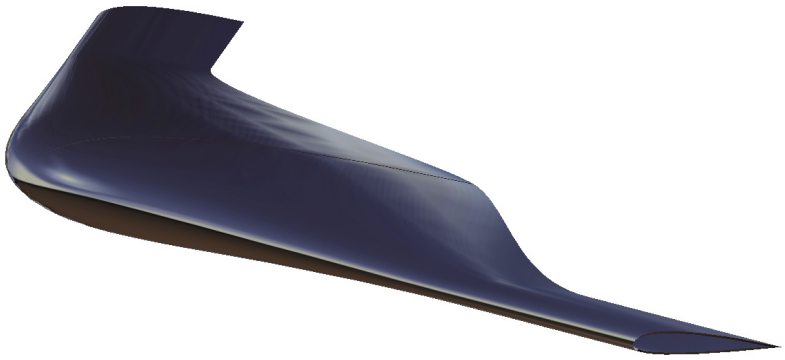
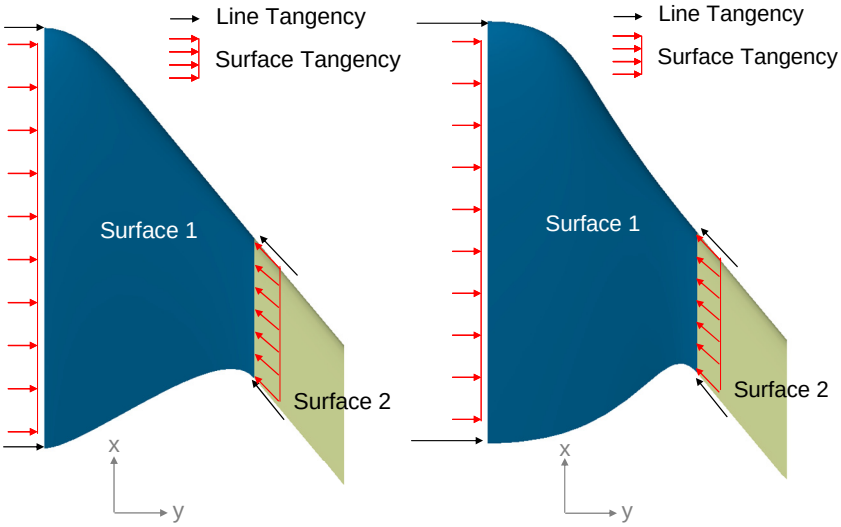
The Flying Wing Example

In this example a simplified outer shape of a flying wing UAV will be constructed.

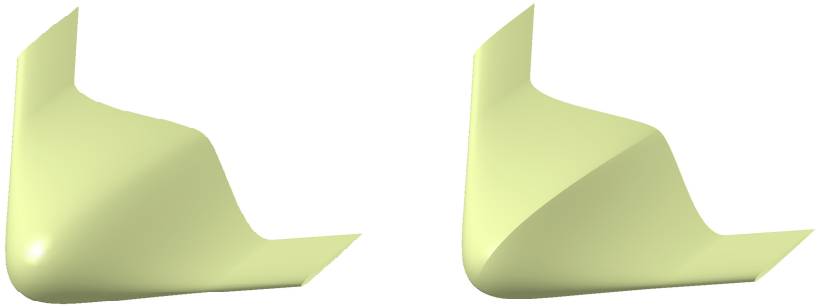


The objective of this exercise is to give the students a very basic understanding of the GSD workbench and how it can be used in a future multidisciplinary parametric framework.



The modeling concept of this simplified flying wing UAV is that by using correct line and surface tangency one can easily and successfully construct a surface based model. The designer will firstly need to construct the needed profiles and help curves to be able to construct the first surface, namely Surface 2. Then two help curves are created of which are tangent to both Surface 2 and in Y direction across the zx axis. When creating Surface 1 the two help curves together with Surface 2 and another help surface in the Y direction will be used to define its final shape. The importance of tangencies can be exemplified as following:

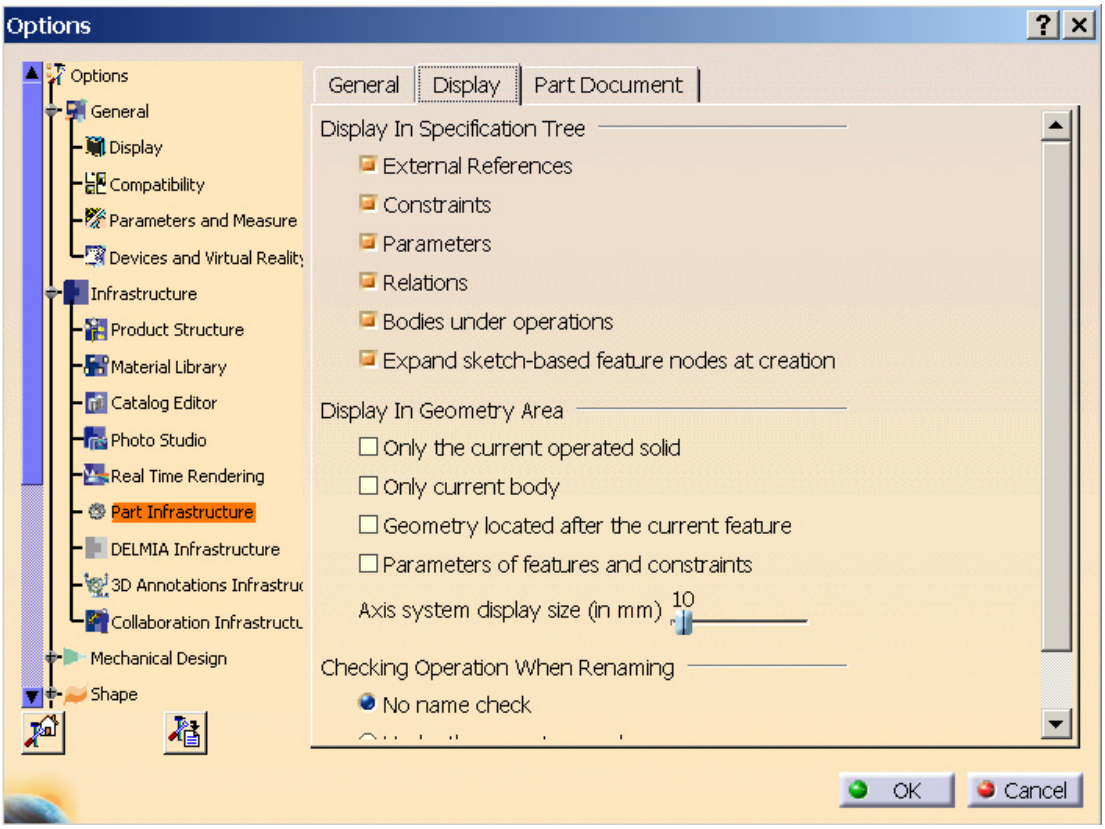
- When the tangent curves at zx axis are increased the shape of Surface 1 will vary as seen in figure above.
- When the surface tangency placed on the zx plane is removed then a seam will appear as shown in figure below.



In the following sub chapters a detailed description for how to create the UAV model is made. Take note that for every object created in the GSD workbench a new set of parameters are created. This feature is extremely powerful and useful as discussed earlier in this chapter and will be further exemplified in future exercises.

Start the exercise

Before starting this exercise make sure the following options are correctly set. Select Options from the Tools menu to verify following setting.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Compatibility
Parameters and Measure
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Infrastructure
Product Structure
Material Library
Catalog Editor
Photo Studio
Real Time Rendering
Part Infrastructure
DELMIA Infrastructure
3D Annotations Infrastruc
Collaboration Infrastructu
Mechanical Design
Shape
General
Display
Part Document
Display In Specification Tree
External References
Constraints
Parameters
Relations
Bodies under operations
Expand sketch-based feature nodes at creation
Display In Geometry Area
Only the current operated solid
Only current body
Geometry located after the current feature
Parameters of features and constraints
Axis system display size (in mm)
10
Checking Operation When Renaming
No name check
OK
Cancel

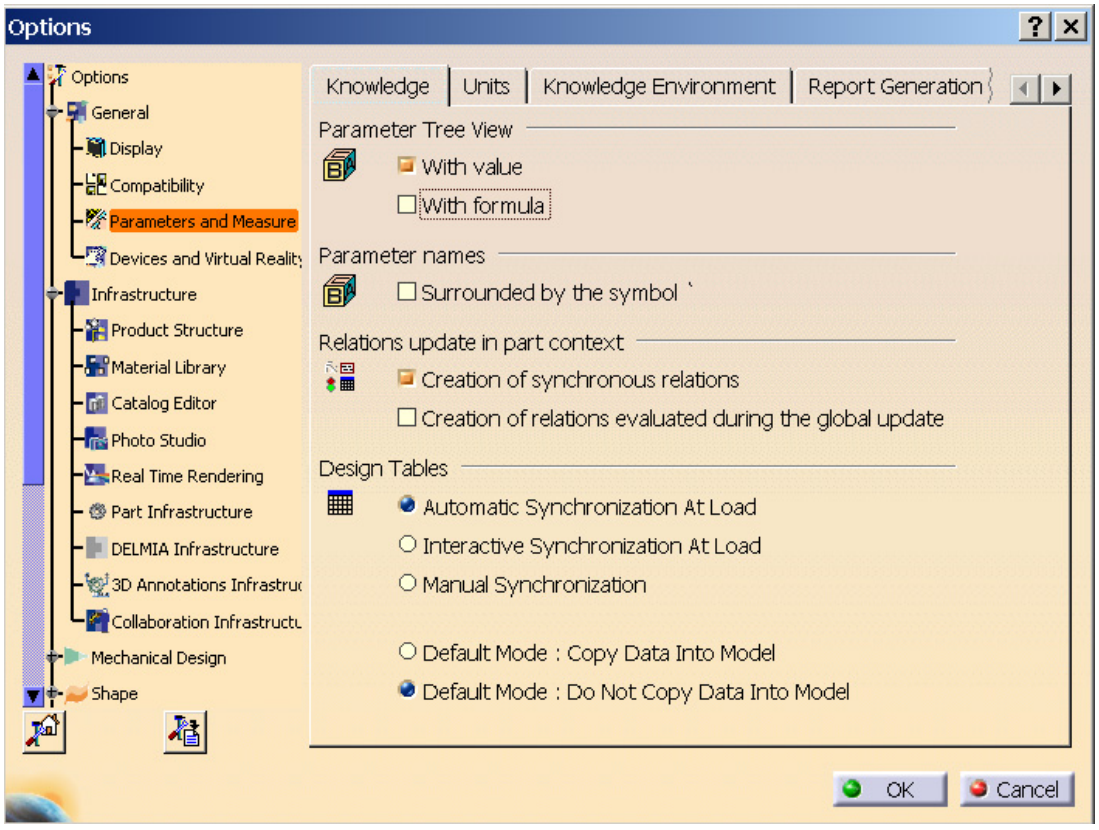
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Photo Studio
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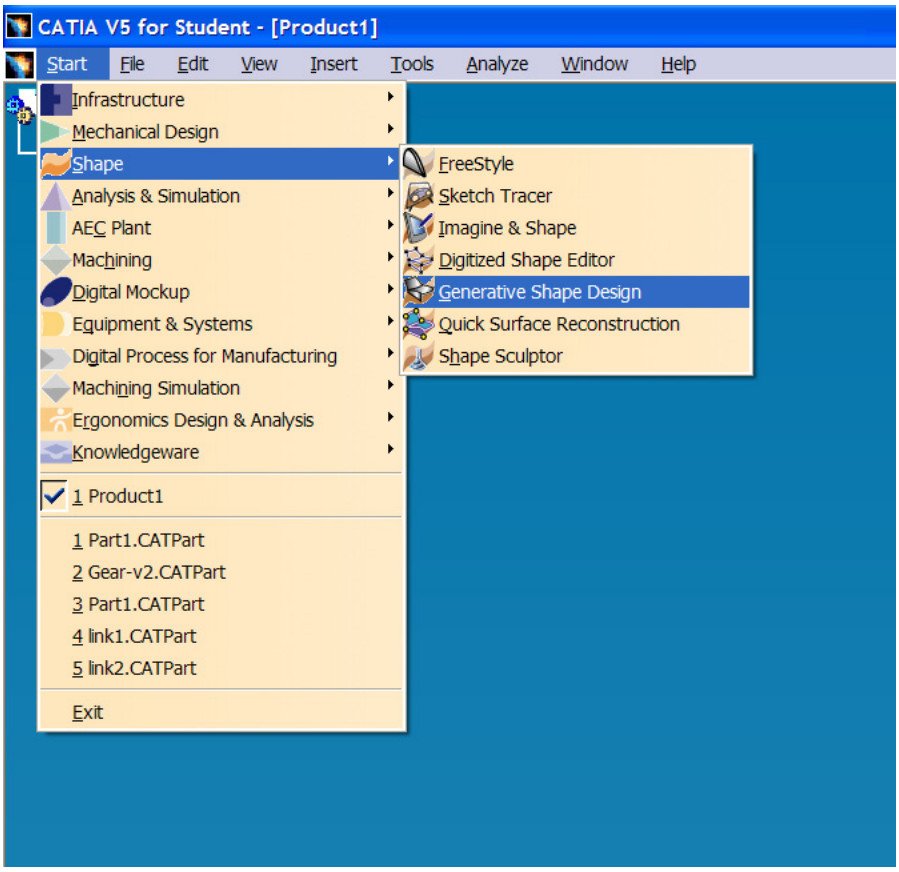
Mechanical Design
Shape
Knowledge
Units
Knowledge Environment
Report Generation
Parameter Tree View
With value
With formula
Parameter names
Surrounded by the symbol `
Relations update in part context
Creation of synchronous relations
Creation of relations evaluated during the global update
Design Tables
Automatic Synchronization At Load
Interactive Synchronization At Load
Manual Synchronization
Default Mode : Copy Data Into Model
Default Mode : Do Not Copy Data Into Model
OK
Cancel

Enter the GSD workbench as the following picture.

