# Extending the Frontiers of Semiconductor Failure Analysis

## ZEISS Xradia 630 Versa 3D X-ray Microscopy


ZEISS Xradia 630 Versa 3D X-ray microscopy (XRM) is the ultimate non-destructive imaging solution in failure analysis and process development for semiconductor and electronic packages, components, and devices, including:

- Heterogenous integration devices
- 2.5D/3D packages with TSVs
- Fan-out wafer level packages with redistribution layers
- High bandwidth memory and V-NAND
- Flip chip C4 bumps and microbumps
- Smartphones and components

The next-generation Xradia 630 Versa extends the limits of submicron-resolution 3D imaging and analysis, enabling unprecedented 450 nm spatial resolution. It delivers effortless data acquisition workflows for all users with a redesigned user interface and provides faster scan times across broader length scales with a flat panel detector.

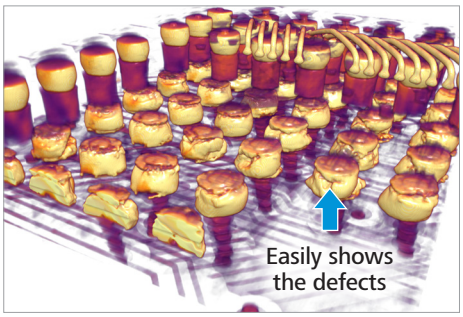
These advancements make Xradia 630 Versa ideal for construction analysis, packaging analysis, and failure analysis.

### Highest-resolution 3D X-ray Imaging

- Visualize virtual cross-section images of fault locations and buried features without cutting the samples
- Achieve industry-leading 450 nm spatial resolution, maintaining 500 nm spatial resolution even at the highest energy
- Obtain unsurpassed performance for high-resolution while imaging at long working distances in packages, circuit boards and large electronic devices

### Effortless Data Acquisition

- A newly designed user interface NavX uses Human Centered Design (HCD) principles. It improves scan setup efficiency and reduces learning curves for all users.
- Infographic mental models and guidance provide instant access to procedural suggestions and feedback, eliminating the need for costly training and reducing the learning curve
- Integrated new workflows such as Projection Scout and Volume Scout, streamline user interactions during scan setting
- NavX user interface enables high-productivity data acquisition and improves the success rate of root cause analyses



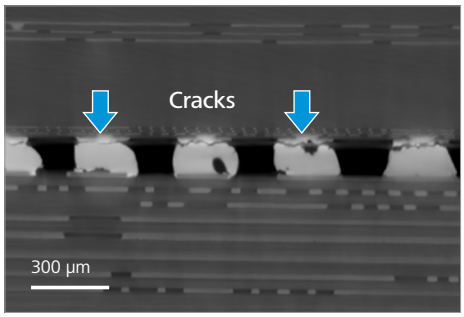




***Figure 1*** *Non-destructive visualization and characterization of solder fatigue cracks in a thermal cycled smartphone SIP control board at 2.5 µm voxel resolution*

ZEISS

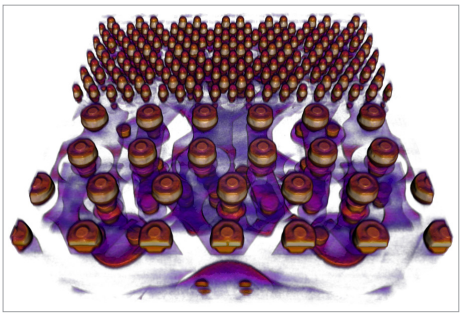
Seeing beyond

## Superior Image Quality at Improved Scan Speed

- ZEISS's unique Resolution at a Distance (RaaD) technology for high resolution even at large working distances
- Improved resolution and contrast performance even at high energy range with optional 40X-Prime objective
- Broader length scales of sample sizes and fields of view (FOV) with an included flat panel detector (FPX)
- High-speed scans with FPX on large semiconductor packages and electronics products
- Optional AI supercharger module (DeepRecon Pro + DeepScout) to improve scan speed
- Plan-view and cross-sectional images may be viewed with accurate isolation of the desired plane, in any direction
- High Aspect Ratio Tomography (HART) for faster imaging of semiconductor packages and electronic samples
- Optional Autoloader for continuous operation

