



# TRITOP

Optical Photogrammetry System



Seeing beyond



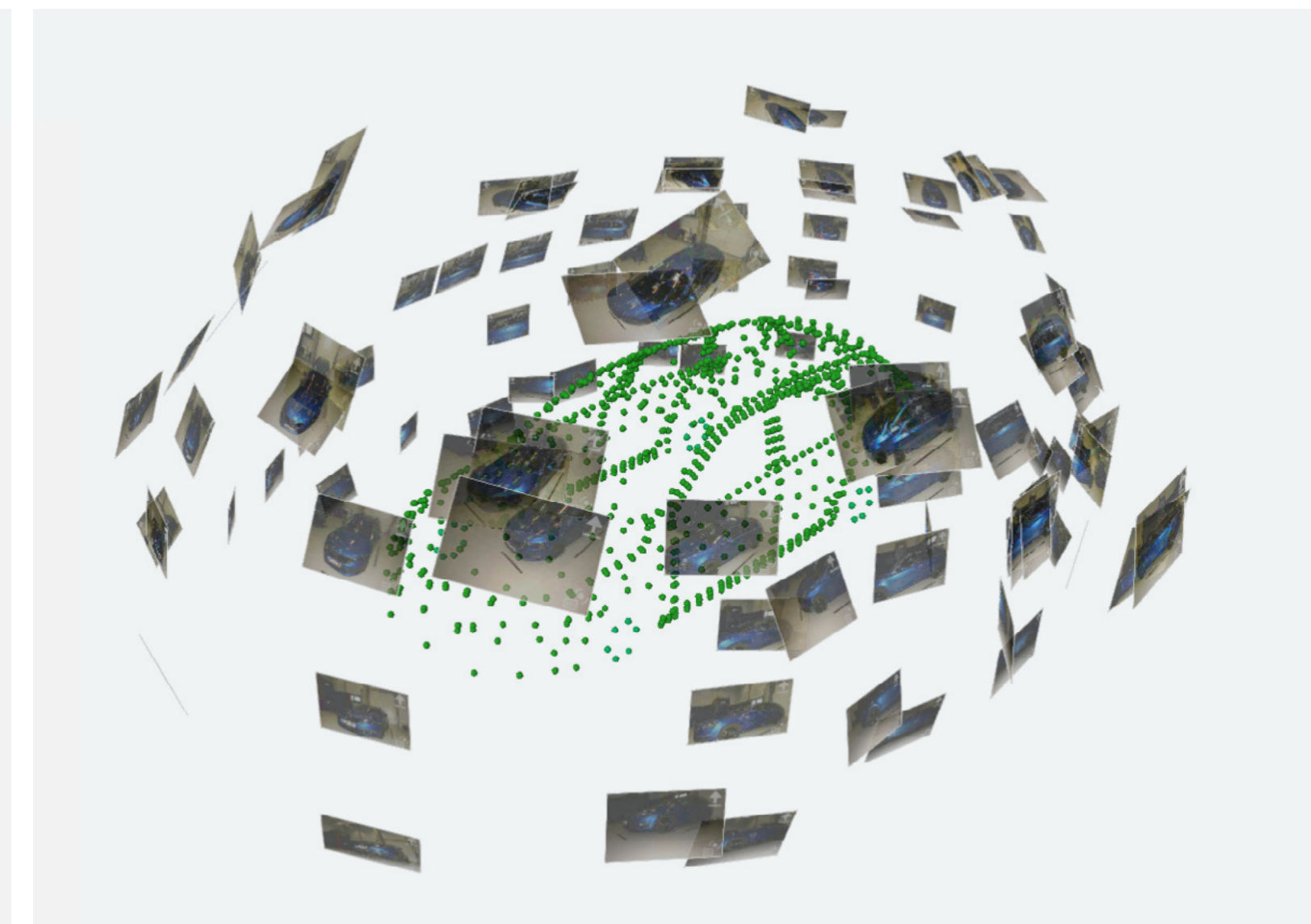
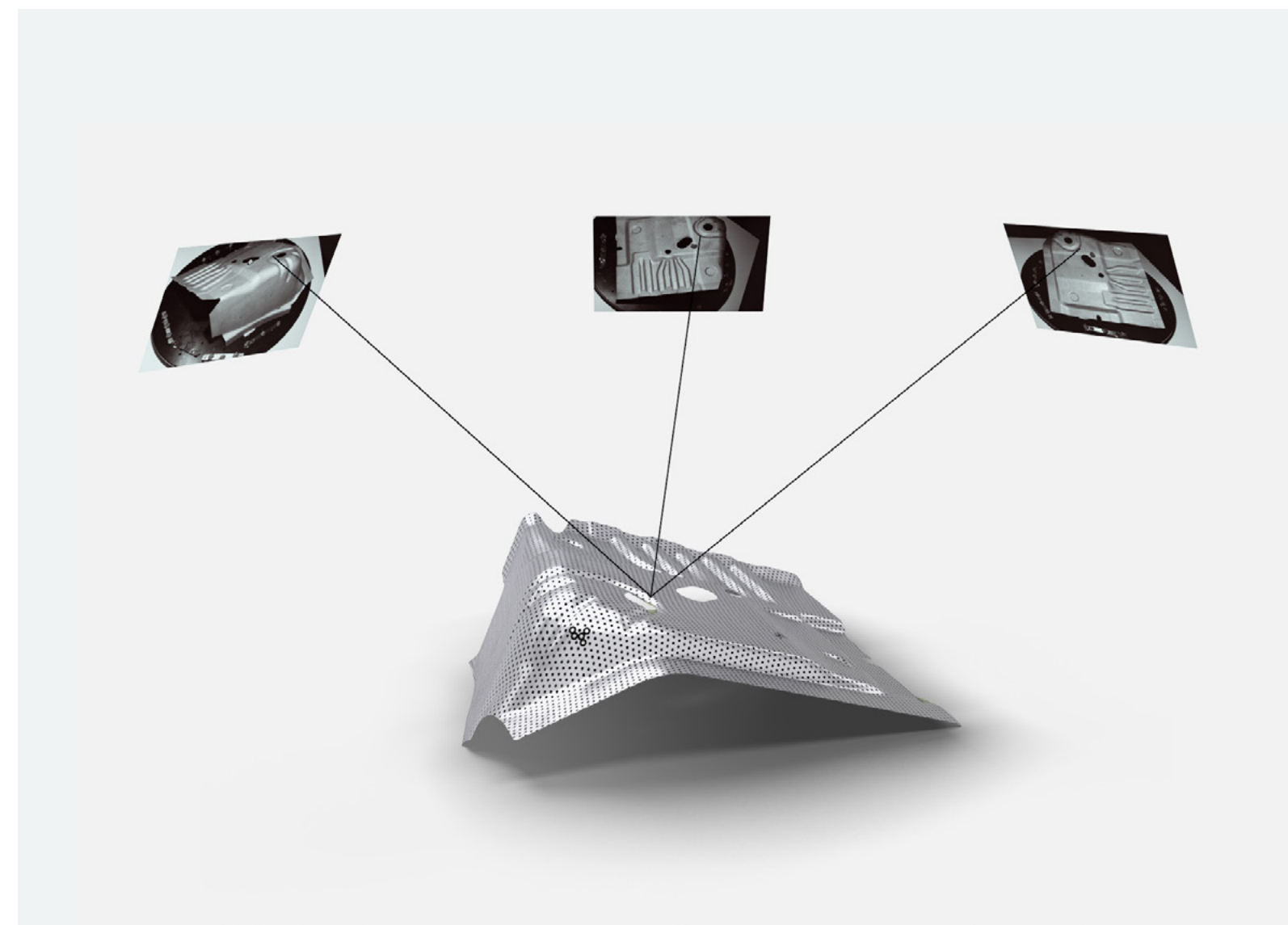
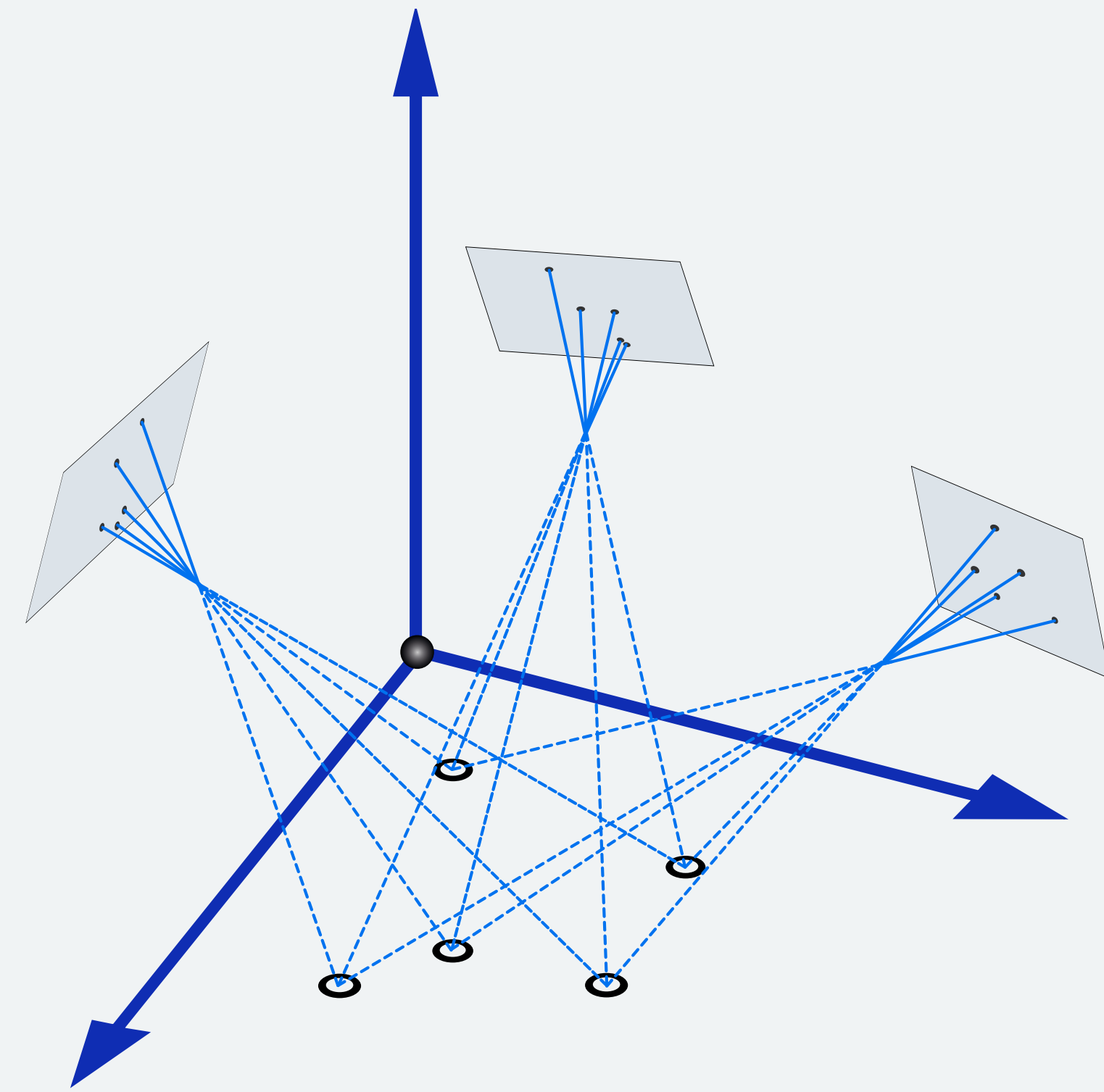
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# Photogrammetry

