



Product Information  
Version 1.1

## **ZEISS Xradia 510 Versa**

Submicron X-ray Imaging: Maintain High Resolution  
Even at Large Working Distances



We make it visible.

# Breakthrough Flexibility for 3D Submicron Imaging

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- › The Advantages
- › The Applications
- › The System
- › Technology and Details
- › Service

Achieve new levels of discovery with ZEISS Xradia 510 Versa 3D X-ray microscopes (XRM), the industry's premier *in situ* / 4D solution. Breakthrough technology and detectors deliver submicron imaging for diverse sample sizes. Use the instrument's powerful combination of world-leading resolution and contrast with flexible working distances to extend the power of non-destructive imaging in your lab.



# ZEISS Xradia 510 Versa: Flexible. Innovative. Non-destructive.

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## **Define XRM: "Versatile"**

Non-destructive X-ray imaging preserves and extends the use of valuable samples over time. Maximize the power of X-ray microscopy (XRM) with Xradia 510 Versa using flexible 3D imaging for a wide range of samples and research environments. Extending synchrotron-caliber performance to premier labs worldwide, Xradia 510 Versa achieves 0.7  $\mu\text{m}$  true spatial resolution with minimum achievable voxel size of 70 nm. Experience increased versatility for soft or low-Z materials with advanced absorption contrast along with innovative phase contrast to overcome the limitations of traditional computed tomography approaches.

## **Achieve Performance Beyond Micro-CT**

Extend scientific research beyond the limits of projection-based micro- and nano-CT systems with ZEISS Xradia Versa solutions. Where traditional tomography relies on a single stage of geometric magnification, Xradia 510 Versa features a unique two-stage process based on synchrotron-caliber optics. Multi-length scale capabilities enable you to image the same sample across a wide range of magnifications. You will also find that Xradia 510 Versa is easy to use by everyone in your busy lab.

## **Choose the Industry's Premier 4D / *In Situ* Solution**

Uniquely characterize the microstructure of materials in their native environments and study the evolution of properties over time (4D). Breakthrough Resolution at a Distance (RaAD) enables unprecedented lab-based exploration for a diverse array of applications, sample types and under varying conditions in high-precision *in situ* rigs. The Xradia Versa *In Situ* Kit allows you to optimize set-up, makes operation easy and provides a faster time to results

## Your Insight into the Technology Behind It

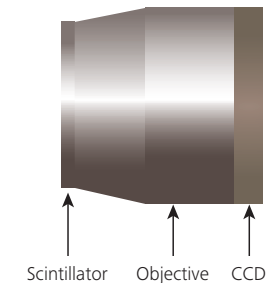
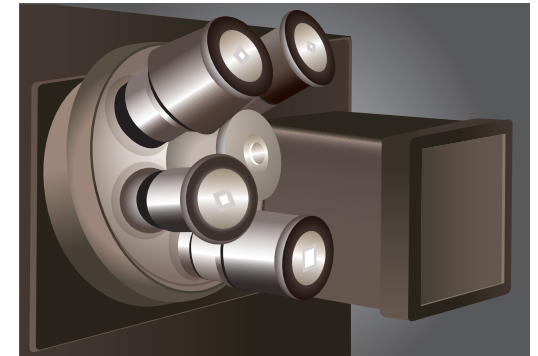
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Your premier research requires three-dimensional insight into subjects in their native states and as they evolve over time. World-leading research facilities, universities, synchrotrons, national and private labs have deployed X-ray microscopy (XRM) to meet the growing need for flexible, 3D/4D imaging at high resolution.

X-ray microscopy plays a vital role in your imaging workflow, delivering high resolution and contrast while preserving your valuable samples for future use. Adding a non-destructive stage to the traditional workflow complements your electron and optical capabilities, easily identifying regions of interest for further study with techniques that may require sacrificing your sample.

