

#HandsOnMetrology

APPLICATION REPORT

Fringe projection 3D scanners: Choose the right solution for technical and production requirements

This application report describes how fringe projection technology can be used for a wide range of 3D scanning projects. We highlight how fringe projection 3D scanners grow with technical and production requirements – from basic manual measurements and extending to semi and fully automated inspection workflows. Furthermore, this report gives insights into the underlying technology, outlines typical use cases and demonstrates how different systems can be combined into a scalable, futureproof 3D scanning strategy.

ZEISS



Executive introduction



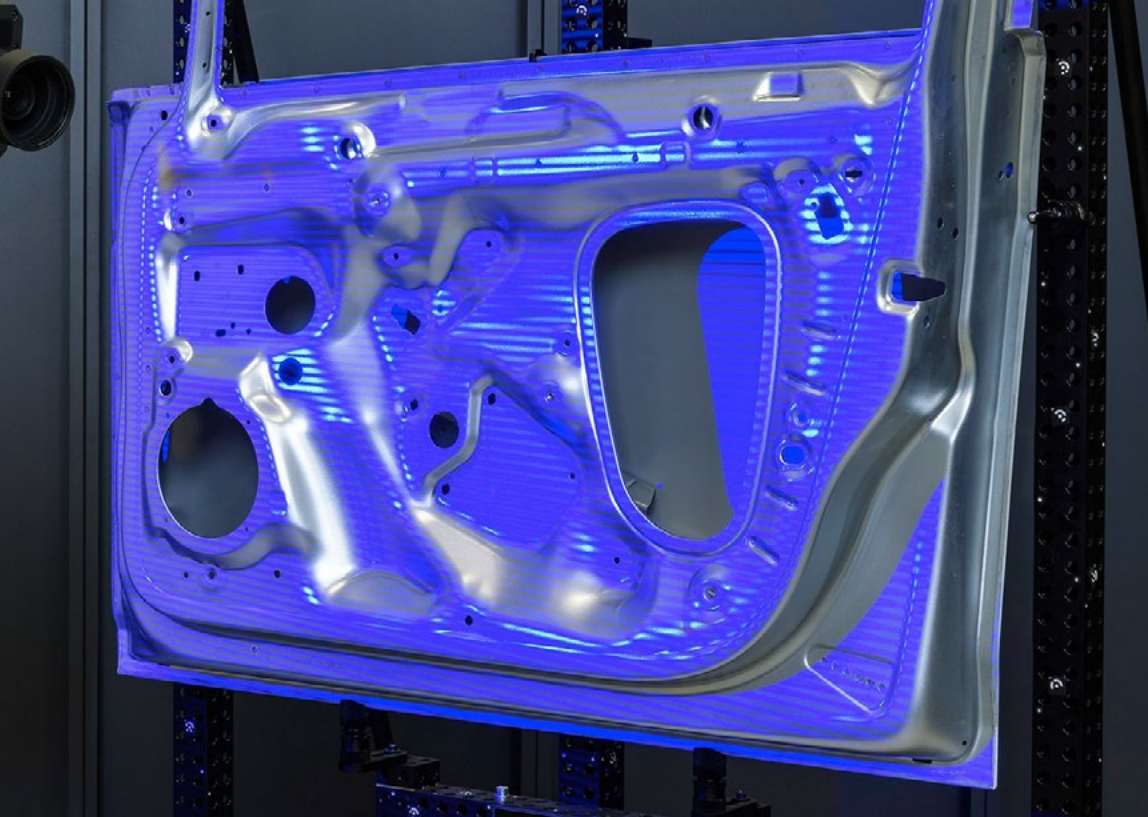
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3D scan technology basics: 3D laser scanning

In the broader 3D scanning landscape, two major technologies dominate: laser line scanning and structured light, also known as fringe projection.

