Manual for 0-Thickness Face in Wavenology EM

Wave Computation Tech.

Aug., 2017

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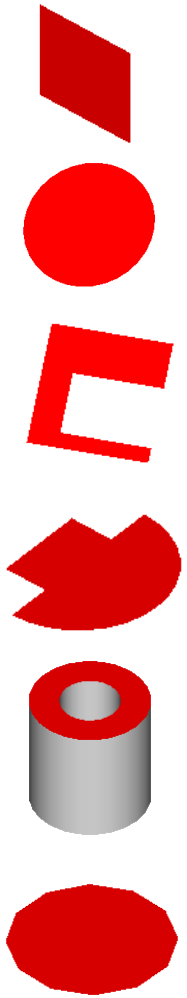
  - Rectangular Patch antenna
  - Vivaldi antenna

0-Thickness Face in Wavenology EM

- Rectangle
- Ellipse
- Polygon
- Any shape covered from curves
- The copy of a face from a 3D solid
- Load from SAT model

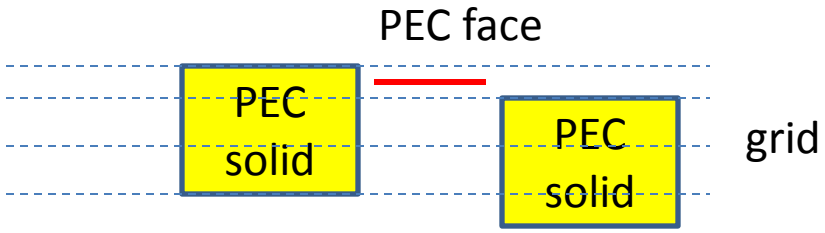


The Effective 0-Thickness Face in Wavenology EM

- A face must be defined with a material
- Only following planar faces will be used in Wavenology EM, others face structure will be skipped or prevented in the simulation
  - Material: ***PEC*** or ***PMC***
  - The planar face normal must be in X, or Y, or Z axis
- Due to the meshing implementation, only the PEC face on the meshing grid will be effective, for other situations as following, the PEC/PMC faces can not be guaranteed effective in the engine

PEC Face

➢ **automatic mesh but with complicated structures**

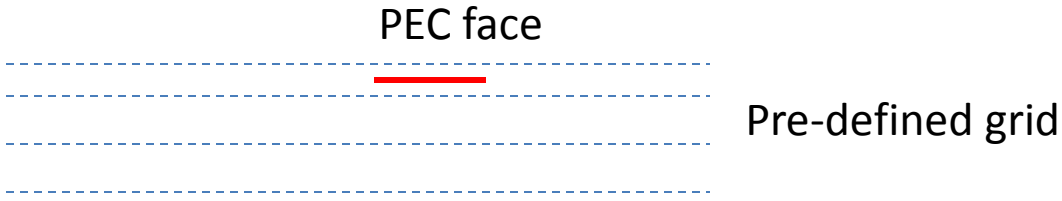


In this situation, due to the conflict among min/max ratio, adjacent cell ratio, etc, there is not any grid on the PEC face, there will be two cases:

❑ the PEC face will be effective with an alignment to a closest grid by an threshold

❑ the PEC face will be skipped if the distance to a closest grid is bigger than the threshold

➢ **manual or user-defined mesh**



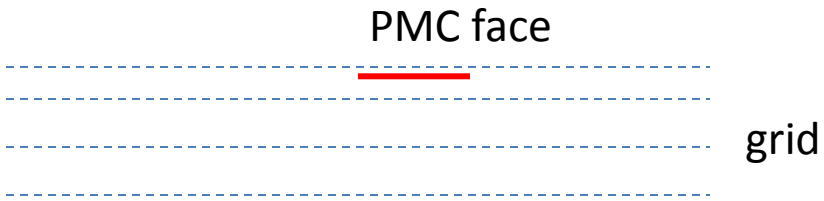
In this situation, there will be two cases:

❑ the PEC face will be effective with an alignment to a closest grid by an threshold

❑ the PEC face will be skipped if the distance to a closest grid is bigger than the threshold

PMC Face

➢ **due to the grid system is using E grid, for PMC face, it is hard to make a grid that let PMC face exactly on a cell center**



Same as PEC face, there will be two cases:

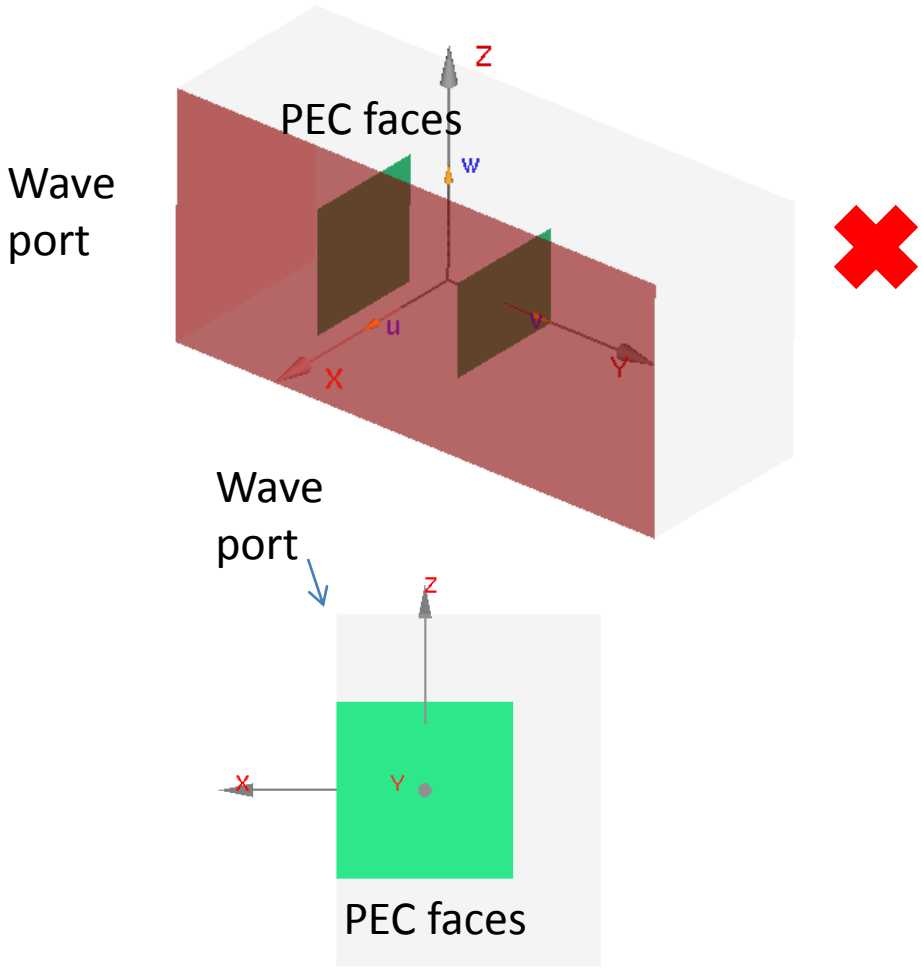
❑ the PMC face will be effective with an alignment to a closest cell center by an threshold

❑ the PMC face will be skipped if the distance to a closest cell center is bigger than the threshold

If there is a need to make PMC object effective in engine, the best way is defining a PMC solid with a thickness, not a PMC face.

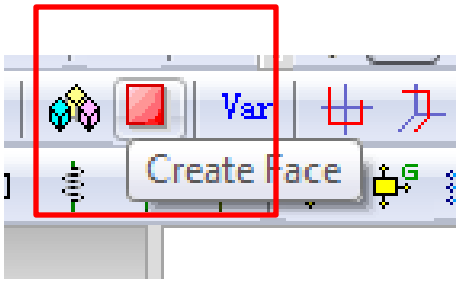
Others limitations on 0-Thickness Face

➢ current WCT Waveport solver can not support 0-thickness face. So, please do not put any 0-thickness PEC/PMC face in a wave port range. As following,

