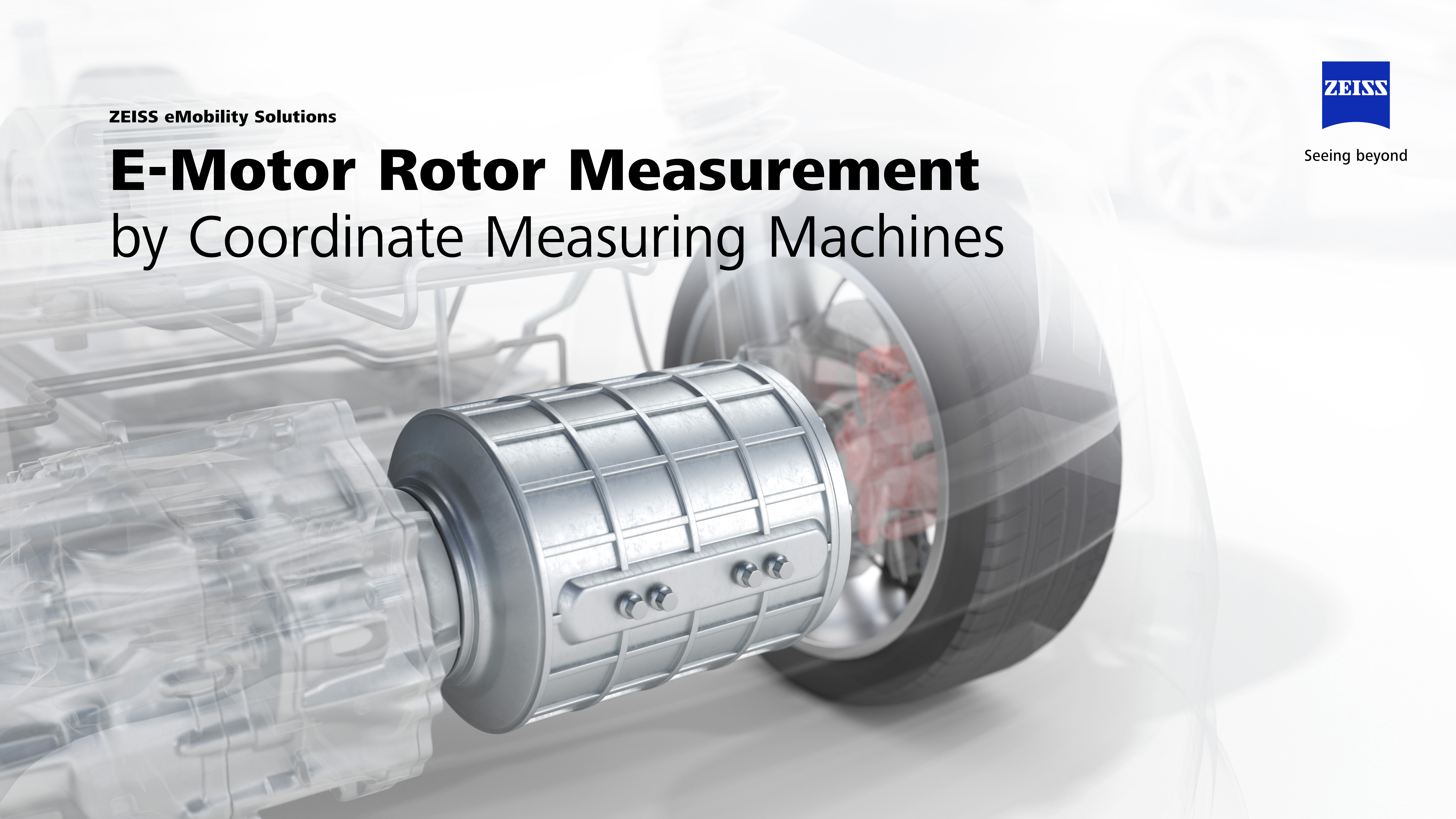


ZEISS eMobility Solutions

E-Motor Rotor Measurement by Coordinate Measuring Machines



Seeing beyond



E-Motor quality control

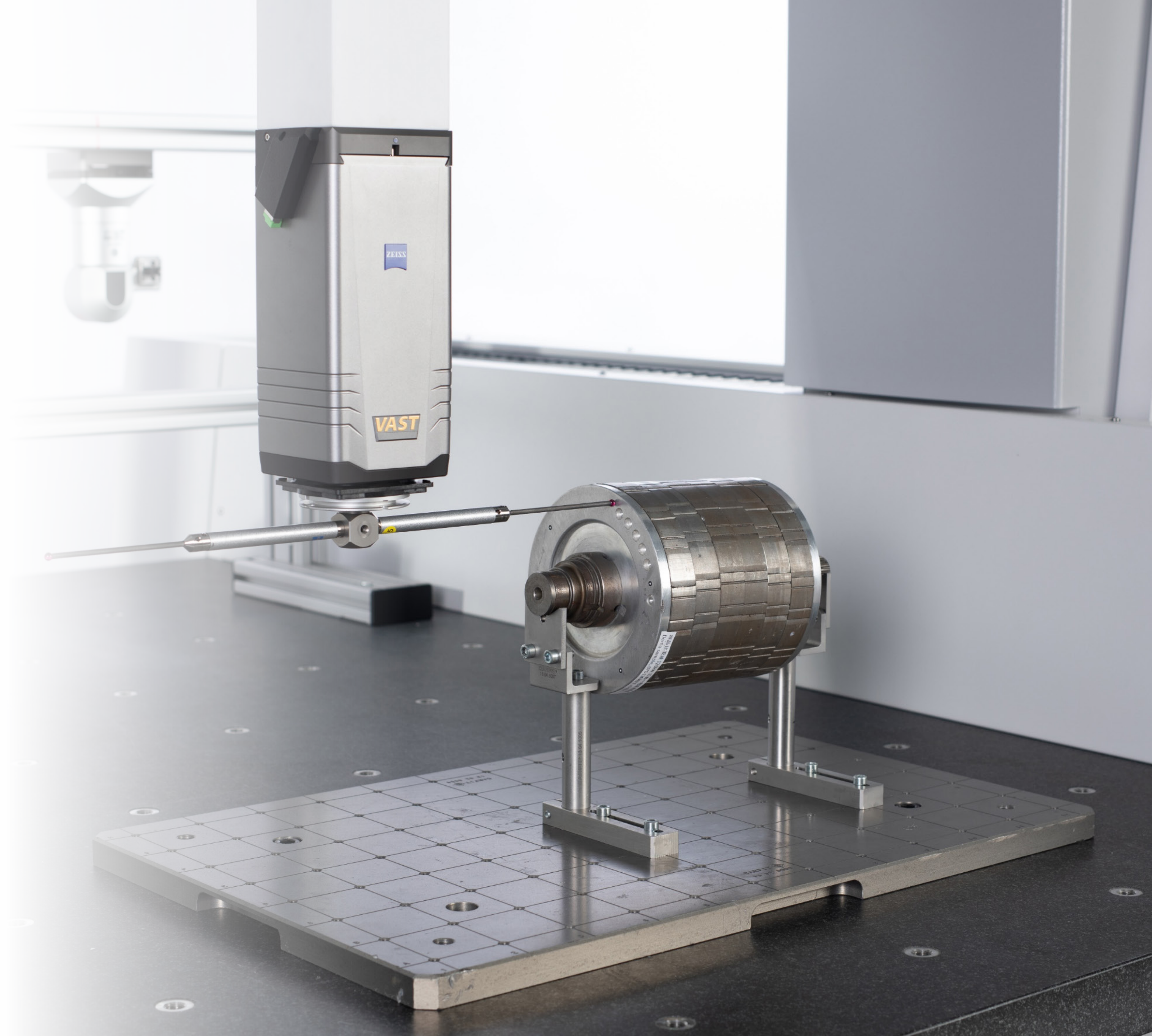
CMM solutions for full dimensional measurement

Electric motors are the powerhouses of an electric vehicle (EV) – they combine high speed and enormous torque, as well as constantly optimized power density. To achieve peak performance with minimal wear, all components must interlock precisely.

The motor rotor, a key component within the electric motor, is the rotating part to interact with the stator to generate motion. The design and material of the rotor significantly