



**ZEISS EVO**  
Scanning Electron Microscope





## Industry has a New Ally.

Count on ZEISS EVO as the best qualified SEM to support industrial QA and FA labs.

In an industrial quality, failure analysis, or research environment, the scanning electron microscope is the solution of choice for metallography and failure analysis applications, due to its ability to provide both high resolution imaging and high spatial resolution elemental chemistry.

Designed specifically for routine inspection and analysis applications, ZEISS EVO excels at offering an operational concept that appeals not only to experienced microscopists, but also to engineers who are not SEM experts. It delivers best-in-class, high quality data, especially for non-conductive parts that cannot be coated with a conductive layer due to a requirement for subsequent inspection.

A truly unique attribute of EVO is its seamless integration into a multi-modal QA or FA workflow, thanks to features like semi-automated relocation of regions of interest and data integrity solutions – across systems, labs or even locations.

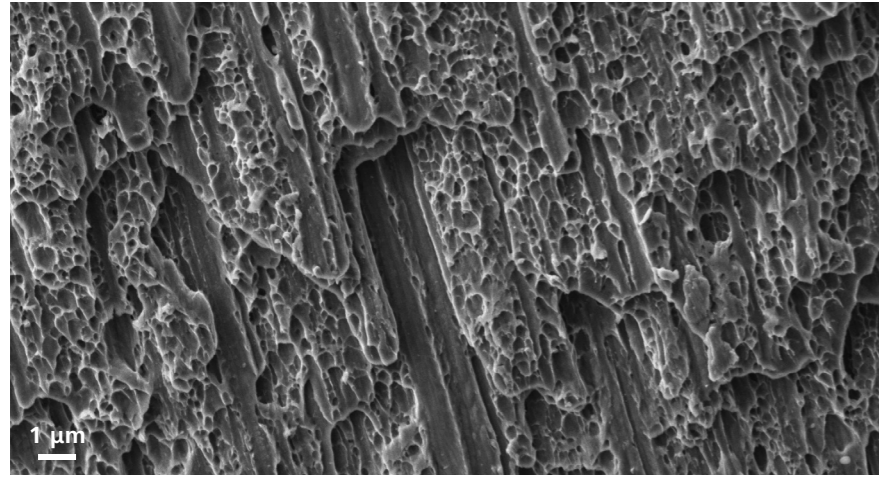
EVO is also the platform for certain turn-key industrial solutions for cleanliness as well as mineral analysis and processing.

With a wide choice of chamber sizes, vacuum system, electron emitter types, and analytical options, the odds are good that your EVO can be matched closely to your price-performance requirements.



## Take Your Investigation to the Next Level.

EVO takes over when you've reached the resolution or contrast limit of light microscopy, but still need answers.



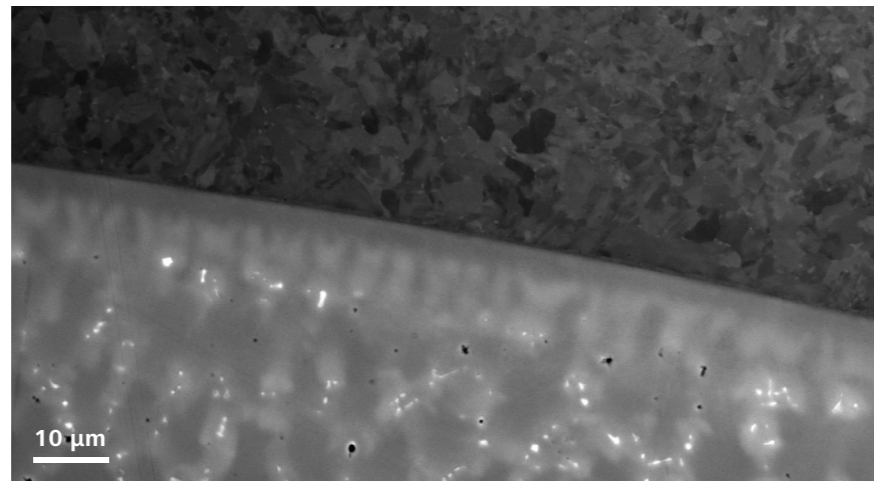
### High Resolution Surface Morphology

Secondary electron (SE) imaging – with a maximum resolution of a couple of nanometers – comfortably covers most of the sub-micron length-scale. While light microscopy yields contrast (reflections) from surfaces, secondary electron emission yields contrast from edges on the sample surface, thereby providing greater detail of surface morphology, such as that of metal fractures.

