

# Carl Zeiss Industrial Metrology



AUGSBURG  
COLLEGE

June 5, 2012

# Agenda

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- 1 Carl Zeiss - Corporate Overview
- 2 Carl Zeiss Industrial Metrology
- 3 New Products and Technologies

# Agenda

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- 1** Carl Zeiss - Corporate Overview
- 2** Carl Zeiss Industrial Metrology
- 3** New Products and Technologies

# Milestones in the Company's History



- 1846** Carl Zeiss opens a workshop for precision mechanics and optics in Jena.
- 1857** Production of combined microscopes begins.
- 1875** Ernst Abbe becomes part owner of Carl Zeiss.
- 1884** Founding of the firm that will later become Jenaer Glaswerk Schott & Genossen by Otto Schott, Ernst Abbe, Carl Zeiss and Roderich Zeiss.
- 1889** Founding of the Carl Zeiss Stiftung by Ernst Abbe.
- 1945** Partial destruction of the Jena factory during World War II.



# Milestones in the Company's History



- 1948** Partition into Carl Zeiss headquartered in Oberkochen and 1948-expropriated state-owned enterprise "VEB Carl Zeiss Jena."
- 1991** Reunification of the two separated companies.
- 2004** Carl Zeiss is retroactively transformed into a stock corporation effective October 1, 2003. At the same time, the revised foundation constitution takes effect. The company will continue to be wholly owned by the Carl Zeiss Foundation.



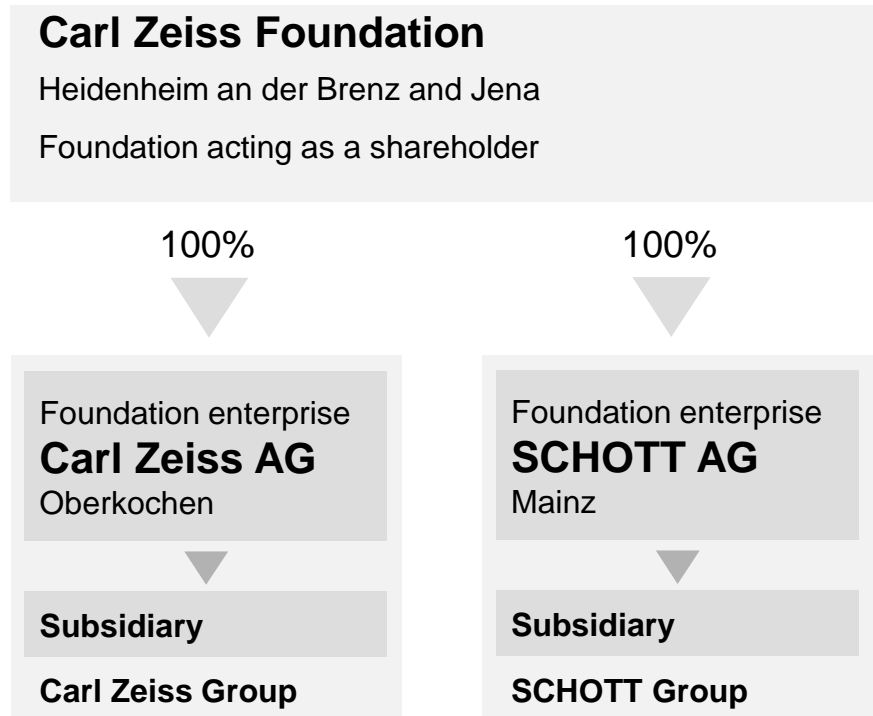
# Milestones in the Company's History



- 2005** The Eyeglass Division merges with US-based SOLA to create one of the globally leading eyeglass lens providers.
- 2007** Carl Zeiss Meditec AG added to the TecDax of the German Stock Exchange
- 2008** Carl Zeiss honored as Germany's top employer
- 2009** Industrial Metrology celebrates its 90 anniversary



# Independence and long-term perspectives

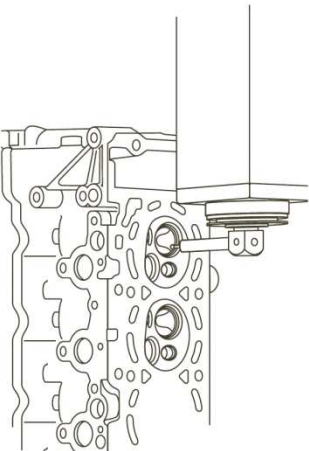


Carl Zeiss AG is fully owned by the Carl Zeiss Stiftung (Carl Zeiss Foundation).

The Carl Zeiss Foundation provides the company with long-term perspectives and the security of ownership stability.

This enables the Executive Board to gear the companies toward sustained, strategic development.

# 2009: Celebrating 90+ years of Industrial Metrology



90 years  
Industrial Metrology  
at Carl Zeiss





# The Carl Zeiss Group



Carl Zeiss is a leading group of companies in the optical and optoelectronic industries.

Carl Zeiss AG is not publicly listed and is wholly owned by the Carl Zeiss Foundation.

Carl Zeiss focuses on the future markets of

- Medical and Research Solutions
- Eye Care
- Industrial Solutions and
- Lifestyle Products.

# Innovation – The Key to Success

Fiscal year 2009/10



Patent applications **294**

R&D spending **291** million euros  
(10% of revenues)

Employees in  
R&D worldwide **2,000** (15% of workforce)

# Fiscal year 2009/10 at a glance



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**Revenues** **2.98** billion euros

**Incoming orders** **3.2** billion euros

**Net income/net loss** **208** million euros

Balance sheet date: 30 September 2010 (without Carl Zeiss Vision)

# Fiscal year 2010/11 at a glance



Revenues

4.23 billion euros

Incoming orders

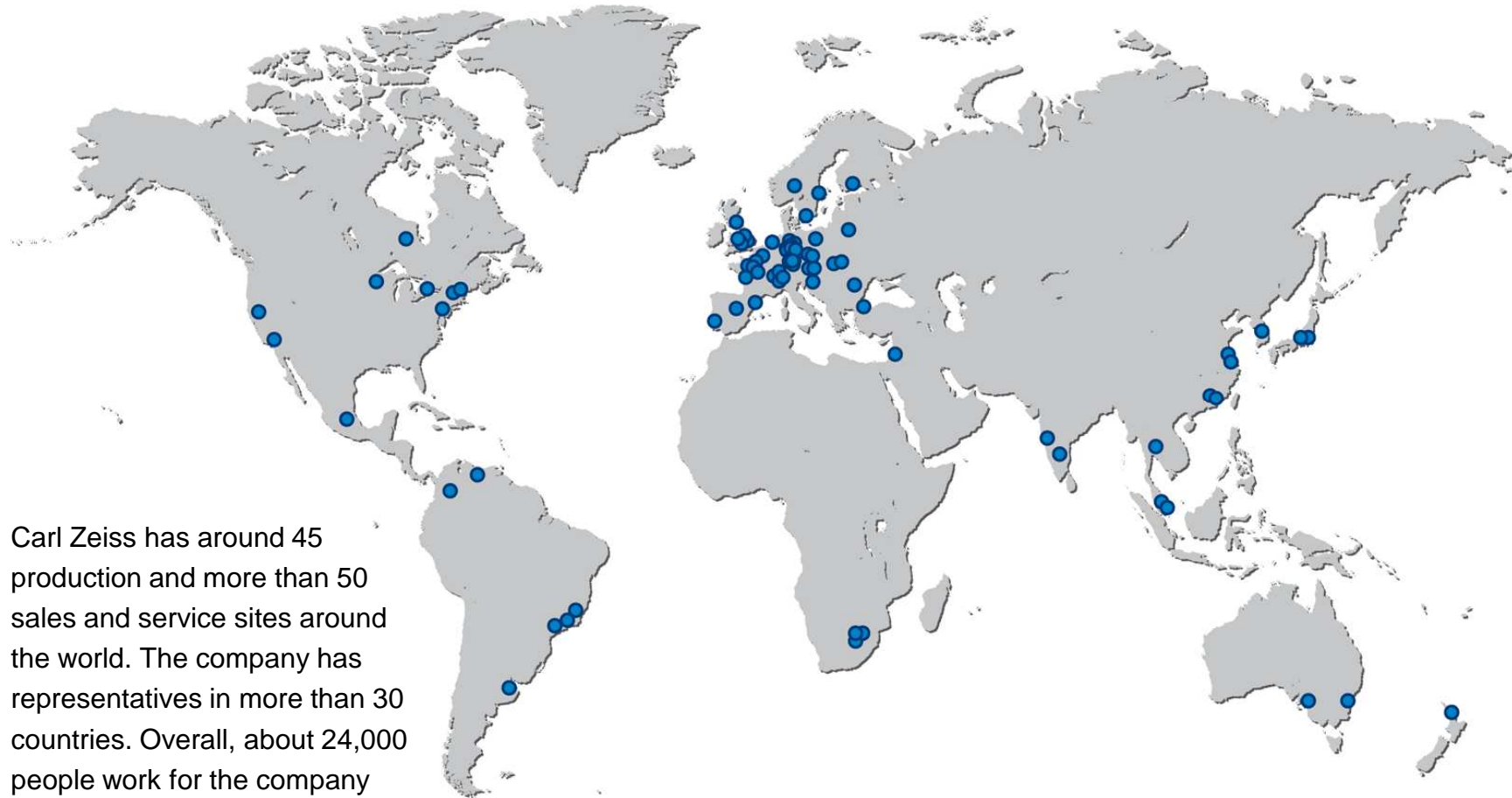
4.24 billion euros

Net income/net loss

14%

Financial Highlights	
<b>Revenue</b>	EUR 2.105bn (first half of 2010/11: EUR 2.143bn)
<b>EBIT</b>	EUR 232m (first half of 2010/11: EUR 355m)
<b>Equity</b>	EUR 1.323bn (30 September 2011: EUR 1.221bn)
<b>Equity ratio</b>	28%
<b>Investments in property, plant and equipment</b>	EUR 108m (fiscal year 2010/11: EUR 164m)
<b>Investments in R&amp;D</b>	EUR 190m (first half of 2010/11: EUR 173m)
<b>Employees</b>	24,862 (30 September 2011: 24,192)

# Locations of the Carl Zeiss Group



Carl Zeiss has around 45 production and more than 50 sales and service sites around the world. The company has representatives in more than 30 countries. Overall, about 24,000 people work for the company around the globe.

