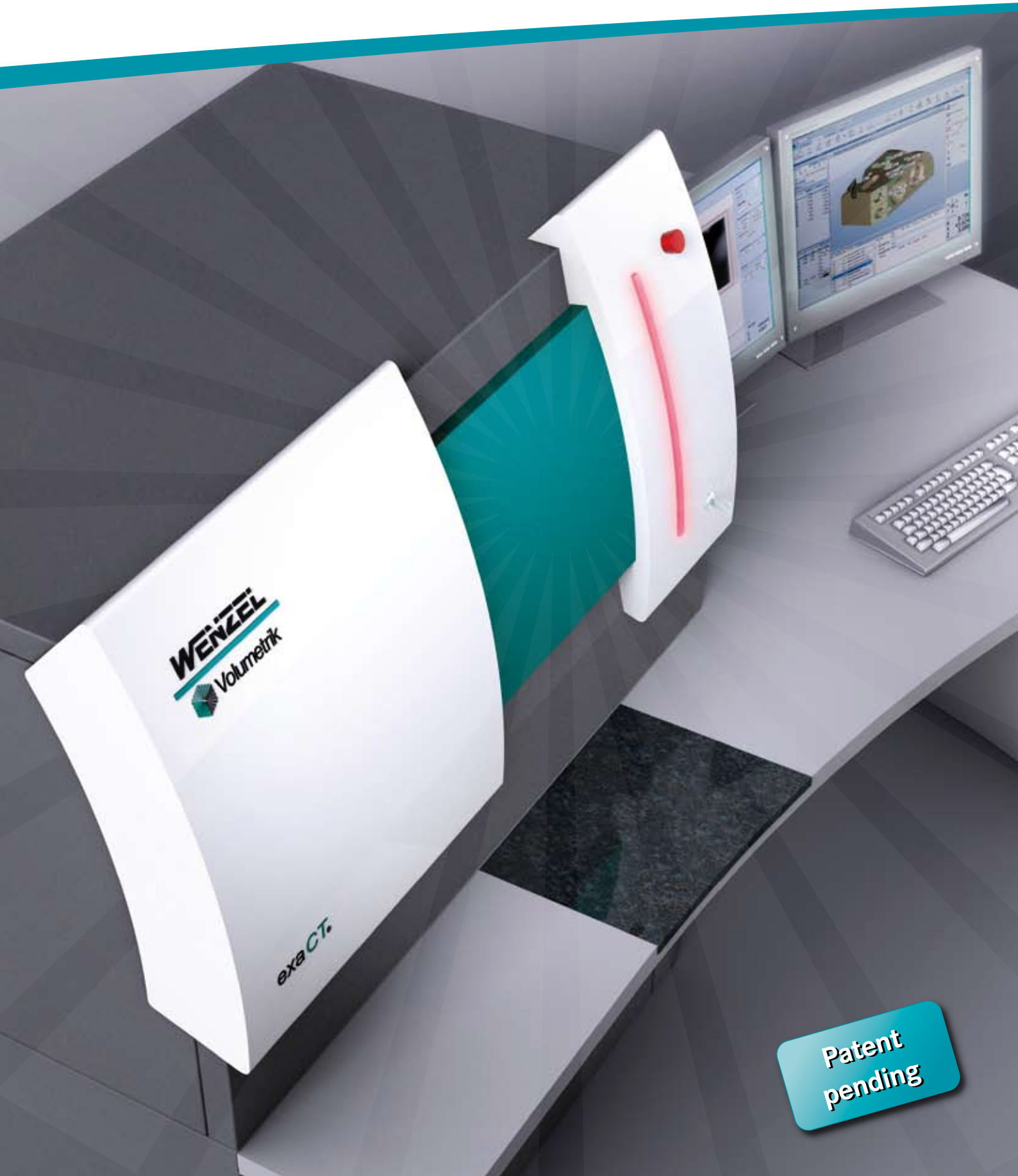
WENZEL®
Volumetrik

The new generation of industrial computed tomography

The CT workstation exaCT®



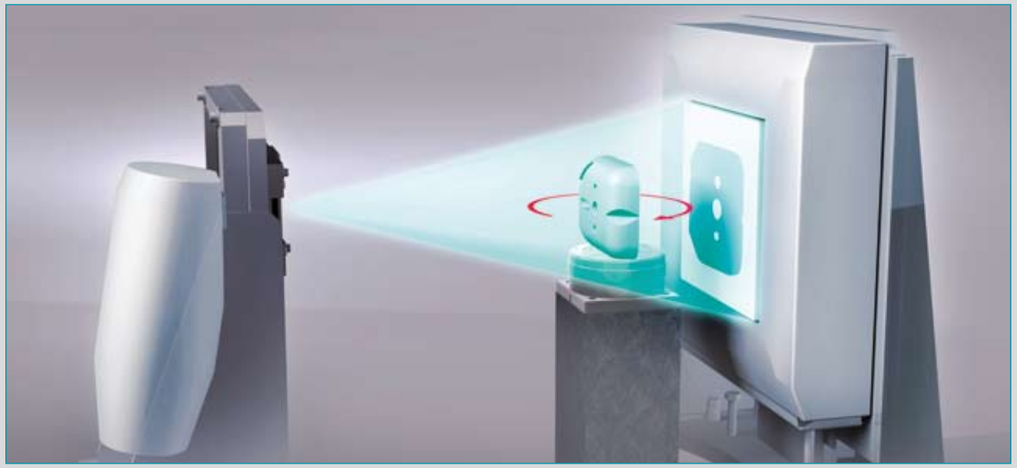
Volume scanning technology

Innovation with a family tradition

Founded in 1968, the family-owned, WENZEL Metrology Group is one of the world's leading providers of high-precision coordinate and gear measurement technology along with industry leading measurement software. When it comes to innovation, WENZEL products continuously set unrivalled standards, that are characterised by manufacturing quality and high precision. Through the acquisition of WENZEL Volumetrik in 2008, the WENZEL Group has extended its product portfolio into the sector of industrial computed tomography (CT). WENZEL Volumetrik is a leading innovator among CT manufacturers and specifically provides powerful and precise devices for carrying out non-contact, non-destructive three dimensional measurements and testing of both internal and external structures of objects. This makes the volume scanning technology from Volumetrik the perfect addition to the coordinate measurement technology from the WENZEL Group.

What is volume scanning technology?

Computed tomography has been used since the 1970s for medical applications. They constitute a further development of classic X-ray technology. While radioscopy X-ray devices reproduce two-dimensional radiographic images of objects, the computed tomography volume scanning technology from WENZEL generates three dimensional volume data.
Its deployment in the industrial sector is relatively recent. The technology of the WENZEL computed tomography is adapted to industrial applications, so that internal and external structures of components can be captured completely.



Operating principle of the exaCT®: The component is rotated in the path of the X-ray beam and a three-dimensional model is reconstructed from a number of two-dimensional projections.

Compact, precise and low-maintenance

If the name WENZEL appears on a new type of measuring machine, this stands for innovation, quality and service. The new exaCT® combines decades of experience in measurement technology and extraordinary quality of WENZEL along with the advanced expertise in CT development from WENZEL Volumetrik. With a new modular system design concept and with innovative sensor technology, WENZEL Volumetrik now produces a range of CT device variants that permits adaptation to different customer requirements.
The result is the exaCT®, an appealing tomography workstation with a compact construction that is more powerful, precise and with very low-maintenance, compared to devices from other manufacturers.

