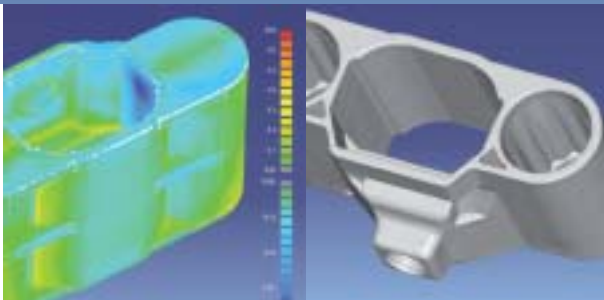


Metrotom. The Revolution in Metrology.



We make it visible.

Metrotom. Make surface and interior geometries visible and measurable.



Key features



Comprehensive design

- 3D computer tomography with micro-focus x-ray tubes and detector
- Rotary table for clamping device and positioning device from Carl Zeiss

Safe technology

- Full-protection enclosure
- Meets radiation protection regulations in accordance with DIN 54113 for full-protection devices (0.5 mr/h on external skin) of this type
- Ergonomic design (unique loading position)

Machine technology



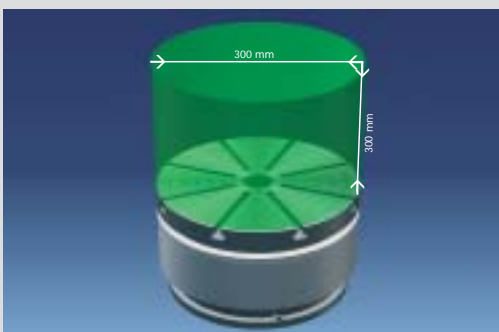
Proven linear technology

- In-house machine components related to precision
- Compensation of guideway errors (CAA corrected)

Original Carl Zeiss Rotary Table

- Rotary table with direct drive
- In-house air bearings
- Resolution: 0.036"
- Max. load (centric): 500 N

Measuring range



Optimum measuring range

- 300 x 300 x 300 mm

Inspectable materials

- Dependent on the amount of total material thicknesses and composition
- Plastics up to 250 mm thick
- Light metal alloys up to 120 mm thick (Al, Mg)
- Model construction materials up to 200 mm thick (plaster, wood, bakelite, resin and sand cores)
- Ceramics and compound materials (depending on the density, porosity and composition)
- Steel (Metrotomography® up to 10 mm, defect checks up to 15 – 18 mm)

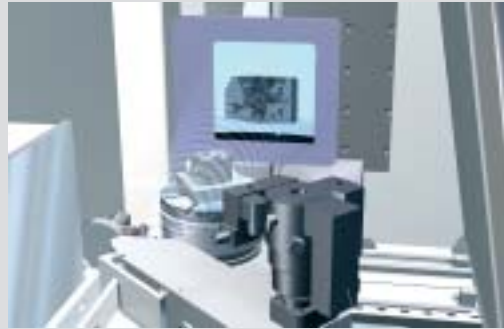
Sensor systems

Micro-focus x-ray tubes

- High voltage: 10 – 225 keV
- Tube power: 5 – 3000 μ A
- Target performance: 320 W max.
- Angle of reflected beam: 50° conical
- Angle of useful beam: 30° conical
- Size of focal point: > 7 μ m

Flatbed detector:

- Detector system with extremely high sensitivity
- 1024 x 1024 pixels at 400 μ m² for 3D-CT
- Low distortion, digital radiography



Operation

Simple and safe

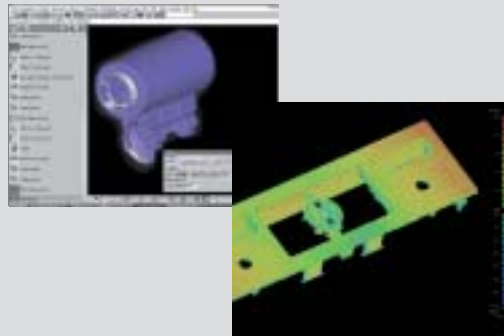
- Doors close automatically as soon as measurement starts
- Easy-to-understand operation and advanced ergonomic design
- Operator never has to enter the measuring area
- Metrology evaluation in a familiar software environment
- Minimal training required



