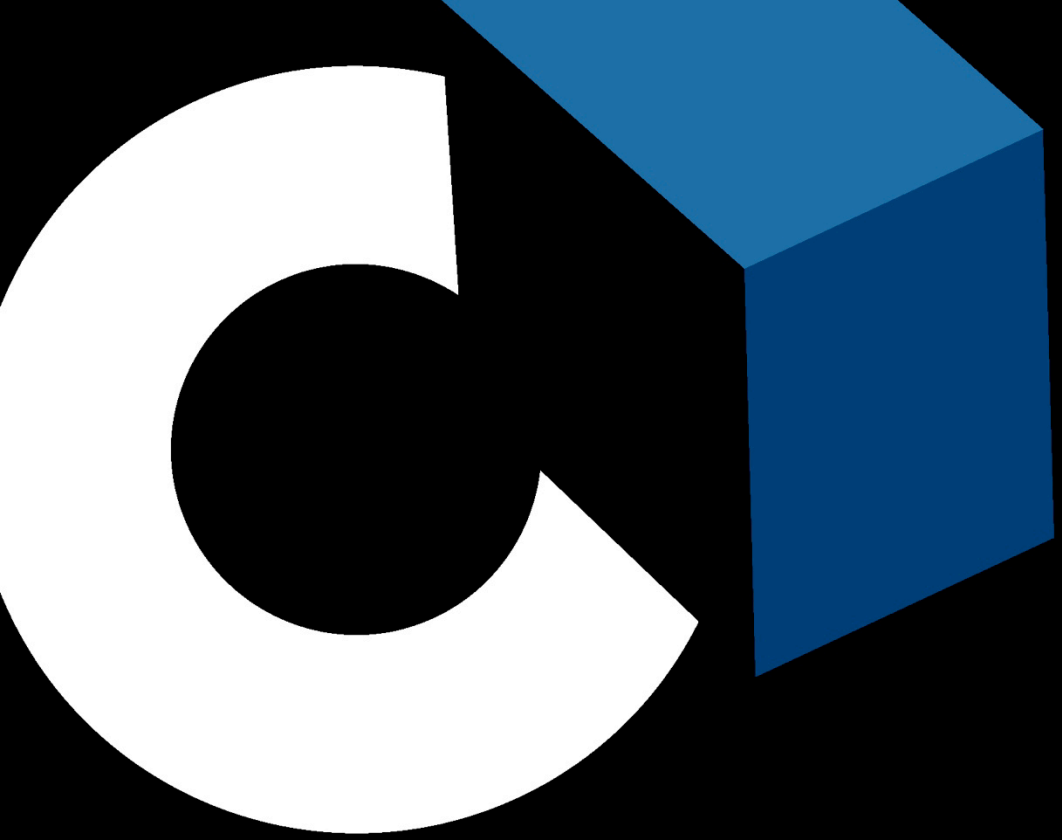

HANDYSCAN 3D TRAINING SCRIPT

MAY 2014

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AGENDA

- Introduction
- Calibration
- Configuration
- Creating Positioning Model
- Scan Procedure
- Saving Acquired Data
- Additional Functions
- Hands-on session

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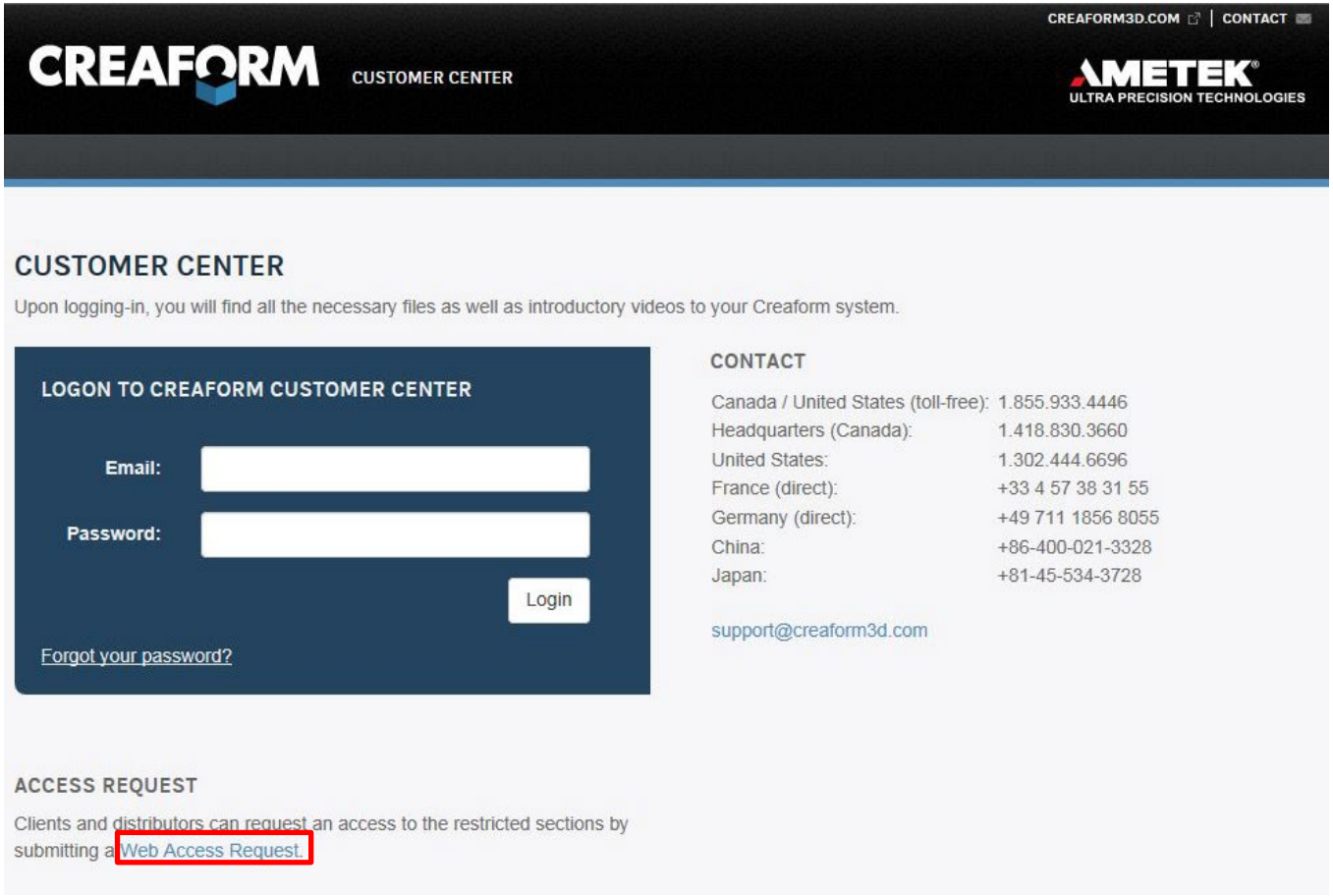
INTRODUCTION

WEB ACCESS REQUEST

support.creaform3d.com



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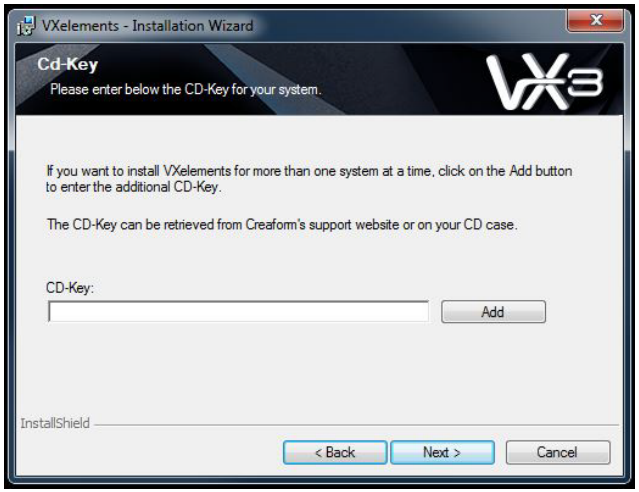
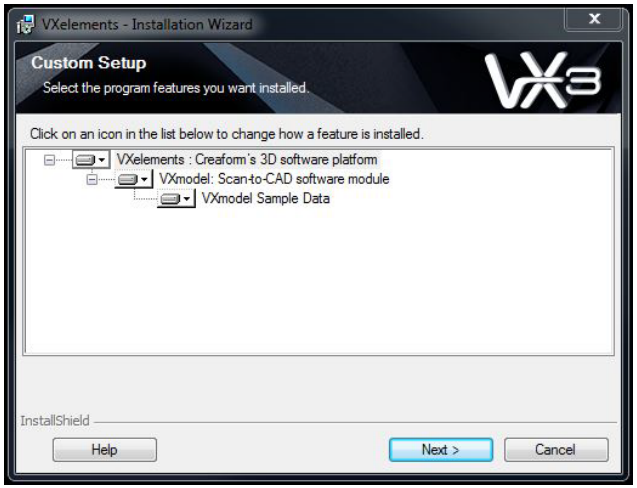
INSTALLING VXELEMENTS

- Install VXelements from the USB Key provided by Creaform or from *Customer Center* on Creaform's website

- Enter the required product CD Key (1 per product)





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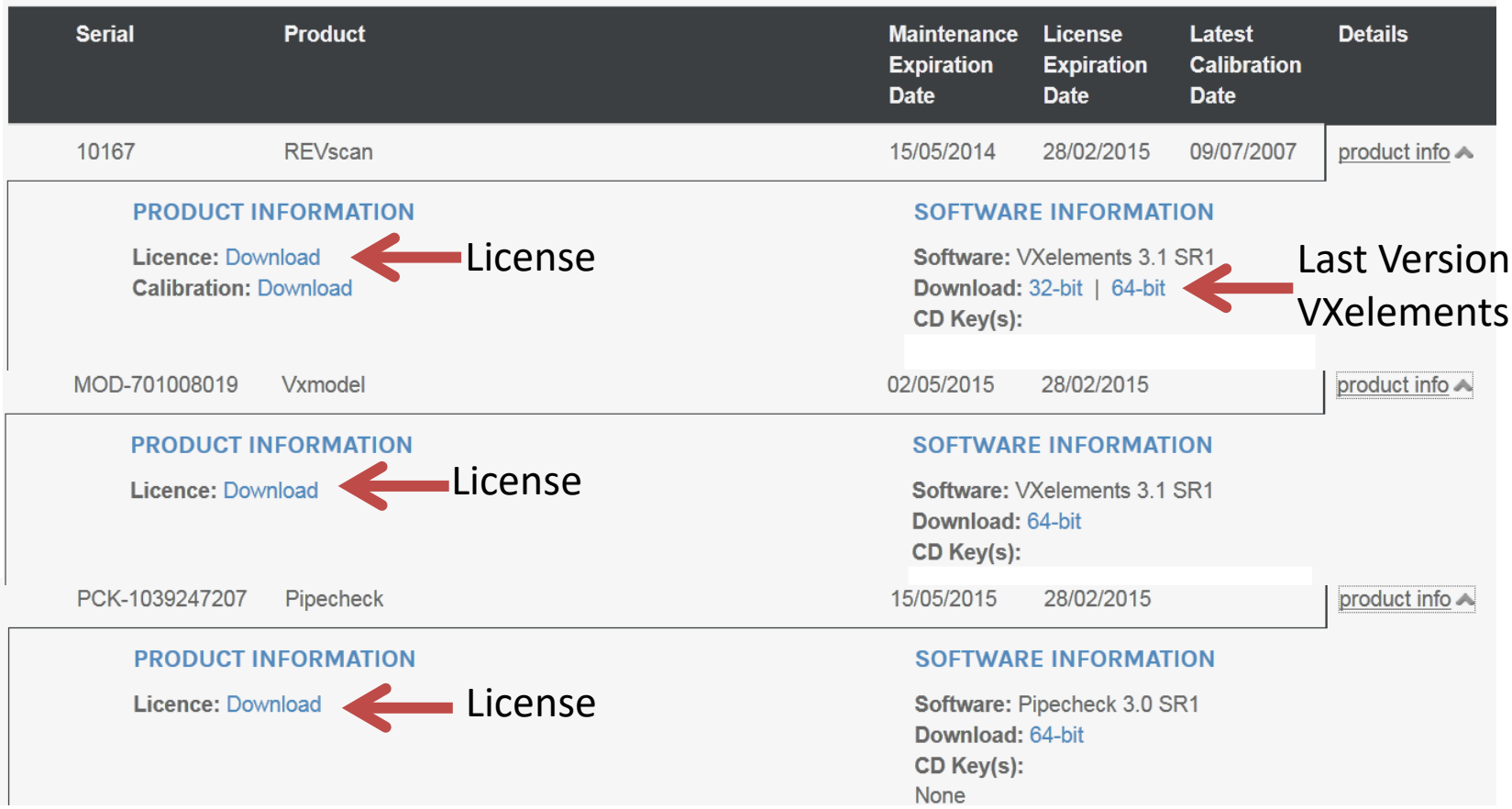
CREAFORM CUSTOMER CENTER

- Download the license file for the appropriate product



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LICENSE & SOFTWARE UPDATES

- Types of license provided by Creaform

Dongle (VXmodel & Pipecheck)

.clf file (Scanners, CMMs and MAXshot)

- When do we need to update our license files?

When a new version of VXelements has been installed.
A service release is not a new version.

- How to update your license files?

Dongle (VXmodel & Pipecheck)

The license file is an executable file. Connect the dongle and double-click on the license file.

.clf file (Scanners, CMMs and MAXshot)

The file needs to be replaced in VXelements product manager.

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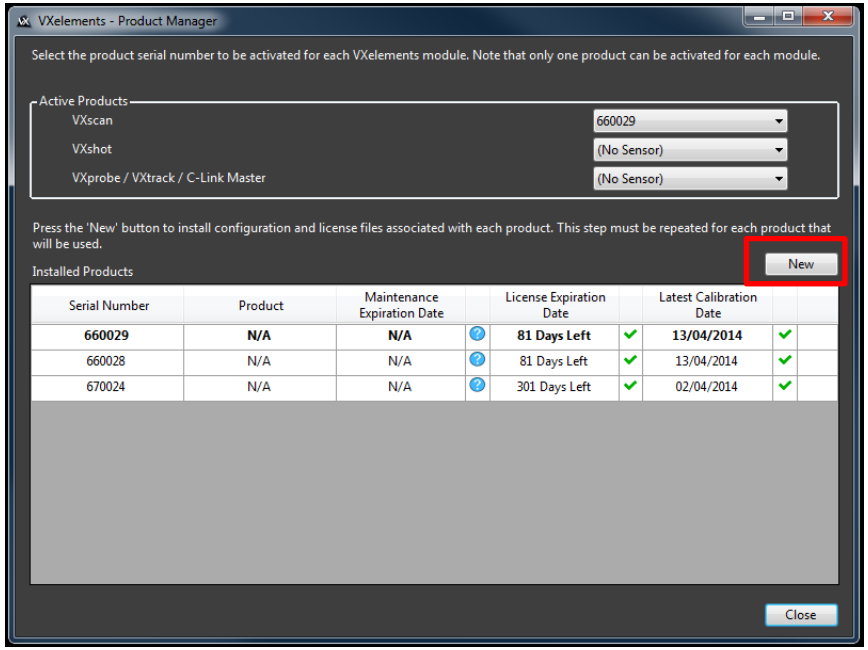
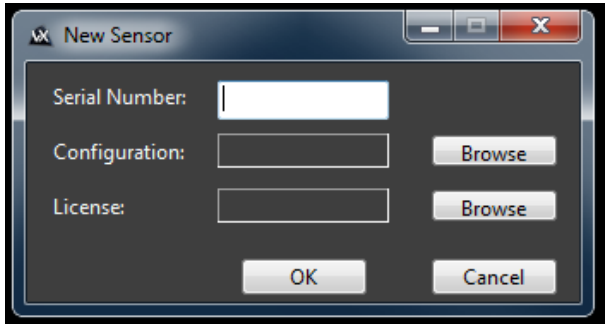
ACTIVATING YOUR PRODUCT IN VXELEMENTS

- Open the **Product Manager**
- Click on **New** or select it from the list of active products
- Enter the Serial Number
- Attach license and configuration files





The configuration file is available from the Customer Center. Each system has a unique configuration file.

