Ansys Mechanical Beyond the Basics

Module 02 Student Step-by-Step Guide: Further Geometry Considerations

Release 2021 R2

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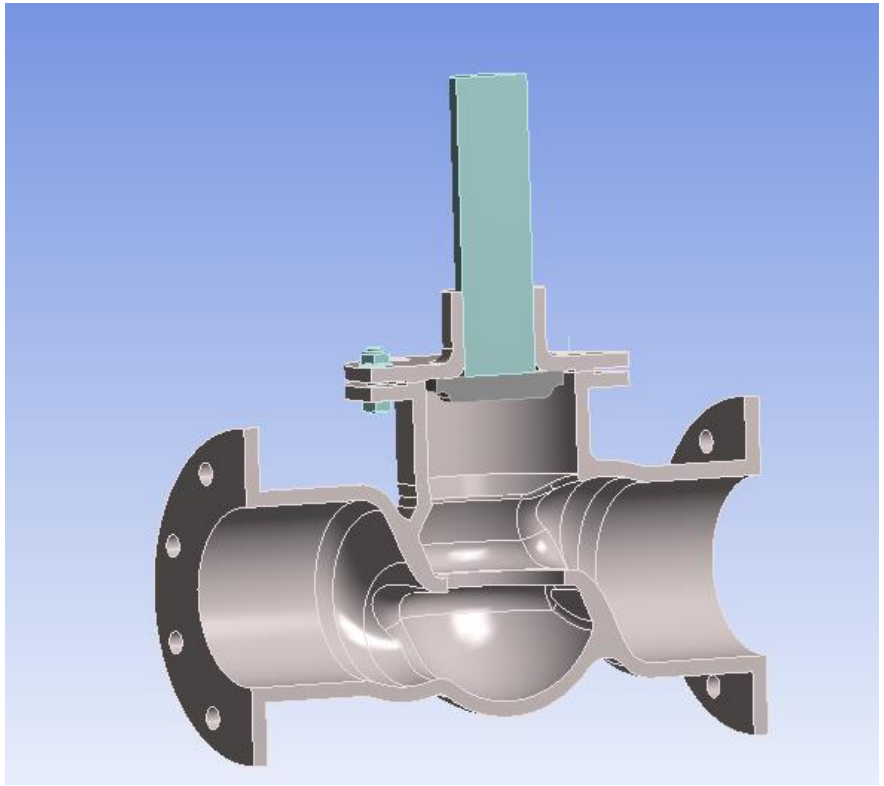
Step-by-Step Guide 02: Further Geometry Considerations

- **Use this guide to repeat the steps the instructor demonstrated within this module**



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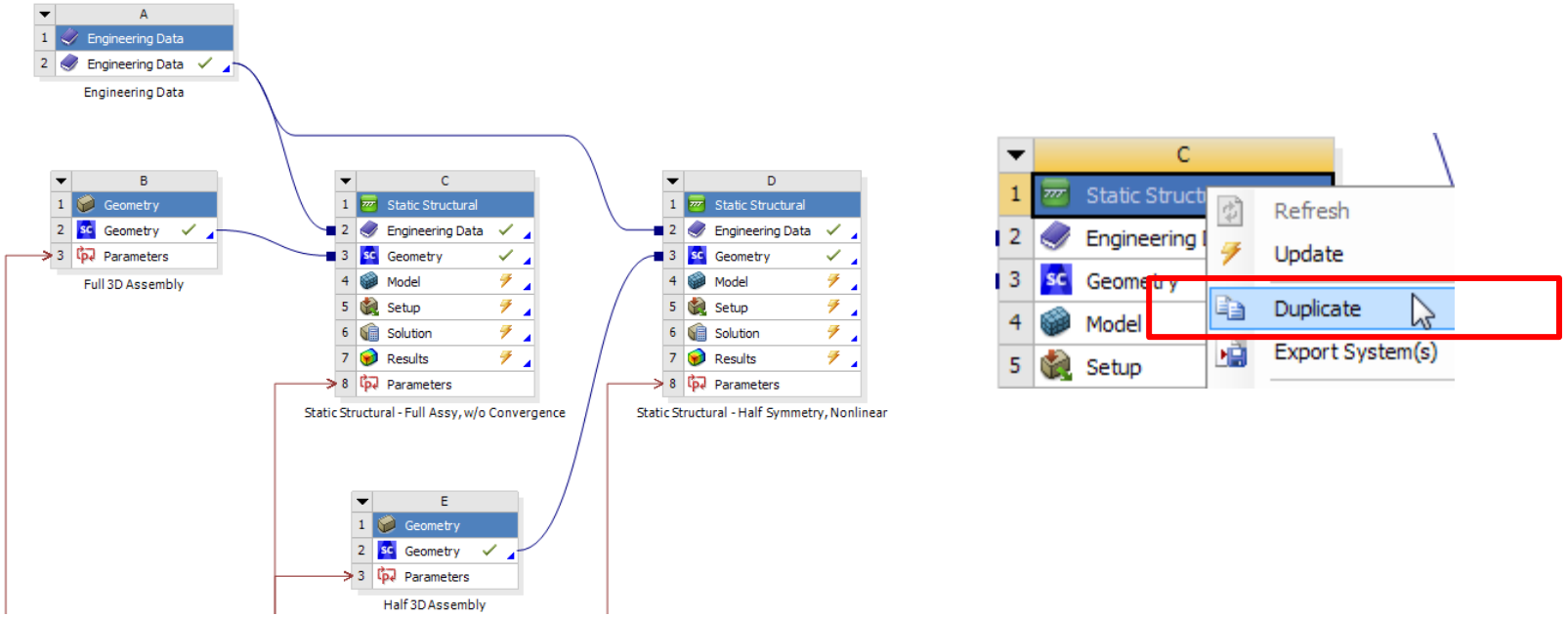
Step-by-Step Guide 02: Further Geometry Considerations

- **Open Archive "Globe_Valve_SS02_Start.wbpz"**
- The Project contains two Static Structural Analysis Systems, C and D. C represents the full assembly at the conclusion of Part 1 of this course. D represents the half symmetry model after all the geometry updates from SpaceClaim have been performed.
- To preserve both Analysis Systems, **Duplicate** Analysis System C. Answer no for upstream connections.



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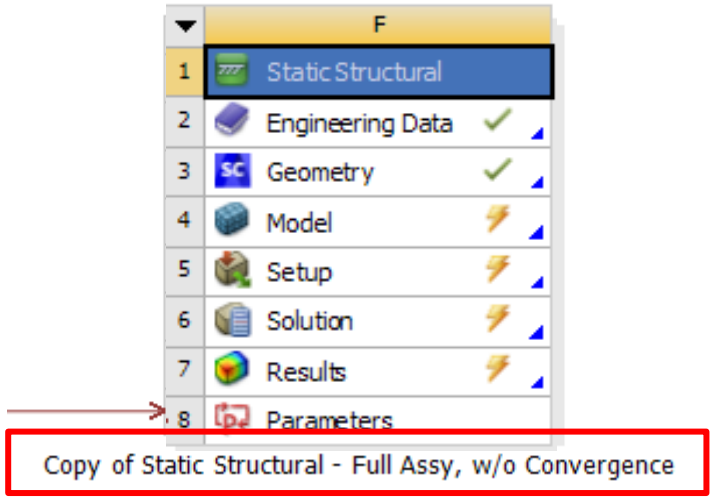
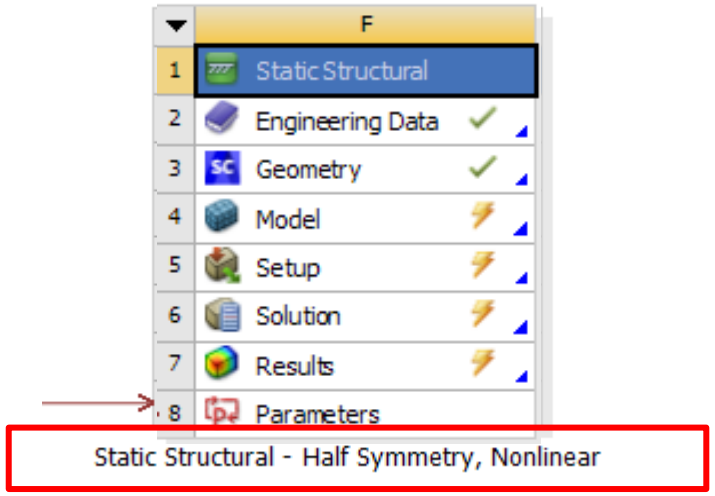
Step-by-Step Guide 02: Further Geometry Considerations

- **Rename** the newly created Analysis System from "**Copy of …**" to "**Static Structural – Half Symmetry, Nonlinear**" as shown below.





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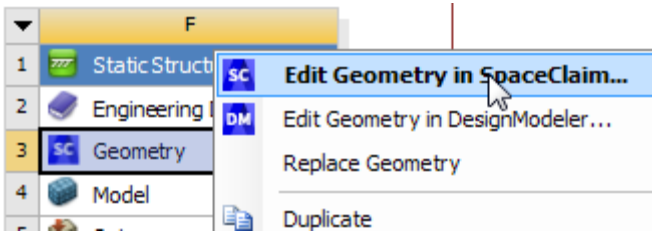
Step-by-Step Guide 02: Further Geometry Considerations