Software

Easy-to-use, precise software

- New technology, known evaluation environment: Calypso
- All evaluation possibilities: testing and measuring with Calypso, reverse engineering and geometry comparison
- Unique: automatic recognition of cavities
- Analysis separate from the machine
- Already generated protocols can be reused with Calypso



Precision

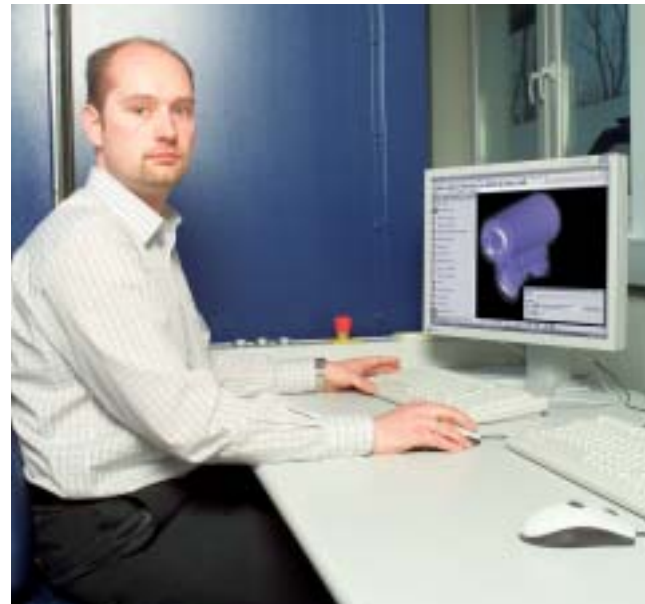
Optimum accuracy

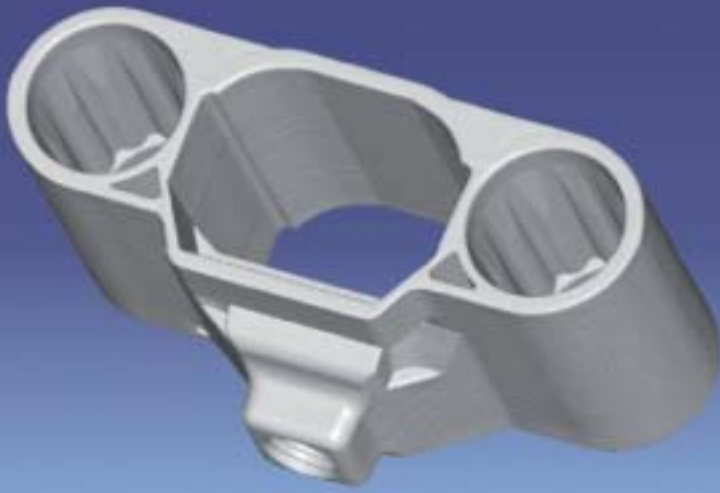
- Unparalleled precise results for internal and external geometries
- Accurate with most aluminum, plastic and elastomer applications
- Exact verification of accuracy after a GR&R (Gage Repeatability & Reproducibility) measurement on a workpiece



A new world of Metrology.

Metrotomography[®], the fusion of metrology and tomography, delivers new possibilities to industrial metrology. It is now possible to measure very accurately and non-destructively in areas where only inspections or no quality assurance took place in the past - the interior of highly complex parts.