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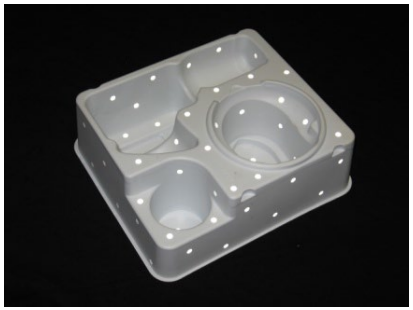
TYPICAL WORKFLOW

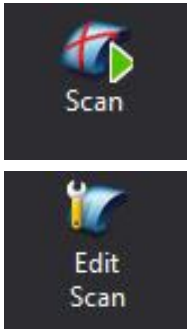
Prepare

- Position the targets on the part
- Calibrate the scanner
- Configure the scanner parameters
- Define the scan parameters



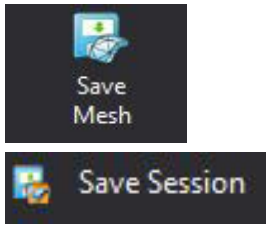
Scan

- Scan the part
- Edit the mesh



Save

- Save VXelements session
- Save STL



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HARDWARE

USB Key

Positioning Targets

Power Supply

HandySCAN 3D

USB 3.0 Cable

Calibration Plate

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SYSTEM CONNECTION

- Plug the power supply to an electric source
- Connect the power supply into the USB cable
- Connect the USB cable into the computer
- Connect the other extremity of the USB cable into the scanner
- Launch VXelements

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MULTI-FUNCTIONAL BUTTONS

1. Scan button

- Long click: Start/Stop scan process
- Short click: Start acquisition/Pause

2. Toggle mode button

- Toggle between Zoom and Shutter mode

3. +/- button

- Function adjustement: zoom or shutter

For zoom mode

Double-click + : Reset Viewpoint and double-click again Fit to Screen

Double-click - : Lock / Unlock Viewpoint

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SCANNER POSITION

Standing-up	On the side

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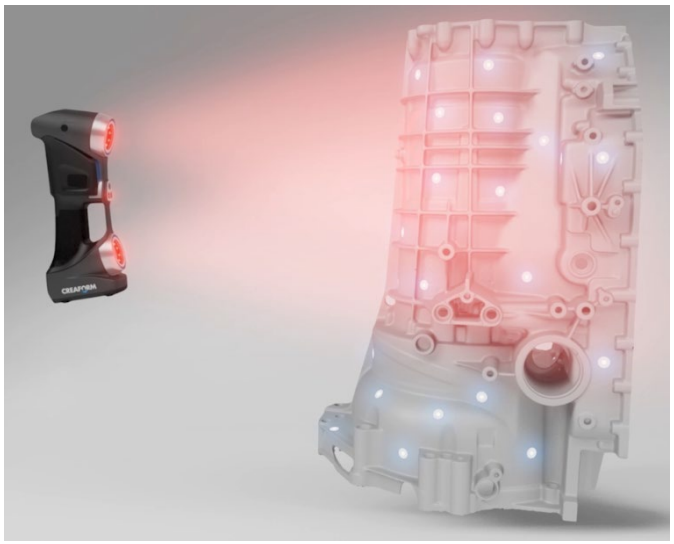
OPERATING PRINCIPLES

Self positioning

3D laser scanner



- Does not require external positioning system
- Position of the scanner in relation to the part is determined by triangulation (in real-time)
- Reference is linked to the part, since targets are affixed to it
- Part can be moved during data acquisition

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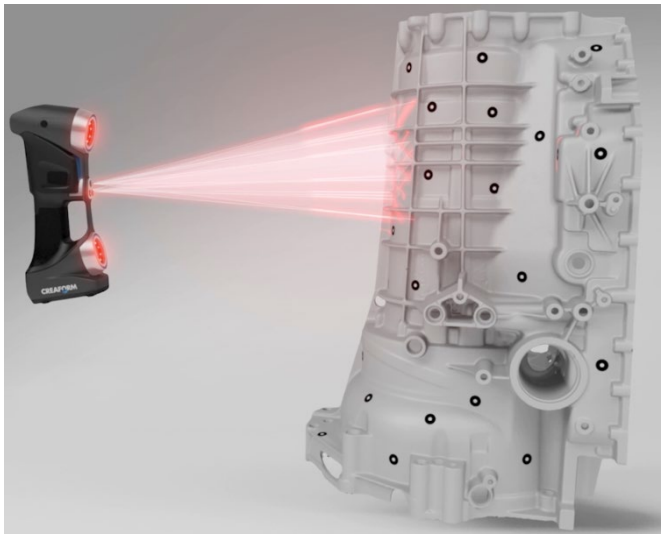
OPERATING PRINCIPLES

- **Surface Acquisition: Real Time Surface Rendering**



- Automatic surface generation
- Laser projected on the object is deformed according to the shape of the object. While scanning, the cameras record this particular shape and calculate it.

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OPERATING PRINCIPLES
LIGHT PATTERN VISIBILITY

- Needs good visibility of the light pattern on the part
- Visibility of the light pattern is greatly influenced by the color of the part and the material type
  - High reflectivity
  - Black color
- Acquisition parameters can be adjusted in order to counteract the effect of black, reflective and transparent object.
- Good part preparation will also lead to better results.

GLOSSARY

- Introducing Creaform Glossary
- Concepts and definitions linked to Creaform technologies

TECHNICAL SPECIFICATIONS

	HandySCAN 300	HandySCAN 700
WEIGHT	0.85 kg	
DIMENSIONS	122 x 77 x 294 mm	
MEASUREMENT RATE	205,000 measures/s	480,000 measures/s
SCANNING AREA	225 x 250 mm	275 x 250 mm
LIGHT SOURCE	3 laser crosses	7 laser crosses (+1 extra line)
LASER CLASS	II (eye-safe)	
RESOLUTION	0.100 mm	0.050 mm
ACCURACY	Up to 0.040 mm	Up to 0.030 mm
VOLUMETRIC ACCURACY*	0.020 mm + 0.100 mm/m	0.020 mm + 0.060 mm/m
VOLUMETRIC ACCURACY (WITH MAXSHOT 3D)*	0.020 mm + 0.025 mm/m	
STAND-OFF DISTANCE	300 mm	
DEPTH OF FIELD	250 mm	
PART SIZE RANGE (RECOMMENDED)	0.1 – 4 m	
CONNECTION STANDARD	1 X USB 3.0	
OPERATING TEMPERATURE RANGE	15-40 °C	
OPERATING HUMIDITY RANGE (NON-CONDENSING)	10-90%	

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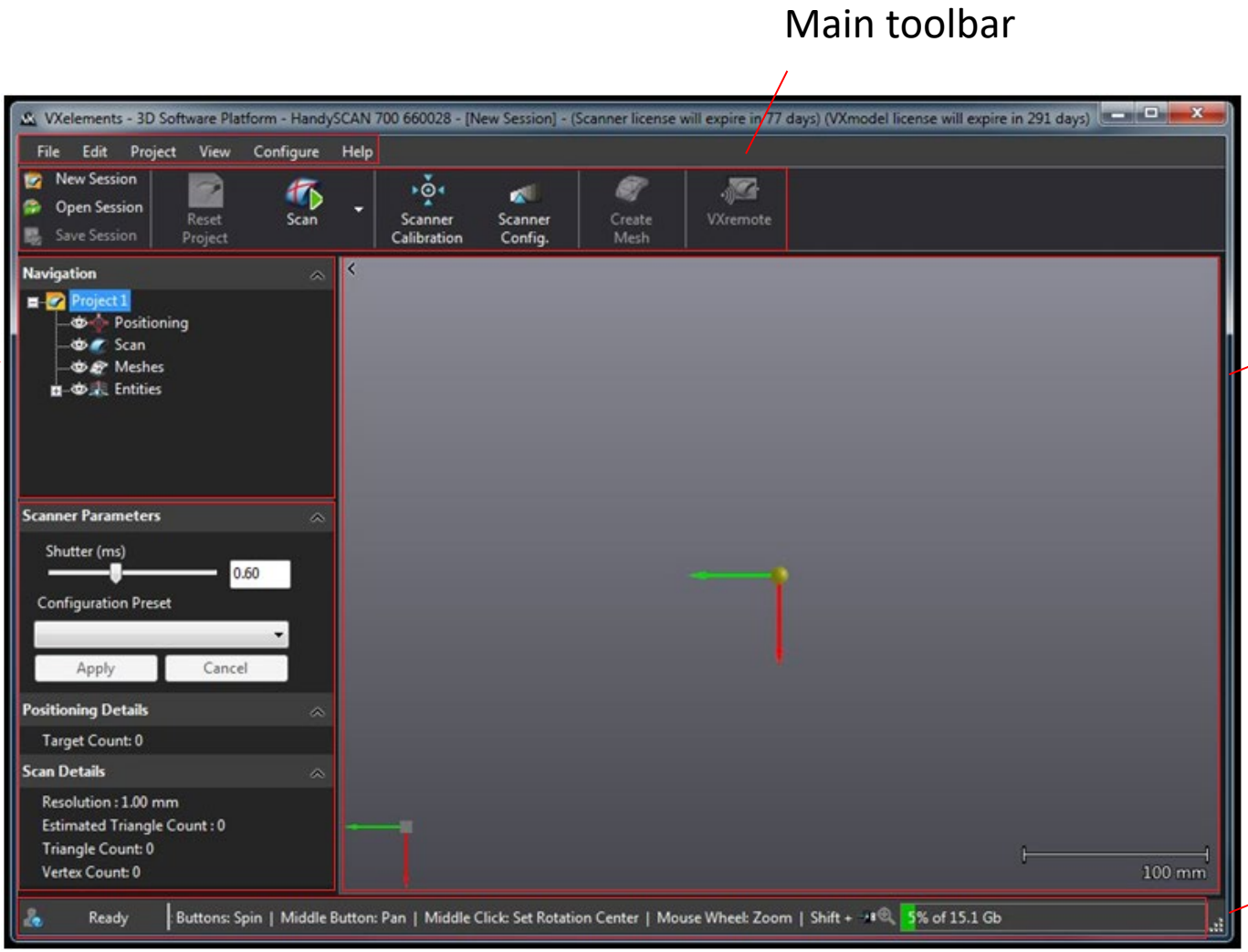
SOFTWARE INTERFACE



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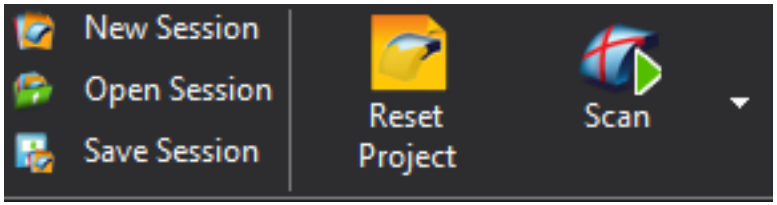
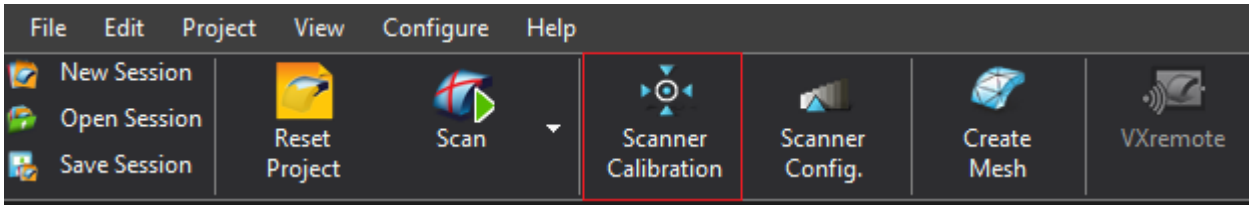
MAIN TOOLBAR



- To create a new session file
- To open an existing session file
- To save the current VXelements session file
- To reset the current project. The project parameters will not be reinitialized in New Session
- To start and stop scanning

CALIBRATION

CALIBRATION



- To ensure good data quality, calibration is recommended before every project and whenever you experience temperatures change or bad surface quality.

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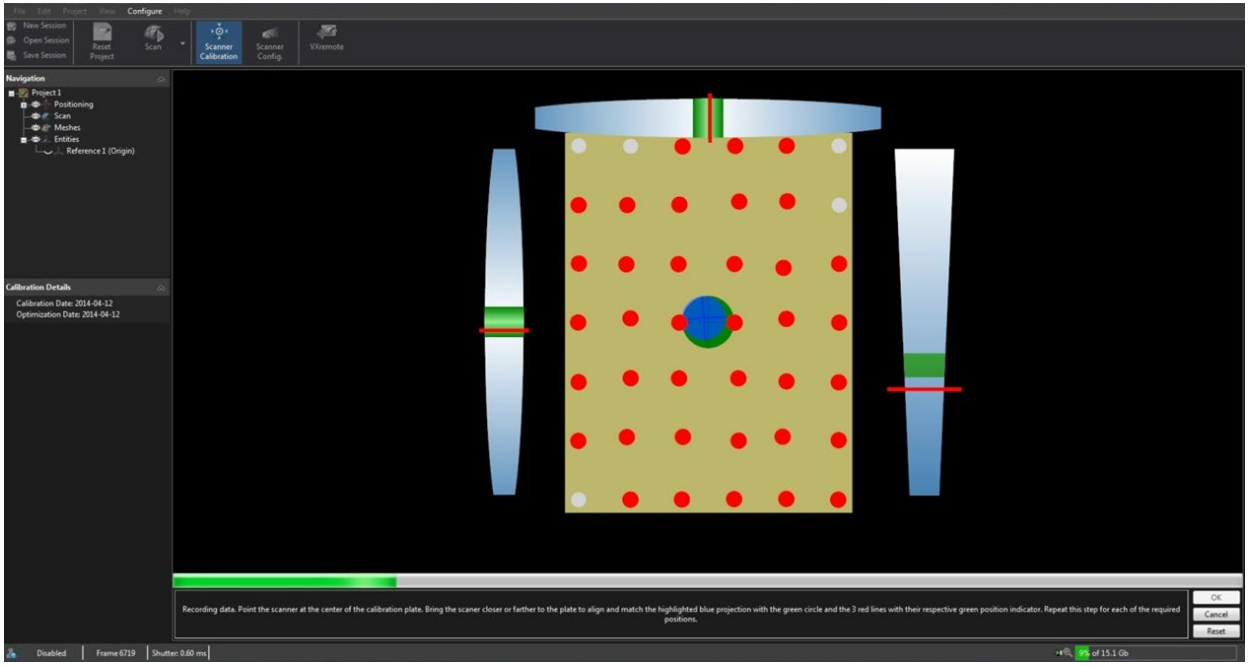
CALIBRATION

- No targets near the calibration plate
- Leave the calibration plate into the case if possible
- Make sure that no reflective objects are near the calibration plate
- Make yourself comfortable to perform calibration
- Detection of a false, damaged or misplaced target is likely to make the process fail

CALIBRATION

- Scanner must point at the center of the calibration plate showed by the circle and align the red line (height and orientation of the scanner) on the green rectangular.



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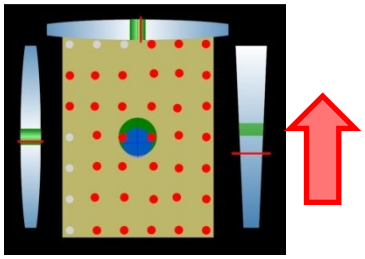
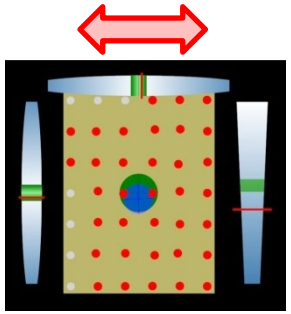
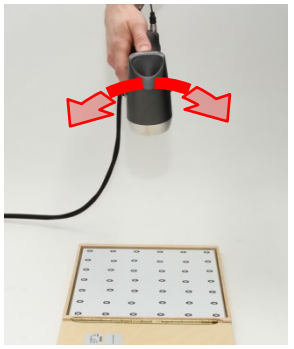
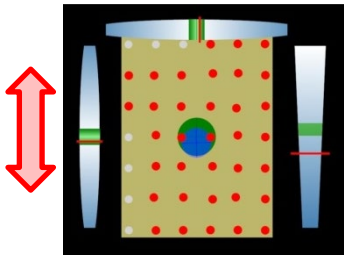
CALIBRATION

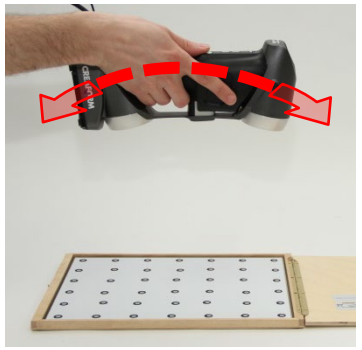
- **Measurements 1 to 10** at different height normal to the calibration plate
  - Right indicator: height of the scanner
- **Measurements 11-12** at angle
  - Top indicator: orientation of the scanner
- **Measurements 13-14** at angle
  - Left indicator: orientation of the scanner











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CALIBRATION EXERCISE

YOUR TURN TO TRY!