Measuring by capturing

Photogrammetry is a non-contact measuring method. Pictures of the object to be measured are taken from different views with a digital measuring camera.

The position of a measuring point in space is determined by triangulation of directional bundles. Knowing the respective spatial orientation in the object coordinate system, the required 3D coordinates can be computed from the ray intersections.



# Measuring Tasks

## Mastering tasks photogrammetrically

TRITOP captures precise three-dimensional coordinates of individual measuring points on objects and components. Within a short measuring time, the features, i.e. the coordinates and orientation of the respective measuring point in space, are determined photogrammetrically.

Being a mobile measuring system, TRITOP is suited for measuring tasks in 3D coordinate metrology and 3D testing. Conventional measuring methods, such as measuring tapes and batter boards, are replaced by TRITOP, along with complex displacement measuring systems and displacement transducers.

**TRITOP offers a high level of accuracy, repeatability and ease of use: portable, fast and highly precise.**



**The object is not touched during the measurement.**

TRITOP allows for non-contact acquisition of 3D coordinates. Especially in confined spaces and in areas that are difficult to access, TRITOP reveals its strengths. Even fragile objects and sensitive surfaces can be measured.

**Hand-held and freely movable**

When inspecting large objects, maximum flexibility and mobility is required. TRITOP is designed for harsh measurement environments. Due to minimum hardware requirements, the lightweight, wireless system is location-independent and completely freely movable.

**Robust and temperature-stable**

TRITOP is insensitive to vibrations and impacts. The robust technology is temperature-stable and maintenance-free, which means no wear or loss of accuracy. The bundle block adjustment of the software ensures robust image acquisition.



**Accelerates inspection processes**

Compared to conventional measuring methods, TRITOP captures high-precision 3D coordinates in a significantly reduced measuring time even under harsh ambient conditions. The visualization of the measured values and analysis data speeds up the evaluation.

**User guidance enables error-free work**

TRITOP can be operated intuitively via the ZEISS INSPECT software, which can also be combined with ATOS and ARAMIS sensors. The well-structured user guidance enables working without errors and thus ensures high data quality.

**High data quality**

Due to the high spatial resolution, TRITOP can capture individual measuring points on objects with absolute precision. The self-monitoring system provides continuous feedback on the image quality and thus ensures precise measuring results.

# 3D Coordinates

## for efficient inspections

In photogrammetric measurements with TRITOP, the object coordinates are acquired using a digital measuring camera. Pictures of the object to be measured are taken from different views.

The user receives 3D coordinates for each measuring point as a 3D point cloud. The 3D coordinates can then be used to carry out various metrological analyses.