- Open SpaceClaim: **RMB on cell F3 → Edit Geometry in SpaceClaim**



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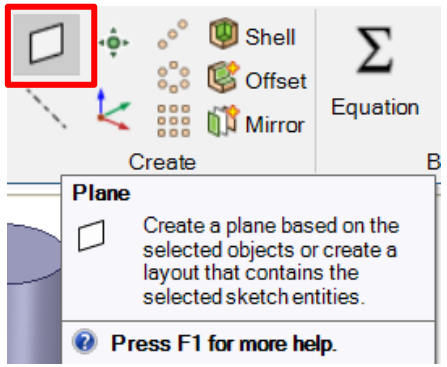
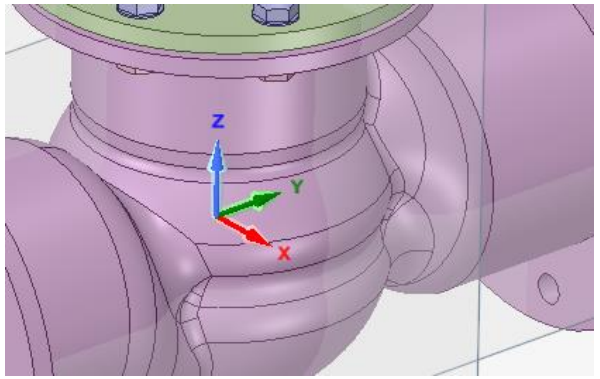
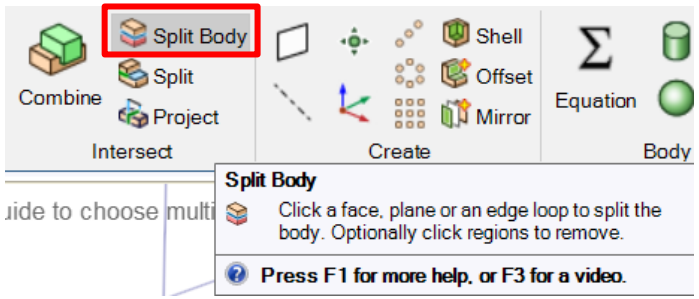
Step-by-Step Guide 02: Further Geometry Considerations

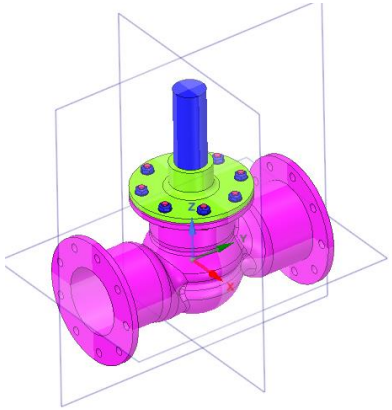
- **Work on symmetry**: Use a plane to split bodies:
  - Navigate in the Design tab and click on the **Plane** tool
  - Select the coordinate system triad at the center of the Valve Body.





  - Navigate in the **Design** tab and click on the **Split Body** tool
  - Select the target objects: all bodies (to select all the bodies: use the box selection with your mouse)





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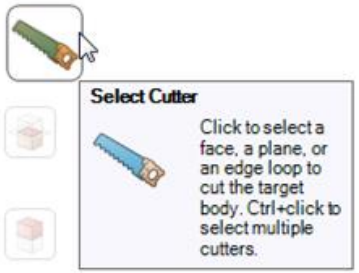
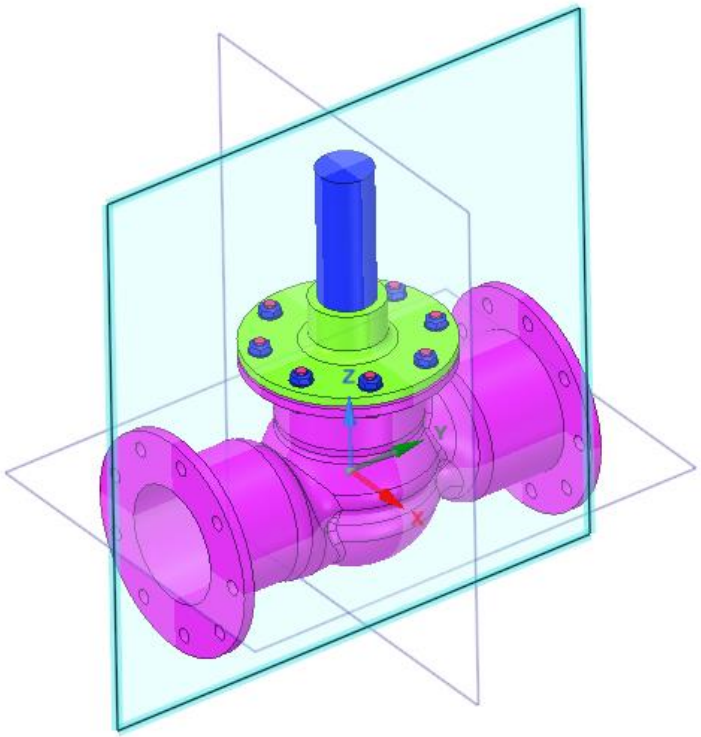
Step-by-Step Guide 02: Further Geometry Considerations

- Select the **Cutter**: click on the existing plane





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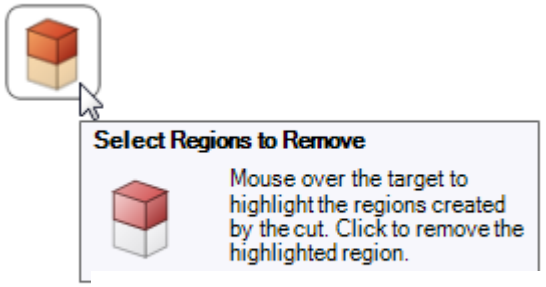
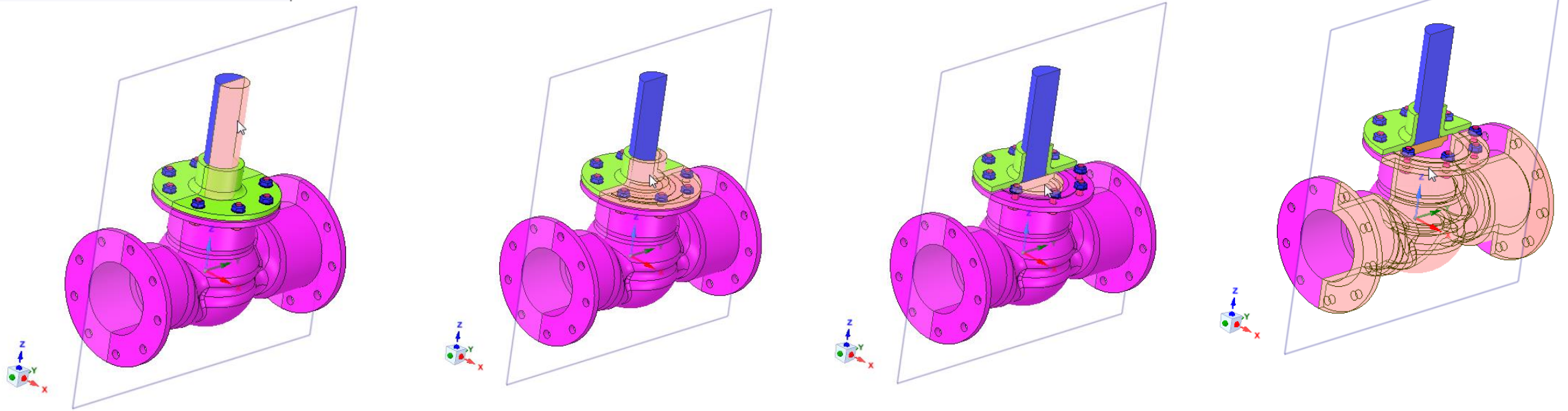
Step-by-Step Guide 02: Further Geometry Considerations

- Select **Regions to Remove**: click one by one on bodies contained in the +X part of the space





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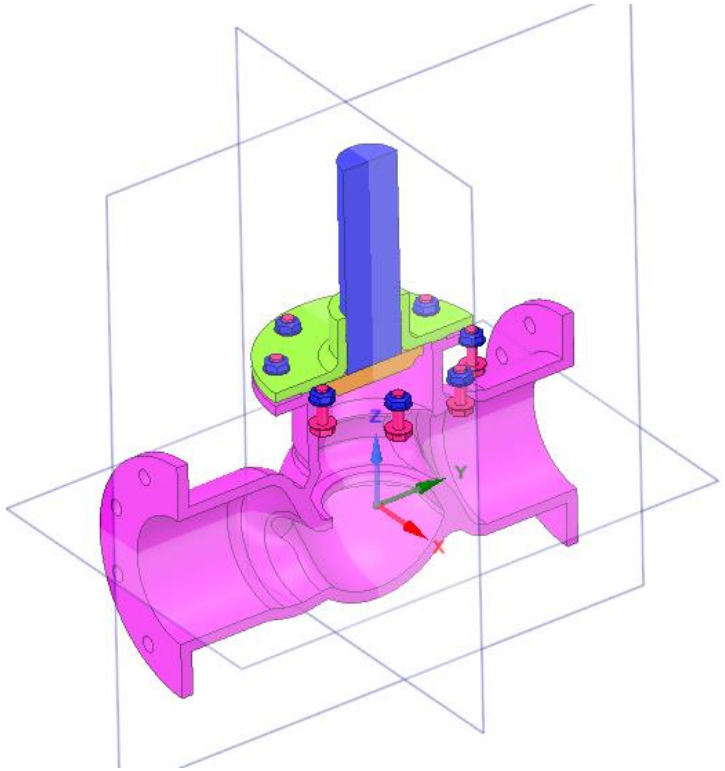
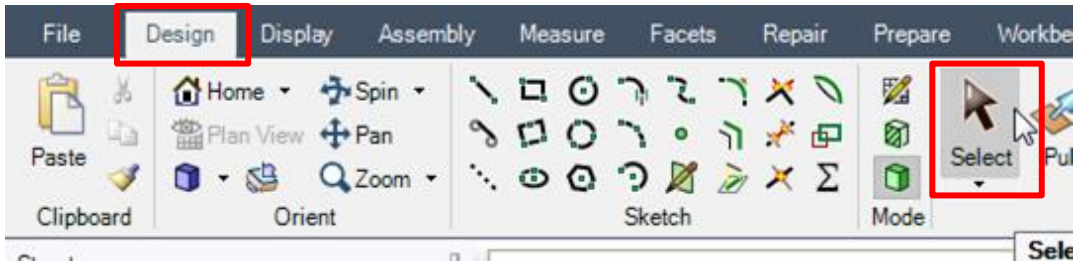
Step-by-Step Guide 02: Further Geometry Considerations

- Half of the geometry and all nuts and bolts bodies should remain at this stage of this guide.