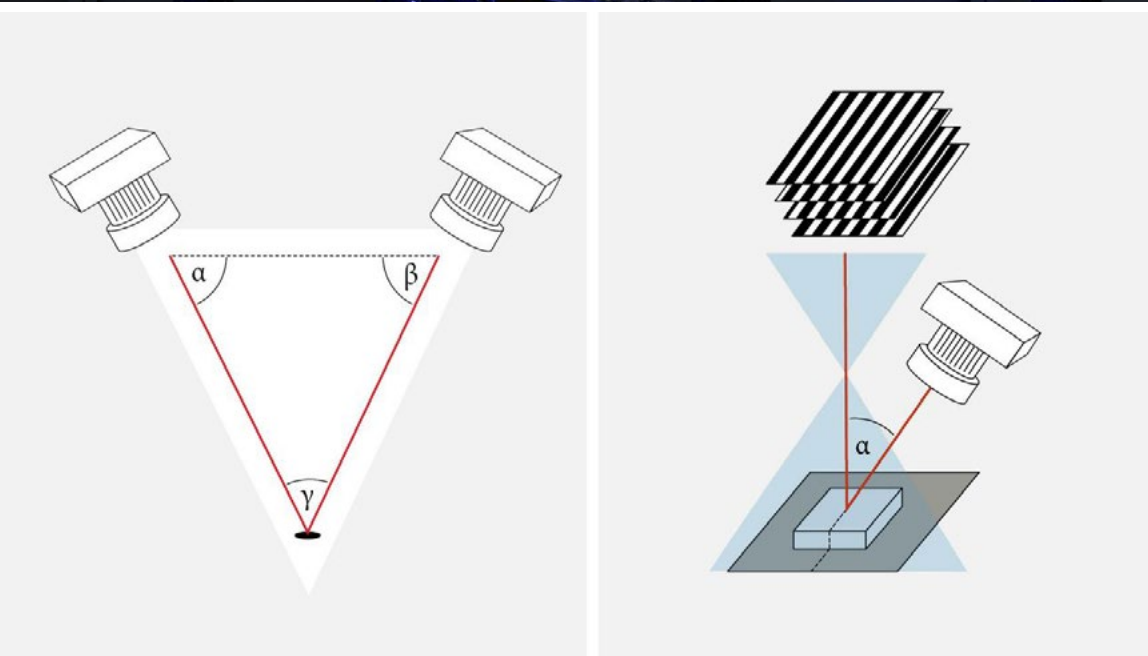
Laser scanners project one or several laser lines onto an object and move them over the part surface while cameras track the line position. This approach is well suited for portable, handheld devices that work directly on-site. Laser scanners work well on a wide variety of materials and are a strong choice when large components need to be digitized quickly in the field or on the shop floor. The user traces the part with the laser, adapts resolution as needed, and thus benefits from high degrees of flexibility.