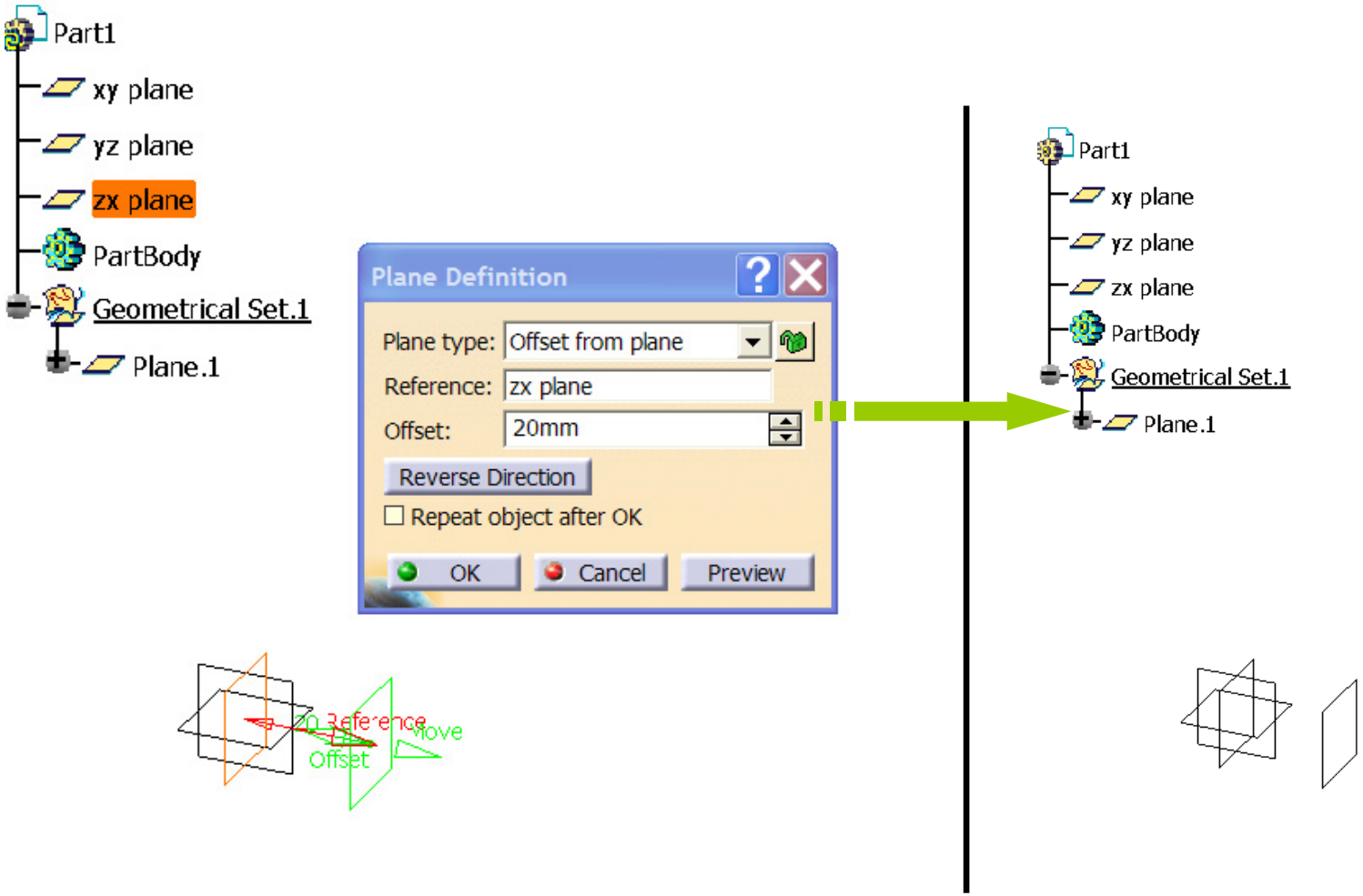


Please note:

You can always press F1 when in a function in CATIA. When pressing F1, a help window will open explaining in detail the function that you are currently working in. This is very helpful, so try to use F1 during this exercise.

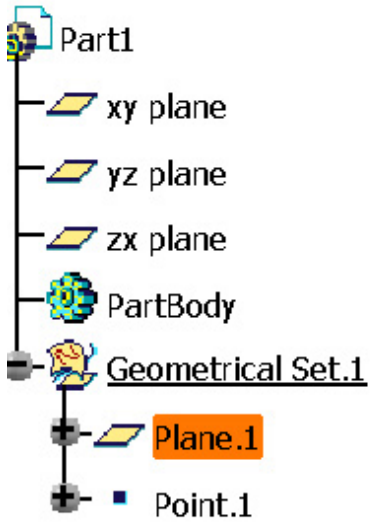
Create a Plane

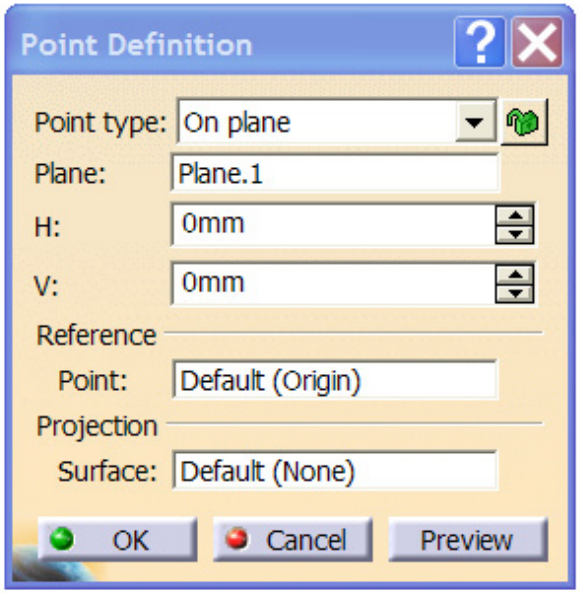
- Create an offset plane from the *zx plane* and 20mm Offset.