affect the motor's efficiency, power output, and thermal performance. Innovations in rotor technology can enhance torque characteristics, reduce energy losses, and improve durability, all of which are essential for enhancing the performance and range of EVs.

Hairpin rotors are finely machined due to the operation at speeds up to 20,000 rpm, bringing challenges in manufacturing rotor shafts, packages, and assemblies.

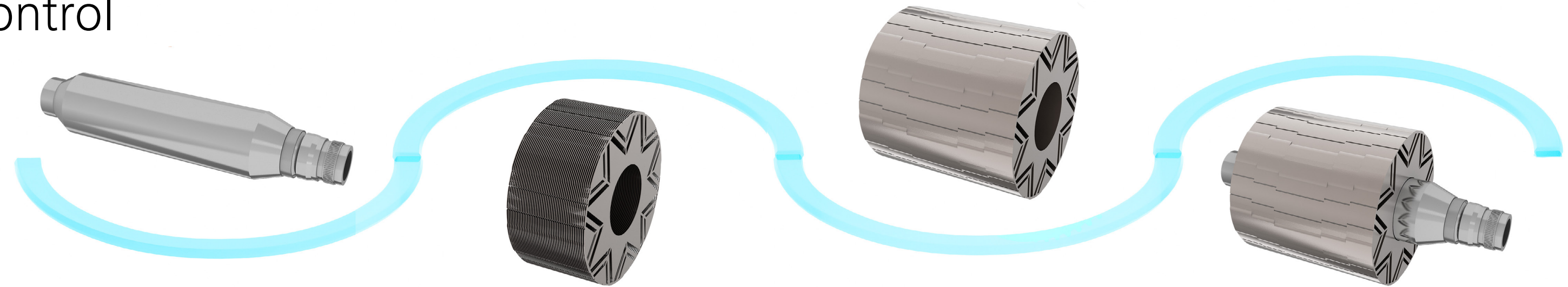
Furthermore, the design and manufacturing trends of rotors are lightweight and compactness. This requires higher thermal management performance, higher manufacturing precision, better selection of materials, and so forth.