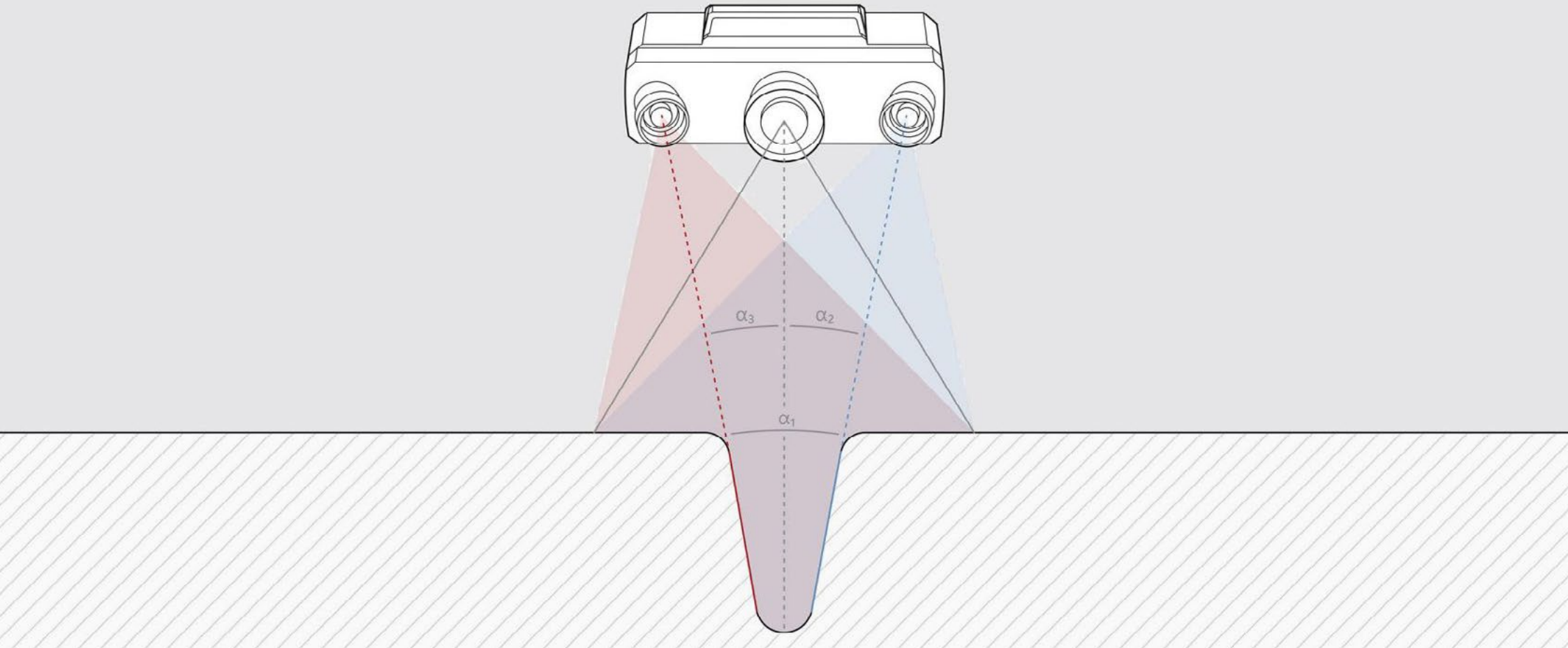


3D scan technology basics: fringe projection

Fringe projection, also known as structured light scanning, follows a different principle. Instead of a moving laser line, the system projects a series of patterned fringes onto the part and uses one or more cameras to observe how these patterns bend on the surface. From the bending, the system reconstructs precise 3D coordinates using triangulation. Fringe projection systems are preferred when high accuracy, low noise and very detailed surface meshes are required. They excel at capturing small features, sharp edges and subtle shape deviations. Because each scan captures a lot of information in a single shot, this technology is well suited for automation and semi-automation.



In the ZEISS ecosystem, fringe projection scanners such as GOM Scan 1 and ATOS Q share a typical hardware layout: two cameras and one projector in the middle. The two cameras form a calibrated stereo pair that observes the projected fringe patterns. The combined field of view defines the measurement volume. Any component placed within this volume will be scanned with high detail, assuming the surface is optically accessible and within the working distance. This configuration is based on the triangulation principle. The system knows the geometric relationship between the cameras and the projector and can therefore compute 3D points from the observed pattern bending.



The projector in the center uses ZEISS Blue Light Technology. This technology employs a narrow band blue light source that reduces the influence of ambient light, minimizes speckle effects and supports low noise measurements. On top of that, heterodyne fringe projection is used to project multiple fringe patterns with different frequencies and phases. This allows subpixel evaluation and leads to very high local resolution and detailed polygon meshes. The result is a dense, clean point cloud that can be used confidently for inspection, reverse engineering and documentation purposes.

The stereo camera setup brings additional benefits beyond simple data acquisition. Because there are two cameras, each scan contains redundant information. This redundancy allows the system to monitor its own calibration status during operation, to detect unexpected movement or vibration and to compensate for changes in ambient temperature within certain limits. These self-monitoring capabilities are important for automated solutions, where consistent measurement quality over time matters just as much as absolute accuracy on day one.



GOM Scan 1: a small 3D scanner for high standards

GOM Scan 1 is an example of how fringe projection can be made accessible without compromising on metrology-grade performance. It is the most affordable fringe projection scanner in this portfolio, but it is designed with industrial accuracy requirements in mind.

GOM Scan 1 uses a fixed lens configuration, which means the optical setup is predefined for specific fields of view. This has two immediate advantages. First, the system is very quick to set up, because there is no need to configure or swap lenses. Second, the calibration remains stable over long periods, even when the scanner is transported between locations.

The fixed measurement volumes of GOM Scan 1 are tailored to particular measurement requirements. Users can switch between volumes by changing scanner heads rather than reconfiguring the optics. This keeps the workflow focused and predictable. GOM Scan 1 is a strong choice when components demand easy, affordable and accurate digitization, especially in environments where the goal is to get reliable measurements.





ATOS Q: the high performer of industrial 3D scanning

ATOS Q, by contrast, targets a broader range of use cases with a more flexible lens setup. It employs exchangeable lenses, so the same scanner body can be used with different measurement volumes - from very small components to larger parts. One of the key technologies in ATOS Q is the Triple Scan Principle.

In this mode, the system effectively captures the object from three different viewing directions within a single scan sequence. This reduces shadowing and improves coverage, especially on parts with deep pockets, complex edges or overlapping surfaces. The Triple Scan Principle helps ensure that even complicated geometries are scanned evenly, without excessive holes or gaps in the data.

