

# Helios 5 HX DualBeam System

## High-throughput, high quality TEM sample preparation for 7 nm devices

The Helios 5 DualBeam series is the world's first 7 nm-capable DualBeam platform for imaging, analysis and TEM sample preparation in semiconductor failure analysis, process development and process control laboratories.

The Thermo Scientific™ Helios™ 5 HX DualBeam continues the Helios DualBeam legacy to the fifth generation by combining the innovative Thermo Scientific™ Elstar™ Electron Column with UC+ technology for high-resolution and high materials contrast imaging and the superior low-kV performance of the Thermo Scientific™ Phoenix™ Ion Column for fast, precise and sub-nm damage sample preparation. In addition to the industry leading SEM and FIB columns, the Helios 5 HX DualBeam incorporates a suite of state-of-the-art technologies that enable simple and consistent sample preparation for high-resolution TEM imaging on even the most challenging samples.

### High-quality imaging at all landing energies

The ultra high-brightness electron source on the Helios 5 HX DualBeam is equipped with second-generation UC technology (UC+) to reduce the beam energy spread below 0.2 eV for beam currents up to 100 pA. This enables sub-nanometer resolution and high surface sensitivity at low landing energies. The highly efficient Mirror Detector and In-Column Detector in the Helios 5 HX DualBeam come with the ability to simultaneously acquire and mix TLD-SE, MD-BSE and ICD-BSE signals to produce the best overall ultra high-resolution images. Low-loss MD-BSE provides excellent materials contrast with an improvement of up to 1.5x in Contrast-to-Noise ratio, while No-loss ICD-BSE provides materials contrast with maximum surface sensitivity.

### High-throughput, automatable TEM sample preparation

Building on the success of the QuickFlip shuttle, the Helios 5 HX DualBeam incorporates a newly designed Automated QuickFlip shuttle and rotation mechanism to simplify and reduce the time required to prepare inverted TEM samples. When preparing ultra-thin (sub-20 nm) TEM lamella, the best path to the highest-quality TEM image is to prepare the lamella through a process that inverts the sample orientation relative to the ion milling beam. The Automated QuickFlip solution combines a single liftout and weld

### Key benefits

**High-performance** Elstar Electron Column with UC+ monochromator technology for sub-nanometer SEM and STEM image resolution

**Exceptional low-kV** Phoenix Ion Beam performance enables TEM sample preparation with sub-nm damage

**New automated 6-Grid QuickFlip Shuttle** for high-throughput, inverted TEM sample preparation

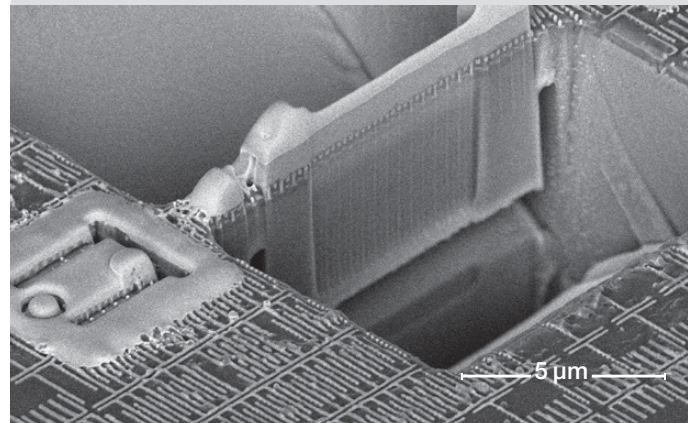
**Sharp, refined and charge-free** contrast obtained from up to seven integrated in-column and below-the-lens detectors

**EasyLift EX NanoManipulator** enables precise, site-specific preparation of ultra-thin TEM lamellae all while promoting high user confidence and yield

**Optional MultiChem Gas Delivery System** provides the most advanced capabilities for electron and ion beam-induced deposition and etching on DualBeams

**iFast Software Developer's Tool Kit Pro** for customizable process automation and improved operator ease-of-use

**Backed by the Thermo Fisher Scientific's** world class knowledge and expertise in advanced failure analysis for DualBeam applications



TLD image of a thinned TEM lamella prior to *in situ* liftout. Wide fields of view can be precisely thinned using standard iFast Software recipes.

with automated flipping of the grid to properly orient the sample within the chamber. This eliminates the need for an operator to unload the TEM grid holder from the chamber and manually adjust the orientation. In addition, the Helios 5 incorporates a new 6-grid Quick Flip shuttle, increasing grid capacity by 50% and allowing for higher throughput of the lamella creation process through increased automation.