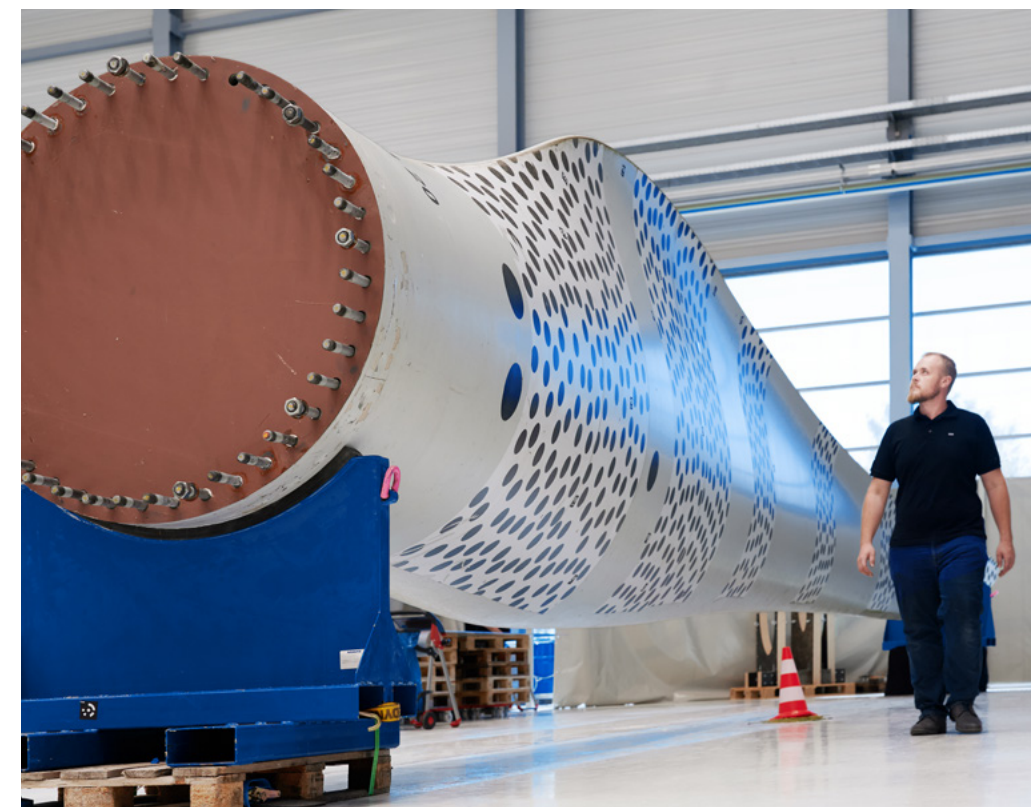
# 3D Coordinates

## for efficient inspections

### All object sizes

Measuring system comes to the measuring object

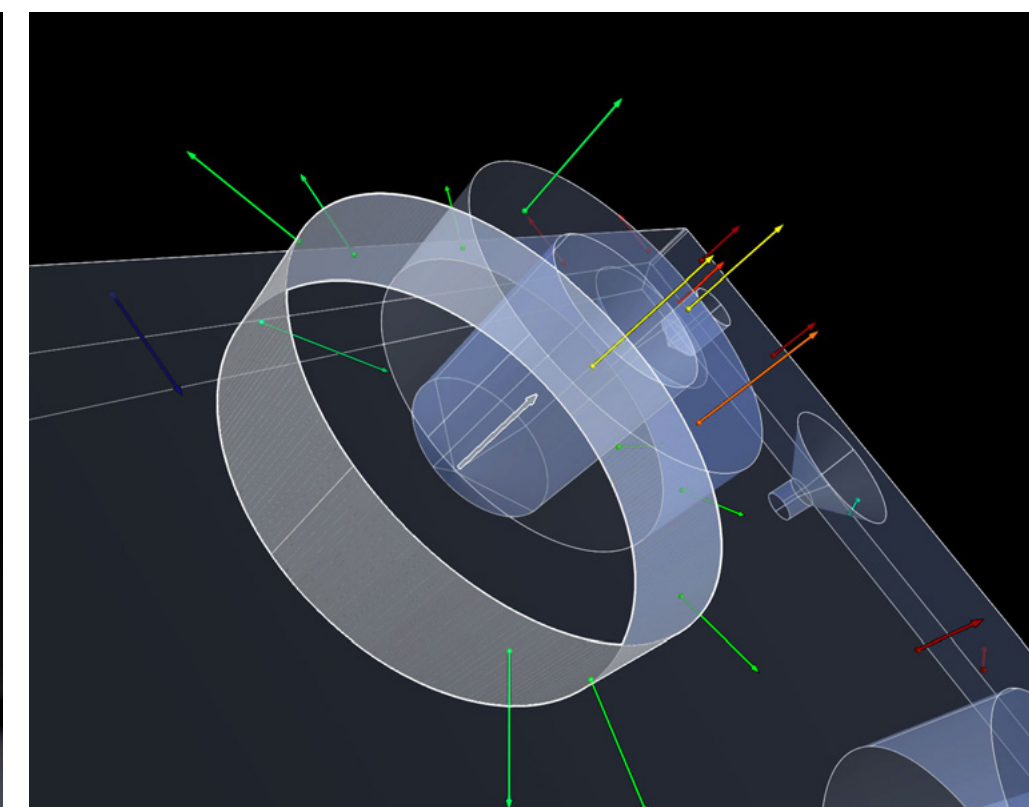
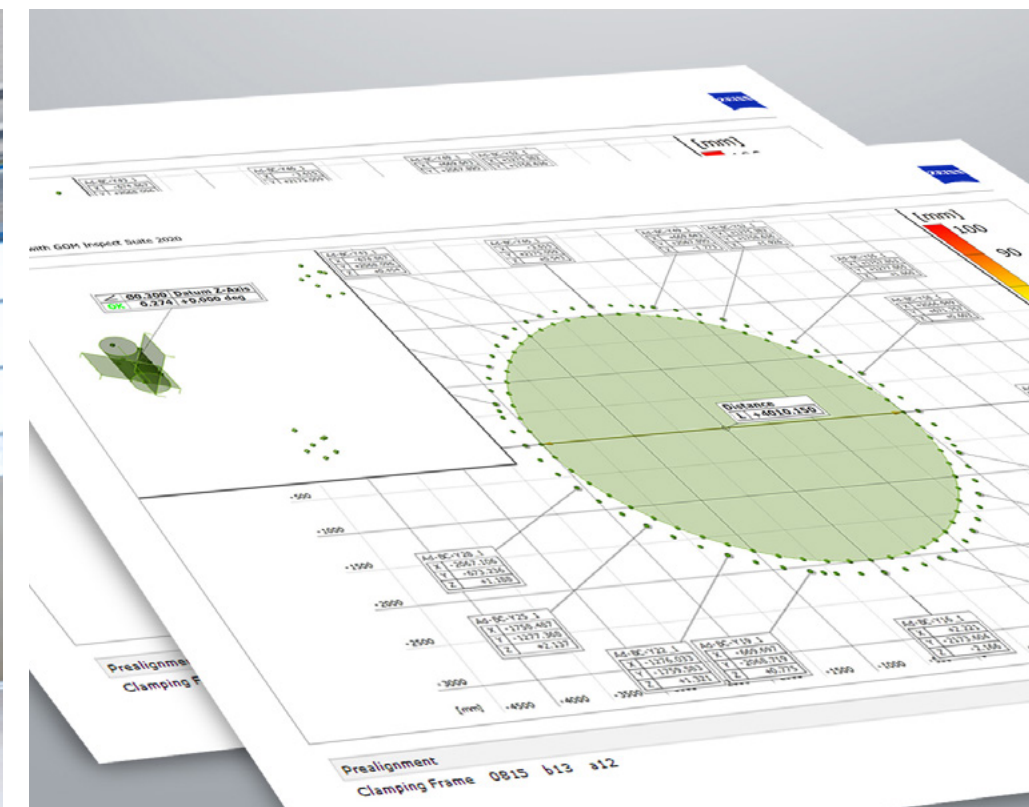
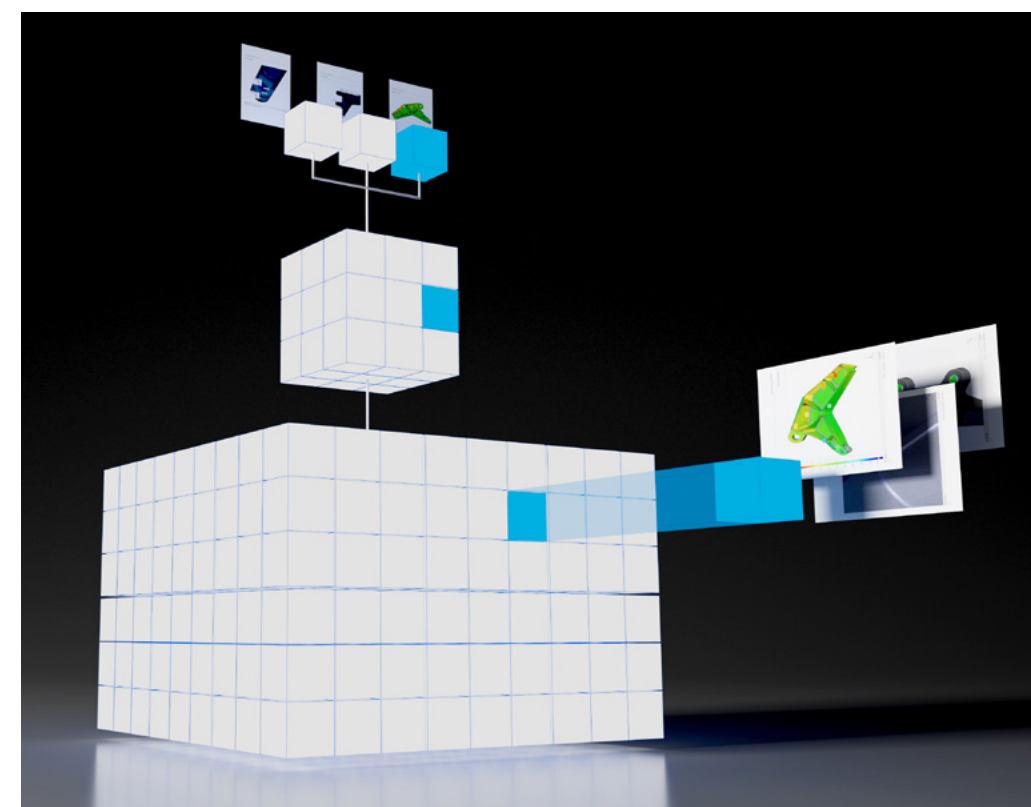
Especially when inspecting large objects, such as ships or wind turbines, TRITOP realizes the “measuring system comes to the measuring object” principle in best practice. The flexible system is at its best with parts of any size and almost any material.



