

Ansys Fluent Getting Started (New Fluent Experience)

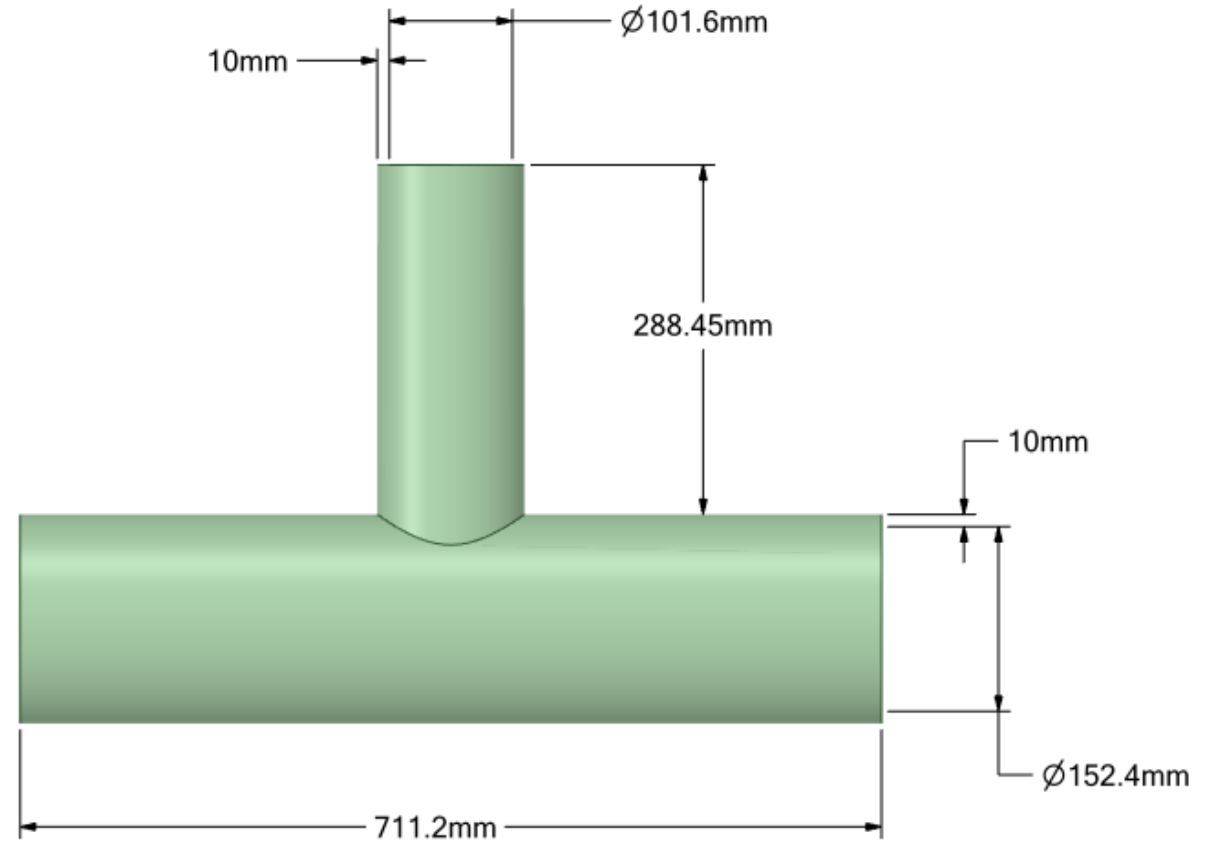
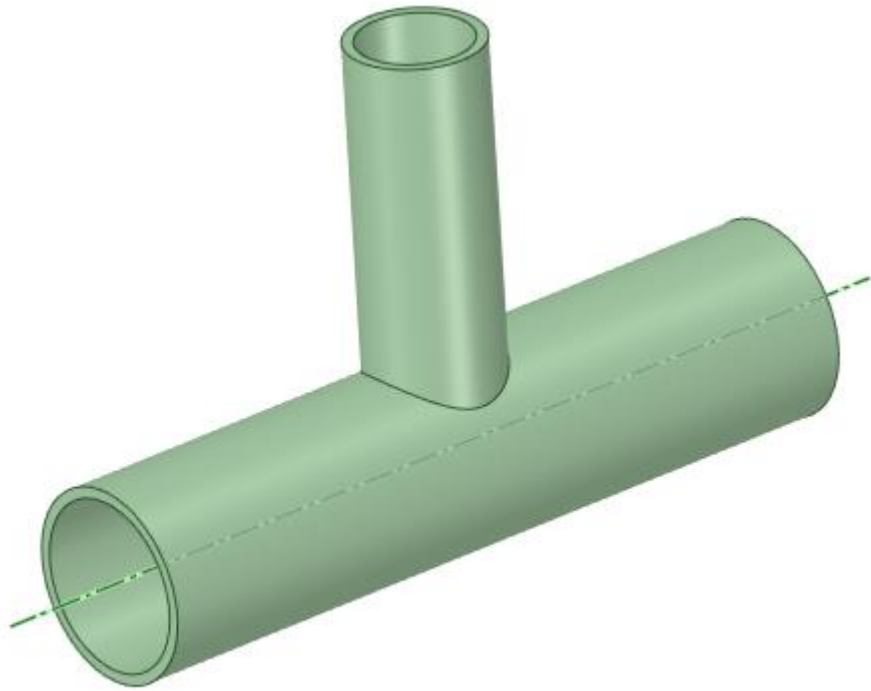
Workshop: Creating Mixing Tee Geometry

Release 2021 R1



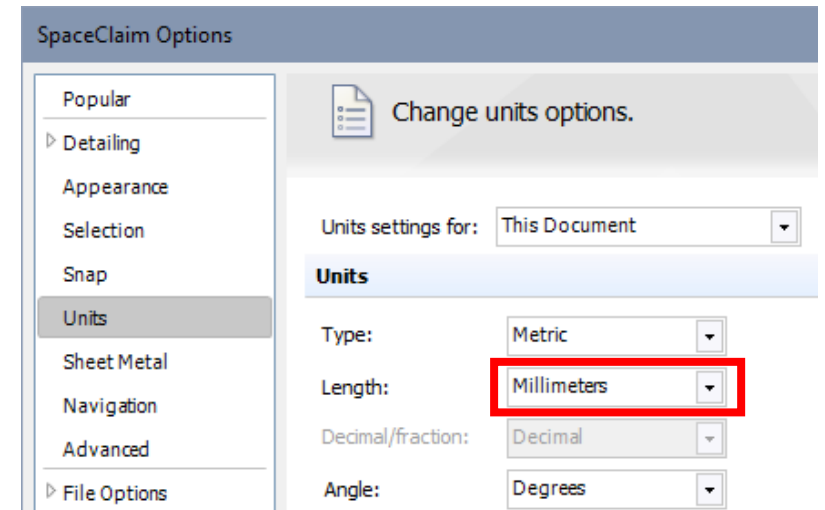
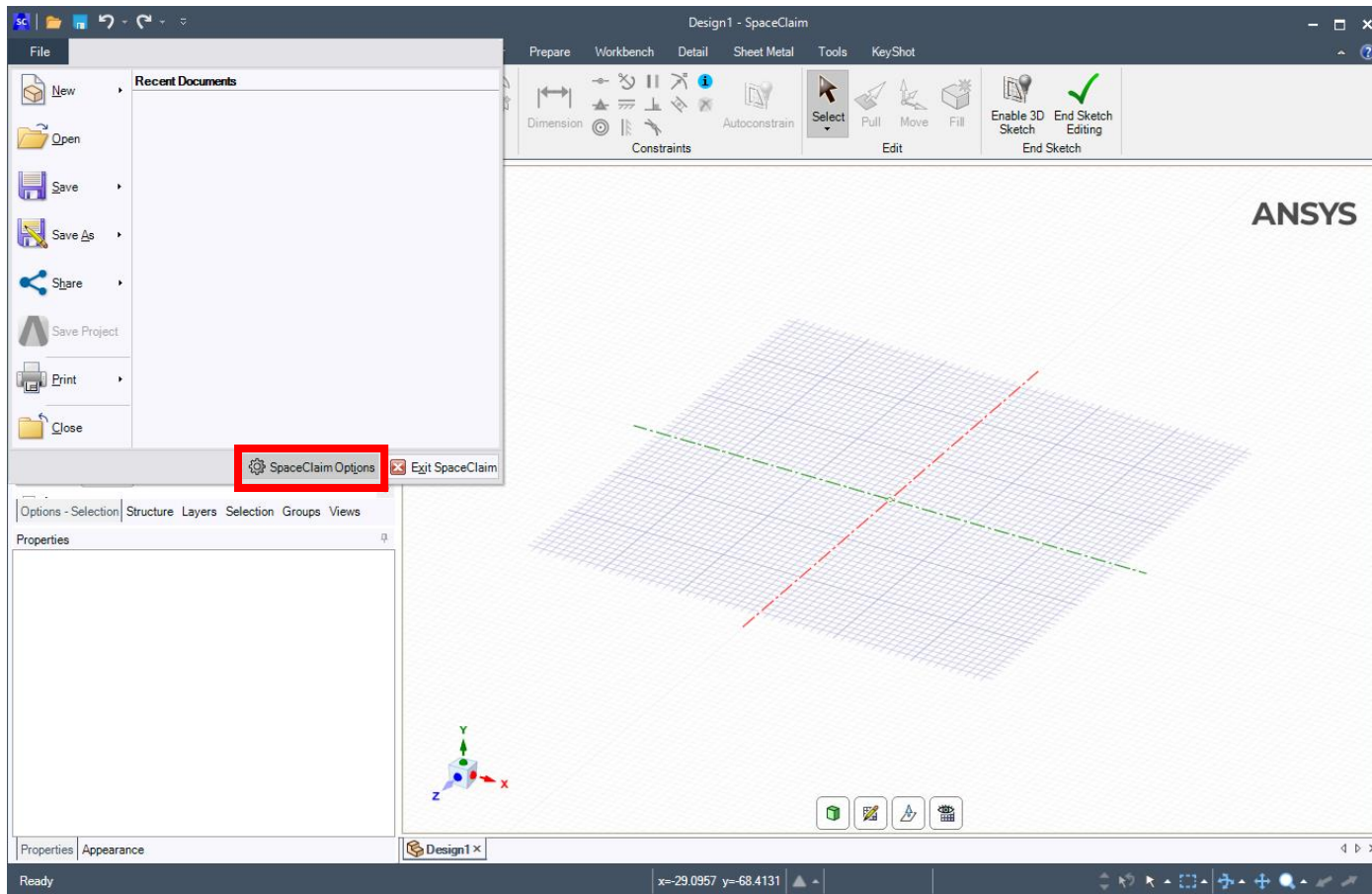
Workshop Objective

