#HandsOnMetrology

Reverse Engineering

ZEISS

Seeing beyond

Why do people look for reverse engineering?

All optical systems generate a mesh (STL) from point cloud data. (Quality is dependent upon the system and manufacturer)

With CAD programs, regardless of which one, the processing in STL is not well supported. Thus, it cannot be used in a proper way for design or alignment.

CAD programs can usually only be used with surfaces and work with solid bodies. (No triangles)

Reverse engineering

Generation of a CAD model from scan data such as polygon meshes or point clouds.

The process from Scan to CAD

Using an existing product as starting points and convert it to original digital concept.

It is perceived as a simple task to reproduce an object, but depending on the task:

- It involves some skills and thinking
- You need to understand the intent of an object and the use of it.

As build modeling

Automatic surfacing

Convert in a simple way towards CAD in certain tolerances
Small deviations between Scan and CAD

E.g. CAD model for flow analysis

Design intent Modeling

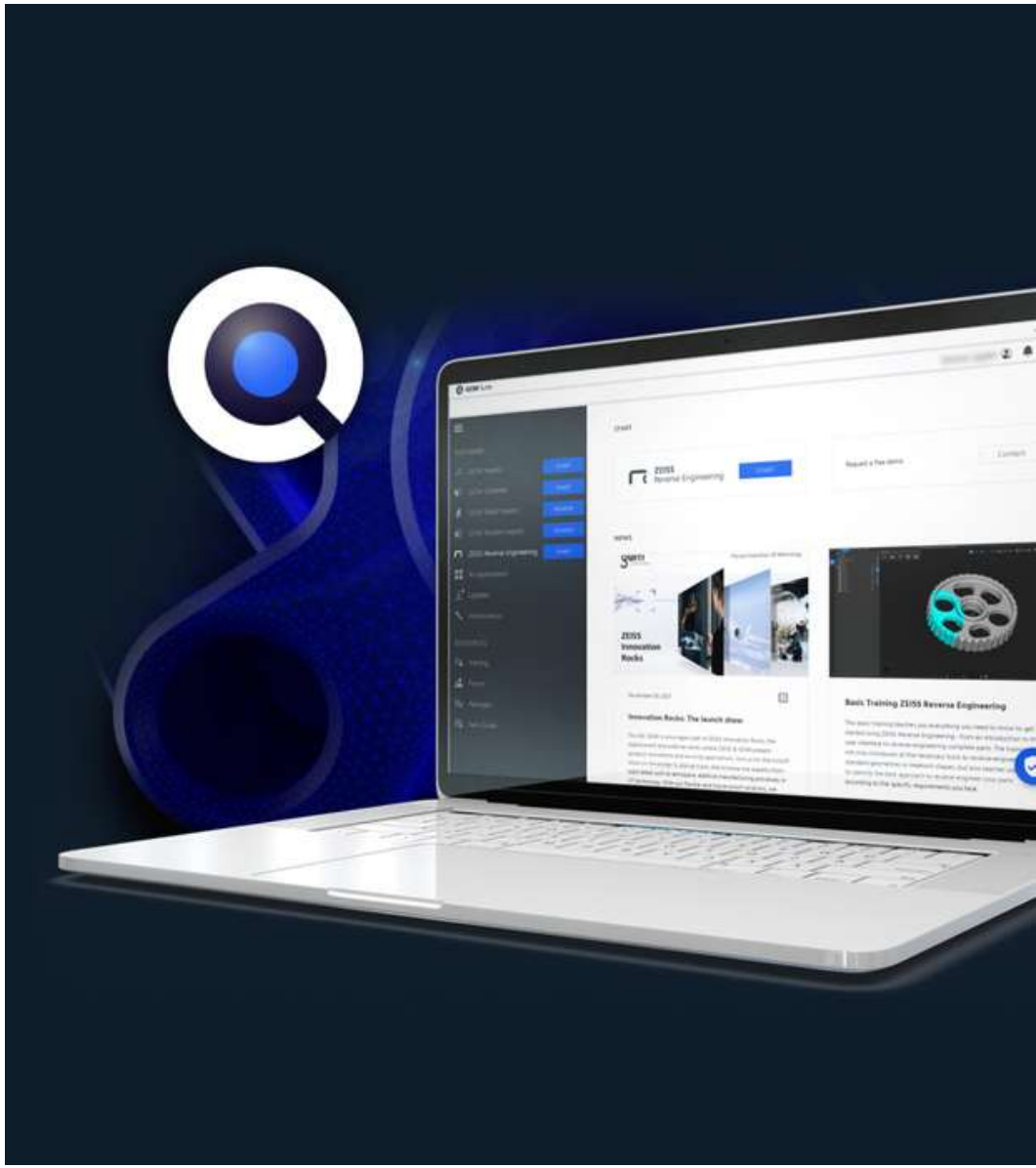
Final design need to be functional
The model should be producable
Bigger deviation between Scan and final CAD model

