



# INSPECTION WITH WHITE LIGHT INTERFEROMETRY



# Automated Inspection Systems with 3D.aero

- 3D.aero is a tech company that develops advanced automation solutions for manufacturers and maintenance providers in the aviation industry. While our expertise lies within the aviation sector, our solutions are also suitable for any other high-maintenance industry. In the development of a new solution, we systematically support customers from the early ideation over feasibility studies up to the delivery of a turnkey solution. This provides a reliable and flexible development process in close teamwork. Our previous projects show, that our systems provide around 30-60 % productivity improvement while delivering 100% reliability and reproducibility.
- For our systems we merge optical sensors, robotics and data analytics to enable a range of functions that are needed for inspection purposes. Whether it being detailed 3D measurements of workpieces or optical detection of damages, 3D.aero delivers high accuracy and reliability. Therefore, stationary inspections, as well as mobile solutions are within our expertise.
- We aim to improve productivity, efficiency and reliability in the field of quality assurance with our tailor-made solutions for any customer.

Sharing this report outside of LinkedIn would be well appreciated and wouldn't require any special allowances.

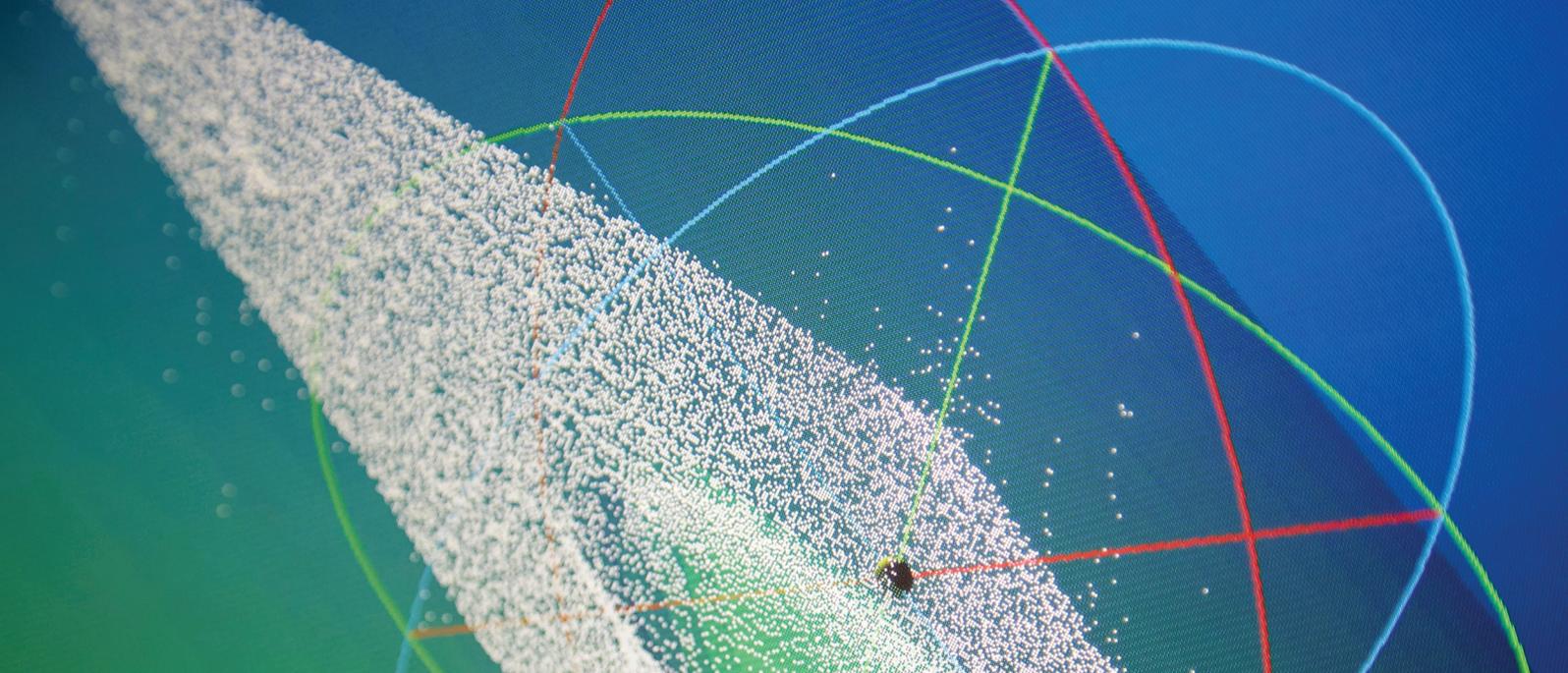


## IS YOUR INSPECTION PROCESS LACKING PRODUCTIVITY AND EFFICIENCY?

When time, reliability and digitization could be upgraded for a process in your company, our White-Light Interferometry (WLI) systems might be the solution for this problem.

With our **WLI systems**, we can precisely measure workpiece surfaces in  $\mu\text{m}$ -resolution, while improving inspection process times and digitizing operations. Our products can **help to make your inspection processes more efficient by automating and speeding them up**. We have the expertise to integrate our automated solutions into existing systems to improve the overall process.

On the following pages, we show you some of our product examples.



