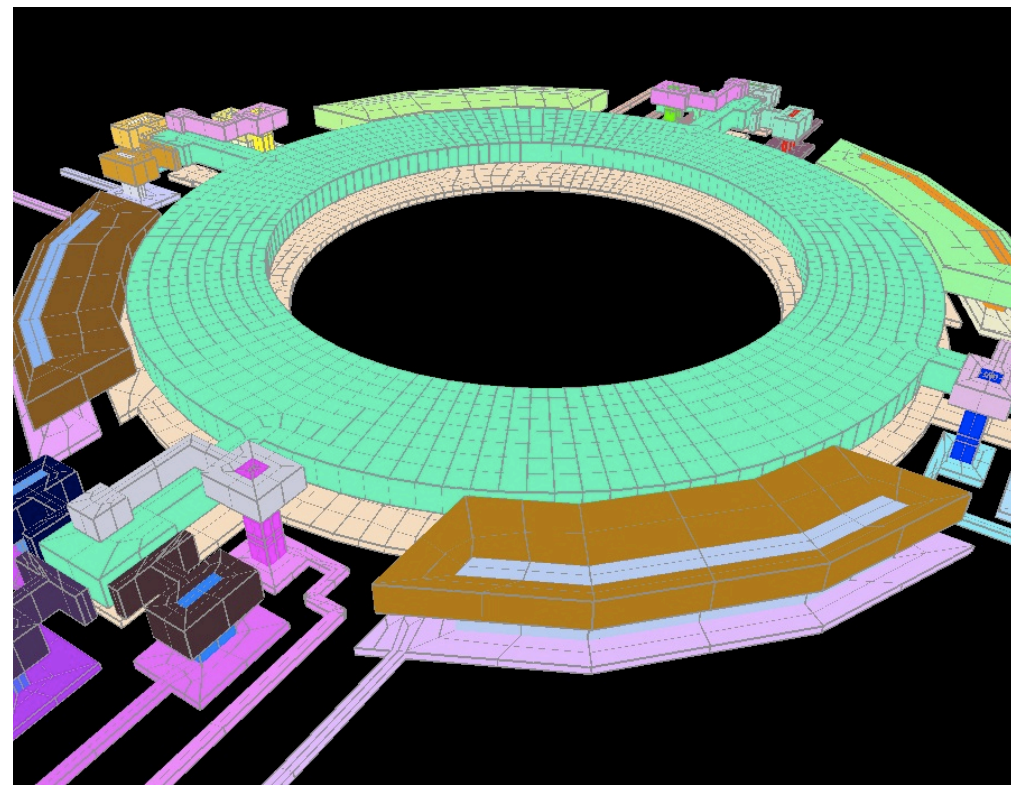
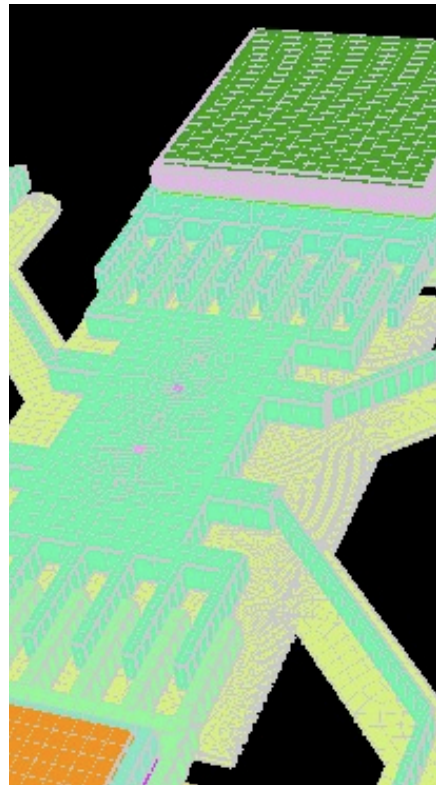


# Getting Started with **3D Builder**

Robust, One Click MEMS Mesher



Getting Started With 3D Builder  
Getting Started Series  
Version 8.5/PC

Part Number 30-090-101  
Sep 2008

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**Patent Number 6,116,766:** Fabrication Based Computer Aided Design System Using Virtual Fabrication Techniques

**Patent Number 6,157,900:** Knowledge Based System and Method for Determining Material Properties from Fabrication and Operating Parameters