E.g. Printed part that now need to be injected model, take care of undercuts and draft angles,…

GOM Suite offers a complete package

GOM Inspect
Allows you to collect your scan data and can be used as a bridge between 3D Scan and CAD. It allows you to extract valuable information from the 3D Scan to export it to CAD to perform Reverse Engineering.

ZRE
The complete reverse engineering software. It consists of all the tools needed to generate a complete CAD model out of a 3D scan.



Reverse Engineering process

The way to a CAD model

Use GOM Inspect as a bridge software to go from Scan to CAD

GOM Suite

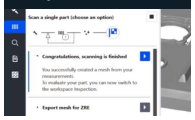
Object

3D Scan

GOM Inspect

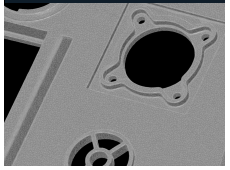
Polygonized mesh

Export to ZRE

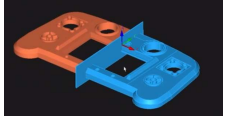


Alignment

Mesh editing

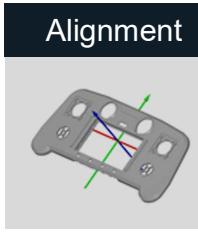


Feature, freeform modeling

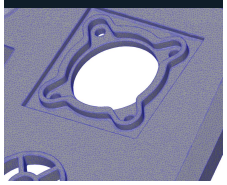


Solid CAD model

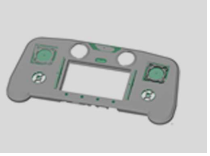
Alignment



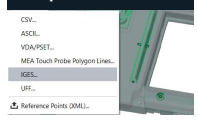
Mesh editing



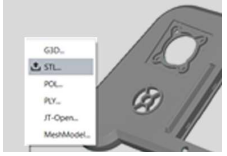
entities and cross-sections



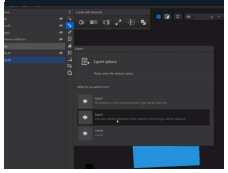
Export to ZRE



Export STL



Export CAD



3D print

Production

ZRE
(Complete RE software)