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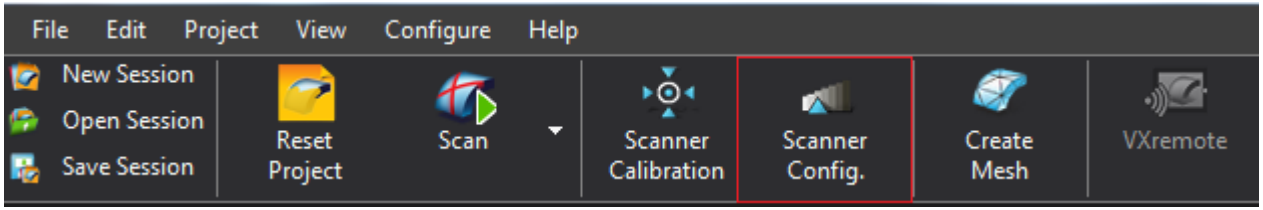
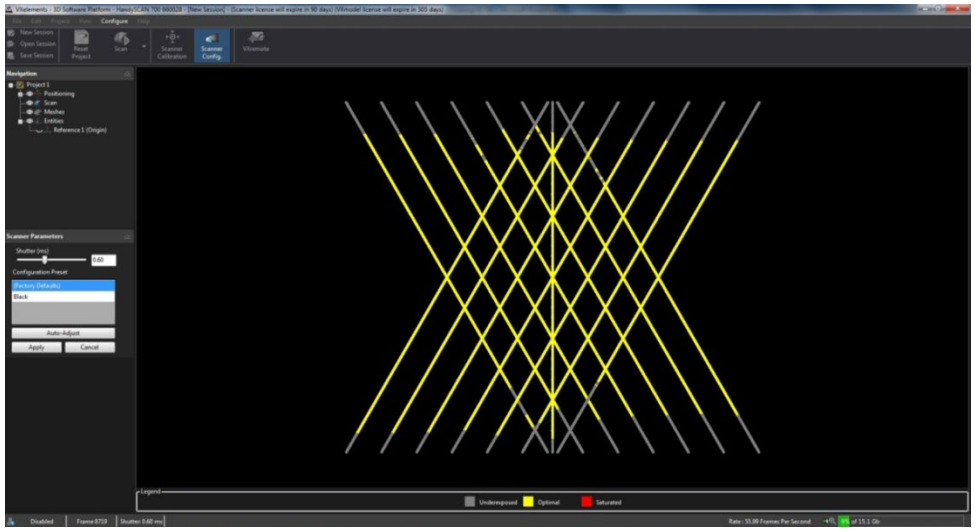
CONFIGURATION

CONFIGURATION

- Configure the sensor shutter time, according to the type of surface to scan.





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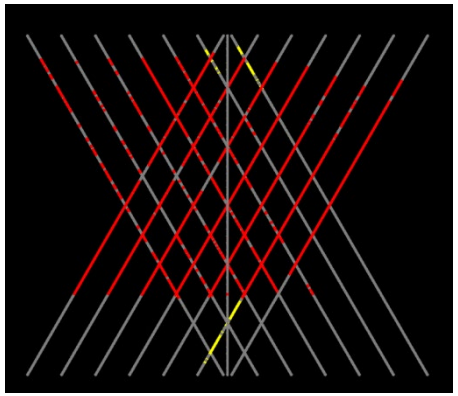
CONFIGURATION

- Automatic Adjustment
  - When laser lines lie completely over the surface
  - Keep the scanner over the surface until the **Optimizing Parameters** message disappears

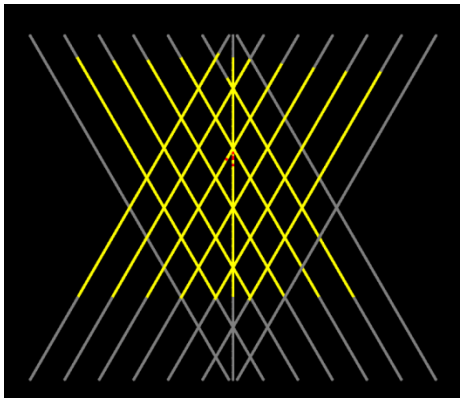
- Manual Adjustment
  - When the part to scan is too small for the entire length of the laser lines
  - When the part is multicoloured

CONFIGURATION

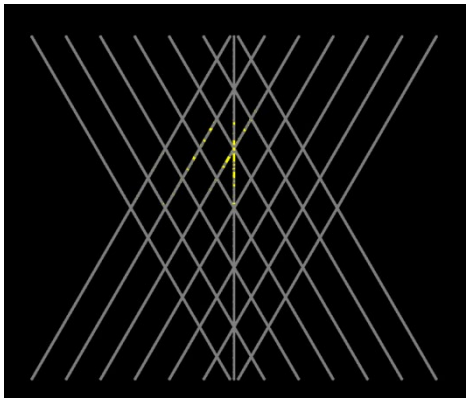
Saturated



Optimal



Underexposed



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CONFIGURATION

Auto Adjust mode

- Click on Auto Adjust
- Make sure the laser lines lie completely over the surface to scan
- Make sure the sensor is perpendicular to the surface
- Keep the scanner over the surface until the Optimizing Parameters message disappears
- Click on Apply and then OK to exit the menu

CONFIGURATION EXERCISE

YOUR TURN TO TRY!

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CREATING POSITIONING MODEL

PART PREPARATION

- Add powder
  - Required for shiny parts
- Apply targets on the part
  - Distance: between 20 mm and 100 mm
  - Flat zones: less target needed
  - Curved zones: more targets needed
  - Do not add too many targets: it's easier to add them than to remove them

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USING THE ENVIRONMENT

Apply targets around the part

- When the part is too small
- When it is not possible to put targets directly on it
- Make sure the relative position of targets in the environment and the part remains unchanged throughout the scanning process.

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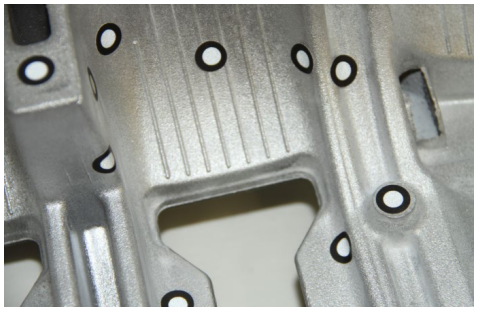
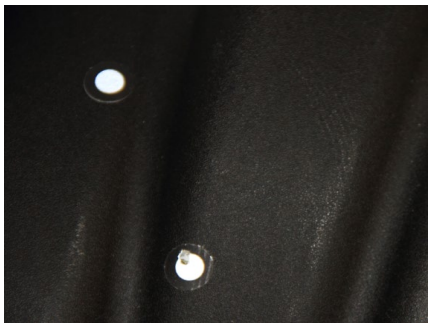
TARGET ISSUES

Avoid:

- Adding targets on high curvature surface
- Adding targets close to edges/details (< 3-4 mm)
- Using damaged or incomplete targets
- Using greasy, dusty, dirty or hidden targets





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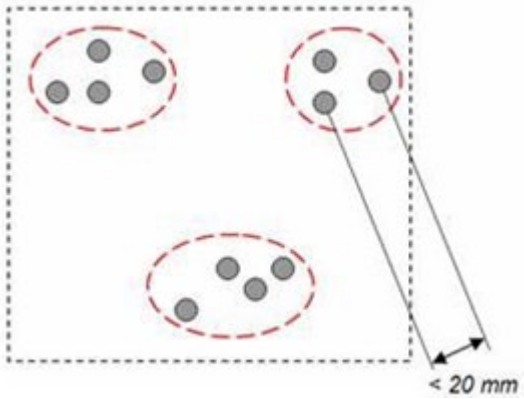
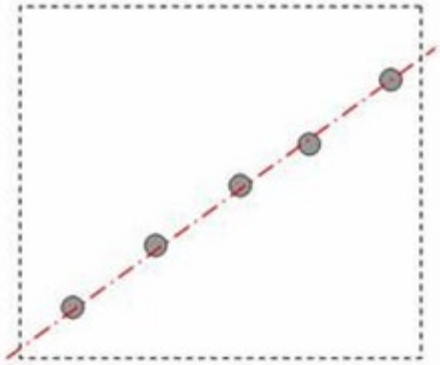
TARGET ISSUES

Do not:

- Group targets

- Align targets on a perfect line (doesn't allow proper triangulation)





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PART PREPARATION

To facilitate the acquisition when working with black, reflective or transparent parts:

Use these products when necessary

- Spot check SKD-S2 Developer
  http://www.magnaflux.com/Distributors/tabid/398/Default.aspx
- Masking tape
- Paint

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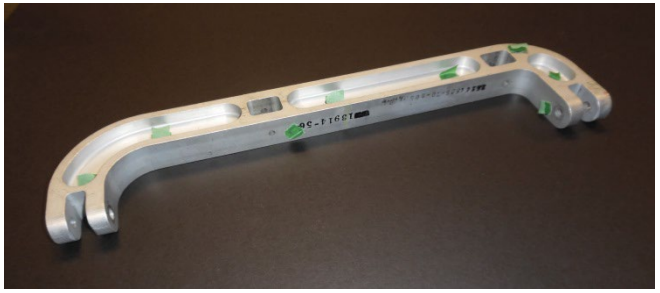
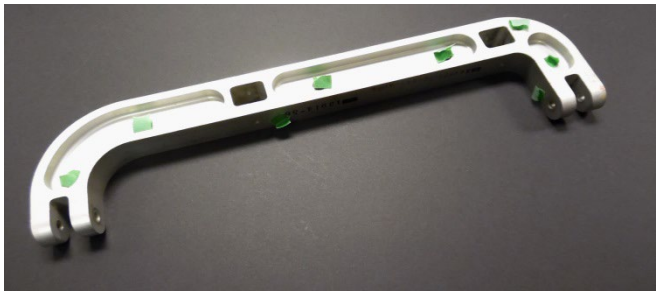
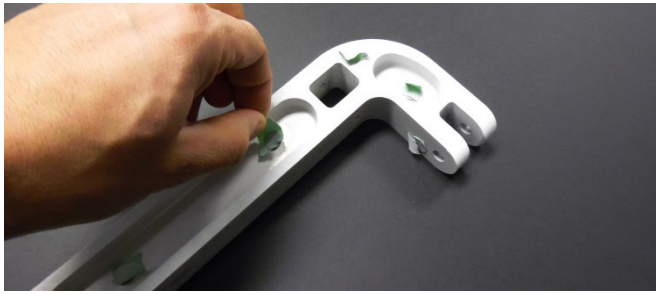
PART PREPARATION POWDER

Method #1

- Apply targets on the part
- Put masking tape bands on each target
- Spray the part
- Remove the masking tape bands
- Scan the part







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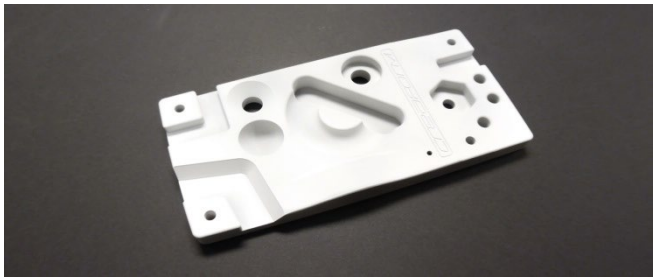
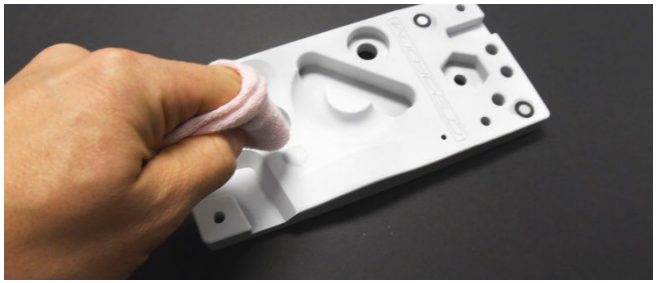
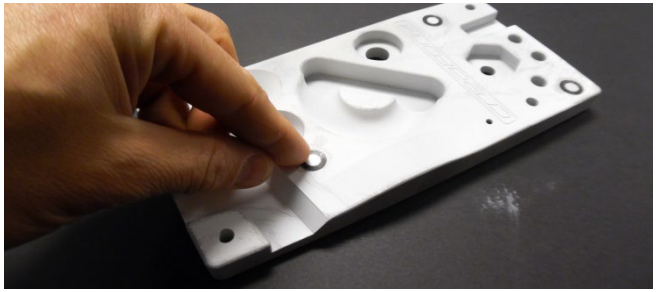
PART PREPARATION POWDER

Method #2

- Spray the part
- Clean up the spots where you want to put targets
- Apply targets
- Scan the part







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PREPARE THE PART
EXERCISE

YOUR TURN TO TRY!

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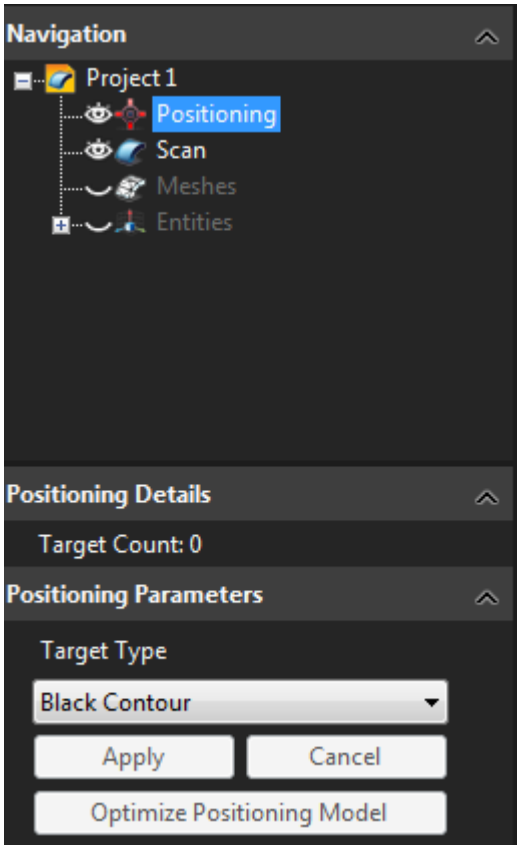
BEFORE SCANNING

- Choose the right target type in **Positioning**



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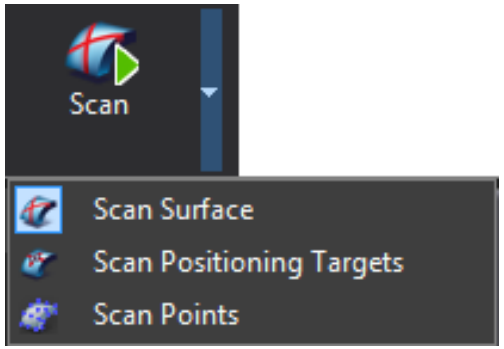
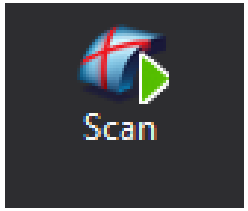
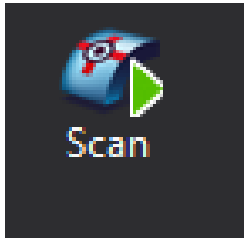
ULTRA PRECISION TECHNOLOGIES

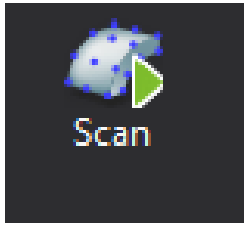
SCANNING OPTIONS



- The scanner acquires the surface and the output is a mesh
- The scanner only acquires the position of the targets and the output is a model that can be saved as a .txt file
- The scanner acquires the surface and the output is a point cloud







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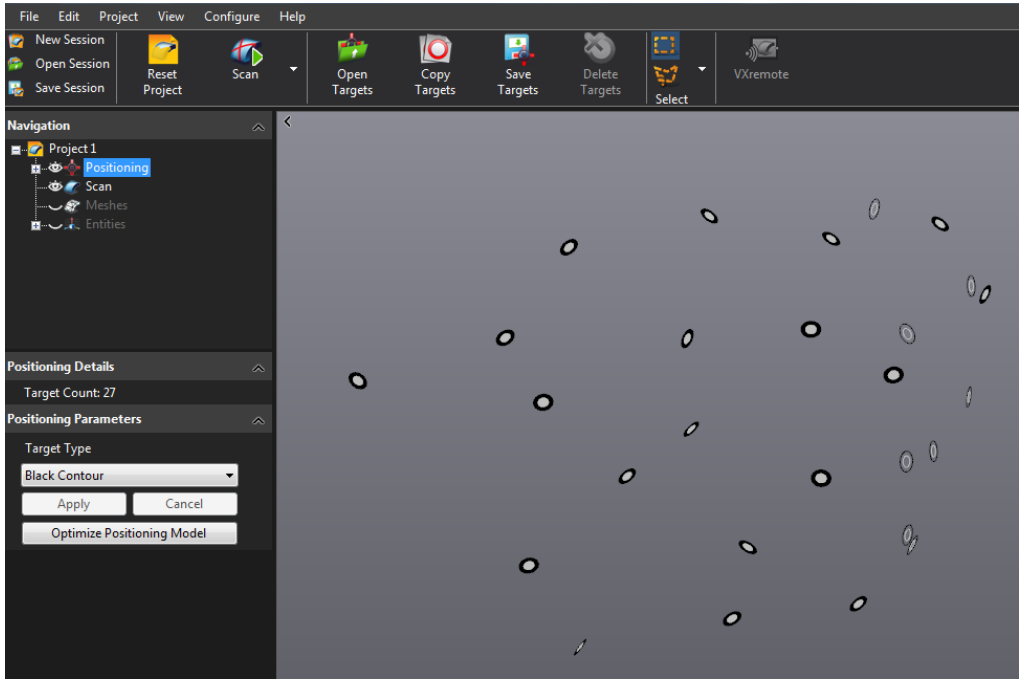
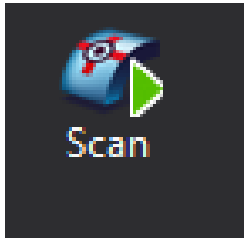
SCANNING POSITIONING TARGETS





