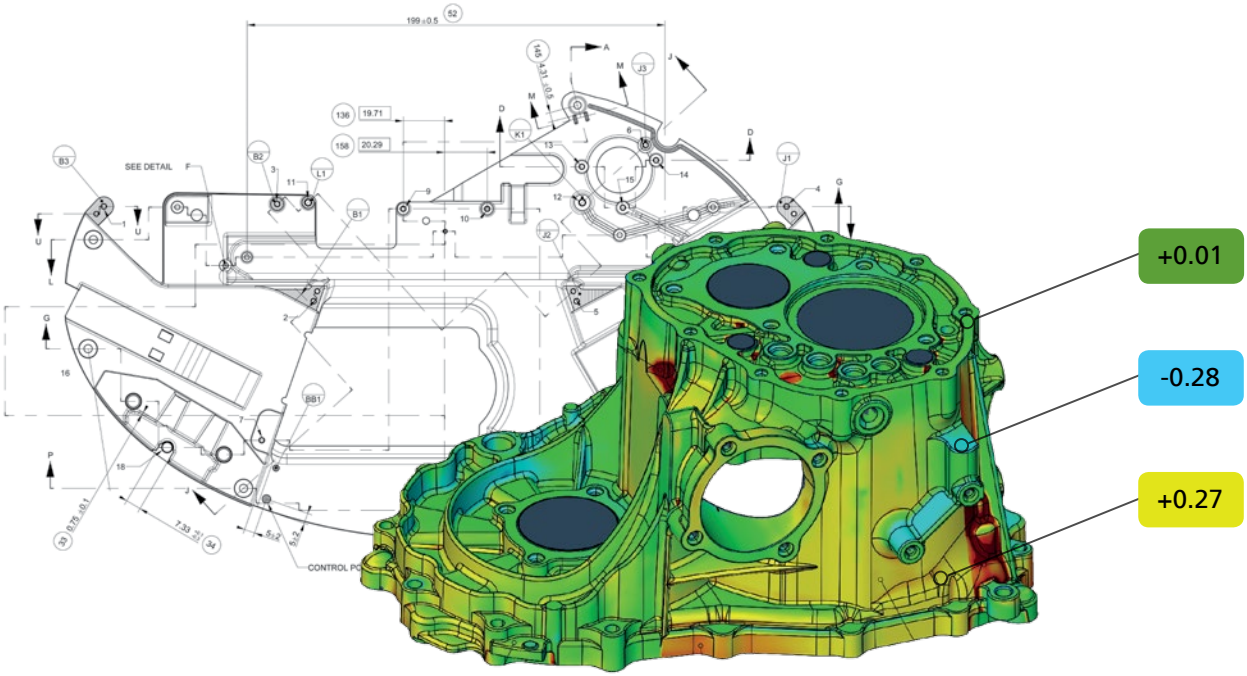
Precise Industrial 3D Metrology



GOM Inspect Software

Evaluation Software for 3D Point Clouds

3D inspection
Processing of polygon meshes
Communication of measuring results

Optical 3D Metrology

In Industrial Quality Control

Optical 3D coordinate measuring machines are replacing tactile measuring systems and gages in many areas of industry. They capture more detailed and easier to interpret quality information about an object with significantly shorter measuring times.

While mechanical measuring systems capture data in a point-based or linear manner, optical measuring systems provide full-field data about deviations between the actual 3D coordinates and the CAD data. As this measuring data contains all the object information, in addition to the surface deviations from the CAD, the software also automatically derives detailed information such as GD&T, trimming or hole positions.

The accuracy of optical measuring machines is not due to expensive and high-maintenance precision mechanics, but is rather based on state-of-the-art optoelectronics, precise image processing and mathematical algorithms. A few precision standards and automated calibration that can be performed by the customer ensure the accuracy of the machine. This also means no loss of accuracy due to wear under harsh conditions. As with the tactile machines, measuring uncertainty is certified with the help of ball bars or step gages.

Over 14,000 GOM measuring systems worldwide ensure the dimensional quality of automotive, sheet-metal, cast and injection molded products as well as turbine blades and wheels. In most cases, the detailed analyses are not used for a simple “OK”/“not OK” evaluation, but form the basis for the optimization of production and machine parameters as part of a value-added measuring procedure.