- The objective is to draw a simple mixing tee from scratch



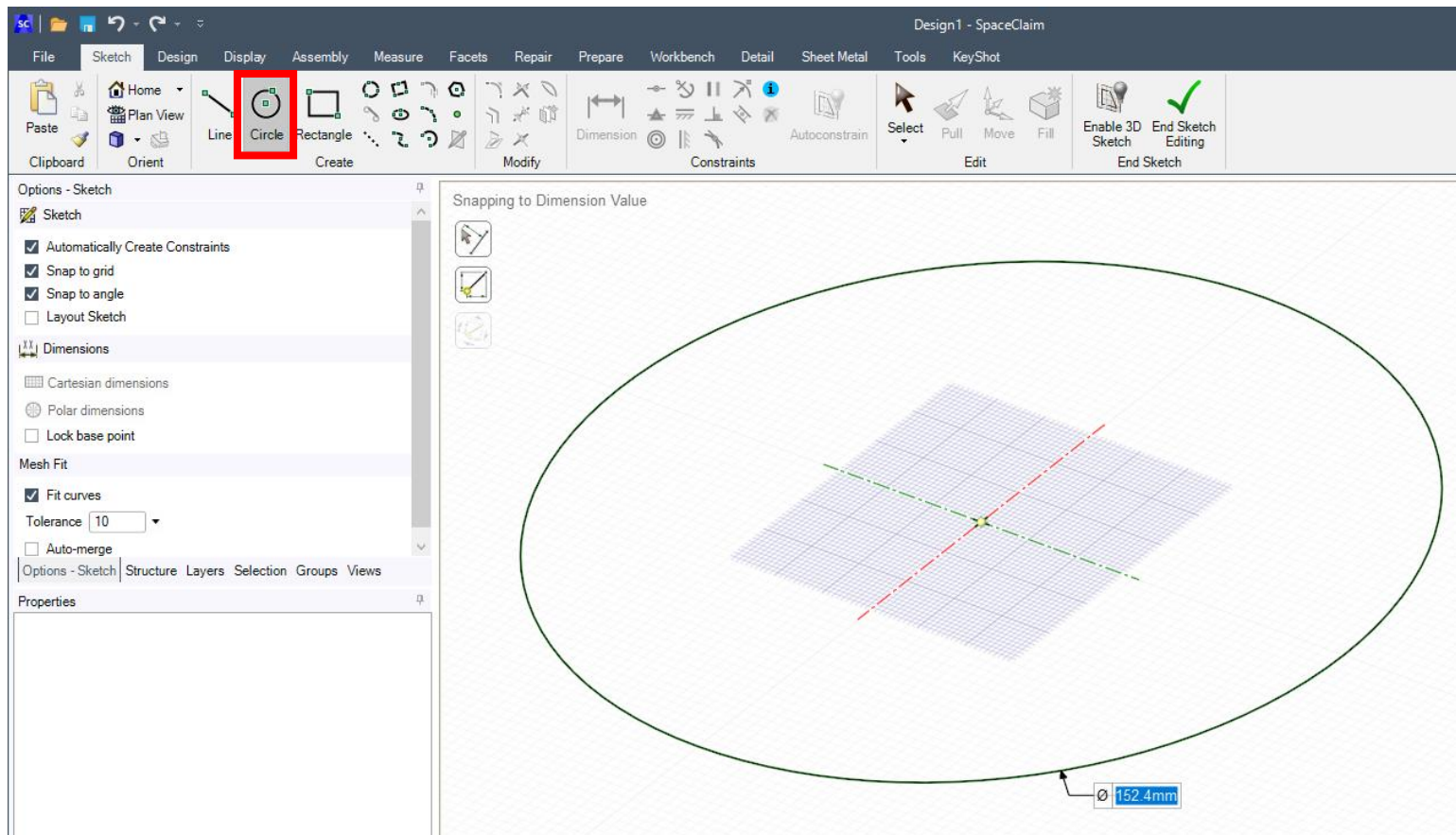
Start SpaceClaim and Set Units

- In the File menu, select SpaceClaim options and ensure the units are set to mm



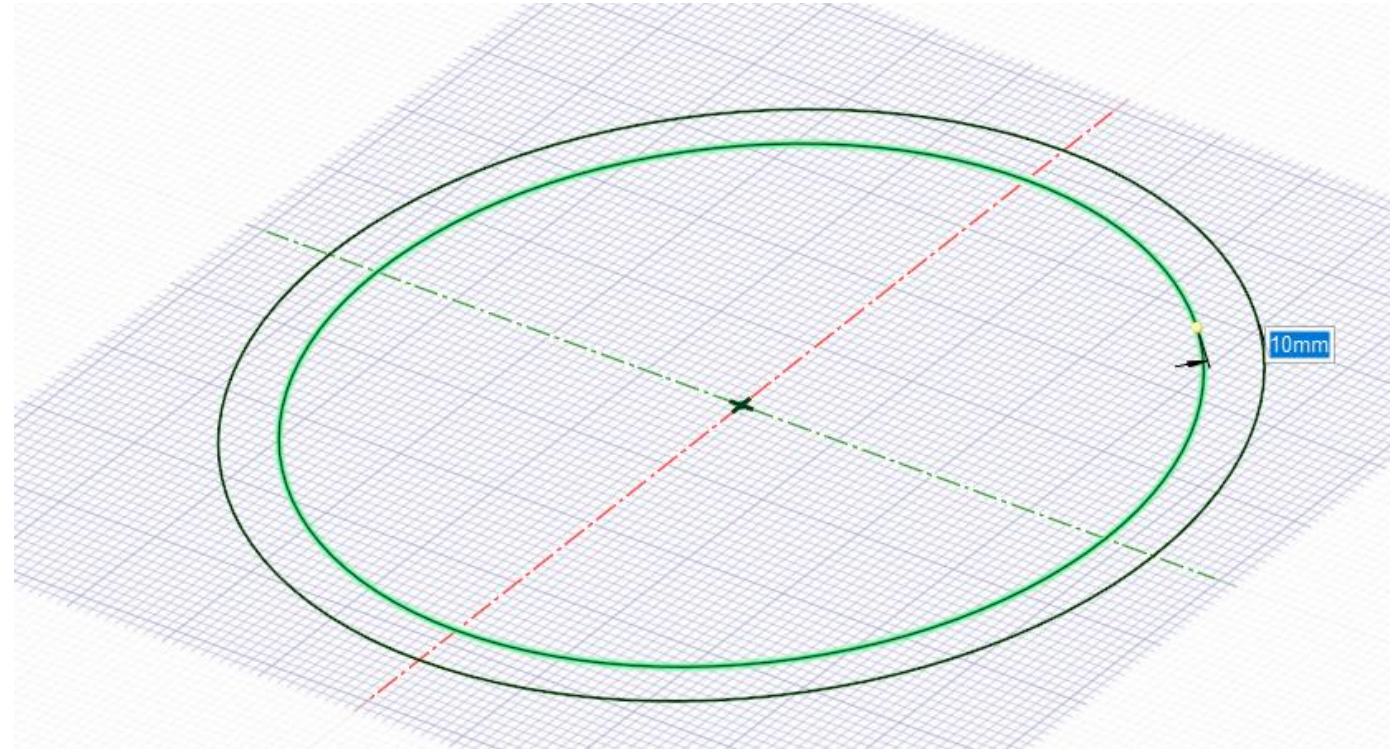
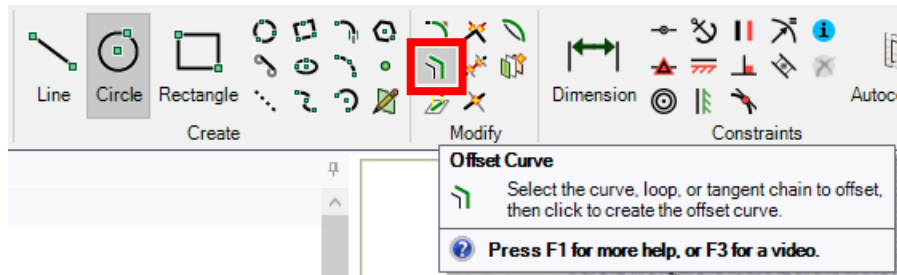
Sketch: Circle

- In Sketch mode, draw a circle of diameter 152.4 mm from the center of the sketch plane
 - Remember after beginning to pull, while keeping the left mouse button pressed down, you can type the value of the dimension



Sketch Mode: Offset Curve

- In Sketch mode, select the Offset Curve tool
- Click on the circle and move outward a distance of 10 mm
- Use the Escape key on the keyboard to exit from the tool