Stainless steel fracture surface, with strong contrast from the fracture surface edges likely delineating metal grains. Horizontal field of view: 10 µm.

### Compositional Imaging

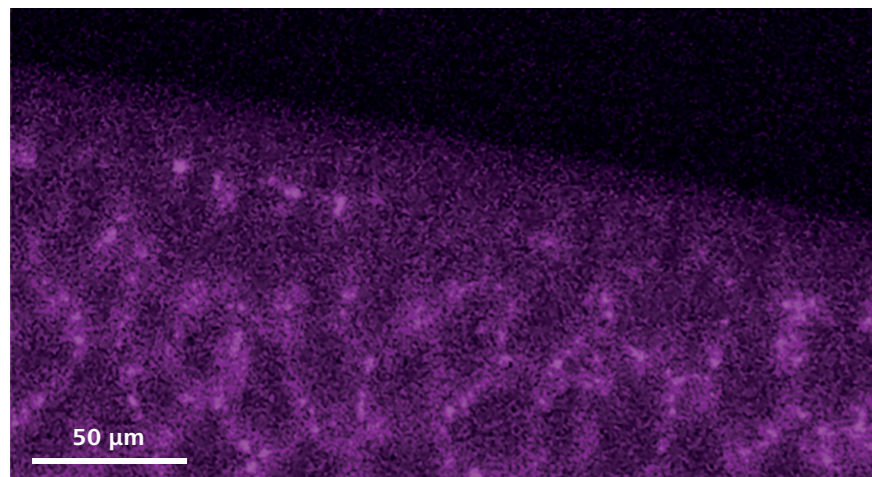
Backscattered electron (BSE) imaging yields contrast that is directly proportional to the density of the materials that constitute your parts or assemblies. It provides a snapshot of compositional heterogeneity that can help you determine the root cause of material failure or quality excursions.



Backscattered electron image of dissimilar joint of low alloy steel (8630) with nickel alloy (625) weld metal, revealing complex compositional heterogeneities across the joint. Horizontal field of view: 100 µm. Sample courtesy: TWI Ltd.

### High Spatial Resolution Elemental Analysis

In Energy Dispersive Spectroscopy (EDS), X-rays generated by the interaction of the finely focused electron beam with the part yields the elemental composition of the surface. Applying a scanning beam yields the distribution of chemical elements across the region of interest. EVO with EDS offers a great solution for visualizing the possible contribution of elemental chemistry to quality challenges or material failures.






Elemental map across the dissimilar joint shown above, revealing the spatial distribution of Molybdenum

## Powerful Yet Affordable

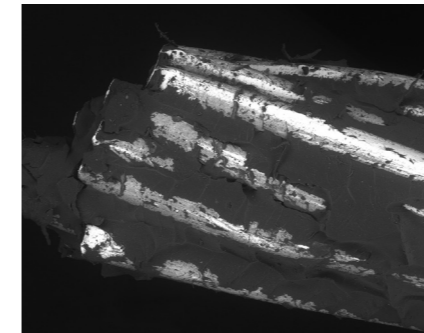
The perfect match to your price–performance requirements

The ZEISS EVO product family caters to a wide range of configuration options:

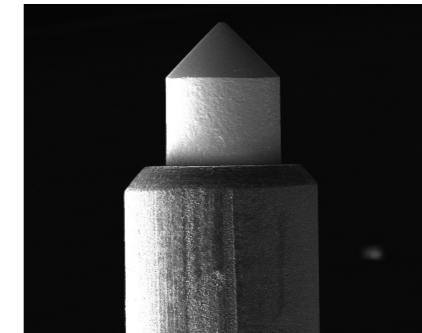
	ZEISS EVO 10	ZEISS EVO 15	ZEISS EVO 25
 Maximum specimen height (mm)	100	135	210
 Maximum specimen diameter (mm)	200	250	300
 Motorized stage travel XYZ (mm)	80 x 100 x 35	125 x 125 x 50	130 x 130 x 50 (or 80)

### Chamber Size

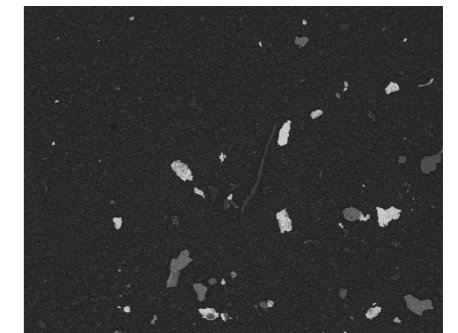
Choose from three vacuum chamber sizes (EVO models 10, 15 and 25) to select the one that best fits your imaging and analysis requirements, whether you work with small components, or very large parts or assemblies, such as powertrain or electrical components.



