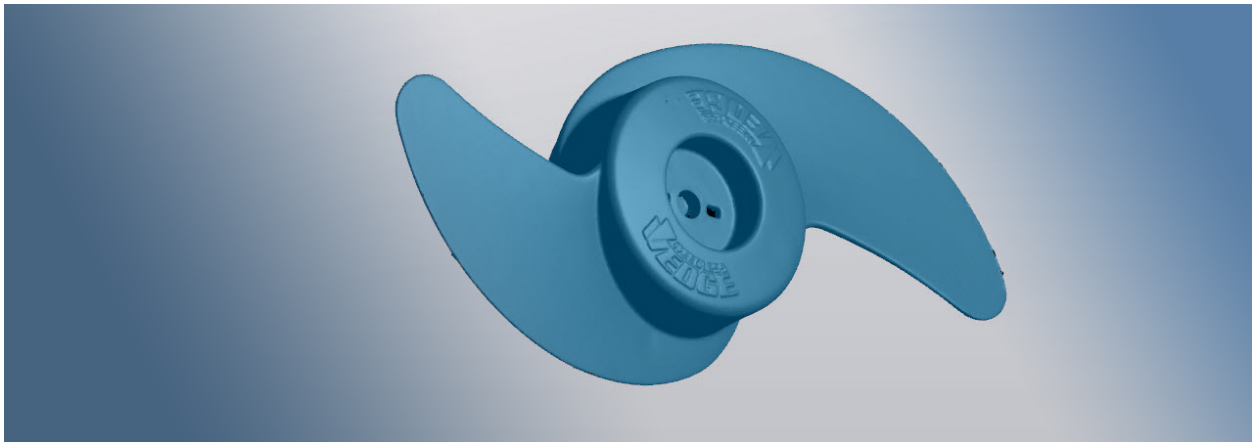




## VXmodel Tutorial - Scan-to-CAD 2



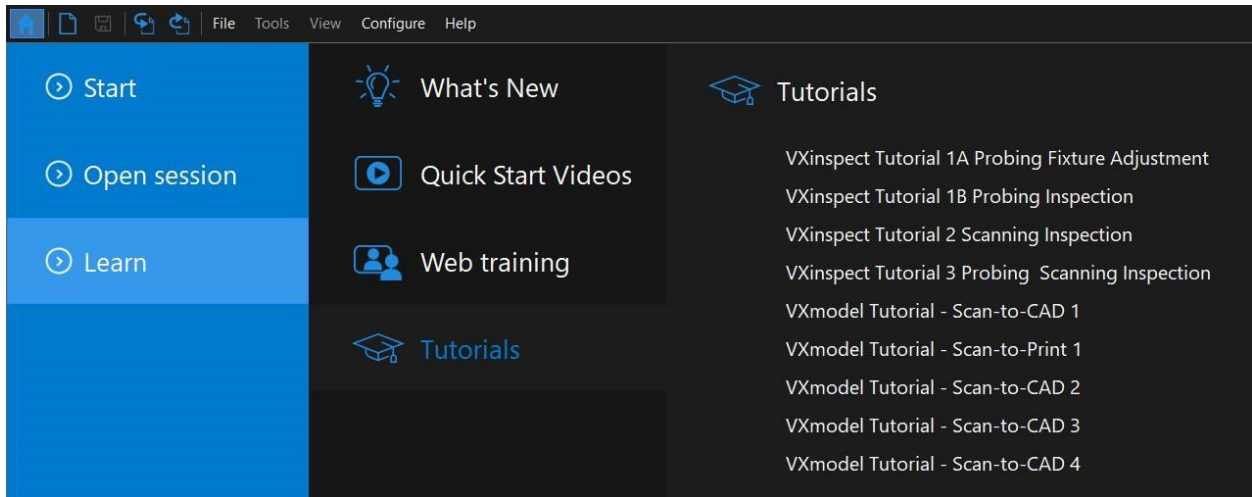
**June2018**

### **Introduction**

This tutorial is intended for users who need to become familiar with VXmodel. It will guide you on a Scan-to-CAD workflow by cleaning and aligning the mesh, then extracting required entities in order to transfer to CAD software.

### **Importing data file**

Data files associated with this tutorial can be downloaded directly from the **Learn** panel of VXelements home page.



The **session file** will automatically open but can also be found here after download: **\*\Documents\VXelements\Tutorials\VXmodel\_2\_CAD\\_DataSet**

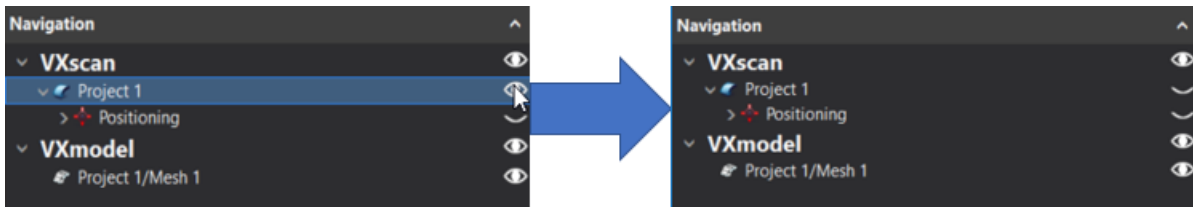
\*The sample data for this tutorial is provided by Creaform.. It is the property of Creaform and is used for informational purposes only.

After completing an acquisition, the **Scan** has to be transferred to the **VXmodel** node by clicking on the **Send to VXmodel** button or by using the **Tools** menu.

Note that for this tutorial, the scan data has already been transferred to the **VXmodel** node of **VXmodel** and the **Scan** and **Positioning targets** nodes were removed.

When working on a session that shows scanning information, hide the **Scan** and **Positioning targets** node from the navigation window to avoid confusion.

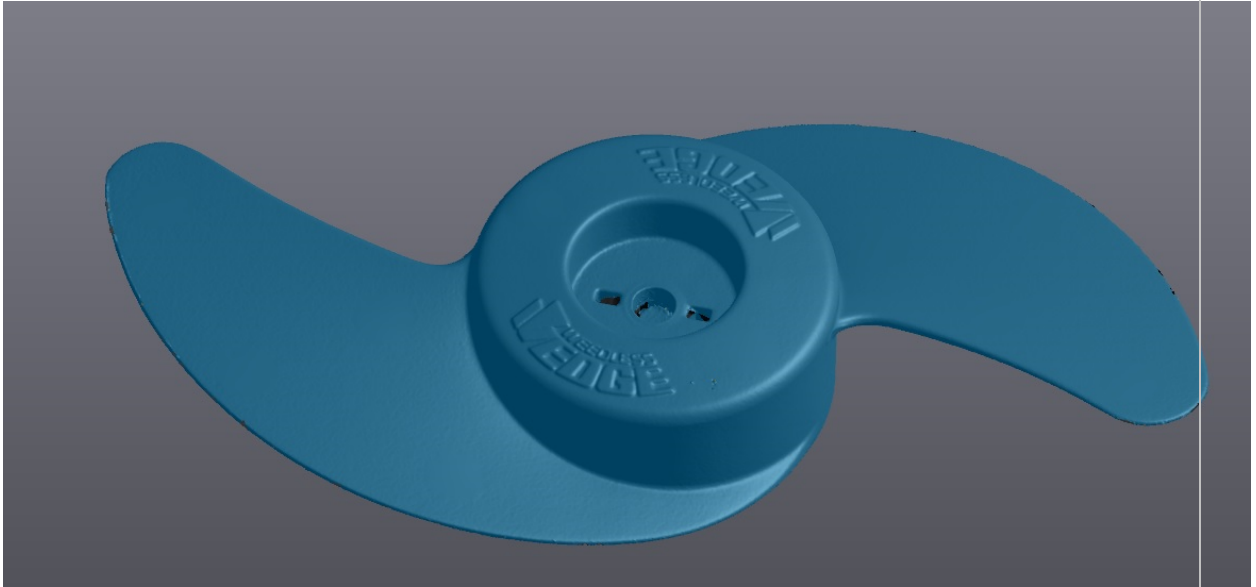
To do so, click on the eye icon to hide or show.