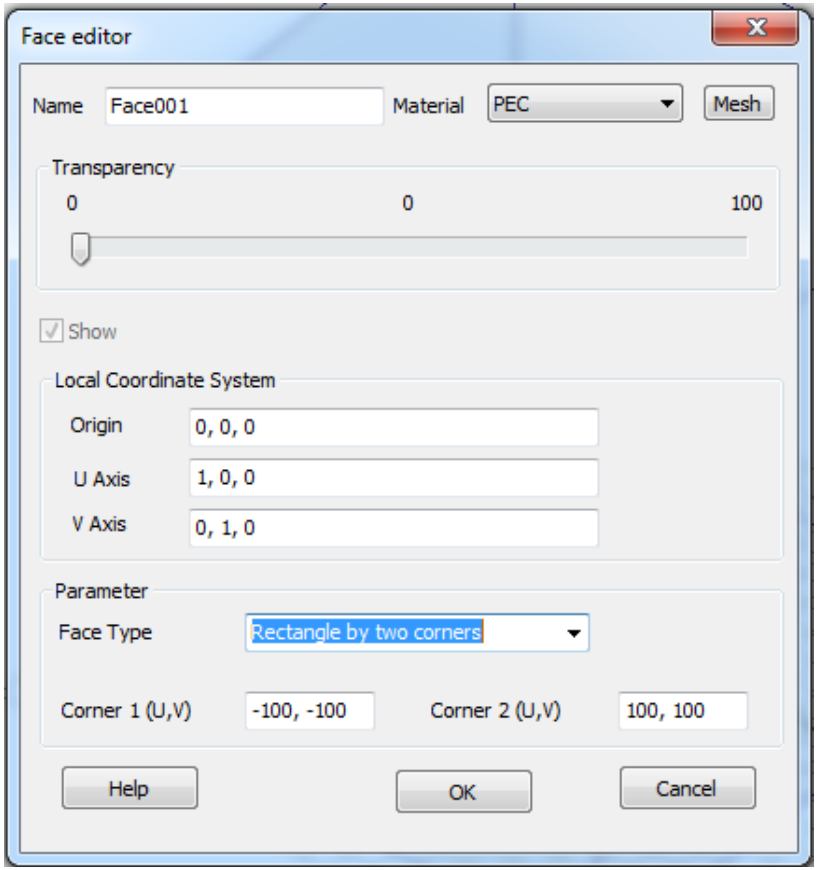


0-Thickness Face Creation & Editing Rectangle

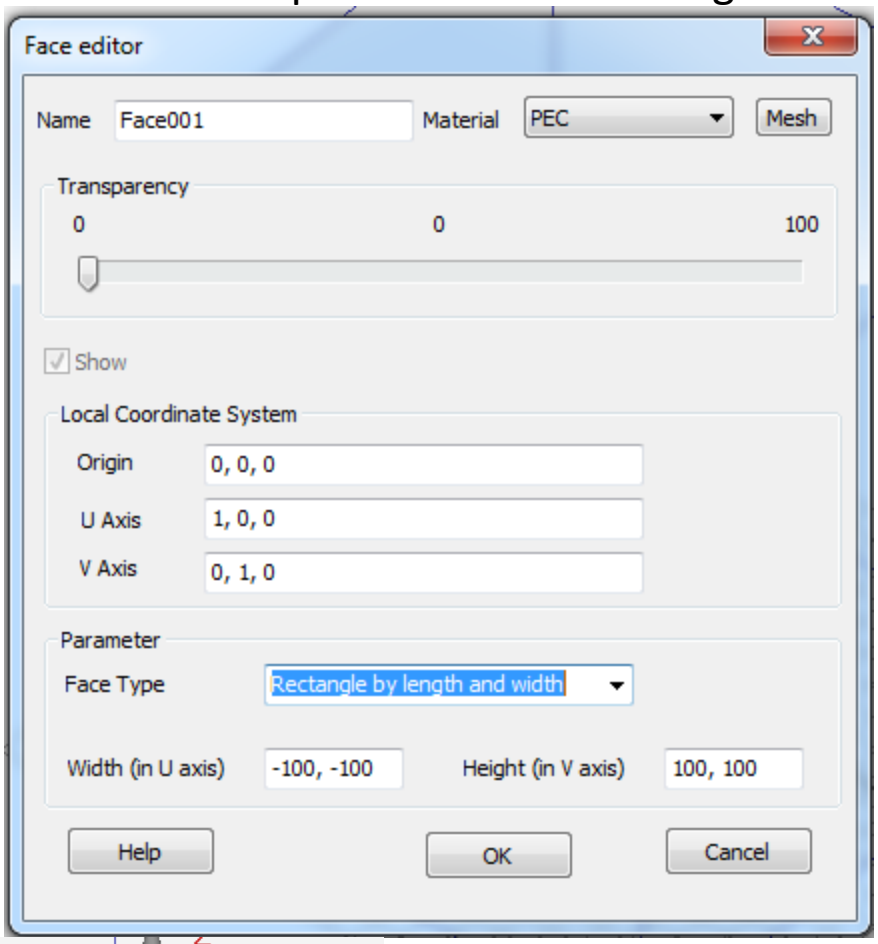
Creation

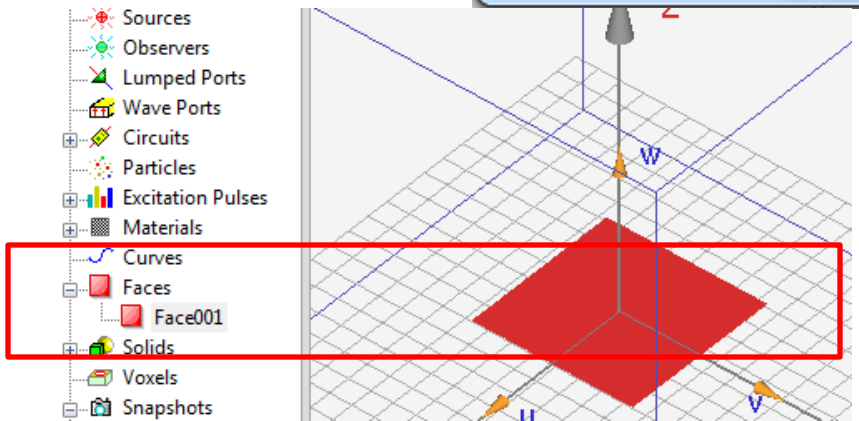


Method I: input two corners of rectangle



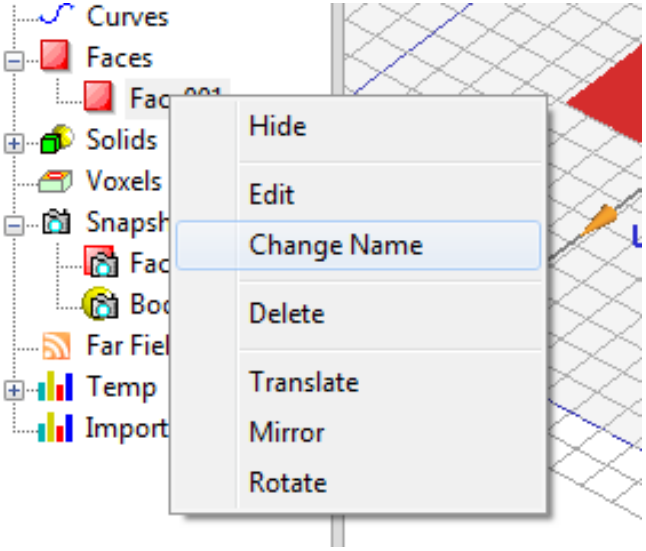
Method II: input the width and height





After “OK”, the face is shown as

Editing



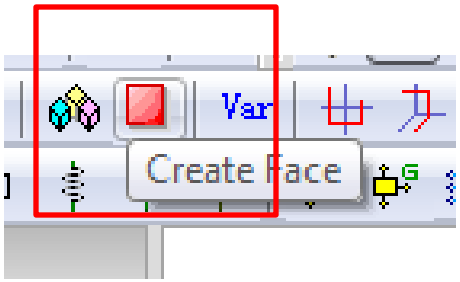
For selected face, it can be edited by:

- Edit input parameters
- change face name
- add transformation
  - Translate
  - Mirror
  - Rotate

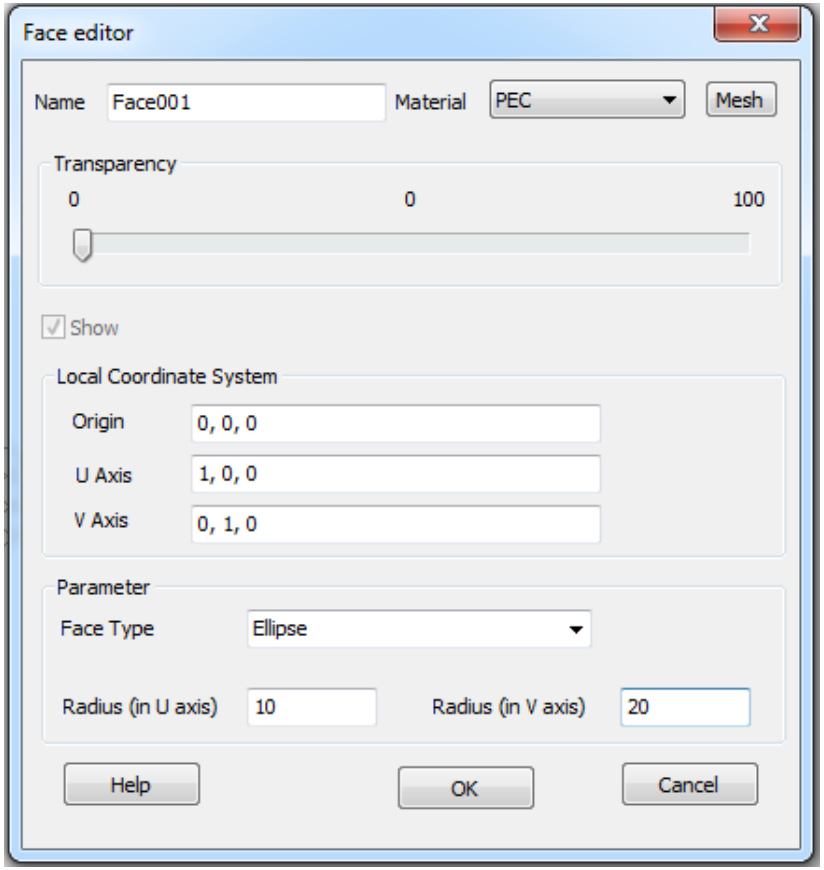
These are the same as that for 3D solid operation.