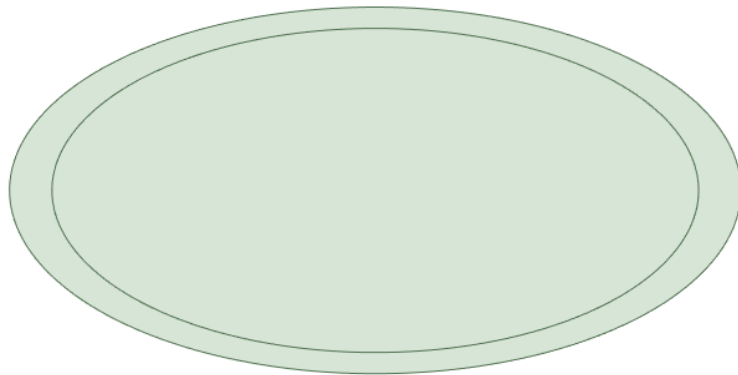
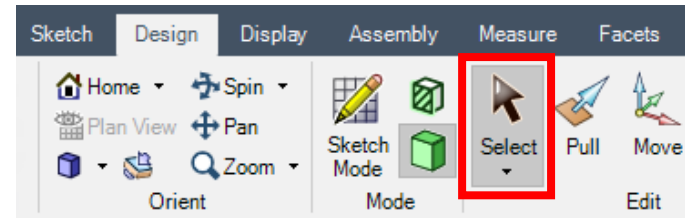
3D Mode: Work with geometry

- Click End Sketch Editing

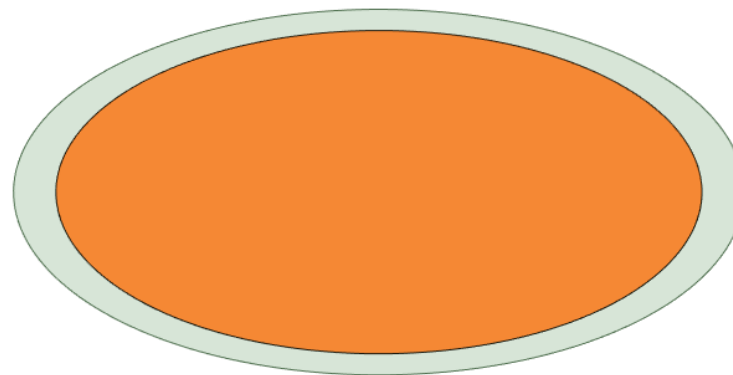


- SpaceClaim will change to the Design tab and activate the Pull tool

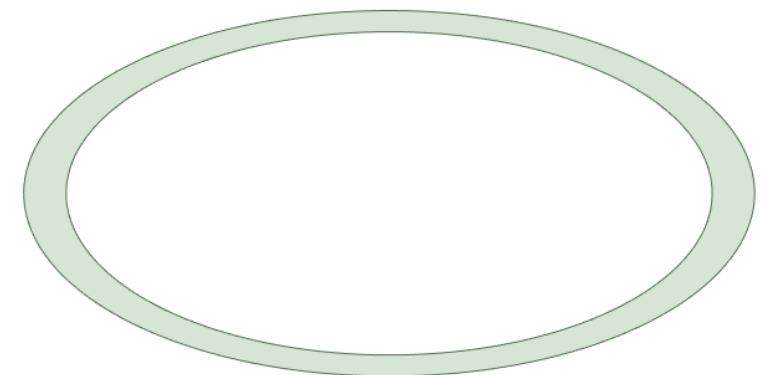
- Change from Pull to Select



On changing to select mode, faces are created from enclosed curves on the sketch



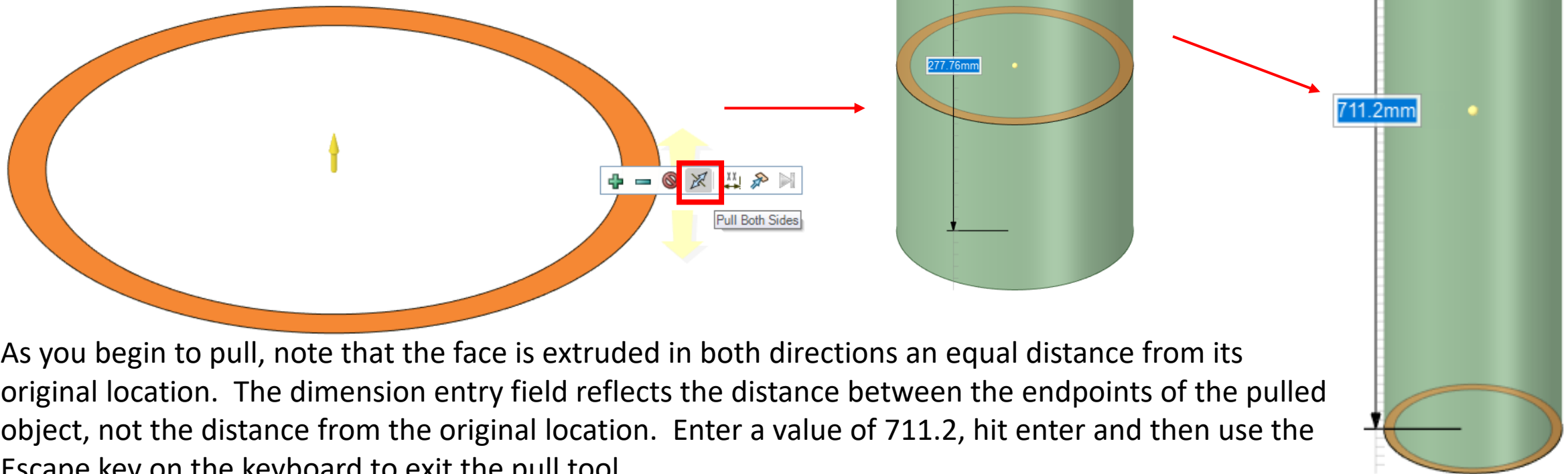
Select the central face with the left mouse button and delete it using the Delete key on the keyboard



Next we will pull the remaining annular face to create the body of the larger pipe

3D Mode: Pull

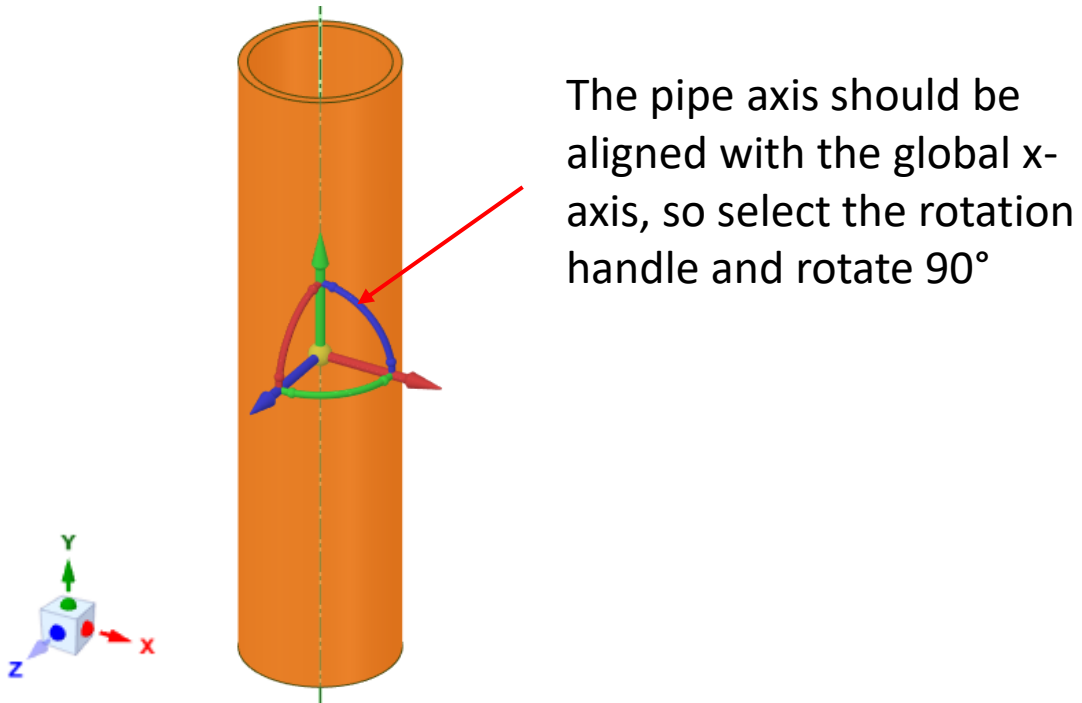
- Activate the Pull tool in the ribbon and left click on the annular face
 - Click Pull Both Sides in the mini-toolbar
 - If the mini-toolbar does not appear when the face is first selected, click on the face one more time with the right mouse button



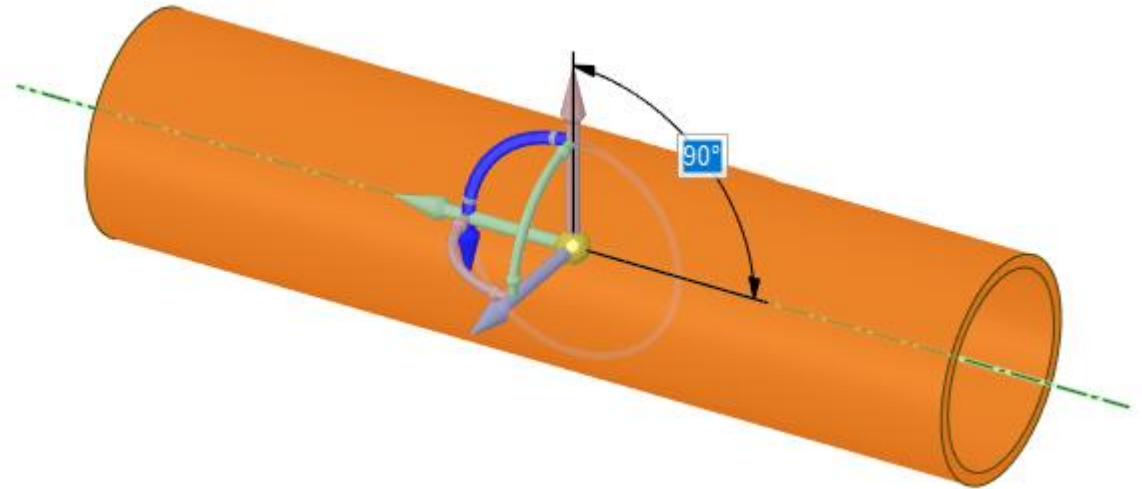
As you begin to pull, note that the face is extruded in both directions an equal distance from its original location. The dimension entry field reflects the distance between the endpoints of the pulled object, not the distance from the original location. Enter a value of 711.2, hit enter and then use the Escape key on the keyboard to exit the pull tool.

