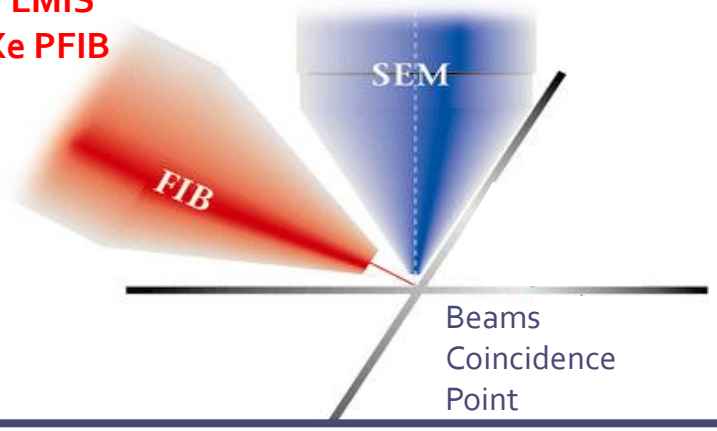
Dual Beam at BGU, capabilities for 3D Nano-scale Materials Characterization

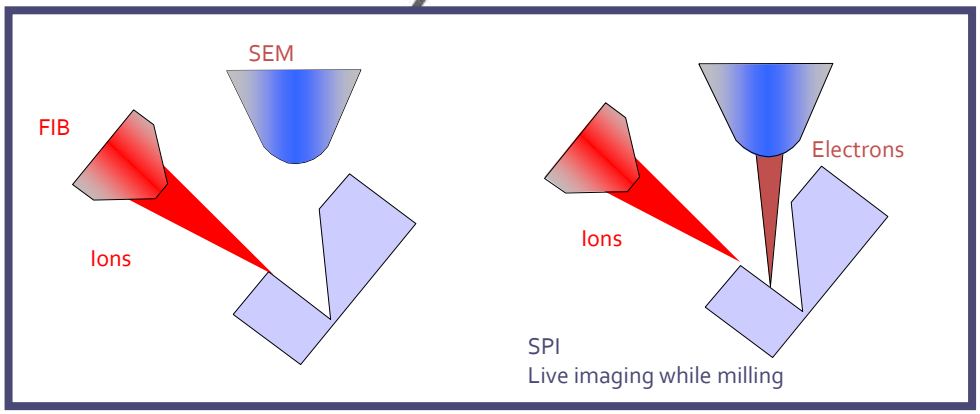
Out line

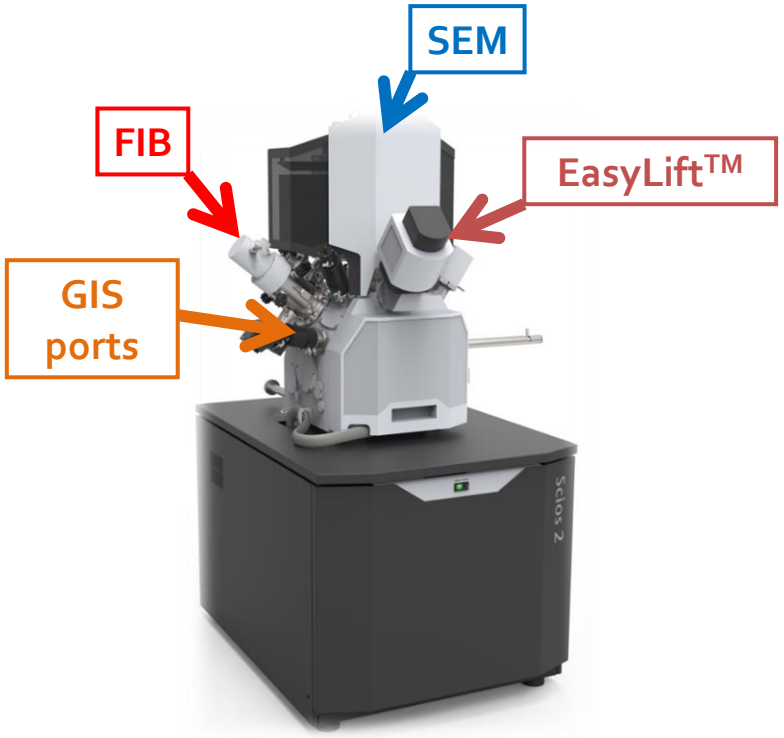
- DualBeam™ overview
- Helios G4 UC
  - SEM - Electron column – Elstar UC+
  - FIB - Ion column – Tomahawk
  - Stage; easylift; multichem; EDX
- Applications:
  - cut and view
  - Site-specific material biopsy: TEM lamella preparation, Atom probe sample preparation, STEM imaging and analysis
  - Nano patterning
  - 3D slicing and tomography
  - Automation