# Carl Zeiss Group

## Business Groups at a Glance (2009/10)



### Medical Systems

Sales 754 m euros

2,880 employees



### Microscopy

Sales 397 m euros

1,720 employees



### Semiconductor Manufacturing Technology

Sales 1,187 m euros

2,550 employees



### Industrial Measuring Technology

Sales 292 m euros

1,770 employees



### Consumer Optics/Optronics

Sales 312 m euros

1,500 employees



### Vision Care

Sales 881 m euros

11,590 employees

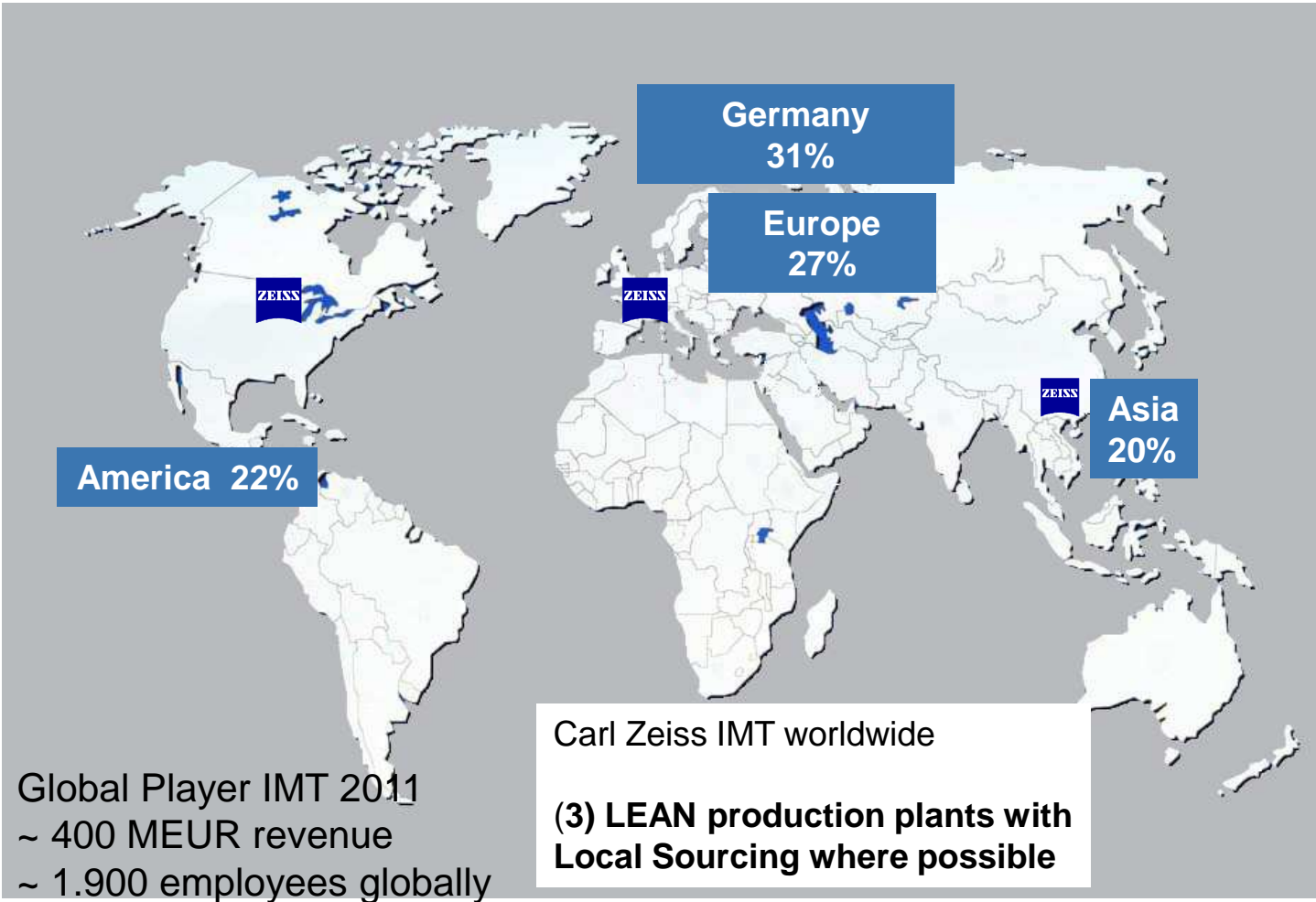
# Agenda

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- 1 Carl Zeiss - Corporate Overview
- 2 Carl Zeiss Industrial Metrology
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# IMT is globally present with sales and service organizations, and (3) production plants







# Industrial Metrology Headquarters in Minneapolis, Minnesota



In 2002, Carl Zeiss Industrial Metrology celebrated the opening of its new headquarters in Minneapolis.



Carl Zeiss has the US industry's most technologically advanced CMM manufacturing facility.

Over 6,000 CMMs produced in this factory for US and export markets



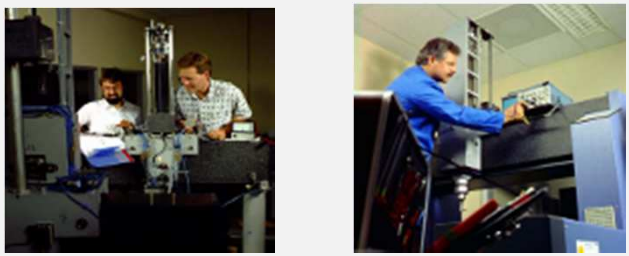
# IMT is has four different business areas ...



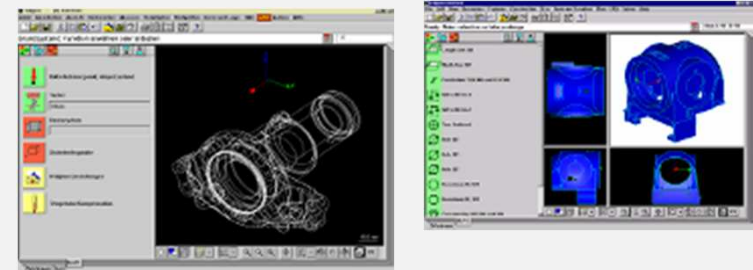
### Systems



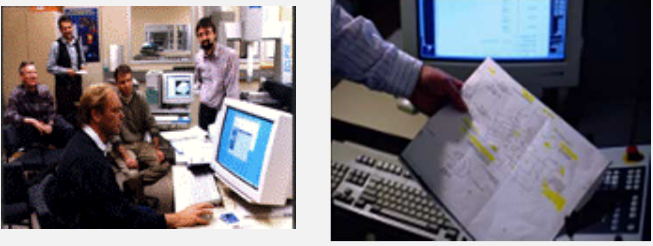
### Technical Service



### Software



### Application Services



# Carl Zeiss Industrial Metrology Overview Measuring Systems



<p><b>Bridge-type CMMs</b></p>										
<p><b>Universal CMMs</b></p>	<p>MMZ E, B</p>	<p>PRISMO</p>	<p>ACCURA</p>	<p>CONTURA G2</p>	<p>SPECTRUM</p>	<p>O-INSPECT</p>				
<p><b>Precision CMMs</b></p>										
<p>MMZ T, G</p>	<p>UPMC ultra</p>	<p>PRISMO ultra</p>	<p>MICURA</p>	<p>F25</p>	<p><b>InLine CMMs</b></p>	<p>DuraMax</p>	<p>GageMax</p>	<p>CenterMax</p>		
<p><b>Horizontal-arm CMMs</b></p>			<p><b>Metrotomographie</b></p>			<p><b>Form, surface and contour measuring instruments</b></p>				
	<p>PRO compact, select and premium</p>		<p>METROTOM 1500 METROTOM 800</p>					<p>Rondcom</p>	<p>Contourecord</p>	<p>Surfcom</p>

# Industrial Metrology Overview: Probes



## Measuring probes

active



VAST gold



VAST XT Gold



DT



MT HSS

passive



VAST XXT

## Touch-trigger probes

from Renishaw:

- TP 2
- TP 6
- TP 20
- TP 200



RST-P

## Articulating probe holder

from Renishaw:

- PH10
- MIH
- MH8



RDS, RDS CAA



DSE

## Optical probes



Eagle Eye



ViScan



LineScan



DTS Wolf & Beck



OTM Wolf & Beck

# Entry level CMMs



**CONTURA G2 direkt** is the entry into ZEISS scanning technology.



**CONTURA G2 RDS** offers the largest selection of probe types in the industry, including touch trigger, non-contact trigger, optical scanning and touch scanning probes.