Xradia Versa solutions employ sophisticated X-ray optics developed for synchrotrons and a unique system architecture. Along with superior resolution and contrast, you will achieve unique multi-length scale imaging and experience flexible working distances and workflow efficiencies for a diverse array of applications and samples with Xradia Versa.

XRM Detector Technology

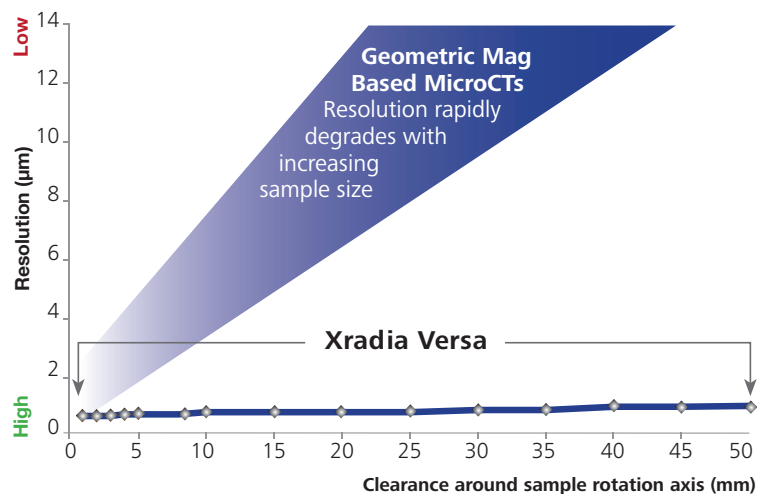


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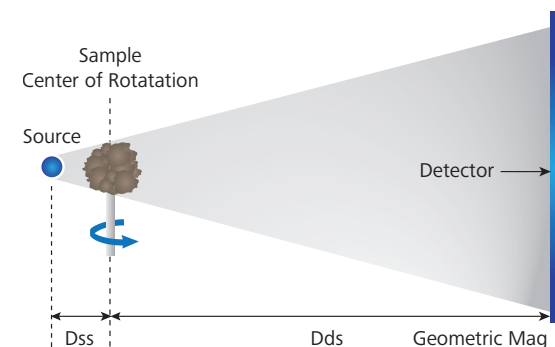
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## ZEISS XRM: Architected for Your Advantage

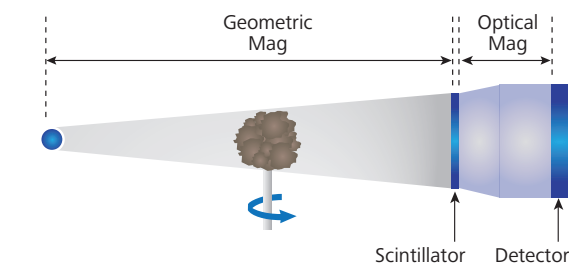
Use the two-stage magnification technique offered by Xradia Versa to uniquely achieve resolution at a distance (RaaD), which enables you to effectively study the widest range of sample sizes, including those within *in situ* chambers. Your sample images are initially enlarged through geometric magnification as they are in conventional micro-CTs. In the second stage, a scintillator converts X-rays to visible light, which is then optically magnified. Reducing dependence upon geometric magnification enables Xradia Versa solutions to maintain submicron resolution down to 700 nm at large working distances.



High resolution is maintained for large samples



Conventional Micro-CT Architecture



ZEISS XRM Two-stage Magnification Architecture

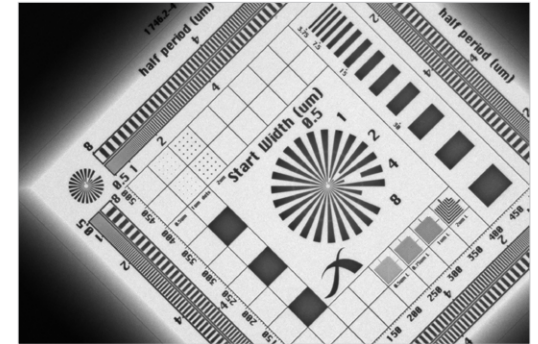
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## Achieve True Resolution

Xradia Versa solutions deliver powerful 3D X-ray imaging, maintaining true submicron spatial resolution across varying distances, sample sizes, and environments. ZEISS XRM are specified on true spatial resolution, the most meaningful measurement of your microscope's performance.