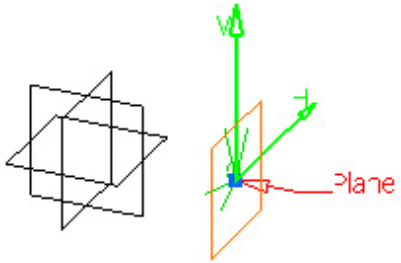


Create a Point

- Create a point in the middle of *Plane.1* as follows

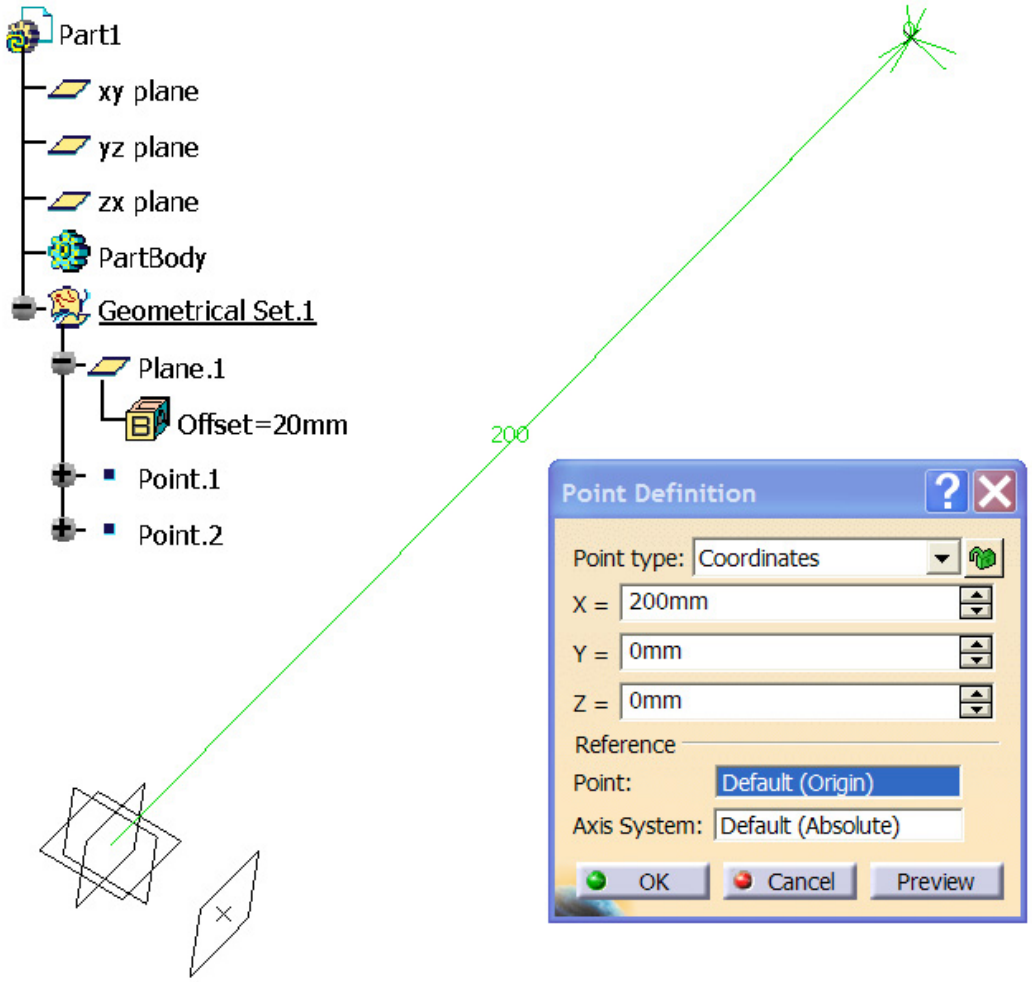






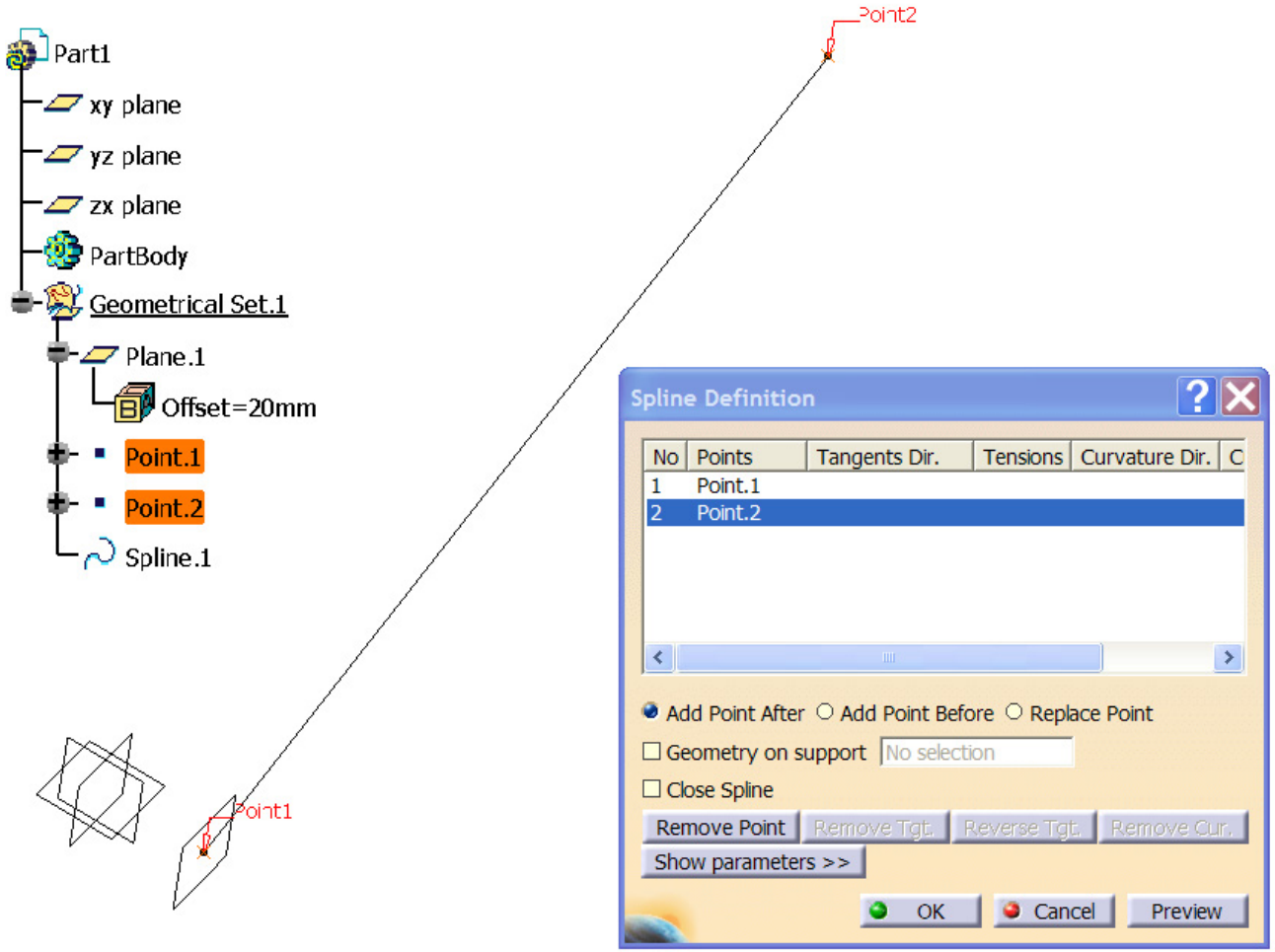
Create a Point

- Create a point with a 200mm *X offset* from *Point.1*



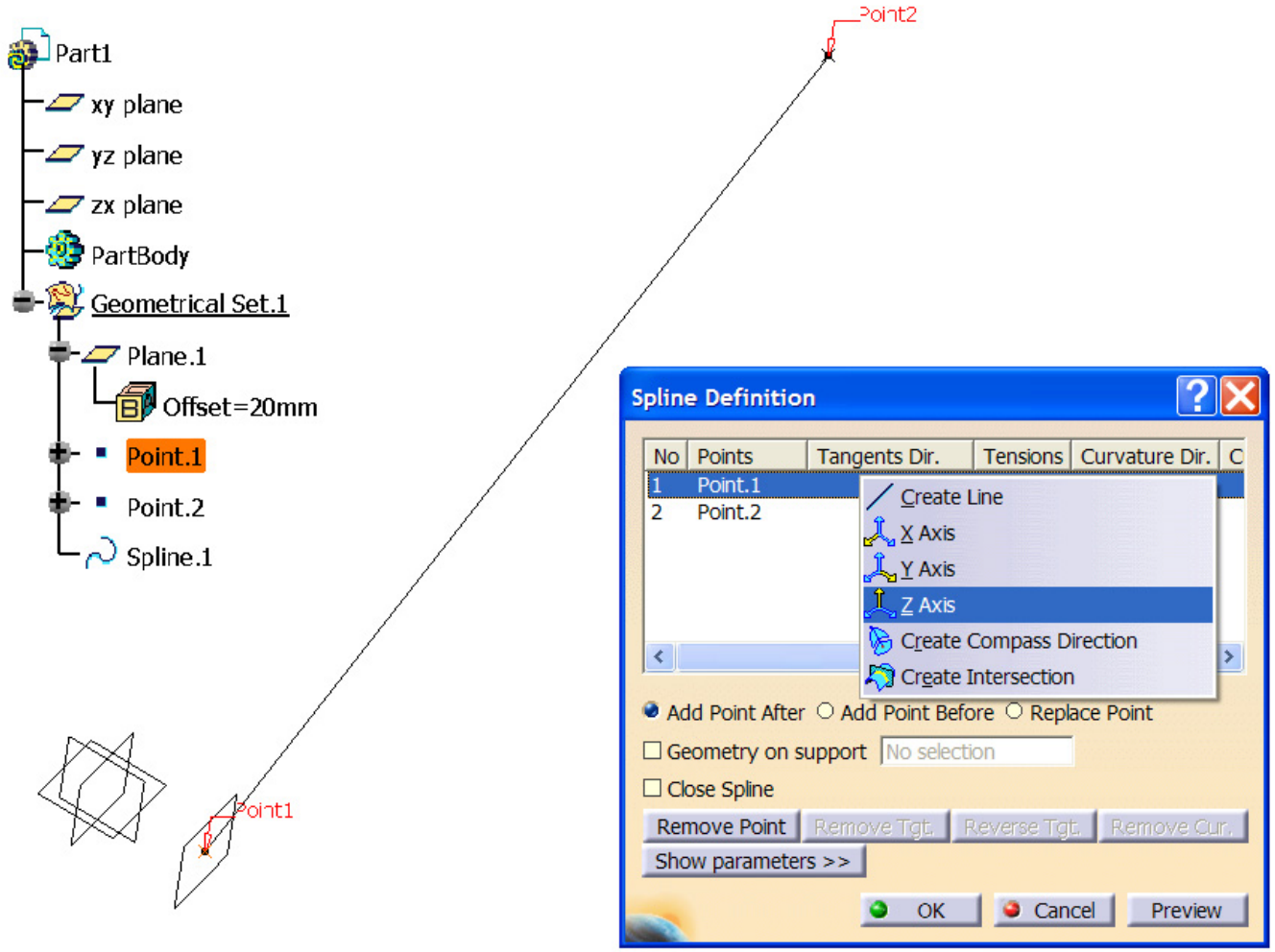
Create a Spline(1/2)

- Create a spline through *Point.1* and *Point.2*



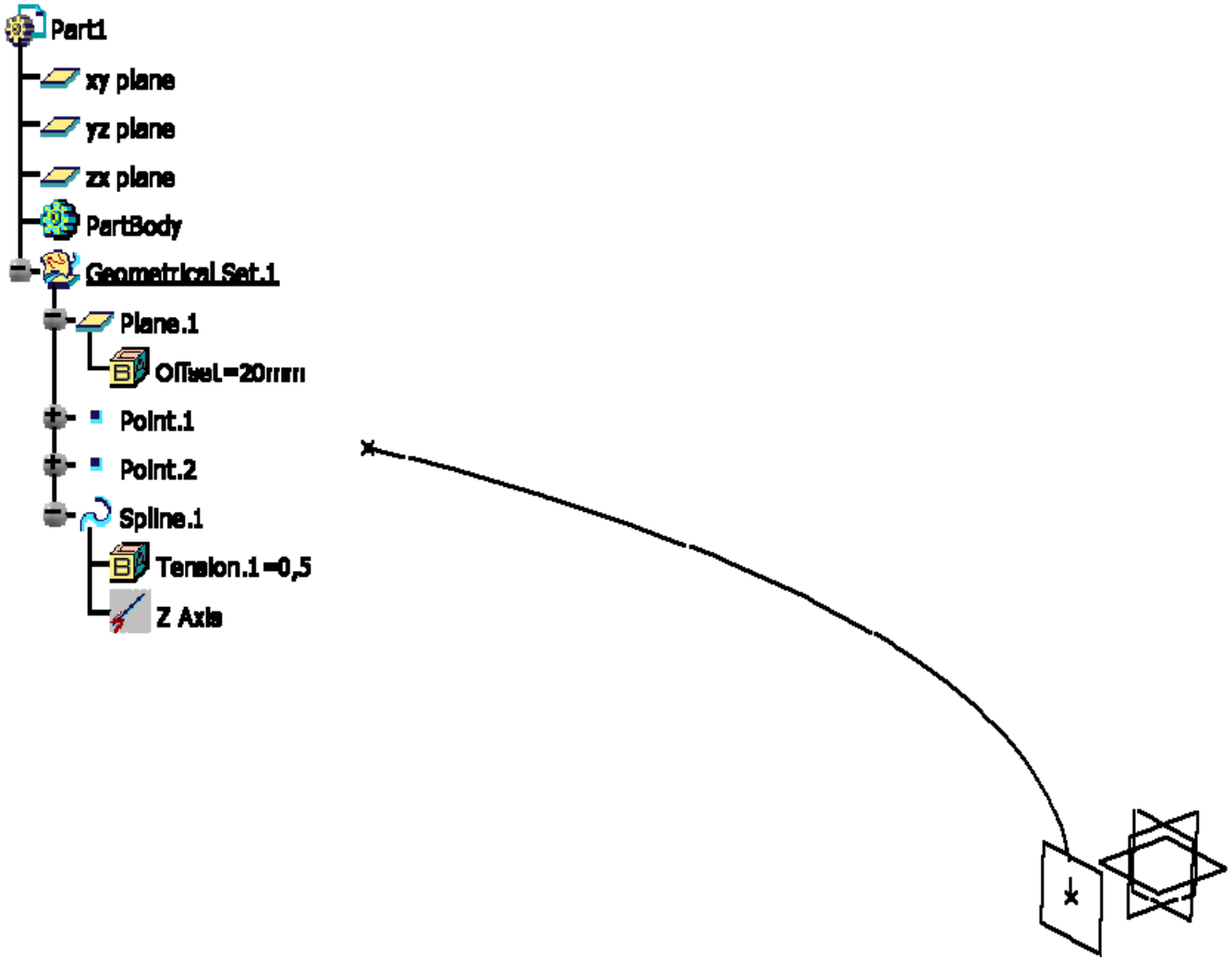
Create a Spline(2/2)

- Create a *Z axis tangency* through *Point.1* by right clicking on Tangents Dir. on *Point.1*



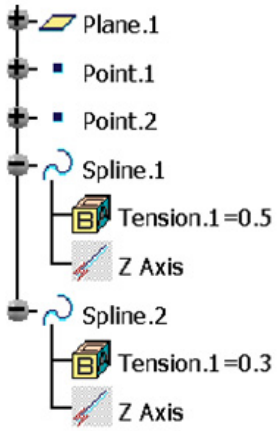
Change Tension

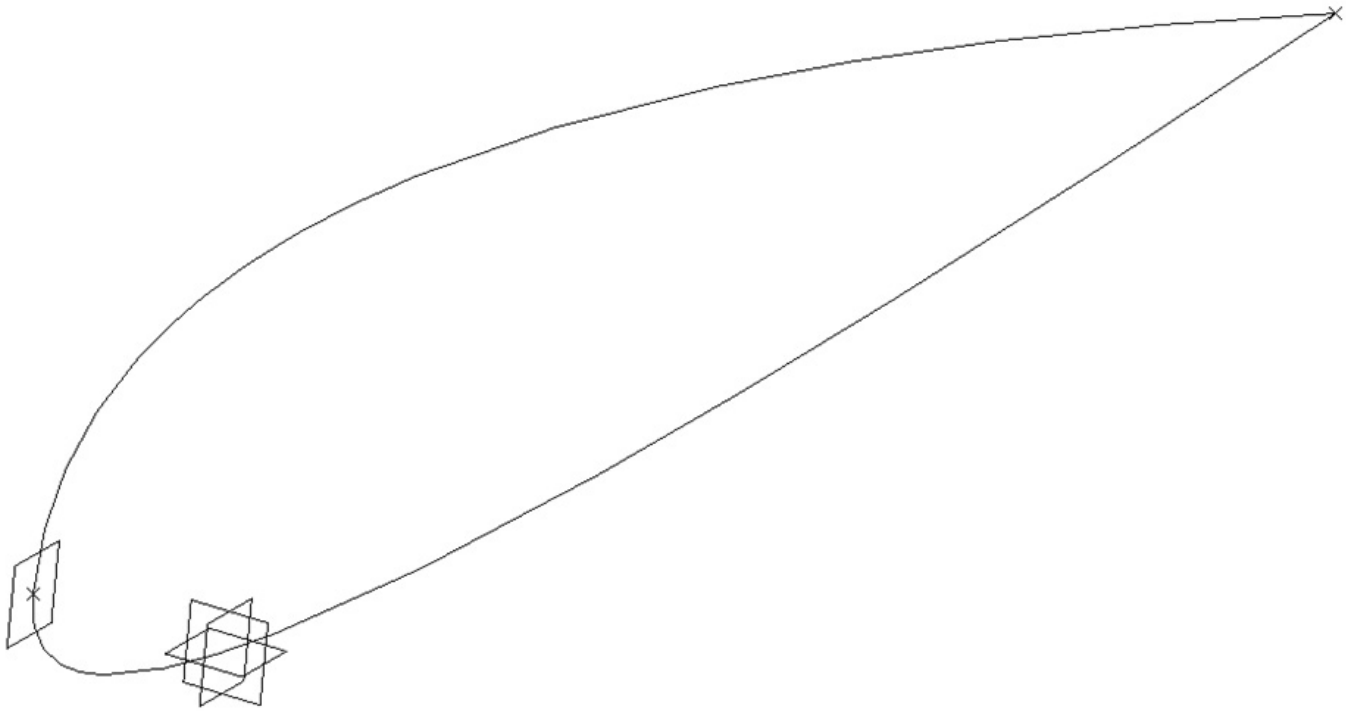
- Change *Tension.1* parameter under *Spline.1* to 0.5



Create Spline number two

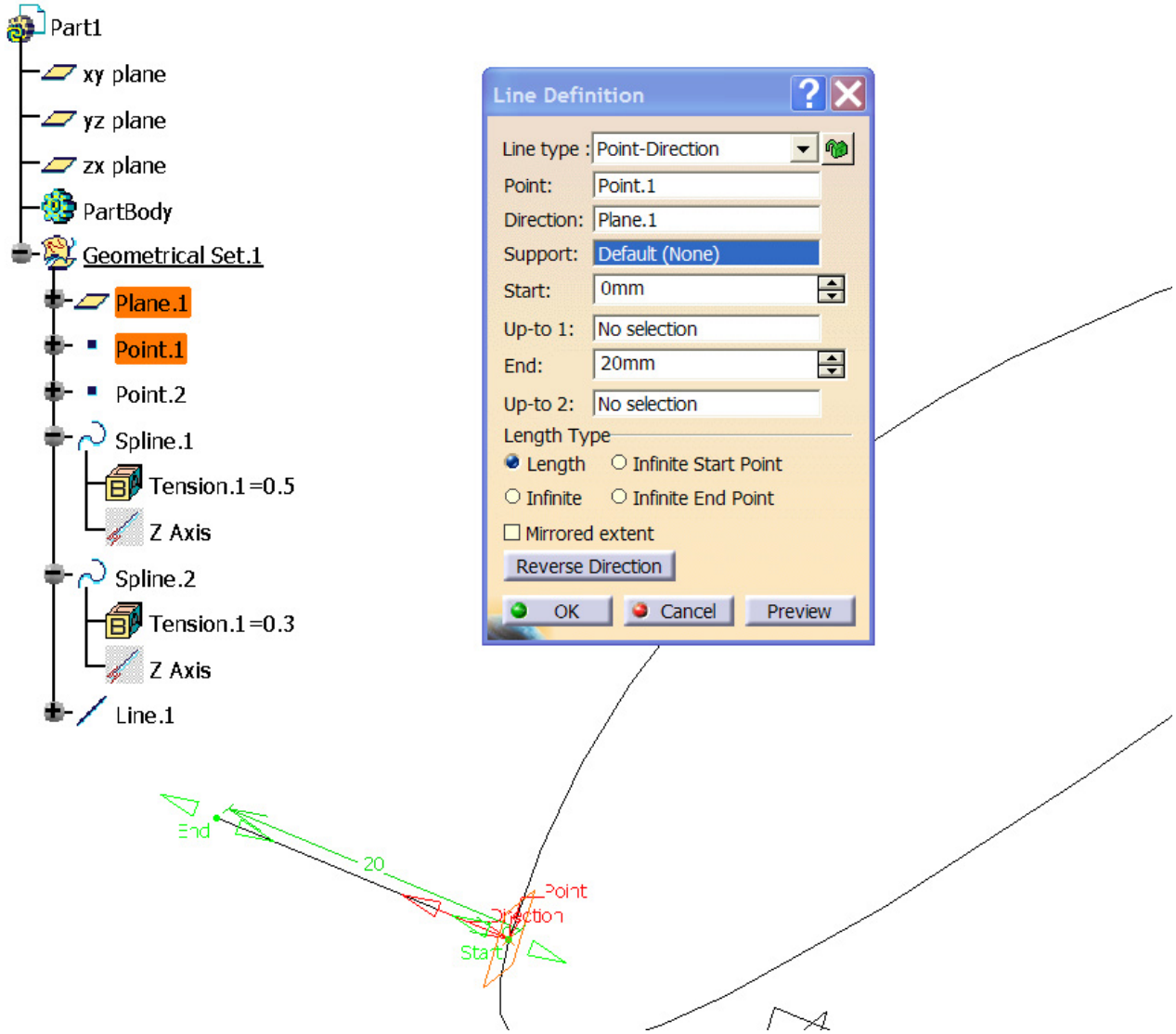
- Repeat the Instructions when creating for *Spline.1* and Create spline number two
- Press Reverse Tgt. while in the spline tool (so the spline goes the opposite direction of *Spline.1*)
- Change tension to 0.3