DualBeam™ Overview

Ga LMIS
or Xe PFIB

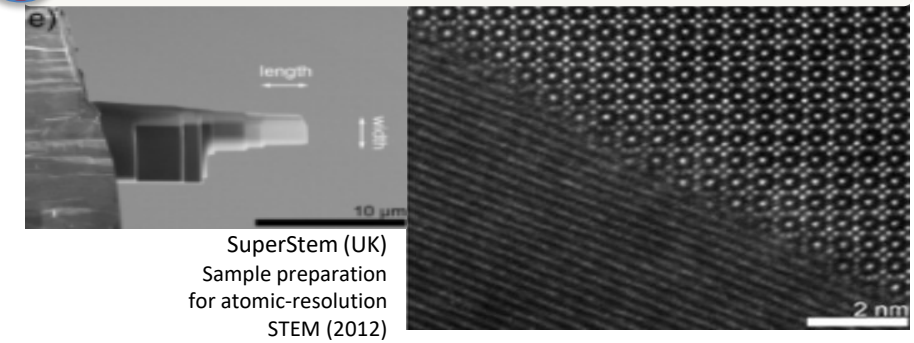






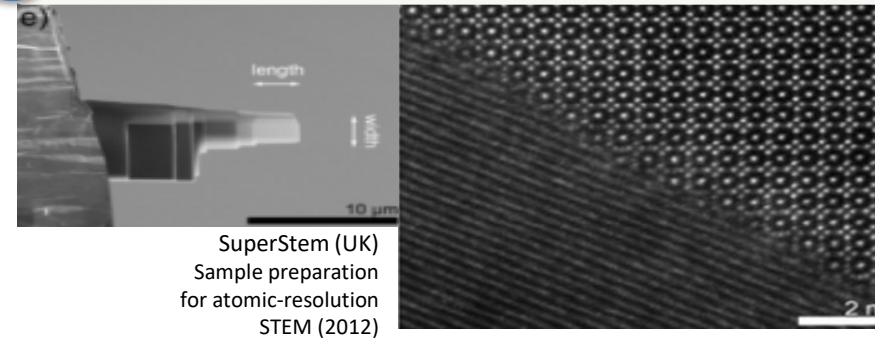
DualBeam™ (FIB/SEM) Applications

1 Cut and view



SuperStem (UK)
Sample preparation
for atomic-resolution
STEM (2012)

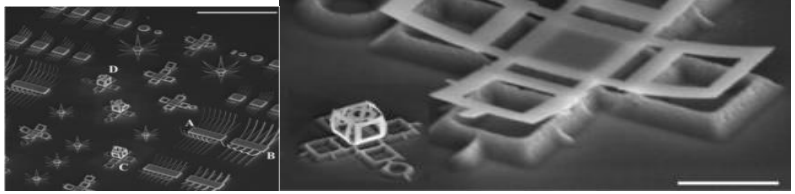
2 Site-specific material biopsy



SuperStem (UK)
Sample preparation
for atomic-resolution
STEM (2012)