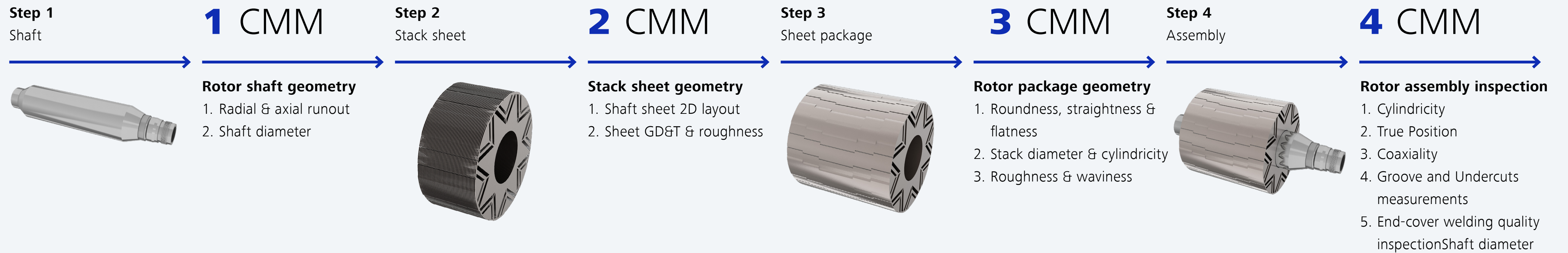
E-Motor manufacturing process

CMM technology enhances quality control

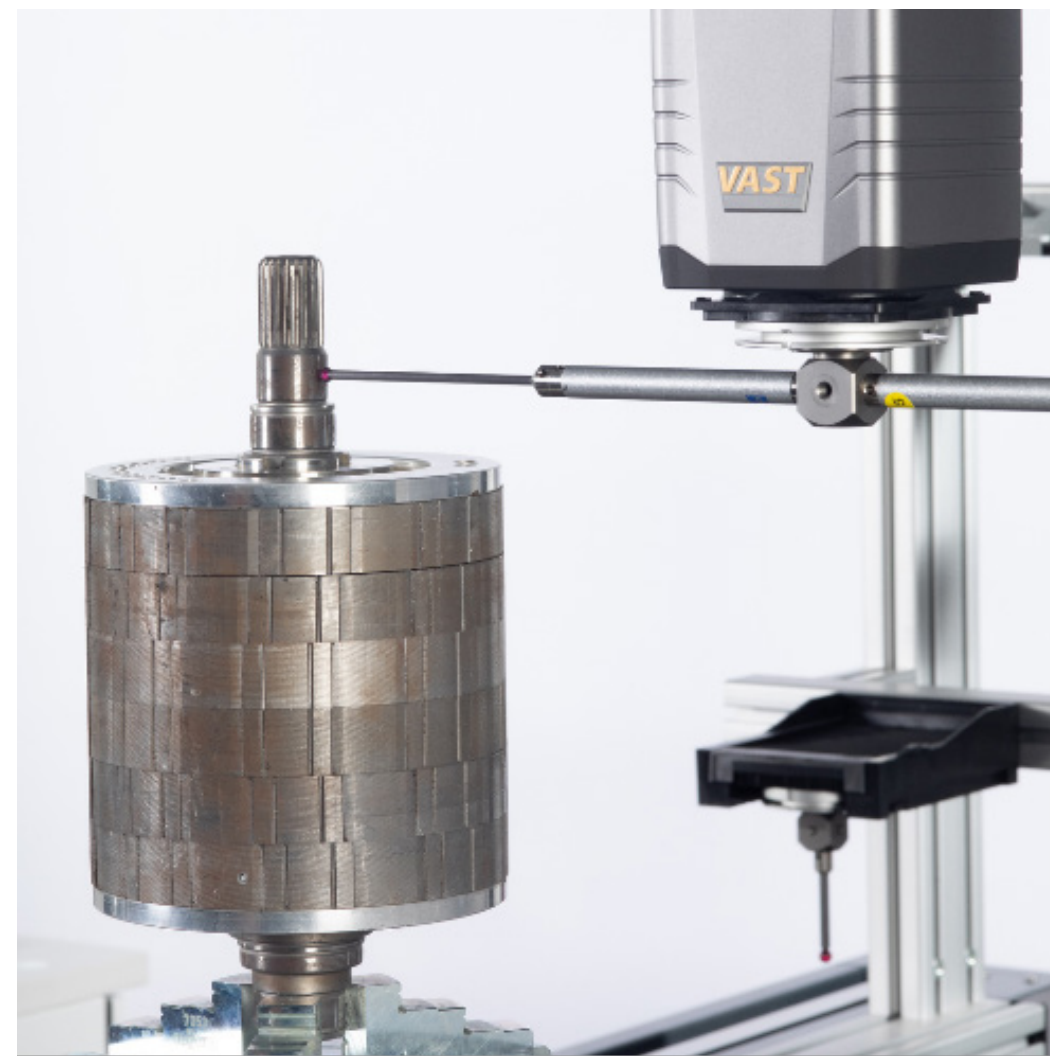
Throughout the process flow of Rotor manufacturing, several critical quality pain points can be addressed by ZEISS solutions. The quality control gates of a rotor has dimensional control requirements at each step. CMM solutions can provide geometry characterization measurement throughout the production process.



