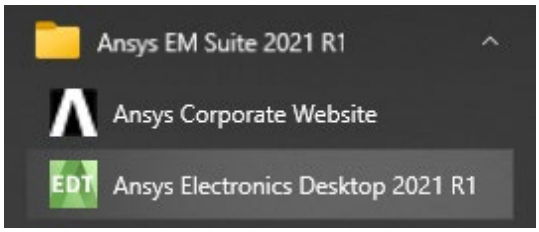
Department of Electrical, Computer and Software Engineering

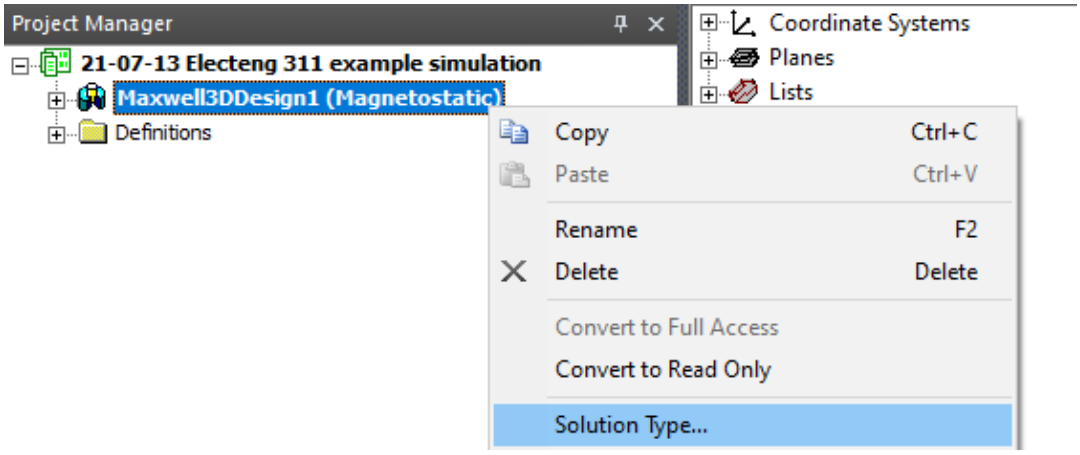
ELECTENG 311: Electrical Engineering Design 2

ANSYS guide (2022)

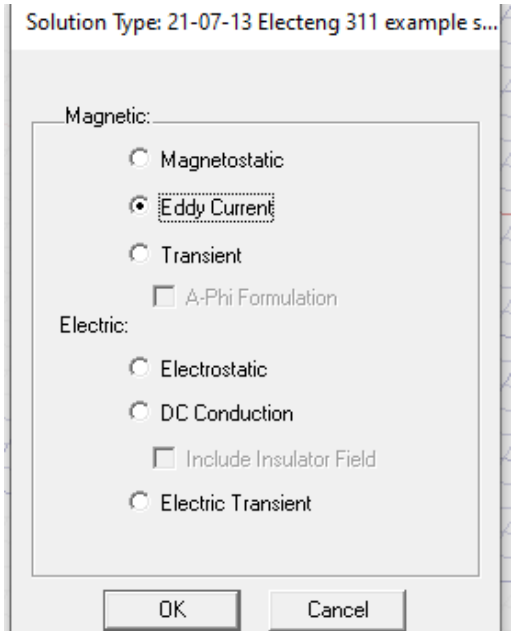
Open ANSYS Electronic Desktop on your computer.



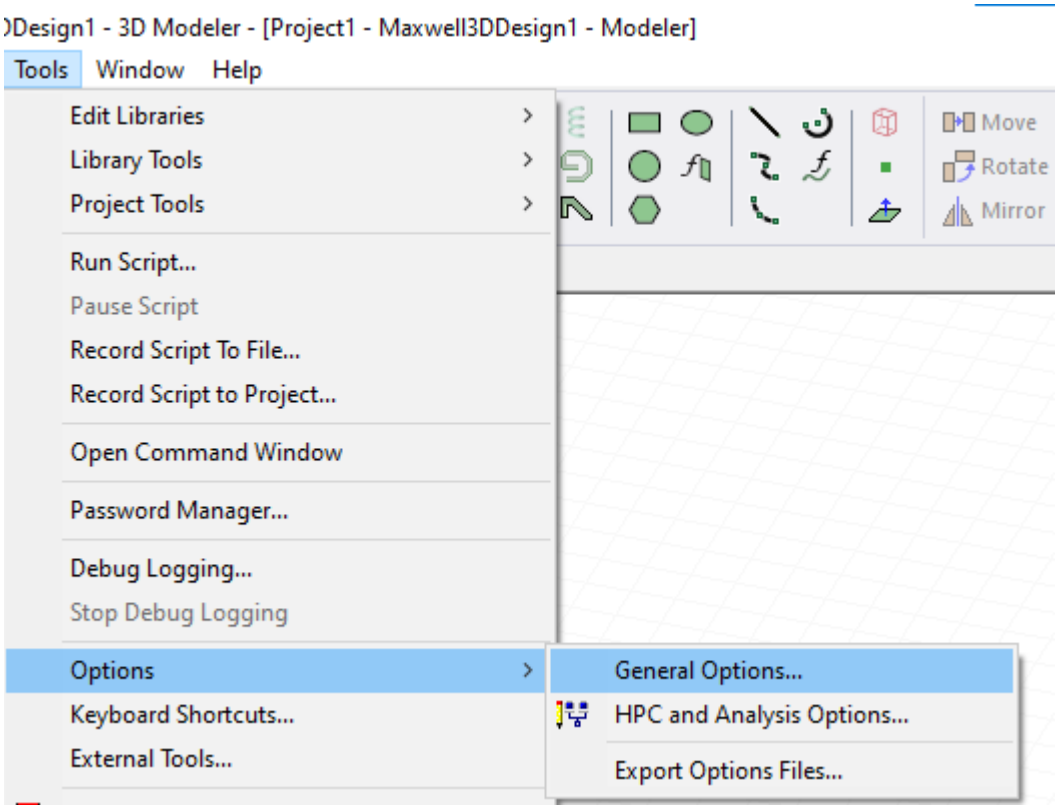
Right click the design project and click Solution Type.



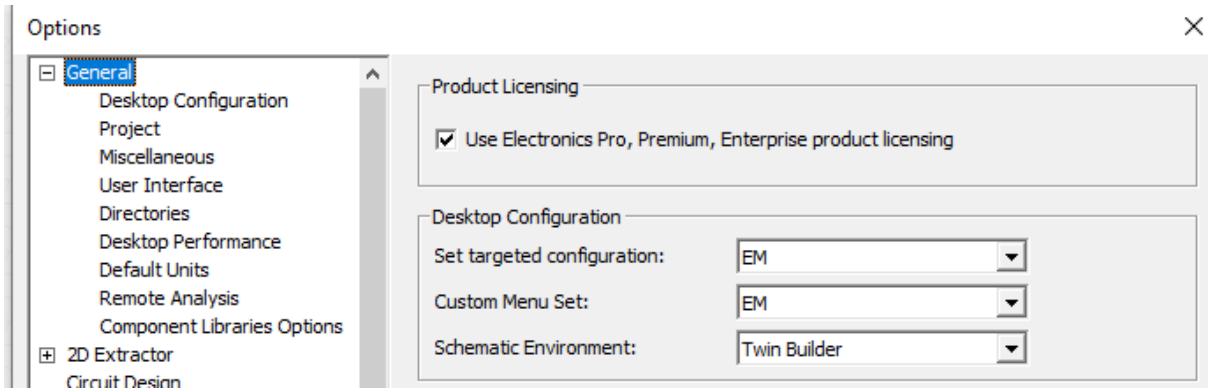
Change the ANSYS solution type to Eddy Current and click OK.



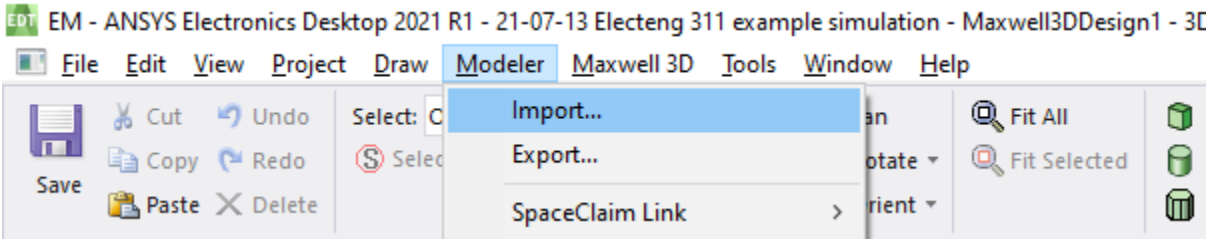
Click on Tools -> Options -> General options



Click General on top left. Then click the check box in Product Licensing.

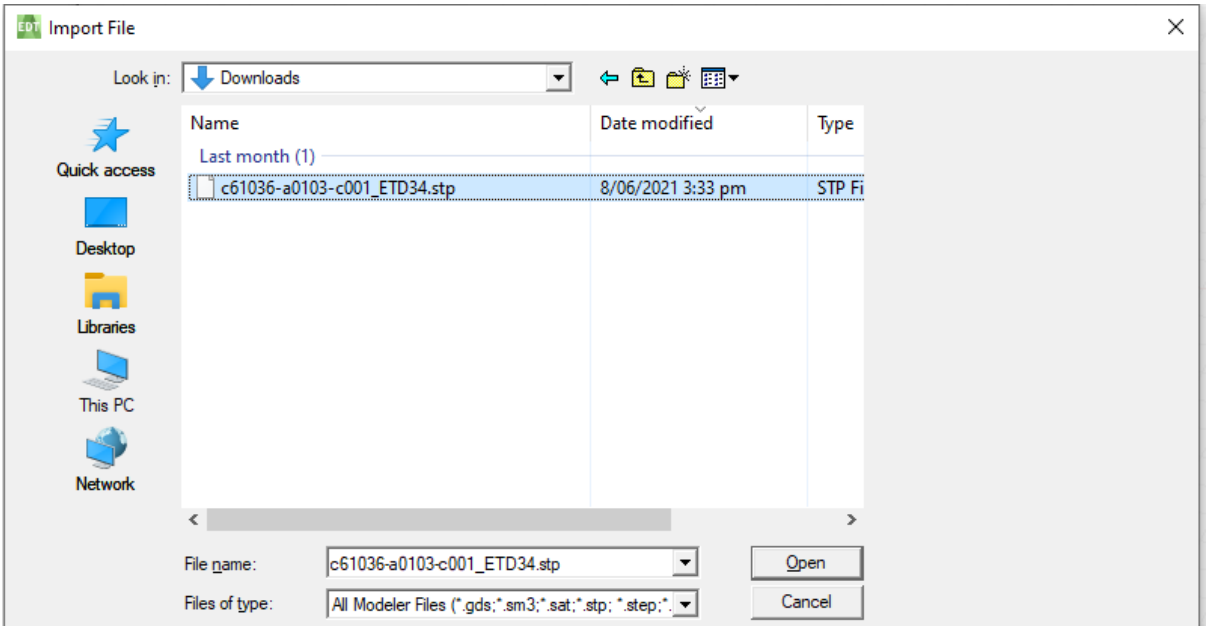


Click on Modeler -> Import

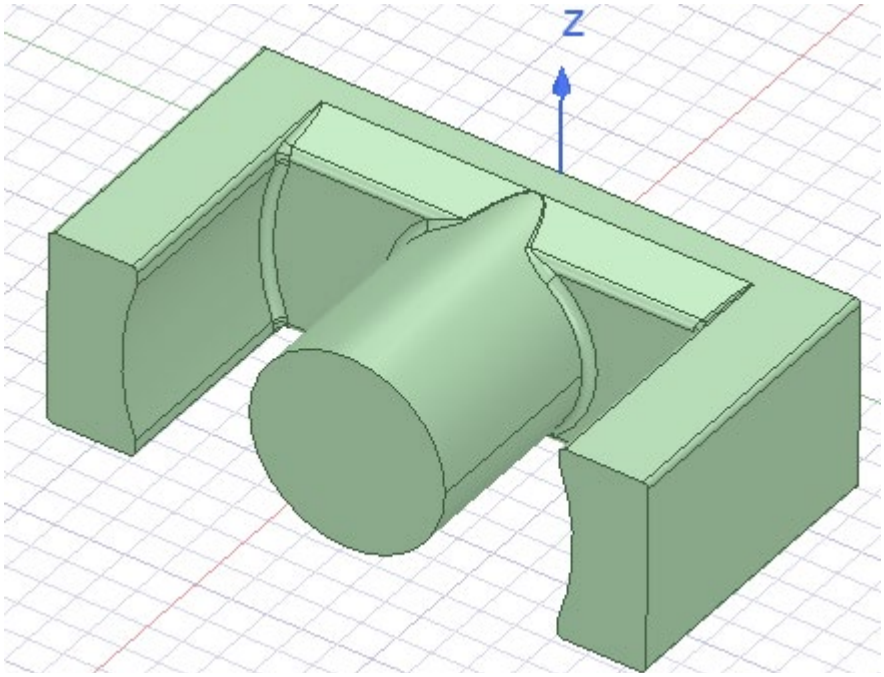


Import the CAD model for B66358G0100X187 (ETD34).

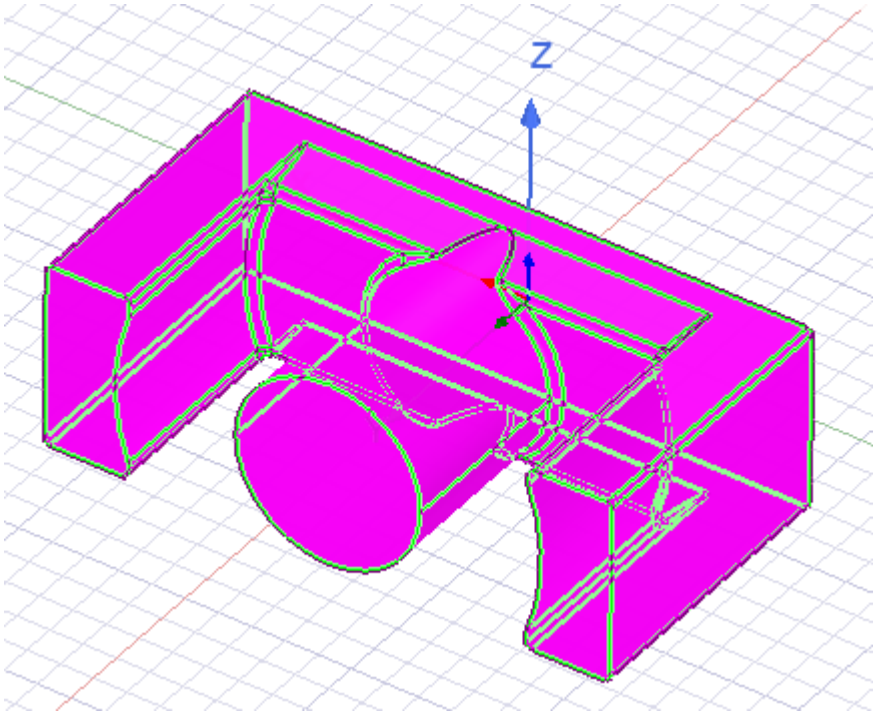
CAD model can be downloaded from:
https://media.digikey.com/pdf/3D%20Models/Epcos/c61036-a0103-c001_ETD34.stp



The imported CAD model should look like this in ANSYS:

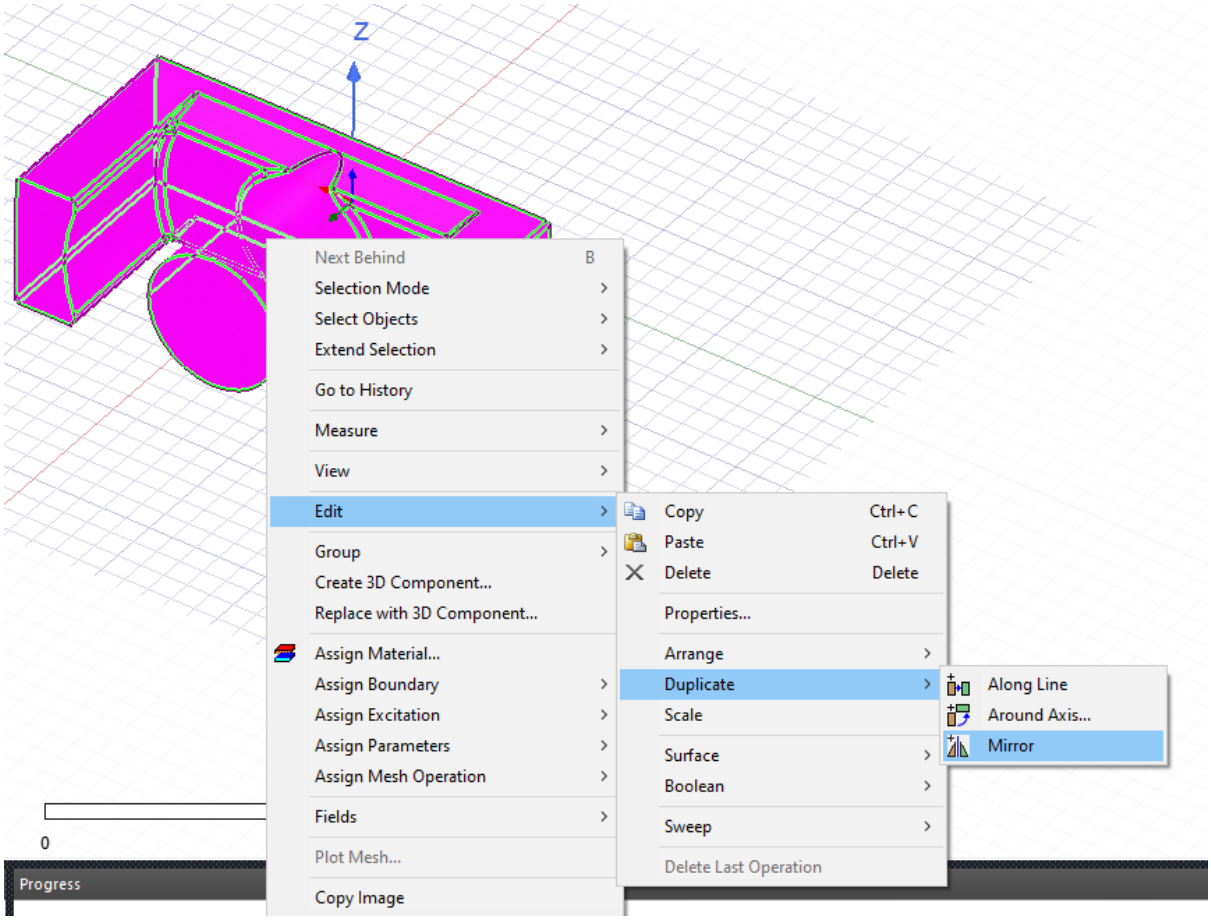


Left click the model to highlight it.

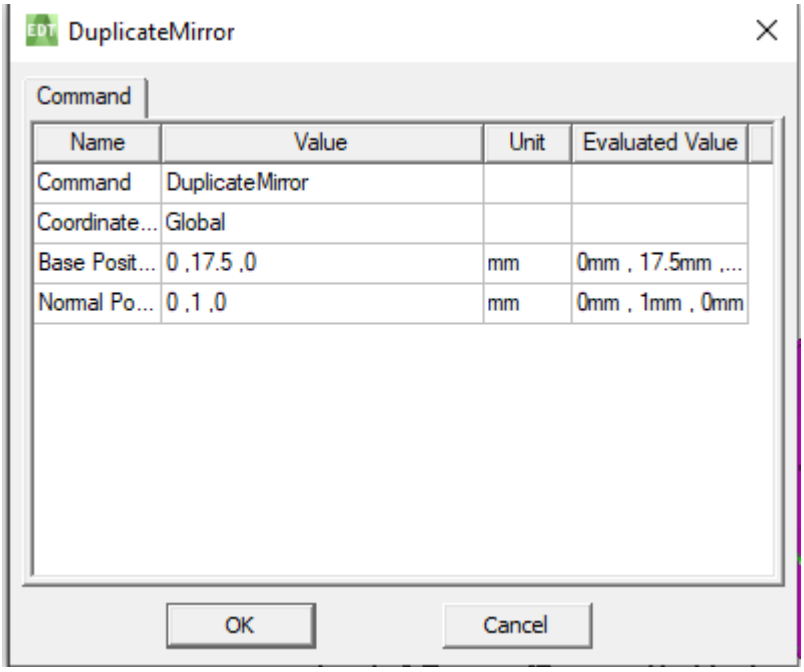


Right click the model to bring up the menu.

