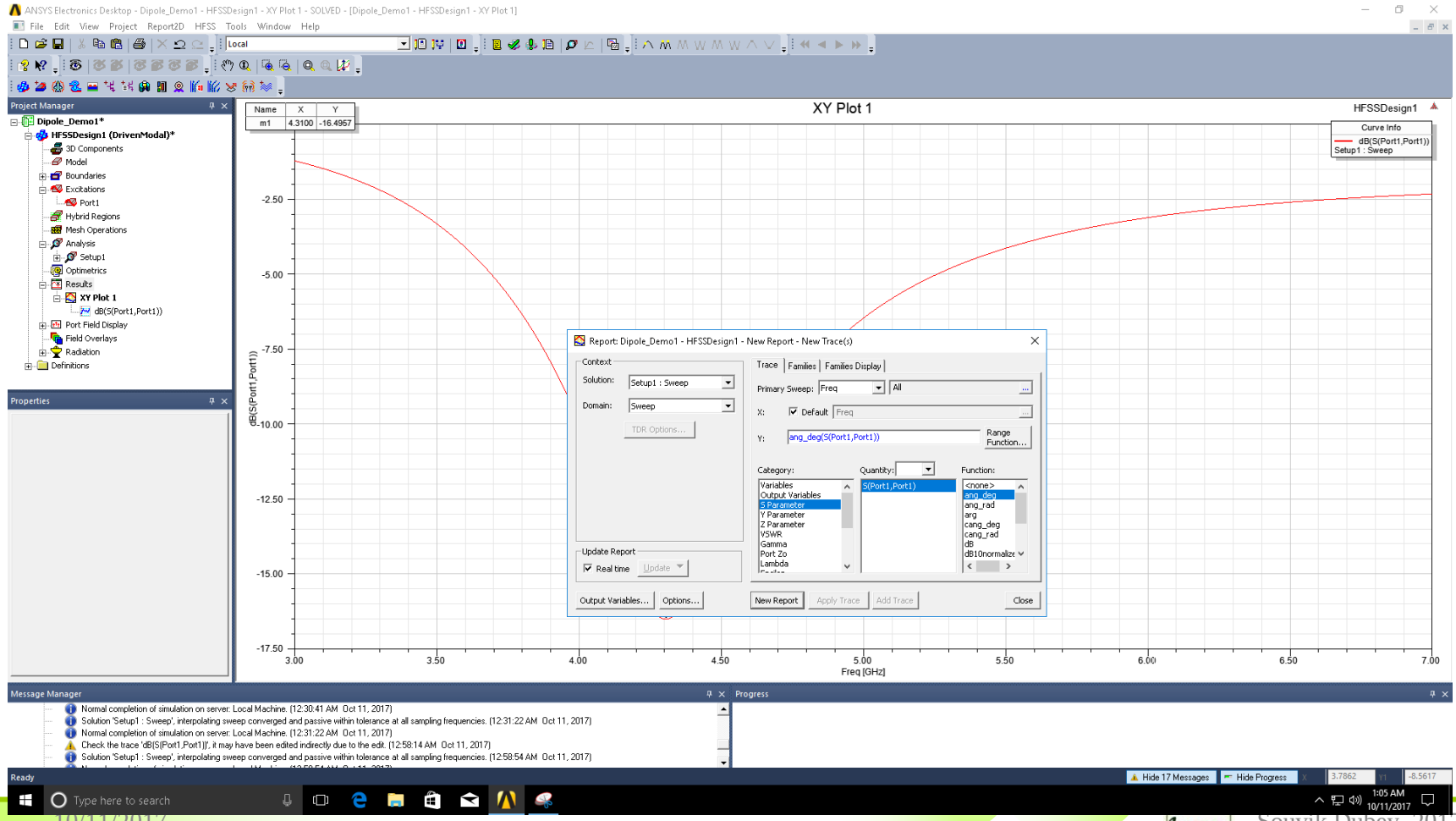
$|S_{11}|$ = -16.5 dB