## What will this tutorial cover?

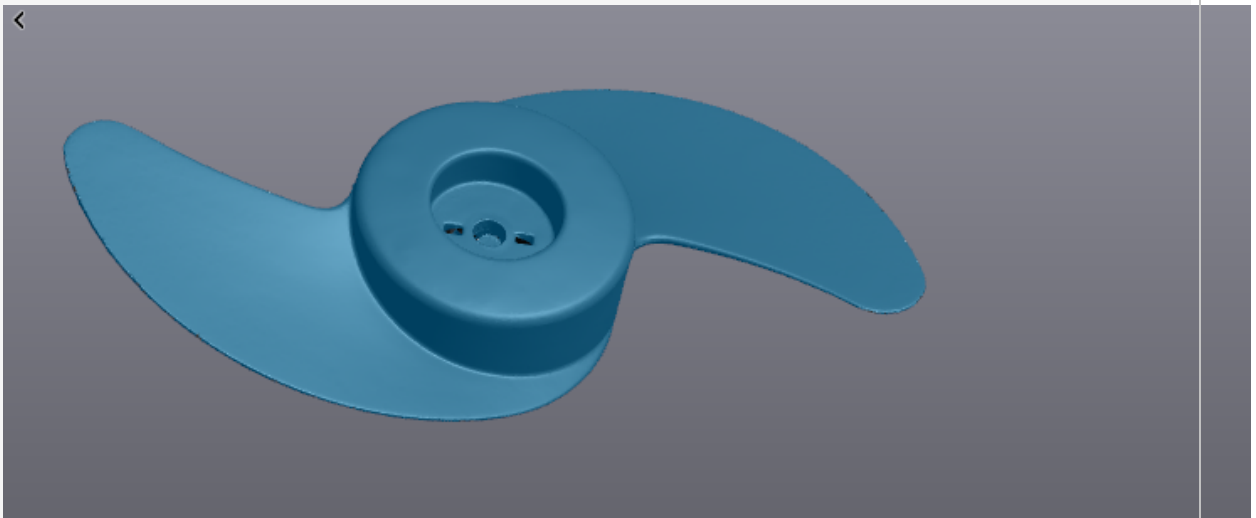
### Step 1.

Clean mesh data



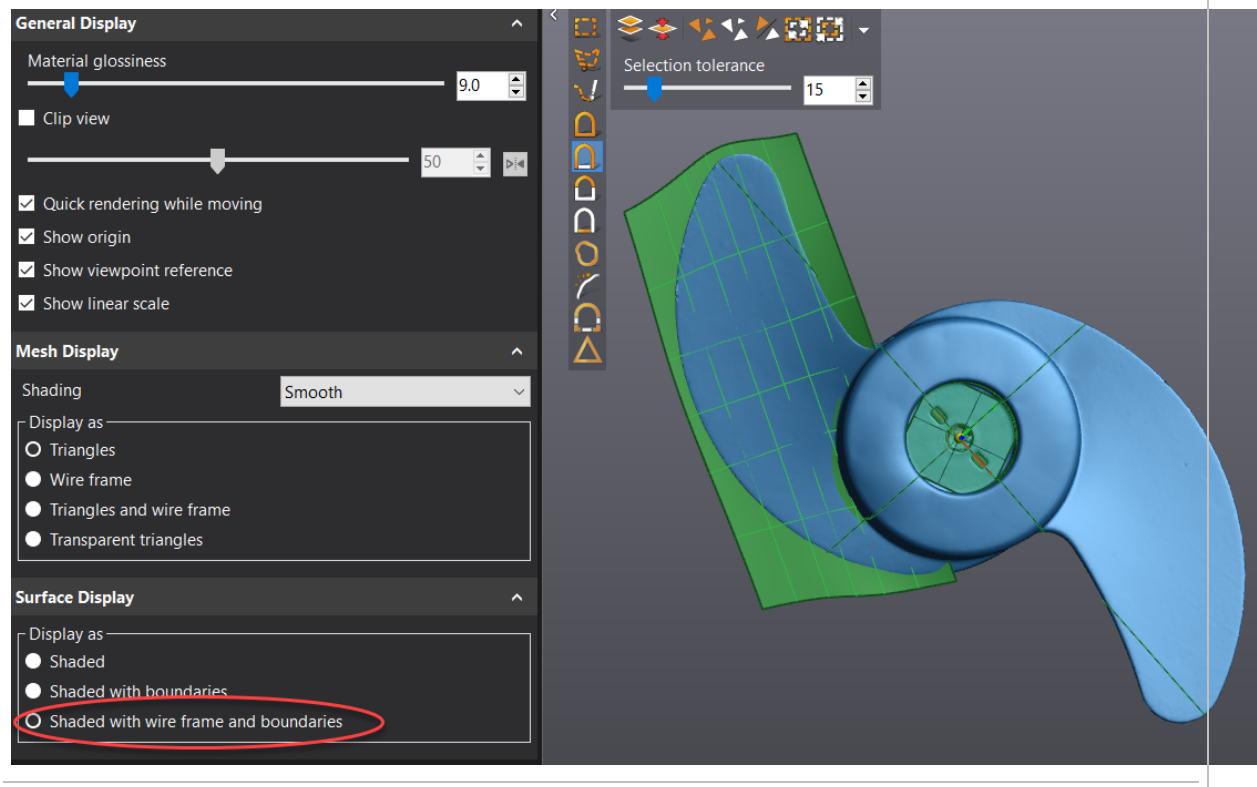
### Step 2.

Defeature detail



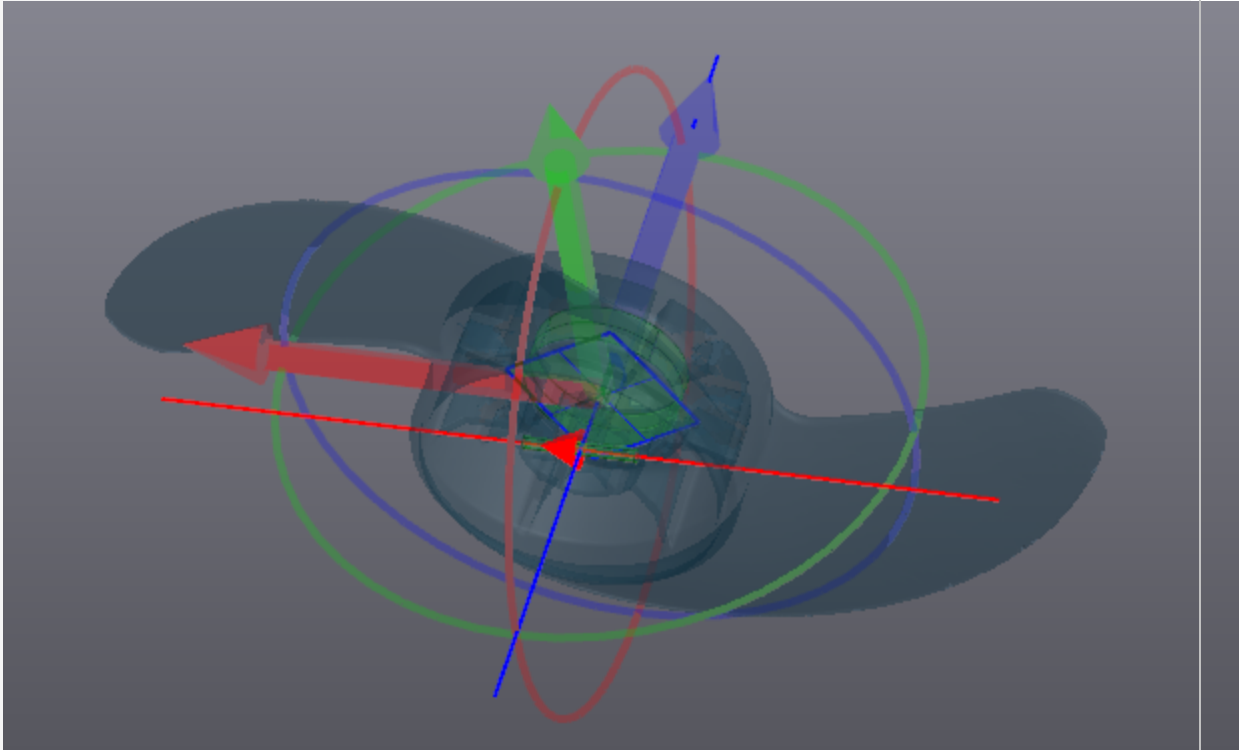
### Step 3.

Create features for alignment



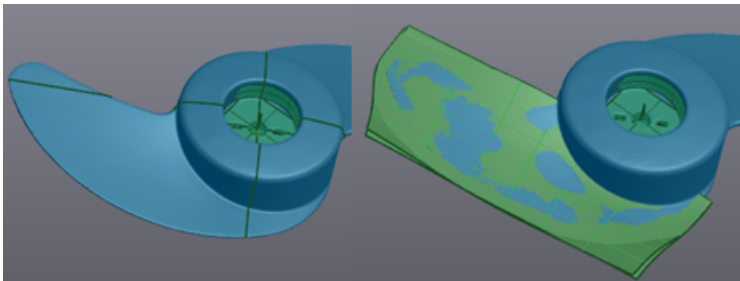
**Step 4.**

Align mesh



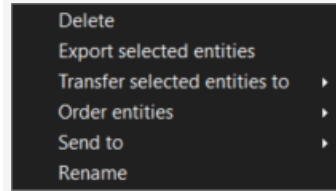
**Step 5.**

Create entities for reverse engineering



Step 6.

Export entities to CAD software



## Clean mesh data

- » Click on **Mesh 1** to see **VXmodel** functions.
- » Click on the **Clean mesh** button .



**Note:** VXmodel will gather information about the mesh and analyze it to find any problematic triangles.

» By default the **Angle between triangles** is set to **45°**, **Maximum bridge width** to **1** edge and all check boxes are checked. **Maximum hole size** can be left untouched.