ATOS Q also incorporates a Blue Light Equalizer, which ensures that the projected fringe patterns are evenly illuminated across the entire field of view. This uniform illumination reduces scanning noise and improves data stability. The system offers additional functions such as reflection detection, back projection of inspection results onto the physical part and live tracking capabilities. In its class, ATOS Q delivers very high accuracy as well as data quality and is positioned as a versatile tool that can handle both manual and automated workflows.





Automation of 3D scanning workflows

Where fringe projection really shines is in automation. ZEISS has been working with automated fringe projection systems for many years and has standardized these solutions in the ScanBox product line. The same automation knowhow is now accessible in more compact and flexible products that let users grow step by step, rather than upgrading directly into a full robot cell.

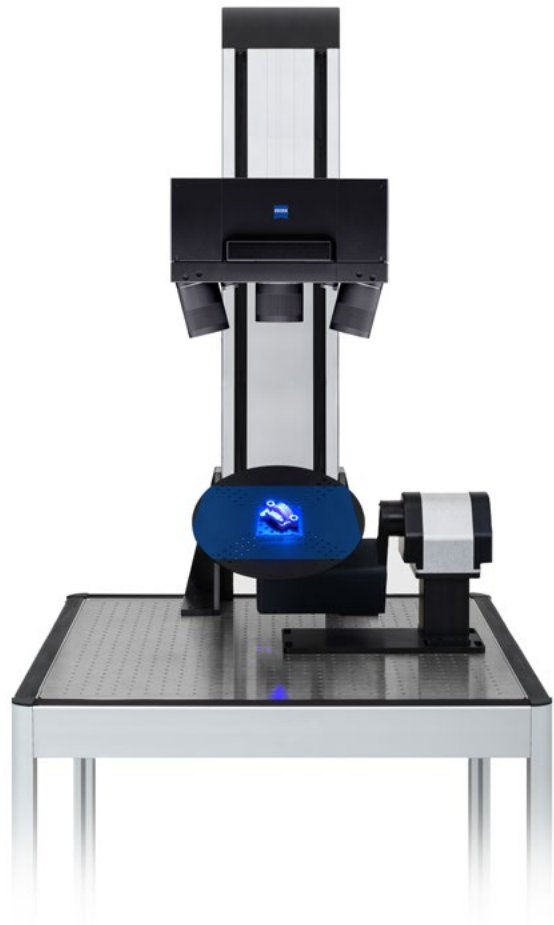


ScanPort: a complete solution for 3-axis automation

ZEISS ScanPort is a good example of a semi-automated, tabletop solution that builds on fringe projection technology. It is compatible with GOM Scan 1 or ATOS Q and was designed around two guiding questions: which level of knowledge is needed for 3D scanning, and how easy can the system be to operate? The result is a compact 3-axis device that rotates and tilts. This simplifies the scanning of parts that require several orientations to be fully captured.

The real strength of ScanPort lies in how it integrates with ZEISS INSPECT software. Dedicated software modes and a workflow assistant guide the user through the creation of scan positions. Once a scanning strategy is defined, it can be stored as a template and reused for similar parts. This means that users do not need to spend days learning complex software before they can produce repeatable, high-quality results. To make things even easier, ScanPort supports an operator kiosk mode. In it the software interface is simplified to the essentials.

Users can select predefined, approved measurement templates. A typical workflow is very straightforward: the operator places the part on the rotation table, selects the correct template and starts the measurement. If the part needs to be flipped or repositioned, the system prompts the user at exactly the right time. This approach minimizes the need for highly trained scanning experts and stabilizes measurement quality across different shifts and users. ScanPort is particularly suitable for components roughly in the 100 to 500 millimeter size range, where recurring measurements and consistent workflows are important.



Motorization Kit: semi-automation for small details

When components become smaller and demand extremely high detail, the ATOS Motorization Kit comes into play. This solution focuses on parts in the range of about 10 to 150 millimeters. In this size range, fringe projection offers unique advantages because the measurement field can be reduced significantly. Concentrating the projected light and the camera pixels on a small area yields very high point density and allows even tiny features to be digitized reliably. However, scanning at this level of detail requires a very stable mechanical setup.

The ATOS Motorization Kit provides such a setup, with a rigid structure that minimizes vibration. It includes an industrial-grade lift that moves the scanner along the vertical axis and a plate that can tilt and rotate the object. This combination gives excellent access to all necessary viewing angles without compromising stability. Just like ScanPort, the Motorization Kit can be configured and operated using ZEISS INSPECT – including the operator kiosk mode. This system is particularly well suited for small parts with intricate details, for example precision components, medical devices or small turbine blades.