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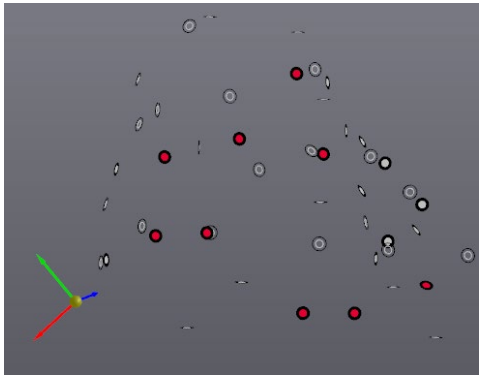
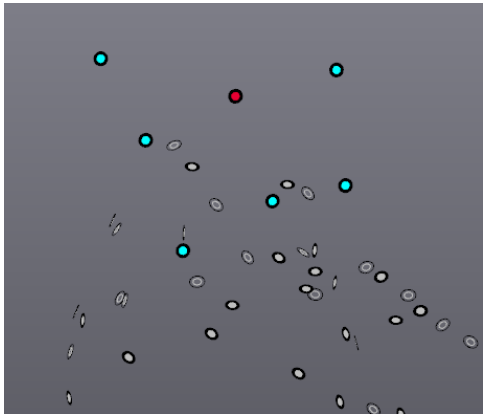
SCANNING POSITIONING TARGETS

- Red targets are seen by the scanner



- Blue targets are not linked to the other targets



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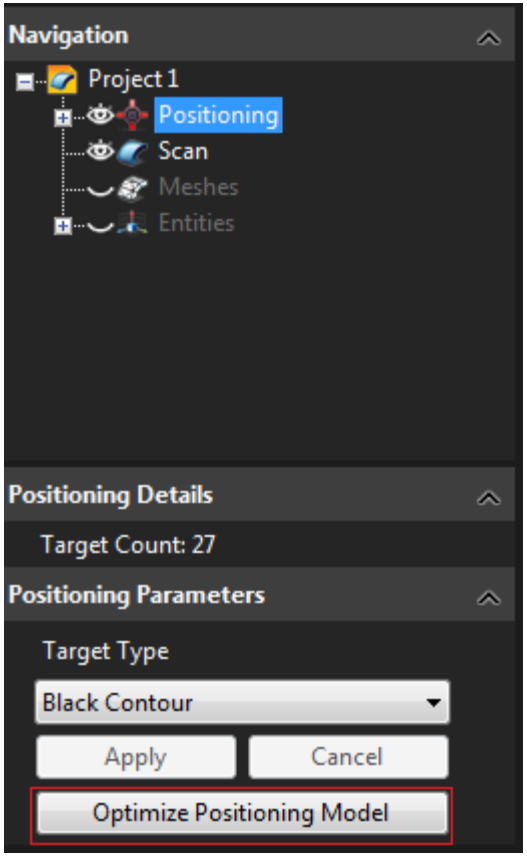
SCANNING POSITIONING TARGETS

Optimize Positioning Model

Allows to obtain a more accurate model



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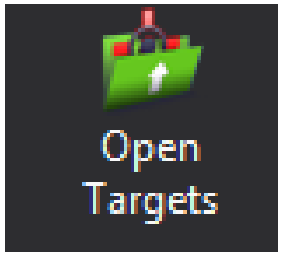
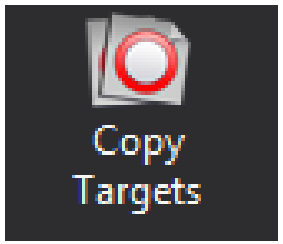
SCANNING POSITIONING TARGETS

- To save the positioning targets as a .txt file

- To import an existing positioning target model into the session

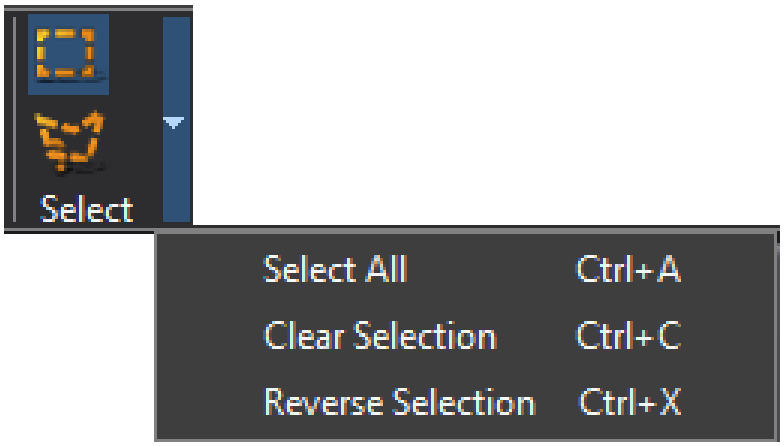


- To add a new project in the session project tree, and duplicate the positioning targets from the previous project



SCANNING POSITIONING TARGETS

- Selection tools are available in the 3D Viewer to select specific positioning targets
  - Rectangle
  - Free Form



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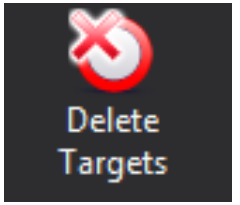
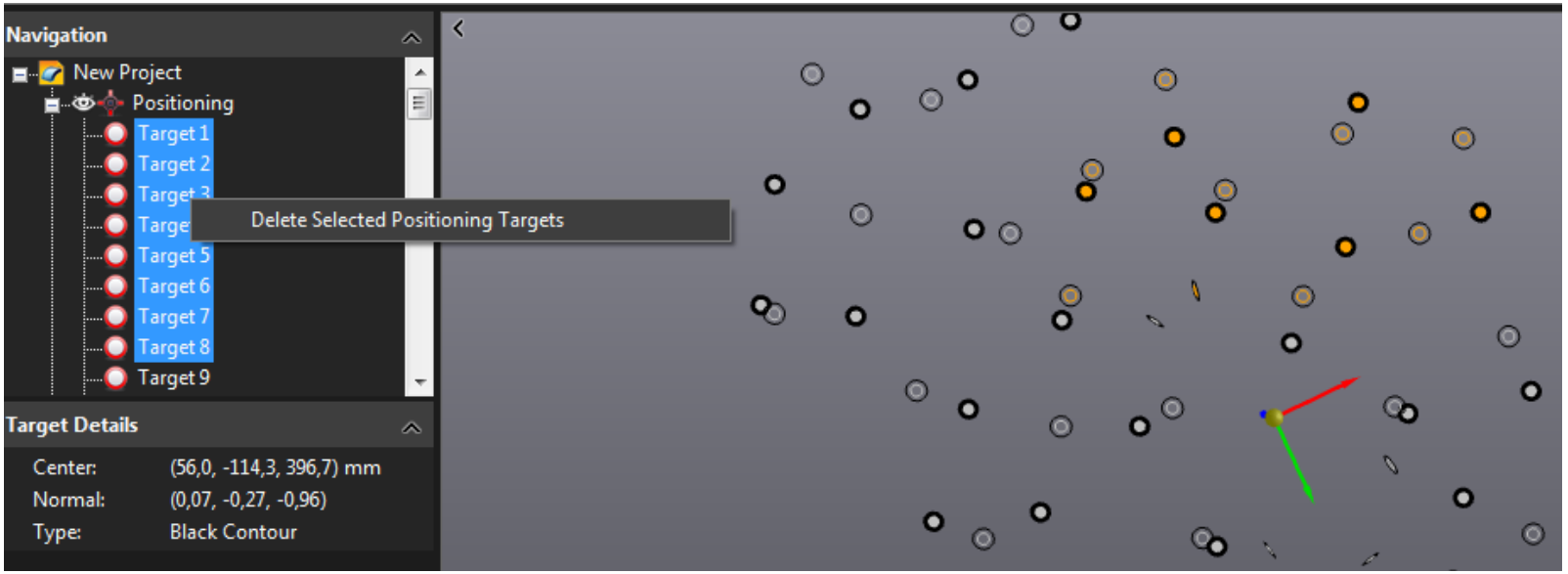
SCANNING POSITIONING TARGETS



- Once selected, positioning targets can be deleted by right-clicking on selected targets in the project tree or by clicking the Delete Targets button



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SCAN POSITIONING TARGETS EXERCISE

YOUR TURN TO TRY!

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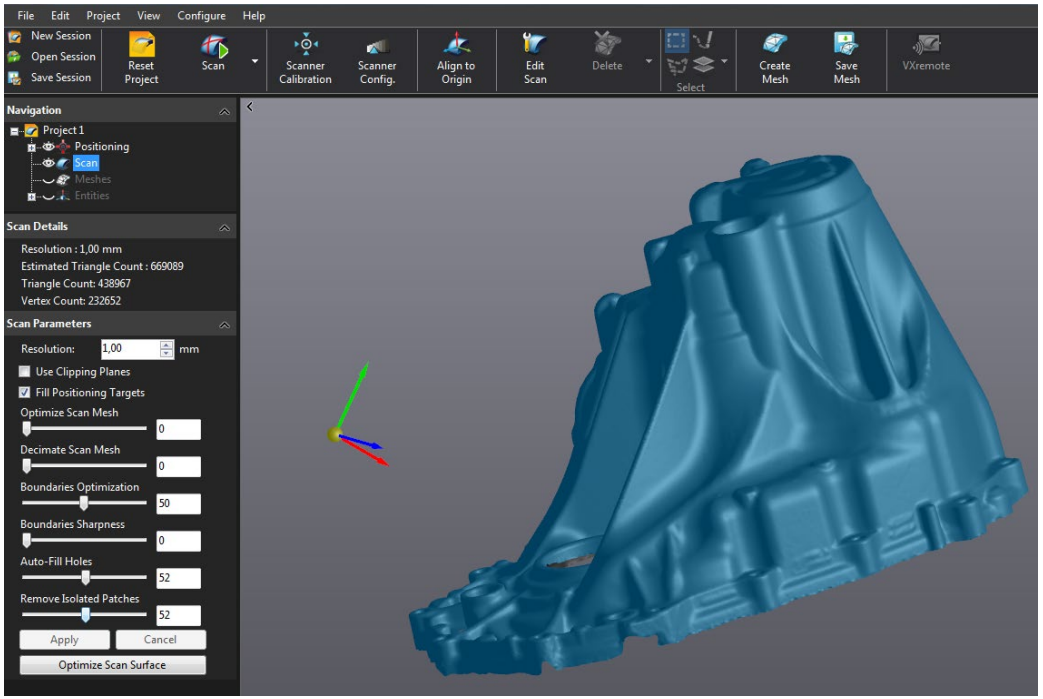
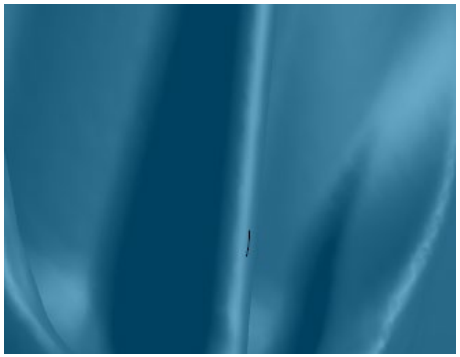
SCAN PROCEDURE

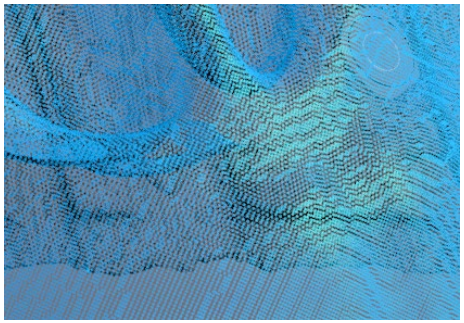
SCAN THE PART

- The scanner acquires the surface and the output is a mesh



- The scanner acquires the surface and the output is a point cloud





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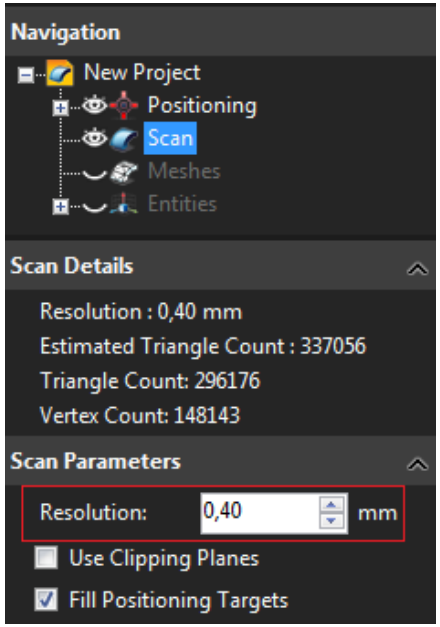
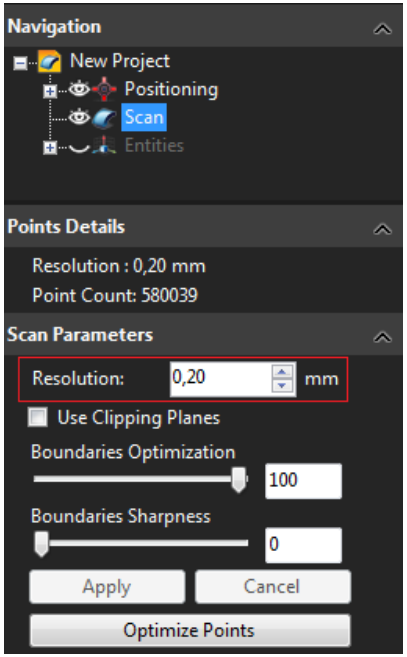
SCAN THE PART BEFORE SCANNING

- Select the right resolution according to the surface of the part to scan

Surface Mode



Point Mode



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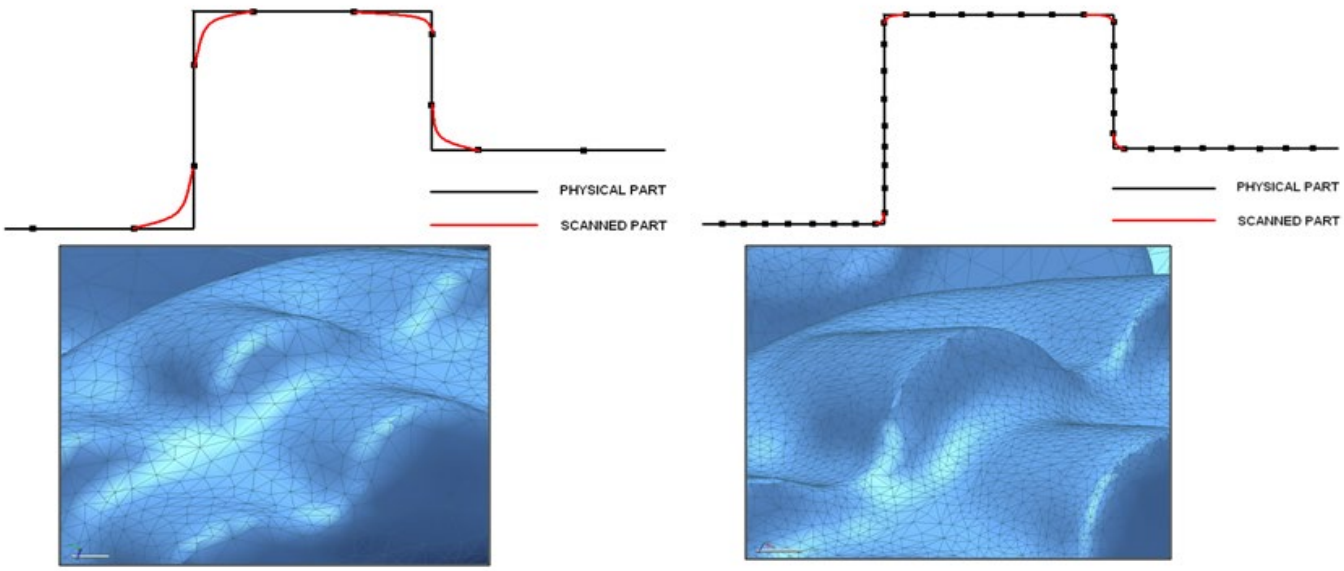
RELATIONSHIP BETWEEN RESOLUTION AND ACCURACY

The resolution refers to the level of details the sensor can acquire



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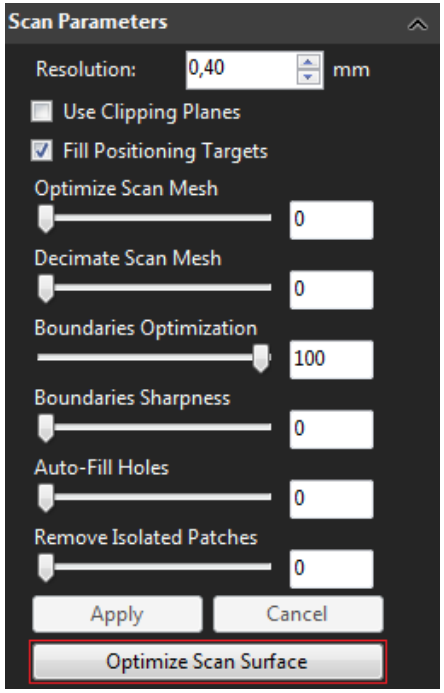
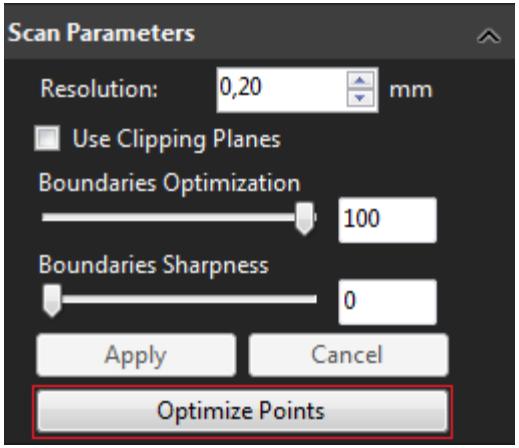
SCAN THE PART
SURFACE & POINTS PARAMETERS

Optimize Surface & Optimize Points

- Optimizing the surface or points reduces the impact of outliers in the resulting mesh or point clouds.