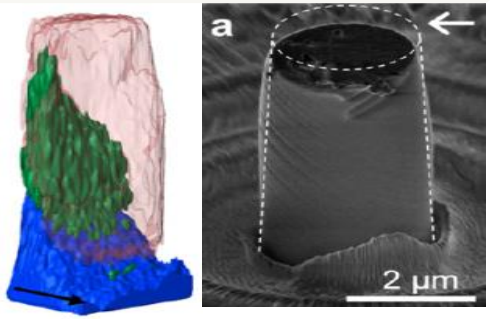
3 Nano patterning

Aalto Univ (FI),
Ion-beam assisted self-assembly of
metallic nanostructures (2012)



4 3D slicing and tomography

Cambridge Univ. (UK)
3D EBSD analysis of deformation in
MgO micropillars (2011)

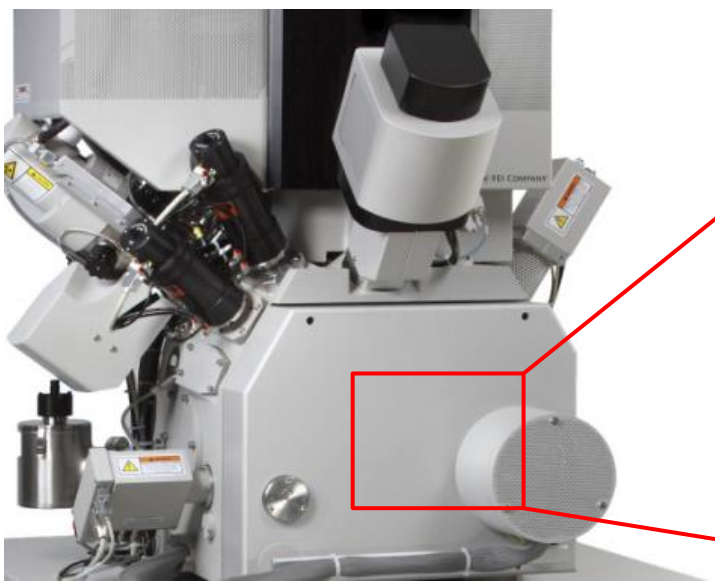


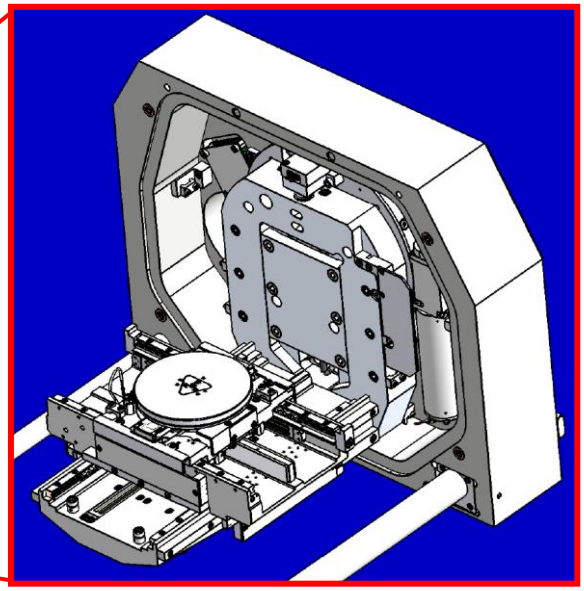
Helios G4 UC – Specifications

SEM	Column technology	Elstar™ UC+ with BD
	Resolution	0.6 nm @ 2 keV 0.7 nm @ 1 keV 1.0 nm @ 500 eV
	Landing voltage range	20 eV – 30 keV
	E-beam current range	0.8 pA – 100 nA
FIB	Column technology	Tomahawk (differential pumping, TOF)
	30kV resolution	2.5 nm using selective edge method
	I-beam current range	0.1pA – 65 nA
Detection	Standard detectors	ETD, TLD (SE/BSE), MD (BSE), ICD (SE/BSE)
Stage	Type	High precision 5-axis motorized , with X-Y-R axis piezo driven
	X-Y-Z Range	150x150x10 mm (max Z clearance 55 mm to eucentric point)
	Tilt Range / Rotation	-10° to +60° / 360° endless
Supporting HW and SW	Navigation	In-chamber Nav-Cam, IR camera, Image registration
	Process monitoring	SPI, iSPI, iRTM, FIB immersion
	Scan strategies	SmartScan™, Interlaced Scanning, DCFI
	Sample cleanliness	Integrated Plasma Cleaner