3D Mode: Move

- Activate the move tool in the ribbon and triple click to select the body



The pipe axis should be aligned with the global x-axis, so select the rotation handle and rotate 90°



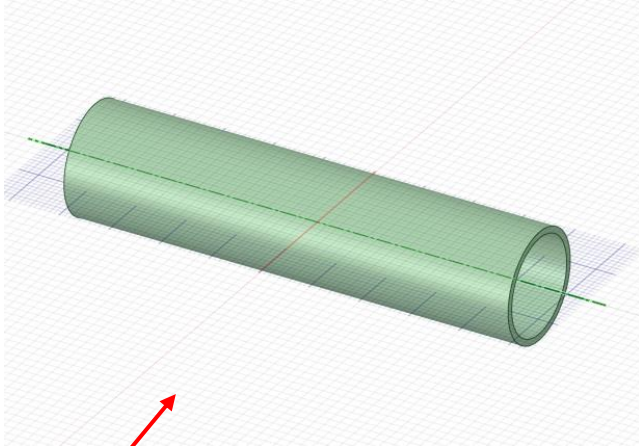
Use the Escape key on the keyboard to exit the move tool after rotation is complete.

/ Discussion

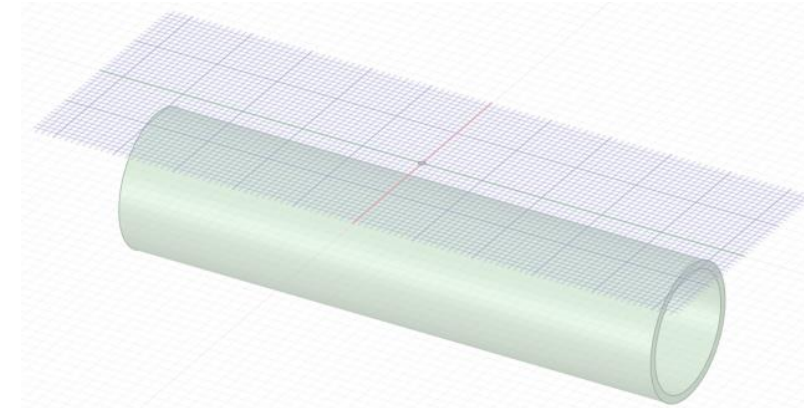
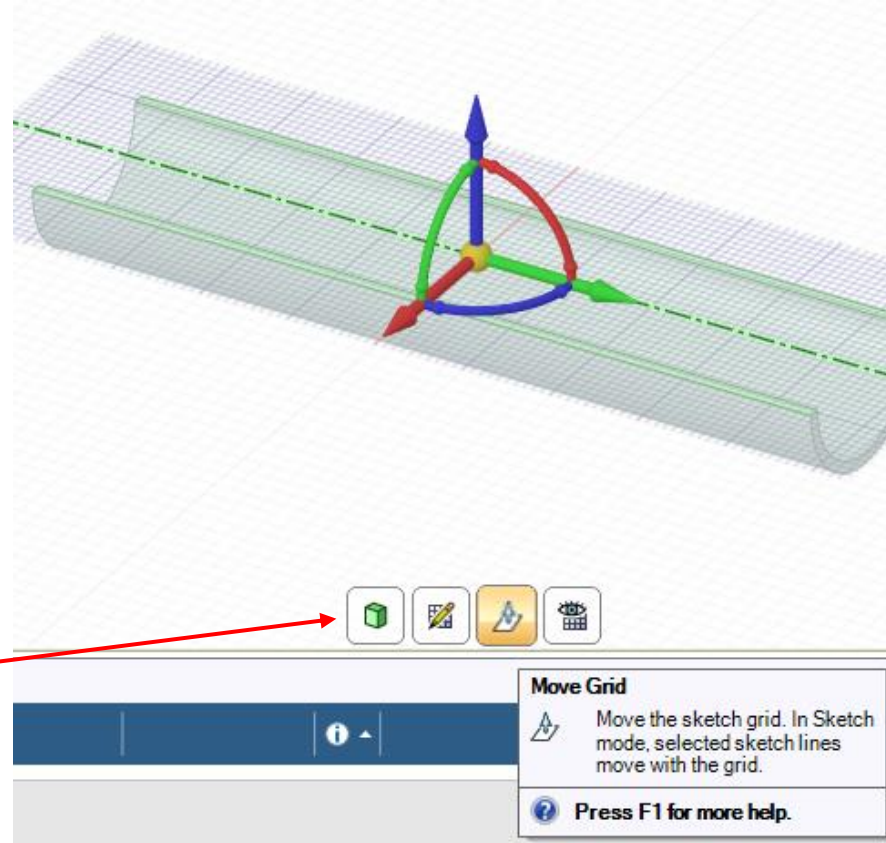
- With SpaceClaim, there are often multiple ways to create the same geometry
 - In this case a sketch was made on the default x-z plane, and then the resulting geometry was rotated into the desired alignment, but alternatively, the sketch plane could have been changed to the y-z plane prior to making the first sketch
 - In this case, the pipe wall was created by pulling an annular face, but alternatively, a solid cylinder could have been created with the outer diameter of the pipe and then cut out at the inner diameter
 - A two sided pull was used because it will turn out to be convenient later for the pipe to be centered at the origin, but there is no requirement to do so ... pulling in one direction would have been fine

Sketch Mode: New Sketch Plane

- Change to Sketch Mode



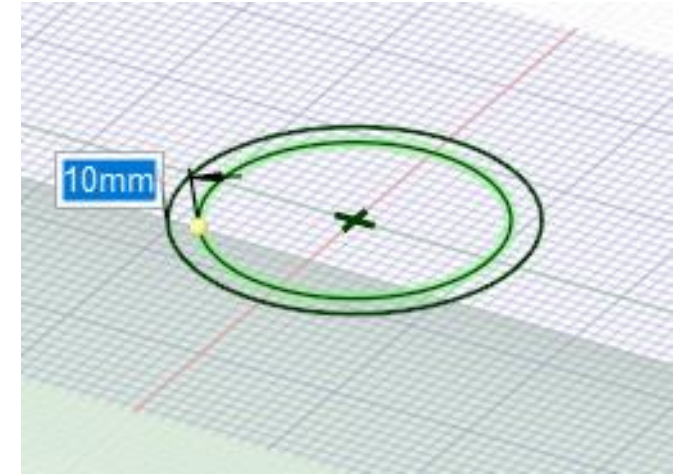
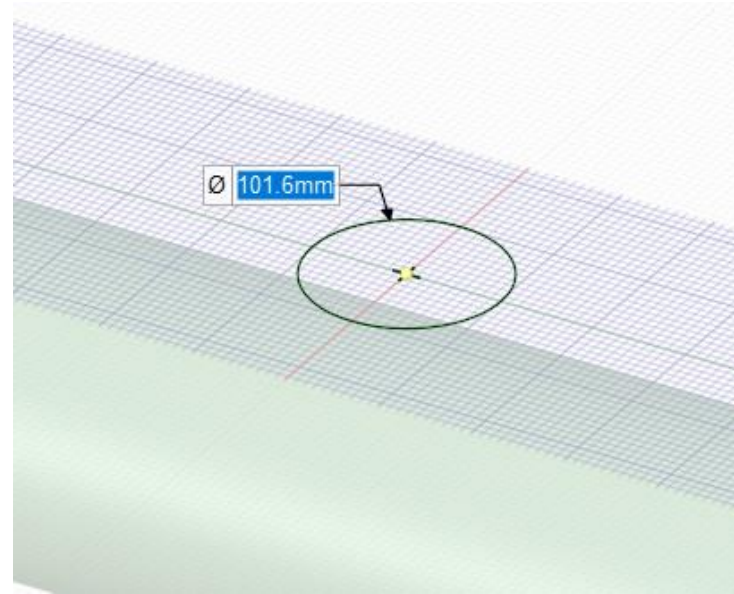
Click in the window to accept the position of the sketch plane. Tool guides will appear in the lower part of the graphics display window.



Use the Move Grid tool and pull the blue axis to position the grid slightly above the pipe. As you will see shortly, the exact position does not matter as long as you can see the entire pipe below the grid. Click the Move Grid tool guide once more to make the move axes disappear.