E-Motor stator production process with CT solution

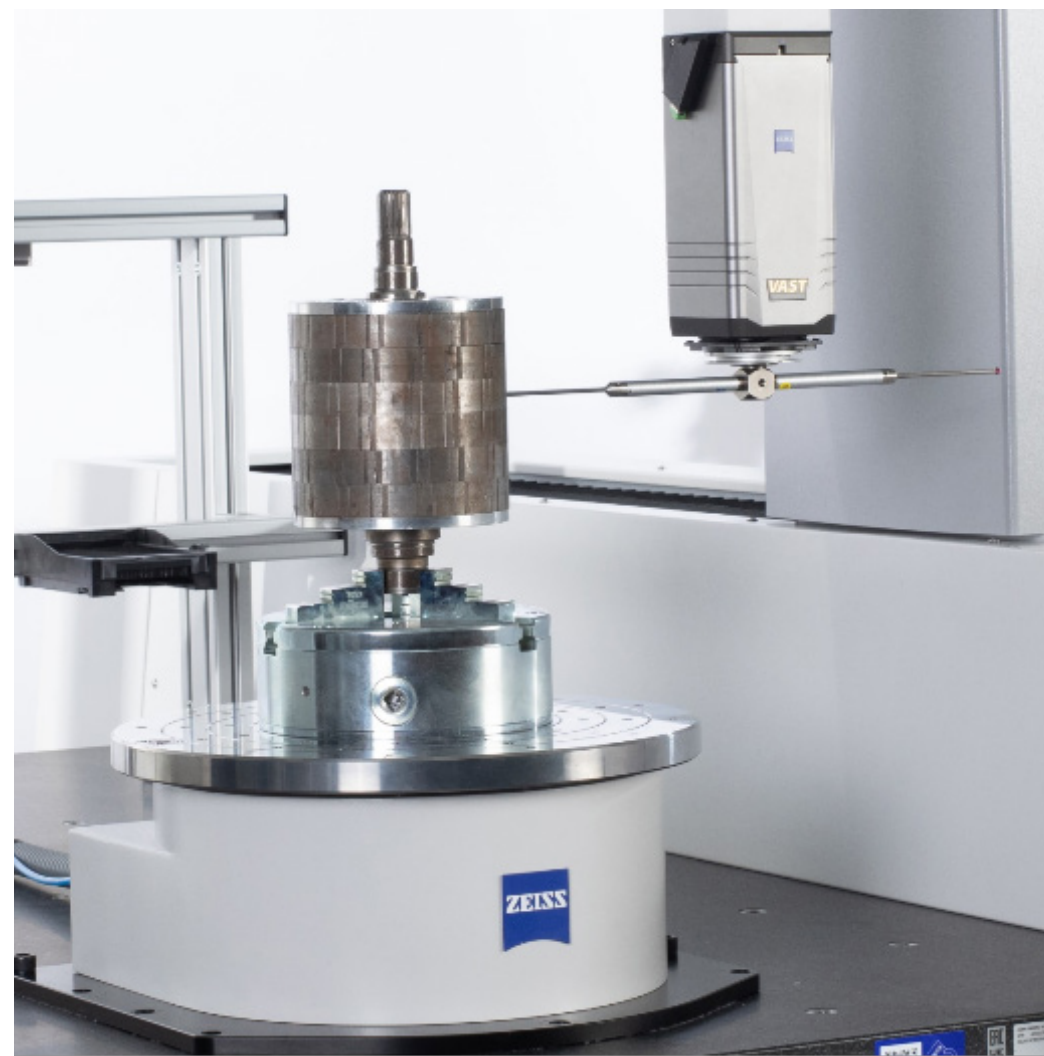


Application areas of CMM measurement



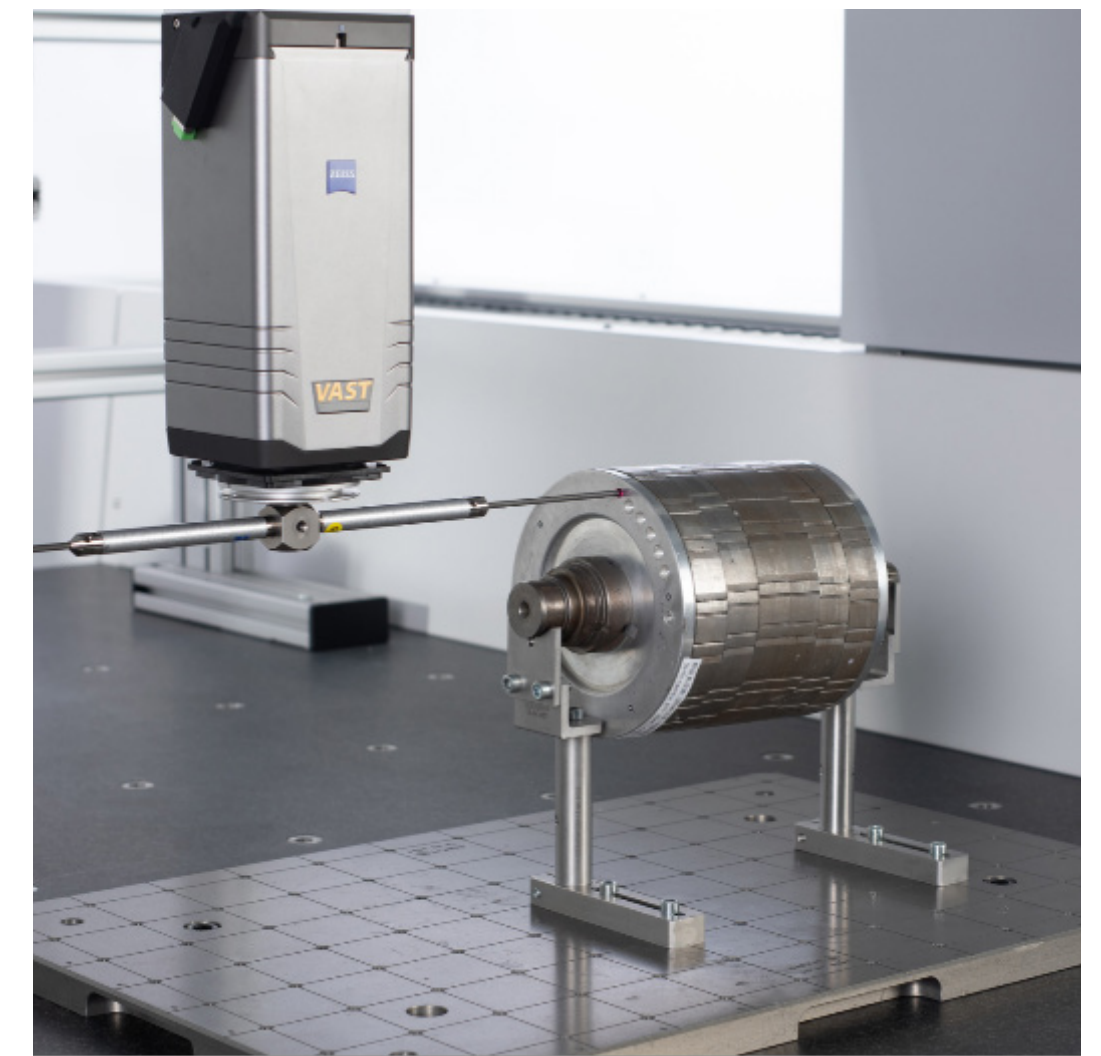
Shaft geometry

- Precise measurement of radial & axial runout (<math><1\mu\text{m}</math>)
- Data acquisition of shaft diameter and cylindricity
