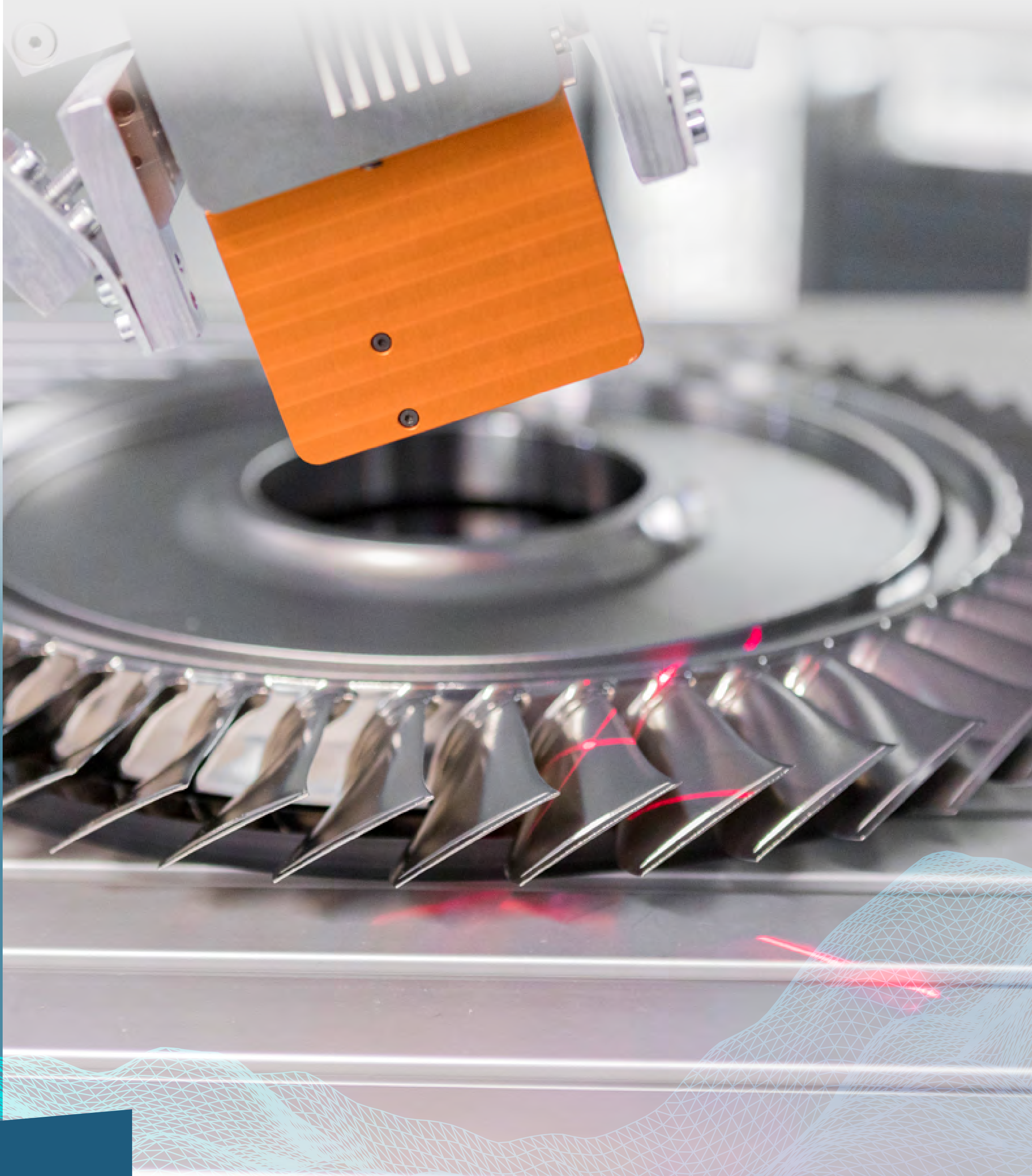
High Precision Surface Inspection

Product line HP-X



3D aero

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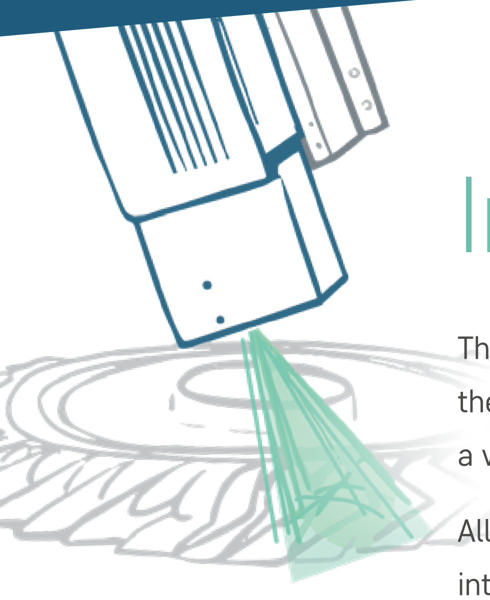


Introduction

The combination of high accuracy white light interferometry with the **3D.OS** image and data processing framework of **3D.aero** offers a wide range of solutions for the field of surface inspection.