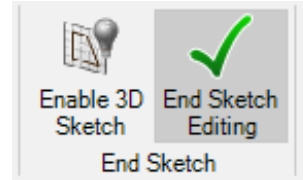
/ Sketch Mode: Circle and Offset Curve

- Draw a circle of diameter 101.6 mm from the center of the sketch plane
- Draw an offset curve with distance of 10 mm from the circle

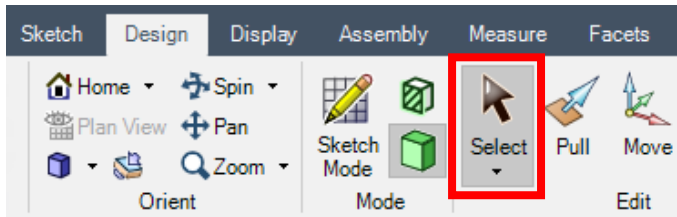


3D Mode: Work with geometry

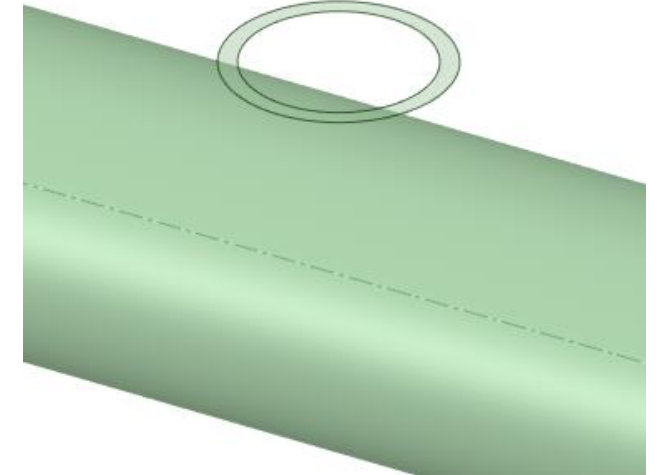
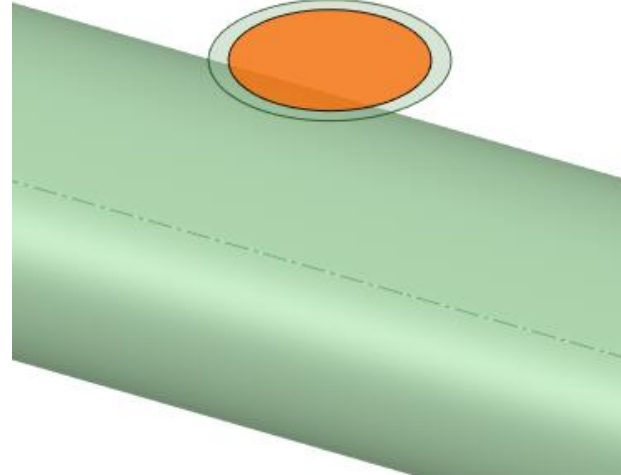
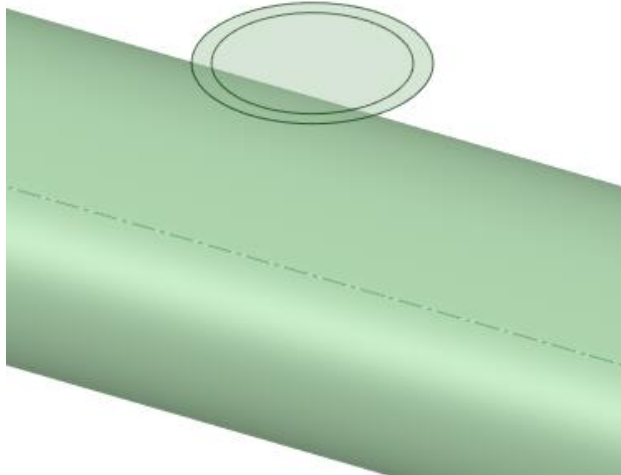
- Click End Sketch Editing



- In the Design tab, click Select

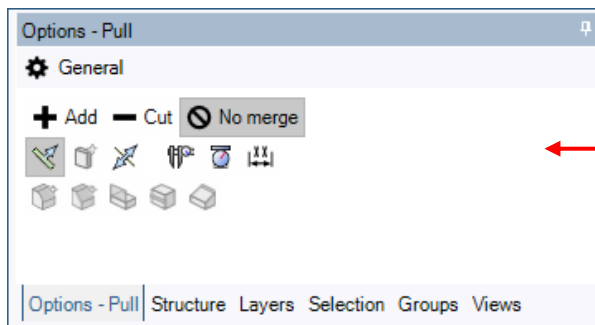
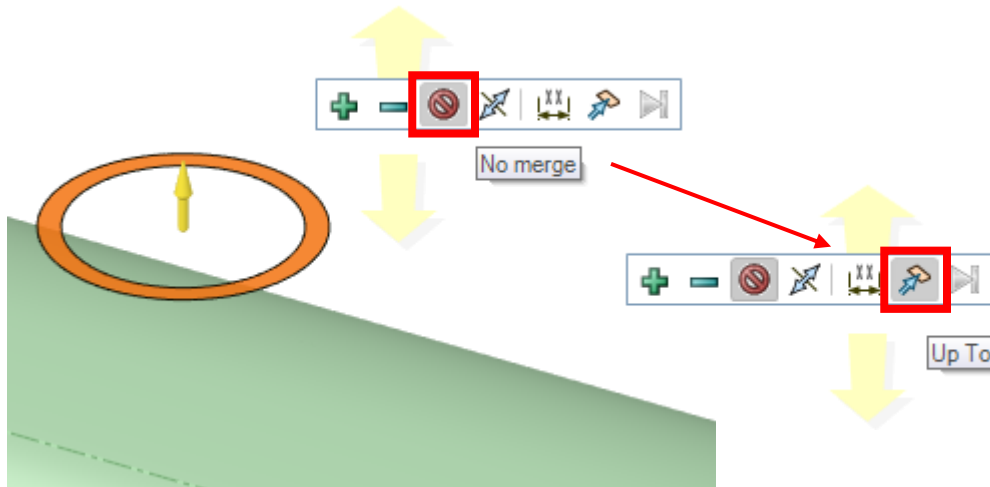
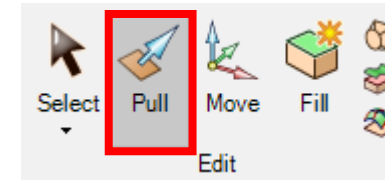


As before, use the left mouse button to select the central face and the Delete key on the keyboard to delete it.

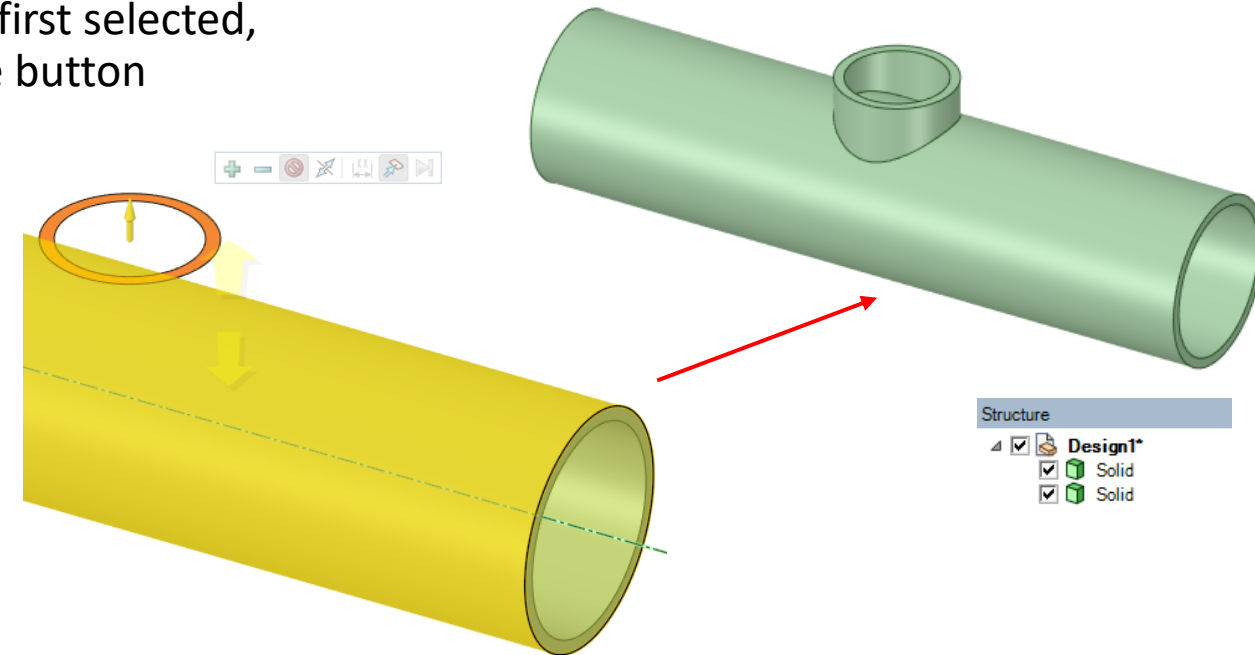


3D Mode: Pull

- Activate the Pull tool in the ribbon and left click on the annular face
 - Click "No merge" and "Up To" in the mini-toolbar
 - If the mini-toolbar does not appear when the face is first selected, click on the face one more time with the right mouse button



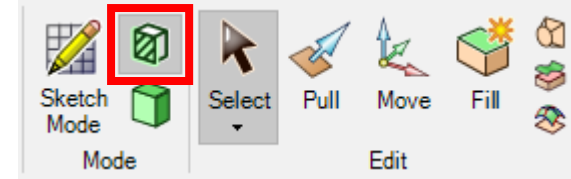
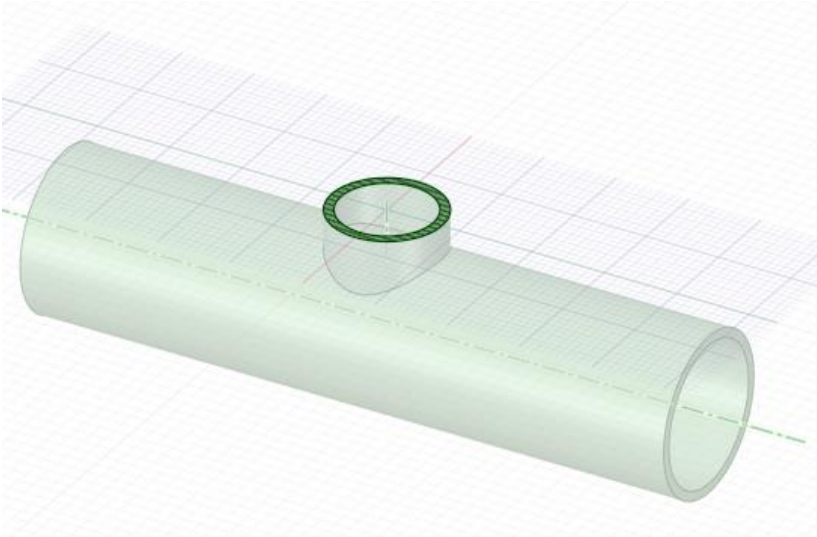
The same options as the mini-toolbar can also be selected in the Options panel



