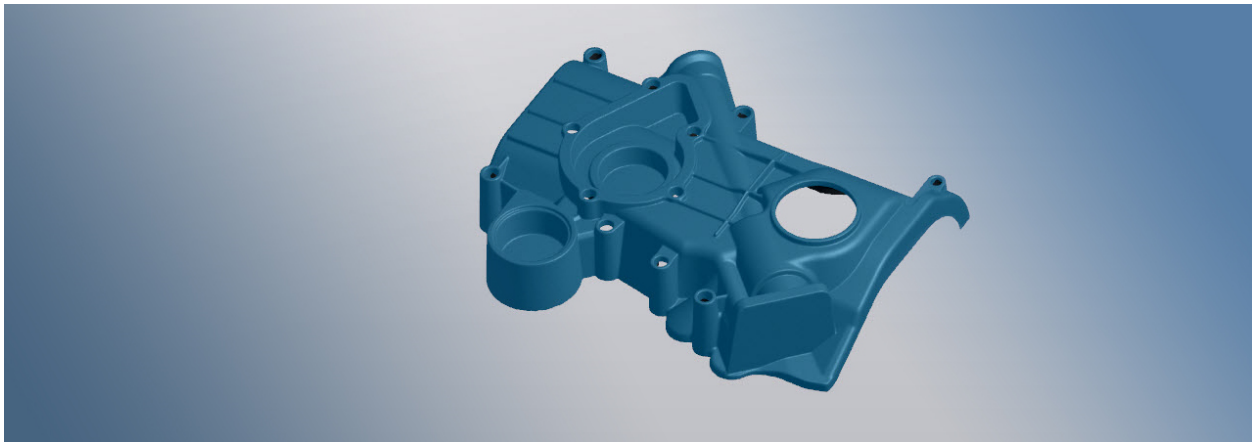




VXmodel Tutorial - Scan-to-CAD 3



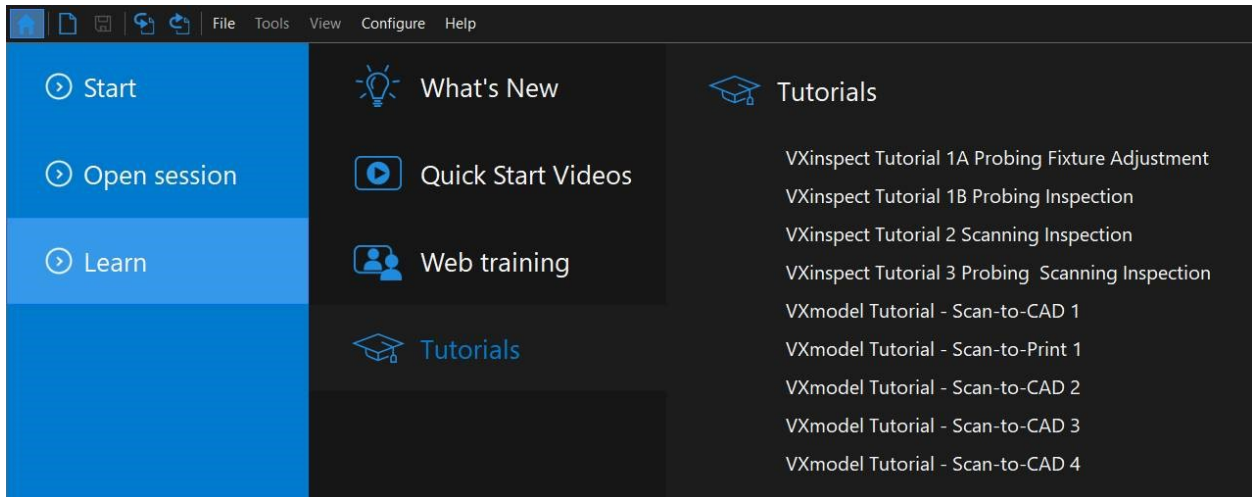
June 2018

Introduction

This tutorial is intended for users who need to become familiar with VXmodel. It will guide you through 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 the can be found here after download: ***\Documents\VXelements\Tutorials\VXmodel_3_CAD_DataSet**

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

After the acquisition, the **Scan** has to be transferred to the **VXmodel** node by clicking on the **Send to VXmodel** button .

Note that for this tutorial, the scan data is already transferred to the **VXmodel** node and the **Scan** and **Positioning Targets** nodes were removed.

When working with a session that still has scanning information, hide the **Scan** and **Positioning targets** node from the **Navigation** pane to avoid confusion.

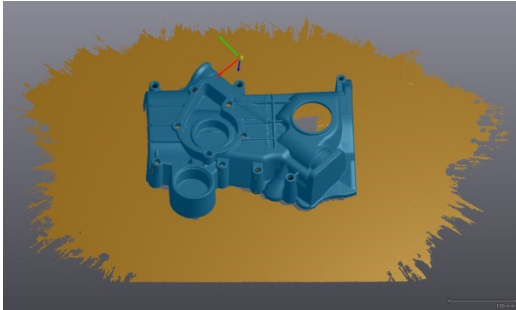
» To do so, click on the eye icon to hide.



What will this tutorial cover?

Step 1.

Remove noise and unwanted data



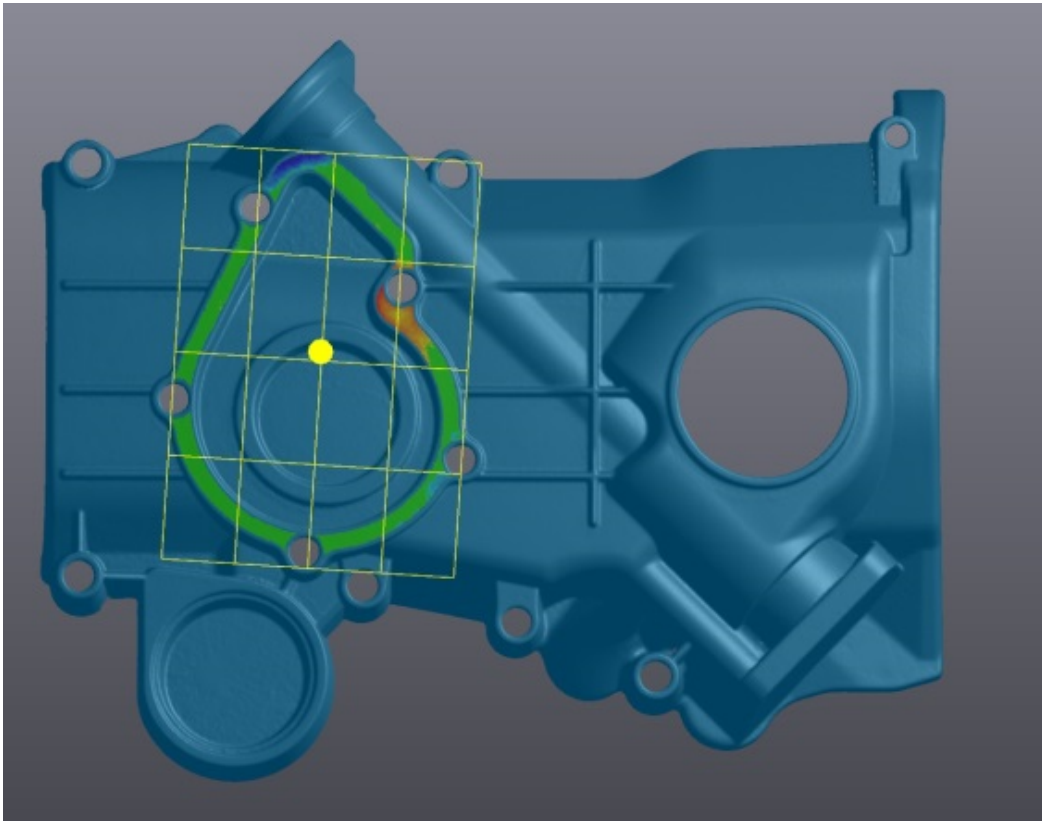
Step 2.