- Return to the selection mode:



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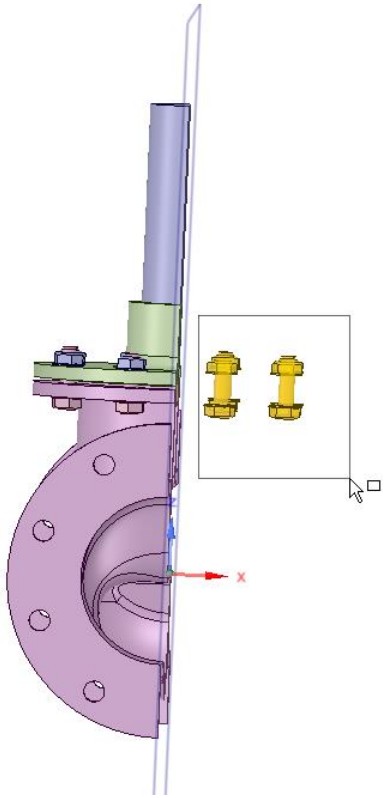
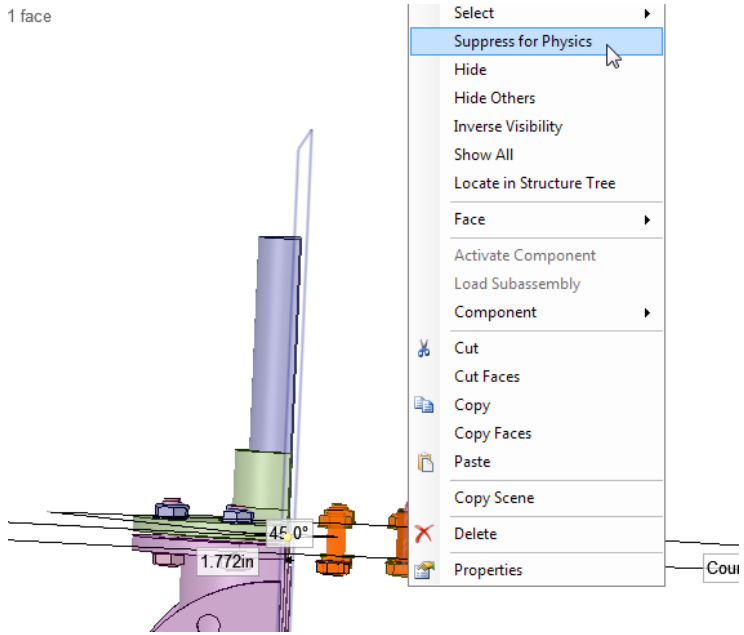
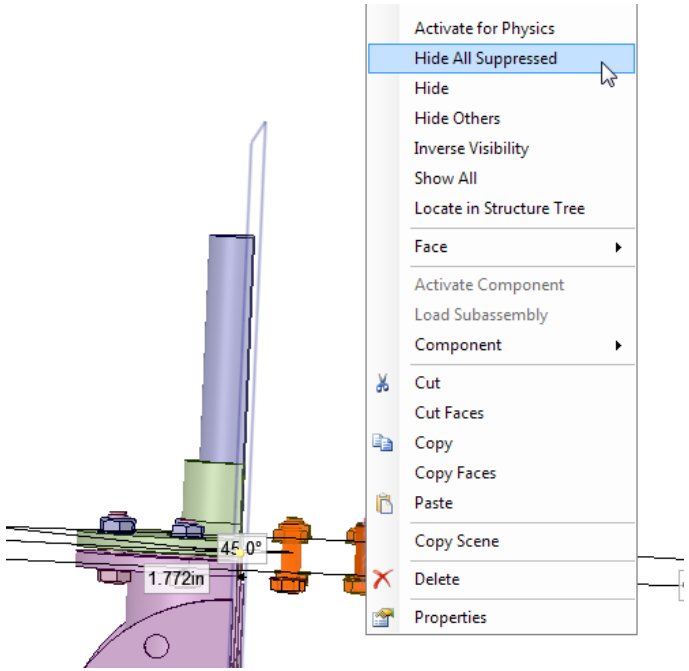
Step-by-Step Guide 02: Further Geometry Considerations

- Select bolts and nuts contained in the +X part of the space
- **RMB** on them → **Suppress for Physics**
- **RMB** again → **Hide All Suppressed**







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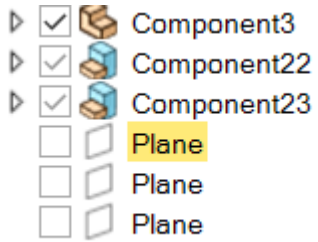
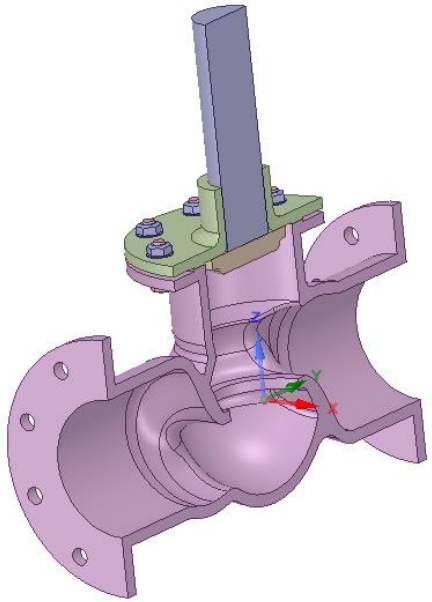
Step-by-Step Guide 02: Further Geometry Considerations

- Hide the planes: **uncheck** the planes in the Tree



- You should now see only one half of the geometry.



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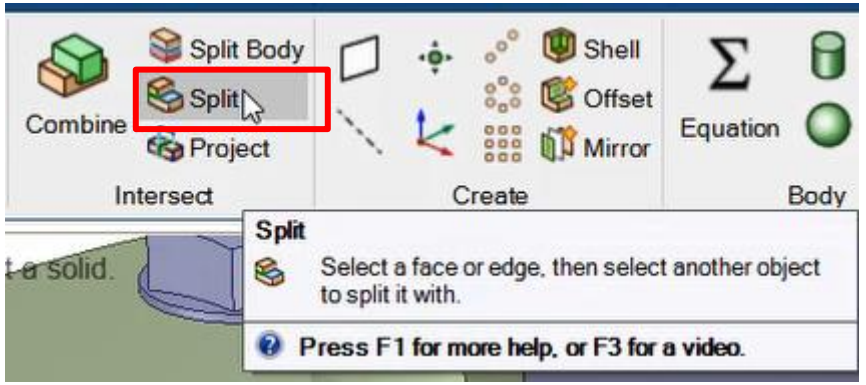
Step-by-Step Guide 02: Further Geometry Considerations

- **<u>Imprints on flanges faces</u>** with bolts and nuts heads: this will be used for bolt connectors definition in Mechanical. The imprinted face will be used to define a rigid region.

  - Navigate in the **Design** tab and select the **Split** tool



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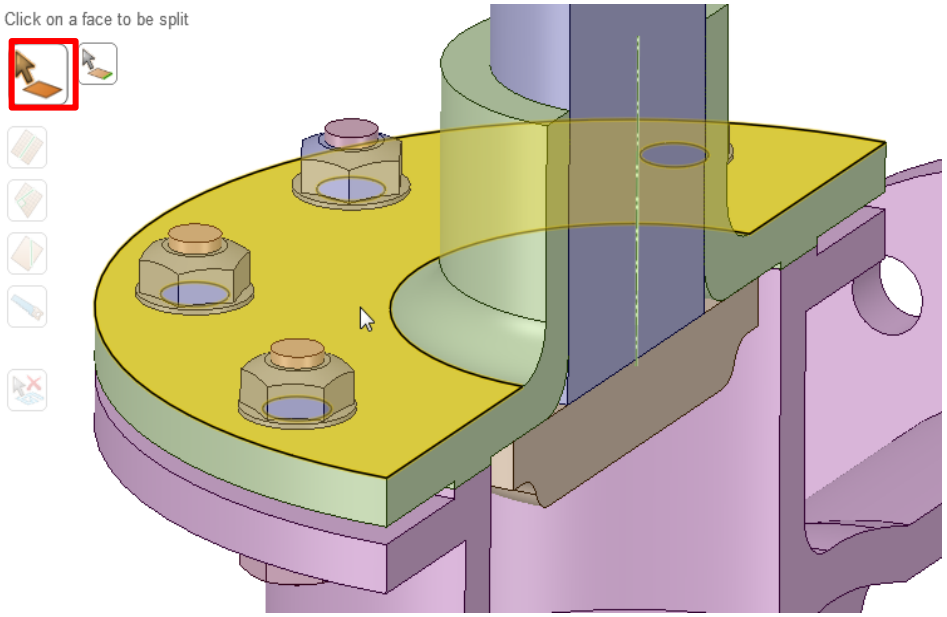
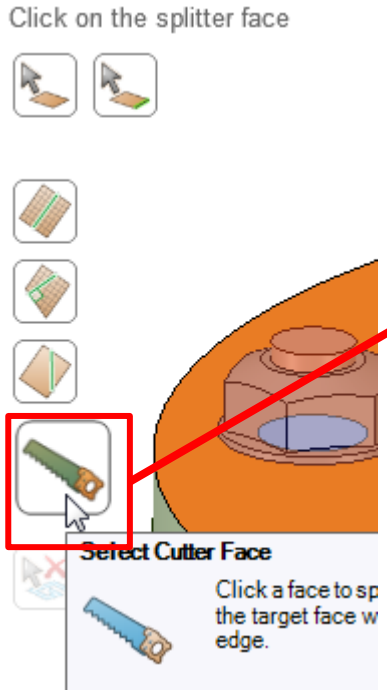
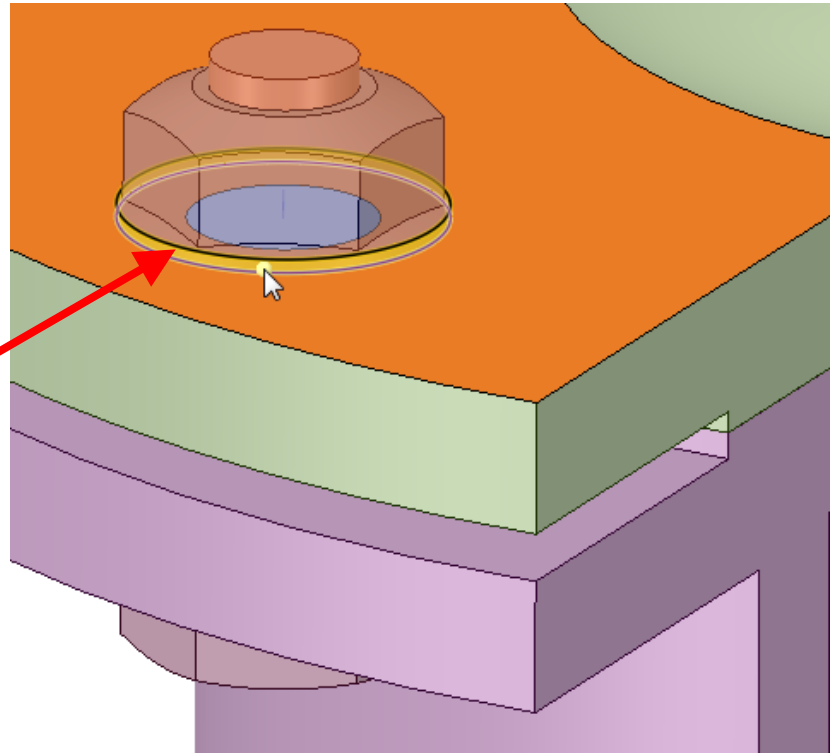
Step-by-Step Guide 02: Further Geometry Considerations

