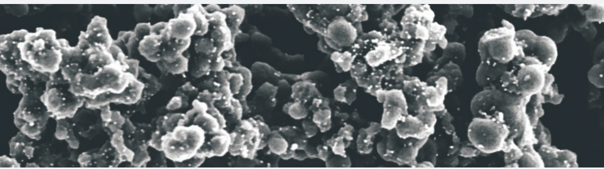
Product Data



Verios™ XHR SEM

Discover the world of Extreme High Resolution SEM

The Verios is the second generation of FEI's leading XHR SEM family, offering sub-nanometer resolution over the full 1 keV to 30 keV energy range with excellent materials contrast. Its extraordinary low-voltage performance provides extremely precise, surface-specific information that has been unavailable previously from other techniques.

Extends SEM Capability

In the Semiconductor and Data Storage markets, the Verios's unprecedented performance significantly extends SEM capability to the 22 nm node and below, offering a complete solution for basic research, process and material development, process control and failure analysis. It delivers accurate, repeatable measurement results, even on extremely sensitive materials. Combined with FEI's IC3D™ metrology software, Verios provides the precise measurements needed to control the technology development process. The Verios features industry leading performance without compromising the high throughput, sample flexibility and ease of traditional SEM.

The Highest Resolution and Contrast Required for Materials Research

For Materials Scientists, the Verios enables important new insights by extending sub-nanometer characterization to novel materials being developed today (e.g., catalyst particles, nanotubes, porosities, interfaces, biological objects and other nanoscale structures). High-resolution, high-contrast images are obtained without the need to transition to TEM or other imaging techniques. Verios offers all the flexibility required from Research applications to accommodate large specimens like full wafers or metallurgical samples, perform fast analysis thanks to its high current mode or work on precise prototyping applications such as electron beam-induced direct deposition of materials or lithography.

Boost Accuracy with Superior Performance

The outstanding imaging capabilities of the Verios begin with the Elstar™ FESEM column. On top of its integrated monochromator (UC) and beam deceleration, which enables Verios's unique low kV performance, the Elstar features other unique technologies such as constant power lenses for higher thermal stability and electrostatic scanning for higher deflection linearity which leads to better measurement accuracy. Its traditional through-the-lens detector, set for highest collection efficiency of SE (secondary electrons) and on-axis BSE (backscattered electrons), is complemented by two new in-column detectors and signal filtering capabilities for stunning resolution and refined materials contrast. Furthermore, an optional STEM (scanning transmission electron mode) detector provides superior performance on thin S/TEM samples.

Empowered by its evolutionary xT software platform, the Verios addresses both the occasional user with a simple yet robust interface, and the SEM expert who can rely on the instrument's flexibility and extended controls for XHR work.

Key benefits

- Best-in-class Elstar™ Schottky Monochromated (UC) FESEM technology and performance with sub-nanometer resolution from 1 to 30 kV
- Innovative electron optics, including FEI's patented UC gun (monochromator), constant power lenses and electrostatic scanning for accurate and stable imaging
- Consistent measurement results with the ability to calibrate to a NIST-traceable standard at high magnification
- Easy access to beam landing energies as low as 20 eV with very high resolution for true surface characterization
- Advanced suite of high-sensitivity, in-column & below-the-lens detectors and signal filtering for low dose operation and optimal contrast selection
- Unique imaging technologies and solutions, including the second generation of FEI's advanced detectors, FEI SmartSCAN™ and DCFI to accurately image charging samples
- Very high precision & stability, piezo-driven 100x100 mm stage in a large analytical chamber
- Multiple navigation packages available, including fast and robust bit cell counting
- Full analytical and prototyping capabilities

Essential specifications

Electron optics

Elstar XHR immersion lens FESEM column

- Elstar electron gun with:
  - Schottky thermal field emitter
  - Hot-swap capability
  - UC technology (monochromator)
- 60 degree dual objective lens with pole piece protection
- Heated objective apertures
- Electrostatic scanning
- ConstantPower™ lens technology
- Beam deceleration with stage bias from -50 V to -4 kV
- Integrated Fast Beam Blanker *

Source lifetime

- Electron source lifetime: 12 months

Electron beam resolution

(site survey required to guarantee resolution specification)

- Resolution @ optimum WD
  - 0.6 nm at 30 kV (STEM *)
  - 0.7 nm at 15 kV
  - 0.7 nm at 1 kV
  - 1.0 nm at 500 V (ICD **)
  - 1.2 nm at 200 V (ICD **)