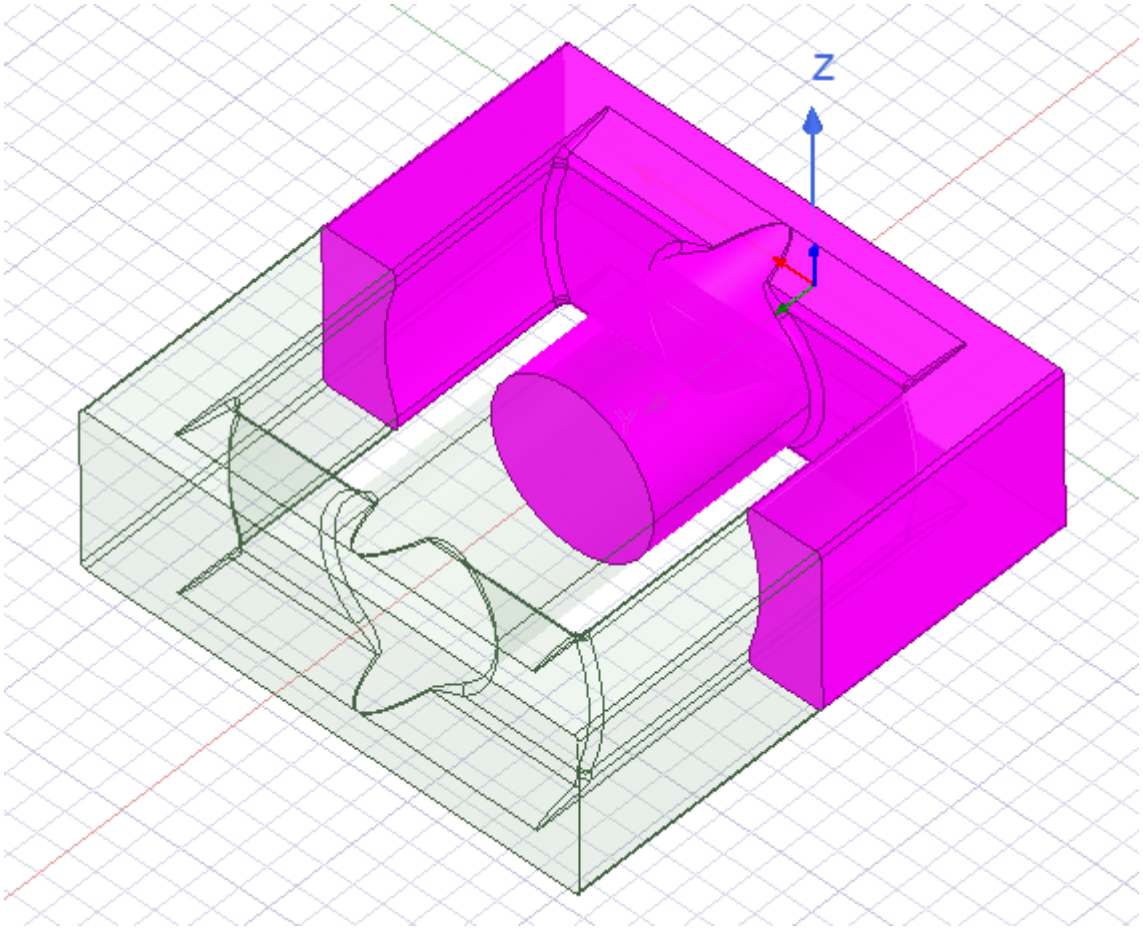
Edit -> Duplicate -> Mirror



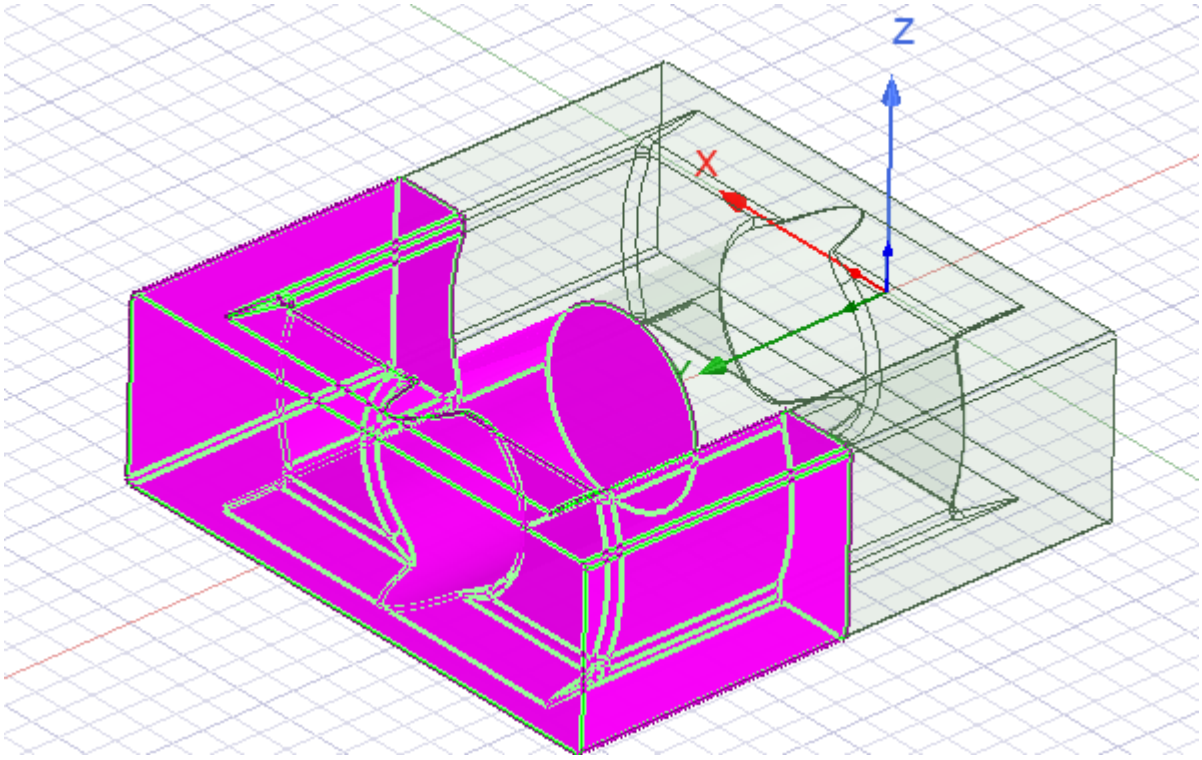
Once in the mirror option, press F4 to bring up the dialogue.



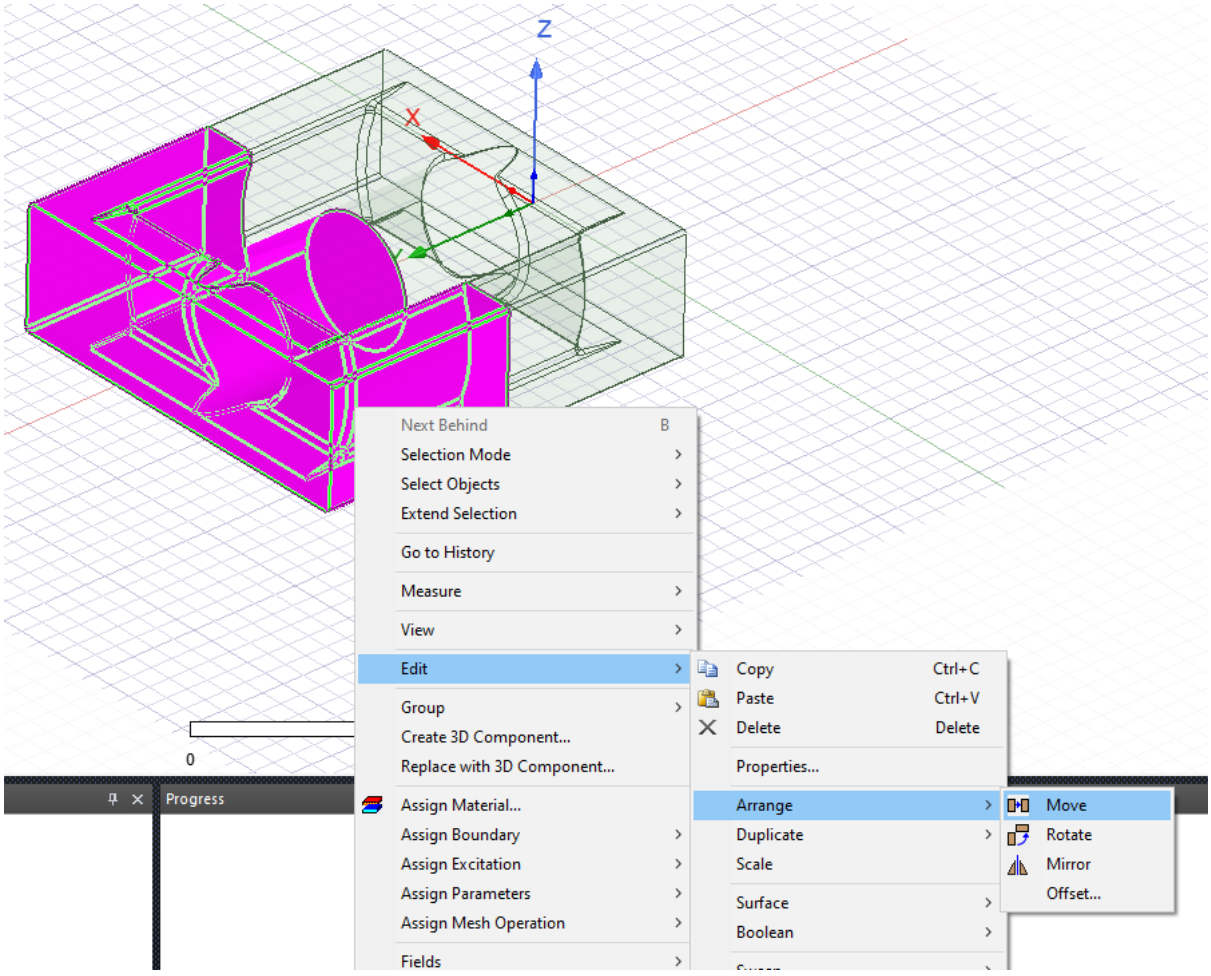
The mirrored model should look like this:



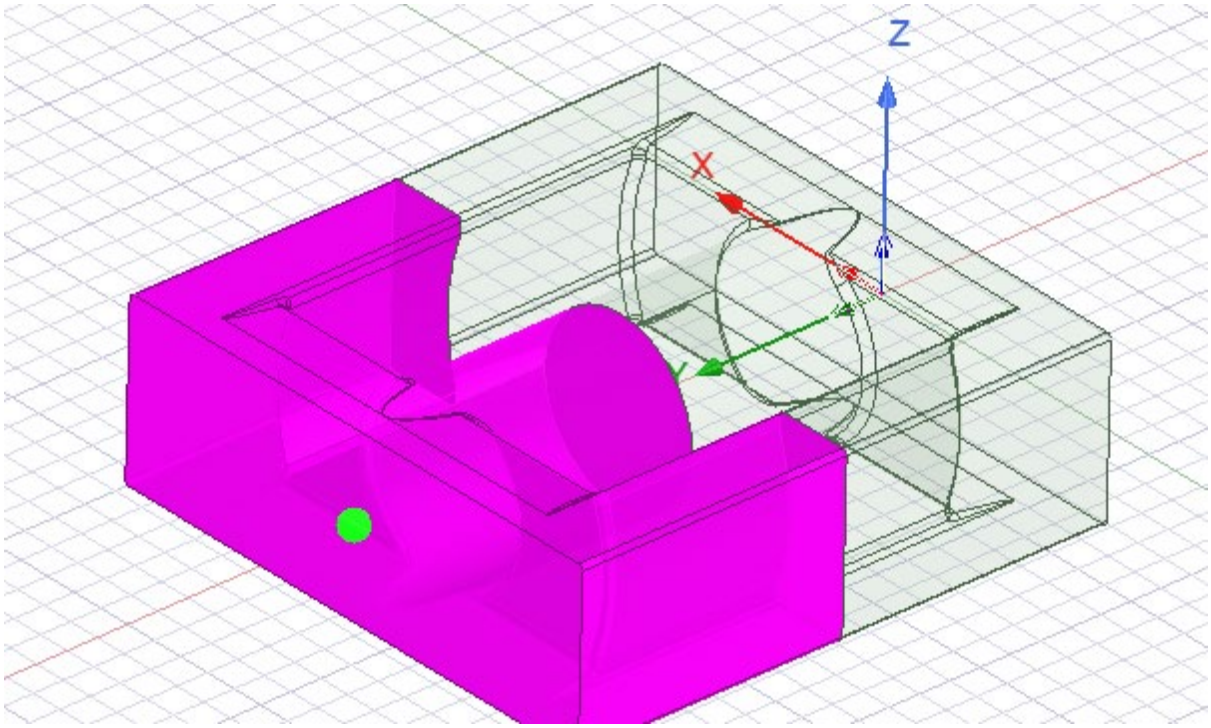
Left click on the duplicated model



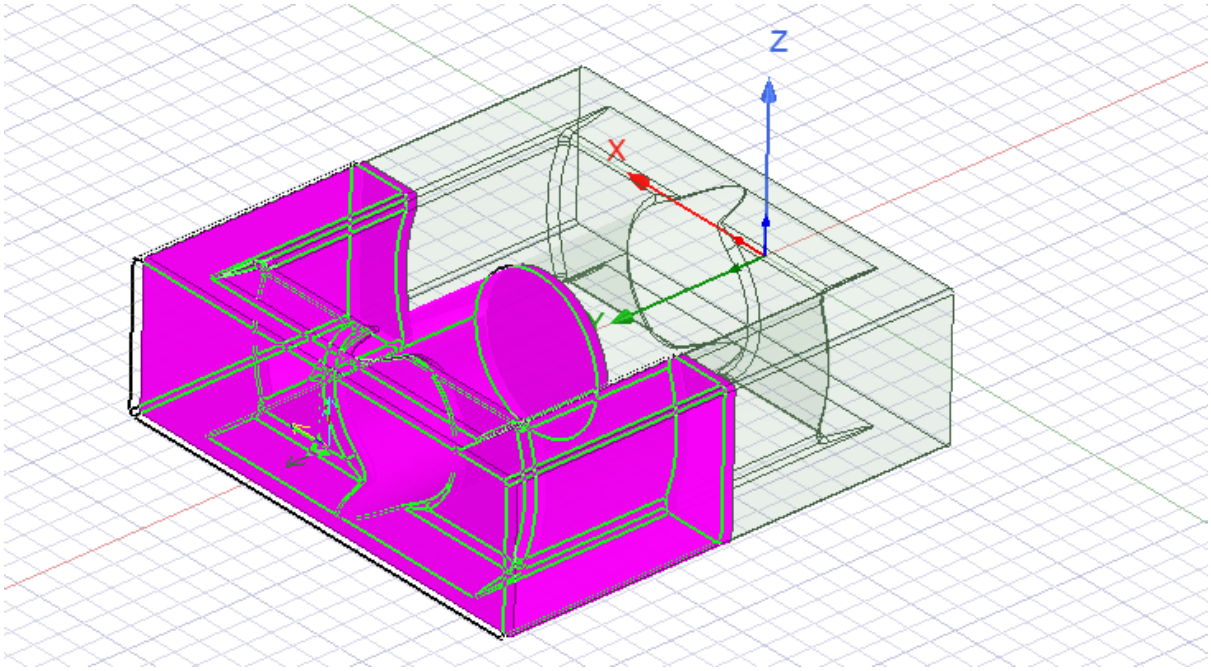
Right click to bring up the menu.



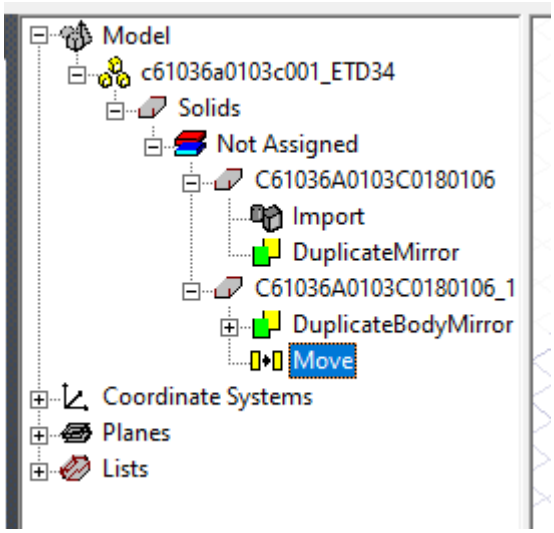
Click once in the middle of the model.



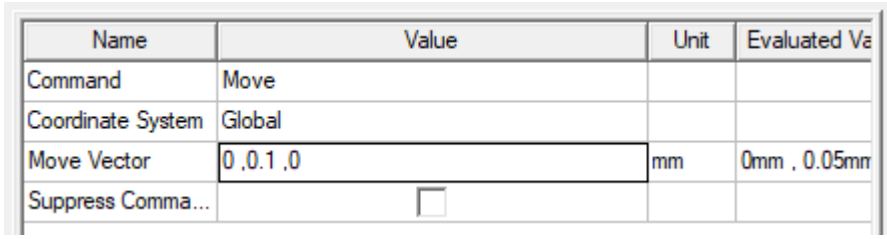
Then click once more when the outline of the duplicated model has moved.



In the project tree find and click on Move.

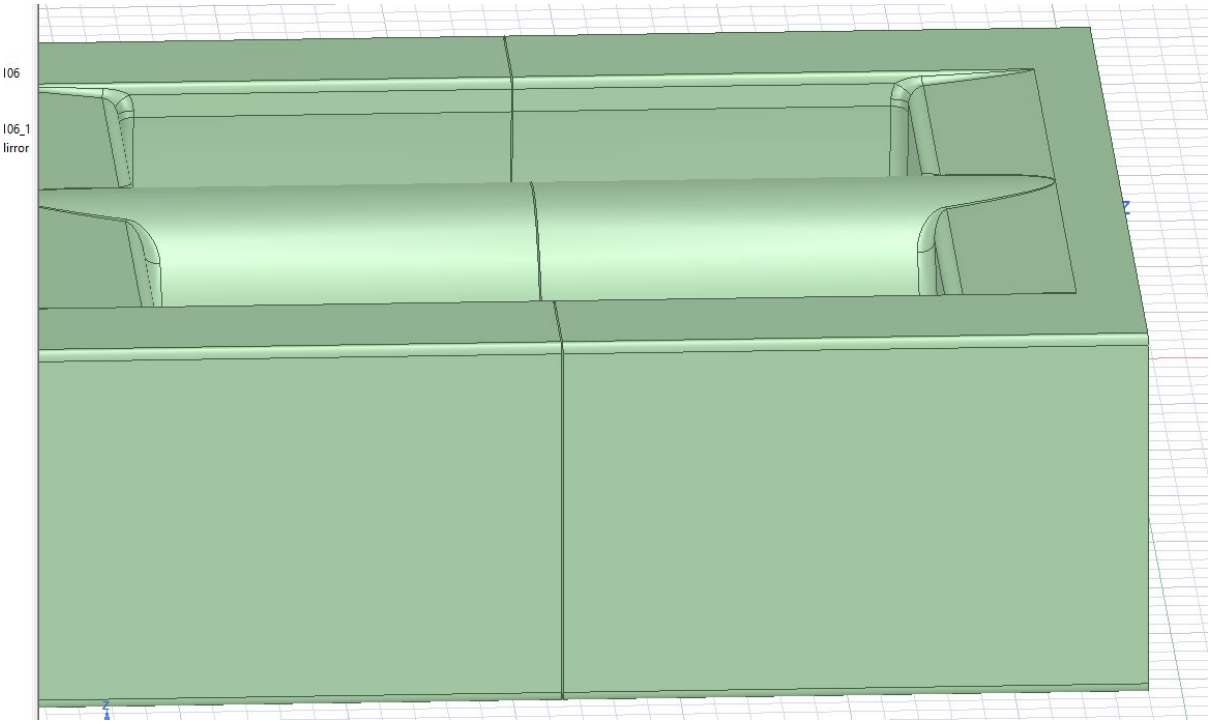


Change the Move vector to be 0, 0.1, 0

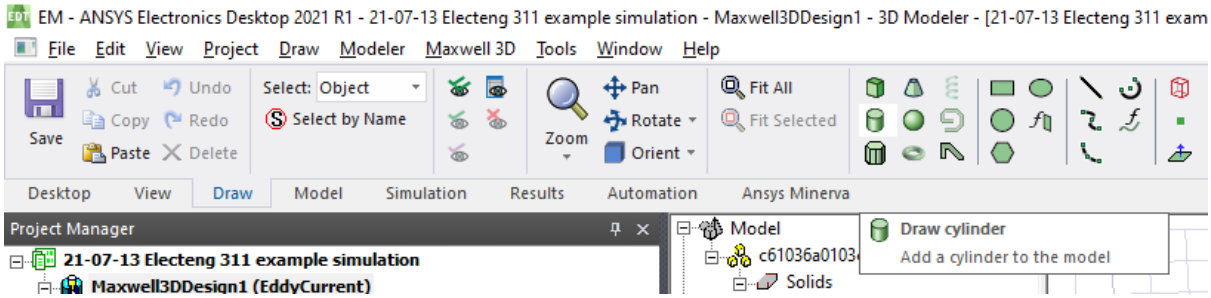


Name	Value	Unit	Evaluated Va
Command	Move		
Coordinate System	Global		
Move Vector	0 ,0.1 ,0	mm	0mm , 0.05mm
Suppress Comma...			

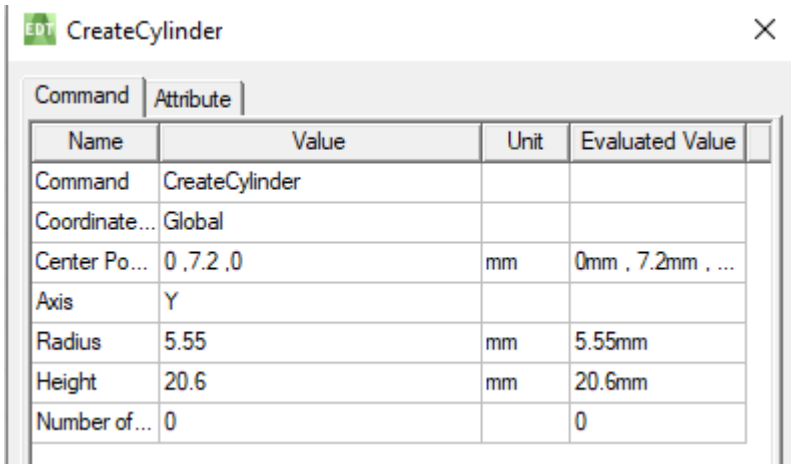
If you zoom into the model, you will see that a small air gap has formed between the two cores.



In the Draw panel at the top. Click draw a cylinder.

