

Quanta 650 FEG

Discover the “any sample, all data” solution for ultimate versatility and high resolution SEM

Addressing the need to investigate a wide variety of materials and characterize structure and composition, the FEI Quanta™ FEG provides unmatched provides flexibility and versatility to handle the challenges of today’s wide ranging research needs.

Today’s research extends beyond simple metals and coated samples and the Quanta series can handle those challenges to produce top quality images and analysis. The Quanta 50 series from FEI is the advanced, flexible solution for current and future research applications. Featuring three imaging modes—high vacuum, low vacuum and ESEM™—it accommodates the widest range of samples of any SEM system, capable of characterizing traditional samples from metals, fractures and polished sections, to non-conductive soft materials. Surface and compositional imaging can be combined with accessories for determining material properties and elemental composition.

The Quanta 50 series is the third generation Quanta system built on the success of previous generations of ESEM Schottky FEG. This series has an easy-to-use and flexible user interface with functions to maximize productivity and data collection. Designed by microscopists for microscopists, this instrument series is truly above and beyond ‘easy to use’. Navigation features include auto navigation montage, double-click stage-movements, drag-to-zoom and other useful features incorporated as standard. SmartSCAN™ and drift compensated frame integration (DCFI) bring new scanning strategy to reduce noise and provide better data. Additional new options such as beam deceleration provide better resolution and contrast, while sensitive detection options offer a sensitive angular-filtered Directional Backscatter (DBS) and an in-column detector sensitivity to improve low kV performance. Nav-Cam™ color image navigation and new retractable detectors provide even greater flexibility to the Quanta FEG series.

Better data. More flexibility. Higher efficiency. General purpose FEG ESEM is now within your reach.

KEY BENEFITS

Only high resolution FEG-SEM with ESEM technology.

Characterize conductive and non-conductive samples with SE and BSE imaging possible in every mode of operation.

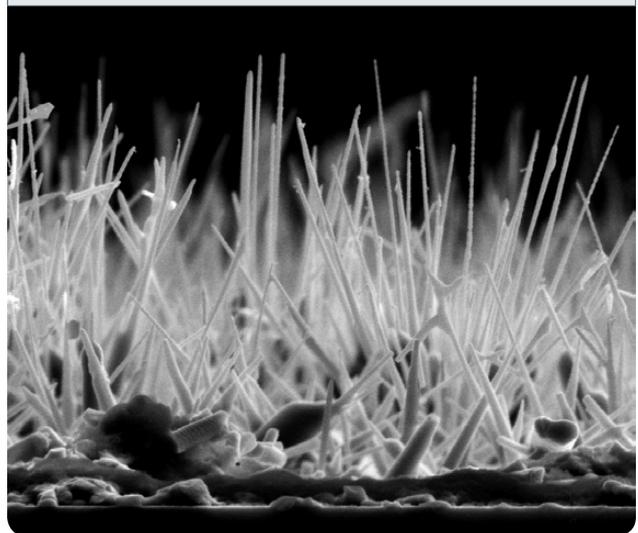
Minimize the amount of sample preparation, low vacuum and ESEM capability enables charge-free imaging and analysis of non-conductive and/or hydrated specimens.

Increase analytical capabilities by enabling EDS and EBSD analysis on conductive and non-conductive samples in high and low vacuum thanks to Quanta’s patented through-the-lens pumping. Stable high current FEG (up to 200 nA) enable fast, accurate analysis.

Perform dynamic *in situ* analysis of diverse samples in their natural state above or below ambient temperatures from -165°C to 1400°C with specialized *in situ* stages.

Enable surface imaging with optional beam deceleration mode and detectors optimized to get surface and compositional information from conductive samples.

Easy to use, intuitive software makes highly effective operation possible for novice users.