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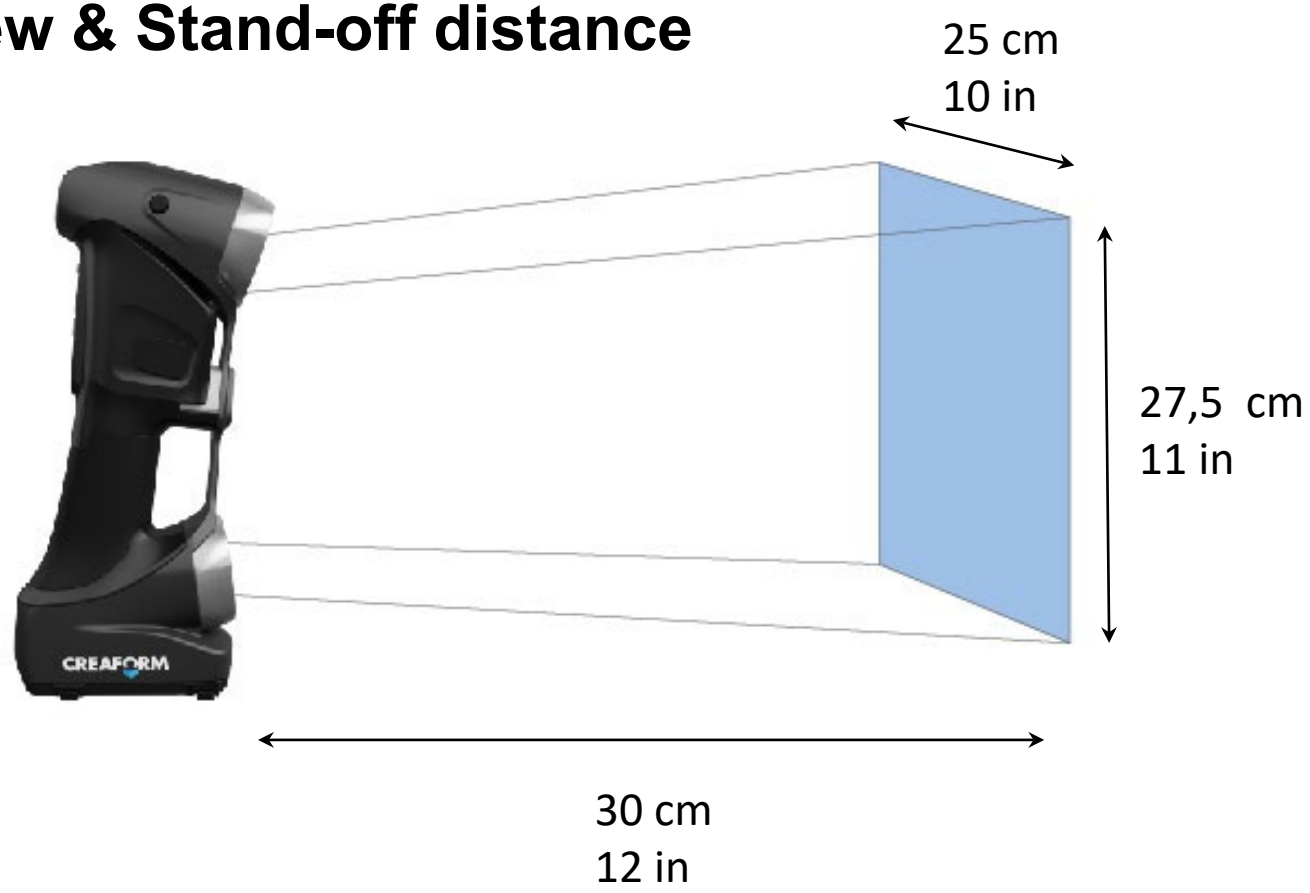
ACQUISITION RULES
SCANNER DISTANCE

Field of view & Stand-off distance



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ACQUISITION RULES
DISTANCE METER

- Distance meter is displayed on the left of the screen while scanning, indicating the distance between the scanner and the part.
- LED located on the upper part of the scanner also indicate distance.

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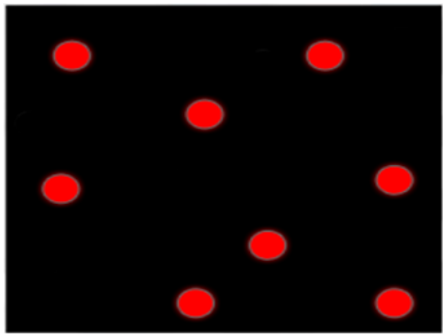
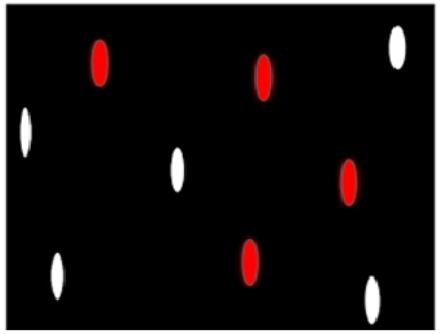
ACQUISITION RULES
SCANNER DISTANCE

- User should stay in the middle range scanning distance for easier and faster data acquisition
- The scanner will not be able to acquire data if it is too close or too far from the part to scan
- If tracking is lost, reposition the scanner in front of an already scanned surface or add targets

ACQUISITION RULES
SCANNER ORIENTATION



Scanner must be as perpendicular as possible to the surface



It is possible to scan at an angle. However, the accuracy of the positioning model will be higher with greater angles of incidence.

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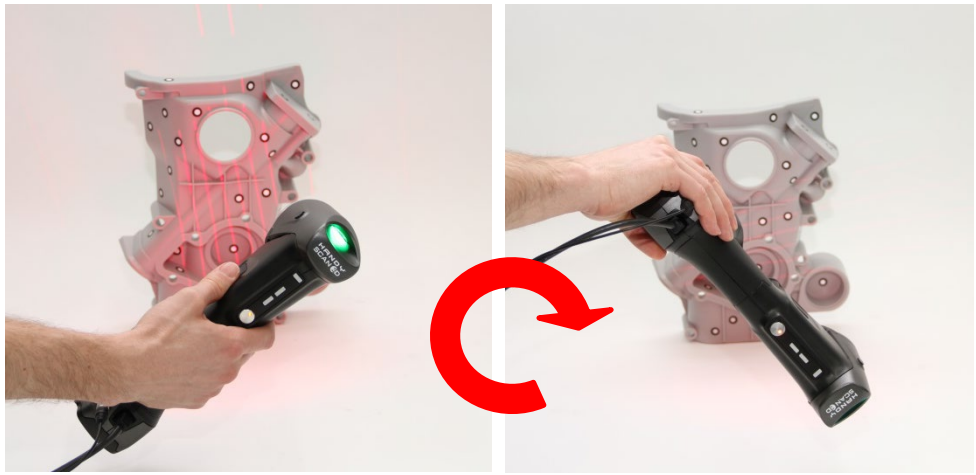
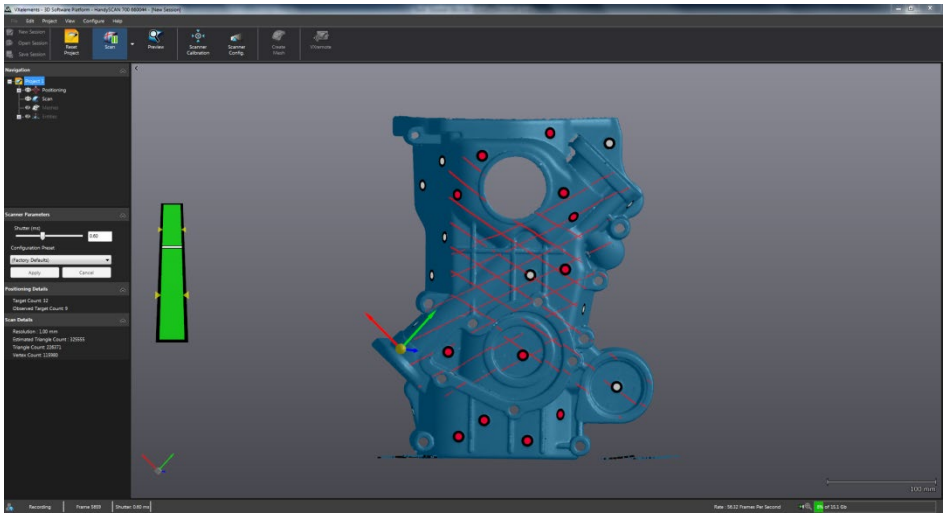
ACQUISITION RULES ACCELEROMETER

- Better 3D visualisation

- Accelerometer stop around 30°





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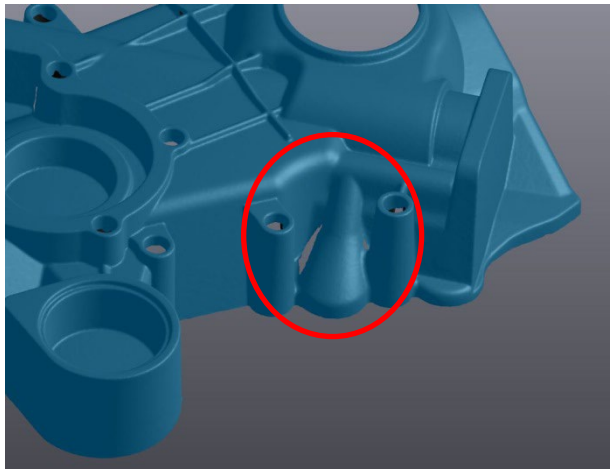
ACQUISITION RULES

Align cameras in a ways that both cameras can see the same laser line



Best orientation	Acceptable orientation

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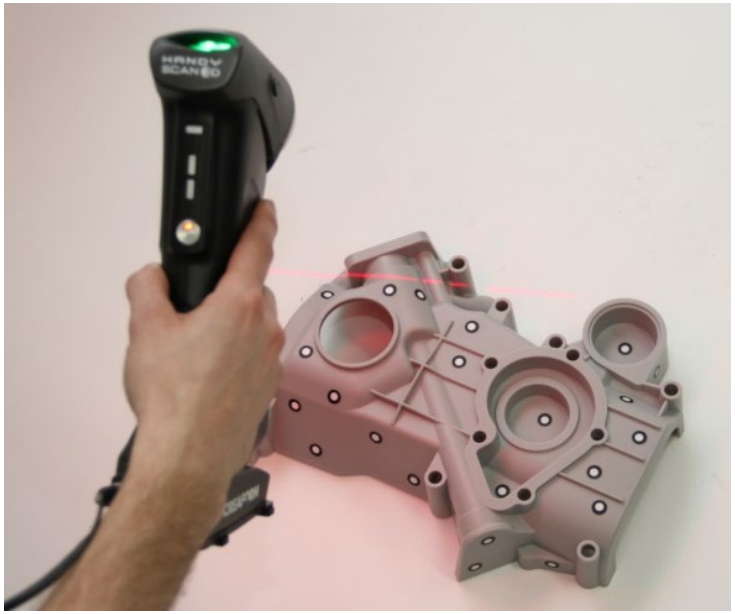
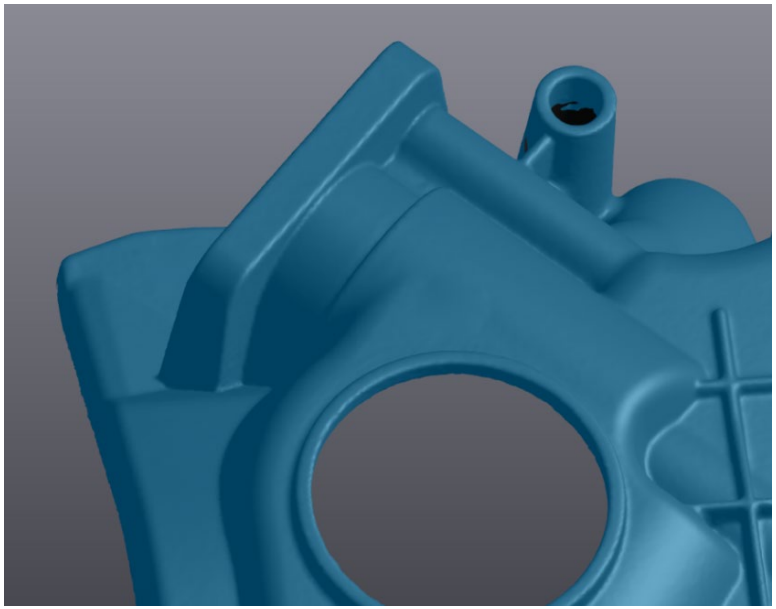
ACQUISITION RULES
SINGLE LASER LINE MODE





1- Scan button

- Toggle between 7 laser crosses and single line
- Double-click during scan to change laser mode

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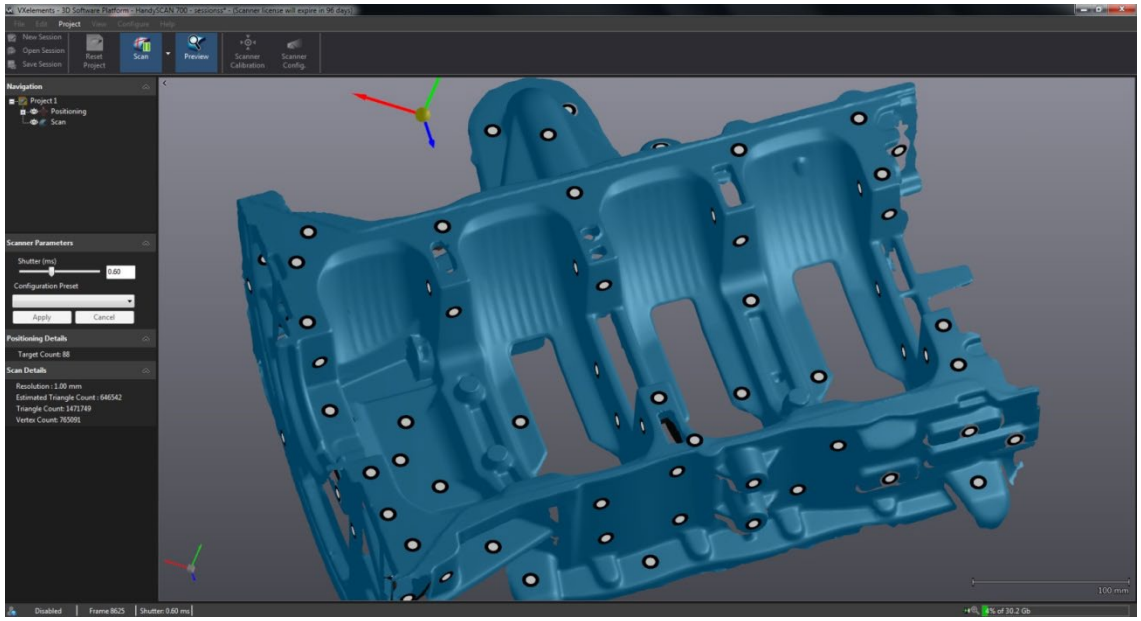
DECREASE CALCULATION TIMES

- **Preview mode** allows you to see the final result rapidly without having to stop the scan completely.



