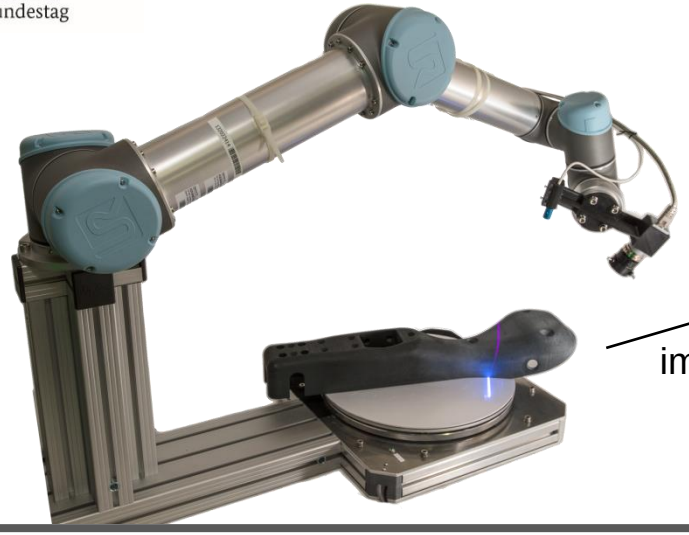
BESCHÄDIGTE BAUTEILE AUF BASIS PRÄZISER (TEIL-)AUTOMATISIERTER SCANMETHODEN REKONSTRUIEREN

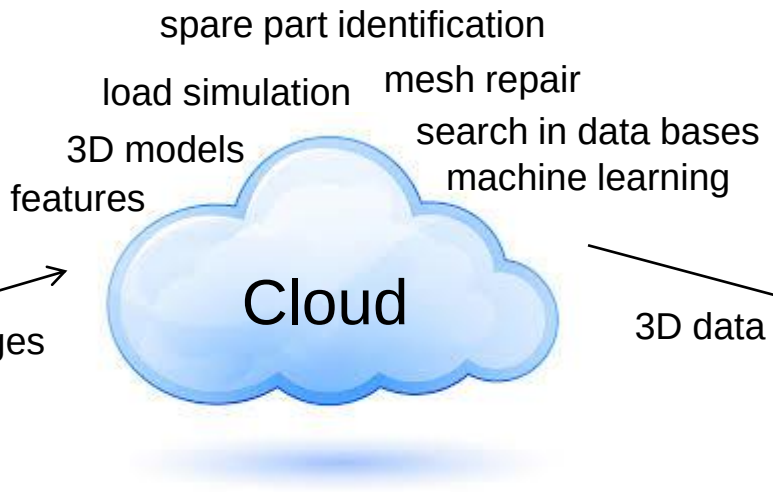
Thomas Lück
cirp GmbH

Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

M3D



images



3D data

Mobile 3D-Erfassung und 3D-Druck für industrielle Anwendungen – M3D

M3D Demonstrators at a Glance

Spare Part Recognition

Demo 1a

Generic part recognition using a smart phones with depth sensor

Spare part ordering
Printability validation

Demo 1b

Generic part recognition using a smart phone and a cloud based 3D reconstruction service

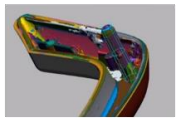
Demo 1c

Printed part recognition and sorting using a web cam

Sample Part: Automotive Chrome Trim

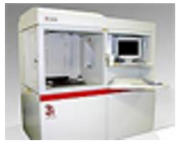
(Automated) 3D Scanning of damaged Part

Surface Reconstruction with the Objective of a Parametric CAD Model

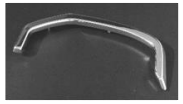


Manual Repair of damaged Areas within CAD Model

3D Printing of Digitally Restored Part



Post processing



Ready to mount Spare Part

3D Scanning, Reconstruction & Printing

Demo 2a

Creating an optimized printable model from a sample object:

3D scan station

Mesh reconstruction & repair

Structural validation & optimization

Demo 2b (Video)

Reconstruction and printing process for damaged spare parts :

3D Scanning
CAD Surface Reconstruction
3D Model Repair
3D Printing
Postprocessing

Challenges

Scanning is an optical method!