- **Select** the upper face of the flange to split it
- **Select** a cutter face: the external circular face of the first nut







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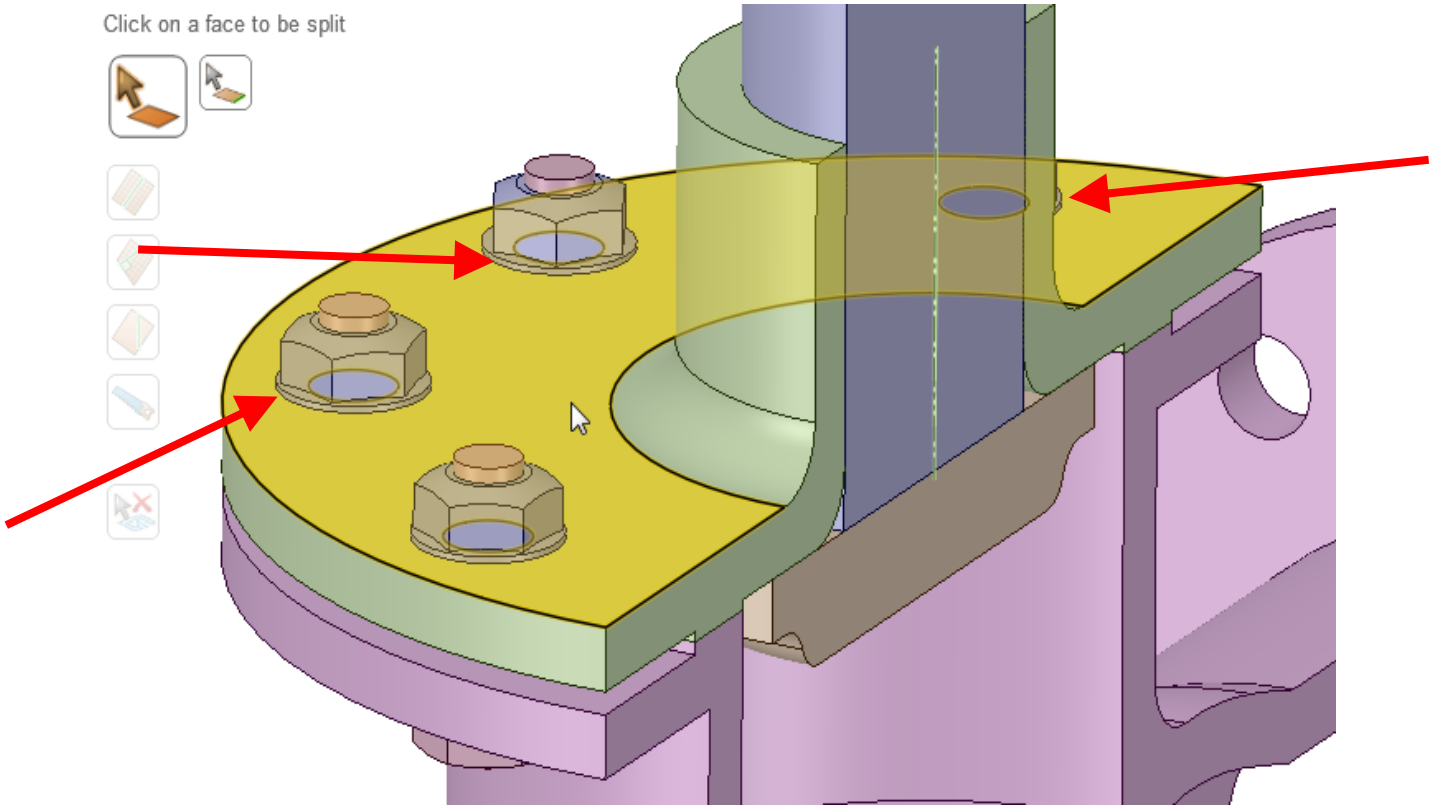
Step-by-Step Guide 02: Further Geometry Considerations

- **Repeat** the steps from previous slide for the remaining 3 nuts



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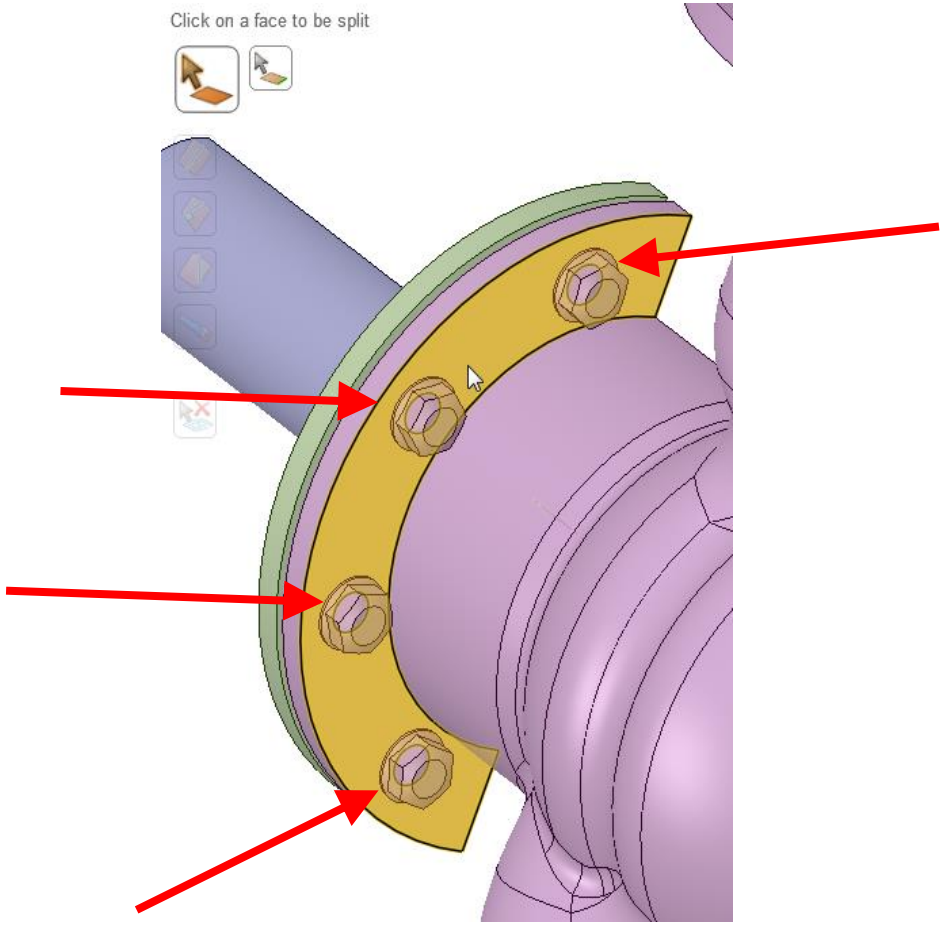
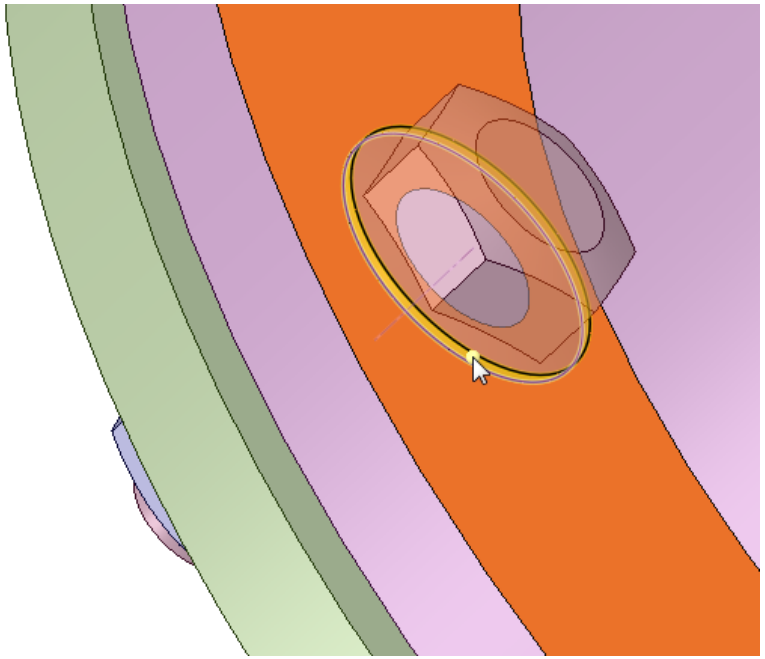
- **Repeat** the steps to imprint the lower face of the valve body flange with the 4 bolt heads:





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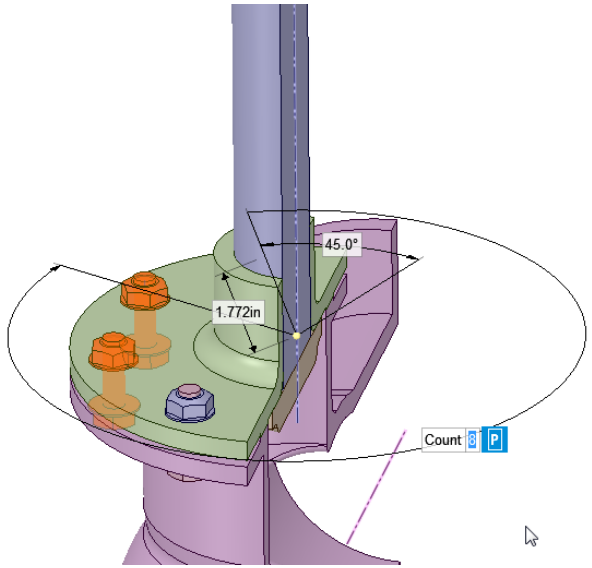
Step-by-Step Guide 02: Further Geometry Considerations

- **<u>Bolts and nuts suppression for physics</u>**
  - Return to the **Select** mode

  - **Select** the 2 bolts and nuts assemblies as on the image

(to select a body in the graphics window triple-click it)



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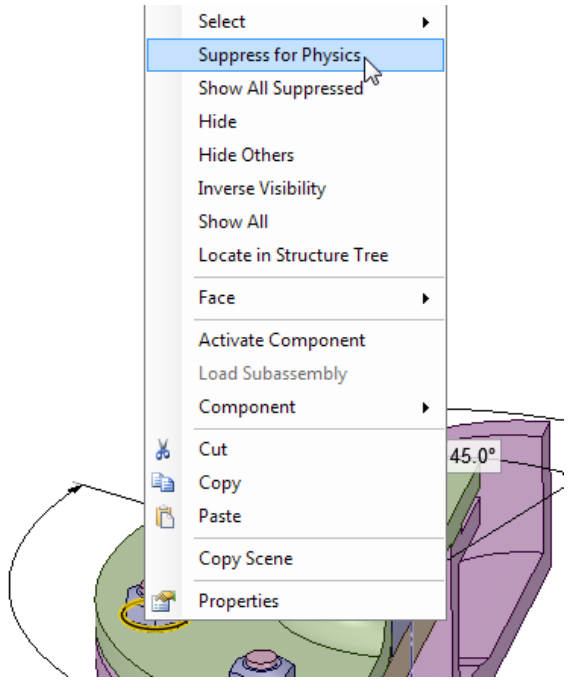
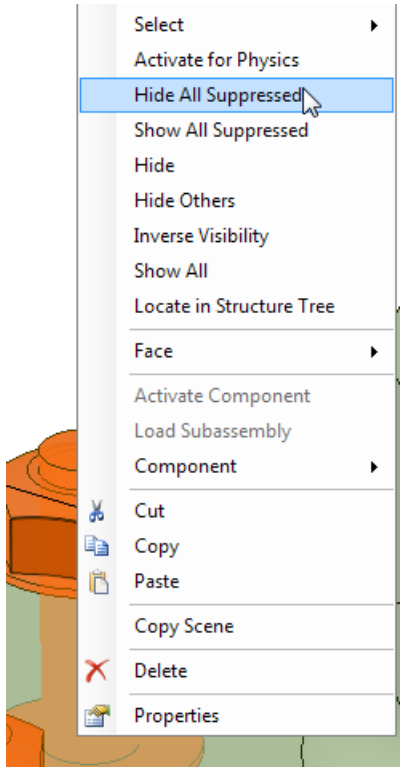
Step-by-Step Guide 02: Further Geometry Considerations

- **RMB → Suppress for Physics**
- **RMB → Hide All Suppressed**





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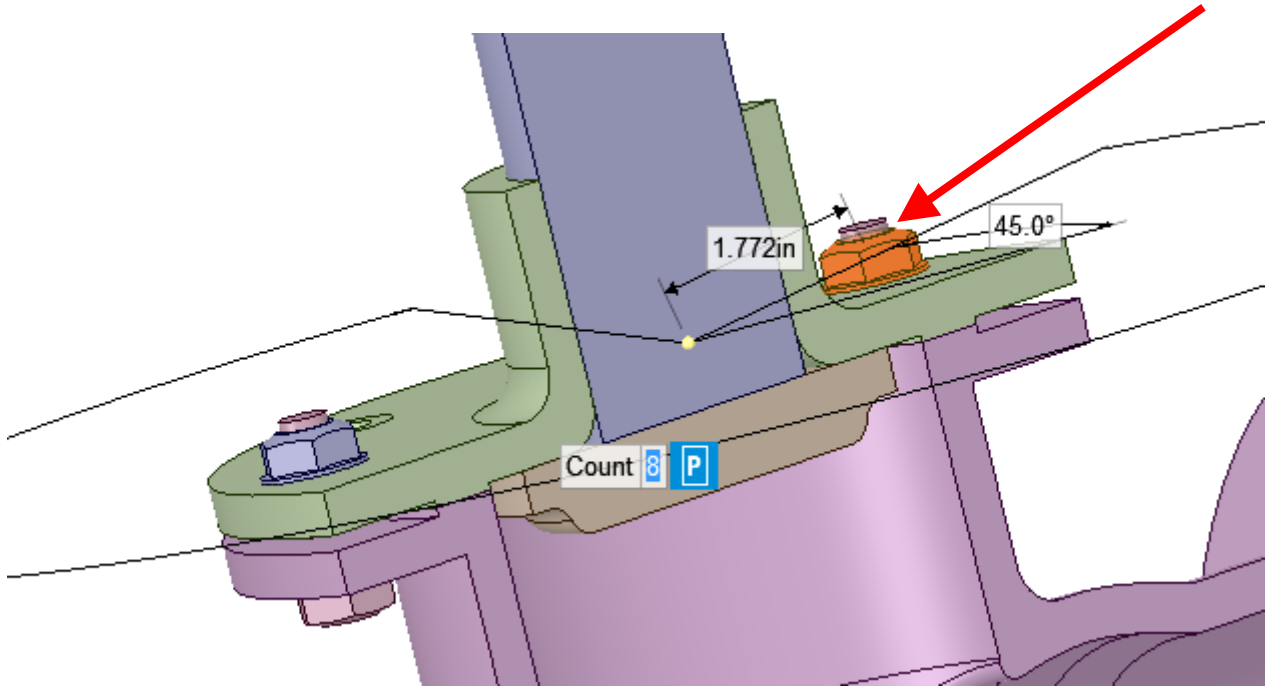
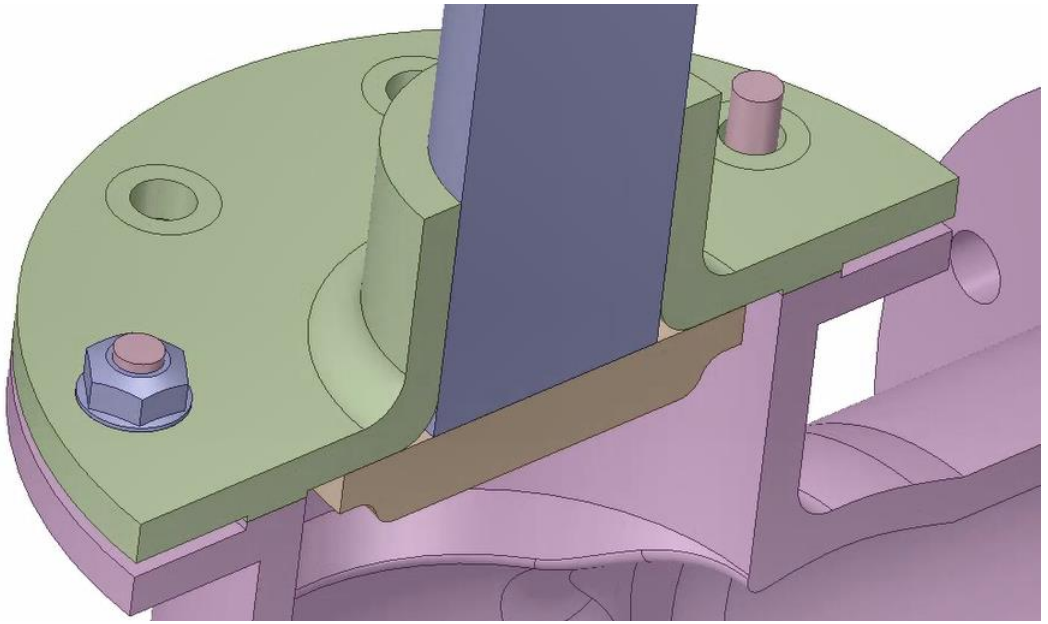
- Repeat the steps to **suppress** and **hide** the following nut (bolt remains activated):





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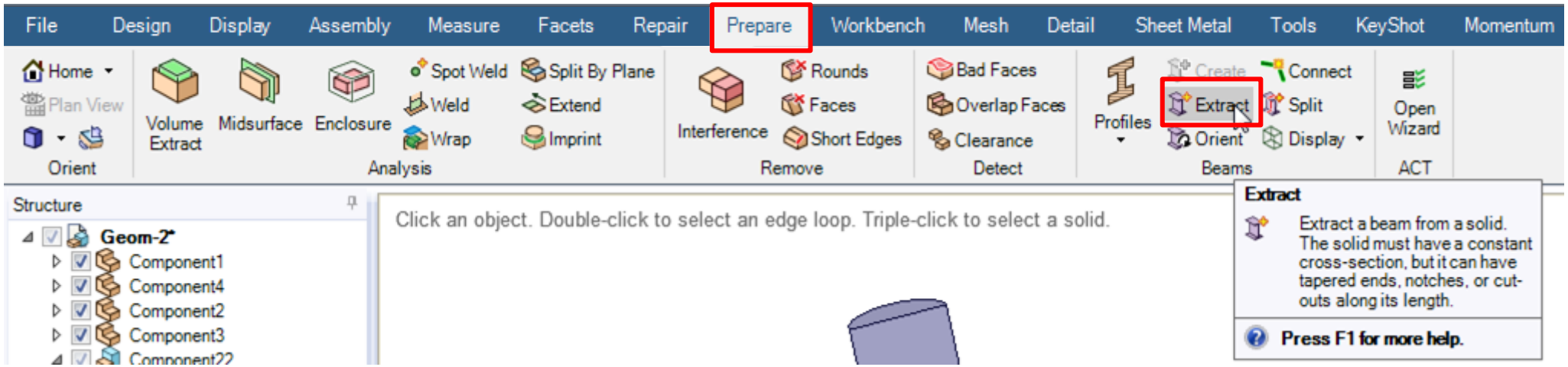
Step-by-Step Guide 02: Further Geometry Considerations