# Main Features



## •✎• **Robust mesher**

Create Manhattan, isotropic & adaptive meshes

## •✎• **All Hex element generation**

High quality meshes for faster simulation

## •✎• **Mask to mesh**

One click Mask to Mesh conversion

## •✎• **Parametric meshing**

Change device parameters without re-meshing

## •✎• **Speed**

Typical meshes in under 1 minute

## •✎• **Export to FEA**

Export to IntelliSuite Multiphysics, ABAQUS, ANSYS, SIMULIA, PATRAN and I-DEAS (needs TEM module)

# App Overview

**Main Toolbar.** Common file and edit functions

**Entities Toolbar.** Assign and edit entities

**Mesh Controls.** Automeshing, mesh validation and setup tools

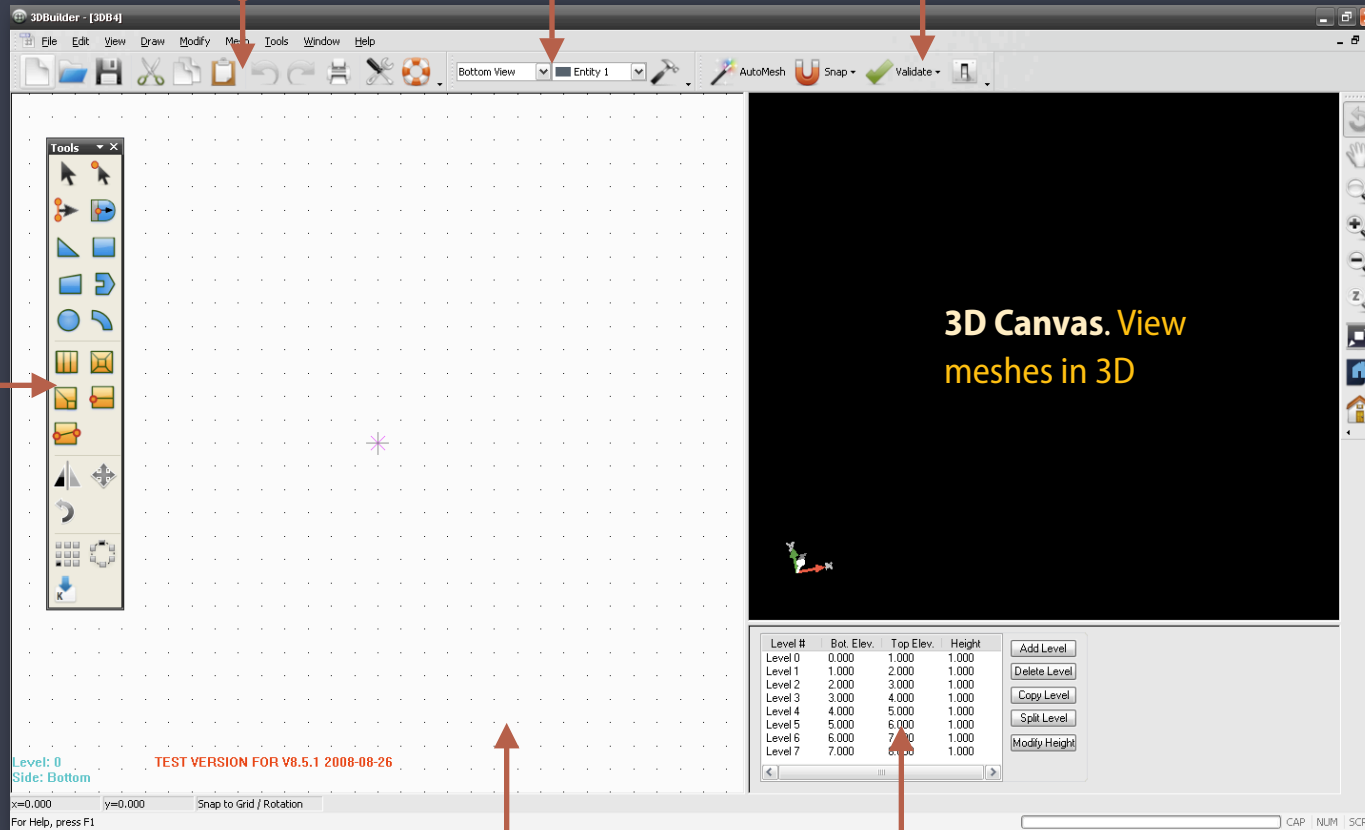
**Tools.** Mesh creation and editing tools.

**View Toolbar.** Zoom, Pan, Rotate, and other controls

**3D Canvas.** View meshes in 3D

**2D Canvas.** Draw and Edit Meshes in 2D

**Level Manager.** Edit Layer stacking, mesh thickness and separation



# App overview

1

3D Builder allows you to manually create **parametric meshes** or automatically convert a mask set into a parametric mesh.