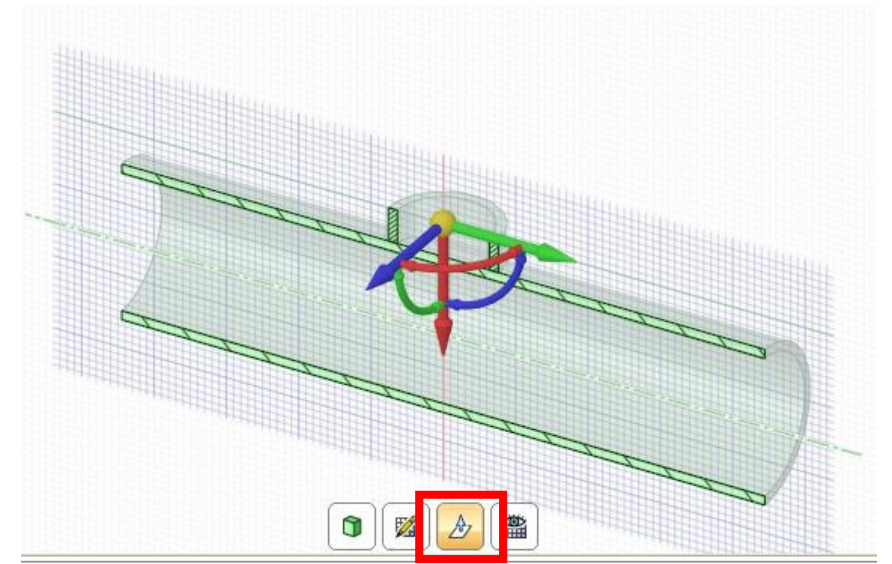
Select the outer face of the pipe after selecting the Up To option

Section Mode

- Select the upper face of the newly created solid and then select Section Mode in the ribbon

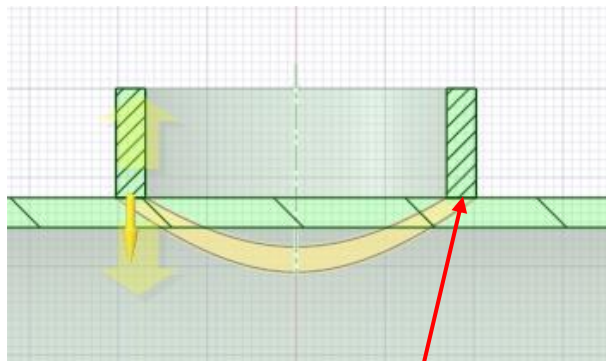
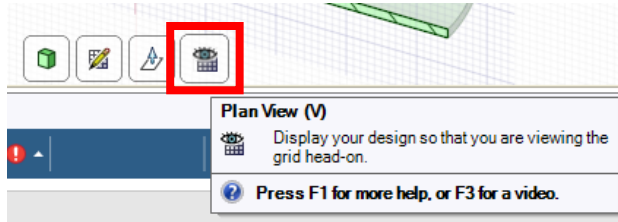
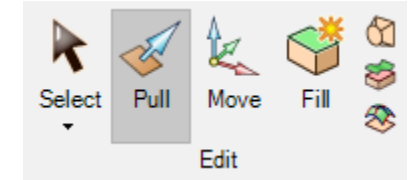


Enable the Move Grid tool. Click and hold down the rotation handle and begin rotating. Without releasing the mouse button, enter 90° for the rotation value. The final position should be as shown. Once the plane is in the right position, click Move Grid again to make the axes go away.

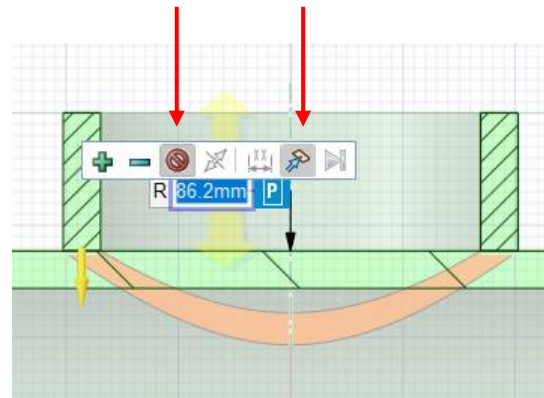


Section Mode: Pull

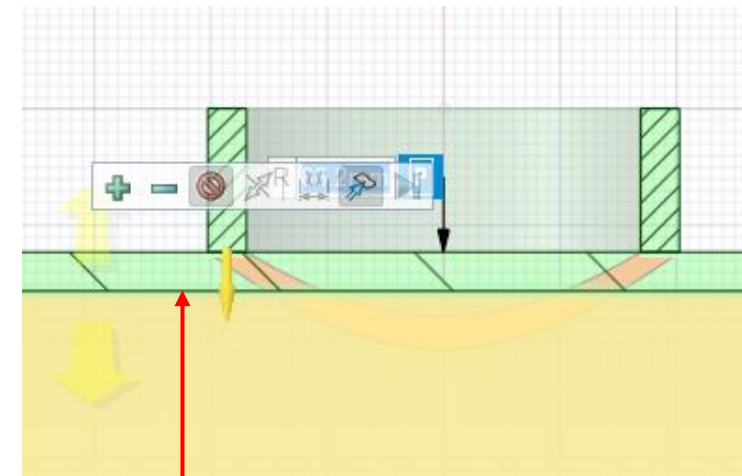
- Enable the Pull tool and use Plan View to align the view with the grid



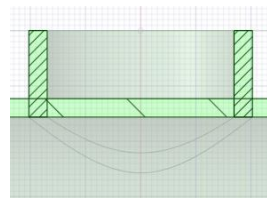
Click near the short edge of the second volume, hold down the Ctrl key on the keyboard and use the scroll wheel to select the lower face



Enable the No Merge and Up To options in the mini-toolbar



Select the edge representing the inner surface of the first pipe as the Up To target.



Result of pull

/ Discussion

- Many decisions related to the creation of the second pipe could have had other options
 - The sketch plane was moved to a location outside of the first pipe because it allows demonstration of the useful Up To feature in the pull tool and the later split and combine operations are more straightforward than they would have been with the second pipe protruding into the first pipe
 - The selecting the outer face to pull to on slide 13 allowed demonstrating the use of the pull tool in section mode – if the inner face had been selected, the second pipe would have extended through the first pipe to the opposite wall, which is a valid configuration but would require a slightly more complicated sequence of split and combine in the upcoming slides
 - The second pull operation (the one on slide 15) demonstrated the use of the pull tool in section mode, but also will later produce an intersection between the two pipes that is relatively easier to work with
 - The use of the No Merge option on slide 13 was not strictly necessary, but it allows the demonstration of that option, plus it makes it easier in this case to create the opening at the pipe intersection

3D Mode: Split

- Enable 3d mode and select Split Body
- Enable Merge when done in the Options panel
 - This merges sections of the original bodies produced by the split so the total number of bodies does not increase

Options - Split Body

General

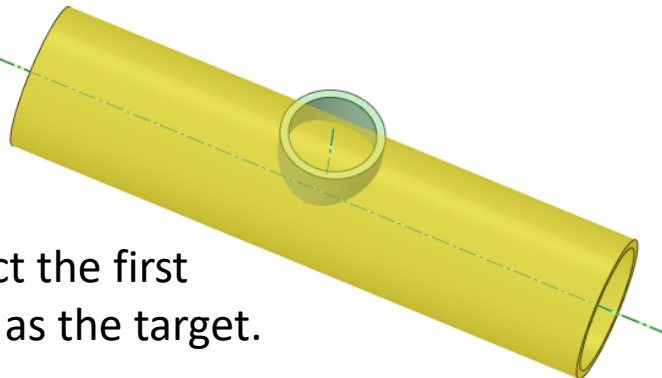
- ☒ Merge when done
- ☒ Extend faces
- ☐ Local slicing
- ☐ Create split surfaces

Options - Split Body | Structure | Layers | Selection | Groups | Views

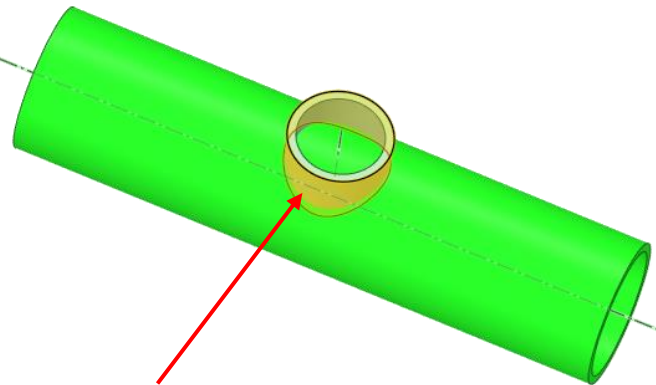
Click a target object. Box select or click the Select tool guide to choose multiple targets.



Select the first pipe as the target.



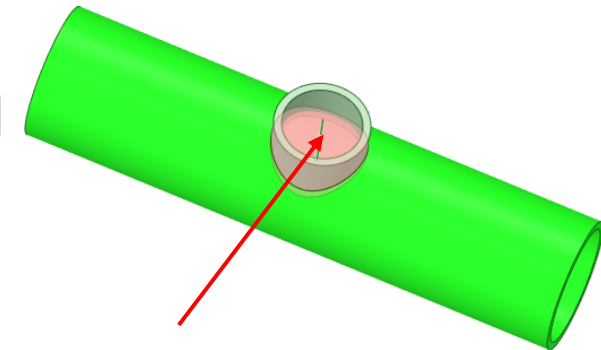
Click a face, plane, or an edge loop to use as a cutter.