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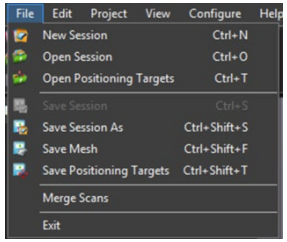
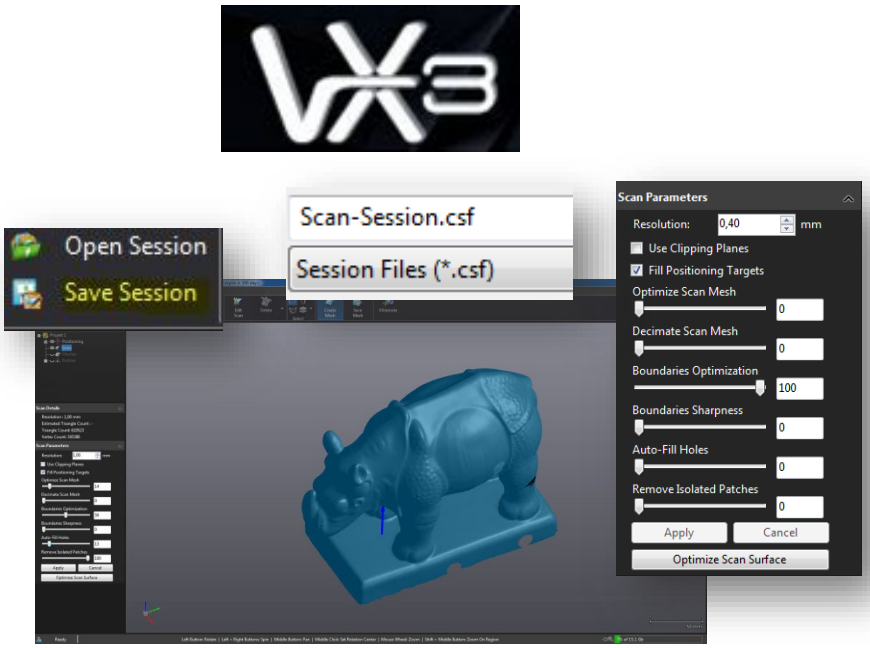
SAVING ACQUIRED DATA

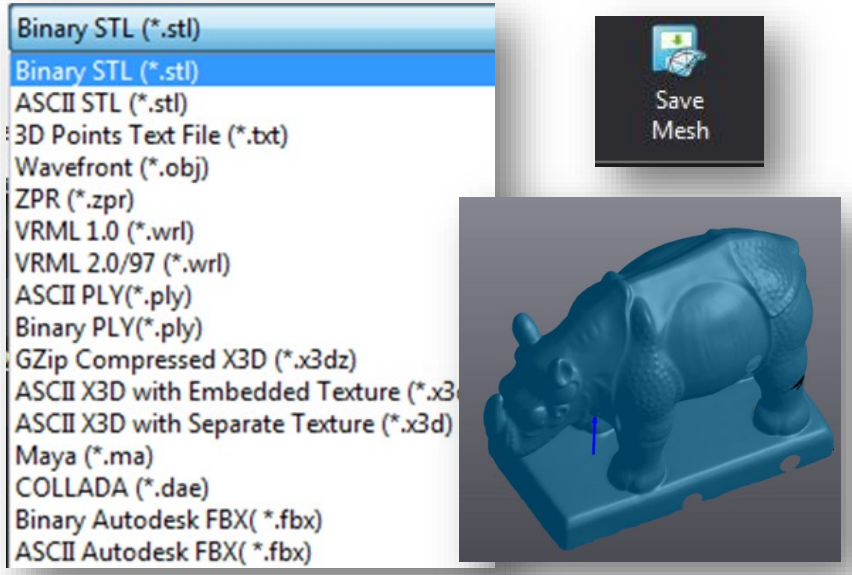
SAVING SCANNED DATA



Save Session

Export





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SCAN SURFACE & SAVE DATA EXERCISE

YOUR TURN TO TRY!

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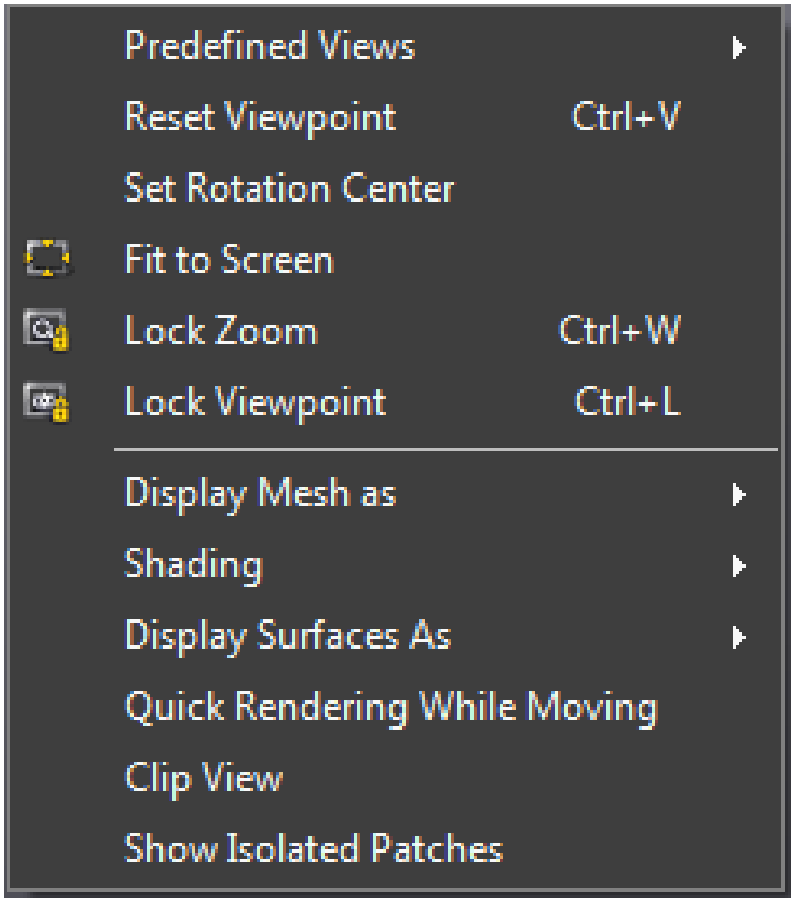
ADDITIONAL FUNCTIONS

CONTEXTUAL MENU

- Right click in the 3D viewer



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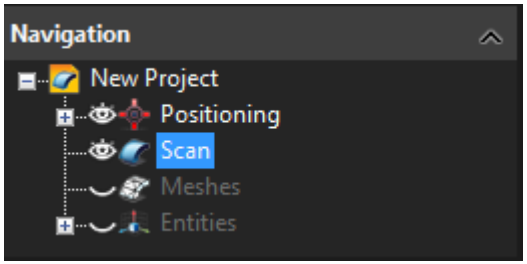
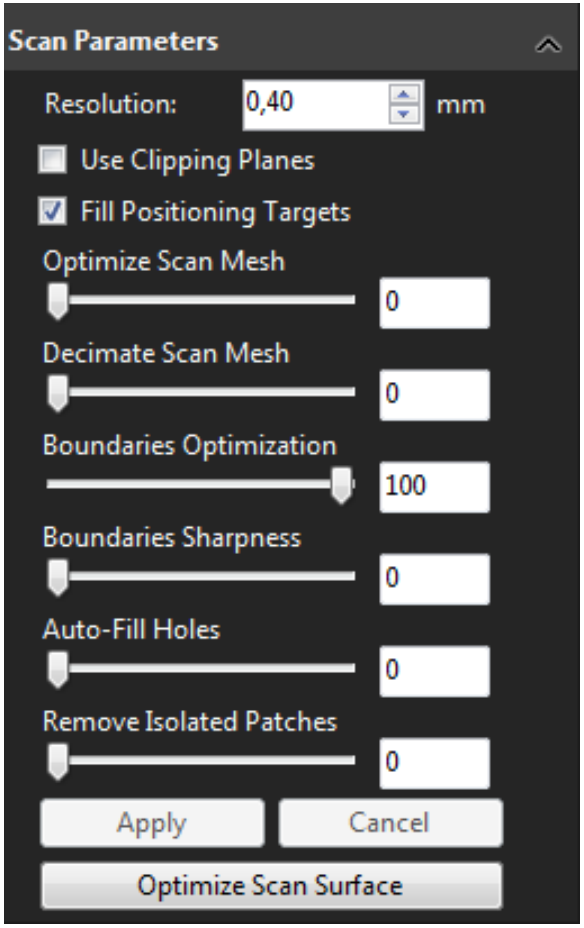
CONTEXTUAL MENU

Options	Description
Predefined Views	Sets required view: top, bottom, left, right, front, back or isometric
Reset Viewpoint	Brings the viewpoint to the position of the last acquisition
Set Rotation Center	Picks a point from which the scan is going to rotate
Fit to Screen	Brings the 3D model in the center of the 3D viewer
Lock Zoom	Sets the zoom level while the viewer follows the movements of the scanner
Lock Viewpoint	Locks the viewer in its current position
Display Mesh as	Changes the display of the mesh in the 3D viewer
Shading Option	Smooth or flat options are available
Quick Rendering while Moving	Lighten file to allow flowing movements when rotate the part in the 3D viewer
Clip View	Allows to see the interior of the part
Show Isolated Patches	Shows removed isolated patches

SCAN PARAMETERS





Fill Positioning Features

- Fills the holes created by the positioning targets on the surface of the object.

Optimize Scan Mesh

- Adds smoothing effect on the mesh and creates sharper edges

Decimate Scan Mesh

- Optimizes the size of the triangles with respect to the curvature
- Outputs a lighter .stl file

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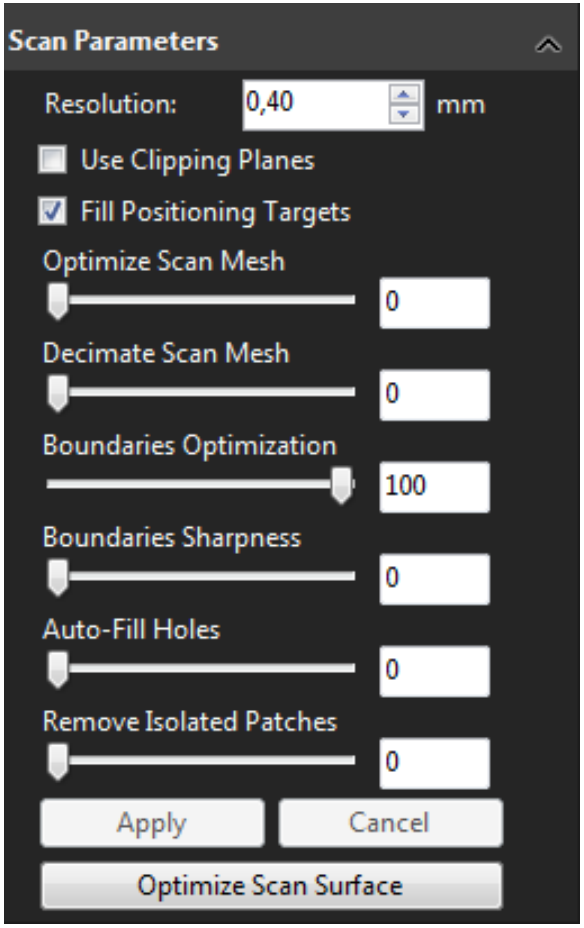
SCAN PARAMETERS



Boundaries Optimization

- Determines the amount of boundaries that will be optimized using the boundaries sharpness value. A higher value will lead to larger boundaries being optimized.

Boundaries Sharpness

- Defines the level of details of boundaries. A larger value will lead to smoother boundaries on boundaries being optimized (based on Boundaries optimization value).

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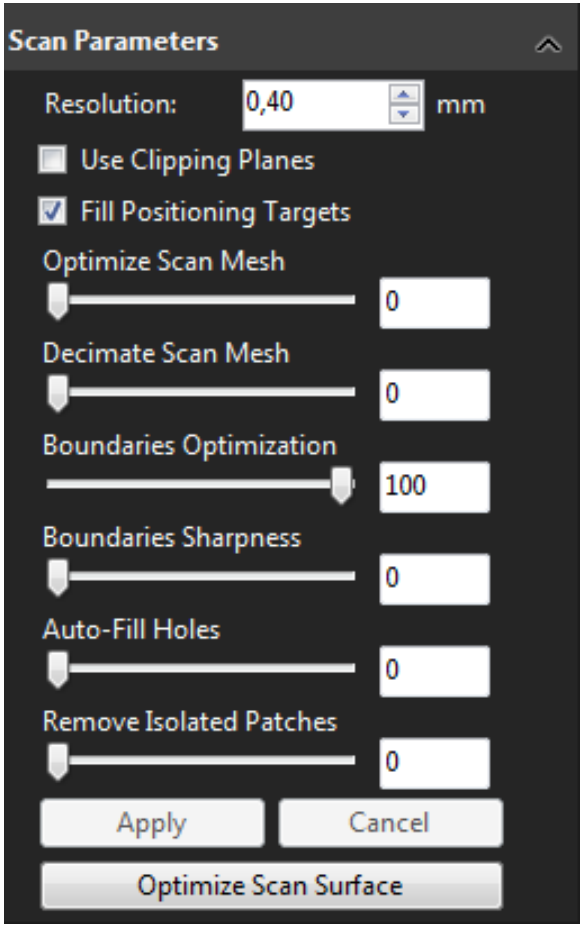
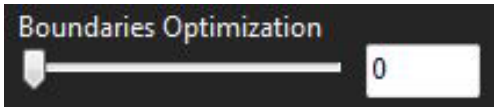
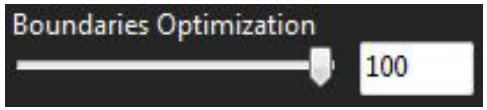
SCAN PARAMETERS
BOUNDARIES OPTIMIZATION



- Optimizes boundaries to make them more fine and accurate.
- The slider is used as a boundary selection that will detect and treat more or less boundaries depending on slider position.
- When optimising boundaries, the ‘’Boundaries Optimisation’’ algorithm use the ‘’Boundaries Sharpness’’ setting.



Minimum treatment is done to all boundaries **without optimisation**. Consequently, the ‘’Boundaries Sharpness’’ function is gray out. The surface reconstruction is faster.