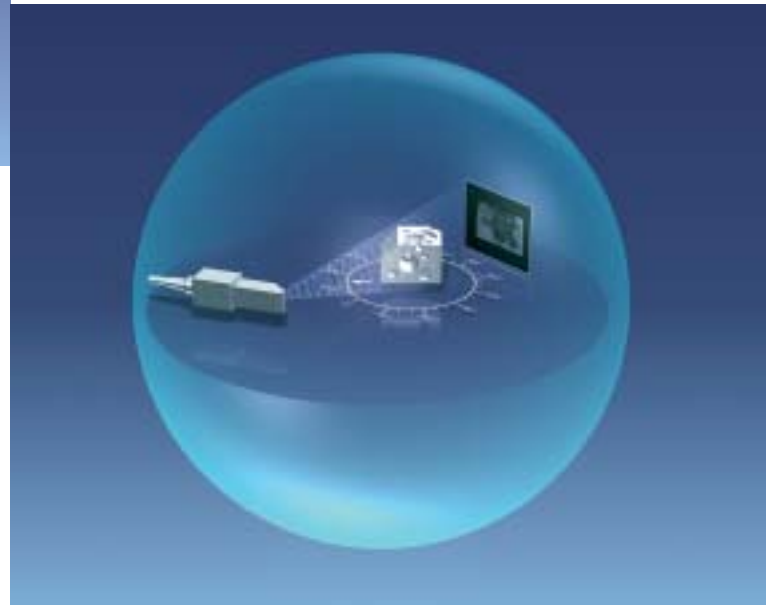


Principle of 2D x-ray technology

The Metrotomography® procedure is based on the principle of x-ray technology. An x-ray source illuminates the respective object with electromagnetic radiation. The beams meet on a detector surface and are recorded in varying degrees of intensity depending on the geometry and absorption characteristics of the irradiated object. The result is a two-dimensional gray-scale image.

Principle of 3D computer tomography

However, the 2D image generated using x-ray technology is only meaningful for visual inspection when shown as a cross section. In the Metrotomography® procedure, the component is rotated 360° around its own axis, resulting in a 3D image of the entire volume of the workpiece.



Evaluation of a metrotomograph

Metrotomography allows you to measure the interior of a workpiece: all recorded data can be applied to all areas of quality assurance and be evaluated. Non-destructive testing technology, such as assembly inspection, damage and porosity analysis, material inspection and defect checks are possible as well as traditional evaluation, reverse engineering applications or a comparison of geometries.

All around safety

The use of x-rays is subject to strict guidelines on radiation protection. Metrotom complies with the directives of the radiation protection ordinance in accordance with DIN 54113 for full protection devices of this type. Furthermore, we provide comprehensive support when laying the foundation, while setting up your Metrotomography® machine and for acceptance testing.

Inspection with one look.

The information provided by quality checks depends on the precision of the image: the more detailed the display, the more precise the evaluation. Thanks to the highly accurate display of even complex internal geometries, the Metrotomography® procedure opens up the entire range of evaluation possibilities to testing technology.

Assembly inspection

Component:

Lighter, plastic

Task:

Check the correct assembly of all single components

Result:

Volume model shows correct assembly



Inspection of materials

Component:

Ski boot, plastic with metal parts

Task:

Inspection of material errors

Result:

Volume model and display of material show no possible breakage points

Defect analysis

Component:

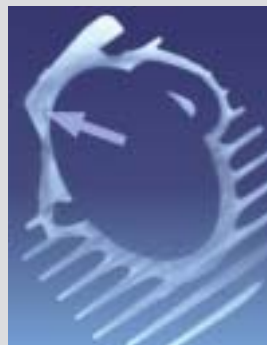
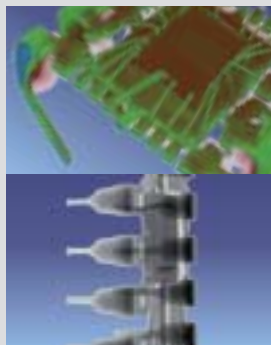
Chip, plastic with metal parts

Task:

Inspection for defects

Result:

3D view of the volume model shows no sources of error



Porosity analysis

Component:

Cylinder, cast

Task:

Inspection for cavities or inclusions

Result:

Susceptibility to breaking as a result of cavities in the casting

Damage analysis

Component:

Miniature coil, plastic with wire

Task:

Determine cause of failure

Result:

Volume model shows wire separation on soldering point

Comparison: Coil size 5 mm



Metrotomography® - overview of the advantages

- Inspection analysis of complex parts
- Non-destructive inspection of previously unreachable internal geometries
- Reduction of product development cycles through fast and highly accurate analyses
- Efficient prototyping
- Automatic recognition of cavities

New technology - familiar evaluation.