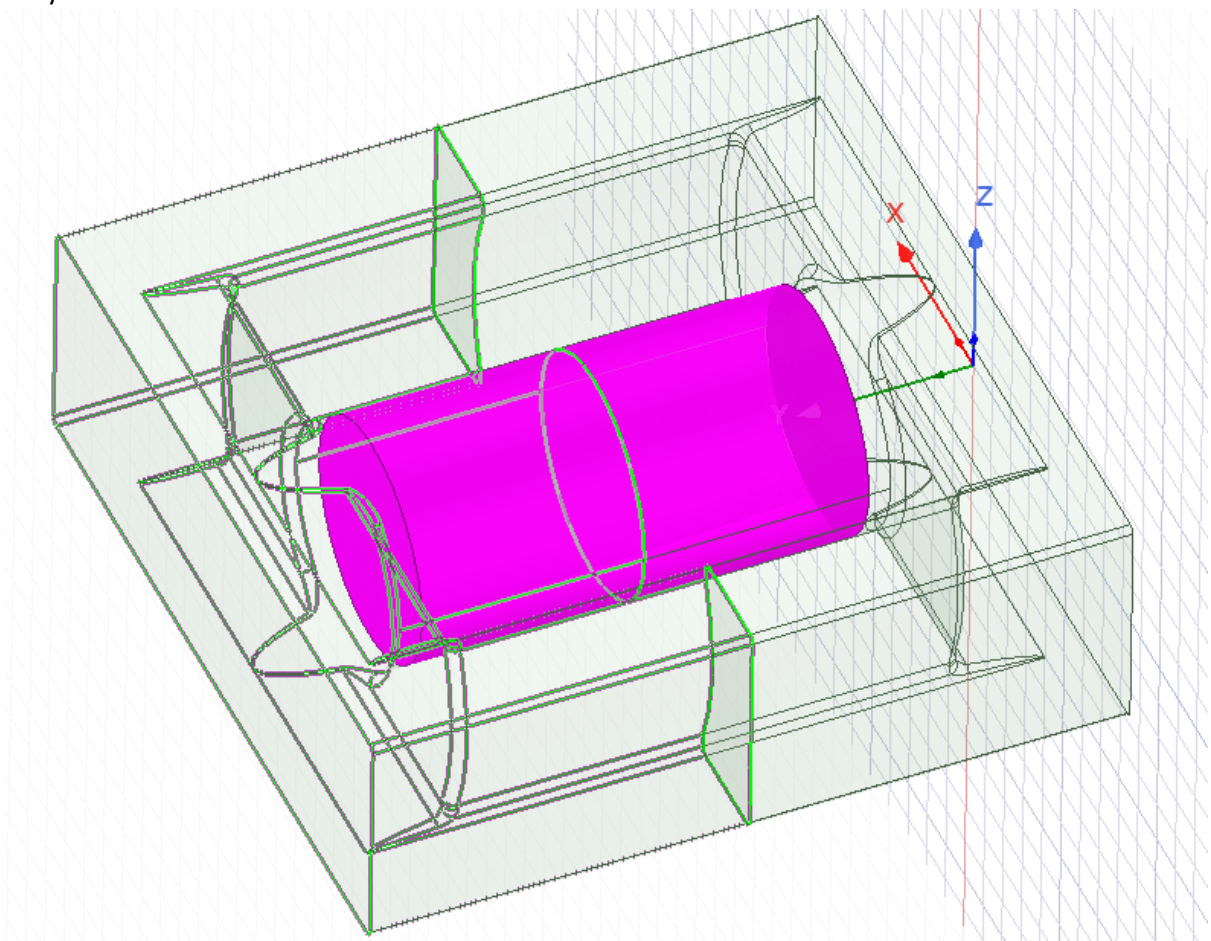


In the dialogue menu, fill in as shown below.

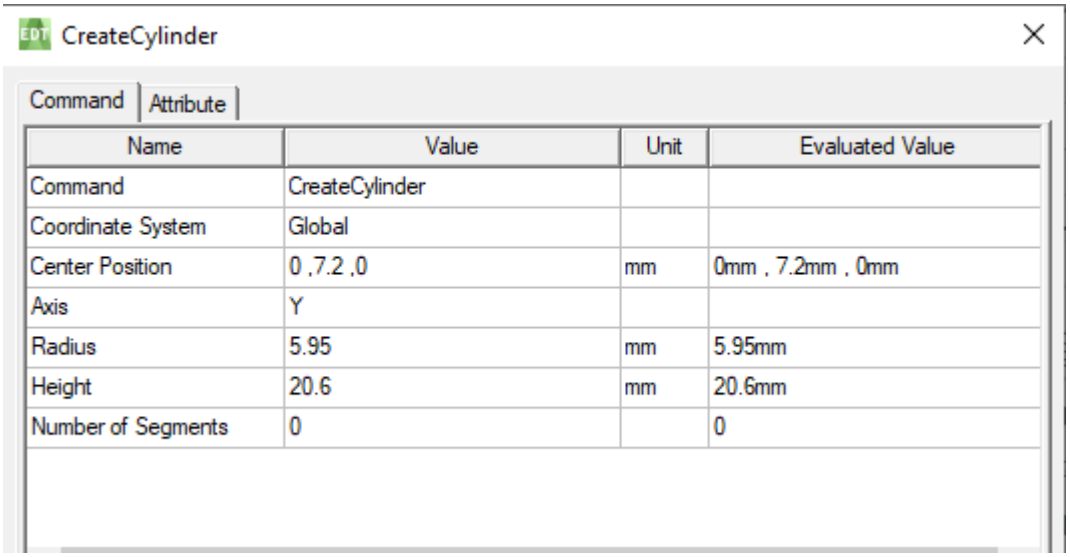


Name	Value	Unit	Evaluated Value
Command	CreateCylinder		
Coordinate...	Global		
Center Po...	0 ,7.2 ,0	mm	0mm , 7.2mm , ...
Axis	Y		
Radius	5.55	mm	5.55mm
Height	20.6	mm	20.6mm
Number of...	0		0

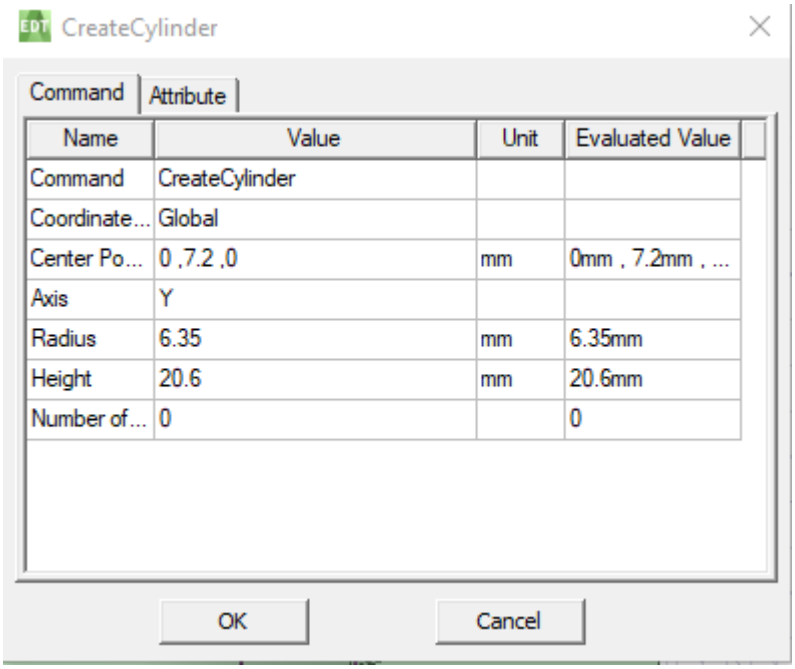
A cylinder should be created as shown below.



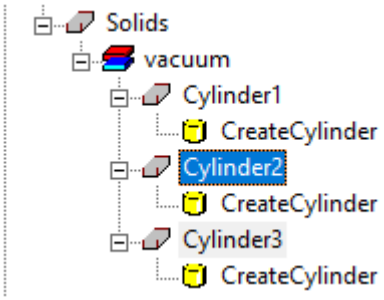
Create another cylinder using the Draw cylinder with the dimensions below.



Create a third cylinder using the same methods. Dimensions below.

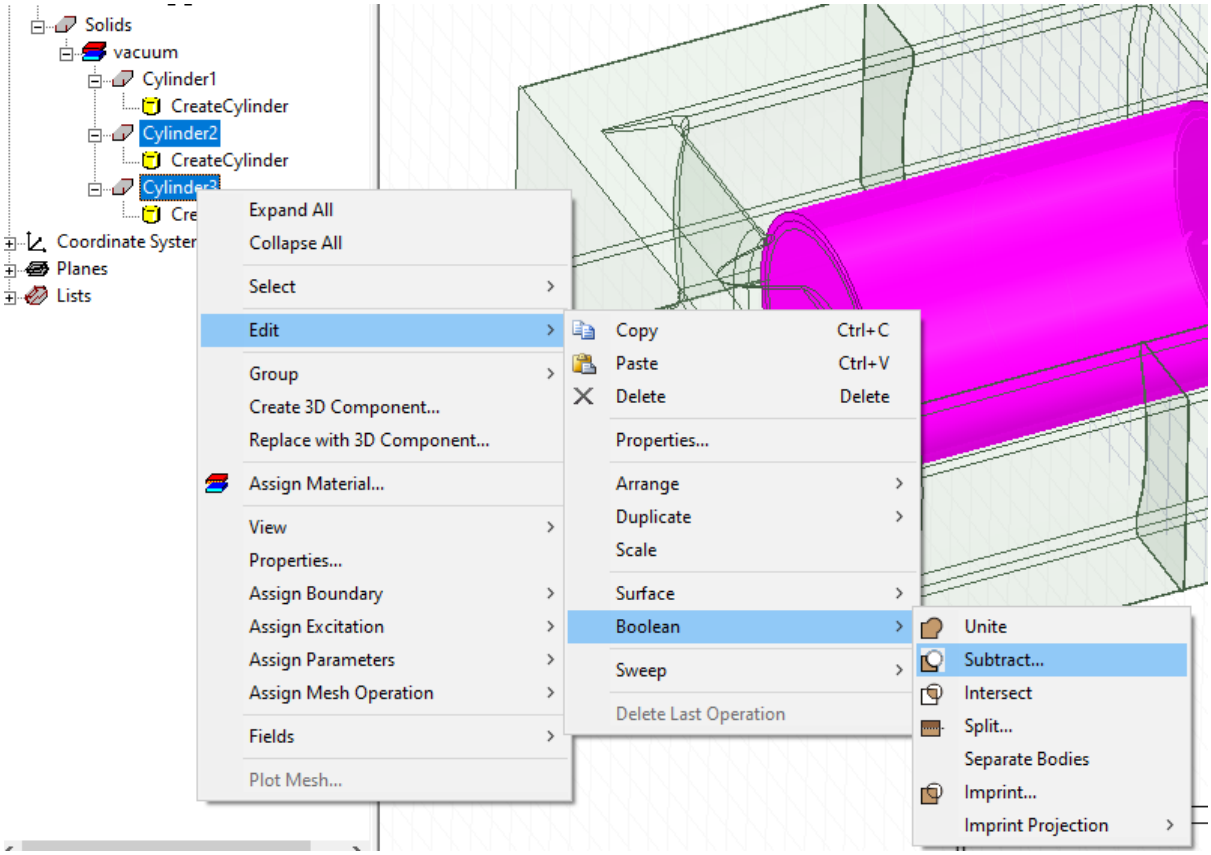


Click Cylinder3 in the project menu. Hold control key and click Cylinder2.

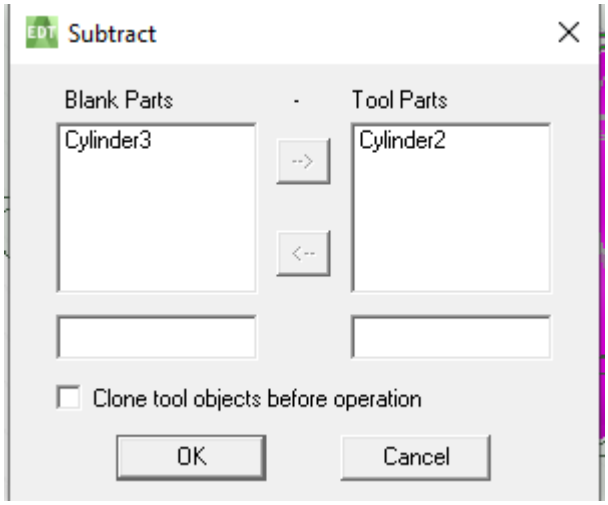


Right click Cylinder3 to open the menu.

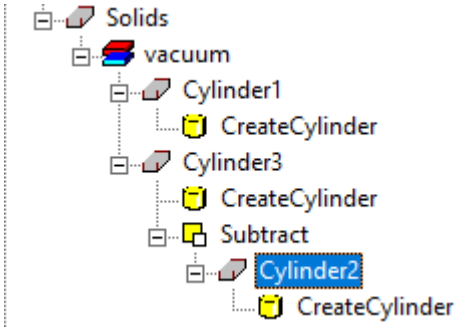
Edit -> Boolean -> Subtract



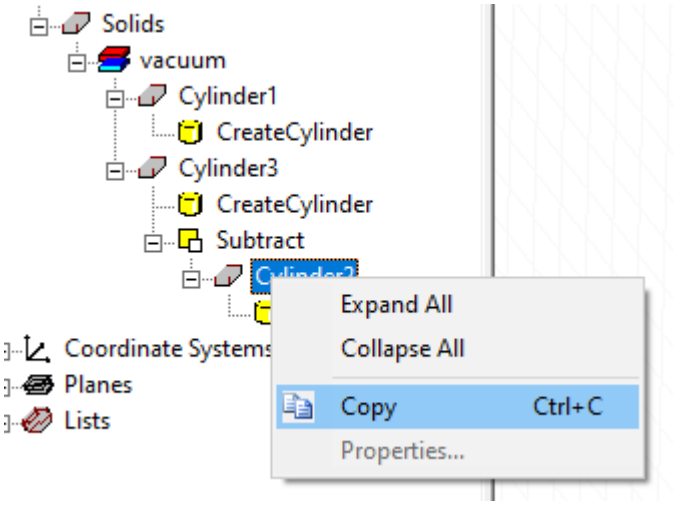
The following menu pops up. Click OK.



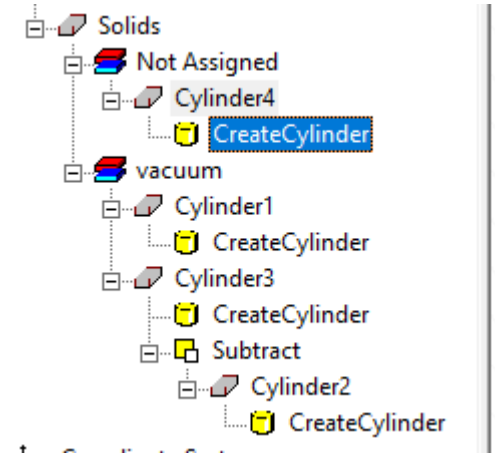
Then click on Cylinder2 in the project tree.



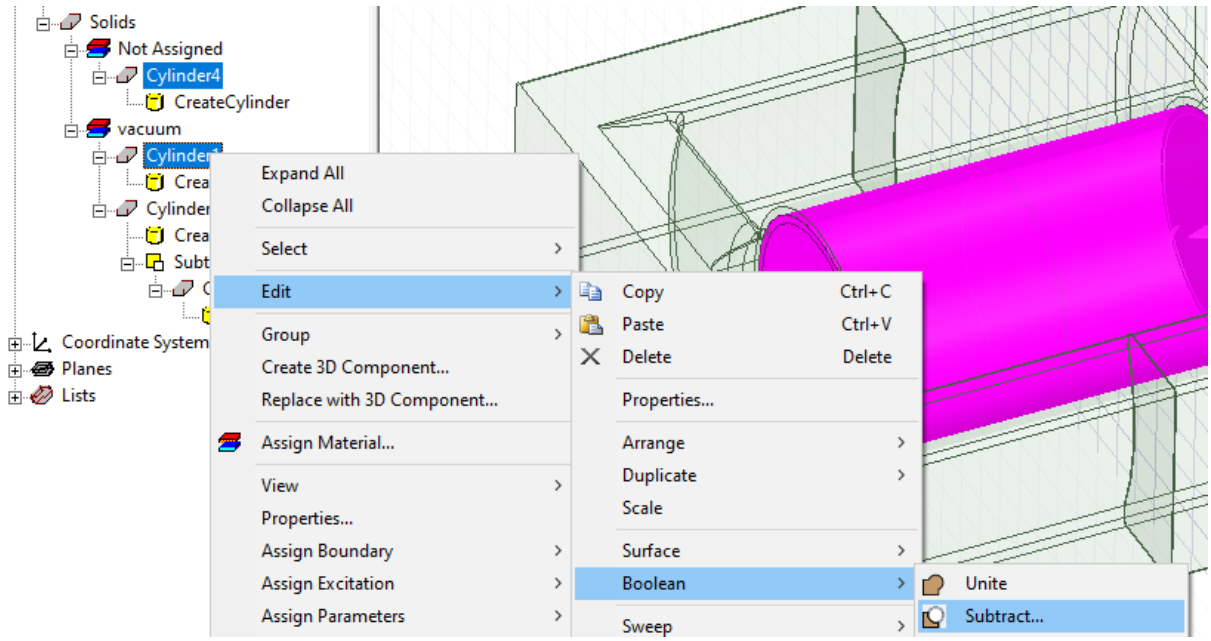
Right click on Cylinder2 and copy.



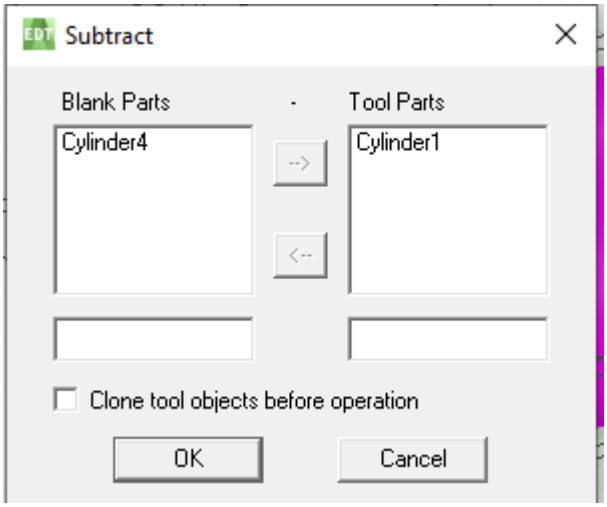
The press Control and V at the same time. Cylinder4 should appear.



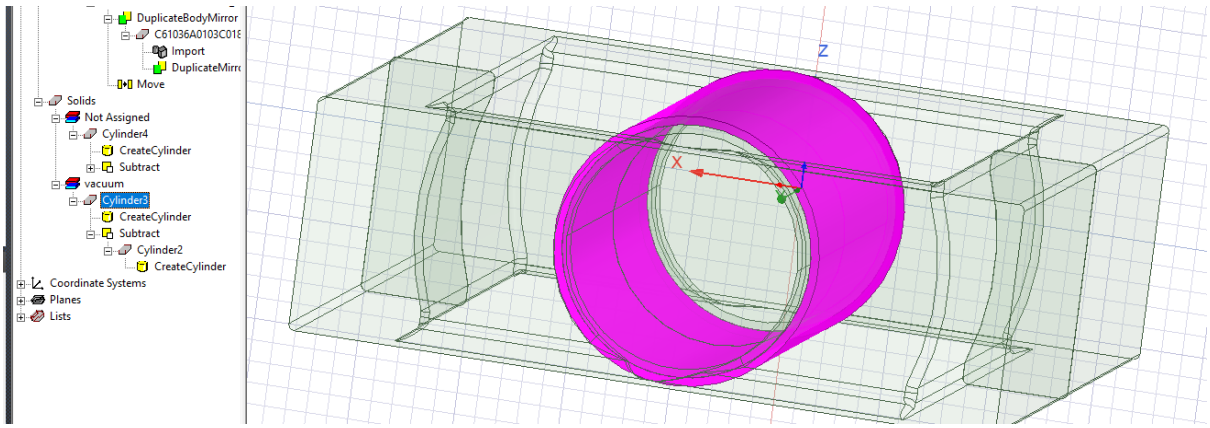
Then subtract Cylinder1 from Cylinder4. Click Cylinder4 first then hold control while clicking Cylinder1. Right click Cylinder4 to get to the subtract in the menu.



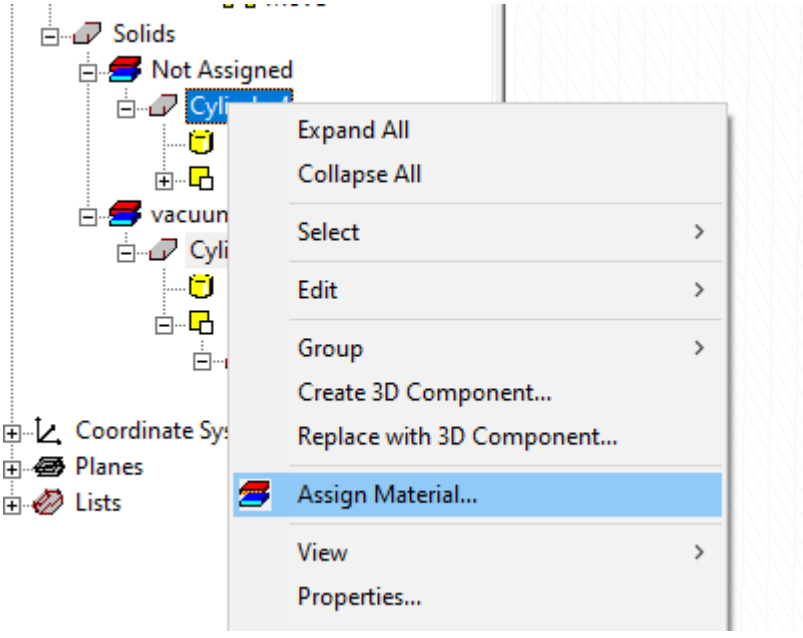
The subtraction should look like this.