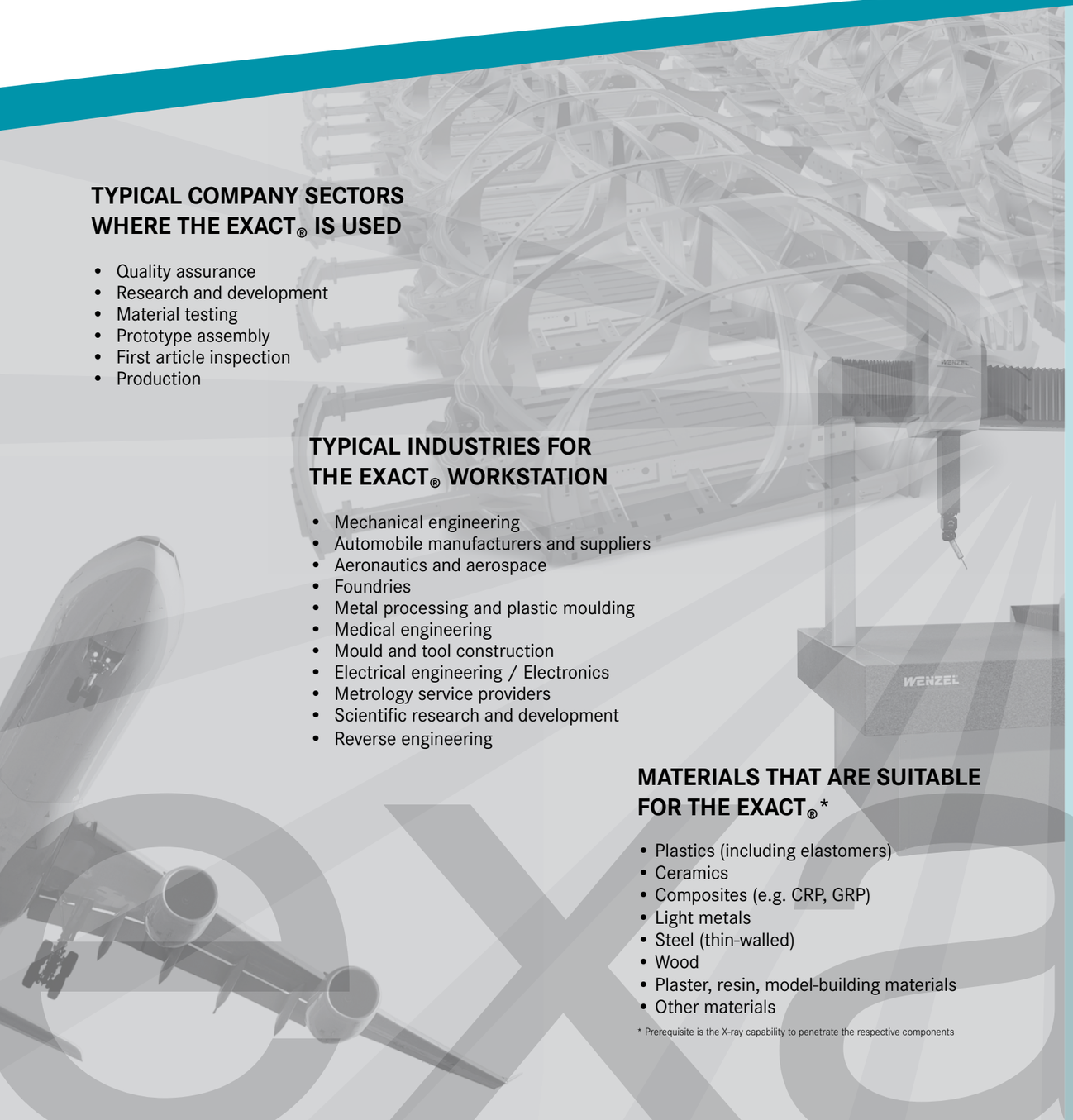
SAFETY INCLUDED

The new exaCT® workstation is a fully protected device based on the strict legal requirements of the German X-ray Directive and DIN 54113. Its use is non-hazardous for the operator.
There is also no danger from components that have been exposed to X-ray.

Fields of application

Can be used across various industries

Measurements with tactile or optical coordinate measurement machines cannot be carried out on every component. The exaCT® volume scanning technology enables measurements to be taken inside objects. A further advantage is the rapid data acquisition and high density of the volume data. This makes its use technically and economically interesting, where complete scanning of the geometry is required in a short period of time.



TYPICAL COMPANY SECTORS WHERE THE EXACT® IS USED

- Quality assurance
- Research and development
- Material testing
- Prototype assembly
- First article inspection
- Production

TYPICAL INDUSTRIES FOR THE EXACT® WORKSTATION

- Mechanical engineering
- Automobile manufacturers and suppliers
- Aeronautics and aerospace
- Foundries
- Metal processing and plastic moulding
- Medical engineering
- Mould and tool construction
- Electrical engineering / Electronics
- Metrology service providers
- Scientific research and development
- Reverse engineering

MATERIALS THAT ARE SUITABLE FOR THE EXACT®*

- Plastics (including elastomers)
- Ceramics
- Composites (e.g. CRP, GRP)
- Light metals
- Steel (thin-walled)
- Wood
- Plaster, resin, model-building materials
- Other materials

* Prerequisite is the X-ray capability to penetrate the respective components

The exaCT solution for many tasks

The applications for the exaCT® workstation are measurement and testing technology where 3D data of complex internal and external structures are required.

The tasks that can be performed with the exaCT® are numerous and range from material analysis, through the testing of joining technology, right up to reverse engineering.

The following applications provide an overview.

Measurement technology

Dimensional control
The measurement of regular geometries and free-form surfaces as well as the corresponding volumes with the exaCT® is accurate, non-contact and non-destructive. The measurement is carried out in the same way as with a conventional coordinate measurement machine – but also inside the components.

Wall thickness analysis
In many cases, components of specific wall thickness must be kept within tolerance. The exaCT® provides quick, precise measurements which can be displayed by colour rendering.

Actual-to-nominal comparisons
The exaCT® can check CAD nominal data against actual measured data on real parts or the size of the deviations of specific components in comparison to a ‘master’ part. Components that are subject to extended use, with a degree of wear on the components can be tested. Deviations can be displayed and evaluated by colour rendering, statistical evaluations or single point deviations.

Tool and component optimisation
The exaCT® enables a significant reduction in the development cycles, during the sampling process. This is achieved through iterative compensation of material shrinkage in injection and casting moulds, hence considerably reducing costs.

Development, rapid prototyping and reverse engineering
The exaCT® can also be used for development, design or for the reconstruction on the basis of existing components.
In the case of reverse engineering, CAD-compatible data can be generated.