Unlike standard computer tomography procedures, Metrotomography® goes beyond pure visual inspections and offers the possibility of also measuring the internal and external geometries of highly complex workpieces. And that with the same evaluation environment as before.

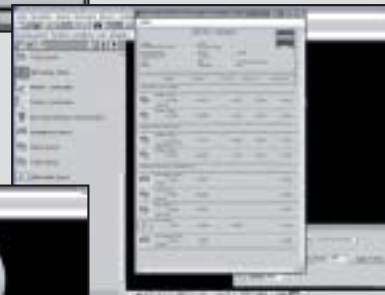
Read the features and orientation from the drawing or the CAD data set and specify a measurement strategy



Enter and align the CAD model with the CT dataset.



Start new CNC measurement plan and evaluate the protocol.



Generate a CNC measurement plan based on the CT data set or the CAD data

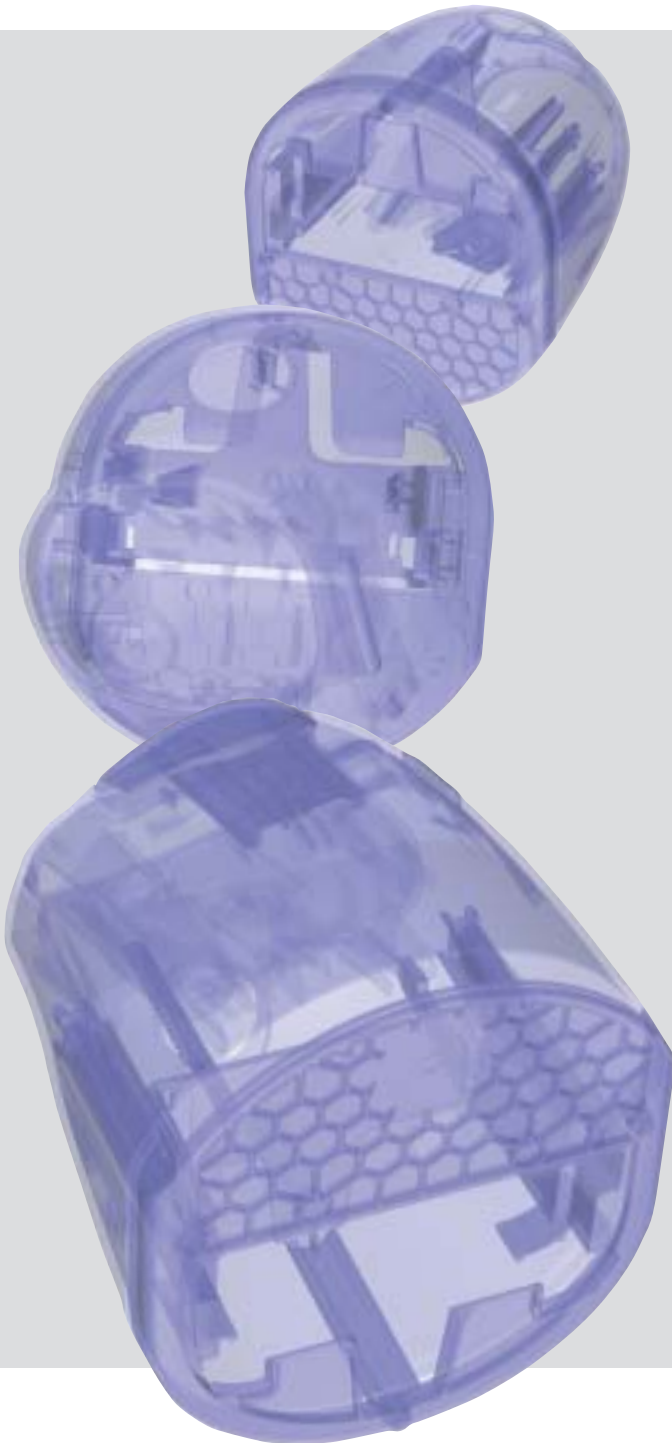


Metrotomography® - overview of the advantages

- Metrology inspection of workpieces that previously could not be measured
- Familiar evaluation environment
- Use of existing Calypso protocols
- Evaluation away from the machine

Fast and efficient with Metrotomography®: from the first casting to the test sample report.