- **Beam Extraction**
  - Navigate in the **Prepare** tab and click on the **Extract** tool



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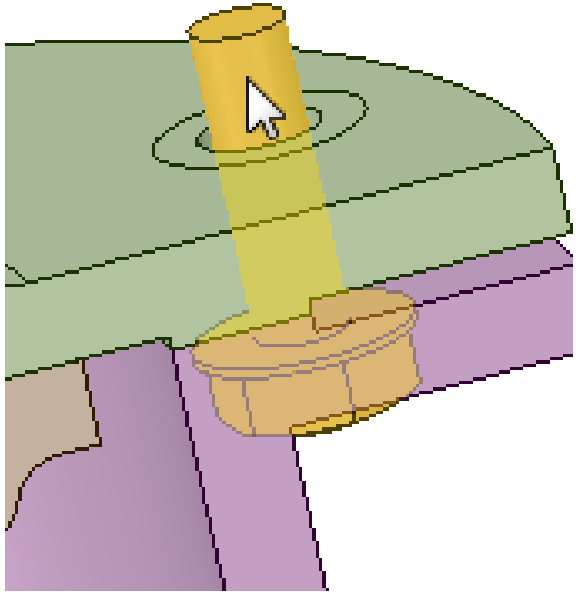
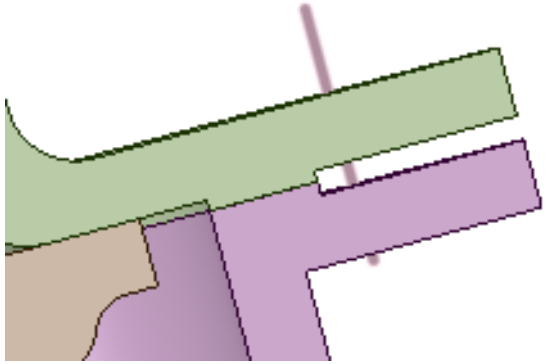
Step-by-Step Guide 02: Further Geometry Considerations

- **Select** the bolt (the one for which the nut has been suppressed) to extract the beam
- **Escape** on the keyboard to exit the **Extract** tool





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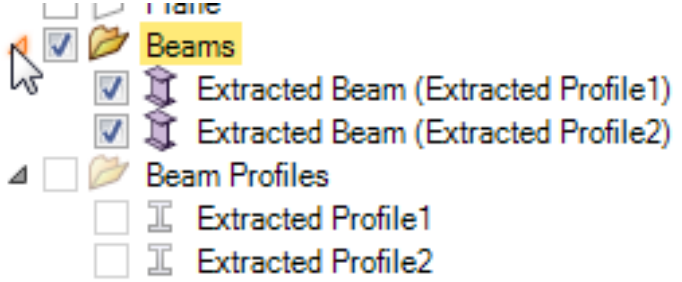
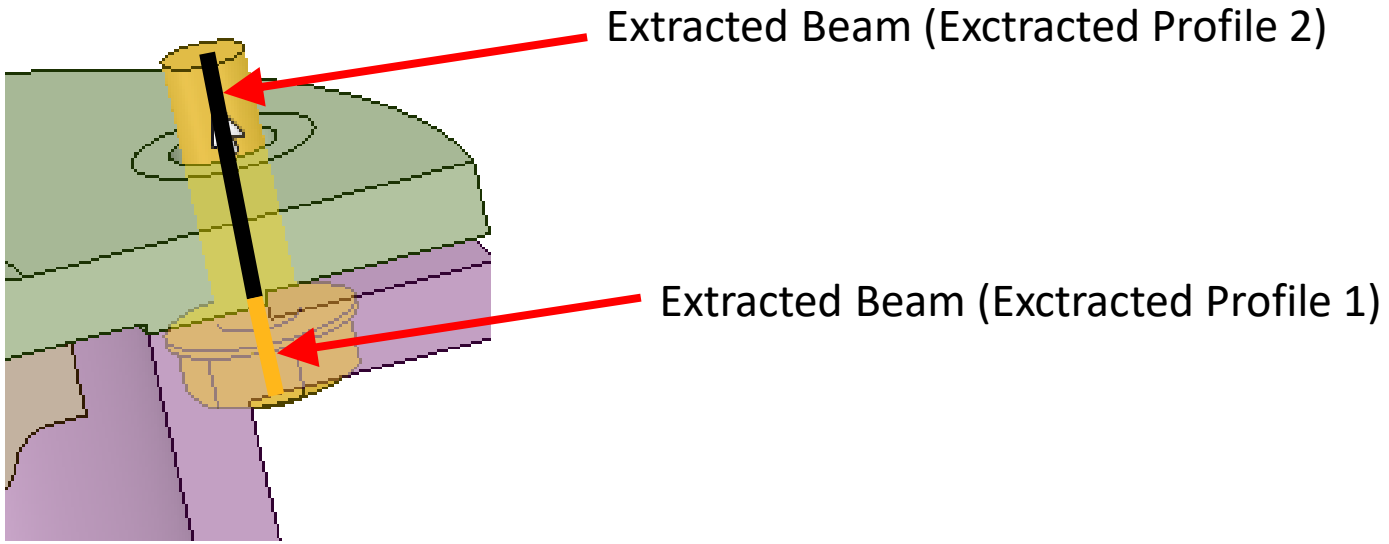
Step-by-Step Guide 02: Further Geometry Considerations

- **Navigate** into the tree to see the created Extracted Beams

2 beams have been extracted, with 2 Profiles

They correspond to the 2 different sections of the bolt:





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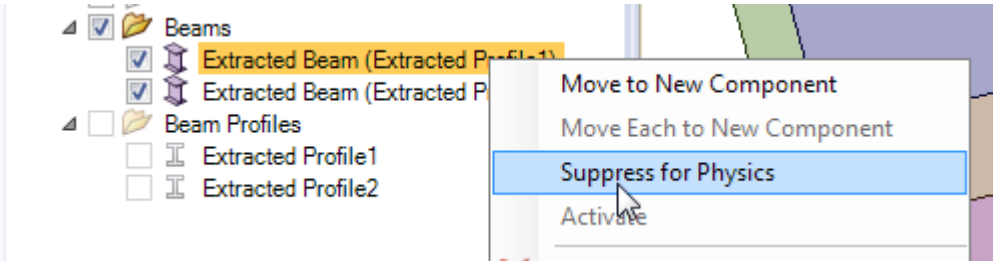
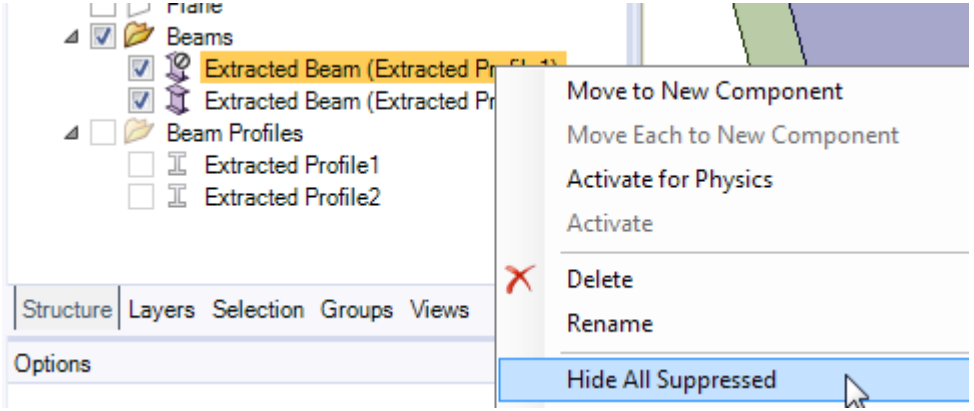
- Only bolt number 2 will be kept for the rest of the training course
- **Suppress** the Beam with profile number 1





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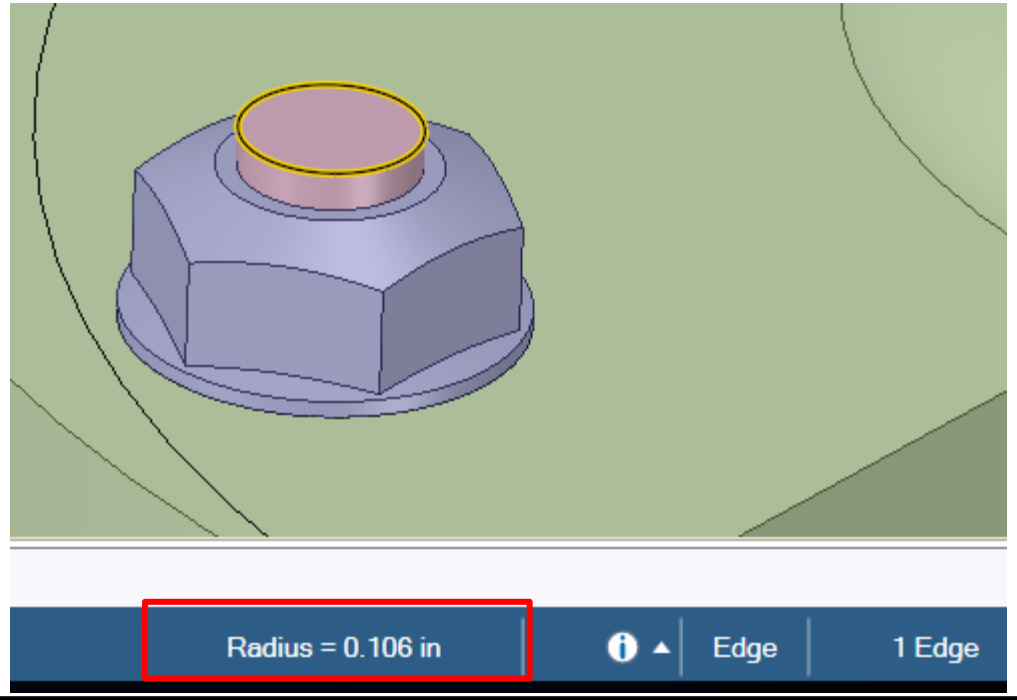
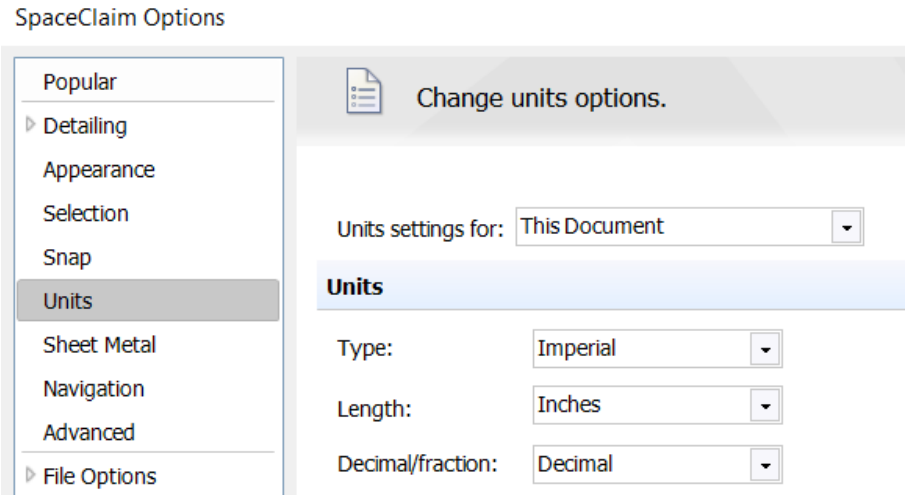
- Let’s check the shape of the extracted profile
- Select the edge of the remaining bolt shaft
- Note the **Radius = 0.106** in value at the bottom of the Graphics window
- *If necessary, Units can be changed in SpaceClaim by **File → SpaceClaim Options → Units***