Defect Type	Count
Isolated patches	0
Self-intersections	0
Spikes	1996
Small holes	98
Singular Vertices	26
Creased edges	80
Narrow triangles	21
Outcropping triangles	230
Narrow bridges	1021
Non-manifold triangles	78

**Parameters**

Isolated patches threshold: 1

Spike Level: 25

Angle bet. creases (°): 45

Narrow bridges width (edges): 2

Max hole size (edges): 30

Buttons: Apply, OK, Cancel, Preview



**Note:** The numbers found on the right indicate the triangle count for each type of defect.



**Note:** Each type of defect for which the check box is active, related triangles will be selected in the 3D view and will be processed by the **Clean mesh** tool once you click on **Apply**.

» Leave default parameters and click **Apply**, then **OK**.




**Note:** Clicking on **Cancel** after **Apply** will cancel the whole operation.






## Defeature detail

To reverse engineer a part, you may need to create cross-sections. As we want the global shape of the part and not the shape of the letters in the writings, it is better to remove them using the **Defeature** icon.

- » Select the **Free form**  icon .
- » Hold the **CTRL** key and left click to select the two logos on top of the scan.

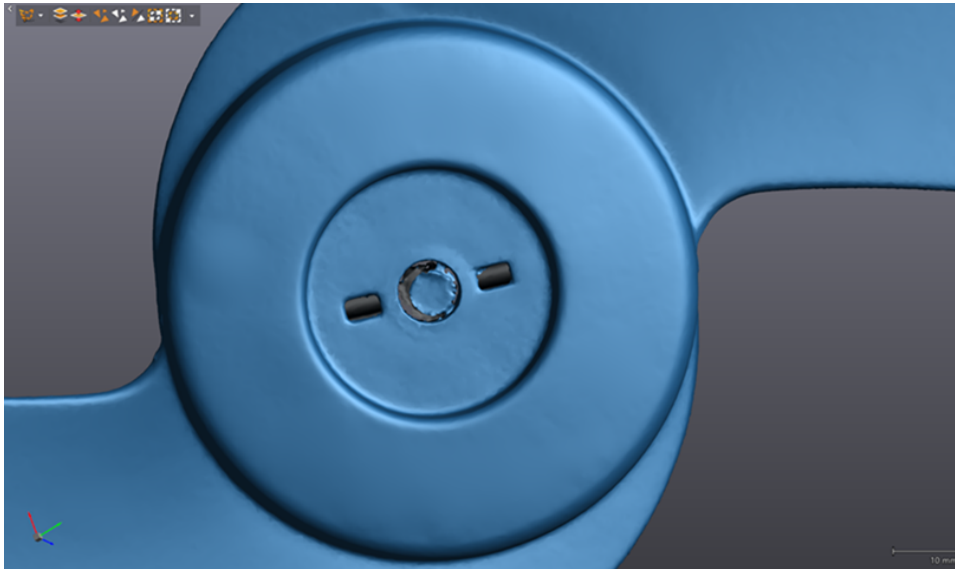
**Note:** It is important to select all the logo triangles. To do so, you can use the **Brush** selection tool to get any small patches that were not selected by the **Free form** tool.



» Click on the **Grow selection**  icon until all the triangles are selected in this region.



» Select the **Defeature** icon.



## Create features for alignment

Various geometric entities need to be created on the mesh and further used as in the alignment process. It is essential to choose the most important and relevant entities for the alignment. The whole reconstruction will be affected by this alignment. A good alignment will make the next steps easier and will improve the end result.

### Add cylinder 1

- » Click on the **Add a cylinder**  icon.
- » Set the **Building mode** to **Triangles selection**.

**Create Cylinder**  
Building Mode: Triangles Selection  
Name: Cylinder 1

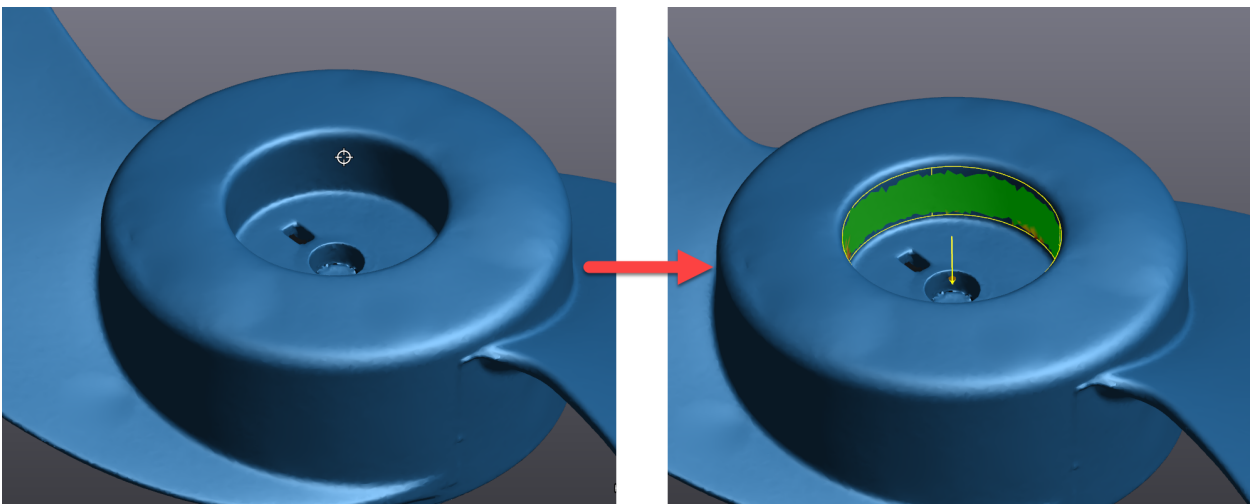
- » Set the **Selection tolerance** for the **Similar curvature** to **35**.

Selection tolerance: 35



**Note:** Values range from 0 to 100 for selection tolerance. The higher the selection tolerance value, the larger the amount of triangles selected. This is due to a larger permission in the difference in the normal orientation of the triangles.

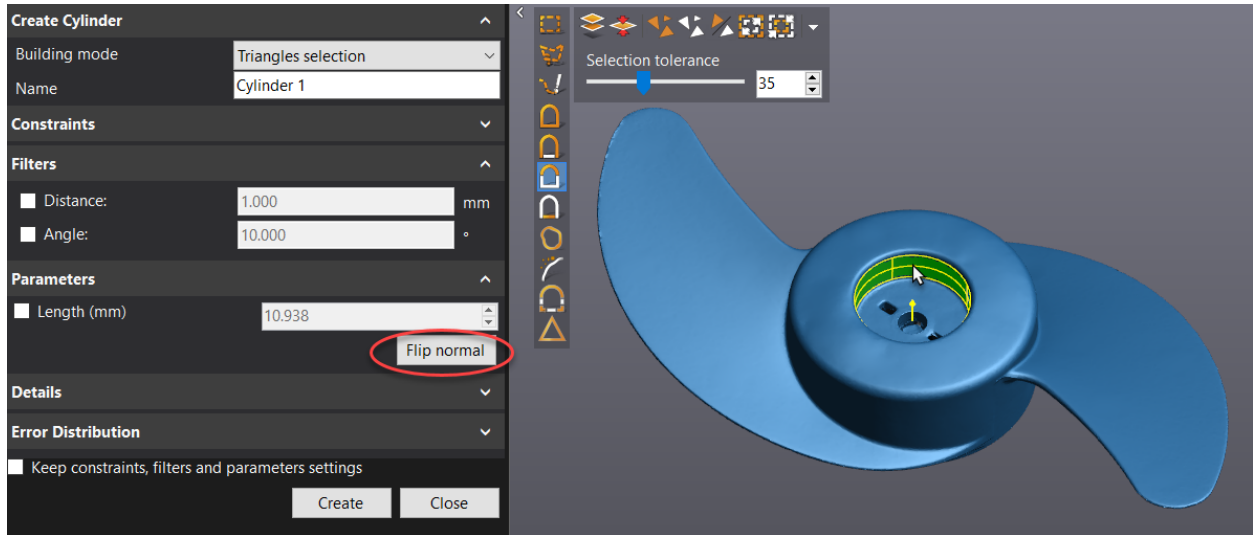
- » Hold the Ctrl key and left click the cylindrical surface as shown below.





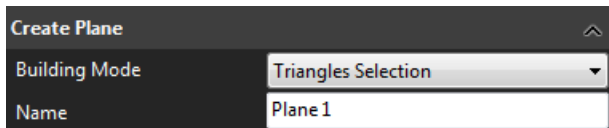
**Note:** A preview of the resulting cylinder is displayed as well as a deviation color map between the selected triangles and the best fitted cylinder.

- » Check the **Filters** and leave the **Distance** and **Angle filtering** unchecked.
- » Click on **Flip normal** if required to have the **Cylinder** axis (in yellow) pointing up.
- » Click on the **Create** button to finalize and then **Close**.