ScanCobot: intuitive 7-axis automation

For applications that require an even higher level of automation, ZEISS ScanCobot provides a mobile, compact 7-axis solution. ScanCobot combines ATOS Q with a collaborative robot and a rotary table, essentially bringing the core ideas of the ScanBox product line into a smaller, affordable, more flexible platform.

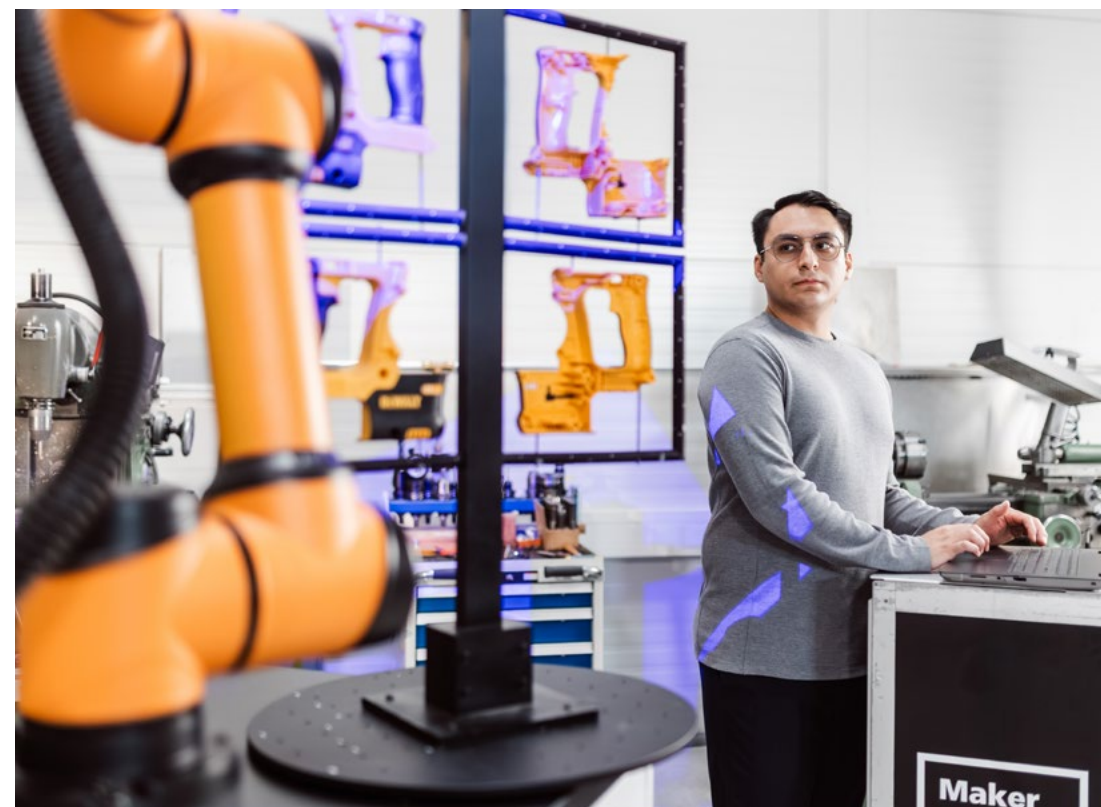
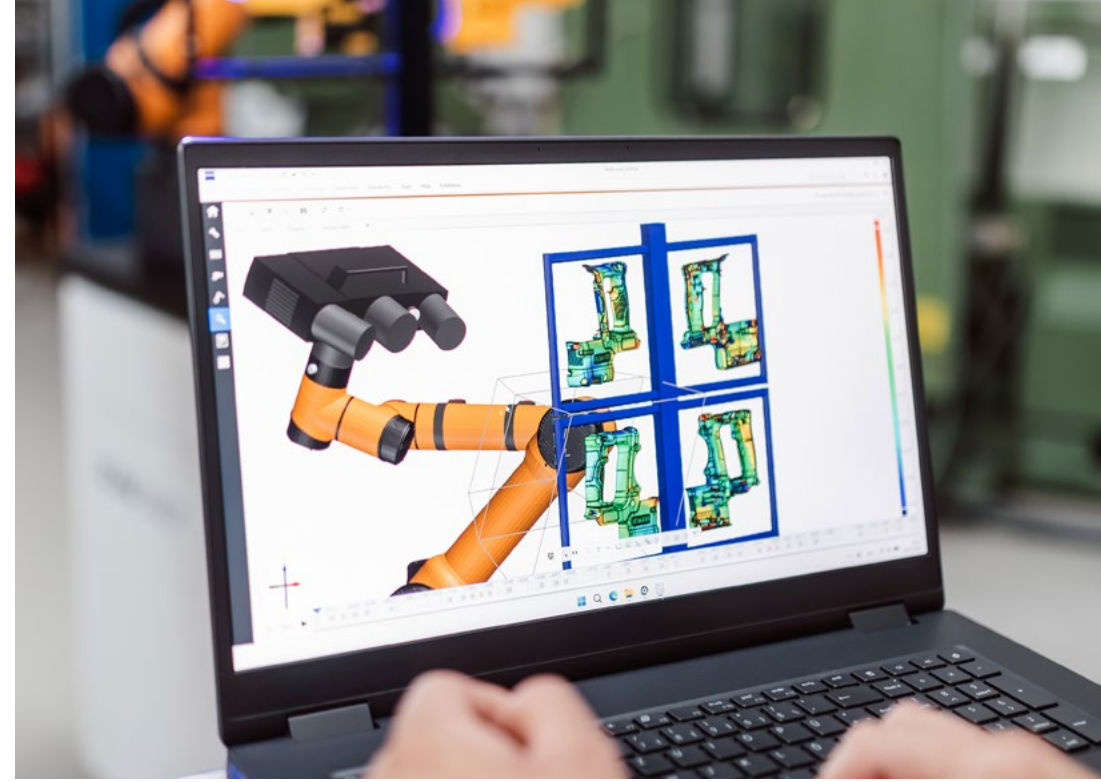
This system is ideal when parts have challenging features that must be captured from many different angles, when programming effort needs to be reduced or when higher throughput is required.