Fill Holes



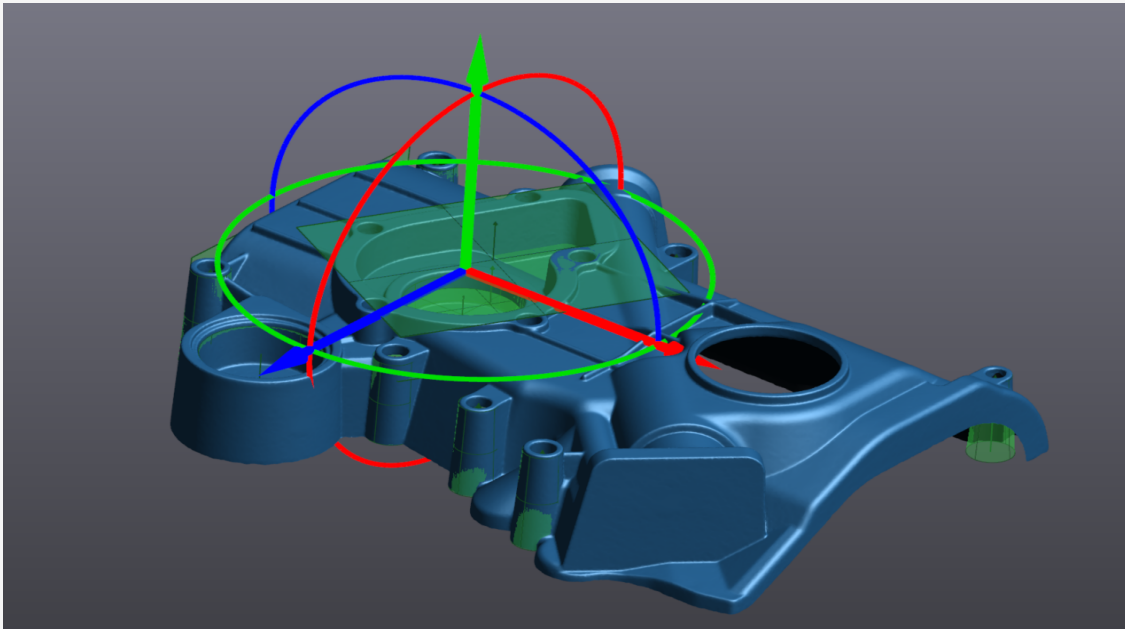
Step 3.

Create Features



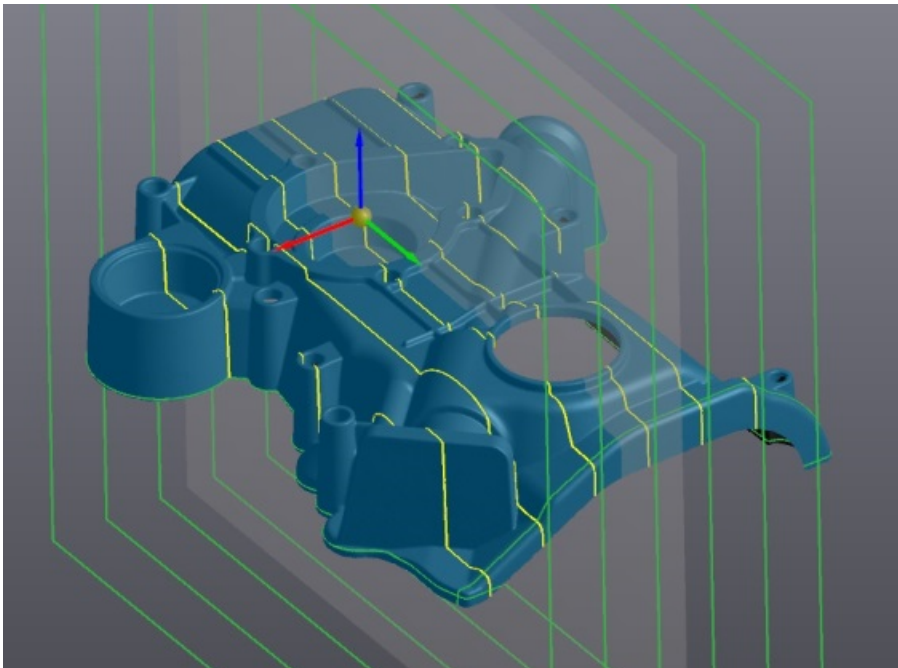
Step 4.

Align mesh



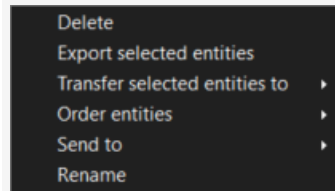
Step 5.

Creating Cross-Sections




Step 6.

Export for CAD software



Remove noise and unwanted data

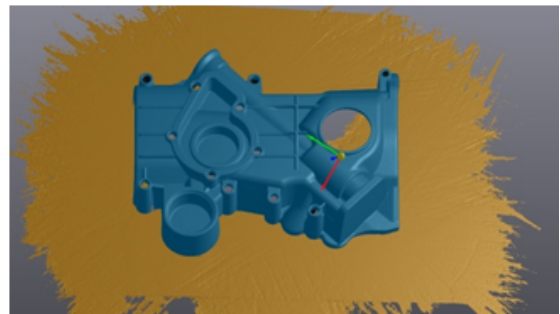
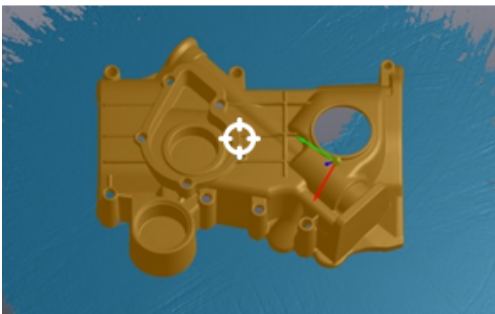
At this step, we will use the selection tools to remove data that was captured during the acquisition but is not necessary in the reverse engineering process.

- » Click on **Mesh 1** to see **VXmodel** functions.
- » Select the **Connect**  icon.



Note: **VXelements** will gather all the triangles that are connected to the triangle selected.

- » Reverse the selection from the selection toolbar by choosing Inverse Selection.



- » Click on the **Delete** icon.




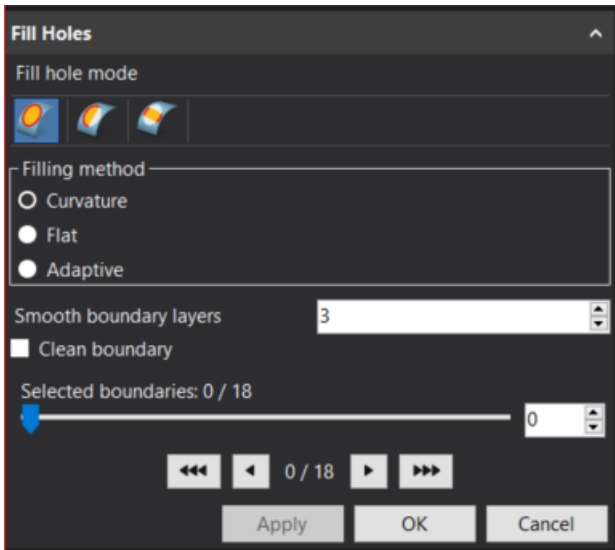
Note: By reversing the mesh selection, only the unwanted data remains selected.