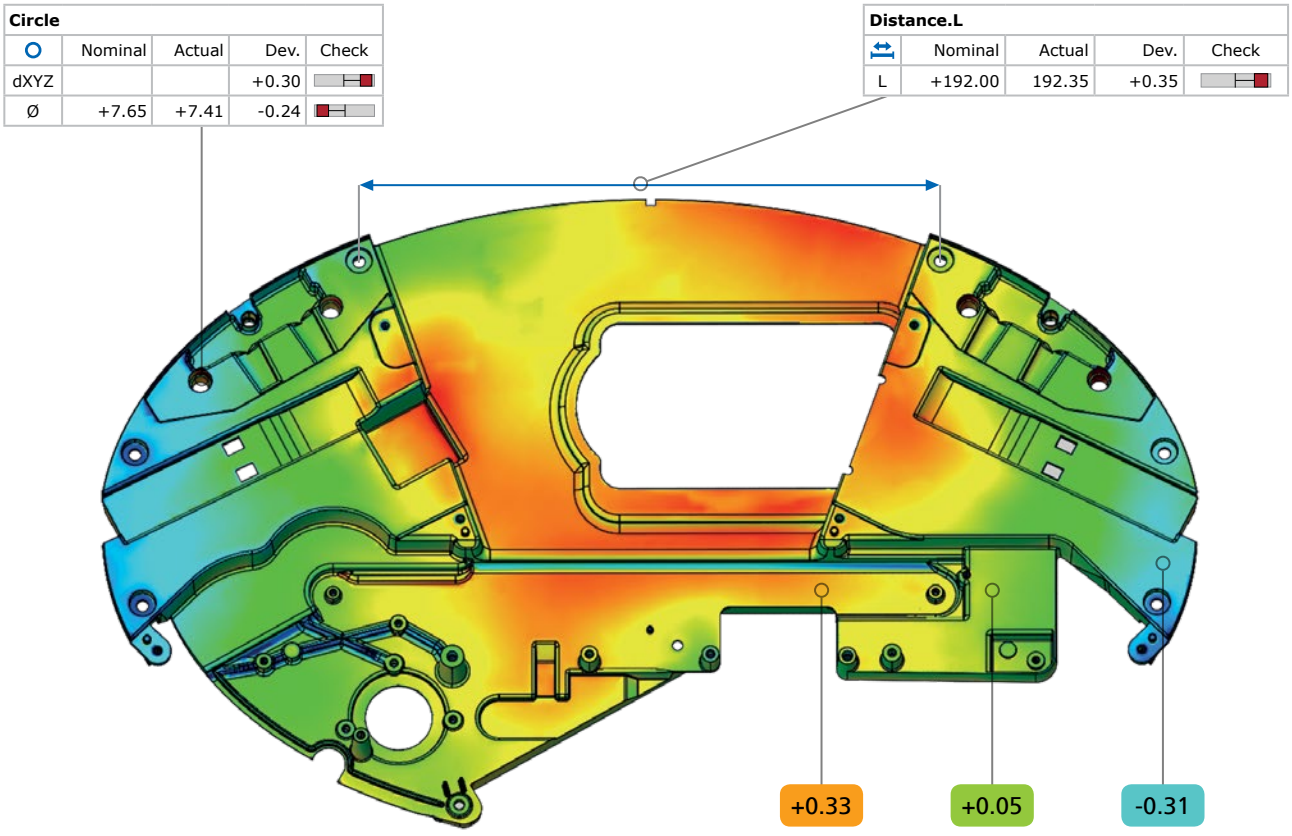
Certified Software for 3D Metrology

In modern industrial metrology, different measuring technologies are implemented based on application requirements. These solutions produce data for processing and evaluation, and often many different software packages are used. GOM Inspect Professional offers inspection and evaluation functions for measurement data from GOM's measuring systems, 3D scanners, laser scanners, CTs, CMMs and other sources.

In order to ensure precise measurement accuracy, both GOM Inspect Professional and GOM Inspect software have been tested and certified by PTB and NIST institutions. The accuracy of the evaluation software is tested by comparing the results from the software with reference results. The GOM software has been placed in Category 1, the category with the smallest measurement deviations.

Industrial requirements – Optical 3D metrology is growing in importance in industrial processes. More measurement data is continuously produced. This data needs to be processed and analyzed, and traditional tools are often not able to meet modern demands anymore. The GOM Inspect software fulfills today's industrial requirements and ensures short development times, optimized production processes and high process safety.

Software for 3D point clouds – GOM Inspect Professional polygonizes point clouds into high-quality 3D mesh data and offers a range of mesh processing functions. Inspection is based on a comparison of measurement data with CAD data and an analysis of false color plots, 2D sections or multiple inspection points. The free GOM Inspect software allows easy exchange and further analysis of the measurement results.



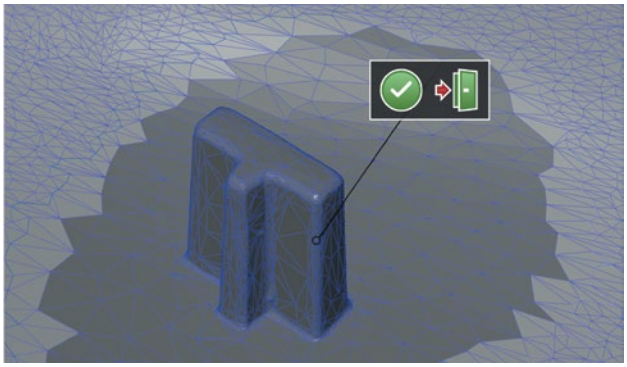
Data Import

Interfaces

The GOM software has many interfaces for importing measuring data from different sources like laser scanners, white light scanners, CMMs and CTs. Data can be processed, filtered and thinned in the software. Common and neutral as well as native formats are available for importing CAD data.

Polygon Meshes From Point Clouds

3D meshes for parts and components are calculated from 3D point clouds for visualization, simulation, surface reconstruction and nominal/actual comparison. The meshes are also suited for virtual assembly based on measurements from different sources. The precise polygon meshes can be exported to a number of standard formats such as STL, G3D, JT Open, ASCII and PLY. Polygon meshes can be exported in STL format for applications such as 3D printing.