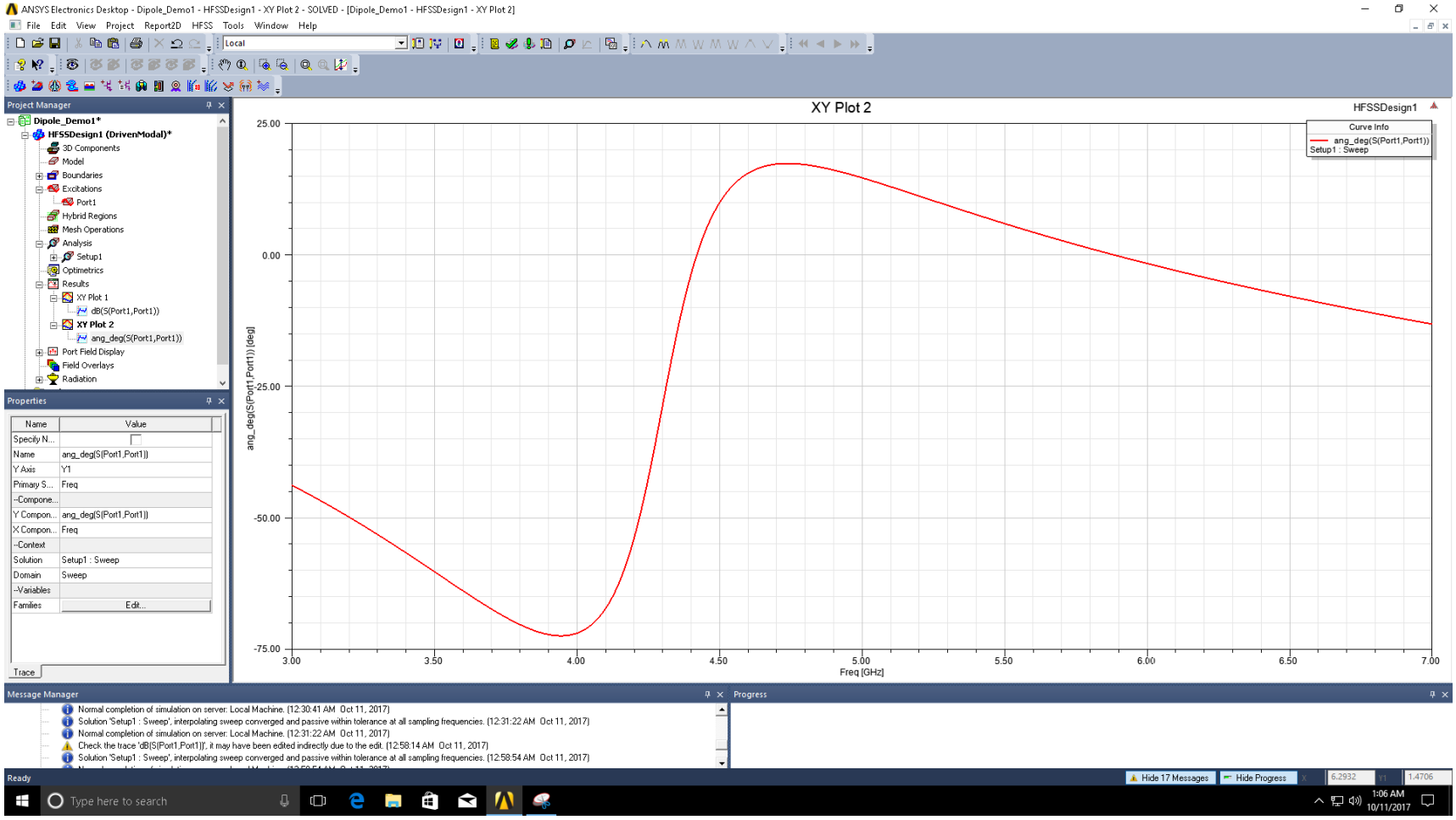
View Results (phase)

