Introduction to Ansys SpaceClaim

Workshop 2.1: Creating Geometry

Release 2022 R1

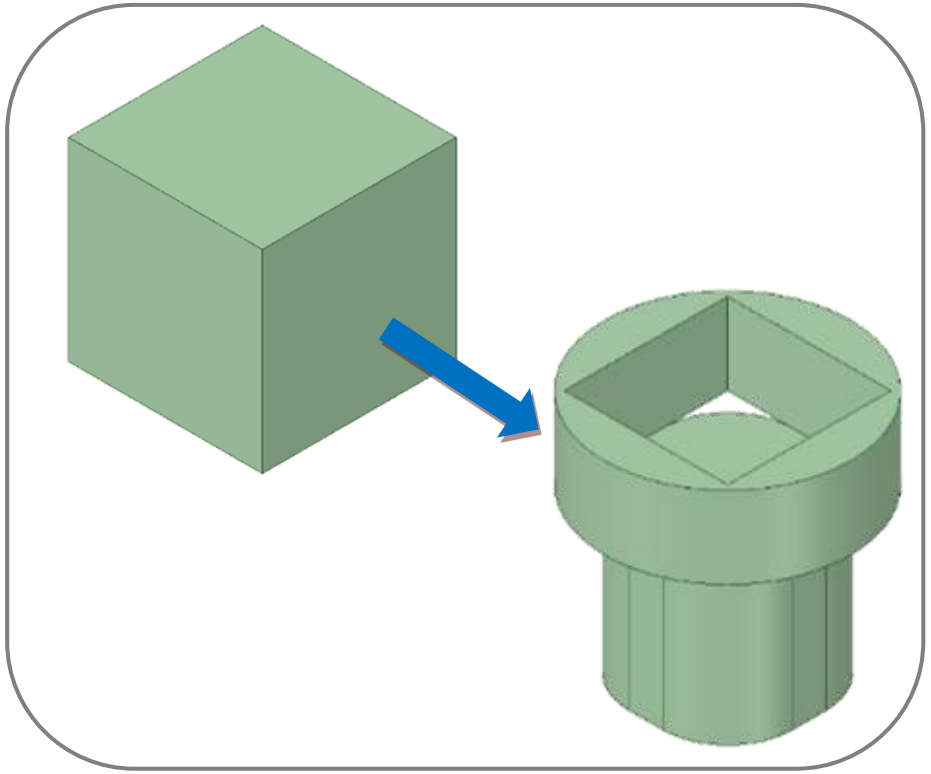
Please note:
- These training materials were developed and tested in Ansys Release 2022 R1. Although they are expected to behave similarly in later releases, this has not been tested and is not guaranteed.
- The screen images included with these training materials may vary from the visual appearance of a local software session.
- Although some workshop files may open successfully in previous releases, backward compatibility is somewhat unlikely and is not guaranteed.

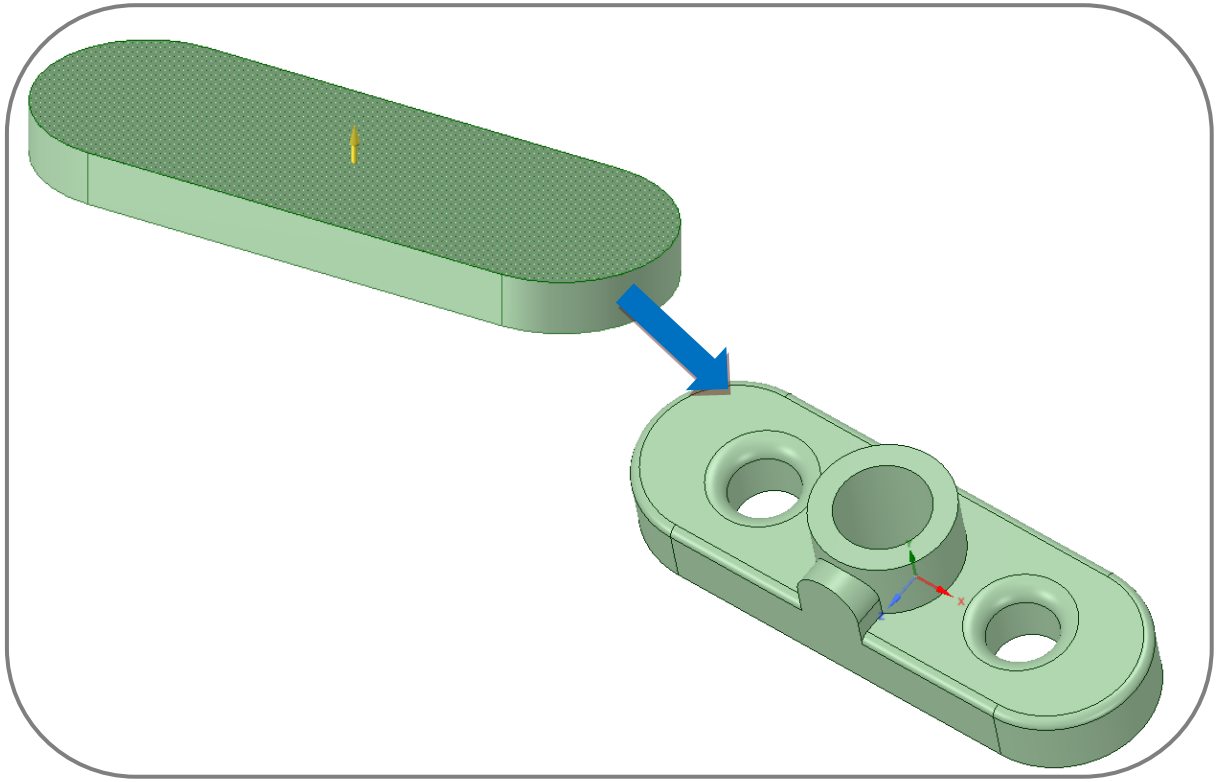
Key Learning Points

- Completion of this workshop will help to gain an understanding of:
  - Modes available in SpaceClaim
  - The concept of “Planes”
  - Creating sketches
  - The available modelling tools
  - Advanced features in the Structure Tree
  - The display Tab

Objectives

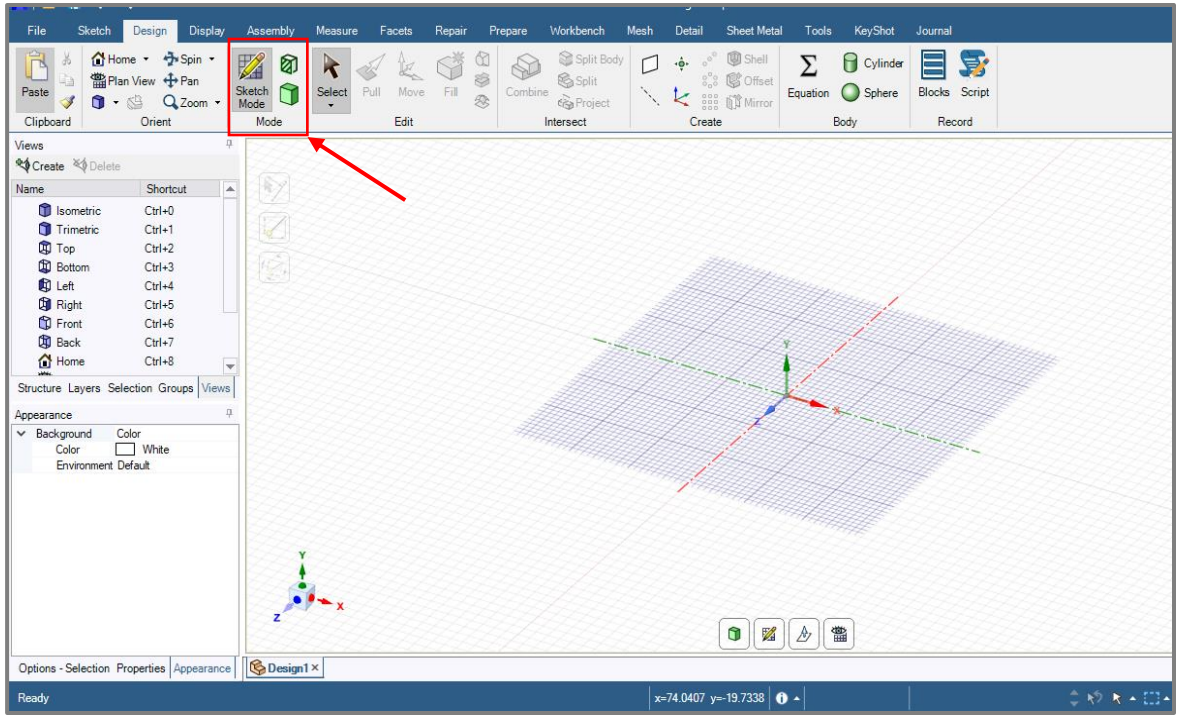
- Creation of simple geometry by extrusion of a sketched plane
- 3D modification in section mode
- Creation of a more complex component
- Learning how structure tree impacts geometry modifications





SCDM modes, planes, and sketches (1)

The three modes of SCDM are “sketch”, “section”, and “3D” mode

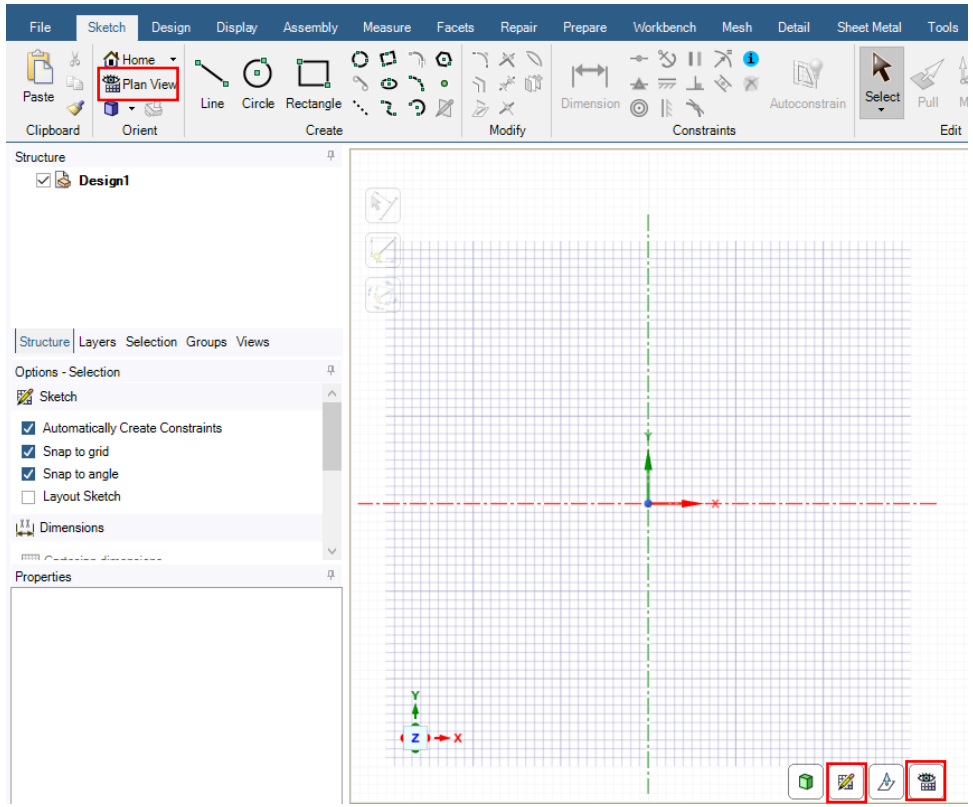


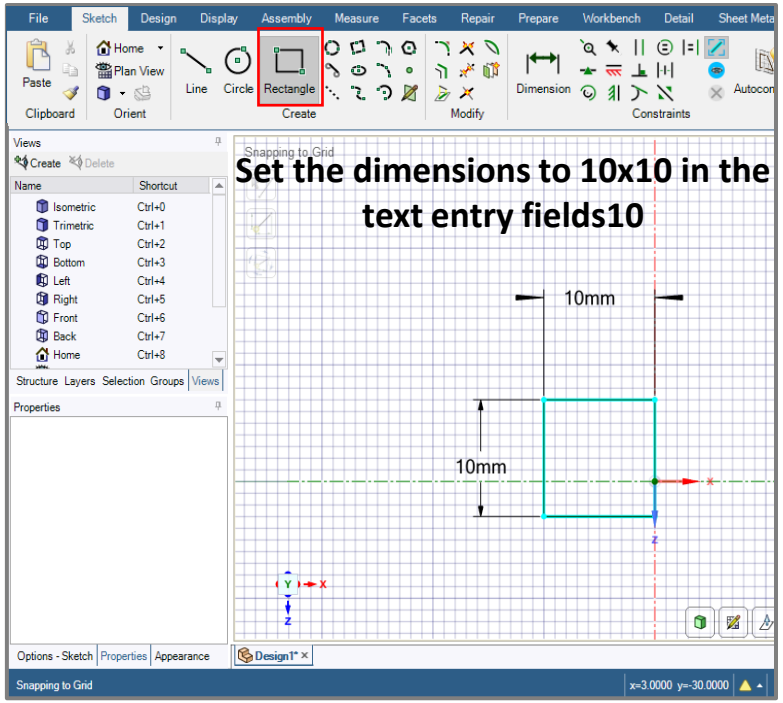
	Sketch mode displays the sketch grid, so any of the sketch tools can be used to sketch in 2D
	Section mode allows editing solids and surfaces by working with their edges and vertices in cross-section. All the sketch tools can be used in Section mode to create and edit solids and surfaces
	3D mode allows working directly with objects in 3D space

