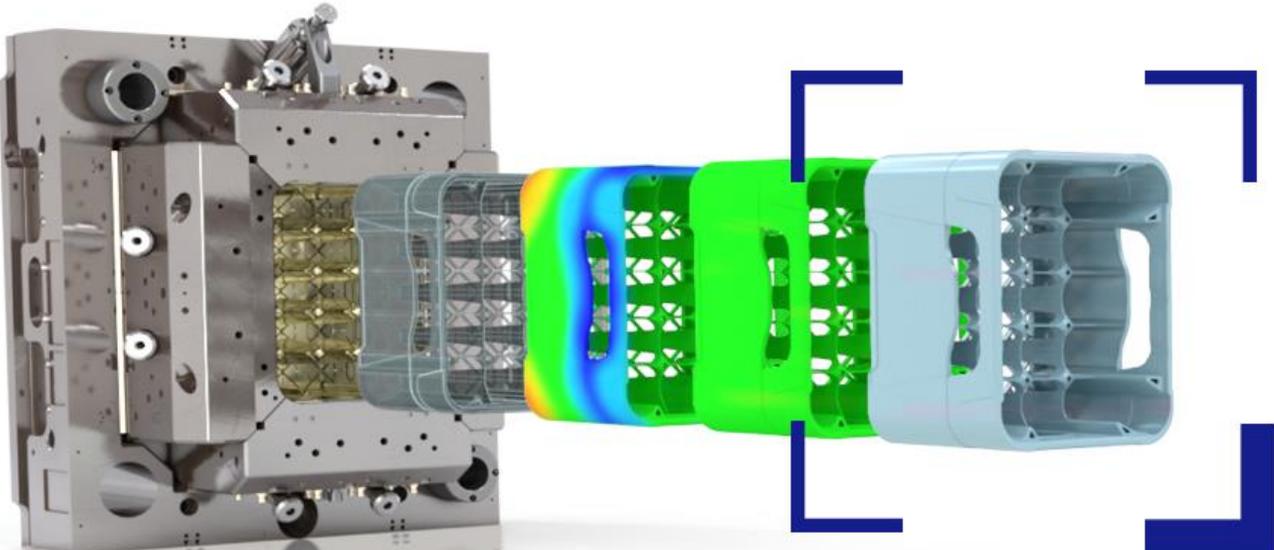


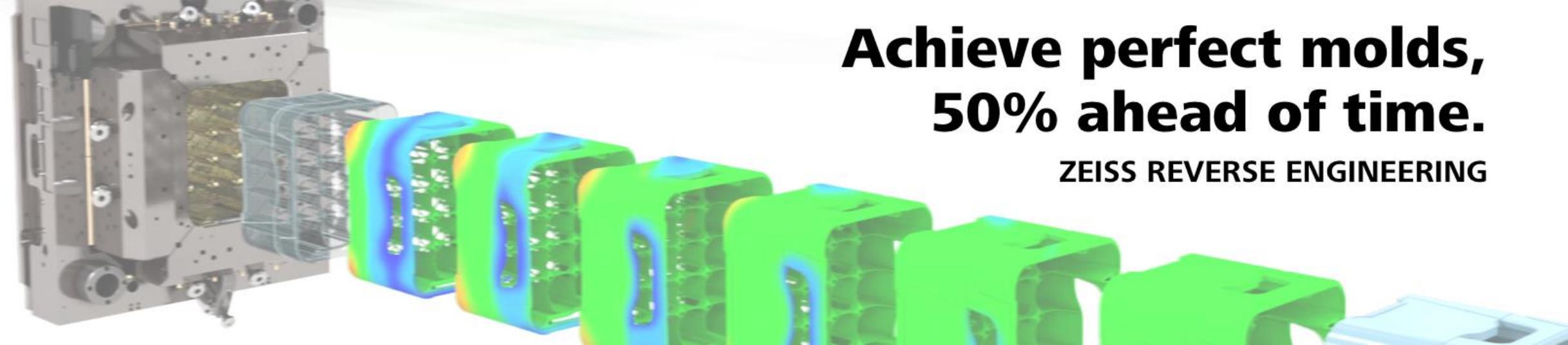


Seeing beyond



**Achieve perfect molds,
50% ahead of time.**

ZEISS REVERSE ENGINEERING



ZEISS REVERSE ENGINEERING

The main functions



01

Reverse engineering (basic) Generation of a CAD model from scan data such as polygon meshes or point clouds.