Backscattered electron image of a tyre cord, showing the steel wire (bright) intermixed with rubber (dark). Horizontal field of view: 2 mm.



Secondary electron image of a lanthanum hexaboride electron emitter



Backscattered electron image of particles on a filter. Horizontal field of view: 4 mm

### The Environment to Match Your Samples

Choose between the standard (high) vacuum configuration for metallic and other conductive parts, or add the optional Variable Pressure (VP) mode for imaging and analysis of non-conductive parts, without coating or preparation that might interfere with your multi-modal QA or FA analysis workflow. When choosing VP, be sure to also select the best-in-class secondary electron detector, the ZEISS C2D, for surface morphology imaging of non-conductive parts.

### Electron Source

Choose between the standard thermal electron emitter (tungsten hairpin), or treat yourself to a lanthanum hexaboride (LaB<sub>6</sub>) thermal emitter and benefit from up to 10 times more electron beam brightness. ZEISS has continuously improved the implementation of LaB<sub>6</sub> in SEMs over decades, resulting in enhanced ease-of-use and better image quality, especially when using VP mode.

### Analytical Capabilities that Extend EVO's Utility

Optionally, configure your EVO with particle analysis capabilities, enabling you to greatly enhance productivity through overnight runs of filters from your colleagues' cleanliness analysis workflows.



## Get More Hands on Deck.

SEM operation for both expert and novice users

In industrial material laboratories, throughput and time to data suddenly becomes critical when quality excursions in manufacturing are discovered, or failed parts are returned from the field. As resources are deployed to get answers, it is good to know that the EVO SEM can be operated by both expert and non-expert electron microscopists by means of the dedicated, simplified graphical user interface.

### SEM Operation for Experienced Users

By default, the EVO is operated from a Windows 10 graphical user interface, ZEISS SmartSEM, which features all the functionality required by the expert user. Additionally, a control panel is available providing convenient shortcuts to the most common functions, such as magnification, focus and stigmatism, or contrast and brightness.



SmartSEM: interface for experienced users

### SEM Operation for Non-Microscopists

For novice and occasional users, EVO also can be operated from the simplified graphical user interface SmartSEM Touch, by mouse or touch control. This interface allows pre-programming of instrument settings for repetitive imaging of parts commonly occurring in a quality inspection or failure analysis environment.



SmartSEM Touch: interface for novice users



*ECR Engines is a high-performance engine production and development company that has earned over 250 victories in NASCAR racing series. The company extracts the maximum performance from conventional V8 engines by relentlessly engineering parts to find every possible bit of incremental improvement and through systematic quality inspection of all failure prone parts. Over the last few years, ECR Engines has replaced their equipment from other vendors and is now operating exclusively with ZEISS instruments.*

## Image as Presented.

Analyze samples in their native state for the most accurate, best quality image and data.

Understandably, there may be reluctance to move a particular part to SEM. Non-conductive surfaces will charge under the electron beam. While a range of sample preparation solutions exist to mitigate this challenge, parts that will continue through a multi-modal QA or FA workflow must remain unaltered.

EVO excels at extracting the maximum data quality from uncoated and unaltered parts. EVO's variable pressure operation suppresses surface charge by a process of gas ionization in the vacuum chamber. Dedicated variable pressure detectors (in particular, EVO's charge cascade detector, C2D) are optimized for secondary electron detection, at reduced beam acceleration voltages, and – if required – long working distances. And last but not least: the optional lanthanum hexaboride (LaB<sub>6</sub>) emitter ensures the best possible noise-free images under these challenging conditions.