The part is in the middle of development, tools are being manufactured, the first casting is finished - now the workpiece must be quickly and precisely measured. This is just a matter of a few seconds with Metrotomography®.



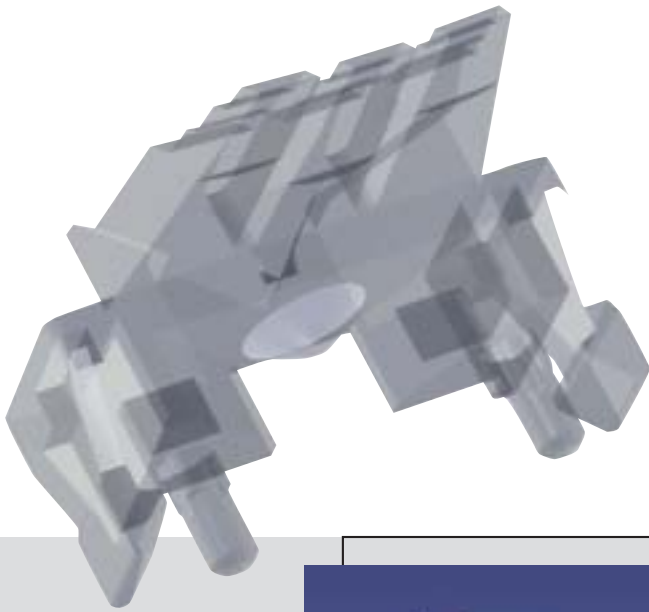
Quality assurance is often an extensive process during the development and design phase of every day objects such as cell phones and razors or toothbrushes, as well as automotive parts. Between the single development steps, the part must be repeatedly inspected – with traditional measuring methods this is usually a very time-consuming process that becomes impossible with complex components.

This is where Metrotomography® is the ideal measuring method for quickly and efficiently generating highly accurate quality data on a workpiece.

The Clean&Renew™ system from Braun: the surface quality and internal geometry was inspected using Metrotom.

Metrotomography® - overview of the advantages

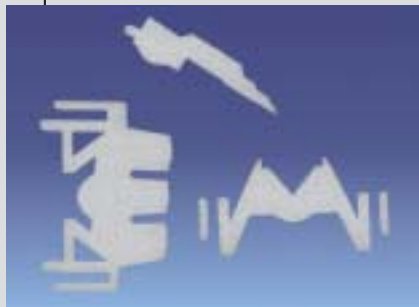
- Fast and highly precise quality assurance during development
- Complete internal and external geometry of every measurable part
- Efficient component optimization for the casting process
- Generation of measurement data of parts that could not be measured in the past



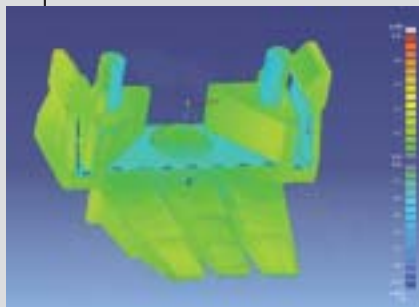
The light guide of a well-known automobile supplier – here the CAD data from the simulation software – was checked for proper operation using Metrotomography®.



CAD data only is available for quality assurance as this light guide was developed using simulation software. Without Metrotomography®, it would only be possible to conduct a limited inspection of the part by destroying it as it is impossible to produce detailed information on material quality with parts that are approximately 1.5 cm big.



A volume model is generated during the Metrotomography® process which enables initial visual checks. The sections displayed here show no inclusions or other material defects.



The actual data is determined via reverse engineering. Any deviations are visible chromatically. For the first time, it is possible to compare geometries directly for this part.