Testing technology

Material defect analyses
The exaCT® can be used to examine workpieces non-destructively for material defects such as cracks, pores, pinholes, inclusions, inhomogeneities or variations in density. The defects are displayed and evaluated as 2D sectional representations or 3D representations in which virtually any 3D sections can be placed.

Structural analyses
Flaws, delaminations (especially in composites) or material defects that are attributed to incorrect or deficient material composition or structure can be detected reliably with the exaCT® and analysed using 2D or 3D visualisations.

Assembly tests
Assemblies can be inspected with the exaCT® in order to check assembly results. This makes it possible to ascertain whether the position of separate components match one another, or parts have been wrongly assembled, or seals are defective, etc. Even malfunctions that are no longer visible after cutting or disassembly can be detected.

Joining technology testing
The exaCT® can be used to quickly identify and analyse defective joints non-destructively during welding, soldering, riveting or gluing.

Electronics testing
The exaCT® can be used for checking soldered or glued joints in electronic components. Joints and attachments that are defective are visible on the tomographic result.

Product advantages

Superior point by point

The new exaCT® computed tomography workstation has an innovative system concept. WENZEL Volumetrik has systematically concentrated on the specific needs of the user. The result is a device that is not only partially superior, but point by point to comparable devices. The exaCT® is based on a modular system concept with an exceptional system stability. The integrated desk serves as a workspace for measurement and data analysis forming a perfectly designed, ergonomic workstation.
Also integrated: software, service, consultation and training.

Lower footprint with higher performance

The compact computed tomography workstation is easy to integrate in a wide range of working environments. This saves expensive production floor space. Access to the rear is not required which means the exaCT® can be installed close to the wall, saving space. The exaCT® also provides higher performance with smaller equipment dimensions than comparable products from other manufacturers.

Perfect operating ergonomics

Not only is the design of the exaCT® attractive, but also the superior ergonomics are a major benefit. Everything is designed in such a way that the exaCT® is easy to operate while providing a perfect overview. Just how the perfect CT workstation of the future should be!

High level of proprietary manufacture

There is a large amount of proprietary manufacturing from WENZEL. For the exaCT®, this means: all of the installed components are perfectly matched to one another, the software has proven its performance in practice. Logical consequence: the need for servicing the system and the time and effort required for training are low.

Automatic loading door

Integrated in the operating concept, the software-controlled door opens and closes at the right time.

High-precision mechanics from our own production line

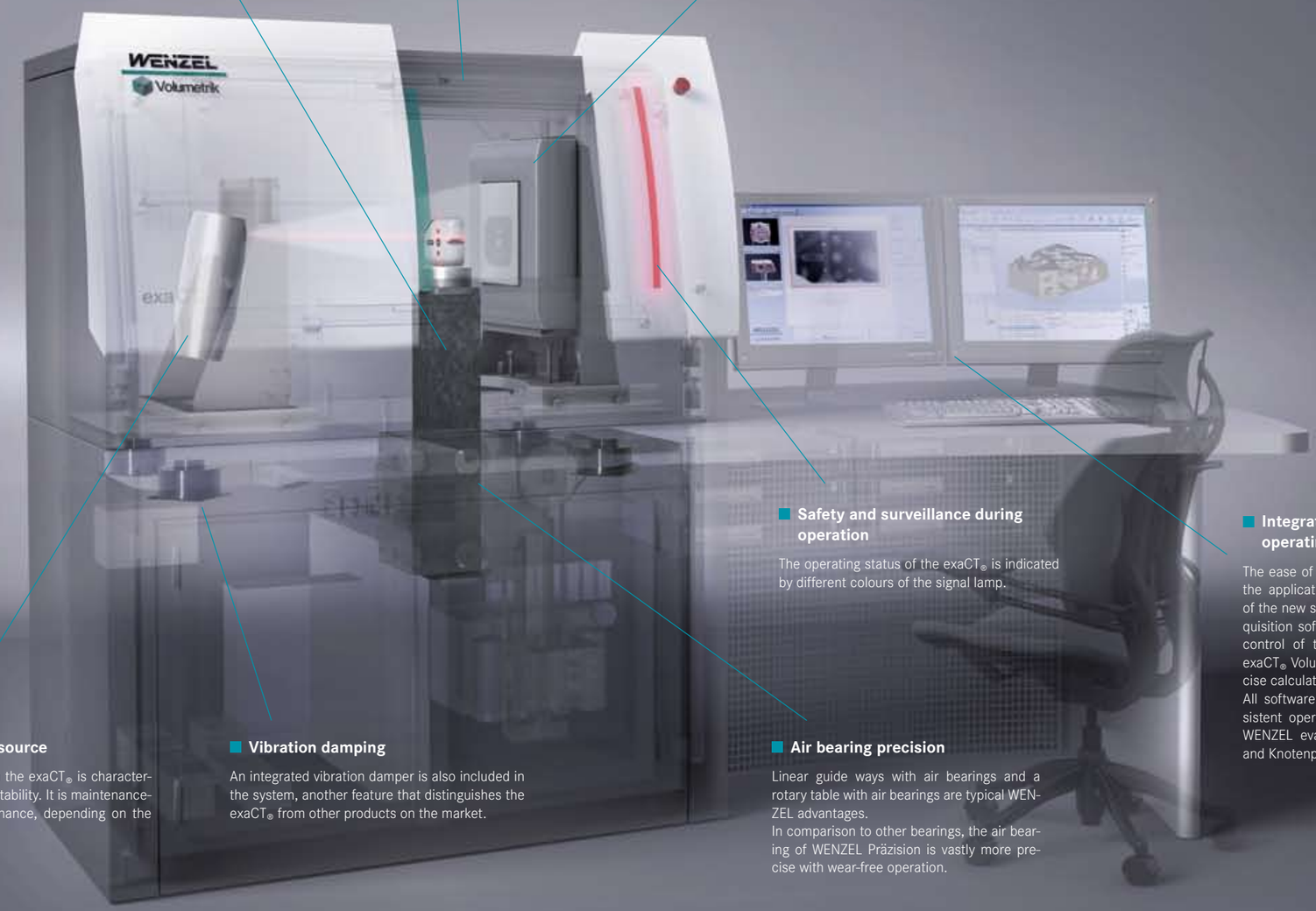
WENZEL Präzision has been known for decades for its superior, high-precision mechanics in the field of coordinate measurement technology. Therefore, the granite-based mechanics of the exaCT® originate from WENZEL Präzision.