## High-quality, ultra-thin TEM sample preparation

Preparing high-quality, ultra-thin TEM samples requires polishing the sample with very low-kV ions to minimize damage to the sample. Our most advanced Phoenix Focused Ion Beam (FIB) Column not only delivers high-resolution imaging and milling at 30 kV, but now expands unmatched FIB performance down to accelerating voltages as low as 500 V, enabling the creation of 7 nm TEM lamellae with sub-nm damage layers.

## Enabling Flexibility

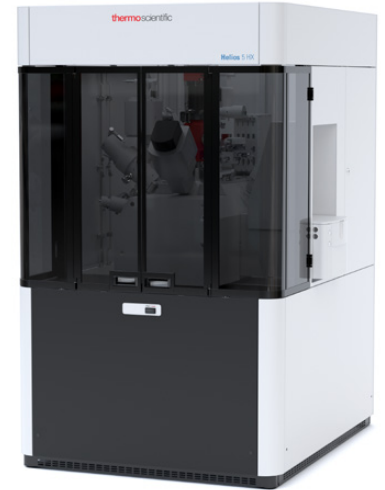
Smart Alignments actively maintain the system for optimum performance, ready to deliver the highest performance for all users. Patterning improvements ensure the highest quality depositions at any condition, and an extensive automation suite make the Helios 5 the most advanced DualBeam ever assembled – all backed by Thermo Fisher expert application and service support.

## Specifications

- Electron source
  - Schottky thermal field emitter, over 1 year lifetime
- Ion source
  - Gallium liquid metal, 1,000 hours
- Landing Voltage
  - 20 V–30 kV SEM
  - 500 V–30 kV FIB
- SEM resolution
  - Optimal WD
    - 0.6 nm @ 2–15 kV
    - 0.7 nm @ 1 k V
    - 1.0 nm @ 500 V
  - Coincident WD
    - 0.6 nm @ 15 kV
    - 1.2 nm @ 1 kV
- FIB resolution coincident WD
  - 4.0 nm @ 30 kV using preferred statistical method
  - 2.5 nm @ 30 kV using selective edge method
  - 500 nm @ 500 V using preferred statistical method
- EDS resolution
  - <30 nm on thinned samples
- *In situ* TEM sample liftout
  - Thermo Scientific™ EasyLift™ EX NanoManipulator
- Stage
  - Five-axis, all-Piezo motorized
  - Auto-QuickFlip Shuttle
  - Automated loadlock
- Sample types
  - Wafer pieces, packaged parts, TEM Grids, whole wafers up to 100 mm
- Maximum sample size
  - 70 mm diameter with full travel
- Application software
  - Thermo Scientific™ iFAST™ Software Developers Kit
  - Professional automation software
- AutoTEM 5 TEM Sample Preparation Suite
- User interface
  - Windows® 7 GUI with integrated SEM, FIB, GIS, simultaneous patterning and imaging mode
  - Local language support: Check with your local Thermo Fisher sales representative for available language packs
  - Two 24-inch widescreen LCD monitors

## Key options

- Beam chemistry
  - Standard Gas Injection Systems
  - MultiChem Gas Delivery System
- Software
  - Thermo Scientific™ Auto Slice & View™ Software, Magma CAD Navigation
  - Thermo Scientific™ MAPS Software
- Hardware
  - EDS, WDS, EBSD analysis



Find out more at [thermofisher.com/EM](http://thermofisher.com/EM)