**CONTURA G2 aktiv** is a redefinition of the mid-range CMM. It brings all of the benefits of scanning into the price range of touch-trigger CMMs.

# Ultra Precision Measuring Centers

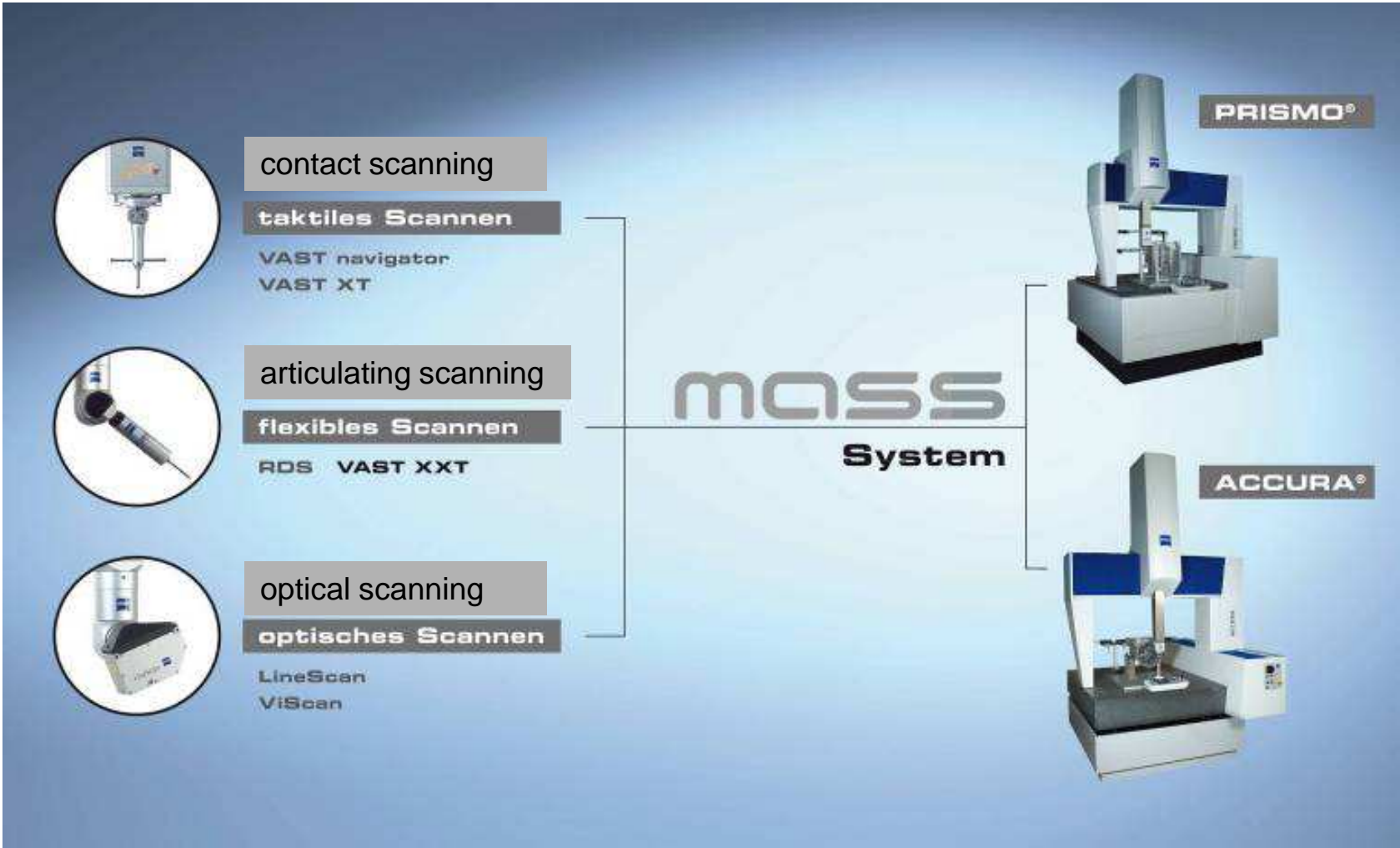


**PRISMO Navigator** The CMMs that revolutionized the industry making multi-point measurement a reality for everyday quality control.

**PRISMO S-ACC** for ultra precision delivering leading-edge accuracy with an unparalleled measuring times make the CMM of choice for the lab.



# MASS – Multi Sensor Platform for PRISMO and ACCURA



# PRO and PRO T: Platform for Productivity in Car Body Measurement



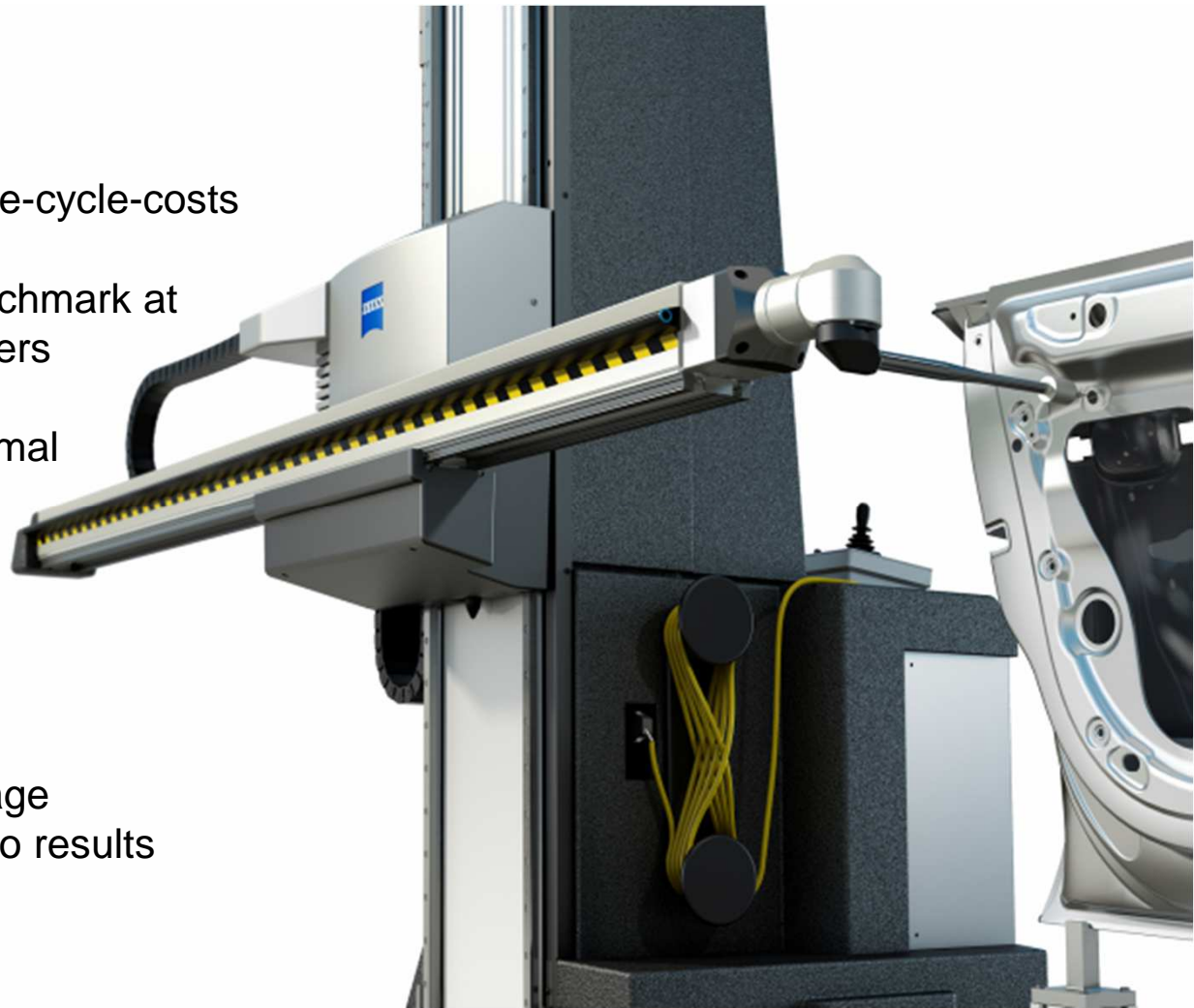


# CARMET II

## The new entry-class sheetmetal CMM



- Low initial costs and life-cycle-costs
- RDS-C CAA – the benchmark at articulating probe holders
- F.I. technology for optimal temperature stability and attractive design
- CARMET and the new measuring software CALIGO – the productive package leads simple and fast to results



# CARFIT® Fixturing technology at its best



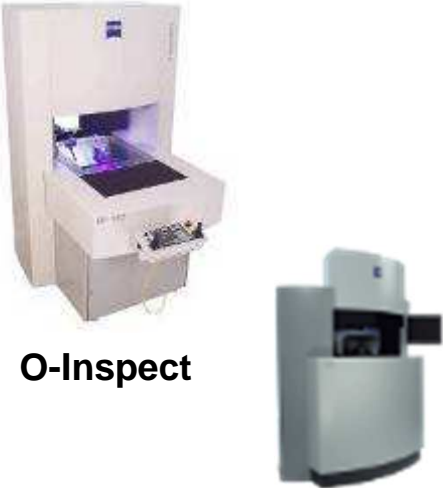
- Manufacture of customized inspection fixtures based on a modular and standardized CARFIT® system design
- Combines the advantages of fixed fixtures with the flexibility of a modular work piece clamping system
- Versatile and inexpensive standard fixture components
- Robust technology that has been proven for many years
- Design of measuring fixtures with a CARFIT® component library (Catia, UG)



