

Helios MX1 PFIB-SEM

The Thermo Scientific Helios MX1 PFIB-SEM Wafer DualBeam accelerates time-to-data for semiconductor manufacturers by offering reliable, high-performance critical dimension metrology and defect analysis to improve yield ramp and maintain in-line process control for advanced 3D architectures and buried structures.

Today's most advanced semiconductor fabs are creating technology inflections, pushing the limits of physics and chemistry with nanoscale features, novel materials, and increasingly complex 3D structures to meet the growing market demand for faster and more powerful devices which consume less energy. Shrinking geometries and the transition to new device architectures have significantly increased the volume of the high-resolution 3D metrology and defect analysis required for process development and manufacturing. SEM metrology is becoming more valuable as other metrology techniques reach their limitations. In-line 3D SEM process monitoring provides fast time to results of the critical data needed to validate or identify excursions of the growing number of process steps required to fabricate these advanced chips and devices in the competitive market of high-volume manufacturing.

The Thermo Scientific™ Helios™ MX1 PFIB-SEM is the latest generation of wafer DualBeam™ PFIBs to meet the demands of fully automated 3D SEM metrology. It provides faster actionable time to data at the wafer level to speed up the process yield improvement by process control and monitoring with improved PFIB, SEM, and metrology performance enhancements while offering improved reliability and availability. This instrument includes the addition of a multi-ion species PFIB, supporting both xenon and argon. Argon milling exhibits a performance boost by producing high-quality mills 2–3x faster than xenon. Xenon, combined with novel chemistries, supports large-area, targeted delayering supported by automated end-pointing algorithms.

A fully automated and integrated workflow enables full-volume, high-resolution synthetic metrology using virtual slices extracted from 3D reconstructed volumes. The Helios MX1 PFIB-SEM uses the Thermo Scientific Elstar™ Electron Column with performance enhancements to imaging throughput, image quality, and stability. New auto-functions improve both low-kV stability and throughput. Metrology mode enables faster acquisition. The biased Mirror Detector offers enhanced material

Key features

New multi-ion species plasma source (Xe^+ / Ar^+) for outstanding performance in high-volume removal and precision milling supporting diagonal mill, delayering, and cross section applications.

New Metrology Studio user interface with flexible SMART targeted activities provides faster time to recipe and simplifies automated metrology development.

Thermo Scientific MultiChem™ Gas Delivery System provides advanced capabilities for electron and ion beam-induced deposition and etching.

ECS enables host-driven factory automation.

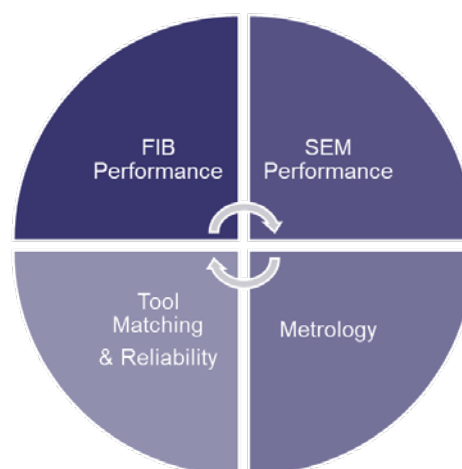
iFast Software provides full orchestration of automated wafer navigation, milling, imaging, metrology, 3D reconstruction, virtual slice metrology, and data reporting.

New Job History Services and web-based unified user interface, Cortex, provide a seamless user experience navigating to process images, designing metrology recipes, viewing metrology results, and 3D reconstructions.

High-performance server to support accelerated computation.