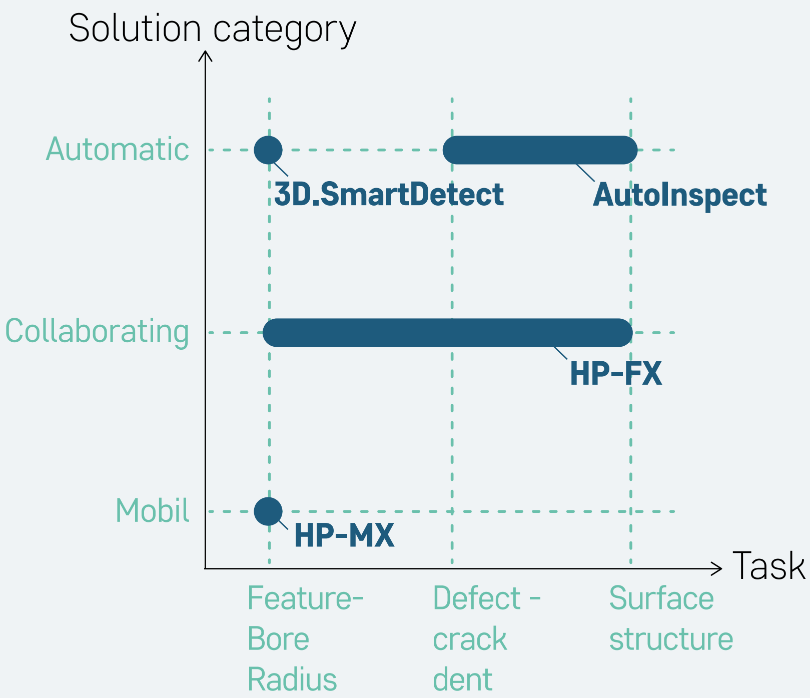
All products within the HP-X product line are based on white light interferometry and combine different usage concepts with the high accuracy measurement technology to solve a wide range of measurement tasks. The solutions are optical systems for precise dimensional measurements, detection of component features and 3D digitizing of various surfaces or anomalies - such as nicks, dents, scratches, chipping, pitting or corrosion - in µm resolution.

Due to the different usage concepts of the systems, special requirements can be combined within the solution categories in order to solve all emerging measurement tasks reliably and precisely.

For example, the performance of repetitive measurement tasks, mobile or hand-held examinations, as well as fully automated overall component examinations can be enabled, which significantly increases the reproducibility of results and quality efficiency.

Advantages of the Application

In addition to component features, white-light interferometry can also be used to digitize defects and surface structures in the sub-micrometer range. The robustness of the technology allows data to be recorded even on surfaces that are classically challenging for optical metrology. Neither the recording angle, nor reflection, nor contamination have a relevant negative influence on the data quality.
To extend the working range, the sensor can also be supplemented by an actuator system. This can range from a simple linear axis to an industrial robot. In this way, the degree of automation of the system is also flexible and can be customized.



By means of the **3D.OS**, different operations can be carried out in this highly accurate data.
These are for example:

- Preprocessing and preparation of data
- Registration of single images to a complete model
- Preparation, filtering and reduction of the model data
- Classification and interpretation of the data
- Visualization of the data
- Interaction with collaborators
- Forwarding of data to other machines or MES systems
- Summary of results in individually designed reports

Application spectrum

The range of functions of the 3D.OS results in a variation of different applications for a WLI sensor. In addition to the measurement of component features and surface defects, surface structures can also be recorded and analyzed.

Measurement of component features

With the functionality of the **3D.OS**, component features can be measured highly accurately in three dimensions in the data of the WLI sensor and its position can be determined. Angles, corners, edges, holes, radii are some examples of possible features. If the setup is supplemented by an external sensor system, absolute dimensional measurements can also be performed.