2

3D Builder allows you to build high fidelity **hexahedral** meshes in a jiffy. Use the drawing and mesh editing tools to create your meshes. Use mesh refinement techniques such as subdivision, zippering, spider-webbing and corner frames to intelligently refine your mesh.

3

**Mesh tracing** allows you to use your mesh as a template to trace elements one by one. Works great for optimal meshes!

**Automeshing** allows you to easily create manhattan, isotropic or adaptive meshes.

Use **mesh validation** tools to validate the mesh connectivity and compatibility.

Finally, **export** your meshes to analysis modules. You can use any of the multiphysics modules to export the meshes to other FEA software such as I-DEAS, Simulia, Ansys or Ansoft.

4

5

6

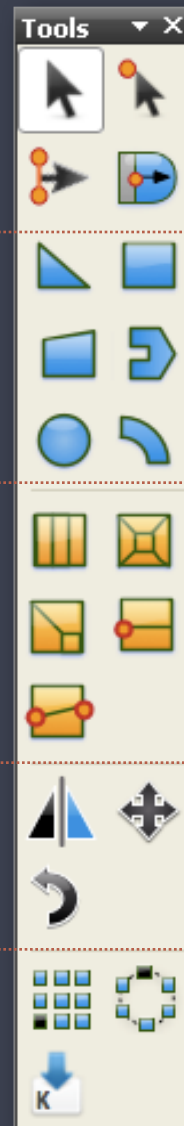
# Tools

**Select Elements.** Select by clicking or dragging around objects.

**Modify Top/Bottom nodes.** Move top and bottom nodes of an object.

**Draw Elements.** Elements are automatically converted into hexahedral elements.

**Edit Tools.** Tools for mirror, rotate, rotating meshes.



**Modify Nodes.** Move selected node while maintaining connectivity.

**Modify the edge of an element.** Used in fluidic simulations only.

**Mesh Refinement Tools.** Refine mesh elements further using techniques such as sub-division, zippering, spider webbing and corner frames.

**Misc.** Tools for arraying and keyboard viewer.



# Drawing tools

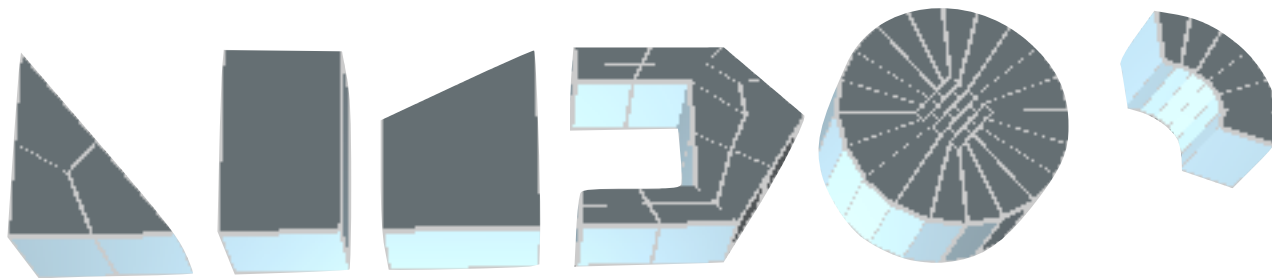
Icon



Top View



3D View



**Draw objects as you would in any CAD tool. Objects are automatically meshed into hexagons as they are drawn!**

# Local mesh refinement tools: Slice & Dice

Icon



Before



After



Slice

Spider  
Web

Corner  
Frame

Zipper

Zipper 2



# View

**Rotate 3D View.** Use mouse to freely rotate 3D view. Use scroll ball to zoom in and out .



**Pan and Zoom.** Work in either 2D canvas or the 3D canvas. Depending upon user focus.

**Z-scale.** Change 3D scaling to view low aspect ratio structures better.

**Zoom to fit.** Zoom to extents works in 2D or 3D canvas.

**Set Home.** Commits current 2D view to memory.

**Go Home.** Switches 2D view to saved view.

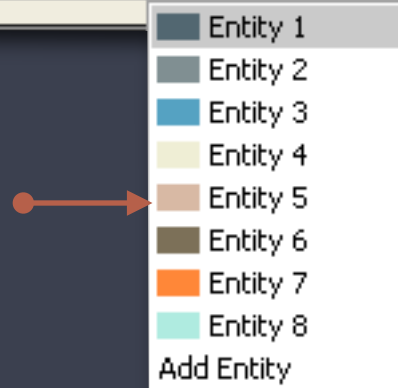
# Entities

**View.** Toggle between top and bottom views of a level. Nodes on the top and bottom of a level can be edited independently.