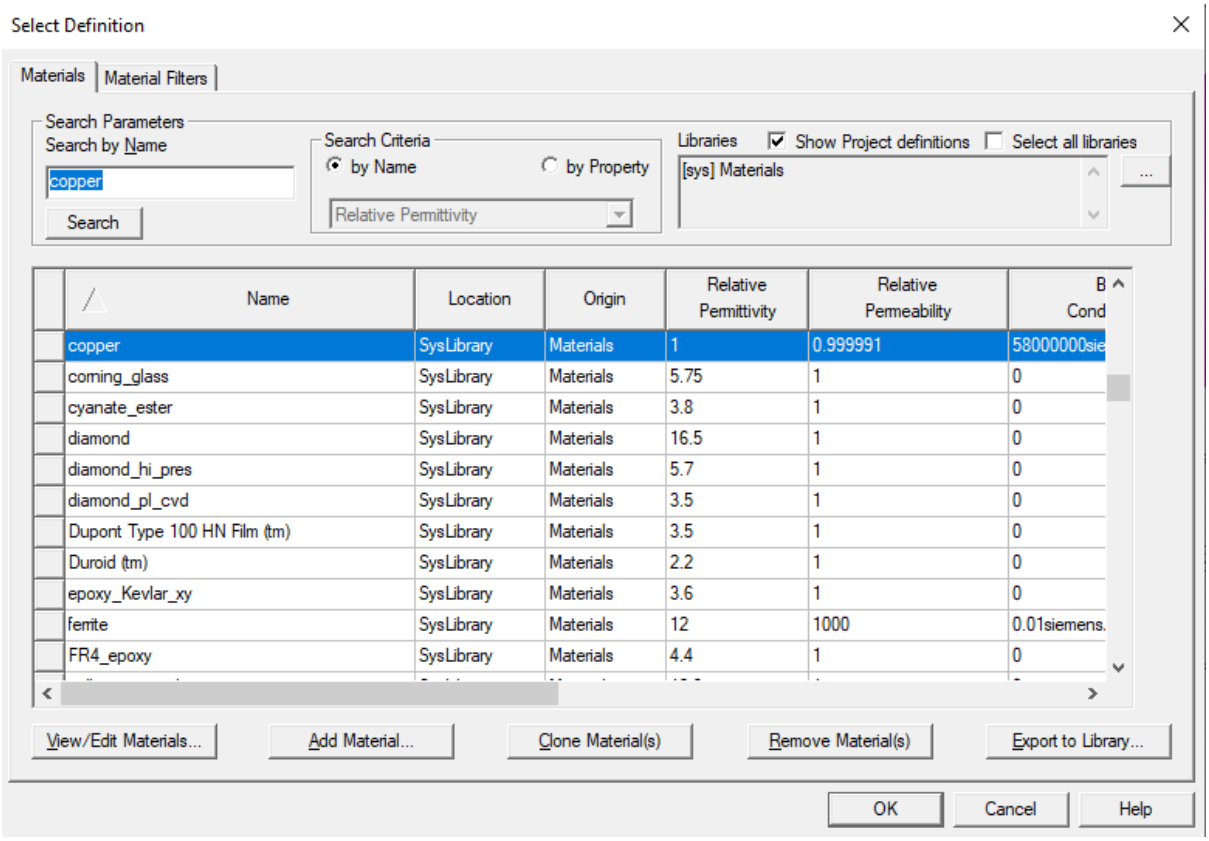
The subtracted model should look like this.



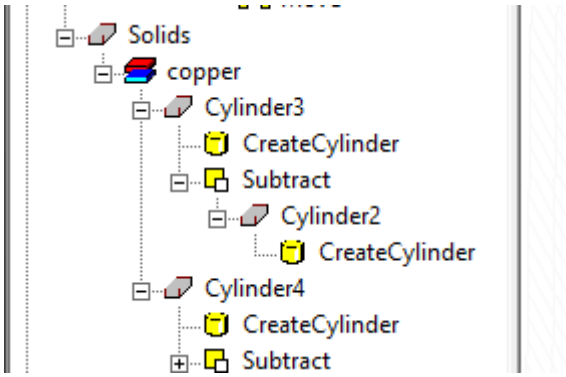
Hold control and click Cylinder3 and Cylinder4. Right click to show the menu. Go to Assign Material.



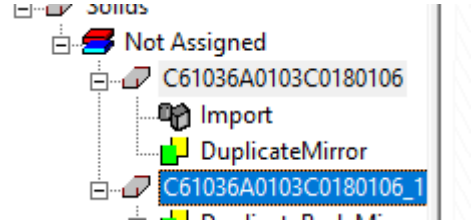
Find copper in the Materials library and click copper. Then click OK.



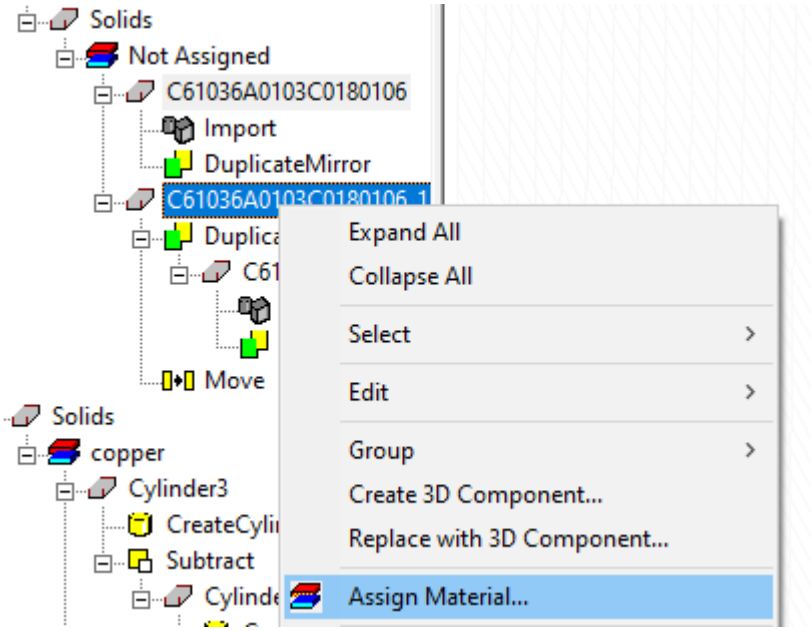
This should have set the properties of the cylinders to be copper as shown.



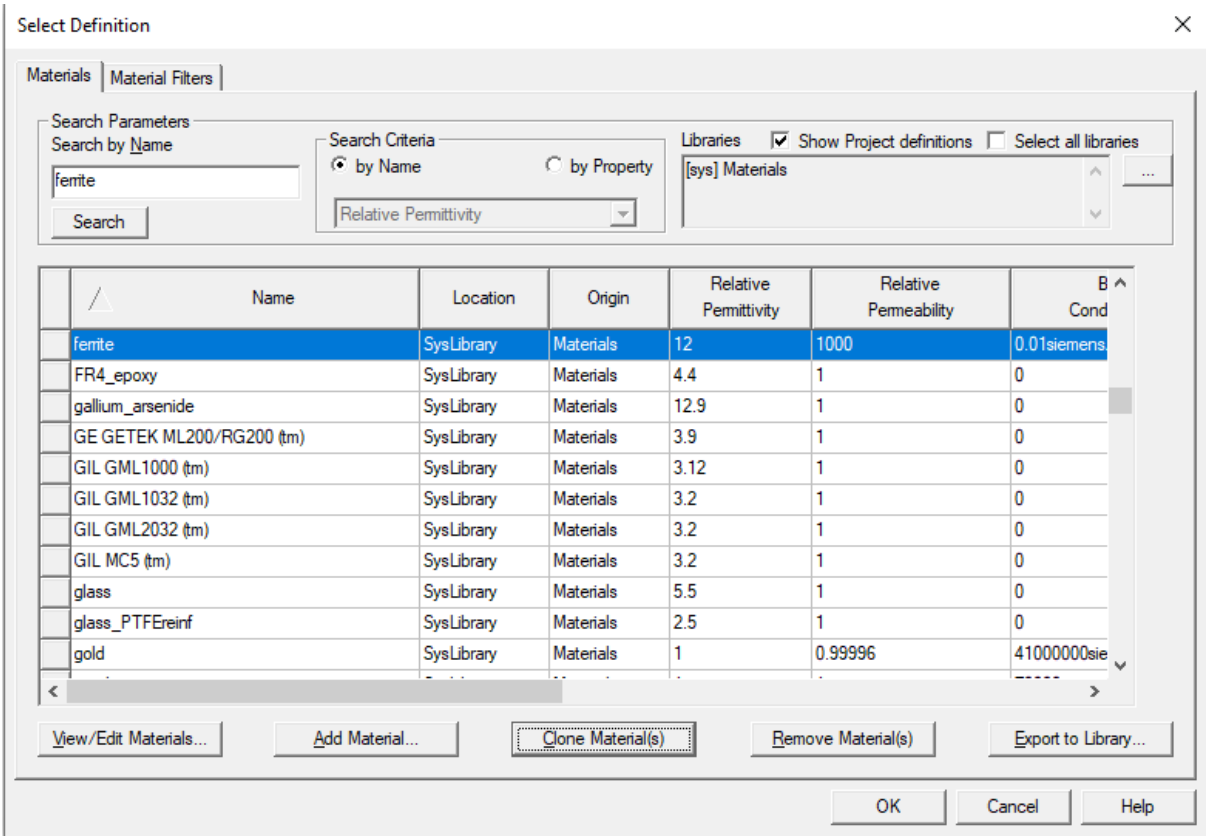
Similarly, hold control and click on the two models of the ferrite core.



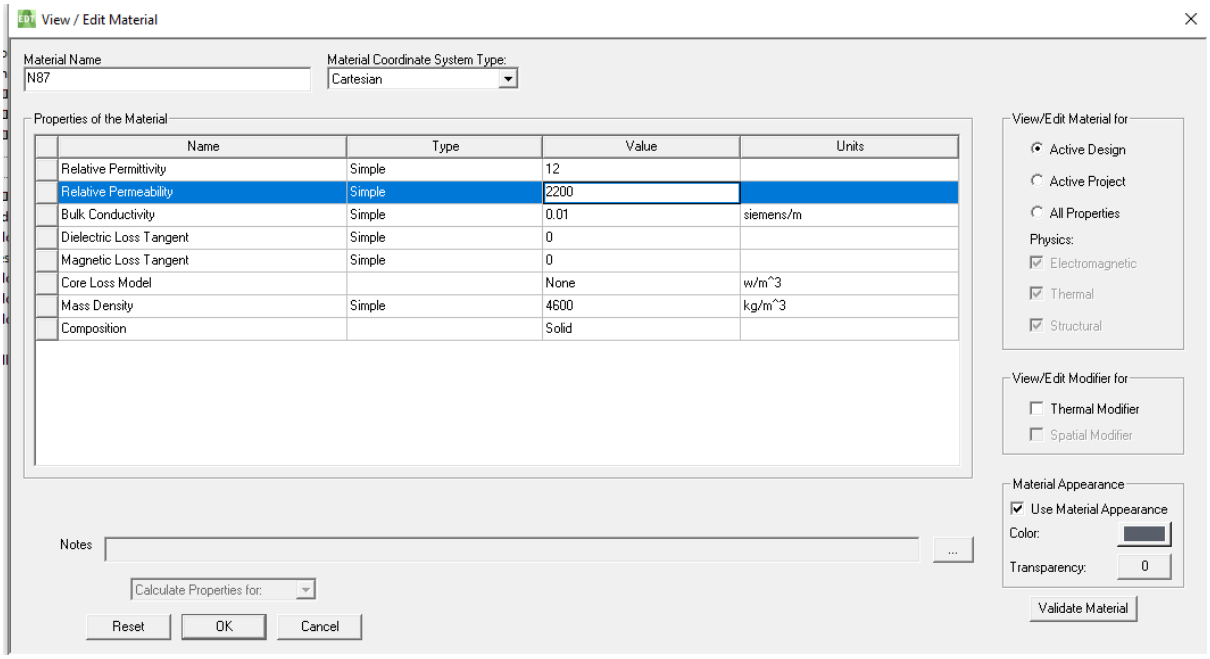
Right click the model and click Assign Material.



Find ferrite in the Materials library and click ferrite. Then click Clone Material(s).

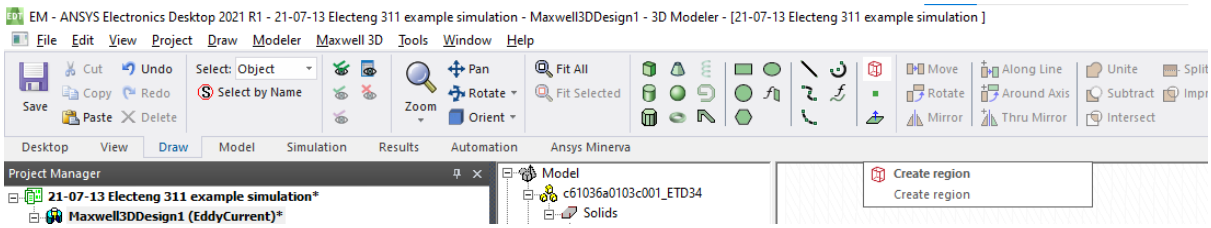


Fill in the dialogue box as shown.

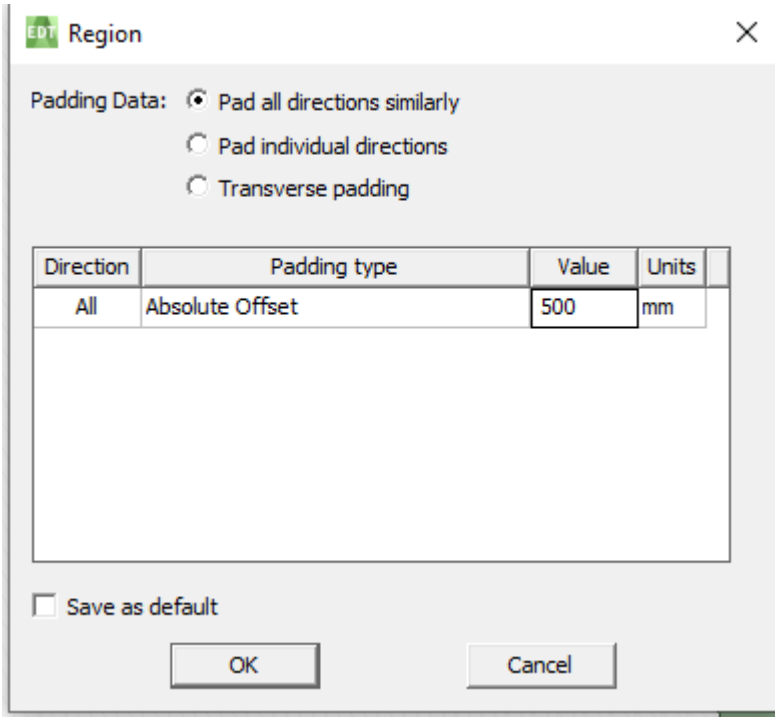


Click Ok.

In the Draw panel, click the red button for Create region.

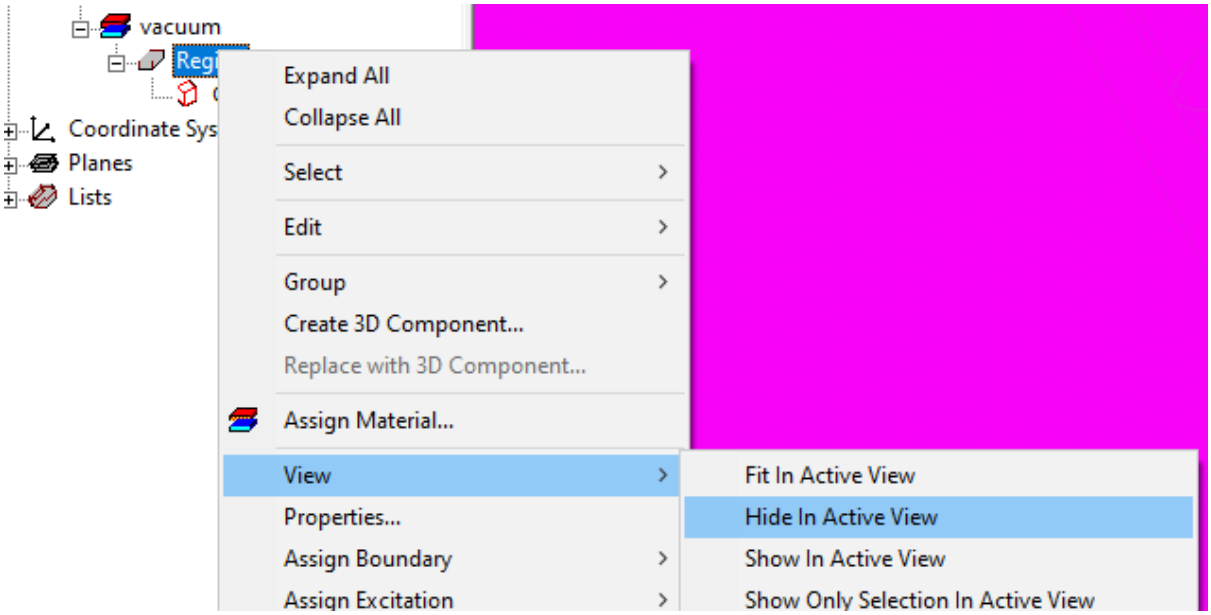


Enter the dialogue as shown.



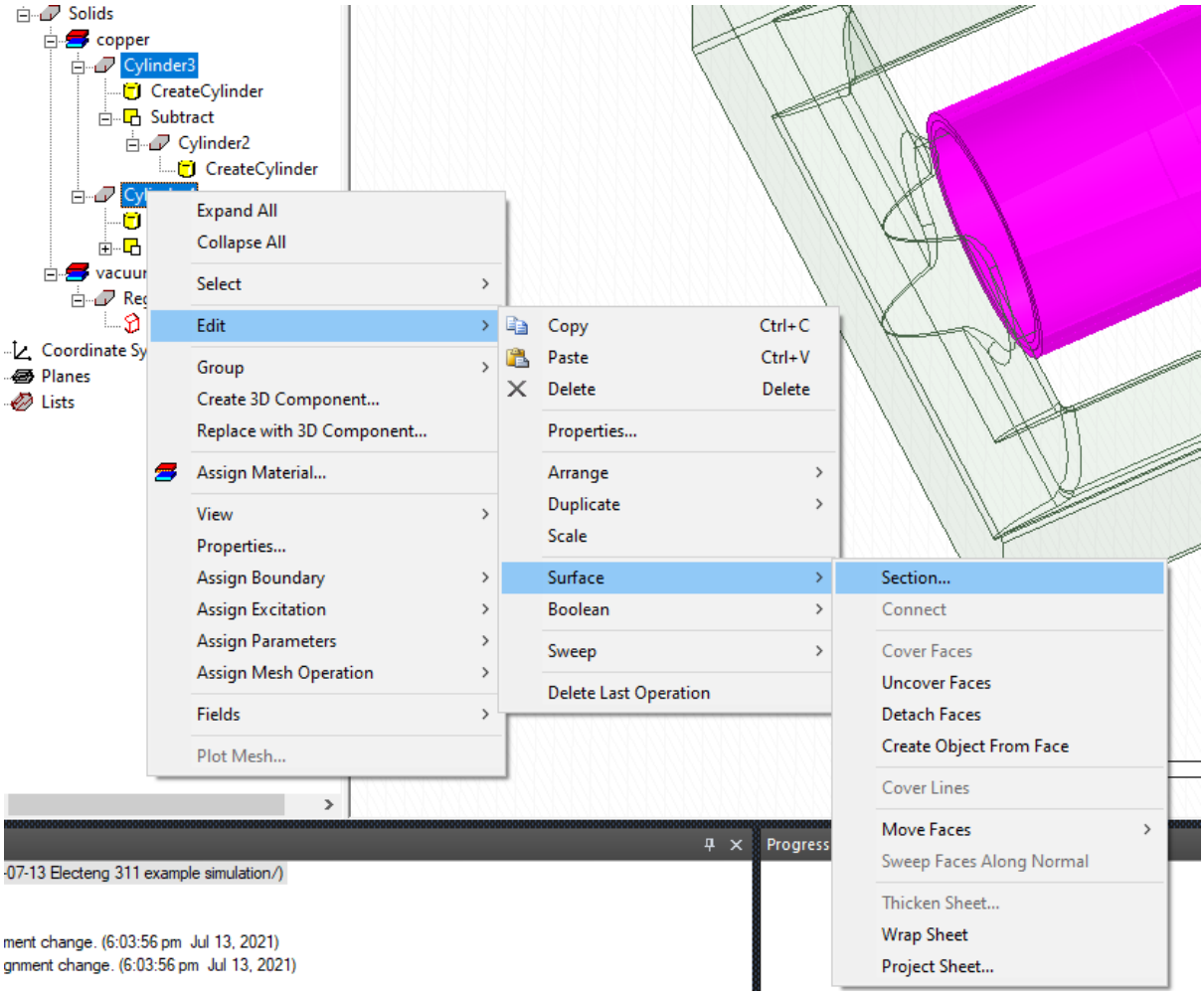
In the project tree, right click on the region.

View -> Hide in Active View.

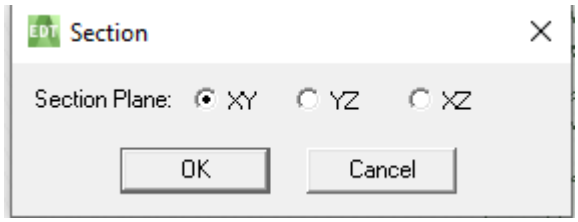


Hold control and click Cylinder4 and Cylinder3. Right click on the Cylinder4 for the menu.