SCDM modes, planes, and sketches (2)

Let’s start by creating unit box

- Click on the sketch mode, select the x-y plane, and start sketching
- Enter the“Plan View” to begin sketching the box

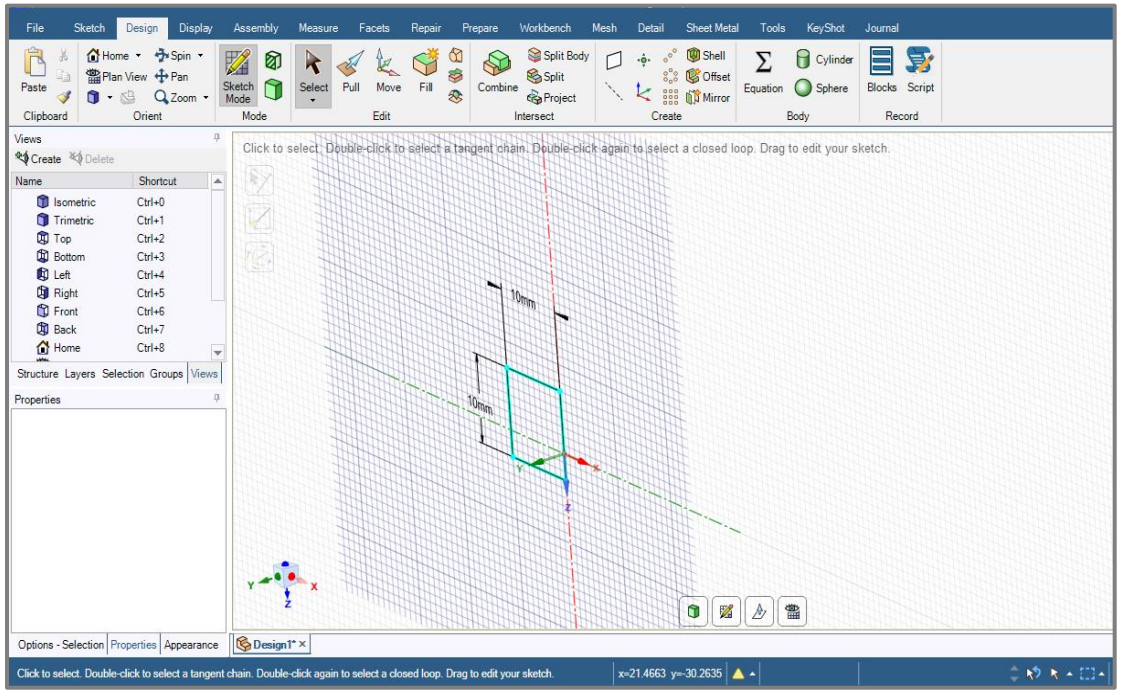


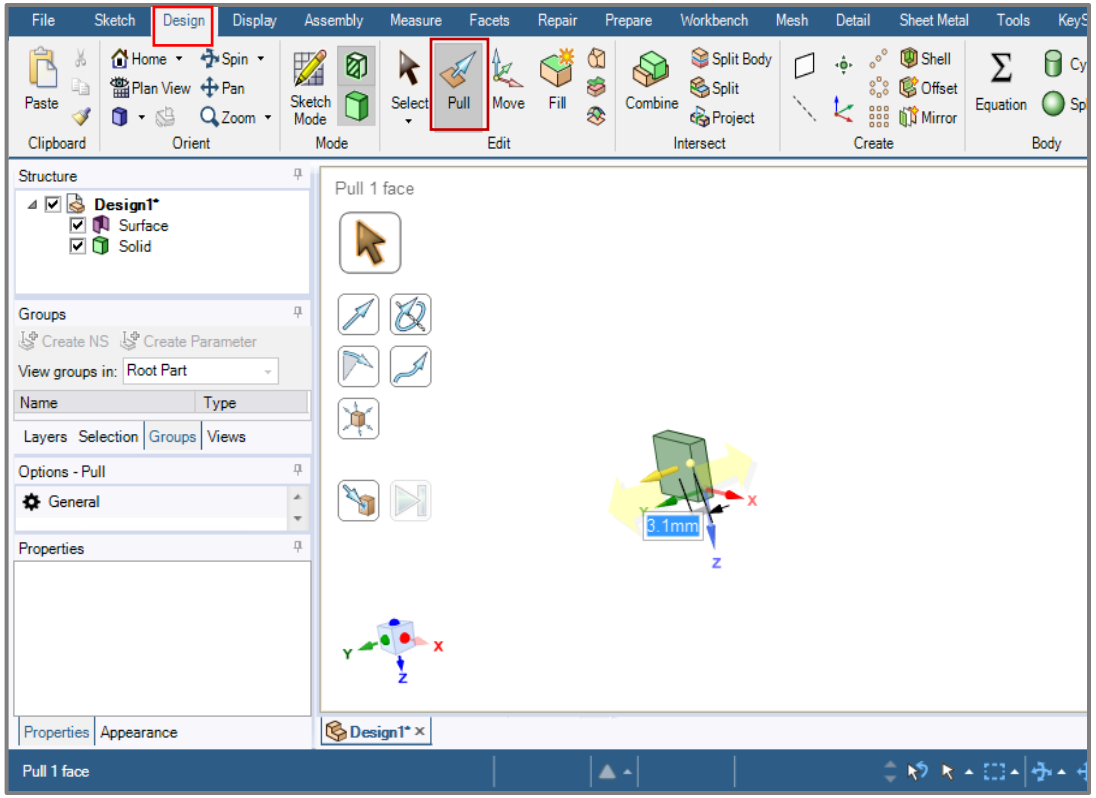


SCDM modes, planes, and sketches (3)

"**Pull**" the box in the +z direction to make it a 3D cube

- Click-hold the middle mouse button (MMB) to rotate the 2D box sketch
- Enter 3D mode and use the "Pull" tool to drag the face in the +z direction up to 10 mm

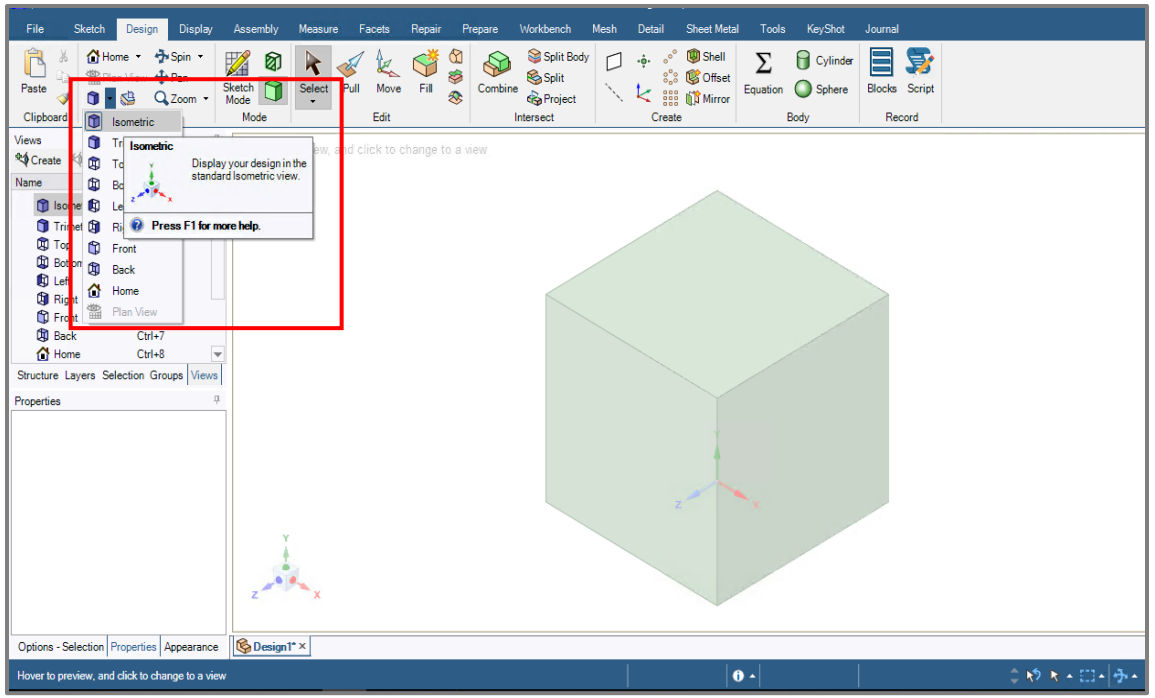


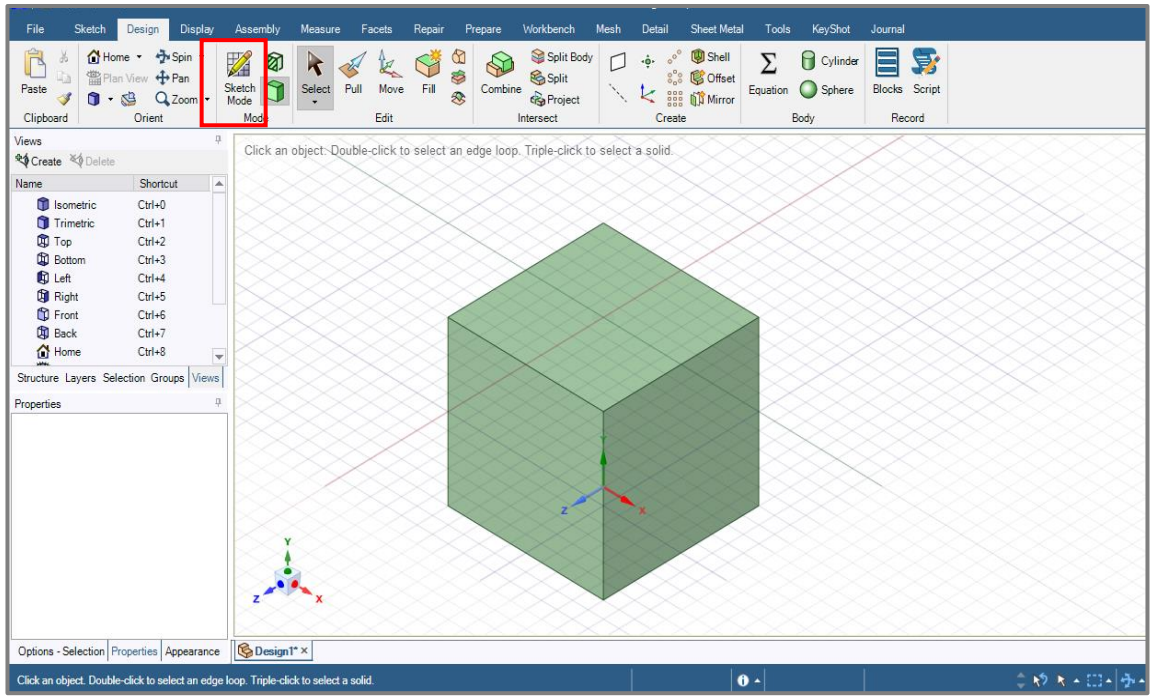


SCDM modes, planes, and sketches (4)