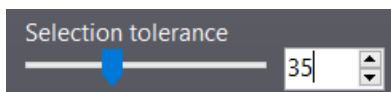


## Add plane

- » Click on the **Add a plane**  icon.
- » Set the **Building mode** to **Triangles selection**.

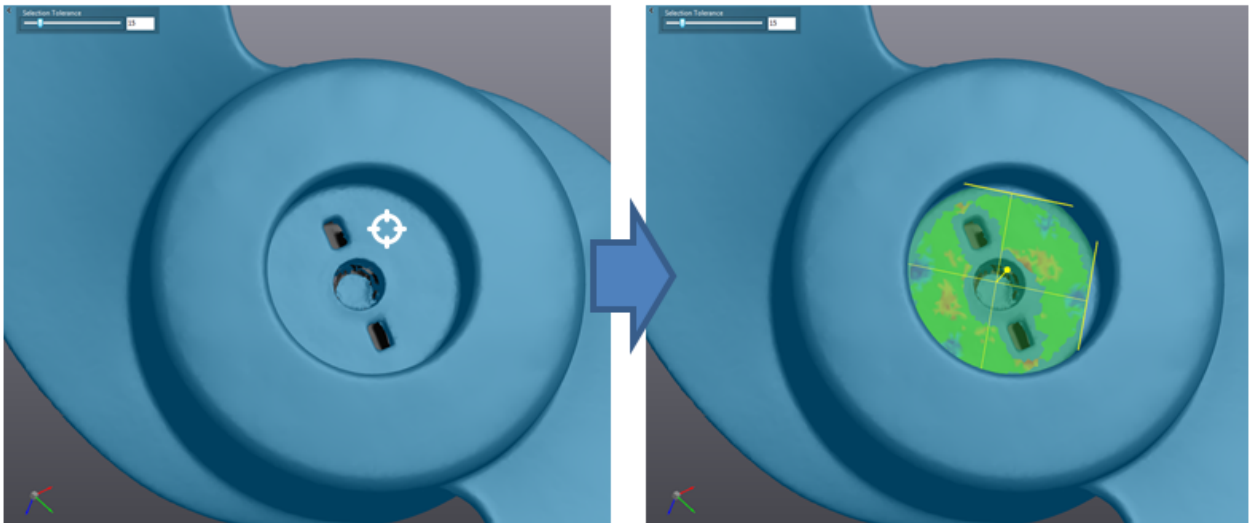


- » Set the **Selection tolerance** for the **Similar normals** selection tool to **35**.



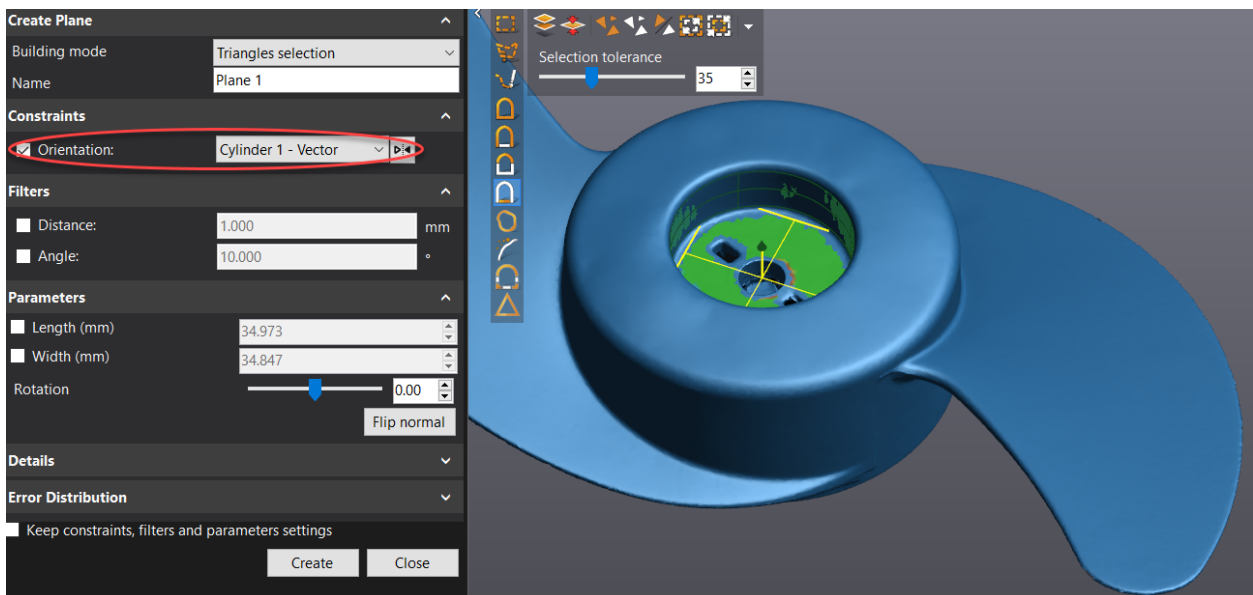
**Note:** Values range from 0 to 100 in the Selection Tolerance. The higher the selection tolerance value, the larger the amount of triangles selected. This is due to a greater difference allowance in the triangles normal orientation.

- » Orient the model as per the figure below, hold the **CTRL** key and left click on the flat surface inside the middle section.





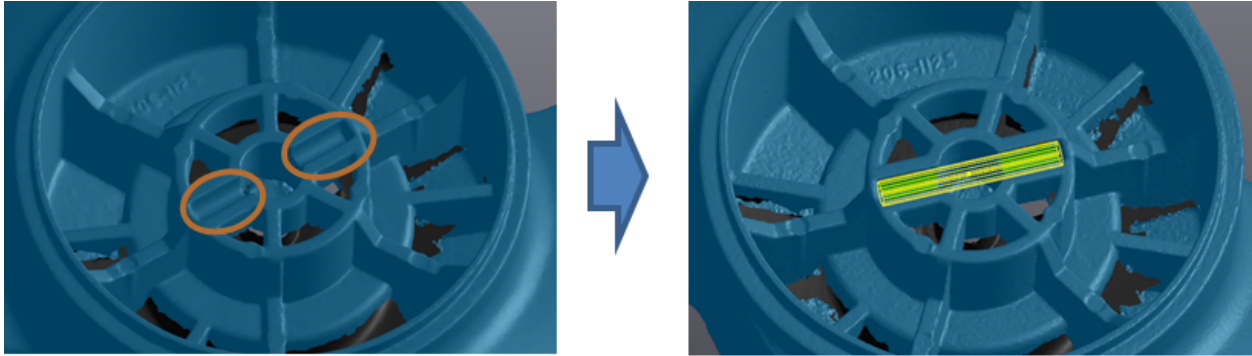
**Note:** A preview of the resulting plane is displayed as well as a deviation color map between the selected triangles and the best fitted plane.

- » Under **Constraints** check the **Orientation** box, highlight the **Cylinder** icon and select **Cylinder 1 - Vector**.
- » Click on the **Create** button to complete the operation.

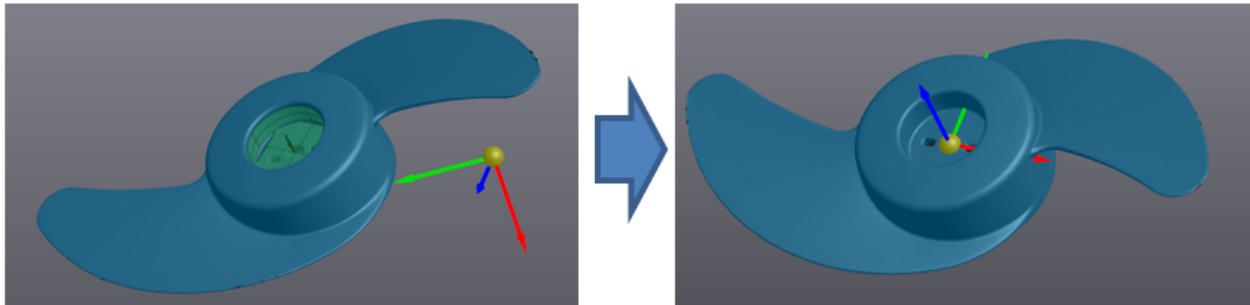


## Add cylinder 2

- » Click on the **Add a cylinder**  icon.
- » Select the **Free form**  icon .
- » Hold **CTRL** key and select the cylindrical areas indicated below.
- » Click on the **Create** button to complete the operation and **Close**.



## Align mesh





Alignment is done by pairing entities previously created with the XYZ reference frame.

- » Click on **Align to origin**  icon.
- » From the **Constraint selection**, under the **Entity** column, select **Cylinder 1** from the drop-down menu and pair it with **Axis Z** under the **Constraint** column . Repeat for **Plane XY** with **Plane 1**, then for **Axis X** with **Cylinder 2**.

