FEI Helios NanoLab 1200 AT specification

FEI Certified Helios 1200AT – As Is				
1	1117595	Helios NanoLab 1200AT The core instrument (Helios NanoLab 1200AT) includes: - Workstation with Windows XP - Manual user interface and joystick - Two 24" 16:10 LCD monitors - xT software version 5.x - Separate support PC with Windows 7 - Integrated plasma cleaner - Drift control system - NavCam - Elstar electron column with TLD in-lens detector with SE & BSE modes - Tomahawk ion column - ICE ion detector for collection of secondary ions and electrons - 300 mm eucentric stage - Power line conditioner - Edwards XDS35i dry pumps (2)	1	
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Solution Description

1117595   Helios NanoLab 1200AT DualBeam

FEI's Helios NanoLab™ 1200AT DualBeam™ brings the next generation of electron beam image quality, ion beam operation, and system design to FEI's full wafer DualBeam lineup. The Helios NanoLab 1200AT DualBeam system is a fully digital Field Emission Scanning Electron Microscope (FE-SEM) equipped with Focused Ion Beam (FIB) technology and an optional 30 kV STEM detector. It allows for complete in-situ sample preparation and high-resolution analysis on full semiconductor or data storage wafers up to 300mm in diameter. The system architecture is optimized to support automated TEM preparation or Slice and View applications.

The key enabling technologies are all integrated onto a single platform including:

- Ultra-high resolution Elstar™ electron optics (magnetic immersion lens with ultra-high brightness NG emitter) with electrostatic scanning, advanced SE and BSE in-lens detection, utilizing ConstantPower™ design of electromagnetic lenses for ultimate stability, high controllability and reproducibility of the electron beam.
- High-resolution (field emission) ion optics (Tomahawk™ column) featuring two-stage differential pumping and time of flight correction.
- Significantly enhanced iFast runner with wafer map display showing user defined site plans or defect maps imported from defect files.
- A 4-quadrant "Beam per Quad" User Interface running on the Windows XP Professional SP3 operating system.
- Manual user interface and joystick for control focus, stigmation, magnification, contrast, brightness and fine stage movement.
- High-precision stage accommodates up to 300 mm full wafers, with 305 mm travel along the x and y axes, and integrated single wafer loadlock.
- Integrated plasma cleaner to maintain chamber cleanliness, fully integrated into the user interface and vacuum system.
- NavCam, an integrated color camera with digital zoom that can help find areas quickly based on sample features including color, large structures and markings on the wafer or sample surface.
- Advanced control of gas chemistries including FEI proprietary MultiChem gas delivery system for enhanced precision deposition or bulk material removal (optional).
- Annular STEMIII detector with improved materials contrast and simultaneous BF/DF/HAADF segment collection. (optional)
- Designed for SEMI S2-0706, S8-0711 and CE compliance

The Automated Technology (AT) is delivered through the following powerful technologies:

- The FEI EasyLift EX system allows the user to extract lamellae created with the Helios 1200AT and attach it to a TEM grid for in-Situ STEM imaging or transport out of the Helios 1200AT system. This option includes the micromanipulator hardware system and software application, integrated into the Helios 1200AT user interface. Rotation functionality adds the ability for the probe shaft to be rotated, allowing for thinning of both sides of attached lamella and probe sharpening. All this functionality is available within the DualBeam chamber. (Option)
- QuickFlip™ technology integrated into the high throughput 300 mm wafer carrier. The Helios 1200AT full wafer carrier incorporates 4 QuickFlip TEM grid holders to the wafer carrier frame. Each QuickFlip TEM gridholder can accommodate 2 OmniProbe half-moon type gridholders. This allows up to eight (8 TEM grids to be mounted at one time with the 300 mm wafer carriers. The grid holder(s) may be mounted at pretilts of 0° or 90°, and can be quickly flipped between the 2 positions for high throughput front and back side thinning. (optional)
- iFast™ automation software permits users to obtain multiple, site-specific lamella samples or high resolution images in a semi or fully automated process to maximize throughput and sample yields. The iFast software allows users of varying skill levels to reproduce the results of the most productive and experienced operators.
- The iFast Developer's Tool Kit Professional enables the user to quickly and easily create new recipes or modify existing ones to fit their specific needs. Recipes are edited within an intuitive graphical interface, enabling faster learning of the programming environment as well as an easier understanding of existing recipes. Within the iFast Developers environment the user is able to control columns, detectors, stage motion and site alignment, with logical operation and looping. (optional)
- iFast Semiconductor Wafer Navigation (optional) minimizes overhead associated with navigation to the region of interest for sample preparation. Navigation capability includes:
  - Wafer maps can be generated based on imported KLARFs and defect rootcause analysis activities conducted on defect locations via iFast recipes.
  - Wafer Map software provides iFast the ability to display a graphical map of a user specific wafer from its associated iFast recipe. Users can create a predefined site list and wafer global alignment routines which can then be run in an automated iFast Runner session by a Helios 1200AT operator.
  - Cell Navigator function helps locate an exact bit in large repeating array. The user identifies the repeating cell and array corners in a graphical user interface, and image recognition technology then quickly allows navigation to a specified bit/cell in the array.
- Key features of iFast:
  - Graphical programming environment
  - FIB column controls: Imaging, milling, deposition, apertures, accelerating voltage
  - SEM column controls: Imaging, deposition, accelerating voltage, beam current
  - Alignment tools: Image recognition, edge finding
  - If-Then logical operations
  - Looping using either a fixed value or until a conditional statement is met
  - Includes iFast Recorder, which records the users on tool actions and places them into a recipe, which can be rerun as is, or added to a larger recipe.
  - Additional licenses for an offline version are available at additional cost.

Included with the iFast automation environment are recipes for automatic daily PM (ADPM) and contamination checks. These powerful recipes allow service engineers to perform automated daily checks of all critical system parameters such as column conditions, chamber pressure, beam current, and many more. The recipe can be set to provide popup alerts when measured values exceed normal parameters. ADPM data is saved locally and can be exported to site SPC databases. The contamination recipe allows service engineers to quickly and consistently check for contamination inside the vacuum chamber which can affect imaging performance.

Helios NanoLab 1200AT Features and specifications
Geometry
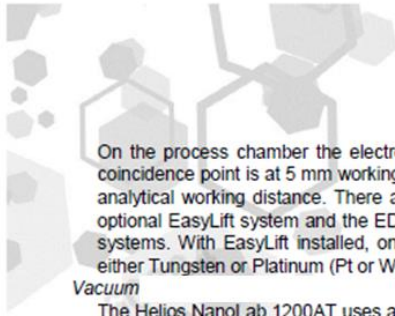
On the process chamber the electron and ion column are mounted at 52 degrees to each other. The beam coincidence point is at 5 mm working distance, which is also the eucentric working distance of the stage and the analytical working distance. There are 5 GIS ports grouped around the ion column. With the presence of the optional EasyLift system and the EDS detector, three of these ports remain available for installing gas injection systems. With EasyLift installed, one of these GIS ports must be dedicated to the EasyLift deposition gas – either Tungsten or Platinum (Pt or W). The optional EDS system also consumes a GIS port.

Vacuum

The Helios NanoLab 1200AT uses an entirely oil-free vacuum system, utilizing an Edwards XDS35i scroll pump. Differential pumping on the electron column ensures tip operation at the ultra-high vacuum levels (10^{-10} mbar) even with a controlled gas flow in the specimen chamber.

Sample navigation

The Helios NanoLab 1200AT is equipped with a 5-axes motorized X-Y-Z-rotate-tilt stage with piezoelectric control of all axes. Travel along the X and Y axis is 300 mm and the tilt range is –15 to 55 degrees. The motorized Z-range is 8 mm. Stage repeatability in X and Y directions is 2.5 µm, 3σ globally (up to 300 mm) and 0.5 µm, 3σ locally (up to 25 mm).