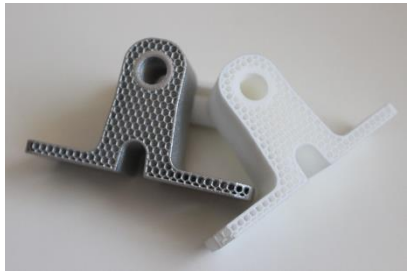
- Dirty, rusty
- Shiny and reflecting
- Transparency
- Damaged
- Hidden areas
- Assembly

chrome strip

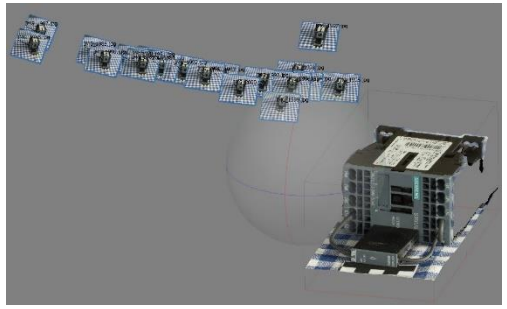
transparent part

armrest

lightweight part



Scanning method



- With photos
  - Mobile
  - Online feedback required
  - Still limited accuracy
- Step by step with structured light => state of the art equipment available
  - best accuracy with tripod => needs educated user and doesn‘t fit into trouser pocket
- With structured light automated by robot
  - Fast
  - Economical
  - reliable

Reconstruction process

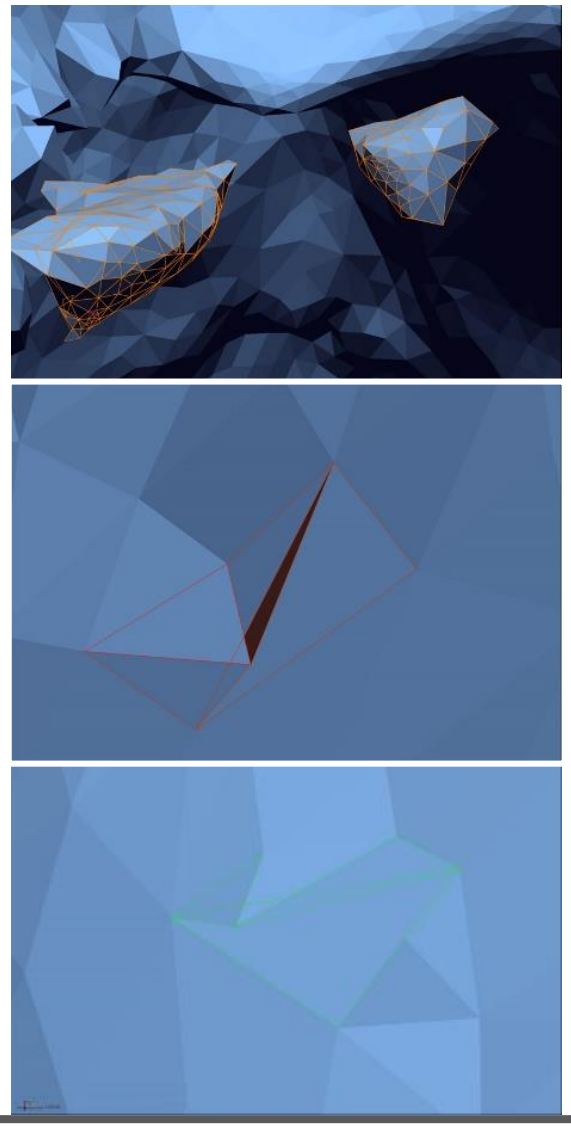
- Read data values
- Post-processing scanned data
  - Removal of overlapping triangles
  - Correction of sharp triangles
  - Removal of intersecting triangles
- Dividing scan data into „sets“
- Reconstruction based on the scanned data