**Modify entities.** Modify entity description and color.

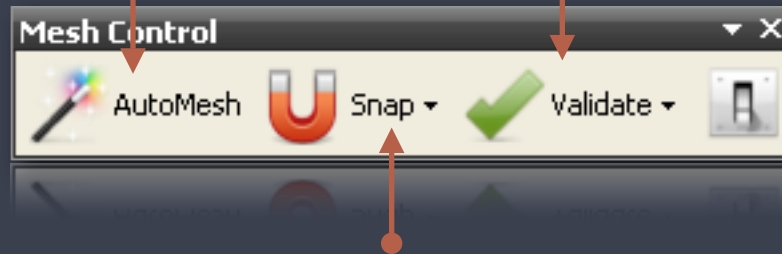
**Set Entity.** User drop down to change the entity of selected objects or to set the default entity for new elements.



# Mesh controls

**AutoMesh.** Automatically create a mesh from a mask set.

**Validate (drop down).** Validate mesh connectivity and compatibility.



**Snap (drop down).** Allow user to turn on and off snaps

**Setup.** Setup viewports, grid sizes etc

Side note



Application Icon



Document Icon.  
Extension .solid

# Level controls

**Level Manager.** Set the thickness and elevation of the current drawing level — this sets the extrusion height and position of the entities in the level. User can parametrically vary mesh thickness and elevation of each level.



The screenshot shows a 'Level Manager' window with a table of levels and a set of control buttons. The table has four columns: 'Level #', 'Bot. Elev.', 'Top Elev.', and 'Height'. It lists levels from 0 to 7, each with a 1.000 height. To the right of the table are five buttons: 'Add Level', 'Delete Level', 'Copy Level', 'Split Level', and 'Modify Height'. A red arrow points from the text 'User can parametrically vary mesh thickness and elevation of each level.' to the 'Level #' column header. Another red arrow points from the text 'Manipulate levels. Modify level settings, add, remove and split a level into multiple levels.' to the 'Delete Level' button.

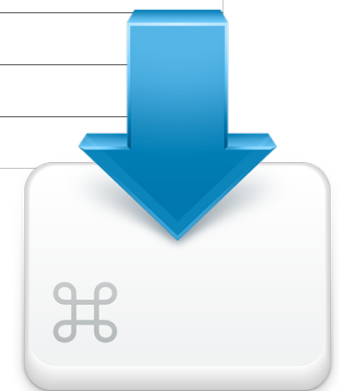
Level #	Bot. Elev.	Top Elev.	Height
Level 0	0.000	1.000	1.000
Level 1	1.000	2.000	1.000
Level 2	2.000	3.000	1.000
Level 3	3.000	4.000	1.000
Level 4	4.000	5.000	1.000
Level 5	5.000	6.000	1.000
Level 6	6.000	7.000	1.000
Level 7	7.000	8.000	1.000

**Manipulate levels.** Modify level settings, add, remove and split a level into multiple levels.

# Important Keyboard Shortcuts

Function	Keyboard Shortcuts
<b>Manipulate View</b>	
Zoom In	Ctrl+↓
Zoom Out	Ctrl + ↑
Zoom Window	Z
Fit All	F
Pan	P
Rotate	R
Lighting On/Off	Ctrl+L
<b>Draw</b>	
Triangle	T
Rectangle (Box)	B
Quadrangle	Q
Polygon	G
Circle	C
Arc	A
Snap to Grid	Shift+G
Snap to Object	Shift+V
No snap	Shift+N

Function	Keyboard Shortcuts
<b>Mesh</b>	
Auto Mesh	Ctrl +M
Multiple slices	Ctrl + Shift + L
Spider Web	Ctrl +Shift + W
Corner Frame	Ctrl +Shift + F
Zipper	Ctrl +Shift + Z
<b>Modify</b>	R
Node	N
Edge	E
Move	M
Reflect	/
Rotate	Ctrl+R
Sidewall Angle	W
<b>Other</b>	C
Undo	Ctrl + Z
Redo	Ctrl + Y
Keyboard Entry	Ctrl + K
Setup	Alt + ;



# Working with the Auto Mesher



**Mesh type.** Choose mesh type depending upon mask type and intent. Use Manhattan meshing for rectilinear masks, non-manhattan isotropic for complex mask shapes.

**Choose mask file.** Browse hierarchy to choose mask file.

MESHING TYPE

Mask File:

Browse...