### Process reliability

Parametric inspection

The software allows for traceability of the computation of the inspection results. The passive parametric concept reveals the dependencies between the various elements. Whenever evaluation steps are adjusted, the affected elements are updated automatically.



### Indoor to offshore

Independent of ambient conditions

With TRITOP, objects and parts can be measured and analyzed even under harsh ambient conditions: directly on the shop floor, in a climate chamber or offshore. The system provides precise measuring results, even with challenging lighting conditions.

### Effective tool for analysis

Powerful software

All features for inspection and analysis of ZEISS INSPECT are fully available for TRITOP as well. This analysis tool enables the visualization of measuring results, various analyses and includes comprehensive reporting functions.

### Minimum training effort

Courses for all levels of expertise

In various courses, users learn how to easily handle the TRITOP photogrammetry system. Training centers offer local in-person trainings, Live Online Training sessions and time-flexible eLearning courses for all levels of expertise.

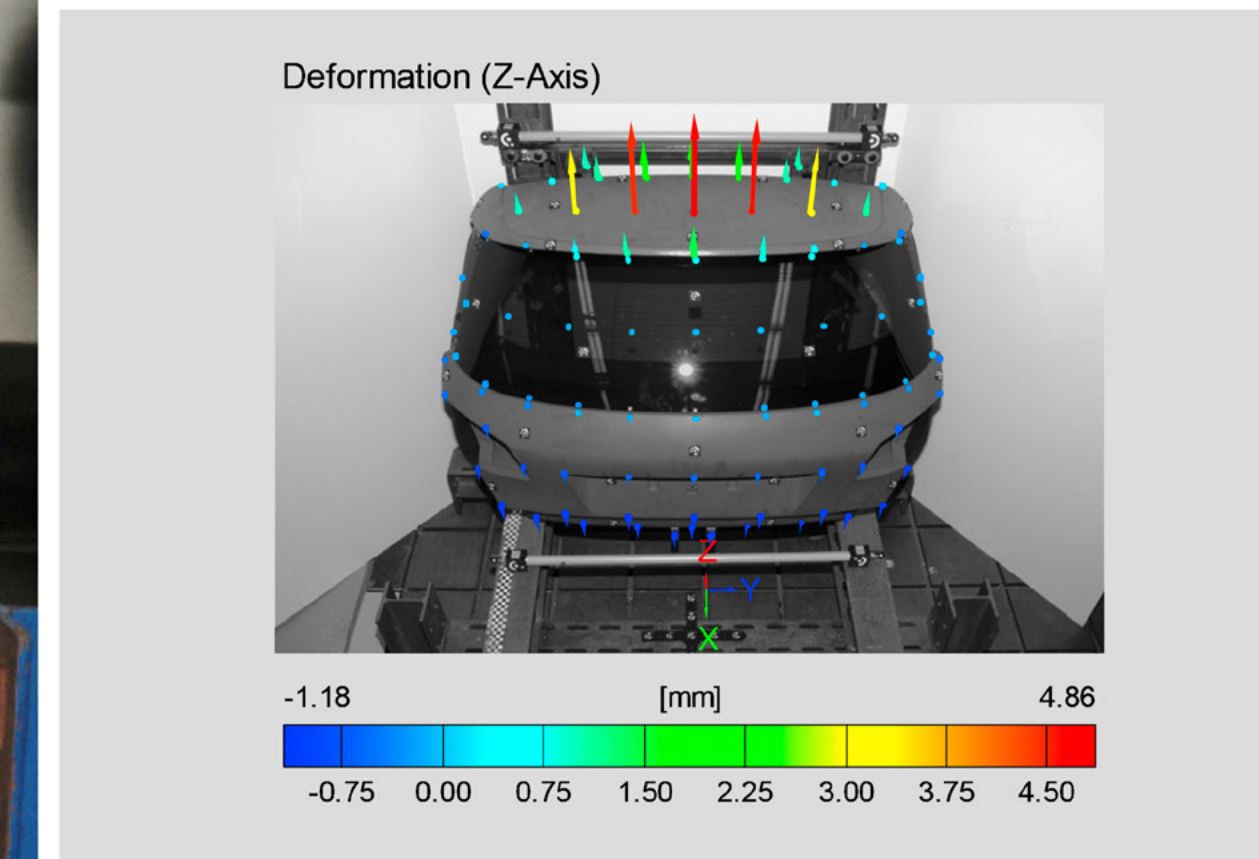
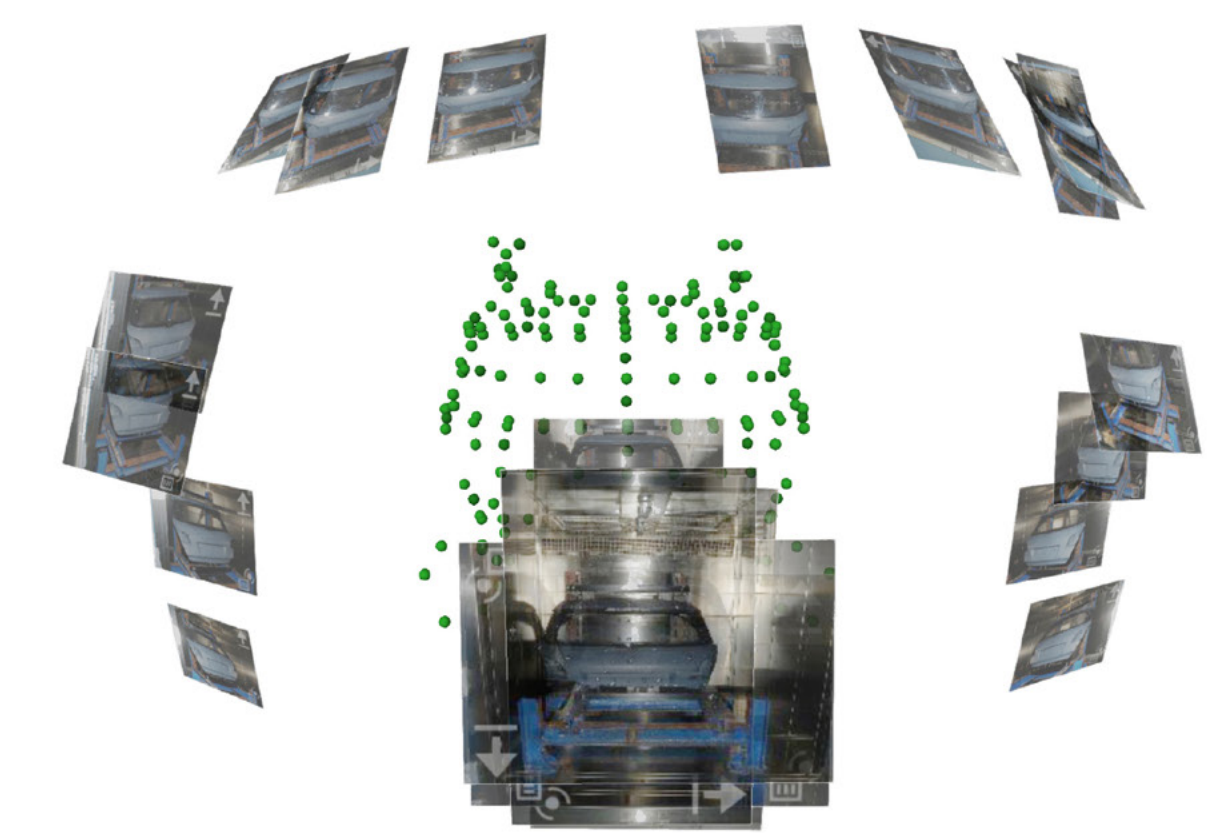
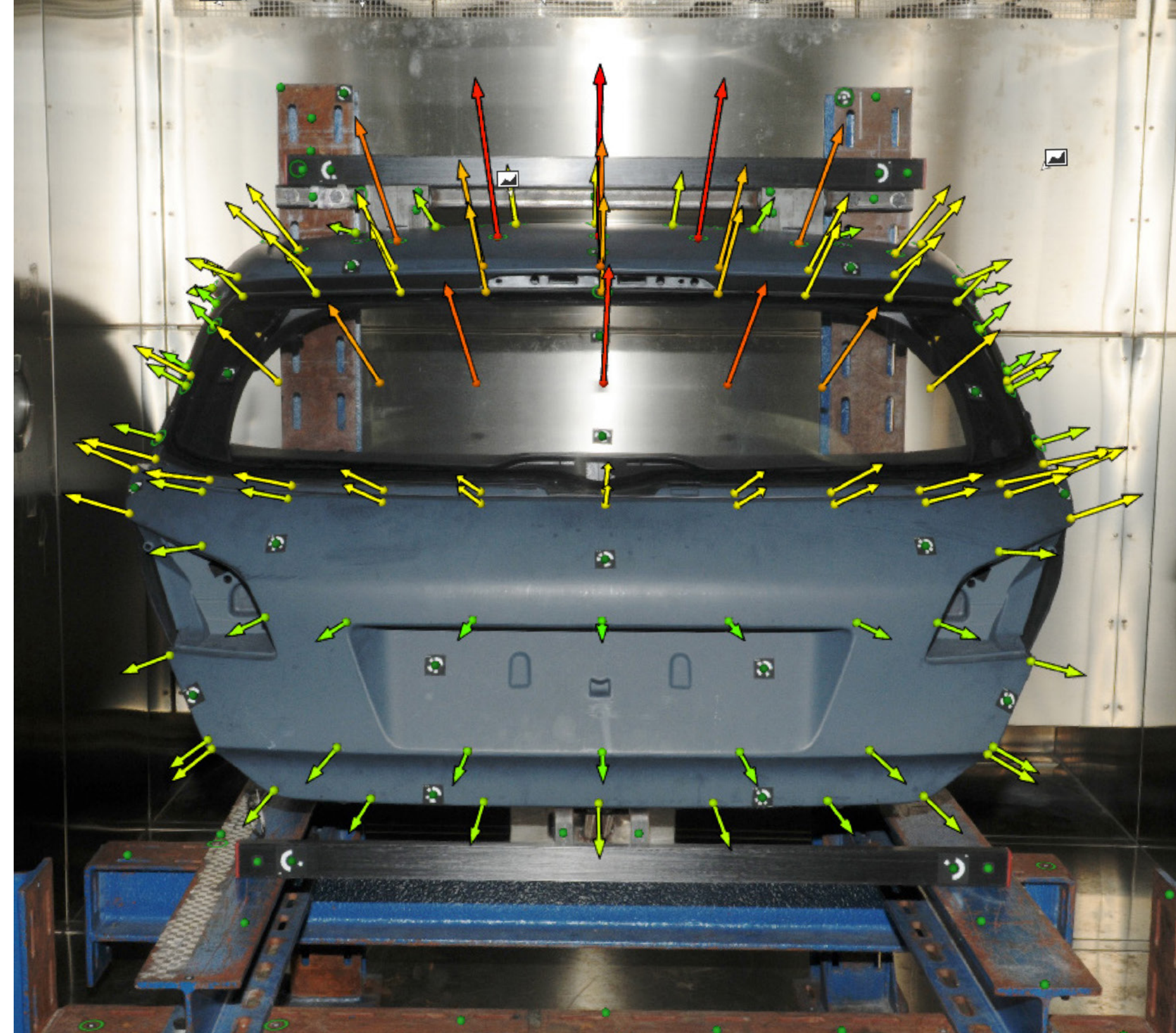
# At Any Location