Tool correction (option) Simple and fast optimization of a tool.

02

03

Volume calculation (option) Automated and reproducible volume calculation.

Digitization

“I do not have the CAD model for a part, but I need to produce it.”

Cost effectiveness

How **accurate**
are your created surfaces?

How to further use your
generated **measurement data.**

Reverse Engineering process

The way to a CAD-model



01

Reverse engineering (basic) Generation of a CAD model from scan data such as polygon meshes or point clouds.



ZEISS REVERSE ENGINEERING

1. Object

2. Data collection / 3D-Scan

STL, PLY,
All ASCII-Formats

3. Import
Point cloud
/Polygon
mesh to ZRE

4. Reverse
Engineering

5. Create &
export CAD-
Model

- Manually produced parts
- Manually modified parts
- Design-Studies



Features for data preparation, e.g.

- hole filling,
- flattening,
- etc.

Features for surfaces reconstruction: e.g.

- Extrusion,
- "define the number of patches"
- "lofting along contour curves"

Export in formats:

- IGES
- STEP
- SAT

Production

Prototype

“It takes too many correction loops
until I have the final mould.”

Accuracy

Avoid undercuts

Competitiveness

Earlier SOP

Error-prone process
with Excel

How to align the data?

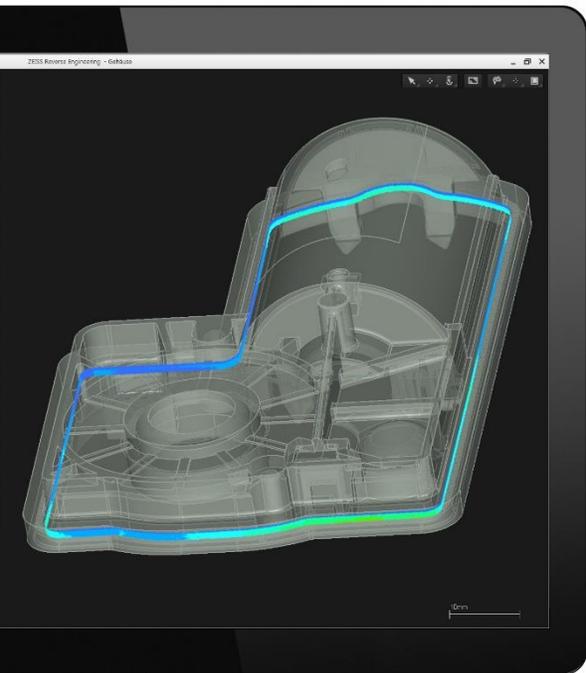
Independence of technology

Tool correction process

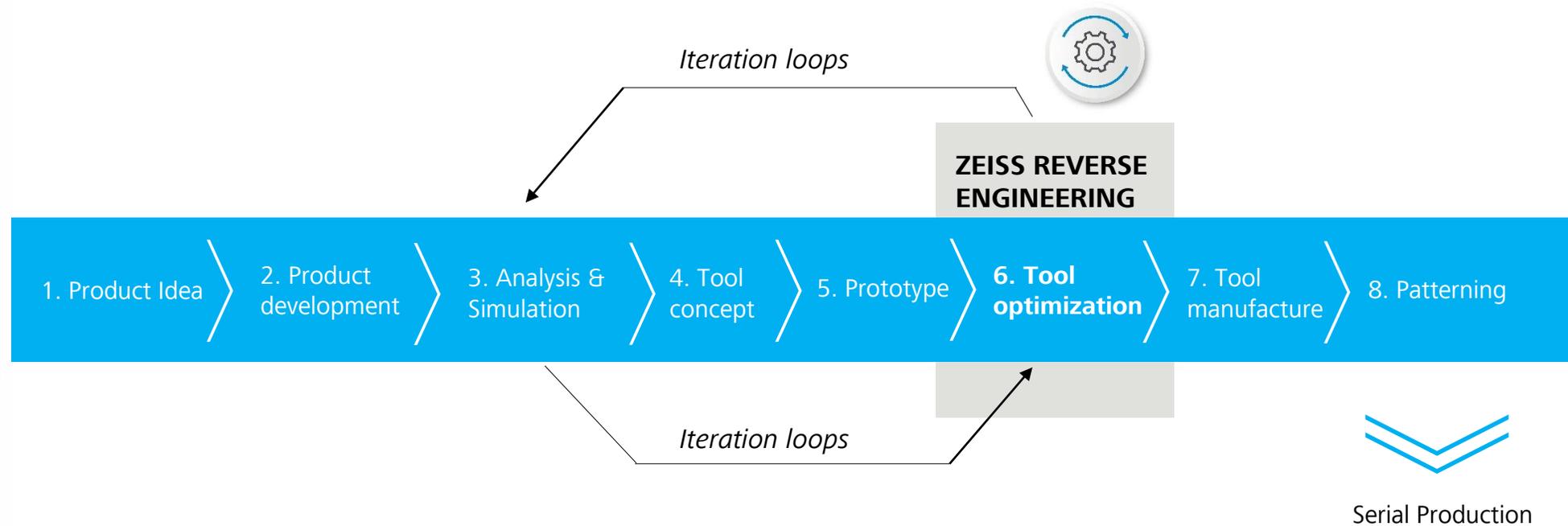
Save at least 50 percent of the needed iteration loops & get earlier to your start of production!