Clean-up and repair

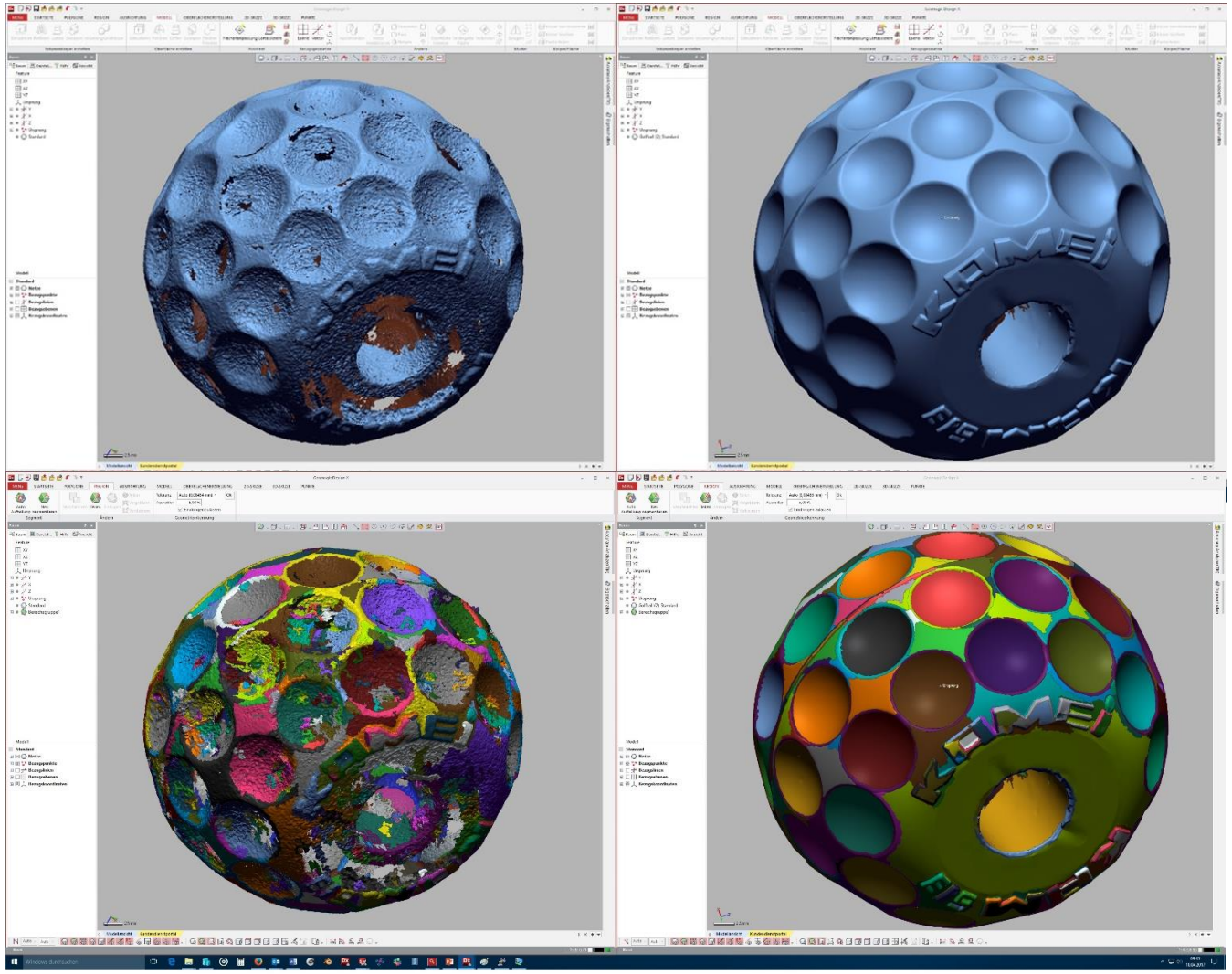
- Repair:
  - Proactive post-processing of the dataset by adding, removing or refining triangles
  - „filling in“ holes, modelling edges, removal of „outliers“
  - Aim of a „waterproof“ STL