Mesh Processing

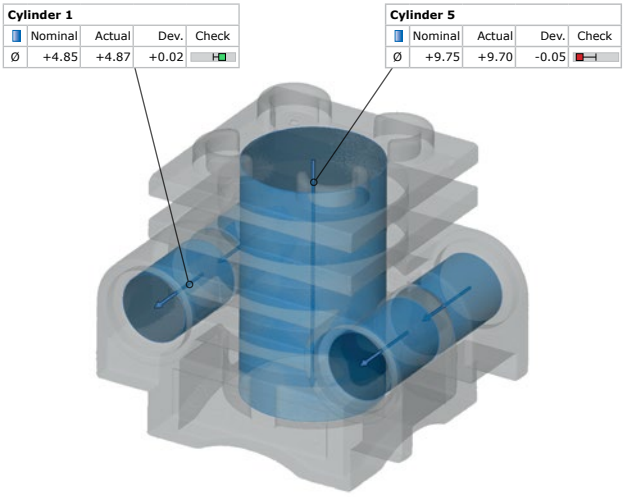
Polygon meshes can be smoothed, thinned and refined. In addition, holes in the mesh can be filled and curvatures can be extracted. The mesh is processed using curvature-based algorithms and tolerances. The software provides the user with a live preview of each processing step.

Furthermore, a golden mesh can be determined by finding the best mesh or calculating an average mesh.

CT Import

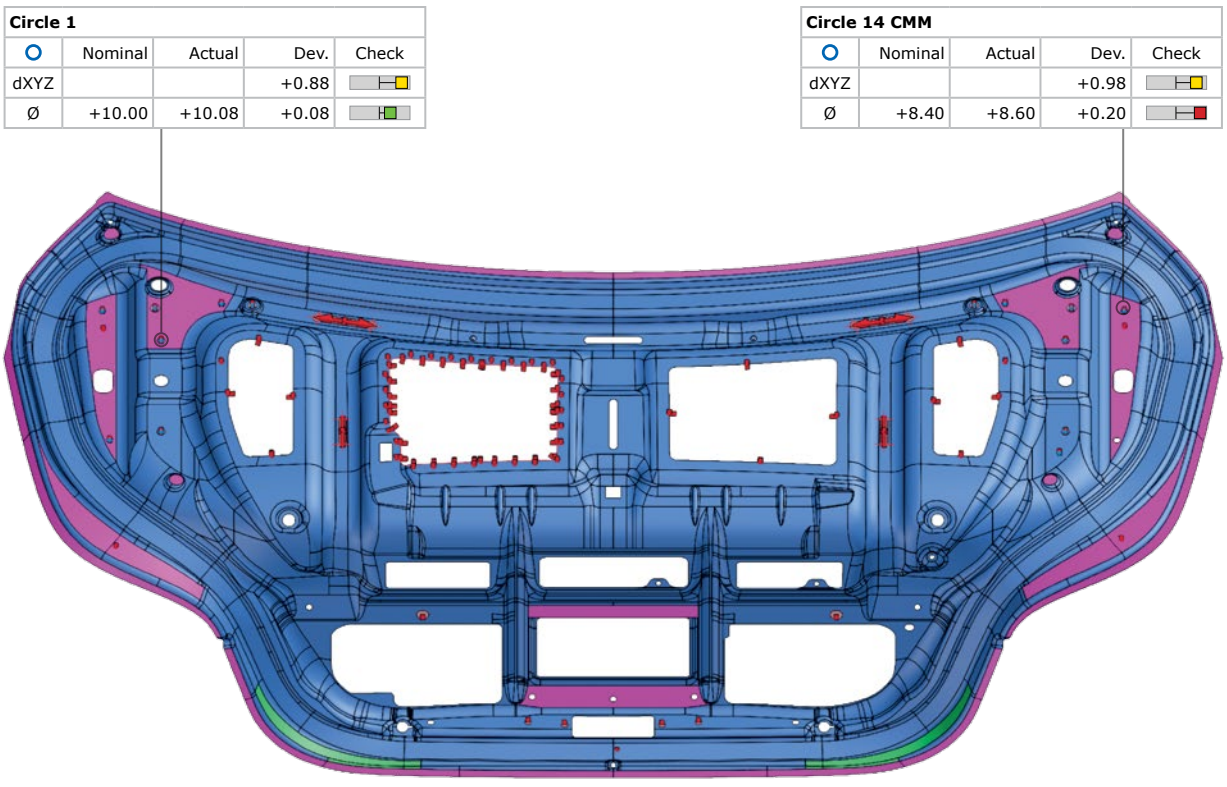
Scanned volume models can be directly visualized and evaluated in the software. Volume data captured by computer tomographs can be imported via drag & drop in common formats (.vgi, .vgl, .pcr, .exv, .rek) or as raw data and can be directly evaluated. In addition, the different materials of a scanned object can be imported as separate surface meshes.

Besides separately scanned objects, the software also allows importing data sets including several objects that were scanned with one CT simultaneously. Up to 32 objects can be imported as individual meshes at once. The GOM Inspect software offers different polygonization modes for importing data.



CAD Import

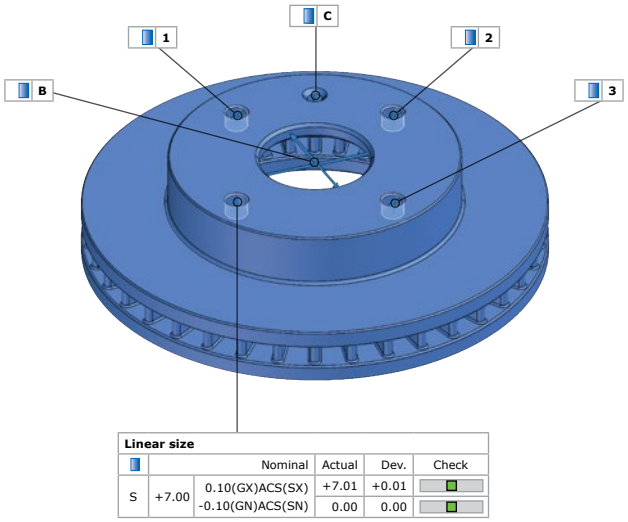
Neutral CAD formats such as IGES, JT Open and STEP as well as native formats like CATIA, NX, Solidworks and Pro/E can be imported into GOM Inspect Professional at no extra costs. The individual data formats are imported via drag & drop and are automatically identified and assigned by the software.