Spatial resolution refers to the minimum separation at which your imaging system can resolve a feature pair. You would typically measure it by imaging a standardized resolution target with progressively smaller line-space pairs. Spatial resolution accounts for critical characteristics such as X-ray source spot size, detector resolution, magnification geometry, and vibrational, electrical and thermal stability. Other terms such as "voxel," "spot size," "detail detectability," and "nominal resolution" do not convey your system's full performance.



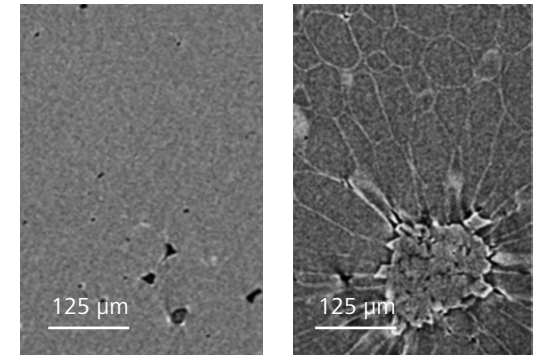
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## Gain an Edge in Contrast

Your imaging requires superior contrast capabilities to reveal details you need to visualize and quantify features. Xradia Versa deliver flexible, high contrast imaging for even your most challenging materials – low atomic number (low Z) materials, soft tissue, polymers, fossilized organisms encased in amber, and other materials of low contrast.

Our comprehensive approach employs proprietary enhanced absorption contrast detectors that provide you with superior contrast by maximizing collection of low energy photons while minimizing collection of contrast-reducing high energy photons. In addition, tunable propagation phase contrast measures the refraction of X-ray photons at material transitions to allow you to visualize features displaying little or no contrast during absorption imaging.



*Pear imaged with absorption contrast – no visibility of cell walls (left), and pear imaged with phase contrast, showing details of cell walls in normal cells and stone cells (right).*

# Precisely Tailored to Your Applications

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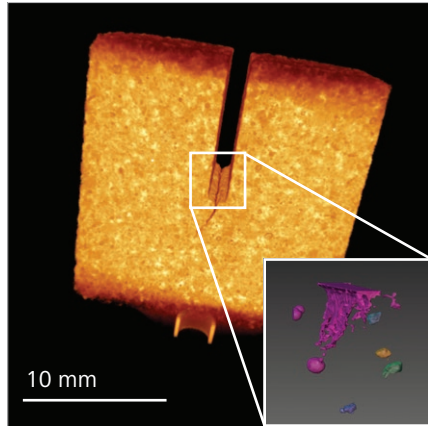
	Task	Xradia 510 Versa offers
<b>Materials Research</b>	Expand your materials research capabilities from visualizing cracks in soft composite materials to measuring porosity in steel, all with a single system	View into deeply buried microstructures that may be unobservable with 2D surface imaging such as optical microscopy, SEM, and AFM
	Perform <i>in situ</i> studies by imaging under varying conditions such as tensile, compression, dessication, wetting and temperature variations	You have the ability to maintain resolution at a distance for <i>in situ</i> imaging experiments, allowing you to study a wide variety of sample sizes and shapes using various <i>in situ</i> apparatus. With the non-destructive nature of X-ray, you can additionally understand the impact of these varying conditions over time.
<b>Life Sciences</b>	Quantify osteocyte properties for bone morphology, map neural networks, study vasculature, and understand development of bio structures	Leverage the highest resolution and highest contrast for exploring unstained and stained hard and soft tissues
<b>Natural Resources</b>	Characterize and quantify pore structure, analyze mineral liberation efforts, study carbon sequestration effectiveness	Experience the most accurate 3D, submicron characterization of rock pore structures for digital rock simulations and perform <i>in situ</i> multiphase fluid flow studies
<b>Electronics</b>	Optimize your processes and analyze failures	Use non-destructive submicron imaging of intact packages for defect localization and characterization, complementing or replacing physical cross-sectioning