# In the past years IMT has consequently extended its portfolio to new application areas



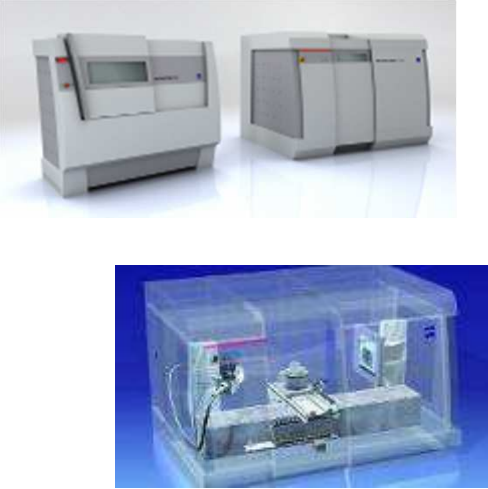
## Multisensor/ Microtechnology



**O-Inspect**

**F25**

## Metrotomography



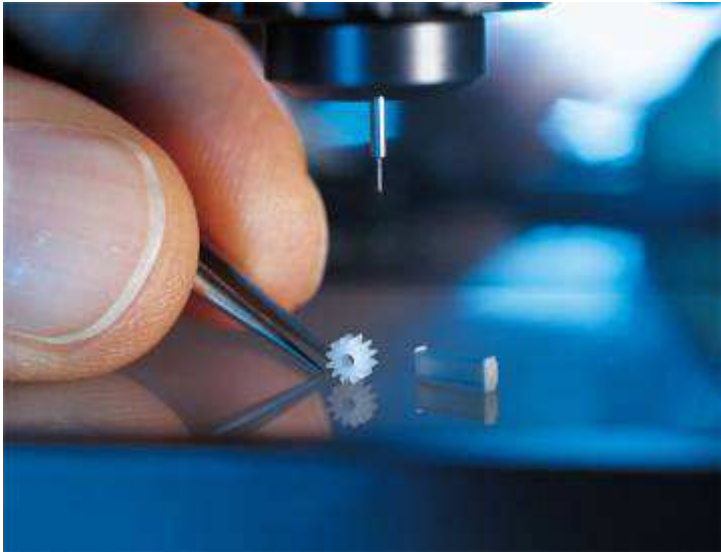
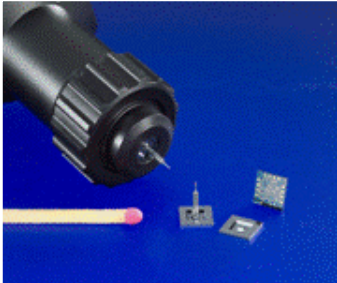
**Metrotom 800+ 1500**

## Inline Metrology



**MaxLine**

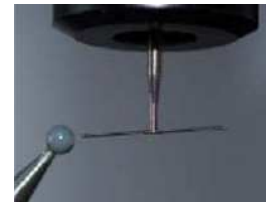
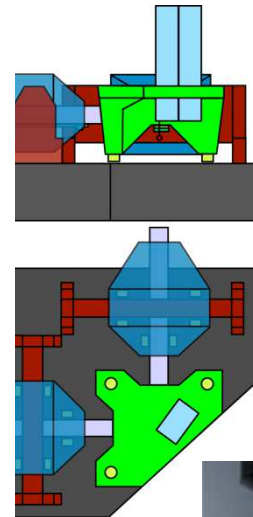
# F25 – For measurement of Micro-parts





# Micro Parts Measuring Machine F25

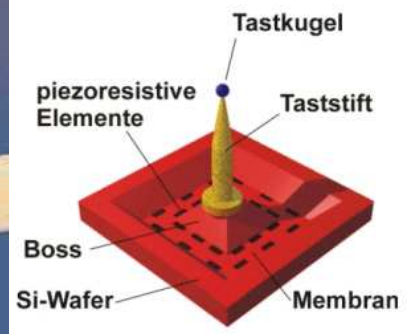
## iF Design Award 2006



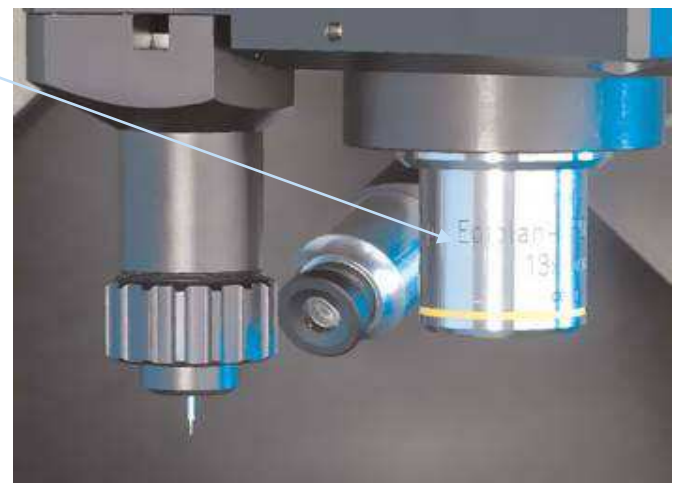
### core features (F25)

- fixed table for workpiece
- Abbe error free design  
(all scales cross at sensor center point)
- tactile 3D scanning sensor with ability to use T-probe with diameter down to 120 $\mu$ m, adjustable measuring force down to 0.5mN
- MPE (E) =  $0.25+L/666$   
(measured with ball plate)
- measuring volume 130x130x100  
zoom lense with fixed magnification

# Micro Parts Measuring Machine F25



## Dual Sensor Operation



# O-Inspect: Multi-Sensor CMM Fusion of Two Core Competences of Carl Zeiss

## Measuring range:

400 x 400 x 200 mm

## Sensor:

- VAST XXT
- 12x Zoom Optic Discovery.V12



## Accuracy:

### VAST XXT contact measuring probe:

$$MPE_E = 1,9 + L/250 \mu\text{m} \text{ (L in mm)}$$

### Discovery.V12 Optic:

$$MPE_{E-2D(OT)} = 1,9 + L/250 \mu\text{m} \text{ (L in mm)}$$



# Metrotomography with the METROTOM X-Ray CT for metrology

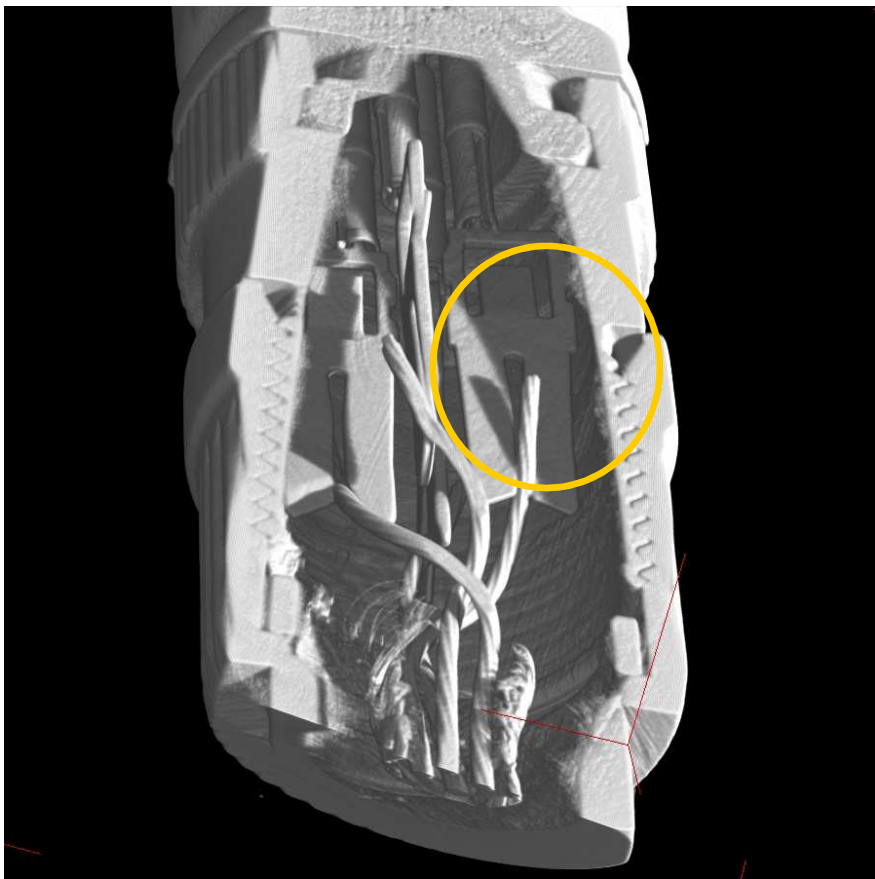
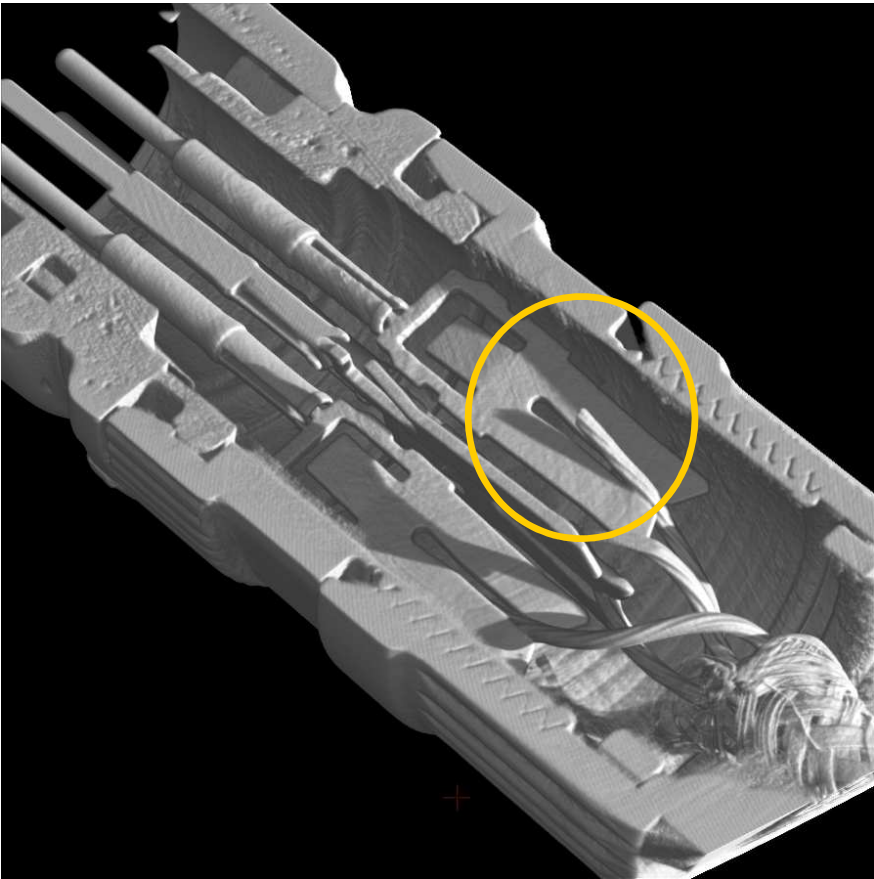