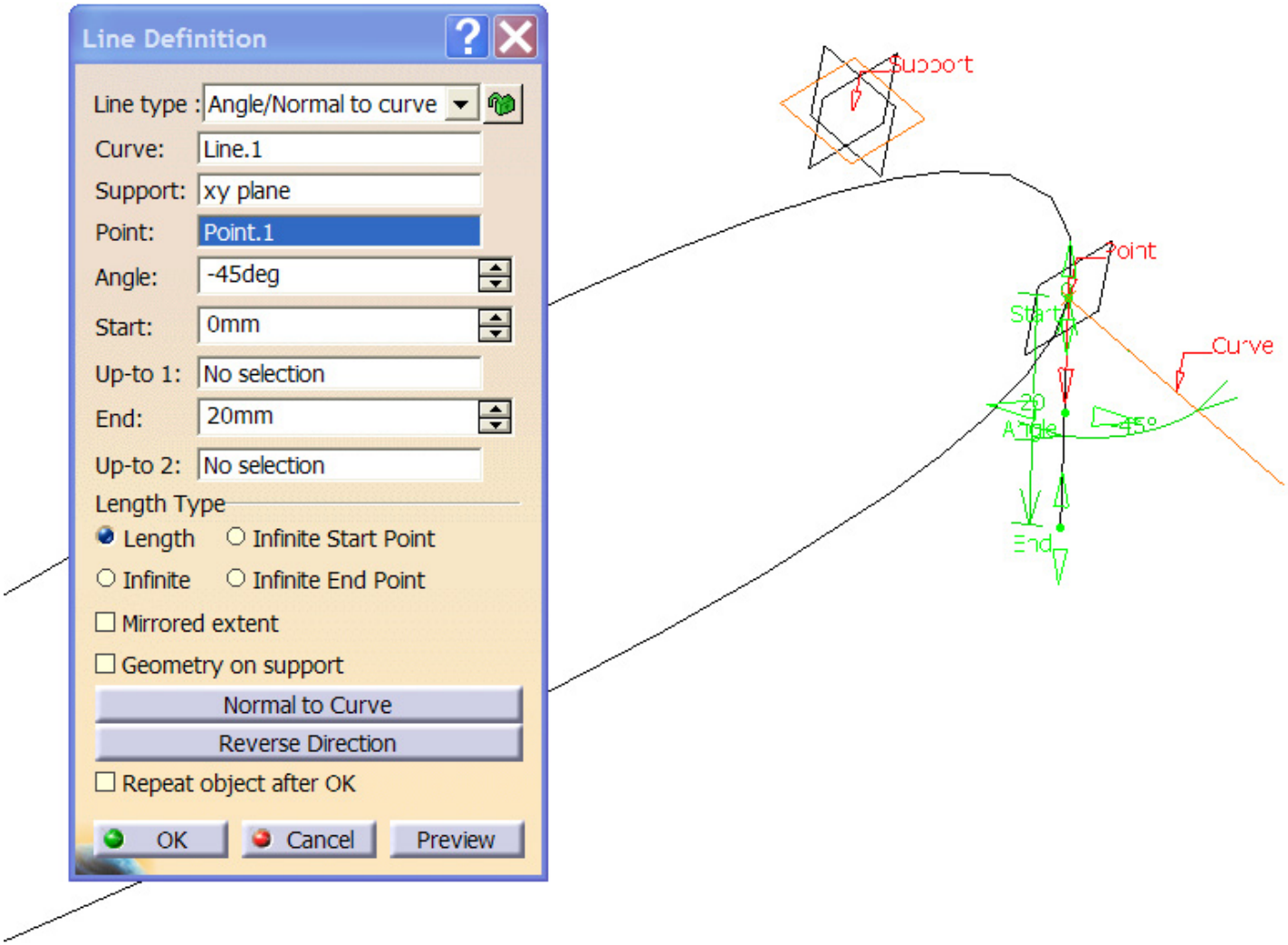
Create a Line

- Create a Line, of type Point-Direction and choose *Plane.1* as Direction and *Point.1* as Point.



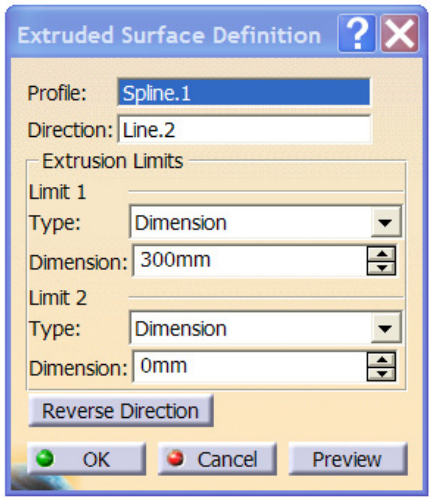
Create one more Line

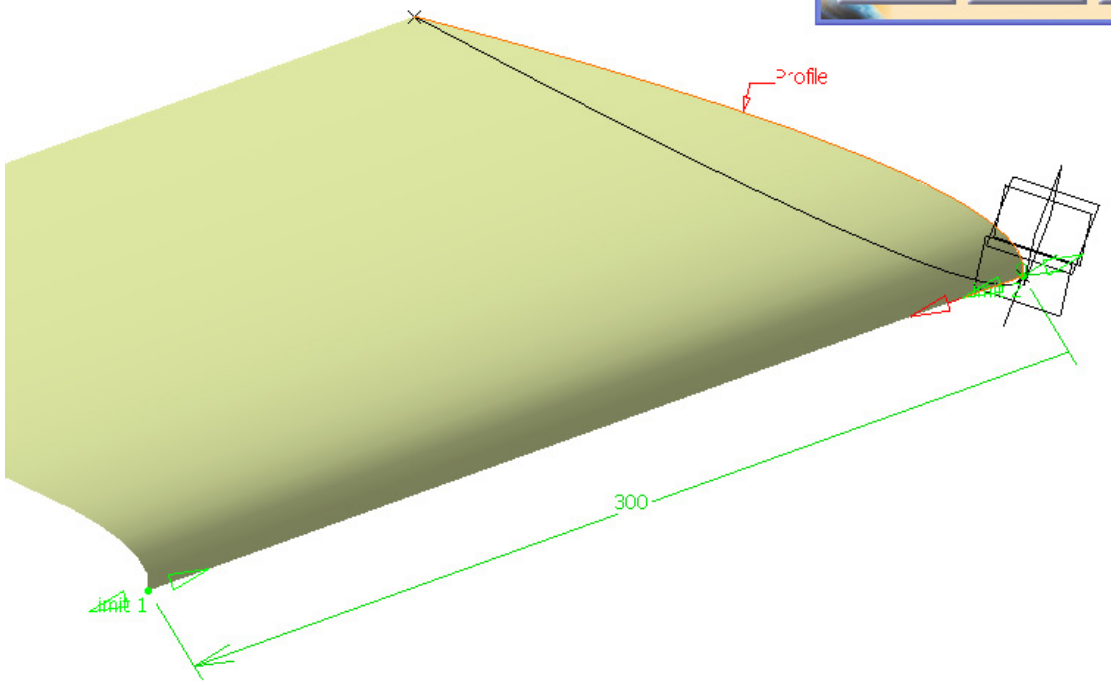
- Create a line of type *Angle/Normal to curve* and choose *Point.1* as Point, *xy plane* as Support and *Line.1* as Curve. Change the Angle to -45 deg



Extrude Surface (1/2)

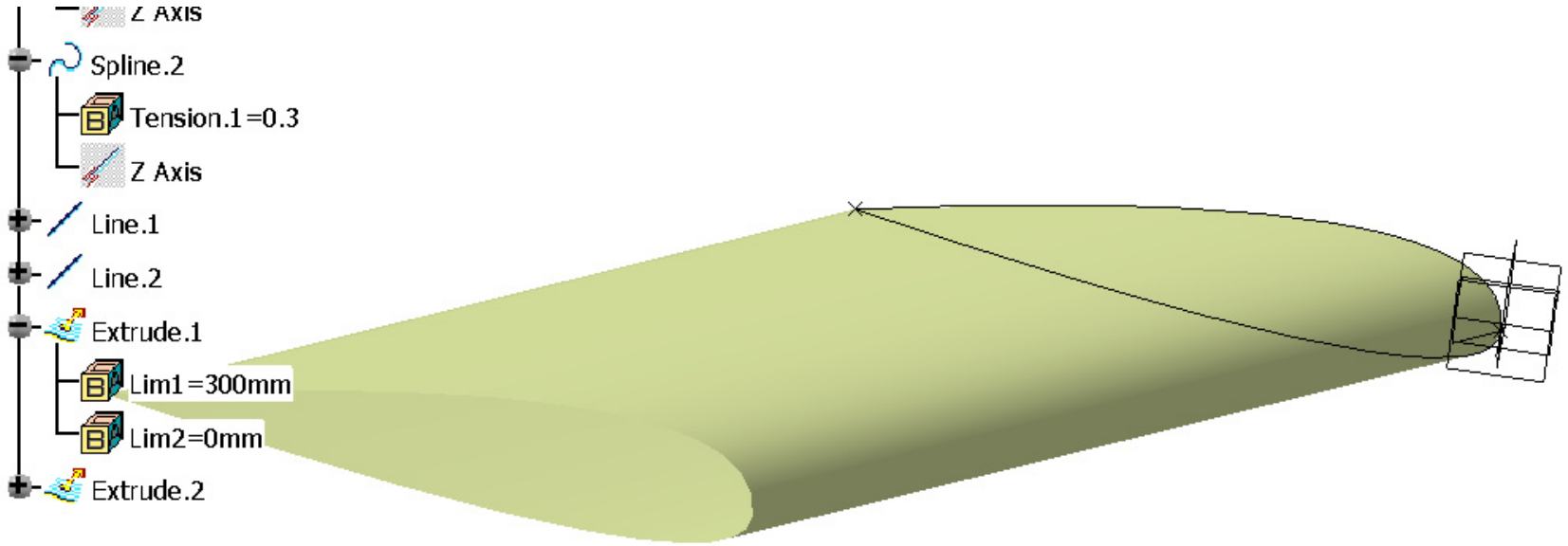
- Choose the *Extrude Surface tool* and Choose *Spline.1* as Profile and *Line.2* as Direction





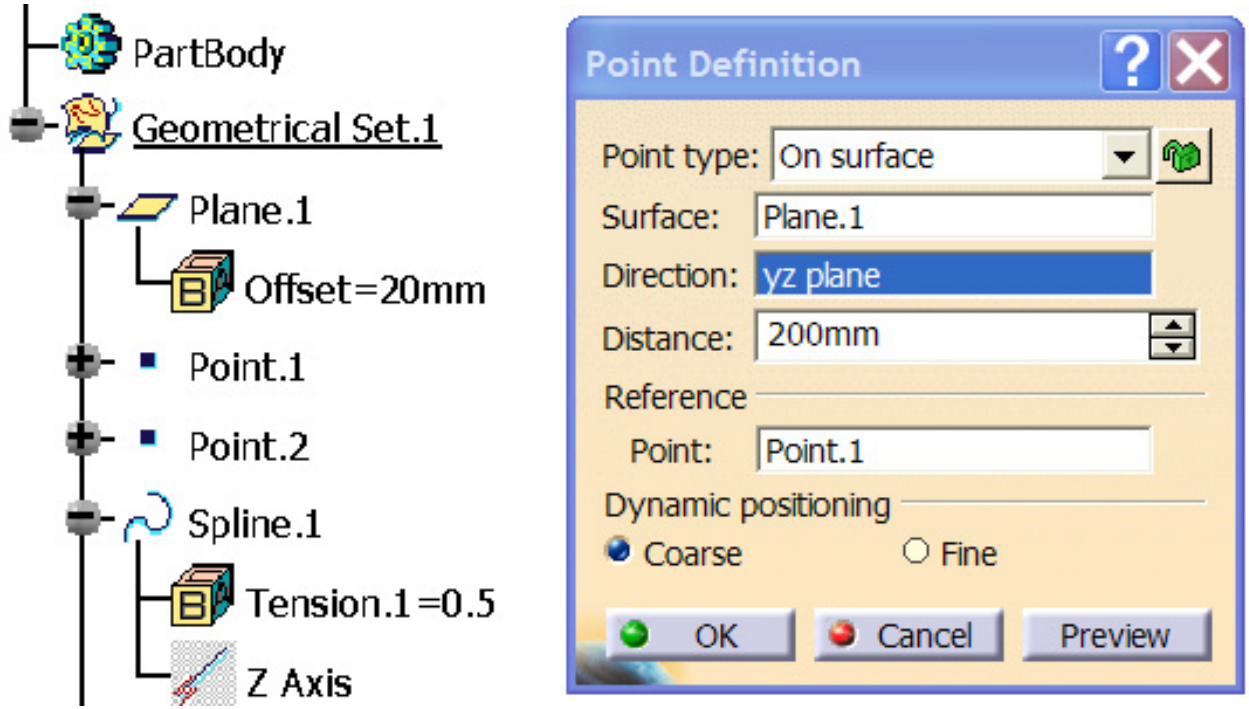
Extrude Surface (2/2)

- Repeat the same procedure to create the bellow surface with *Spline.2* as Profile.