Full-Field Analysis

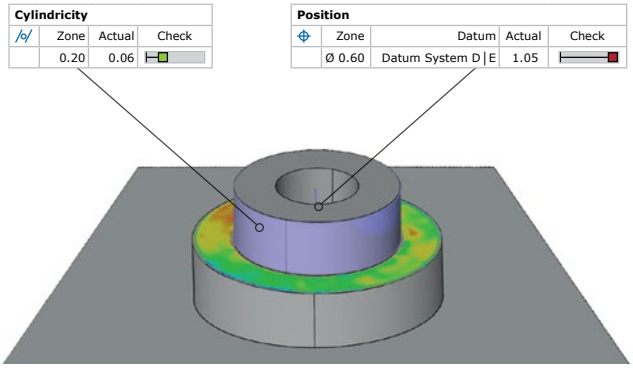
Deviation Plots Derived from Point Clouds

A significant advantage of the optical metrology is the full-field evaluation and visualization in color-coded deviation plots. In this way, problematic areas of parts can be identified intuitively and respective measures can be derived.



FTA / PMI

In concepts such as PLM (Product Lifecycle Management), as much process and part information as possible is gathered in the form of PMI (Product Manufacturing Information) to ensure a comprehensive and company-wide management and control of production chains. GOM supports interfaces for digital transfers of inspection features. Quality criteria and datum systems that were implemented by a semantic construction into the CAD can be transferred digitally and evaluated in a context-sensitive way. Since the inspection plan is generated directly during the CAD import, additional work-intensive programming is not necessary.



GD&T Analysis

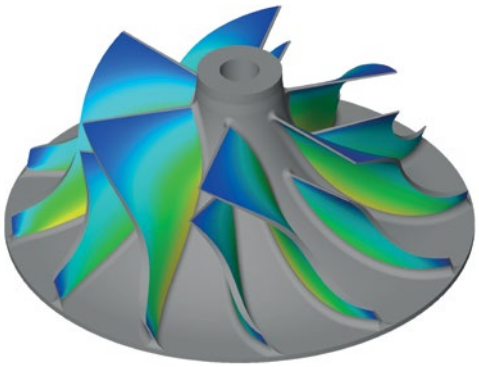
Corresponding GD&T elements are, for example, planarity, parallelism or cylindricity. Both, a standardized analysis of 2-point distances and of the maximum material requirement as well as the position tolerance in local datum and coordinate systems are possible.

GOM supports ISO standards as well as ASME standards and continuously implements updates of the standards into the software.

Alignments

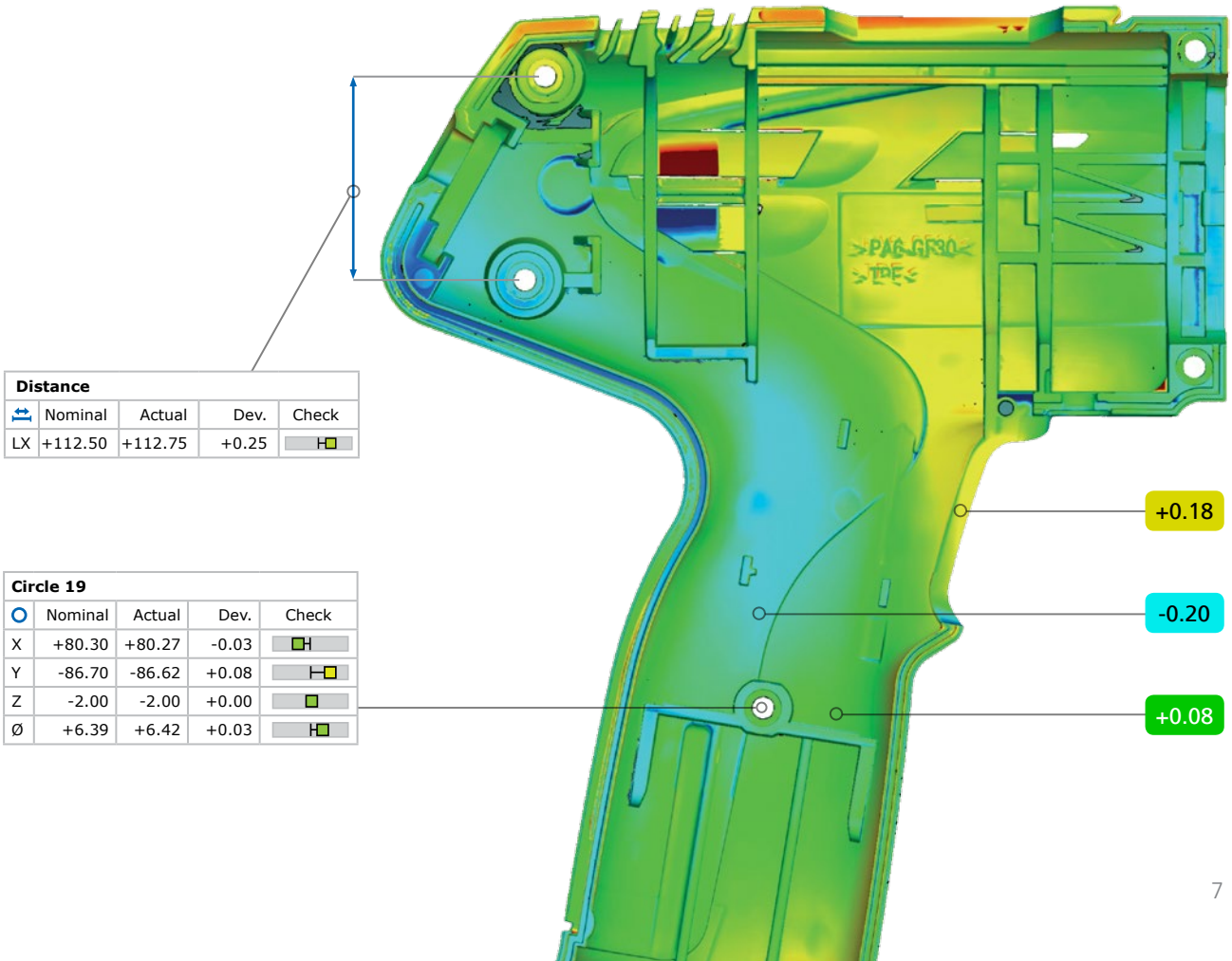
The GOM 3D software includes all standard alignment functions. These include: RPS alignment, hierarchical alignment based on geometric elements, alignment in a local coordinate system, alignment by reference points as well as various best-fit methods, such as global best-fit and local best-fit.