All detected boundaries are optimised

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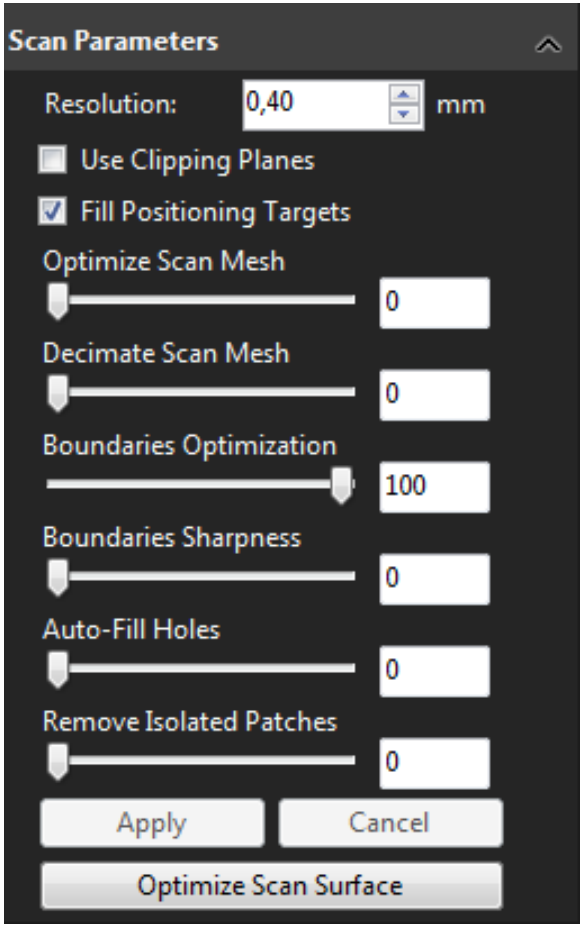
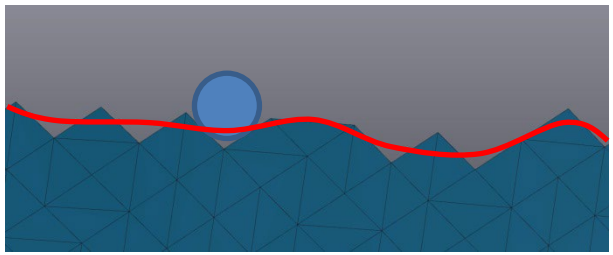
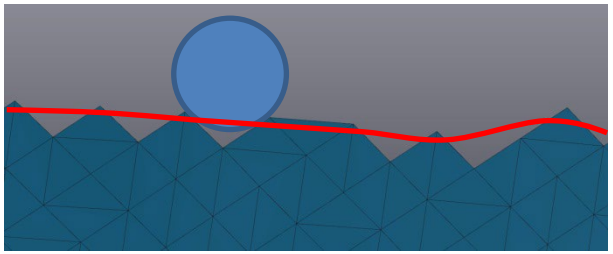
SCAN PARAMETERS
BOUNDARIES SHARPNESS



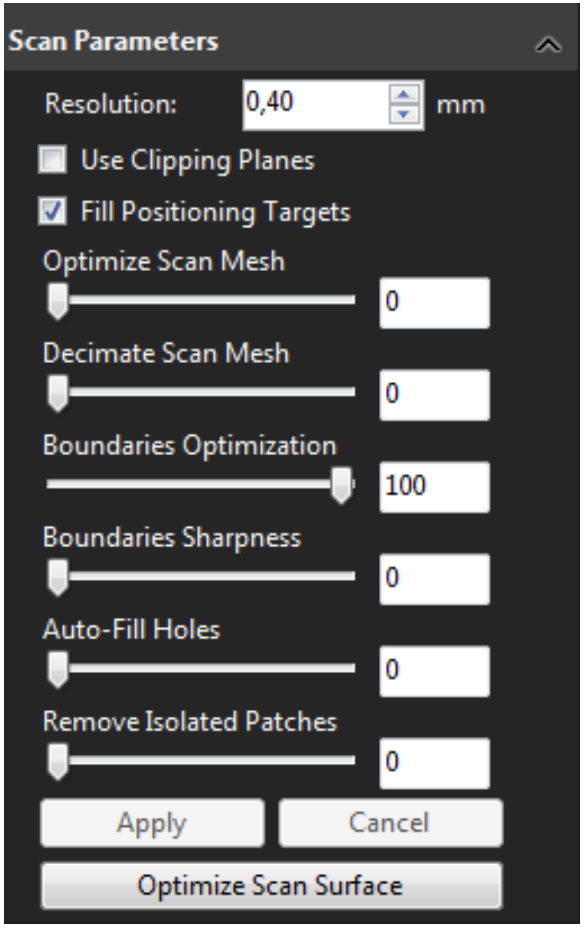
- Defines the level of details of boundaries.
- It will affect all boundaries detected and treated by the ‘’Boundaries Optimization”

By increasing the slider value, it increases the size of the blue circle showed in the image below use in the algorithm to make the boundary more sharp. The red line represent the end result.





SCAN PARAMETERS



Auto-Fill Holes

- Automatically fills open boundaries from the mesh
- Moving the slider to the right increases the size of the holes that are filled

Remove Isolated Patches

- Deletes isolated patches of triangles.
- Sets the size of the patches that are removed.

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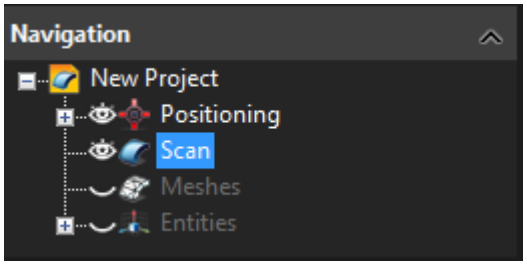
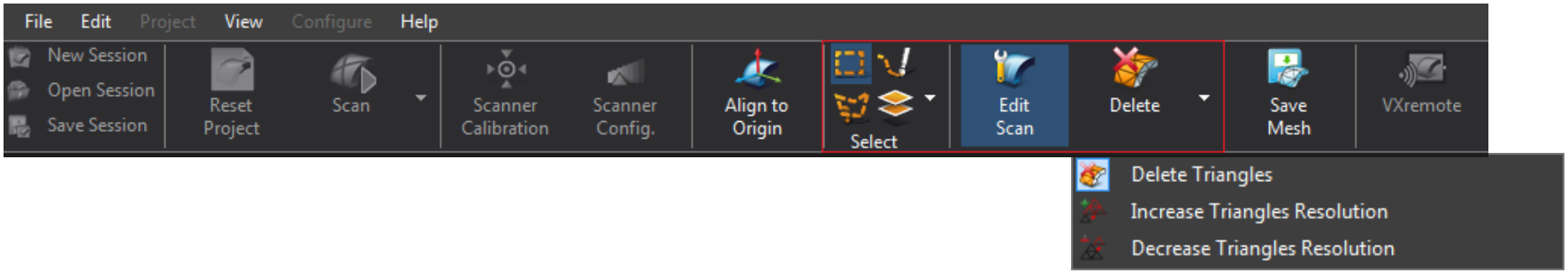
EDIT SCAN





- Click on Edit Scan to access selection tools
- Select a tool: rectangle, brush, free form or select through
- Select triangles you want to modify
- Apply modification: delete triangle, increase triangle resolution or decrease triangle resolution

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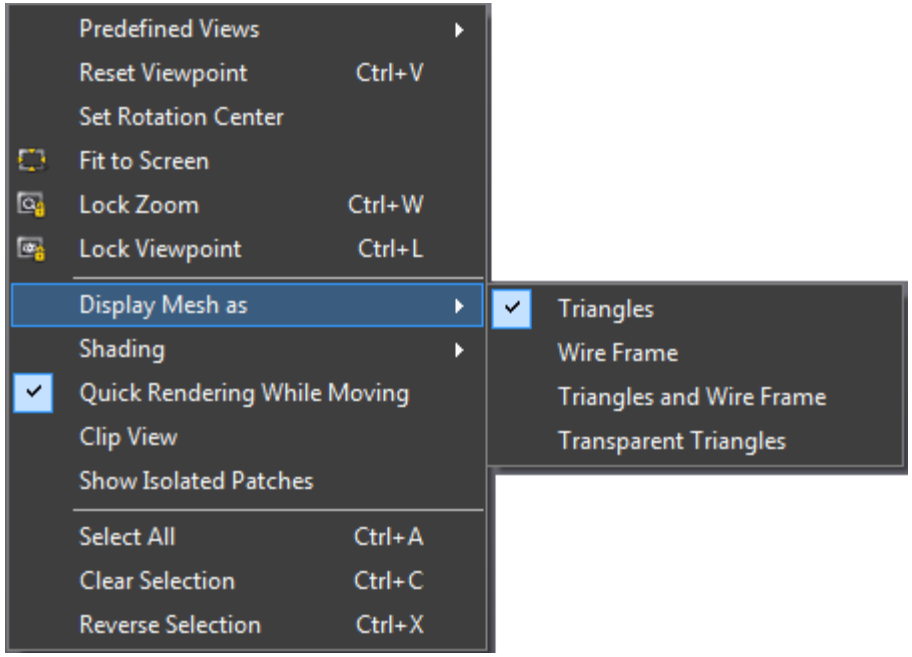
MESH DISPLAY

- Right click anywhere in the 3D viewer to change the Mesh Display



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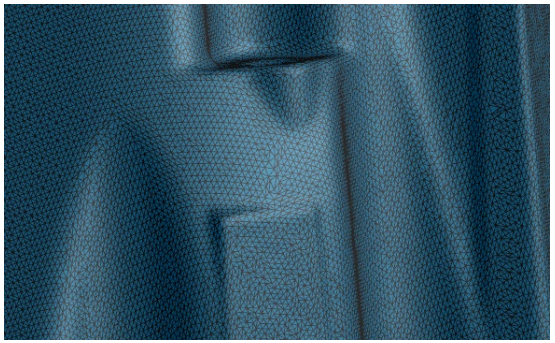
MESH DISPLAY

Triangles



Triangles & Wire Frame

Wire Frame

Transparent Triangles

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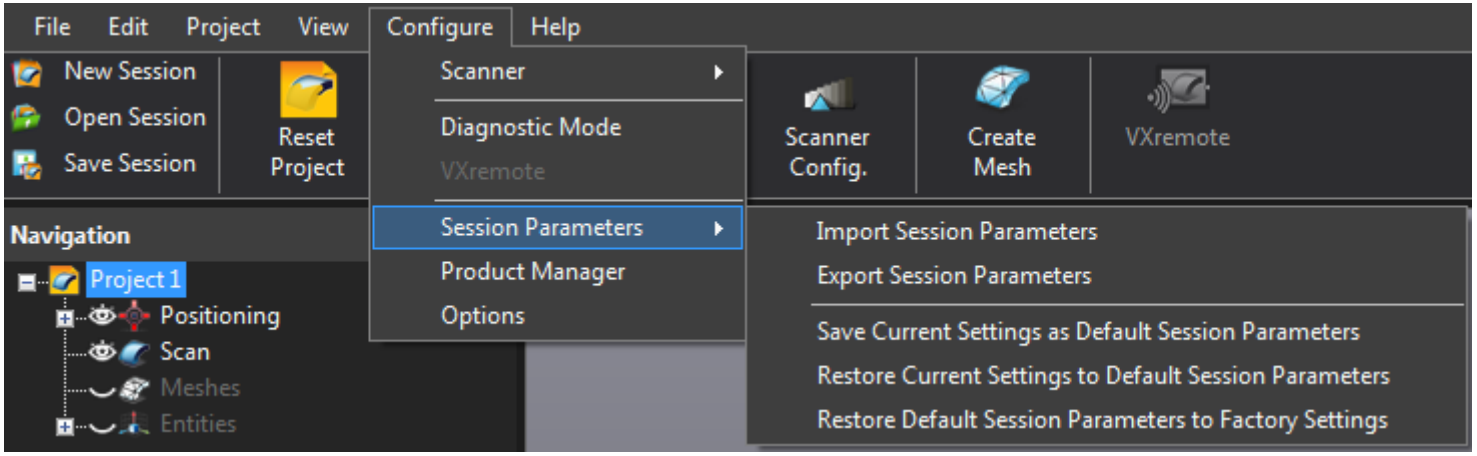
SESSION PARAMETERS

- Set the parameters that VXelements uses by default when launching the software
- Users can also import and export the parameters



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MESH AND PARAMETERS EXERCISE

YOUR TURN TO TRY!

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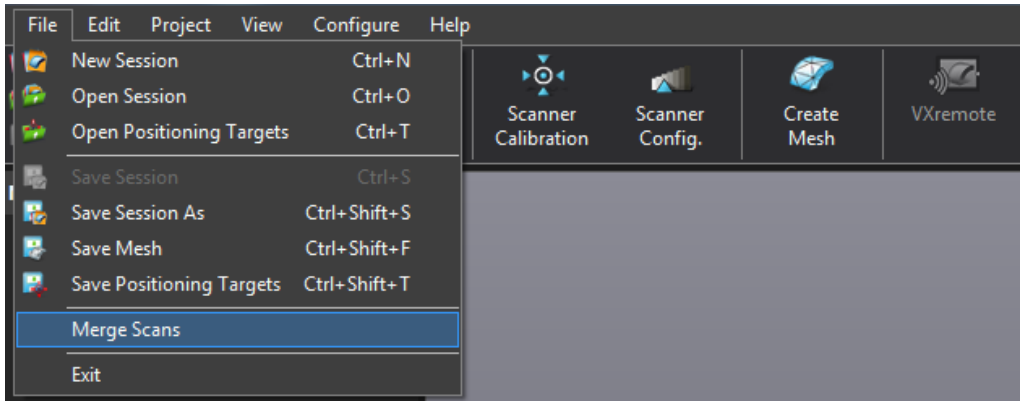
MERGE SCANS

Merge the raw data of different sessions acquired in the same coordinate system

- Many scanners are used to scan the same part
- A project requires a lot of RAM and has to be split into several sessions
- A complex part is scanned in more than one session



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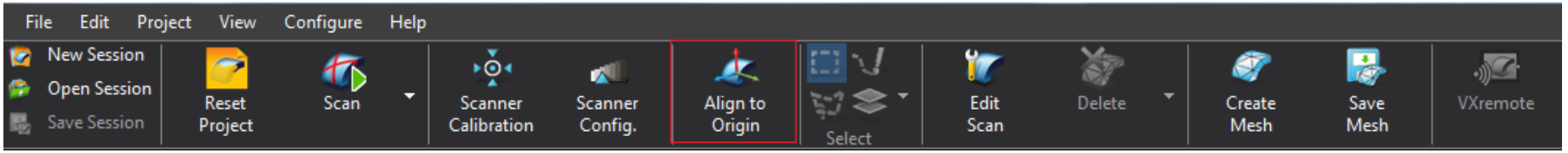
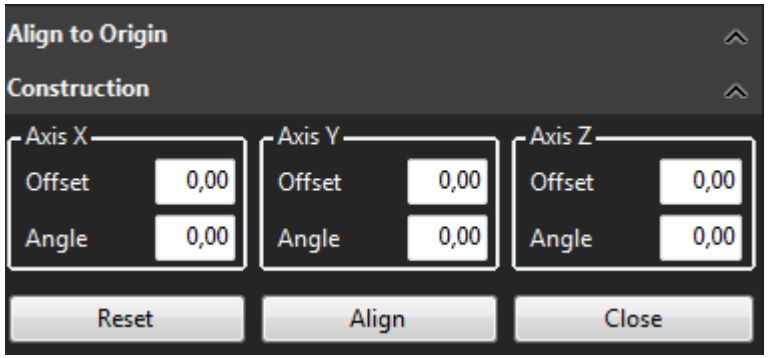
ALIGNMENT



- Automatically analyzes the scanned object
- Adds a reference at the center of the object
- Aligns the axes along the principal axes of the object



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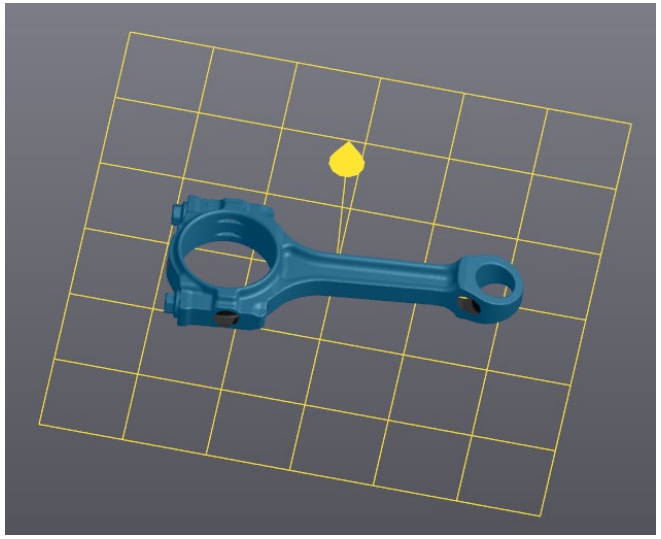
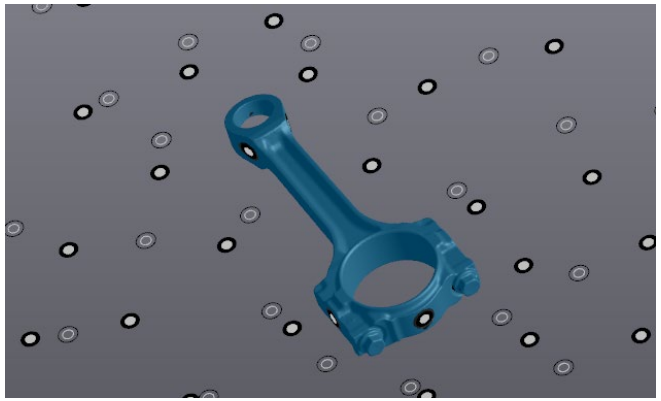
CLIPPING PLANES