Assistance in setting up also provided

Integrated video cameras and laser markers are used for rapid and precise set-up of the workpieces.

Detector for industrial use

The detector integrated in the exaCT® is a proprietary development of WENZEL Volumetrik. It was specially optimised for metrological use in the industrial sector and provides excellent resolution, high dynamics and sensitivity – and hence a unique image quality.



Stable X-ray source

The X-ray source in the exaCT® is characterised by its special stability. It is maintenance-free or low-maintenance, depending on the device variant.

Vibration damping

An integrated vibration damper is also included in the system, another feature that distinguishes the exaCT® from other products on the market.

Safety and surveillance during operation

The operating status of the exaCT® is indicated by different colours of the signal lamp.

Air bearing precision

Linear guide ways with air bearings and a rotary table with air bearings are typical WENZEL advantages.
In comparison to other bearings, the air bearing of WENZEL Präzision is vastly more precise with wear-free operation.

Optimum price/performance ratio

The exaCT® sets new benchmarks in terms of price/performance ratio. Therefore, computed tomography is now affordable, even for medium-sized companies.

Low-maintenance

The high manufacturing quality, the proven WENZEL mechanics, air bearings and stable X-ray source lead to low maintenance and high availability. If still failure occurs, the global WENZEL Service organisation is just around your corner.

Integrated computing power and control cabinets

A high-performance computer cluster is integrated under the desk for rapid reconstruction of the 3D volume data. A separate rack is not required in the majority of instrument variants.
The electronic components are also integrated in the lower part of the exaCT®, removing the need for a separate control cabinet.

Integrated and consistent operating concept

The ease of operation and high performance of the application software are further highlights of the new system. The exaCT® control data acquisition software was developed for optimised control of the computer tomograph and the exaCT® Volume reconstruction software for precise calculation of the 3D volume data.
All software modules are integrated in a consistent operating concept just like the proven WENZEL evaluation tools, Metrosoft QUARTIS and Knotenpunkt PointMaster.

Simply exaCT

One idea in several models

The exaCT® is based on a modular concept. This allows a number of device variants, according to customer requirements These are primarily differentiated by the X-ray source, the detector and by the component sizes that can be measured.