Edit -> Surface -> Section

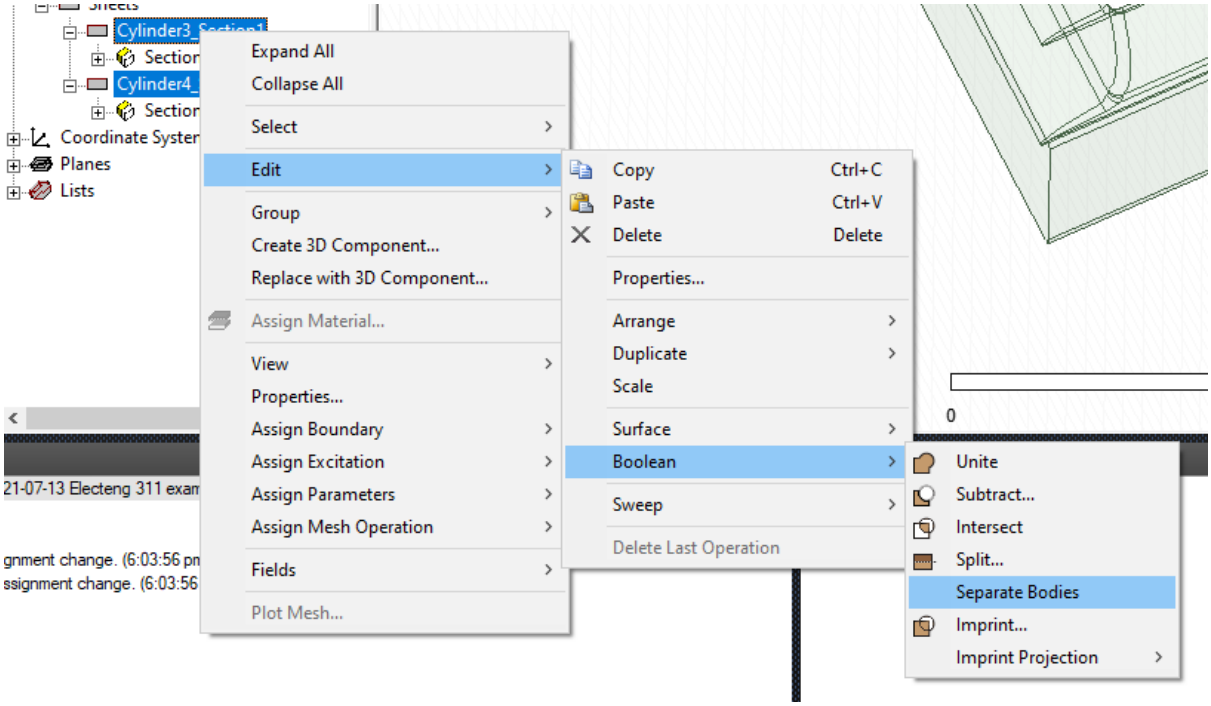


Click XY and click OK.



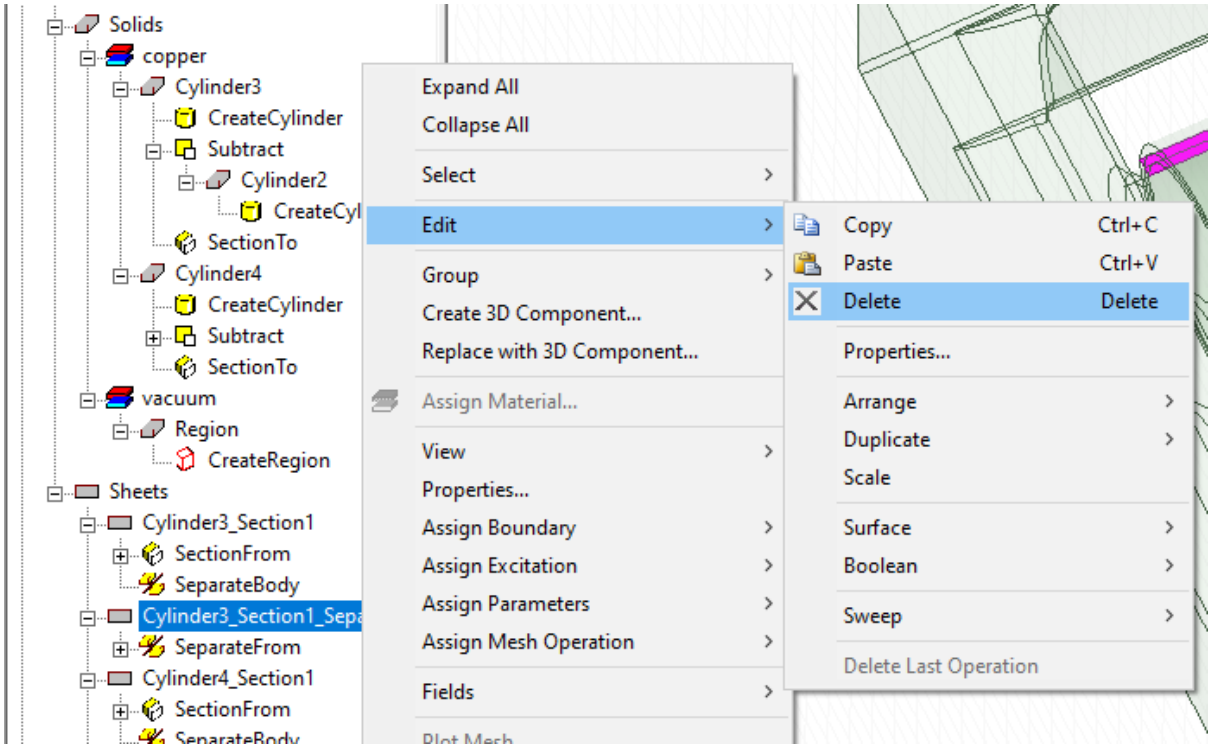
Hold control and click on the Cylinder3_Section1 and Cylinder4_Section1. Right click to bring up the menu.

Edit -> Boolean -> Separate Bodies.



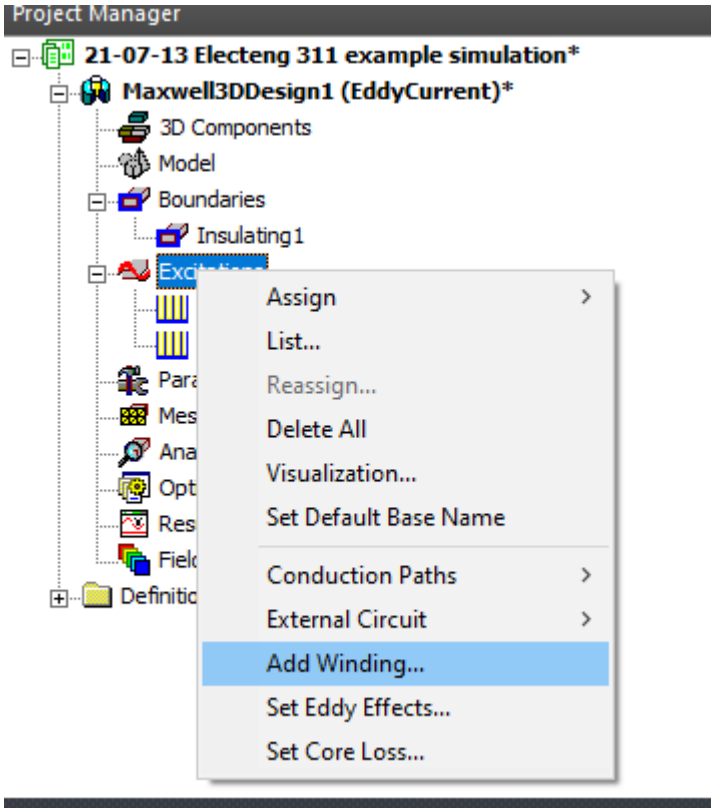
Hold control and click on Cylinder3_Section1_Separate1 and Cylinder4_Section1_Separate1 and right click to bring up the menu.

Edit-> Delete

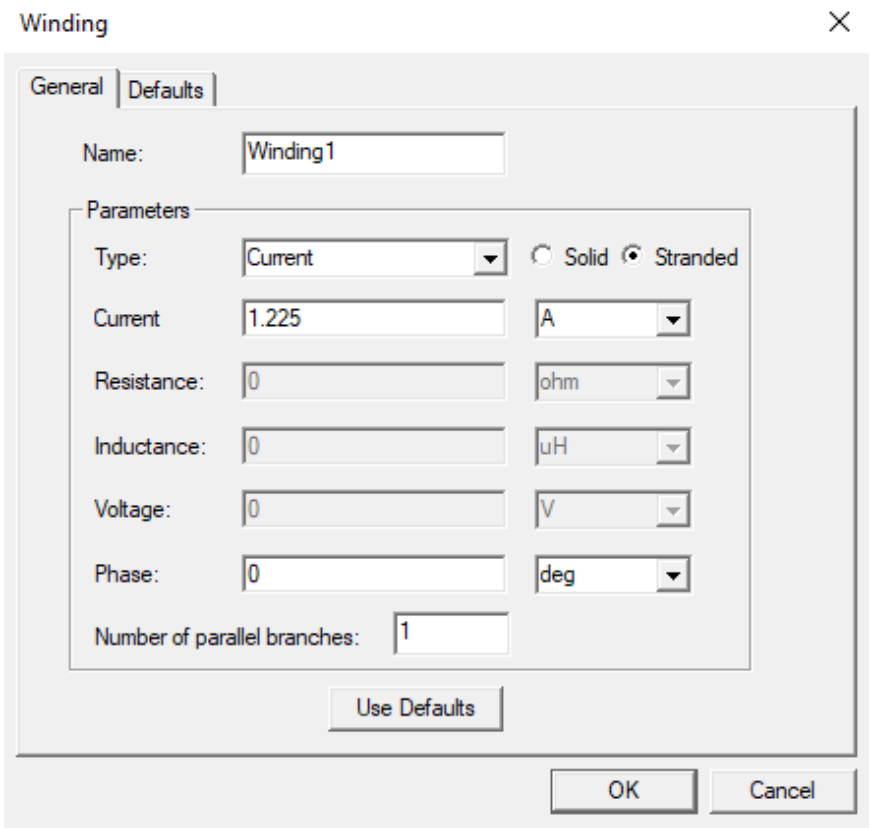


Right click on Excitation in the Project Manager.

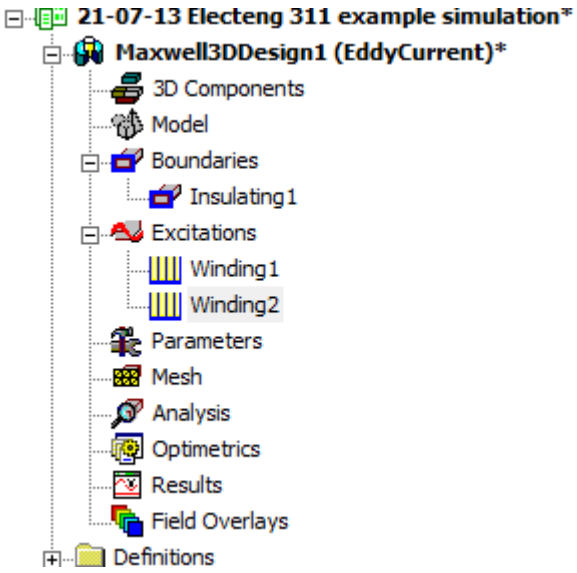
Add Winding



Fill in the dialogue menu as shown.

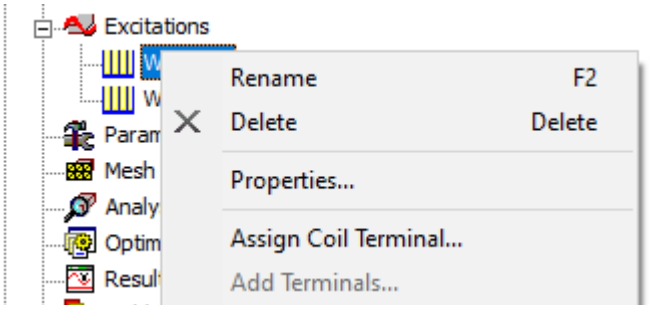


Do the same again. There should be two windings now in the Project Manager.

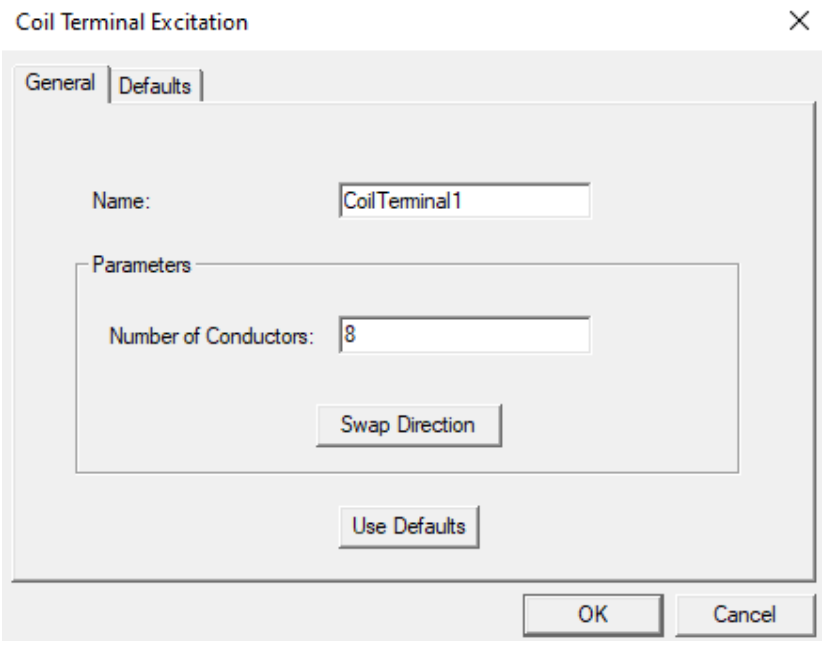


Click on Cylinder3_Section1 in the project tree then right click Winding 1 in the Project Manager.

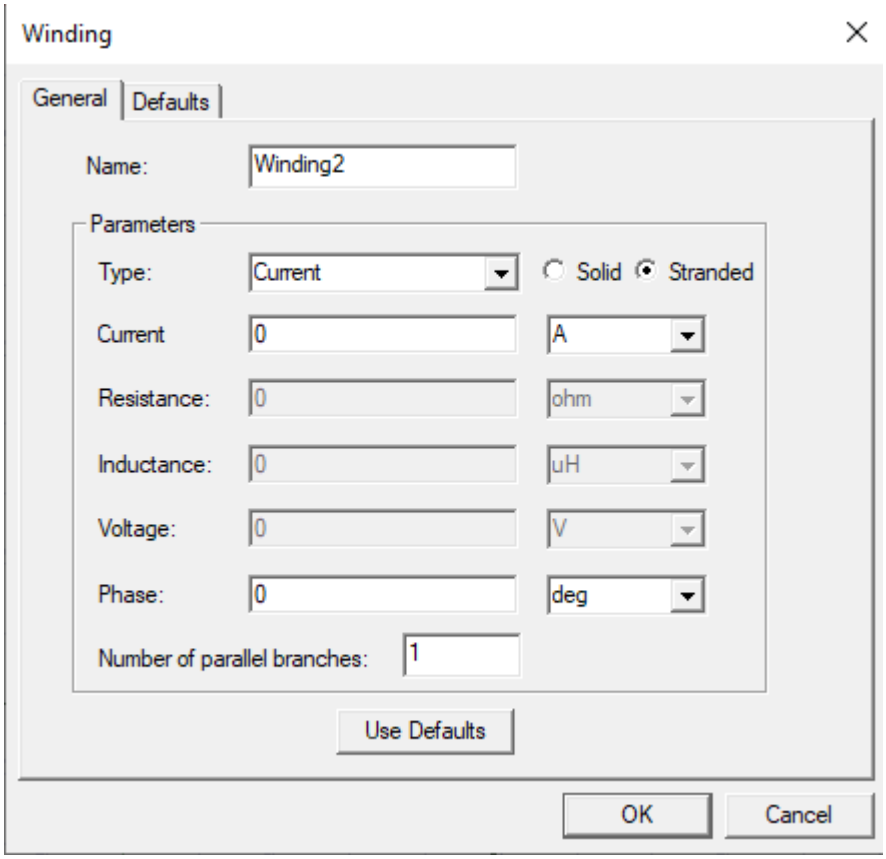
Assign Coil Terminal.



Fill in the dialogue box as shown.

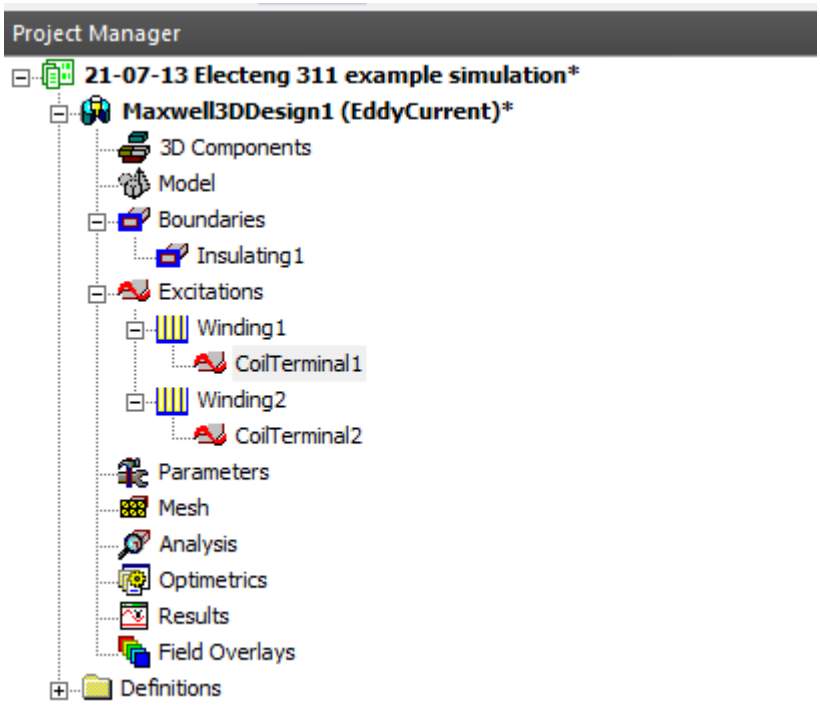


Do the same for Cylinder4_Section1.



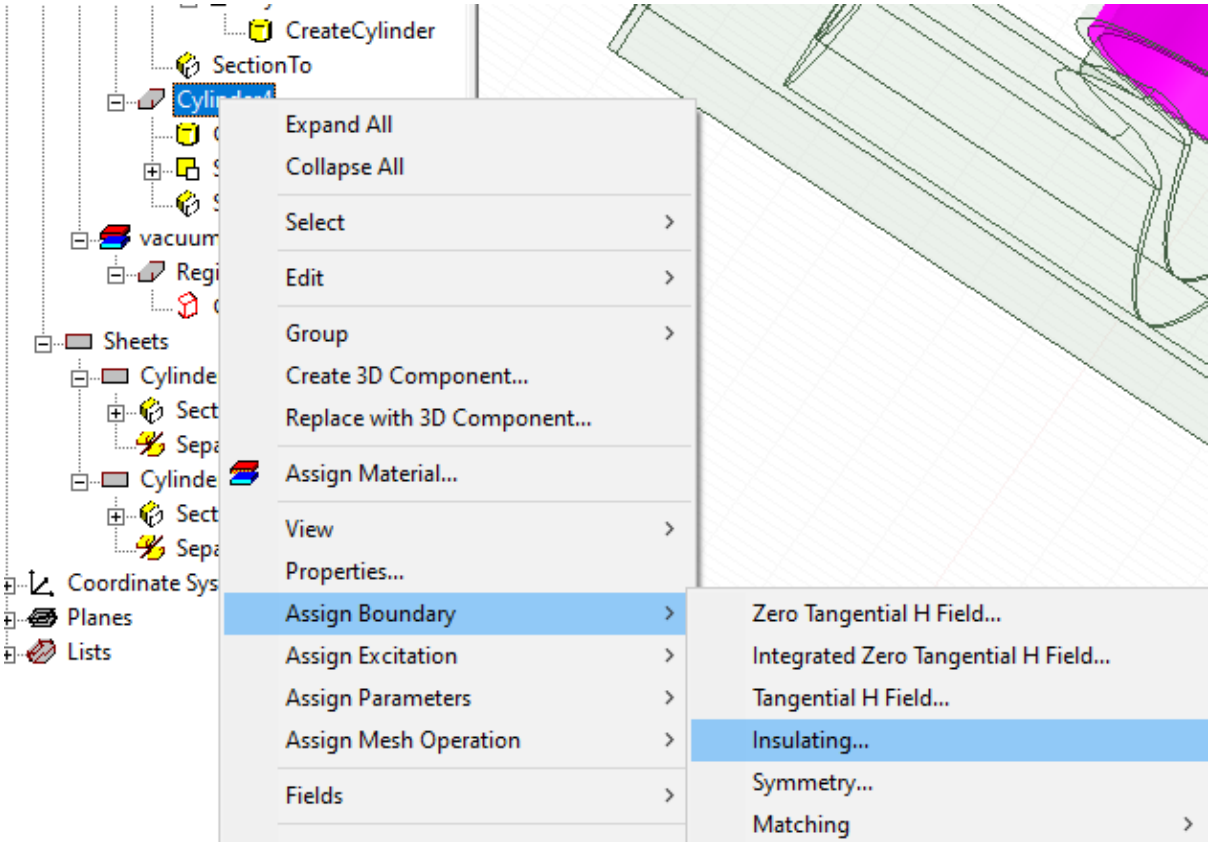
Note that the current in the secondary winding is 0A here.