02

Tool correction (option) Simple and fast optimization of a tool.



Example: filter housing



Accurately measure medication

Certainty

Effects on exhaust gas

Reproducibility:
User-independent
results

Reduction of measurement errors

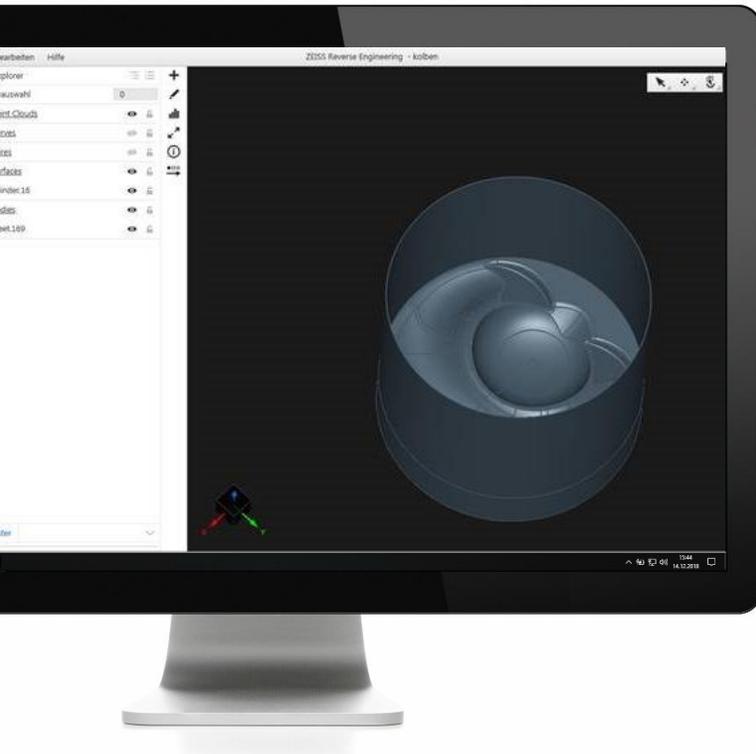
Less measurement time

Volume Calculation Process



03

Volume Calculation (option) Automated and reproducible volume calculation.



1. Data collection
tactile / optical

2. Alignment

3. Export of data

4. Import of measuring points & CAD-model

5. Data processing

6. Volume Calculation

7. Display of the volume

**ZEISS CALYPSO, ZEISS colin3D,
NON-ZEISS software**

**ZEISS REVERSE ENGINEERING
+ option Volume**

ZEISS PiWeb

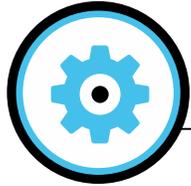


Example: cylinder piston of an automotive engine

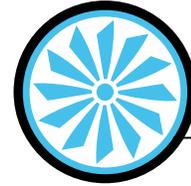
ZEISS REVERSE ENGINEERING **Applications**