With metrotomography, it is now possible to non-destructively measure and make visible features and structures from the interior of parts i.e. material defects (cracks, porosity, and inclusions) as well as internal workpiece features that cannot be probed.

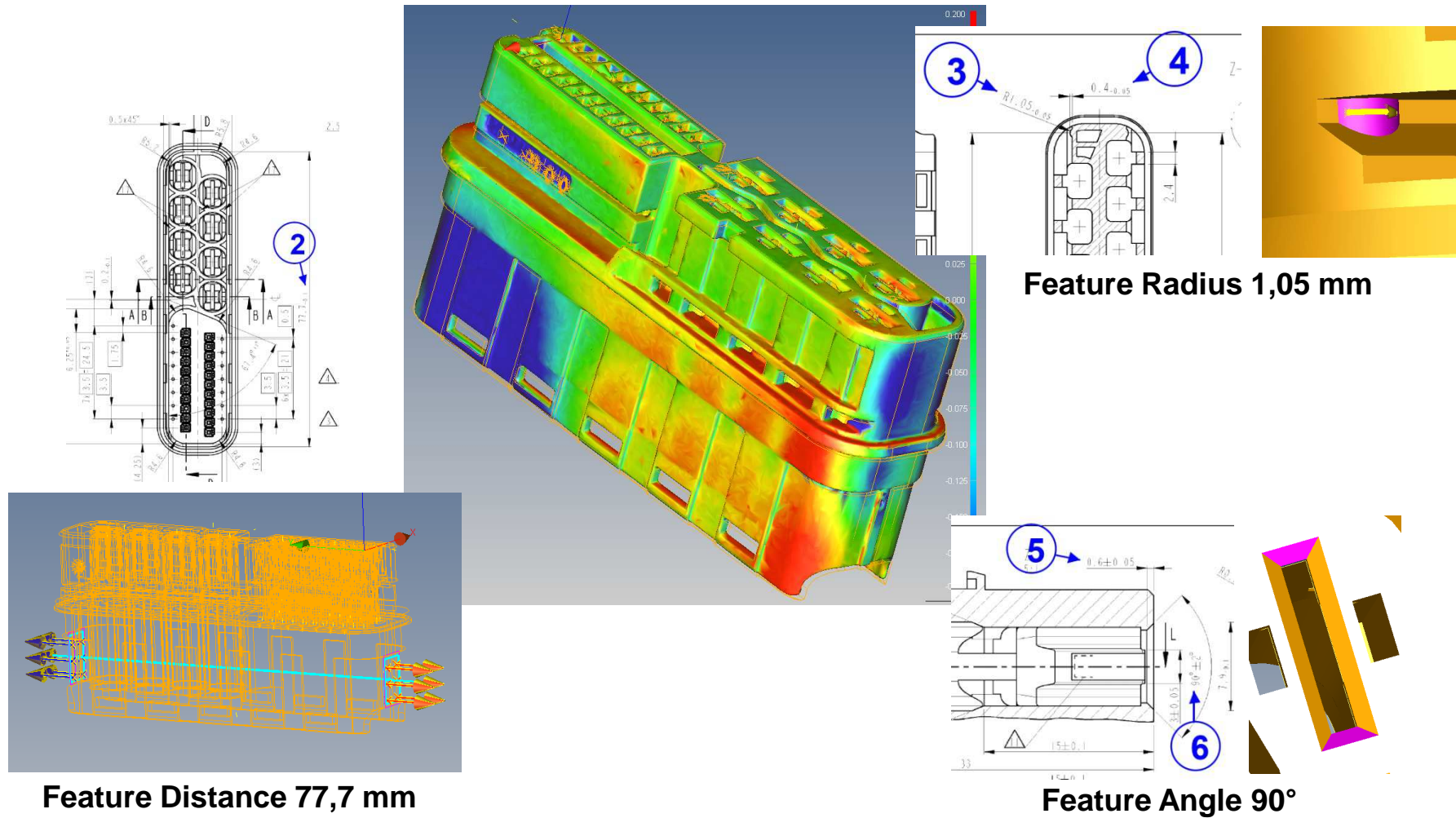
The target application of this technology is plastic injection molding, small lightweight castings and composite materials.



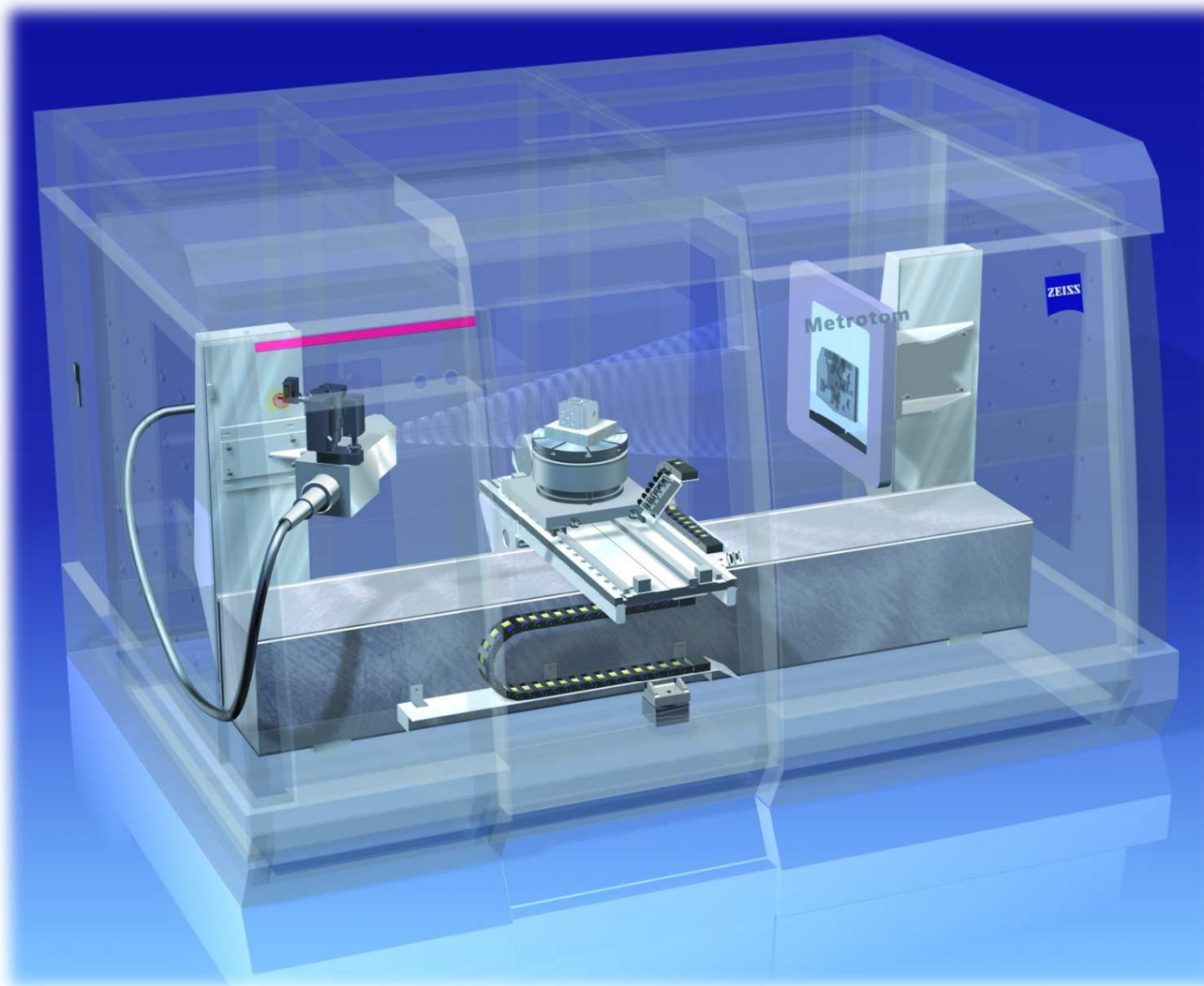
# Metrotomography® Applications: Non-destructive Testing



# Metrotomography® Applications: Dimensional Metrology on complex plastic molded parts



# Metrological CT - Metrotom



## Metrological CT

- Kinematic design
- Stiff platform
- Temperature compensation thru reference
- Fixed distance between source and detector
- Only rotary axis moving during measurement.