0-Thickness Face Creation & Editing Ellipse

Creation

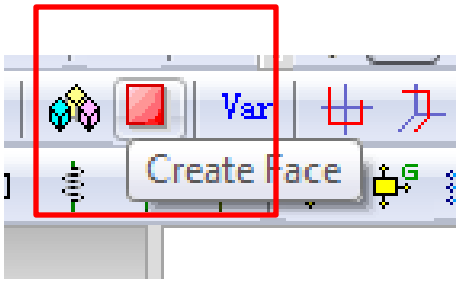


input the radius of ellipse

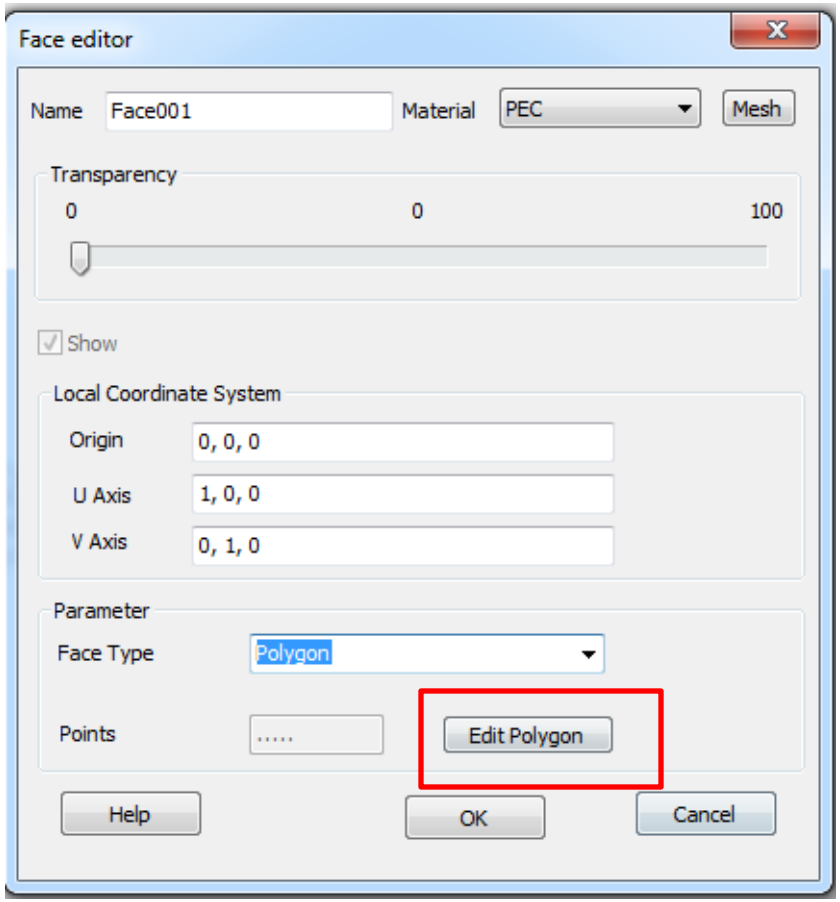


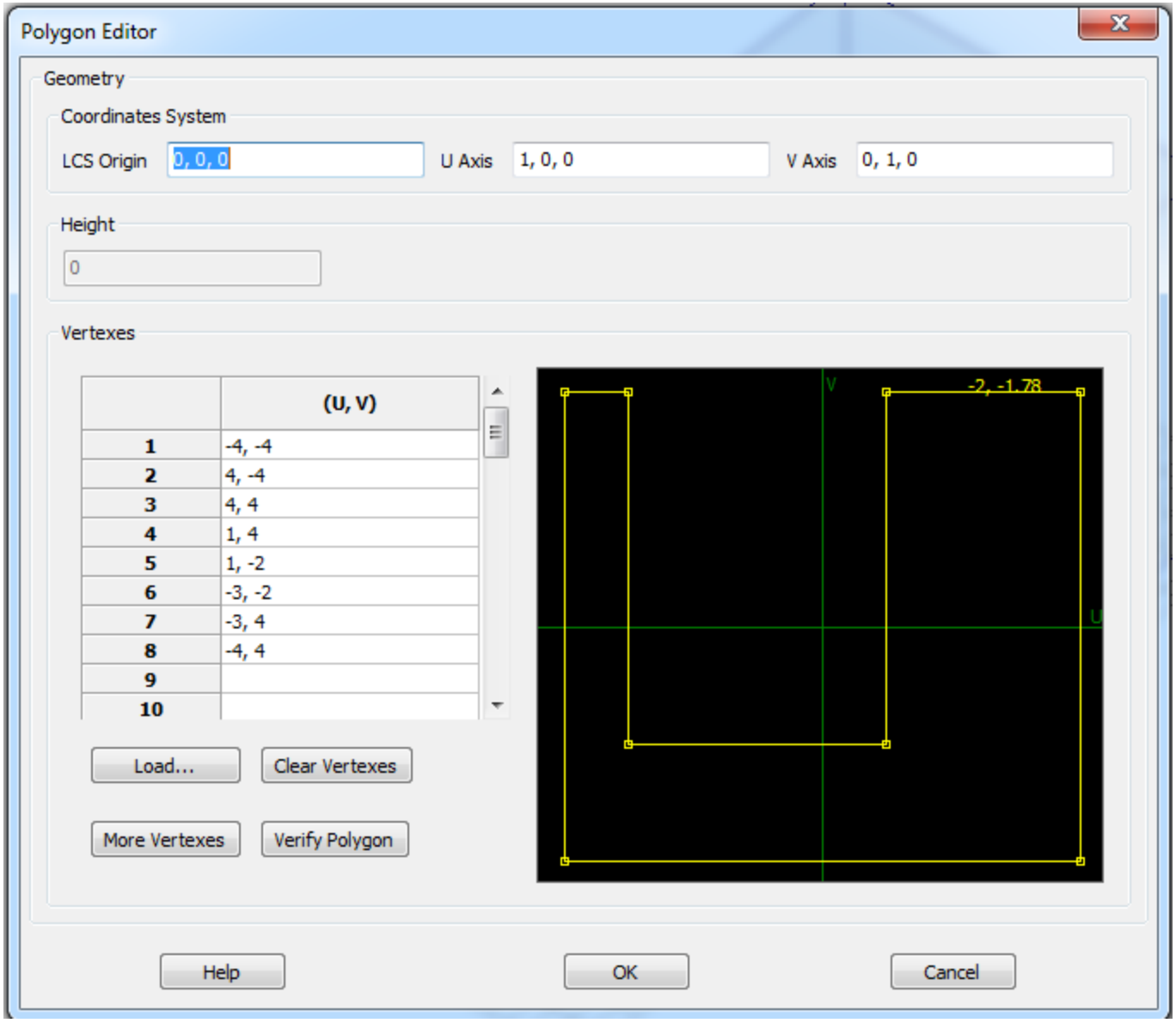
0-Thickness Face Creation & Editing Polygon

Creation



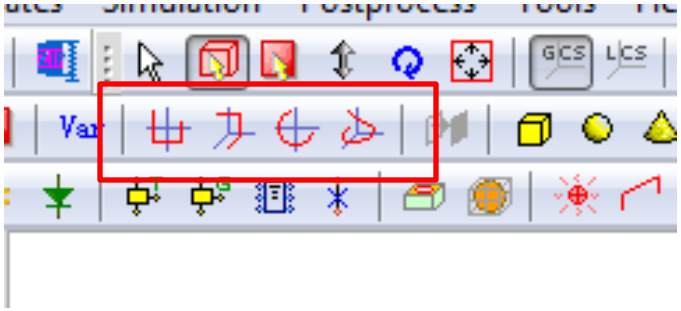
input the vertexes of polygon

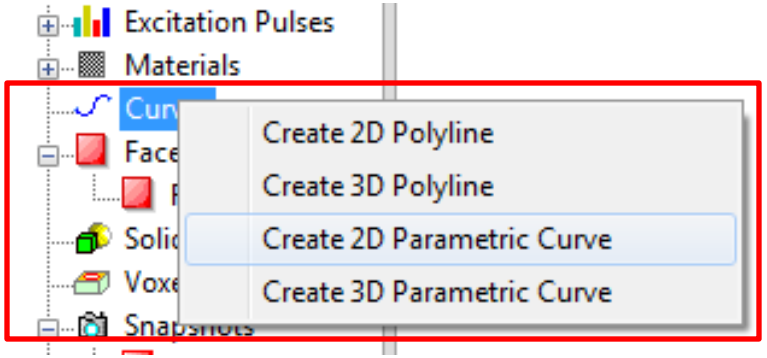



Polygon Editor
Geometry
Coordinates System
LCS Origin
0, 0, 0
U Axis
1, 0, 0
V Axis
0, 1, 0
Height
0
Vertexes
(U, V)
1 -4, -4
2 4, -4
3 4, 4
4 1, 4
5 1, -2
6 -3, -2
7 -3, 4
8 -4, 4
9
10
Load...
Clear Vertexes
More Vertexes
Verify Polygon
V
-2, -1.78
U
Help
OK
Cancel

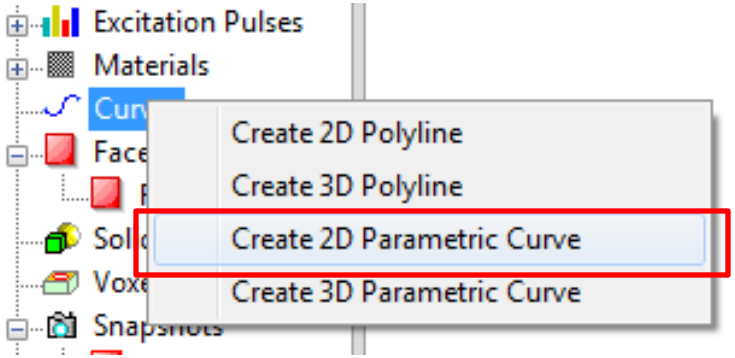
0-Thickness Face Creation & Editing
Any shape covered from curves