#HandsOnMetrology

GOM Inspect as Bridge software to go from Scan to CAD

Data acquisition inside GOM Inspect

Smart polygonization

Creates a mesh with highest detail while keeping the mesh size easy to handle

Direct interface to ZRE

Prepare the mesh with intelligent Mesh Editing

Close holes
Smooth and thin mesh
Repair mesh
Refine mesh
…

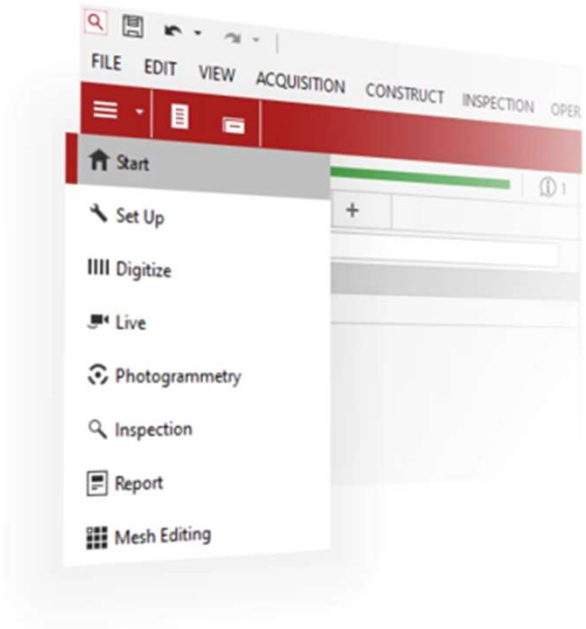
Different alignment possibilities

Extract feature from 3D scan and transfer to CAD

Circles
Planes
Cylinders
Cross-sections

Full inspection capabilities to check dimensions and deviations

Get started with a free version of GOM Inspect …



Diverse applications – one workflow

Download: www.handsonmetrology.com/products/gom-inspect

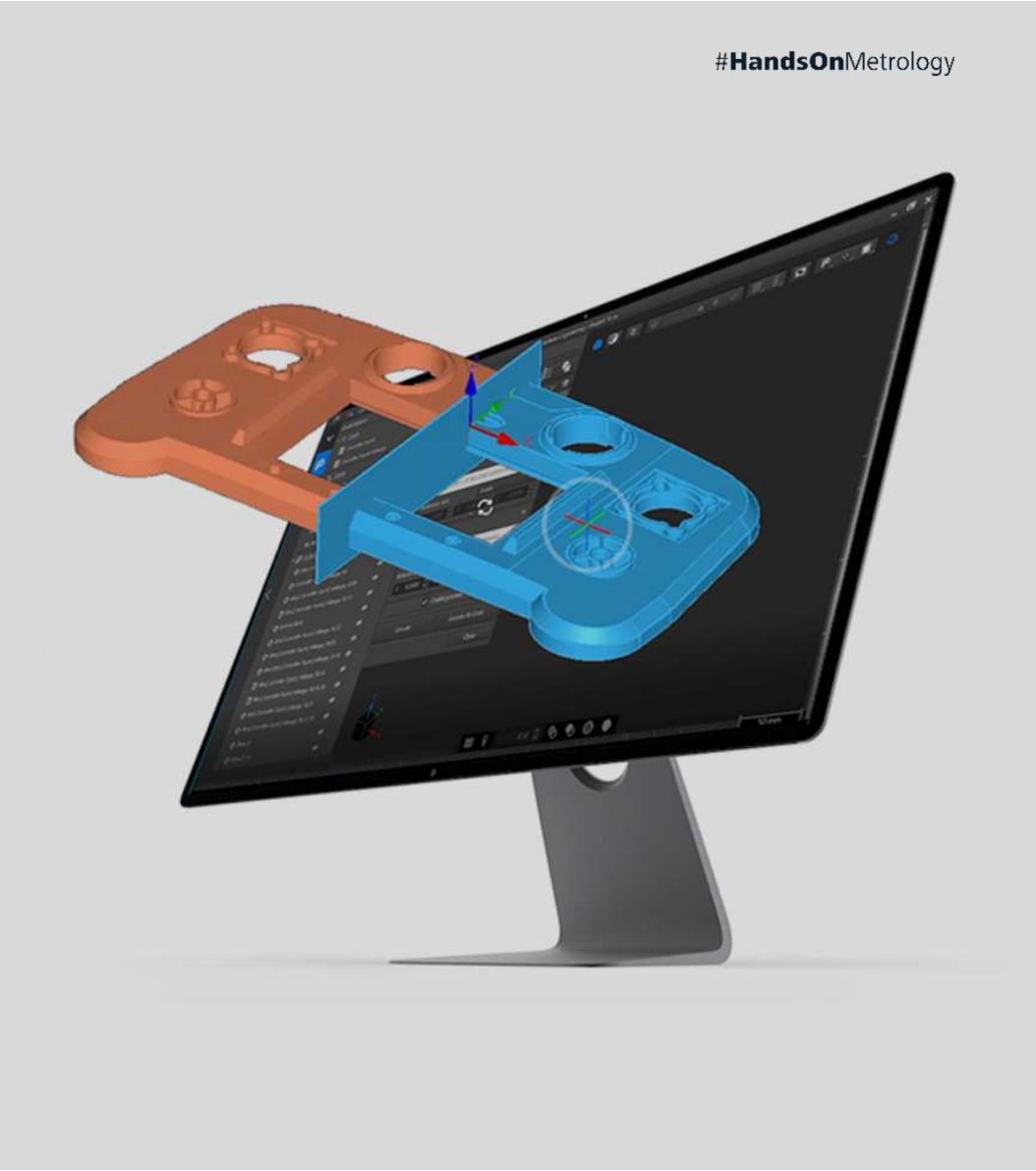
ZRE (ZEISS Reverse Engineering) – Complete RE software