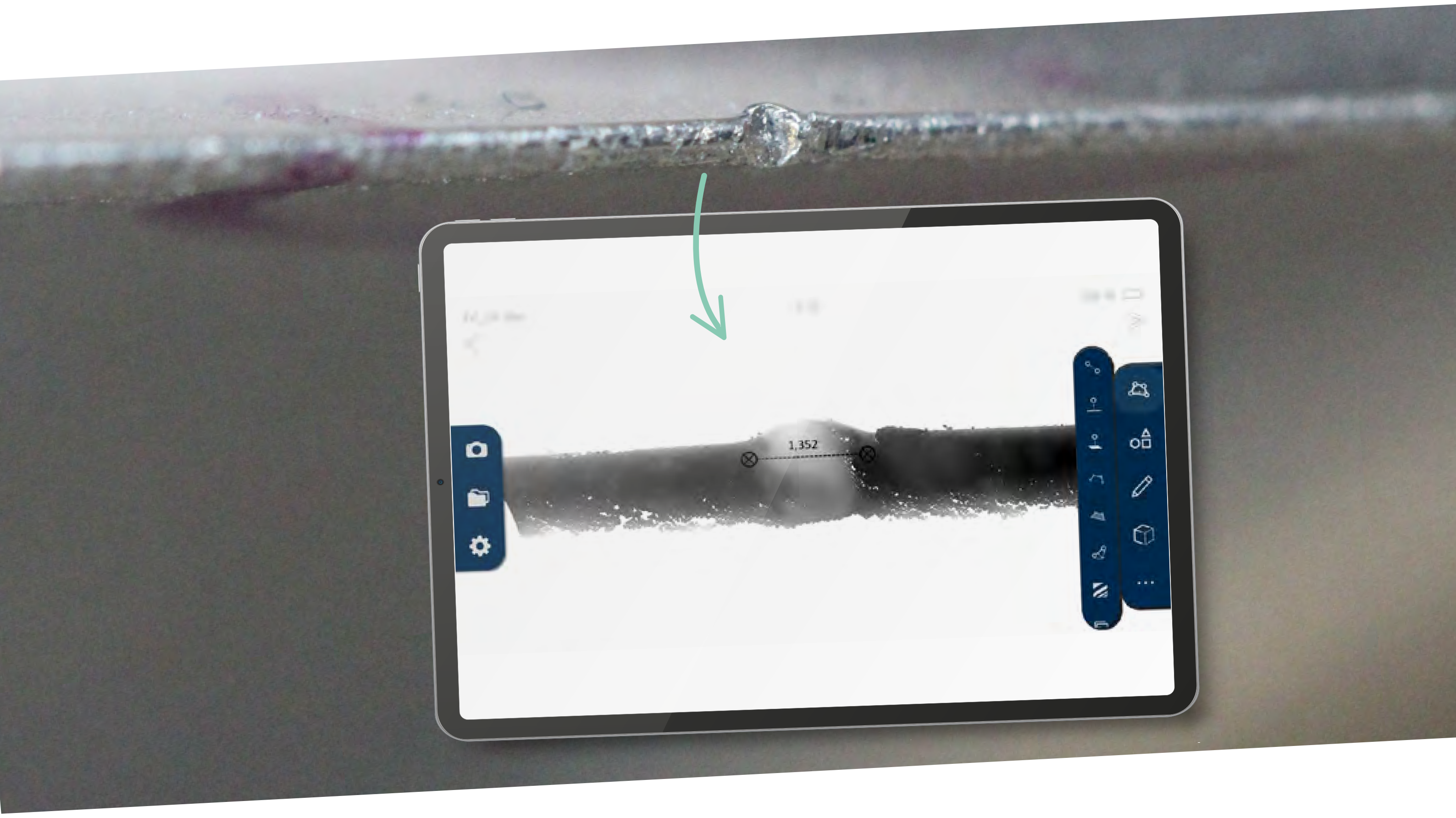
Example: Result images - measuring the drill bit