Sample holders available

- 300 / 200 nm semiconductor full wafer holder
- Holders for, 150 or 200 mm data storage wafers (1.2 mm wafer thickness)
- Small parts holder with pre tilt mounts and support for TEM lamella and wafer pieces up to 50 mm^2 (semiconductor and data storage versions)
- Packaged parts holder for non-wafer parts up to 7 mm thick
- 6" x 0.25" standard photomask holder
- Quarter wafer piece holder for larger wafer pieces up to ¼ wafer size
- All holders load manually through loadlock

Electron optics

Elstar™ UHR immersion lens FE-SEM column

- Magnetic immersion lens electron optics with ultra-high brightness NG emitter
- Source: Schottky field emitter mounted on the NG hot-swap gun module
- Source lifetime: 1 year guaranteed
- Voltage: 350 V to 30 kV, continuously adjustable
- Beam current: ≤ 22 nA
- Resolution: 1.0 nm @ 15 kV, 1.4 nm @ 1 kV at optimal WD
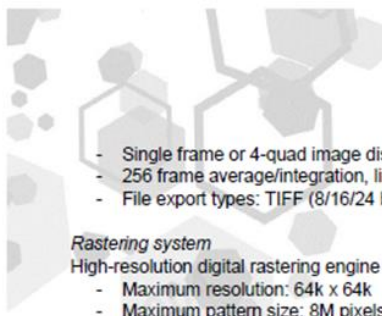- Detection: in-lens secondary electron (SE) and backscattered electron (BSE)

Ion optics

Tomahawk™ field emission focused ion beam optics with liquid Gallium ion emitter.

- Source lifetime: 1000 hours
- Voltage: 0.5 kV to 30 kV
- Differentially pumped
- Beam current: 1.1 pA - 65 nA (15-position aperture strip)
- Resolution: 4.5 nm @ 30 kV (at coincident point)
- Detection: ICE detector (direct ion detector)

Imaging system

High-resolution digital imaging engine controlled from the User Interface.

- Resolution: 512x442, 1024x884, 2048x1768, 4096x3536 pixels
- Dwell Time: 25 ns/pixel to 25 ms/pixel

- Single frame or 4-quad image display
- 256 frame average/integration, line integration and averaging
- File export types: TIFF (8/16/24 bit), BMP and JPEG

Rastering system
High-resolution digital rastering engine controlled from the User Interface
- Maximum resolution: 64k x 64k
- Maximum pattern size: 8M pixels
  Minimum Dwell Time: 25 ns/pixel
  Maximum Dwell Time: 25 ms/pixel
- Multiple pattern shapes
- Variable dwell time pattern to give 3D milling
- Complex milling patterns through Bitmap import

Detection

The Helios NanoLab 1200AT features in-lens SE and BSE detection specially designed for high-resolution imaging at both high and low kV's, as well as an Everhart-Thornley SE detector for conventional SE detection, and ICE detector for SE and secondary ion imaging. Electron Beam Current Measurement is also standard.

The ICE is a detector for secondary ion and electron detection. Its novel design is optimized for imaging with the ion column in both ion and electron collection mode. The patented ion detection scheme provides revolutionary secondary ion imaging. Additionally, ICE has a high current and low current mode, increasing the useful beam current dynamic range.

The optional STEM detector enables scanning transmission imaging in bright field, dark field and high-angle dark field modes.