If CAD data is required again, because the casting process is changed, for example, the software calculates a point cloud from the volume model. Splines and knots are generated via reverse engineering, delivering a complete CAD model at the end of the procedure.

Is it what it really should be?

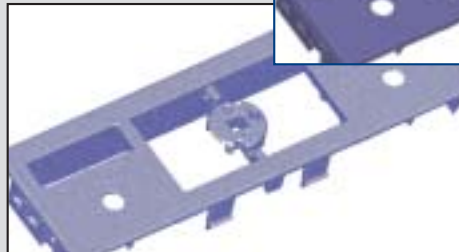
Many single parts are developed solely with simulation software, particularly in automobile construction. In this case, only CAD data is available for quality assurance in volume production. With Metrotomography®, it is possible to conduct the necessary comparison of external and internal geometries reliably and within a short time.

How it works:

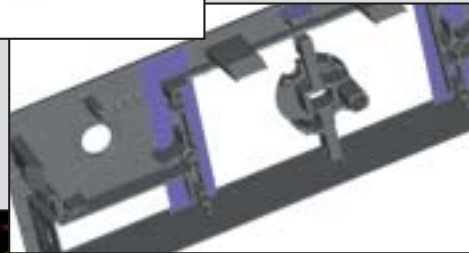
1 Scan the CAD design data



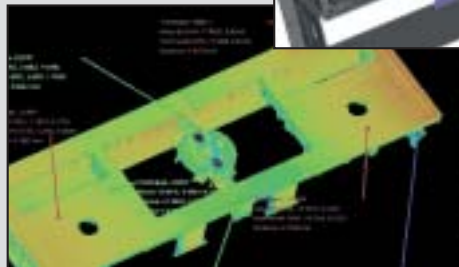
2 Enter the point cloud from the metrotomograph



