

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 precise measurements needed to control technology development process. The Verios features industry leading performance without compromising the high throughput, sample flexibility and ease of traditional SEM.

The improved beam current specification of 100 nA makes the Verios also very suitable as an analytical tool. The specimen chamber has dedicated detector ports for EDS and EBSD options. Also configurations with a WDS spectrometer, a Dual EDS detection system or EDS+EBSD detection at the same azimuth angle will be possible on the Verios specimen chamber.

KEY BENEFITS

Best-in-class Elstar™ Schottky Monochromated (UC) FESEM technology and performance with sub-nanometer resolution from 1 to 30 keV

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 certified standard at high magnification

Easy access to beam landing energies as low as 20 eV with very high resolution for true surface characterization

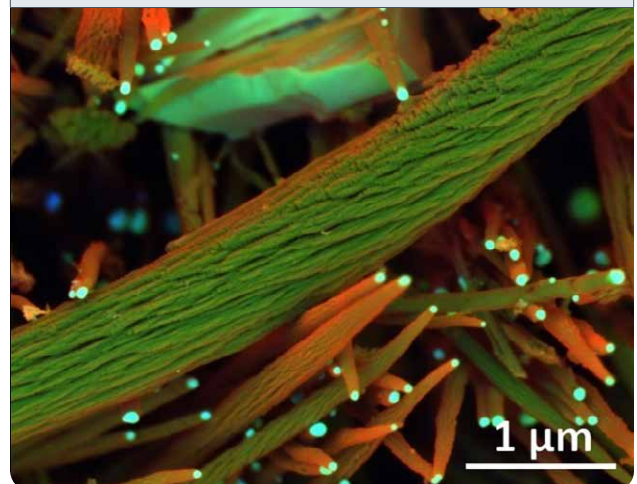
Advanced suite of high-sensitivity, in-column & below-the-lens detectors and signal filtering for low dose operation and optimal contrast selection

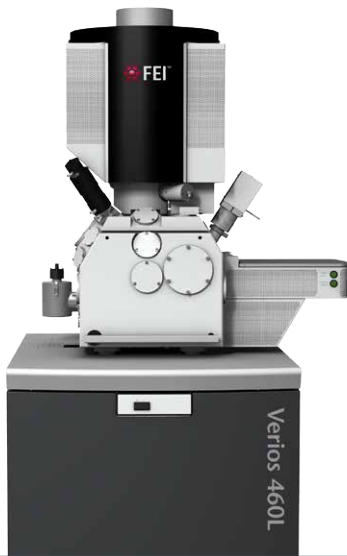
Unique imaging technologies and solutions, including the second generation of FEI's advanced detectors, FEI SmartSCAN™ and DCFI to accurately image charging samples

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





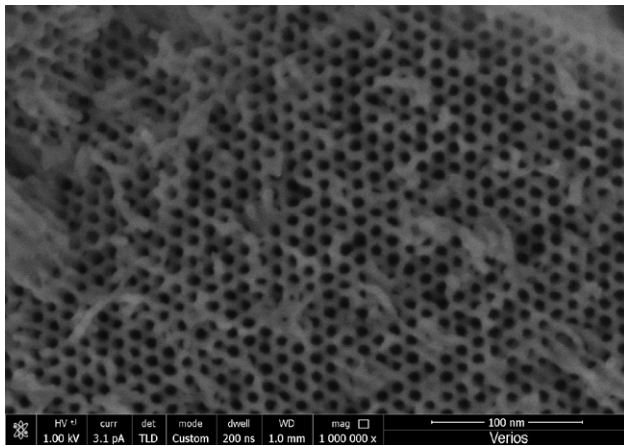
The Highest Resolution and Contrast Required for Materials Research

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.

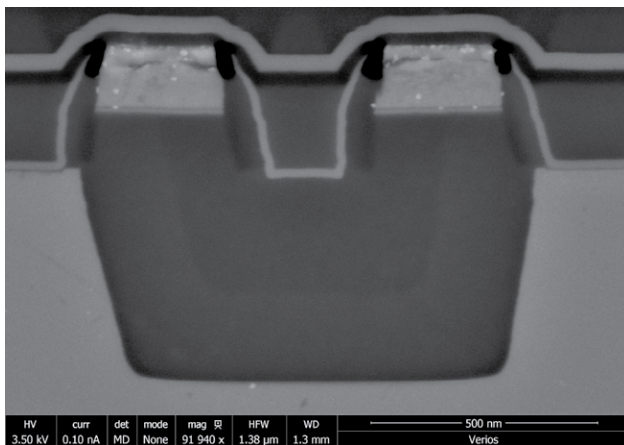
Boost Accuracy with Superior Performance

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.