Meshing Type

Non-Manhattan Isotropic

Non-Manhattan Adaptive

Manhattan

Options

Mesh Size 30  $\mu\text{m}$

Max Segment 10

Min Segment 2

Advanced Setup

OK Cancel

**Mesh size.** Choose average size of the hexahedral mesh.

**Advanced Setup.** Select advanced setup to enter the mask layer stack up information.

# Working with the Auto Mesher (2)



**Advanced Setup for Layers**

**Mesh Details**

- Simplify polygons (arcs, circles etc) whose edges exceed  um
- Meshing tolerance  sq.um
- Ignore polygons with areas smaller than
- Automatically assign entities

**Model Details**

Process Modeling     3D Modeling

	Layer # in Mask	Layer Name	Processing	Thickness	Bottom Elevation
<input checked="" type="checkbox"/>	0	HOLE1	Hole	2	3.1
<input checked="" type="checkbox"/>	13	POLY0	Ground Plane	0.5	0.6
<input checked="" type="checkbox"/>	43	ANCHOR1	Anchor	2	1.1
<input checked="" type="checkbox"/>	45	POLY1	Structural(Conformal)	2	3.1
<input checked="" type="checkbox"/>	47	POLY1_POLY2_VIA	Structural Via	0.75	5.1
<input checked="" type="checkbox"/>	49	POLY2	Structural(Conformal)	1.5	5.85
<input checked="" type="checkbox"/>	50	DIMPLE	Dimple	0.75	2.35
<input checked="" type="checkbox"/>	51	METAL	Structural(Conformal)	0.5	7.35

Load Settings...    Save Settings...    Cancel    OK

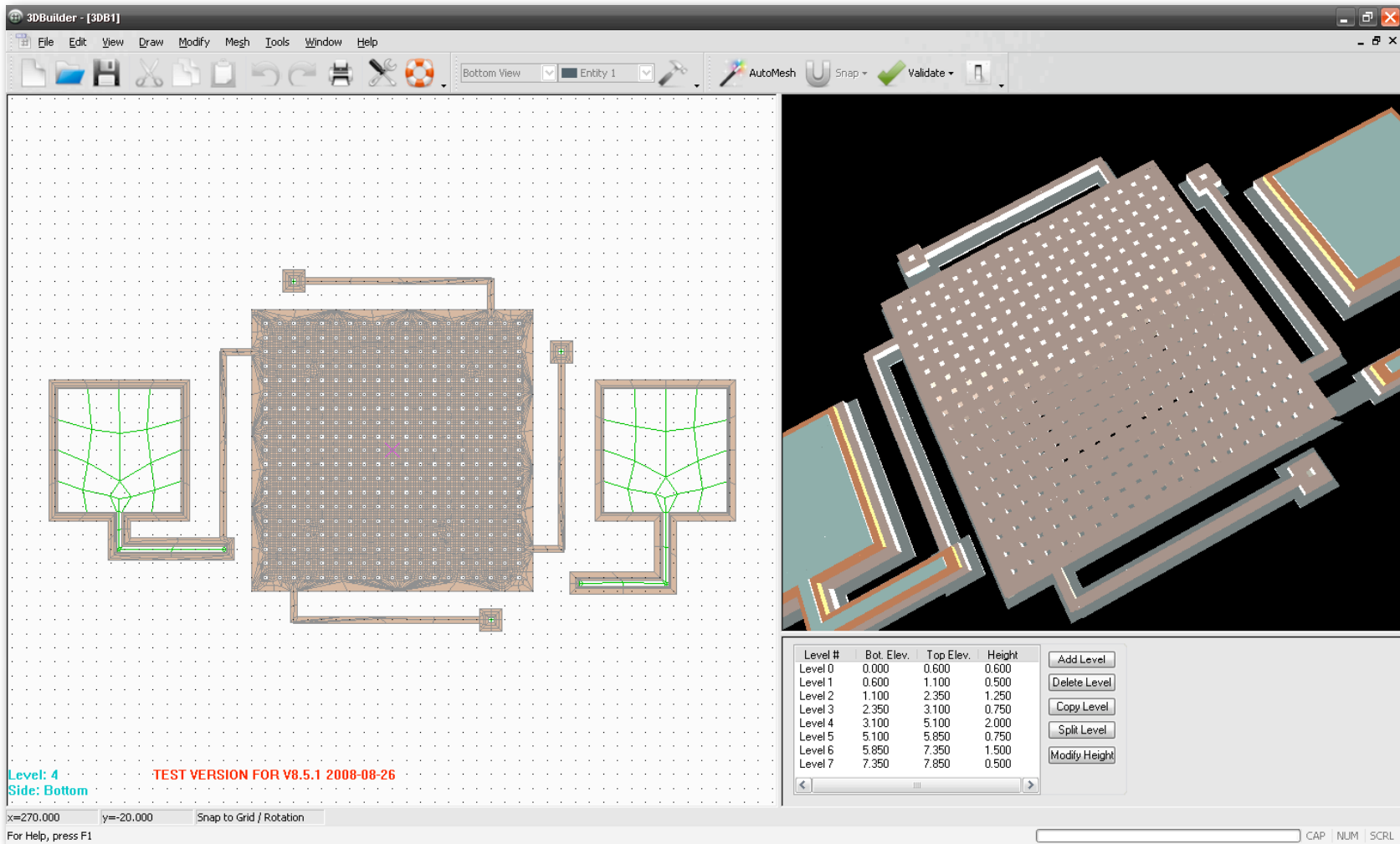
**Mesh Simplification.**  
Setup for simplifying meshes.