3D visualisation result

Measurement results in software

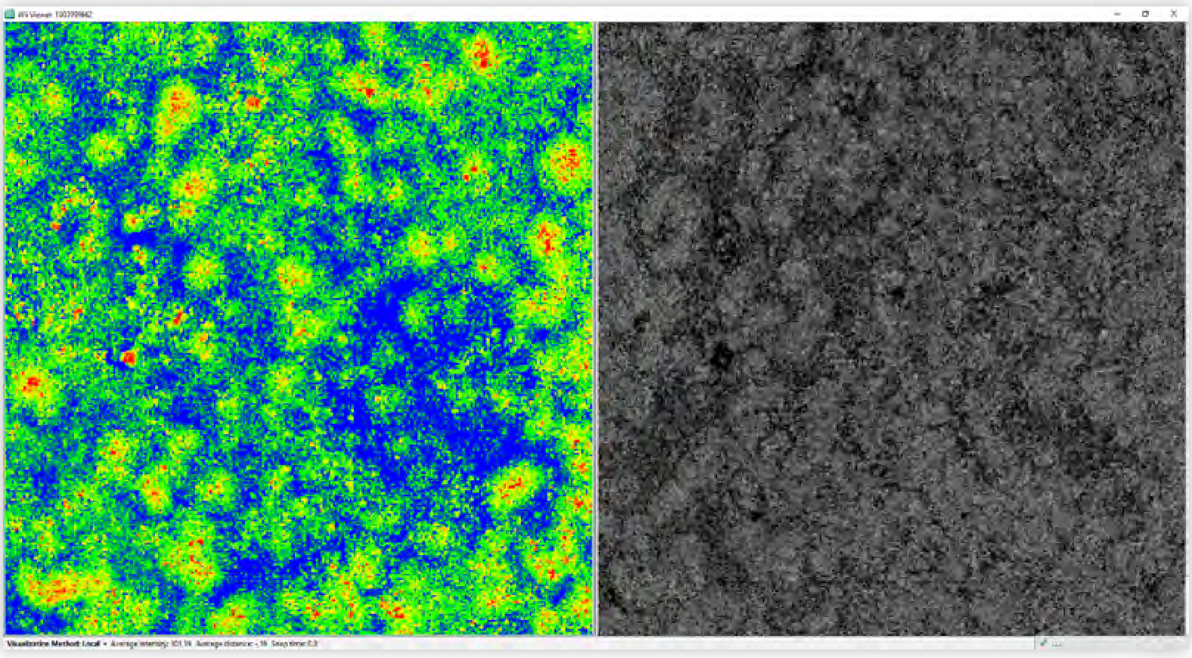
Measurement of surface defects

Today, the precise measurement of surface defects is mainly carried out in measuring laboratories. This is time-consuming and generates waiting times in different stations. With the WLI, these measurements can be carried out under production conditions in the workshop. Due to the high resolution of the measurement technology, even damage such as dents, scratches and cracks can be measured that have dimensions in the hundredth of a millimeter range.



Measurement of surface structures

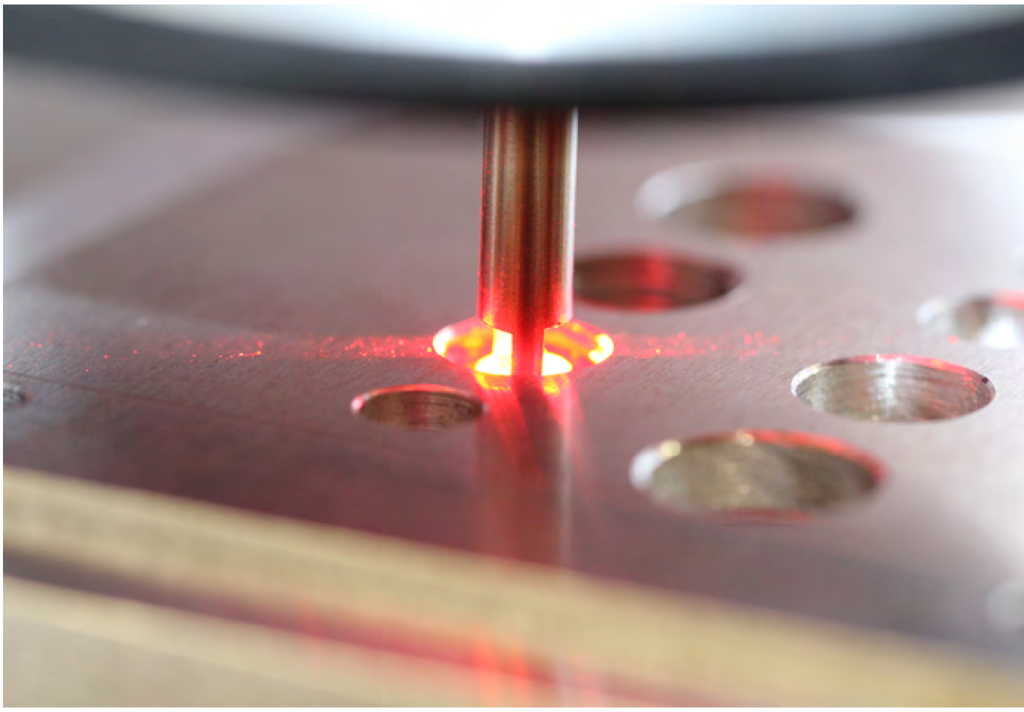
The measurement of fine surface structures requires a high-resolution measuring method. The expression of surface roughness or impact domes in coverage testing can be in the low micrometer range. Only a few methods are suitable for the task of digitizing these structures. Of these methods, in turn, only a fraction are suitable for in-line use on the shop floor. White-light interferometry meets all these requirements and generates surface data on any surface in less than a second. Even high-precision data acquisition in boreholes is possible with a **3D.aero** measuring device based on white light interferometry.