# Currently available Zeiss CMM – CT systems



**METROTOM 1500**

## Performance features

<b>Tube</b>	225kV/225W
<b>Detector</b>	1024 x 1024 pixels
Optional	2048 x 2048 pixels
<b>Measuring range</b>	Ø300 x 350 mm
<b>Lifting table</b>	150 mm
<b>adjustment range</b>	
<b>Source-detector distance</b>	1500 mm



**METROTOM 800**

## Performance features

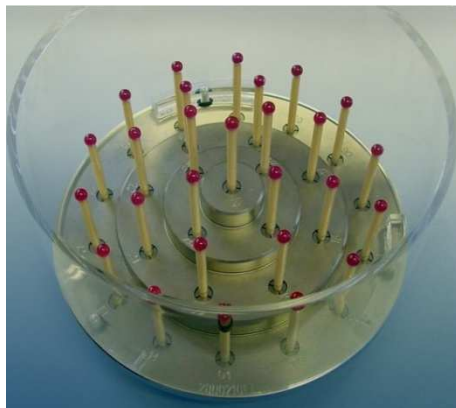
<b>Tube</b>	130kV/39W
<b>Detector</b>	1900 x 1512 pixels
<b>Measuring range</b>	Ø125 x 150 mm
<b>Lifting table</b>	290 mm
<b>adjustment range</b>	
<b>Source-detector distance</b>	800 mm

# Specification of Accuracy According to VDI/VDE 2630



VDI/VDE Standards for dimensional metrology with CT exist, guideline for specification exists as a draft.

Reference Parts for acceptance tests for CMMs with CT-Sensor according to VDI/VDE 2630:



MetrotomCheck



Step Cylindar



**VDE**

VDI/VDE-Gesellschaft  
Mess- und Automatisierungstechnik

## VDI/VDE 2630

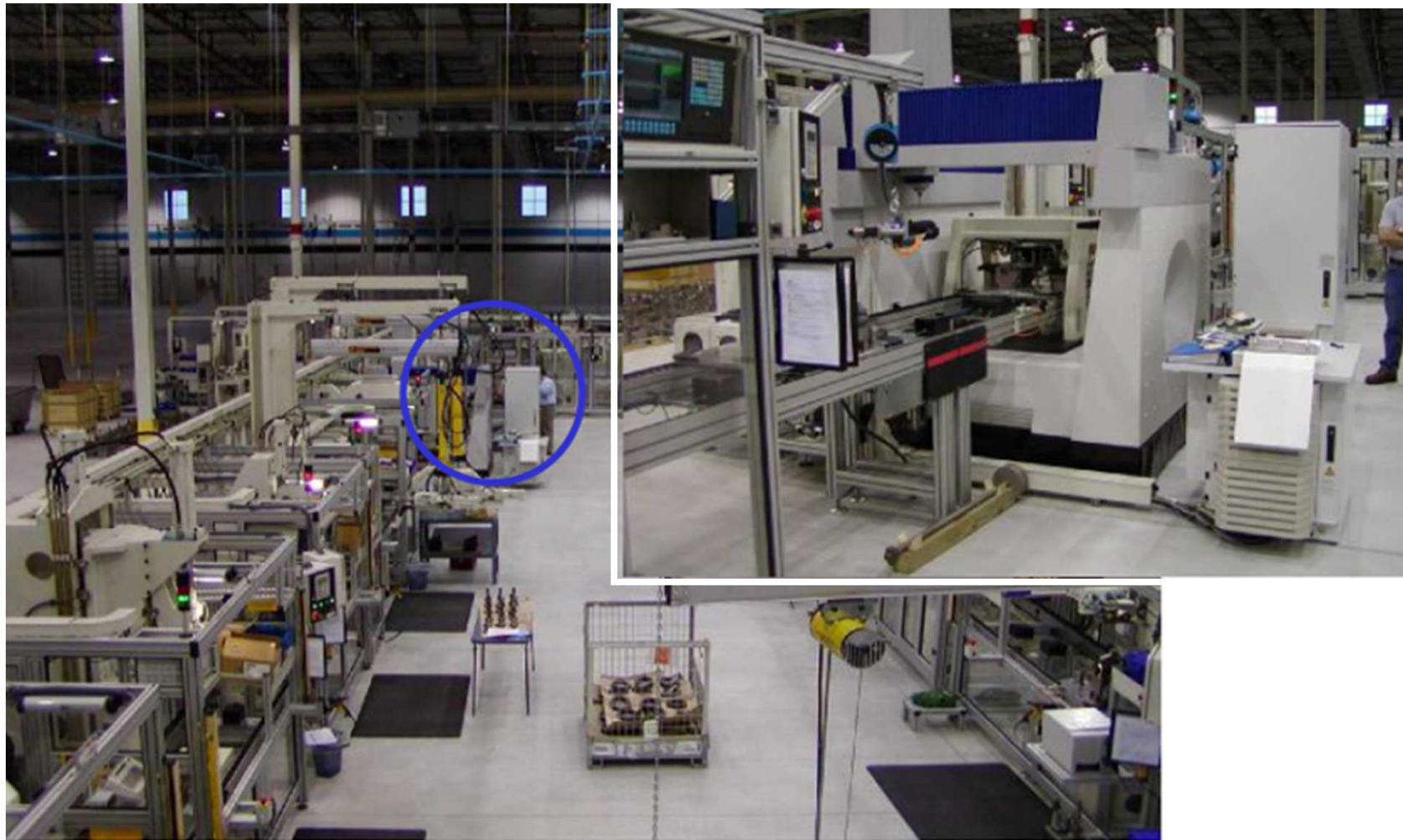
VDI/VDE-RICHTLINIEN		Monat 2009
VERBAND DEUTSCHER INGENIEURE	Genauegkeit von Koordinatenmessgeräten Konstruktiv und deren Prüfung	VDI/VDE 2617 Blatt 13 Entwurf
VERBAND DER ELEKTROTECHNIK INFORMATIKTECHNIK	Leitfaden zur Anwendung von DIN EN ISO 10360 für Koordinatenmessgeräte mit CT-Sensoren	VDI/VDE 2630 Blatt 13 Entwurf
<p>Accuracy of coordinate measuring machines – Characteristics and their testing – Guidelines for the application of DIN EN ISO 10360 for coordinate measuring machines with CT sensors</p> <p>Computed tomography in dimensional measurement – Guidelines for the application of DIN EN ISO 10360 for coordinate measuring machines with CT sensors</p> <p>Gründungsdatum 2009-04-01</p> <ul style="list-style-type: none"> <li>• Vorgeschrieben in Tabelle 1 des DMI per E-Mail an <a href="mailto:info@vde.de">info@vde.de</a></li> <li>• In Frage dieser Richtlinie beantwortet werden unter <a href="http://www.vde-richtlinien.de/produkte">http://www.vde-richtlinien.de/produkte</a></li> <li>• in Kooperation mit VDE/FAK/Deutscher Mess- und Automatisierungstechnik (DAMI) 10 11 39 0000 000000</li> </ul>		
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<p>VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA)                  Postfach 10 11 39 0000 0000                  Postfach 10 11 39 0000 0000</p>		
<p>VDI/VDE-Handbuch Mess- und Automatisierungstechnik Band 2: Fernoptisches Messen                  VDI/VDE Handbuch 10000-0 und Fernoptische Messtechnik                  VDI/VDE-Handbuch 10000-0-01 Teil 2: Drehmaschinen</p>		

Arbeitsausschuss des Ausschusses  
gültige Richtlinie!