## Overcoming challenges quickly

TRITOP is particularly suited for measuring very large objects and does an excellent job in the acquisition of coordinates for a wide range of inspection dimensions and object characteristics.

TRITOP masters measuring tasks in quality control and inspection as well as in modern development and manufacturing processes in a short time.

The measuring results also enable product monitoring during development, comparison with CAD data and verification of specifications from drawings, files or tables.



- 1
- 2
- 3
- 4

### 3D testing

## Inspection of precision plastics

TRITOP supports SABIC in the development of innovative plastics for components of various industries. A typical application is the design of a metal-free trunk lid. To inspect the quality of this new plastic trunk lid, prototypes were subjected to torsional stress and thermal conditions.

These tests cannot be carried out with conventional coordinate measuring machines and high-temperature displacement sensors are too time-consuming and inaccurate for SABIC compared to photogrammetry.



# Unbeatable Teams

## Reference coordinates for overarching accuracy

For the precise inspection of very large and often complex parts, TRITOP captures reference point clouds in a first step. ATOS, ARAMIS and T-SCAN hawk 2 use these reference points to automatically transform the individual measurements and achieve the overarching accuracy of the photogrammetric measurement over the entire measuring area.

### TRITOP + ATOS



In almost all industries, ATOS sensors have established as optical 3D measuring systems. The sensors are reliable and versatile and therefore ideally suited for measuring and inspecting complex objects.

If the measured objects are larger than the measuring area of the ATOS sensor or if a single measurement is not sufficient for complex parts, the user links the partial measurements via reference points that are captured by TRITOP. Combining ATOS and TRITOP guarantees high accuracy for large and complex objects.

### TRITOP + T-SCAN hawk 2



T-SCAN hawk 2 was developed to always be where it is needed. The lightweight, portable laser scanner is used in numerous applications and industries. A reliable tool for capturing data with metrological precision.

When measuring large objects, TRITOP provides the reference coordinates. This allows the T-SCAN hawk 2 system to orient itself in space and generate full-field data at key areas that are important for inspection and analysis.

### TRITOP + ARAMIS



ARAMIS sensors enable the dynamic acquisition of 3D coordinates, 3D displacements and 3D surface strain. Based on triangulation, the measuring systems scan precise 3D coordinates for full-field and point-based measurements.

For the seamless acquisition of deformations on large objects, several ARAMIS measuring systems are linked and synchronized with each other. The 3D coordinates are then transformed into a shared measuring project using a point cloud of reference coordinates supplied by TRITOP.

# Reach Your Objective in Just a Few Steps

Simple measuring procedure and evaluation

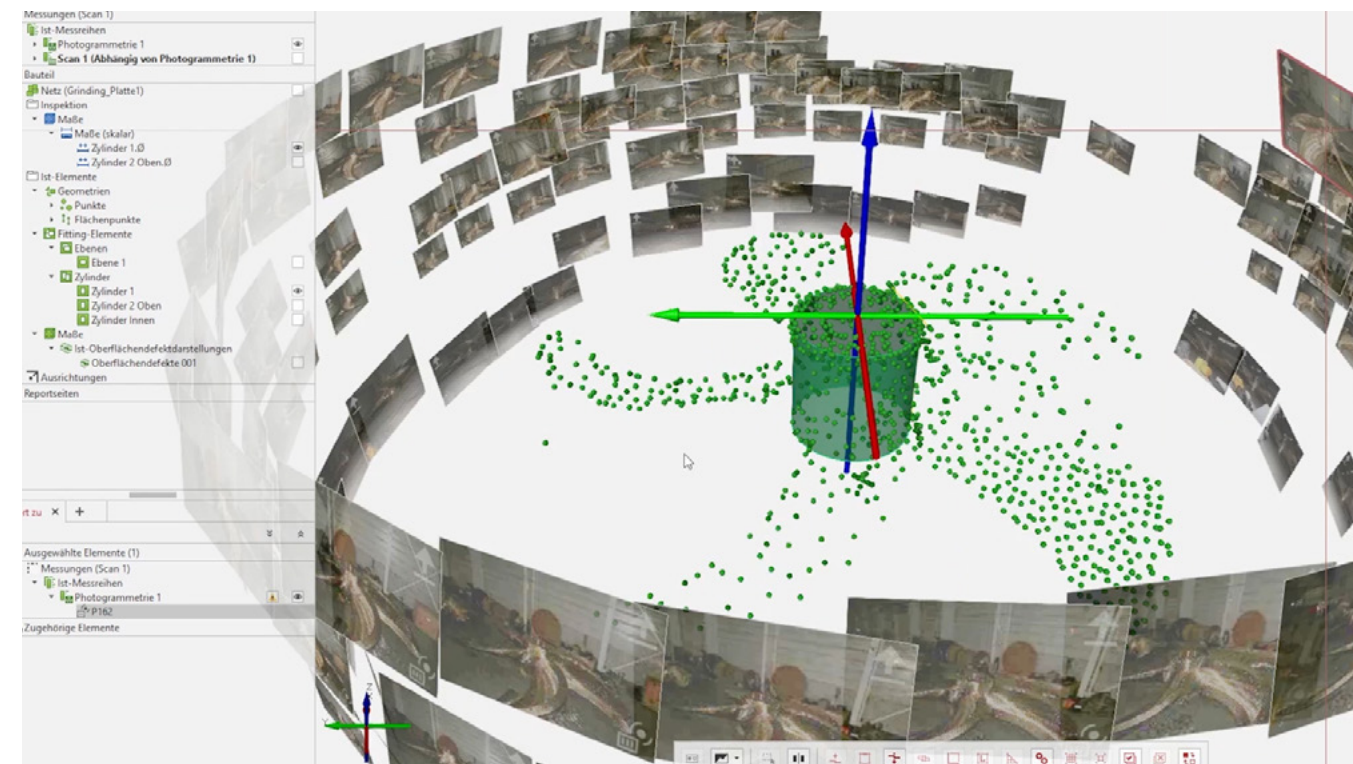
Regardless of whether the measuring task is in the field of 3D coordinate metrology or 3D testing: TRITOP facilitates the measuring procedure and evaluation. The software guides the user through the entire workflow in a process-reliable and user-friendly manner.