The programming of ScanCobot is driven by a dedicated automation module in ZEISS INSPECT. Instead of manually teaching robot paths, the user can load the CAD model of the component along with the inspection plan and let the software perform automatic teaching, sometimes called smart teaching. With a single click, the software calculates all necessary scanner positions and robot trajectories. A built-in measurement simulation shows how much of the part will be scanned, where potential blind spots might be and whether collisions are avoided. If the CAD data changes later due to a design update, the program can adapt to the new geometry with minimal manual adjustment, because the logic is tied to the CAD and inspection features rather than to fixed positions. This makes ScanCobot particularly attractive in development environments or production scenarios where designs change frequently.

Like ScanPort and the Motorization Kit, ScanCobot also offers the operator kiosk mode. This allows operators to execute pre-programmed templates without dealing with the underlying robot programming. Templates can be selected directly in the kiosk interface or triggered by scanning a barcode on the part or job sheet. This is a practical way to run automated inspections across different shifts and teams without requiring robot experts.

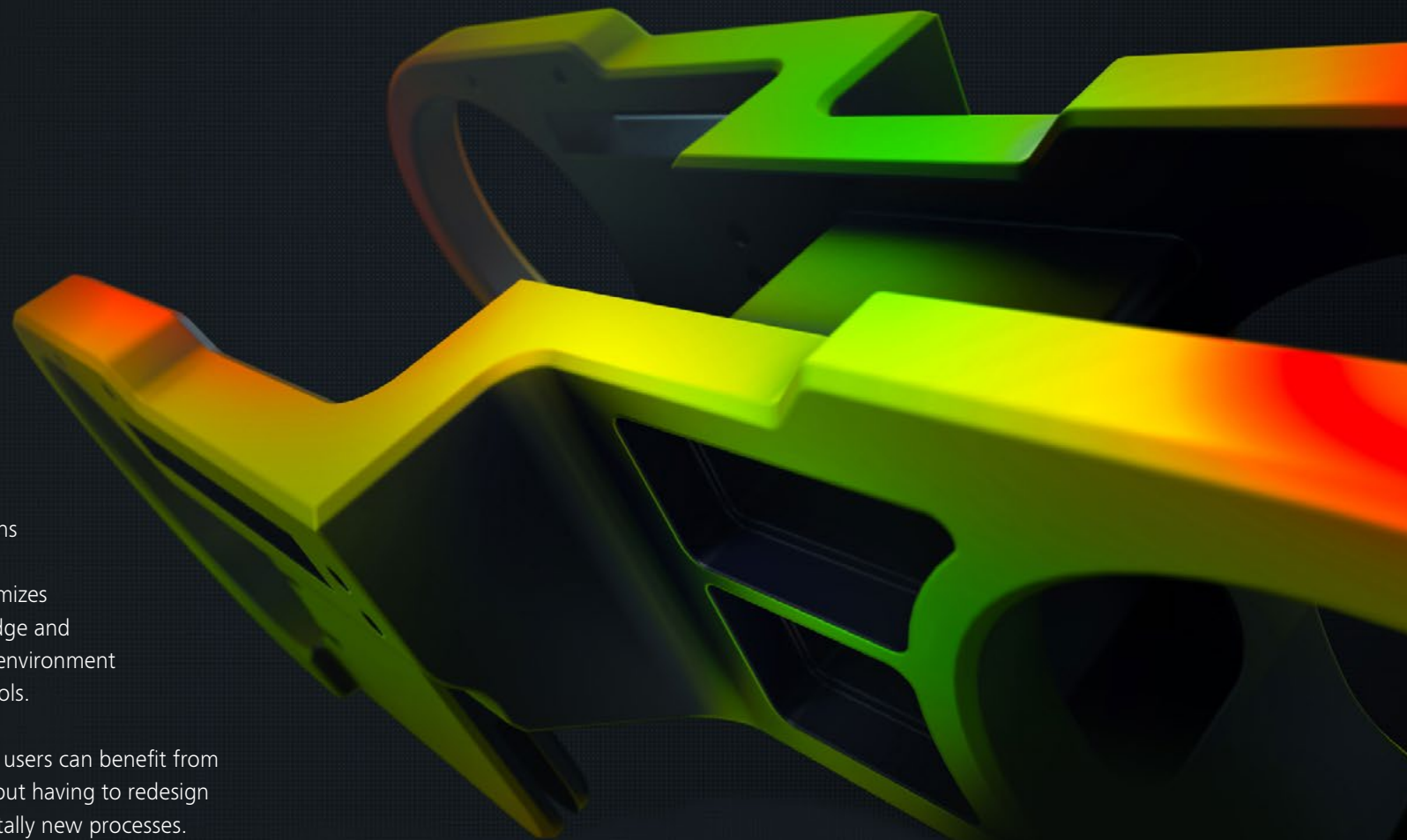
ScanCobot significantly improves throughput using 7-axis automation and is especially useful for complex components such as impellers and industrial gas turbine blades. The leading and trailing edges of such parts are often the most demanding areas to capture reliably. The smart teach feature in ZEISS INSPECT uses the CAD model and inspection elements to determine which areas need higher resolution and which viewing angles are necessary. As a result, ScanCobot can generate measurement programs that automatically position the scanner to capture these critical edges with sufficient detail and coverage. This reduces programming time and increases confidence that all relevant features are measured correctly.