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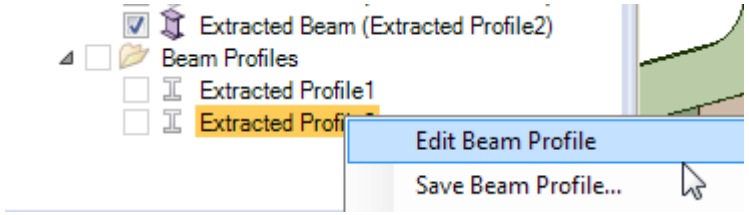
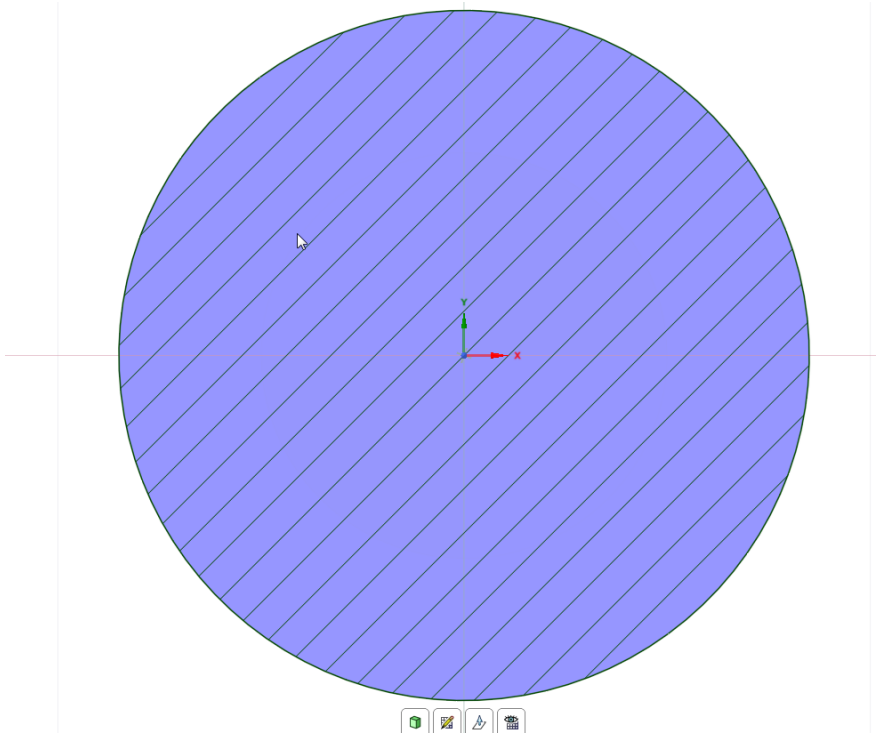
- Navigate into the tree and **RMB** on **Extracted Profile 2** to **Edit Beam Profile**
- Check the profile is a disc





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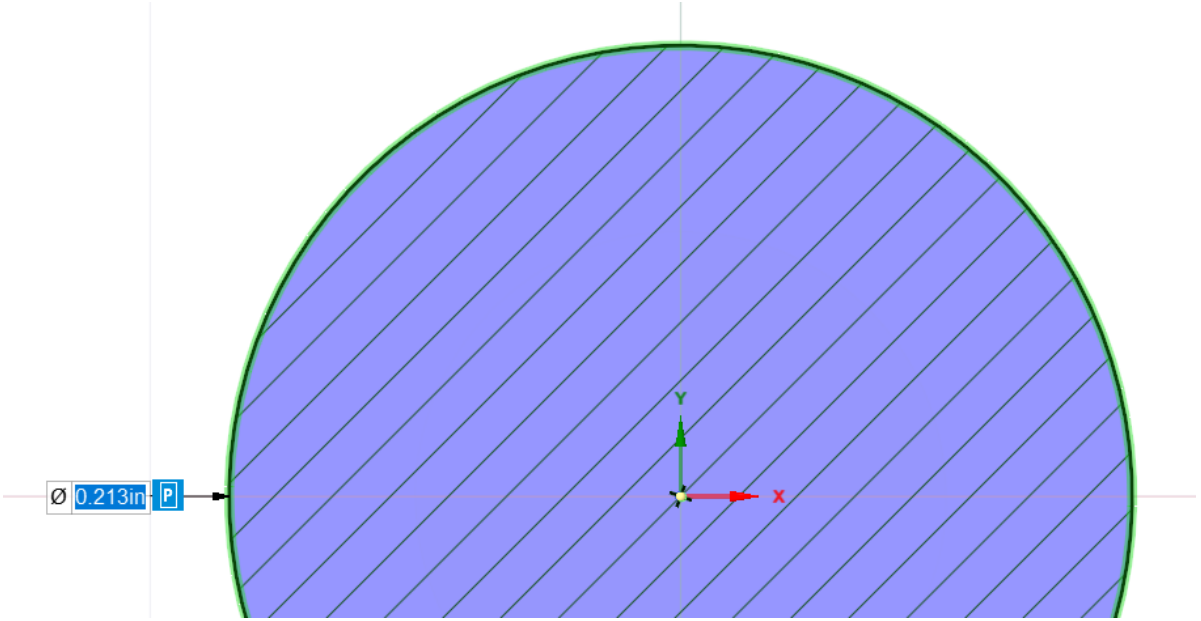
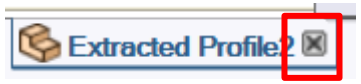
- Select the exterior edge of the disc
- The circle diameter is shown to be **0.213in**



- Close (“x”) the **Extracted Profile2** tab



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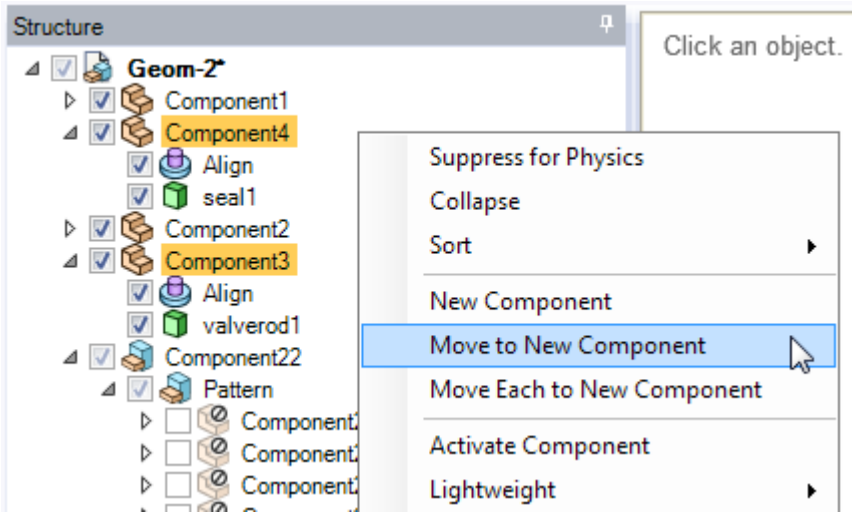
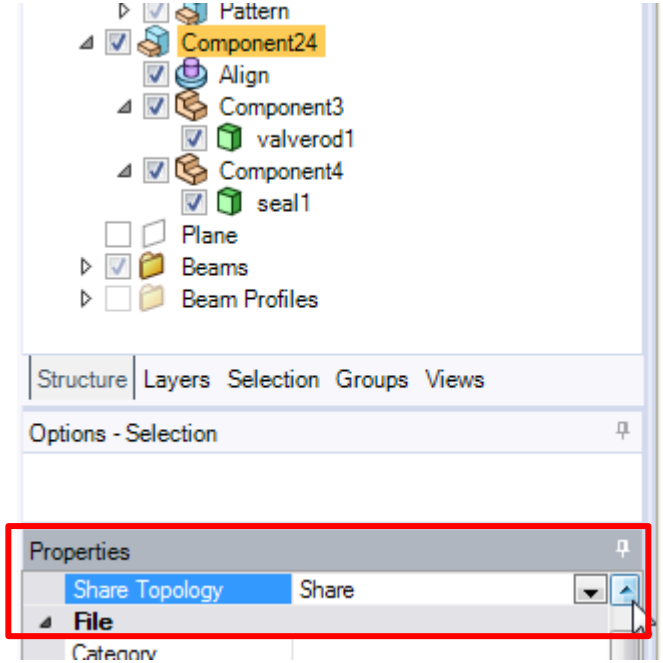
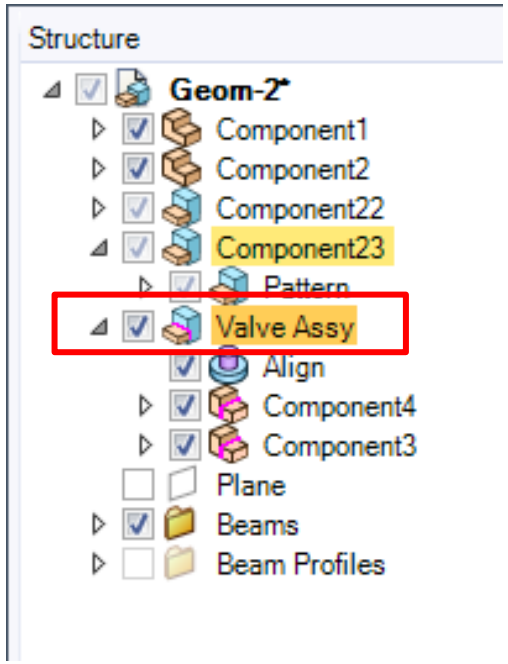
Step-by-Step Guide 02: Further Geometry Considerations