Helps you to complete your complex Reverse Engineering Projects

- Create complete solid models using 3D scan data
- Direct interface from GOM Inspect
- Features for data preparation,
  - Hole filling
  - Smoothing and thinning
  - etc.

- Well-known and easy operation & user guidance
- Different alignment possibilities
- Features for surfaces reconstruction:
  - Extrusion
  - Define the number of patches
  - Lofting along contour curves
  - etc.

- Powerful tools for freeform surfaces
- High accuracy



Which applications use reverse engineering?

Design

Finished designed products should be a 1 for 1 copy.

CAD is needed for further production or reproduction

After-market

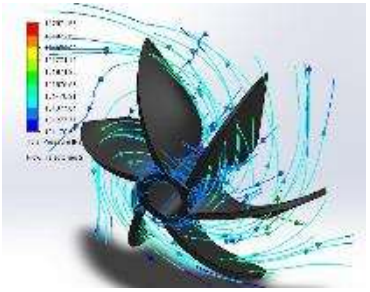
Many manufacturers for add-on parts for cars or other vehicles.

Data of original vehicle is needed. No CAD data of the manufacturer is provided.

Construction

CAD data needed for old parts that need to be reused or rebuilt.

CAD model for flow analyses.

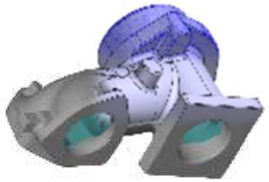


3D Printing

STL is the base for 3D printing, but sometimes you cannot scan everything
(internal geometry)

Reverse engineering is needed to reconstruct certain contours.

The finished model is converted back to STL for printing



Tool Making

Molds should achieve the longest possible service life
(regardless of whether it is plastic, sheetmetal or casting)

95 percent of all tools are reworked by hand because certain influences in the process.

After correction loops, tool needs to be scanned and reverse engineered.

Create your CAD, whatever the shape!