Fill holes

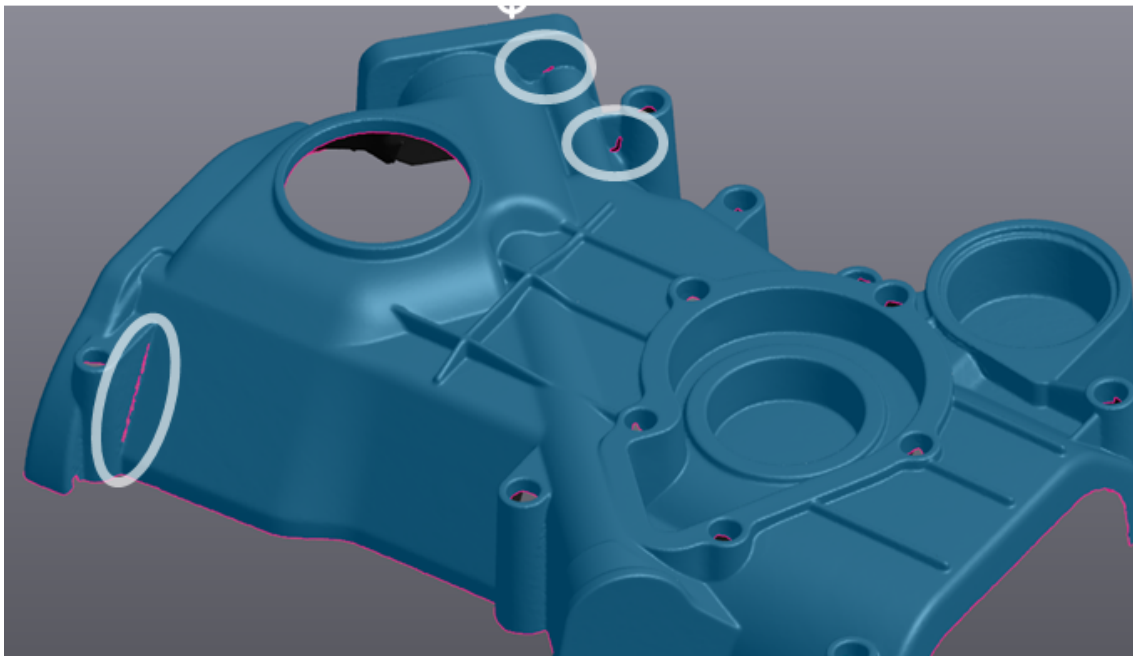
During the scan, at times, holes are created because certain spots might not be fully acquired, such as areas that are unreachable by the laser. These holes can be filled to complete the mesh.



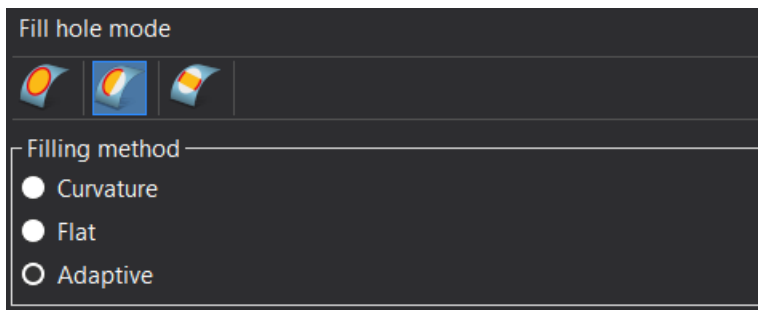
- » Click the **Fill holes**  icon.
- » Set **Fill hole mode** to **Whole**. Set the **Filling method** to **Curvature**, **Smooth Boundaries Layers** to **3** and leave **Clean boundary** unchecked.



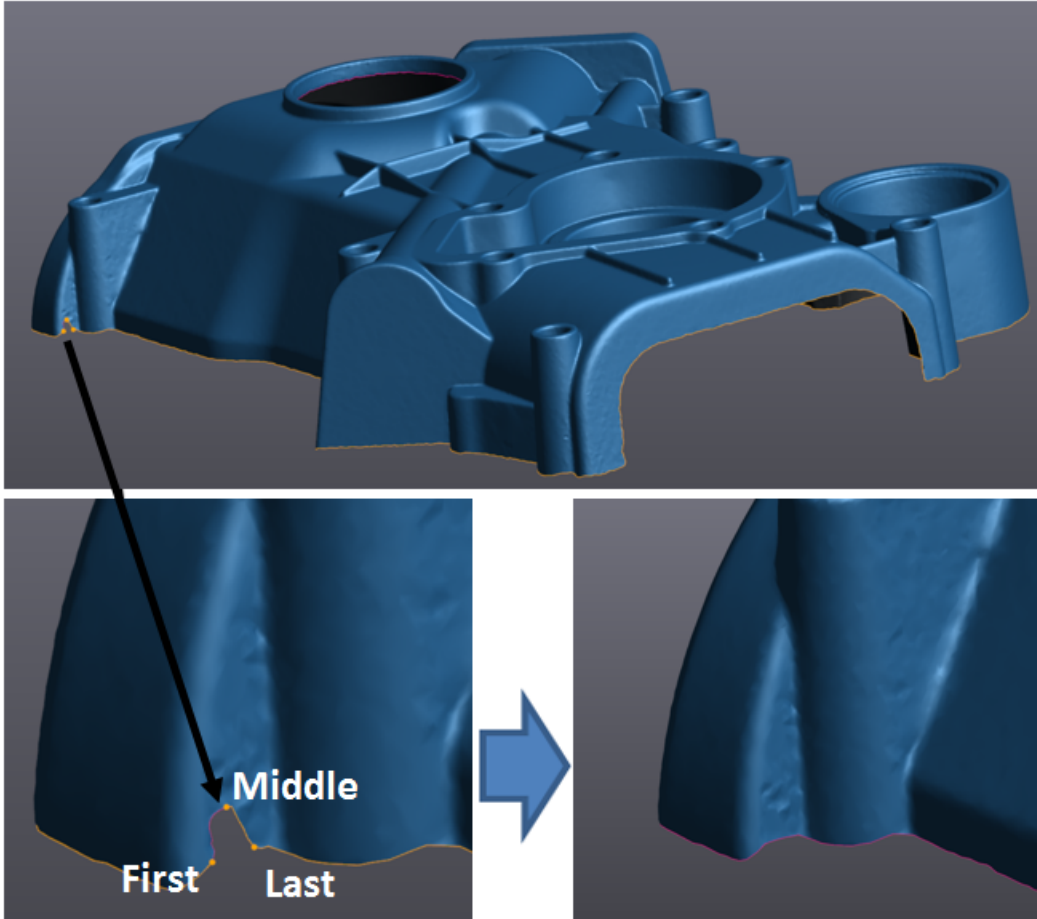
» Left-click on highlighted boundaries in order to fill holes.



» Change the **Filling Method** to **Adaptive** and switch **Whole** to **Partial**.



» Successively click the three points illustrated in the image below, on the boundary.



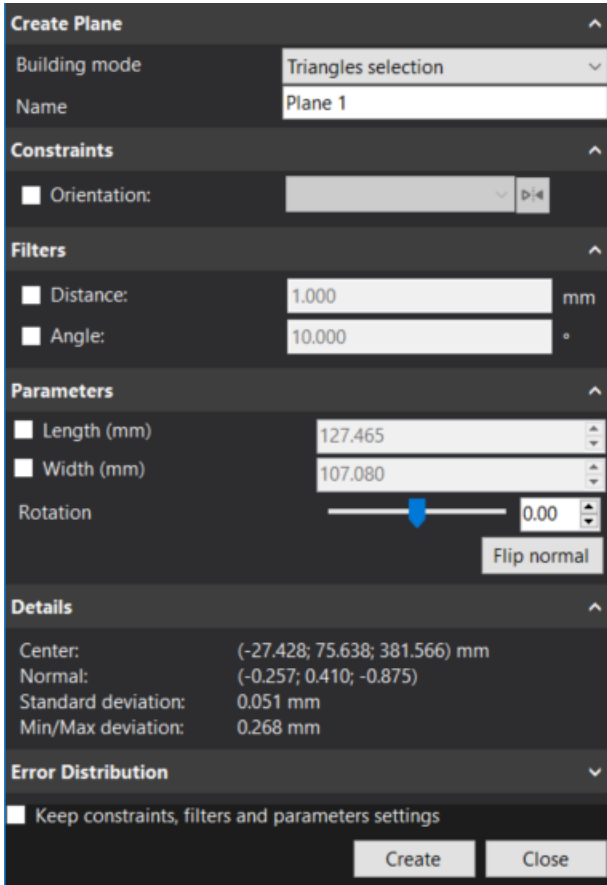
» Click **OK** to confirm the operation.