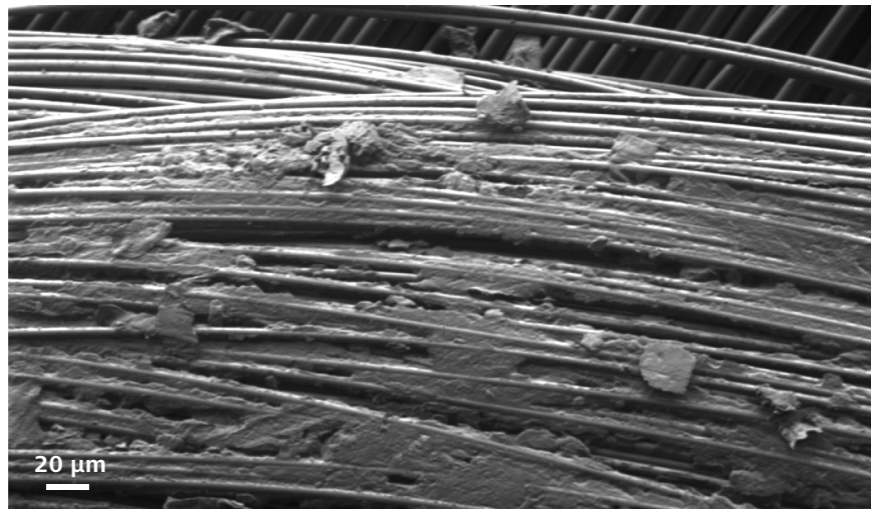
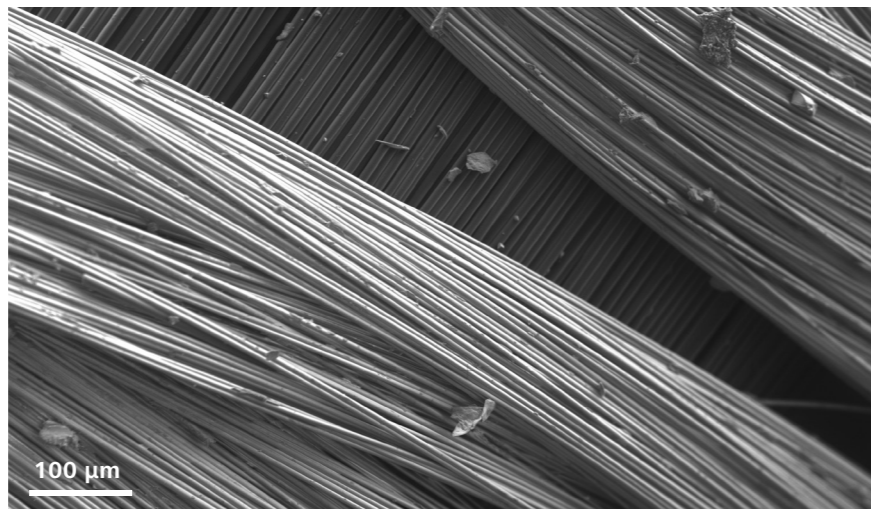


Image of impregnated woven fiber material, revealing the fibers and the filler material. Imaged at low kV with secondary electrons in variable pressure. Particularly at such challenging conditions, the benefits of LaB<sub>6</sub> become most apparent.



Overview image of the same sample, acquired at lower magnification in variable pressure mode with the C2D detector. Horizontal field of view: 1 mm.



## Plays Well with Others.

Benefit from workflow automation and correlative microscopy with ZEISS EVO.

In industrial quality assurance, as well as in failure analysis, a thorough assessment may require data acquired from other inspection or analysis modalities to get to the root of a problem.

This is where EVO excels, by “playing well with others”. The power of the multi-modal workflow, where a part moves from instrument to instrument, is in the acquisition of data complementary to SEM data, which provides an even broader perspective to the problem. The Shuttle & Find module of ZEISS image analysis and archive software, ZEN 2 core, allows EVO to be included in a multi-modal workflow with other ZEISS microscopes. Shuttle & Find and ZEN 2 core streamline sample exchanges and speed workflows with fast, semi-automated relocation of region of interests, automatic storage of data from multiple modalities in a single project folder, and overlay of imaging and elemental chemistry data from multiple modalities.

Multimodal data acquisition is reality already for some, and near future for others in industrial QA and FA environments. In any case, EVO is ready for integration in correlative microscopy or analysis workflows. And for regulated industries such as pharmaceutical or aerospace, every EVO is GxP compliant through the GxP module in ZEN 2 core.