# From the Lab

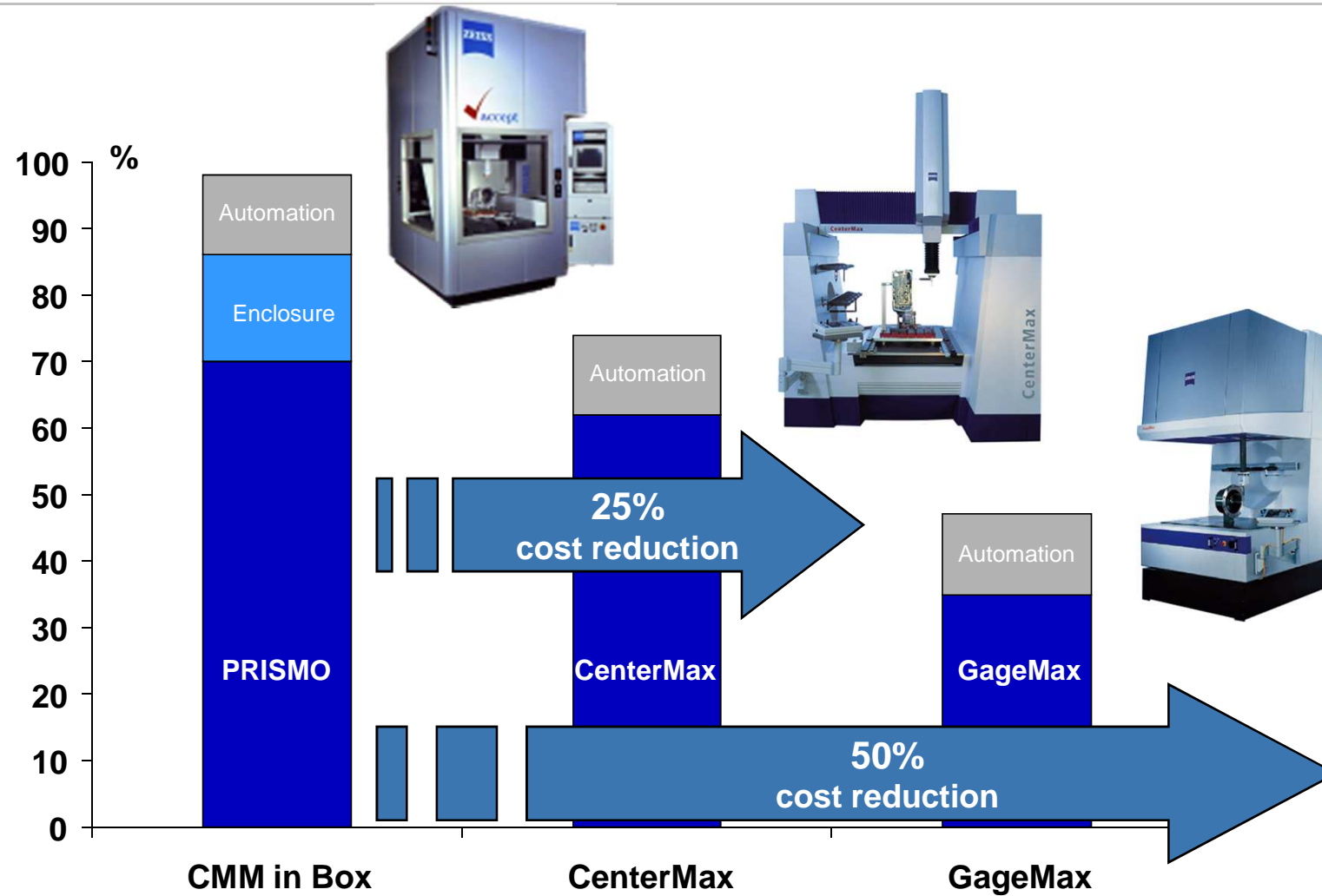


## to direct In-Line installations





# Investment Costs Associated With Inline Solutions: Clear Cost Reduction Over Existing CMMS



# DuraMax Production gage



## Guideways/drives

- No compressed air required
- Low-power drives

## Measuring range

- 500 x 500 x 500 mm

## Operator ergonomic

- Three-sided loading
- Seated or standing operation

## VAST XXT

- ZEISS measuring scanning sensor
- For scanning or single point measurement
- Stylus change directly from the rack



## Shroud covers

- Protect against contamination

## Glass ceramic length measuring system

- For a high temperature range with high accuracy

## Stylus rack

- For 3, 6 or 9 styli; can be changed during CNC operation
- Wide variety of styli for a wide range of workpieces

## Base

- Ergonomic design

## Footprint

- Width: 740 mm, depth: 910 mm



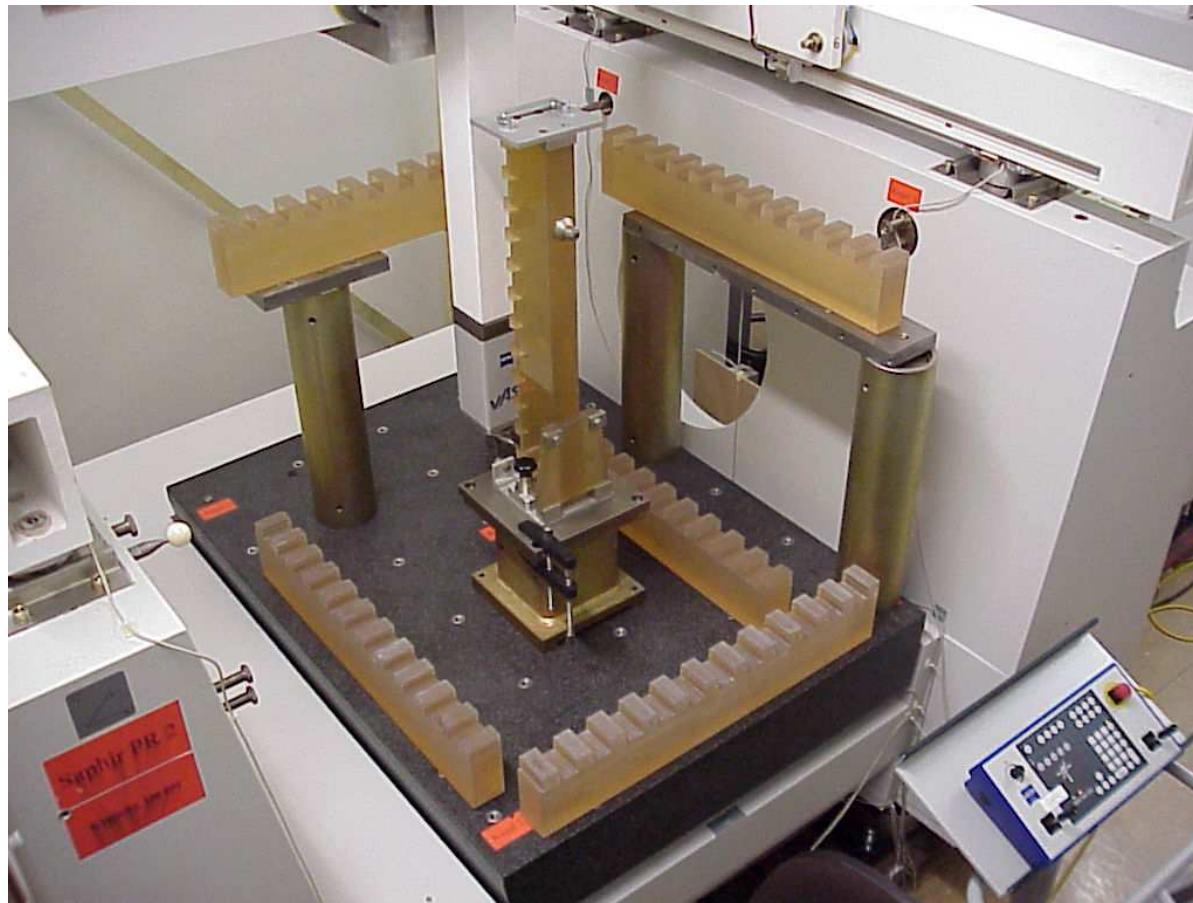
# Inline Solutions: CenterMax – The “Flexible Gage” in Production



# Maxline – Engineered for production environments



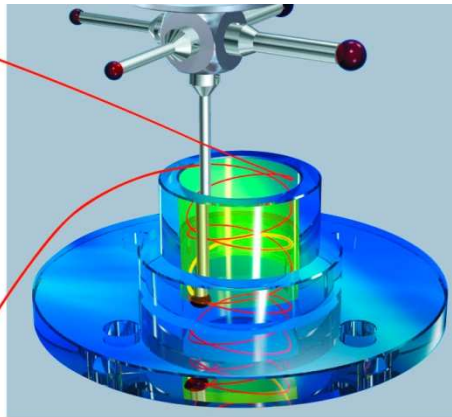
1000's of hours of temperature tests on CenterMax





## Active Sensor VAST XT GOLD

- More dynamics due to optimized movable mass
- Higher rigidity due to optimized joints
- Longer probe tips
- New collision protection



## Measuring Software VAST Navigator

- Scanning with VAST Intelligence
- Automatic measuring strategy generation with navigator functions
- Object optimized programming
- CALYPSO The leading scanning package –



## Control Scanning Engine

- Dynamic full corrections for machine and probe in real time
- Look ahead for fast scanning
- Modular hardware platforms for multi-sensor support and expandability

Carl Zeiss -  
The Scanning People



- Up to 30 % more productivity
- Faster measuring of size, form and position
- Exact measuring with critical probe tips

# Agenda

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# O-INSPECT Multi-Sensor CMM