- Data acquisition & storage of shaft graphical data



Rotor package geometry

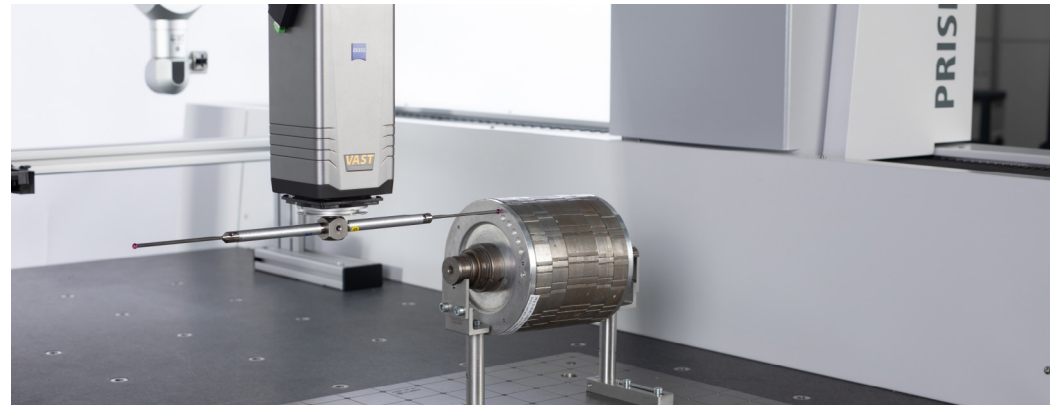
- Data acquisition of package diameter and cylindricity
- Data acquisition of package roundness, straightness and flatness
- Precise measurement of roughness and waviness