Solution categories

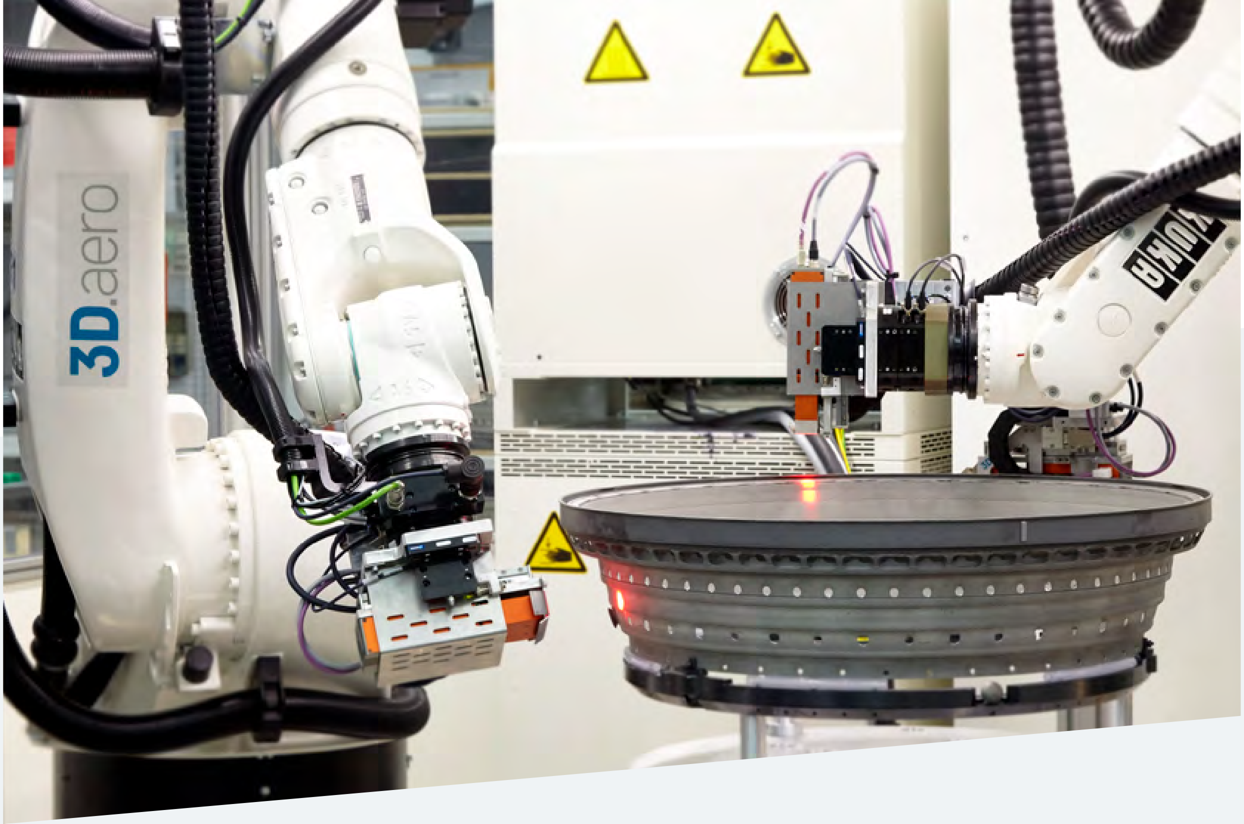
Special kinematics in the stage design

If the linear axis of the WLI sensor, which is necessary for the operating principle, is supplemented by further axes, its measuring range increases considerably. If high-precision axes are selected and a suitable calibration is implemented, the advantages of white-light interferometry can be utilized in a comparably large working space. Such setups are particularly suitable for the high-precision inspection of small workpieces.



Collaborative design

The combination of collaborating robot and WLI sensor with the **3D.OS** results in a flexible, highly accurate measuring device for semi-automatic use in the workshop. In addition to the possibility of guiding the robot manually to a feature or defect, the robot can also automatically travel stored measurement paths and thus automate an inspection. In addition, the robot can support the user in the ideal positioning of the measuring device.



Fully automated design

In fully automatic mode, the technology, based on measuring paths from offline path planning, offers the possibility of performing highly accurate inspection processes 24 hours a day. If the workpiece is also automatically loaded into the machine, the operator only has to start the process and readjust it if errors occur.