Imaging

Images are displayed in an area of 1024 x 884 pixels, configurable for single frame display or 4-quadrant display. Images can be viewed live (up to 4 channels), averaged or integrated. Images can be saved in TIFF, BMP or JPEG file formats, and in 8-bit, 16-bit or 24-bit depth, to the hard disk or LAN from the graphical user interface. Image printing is also available from the user interface with optional thermal screen printer.
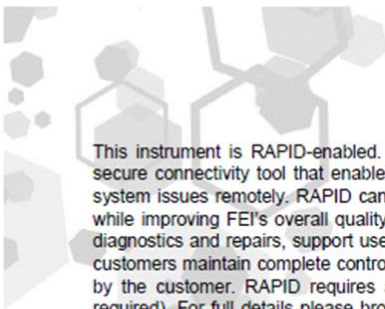
Patterning

Predefined patterns can be drawn in overlay in any of the four quadrants in the UI. Progress of the patterning is monitored in the User Interface through a progress bar. End-point detection is available through a specimen current graph and a software-integrated Real-Time Monitor. Simultaneous imaging and patterning is a standard feature of the Helios NanoLab 1200AT.

System control

The Helios NanoLab 1200AT is controlled from a Windows XP Graphical User Interface running at 1280 x 1024 screen resolution on a dedicated microscope controller. A support computer is standard on the system for software utilities that could interfere with the control software running on the controller (e.g. LAN connection). The system includes two 24-inch widescreen 16:10 LCD monitors, an optical mouse and a height-adjustable office desk. The two computers are controlled with a single keyboard and mouse using an automatic switch box ("MagicSwitch"). A manual user interface allows for hands-on control of coarse and fine focus, stigmation, magnification, X and Y shift, contrast and brightness in addition to standard mouse control. The stage can be controlled through the user interface or by a standard included joystick.

RAPID™

This instrument is RAPID-enabled. RAPID (Remote Access Program for Interactive Diagnostics) is a highly secure connectivity tool that enables FEI's service engineers to connect directly to the instrument to address system issues remotely. RAPID can significantly speed up repair time and thus reduce instrument downtimes, while improving FEI's overall quality of service. FEI's service engineers use RAPID to perform remote system diagnostics and repairs, support user operation and view images for enhancing system performance. However, customers maintain complete control of how and when RAPID is used – each RAPID session must be initiated by the customer. RAPID requires a high-speed internet connection (> 5 MB/sec recommended, 1 MB/sec required). For full details please browse to the RAPID pages on www.fei.com. *Note: Use of RAPID is optional and not required for successful system operation.*

System Support

The microscope entitles the owner to free access to the on-line resources of FEI for Owners and free membership of the FEI FIB & DualBeam User Club (see www.fei.com/owners for details). These are valuable resources enabling users to link to other users of FEI instruments around the world. Main features are:
- Learn and stay updated on new developments, microscope enhancements and applications
- Share expertise and knowledge with peers
- Discuss and communicate with FEI specialists
- Share automation scripts for the (optional) iFast automation software packages

By using these support activities, customers of FEI are able to interact with other users directly and share knowledge, which will help them being more successful.

Installation requirements
Please refer to the Helios NanoLab 1200AT Pre-installation Guide, FEI part number PN 1046885

1021033   300/200 mm Semiconductor Wafer Holder Kit
Wafer holder for 300 mm and 200 mm (12-inch, 8-inch) standard silicon wafers for loadlock sample entry. Kit includes the wafer holder, mapping and sample wafers. The mapping wafer is a 300 mm silicon wafer with notch, according to SEMI-standards (Sematech 300 mm TW304 silicon). The wafer is patterned with a test pattern in an orthogonal grid of 5 x 5 mm and used for stage calibration and mapping. The samples wafer is configured with 18 different samples used for system acceptance testing (resolution, milling performance, etc.). This holder accommodates up to four (4) Quick-Flip™ High Throughput Gridholders to load up to 8 Omniprobe compatible half-moon grids. Kit includes mapping and samples wafers for stage and NavCam calibrations.

1011761   Carbon Deposition Precursor for MultiChem
Gas chemistry solution (Naphthalene) for Ion or Electron beam deposition of Carbon-based material. The package includes the gas precursor crucible for the MultiChem Gas Delivery System and is shipped with the basic SEM/FIB/SDB/WDB system and is assembled on site.