The Project Manager should look like this.

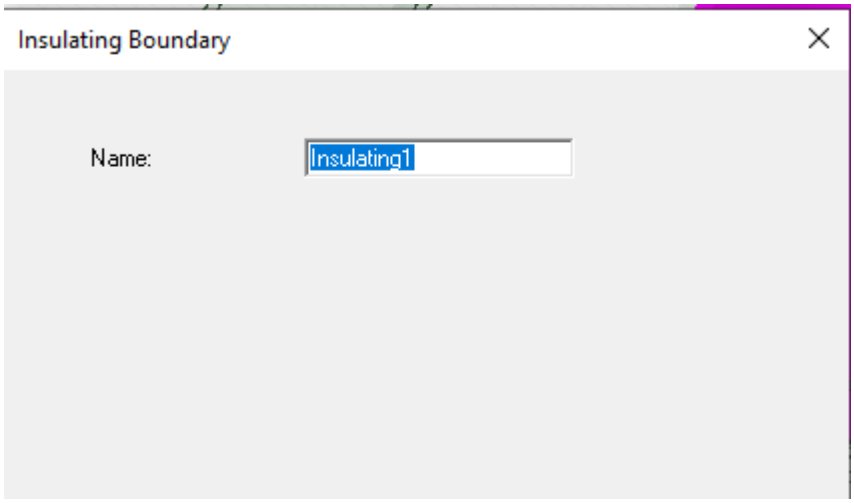


In project tree, right click Cylinder4.

Assign Boundary -> Insulating

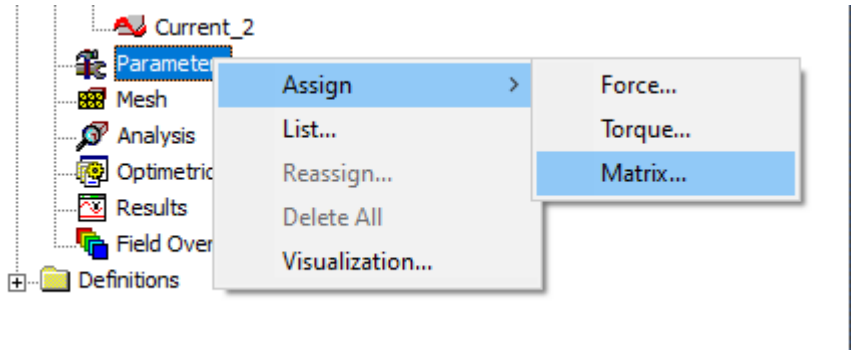


Click OK.

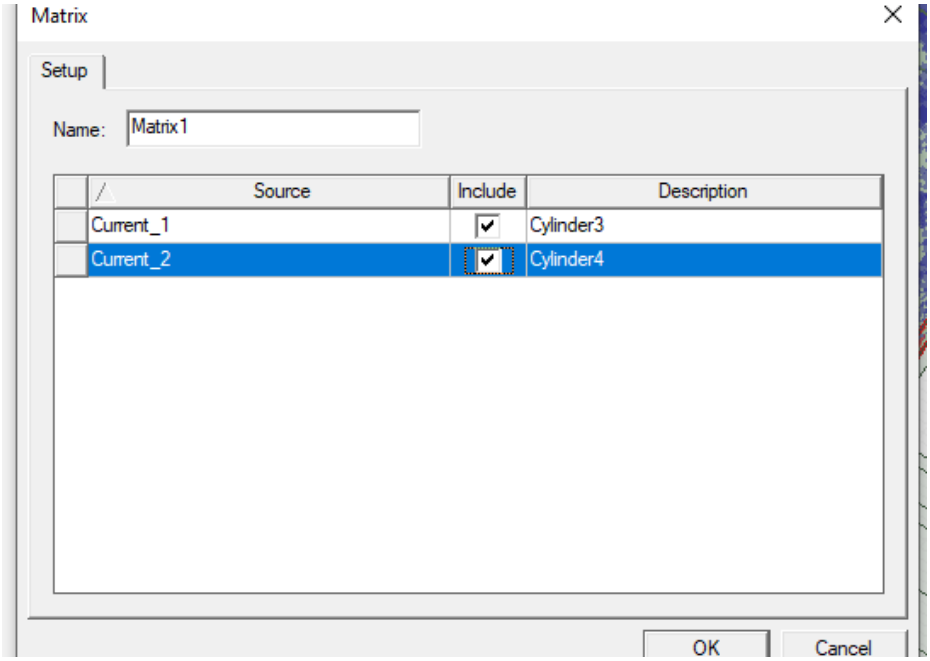


In the Project Manager, right click Parameters.

Assign -> Matrix.

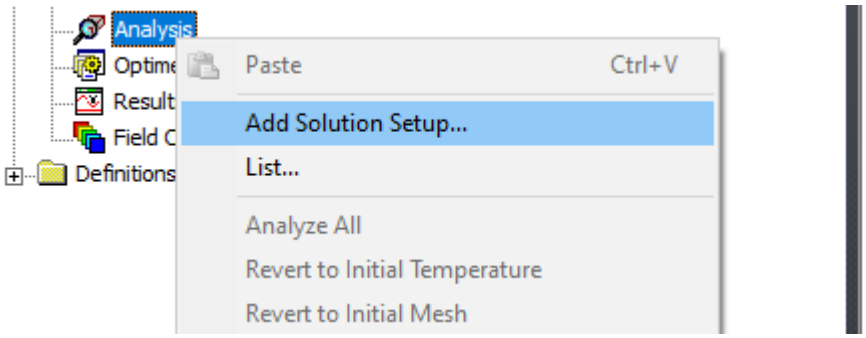


Click the check boxes for include for both.

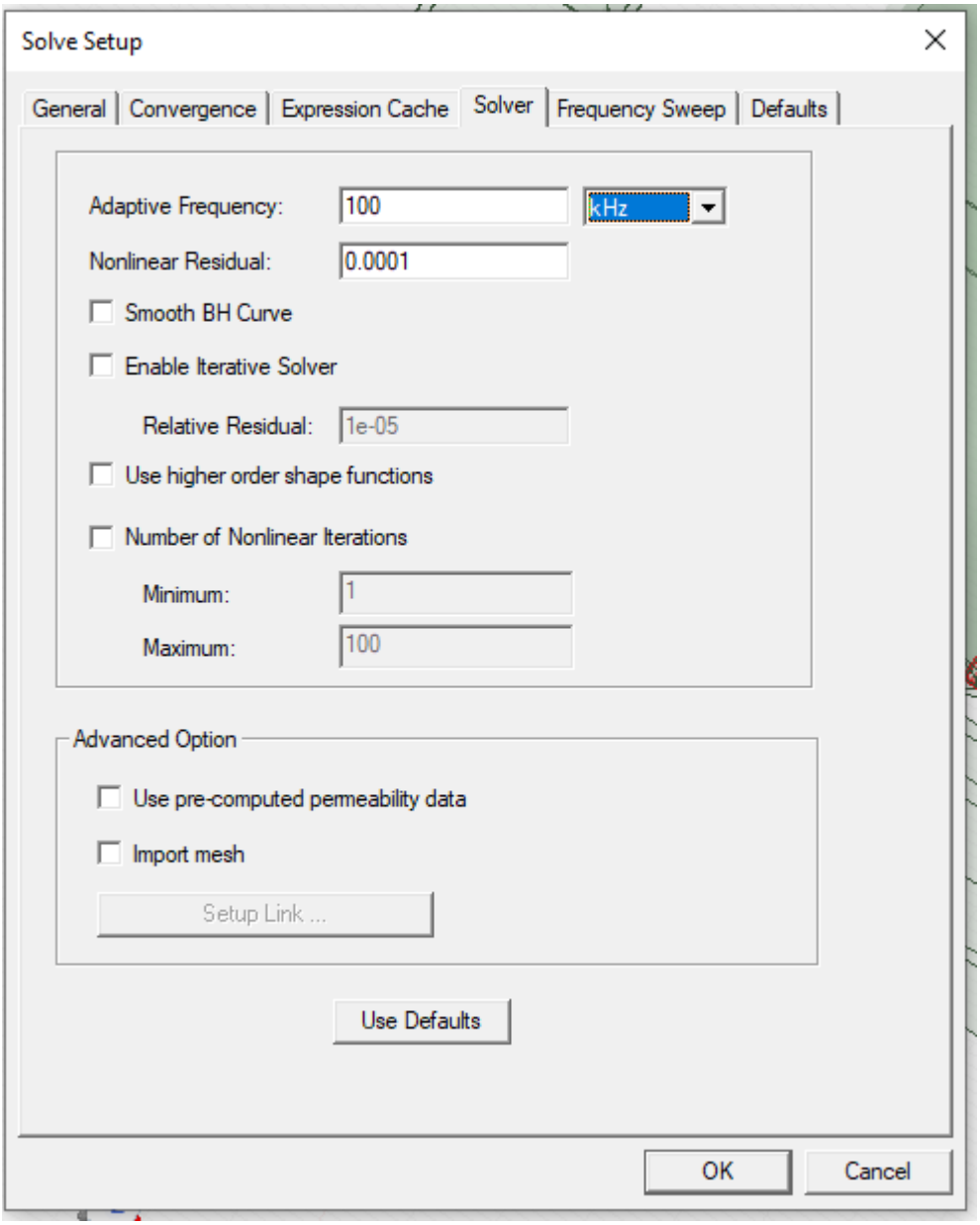


Right click Analysis.

Add Solution Setup

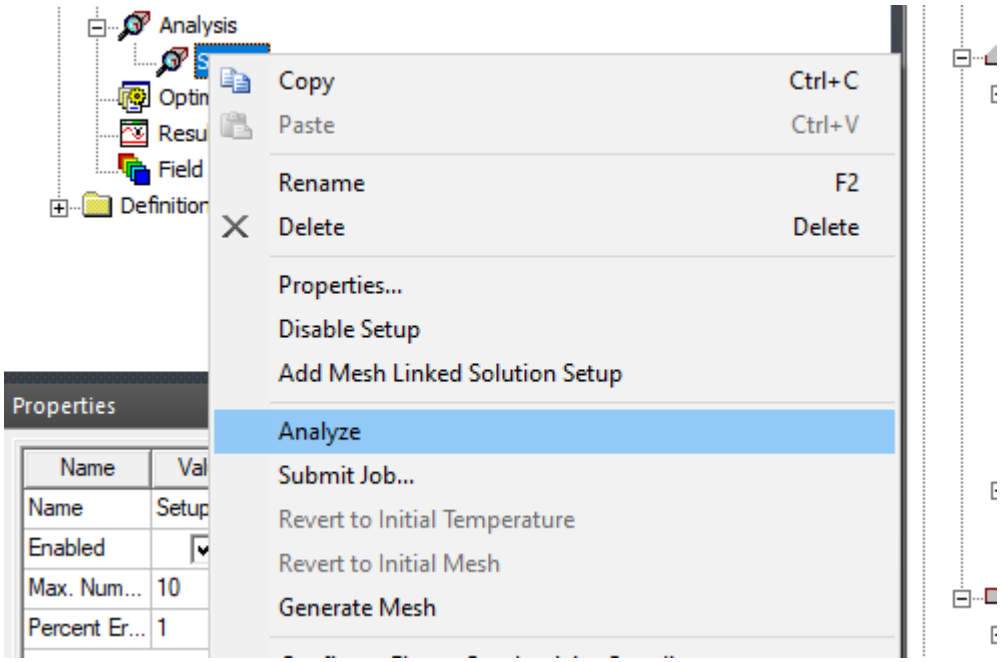


Go to Solver. Change the frequency to be 100 kHz.

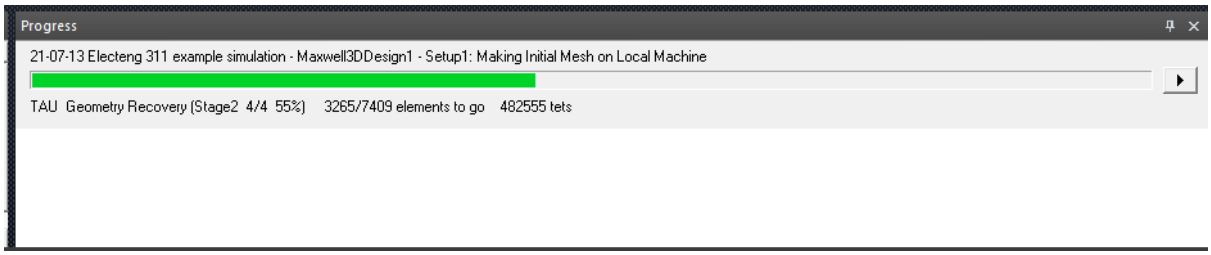


Right click Setup1.

Analyze.

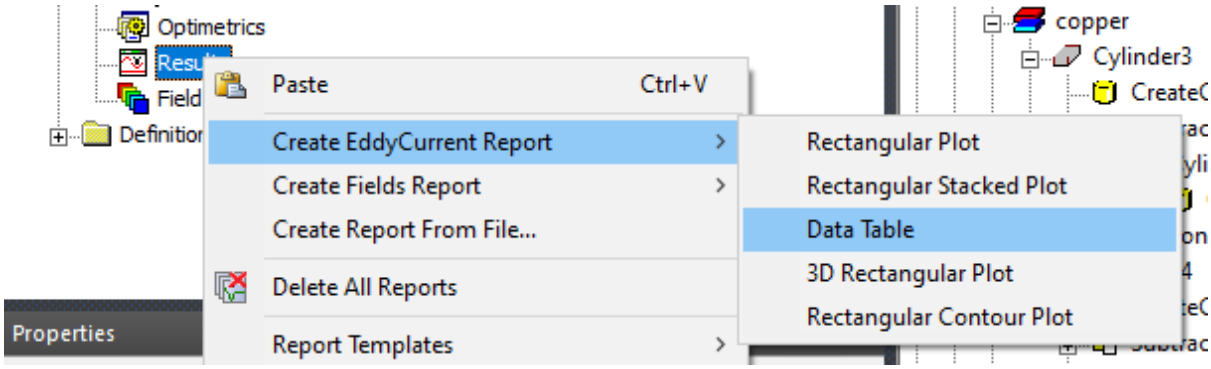


ANSYS should show a progress bar at the bottom. Solving of the model can take a few minutes.

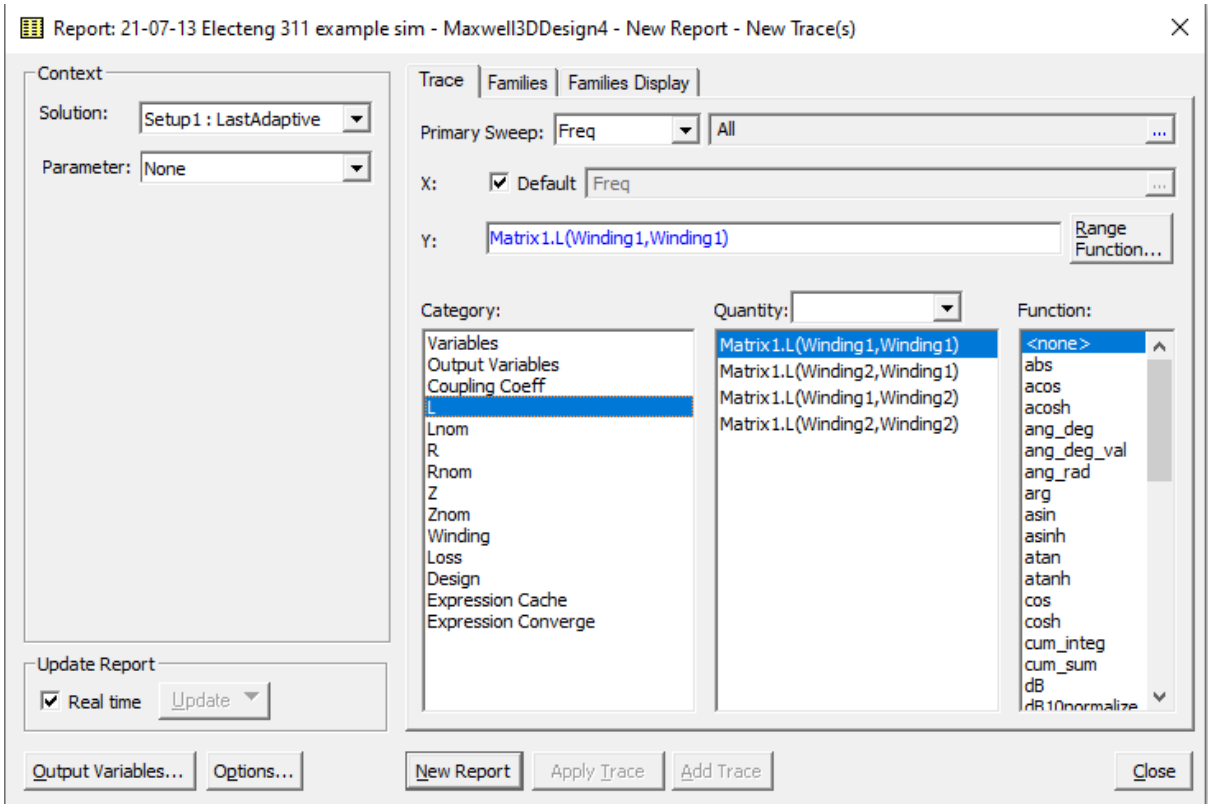


When the simulation is done, right click result.

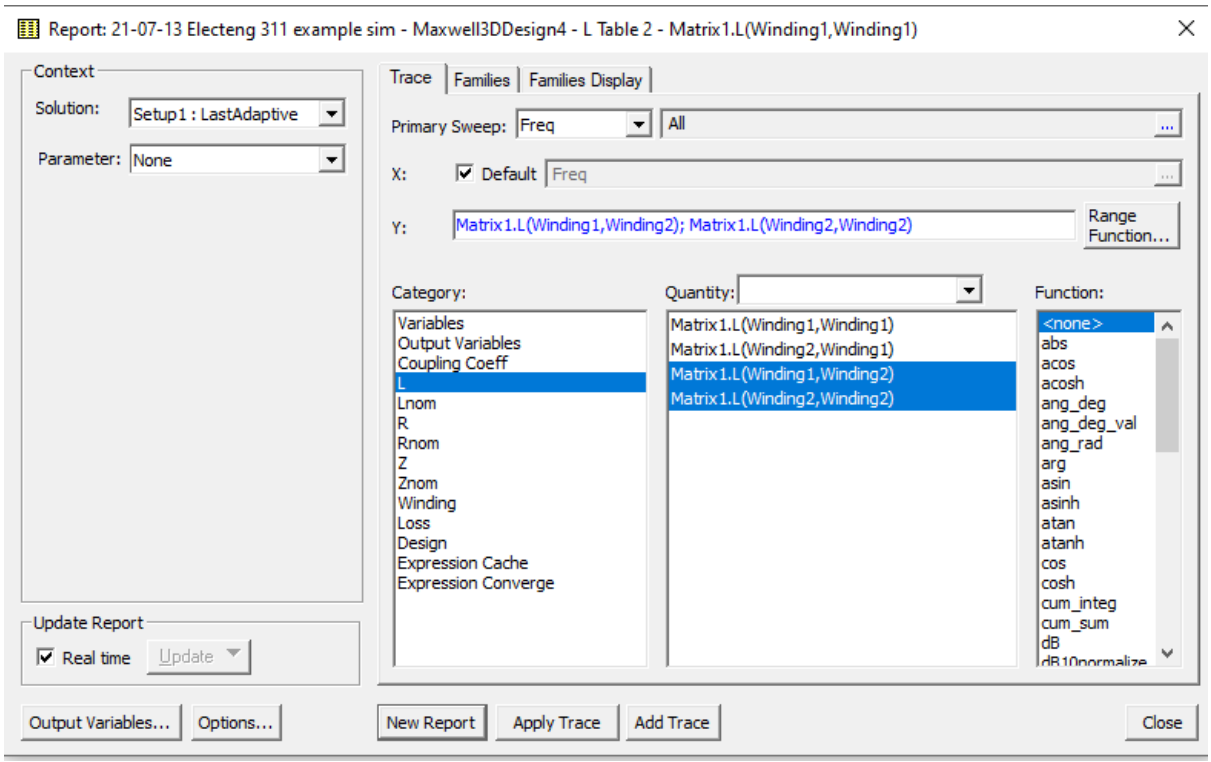
Create EddyCurrent Report -> Data Table



Click L then Matrix1.L(Winding1,Winding1). Then press New Report.