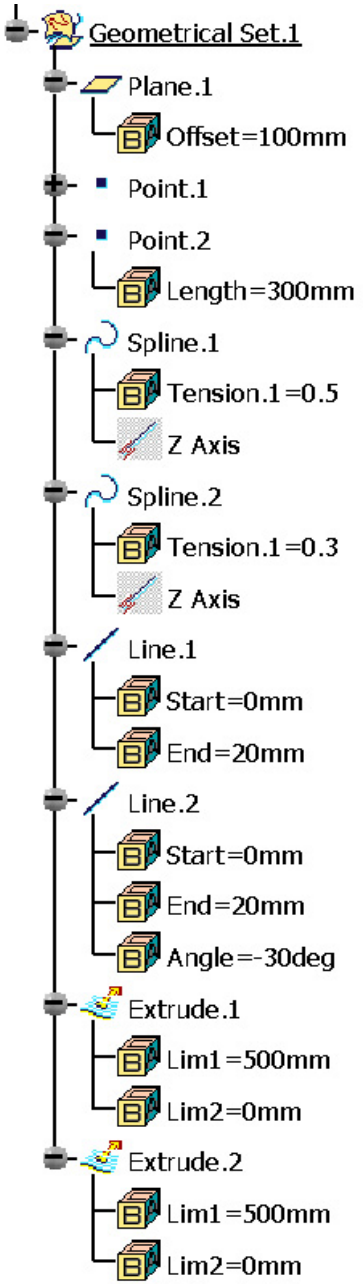


Change Point type

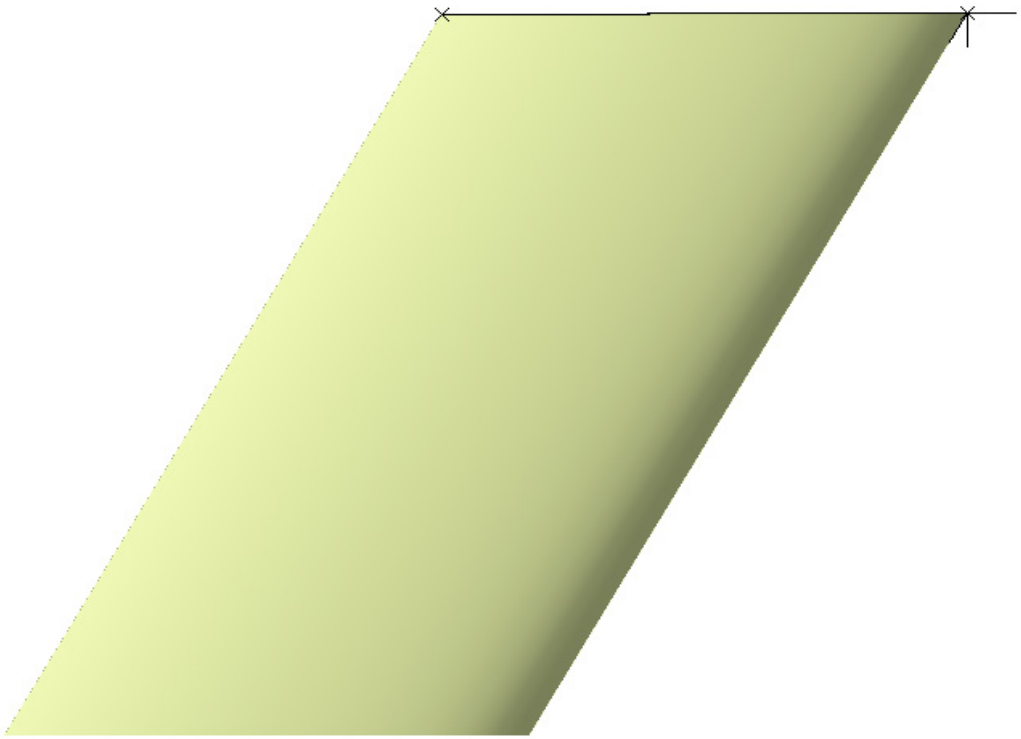
- Change the *Point type* of *Point.2* to the following. Change the direction to *yz plane*



Modify Parameters

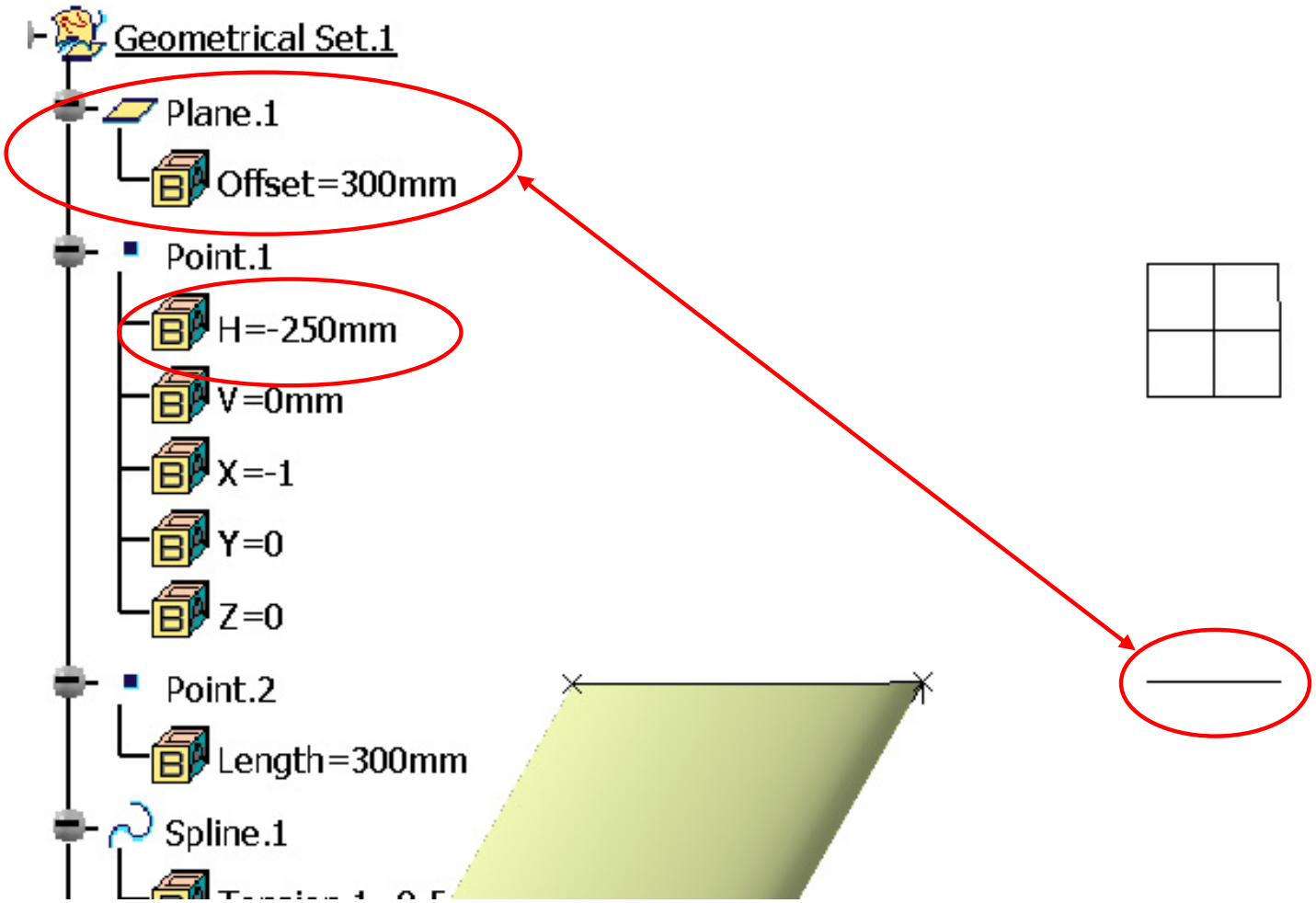


- Modify your parameters to the following to further understand how your model works



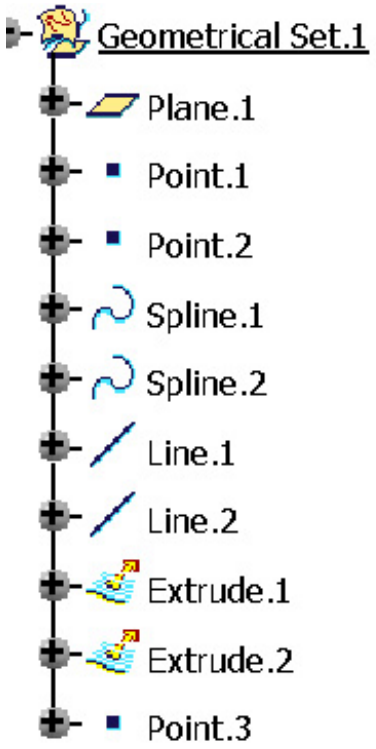
Modify Plane

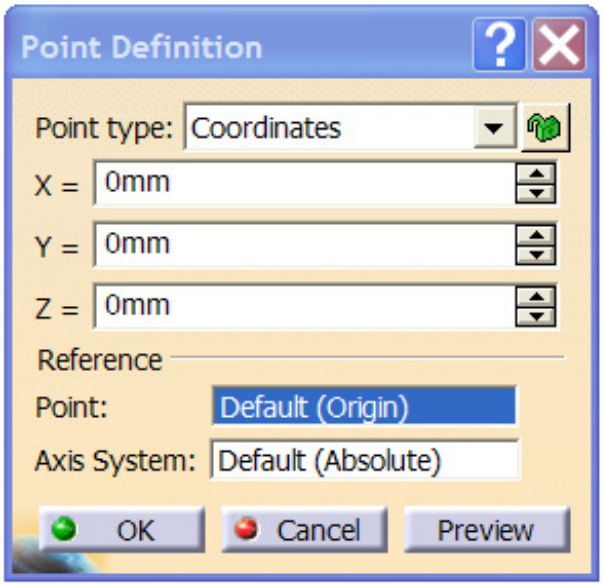
- Modify *Offset* of *Plane.1* to 300mm and *H* of *Point.1* to 250mm

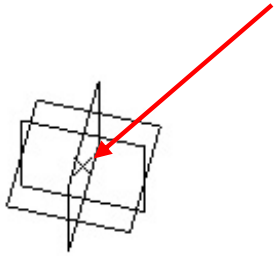


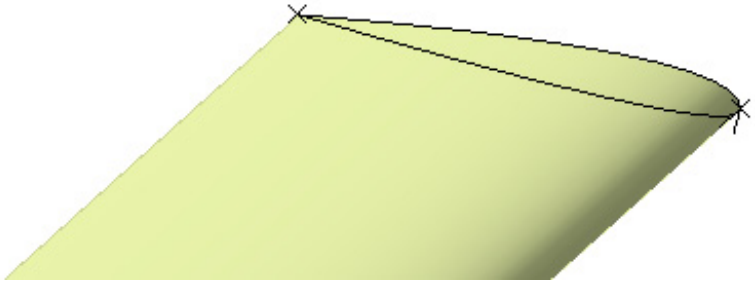
Create a Point

- Create a new Point as following



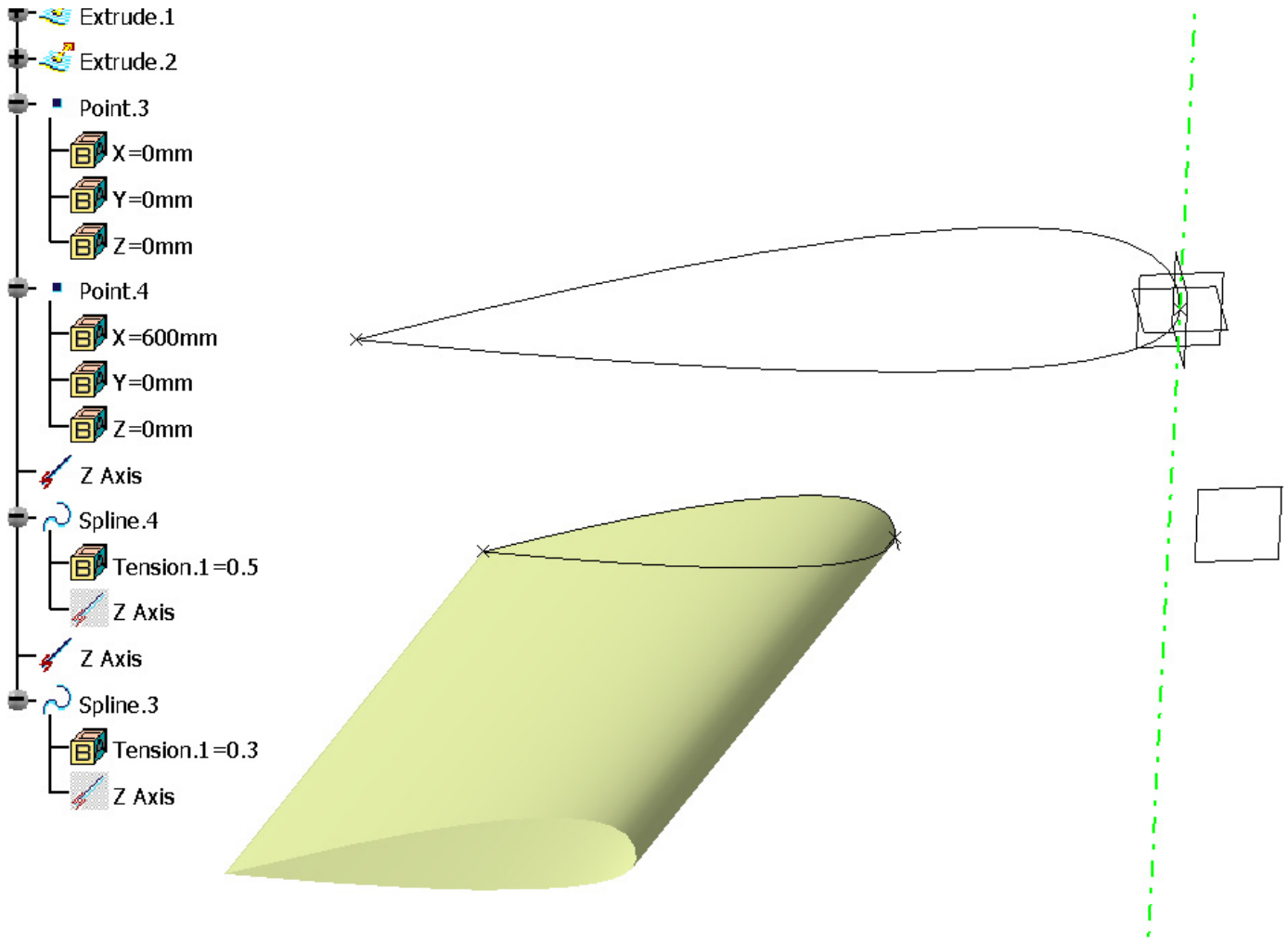






Create another Profile (Two more Splines)