### Align to origin ^

Name

Alignment mode

### Constraint ^

Entity		Constraint		
Cylinder 1	▶◀	Z Axis	▼	✕
Plane 1	▶◀	XY Plane	▼	✕
Cylinder 2	▶◀	X Axis	▼	✕

### Details ^

Specify axis location and orientation


	X Axis	Y Axis	Z Axis
Offset	🔒 -190.23	🔒 262.44	🔒 228.66
Angle	🔒 155.11	🔒 28.82	🔒 -82.61

### Constraint ^

Deviation constraint 1:	0.000 (mm)	0.000 (°)
Deviation constraint 2:	0.000 (mm)	0.000 (°)
Deviation constraint 3:	0.000 (mm)	0.275 (°)


Reset
Align
Close





**Note:** On the right of the Entity column, the **flip**  button allows flipping the normal of paired entities.
















**Note:** As entities are paired, the degrees of freedom (DOF) of the Mesh decrease. Constrained DOF are marked as greyed out **Offset** or **Angle** text boxes.


**Align to origin** 

Name







Alignment mode  


**Constraint** 

Entity	Constraint
Cylinder 1  	Z Axis  
Plane 1  	XY Plane  
Cylinder 2  	X Axis  

**Details** 

Specify axis location and orientation

	X Axis	Y Axis	Z Axis
Offset	 -190.23	 262.44	 228.66
Angle	 155.11	 28.82	 -82.61

**Constraint** 

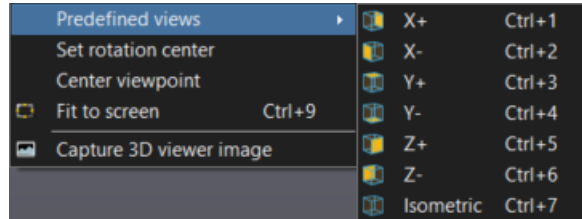
Deviation constraint 1:	0.000 (mm)
	0.000 (°)
Deviation constraint 2:	0.000 (mm)
	0.000 (°)
Deviation constraint 3:	0.000 (mm)
	0.275 (°)

» Click on **Align** to finalize the mesh alignment to the origin.





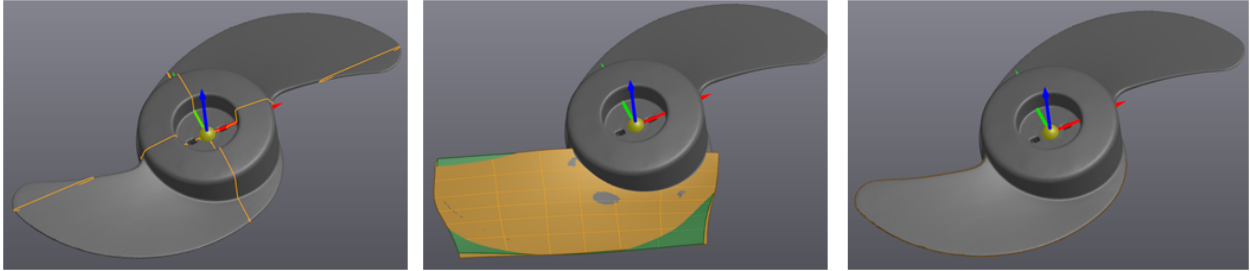
**Note: Predefined Views** are available by right clicking in the 3D view. These views are based on the reference frame defined as the origin.



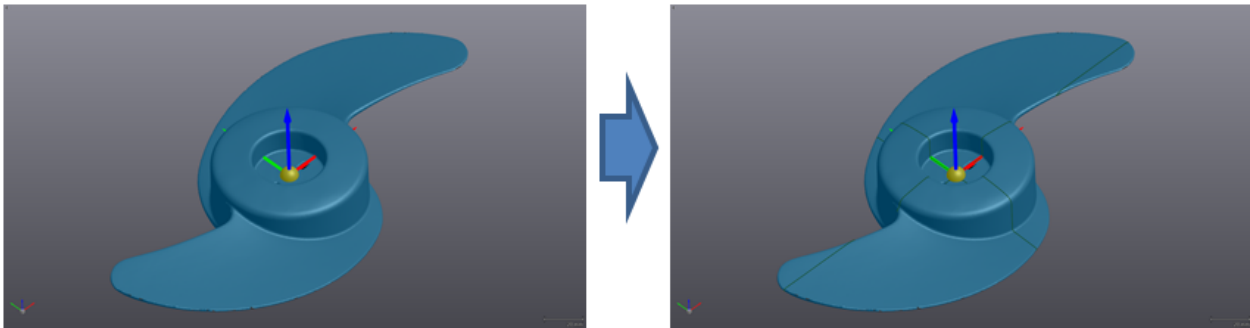
**Note:** Manual alignment can be performed by dragging the arrow or circle of the reference frame in the 3D view.


## Creating entities for reverse engineering

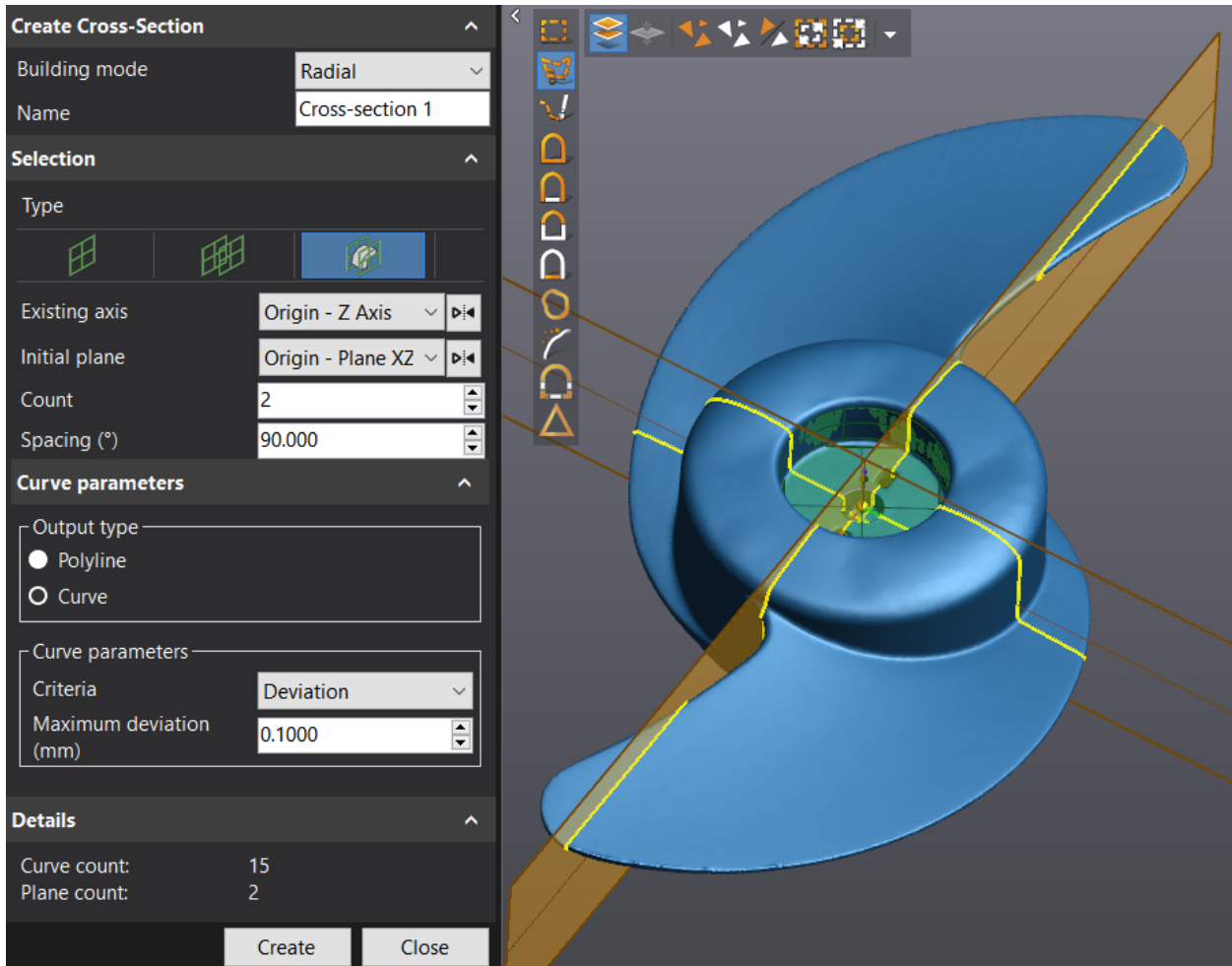
Geometric entities will be extracted in preparation for CAD software.



## Create a cross-section



- » Click on **Add a cross-section**  icon.
- » Set the **Building mode** to **Radial**.
- » For **Existing axis** select **Origin – Z Axis** and for the **Initial plane** select **Origin – Plane XZ**.
- » Set the **Count** to **2**, the **Output type** to **Curve** and **Curve parameters** to **Deviation** with a value of **0.1 mm**.