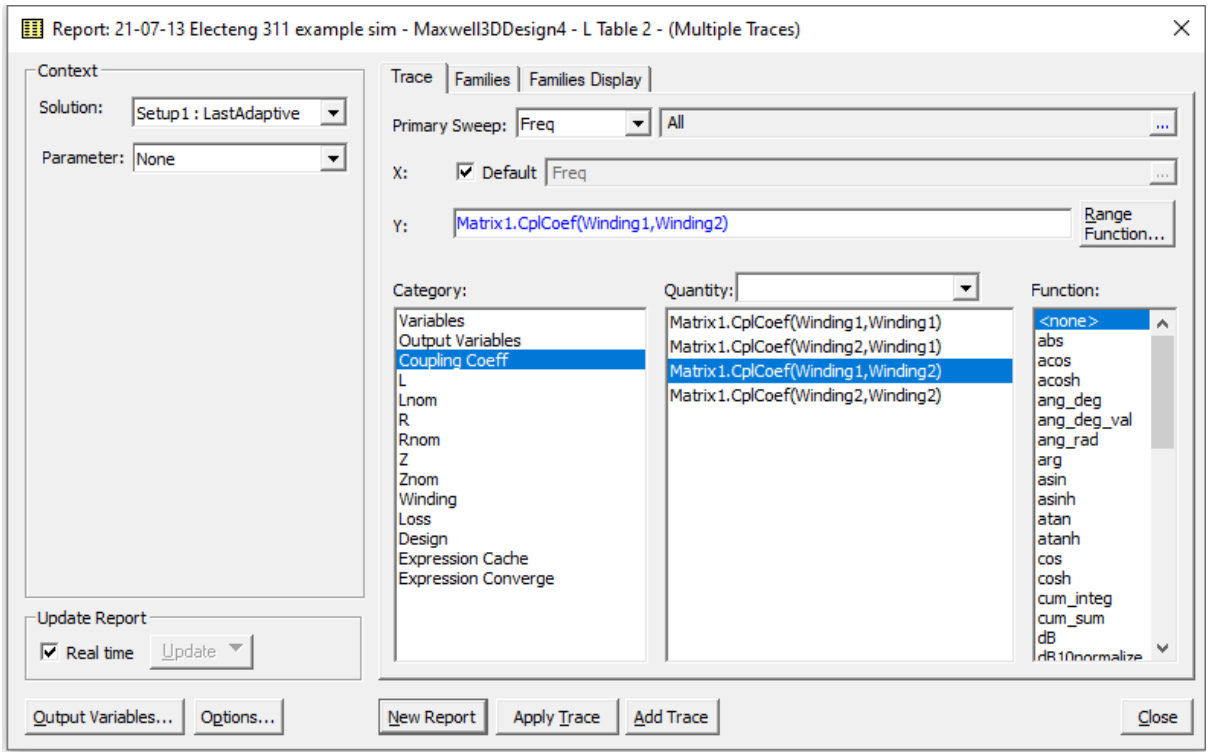


Hold control and click Matrix1.L(Winding1,Winding2) and Matrix1.L(Winding 2, Winding 2) then click Add Trace.

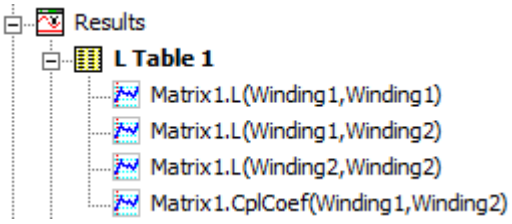


Click Coupling Coeff.

Click Matrix.1CplCoef(Winding1, Winding 2) and click Add Trace



In the Project Manager, double click L Table 1.



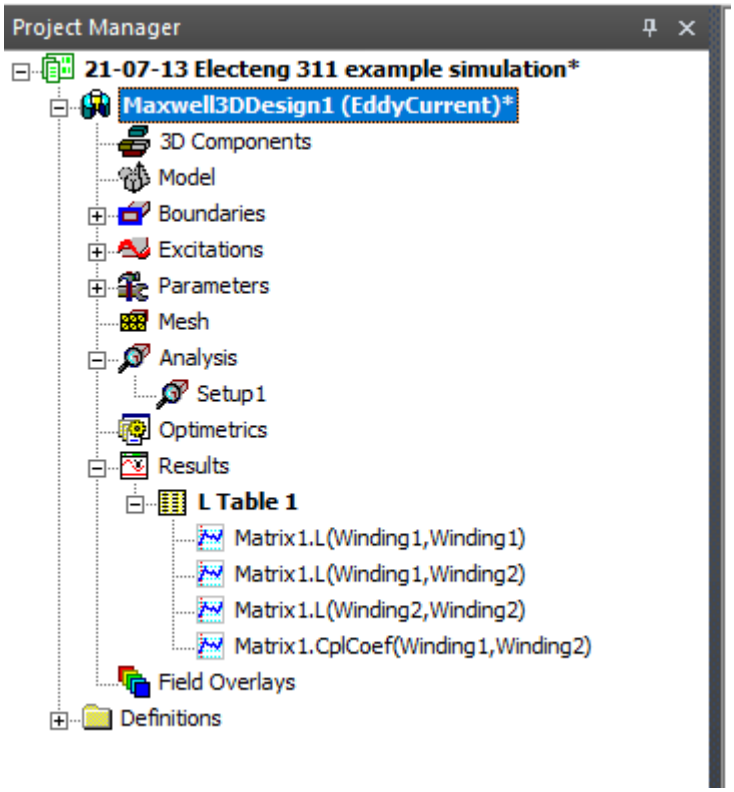
Check if you get these following results.

L Table 1

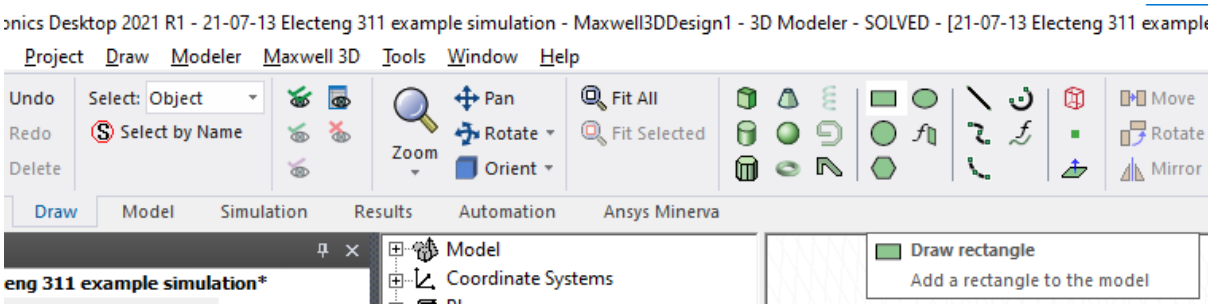
	Freq [kHz]	Matrix1.L(Winding1,Winding1) [uH] Setup1 : LastAdaptive	Matrix1.L(Winding1,Winding2) [uH] Setup1 : LastAdaptive	Matrix1.L(Winding2,Winding2) [uH] Setup1 : LastAdaptive	Matrix1.CplCoef(Winding1,Winding2) Setup1 : LastAdaptive
1	100.000000	38.862904	38.840426	38.856051	0.999510

Freq: 100kHz, Lp: 38.86uH, M: 38.84uH, Ls: 38.86uH, k: 0.9995

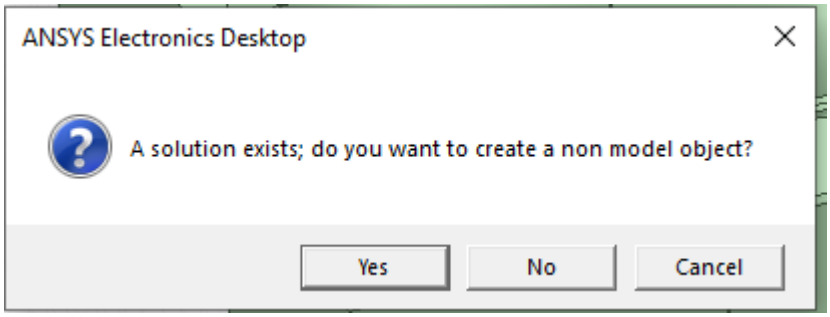
Double click Maxwell3DDesign1. This returns you to model view.



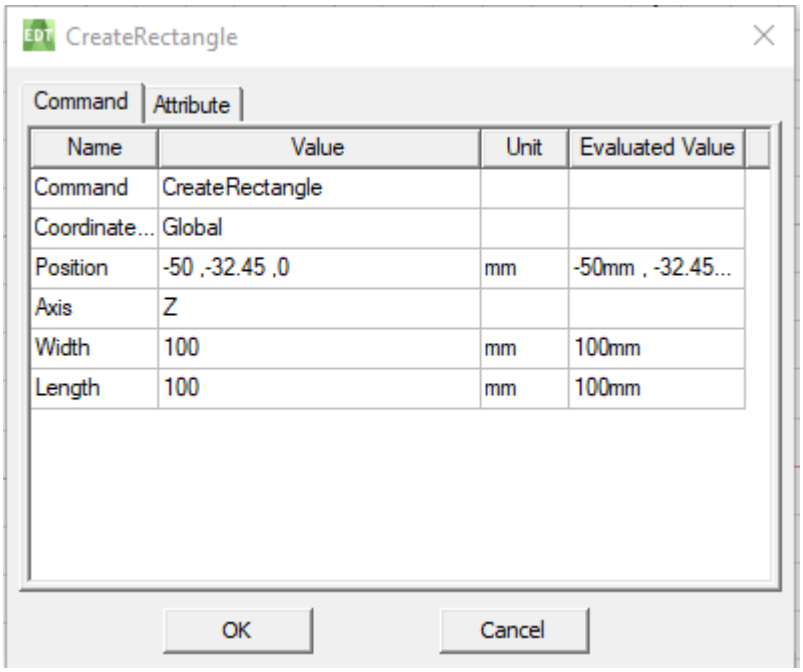
In the Draw panel, click Draw rectangle icon.



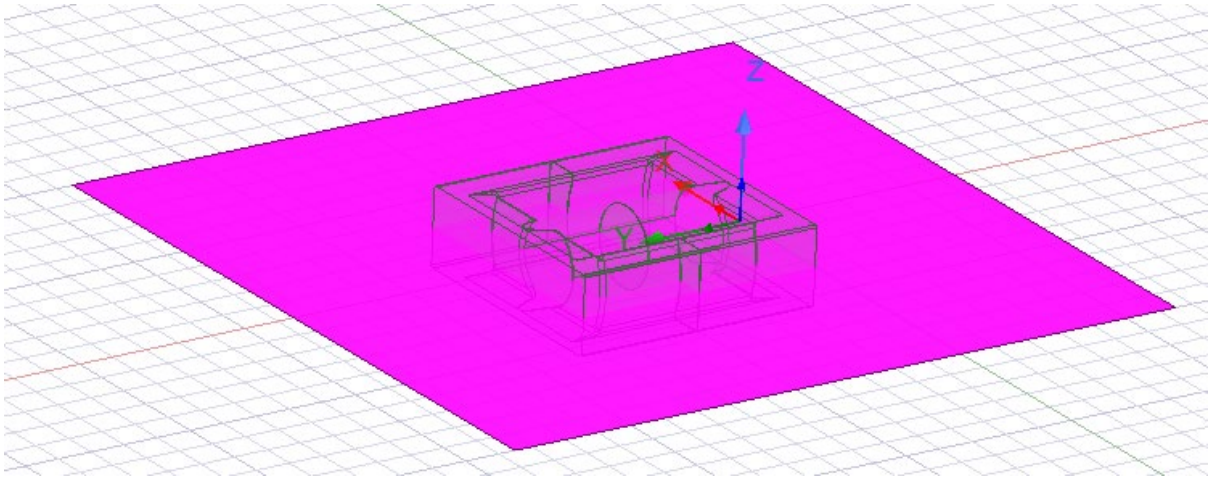
When this pop up is displayed, click yes.



In the dialogue box fill in as shown.

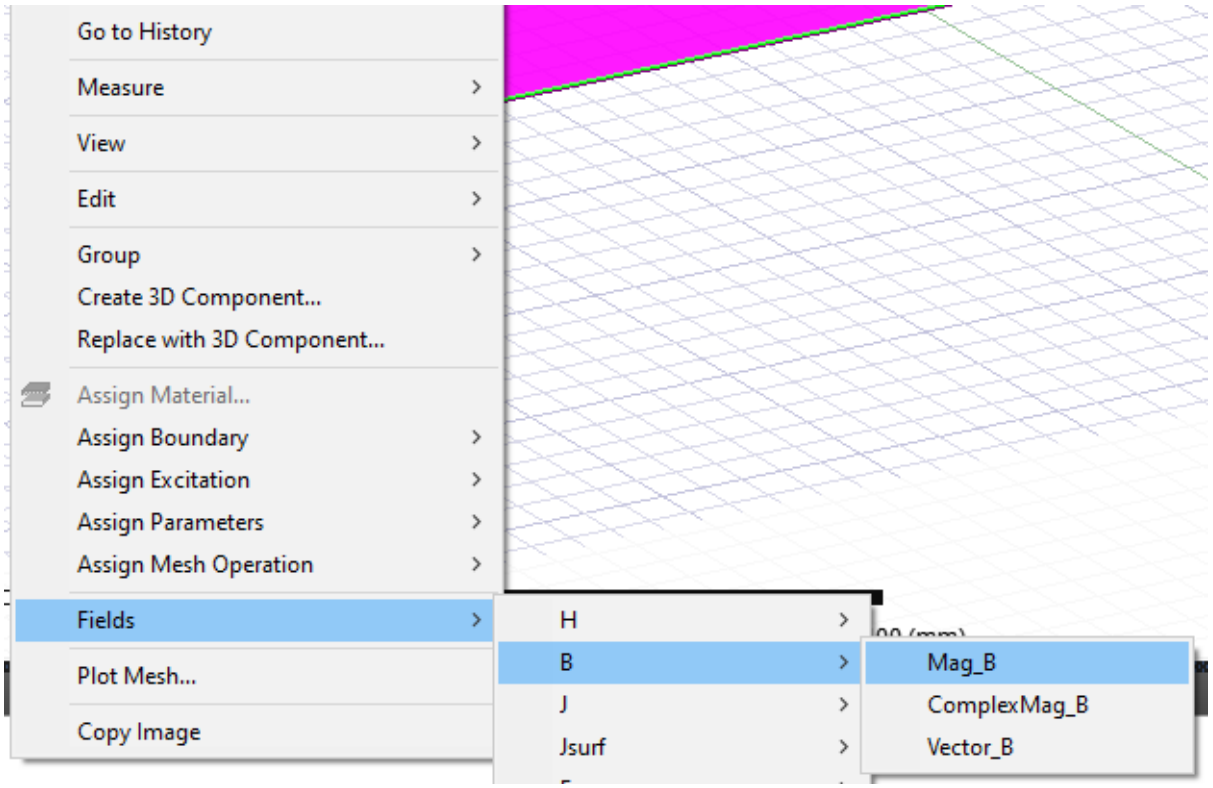


This creates a rectangular plane as shown.

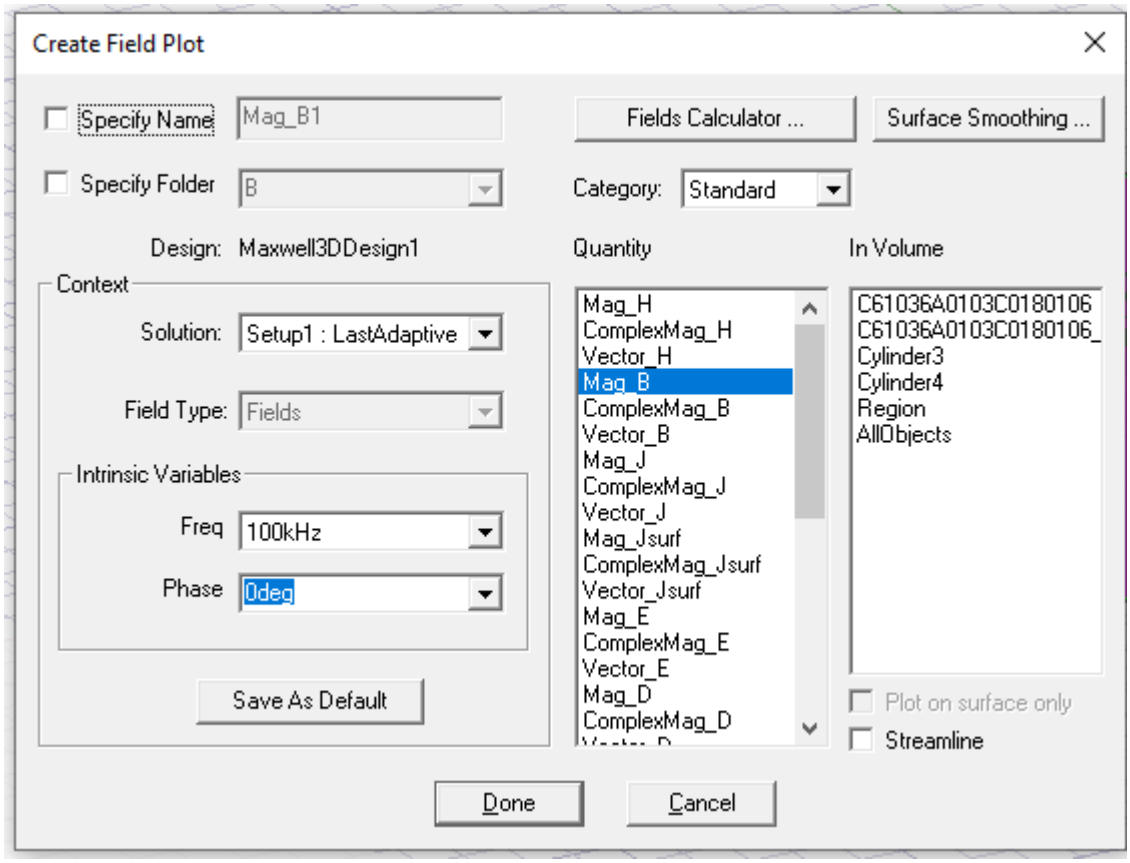


Right click the rectangle.

Fields -> B -> Mag_B

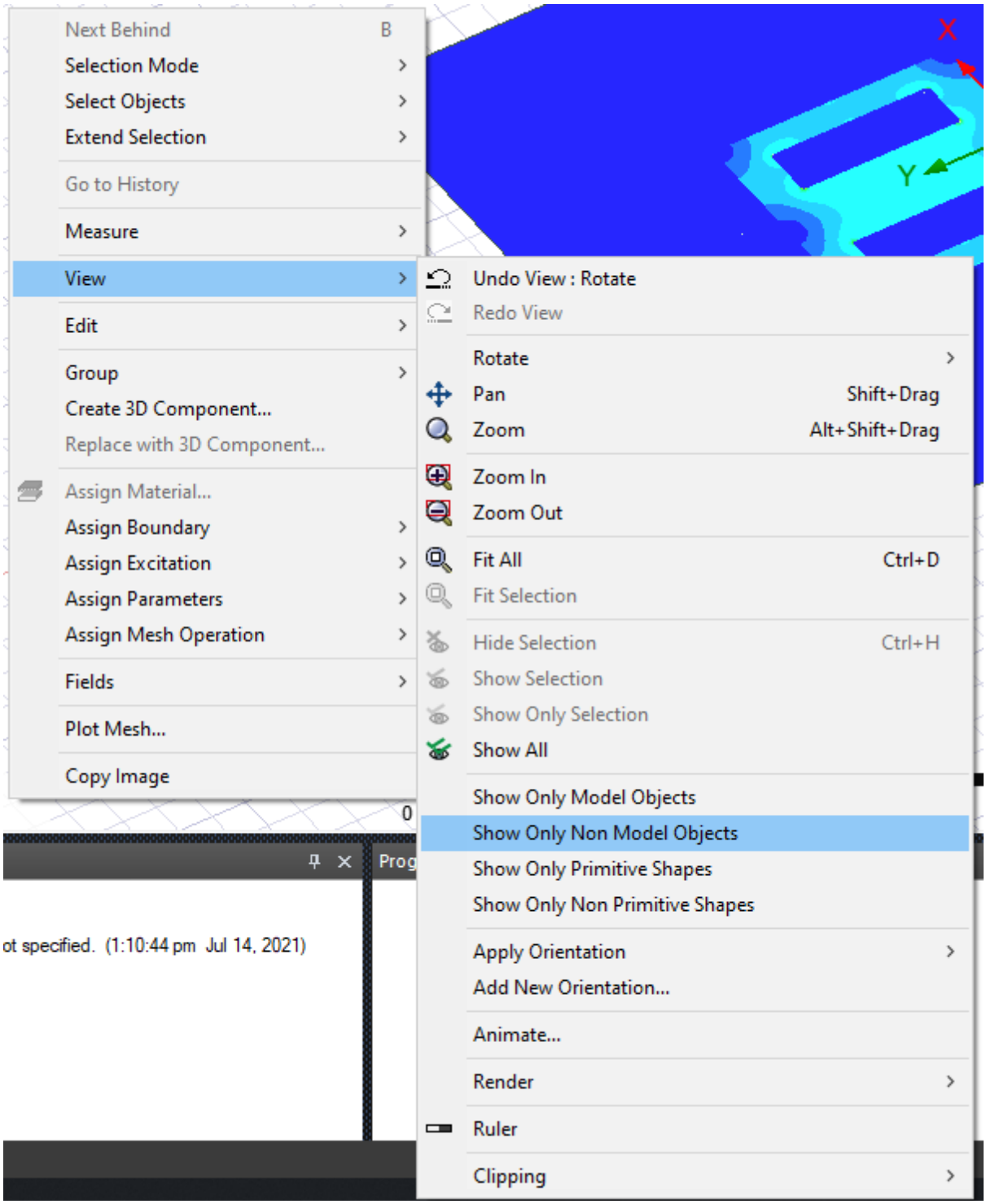


Press Done.



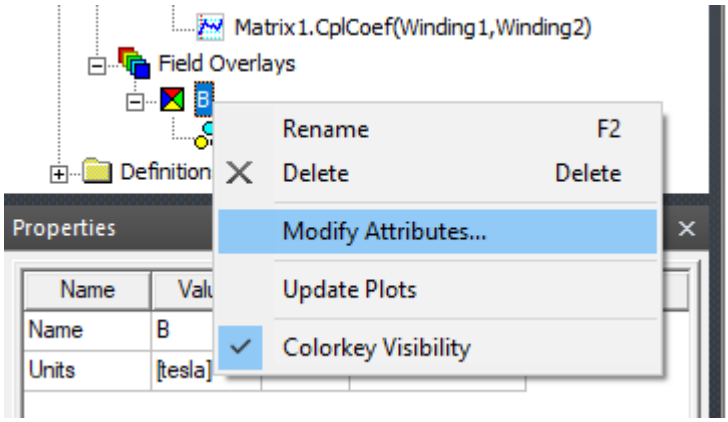
Right click on the project space anywhere to bring up the menu.