Mobile devices

In order to be able to produce highly precise individual images with a WLI on large components, there is also the possibility of using a portable device. Here, a WLI sensor is embedded in a kinematic system that enables its flexible and stable positioning on a surface.

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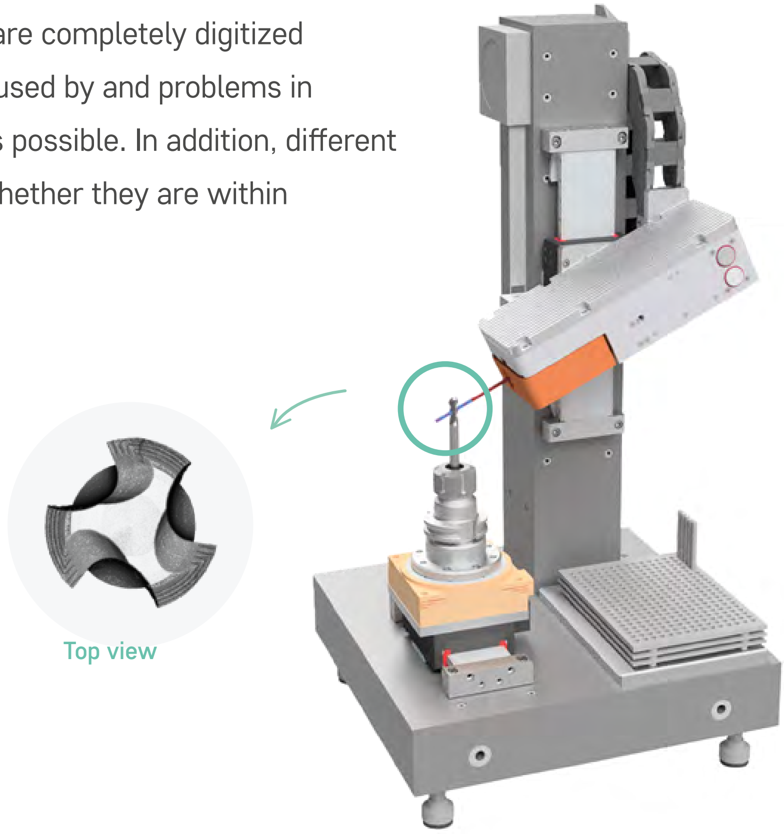
Application examples