Select the outer face of the second pipe as the cutter.



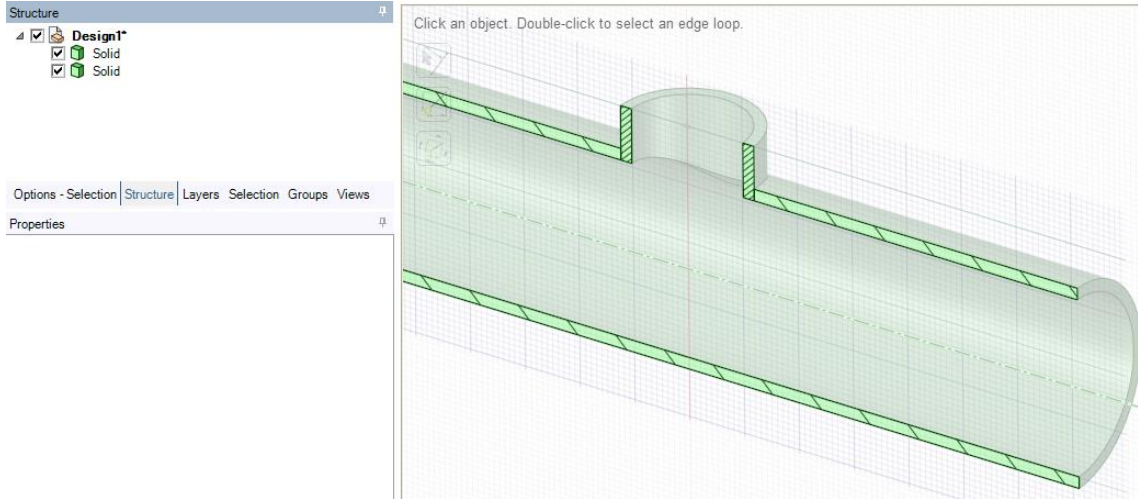
Click regions to remove. Press Ctrl to select an additional cutter. Use Merge When Done option to merge remaining regions.



Select the intersection region to remove, then click in a blank area of the graphics window to finish the split operation.

3D Mode: Merge

- Use Section Mode to review the geometry
 - It has been useful up to this point to have two solids, but now they can be merged using the Combine tool
 - Return to 3D mode before selecting the Combine tool



Click a target object. Box select or click the Select tool guide to choose multiple targets.



Select the first pipe as the target object.

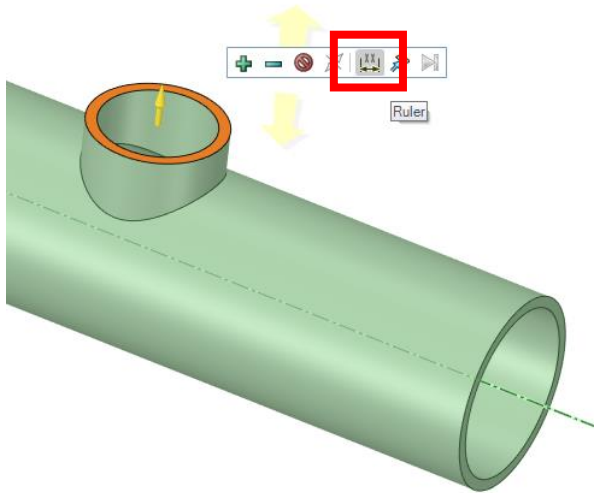
Click an object to merge the target with.



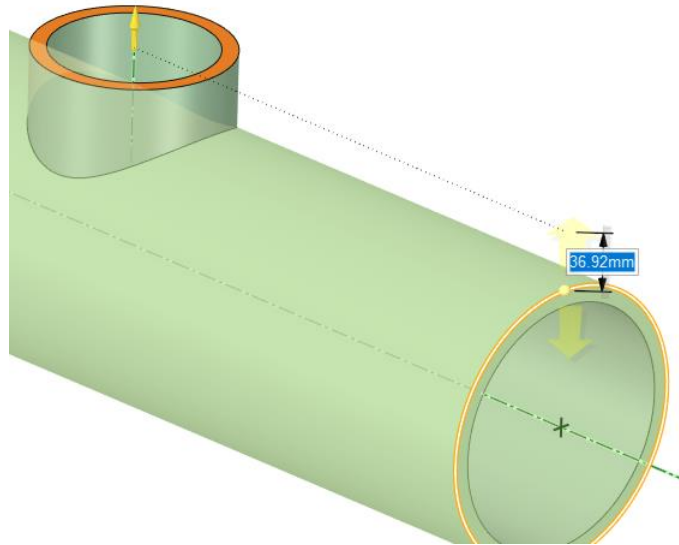
Hold down the Ctrl key and select the second pipe to merge. Use the Escape key to exit the Combine Tool

3D Mode: Pull

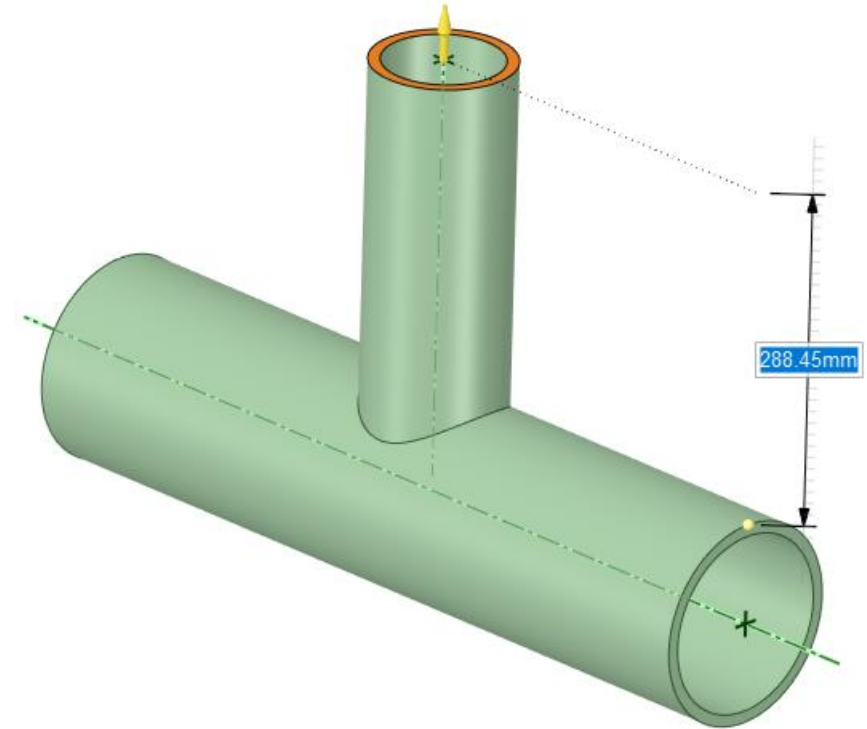
- Activate the Pull tool and select the upper face of the small pipe opening



Select the ruler in the mini-toolbar.



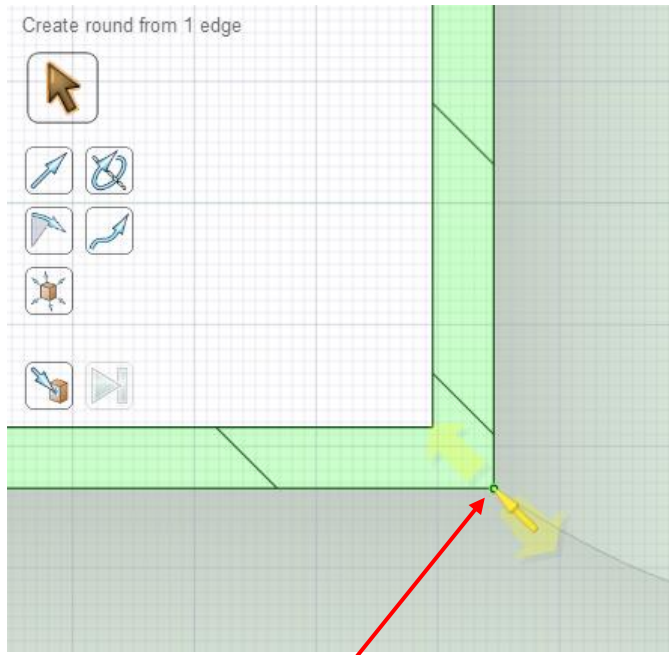
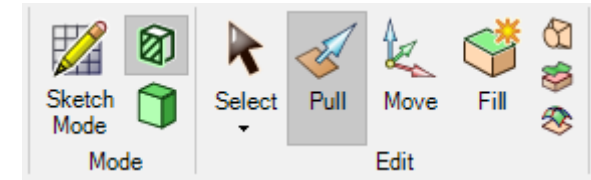
Position the mouse over the outer edge of the larger pipe until it displays the vertical distance between the face and the edge, then left click to fix the anchor point.