# ZEISS Xradia 510 Versa at Work

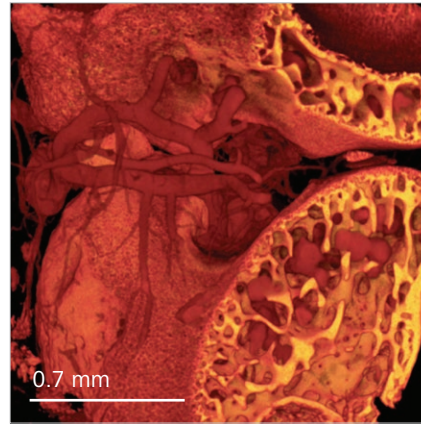
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## Materials Research



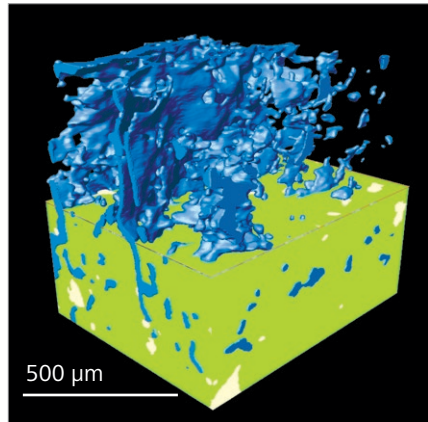
Refractory ceramic – resolve crack propagation

## Life Sciences



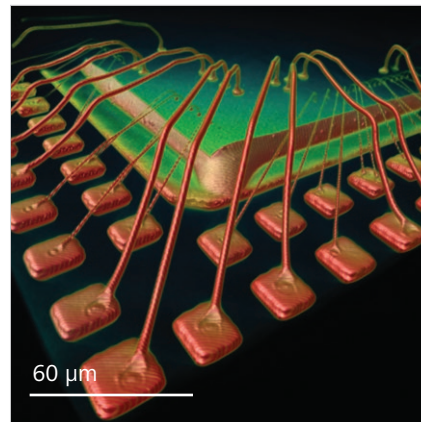
Mouse knee vasculature – study intact sample

## Natural Resources



Carbonate – analyze cores virtually

## Electronics



Wire bond – analyze failures

# Your Flexible Choice of Components

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## 1 X-ray Microscope

- ZEISS Xradia 510 Versa with Resolution at a Distance

## 2 X-ray Source

- High performance, sealed transmission source (30 – 160 kV, Maximum 10 W)

## 3 Contrast-optimized Detectors

- Innovative dual-stage detector system with detector turret of multiple objectives at different magnifications with optimized scintillators for highest contrast
- 2k x 2k pixel, noise suppressed charge-coupled detector

## 4 System Stability for Highest Resolution

- Granite base vibrational isolation
- Thermal environment stabilization

- Low noise detector
- Proprietary stabilization mechanisms

## 5 System Flexibility for Diverse Range of Sample Sizes

- Variable Scanning Geometry
- Tunable voxel sizes
- Absorption contrast mode
- Phase contrast mode
- Wide Field Mode (WFM) for increased lateral tomography volume with 0.4X objective
- Vertical Stitching for joining multiple tomographies vertically

## 6 Autoloader Option

- Maximize productivity by reducing user intervention
- Programmable handling of up to 14 samples
- Automated workflows for high volume, repetitive scanning