- Clean up:
  - Passive post-processing of the dataset by removing protruding contours, overlapping triangles, small groups or creased triangles
  - Aim of a „neat“ dataset

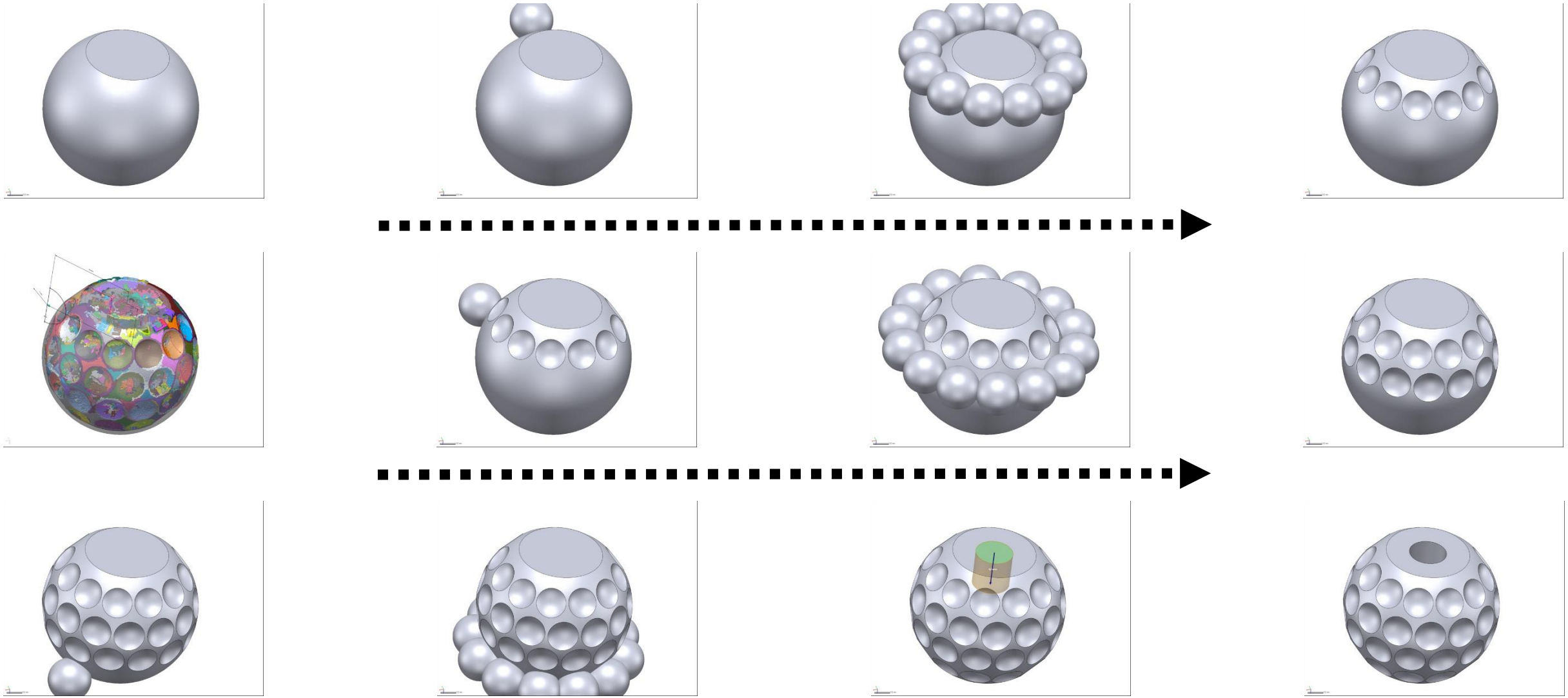
→ To avoid distorting the reconstruction‘s results, it does not make any sense to add triangles or refine the mesh.