Customers can also use their own specific alignments such as “Balanced beam” or “Equalized nested”, for example, for turbine blades.



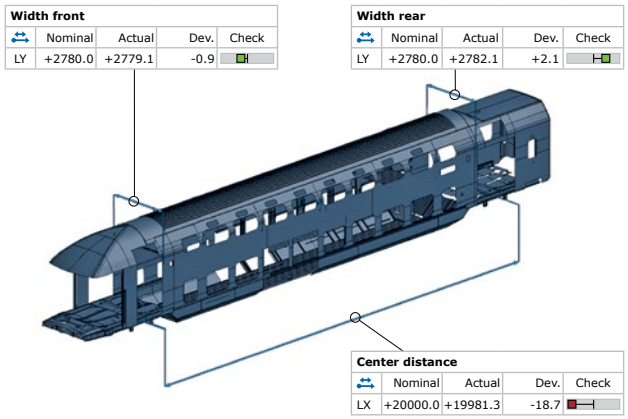
Nominal / Actual Comparison

The computed polygon meshes describe free-form surfaces and primitives. These can be verified by comparing surfaces with a technical drawing or directly with a CAD data set. A 3D analysis of surfaces as well as a 2D analysis of sections or points can be implemented in the software. CAD-based generation of primitives such as lines, planes, circles or cylinders is also possible.



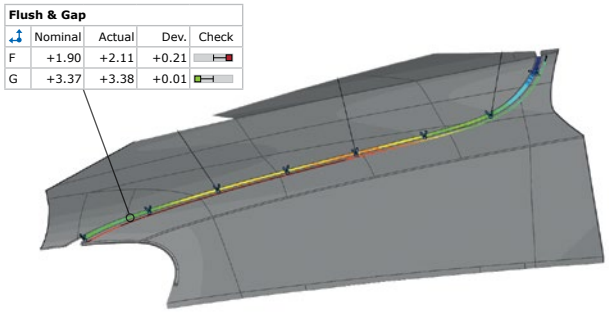
Application-Specific Analyses

Functions for Special Tasks



Point-Based Inspection

The evaluation function can also be used for point clouds. This includes, for example, measurement of distances between individual points and a comparison of points with the CAD model. Construction functions can then be applied to create standard geometries based on several points. This allows an analysis of dimensional accuracy or a GD&T analysis on the generated elements, including flatness, cylindricity or positional accuracy.



Curve-Based Inspection

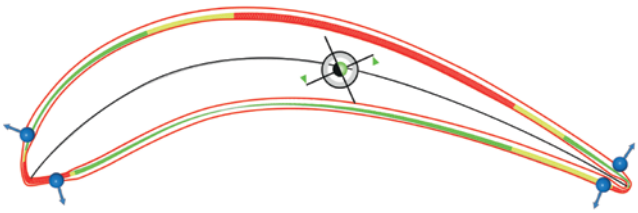
GOM Inspect Professional closes the gap between point-based and surface-based inspection. Full-field digitized data is used to apply construction functions for curves and to visualize their individual properties. Edge curves can, for example, be captured, radii and character lines analyzed and spline curves created. Flush & gap analysis is another element provided in curve-based inspection.

Motion and Deformation Analysis

Analysis of motion and deformation is carried out using a component concept. Points are divided into coherent groups and defined as components. Transformations or corrections to rigid body movements can then be calculated for these components. The 6DoF analysis serves to determine the translation and rotation movements in all directions. Vector fields then help to visualize point movements and deformation over time.