## Benefits

- Highest resolution and contrast for a multitude of package applications: failure analysis, process development, construction analysis and production validation
- Unprecedented 0.45 µm spatial resolution, 40 nm minimum voxel size
- Uncomplicated scan operations with the intuitive NavX user interface and streamlined workflows
- Integrated flat panel detector broadens the dynamic range of sample sizes and fields of view with faster scans
- Flexible system configurations and upgradable path



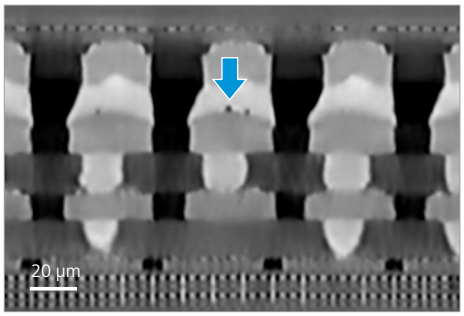



*Figure 2* *(Left) Package interconnects visualized in a 22×26 mm embedded multi-die interconnect bridge (EMIB) package. (Right) Virtual cross-section of 30 µm diameter microbumps of the EMIB package, acquired at 0.32 µm/voxel with a new optional 40X-Prime objective lens.*

## Specifications

| Imaging | ZEISS Xradia 630 Versa | ZEISS Xradia 620 Versa | ZEISS Xradia 610 Versa | ZEISS Xradia 510 Versa |
|---|---|---|---|---|
| Spatial Resolution [a] | 0.45 µm | 0.5 µm | 0.5 µm | 0.7 µm |
| Resolution at a Distance (RaaD) [b] (at 50 mm working distance) | 0.7 µm | 1.0 µm | 1.0 µm | 1.0 µm |
| Min Achievable Voxel [c] | 40 nm | 40 nm | 40 nm | 70 nm |
| **X-ray Source** | | | | |
| Architecture | Sealed Transmission, Fast Activation | Sealed Transmission, Fast Activation | Sealed Transmission, Fast Activation | Sealed Transmission |
| Voltage Range | 30-160 kV | 30-160 kV | 30-160 kV | 30-160 kV |
| Maximum Power Output | 25 W | 25 W | 25 W | 10 W |
| **Detector System** | | | | |
| 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 | FPX, 0.4X, 4X, 20X | 0.4X, 4X, 20X | 0.4X, 4X, 20X | 0.4X, 4X, 20X |
| Optional Objectives | 40X-P [d] | 40X, Flat Panel Extension (FPX) with microCT capability | | |
| **Stages** | | | | |
| Sample Stage (load capacity) | 25 kg | | | |
| Sample Stage Travel (x, y, z) | 50, 100, 50 mm | | | |
| Stage Travel (rotation) | 360° | | | |
| Source Travel (z) | 190 mm | | | |
| Detector Travel (z) | 290 mm | | | |
| **Versa Features** | | | | |
| Scout-and-Scan Control System | NavX™ | ■ | ■ | ■ |
| SmartShield | SmartShield (Lite) | ■ | ■ | ■ |
| Automated Filter Changer | ■ | ■ | | |
| High Aspect Ratio Tomography (HART) | ■ | ■ | | |
| Autoloader | Optional | Optional | Optional | Optional |
| Wide Field Mode | 0.4X and 4X | 0.4X and 4X | 0.4X | 0.4X |
| GPU CUDA-based Reconstruction | Dual | Dual | Dual | Single |

[a] Spatial resolution measured with ZEISS Xradia 2D resolution target, normal field mode, optional 40x objective.
[b] RaaD working distance defined as clearance around axis or rotation.
[c] Voxel is a geometric term that contributes to but does not determine resolution, and is provided here only for comparison. ZEISS specifies resolution via spatial resolution, the true overall measurement of instrument resolution.
[d] 40X-Prime objective

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