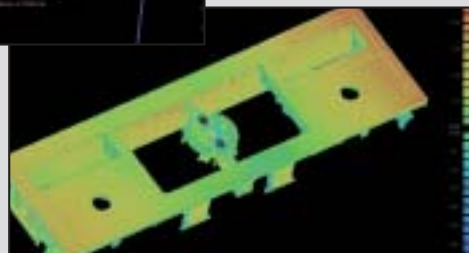
3 Align the data sets to each other

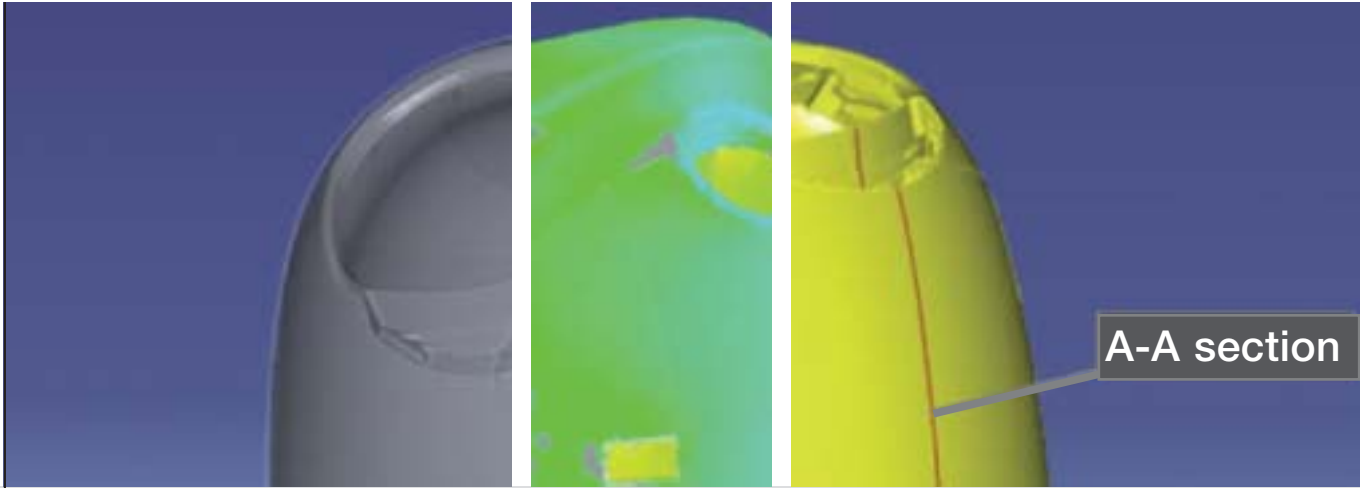


4 Display the deviations as measurement flags or

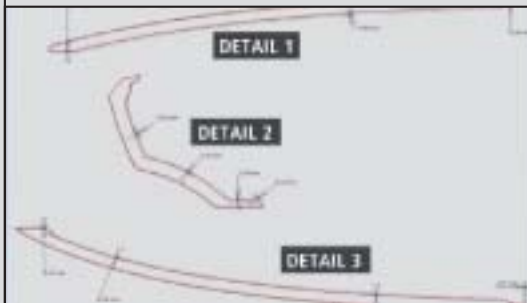


5 Extensive, colorful displays of the deviations





The Metrotomography® data from the razor cleaner from Braun shows a perfect surface; the comparison of geometries shows an almost perfect match between plan and actual data; and the display of the cross section confirms these results.



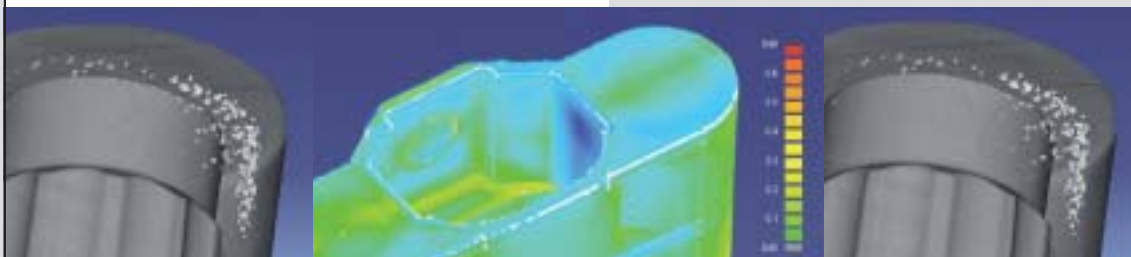
It is also not possible to recognize any defects during a detailed inspection of the cross section.

**Possible for the first time:
exact surface evaluation**

Volume production has already started. Until now, it has not been possible to inspect the surface quality of the Clean&Renew™ system from Braun. The visual inspection revealed no noticeable dents, waves or bumps. The comparison of the geometries and the display of the cross section deliver the metrological proof: optimum surface quality.

Inspection of surface quality

Inspection of material quality



The volume model and the comparison of geometries show material defects.