Switch between 3D Mode and Sketch Mode

- Move to isometric view
- Select Sketch Mode and click on the +y face

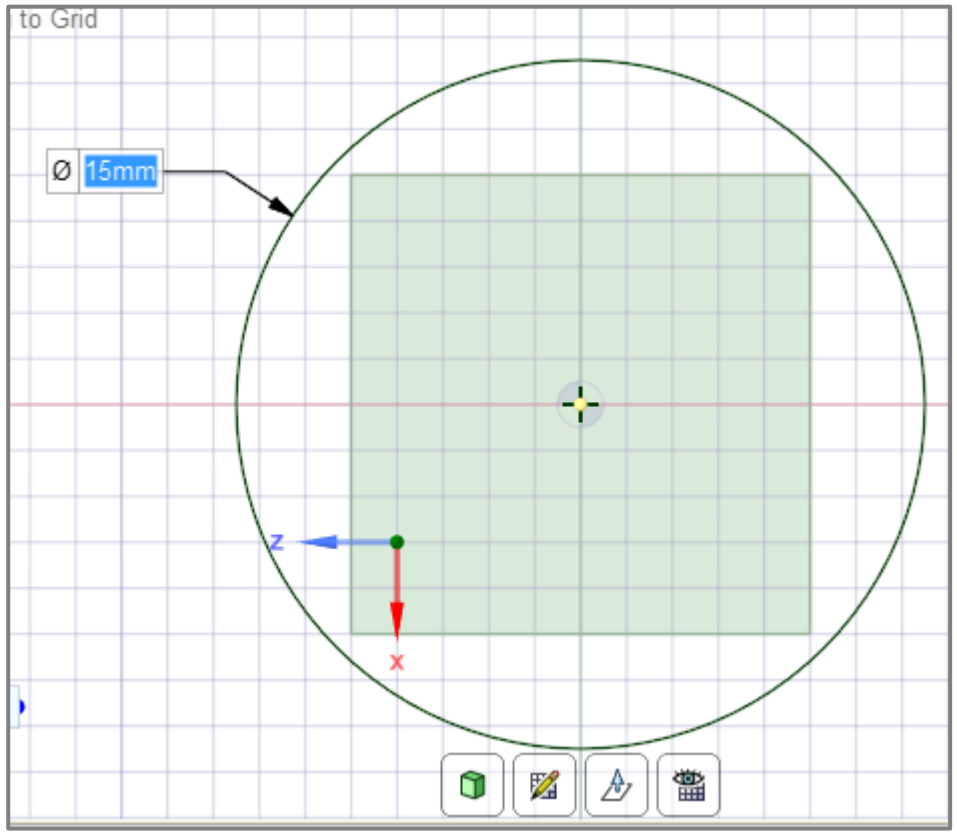


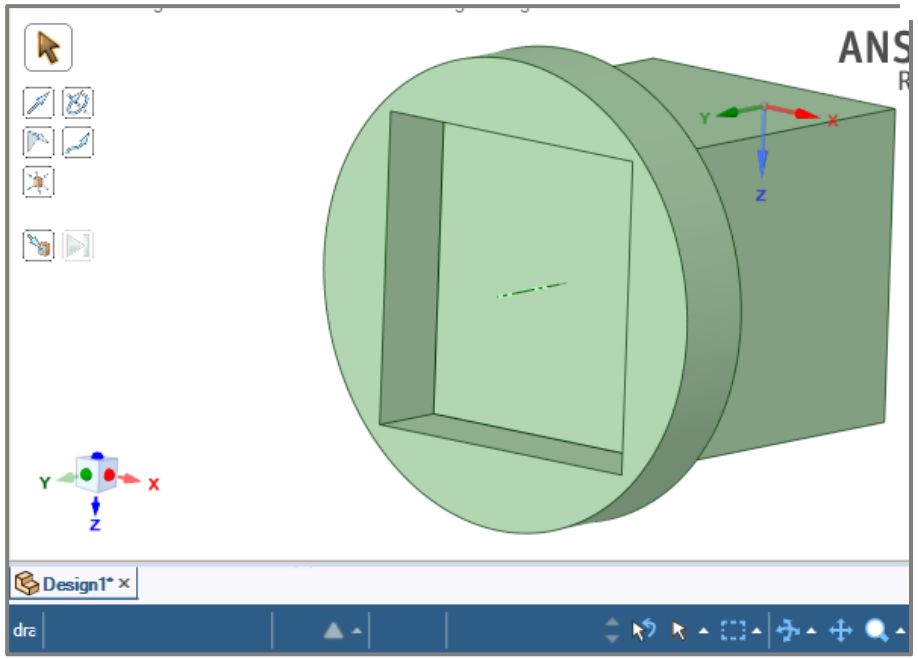


SCDM modes, planes, and sketches (5)

Create a cut-out cylinder on top of the cube

- Select "**Plan View**" and draw a circle with D=15 on the +y face
- Switch to 3D mode and "Pull" the outer part up to 5 mm of the circle into a cut-out cylinder

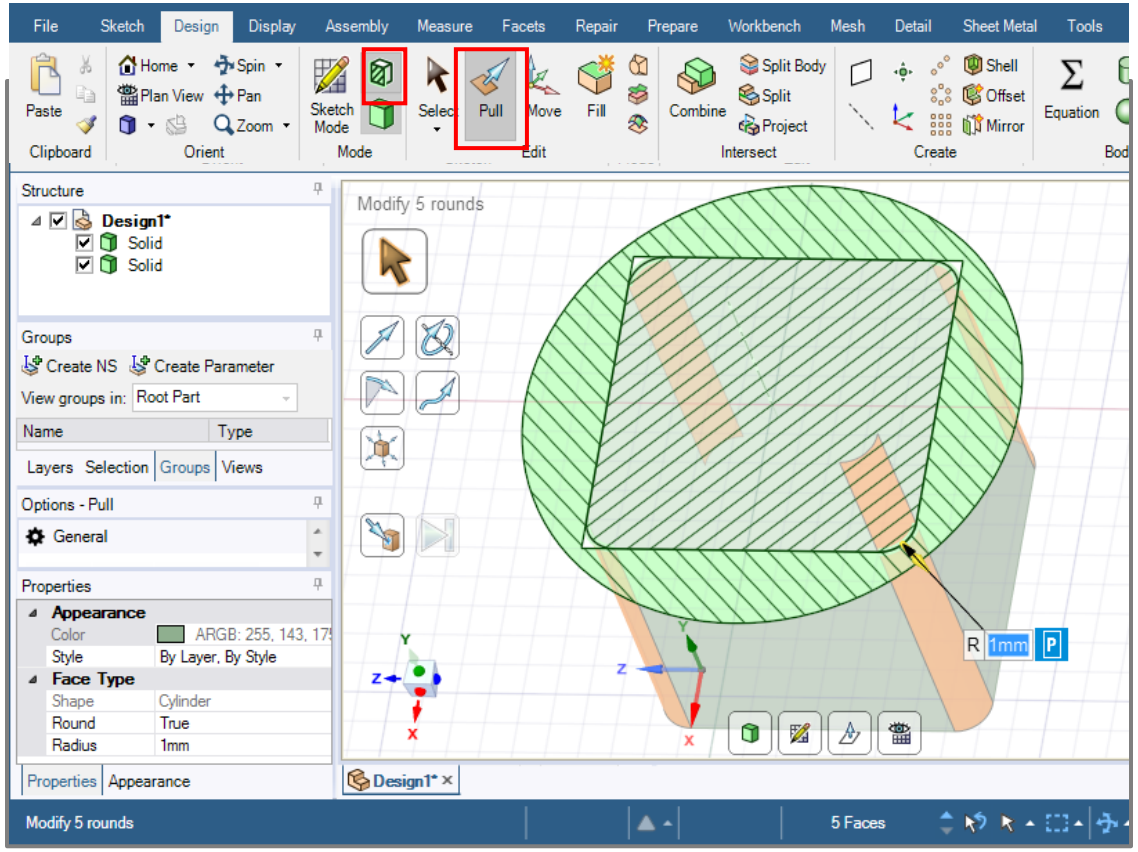




SCDM modes, planes, and sketches (6)

Choose the top face of the cube, then enter "**Section Mode**" to round the edges

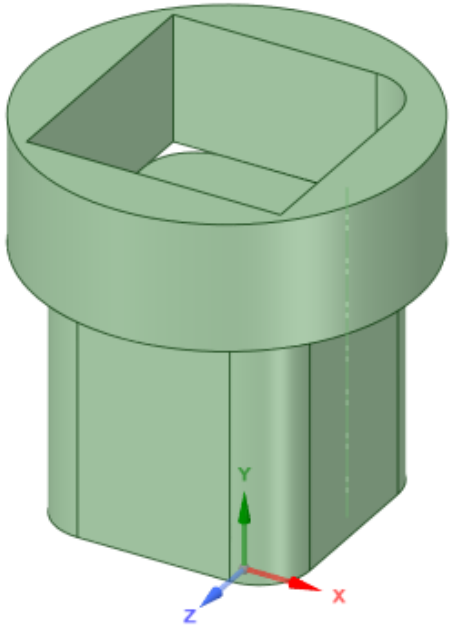
- Move to isometric view
- In Section Mode, "**Pull**" the four corners (Control+click). Change the radius to 2 mm



SCDM modes, planes, and sketches (7)

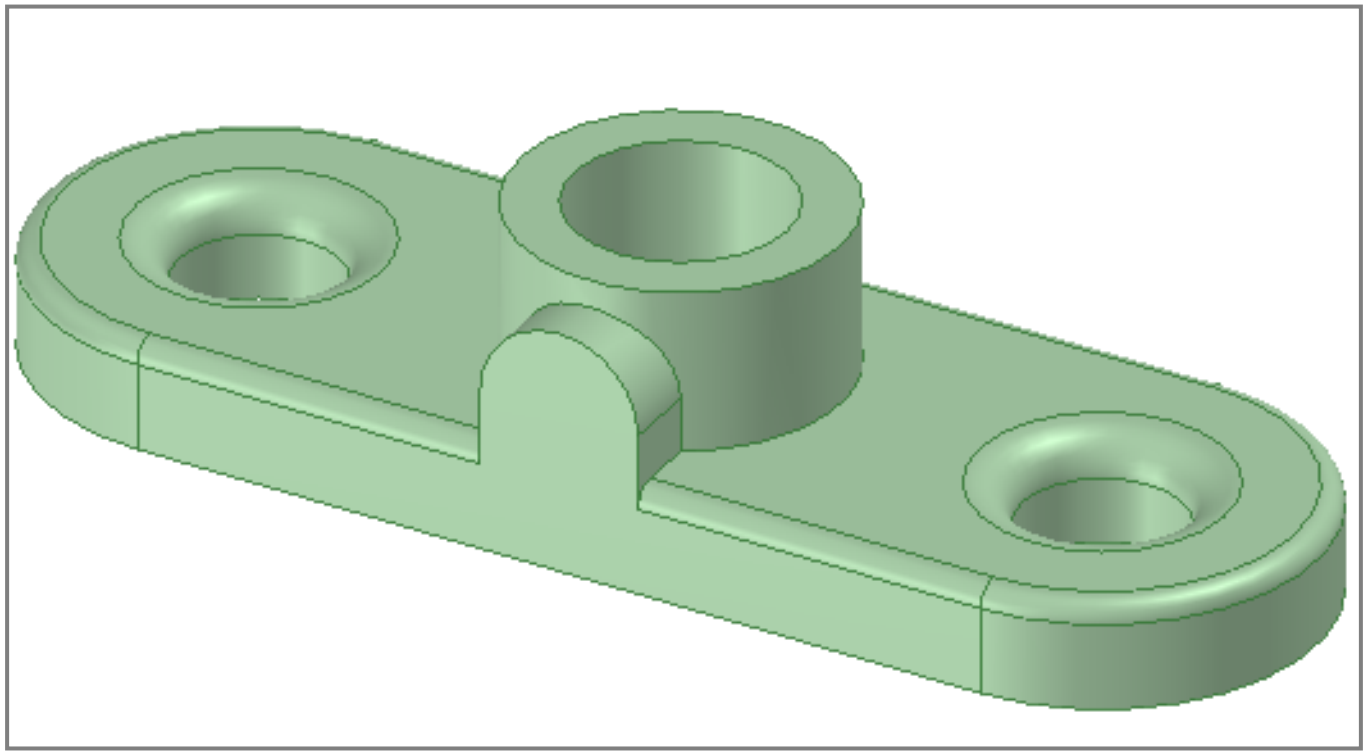
Your final object should be similar to the one below

- Note that you have not altered the upper cylinder, just the lower cube
- Summary of modes:
  - "**Sketch**" mode allows you to do 2D CAD operations on the face of a 3D object
  - "**Section**" mode allows you manipulate 3D objects by viewing only a 2D cross section
  - "**3D**" mode allows you to work directly with objects in 3D space