## COOLING HOLE INSPECTION

The Cooling Hole Inspection system is a product that **specializes in the inspection of miniaturized (shaped) cooling holes in aviation or gas turbine parts**. Here, the white-light Interferometry is needed to not only observe the surface of the workpiece, but also get 3D data from inside the holes. The acquired 3D point cloud data can then be processed by a specially developed algorithm that detects the position, orientation and shape of every cooling hole. With this information, it can be determined whether a cooling hole is blocked or was damaged. Furthermore a dimensional inspection of every hole as well as the complete part geometry is possible. Absolute accuracy can be achieved due to a high accuracy laser tracker system. In general, the Cooling Hole Inspection system can automatically and precisely detect and classify workpiece damages or non-conformities in production and MRO.

## AUTOINSPECT

AutoInspect is a system that was created to **replace the crack detection process using the fluorescent penetrant inspection (FPI) method**. Moreover the system acts as a door opener for further automated process steps like milling or welding, because it delivers a fully digital model of the workpiece and its damages. AutoInspect uses the White-Light Interferometry to get surface data in  $\mu\text{m}$ -resolution for improved inspection performance. By creating a more detailed scan of the workpiece and automatically detecting damaged parts, the AutoInspect system helps the worker to find a damage faster, who can then manually revalidate the damage if desired. This way, the worker doesn't have to search the whole workpiece for damages, but can specifically look at the damages, that AutoInspect detected before. **The current detection performance ranges between half a millimeter to three millimeter crack size according to a POD study (ASTM 2862)**. The probability of false positives (PFP) is usually below 1%. Crack size and PFP rate of course depend on surface conditions.



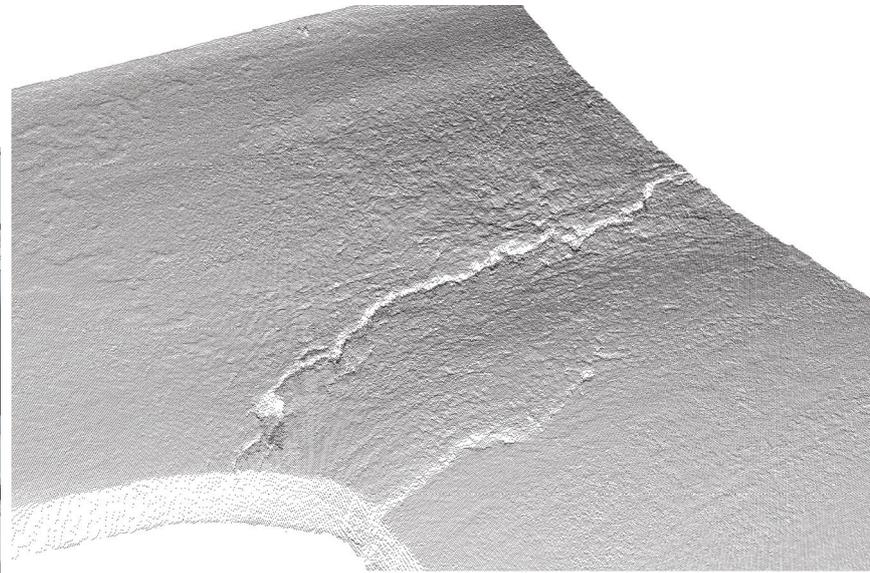
## WHAT MAKES THE WLI TECHNOLOGY SO SPECIAL?

