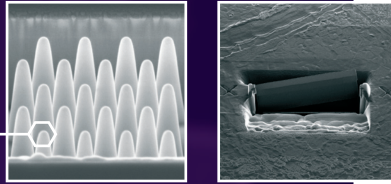
PRODUCT DATA



Make your contribution to the nanotechnology revolution

FEI COMPANY™

Nova™ 600i

Routine nanoscale prototyping, machining, characterization and analysis of structures below 100 nm

- *A complete nanotechnology lab in a single tool, enabling top-down machining or deposition and ultra-high resolution 3D characterization and analysis of nanostructures*
- *Complements your existing tool set by extending the range of applications that you can handle in your lab*
- *Automation of prototyping and machining processes assures accurate and reproducible results*
- *SPI-simultaneous patterning and imaging provides real-time process monitoring for enhanced control*
- *DualBeam geometry is designed to provide optimal ion and electron milling and imaging resolution at the beam coincident point*
- *NEW: more solutions with FEI's versatile GIS technology, providing speed, precision, and control for selective etch and metallic, insulator, and organic material deposition*
- *NEW: 16-bit digital pattern generation enables creation of more complex 3D shapes and structures*
- *NEW: multidisciplinary high resolution FIB allows to image and mill at the nanoscale, while offering dedicated 20 nA high current for fast and accurate material removal and 2 kV polishing for preparing high quality samples*

The Nova™ 600i is the proud successor of Nova 600 NanoLab. It is further optimized for bringing new capabilities and flexibility to researchers and developers needing to create, modify, and characterize complex structures below 100 nanometers. Nova 600i combines ultra-high resolution field emission scanning electron microscopy (SEM) and a new multidisciplinary high resolution focused ion beam (FIB) to complement your existing nanotechnology laboratory tools and extend your applications range for nanoscale prototyping, machining, 2D and 3D characterization and analysis. Setting the Nova 600i apart from other lab systems are its integrated 3D characterization, advanced nanomachining and nanoanalysis capabilities. The Nova 600i is designed to be just that: a complete nanotechnology laboratory in one tool. FEI's versatile and comprehensive beam chemistries allow for deposition, etch and automation, enabling the creation of structures such as: nanotube-based nanostructure assembly, nanobridge creation, photonic array prototyping, laser prototyping, nanostamping, AFM tip modification, MEMS modification, and many more.

Nova 600i enables characterization of these structures via several methods, among them *Slice and View* for 3D reconstruction, ultra-high resolution in-lens backscattered electron imaging for phase contrast characterization, secondary ion imaging for grain contrast, SPI-simultaneous patterning and imaging mode for real-time imaging feedback on the milling process, and STEM for sub-1 nm characterization. Add nanoanalysis capabilities such as EDS and EBSD, and you have a powerful nanotechnology solution that enables you to make your contribution in this growing science.

In biology, the Nova 600i allows cell specialists to study the 3D architecture of cells and tissue at the mesoscopic scale. The system allows fully automated *Slice and View* of resin embedded biological specimen. The focused ion beam is used as an ultra-microtome allowing sequential cuts of almost arbitrary thickness while the SEM column resolves very small details in the block face.

The key enabling technologies in Nova 600i are all integrated onto a single platform such as:

- Ultra-high resolution electron optics (magnetic immersion lens with ultra-high brightness Sirion Schottky emitter) with SE and BSE in-lens detection and STEM imaging
- High resolution high and low energy ion optics (Sidewinder column)
- Advanced control of gas chemistries including FEI proprietary milling and deposition processes
- High precision specimen goniometer with full 150 mm travel along the x and y axis
- A high resolution 16-bit digital patterning engine
- Automation with full access to E-beam, I-beam, patterning and gas chemistry functionality
- A Windows XP 4-quadrant “Beam per Quad” user interface
- System architecture is optimized for automation, which is either optionally available (e.g. AutoFIB™, AutoTEM™, Auto*Slice and View*™, EBS3™) or custom-made to suit your particular application needs

Essential specifications

Optics: DualBeam
UHR immersion lens FE-SEM column with:

- Schottky thermal field emitter
- 60 degree dual-objective lens with pole piece protection
- Heated objective apertures
- Sidewinder ion column
- Ga liquid metal ion source,
- Superior high current performance
- Low FIB energy for ultimate sample quality
- 15 apertures