Now with *Rotary Table* and *Chromatic White Light Sensor*



Plugs



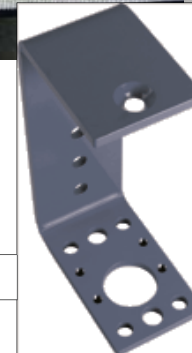
PCBs



Markings on curved Surfaces



3D Sheet Metal

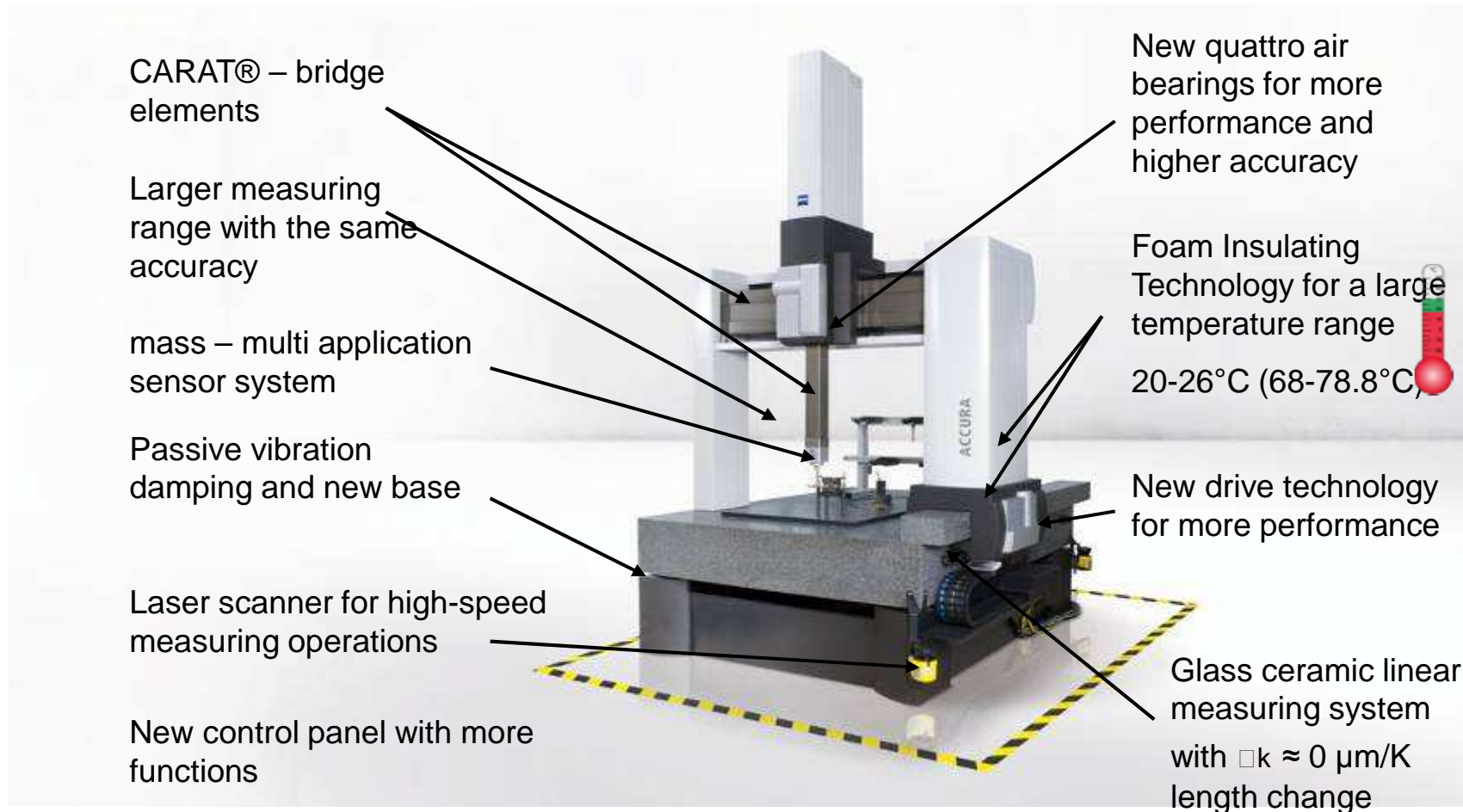


## Expanded O-Inspect Feature Set

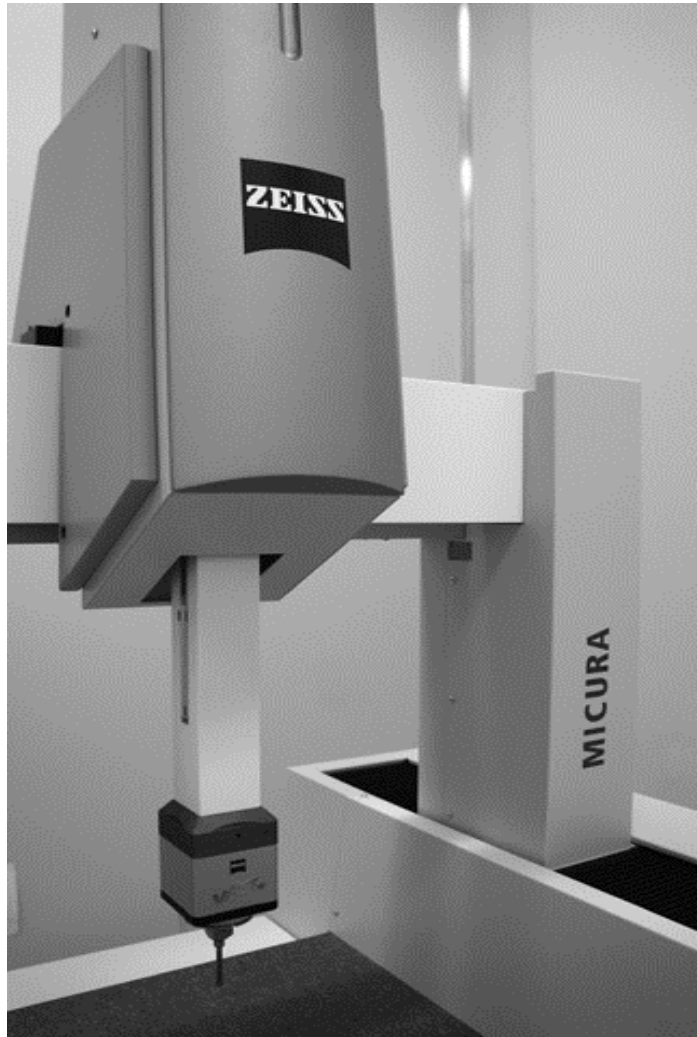
- Three Sensor Systems
  - VAST XXT Scanning
  - ViScan Video Camera
  - **Optional White Light Laser**
- CAD-based Calypso Multi-Sensor Software
- 4<sup>th</sup> axis Rotary Table



# The new ACCURA – Redesigned from the ground up for higher throughput



# Introducing the MICURA ultra-precision scanning CMM



## Small in stature – Big in performance

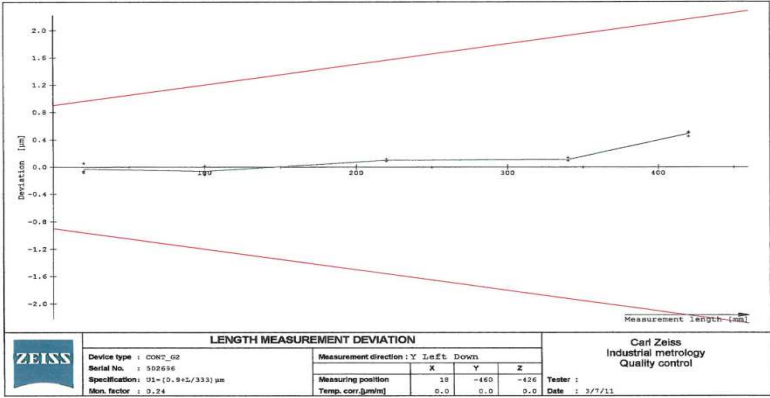
- MICURA® is our solution for small and high precision parts
- Active scanning with VAST XT Gold for utmost in measurement confidence
- Optional navigator® technology for increased throughput and performance
- Small footprint
- MICURA:  $MPE_E=0.7+L/400$   
 $MPE_{THP}=1.3$  with 40s
- Measuring reference temperature  
19 °C to 21 °C
- Part temperature sensor.

# Micura – Engineered and Built in the USA

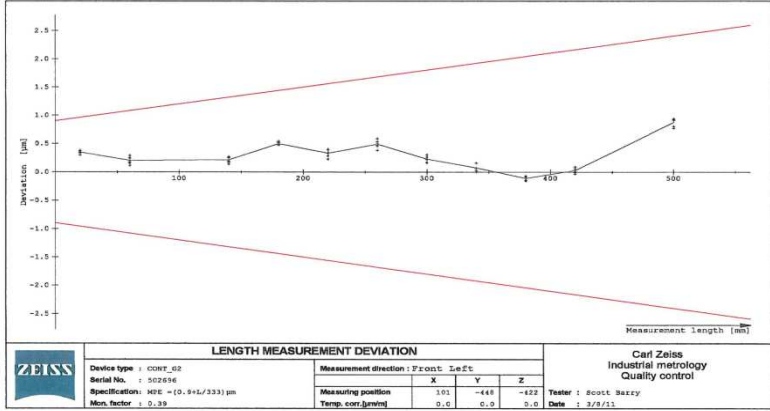
## *Gage room accuracy at entry-level price*



$$U1 = 0.7 + L/400$$



$$U3 = 0.7 + L/400$$







We make it visible.

Thank you for your attention