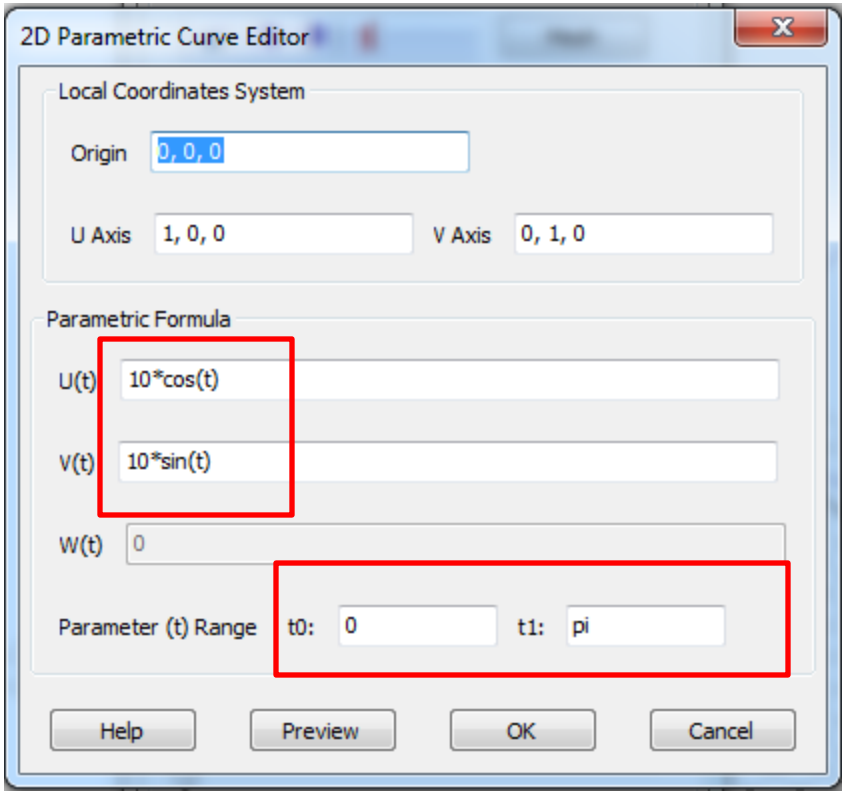
Define one, or multiple curves that can cover a shape.



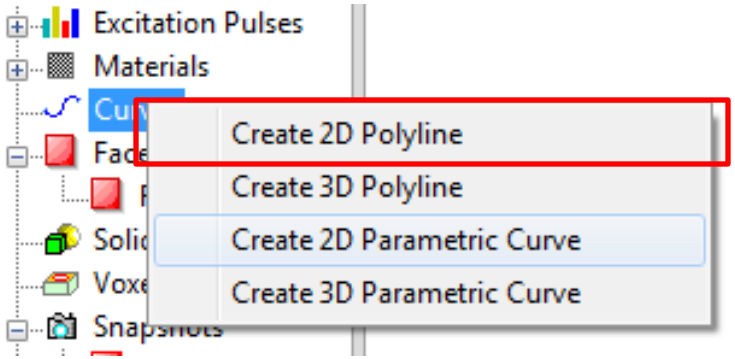


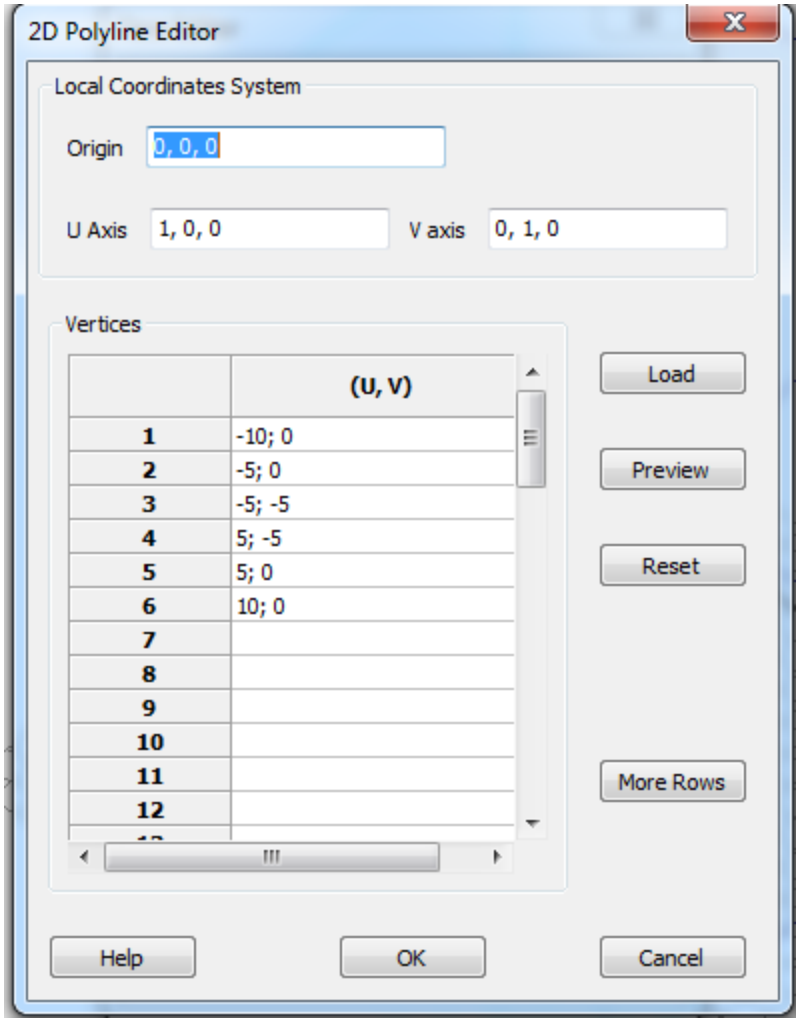
➢ for example, half circle



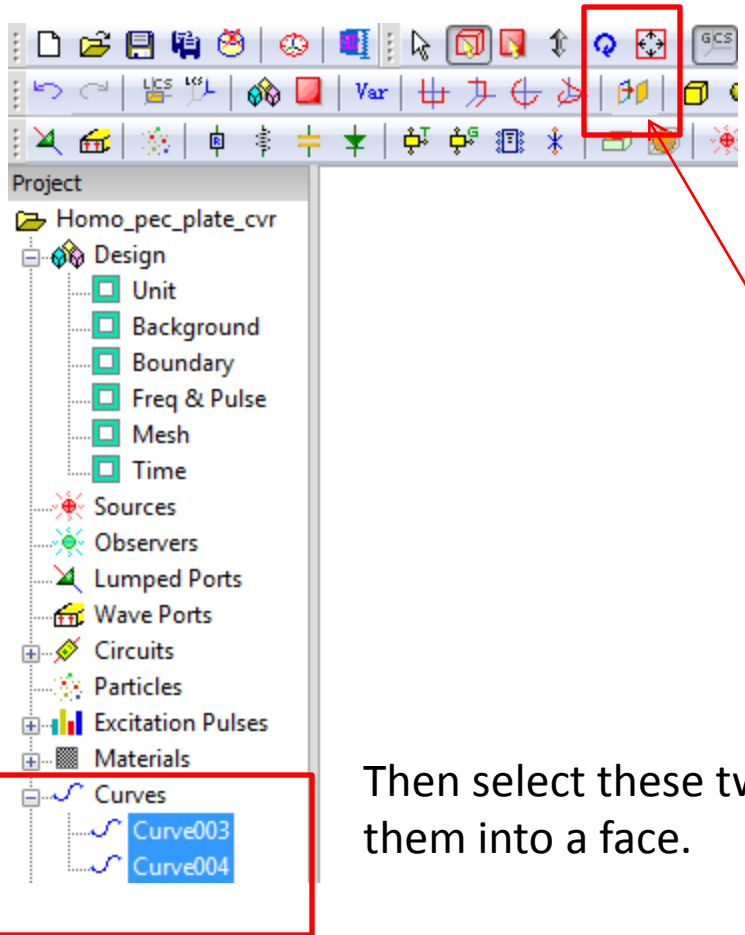


➢ a polyline


Excitation Pulses
Materials
Create 2D Polyline
Create 3D Polyline
Create 2D Parametric Curve
Create 3D Parametric Curve

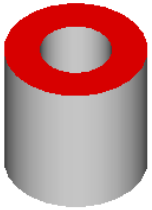

2D Polyline Editor
Local Coordinates System
Origin
0, 0, 0
U Axis
1, 0, 0
V axis
0, 1, 0
Vertices
(U, V)
1 -10; 0
2 -5; 0
3 -5; -5
4 5; -5
5 5; 0
6 10; 0
7
8
9
10
11
12
Load
Preview
Reset
More Rows
Help
OK
Cancel

We can see, these two curves can cover as a shape

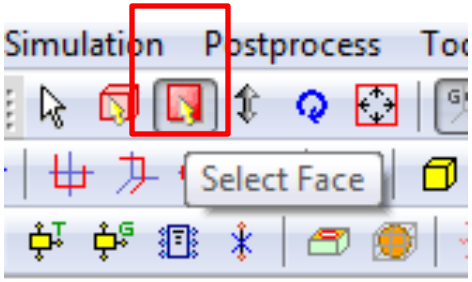


Then select these two curves, ***cover*** them into a face.