Typical applications include:

NanoCharacterization

- Metals & alloys, oxidation/corrosion, fractures, welds, polished sections, magnetic and superconducting materials
- Ceramics, composites, plastics
- Films/coatings
- Geological sections, minerals
- Soft materials: polymers, pharmaceuticals, filters, gels, tissues, plant material, cells
- Particles, porous materials, fibers

In situ NanoProcesses

- Hydration/dehydration
- Wetting behaviour/contact angle analysis
- Oxidation/corrosion
- Tensile (with heat or cooling)
- Crystallization/phase transformation

NanoPrototyping

- Electron beam lithography (EBL)
- Electron beam-induced deposition (EBID)

Essential specifications

Electron optics

- High resolution Schottky field emission
- SEM column optimized for high brightness/high current
- 45° objective lens geometry with through-the-lens differential pumping and heated objective apertures

- Maximum horizontal field width: 5 mm at analytical working distance (10 mm); 18.8 mm at 65 mm WD; 150mm with Navigation Montage routine
- Accelerating voltage: 200 V to 30 kV
- Landing voltage range:
 - Standard: 200 V to 30 kV
 - Beam Deceleration*: 20 V to 30 kV
- Probe current: ≤ 200 nA, continuously adjustable
- Magnification: 6 to 1000000x

Electron Beam resolution

- High vacuum
 - 0.8 nm at 30 kV (STEM)*
 - 1.0 nm* at 30 kV (SE)
 - 2.5 nm at 30 kV (BSE)*
 - 3.0 nm at 1 kV (SE)
- High vacuum with beam deceleration option
 - 3.0 nm at 1 kV (BD mode* + BSED*)
 - 2.3 nm at 1 kV (BD mode* + ICD*)
 - 3.1 nm at 200 V (BD mode* + ICD*)
- Low vacuum
 - 1.4 nm at 30 kV (SE)
 - 2.5 nm at 30 kV (BSE)*
 - 3.0 nm at 3 kV (SE)
- Extended vacuum mode (ESEM)
 - 1.4 nm at 30 kV (SE)

Detectors

- Everhardt Thornley SED (secondary electron detector)
- Large Field Low vacuum SED (LFD)
- Gaseous SED (GSED) (used in ESEM mode)
- Gaseous analytical BSED (GAD)*
- Gaseous BSED (BSE detection at high ESEM pressures)*
- Directional Backscatter (DBS) detector*
- Scintillator BSED/CLD*
- STEM detector*
- In-column detector (ICD) for BD mode*

- Specimen current (EBIC) detector*
- Electron beam current measurement*
- IR camera for viewing sample in chamber
- Nav-Cam™: color optical camera for sample navigation*
- EDS*
- WDS*
- EBSD*
- Cathodoluminescence*
- Raman*

Vacuum system

- 1 x 250 l/s TMP (turbomolecular pump), 2 x PVP
- Patented through-the-lens differential pumping
- Beam gas path length: 10 mm or 2 mm
- Optional upgrade to oil free scroll/dry PVPs
- 2 x IGP
- Integrated IGP battery backup (system protection from unplanned power outage)
- Chamber vacuum (high) $< 6e^{-4}$ Pa
- Chamber vacuum (low) < 10 to 200 Pa
- ESEM vacuum < 10 to 4000 Pa
- Evacuation time: ≤ 150 seconds to high vacuum and ≤ 270 seconds to ESEM (FEI standard test procedures)
 - Optional CryoCleaner cold trap

* optional

Chamber

- 379 mm size left to right
- 10 mm analytical WD
- 10 ports
- EDS take-off angle: 35°

Stage

- X, Y = 150 mm
- Z = 65 mm
- Z clearance = 93.5 mm
- T = - 5° to + 70°
- R = 360° continuous
- Repeatability: 2 µm (X and Y)
- Tilt-eucentric at 29.3 mm mounting height for all working distances
- X and Y movements are in the tilt plane
- Beam deceleration (cathode lens/ sample bias)*

Sample holders

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

System control

- 64-bit graphical user interface with Windows® 7, keyboard, optical mouse
- One 24-inch LCD display, WUXGA 1920 x 1200
- Joystick*
- Manual user interface*

Image processor

- Up to 6144 x 4096 pixels
- File type: TIFF (8 or 16-bit), BMP or JPEG
- Single frame or 4-quadrant image display
- 4 quadrants live
- Live or static signal mixing in color or grayscale
- 256 frame average or integration
- Digital video recording (.avi)
- Image histogram and measurement software