Create feature

Geometric entities created from the mesh will be used for alignment, therefore it is important to choose the entities that are the most relevant to the alignment as the entire reconstruction will be impacted. A good alignment will facilitate the subsequent steps and improve the end result.

Add Plane 1

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



Create Plane

Building mode: Triangles selection

Name: Plane 1

Constraints

Orientation: b-i

Filters

Distance: 1.000 mm

Angle: 10.000 °

Parameters

Length (mm): 127.465

Width (mm): 107.080

Rotation: 0.00

Details

Center: (-27.428; 75.638; 381.566) mm

Normal: (-0.257; 0.410; -0.875)

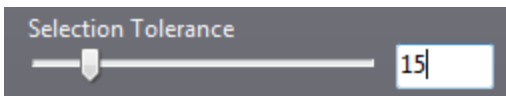
Standard deviation: 0.051 mm

Min/Max deviation: 0.268 mm

Error Distribution

Keep constraints, filters and parameters settings

- » Select the **Similar normal**  icon from the selection tools.
- » Set the **Selection tolerance** to **15**.



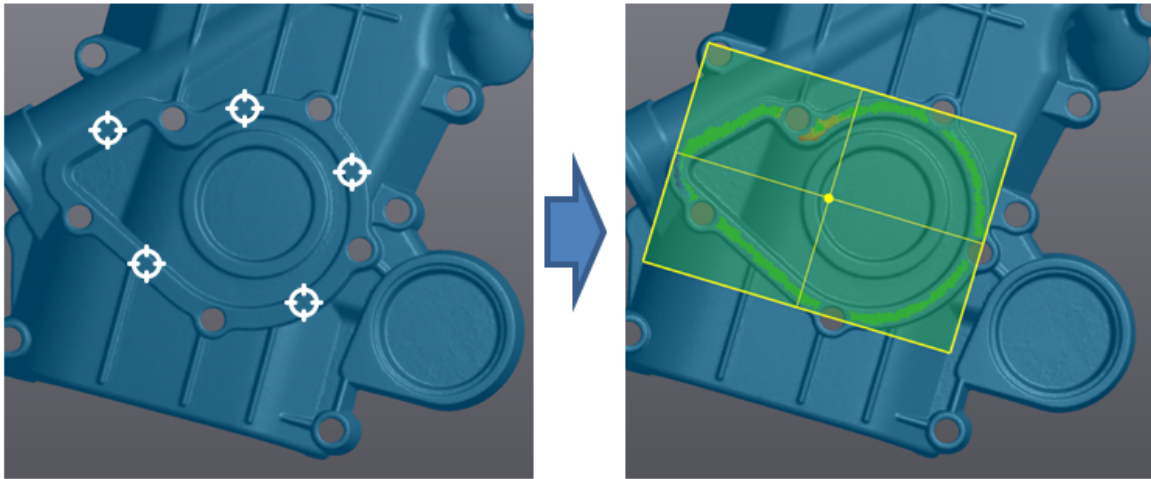
Selection Tolerance

15



Note: The values for **Selection tolerance** range from 0 to 100. The higher the selection tolerance value, the larger the amount of triangles will be 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 flat surface as shown in the figure below.

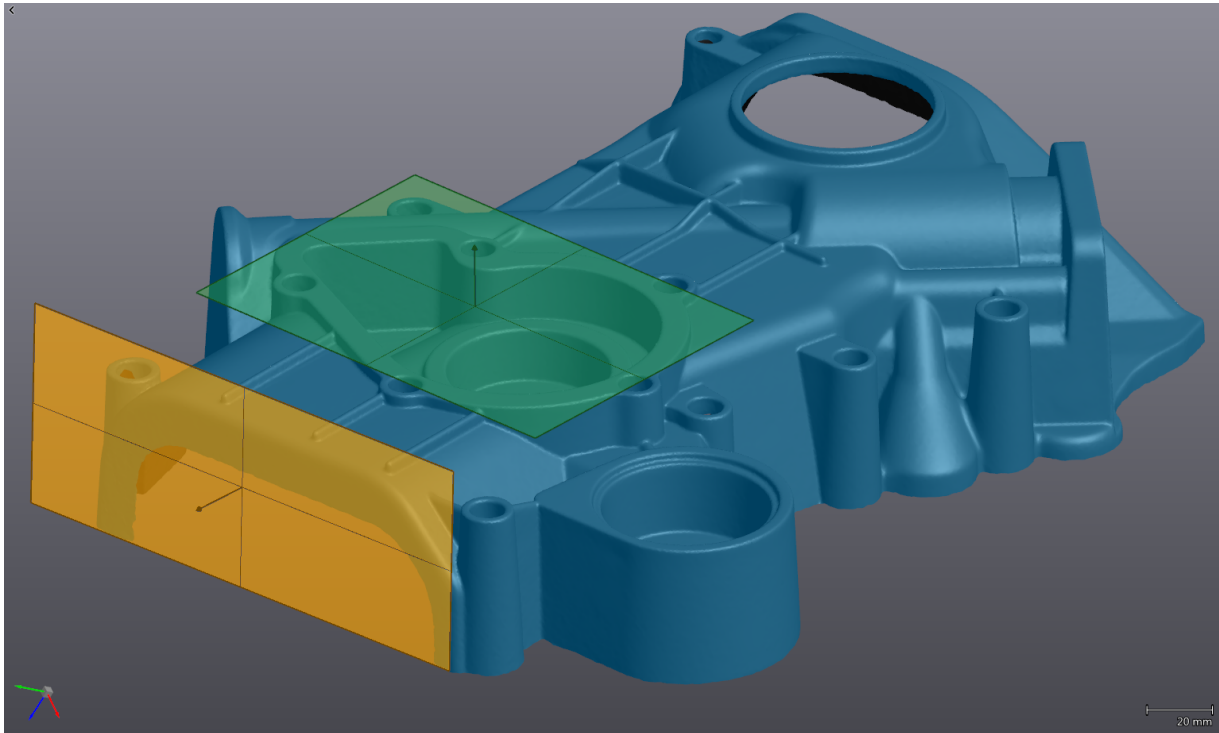


Note: A preview of the resulting plane is shown as well as a deviation colormap between the selected triangles to the best fitted plane.

» Click on **Create** button to finalize.

Add plane 2

- » Use the **Similar normal**  icon .
- » Set the **Selection tolerance** to **30**.
- » Repeat the previous step but this time for a second plane as shown below.



Add Cone 1 (for alignment)

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

Create Cone	
Building Mode	Triangles Selection
Name	Cone 1

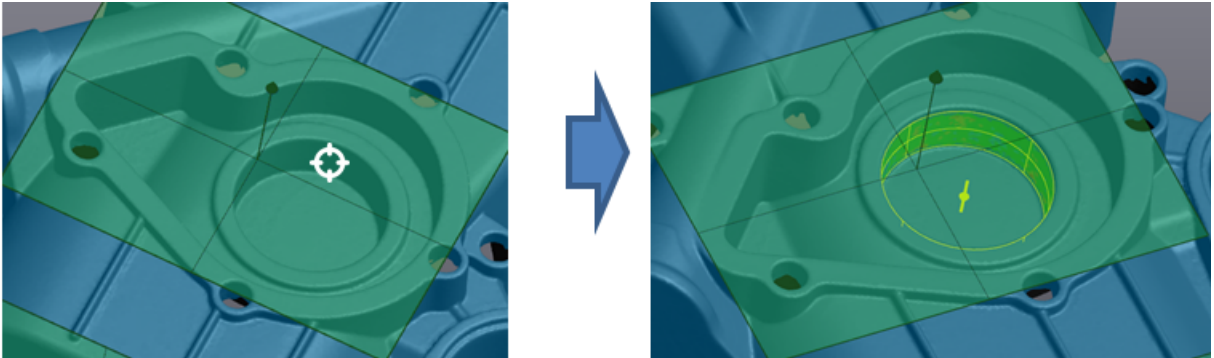
- » Select the **Similar curvature**  icon .
- » Set the **Selection tolerance** to **35**.