In general, the White Light Interferometry is such an advanced method because of the high resolution 3D surface data it can gather. In comparison to other data acquisition methods, the WLI can measure surfaces in  $\mu\text{m}$ -resolution.

**One of the biggest advantages of 3D.aero WLI is its independence of surface conditions. Our WLI can measure nearly every surface, whether it is shiny like a mirror or absorptive like a black painted piece of metal.**

- Michael Ernst, Co-Founder

Even different surface conditions within one field of view does not disturb the measurement due to our smart pixel technology. In general, interferometry means that refracted light is measured where interferences occur. In this specific case, white-light is used to create several different wavelengths that can be measured. Basically, constructive interferences between a reference length and the measured length create the surface data for one measured pixel. Due to this measurement process, the absolute distances of each measured pixel can be recorded. This process is continued for the whole resolution of the measurement, which is usually around 500x500 pixels. The full mapping of the workpiece is created by stitching the single measurements together. Therefore, precise 3D data can be acquired, which is needed to detect small cracks and dents in workpieces. We at 3D.aero made it our specialty to combine the WLI with precise robotics. The ability to have a moveable WLI measuring device makes the 3D.aero products unique compared to otherwise stationary WLI devices.



## CAN WLI TECHNOLOGY BE USED IN MY INDUSTRIAL BRANCH?

Absolutely! White-light interferometry is a method that is suitable for various use-cases. It gives precise data mostly for inspection or production control purposes. If your industry has many high-maintenance parts that need to be inspected periodically, then upgrading to a WLI solution is the step to make. Also inspections that need high precision measurements during production or a robust optical inspection process, should think about a WLI solution. Upgrading the efficiency of processes should always be considered.

## WHAT MAKES THE WLI BETTER THAN CLASSICAL, OPTICAL METHODS?

The WLI is in many points superior to classical, optical measurement methods. Instead of just being based on flat visual surface data, the WLI process can measure distances and therefore create a 3D-scan of the surface. With this data, not only optical defects, but also non-visible anomalies can reliably be detected with high accuracies. The technology also works independently from the workpieces surface. Flat, curved, bent or more complex shapes form no difficulties for our WLI inspection systems. Additionally, there are different optical modules for several differing applications of the WLI. Therefore, many specific application cases are possible with only one machine. Also, vibrations are no problem for the systems reliability. Another factor that separates WLI from other optical measurement methods is the improved measurement speed. In terms of process speed, the WLI systems are normally around **40 - 60%** faster than other known methods with comparable resolution. Lastly, the most important point, that makes the WLI method better compared to classic methods, is the **ability to get  $\mu\text{m}$ -precision within the 3D data pointclouds**. A higher precision always leads to more reliable results, because every aspect of the workpieces surface is inspected, even the smallest cracks and dents are detected to guarantee the highest quality.

## CONTACT US FOR:

- Smart Automation Solutions for Inspection and Production Purposes
- Integration and Adaption of innovative solutions to an existing system
- Development of suitable solutions for any specific customer needs

## ABOUT US:

- Do you have your own application in mind? Feel free to contact us!
- As a tech startup partnering with Lufthansa Technik and Pepperl+Fuchs, we combine proven automation approaches with process know-how from the aviation industry and innovations such as AI and robotics to create advanced automation solutions. At 3D.aero, we also understand that the requirements and needs for technological solutions are as individual as the company and the processes and employees behind them. That is why we have made it our mission to accompany our customers from the problem definition to the development of their own automation solution.

Contact us for further information. We are looking forward to your message!



Michael Ernst / Co-Founder

[miernst@3d-aero.com](mailto:miernst@3d-aero.com)