Rotor assembly geometry

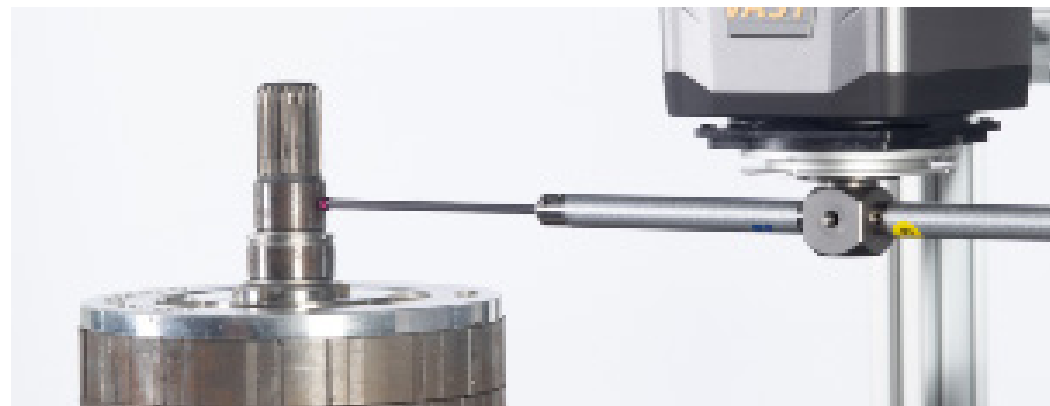
- Data acquisition of true Position and Coaxiality
- Inspection of groove and undercuts
- Measurement of bearing seat

Value proposition of ZEISS solution



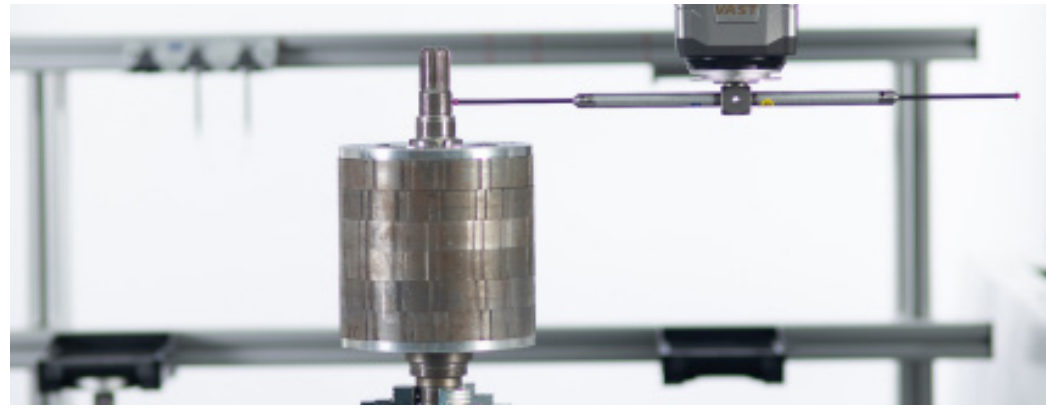
Increase reliability with high precision

- Active Probe System guarantee 0.5um precision for runout measurement
- ZEISS fast probing system guarantee <0.1um in repeatability for diameter measurements
- Ceramic & carbon fiber shafts represent optimum combination of stiffness, light-weight, and stable thermal linear expansion



Increase reliability with magnetism resistance

- Up to 500mm extended probe ensures safety when measuring magnetized rotor assembly
- Professional service support with specifications on measurements with flux density
- Rotary table can perform under magnetized environment



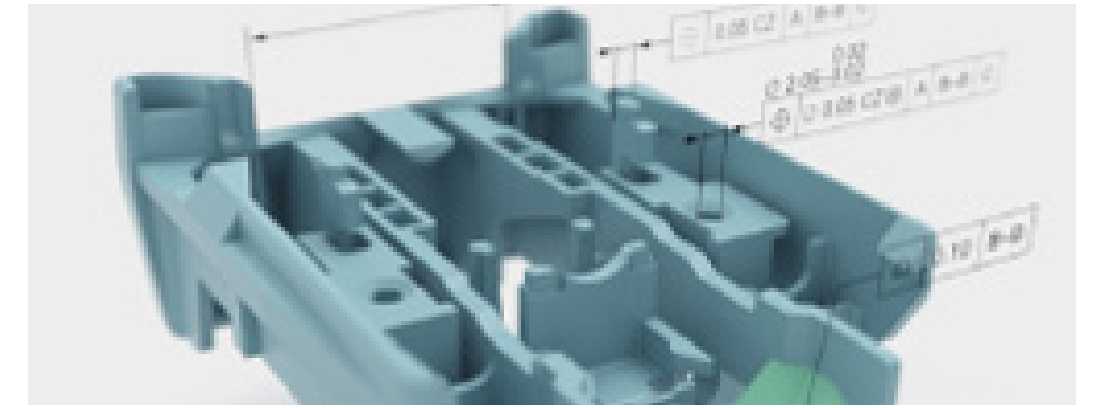
Increase efficiency with high-speed scanning