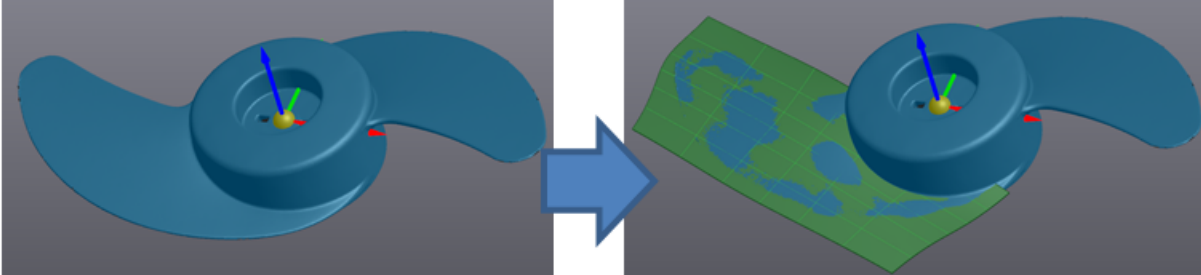



**Note:** Setting **Output type** to **Polyline** creates small segments of lines made from the triangle intersection to the cross-section plane. Curve creates a **Spline** that can be adjusted with either **Maximum deviation** or **Control points** in the **Curve parameter**.

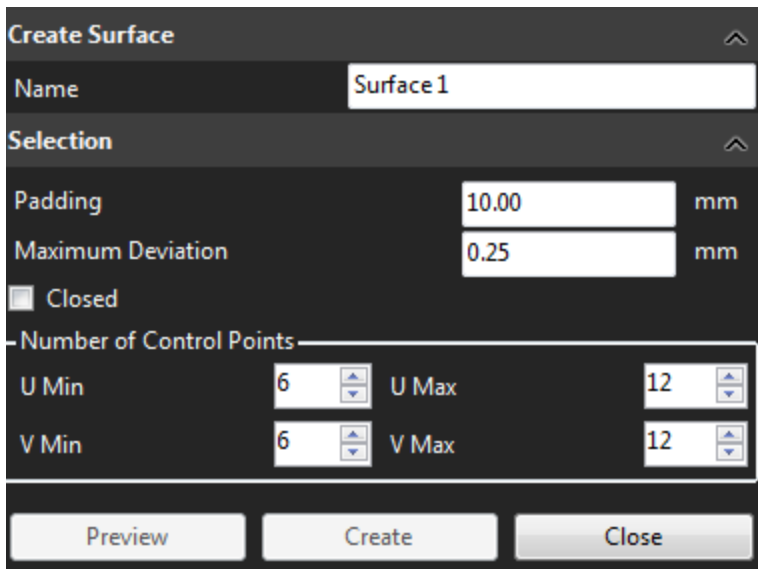
- » Click **Create** to complete the cross-section and **Close**.

## Create surfaces

At this step, two surfaces will be created on each side of one blade in order to extract a CAD surface from it.



- » Click on the roll down **Auto-surface>Single patch** >  icon .
- » Set the **Padding** value to **10 mm** and the **Maximum deviation** to **0.25 mm**.
- » Uncheck the **Closed** box, enter a value of **6** for the **U Min** and **V Min**, and **12** for the **U Max** and **V Max**.



**Create Surface**

Name: Surface 1

**Selection**

Padding: 10.00 mm

Maximum Deviation: 0.25 mm

Closed

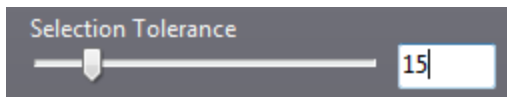
**Number of Control Points**

U Min: 6 U Max: 12

V Min: 6 V Max: 12

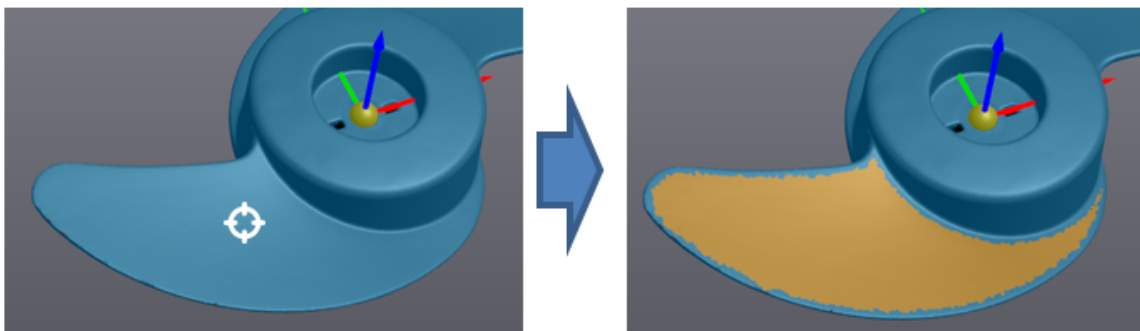
Preview Create Close

- » Select the **Sudden change**  icon.
- » Set the **Selection tolerance** to **15**.

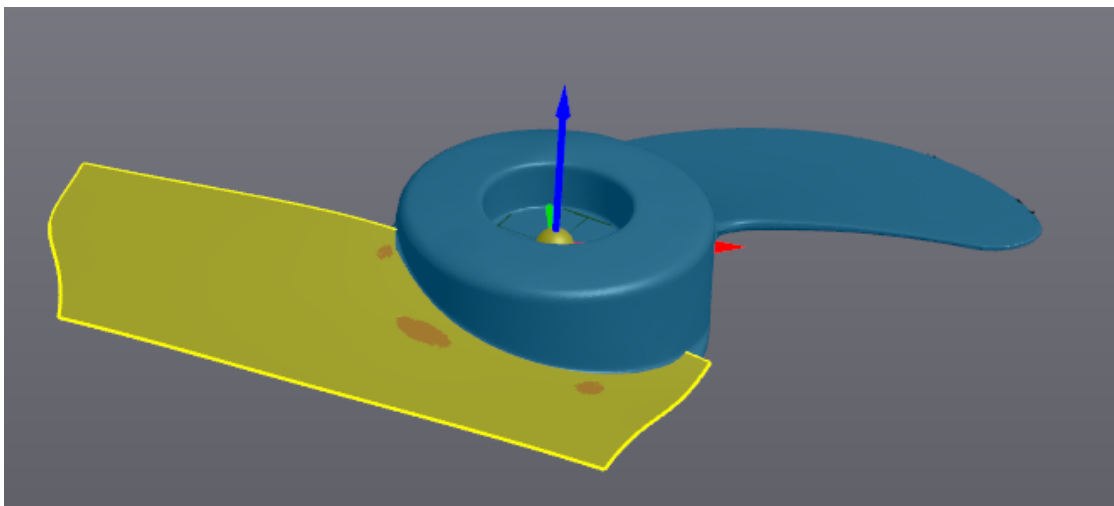


Selection Tolerance: 15

» Hold the **CTRL** key and left click on the top surface of the blade.



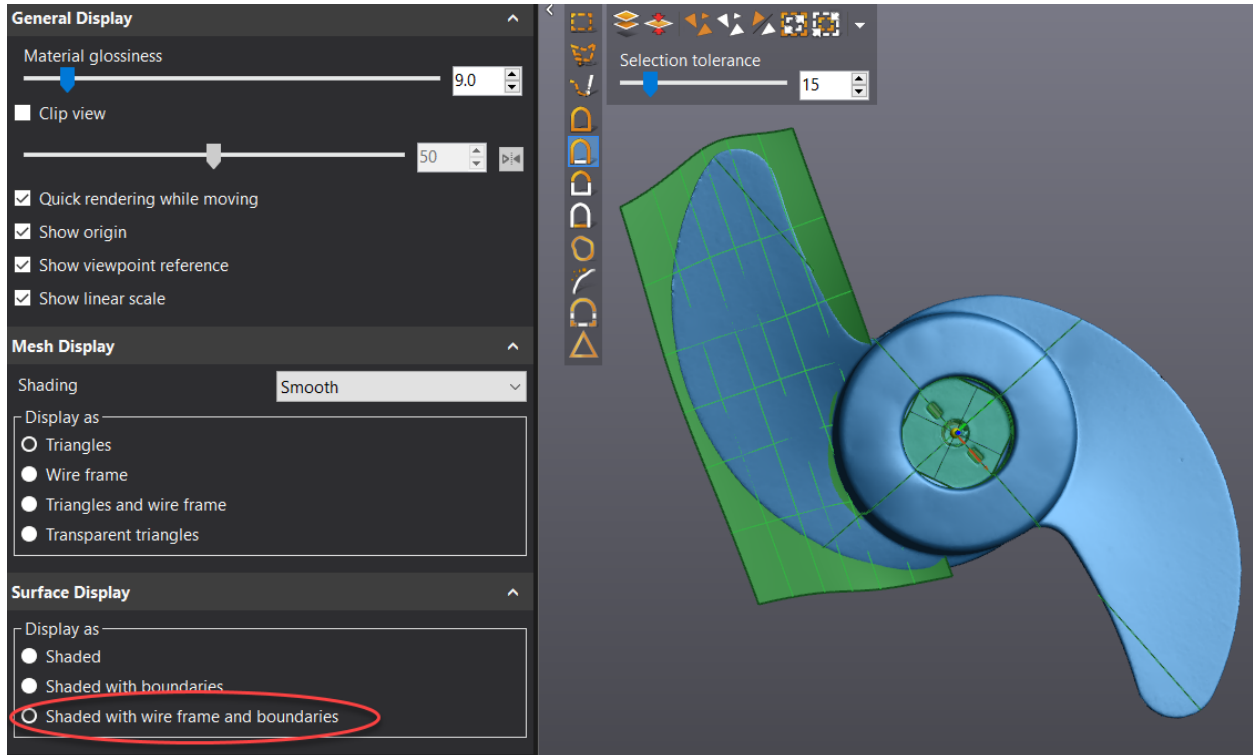
» Use the **Preview** button to validate the result.