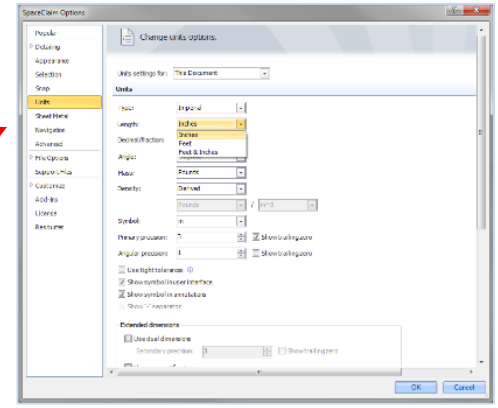


SCDM modeling tools: creation of a simple part

Now that you have a feel for the framework of SCDM, let’s create this part:

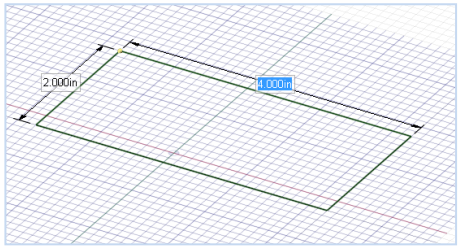


SCDM modeling tools: sketching

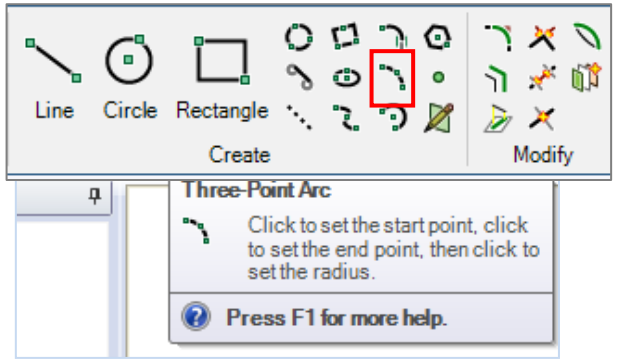


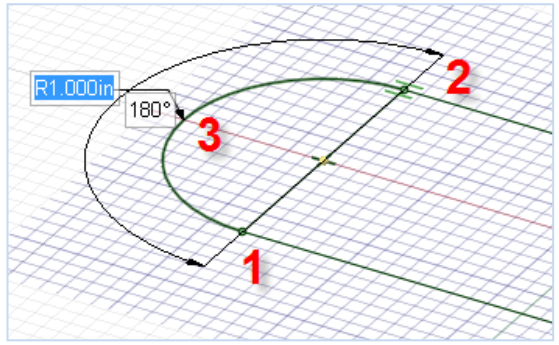
Tips for sketching the base of the component:

- Change the units to inches (“File->SpaceClaim Options->Units)
- Start by drawing a rectangle
- Utilize the “Three-Point Arc” sketch tool or the “Bend” tool (Note: the popup menu gives useful usage instructions!)
- “Trim Away” the remaining line segment

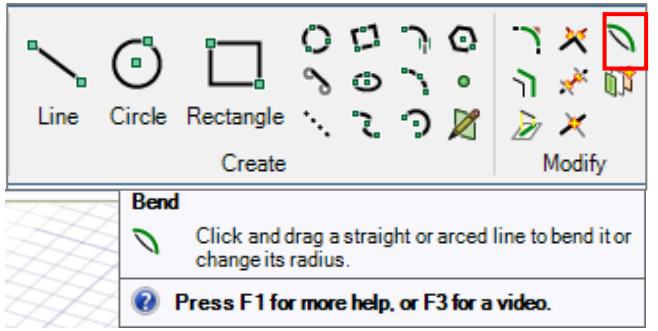


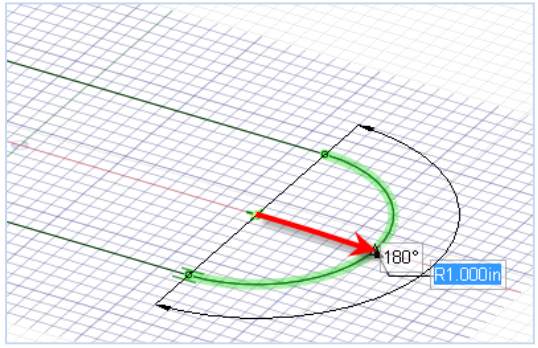
+



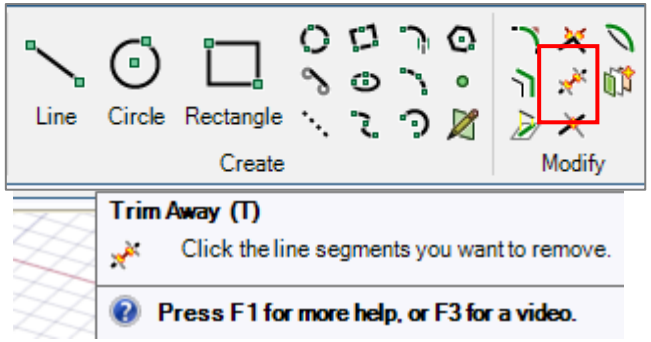


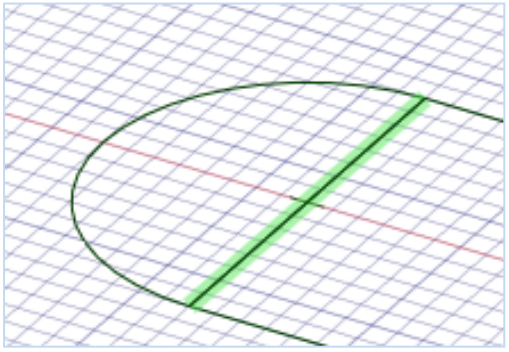
or





+



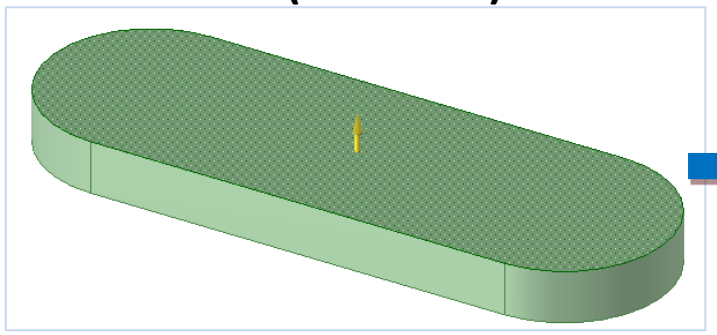


SCDM modeling tools: pulling

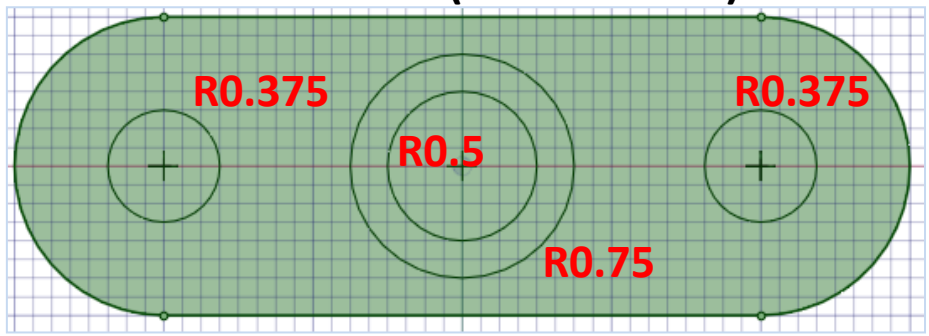
Tips for creating details of the part:

- Utilize the "**Pull**" tool and "**Sketch Mode**" on 3D faces to create the remaining features

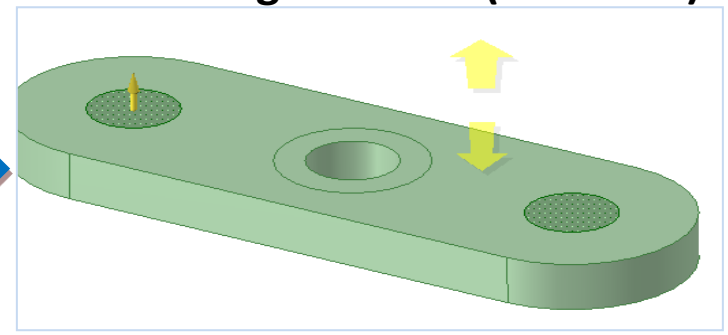
Pull (3D mode)



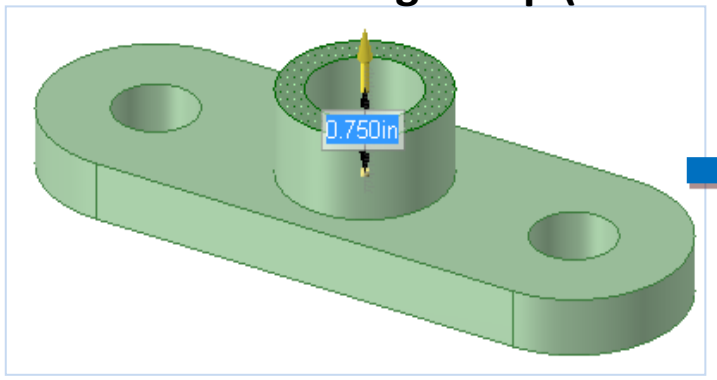
Draw circles (sketch mode)



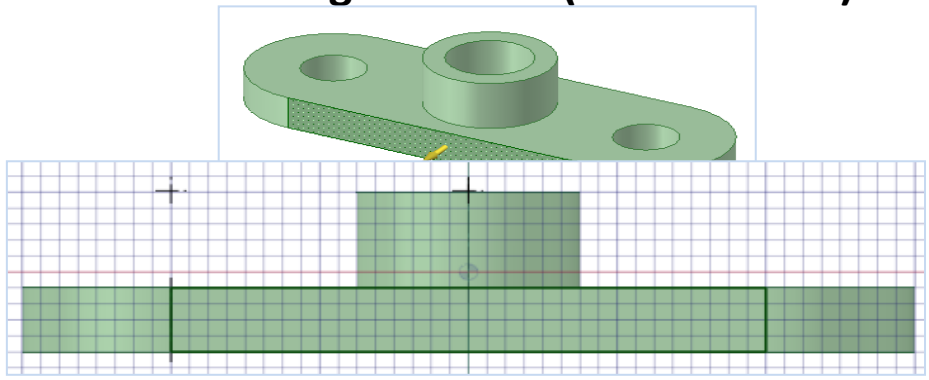
Pull holes through bottom (3D mode)



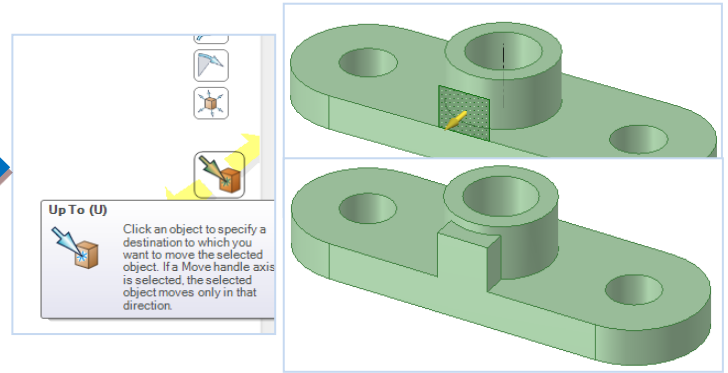
Pull concentric region up (3D mode)



Draw rectangle on side (sketch mode)



Pull Up To cylindrical face (3D mode)

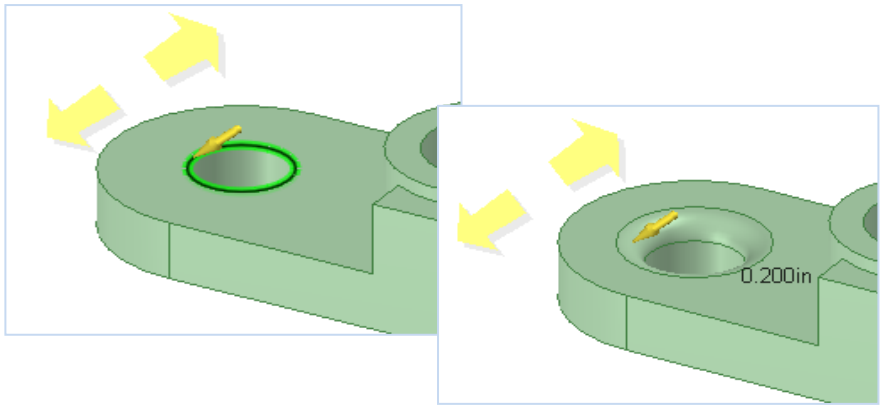


SCDM modeling tools: creating rounds

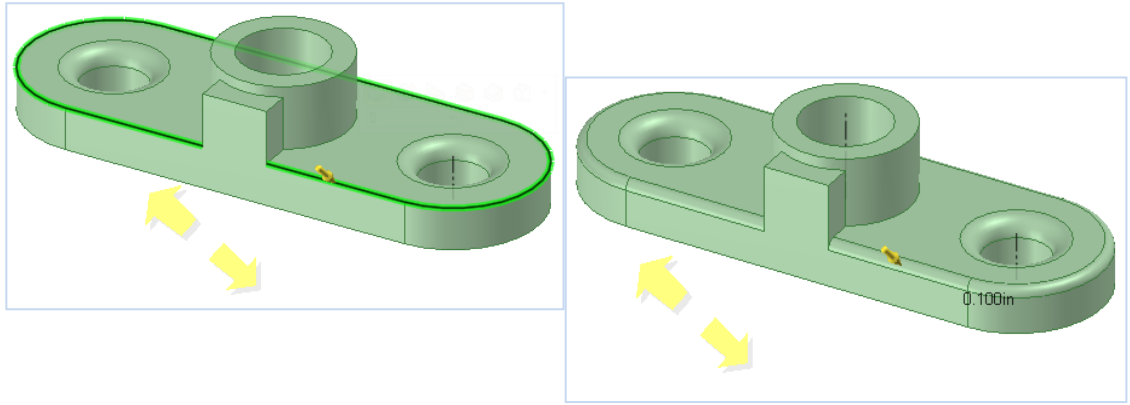
Tips for rounding and smoothing the part:

- "**Pull**" on edges to make rounds

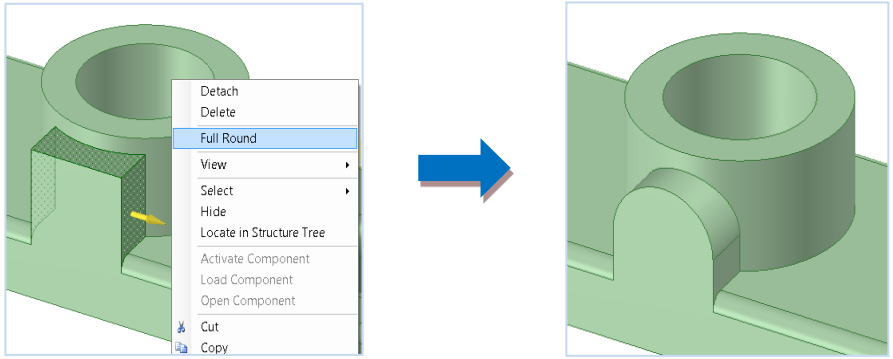
"Pull" (3D mode)



Double-click and "Pull" (3D mode)

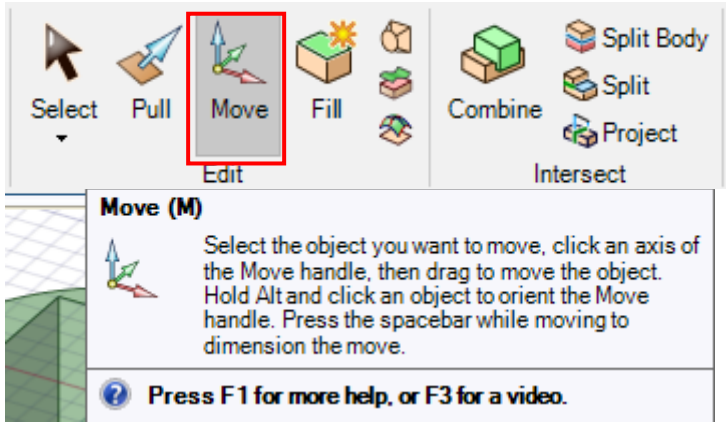


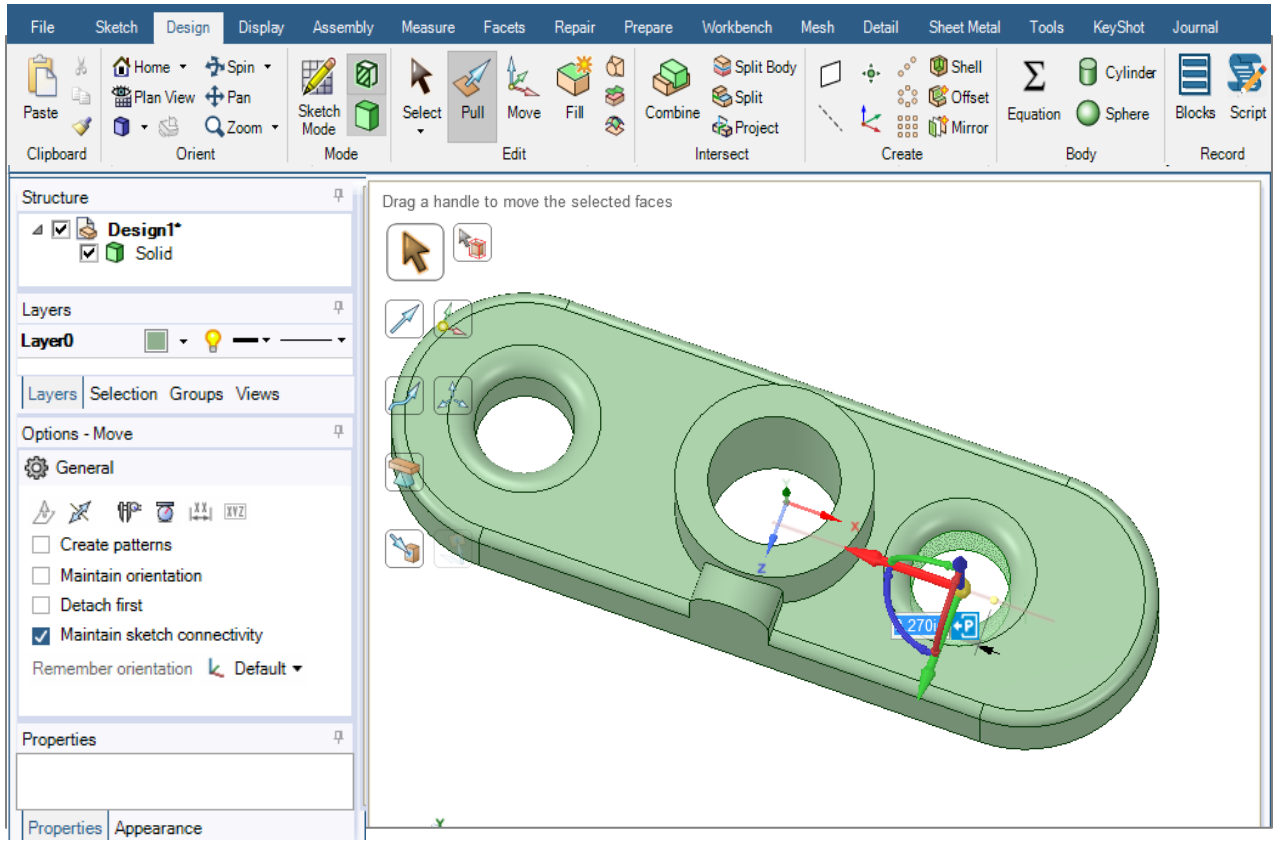
Control-click 3 faces, right-click and "Full Round" (3D mode with "Pull" must be selected)



SCDM modeling tools: move

Move the two outer holes 0.4 inches toward the center





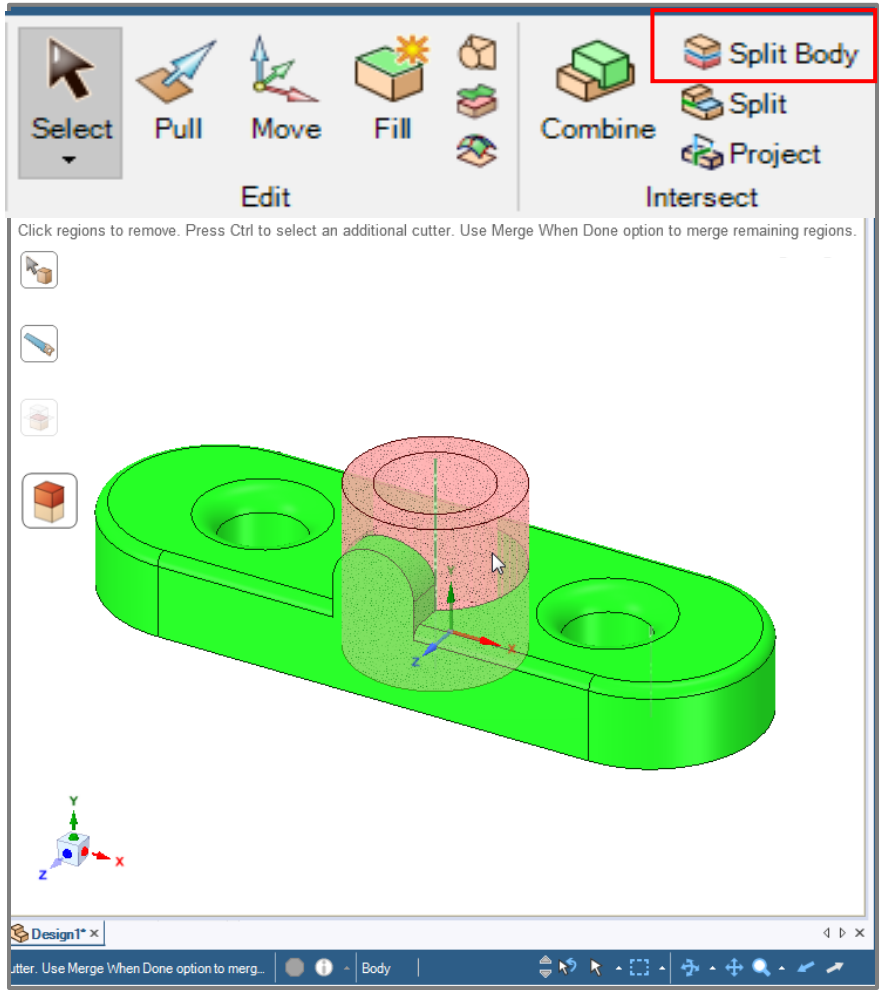
You must click on the red arrow

To define the move direction

SCDM modeling tools: split body

Split the body by the cylindrical surface to create two bodies

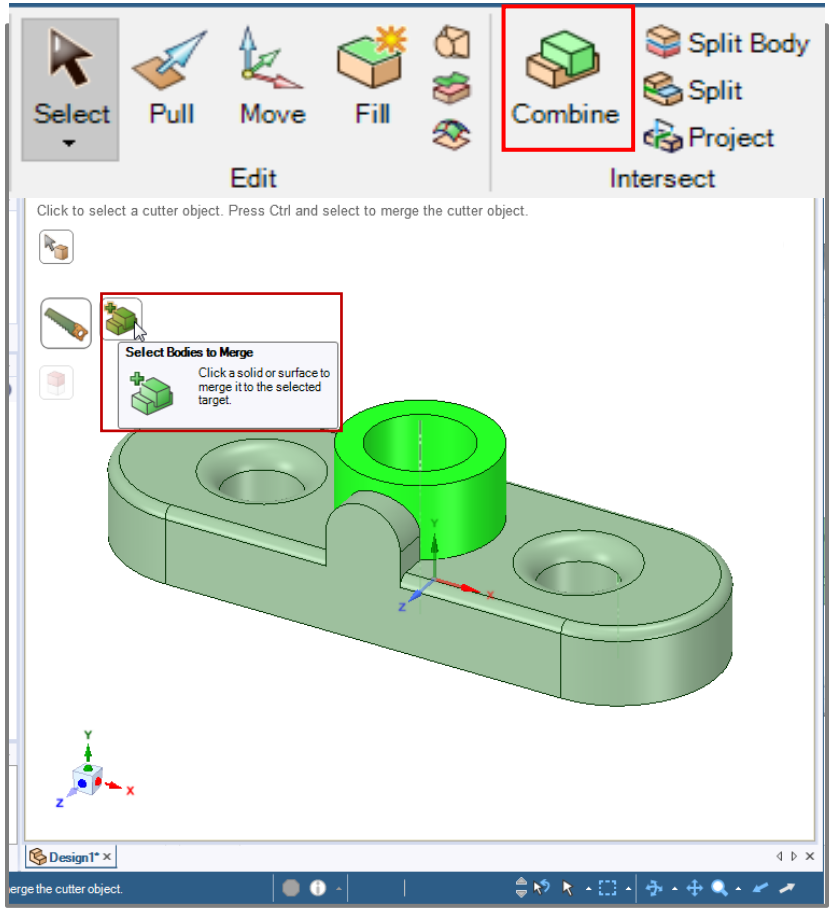
- Click on ‘Split Body’ operation from the Design tab
- Click on body, click on cylindrical surface when saw appears, then click escape to terminate the operation