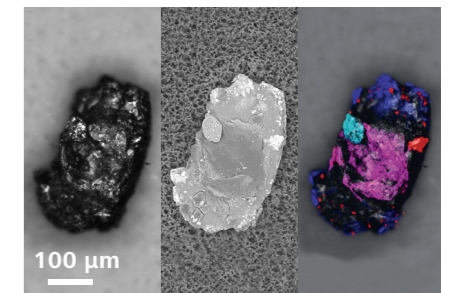
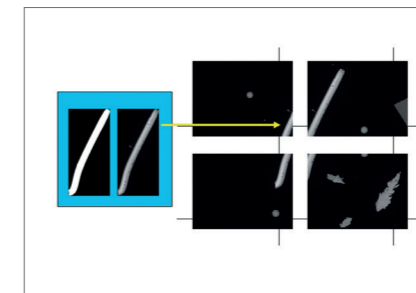
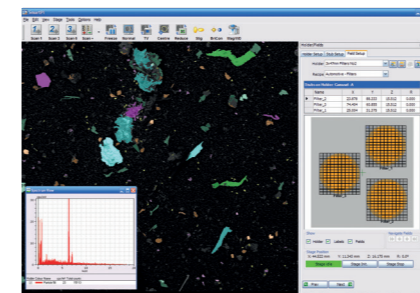
### Popular Multimodal Workflows are:

- ZEISS stereo or digital light microscopes to EVO for enhanced part inspection and documentation
- ZEISS (light) particle analyzers to EVO Correlative Particle Analysis (ZEISS CAPA)
- EVO to ZEISS confocal microscopy for tribology applications

## Value Beyond Routine SEM Applications

Turnkey solutions for industrial cleanliness and mineral processing

SmartPI is the ZEISS automated, standards-compliant SEM Particle Analysis solution that, in contrast to light microscopy-based cleanliness solutions, allows particle classification on the basis of elemental composition. SmartPI data helps engineers relate the cleanliness data to the source of particle contamination. SmartPI is implemented on EVO as a turnkey solution for industrial cleanliness, and is supported entirely by ZEISS.



### Compliant with Industry Standards

The current SmartPI solution was developed in collaboration with a major global automotive component supplier, which assures it meets the most current and demanding industrial cleanliness requirements, including the latest VDA 19 Part 1 and 2 cleanliness measurement standard.

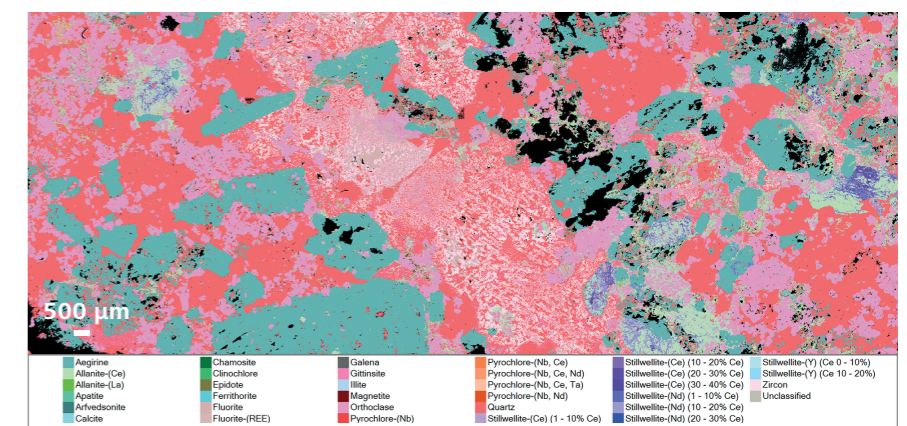
### Cross-Frame Particle Detection

One unique characteristic of SmartPI is the ability to detect cross-frame particles, ensuring the largest particles are not omitted from the measurement.

### Correlative Particle Analysis

SmartPI on the EVO, working together with ZEISS light microscopy particle analyzers, enable a correlative workflow, whereby the light microscopes detect particle size, differentiate shape, and classify metallic particles, before EVO takes over to measure the elemental composition of the metallic particles. This highly efficient workflow not only finds particles, but also classifies particles by size, shape and likely contamination or wear origin.