- Four-axis linkage with rotary table provides fast & precise measurements
- ZEISS VAST scanning technology guarantees <1 um repeatability error at 50mm/s speed
- ZEISS fly scan technology saves 70% probing time



Reduce cost with durable accessories

- Diamond-coated probe provides rough surface resistance
- Ceramic probe with low porosity suits particularly for scanning cast iron surface
- Ceramic sphere & shafts combination minimizes sensor damage risk during measurement under magnetism



Reduce cost with powerful software

- One software realizes GD&T & optical inspections
- Graphical programming UI saves operation training cost



Increase efficiency with multiple sensors

- Multiple sensors guarantee capability of measuring all quality requirements
- Automated sensor switch (MASS System) guarantee reliable and efficient measurements

Recommended portfolio

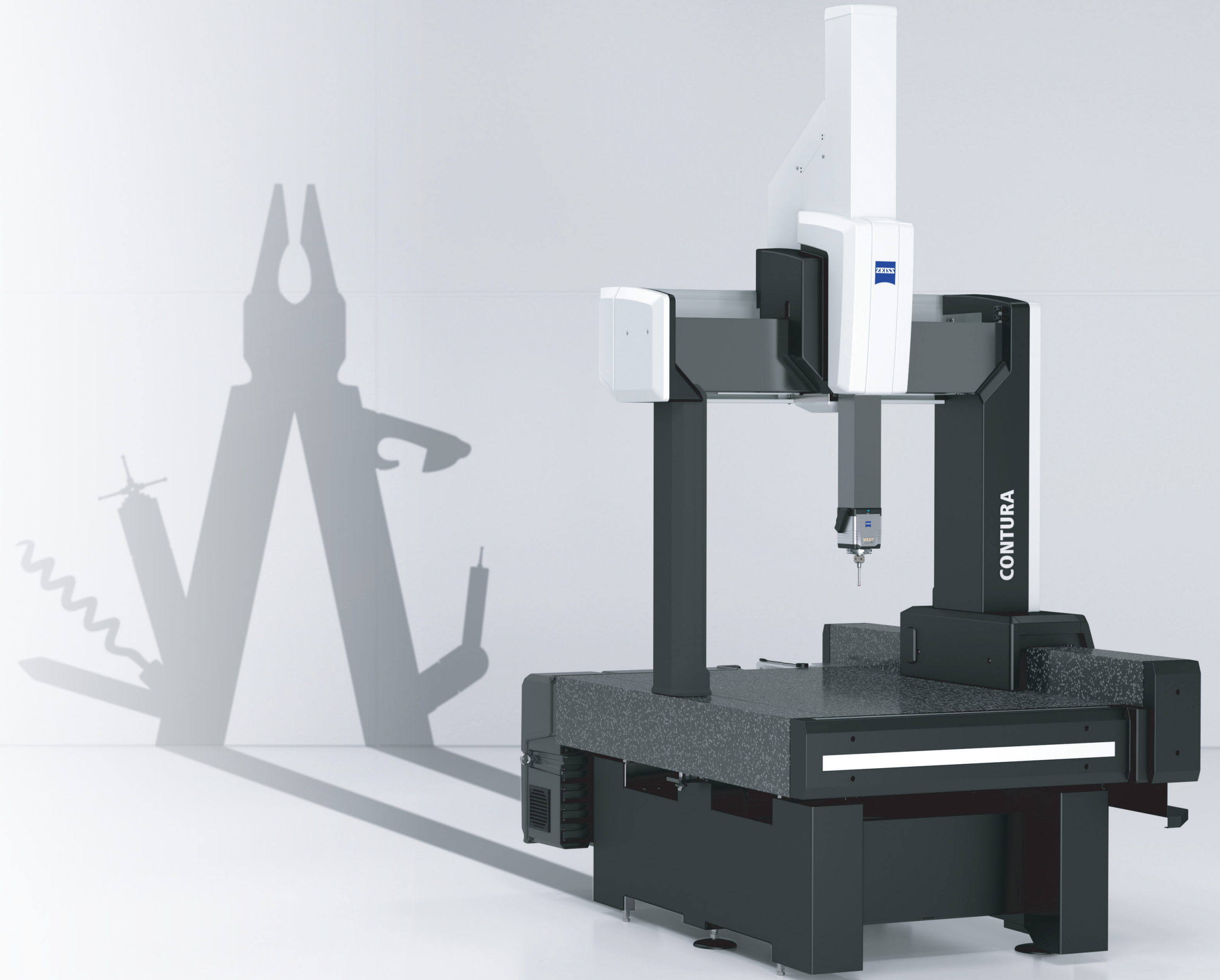
Prepared for all challenges-today and tomorrow