Maximum horizontal field width

- E-beam: 1. 5 mm at WD 4 mm

Landing energy range

- 20 eV - 30 keV

Probe current

- E-beam: 0.8 pA up to 100 nA

Vacuum system

- 1 x 210 l/s TMP
- 1 x PVP (dry pump)
- 2 x IGP
- Chamber vacuum: < 2.6 * 10^{-6} mbar (after 24 h pumping)

Detectors

- Elstar in-lens SE detector (TLD-SE)
- Elstar in-lens BSE detector (TLD-BSE)
- Elstar in-column SE detector (ICD) **
- Elstar in-column BSE detector (MD) **
- Everhart-Thornley SE detector (ETD)
- IR camera for viewing sample/column
- Chamber mounted Nav-Cam+™ *
- Retractable low voltage, high contrast solid-state backscatter electron detector (DBS) **
- Retractable STEM detector with BF/DF/ HAADF segments *
- Integrated beam current measurement

Chamber

- E-beam and EDX coincidence point at 4 mm WD
- 21 ports

Ultra high precision 5-axes piezo-motorized stage

- X, Y = 100 mm
- Z ≥ 20 mm
- T = - 10 ° to + 60 °
- R = 720 ° stroke
- X, Y repeatability 0.5 µm
- X, Y accuracy < 1.5 µm 85 % tolerance interval
- Mechanically tilt eucentric stage with < 5 µm image motion when tilting 0 ° to 52 °
- Compucentric rotation and tilt

Sample sizes

- Maximum size: 100 mm diameter with full rotation
- Maximum sample thickness (via loadlock): 19 mm incl. stub
- Maximum sample thickness (via chamber door): 19 mm incl. stub
- Weight: 200 g (incl. holder)

Sample holders

- Multi-stub holder **
- Multi-sample cross-sectional holder **
- Single stub mount, mounts directly onto stage
- Various wafer and custom holder(s) available by request

Image processor

- Dwell time range from 0.025 to 25000 µs/pixel
- Up to 6144 x 4096 pixels
- File type: TIFF (8, 16, 24-bit), BMP or JPEG
- Single frame or 4 quadrant image display
- SmartSCAN (256 frame average or integration, line integration and averaging, interlaced scanning) and DCFI (Drift Compensated Frame Integration)

* = optional
** = optional for Verios 460, standard for Verios 460L

System control
- 32-bit GUI with *Windows® XP*, keyboard, optical mouse
- Two 24 inch widescreen LCD displays, WUXGA 1920x1200 pixels
- Microscope controlling and support computers seamlessly sharing one keyboard and mouse
- Joystick **
- Multifunctional control panel **
- Remote control *

Supporting software
- 'Beam per quad' graphical user interface concept, with up to 4 simultaneously active quads

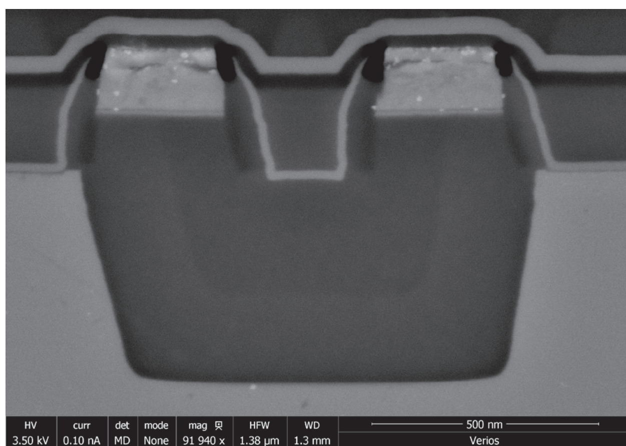
Software options
- Web enabled data archive software *
- Image analysis software *
- iFAST for advanced automation *
- MAPS™ for automatic acquisition of large images and correlative work *
- IC3D metrology offline software **
- Cell Navigator™ for bit cell navigation **

Documentation
- On-line help
- Prepared for RAPID™ (remote diagnostic support)
- Free access to FEI for owners on-line resources

Common accessories
- Analysis: EDS *
- Loadlock **
- Integrated Plasma Cleaner
- FEI CryoCleaner
- Electron Beam Lithography: kits from Raith, Nabity or other vendors *
- FEI acoustic enclosure*
- Cryo SEM: Sample transfer and preparation, cryo stage
- Gas Injection System (GIS) *
- NIST traceable magnification calibration sample *