Stage - Consistently preparing high quality samples

Large, ultra-stable, accurate and repeatable piezo stage





- X-Y-Z range: 150x150x10 mm
- Clearance 55mm to eucentric point
- Rotation: 360° (endless)

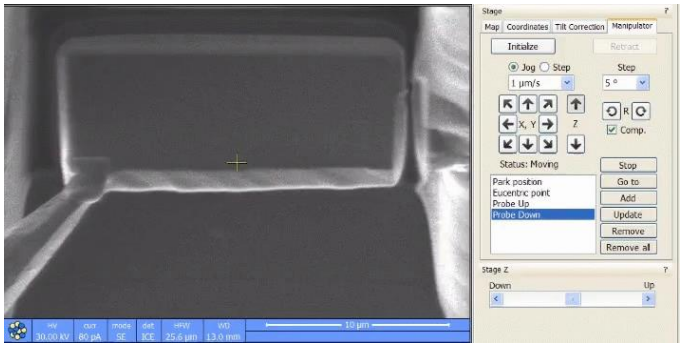
- Tilt range: -10° to +60°
- XY repeatability: 1 µm

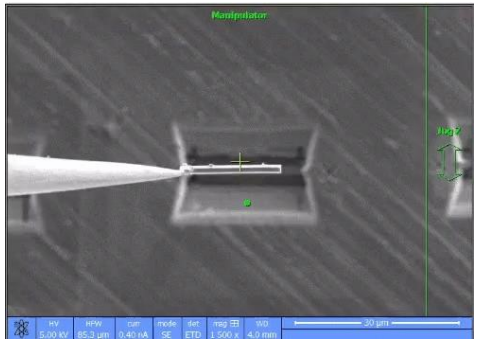
Proprietary & Confidential

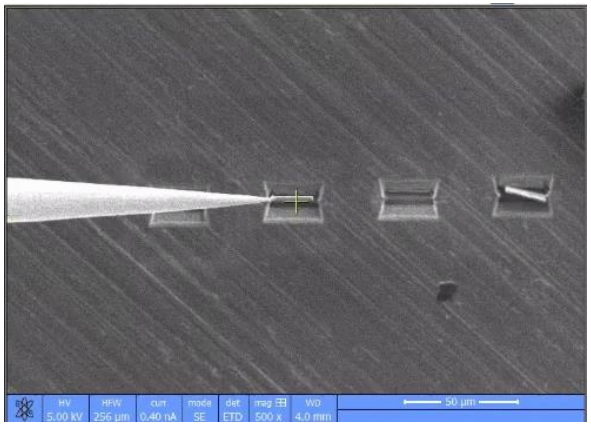
EasyLift - provides computer controlled accurate movement for lift-out

Thermo Fisher **EasyLift**

- Integrated & intuitive controls
- Stable & reliable operation
- Precise and repeatable motion