Fields of applications for all functions

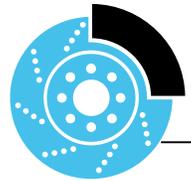
by industries



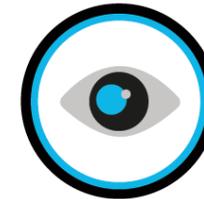
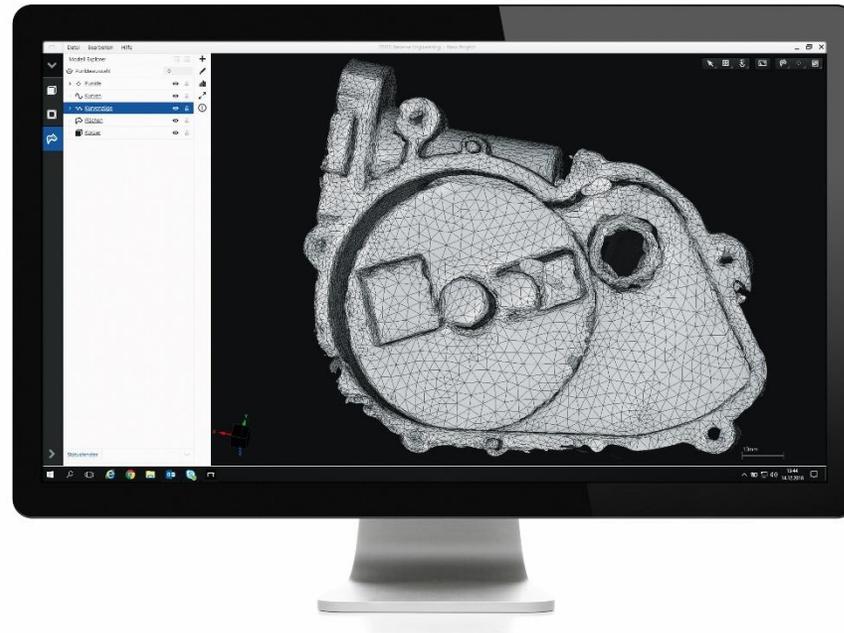
Moulding Industry & Machine Engineering