1060064   Compact UI Table
Mobile User Interface Workstation--all metal construction with powder coated finish, with work surface dimensions of 36.5" wide x 26"deep
• Electrically height adjustable for sit-down and stand-up use
• Dual Monitor Mount with integrated cable management to hold two 24" displays
• CPU holders with covers
• IEC 6 outlet power strip
• Workstation has a footprint 44" wide X 41" deep including integrated PC holders & monitor overhang

1060075   Haskris Chiller, 60 Hz S2 Compliant
Fab compatible refrigerated water recirculating chiller with air cooled condenser that is SEMI S2 and UL listed.

1111592   High-Frequency EMI Cancellation System (SC26)
High-Frequency EMI Cancellation System (SC26)

1021970   High Resolution Optical Microscope
Integrated optical microscope for global alignment and navigation. Magnification of 1300 μm HFOV with 1000 x 1300 pixel color image, displayed within system user interface in separate window. System is capable of 32 X digital zoom.

1062512   iFast Developers Kit Pro + Semiconductor Wafer Navigation
The Professional Version of the iFast Developer's Tool Kit enables the user to quickly and easily create new recipes or modify existing ones to fit their specific needs. Recipes are edited within an intuitive graphical interface, enabling faster learning of the programming environment as well as an easier understanding of existing recipes. Within the iFast Developers environment the user is able to control columns, detectors, stage motion and site alignment, with logical operation and looping.

Key features:
- Graphical programming environment
- FIB column controls: Imaging, milling, deposition, apertures, accelerating voltage
- SEM column controls: Imaging, deposition, accelerating voltage, beam current
- Alignment tools: Image recognition, edge finding
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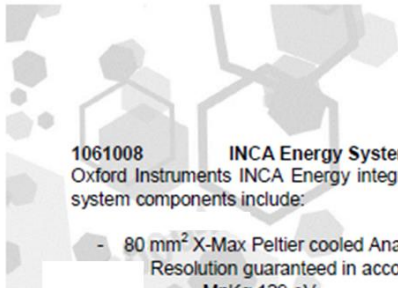- Additional licenses for an offline version are available at additional cost

Semiconductor Wafer Navigation provides a suite of functionality that enables navigation to the correct position on 300mm semiconductor wafers for analysis. Capabilities include:
- Wafer map generation
- site plans
- defect navigation based on KLARF ingestion
- Cell navigation.

Wafer Map software provides iFast the ability to display a graphical map of a user specific wafer from its associated iFast recipe. Users can create a predefined site list and wafer global alignment routines which can then be run in an automated iFast Runner session by a Helios 1200AT operator.

Wafer maps can be generated based on imported KLARFs and defect root cause analysis activities conducted on defect locations via iFast recipes.

Cell Navigator function helps locate an exact bit in large repeating array. The user identifies the repeating cell and array corners in a graphical user interface, and image recognition technology then quickly allows navigation to any bit/cell in the array.

1061008   INCA Energy System with 80 mm2 X-Max SDD Detector

Oxford Instruments INCA Energy integrated software Microanalysis System customized for Helios 1200AT. Main system components include:

- 80 mm^2 X-Max Peltier cooled Analytical Si Drift Detector
    Resolution guaranteed in accordance with ISO15632:2002 for:
    - MnKα 129 eV
    - FKα 75 eV
    - CKα 72 eV
- X-Stream X-ray acquisition system and detector control - An IEEE 1394 based module that provides fully digital X-ray acquisition and detector control
- MICS Microscope Image Capture System - An IEEE 1394 based Microscope Image Capture System that provides X, Y scan generation and two analogue input channels

The Helios 1200AT customized INCA Energy system allows users to:
- Carry out qualitative and quantitative analysis from an image on the Helios 1200AT
- Acquire and print digital images
- Acquire elemental maps and linescans
- Generate reports from a range of templates provided
- Export reports as Microsoft Word™ documents.

Energy Microanalysis System package summary:
- The software programs comprising the standard INCA platform:
- Navigator: navigational software for step by step guidance
- Adviser intuitive on-line help to advise users throughout the analysis
- Information Management System (IMS) which allows simple and logical data management for users
- Reporting: allowing professional report generation with a few mouse clicks.