ZEISS CONTURA 7/7/6

Length measurement error in μm : MPE_E0	$1.5 + L/350$
Max. Travel speed vector V_{max}	$475 \frac{\text{mm}}{\text{s}}$
Max. vector acceleration	$1,85 \frac{\text{m}}{\text{s}^2}$
Max. Scanning speed	$150 \frac{\text{mm}}{\text{s}}$
Measuring sizes	700mm*700mm*600mm

Benefits: ✓

- ZEISS multi application sensor system(MASS)allows for tactile, optical, and roughness measurements to be performed on the same ZEISS machine.
- ZEISS RDS sensor is capable of reaching almost any position of each component with a step size of 2.5 degrees.
- ZEISS ViScan 2D optical probe offers full flexibility for fast measurements.
- ZEISS DotScan, a confocal white light probe, is particularly suitable for measuring sensitive surfaces.
- ZEISS LineScan enables rapid point cloud scanning, allowing for comparison with nominal CAD data or the creation of new CAD models.



Recommended portfolio

Precision in every environment

ZEISS PRISMO Family



Length measurement error: MPE_E0 0.5 + L/500 μm-
0.9 + L/350 μm

Measuring sizes 7/9/5 - 16/42/14

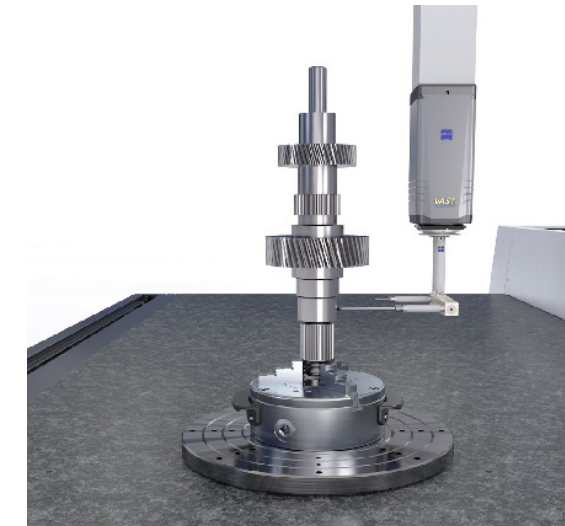
ZEISS mass technology As standard

Benefits: ✓

- ZEISS multi application sensor system(MASS)allows for tactile, optical, and roughness measurements to be performed on the same ZEISS machine.
- ZEISS RDS sensor is capable of reaching almost any position of each component with a step size of 2.5 degrees.
- ZEISS PRISMO ultra guarantees top accuracy up to 0.5 + L/500 μm
- ZEISS VAST Rotary Table Axis (ZVRA) defines the axis of the rotary table for accurate and reliable measurement

ZEISS rotary tables

RT-AB series



Installation on CMM Built-in/Surface-mounted

Max. angular velocity 50°/ s

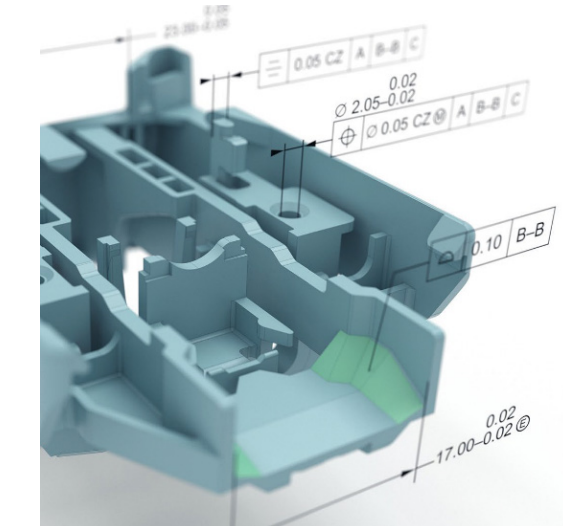
Max. loading 600kg

Benefits: ✓

- ZEISS rotary tables provide an additional axis, thus simplifying the measurement of rotationally symmetric or prismatic workpieces
- ZEISS rotary tables allow the use of simple stylus systems and extending the available measuring range
- ZEISS rotary table functionality is fully integrated into ZEISS basic software
- Computer guidance is provided for a large range of functions

ZEISS CMM software

CALYPSO



Installation possibilities

CALYPSO planner
CALYPSO simulation
Automation
Reporting

Performance enhancer

VAST probing
VAST navigator
VAST performance

Benefits: ✓

- ZEISS CALYPSO VAST probing Significant reduction in time for single point measurements with accuracy and fast single point detection
- ZEISS CALYPSO VAST navigator improves scanning operations of VAST series tactile measurement machines by improving accuracy and significantly reducing the measurement time of circular paths
- ZEISS CALYPSO pallet optimizer reduces the number of sensor and stylus system changes during a pallet measurement in an automated way

38
Sales & Service
Organizations

63
Quality
Excellence
Centers

11
Locations

245
Sales Partners
Worldwide

Global Metrology Network

Our global service network provides easy access to ZEISS expertise around the world. We use local teams to ensure a swift response and reduced downtime. Make your operations even more secure and reliable with ZEISS.

Find your perfect solution today.
Contact our global experts.