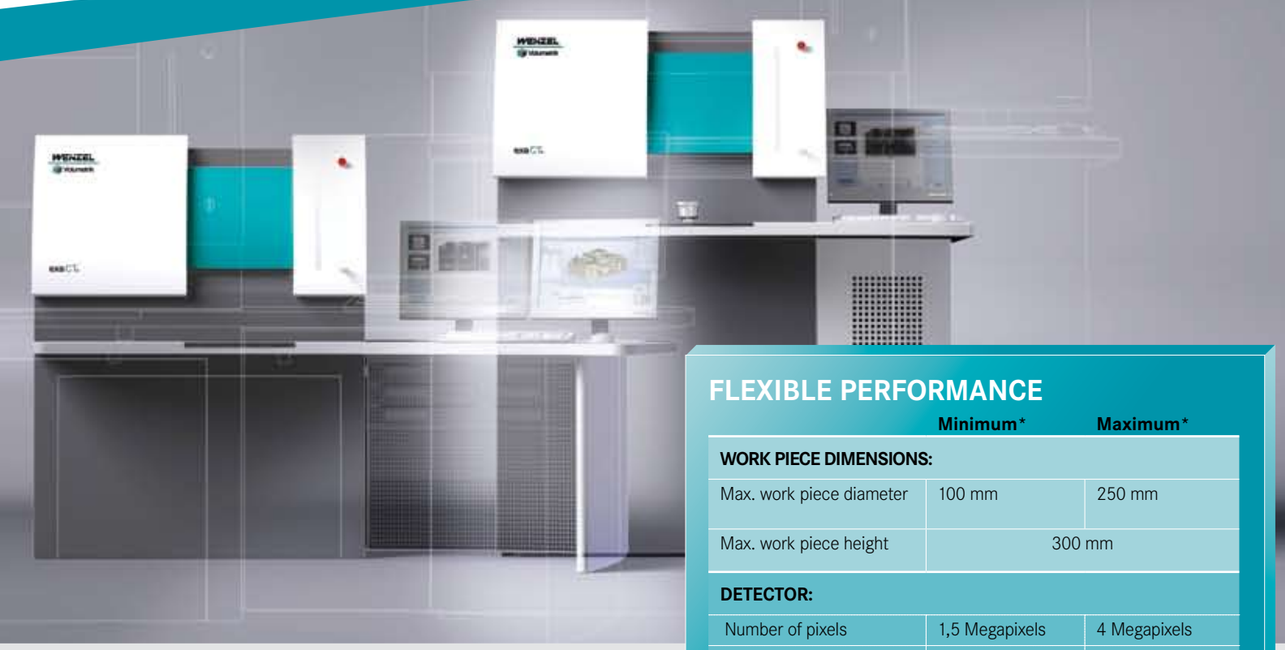
Two versions of the exaCT® CT workstation are also available – one that is integrated in a common desktop workstation for the computer tomograph with evaluation workspace and a special space-saving, pure measurement station.

What connects all exaCT® versions is the compact design (design patent protected), the sophisticated ergonomics and the idea of combining more performance and flexibility with a smaller footprint.

Operating concept

Beautifully simple and well conceived

Above all, the performance capability and the user friendliness of the integrated application software ensure that the full extent of the innovative device concept of the exaCT® is brought to bear. The exaCT® control data acquisition software for optimised control of the computer tomograph and the exaCT® Volume reconstruction software for precise calculation of the volume data was developed by WENZEL Volumetrik. The evaluation software of the exaCT® has a direct link to the proven software products of Metrosoft QUARTIS from WENZEL Metromec and PointMaster from WENZEL Knotenpunkt. Interfaces to other evaluation software packages such as VGStudio MAX are also offered.



CT control and reconstruction

You don‘t need to be a computed tomography specialist to operate the exaCT®. Intuitive user guidance allows excellent measurements to be generated after a short training period. The exaCT® thinks too: Measurement parameters are automatically optimised by the system. Specially developed for industrial use, the CT control unit and reconstruction software ensure high precision and high quality results.
In contrast to other manufacturers, the entire image processing chain and 3D reconstruction are carried out with our own software. This allows the components to be optimised and finely matched to one another, thus achieving the high quality standards.

Dimensional measurement

The decades of experience gained by WENZEL Metromec in 3-dimensional coordinate measurement technology is underlined in the key advantages that the Metrosoft QUARTIS measurement software also offers its users in the field of computed tomography:

- Non-destructive and non contact metrological evaluation of all contours and surfaces of a component as well as the internal structures of workpieces
- Clear, flexible and results-oriented user interface with proven construction and alignment functions
- Full functionality for evaluation of shape, position and dimension with simple display of the measurements in meaningful measurement reports
- Intuitive measurement programming for the automation of measurement sequences

Nominal-to-actual comparison and reverse engineering

The PointMaster software from WENZEL Knotenpunkt is one of the world’s best surface generation tools which can be used to generate and process exact free-form surfaces from CT data. PointMaster also fulfils important functions for CT evaluations:

- Can be used for reverse engineering
- Nominal-to-actual comparisons against 3D CAD models, display using colour rendering
- Innovative functions for iterative compensation of material shrinkage in injection and casting moulds

TWO TYPE OF INSTRUMENT MODELS

CT measurement and evaluation station

- Computer tomograph with integrated desk for measurement and evaluation
- Space requirement with desk (L x W x H): 2300 mm x 1290 mm x 1460 mm