A second turnkey solution available for EVO is Mineralogic, an automated mineralogy solution for geosciences and the mineral processing industry. Request more information about Mineralogic from your ZEISS representative.



## Get more Answers.

Connect with other solutions in the ZEISS QA portfolio.



Optical Inspection and Documentation

### ZEISS Smartzoom 5

Smartzoom 5 is the ZEISS digital light microscope for routine industrial QA inspection and documentation applications. Designed for imaging and measurement repeatability, enhanced depth of field, and automated intelligent illumination, it is the most popular companion to EVO in a multimodal QA inspection workflow.



Surface and Roughness Analysis

### ZEISS Smartproof 5

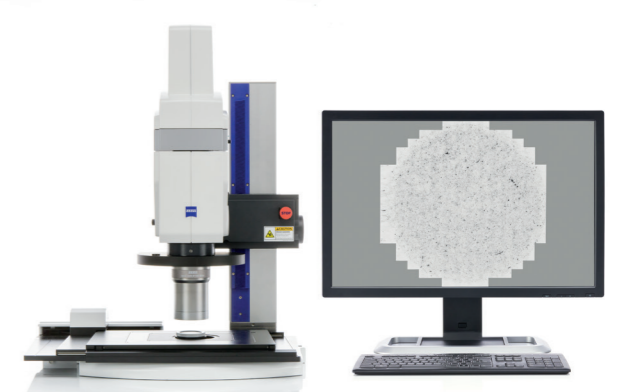
This digital confocal microscope delivers quantitative 3D imaging and roughness measurements for surface analysis investigations. Smartproof 5 is a turnkey and easy to use instrument that can be implemented with minimal training. Non-microscopist users can take advantage of guided workflows to produce fast, precise and repeatable results.



Optical 2D Measurements

### ZEISS O-SELECT

O-SELECT is the digital profile projector for 2D optical metrology applications. Equally turnkey and as easy to use as Smartzoom 5, O-SELECT makes 2D optical measurements available with the touch of a single button.



### Particle Analysis Solutions

For advanced analysis of technical cleanliness, ZEISS has a range of light and electron microscope particle analysis solutions to cover a wide range of particle sizes and types. CAPA Correlative Particle Analyzer combines light and electron microscopy for particle classifications that require understanding of both morphology and elemental composition.