The computed 3D coordinates, displacements and deformations are graphically visualized and can be used, for example, for comparison with CAD data or for GD&T analysis.

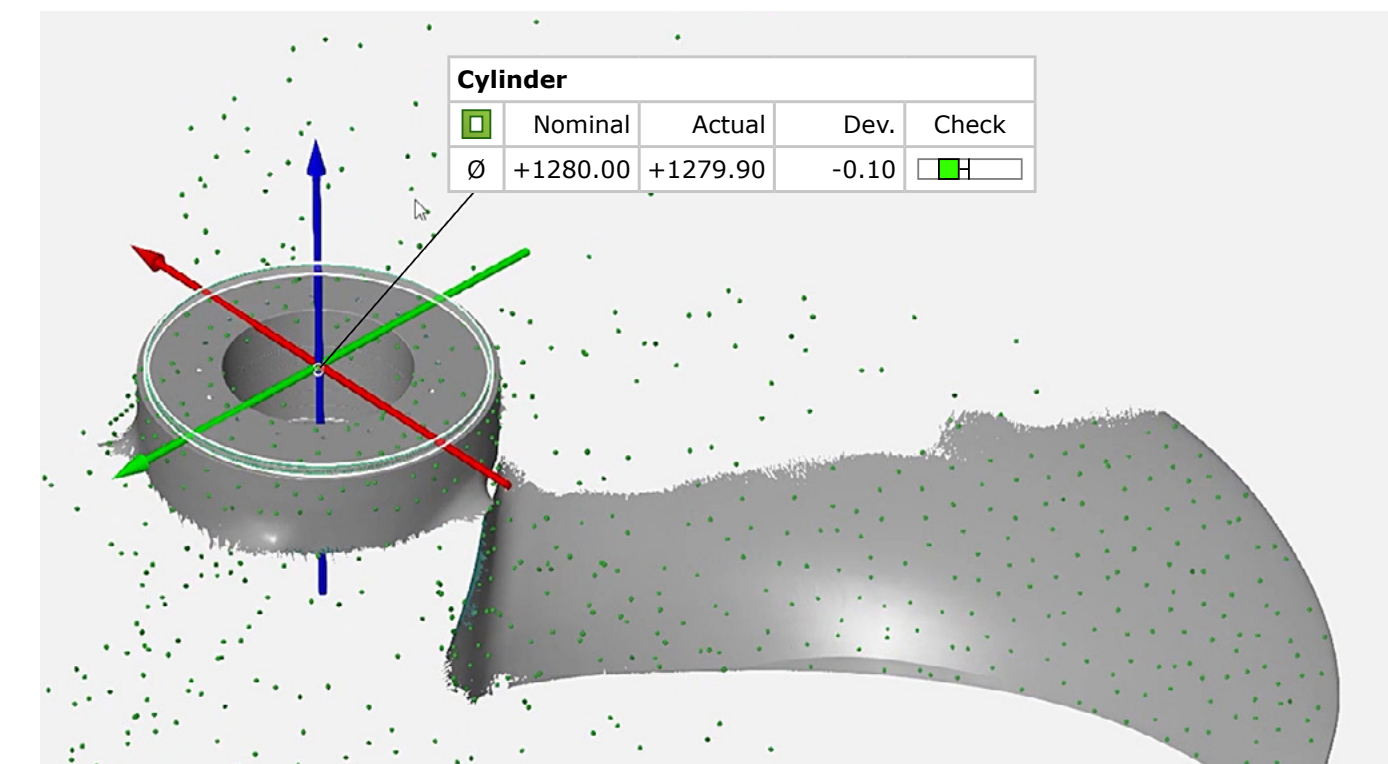
## Step 1 Mark and capture



## Step 2 Process and visualize



## Step 3 Evaluate and document

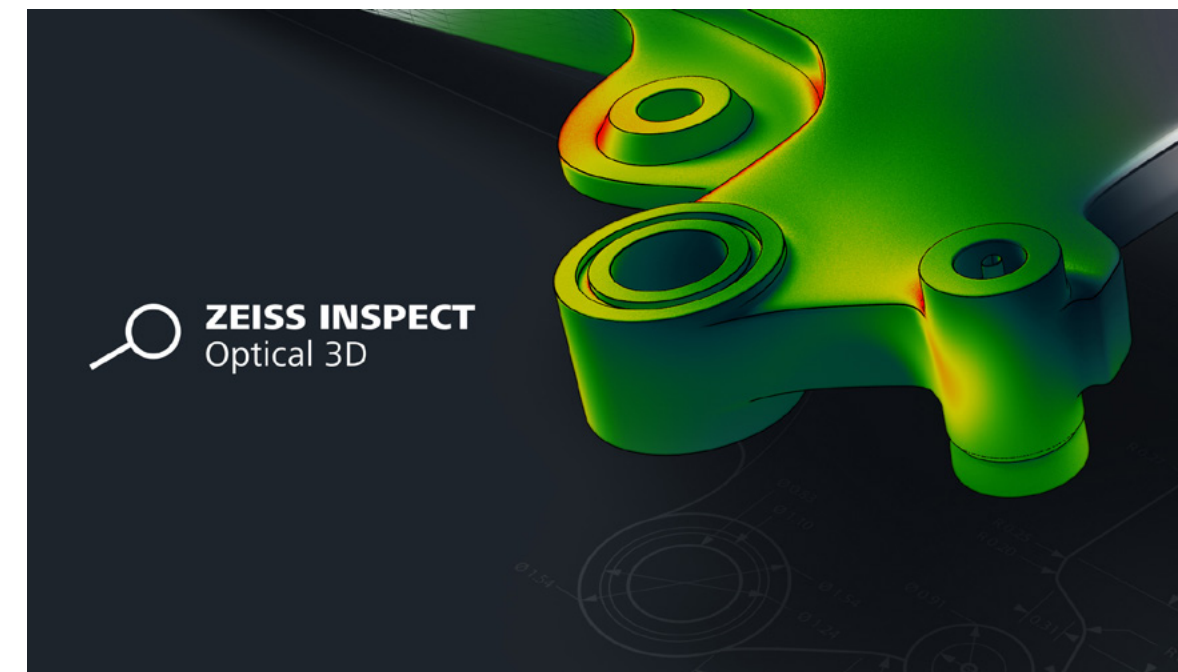


# ZEISS INSPECT

A software tailored to customer's needs

TRITOP comes with powerful software. It guides the user through the entire measurement and evaluation procedure in a process-reliable and user-friendly manner. The thorough support eliminates possible errors from image acquisition to evaluation, simplifies and accelerates the workflow and increases the data quality.