↑ Accurate, very high resolution imaging of SBA-15 (mesoporous silica) porosities. Nanoscale structures preserved thanks to Verios' advanced low dose, low kV and charge mitigation modes. Courtesy of Wei Wu, SICCAS, China



↑ **MD detector.** Excellent materials contrast on semiconductor materials such as this 32 nm Flash device. Sample courtesy of ChipWorks

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 *

* = optional

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

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 *)
 - 0.6 nm at 15 kV
 - 0.6 nm at 2 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: > 2.0 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

- 1×210 l/s TMP
- 1×PVP (dry pump)
- 2×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 EDS 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 = n × 360 ° 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. holder
- Maximum sample thickness (via chamber door): 27.8 mm incl. sample holder
- 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 × 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)

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

* = optional

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

Common accessories

- Analytical Detectors: EDS, WDS, EBSD
- Loadlock **
- Integrated Plasma Cleaner
- FEI CryoCleaner
- Electron Beam Lithography: kits from Raith, Nabyo or other vendors *
- FEI acoustic enclosure *
- Cryo SEM: Sample transfer and preparation, cryo stage *
- Gas Injection System (GIS) *
- NIST certified magnification calibration sample *

Consumables (partial list)

- Replacement Schottky electron source module
- Aperture strips for electron

Warranty and training

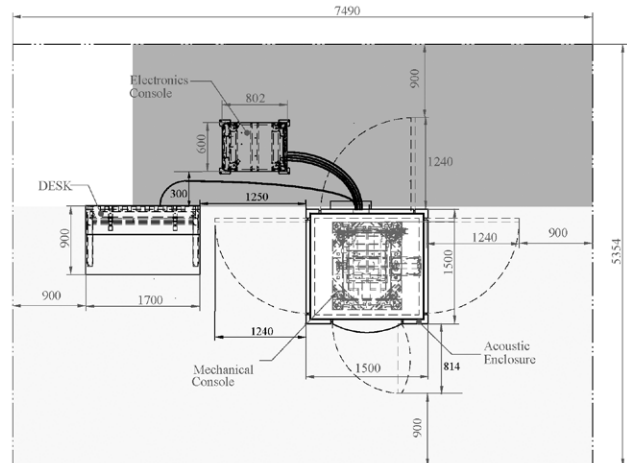
- 1 year warranty
- Choice of service maintenance contracts
- Choice of operation / application training contracts

Installation requirements

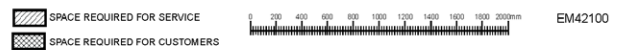
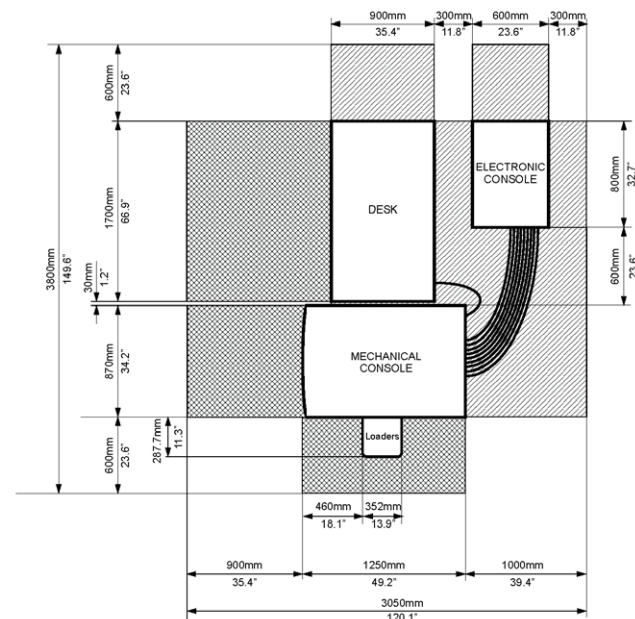
(refer to pre-install guide for additional data)

- Power: voltage 100 - 240 V AC, frequency 50 or 60 Hz \pm 1 %
- Power consumption: < 3.0 kVA for basic microscope
- Earth resistance: < 0.1 Ω
- Environment:
 - Temperature 20°C \pm 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 \times height: preferred 1.2 m \times 2.0 m (minimum 0.9 m \times 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

* = optional

World Headquarters
Phone +1 503 726 7500

FEI Europe
Phone +31 40 23 56000

FEI Japan
Phone +81 3 3740 0970

FEI Asia
Phone +65 6272 0050

FEI Australia
Phone +61 2 6173 6200

Learn more at FEI.com
ContactUs@FEI.com

For current certifications, please visit FEI.com/certifications

©2014. We are constantly improving the performance of our products—all specifications are subject to change without notice. FEI, the FEI logo, and Verios, Rapid, Nav-Cam+, ConstantPower, Elstar, SmartSCAN, and MAPS are trademarks of FEI Company. All other trademarks belong to their respective owners. DS0114-10-2014