Aerospace



Automotive



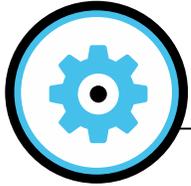
Optical



Medical

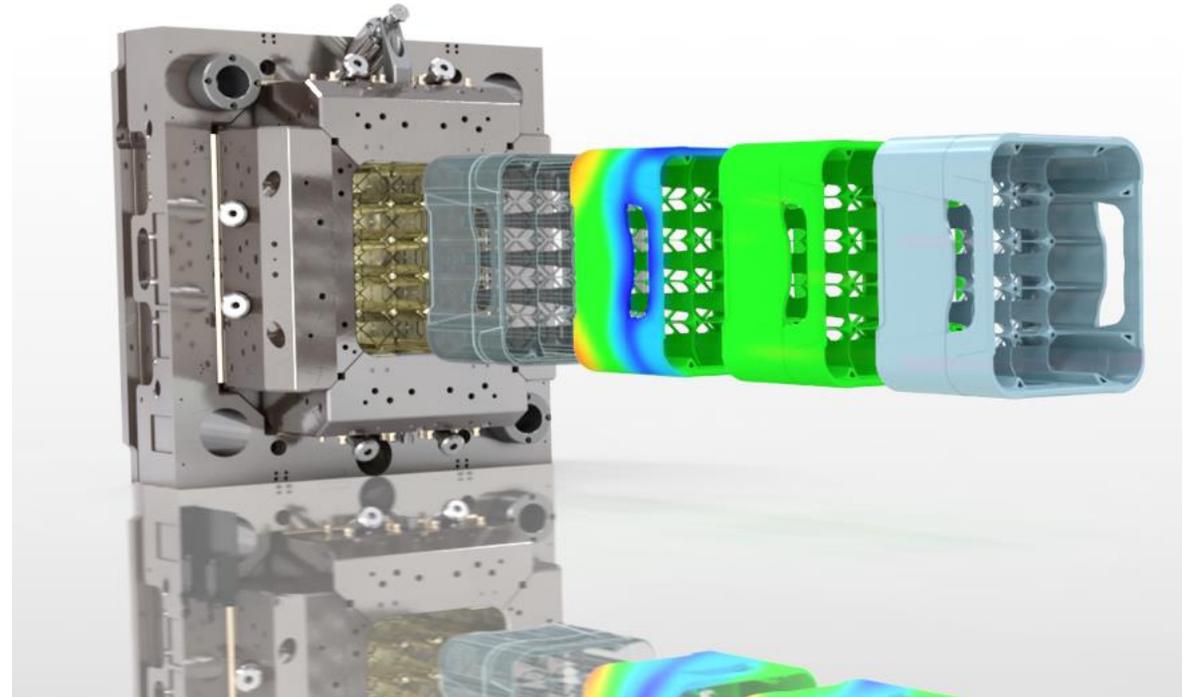
Fields of Applications by Industry

Moulding Industry & Machine Engineering



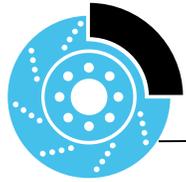
Moulding Industry & Machine Engineering

- ✓ Reverse engineering of injection moulds
- ✓ Reverse engineering of gears
- ✓ Tool correction of press moulds
- ✓ Tool correction of sheet metal performing tools
- ✓ Volume calculation of press moulds
- ✓ Volume calculation of cylinder pistons (hydraulic systems, piston producer)



Fields of Applications by Industry

Automotive



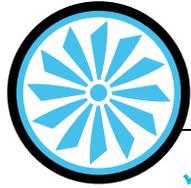
Automotive

- ✓ Reverse engineering of freeform surfaces (e.g. Oldtimer)
- ✓ Volume calculation of combustion chamber
- ✓ Volume calculation of turbocharger