Selection tolerance	35
---------------------	----




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

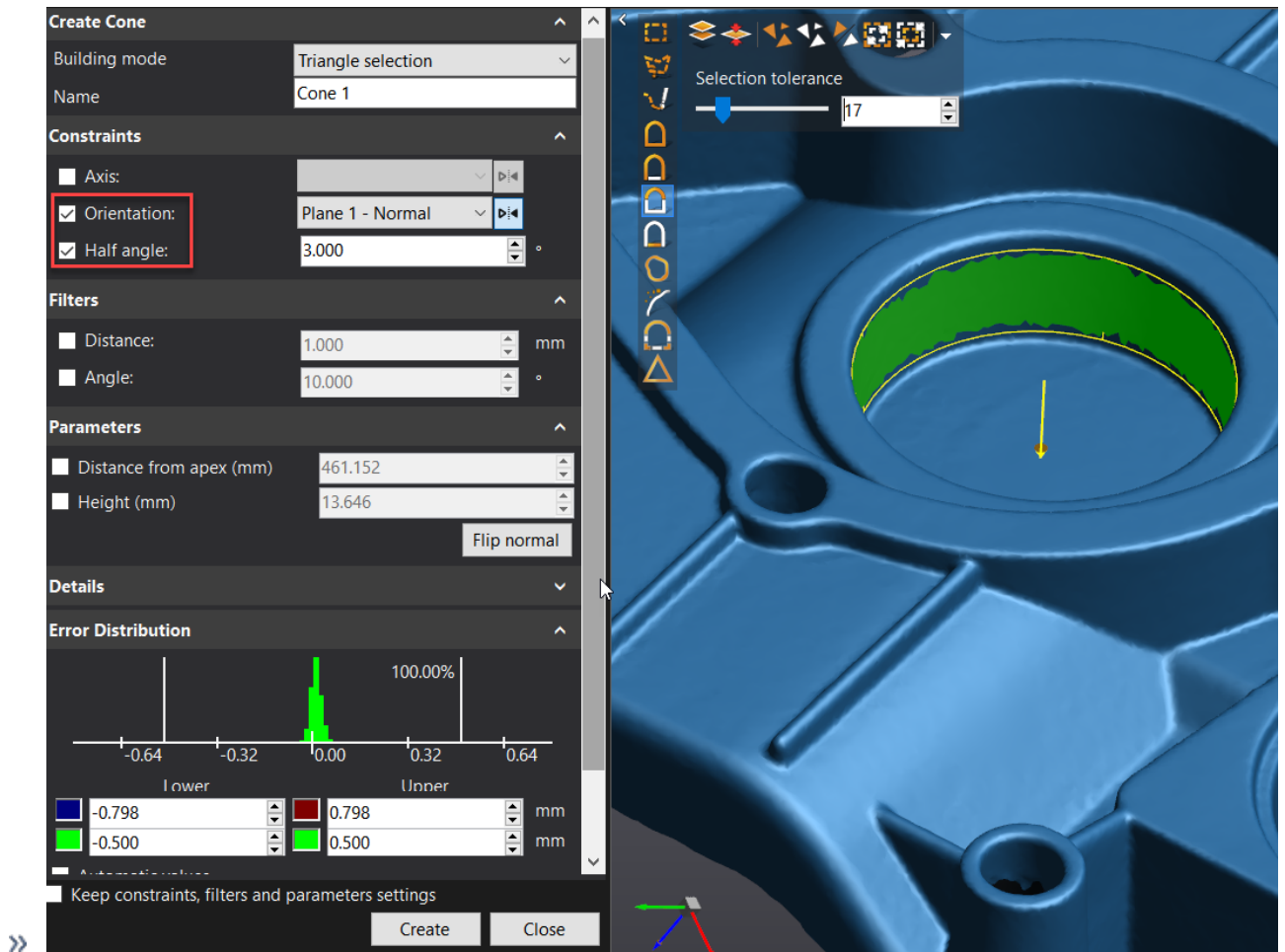
» Hold the **CTRL** key and left click the cylindrical surface as shown below.



Note: A preview of the resulting cone is shown as well as a deviation color map between the selected triangles to the best fitted cylinder.

- » Under **Constraints**, check the **Orientation** box, highlight the **Plane** icon and select **Plane 1 - Normal**.
- » Check the **Half Angle** box and change its value to **3.00°**.

- » Use the **Flip**  button to invert the orientation of **Plane 1**, so the cone axis is pointing toward the mesh.
- » Click on **Create** button to finalize.



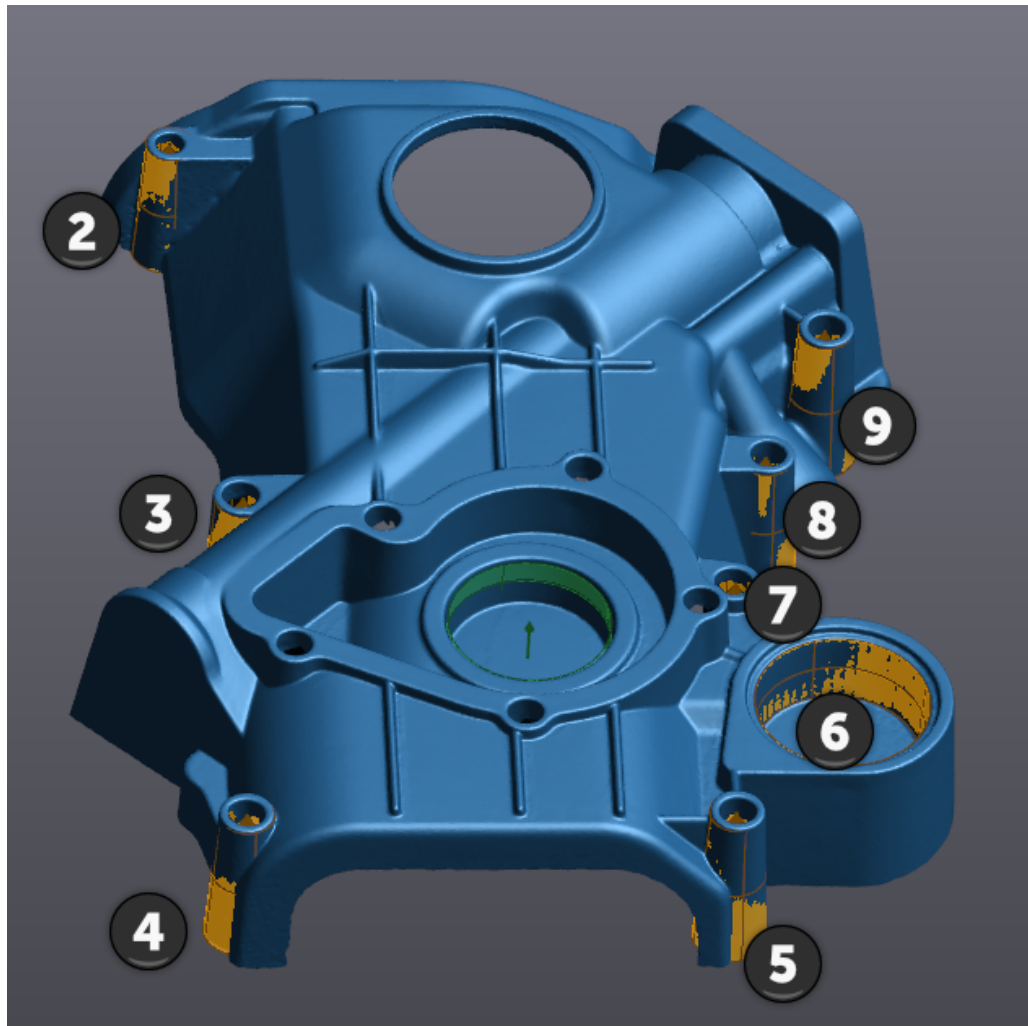
Add cone 2 to 9 (CAD entities)

Repeating the previous steps to build Cones for CAD design.