Results (right click) > Create Modal Solution Data Report > Rectangular Plot

S parameter > S(Port1, Port1) > and_deg > New Report

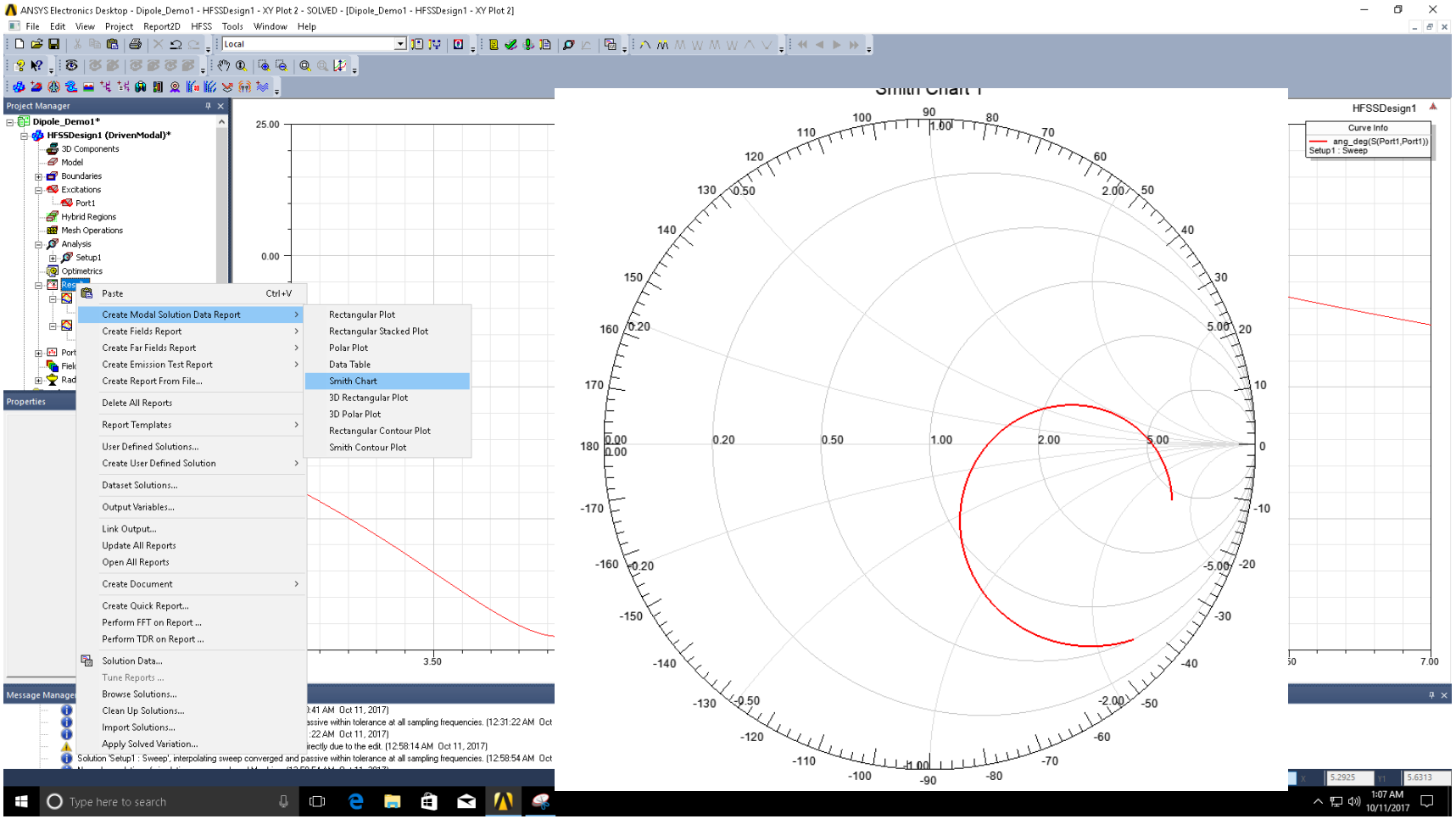


View Results (phase)



View Results (smith chart)

Results (right click) > Create Modal Solution Data Report > Smith Chart



View Results (Far field report)