- **Topology sharing**
  - **Select** Component 4 and Component 3 in the tree, right click and **Move to new Component**
  - **Select** the new created Component and change **topology property** to **Share**
  - **Rename** this Component to “Valve Assy”: RMB → **Rename**







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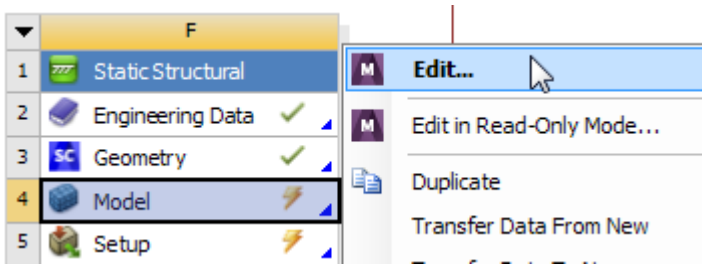
Step-by-Step Guide 02: Further Geometry Considerations

- **Edit** the Mechanical Model in Cell **F4** in order to refresh the geometry modifications in the simulation model file



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Step-by-Step Guide 02: Further Geometry Considerations

- The geometry has changed significantly, so you'll see **questions marks** appearing in the Mechanical tree. It means that some information, (here, the geometry scoping) has been lost and needs to be redefined.
- That has already been done for you and is present in **Analysis System D.**

- However, let's create the **symmetry region** in this analysis system (Static Structural E)

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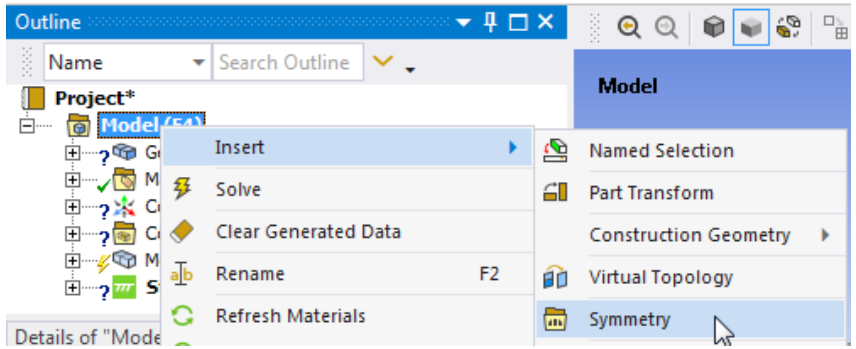
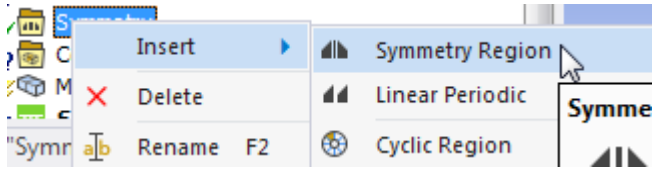
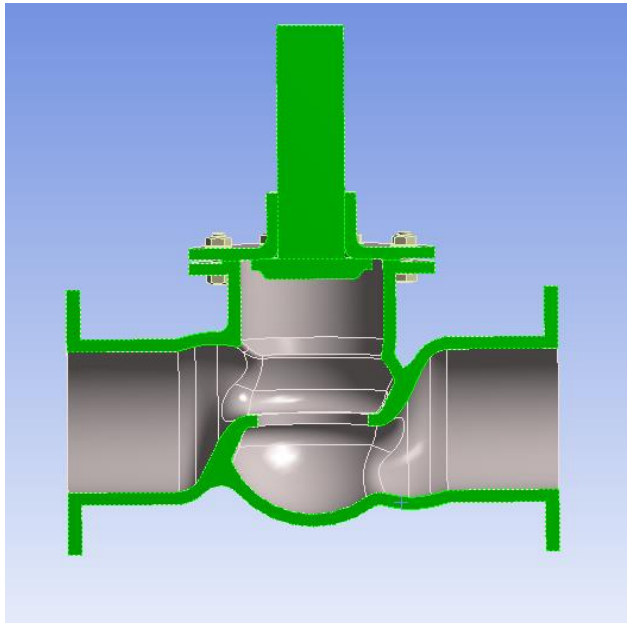
Step-by-Step Guide 02: Further Geometry Considerations

- **Symmetry definition:**
  - **RMB on Model → Insert → Symmetry**
  - **RMB on Symmetry branch → Symmetry Region**
  - **Select** all faces on the YZ plane and apply selection







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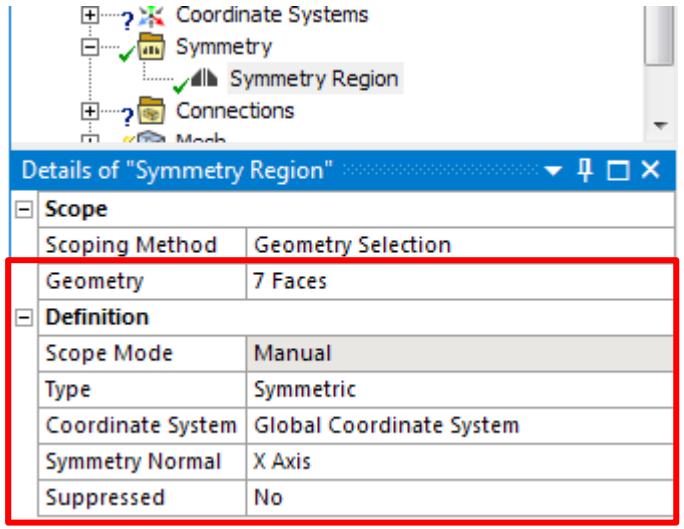
Step-by-Step Guide 02: Further Geometry Considerations

- **Define the following properties:**



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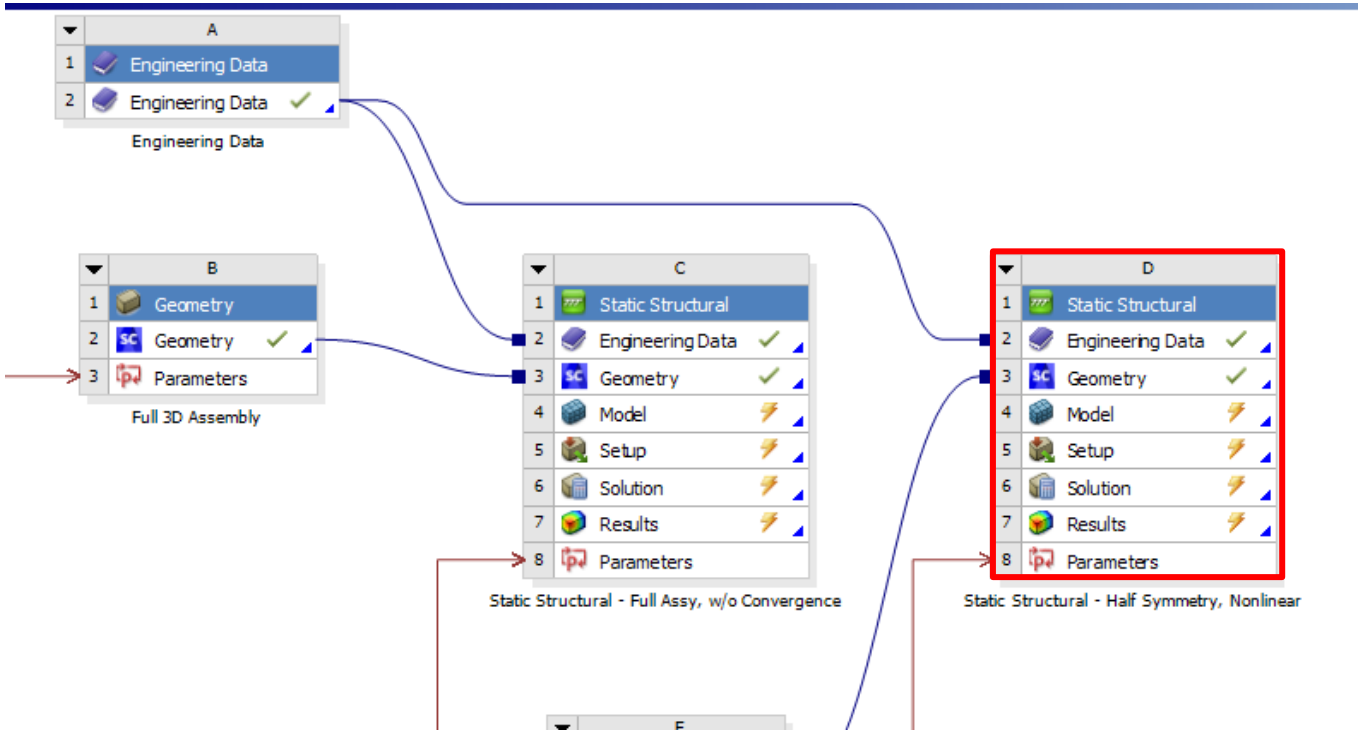
Step-by-Step Guide 02: Further Geometry Considerations

Note: The Mechanical model, correctly defined, with the half geometry has been set up for you in the analysis system D. Feel free to refer to it moving forward rather than re-attaching all the missing geometry scoping.



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