- » Constrain all next **8 Cones** on **Plane 1** and change **Half Angle** to their approximate value. You can check **Keep constraints, filters and parameters settings** option in order to avoid readjusting the parameters for every new cone.
- » After completing all 8 cones, click **Close** to finalize.



Note: A preview of the resulting cone is shown as well as a deviation color map between the selected triangles to the best fit cylinder.



Add Plane (CAD entities)



- » Click on the **Add a plane** icon.
- » Set the **Building mode** to **Plane offset**.
- » Select **Plane 1** and set an **Offset** value of **-25 mm**.

Create Plane ^

Building mode: Plane offset v

Name: Plane 3

Selection ^

Select plane.

Plane 1

Plane 2

Offset: -25.00 mm

Parameters ^

Length (mm): 127.465

Width (mm): 107.080

Rotation: 0.00

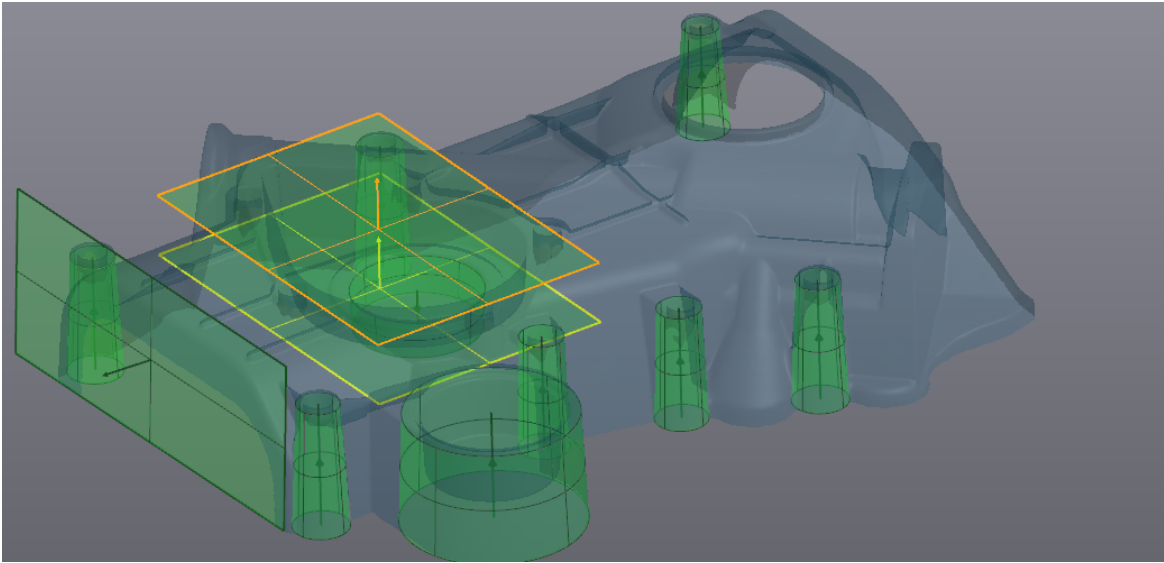
Flip normal

Details v

Keep constraints, filters and parameters settings

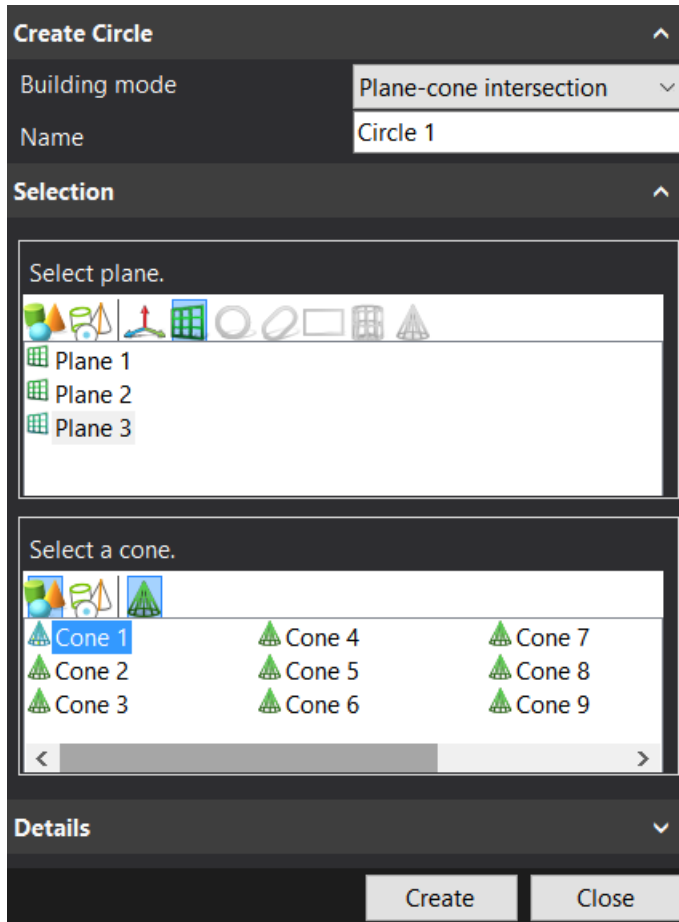
Create Close

» Click on **Create** button to finalize.