SCDM modeling tools: combine

You could undo the action to get a single body back, or you could “Combine” the two bodies into one

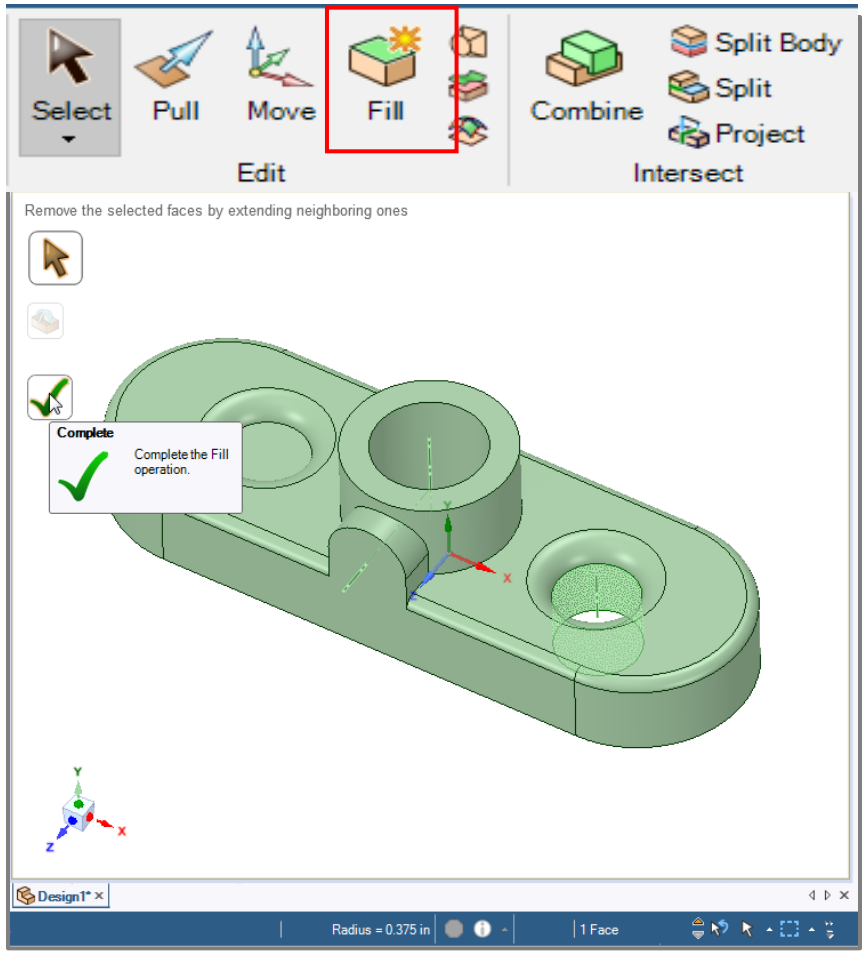
- Click one body, hold Control and click the second body, then click Escape
- Now both bodies are combined into one



SCDM modeling tools: fill

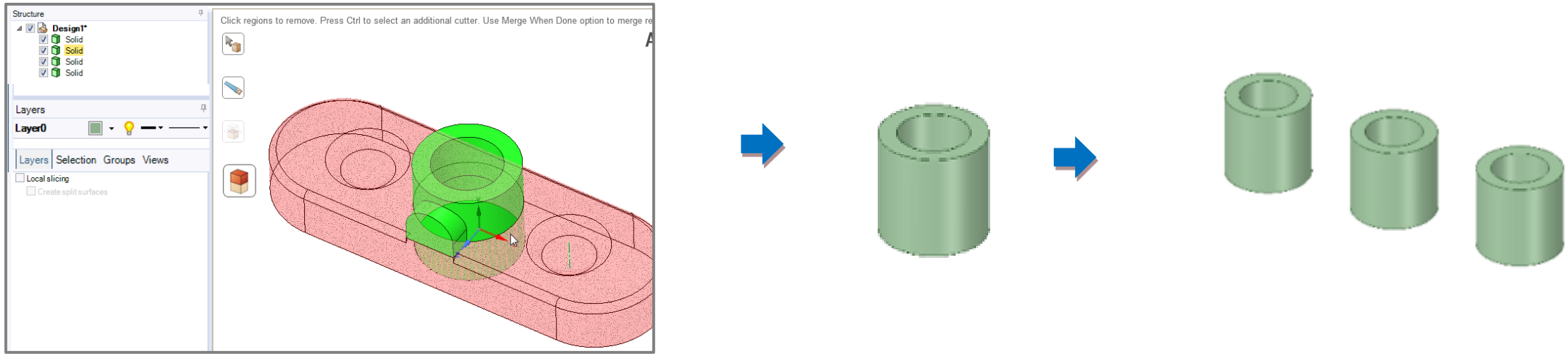
Fill a selected region with neighboring geometry

- Click the inner cylindrical surface, then click the “check” (repeat for another hole as well)
- Save the model as “bracket.scdoc” before continuing to the next slide



SCDM modeling tools

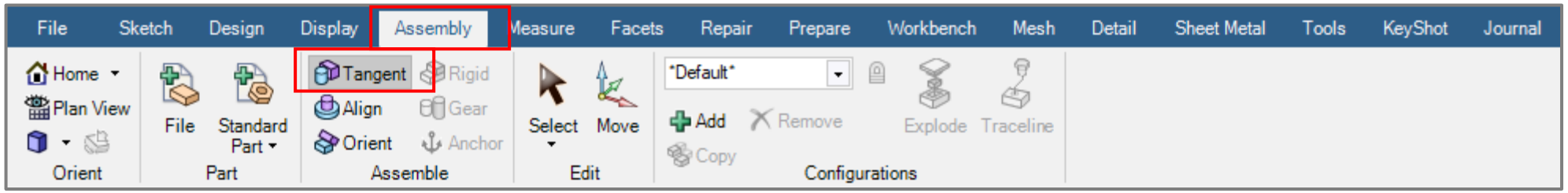
- "**Split**" the body by the outer cylindrical face and remove the base so that only the cylinder remains
- Copy-Paste (Control-C followed by Control-V) the cylinder twice in the structure tree and move them so that they are in a line

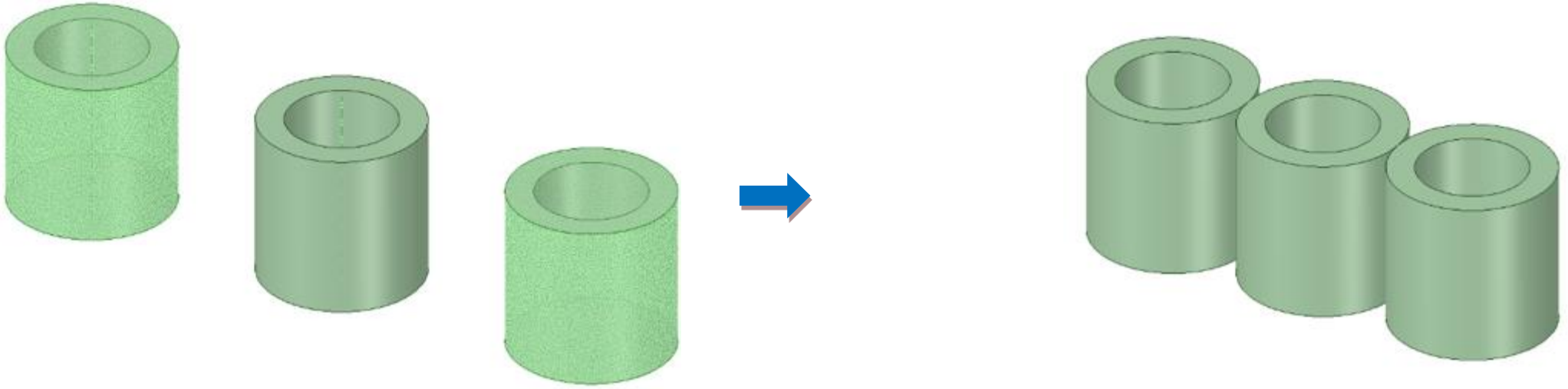


SCDM modeling tools: tangent

Make the outer cylinders tangent to the center cylindrical surface

- Note the use of Control-Click to select multiple geometries

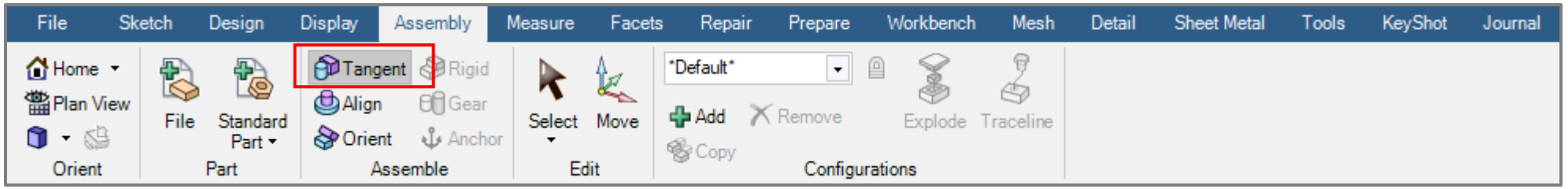


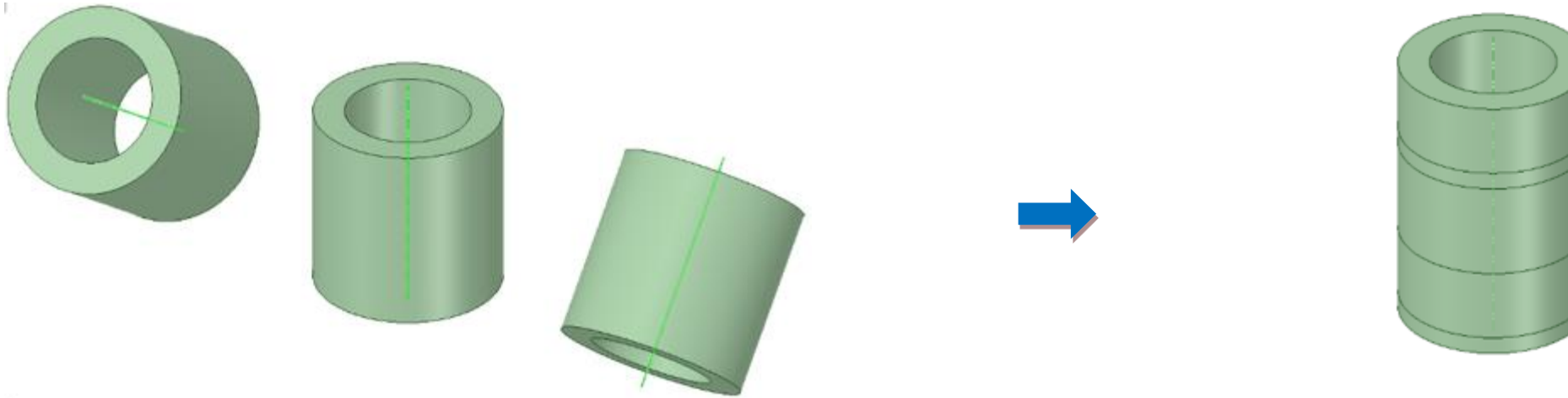


SCDM modeling tools: align

Align the axis of all three cylinders

- Undo “**Tangent**” (previous slide) and use “**Move**” to rotate the outer two cylinders by some arbitrary angle
- Utilizing “**Align**” will make all axis line up on one another