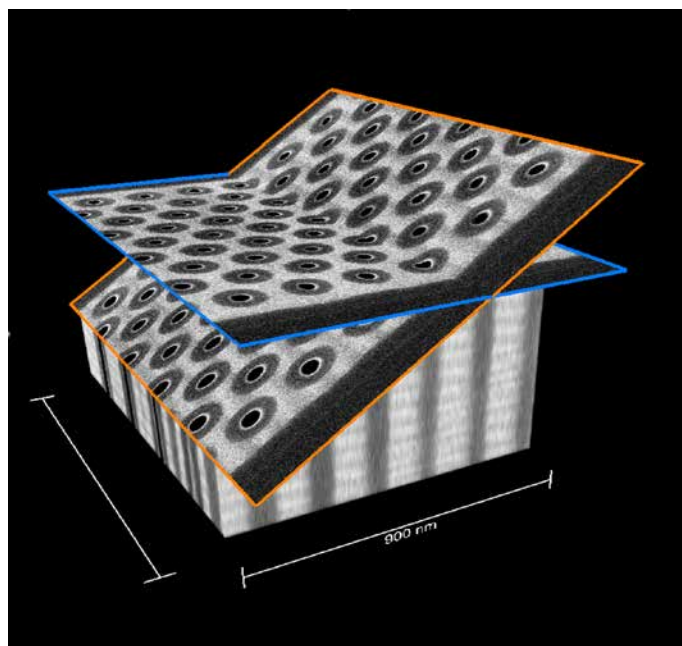
New in-chamber, fixed sample calibration standards enable tool calibration and monitoring between wafer loads for improved availability.

Standardized validation process for metrology performance matching and verification.