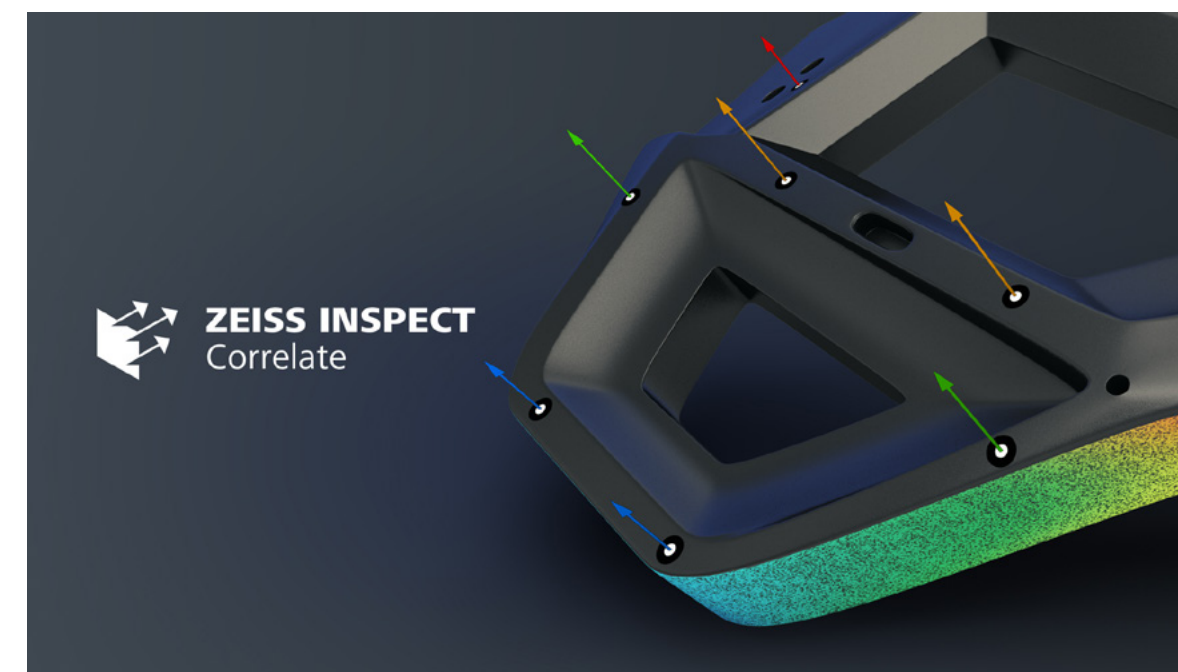
With ZEISS INSPECT, you can visualize the measuring results and benefit from a variety of options for analysis and reporting depending on the measuring task. This analysis tool offers intelligent solutions for reliable documentation. Additional third-party software is no longer needed.



## ZEISS INSPECT Optical 3D

For simple or complex inspection tasks

The stand-alone solution for 3D measurement technology is the industry standard for the entire inspection workflow. In addition to extensive GD&T analysis, it provides, e. g., options for nominal-actual comparisons and angle measurements.



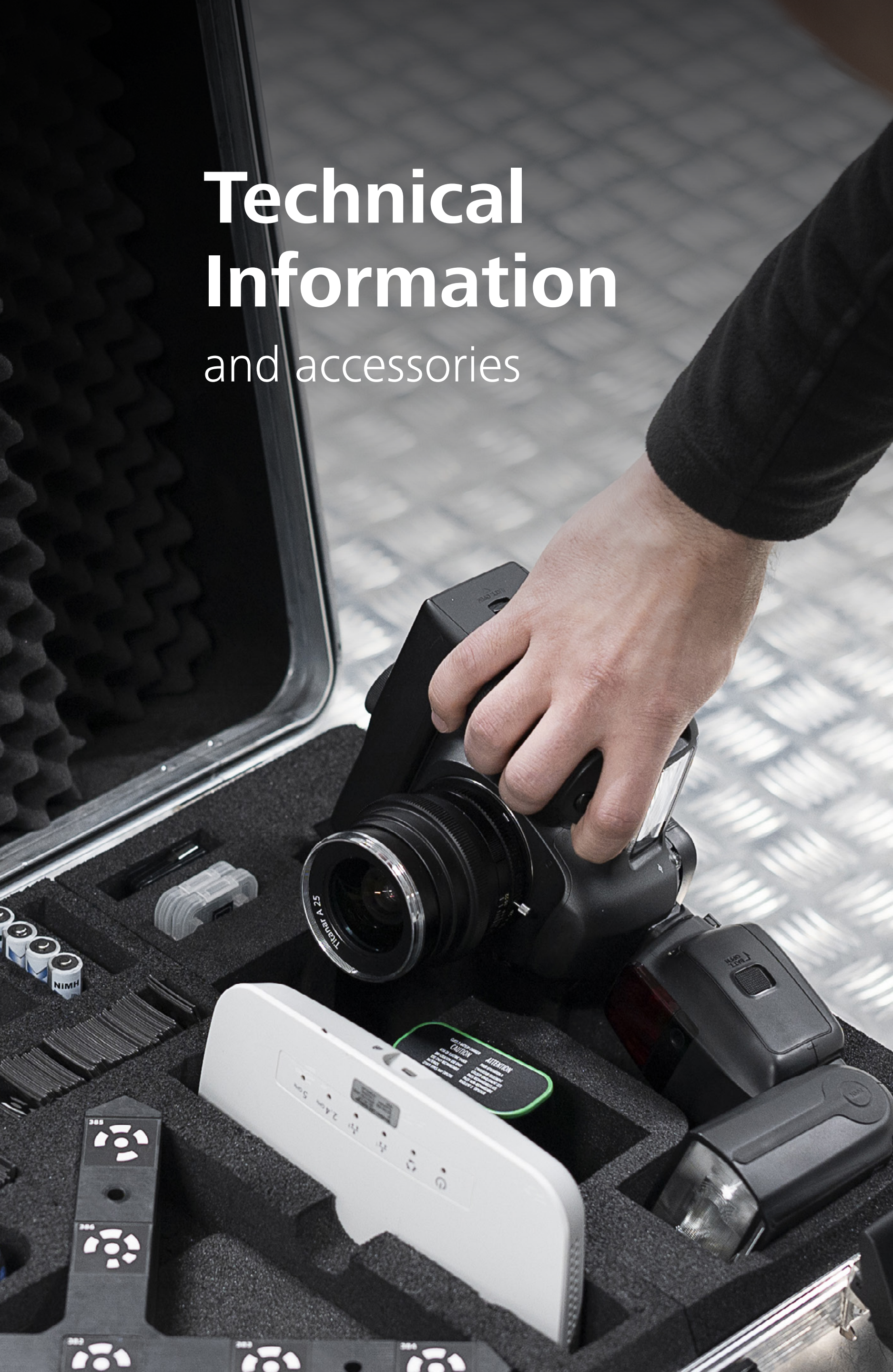
## ZEISS INSPECT Correlate

Everything in motion

ZEISS INSPECT Correlate is an inspection software for strains, 3D displacements, 3D deformations as well as velocities and accelerations, as tested in many production-related research and development tasks. The software evaluates 2D and 3D data based on digital image correlation.

# Technical Information

and accessories



Measuring System

**TRITOP DX System**

**TRITOP Full-Frame System**

Image sensor

Color CMOS

Color CMOS

Sensor dimensions

22.3 mm x 14.8 mm, (APS-C format)

36.0 mm x 24.0 mm (full-frame)

32.5 million pixels

32.5 million pixels

20.1 million pixels

Dimensions (camera housing)

Approx. 141 x 105 x 77 mm

Approx. 158 x 164 x 83 mm

Weight (camera housing)

Approx. 700 g

Approx. 1,250 g

Camera lens

Titanar 25

Titanar 25

Image transmission via WiFi

Not supported

WiFi transmitter included

Operating condition temperature

0 °C to +40 °C

0 °C to +40 °C

Operating condition humidity

Up to 85% (non-condensing)

Up to 85% (non-condensing)