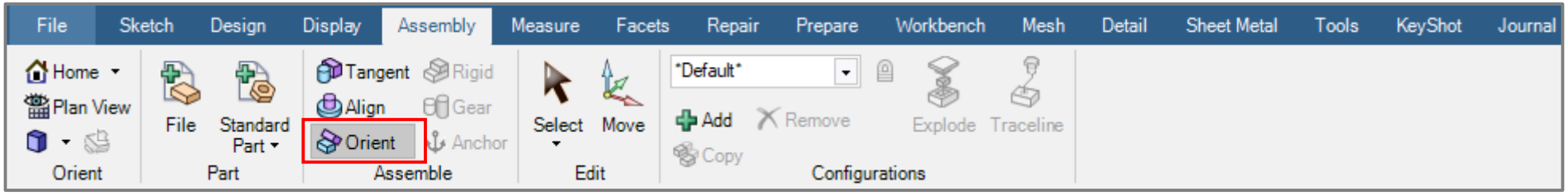


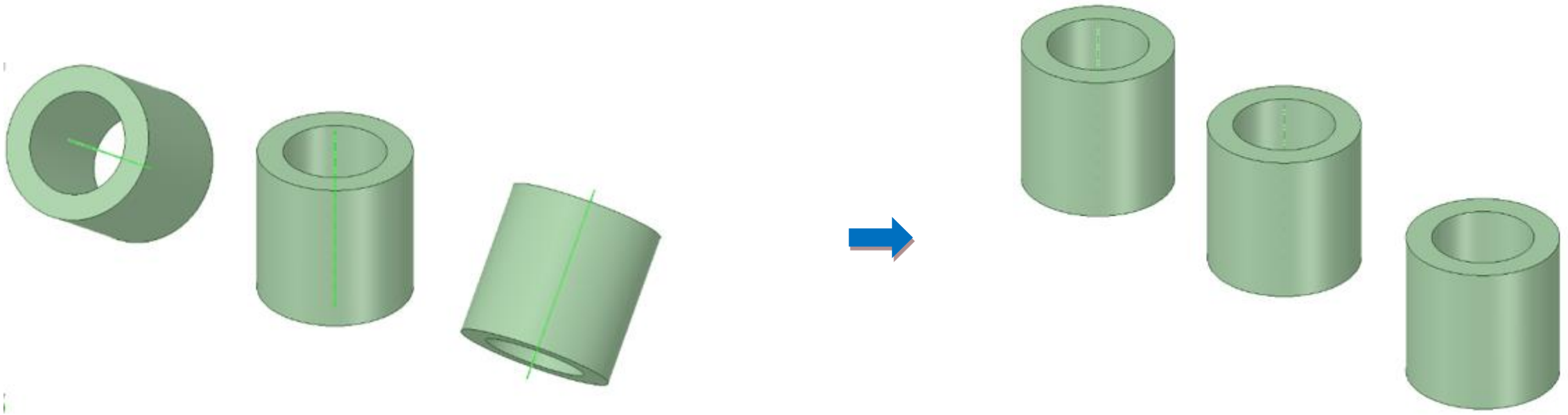


SCDM modeling tools: orient

Orient the axis of all three cylinders

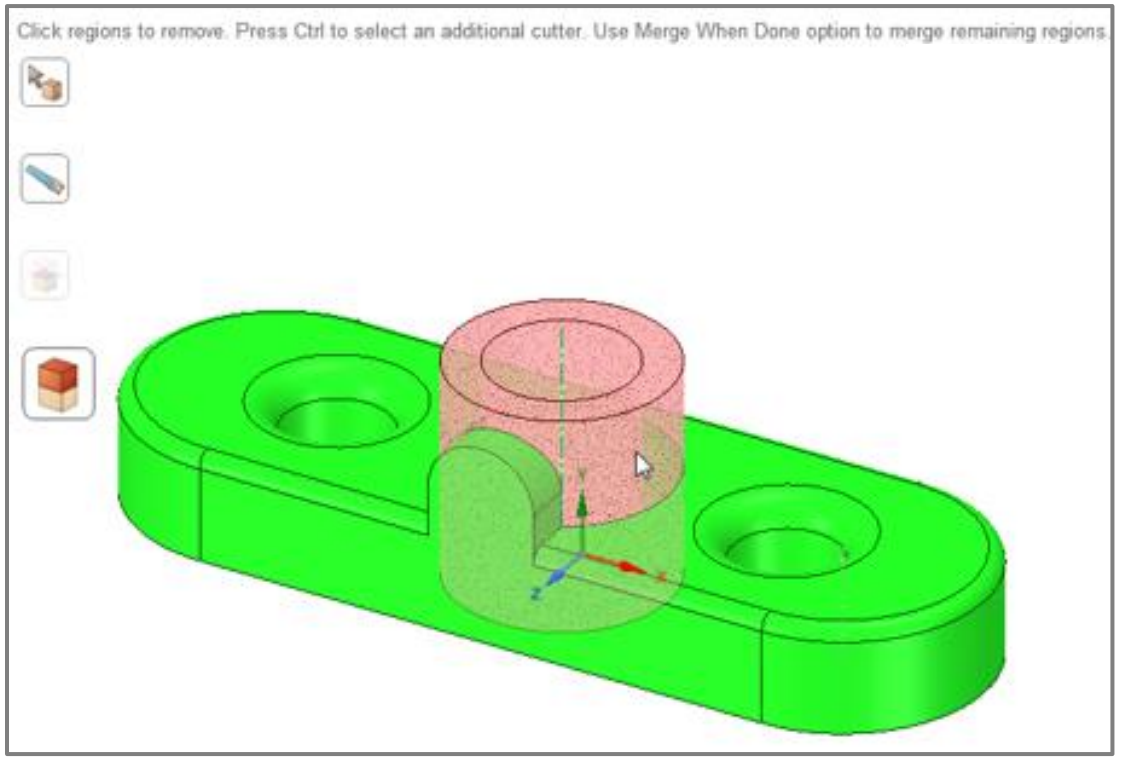
- Undo “**Align**” (previous slide)
- Utilizing “**Orient**” will make all axis point in the same direction (note the distinction between align and orient)





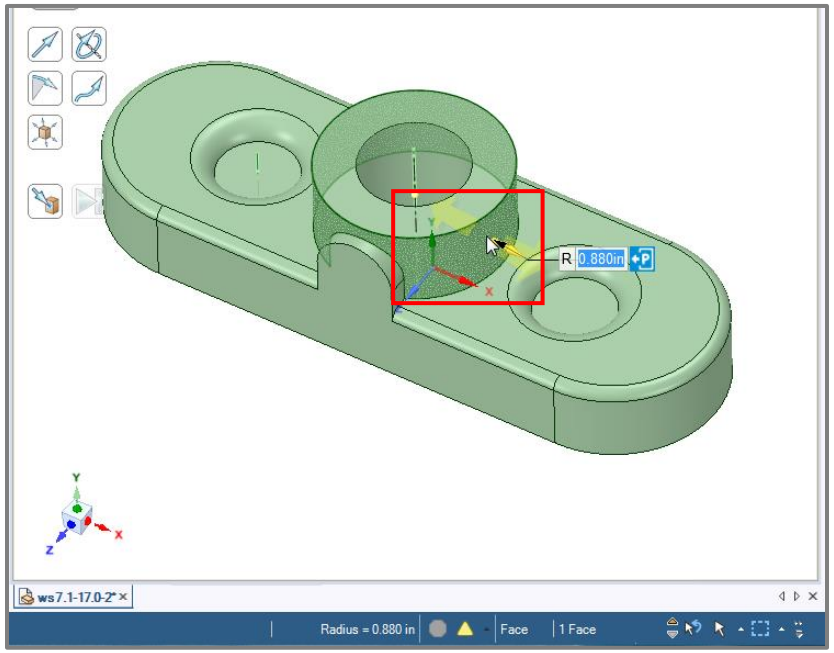
SCDM assembly tools: components (1)

- Open “bracket.scdoc”, which was saved earlier
- “**Split**” the body by the outer cylindrical surface, as before
- You should have two solids after the split (exactly as in slide 16)



SCDM assembly tools: components (2)

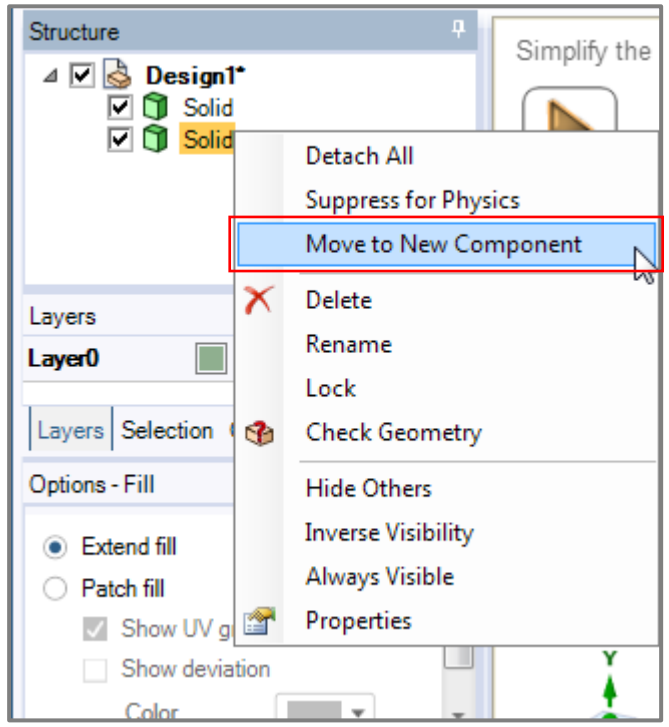
- “Pull” the outer cylinder face outward a small amount…
- The 2 solids are automatically merged into 1 solid
- Often times it is desirable to keep bodies separate… How can we do this?

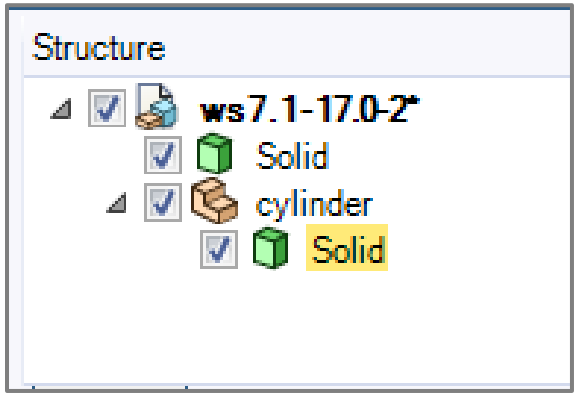


SCDM assembly tools: components (3)

The structure tree can be divided into different components

- Undo the previous "**Pull**", right-click on the cylinder solid in the structure tree and "**Move to New Component**"
- Perform the same pull as before… note that the solids are not merged

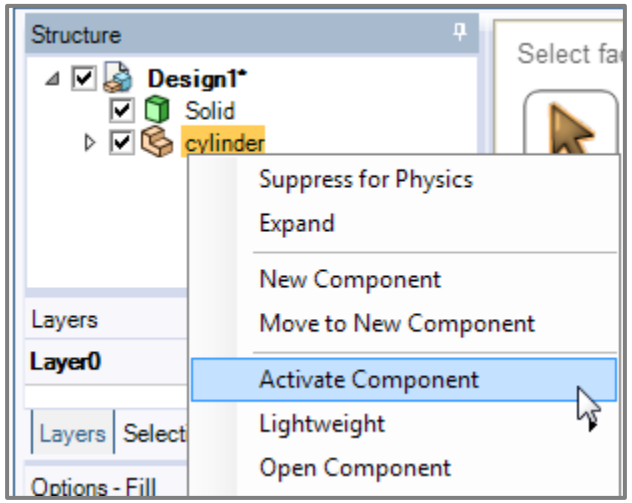


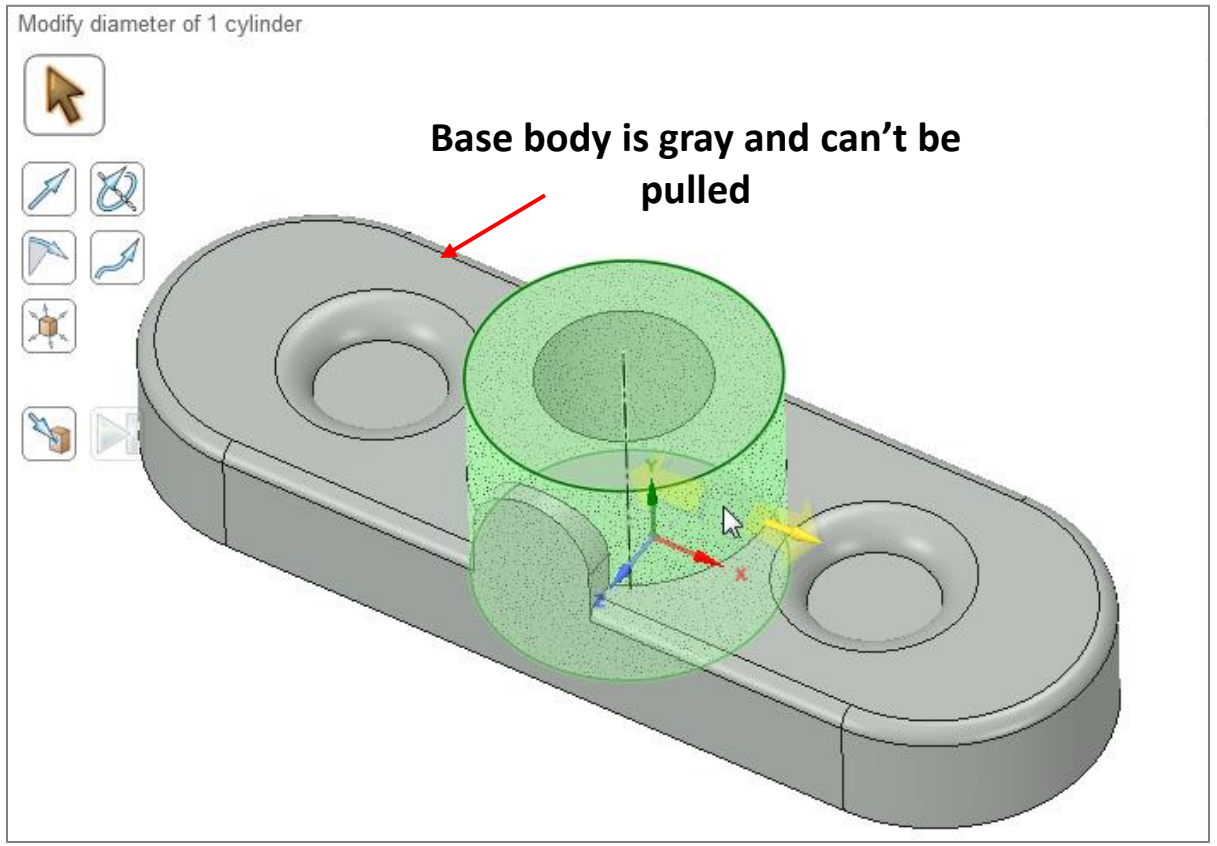


SCDM assembly tools: components (4)