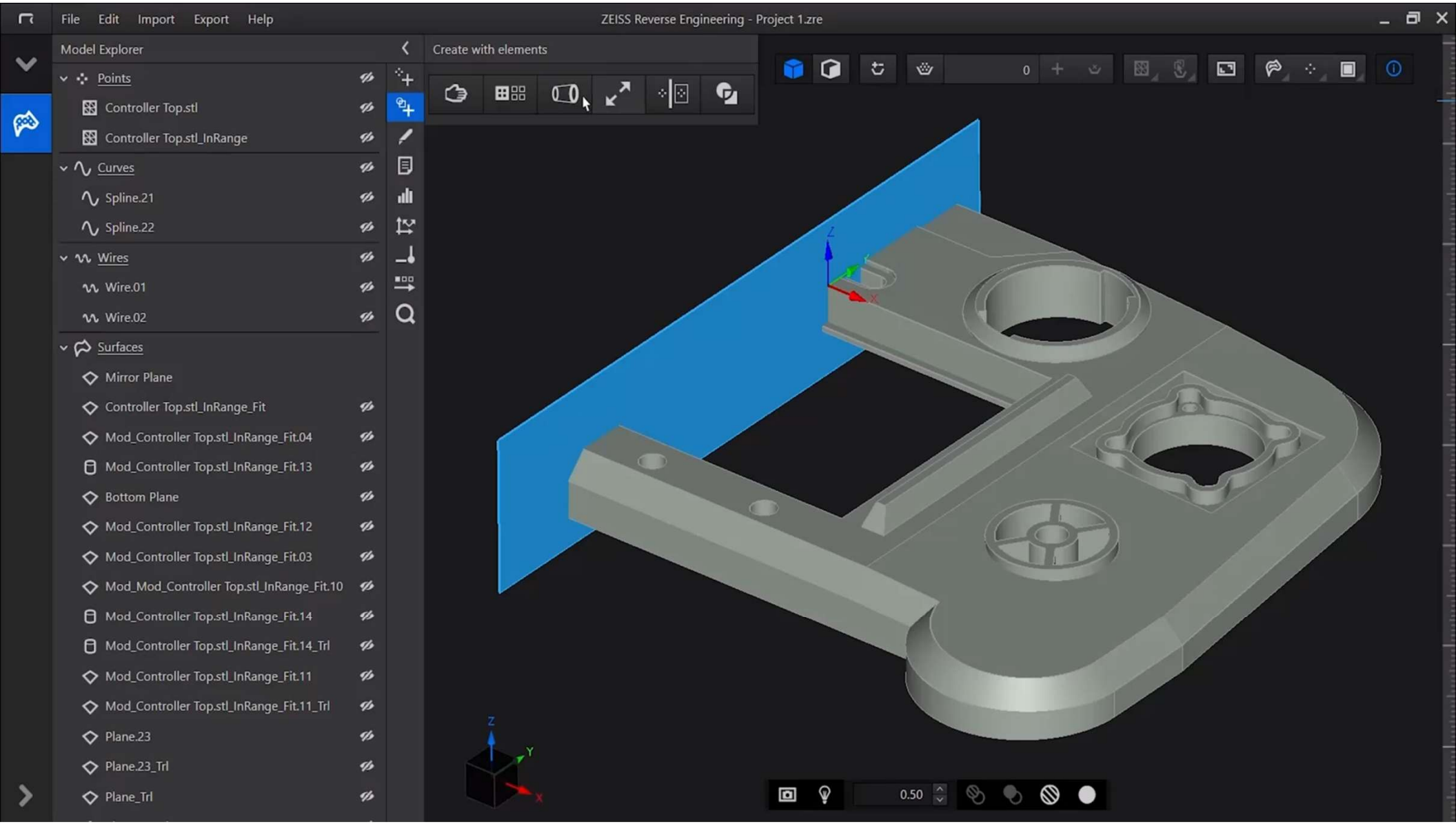
ZEISS Reverse Engineering has the perfect tools to accomplish your reverse engineering tasks, regardless of the part type.
Here are a few examples:

Geometric Parts

Geometries can be created directly from mesh data

Elements can be aligned, constrained, and edited according to design intent

Powerful mirror function is useful for symmetric parts

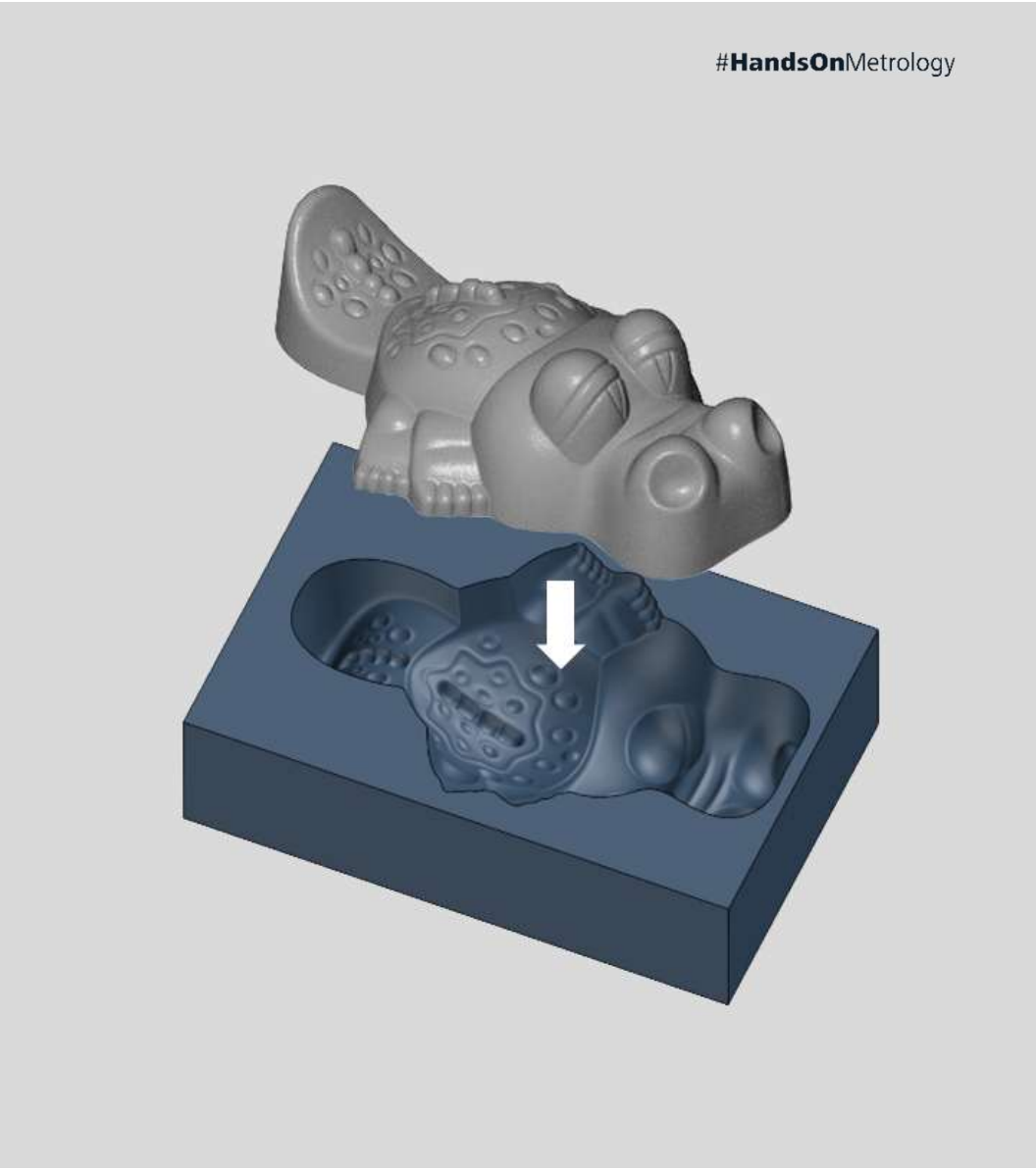

File
Edit
Import
Export
Help
ZEISS Reverse Engineering - Project 1.zre
Model Explorer
Create with elements
Points
Controller Top.stl
Controller Top.stl_InRange
Curves
Spline.21
Spline.22
Wires
Wire.01
Wire.02
Surfaces
Mirror Plane
Controller Top.stl_InRange_Fit
Mod_Controller Top.stl_InRange_Fit.04
Mod_Controller Top.stl_InRange_Fit.13
Bottom Plane
Mod_Controller Top.stl_InRange_Fit.12
Mod_Controller Top.stl_InRange_Fit.03
Mod_Mod_Controller Top.stl_InRange_Fit.10
Mod_Controller Top.stl_InRange_Fit.14
Mod_Controller Top.stl_InRange_Fit.14_Trl
Mod_Controller Top.stl_InRange_Fit.11
Mod_Controller Top.stl_InRange_Fit.11_Trl
Plane.23
Plane.23_Trl
Plane_Trl
0
0.50