Supporting software features

- SmartSCAN scan strategy
- Drift Compensated Frame Integration (DCFI)
- Navigation Montage automated routine
- SW temperature control for dynamic stages*
- Interval image acquisition in 1 to 4 quads
- Multiple image saving function
- FEI Movie Creator Utility (custom .avi file creation from automatically acquired TIFF image series)
- Large Image Window Functionality (displays image on a separate monitor allows dual full screen imaging from different detectors)

System options

- Beam deceleration
- Manual user interface
- Support PC (including 2nd 24-inch monitor)
- Software controlled switch box
- SW controlled Peltier cooled specimen stage
- SW controlled WetSTEM™ system
- SW controlled 1000°C heating stage
- SW controlled 1400°C heating stage
- CryoCleaner
- CryoCleaner spare vessel
- FEI Gas Injection System: Up to 2 units (other accessories may limit number of GIS available) for beam-induced deposition of the following materials:
 - Platinum
 - Tungsten
 - Carbon
- Prototyping: Integrated 16-bit patterning engine, Electron Beam Lithography modules
- Joystick
- AAS (automatic aperture system)

- Specimen current meter
- Remote control SW
- Specimen holder kit
- Acoustic enclosure for vacuum pump
- 7 or 52 pin electrical feedthrough
- Electrostatic beam blanker
- WDS completion kit
- Oil free pre-vacuum option (dual scroll pumps)
- Integrated Plasma Cleaner

Optional 3rd party accessories

- EDS
- WDS
- EBSD
- Cryo stage
- Cathodoluminescence
- Sample current detector/ EBIC
- Nanomanipulators
- Lithography systems
- CAD navigation
- Electrical probing

Documentation and support

- On-line help
- Quanta FEG Getting Started training CD
- RAPID (remote diagnostic support)
- Free access to FEI for owners on-line resources
- Free membership in the FEI ESEM User Club

* optional

Software options

- Remote control/viewing software
- Image analysis software
- Web-enabled data archive software
- Height mapping/roughness measurement software
- FEI patterning software

Warranty and training

- 1 year warranty
- Optional applications training class available
- Choice of service maintenance
- Choice of operation/application training contracts

Installation requirements

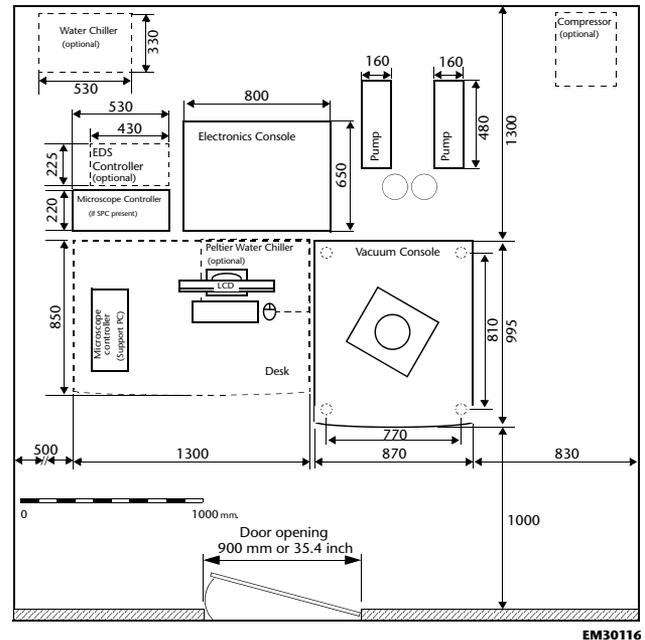
(refer to pre-install guide for additional data)

- Power: voltage 230 V (+ 6%, - 10%), 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, stray AV magnetic fields
 - < 40 nT asynchronous
 - < 300 nT synchronous
- Door width: 90 cm
- Weight: column console 570 kg
- Weight: electrical console 139 kg
- Dry nitrogen recommended: system (0.7 to 0.8 bar, max 10 l/min during vent)
- Compressed air 4 to 6 bar—clean, dry and oil-free
- System chiller is only required if room is not meeting specification according pre-install instructions
- Acoustics: < 68 dBC (site survey required as acoustics spectrum relevant)
- Floor vibrations (site survey required as floor spectrum relevant)
- Vibration isolation table available as option

Energy conservation

- Energy Star compliant monitors and PC systems
- System designed to operate without water chiller

Floor plan



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