Software

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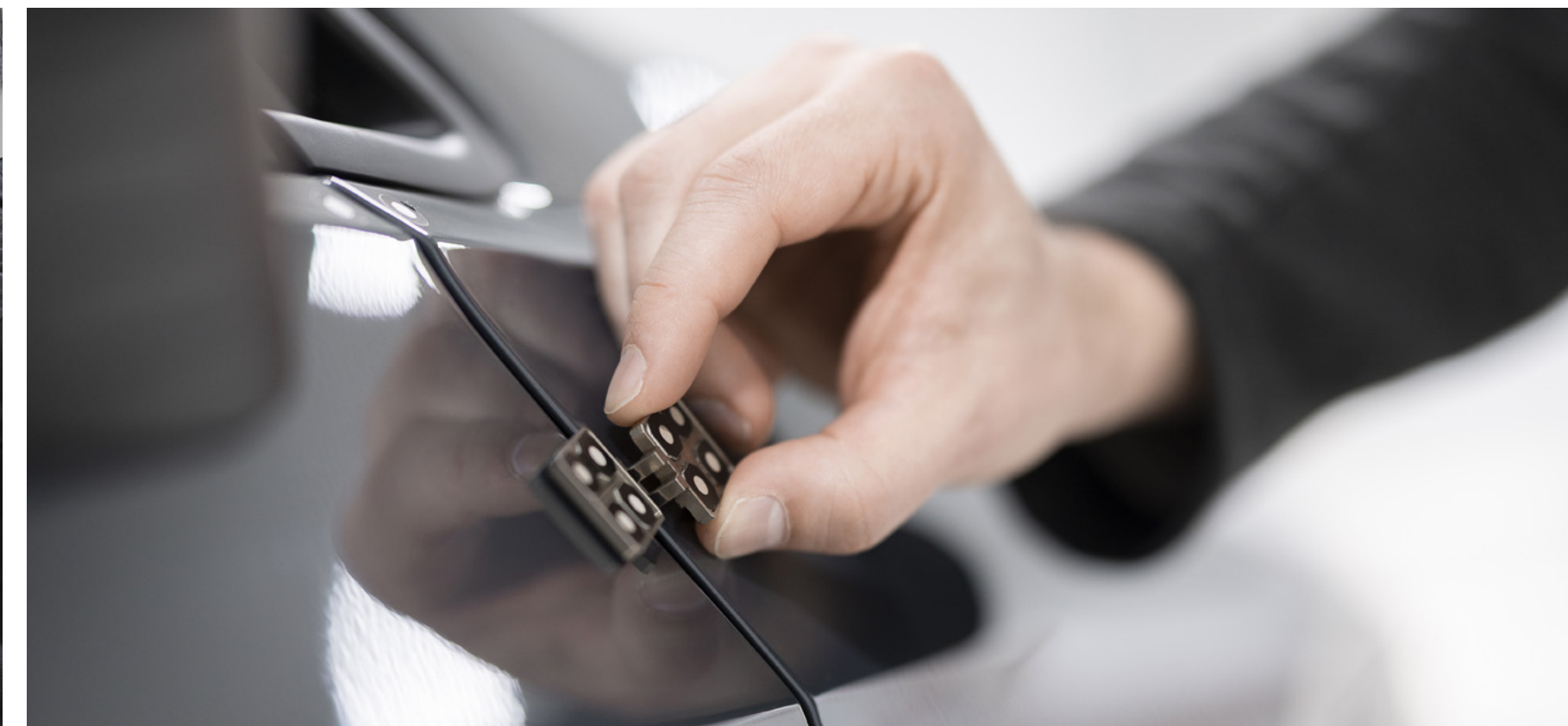
ZEISS INSPECT



## Marking material

Reliable detection of measuring points

For all common measuring tasks, TRITOP is supplied with a comprehensive set of coded and uncoded reference point markers. For particularly large and complex objects, additional reference point markers can be used to achieve a high level of accuracy.



## Adapters

Versatile functionalities

With the help of precisely measured adapters, TRITOP extends its functionality by the measurement of standard geometries. Individual adapters for threads, holes, edges and bolts help to automate alignments and reporting.

## Linear scale bars

Certified and robust

Each TRITOP system is supplied with two DAkkS-calibrated linear scale bars, which ensure the dimensional accuracy of the measured object coordinates. The linear scale bars are lightweight, robust and characterized by a small linear expansion coefficient.

## Telescopic rod

Easy to adjust to the object size

The compact TRITOP extension, which can be extended to a length of up to four meters, enables the optimum distribution of camera positions for large objects – making ladders or scaffolding redundant. The measuring camera, which is mounted on an adapter plate, also captures very high, hard-to-reach areas using a remote release.

## ZEISS Industrial Quality Solutions

ZEISS Industrial Quality Solutions is a leading manufacturer of multidimensional metrology solutions. These include coordinate measuring machines, optical and multi-sensor systems, microscopy systems for industrial quality assurance as well as metrology software for the automotive, aircraft, mechanical engineering, plastics and medical technology industries.

Innovative technologies such as 3D X-ray metrology for quality assurance complete the portfolio.

In addition, ZEISS Industrial Quality Solutions offers a broad global spectrum of customer services with ZEISS Quality Excellence Centers close to its customers.



# Your Holistic Technology Partner

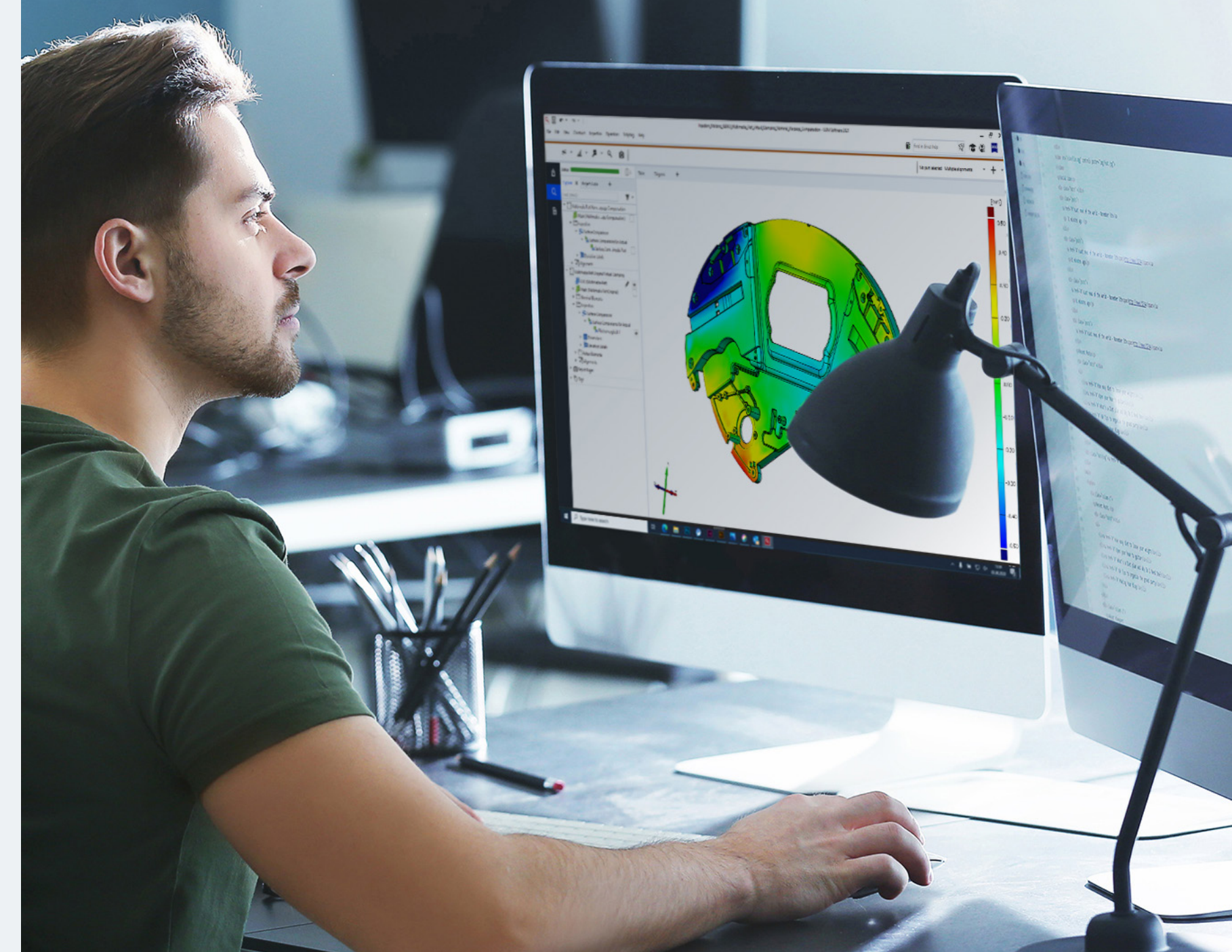
Numerous services and training courses support you in your daily work with 3D measuring technology. Training courses and webinars help you to extend your knowledge about using the software and get to know more application fields for the measuring systems.

The ZEISS Quality Suite supports you with instructions, tutorials and frequently asked questions and answers. Moreover, the user forum offers a platform for mutual exchange and support.

At conferences and application-based workshops, webinars and digital demos, ZEISS directly shares process and measurement technology know-how. In addition, contractual support and services for all measuring solutions are available.

## Training

ZEISS training centers offer training and eLearning courses for all levels of expertise. The training courses follow an internationally standardized concept and are implemented by our certified partners in the corresponding national language. In addition to online training courses and scheduled courses in our training centers, customer-specific on-site training courses are also available on request.



## Support and Service

ZEISS provides support and services to assist you quickly and reliably if required. These are based on the following three pillars: Remote Assistance, Services and ZEISS Metrology Care.



# Did TRITOP Get Your Attention?

Contact us for a free demonstration –  
on site or online.

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