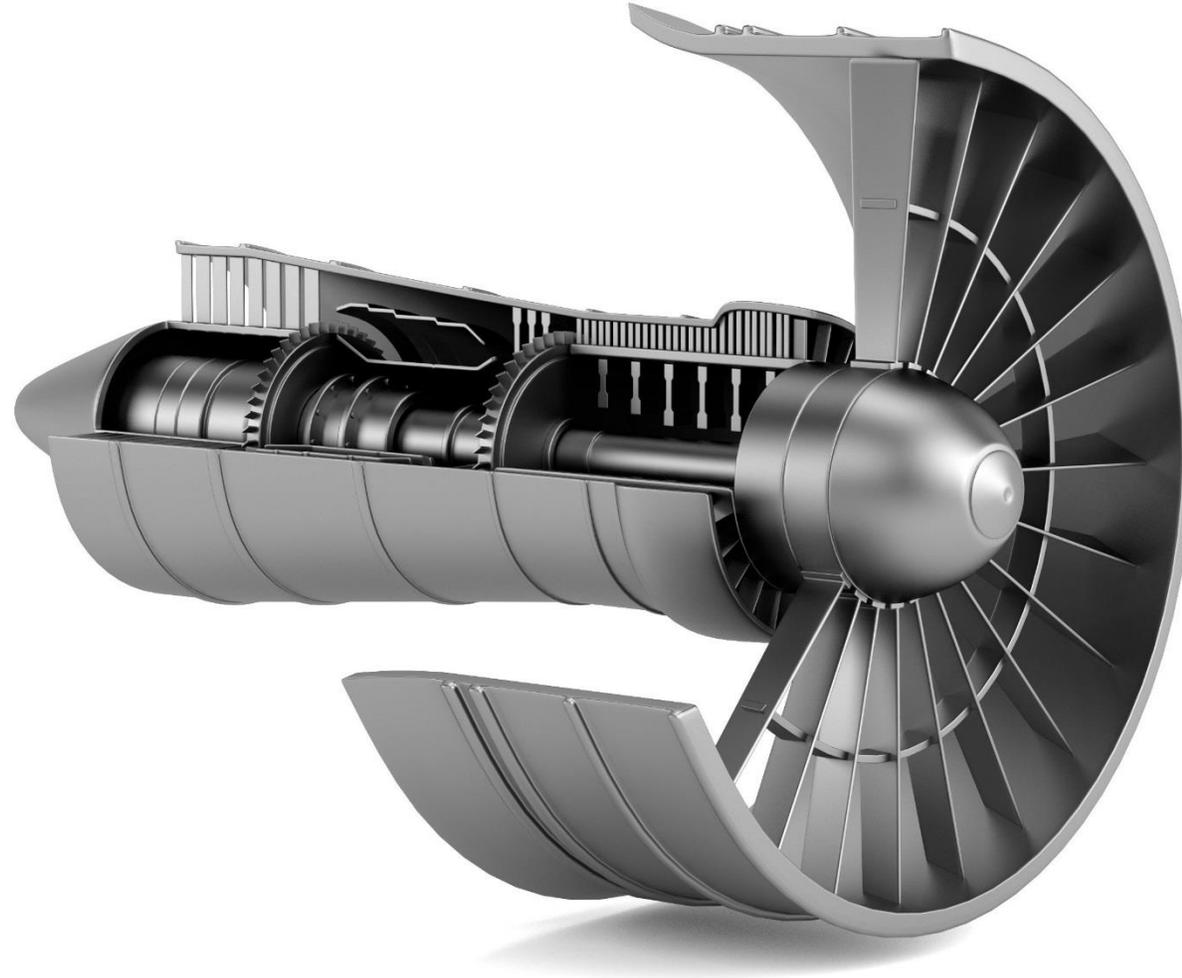
Fields of Applications by Industry

Aerospace



Aerospace

- ✓ Reverse engineering of turbine blades





Optical

- ✓ Reverse engineering of optical lenses



Fields of Applications by Industry

Medical



Medical

- ✓ Reverse engineering of artificial joints
- ✓ Volume calculation of injection needles



ZEISS REVERSE ENGINEERING

Reasons to invest

Cost reduction – Accuracy – Tool correction – Freeform

1. Cost reduction and faster start of production/ time-to-market

Save at least 50 percent of the needed iteration loops throughout your tool correction process and therefore profit from an enormous competitive advantage by an earlier start of production.

2. High Accuracy

ZEISS REVERSE ENGINEERING delivers corrected CAD surfaces with the highest accuracy. This is essential, if you want to produce plastic parts that have the highest accuracy requirements.

3. Independence of measurement device

You can use point clouds and polygon meshes that are either measured by tactile, optical or CT measurement machines. Therefore, it does not matter how the measurement data is generated.

4. Avoiding undercuts

Usually, parts are constructed that they fall out of the mould when the part and the mould move apart. Sometimes it happens that a corrected mould has undercuts, resulting in parts that won't fall out of the mould. To prevent this from happening, ZEISS REVERSE ENGINEERING includes an undercut analysis.

5. Freeform surfaces

Different features help to approximate freeform surfaces, e.g. "set a direction", "define the number of patches" or "lofting along contour curves".

6. Customized software

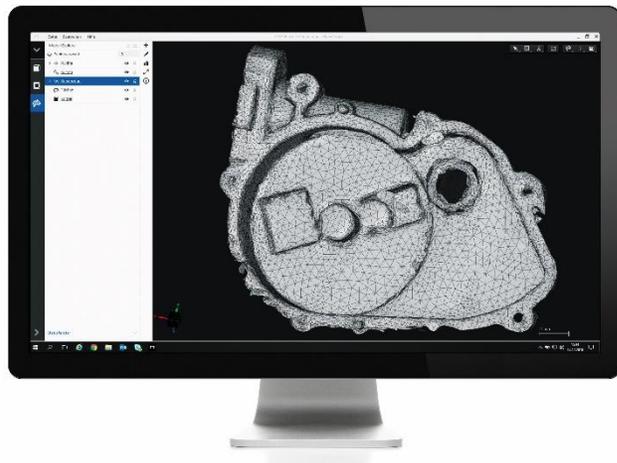
Pay for what you really need: The new ZRE software structure consists of the basis (reverse engineering) and two options (tool correction, volume calculation). For example, if you are only interested in tool correction, you do not have to pay for volume calculation and otherwise.

7. Ease-of-use

The "Blue Path" guides the user through the workflow. This user guidance is included in every ZEISS NEO software, e.g. ZEISS colin3D. It definitely saves costs, because users familiar to the "Blue Path" need less training.

8. Expertise & satisfied customers

ZEISS has been working on reverse engineering for almost 20 years. Some of the application engineers are former toolmakers and metrologists from the injection moulding industry. Satisfied customers confirm the effectiveness of the software.



Experience is everything: no automatic button in ZEISS REVERSE ENGINEERING (basic)

Technical explanation

There are different competitor software with a feature to generate a CAD model automatically. ZEISS REVERSE ENGINEERING does not include an automatic surface reconstruction-feature. The user has to do the surface reconstruction step by step on his own. Therefore, the software offers features to help him throughout this process.