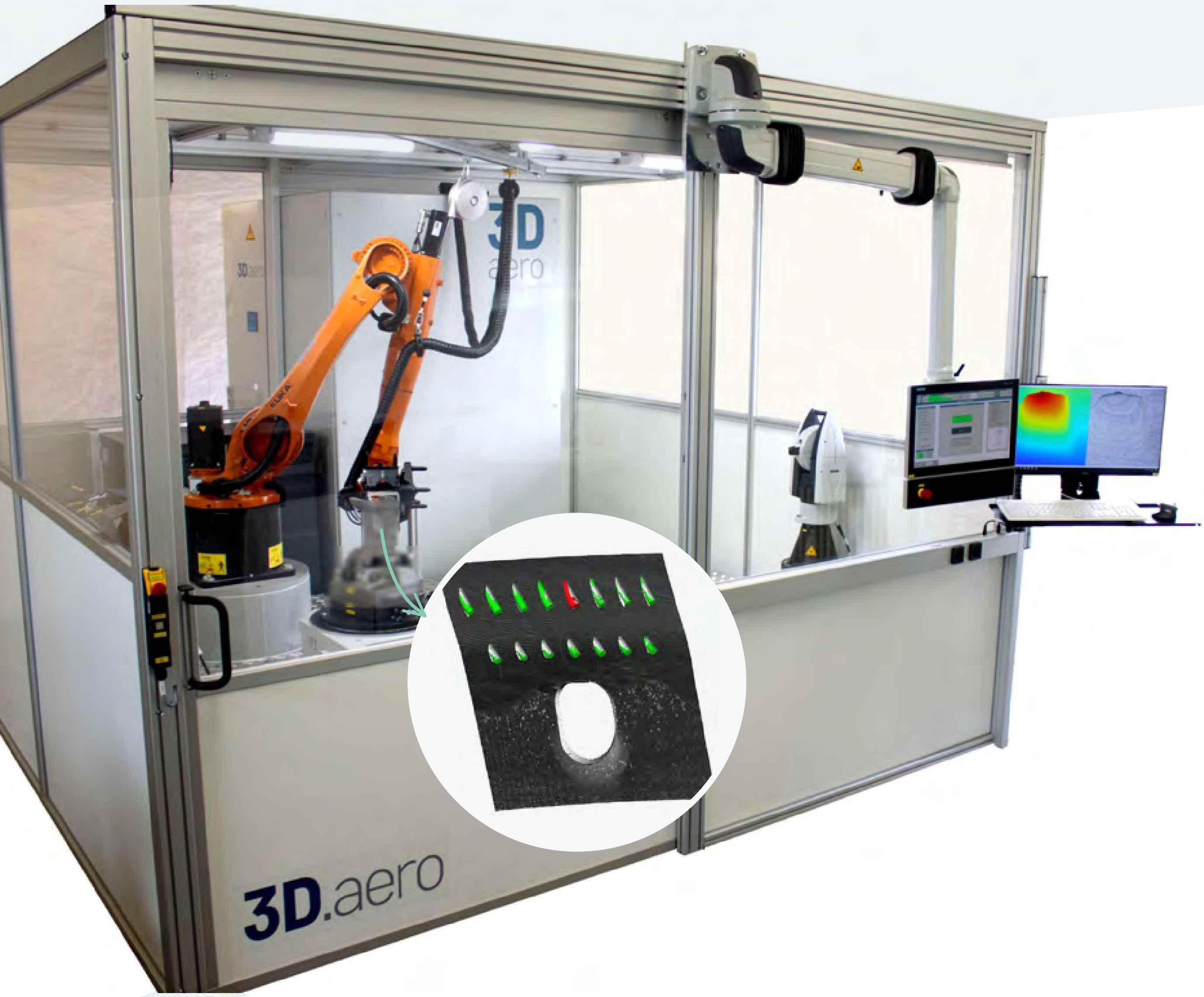
ToolInspect

Tool measurement is a feature and defect measurement in the table setup. In this example, against the background of quality assurance, surfaces of different machining tools are completely digitized in order to detect possible damage caused by and problems in the manufacturing process as early as possible. In addition, different tool parameters are checked to see whether they are within a specified limit.



SmartDetect

SmartDetect is a feature measurement with additional external sensor technology in a fully automated setup. Here, a white light interferometer on an industrial robot is used to measure the position and alignment of cooling air bores and simultaneously detect whether bores are closed. Using a laser tracker, the position of the WLI sensor can be reliably determined with a high degree of accuracy throughout the entire working range of the robot. Thus, the WLI recordings can also be determined with high accuracy in relation to each other.



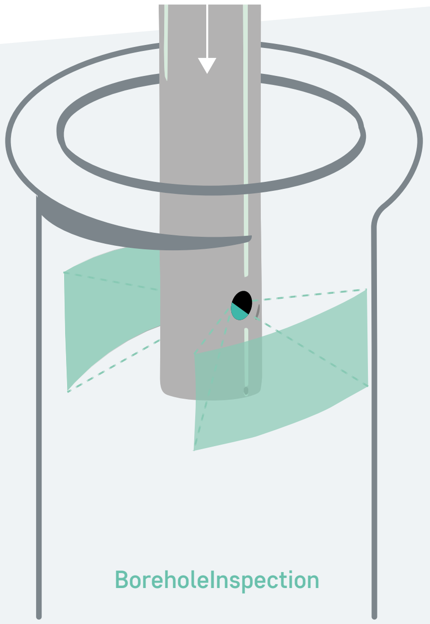
Coveragecheck

CoverageCheck is a measurement of surface structures in a collaborative setup. The WLI sensor is guided by an operator to different areas of the component to be inspected in order to validate the degree of coverage after surface hardening by shot peening. Measurement paths that are stored by an operator can also be subsequently traversed autonomously by the robot.

DefectMeasurement

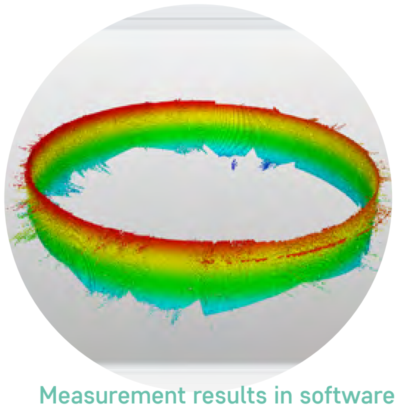
DefectMeasurement is a measurement system for handheld or repeatable measurement of defects and anomalies on the component surface. The application is also based on a collaborative design, enabling easy operation even on complex components. Defects are digitized and diagnosed with high accuracy, thus supporting and optimizing the inspection process.

BoreholeInspection



BoreholeInspection is a unique system for highly accurate measurement of borehole walls and subsequent dimensional inspection. In the drilling process, our system helps to detect damage to the drill bit or material at an early stage, thus optimizing process quality and safety. With the help of a prism, the measuring field of the white light interferometer is split and directed onto the wall of the borehole.