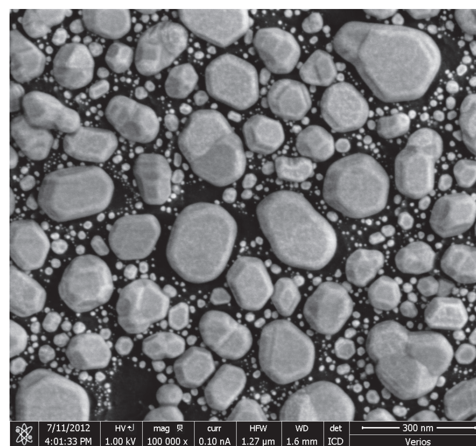
Consumables (partial list)
- Replacement Schottky electron source module
- Aperture strips for electron

Warranty and training
- 1 year warranty
- Choice of service maintenance contracts
- Choice of operation / application training contracts



MD detector – Excellent materials contrast on semiconductor materials such as this 32 nm Flash device

Sample courtesy of ChipWorks



ICD Detector - Exceptional surface sensitivity
Gold on Carbon

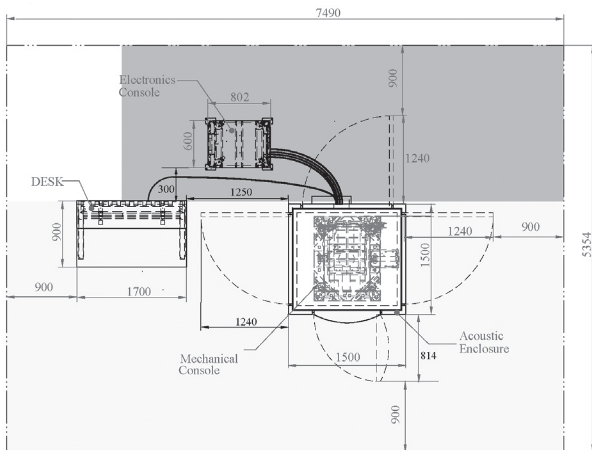
* = optional
** = optional for Verios 460,
standard for Verios 460L

Installation requirements

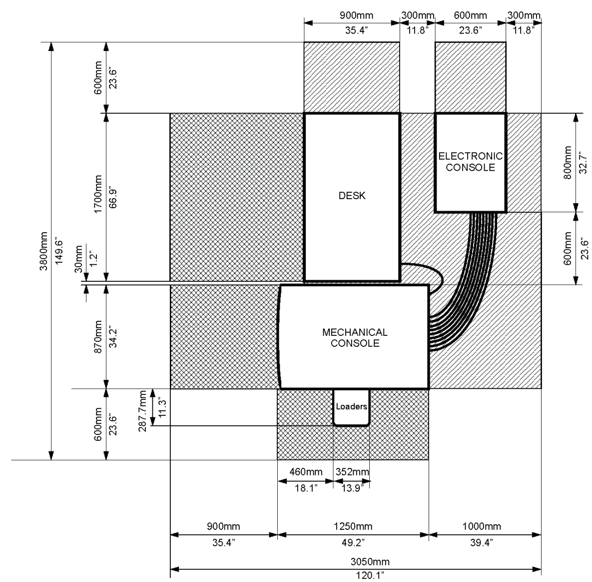
(refer to pre-install guide for additional data)

- Power: voltage 100 - 240 V AC, frequency 50 or 60 Hz ± 1 %)
- Power consumption: < 3.0 kVA for basic microscope
- Earth resistance: < 0.1 Ω
- Environment:
  - temperature 20 °C ± 3 °C
  - relative humidity below 80 % RH, 20 °C
  - stray AC magnetic fields: site survey required
  - acoustics guidelines: Site survey required as floor spectrum relevant
  - floor vibrations: Site survey required as floor spectrum relevant
- Door width x height: preferred 1.2 m x 2.0 m (minimum 0.9 m x 2.0 m)
- Weight: column console 850 kg
- Dry nitrogen
- Compressed air: 4 to 6 bar - clean, dry and oil free
- System chiller
- Vibration isolation table *

Floor plan with enclosure



Floor plan without enclosure



Floor layout E-console behind desk

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TÜV Certification for design, manufacture, installation and support of focused ion- and electron-beam microscopes for the Electronics, Life Sciences, Research and Natural Resources markets.

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