Benefit for customer

- The user is in control of the whole reverse engineering process, if he does the surface reconstruction manually. The user can decide how the generated planes look like. Example: The display of a smartphone consists of only one plane. If you used the automatic button of competitors, the display would consist of two or more planes. If there were two or more surfaces in your generated CAD model, it would be very complex to process the CAD model any further.
- The created CAD model of ZEISS REVERSE ENGINEERING can be further used within CAD software. That's not possible with the automatically generated model.

Competitive environment



Geomagic; Polyworks

New feature for tool correction (option): undercut analysis (ZEISS REVERSE ENGINEERING 2.0)

Technical explanation

Form elements with undercuts do not automatically demold of the injection mould. For the demolding of such parts you need some additional elements like sliders or fordable cores which increase the costs.

To avoid these undercuts and the increase of the costs, ZEISS REVERSE ENGINEERING includes an undercut analysis.



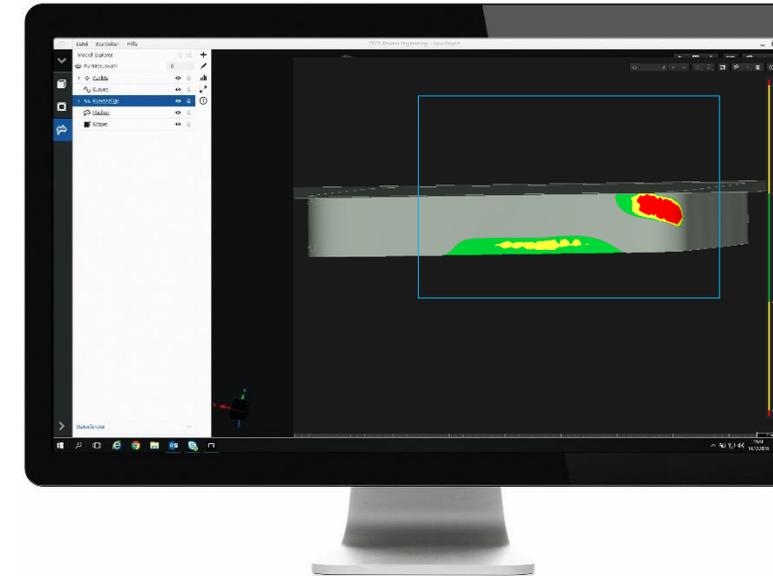
Benefit for customer

- Areas with undercuts can be identified and considered throughout the tool correction process.
- Customers can decide how they want to handle the correction and the undercut.

Competitive environment



Volume Graphics, Werth (winWerth FormCorrect: not launched yet)
VG launched their tool correction feature at CONTROL show 2018, ZRE tool correction is existing since years.



ZEISS REVERSE ENGINEERING

Differentiator



Global availability and Know-How

ZEISS IMT Network

61 Metrology Centers
32 Sales & service organizations
10 production sites
100 business partners
3800 Employees



Benefit for customer

- ZEISS Know-How & application technician globally available.
- Service & support very close to the customer means fast reaction time.
- Less downtime and more security.

Competitive environment

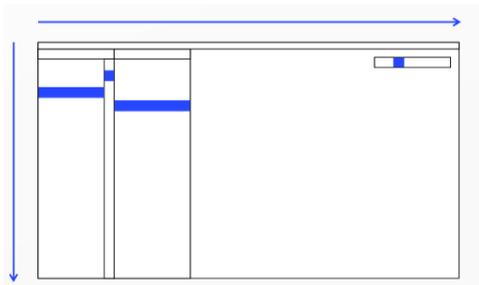


We are most frequently represented worldwide.

The “Blue Path” of ZEISS NEO products

Technical explanation

You can find the “Blue Path” in all ZEISS NEO software packages. The “Blue Path” guides the user through his individual process in the software. It guarantees user guidance and a modern user interface.



Benefit for customer

- Cost savings because of less training hours.
- More efficient operation time due to familiar user interface.
- The user is guided through the workflow. Reduction of mistakes.
- The user only sees the necessary functions in each step.

Competitive environment



Volume Graphics has no comparable user guidance.