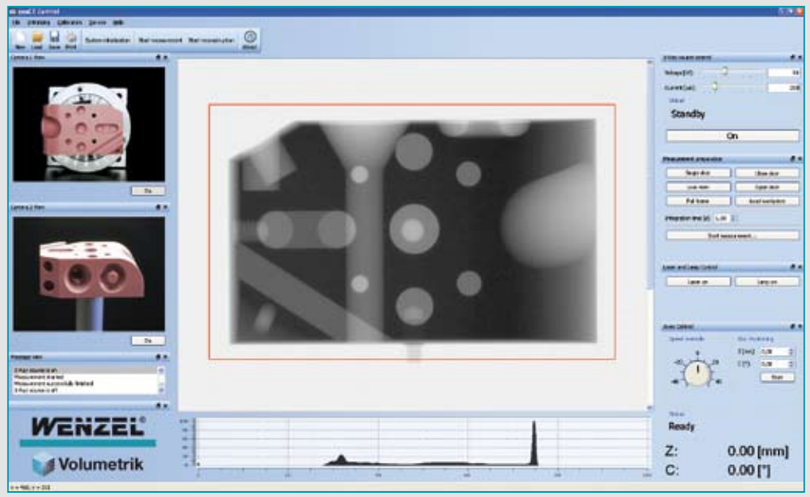
CT measurement station

- Computer tomograph with integrated supporting table for measurement
- The evaluation is conducted at the desk
- Space requirement with supporting table (L x W x H): 1600 mm x 960 mm x 1810 mm

FLEXIBLE PERFORMANCE

	Minimum*	Maximum*
WORK PIECE DIMENSIONS:		
Max. work piece diameter	100 mm	250 mm
Max. work piece height	300 mm	
DETECTOR:		
Number of pixels	1,5 Megapixels	4 Megapixels
Pixel size	20 µm	100 µm
AD conversion	16 bit	
X-RAY SOURCE:		
Maximum acceleration voltage	80 kV	225 kV
Power	50 W	1500 W
Cooling	air (integrated)	water (integrated)
MECHANICS:		
Linear guide ways	Granite guide ways with air bearings	
Turntable bearings	Roller bearing	Air bearing
Position measuring systems	High-resolution optical precision measuring systems	
Calibration and monitoring	Calibration and test artifact acc. to VDI/VDE 2630 (draft)	
Radiation protection	Full radiation protection chamber	
Setup	Close to wall or middle of the room installation possible	
Maintenance accesses	Lateral and front	

* The technical data can lie between the minimum and maximum values, depending on customer requirements.
Technical changes reserved.



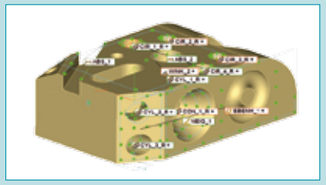
Applications

One measurement – multiple evaluations

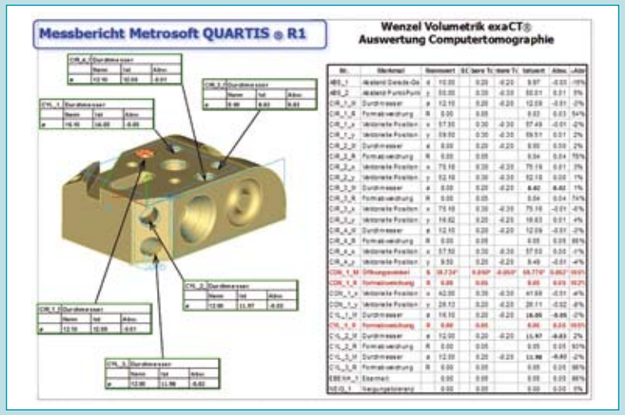
The strengths of the exaCT® are revealed in the specific application. The possible applications are, however, too numerous to mention them all. For this reason we have shown examples of specific applications here to make our advantages clear. As with the exaCT® volume scanning technology, both material and geometry data are present, so multiple evaluations can be carried out on the basis of a single measurement such as a functional and assembly check with material analysis and dimensional metrology. Because of the non contact and non destructive measurement, components that are not suitable for other measurement techniques, such as tactile or optical coordinate measurement machines can be examined. Fast and complete digitising of objects can be performed by scanning the overall geometry in a single measurement step. Deviations from the nominal geometry can be visualised by colour rendering. Also semi-transparent representations can provide a rapid three-dimensional overview of defects in components. Finally, the segmentation of different materials or sections within components can be used for carrying out assembly or material checks.