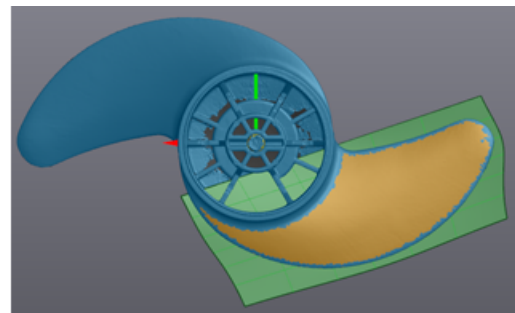
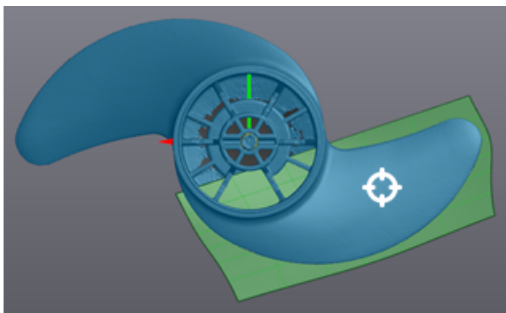
» Click on **Create** to complete the surface creation.



**Note:** Once the surface is created, click on the **Display** button at the bottom of the **Navigation** panel and then change the display settings under **Surface Display**.

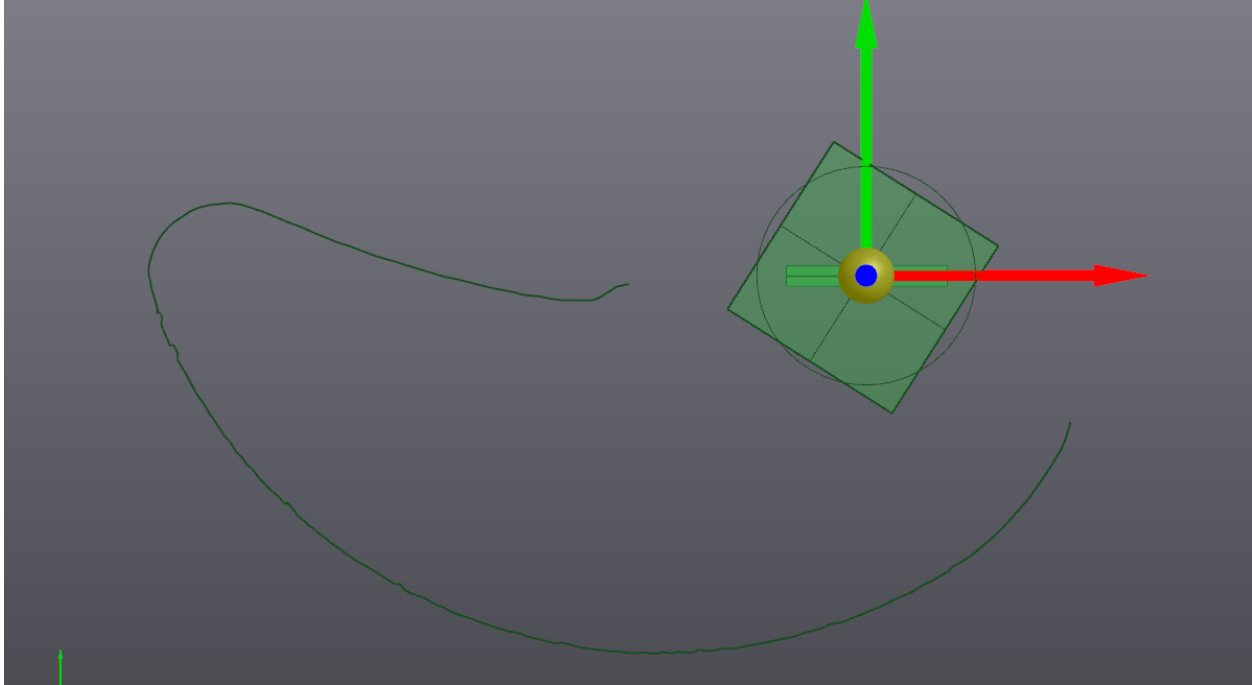



- » Repeat these previous steps for the back side of the same blade
- » Click **Close** to close the **Create surface** dialog box.

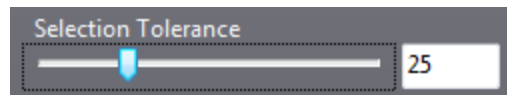


## Define the edge with curves

At this step, we will create the curve profile of the blade, as it will be used as a trimming tool in CAD software.

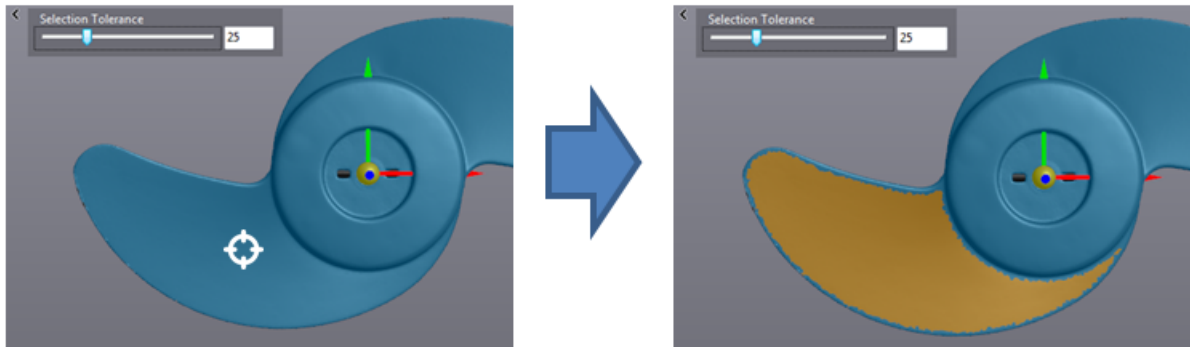


- » Select the **Sudden change**  icon.
- » Set the **Selection tolerance** to 25.

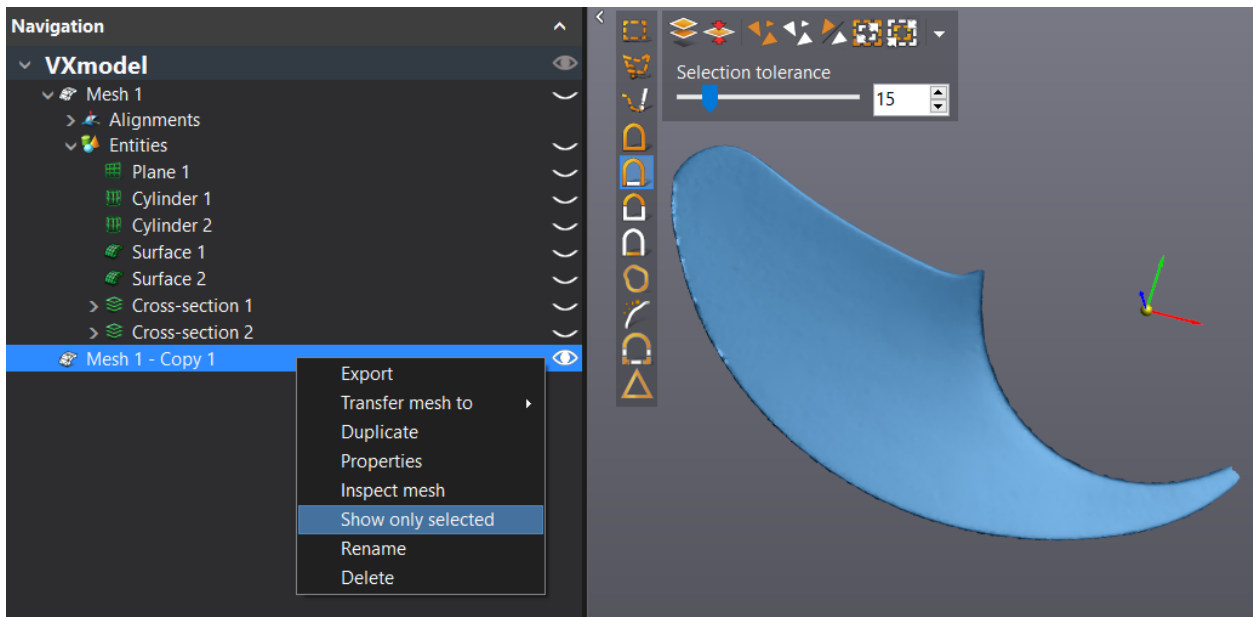


**Note:** You can hide the entities by clicking on the eye icon next to the entity you want to hide.


- » Hold the **Ctrl** key and left click on the blade top surface as shown below (this is the same blade for which surfaces were created before).