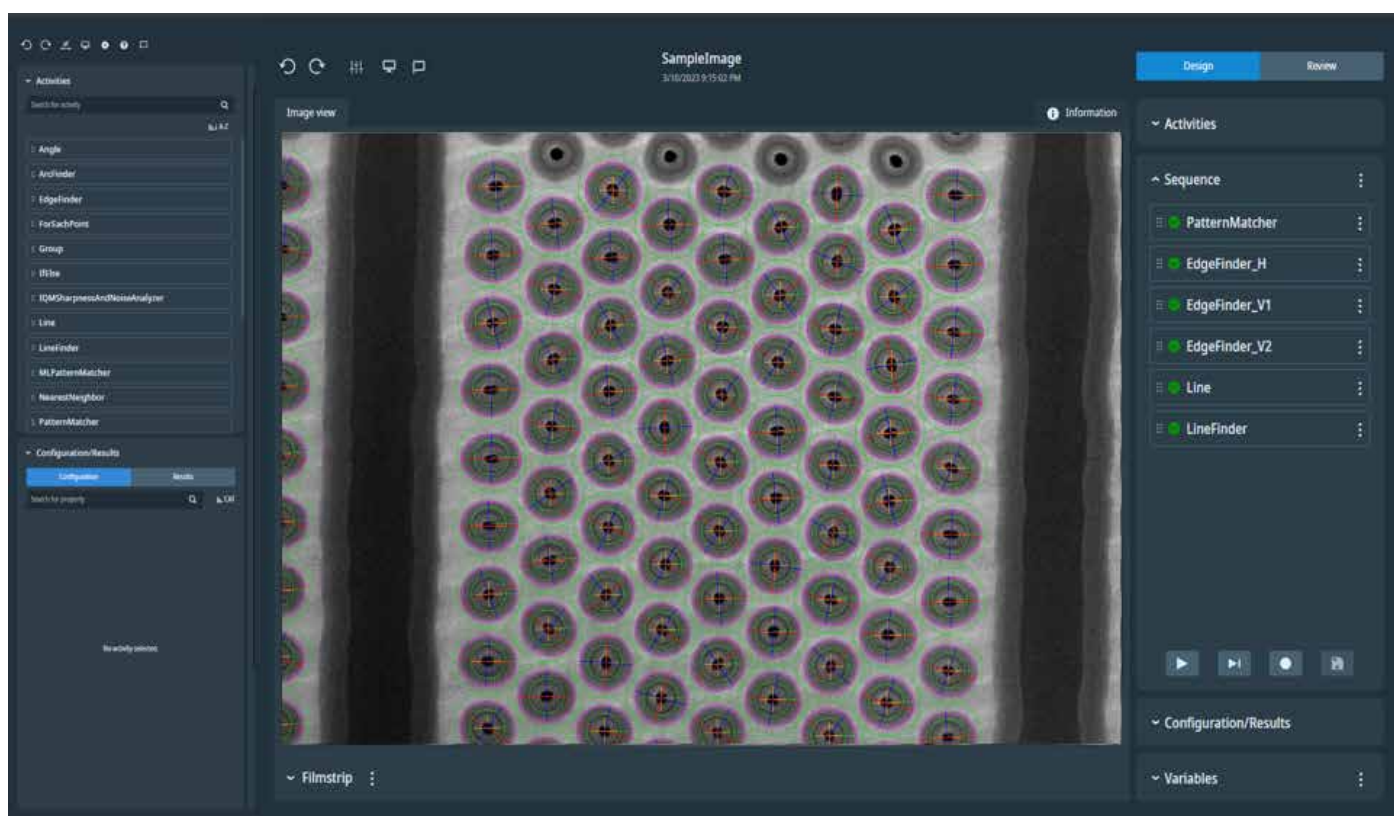


contrast at low landing energies. Metrology Studio, a new user interface for streamlined recipe development includes SMART targeted activities built for common measurement types and a GPU-enabled SDP server, enabling faster time to recipe and overall process throughput.

To support 24/7 production, a single SECS/GEM connection enables factory automation and factory host communication. System availability and reliability are supported by a new in-chamber, mounted fixed sample, enabling system monitoring and calibration during wafer load cycles, leading to reduced downtime and SPC-monitored validation of system performance. A “Green to Green” standard process provides metrology performance monitoring after PM events. The Cortex web app user interface supports ease of use to access real-time images and metrology results including an integrated 3D viewer for 3D volume inspection.



Virtual slices of an automated 3D reconstructed volume created from diagonal milling images.



Metrology Studio, showing virtual slice with metrology overlay.

Specifications

Elstar UHR Immersion Lens FESEM Column

- Elstar Electron Column with ultra-stable Schottky field emitter gun with UC+ monochromator technology
- High performance auto alignments
- Metrology mode enhanced throughput image acquisition
- Electron source lifetime: 12 months

Multi-species Ar⁺ & Xe⁺ plasma ion source

- Ion source: 1 year guaranteed

Detectors

- Elstar Column in-lens SE detector (TLD-SE)
- Elstar Column in-lens BSE detector (TLD-BSE)
- Biased Mirror Detector (bMD) for backscatter electron detection
- High-performance ion conversion and electron (ICE) detector for secondary ions (SI) and electrons (SE)

Sample handling

- 300 mm, five-axis, piezo motorized stage with continuous 360° rotation
- GEM300 factory-compliant automated FOUP loader and EFEM with pre-aligner for loading 300 mm wafers
- Manual Load Port Module (MLPM) for small parts loading

Gas Delivery System

MultiChem Gas Delivery System provides advanced capabilities for supporting electron and ion beam-induced deposition and etch chemistries:

- Milling/deprocessing: Dx, DE
- Conductor dep: tungsten, carbon
- Insulator dep: IDEP2

Automated 3D SEM metrology applications

- Cross-section, imaging, metrology
- Diagonal mill, imaging, metrology
- Gas-enhanced delayering with Xe⁺, imaging, metrology
- 3D reconstruction and virtual slice metrology

Standard hardware

- High-performance, GPU-enabled server
- High-frequency EMI cancellation system
- In-chamber calibration samples
- New standard qualification wafer
- High-resolution optical microscope with 920 µm FOV

Key hardware options

- Standalone gas injection system supporting carbon or tungsten chemistries
- Integrated active vibration isolation system
- Engineer workstation: desk, two monitors, keyboard, and manual user interface

Standard software

- Windows10® operating system
- Intuitive user interface enables simultaneous milling, imaging and deposition by SEM & FIB
- iFast Developers Kit Professional

Software options

- Multiple software configurations, which may include image quality monitoring, Metrology Studio, and automated 3D reconstruction



Installation and facilities requirements are available upon request.

Notes

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