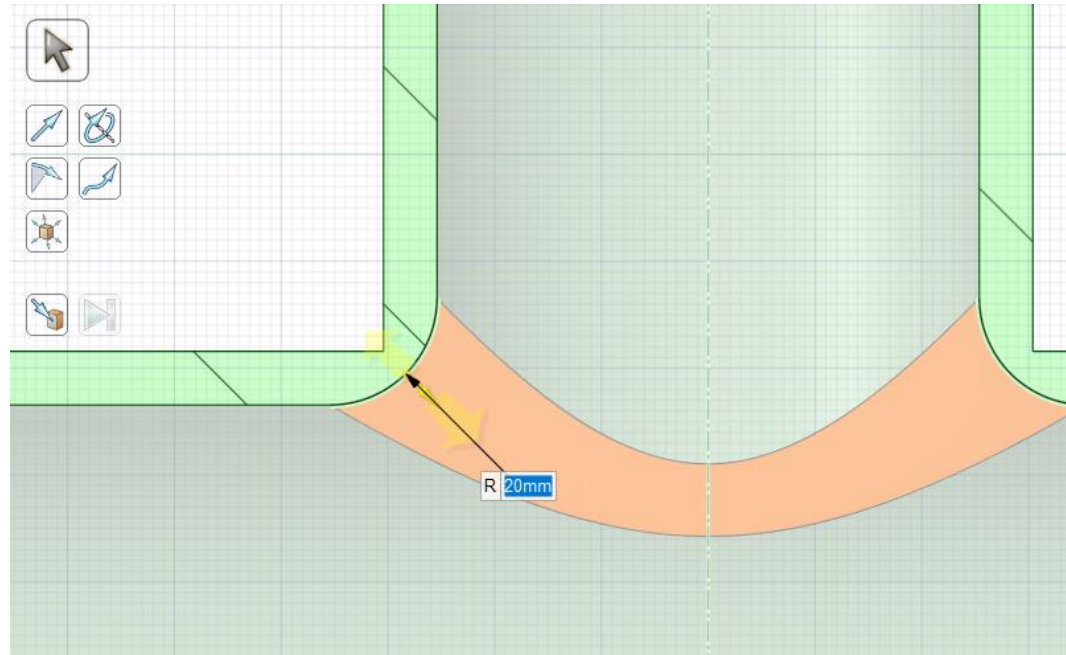
Enter 288.45 mm to set the distance then hit enter. Use the Escape key to exit the pull tool.

Section Mode: Pull

- Change to Section mode and select the same section plane as before, then select Pull mode



Position the mouse over the corner vertex to select the edge at the inner intersection of the pipes.



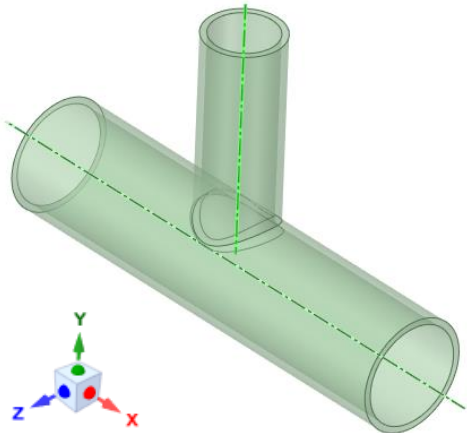
Pull to create a round with a radius of 20 mm. Note that this pull operation could have been performed in 3D mode, but here, using section mode makes it easier to select the edge.

/ Discussion

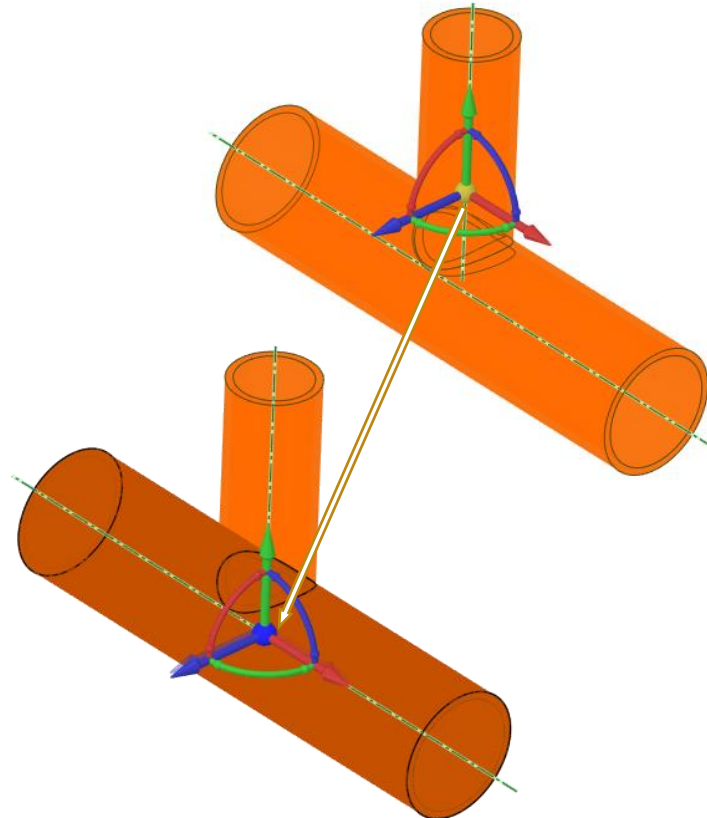
- With SpaceClaim, there are often multiple ways to create the same geometry
 - Due to the way the second pipe was created on slides 13 – 15, the pipe intersection could be created with one split operation and one merge operation – this was done by design here, but it would have been conceivable to instead perform the pull operation on slide 13 such that the second pipe extended through the first pipe and some arbitrary distance completely out the opposite side, and then use a number of split and combine operations to arrive at the same geometry found at the conclusion of slide 18
 - There is not necessarily any benefit to merging the pipes – here it is done mainly to match the geometry that will be used as the starting point for Workshop 02
 - As noted previously, it is not necessary to use Section mode to create the round at the intersection of inner surfaces of the pipes – the purpose of that is to demonstrate that it is possible to do so and can be convenient in many cases
- One final thing to note is that in this workshop, the geometry of the solid part was created
 - Normally for such a simple flow geometry, you would probably just create the fluid volume by creating and intersecting two cylinders, one each with the inner radius of the large and small pipes
 - The purpose of this workshop is to practice geometry creation and creating the solid geometry allows you to learn and practice more SpaceClaim skills than the fluid geometry would allow

3D Mode: Move

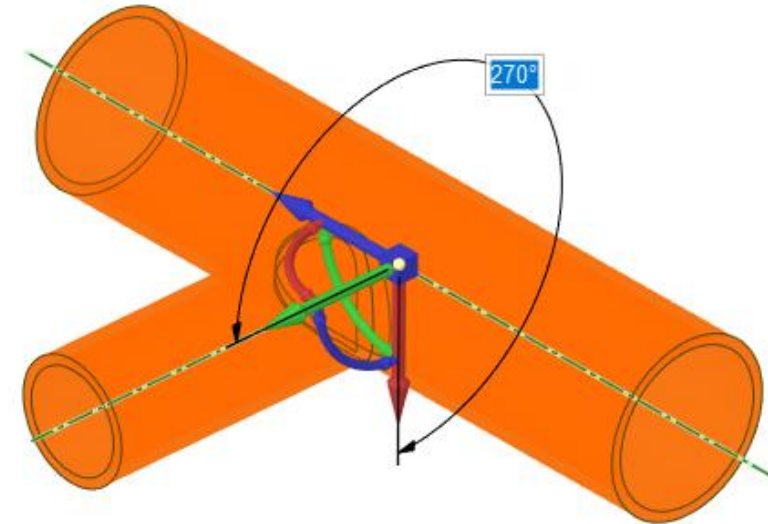
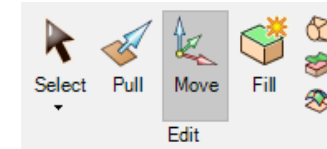
- Activate the move tool in the ribbon and triple click to select the body



The axis of the small pipe should align with the positive z-axis



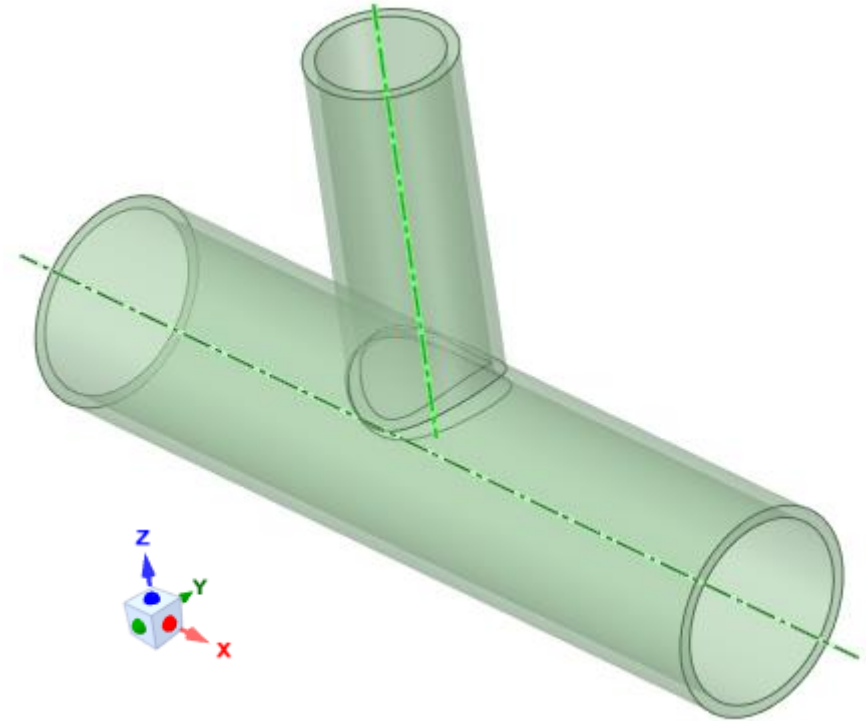
The initial position of the move tool is incorrect. Left click on the yellow sphere at the axis origin and drag it to the intersection of the pipe axes



Use the rotation handle and enter a value of 270° (depending on orientation, sometimes 90° points in the wrong direction)

/ Save Model and Exit

- Save the model as "pipe-tee-r20mm-ws1.3" and exit
- The reason for the move operation on the previous slide was to make the geometry identical to that which will be used as the starting point for Workshop 02



/ Summary

- This workshop covers skills presented in Lecture 1.2
 - Sketch tools
 - Including repositioning the sketch plane
 - Working in sketch mode, section mode and 3d mode
 - Creating geometry from sketches using pull operations
 - Working with the pull and move tools
 - Including Pull options – No Merge, Up To, Ruler
 - How to reposition the move handle
- And some presented in Lecture 1.1
 - Additional use of the split and combine tools



End of presentation