ZEISS INSPECT one established central data hub

All of these systems share the same software platform, ZEISS INSPECT, which also powers ZEISS laser scanners, Xray solutions and CMMs. This common foundation reduces training effort, simplifies integration and minimizes the impact of staff changes, because knowledge and workflows remain centered on one software environment rather than being scattered across multiple tools.

With continuous innovation in ZEISS INSPECT, users can benefit from new functions and improved algorithms without having to redesign their hardware setup or commit to fundamentally new processes.



Upgrading from manual to automated 3D scanning is easy

In conclusion, fringe projection technology is an excellent choice for organizations that want a high-accuracy, low noise, and automation-ready 3D scanning solution. By starting with manual systems and gradually adding semi and fully automated components as requirements grow, it is possible to build a robust, scalable 3D metrology infrastructure tailored to specific applications and part sizes, all while staying within one cohesive software and hardware ecosystem.



Technical data

GOM Scan 1



Type	GOM Scan 1 (100)	GOM SCAN 1 (200)	GOM SCAN 1 (400)
Points per scan	6 million	6 million	6 million
Point distance	0.037 mm	0.060 mm	0.129 mm
Measuring area	100 x 65 mm ²	200 x 125 mm ²	400 x 250 mm ²
Working distance	400 mm	450 mm	500 mm
Light source	LED	LED	LED
Weight	approx. 2.5 kg	approx. 2.5 kg	approx. 2.5 kg
Dimensions	290 x 215 x 80 mm ³	290 x 215 x 80 mm ³	290 x 215 x 80 mm ³
Cable length	5 m	5 m	5 m
Connection	USB 3	USB 3	USB 3
Operating system	Windows 10	Windows 10	Windows 10
Software	ZEISS INSPECT	ZEISS INSPECT	ZEISS INSPECT