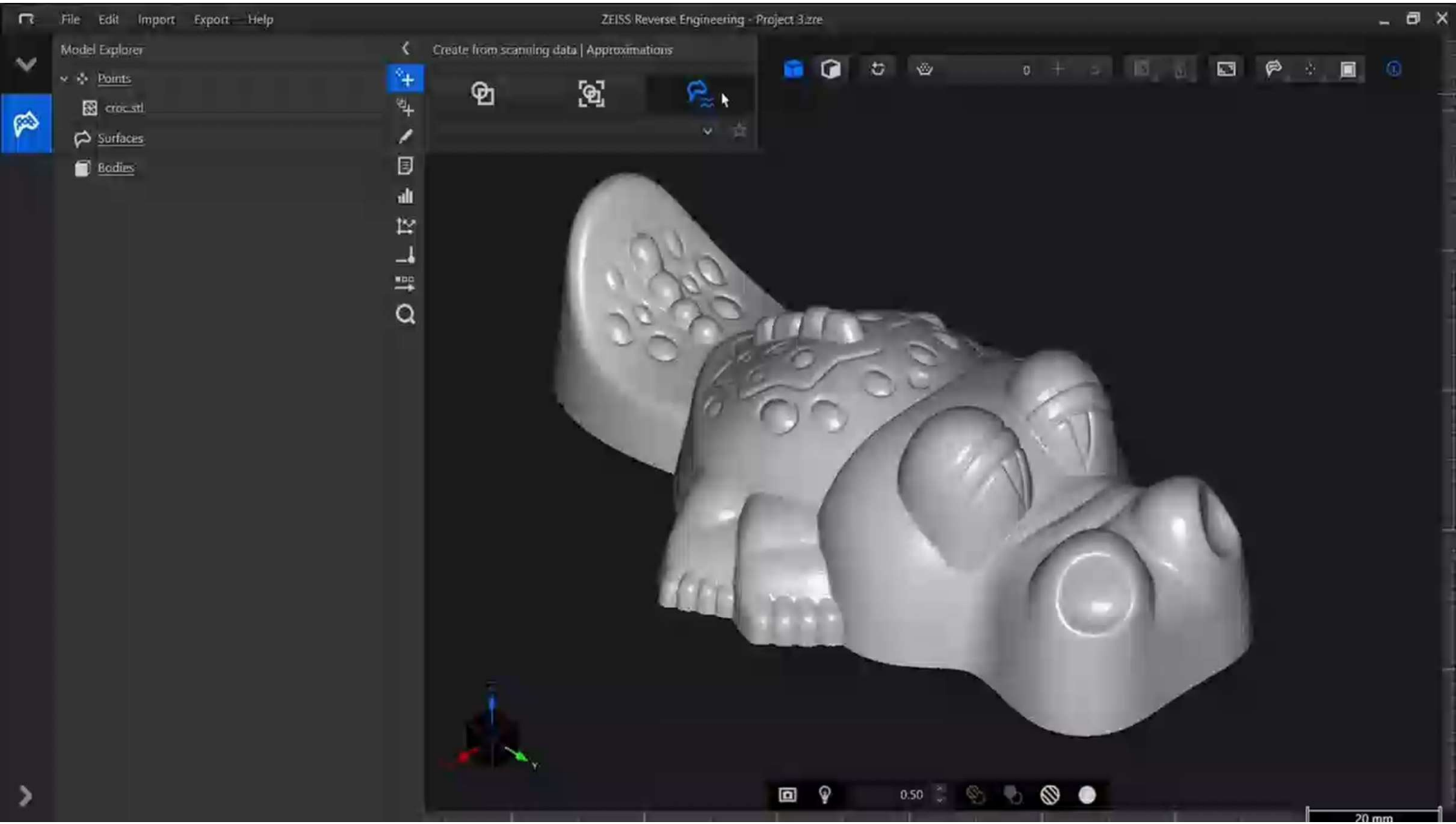
Freeform Surfaces

Easy transition from product to tool mold for reverse engineering applications

Freeform surfaces simply created with one tool in ZRE

Clean, detailed mesh used to generate accurate CAD model

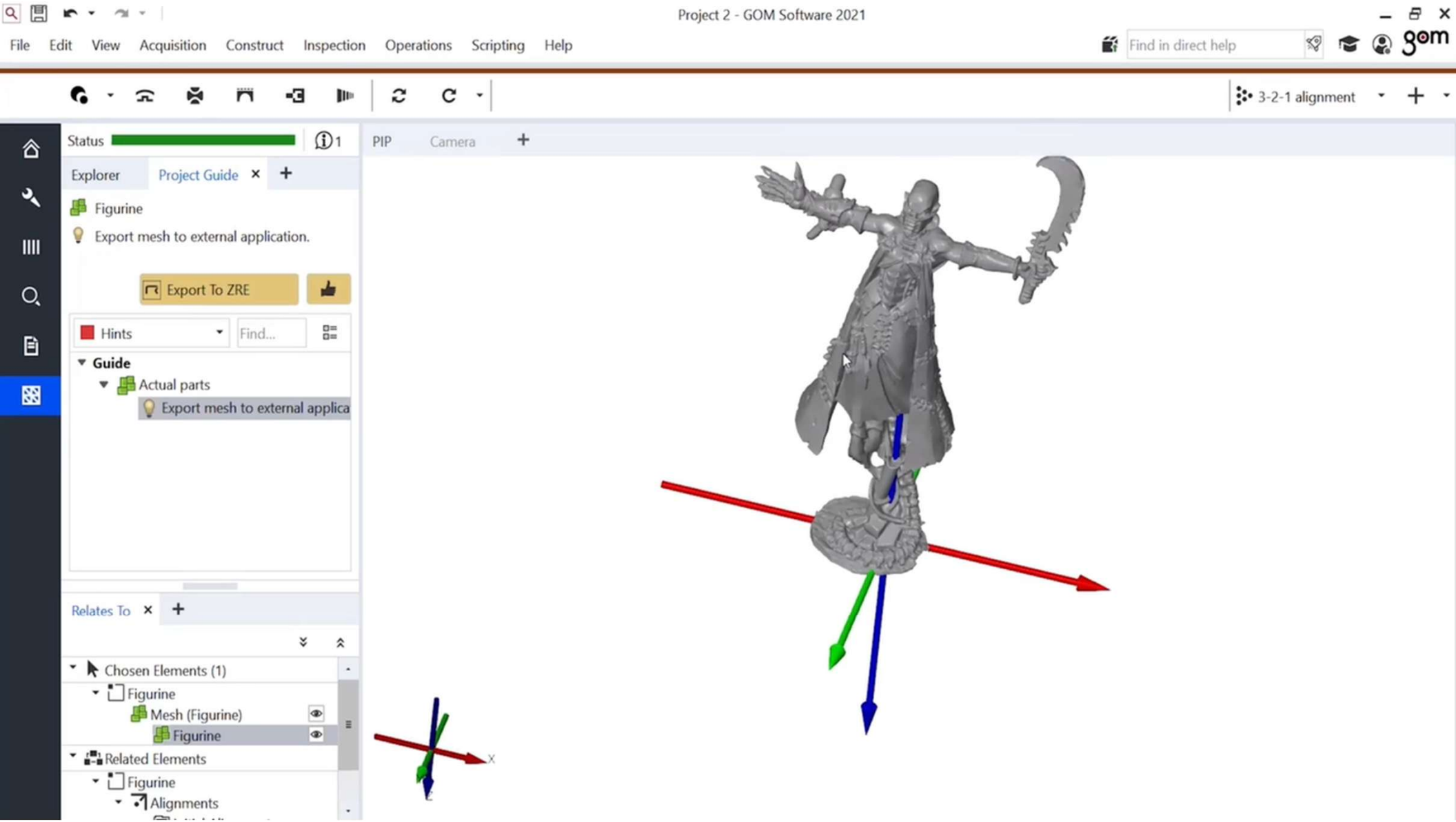



File
Edit
Import
Export
Help
ZEISS Reverse Engineering - Project 3.zre
Model Explorer
Points
croc.stl
Surfaces
Bodies
Create from scanning data | Approximations
0.50
20 mm

Organic Shapes

CAD creation of organic shapes is easily done with one tool, automatic surfacing.

Clean, detailed mesh used to generate accurate CAD model


Project 2 - GOM Software 2021
File
Edit
View
Acquisition
Construct
Inspection
Operations
Scripting
Help
Find in direct help
3-2-1 alignment
Status
1
Explorer
Project Guide
Figurine
Export mesh to external application.
Export To ZRE
Hints
Find...
Guide
Actual parts
Export mesh to external applica
Relates To
Chosen Elements (1)
Figurine
Mesh (Figurine)
Figurine
Related Elements
Figurine
Alignments
PIP
Camera
X
Z