**Mask layer stack up and design intent.** Set thickness and elevation for each layer along with processing intent.

**Load and Save Settings.** Saves layer stack up as either a ".spro" or ".sopt" file depending upon process modeling or 3D modeling intent

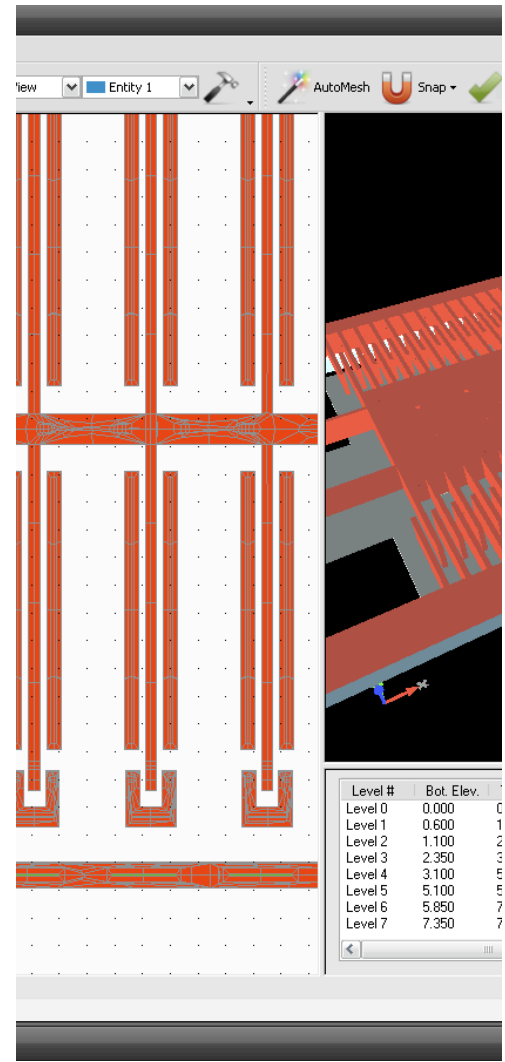
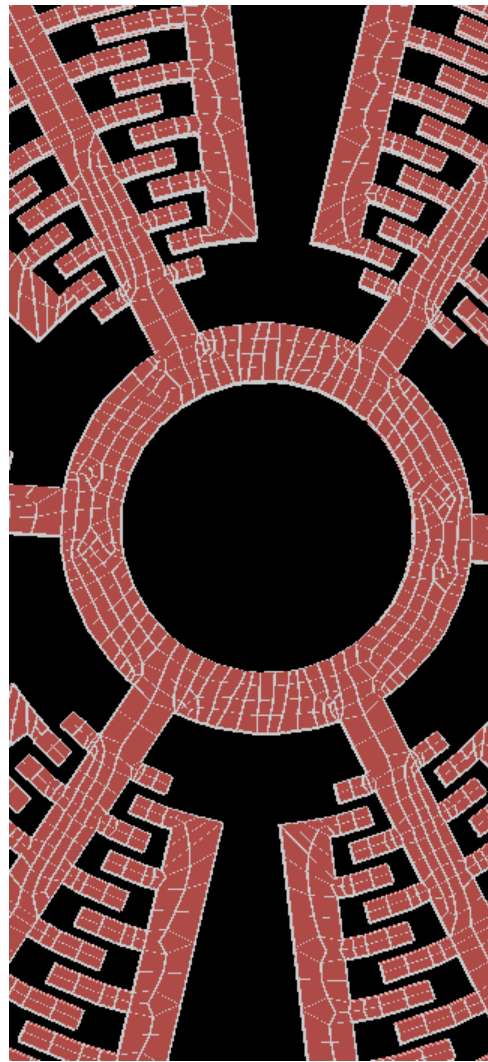
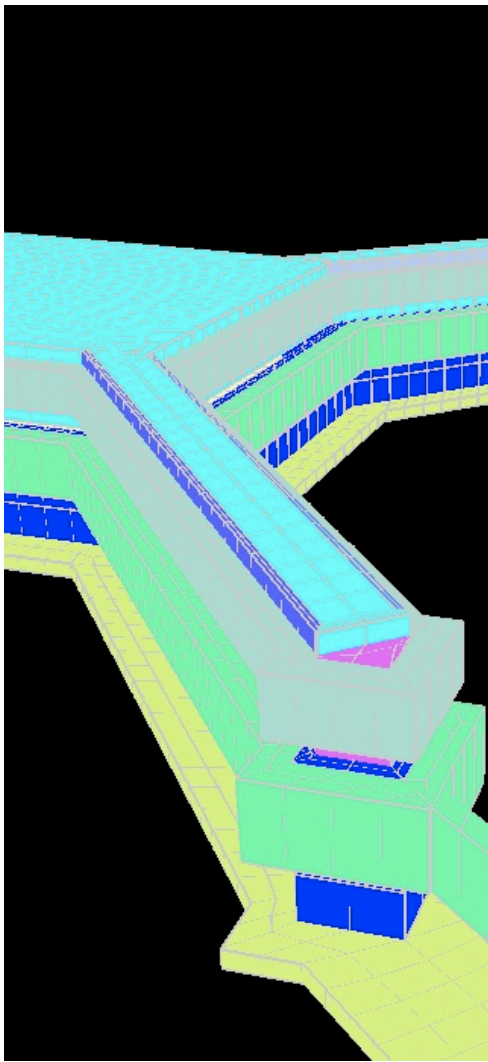
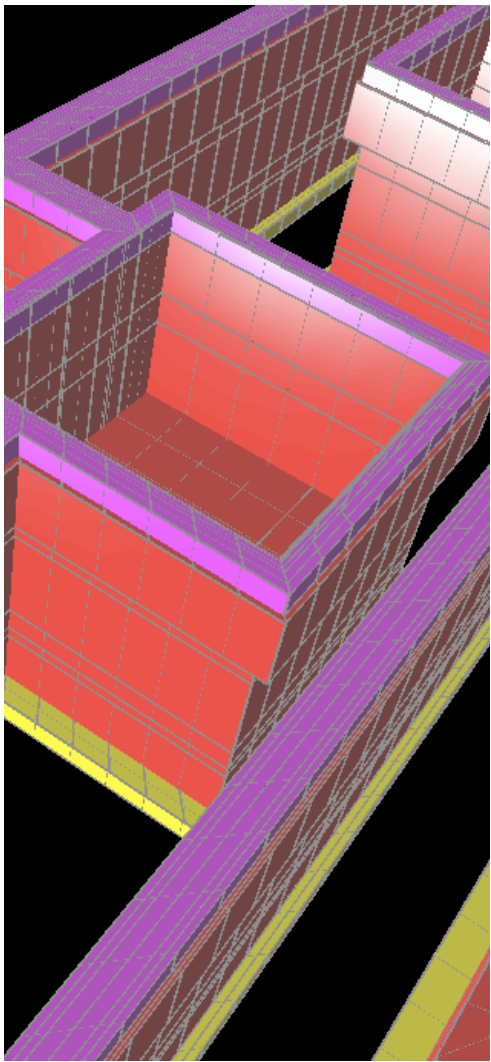