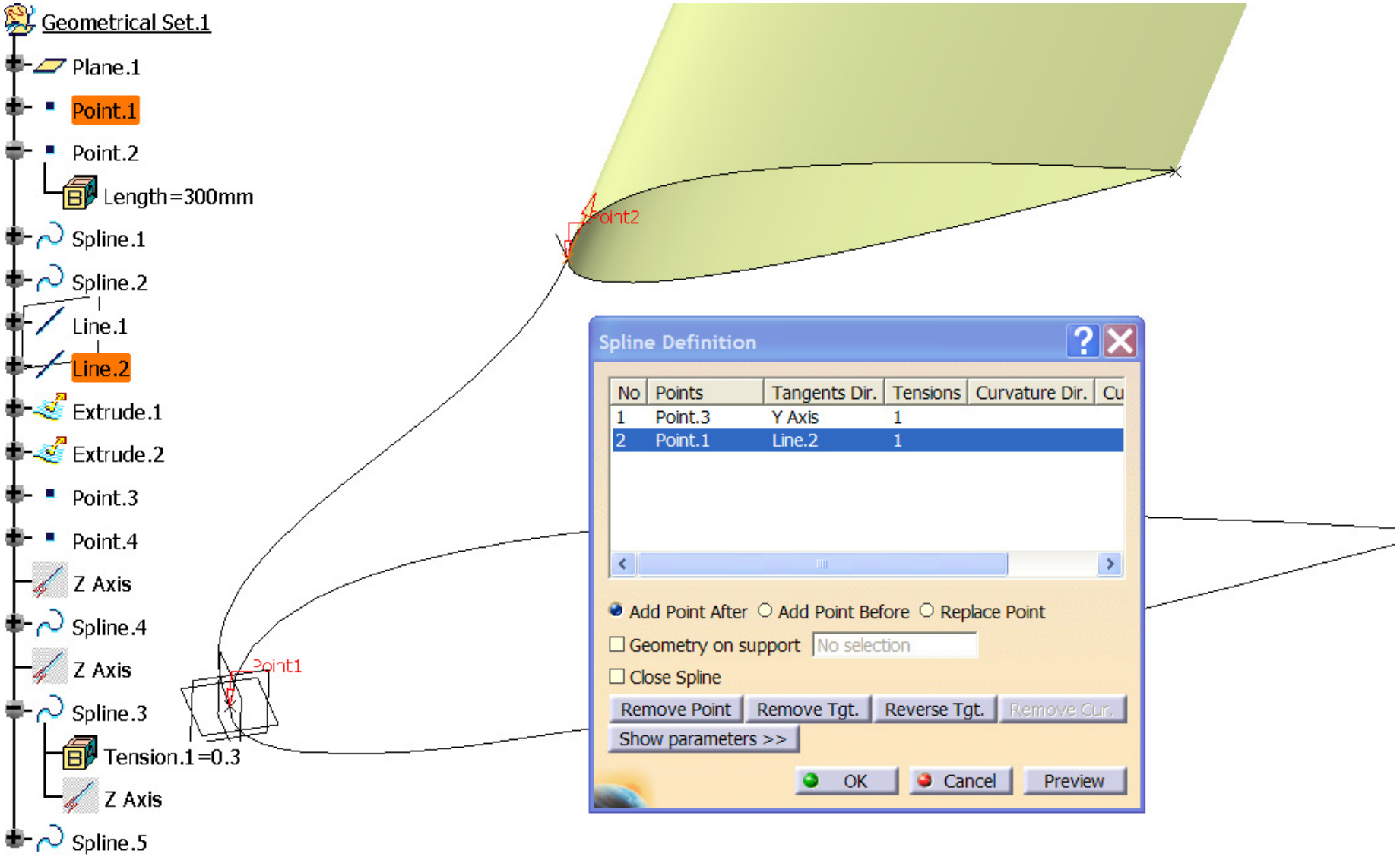
- Introduce a new profile based on the newly created point as such
- Note: See Step 4 to Step 7 in this tutorial



Create a Spline (1/2)

- Create a Spline connecting the two profiles (See picture on next step).
- Give Tangent Dir. *Y axis* for *Point.3*
- Give Tangent Dir. *Line.2* for *Point.1.*
- Note: To be able to choose *Line.2* you have to click directly on the tree.

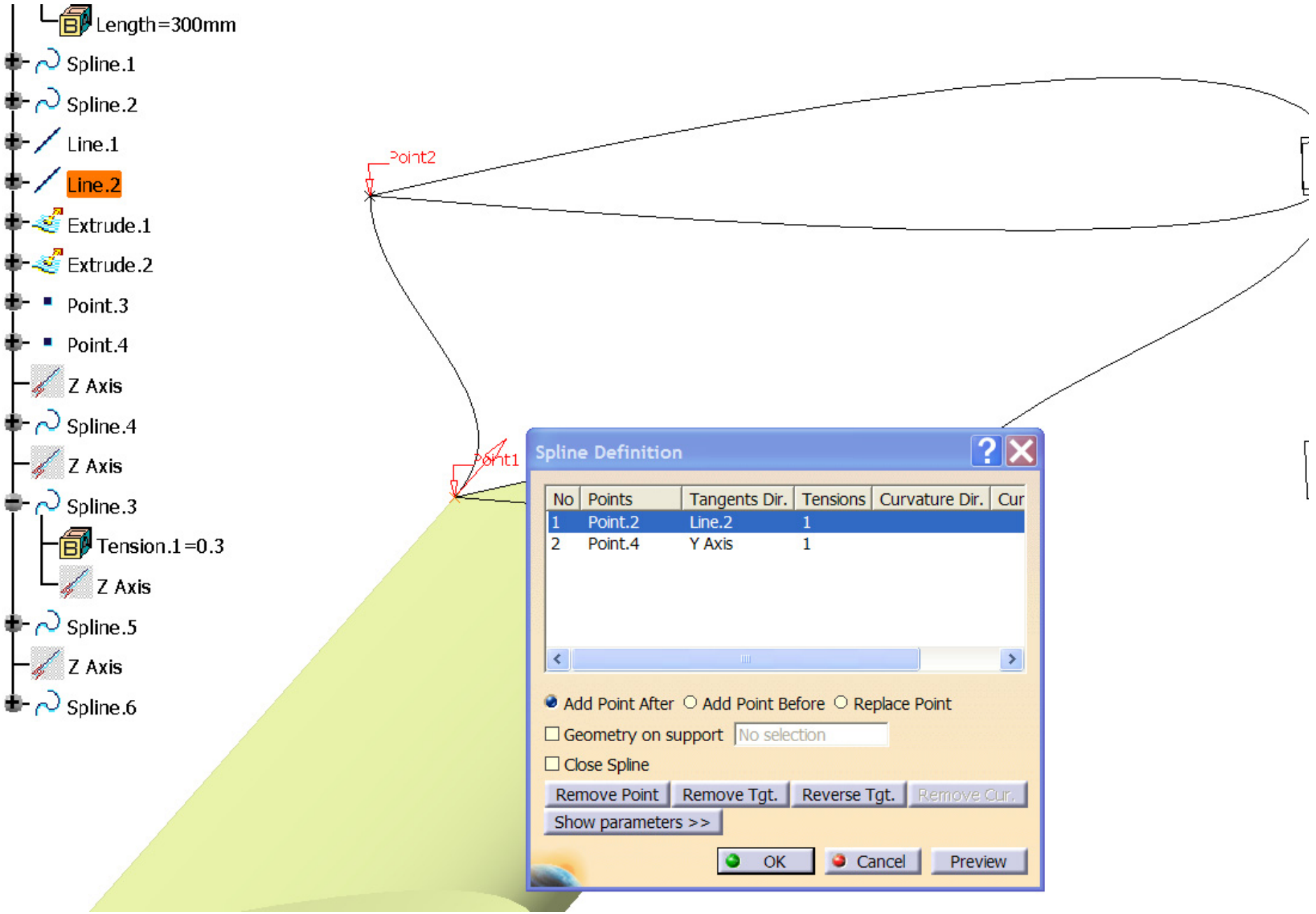
Create a Spline (2/2)



Create one more Spline (1/2)

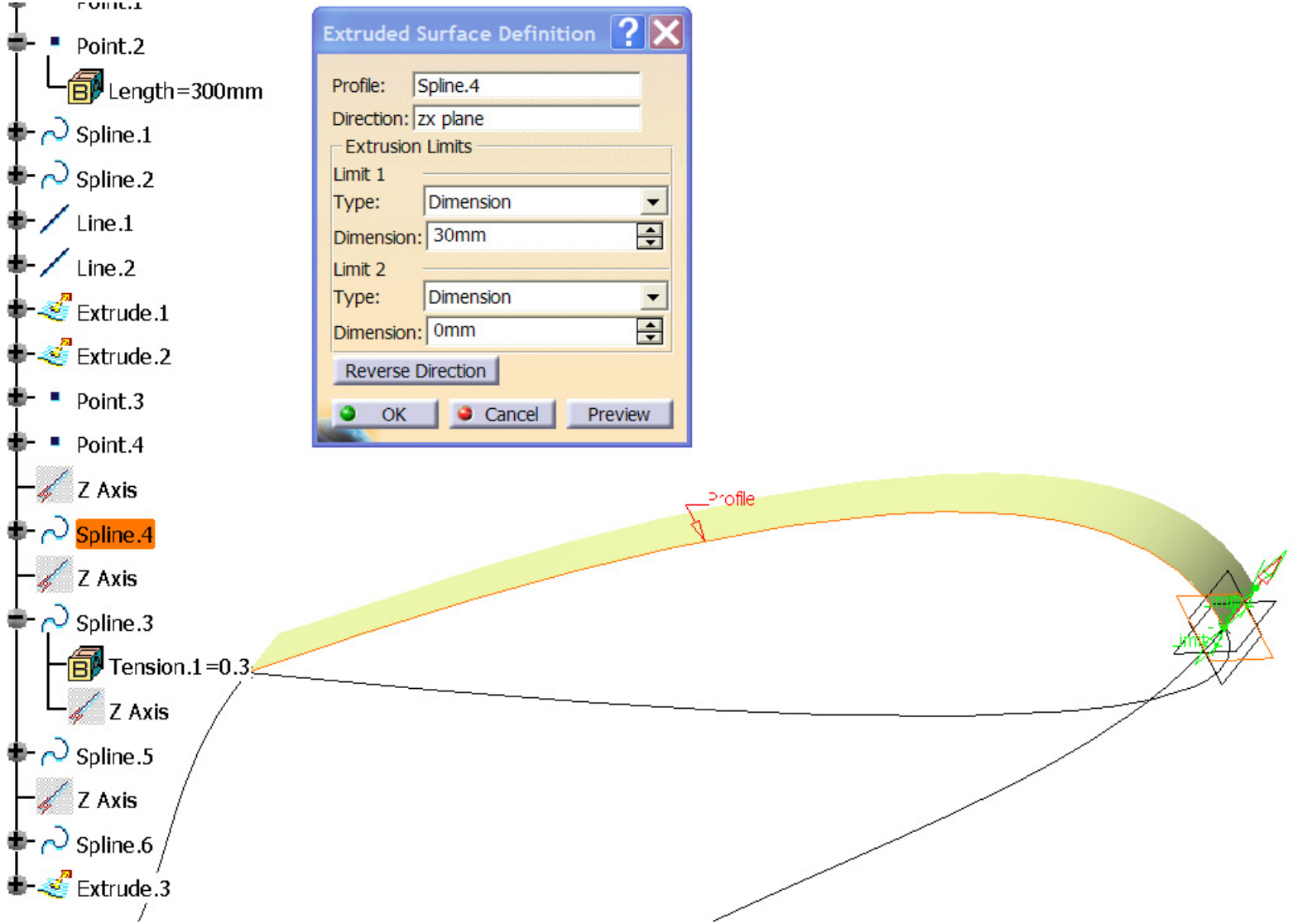
- Create another Spline connecting *Point.2* and *Point.4*.
- Introduce Tangent Dir. on this Spline as well (See picture on next step).

Create one more Spline (2/2)



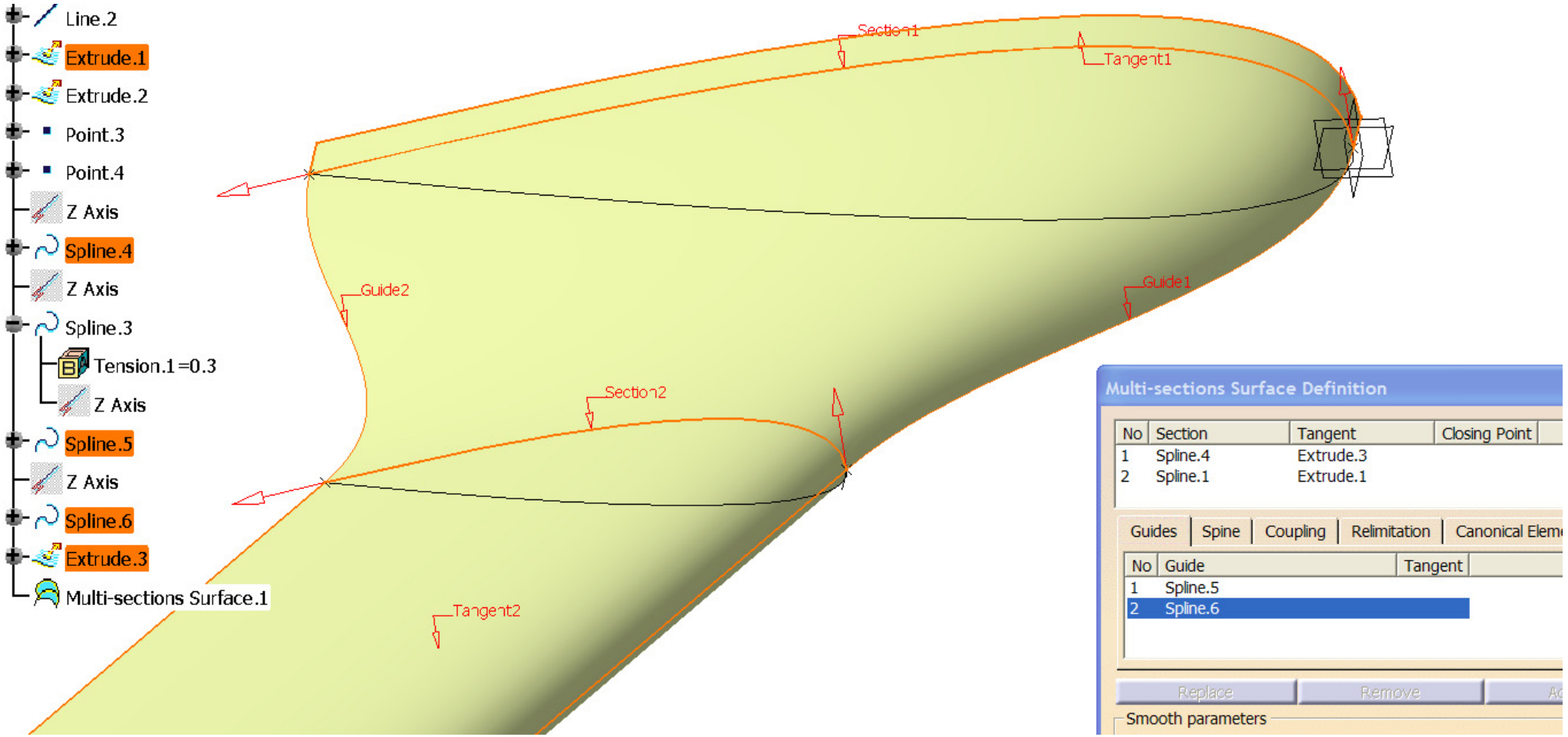
Create an Extrude Surface

- Create an *Extrude Surface* on Spline.4 This will be used as a Guide surface later. Use direction *zx plane*