- This function is used to clean STL automatically and reduce session file



- Any plane can be used as clipping plane



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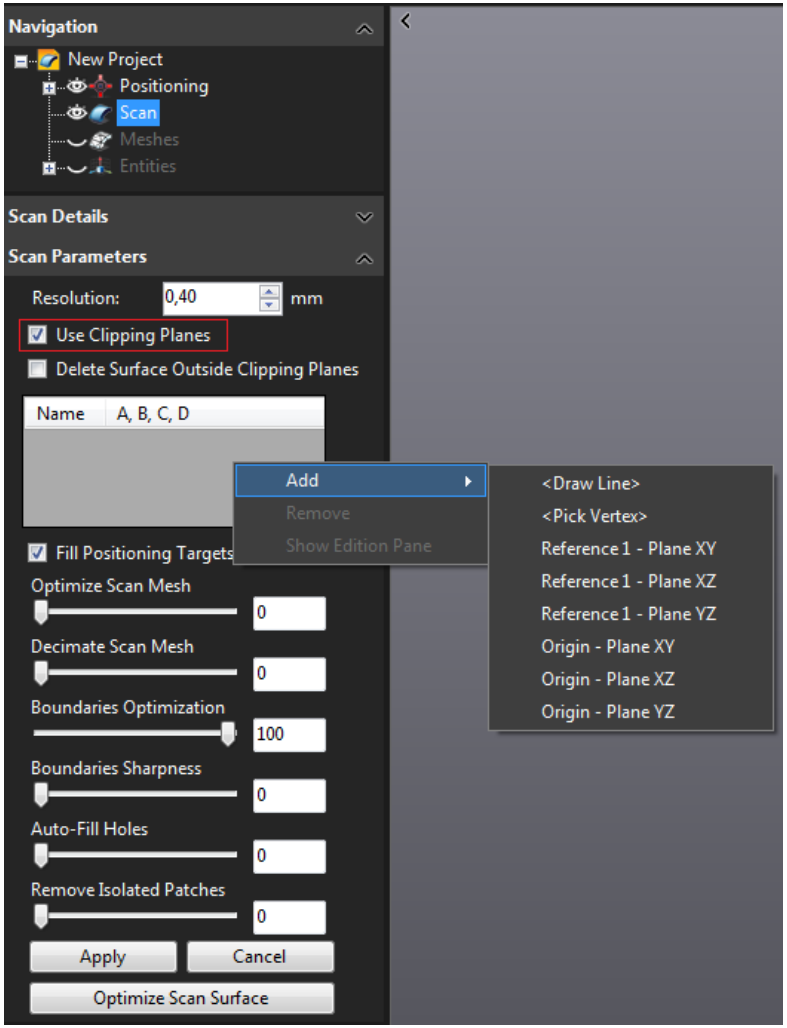
CLIPPING PLANES

- Check **Use Clipping Planes** box
- Right click in the **Name** box to add a plane



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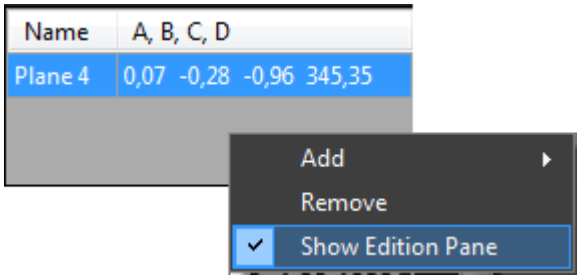
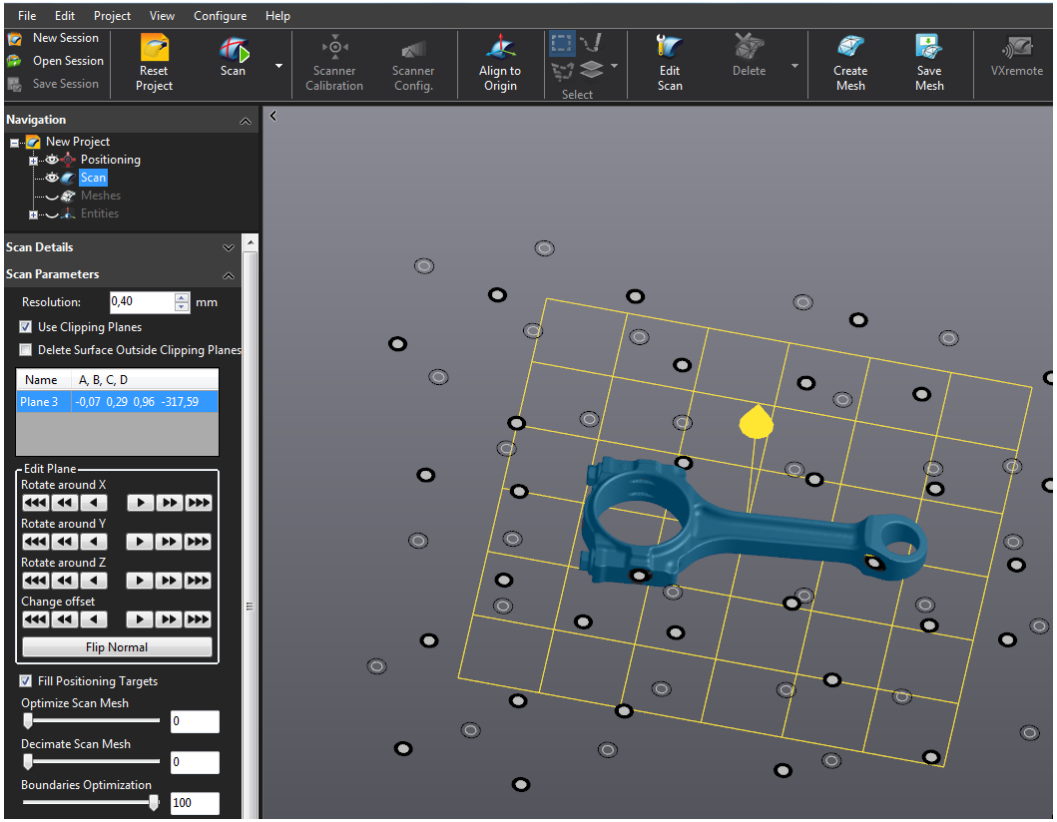
CLIPPING PLANES

- User can rotate, offset plane as needed when activating **Show Edition Plan**





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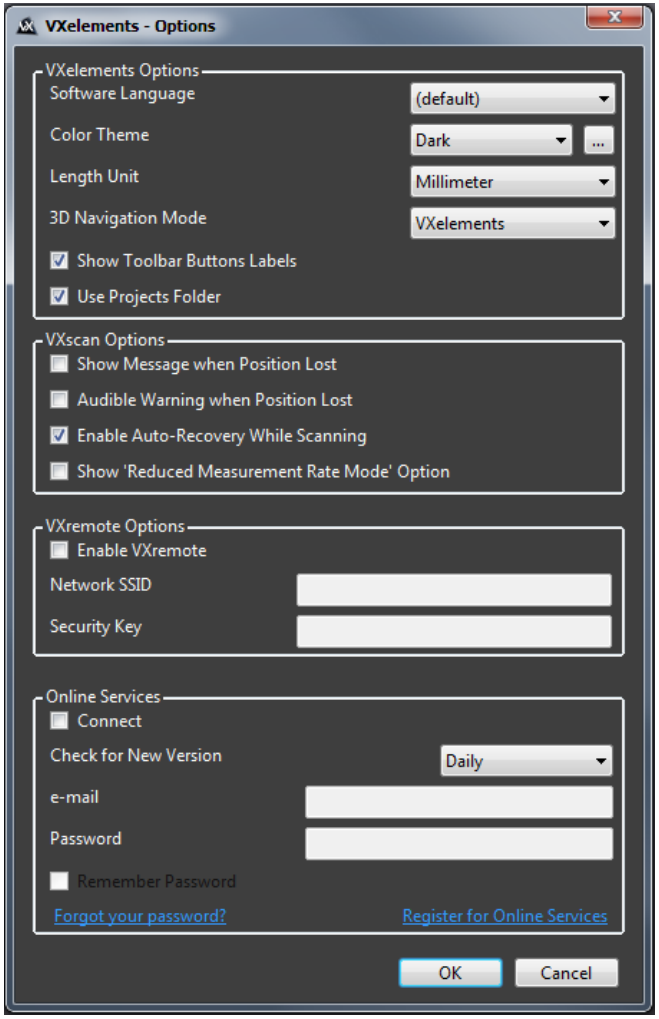
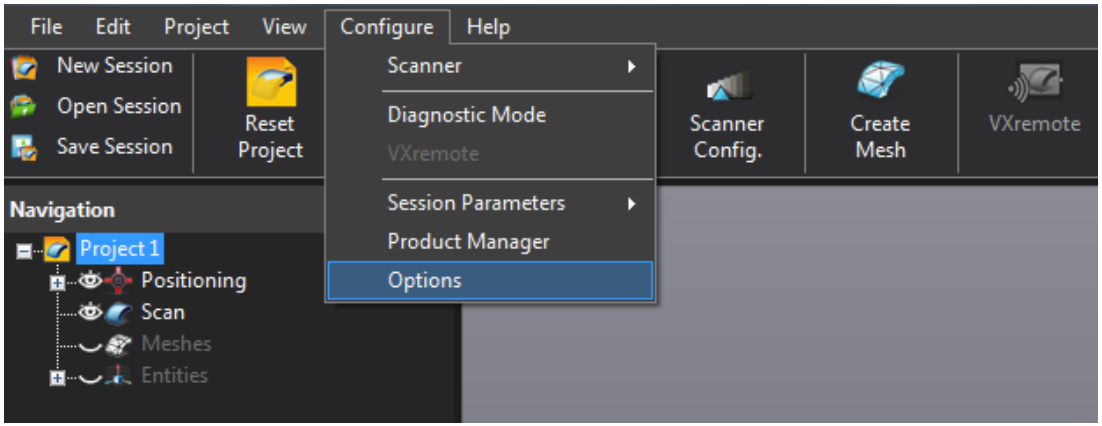
OPTIONS





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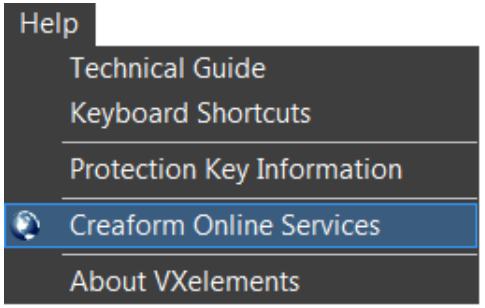
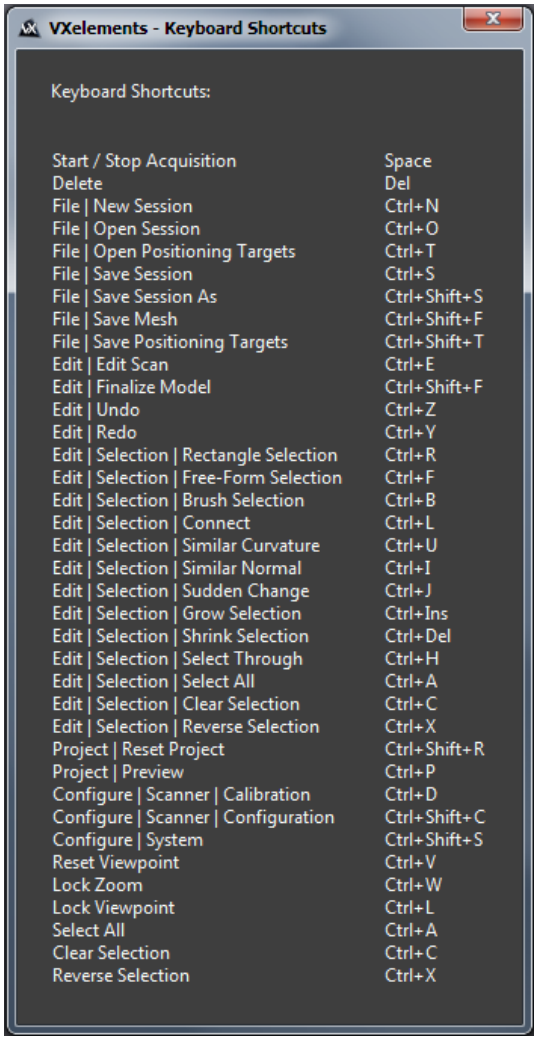
CREAFORM ONLINE SERVICE

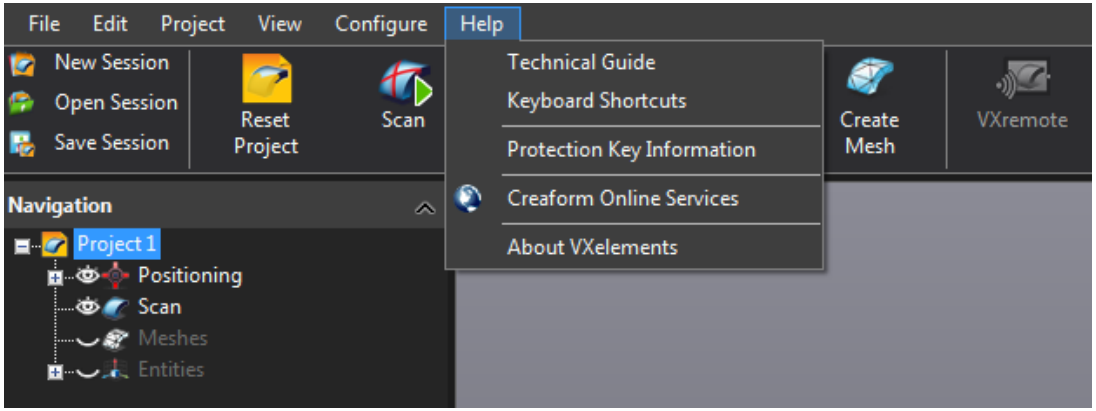
- Used to link VXelements with Creaform Customer Center
- Allows the users to access all the relevant information about his product directly within VXelements
  - Maintenance expiration date
  - License expiration date
  - Last calibration date



- Ensure that the license files and software version installed on the computer are up to date

HELP





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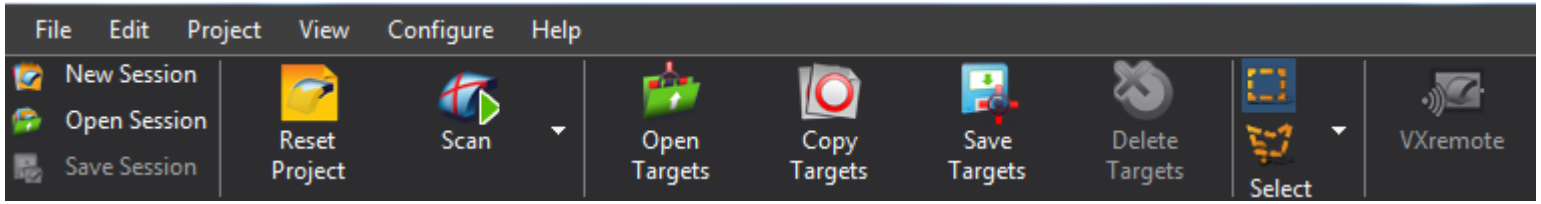
HANDS-ON SESSION

EXERCISE 1 – CUSTOMER PART
SCAN POSITIONING TARGETS ON A SIMPLE PART

- How to position targets
  - Distance: between 20 mm and 100 mm
  - No targets on high curvature surface
  - No targets near edges
- How to acquire targets
  - Start in the center
  - Web pattern
- Make sure that at least 4 targets are visible at all times
- Look at the distance meter to make sure you have the right stand-off

EXERCISE 1 – CUSTOMER PART VXELEMENTS FUNCTIONS

- Positioning targets
  - Choose right target type
  - Optimize positioning model
  - Import targets
  - Copy targets
  - Save targets
  - Delete targets
  - Move object
- Save session
- New session
- Reset session



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EXERCISE 2 – CUSTOMER PART
SCAN SURFACE A SIMPLE PART

- Define resolution according to the surface type
- Watch the scanning distance
- Watch the scanning speed
- Watch the scanning angle
- Normal to surface

Looking at the screen helps a lot

Simple part: white, matte, flat, no details, no undercuts

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EXERCISE 2 – CUSTOMER PART VXELEMENTS FUNCTIONS

- Surfaces
  - Change resolution
  - Optimize surface
- Edit Scan
  - Decimate
  - Fill holes
  - Etc.
- Save Mesh

EXERCISE 3 – CUSTOMER PART
SCAN SIMPLE PART WITH GEOMETRY

- Adjust scanning resolution throughout the scan
- Pay attention to difficult areas (pockets, undercuts)

Simple part with several geometry elements, white, matte, small to medium size.

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EXERCISE 3 – CUSTOMER PART VXELEMENTS FUNCTIONS

- Surfaces
  - Change resolution
  - Optimize surface
- Edit Scan
  - Decimate
  - Fill holes
  - Delete
  - Increase resolution
  - Etc.
- Save Mesh

EXERCISE 4 – CUSTOMER PART SCAN LARGE PART

- Adjust scanning resolution throughout the scan
- Pay attention to difficult areas (pockets, undercuts)
- Use several scanning sessions

Large dimension, white, matte, with several geometry elements (complex)

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EXERCISE 4 – CUSTOMER PART VXELEMENTS FUNCTIONS

- Merge scans
- Surfaces
  - Change resolution
  - Optimize surface
- Edit Scan
  - Decimate
  - Fill holes
  - Delete
  - Increase resolution
  - Etc.
- Save Mesh

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EXERCISE 5 – CUSTOMER PART COMPLETE PROCESS

- Based on the HandySCAN Reference Card:
  - Connect the system
  - Calibrate the scanner
  - Configure the scanner
  - Scan positioning targets
  - Adjust Scan Parameters
  - Scan surface
  - Edit Mesh
  - Save

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