Source lifetime:

- Electron source: 12 months lifetime
- Ion source: 1000 hours guaranteed

Electron beam resolution @ optimum WD:

- 1.1 nm @ 15 kV
- 2.5 nm @ 1 kV

Electron beam resolution @ coincident point:

- 1.5 nm @ 15 kV
- 2.0 nm @ 5 kV

Ion beam resolution @ coincident point:

- 7.0 nm @ 30 kV (5.0 nm achievable)

Maximum horizontal field width:

- E-beam: 3.0 mm at beam coincident point (WD 5 mm)
- I-beam: 2.5 mm at 5 kV at beam coincidence point

Accelerating voltage:

- E-beam: 200 V - 30 kV
- I-beam: 500 V - 30 kV

Probe current:

- E-beam: < = 20 nA in 21 steps
- I-beam: 1.5 pA - 20 nA (15 position aperture strip)

Vacuum system:

- 1 x 240 l/s TMP
- 1 x PVP (dry pump)
- 3 x IGP (total for electron column and ion column)
- Chamber vacuum: < 2.6 * 10 - 6 mbar (after 24 h pumping)

Detectors:

- In-lens detector (TLD) for secondary and back¬scattered electrons
- Everhardt Thornley SED for secondary electrons
- IR camera for viewing sample/column
- CDEM for secondary electron and secondary ion imaging (optional)
- STEM detector (optional)

Chamber:

- 5 mm E- and I-beam coincidence point = analytical WD

- Angle between electron and ion columns: 52°

5-axis UHR motorized stage:
- XY : 150 mm, piezo-driven
- Z > = 10 mm
- T = -10° to + 60°
- R = N x 360° (endless), piezo-driven
- Tilt accuracy (between 50° to 54°) 0.1°
- X,Y repeatability 1.0 μm

Sample sizes:
- Maximum size: 150 mm diameter with full rotation (larger samples possible with limited rotation)
- Maximum thickness: 20 mm (for 7 mm WD)
- Weight: 500 g (including the sample holder)

Sample Holders:
- Multi-stub holder (includes pre-tilt mounts)
- Plate for mounting multiple packages or wafer pieces (mounts onto multi-stub holder)
- Single stub mount, mounts directly onto stage
- FIB/TEM specimen kit (with two TEM grid holders and a sample loading base)
- Various wafer and custom holder(s) available by request

Image processor:
- Dwell time range from 0.025 to 25000 μs/pixel
- Up to 4096 x 3536 pixels
- File type: TIFF (8, 16, 24 bit), BMP, or JPEG
- Single frame or 4-quad image display
- 256 frame average or integration

System control:
- 32-bit GUI with Windows XP SP 2, keyboard, optical mouse
- Two 19 inch LCD displays, SVGA 1280 x 1024
- MagicSwitch™ (optional)
- Joystick (optional)
- Multifunctional control panel (optional)

Supporting software:
- "Beams per quad" graphical user interface concept
- SPITM - simultaneous patterning and imaging
- Patterns supported: lines, boxes, open boxes, polygons, circles, cross section and cleaning cross section
- Pattern based on current and imported image
- Directly imported BMP file for 3D milling
- Material file support for "minimum loop time", beam tuning and independent overlaps

Common accessories:
- Up to 5 gas injectors for enhanced etch or deposition (other accessories may limit number of GIS available)
- Gas chemistry options:
  - Platinum metal deposition
  - Tungsten metal deposition
  - Carbon deposition
  - Insulator deposition II
  - Gold deposition
  - Enhanced Etch™ (iodine)
  - Insulator enhanced etch (XeF2)
  - Delineation Etch™
  - Selective carbon mill (SCM)
  - Empty crucibles for FEI approved, user supplied materials
- In situ sample lift-out system (Omniprobe™ 100.7 or AutoProbe)
- Charge neutralizer
- Fast beam blanker
- EDX integration kit (EDAX/Oxford Instruments)
- EDX options

Consumables (partial list):
- Replacement Ga-ion source
- Replacement Schottky electron source module
- Aperture strips for electron and ion column
- CDEM detector
- Gas chemistry crucible