Airfoil Inspection

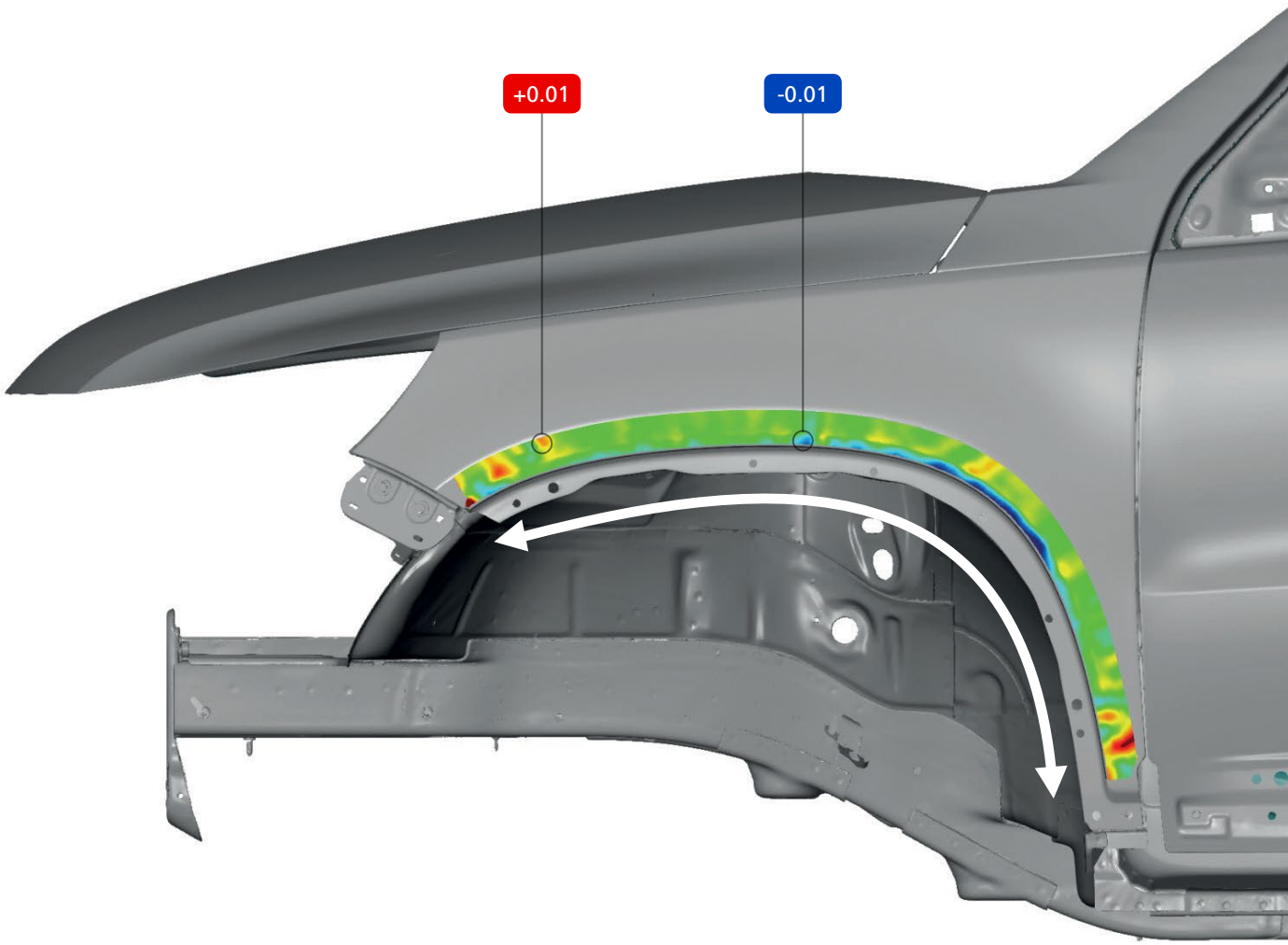
GOM Inspect Professional combines general inspection functions with application-specific evaluations. Native quality control functionality for the analysis of airfoils and turbine blades include: inspection of profile mean line, profile centroid and profile thickness of turbine blades on the basis of 2D sections. The profile's center of gravity, radii and twist can also be calculated.



Inspection of Surface Defects

Optical metrology allows a series-accompanying and reproducible evaluation of surface defects. The results are objective and available in a shorter time than with the conventional method of the grind stone.

For the surface defect map to match the form of the part directly, the GOM Inspect software makes an inspection of surface defects even in curved directions possible. Furthermore, the software computes the direction of the surface normals automatically. Only one defect map is required to inspect large areas that are to be analyzed in the same direction according to the inspection plan.



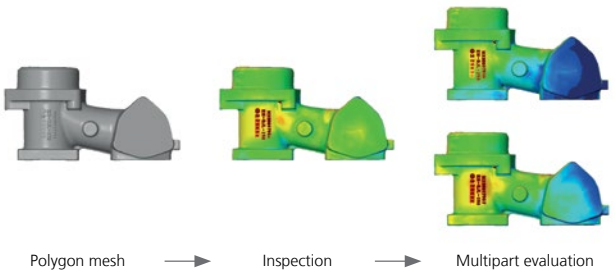
Visual Programming

Evaluations – Measurements – Workflows

With the parametric concept of the software, the simple creation of templates is possible – directly in the graphical user interface and without the need for programming skills.

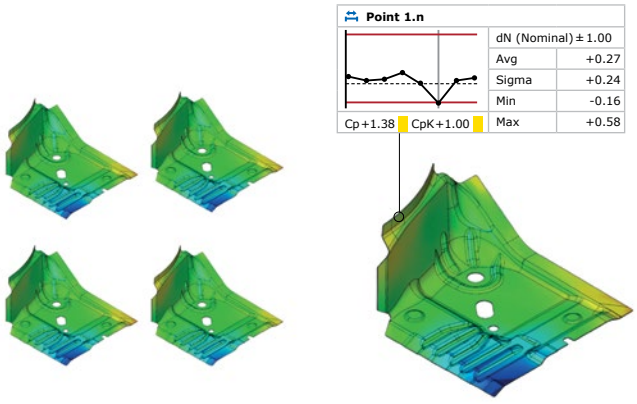
Parametric Inspection

The GOM software is based on a parametric concept, which forms the underlying foundation for every function. This parametric approach ensures that all process steps are traceable, thus guaranteeing process reliability for measuring results and reports.