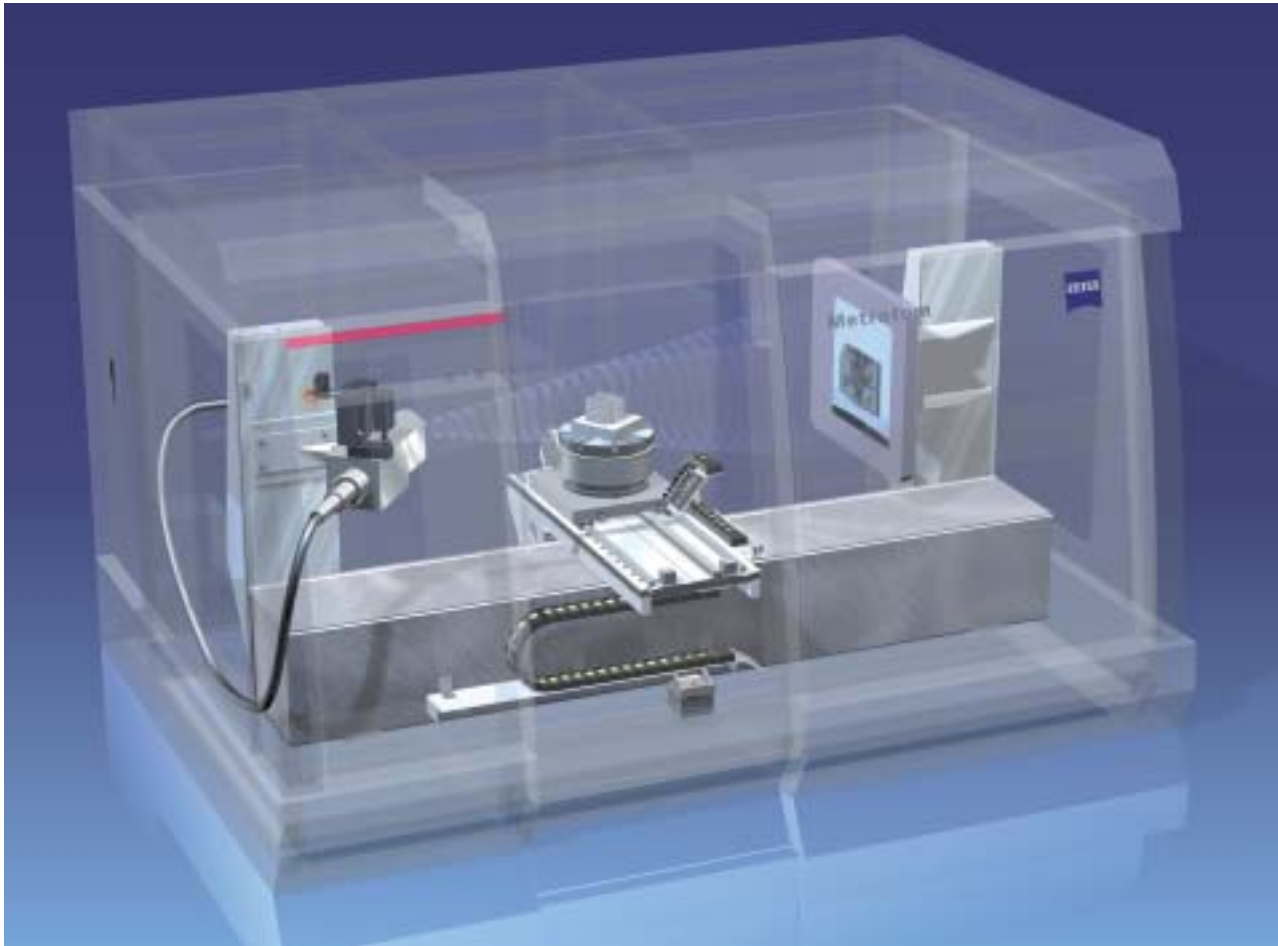
Irregular fracture behavior:

The cause could not be detected from the exterior; however, this clamp from Gottlieb Nestle GmbH continuously fractured at varying locations during the material tests. The tomograph and geometry comparison showed that a tool was deformed during injection. It was possible to modify the tool while still in the development phase.

**Metrotomography® -
overview of the advantages**

- Comparison of internal and external geometries in areas where it had only been possible to conduct visual inspections at best
- Continuous support from development to the prototype
- Fast modification of tools while still in development

60-20-140-e Printed in Germany LBW-TS-VII/2006 Too
Some of the options shown are not included in the basic package. Subject to change in design and scope
of delivery and as a result of ongoing technical development. Printed on chlorine-free bleached paper.
© Carl Zeiss © conception, text and design: SK+P, Munich-Unterföhring.



Contact for the machine:

Carl Zeiss
Industrielle Messtechnik GmbH
73446 Oberkochen
Germany
Sales: +49 1803 336 336
Service: +49 1803 336 337
Fax: +49 7364 203 870
Email: imt@zeiss.de
Internet: www.zeiss.com/imt

Contact for the service:

Carl Zeiss
3D Metrology Services GmbH
Heinrich-Rieger Str. 1
73430 Aalen
Germany
Telephone: +49 7361 559-1800
Fax: +49 7361 559-1899
Email: info@zeiss3d.de
Internet: www.zeiss3d.de