Main software features and abilities of the INCAEnergy are:
INCA Energy Analyzer Navigator, INCA Energy Mapping Navigator, INCA Energy Point and ID Navigator, SmartMap, Data export, Spectrum Examiner, Pile-up correction. Spectrum subtraction, Reporting, Bubble Help and INCA Encyclopedia. Optional SiteLock and TEM Quant are also included with the customized Helios 1200 INCAEnergy package.

Installation by Oxford Instruments and 1 year warranty are included.

1061010   INCA Integration Kit

The INCA integration kit provides a special Helios support computer configuration, which can be used by Oxford Instruments software to control the INCA Energy EDS system. In order to do so, a FireWire card is installed to connect to the Oxford hardware. The integration kit allows the INCA Energy software to run from the Helios support PC. The kit limits the number of PC's, keyboards and mice to the absolute minimum and ensures smooth installation in the field as the kit was developed in close collaboration with Oxford Instruments.

1011767   Insulator Enhanced Etch Precursor for MultiChem

Gas chemistry solution (XeF_2) for enhanced etching of insulator materials. This gas chemistry is used to selectively remove insulating materials while inhibiting the removal of conducting materials. The package includes the gas precursor crucible for the MultiChem Gas Delivery System. This gas chemistry crucible is shipped with the basic SEM/FIB/SDB/WDB system and is assembled on site.

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1060043   **MultiChem Gas Delivery System**

FEI's MultiChem Gas Delivery System is a flexible gas delivery system used for precision gas assisted etching or deposition. MultiChem allows the operator to precisely control precursor flow rates and gas delivery location as well as mix two precursors prior to sample delivery. MultiChem can support up to 6 different chemistries. Simple and fast crucible replacement translates to less downtime. Application files for each available chemistry are included to optimize performance.

Key Features:
- Gas delivery system with up to 6 chemistries
- Supports gaseous, liquid and solid precursors
- Only occupies one port of the vacuum chamber
- Capable of fine gas flow / pressure control
- Able to mix gases
- Two injection lines with cooling capability to provide better gas flow control with high vapor pressure precursors
- Provides motorized X, Y motion suitable for gas needle alignment
- Gas crucible design does not require chamber vent or needle realignment after replacement
- Full integration in the main system user interface and applications

1021954   **Pre-installation Kit**

Kit shipped ahead of main Helios Wafer DualBeam system to allow facilities to be set up in advance of tool installation. Kit includes power conditioner, pumps, facilities connection box, cables and hoses. Includes full size floor installation template with required hole pattern for Helios Wafer DualBeam systems, which allows planning and layout of tool site prior to installation of system.

1050432   **Site Service Kit**

The site tooling kit provides tools necessary for FEI service engineers to properly maintain the Helios NanoLab 1200AT stage and column modules. These tools are required to remove the stage and column that allow access to individual module components.

1011757   **Tungsten Deposition Precursor for MultiChem**

Gas chemistry solution for Ion or Electron beam deposition of Tungsten-containing material. Tungsten gas chemistry is the preferred metal deposition in case low electrical resistance of the deposited material is required. The package includes the gas precursor crucible for the MultiChem Gas Delivery System and is shipped with the basic SEM/FIB/SDB system and is assembled on site.

4022 400 40381   **FCA Oregon Airport (T-18)**

Free Carrier Oregon Airport (USA) Incoterms 2010. The Seller's obligations are fulfilled when goods are delivered to a carrier nominated by the Buyer at a named airport in The United States cleared for export. The Seller takes care of pre-transport (Factory – Airport) only. If delivery takes place at the Seller's premises the Seller has an obligation to load the goods onto the buyer's collecting vehicle. The risk of loss or damage passes to the Buyer upon when goods are delivered to a carrier at a named airport by the Buyer's forwarder. In accordance with FEI's terms and conditions of sale, title transfers at the same point that risk of loss transfers.