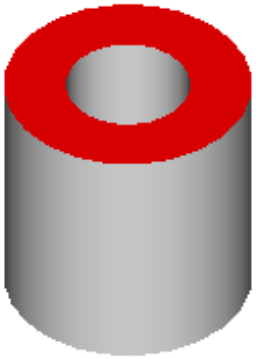
0-Thickness Face Creation & Editing
The copy of a face from a 3D solid

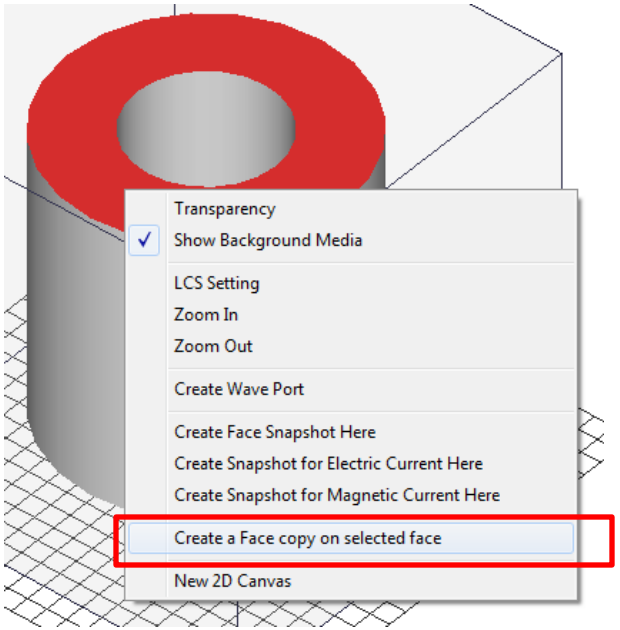


Switch to “Select Face” mode



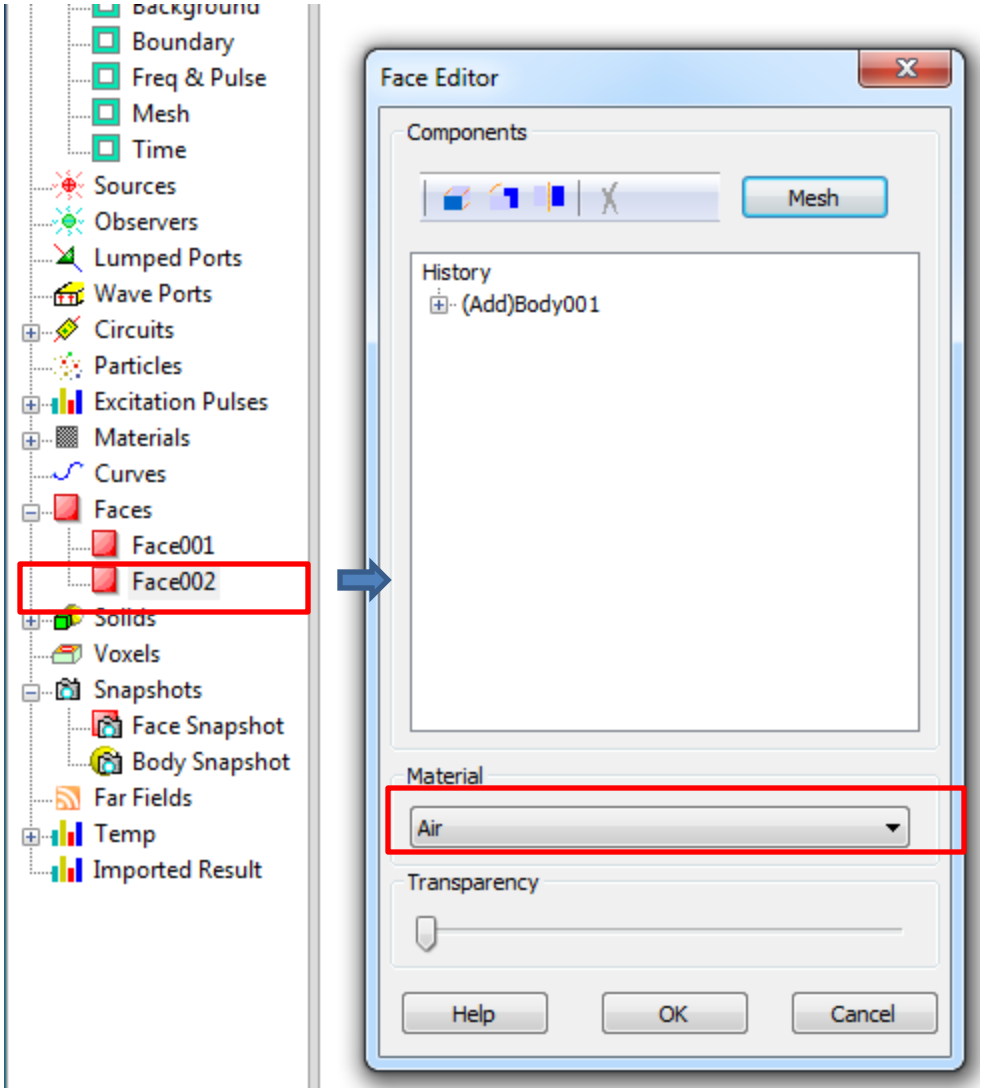
Select a face of 3D solid



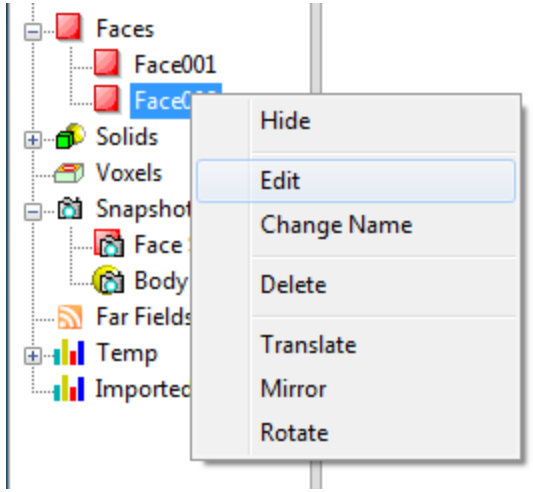


Create a copy of selected face

The created face will use the material of the solid, but user can modify it by ***double click*** this new face,