(1) D-K-21312-01-00 according to DIN EN ISO/IEC17025:2018

(2) Acceptance Test based on ISO 10360

Technical data ATOS Q



Type	ATOS Q 8M	ATOS Q 12M
Light source	LED	LED
Points per scan	8 million	12 million
Measuring area	100 x 70 – 500 x 370	100 x 70 – 500 x 370
Point distance	0.04 – 0.15	0.03 – 0.12
Working distance	490 mm	450 mm
Weight	approx. 4 kg	approx. 4 kg
Dimensions	approx. 340 mm x 240 mm x 83 mm	approx. 340 mm x 240 mm x 83 mm
Cable length	10 m fiber optic cable	10 m fiber optic cable
Operating system	Windows 10	Windows 10
Measuring volumes	50, 100, 170, 270, 350, 500	50, 100, 170, 270, 350, 500

Technical data

ScanPort

ZEISS ScanPort

Light source	Blue Light Technology
Points per scan	Up to 12 million ⁽¹⁾
Scanning volume	Up to diameter 500 x 300 mm ³ ⁽²⁾
Points distance [mm]	Up to 0.03 mm
Payload	20 kg
Weight	approx. 22 kg (modular concept: heaviest part 11 kg)
Packing dimensions	550 mm x 725mm x 180 mm
Interface	USB 2.0
Power	AC 100 ~ 240V, 50/60 Hz
Operating system	Windows 11
Software	ZEISS INSPECT



(1) Compatible with ATOS Q & GOM Scan 1

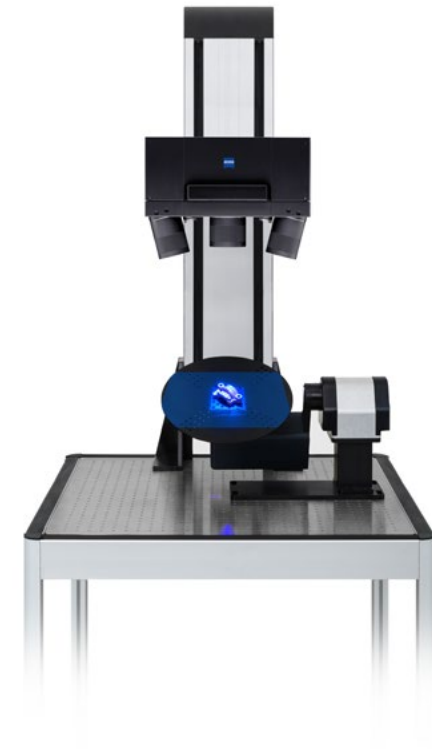
(2) Rotation table diameter 350 mm

Technical data

ATOS Motorization Kit

ATOS Motorization Kit

Max payload of tilt and swivel unit	Included (multiple blue laser crosses)
Weight	linear motion unit: 27.5 kg Tilt and swivel unit: 10.5 kg
Rotation angle (swivel unit – axis 1)	360
Rotation angle (tilt unit – axis 2)	230
Max. traverse path of linear motion unit (axis 3)	approx. 600 mm
Power	wide range input 90–240 VAC, 50–60 Hz
Power consumption	400 W
Operating system	Windows 11
Software	ZEISS INSPECT
Compatible 3D scanners	GOM Scan 1 ATOS Q



Technical data

ScanCobot

ZEISS ScanCobot (available with optional housing)

System weight	< 185 kg
Working height	1000 mm
Power supply	Standard, 100-240 V (1-phase, 16A)
Dimensions	975 mm x 755 mm
Max. part size	500 mm diameter
Max. part weight	50 kg

Type	ATOS Q 8M	ATOS Q 12M
Light source	LED	LED
Points per scan	8 million	12 million
Measuring area	100 x 70 – 500 x 370	100 x 70 – 500 x 370
Point distance	0.04 – 0.15	0.03 – 0.12
Working distance	490 mm	450 mm
Weight	approx. 4 kg	approx. 4 kg
Dimensions	approx. 340 mm x 240 mm x 83 mm	approx. 340 mm x 240 mm x 83 mm
Cable length	10 m fiber optic cable	10 m fiber optic cable
Operating system	Windows 10	Windows 10
Measuring volumes	50*, 100*, 170, 270, 350, 500	50*, 100*, 170, 270, 350, 500

* Selected environment only





Find the right 3D scanning solution

No matter what your application is, there's a 3D scanning solution that's right for you and perfectly supports your metrology needs. Whether it's a 3D laser scanner, a fringe projection system, manual, or automated – we help you make the right choice.



Do you want to find out more?

Get in touch with your local
#HandsOnMetrology partner



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