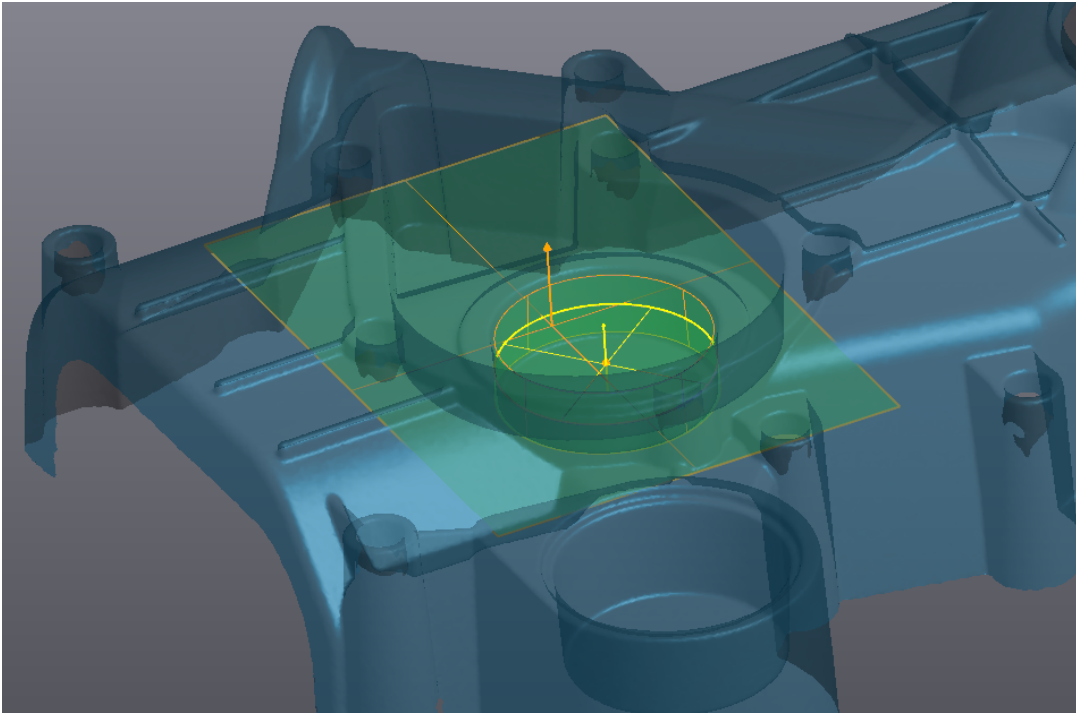


Add Circle 1

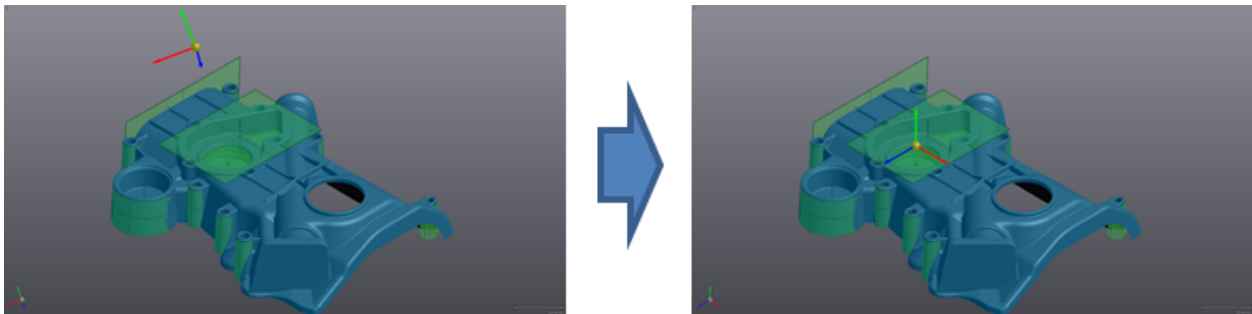
- » Click on the **Add a circle** icon.
- » Set the **Building mode** to **Plane-Cone intersection**.
- » Select the **Plane 3** and **Cone 1**.



» Click on **Create** to finalize and then **Close**.



Align mesh



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

» Click the **Align to origin**

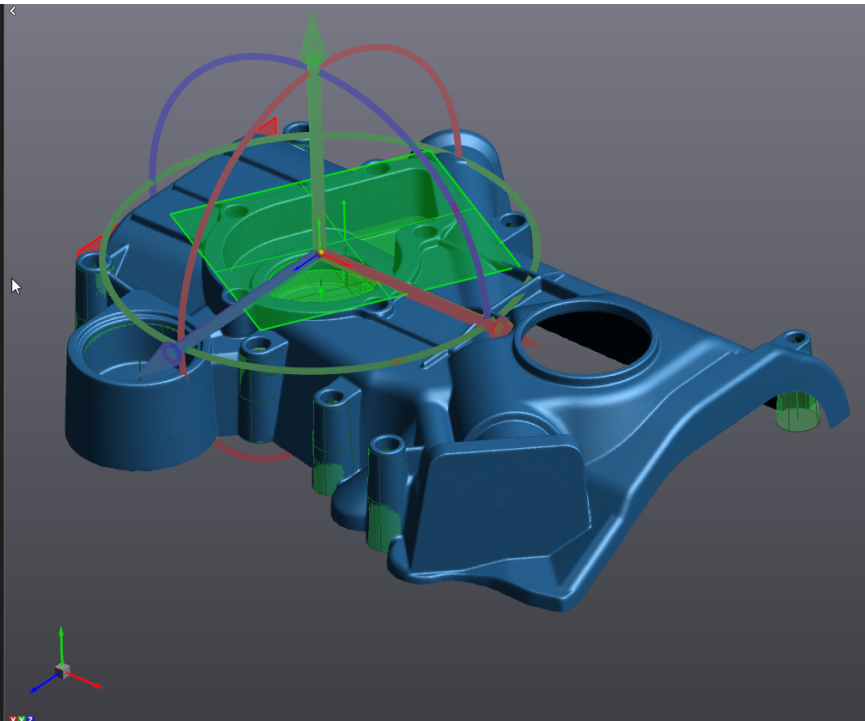
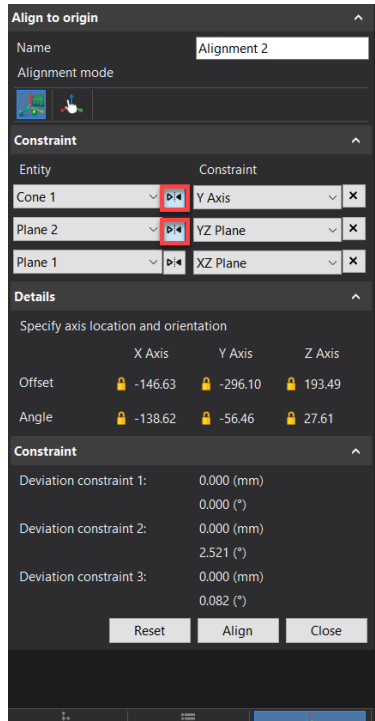


icon .

» In the **Constraint selection**, under the **Entity** column, select **Cone 1** from the drop-down menu and pair it with **Y Axis** under the **Constraint** column.

» Repeat to pair **Plane 2** with **YZ Plane**, then **Plane 1** with **XZ Plane**.

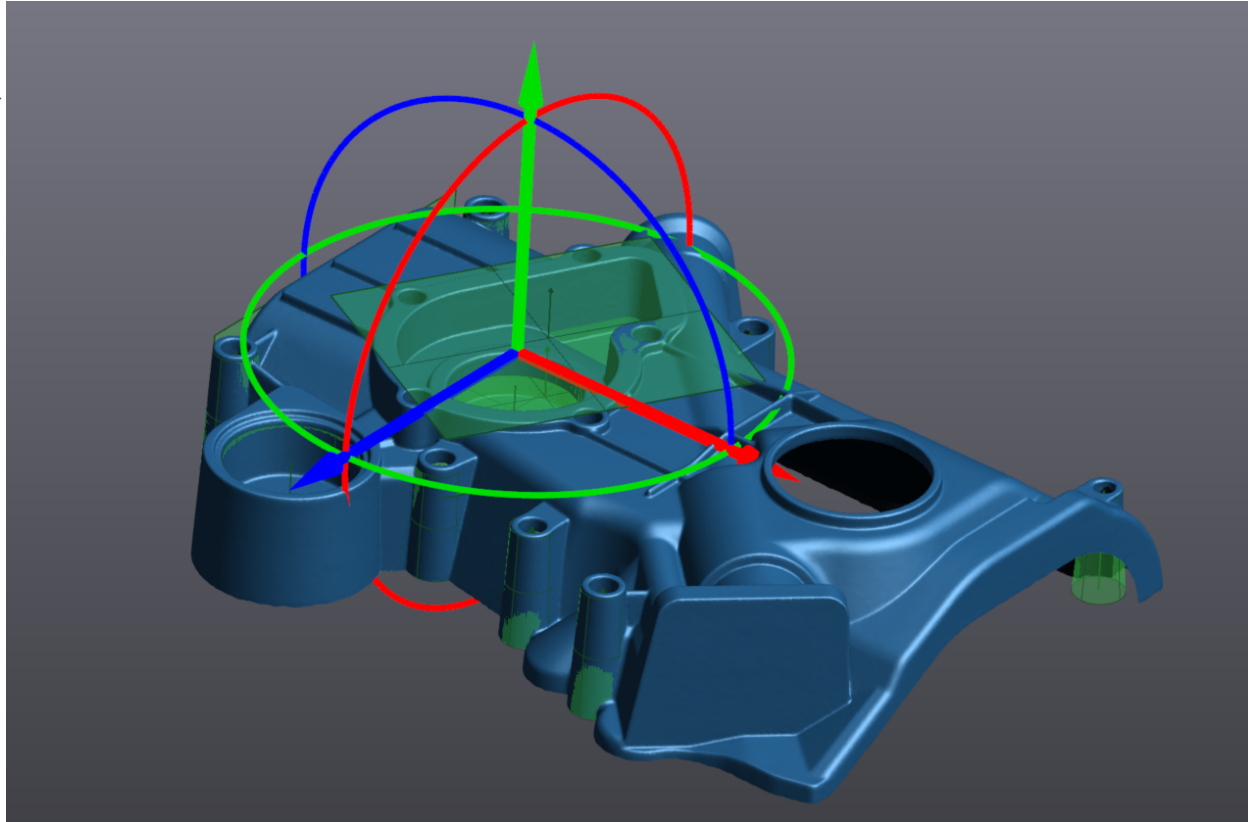
» Use the flip button to invert **Cone 1** and **Plane 2**.