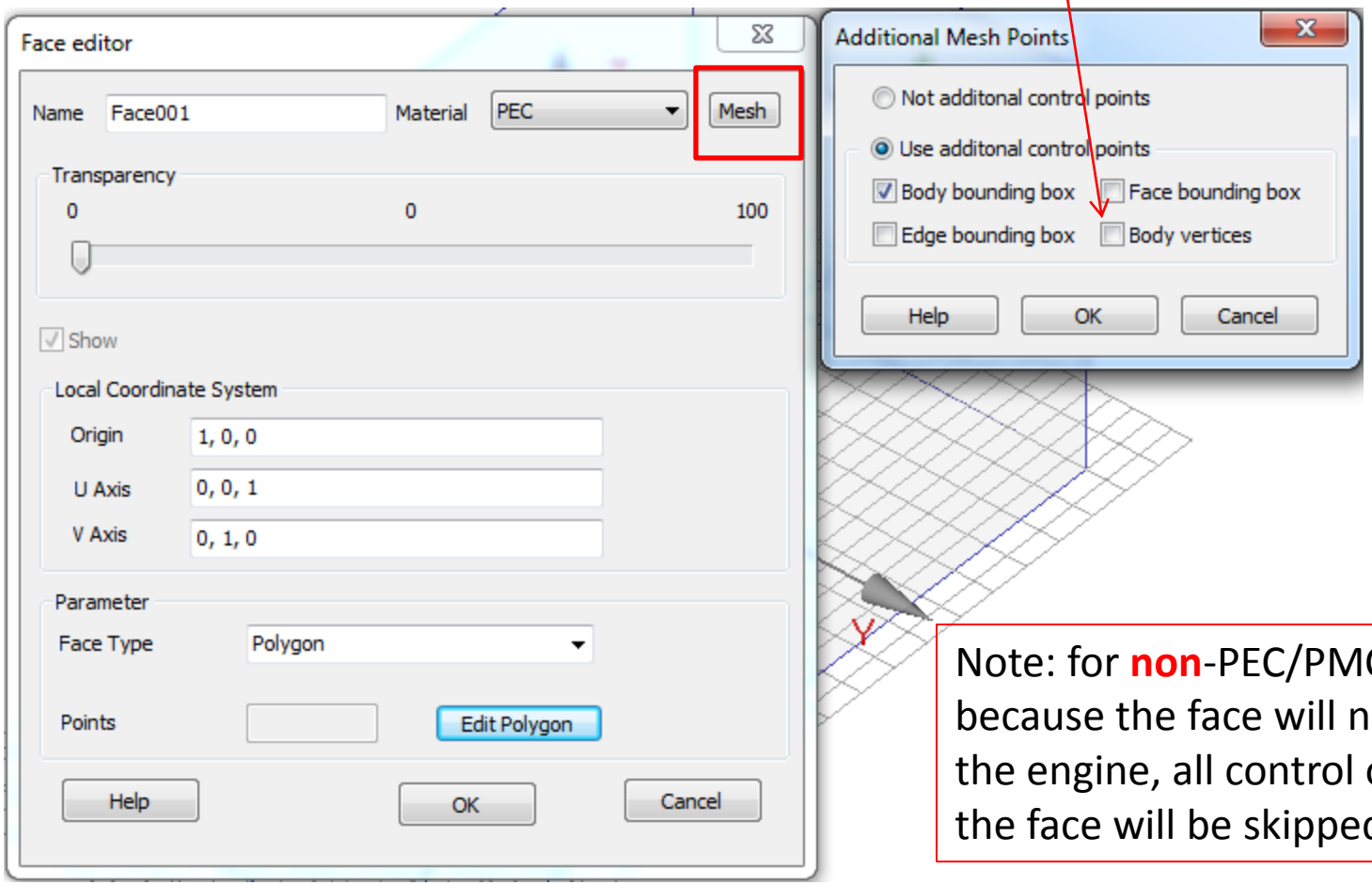


or as previous page, modify through menu



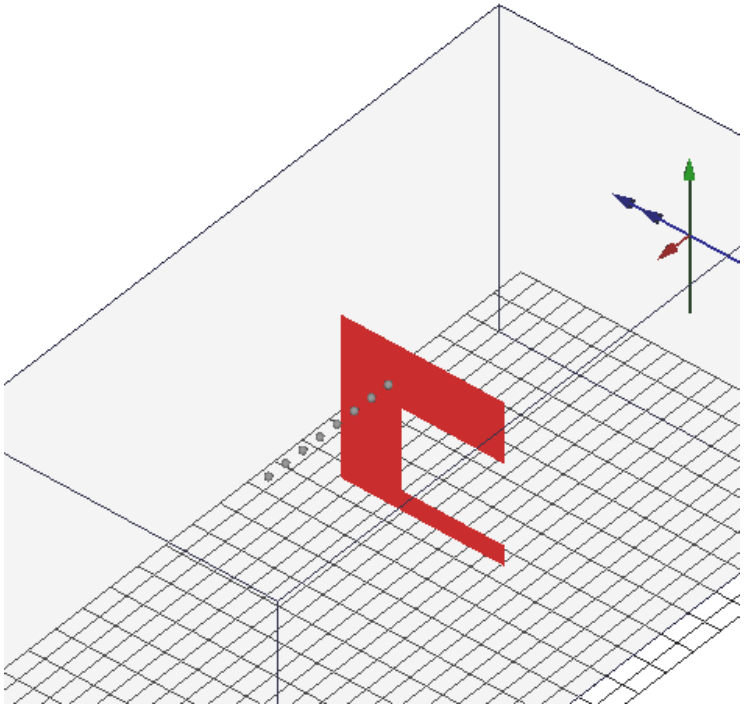
Mesh Control for PEC Face

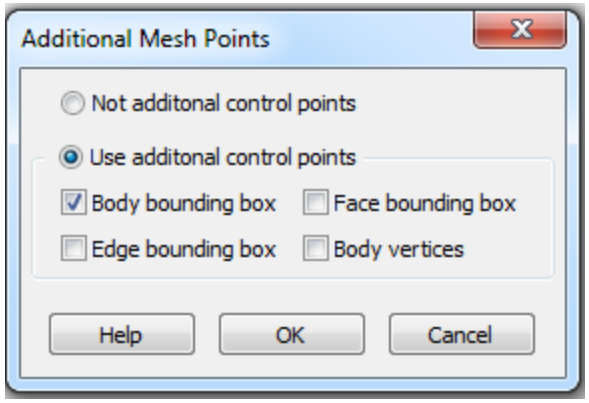
The default mesh control for face is “Bounding box” only, for a shape with hole or non-convex structure, please turn on “Body vertices” option

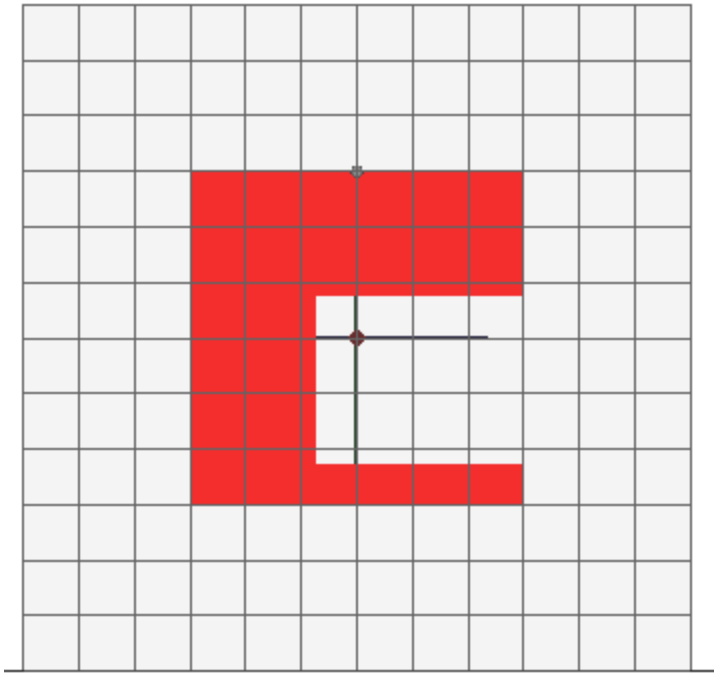


Note: for **non**-PEC/PMC face, because the face will not work in the engine, all control options on the face will be skipped.