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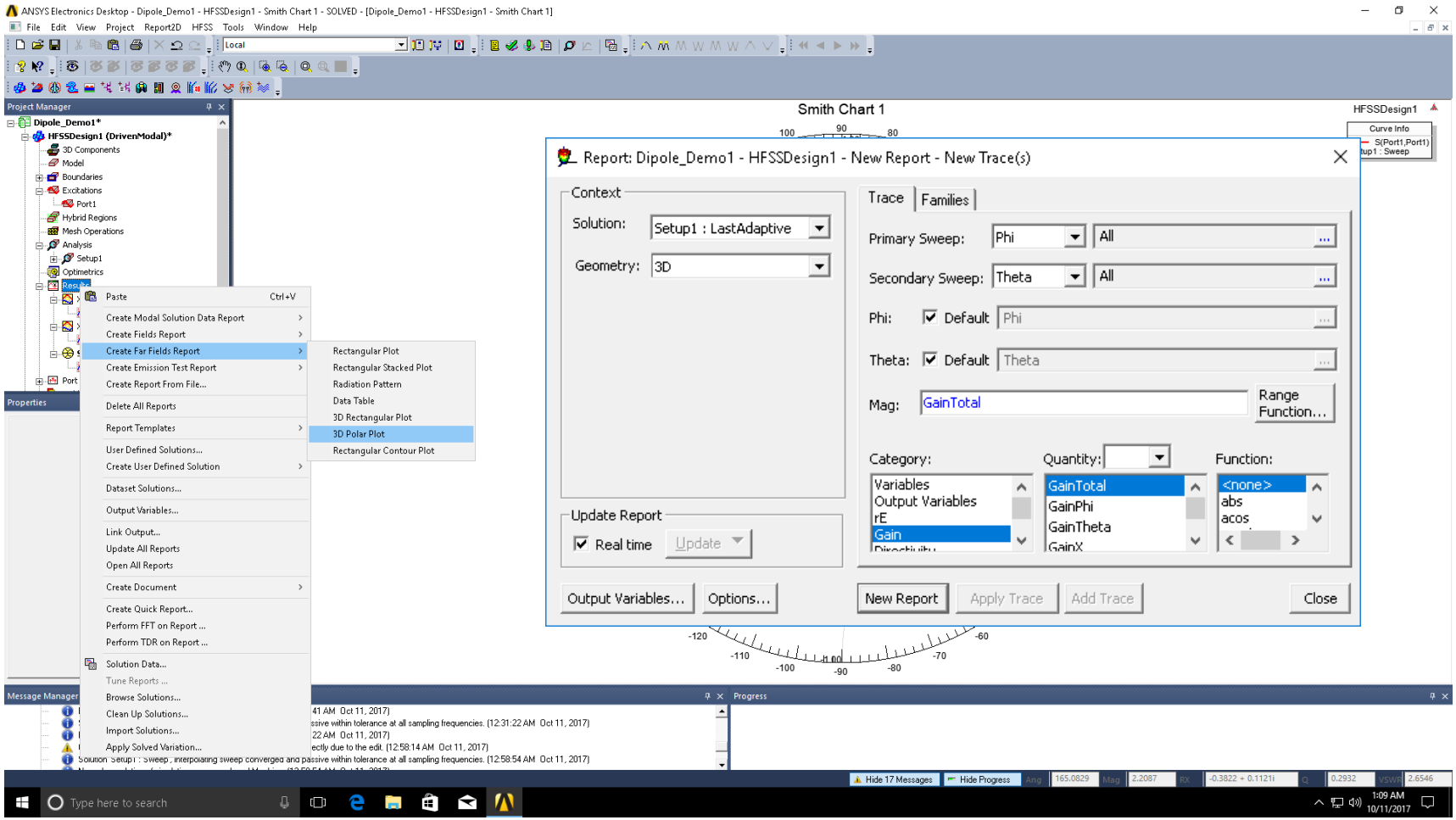
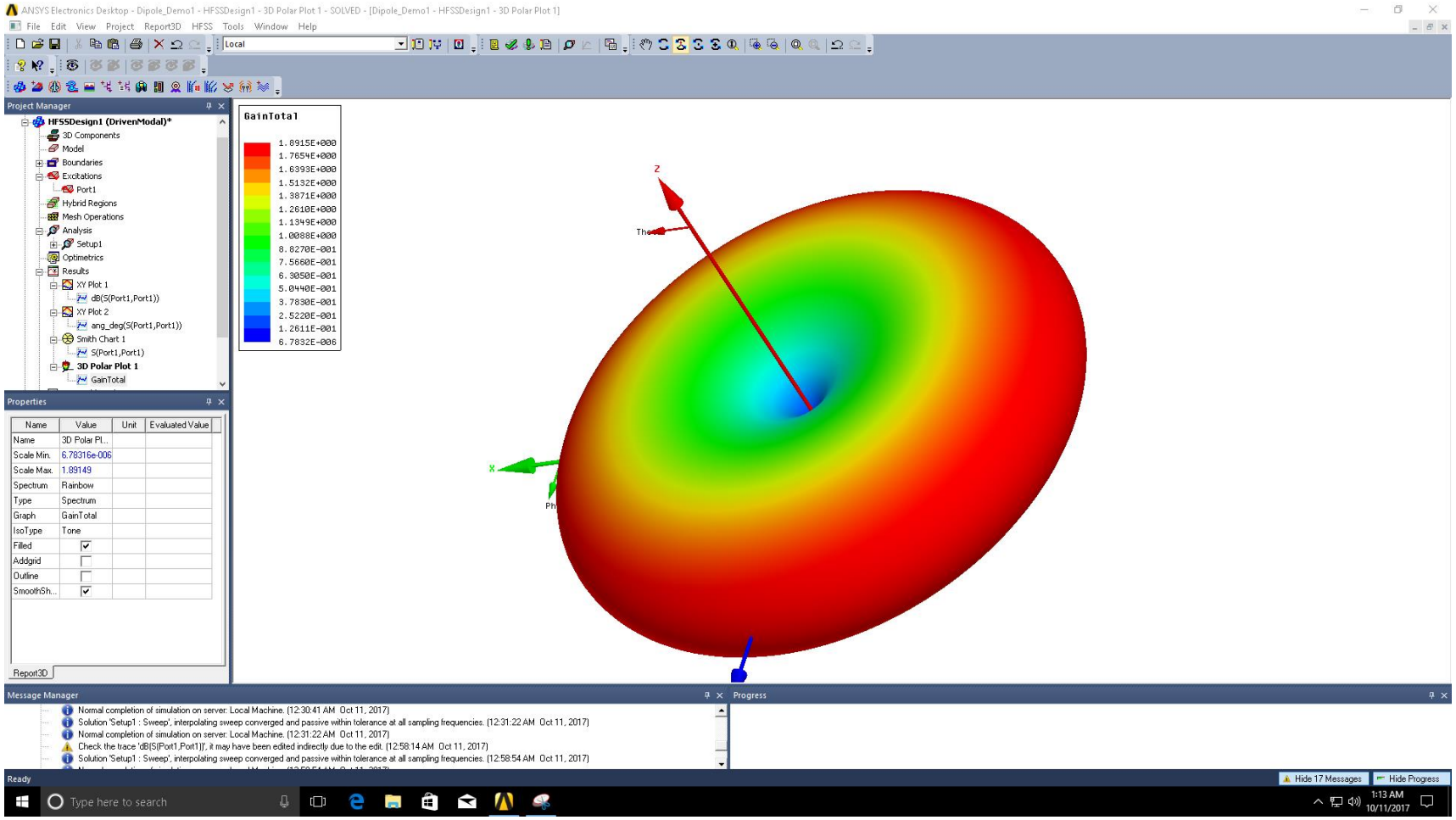
Results (right click) > Create Far field report > 3D polar plot

Select Gain > Gain Total > New Report



View Results (Far field report)



Thank You !

Further Queries

souvik.dubey@mavs.uta.edu

Download link:

http://www.souvikdubey.com/hfsstutorial.html