## 7 Sample Stage

- Ultra-high precision 8-degrees of freedom sample stage
- 15 kg sample mass capacity

## 8 X-ray Filters

- Single filter holder
- Set of 12 filters included
- Custom filters available by special order

## 9 In Situ and 4D Solutions

- Resolution at a Distance (RaaD) enables superior *in situ* imaging
- Integrated *in situ* recipe control for Deben stages
- *In situ* interface kit option
- Custom *in situ* flow interface kit by special order

## 10 Instrument Workstation

- Power workstation with fast reconstruction
- Single CUDA-based GPU
- Multi-core CPU
- 24" display monitor

## 11 Software

- Acquisition: Scout-and-Scan Control System
- Reconstruction: XMReconstructor
- Viewer: XM3DViewer
- Compatible with wide breadth of 3D viewers and analysis software programs
- ORS Visual SI for 3D visualization and analysis (optional)

# Technical Specifications

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<b>Imaging</b>	
Spatial Resolution	0.7 $\mu\text{m}$
Resolution at a Distance (RaaD)* at 50 mm working distance	1.0 $\mu\text{m}$
Minimum Achievable Voxel** (Voxel size at sample at maximum magnification)	70 nm

\* RaaD working distance defined as clearance around axis of rotation

\*\* Voxel (sometimes referred to as “nominal resolution” or “detail detectability”) is a geometric term that contributes to but does not determine resolution, and is provided here only for comparison. ZEISS specifies on spatial resolution, the most meaningful measurement of instrument resolution.

<b>X-ray Source</b>	
Type	Sealed transmission
Tube Voltage Range	30 - 160 kV
Maximum Output	10 W
Radiation Safety (measured 25 mm above surface of enclosure)	< 1 $\mu\text{S/hr}$

<b>Detector System</b>	
ZEISS X-ray microscopes feature an innovative detector turret with multiple objectives at different magnifications. Each objective features optimized scintillators that deliver the highest absorption contrast details.	
Standard Objectives	0.4X, 4X, 20X
Optional Objectives	40X

<b>Stages</b>	
Sample Stage (load capacity)	15 kg
Sample Stage Travel (x, y, z)	45, 100, 50 mm
Stage Travel (rotation)	360°
Source Travel (z)	190 mm
Detector Travel (z)	290 mm
Sample Size Limit	300 mm

<b>Feature Comparison</b>	<b>Xradia 520 Versa</b>	<b>Xradia 510 Versa</b>	<b>Xradia 410 Versa</b>
Scout-and-Scan Control System	■	■	■
Automated Filter Changer	■		
High Aspect Ratio Tomography	■		
Dual Scan Contrast Visualizer	■		
Autoloader	Optional	Optional	Optional
Wide Field Mode	0.4X and 4X	0.4X	0.4X
GPU CUDA-based Reconstruction	Dual	Single	Single
<i>In Situ</i> Interface Kit	Optional	Optional	Optional

# Count on Service in the True Sense of the Word

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Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What's more, we'll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

## **Repair. Maintain. Optimize.**

Attain maximum uptime with your microscope. A ZEISS Protect Service Agreement lets you budget for operating costs, all the while reducing costly downtime and achieving the best results through the improved performance of your system. Choose from service agreements designed to give you a range of options and control levels. We'll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization's standard practices.

Our service on-demand also brings you distinct advantages. ZEISS service staff will analyze issues at hand and resolve them – whether using remote maintenance software or working on site.

## **Enhance Your Microscope System.**

Your ZEISS microscope system is designed for a variety of updates: open interfaces allow you to maintain a high technological level at all times. As a result you'll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.



*Profit from the optimized performance of your microscope system with a Carl Zeiss service contract – now and for years to come.*

>> [www.zeiss.com/microservice](http://www.zeiss.com/microservice)

The moment exploration becomes discovery.  
**This is the moment we work for.**

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