Example of Mesh Control on a polyline face

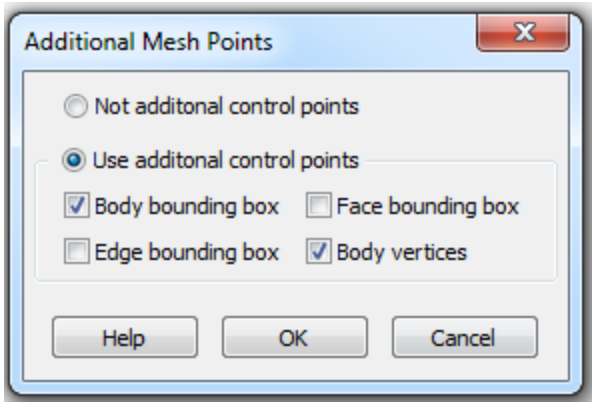




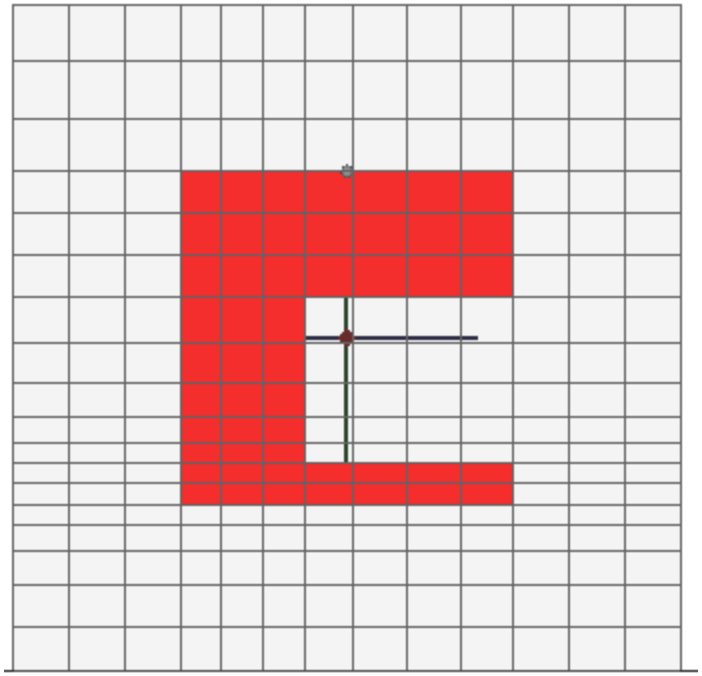


Mesh with
default setting

Enable “Body vertices” option

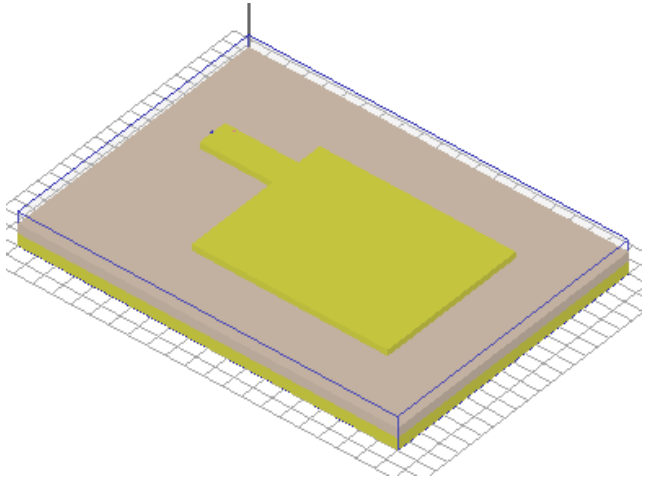


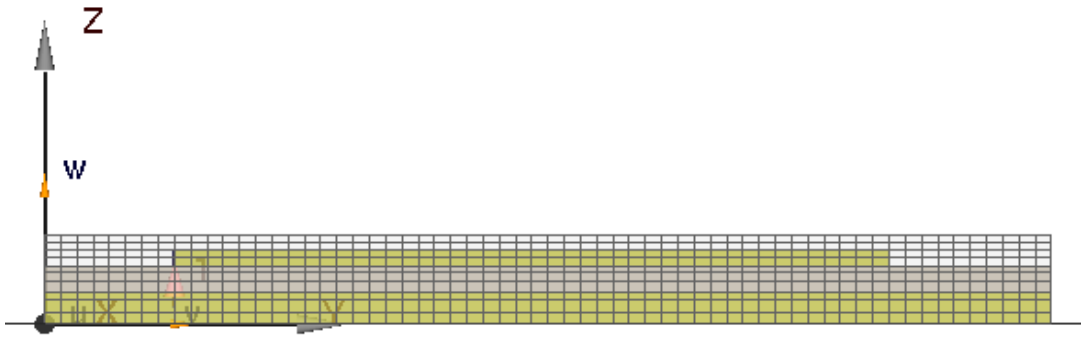
Mesh with vertices setting



Benchmark Test (1)
Rectangular Patch Antenna

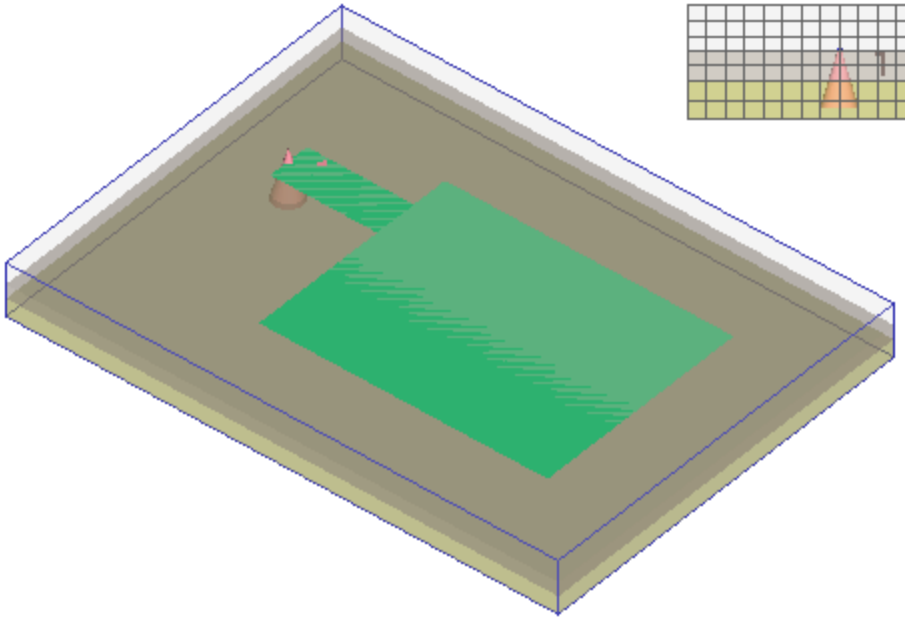
Original setting, the patch has a thickness as 0.5 mm

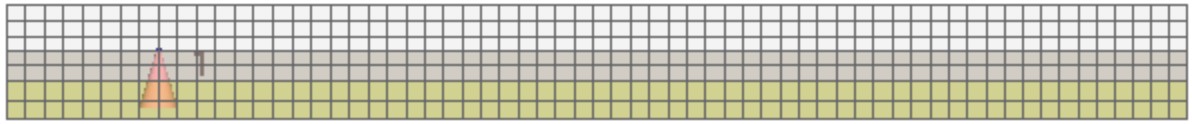




Automatic Mesh option:
Cells: 46 x 62 x 10, Delta time: 5.81797e-013 sec

Replace patch by 0-thickness PEC faces

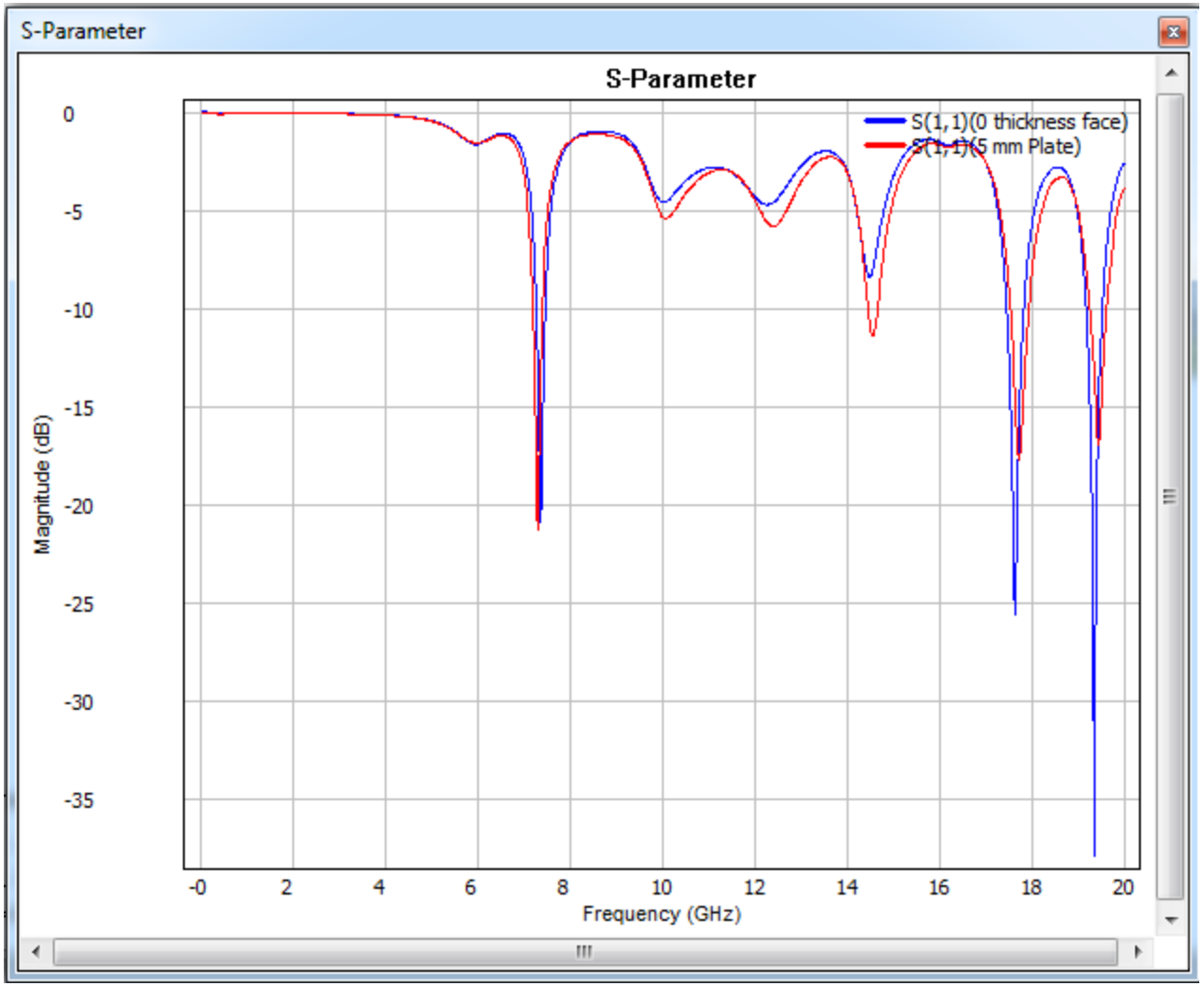




Automatic Mesh option:
Cells: 46 x 63 x 7, Delta time: 7.39054e-013 sec

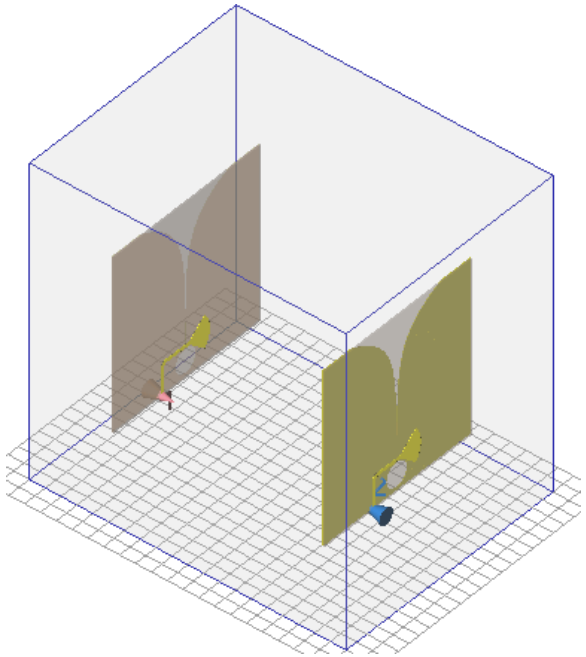
We can the number of cell in Z is reduced from 10 to 7, and the simulation Δt increase from 5.8e-13 to 7.4e-13 s.

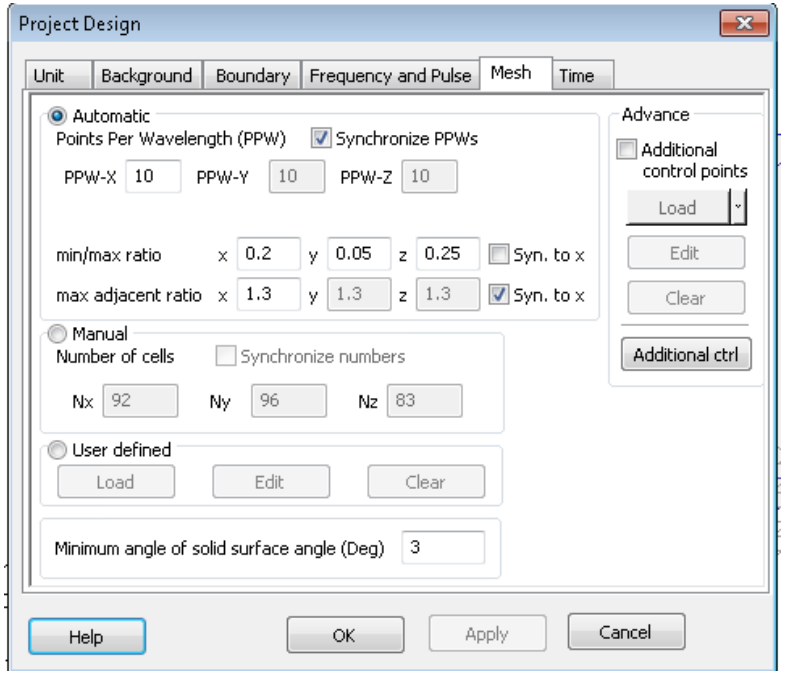
The results from two setting are close.