Teaching By Doing

With Teaching by Doing, any completed evaluation can be easily applied to two or more parts. Thanks to the parametric design, the software automatically stores each individual inspection step. There is no difference between single and multiple evaluations. All evaluation steps can be operated without scripting, previous planning or user intervention, so that no time is spent on programming.

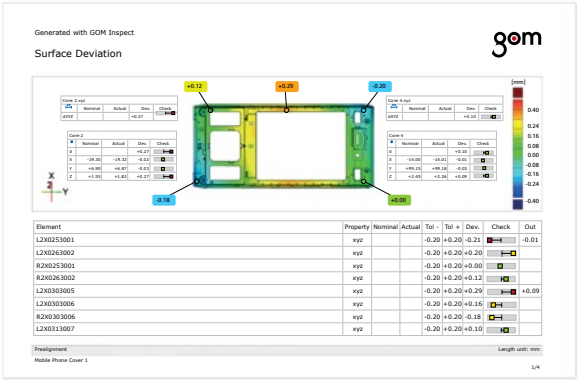


Trend, SPC and Deformation Analysis

The underlying parametric concept of the GOM software enables a trend analysis for multiple evaluations, for example, in statistical process control (SPC) or for deformation analysis. This enables full-field evaluation of several parts or stages within a single project and offers functionalities for determining statistical analysis values such as Cp, Cpk, Pp, Ppk, Min, Max, Avg and Sigma.

Reporting

The reporting module allows creating reports including snapshots, images, tables, diagrams, text and graphics. The results can be visualized and edited in the user interface and then exported as a PDF document. Templates are reusable and each scene saved in a report can be restored in the 3D window.



Kiosk Interface

The Kiosk Interface is a special user interface for a simplified control of the ATOS ScanBox. The software handles the entire process control and performs the measuring and inspection procedure automatically ensuring high precision and data quality: measurement parameters, data, and the operating system are protected.

Virtual Measuring Room (VMR)

The VMR is a virtual, yet functional representation of the real measurement environment, consisting of sensor, kinematics, component with fixture and measurement plan. Combined with the parametric inspection workflows offered by GOM Inspect Professional, the VMR enables the execution of automated measuring procedures: import of measurement plans, offline and online programming, 3D measurement simulation, collision control, process reliability, data acquisition, inspection and reporting.

GOM Services

Support and Training

GOM provides its customers with support and advice throughout the entire product life cycle. GOM application engineers are employed worldwide to commission measuring systems for customers on site and in the local language, or to provide user-specific advice on a measuring task. By email and on the phone, the GOM Support Team not only provides answers to questions relating to software and hardware, but also to applications and processes. An individual update program allows GOM customers to benefit from the latest product developments.

The aim of GOM is not only to provide measuring systems, but also the corresponding technological expertise. GOM provides standardized training courses worldwide for beginners and advanced users for this purpose.

In the GOM Service Area under www.gom.com/service, registered customers are given access to user manuals and application-specific video tutorials. A knowledge database also provides various articles with information on hardware and software. In discussion forums, users also have the option of asking questions and sharing their experiences with other users and GOM experts.

Free GOM Inspect Software

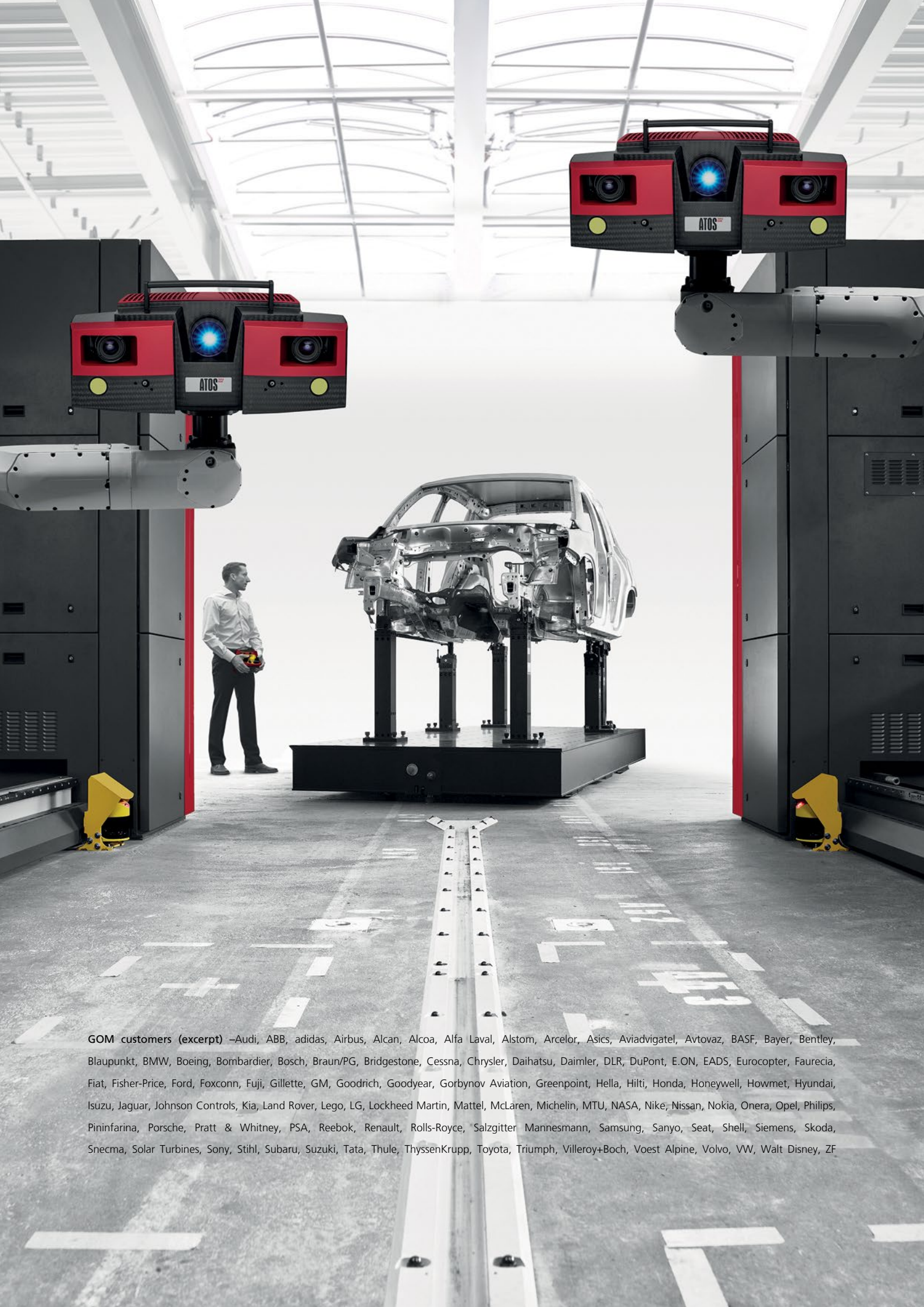
GOM Inspect is a free 3D inspection and mesh processing software for generating polygon meshes and can be used as a viewer for measuring results and CAD data. The free software is designed for users who process and evaluate 3D data.