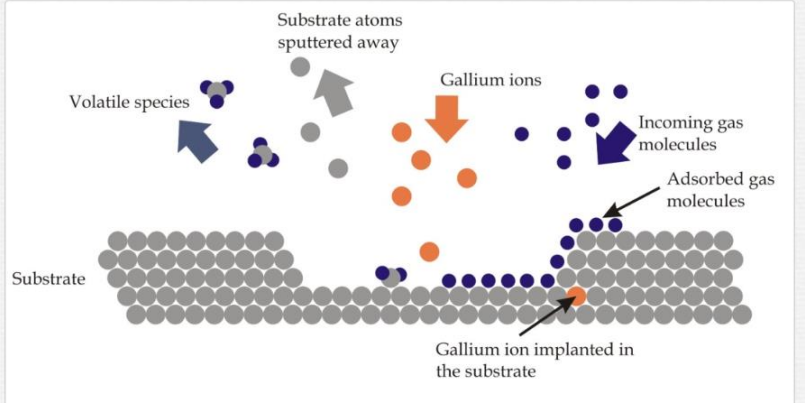
Consistently preparing high quality samples with EasyLift - fully integrated in-situ lift-out (INLO) solution

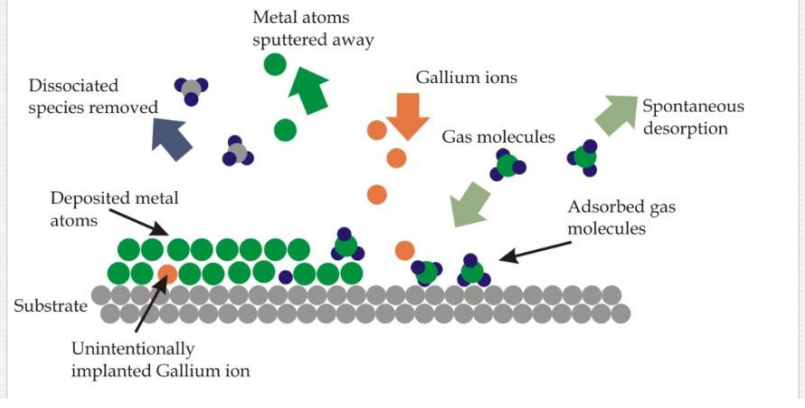
Proprietary & Confidential

Multichem - provides computer controlled accurate movement for lift-out

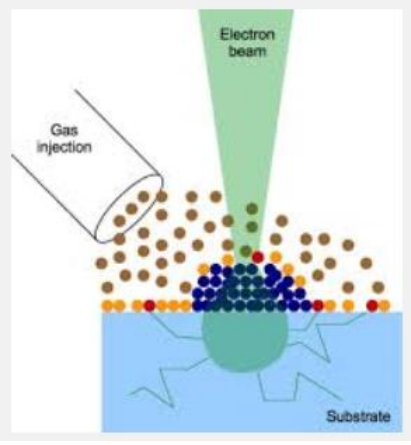
- Up to 6 different precursors are available with one injection nozzle.
- Allow chemical deposition or etch in addition to the ion physical sputter.

Gas enhance

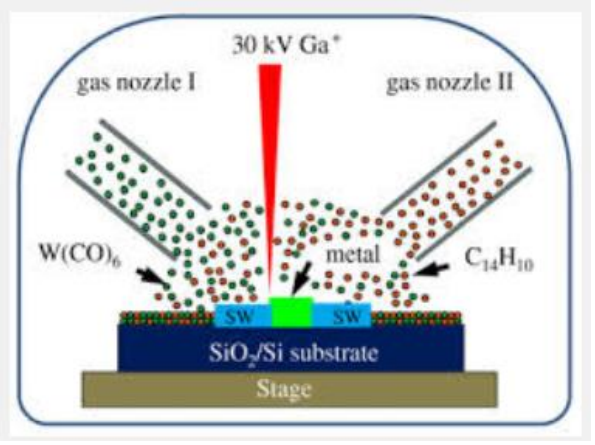




e beam



I beam



Helios G4 UC - Enabling breakthrough innovations with DualBeam™ — faster and easier than ever before

- **Fast and easy preparation** of high quality samples for HR S/TEM and APT
- **Extreme high resolution imaging** with the most precise contrast
- **Access highest resolution**, multi-scale and multi-modal subsurface and 3D information
- **Fast, accurate, and precise milling and deposition** of complex structures with critical dimensions of less than 10 nm