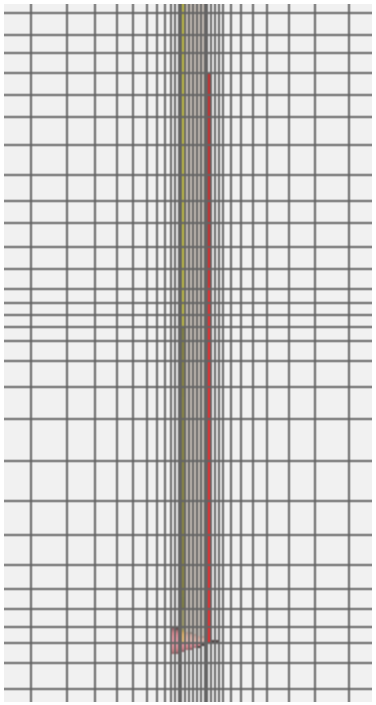


Benchmark Test (2)
Vivaldi Antenna

Original setting, the patch has a thickness as 0.288 mm, need to use a good control to capture details

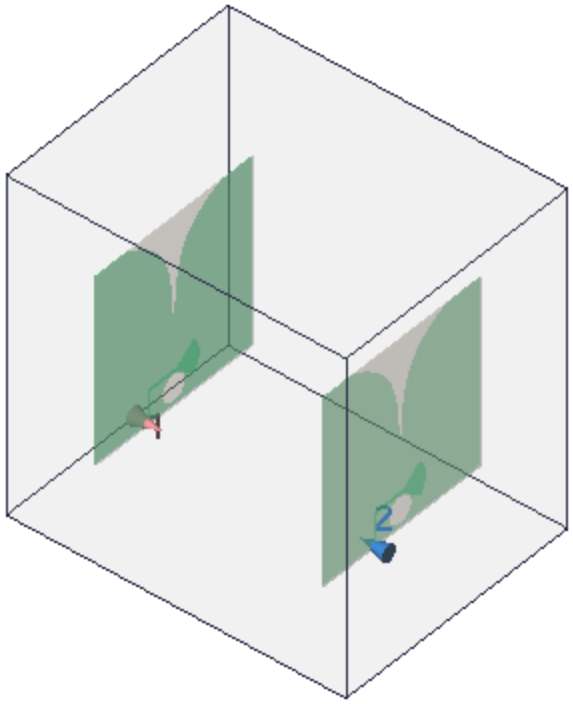


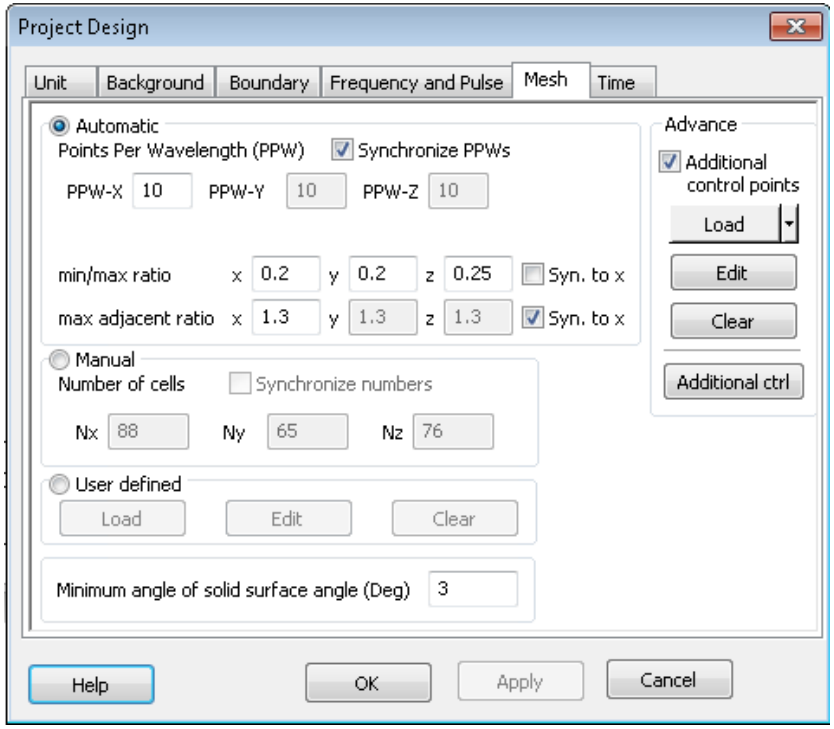


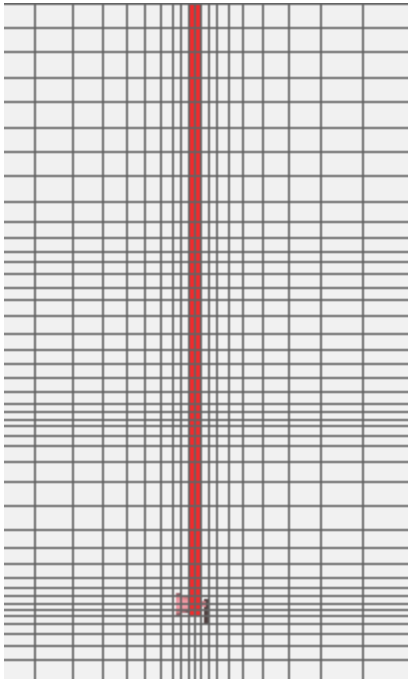


Automatic Mesh option:
92 x 96 x 83, Delta time: 4.20489e-013 sec

Replace patch by 0-thickness PEC faces, with almost the same mesh parameters. This mesh options is for comparison purpose, we can use default setting, the result is almost not change



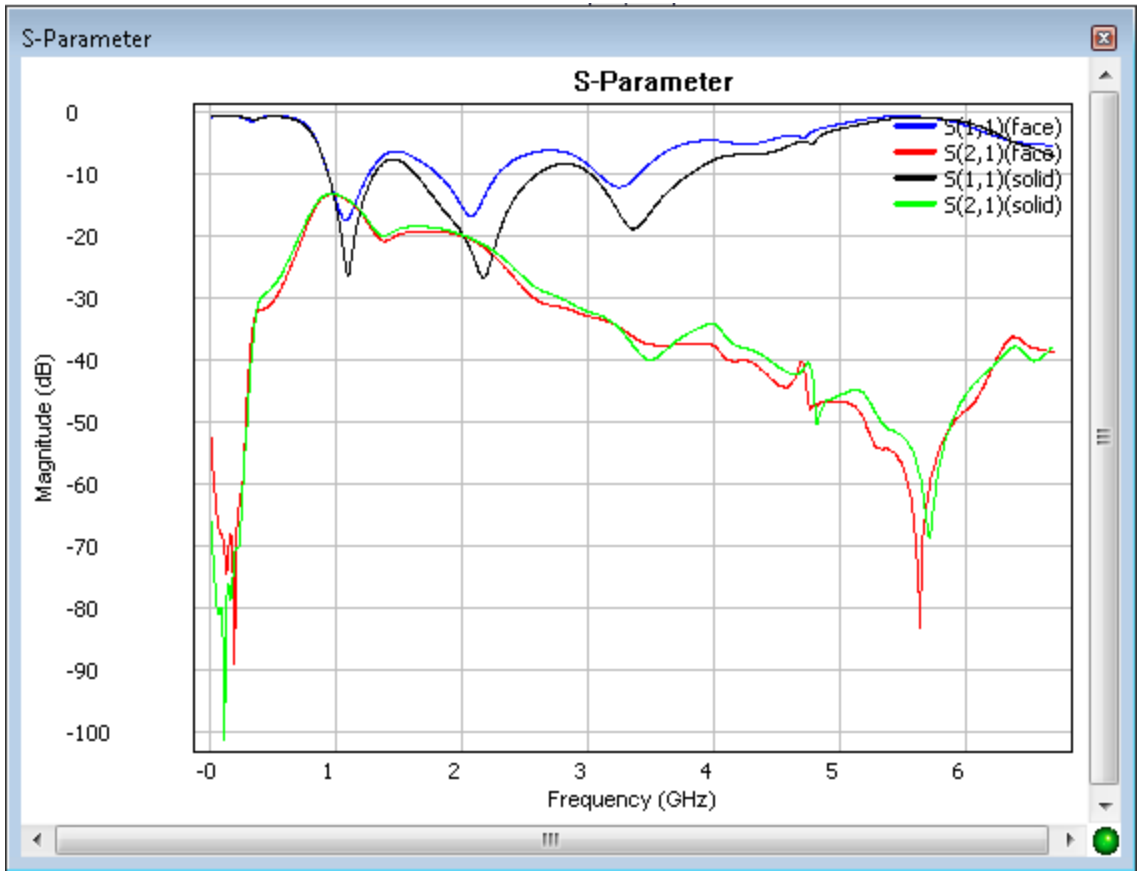




Automatic Mesh option:
Cells: 88 x 65 x 76, Delta time: 8.93929e-013 sec

We can see the most significant change is Δt increase from 4.2e-13 to 8.9e-13 s.

We can see the 0-thickness setting still can find the correct resonant freq., and the S21 is almost the same.



- So, from the benchmark tests, we suggest
  - if user want a fast simulation to estimate the performance of system, use a 0-thickness face to build the model.
  - if user need a more accurate result, and if the model built from 0-thickness exists, user can grow the plate to a desired thickness from the face.