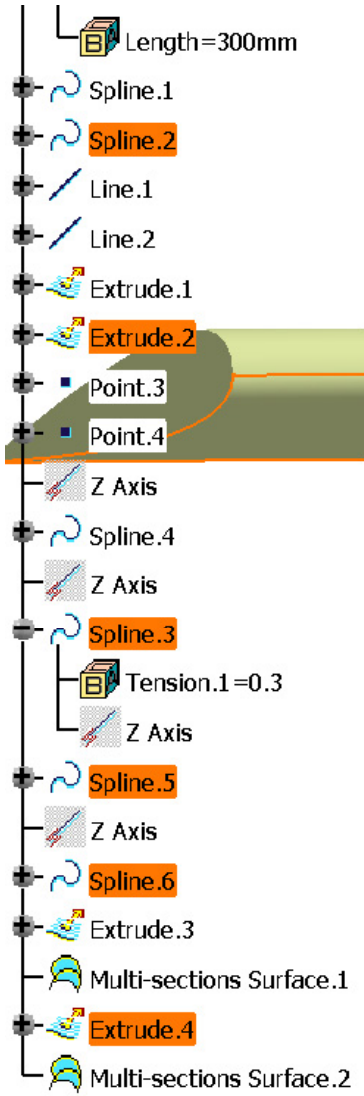
Create a Multi-section Surface

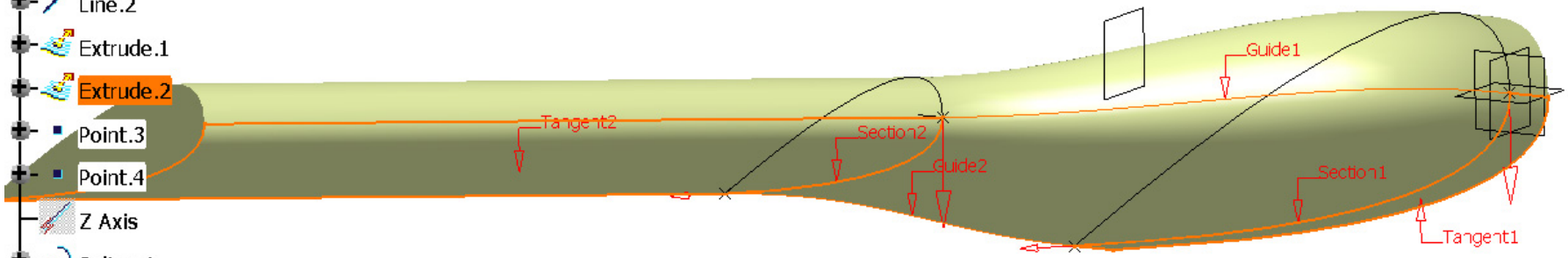
- Choose the Multi-section Surface tool and create a surface by choosing *Spline.4* and *Spline.1* as Sections and *Spline.4* and *Spline.6* as Guides.
- Also choose *Extrude.3* and *Extrude.1* as Tangent.

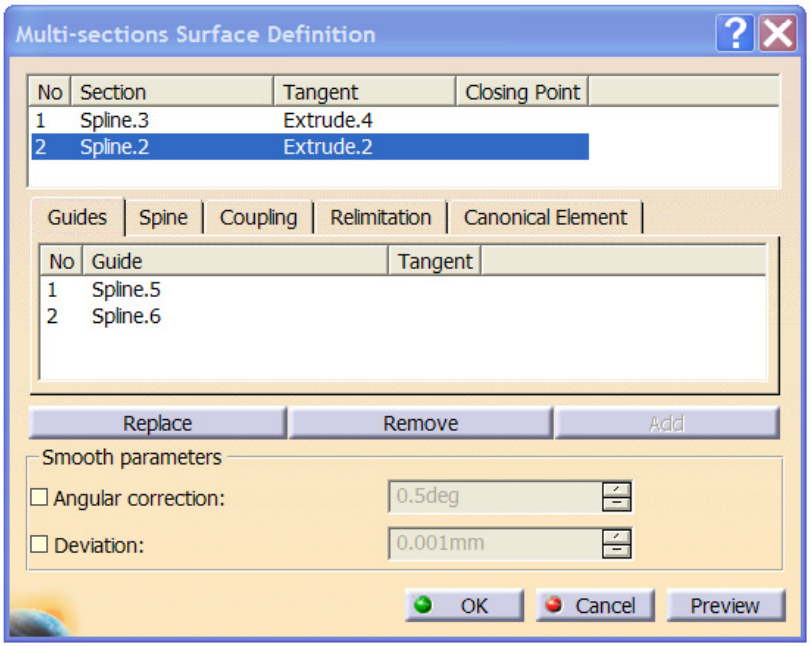


Create another Multi-section Surface

- Do the same procedures as previous step and create another surface for the underside.

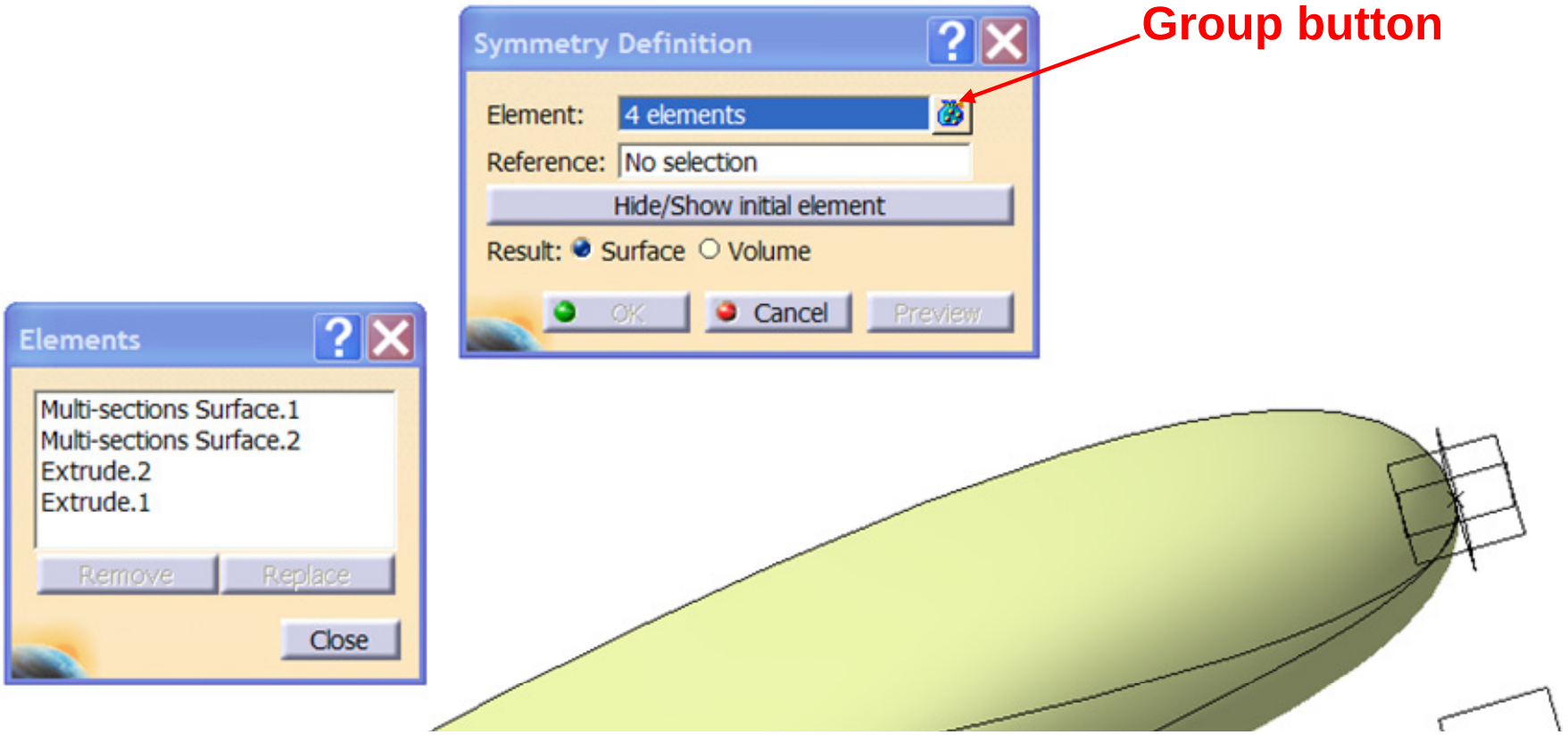






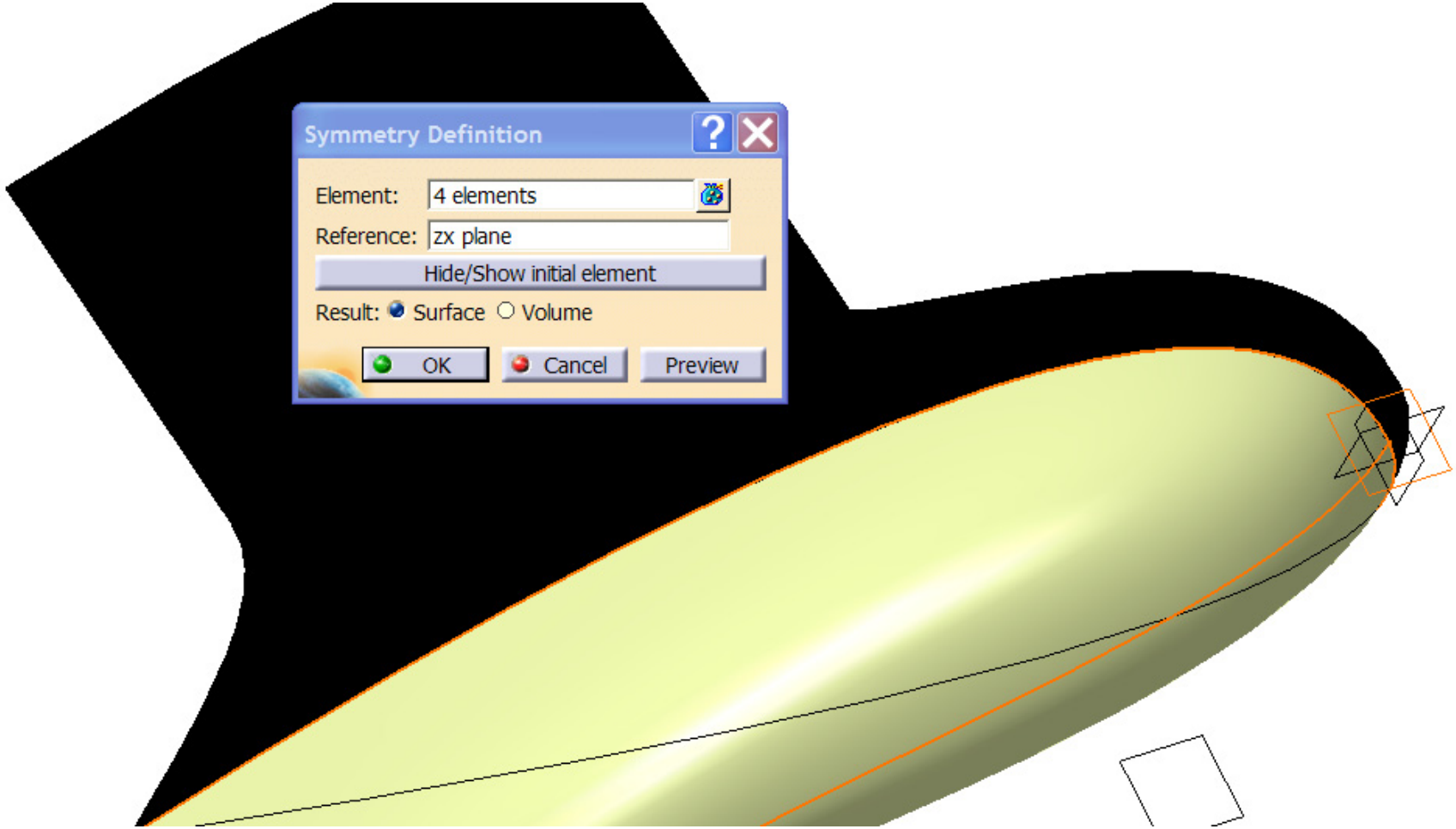
Create a Symmetry (1/2)

- Hide the help surfaces created.
- Choose the *Symmetry tool* and select the following surfaces by first clicking on the *group button*.
- When finished press Close.