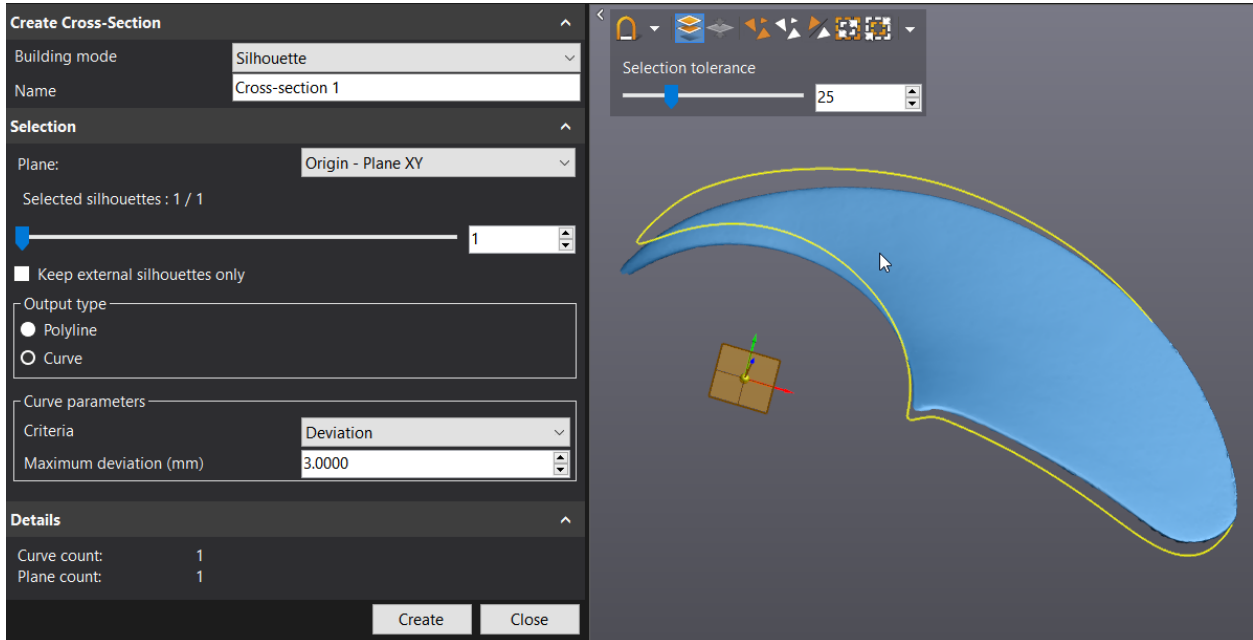


- » Click on the **Grow the selection** icon 4 times .
- » Click on the **Copy** button from the main toolbar. A new mesh **Mesh 1 - Copy 1** will be created with the selection.
- » Right Click on **Mesh 1 - Copy 1** and select **Show only selected**





- » Click on **Add a cross-section**  icon .
- » Set the **Building mode** to **Silhouette**.
- » In **Plane definition** select **Origin – Plane XY**.
- » Set the **Output** to **Curve** and **Curve parameters** to **Deviation** with a value of **3 mm**.

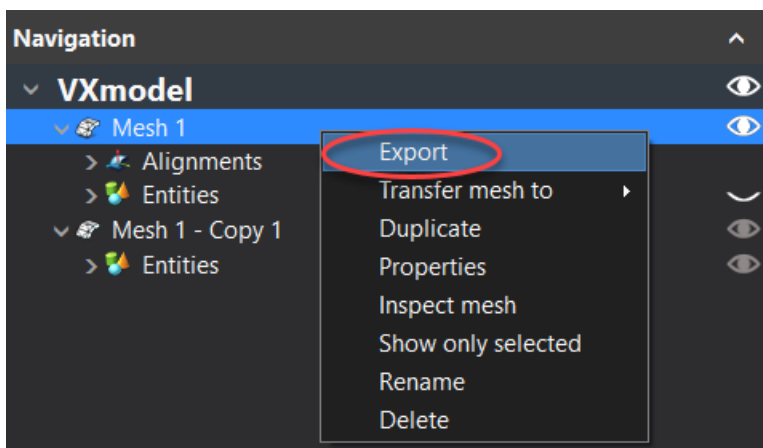


## Exporting entities to CAD software

At this step, we will save the aligned mesh and the entities that will be used in the CAD software.

### Save mesh model

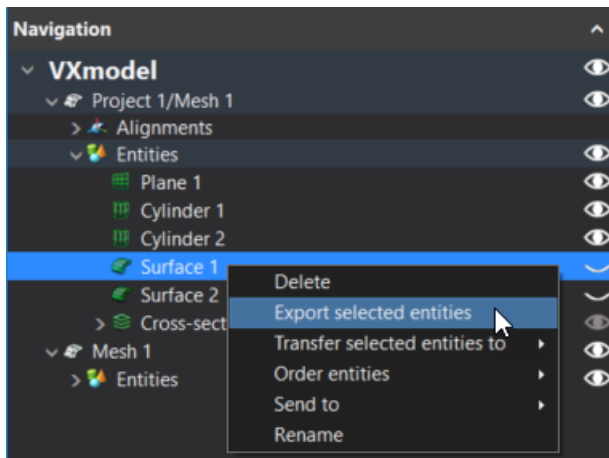
- » Highlight **Mesh 1** by clicking on it.
- » Right Click on the **Mesh 1** and select **Export**



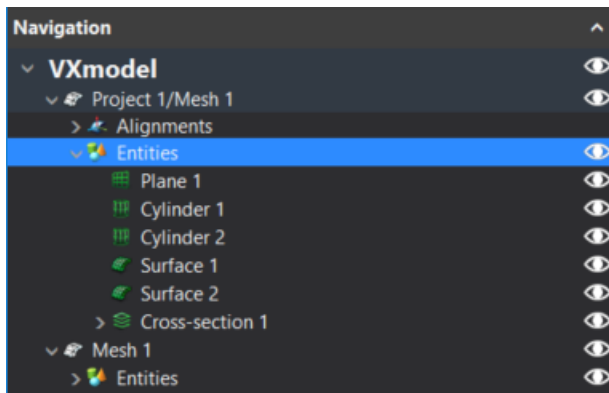
» or click on the **Export mesh** icon.

## Exporting entities

- » Highlight **Surface 1** and **Surface 2** in the **Entities** node by holding **CTRL** button and clicking on them.
- » Right click on the surface and select **Export Selected Entities**



» Highlight the **Entities** node by clicking on it.



- » Click on the **Export >All Entities** button .
- » Repeat this operation to export the cross-section from **Mesh 1 - Copy 1**

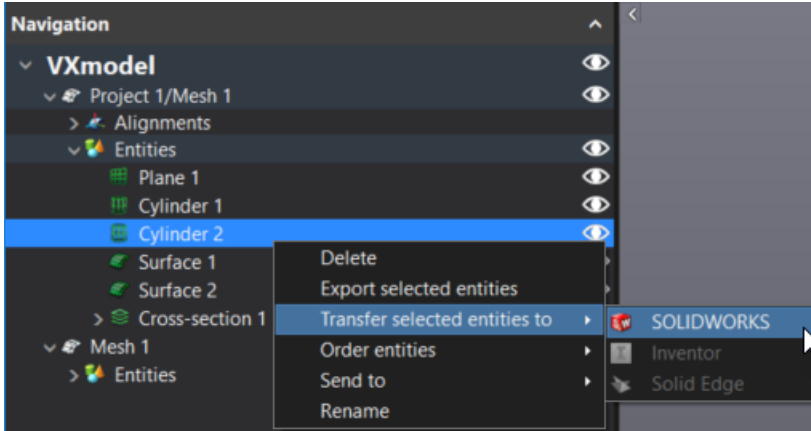


**Note:** To export one or more entities, select only the ones to be exported before clicking **Export Entities**.

## Export entities – SOLIDWORKS, Inventor and Solid Edge users

If you use SOLIDWORKS, Inventor, or Solid Edge, **VXmodel** has a built-in CAD transferring function that executes the previous steps of exportation directly to SOLIDWORKS, Inventor, or Solid Edge.

- » Click on the **Entities** node or on specific entities and click on **Transfer to SOLIDWORKS** button or use the drop-down to select either Solid Edge or Inventor.
- » Right-click on selected entities and use **Transfer selected entities to** in order to directly export those entities to SOLIDWORKS, Inventor, or Solid Edge.



**Note:** If SOLIDWORKS, Inventor, or Solid Edge is not open, the function will open it and create a new part and import the entities. If SOLIDWORKS, Inventor, or Solid Edge is open, it will import, in the active part, the entities.

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