View -> Show Only Non Model Objects

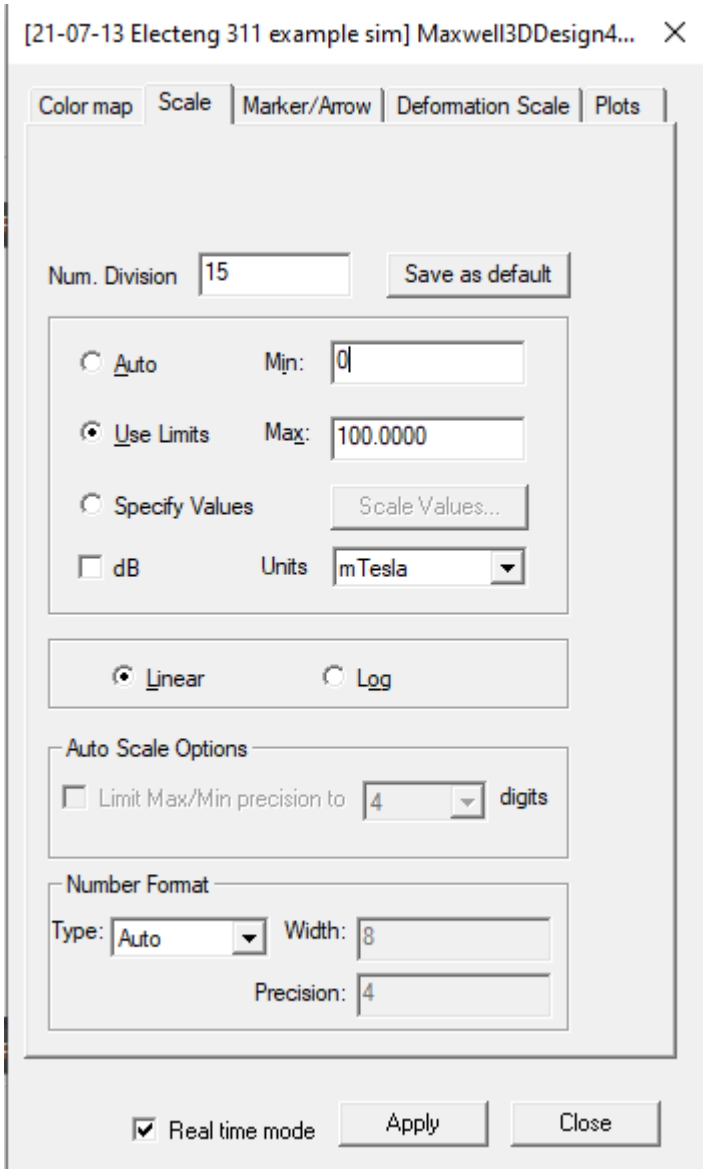


In the Project Manager, right click B

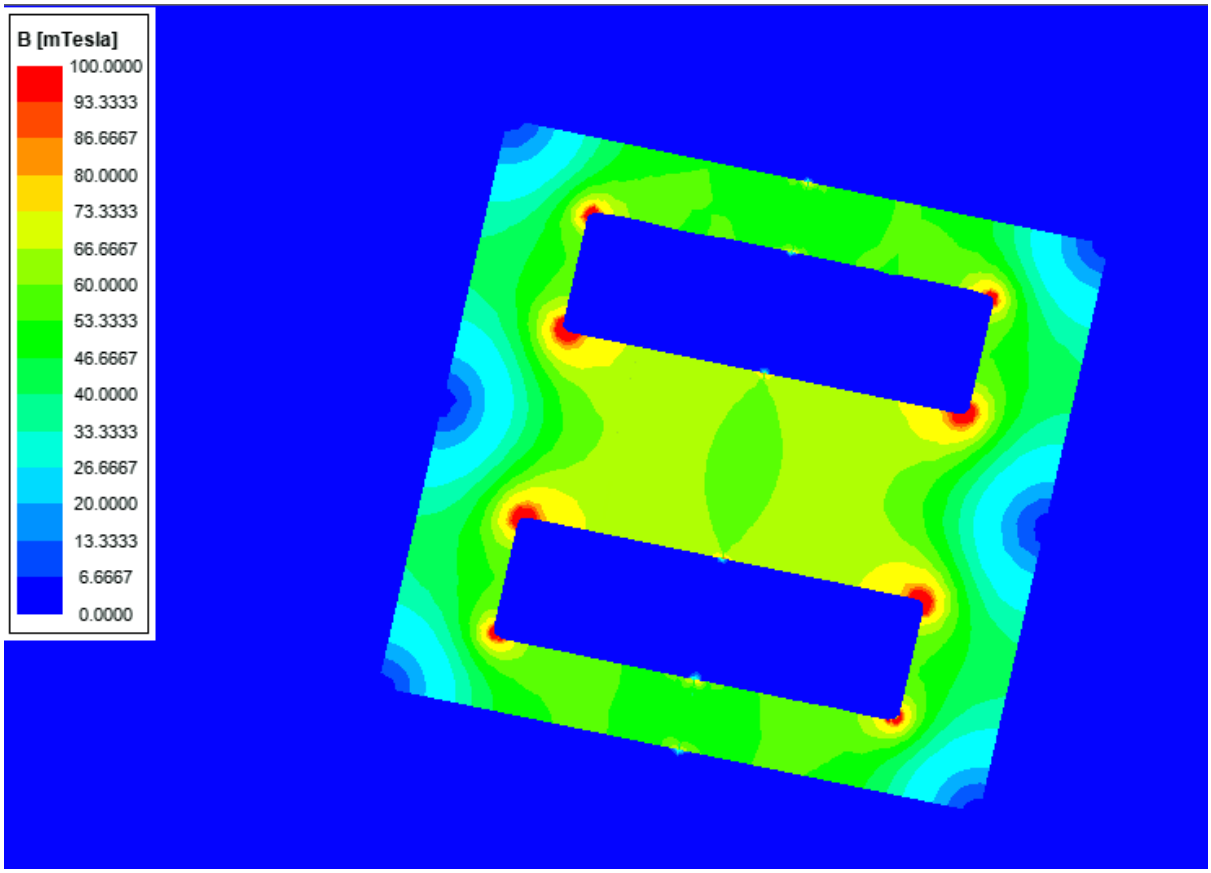
Modify Attributes



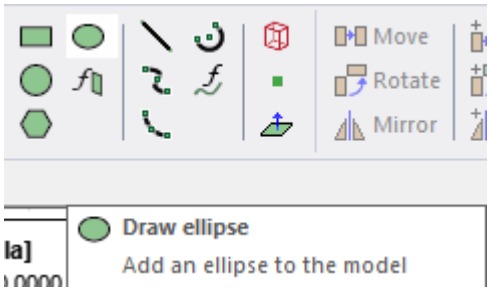
Fill in the dialogue box in Scale.



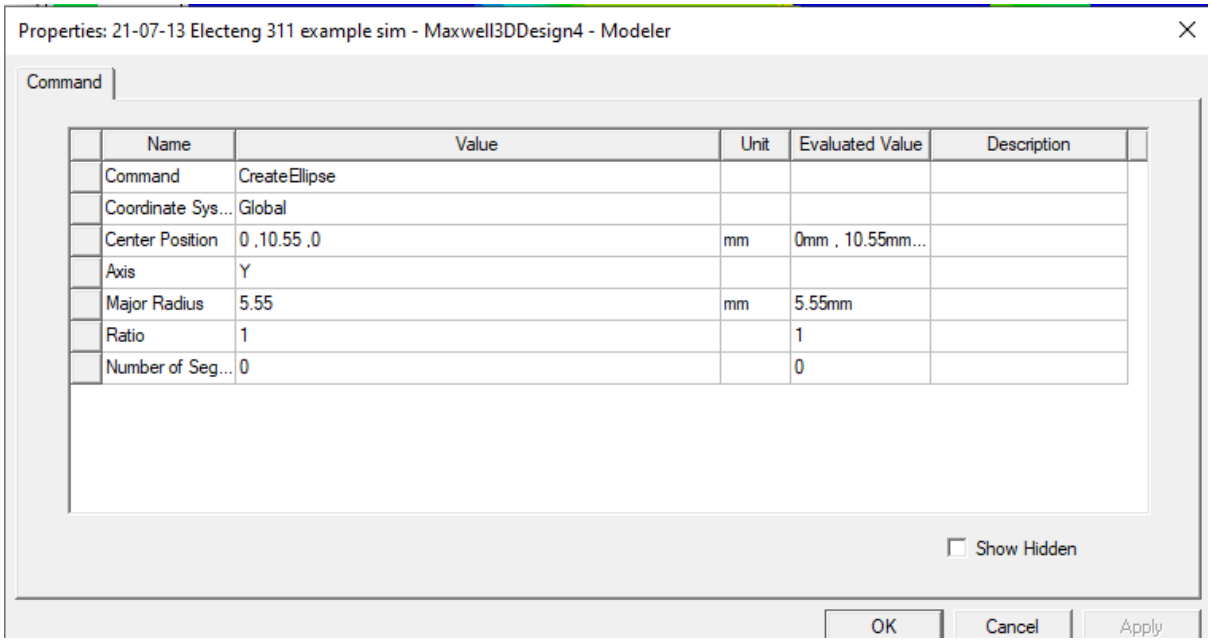
Check that your model now looks like this.



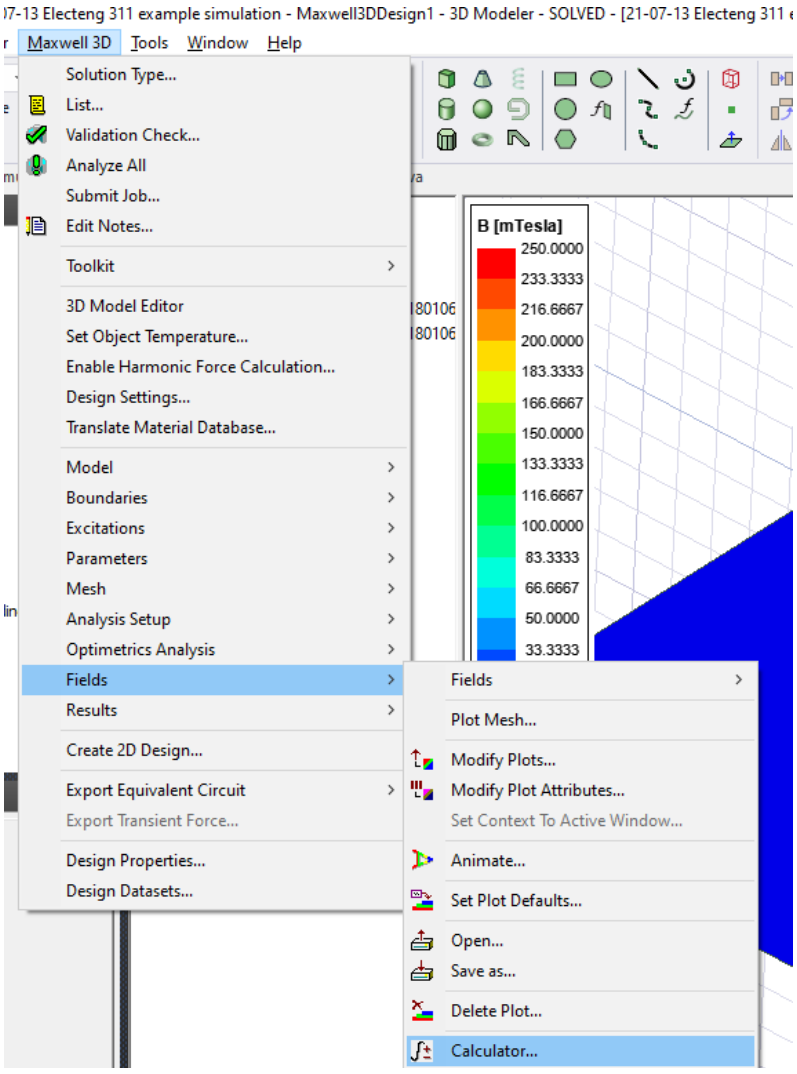
In the Draw panel, click Draw ellipse.



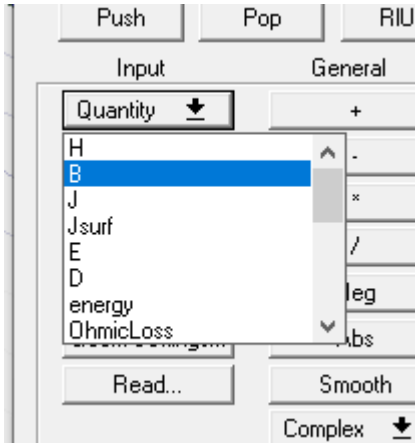
Fill in the dialogue box as shown.



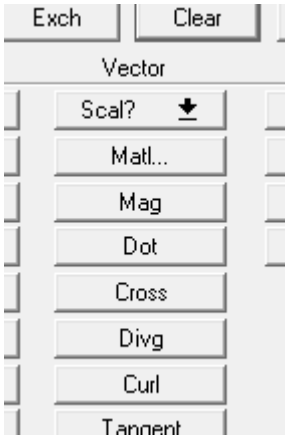
Go to Maxwell 3D -> Fields -> Calculator



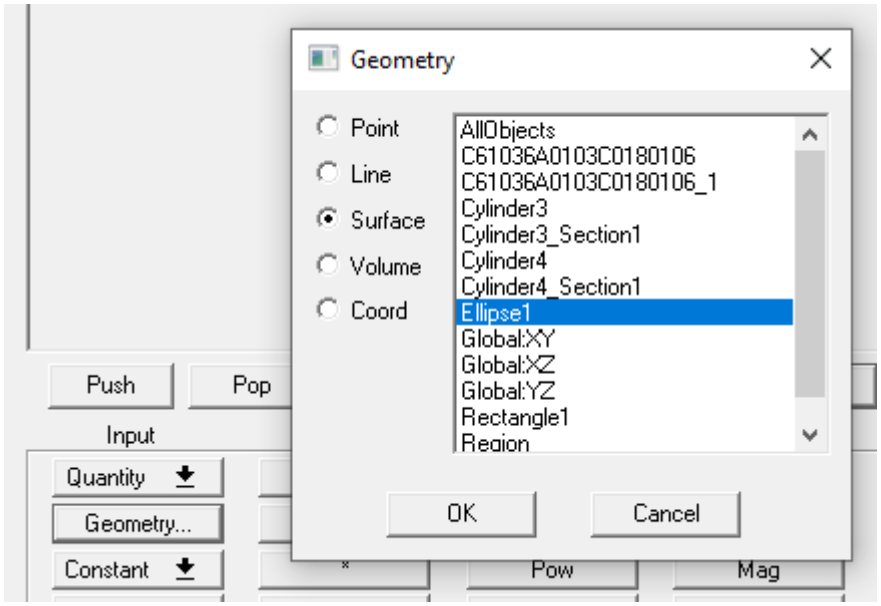
Click Quantity -> B



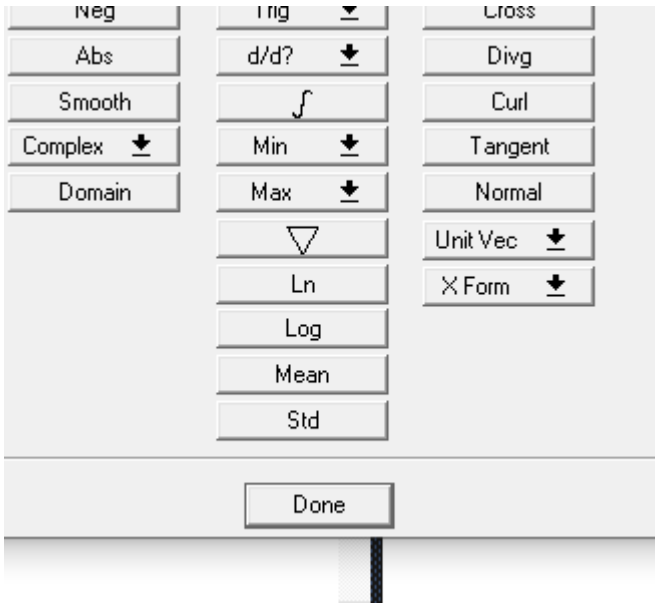
Press Mag



Click Geometry -> Surface -> Ellipse1

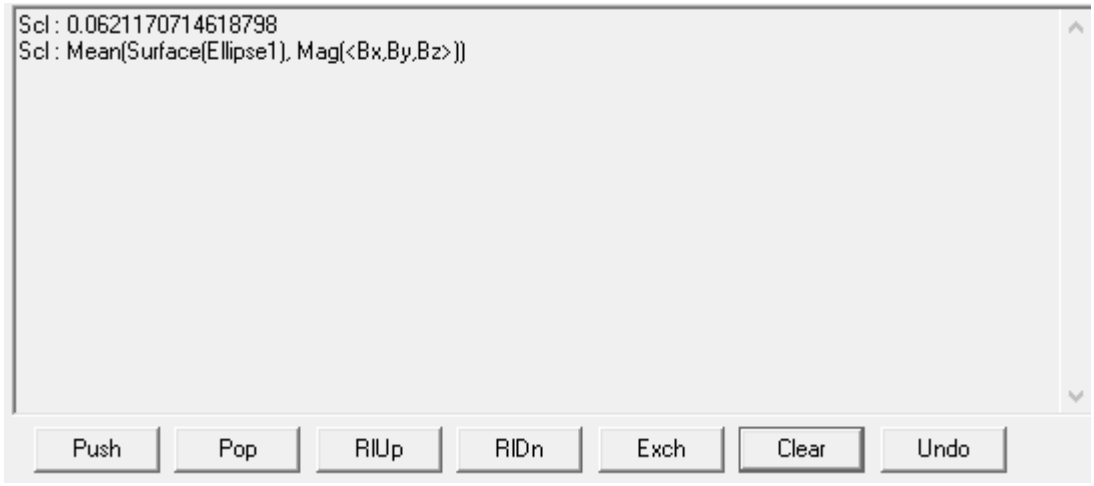


Click Mean



Click Eval

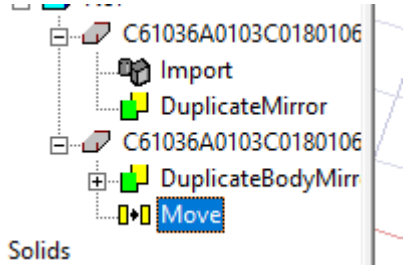
Your average magnetic field in the air gap should be display as shown.

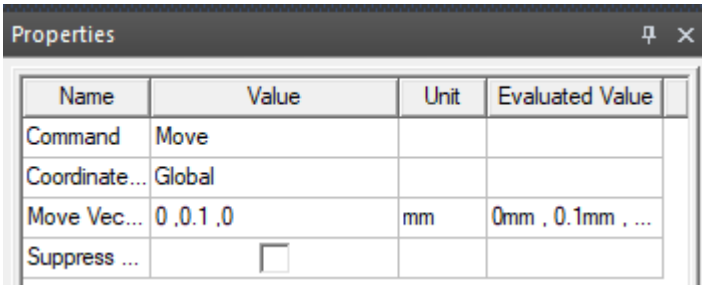


According to the calculation, average B field is 62.1mT.

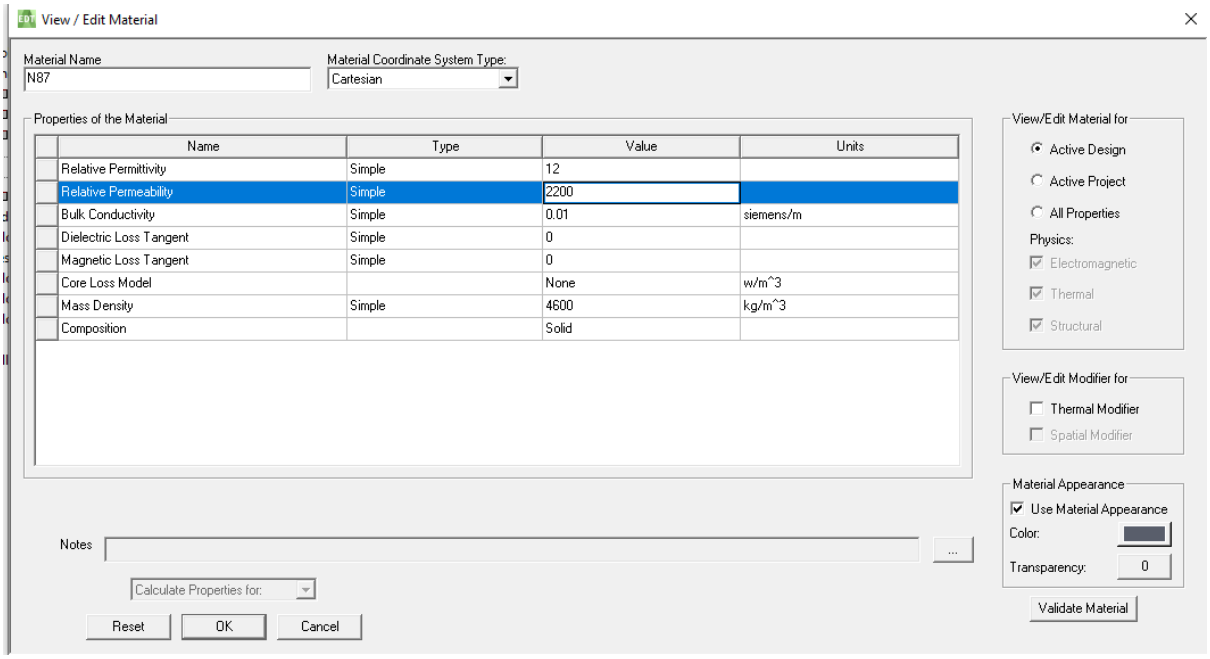
For your project, you may need to change the air gap, relative permeability of the core and the number of turns in your simulation.

Remember that the air gap can be changed using the Move function.





Relative permeability of the core can be changed using the material properties tab.



The turns can be changed in CoilTerminal1 and CoilTerminal2.