Individual components can be activated

- Right-click the cylinder component and "**Activate Component**"
- Only features of the active component can be pulled

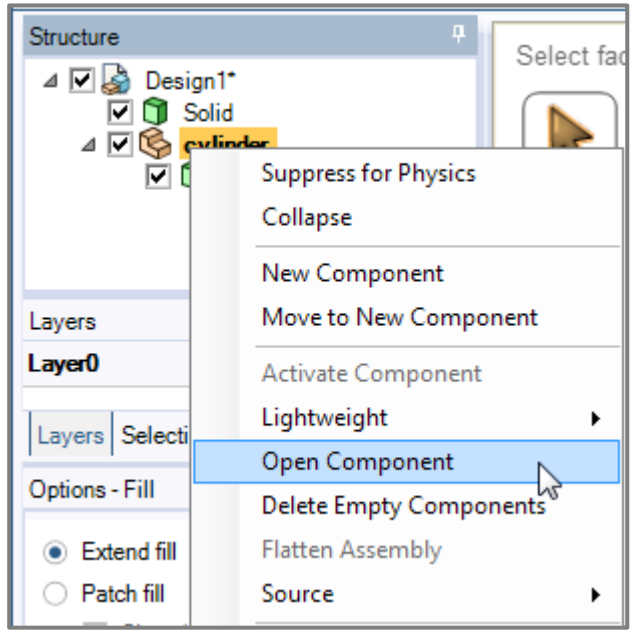


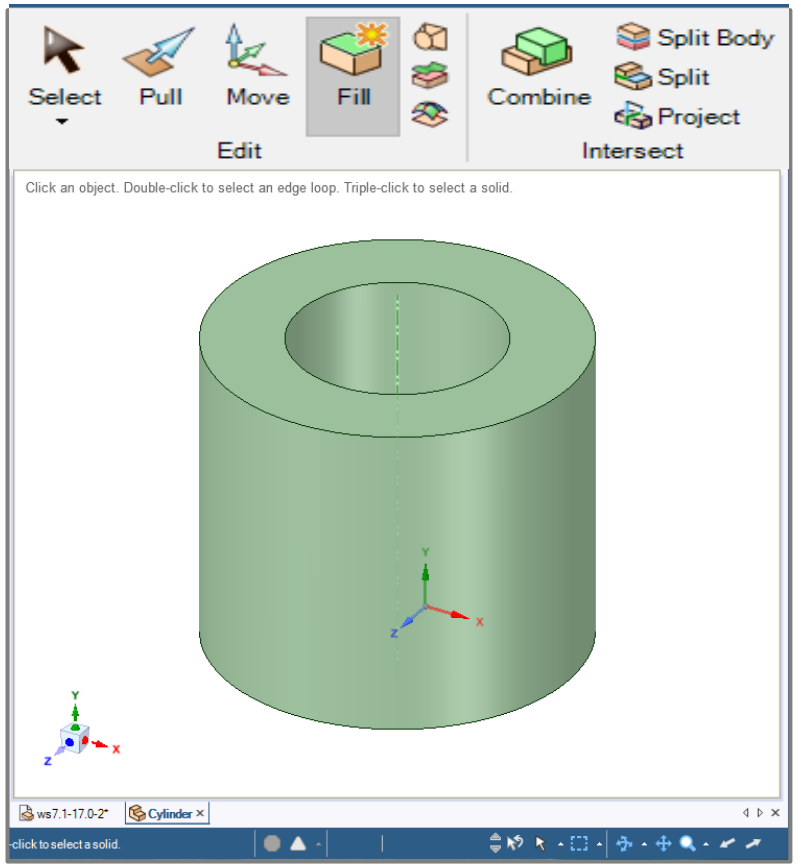


SCDM assembly tools: components (5)

Individual components can be opened in a separate tab

- Right-click the cylinder component and "**Open Component**"
- Changes in the separate tab are updated in all tabs

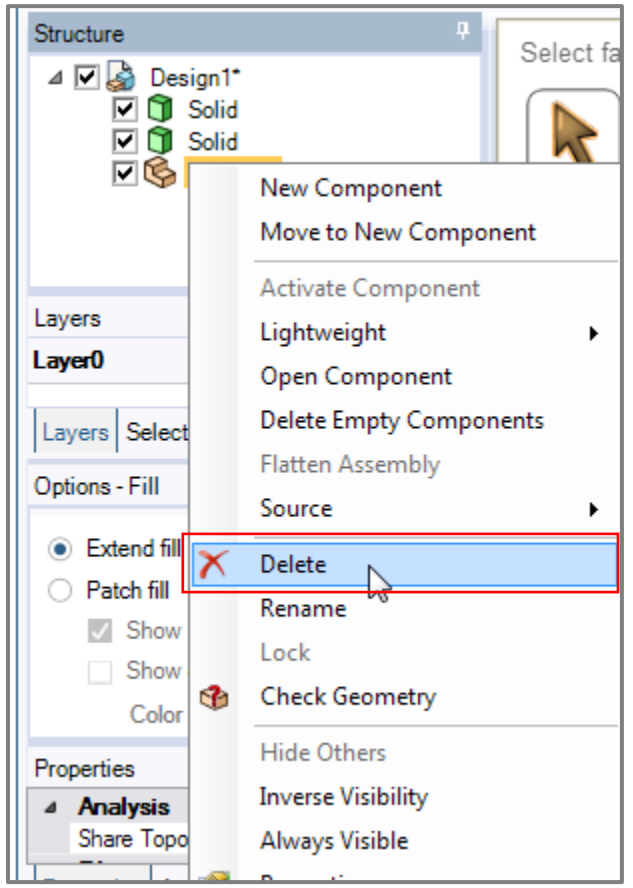




SCDM assembly tools: components (6)

Objects and components can be dragged and dropped within the structure tree

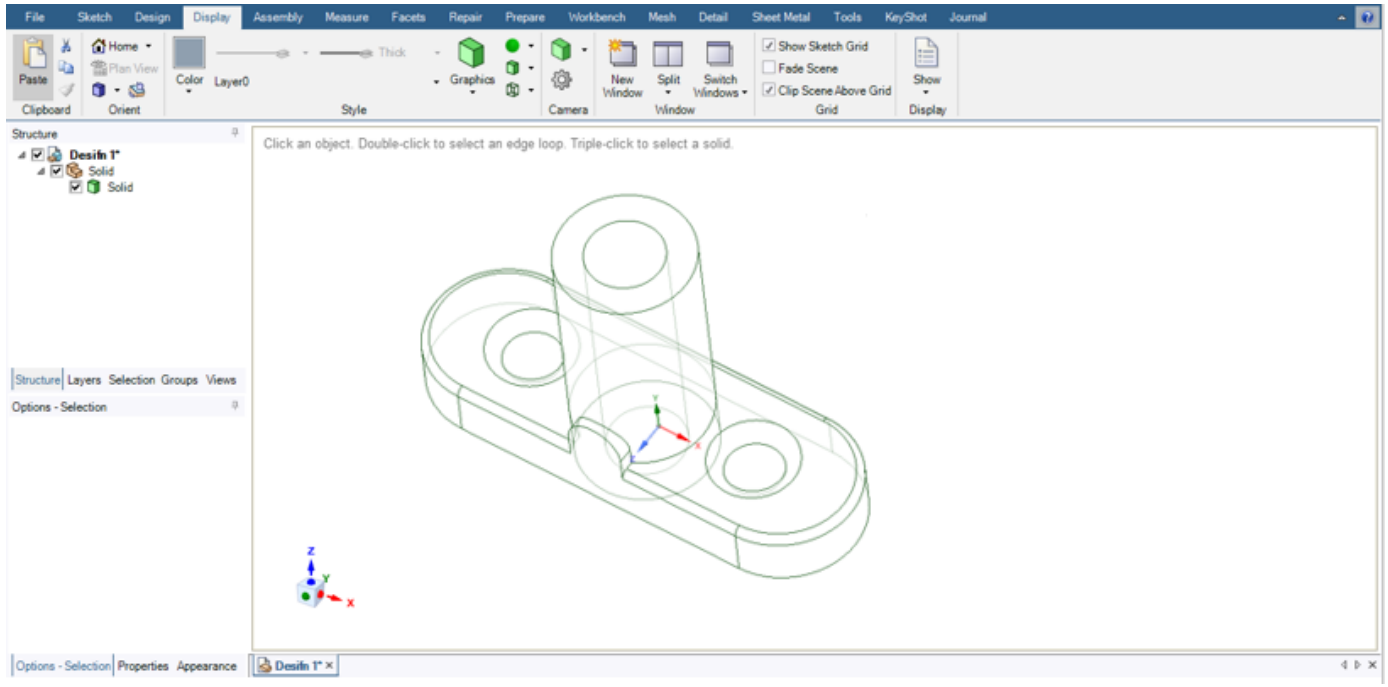
- Drag the cylinder object out of its own component and into the main tree
- Delete the cylinder component (Right-click and delete, or delete from keyboard)

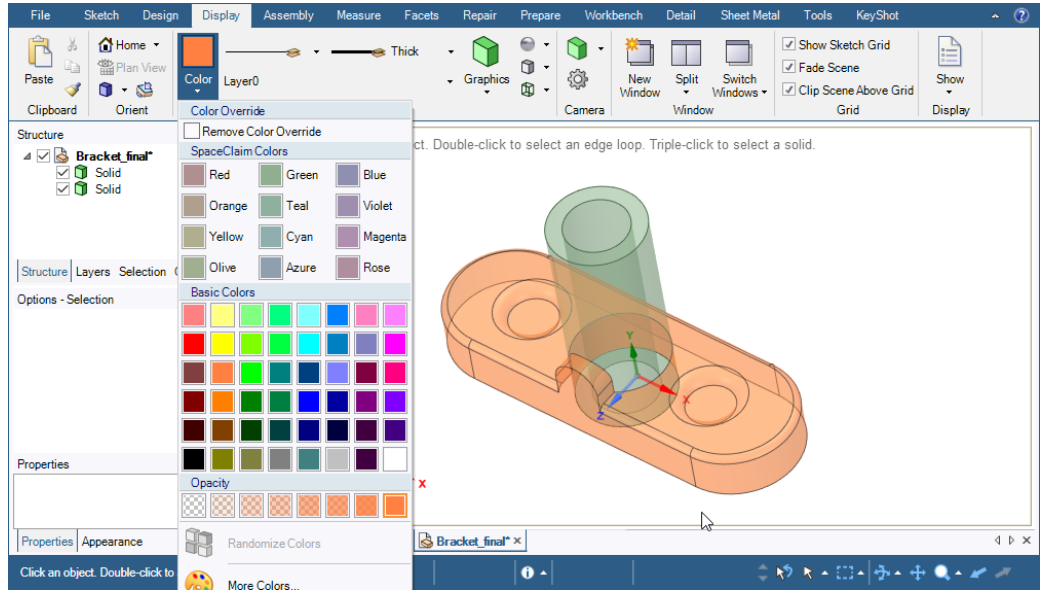


SCDM assembly tools: display options

Visibility options are under the “Display” tab

- Control global visibility and visibility for individual objects
- Try setting “**Color**”, “**Finish**” and “**Transparency**” for individual objects





End of presentation