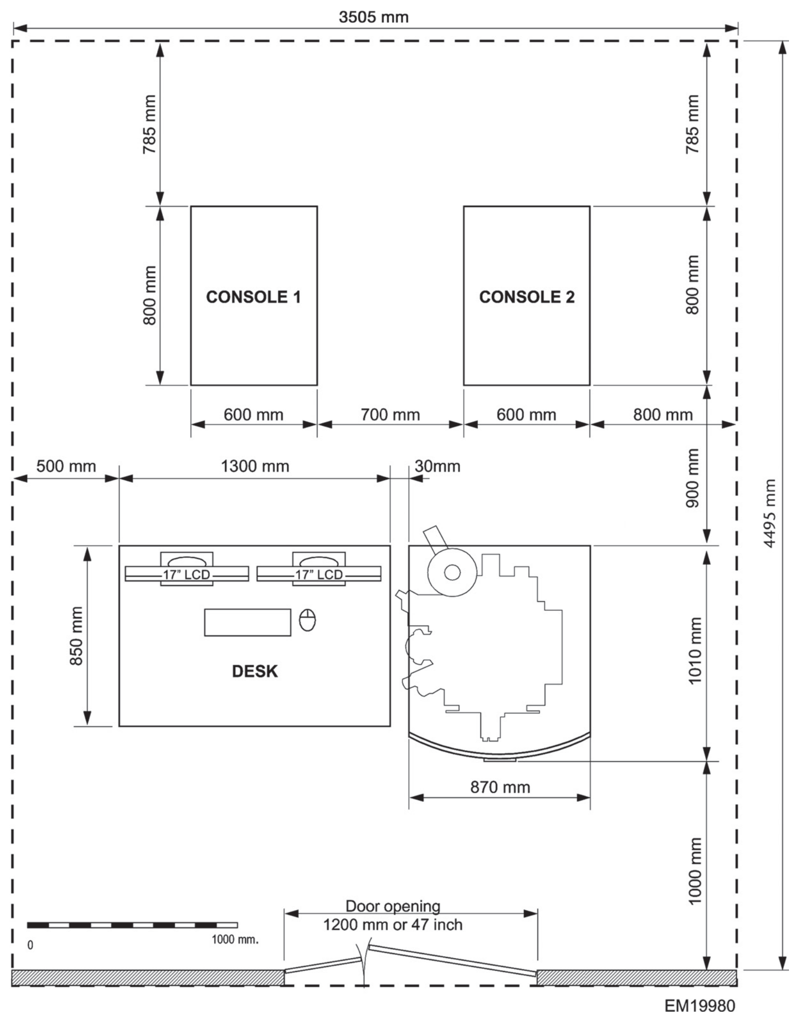
Software options:
- AutoFIB functionality for multi-site sample preparation
- AutoTEM wizard - automated sample preparation with section wizard
- Auto*Slice and View* – automated sequential mill and view to collect series of slice images for 3D reconstruction
- EBS3 – automated sequential mill and acquire EBSD maps to collect series of slice maps for 3D reconstruction
- Tomography 3D reconstruction software
- CoppeRx™ proprietary milling strategy
- FEI-Knights technology CAD navigation
- Web-enabled data archive software
- Image analysis software

Essential specifications

Warranty and training
- 1 year warranty
- 2 coupons for applications training class (at factory)
- Choice of service maintenance contracts
- Choice of operation / application training contracts

Documentation
- Operating instructions handbook
- On-line help

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 AC magnetic fields < 100 nT asynchronous < 300 nT synchronous
- Door width: 120 cm
- Weight: column console 750 kg
- Dry nitrogen: system (0.7 - 0.8 bar, max 10 l/min during vent); dry pump (1.0 bar, 2 l/min)
- Compressed air 4 - 6 bar - clean, dry and oil-free
- System chiller
- Acoustics: < 68 dBC (site survey required as acoustic spectrum relevant)
- Floor vibrations: site survey required as floor spectrum relevant
- Vibration isolation table available as option



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TÜV Certification for design, manufacture, installation and support of focused ion- and electron-beam microscopes for the NanoElectronics, NanoBiology, NanoResearch and Industry markets.

FEI COMPANY™
TOOLS FOR NANOTECH

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