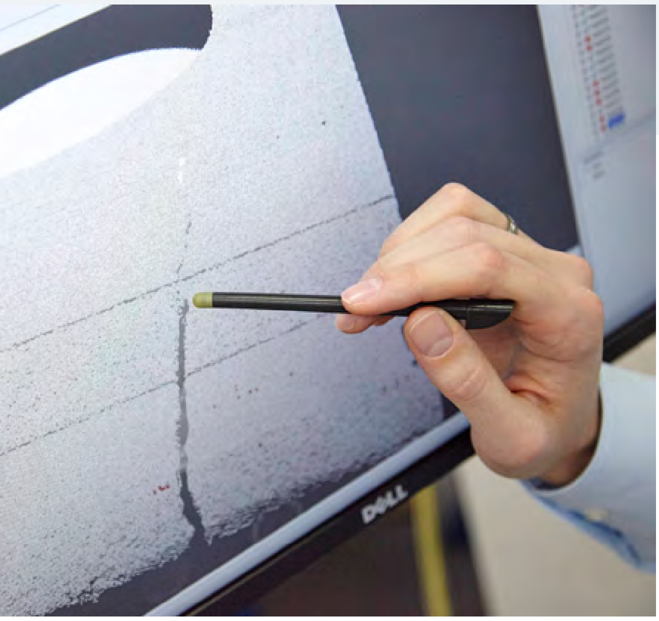
3D visualisation result

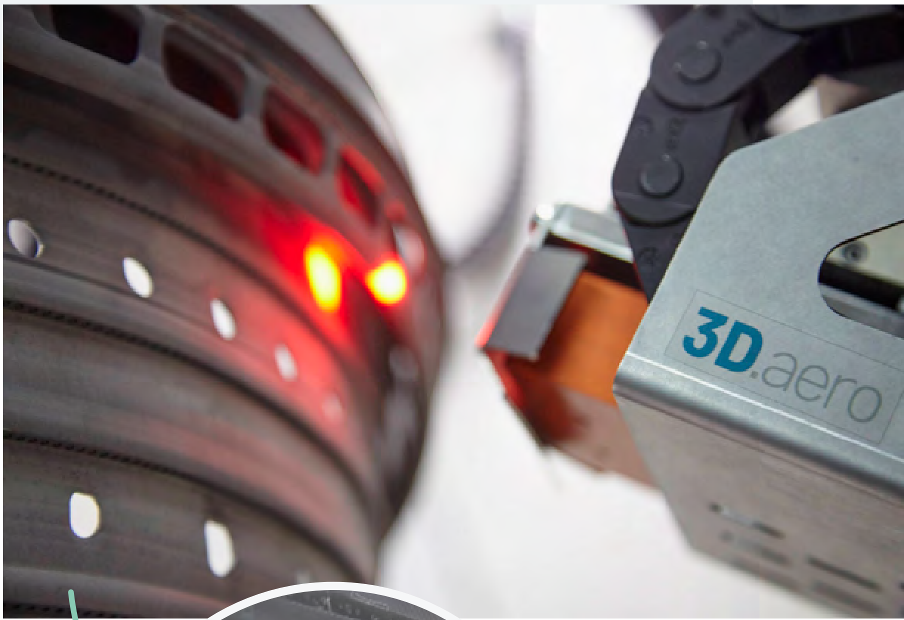


Measurement results in software

AutoInspect

AutoInspect is a fully automated robot-based system for crack detection in combustion chamber components. Approximately 75,000 images from two measuring devices are combined to form an overall model before anomalies are detected in this model and cracks are classified using artificial intelligence. For reasons of efficiency, the extensive data evaluation already takes place during data acquisition. The system also calibrates and validates itself fully automatically.





Why should you choose 3D.aero?

YOUR CUSTOMER BENEFIT:

- High productivity through intelligent and innovative automation solutions
- Comprehensive software framework **3D.OS** that has been proven for many years in the aerospace and automotive industries: sensor integration, image processing, artificial intelligence, visualization, soft PLC, comprehensive communication interfaces, logging and audit trail, user management, remote control, user-friendly HMI
- High ergonomics through sensible arrangement of operating elements and ergonomic design of the workspace
- Avoidance of operating errors and cleaning effort by adhering to the poka yoke philosophy
- Maintenance- and TPM-friendly design
- Use of well-known, reliable and durable components
- Satisfied operators through influence in the design process, unbureaucratic support in daily operation as well as premium documentation

As a long-standing partner of the aerospace industry and the associated expertise in the field of large component measurement, we know your challenges and quality requirements.

You have another application in mind? Then challenge us and benefit from our know-how in the field of measurement technology and quality assurance.

Kontakt

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