# Working with the Auto Mesher (3)



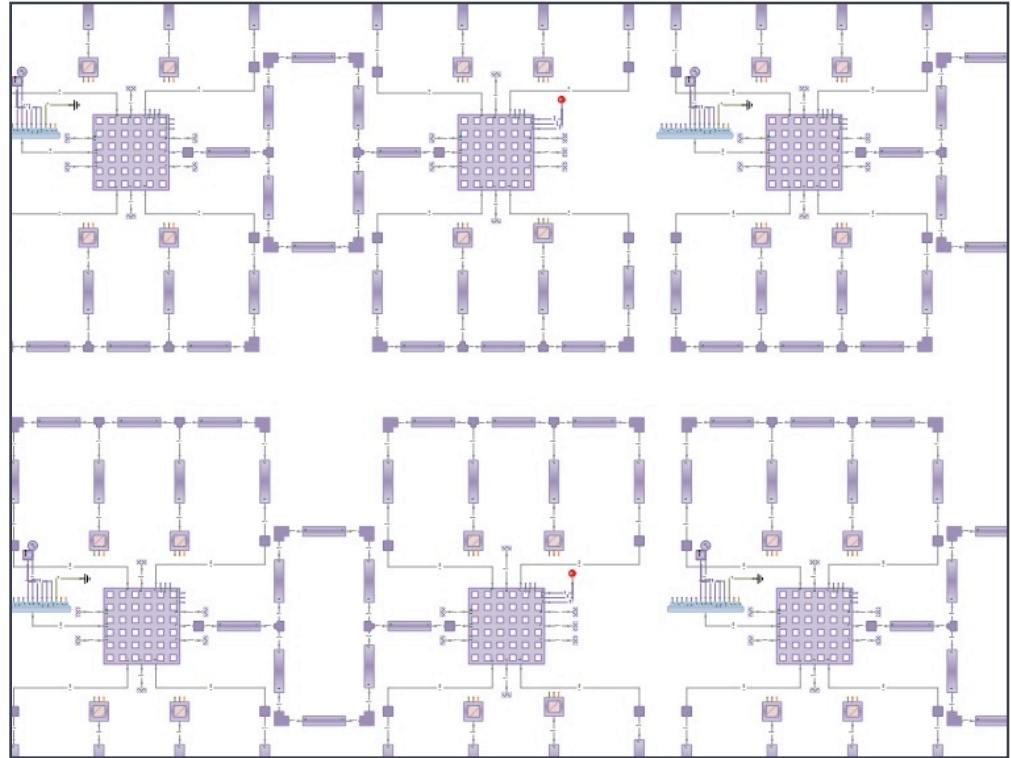
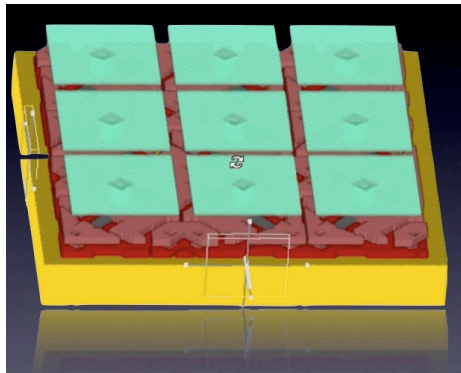
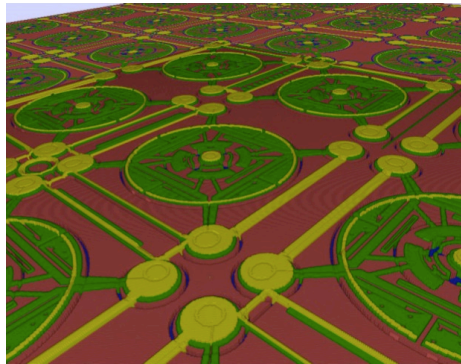
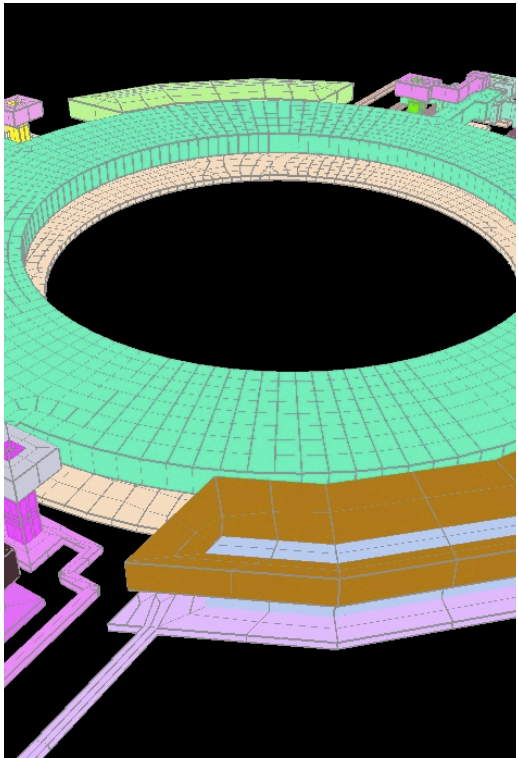
## Meshed structure

Auto Mesher: Convert Mask Set into 3D Mesh



## 3D Builder

Robust All Hexahedral Meshing • Auto and Manual Meshing Modes • One click mask to mesh conversion • Handle conformal and planarized devices • Create parametric meshes



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