Potential defects



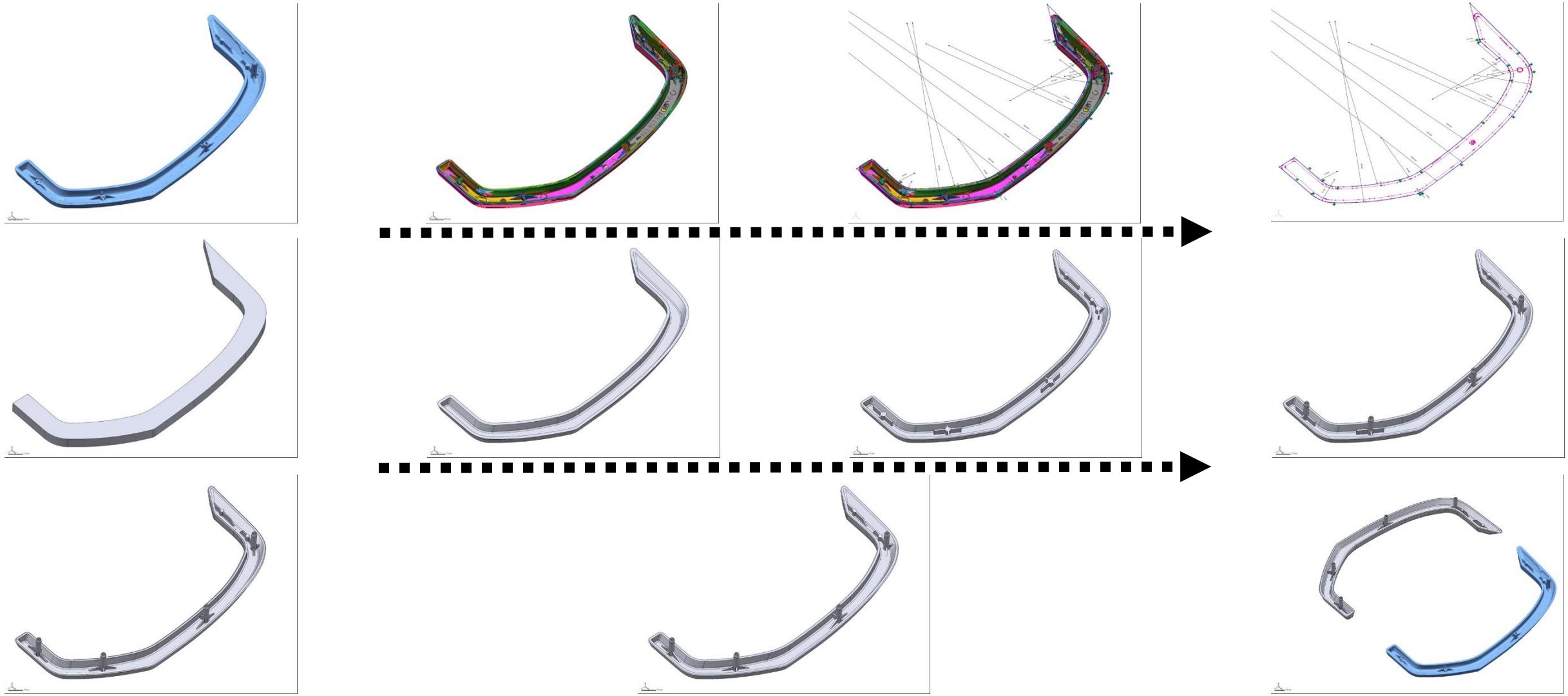
Reconstruction of a gear knob



Repair by reconstruction

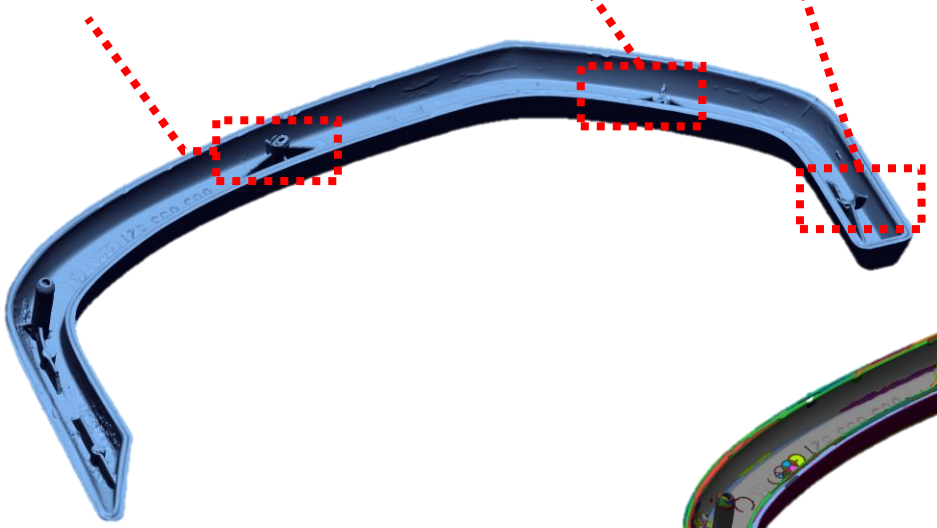
- Why?
  - Achieve proper parametric CAD-Modell and compensate scan deviations by „correct“ geometries

Reconstruction of a chrome strip

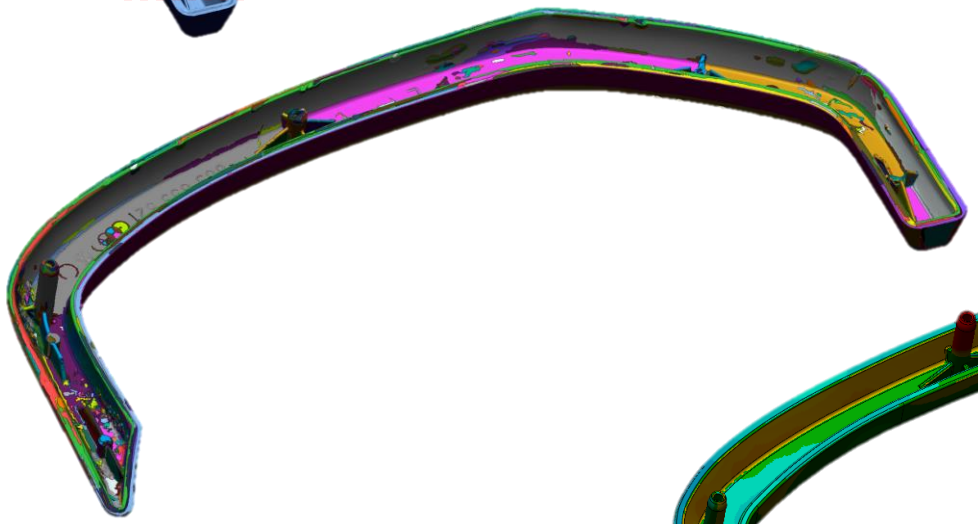


Repair by reconstruction

broken domes

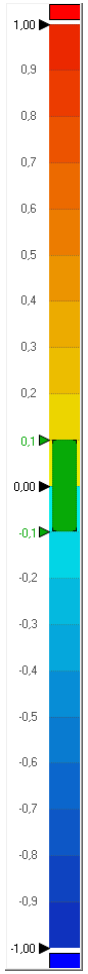


Scan data from structured light scanner „GOM“



Processed scan data with proposed identification of regions

Reconstructed scan data as proper CAD model, with repaired domes



Colours show deviation from original scan

Additively manufactured component

- Produced by SLA
- Polished and metallised

Reference Ro80 rear light

The end