3D X-ray Microscopy

### ZEISS Xradia

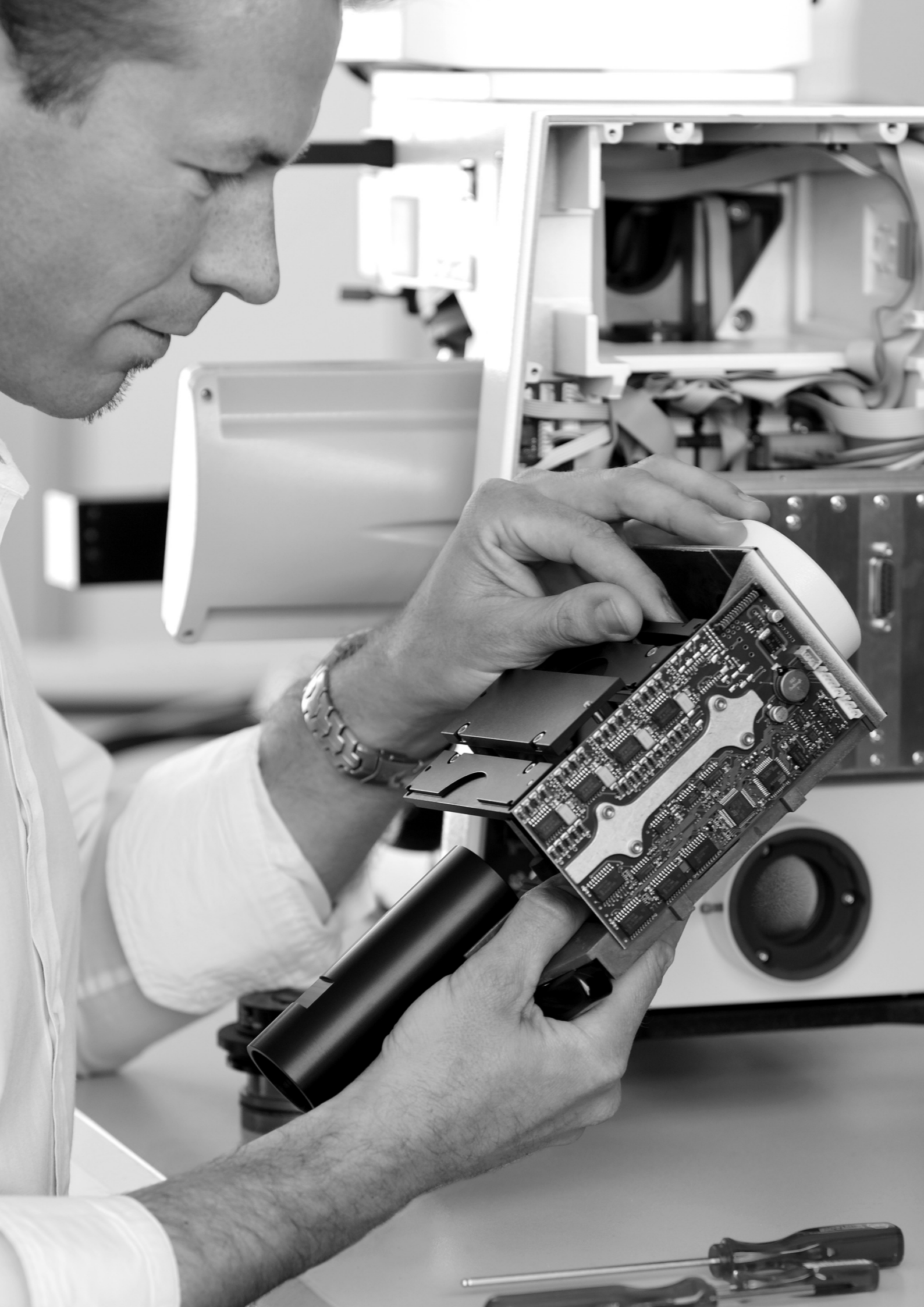
XRM is the ZEISS non-destructive 3D imaging solution that performs X-ray computed tomography with imaging resolutions well below 1 micrometer. XRM is ideal for parts or assemblies that cannot be sectioned or dismantled for inspection of the internal materials and structures.



### ZEISS Industrial Metrology Portfolio

If you need to include additional capabilities to meet your QA requirements, check out the ZEISS IMT group's dedicated industrial metrology solutions which include a range of sensor, infrared and X-ray based inspection and metrology solutions.

[www.zeiss.com/metrology](http://www.zeiss.com/metrology)



## Service and Support for Your ZEISS Microscope System.

ZEISS Moments are about passion. The same passion that drives us to support and accompany you and your ZEISS microscope over its life cycle makes sure that your work will lead systematically to success.

### **You Work Hard: We Make Sure Your Microscope Keeps Pace with You.**

High imaging quality, reliable results and instrument availability are the parameters of your day-to-day working life. Your ZEISS microscope integrates seamlessly into this demanding workflow. It provides you with insights and results that you can trust: thorough, comprehensive and reproducible. With ZEISS Life Cycle Management we help you to keep your microscope in optimum condition to get these optimum results.

### **Life Cycle Management Comes with Your Microscope**

Life Cycle Management from ZEISS backs up our solutions throughout the working life of your ZEISS microscope system. From the procurement phase onward, you can count on our support, starting with site surveys to optimize the location for your microscope system. Throughout the operational phase we will complement our service with support for relocations and upgrade opportunities that enhance or expand your possibilities. As soon as you think about replacing your long-serving microscope with a new one, we will take care of the disassembly and disposal of systems that are no longer needed. Rely on our service features: our employees analyse the status of your system and solve problems via remote maintenance or directly at your location.

### **From Expert to Expert**

Never hesitate to ask our application specialists to support your specific tasks. And be sure to tap into our training sessions for any colleagues or employees who will be working with your ZEISS microscope.

### **Peace of Mind and Availability with Regular Maintenance**

Your service plan is tailor-made for you. Make sure you take advantage of all the opportunities your ZEISS microscope system offers. Get optimized performance, instrument reliability and availability at predictable costs. Choose from different service levels of our Protect Service Plans, ranging from Protect preventive, via Protect advanced, to Protect premium. We look forward to discussing your ideal service plan personally.







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