In GOM Inspect, the parametric functionality is not fully available. The parametric functionality ensures the traceability of measuring data. However, the creation of templates or macros for multiple evaluation and the parametric inspection functionality are only fully available in GOM Inspect Professional. With GOM Inspect, employees, suppliers and customers have a free tool available for evaluating and analyzing measuring results together.

GOM Inspect Compared to GOM Inspect Professional

	GOM Inspect	GOM Inspect Professional	GOM Inspect Enterprise
Polygonize scanner data	■	■	■
Mesh processing	■	■	■
CAD import of basic formats	■	■	■
CAD import of native formats	–	■	■
Import/export of measuring data	■	■	■
Import of volume data	■	■	■
Parametric inspection	–	■	■
Traceability	■	■	■
Teaching by doing	–	■	■
Alignments	■	■	■
Nominal/actual comparison	■	■	■
GD&T analysis	■	■	■
Trend analysis	■	■	■
Creation of trend projects	–	■	■
Airfoil inspection	■	■	■
Surface defect map	■	■	■
Curve-based inspection	■	■	■
Point-based inspection	■	■	■
Scripting	–	■	■
Templates	–	■	■
Reporting	■	■	■
Virtual measuring room (additional module)	–	■	■
Flexible solution for network licenses	–	–	■

Further information at **www.gom-inspect.com**



GOM customers (excerpt) –Audi, ABB, adidas, Airbus, Alcan, Alcoa, Alfa Laval, Alstom, Arcelor, Asics, Aviadvigatel, Avtovaz, BASF, Bayer, Bentley, Blaupunkt, BMW, Boeing, Bombardier, Bosch, Braun/PG, Bridgestone, Cessna, Chrysler, Daihatsu, Daimler, DLR, DuPont, E.ON, EADS, Eurocopter, Faurecia, Fiat, Fisher-Price, Ford, Foxconn, Fuji, Gillette, GM, Goodrich, Goodyear, Gorbynov Aviation, Greenpoint, Hella, Hilti, Honda, Honeywell, Howmet, Hyundai, Isuzu, Jaguar, Johnson Controls, Kia, Land Rover, Lego, LG, Lockheed Martin, Mattel, McLaren, Michelin, MTU, NASA, Nike, Nissan, Nokia, Onera, Opel, Philips, Pininfarina, Porsche, Pratt & Whitney, PSA, Reebok, Renault, Rolls-Royce, Salzgitter Mannesmann, Samsung, Sanyo, Seat, Shell, Siemens, Skoda, Snecma, Solar Turbines, Sony, Stihl, Subaru, Suzuki, Tata, Thule, ThyssenKrupp, Toyota, Triumph, Villeroy+Boch, Voest Alpine, Volvo, VW, Walt Disney, ZF

GOM

Precise Industrial 3D Metrology

GOM develops, produces and distributes software, machines and systems for industrial and automated 3D coordinate measuring technology and 3D testing based on latest research results and innovative technologies.

With more than 60 sites and an employee network of more than 1,000 metrology specialists, GOM guarantees professional advice as well as support and service to operators on-site in their local languages. In addition, GOM shares knowledge on processes and measurement technology in training courses, conferences and application-based workshops.

GOM has been developing measuring technology in Braunschweig since 1990. In the respective research and development departments, more than 100 engineers, mathematicians and scientists shape the measuring technology of the present and the future.

Today, more than 14,000 system installations improve product quality and accelerate product development and manufacturing processes for international companies in the automotive, aerospace and consumer goods industries, their suppliers as well as many research institutes and universities.

GOM headquarters in Braunschweig, Germany

www.gom.com