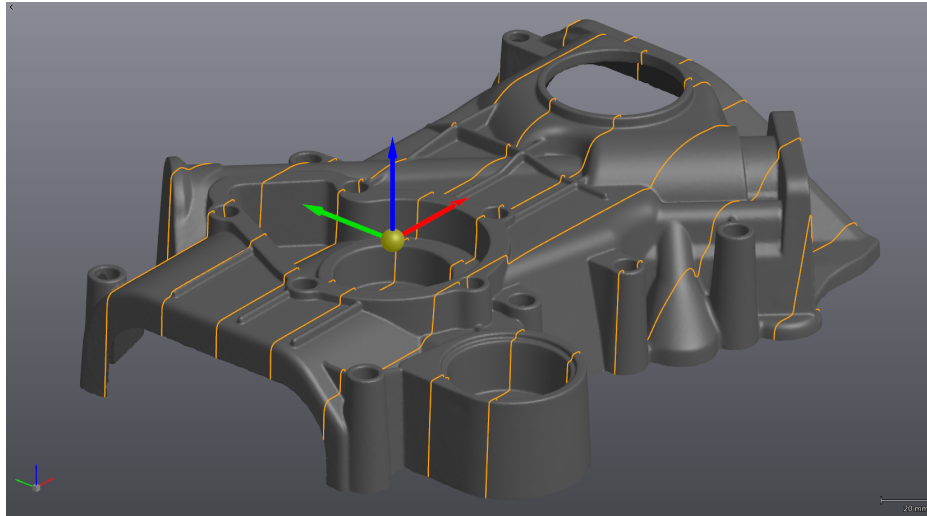



Note: For paired entities, the degrees of freedom (DOF) of the Mesh decrease. The constrained DOF are locked next to the **Offset** and **Angle** text boxes.

» Click on **Align** to complete the alignment.



Creating cross-sections



- » Click on the **Add a cross-section**  icon.
- » Set the **Building mode** to **Linear**, select the **Type** with the **Whole mesh** icon and the **Existing plane** to **Origin – Plane XY**.
- » In the **Count** enter a value of **8** with **30 mm Spacing**
- » Set the **Output type** to **Curve** and the **Curve parameters** to **Deviation** with a value of **0.1 mm**.




Create Cross-Section ^

Building mode v

Name v

Selection ^

Type

Existing plane v

Count v

Spacing (mm) v

Curve parameters ^

Output type

Polyline
 Curve

Curve parameters

Criteria v

Maximum deviation (mm) v

Details v



Note: Setting **Output** to **Polyline** creates small line segments from the intersection of all the triangle to the cross-section plane. Curve creates a spline that can be adjusted with either **Maximum deviation** or **Control points** in the **Curve parameters**.

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

Export Entities

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

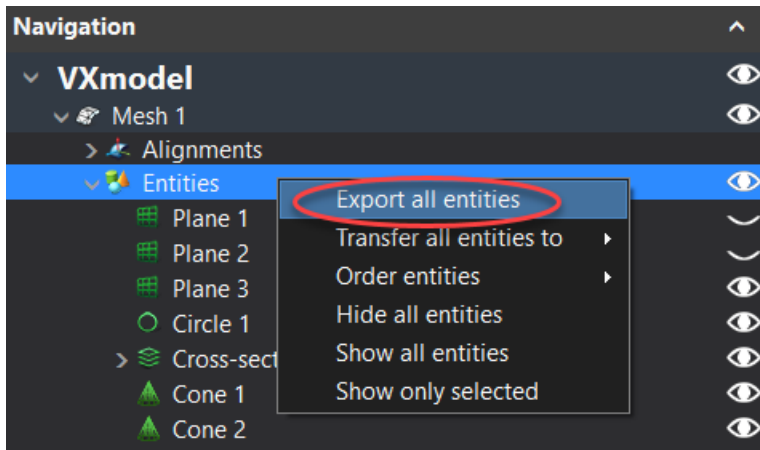
Save mesh model

- » Highlight the **Mesh 1** by clicking on it in the **Navigation** tree.
- » Click on the **Export > mesh** button or Right click on the mesh to export the mesh.

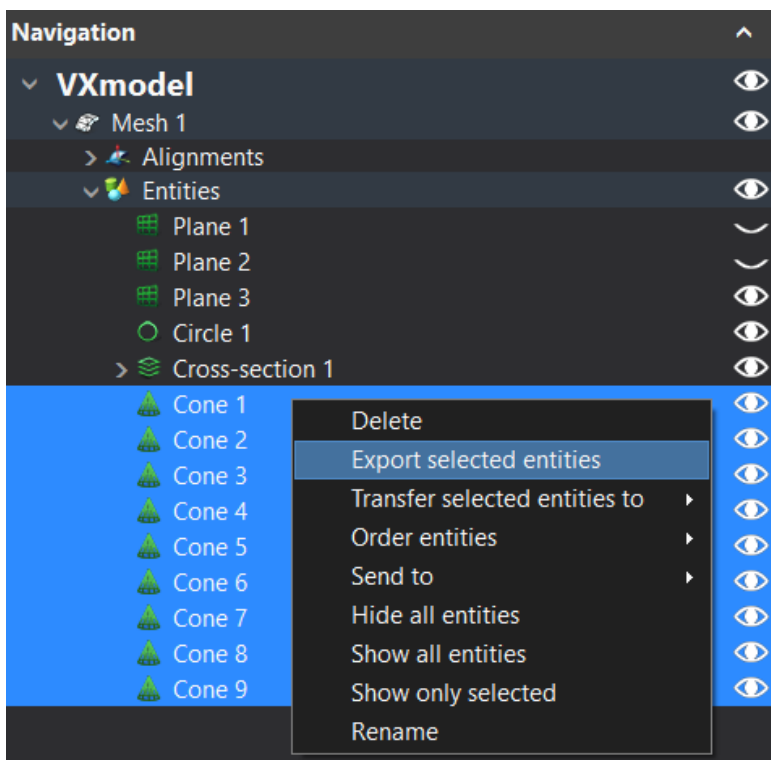
Export entities

Export the entities in **STEP** format to use in the CAD software

» Right click on the **Entities** and select **Export all entities**



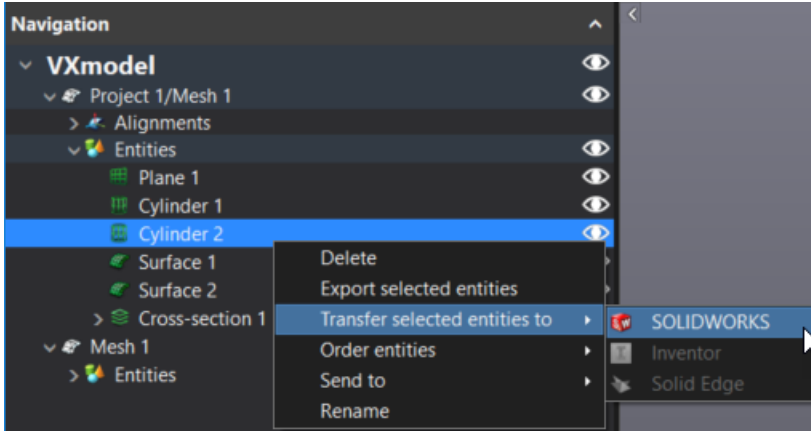
Note: To export one or more entities, select only the ones to be exported before clicking **Export selected entities**



Export entities – SOLIDWORKS/Inventor/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 opened, it will import the entities in the active part.

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