Create a Symmetry (1/2)

- Choose the *zx plane* as *Reference* and press OK



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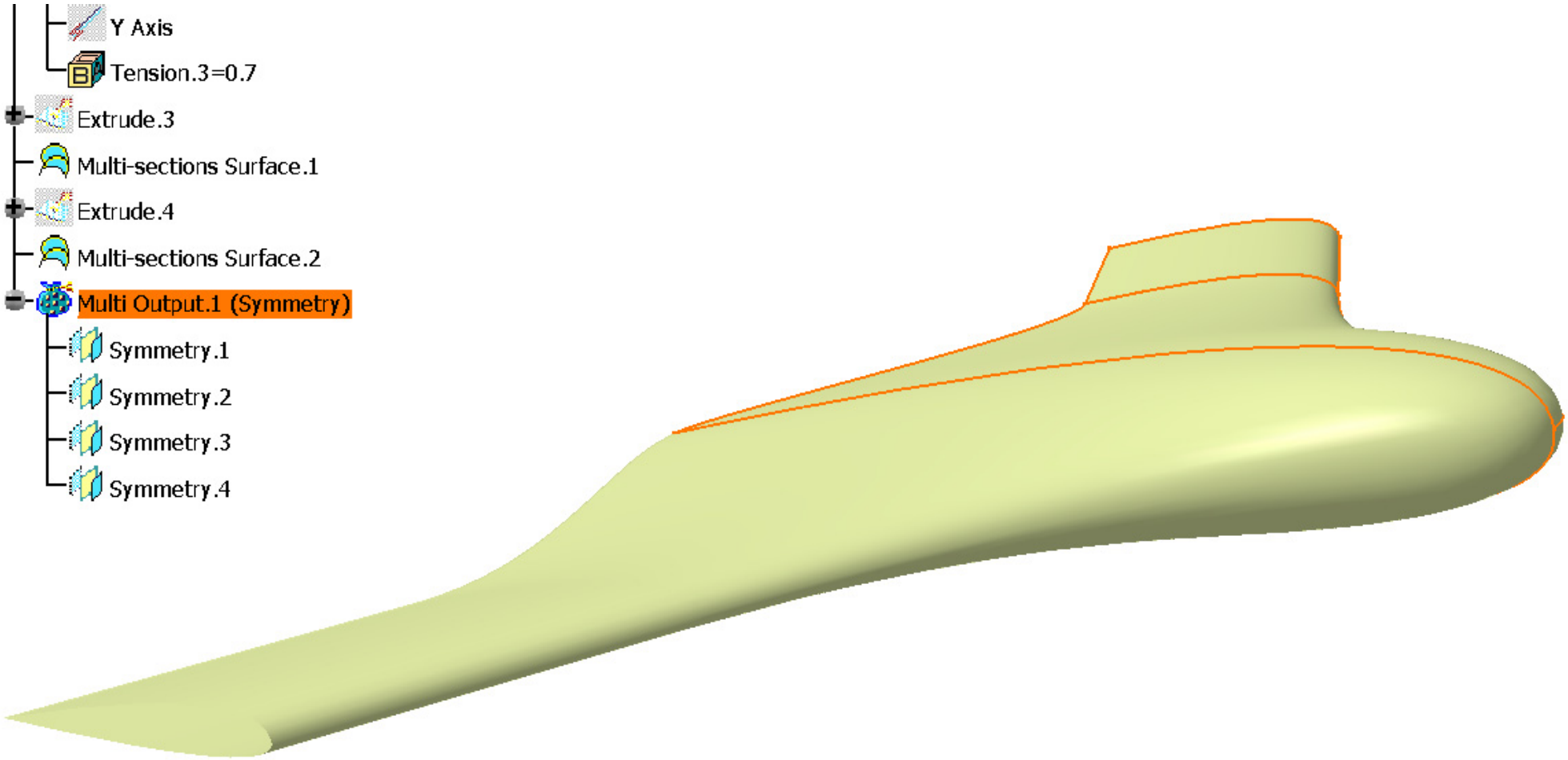
Modify Parameters

- Modify the parameters in the *model tree* to get the appearance you whish for

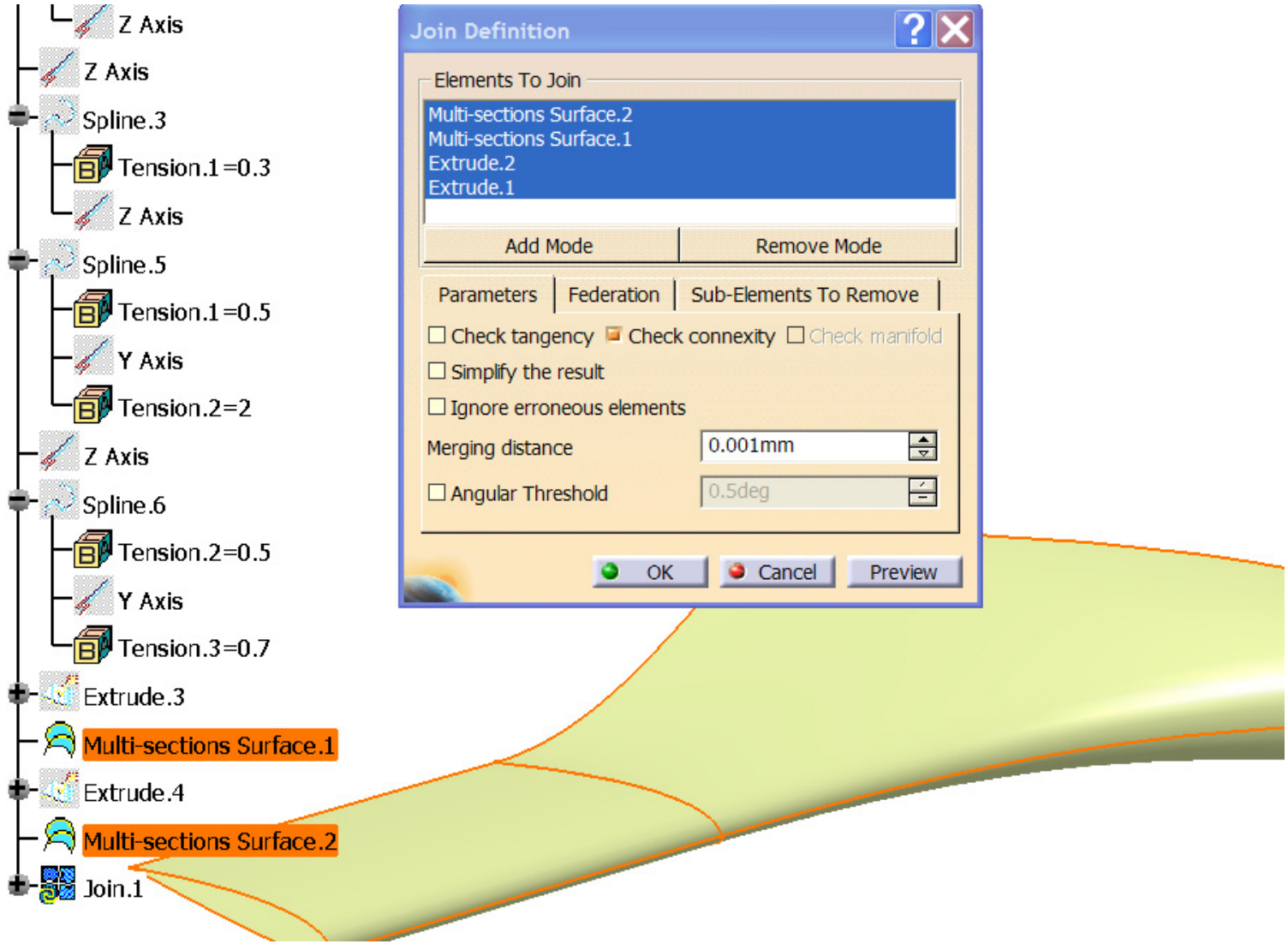
Delete an object

- Delete the *Multi Output.1* object.



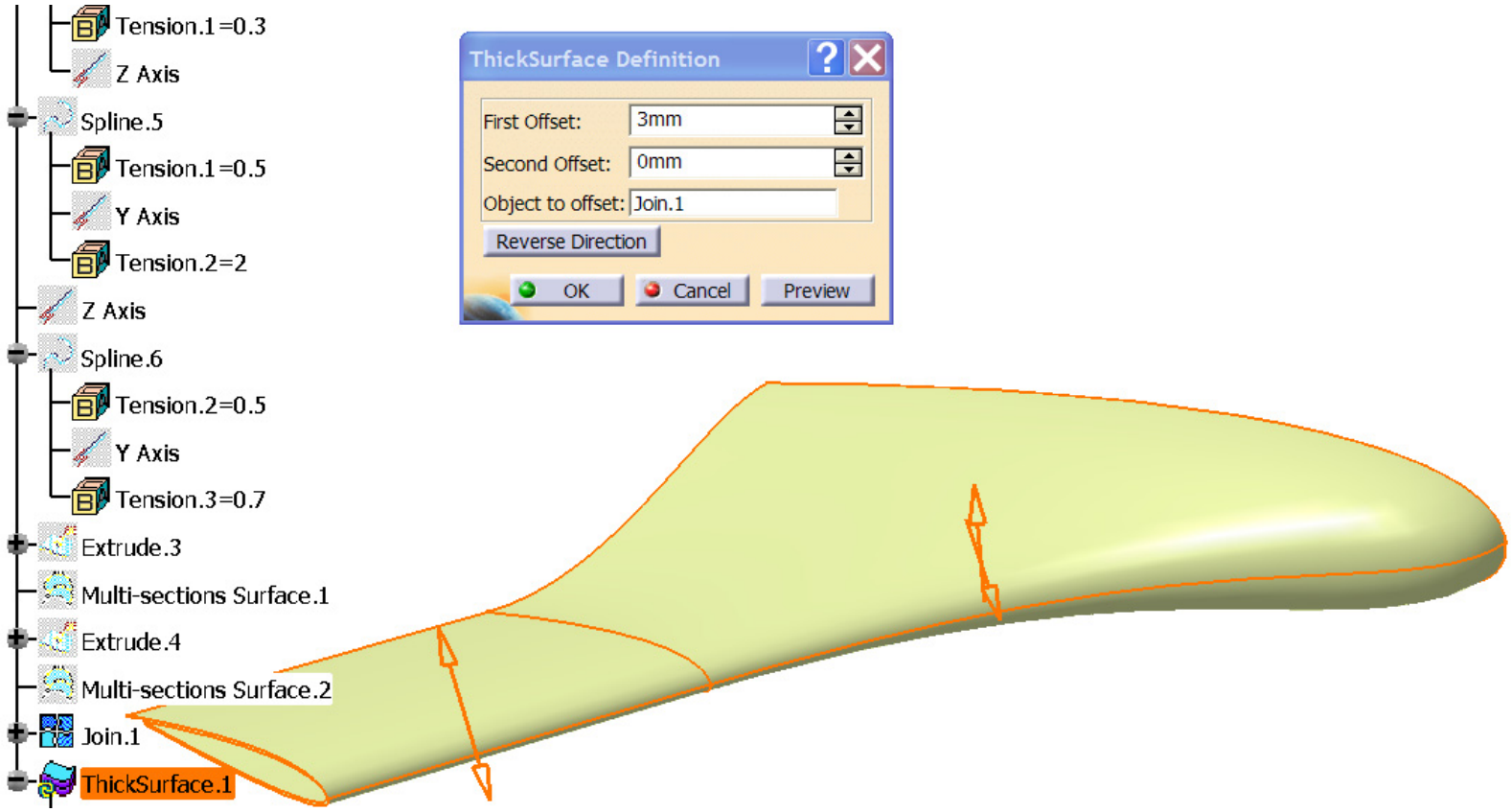
Create a Join

- Select the *Join tool* and choose the following four surfaces of the model.



Create a ThickSurface

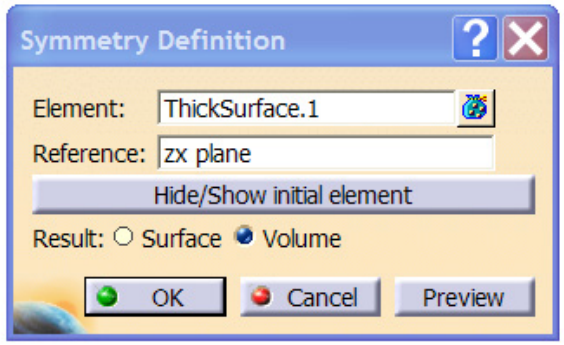
- Select the *Thick Surface tool* and choose *Join.1* and give a thickness of 3 mm.

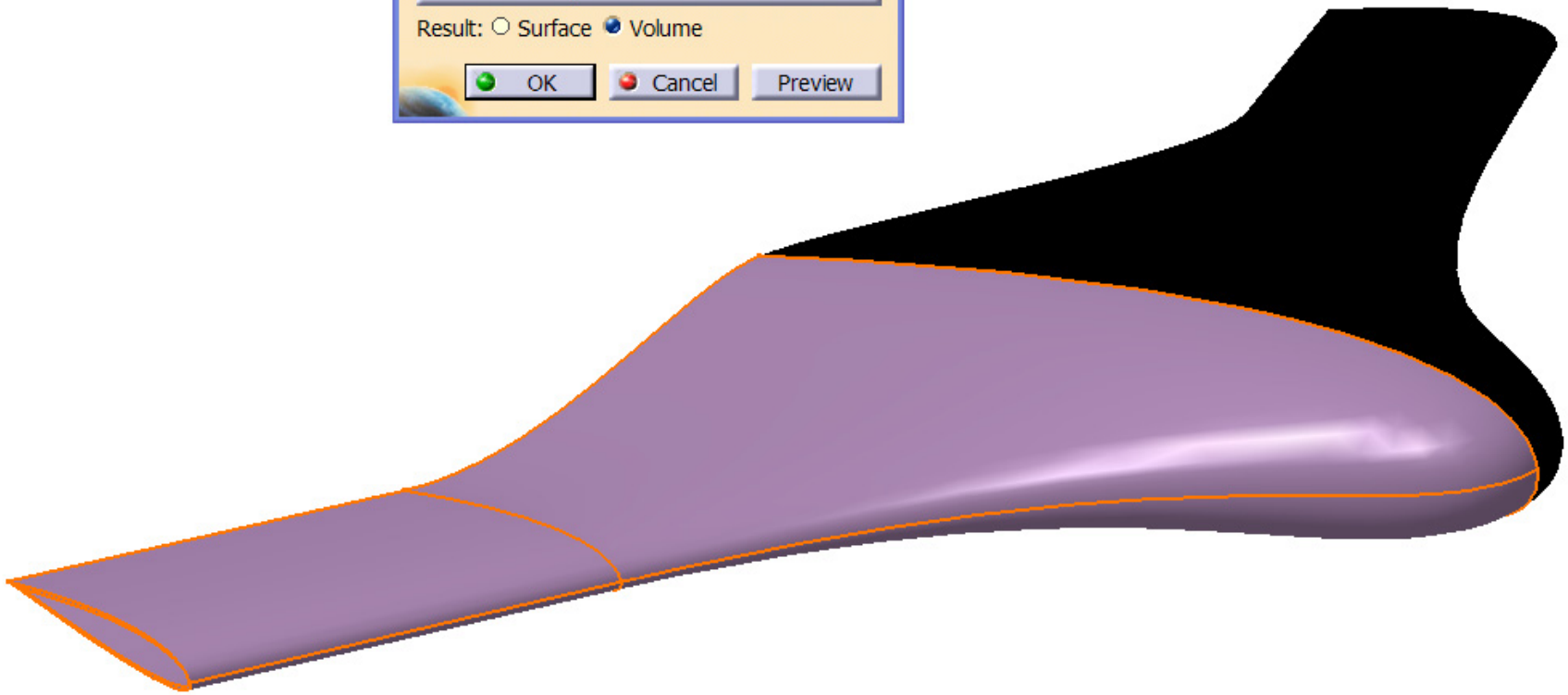


Authors update: Sometimes, the *Thick Surface Definition* malfunctions when trying to give thickness to the joined surfaces of the UAV. In that case, specify two “Join Definition”, one for the upper half of the UAV and one for the bottom half and then use the *Thick Surface Definition*.

Create a Symmetry

- Hide *Join.1*
- Select the Symmetry tool and choose *ThickSurface.1* as Element and *zx plane* as Reference.





Modify Parameters

- Modify the parameters again and this exercise is concluded