Dimensional measurement technology on a plastic component

Volume model of the component in semi-transparent display. The internal structures are visible

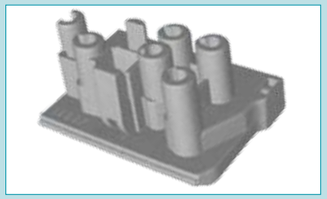


Virtual probing points

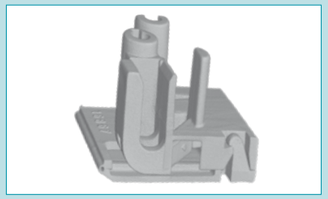


Measurement report: Shape and position tolerances are evaluated in the same way as with conventional coordinate measurement machines

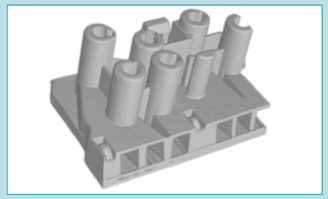
Functional check and material analysis of a plug-type connector



Visualisation of the connector



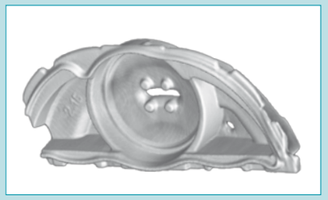
Virtual 3D section through the connector: the closing mechanism can be checked when it is closed.



Material analysis: The 3D section reveals pores beneath the surface of the injected moulded component

Nominal-to-actual comparison of a silicon component

Elastic silicon component

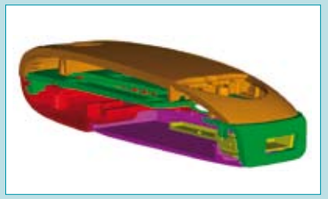


3D visualisation of the interior

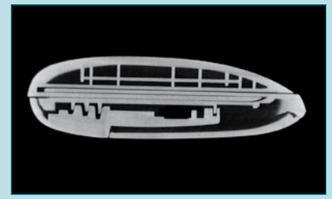
The colour rendering shows deviations throughout the component. The measurement flags show deviations at selected points

Assembly check of a cellular phone housing

Sliding cellular phone housing

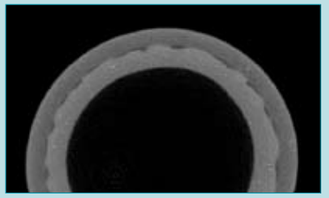


Virtual 3D section through the segmented cellular phone housing: The position of the individual parts is analysed when assembled

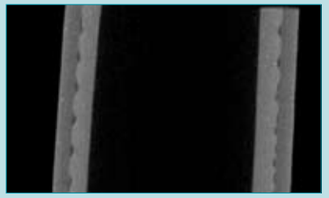


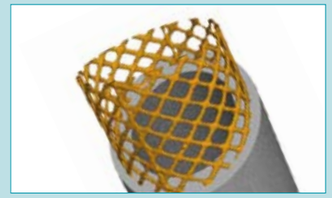
The gaps and correct assembly can be checked

Material and structural analysis of a hose



Transverse and longitudinal section through a hydraulic hose: the different rubber composition is revealed by grey tones. Inclusions in the material can be detected as bright points

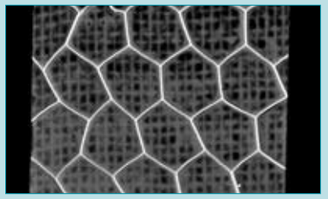




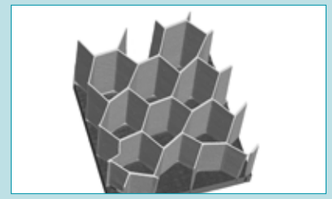
The mesh structure can be visualised and analysed through material segmentation

Defect analysis on a composite component

Composite component made of CRP and aluminium

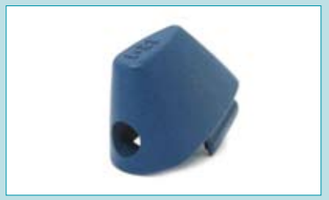


The 2D section shows the aluminium structure and tissue structure (adhesive layer)



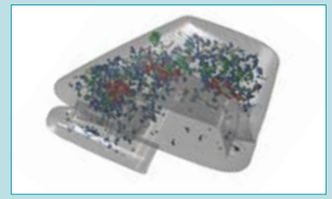
The volume rendering allows the analysis of the 3D honeycomb structure.

Porosity analysis on an aluminium cast part



Aluminium cast part

The virtual 2D section shows porosity in the component



The 3D porosity analysis shows the size, distribution and position of the voids in the component

At a glance

exaCT® – The most important advantages

- High-performance computed tomography workstations with small footprint
- Precise, non contact and non destructive measurement, even inside components
- Versatile volume measurement technology: One measurement – multiple evaluations
- Latest generation of innovative detector technology
- Precision mechanics from WENZEL
- Excellent operating ergonomics
- Ease of use of the proprietary data acquisition, reconstruction and evaluation software
- Flexible system concept and device variants for adapting to a wide range of customer requirements
- Optimum price/performance ratio
- Low-maintenance

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