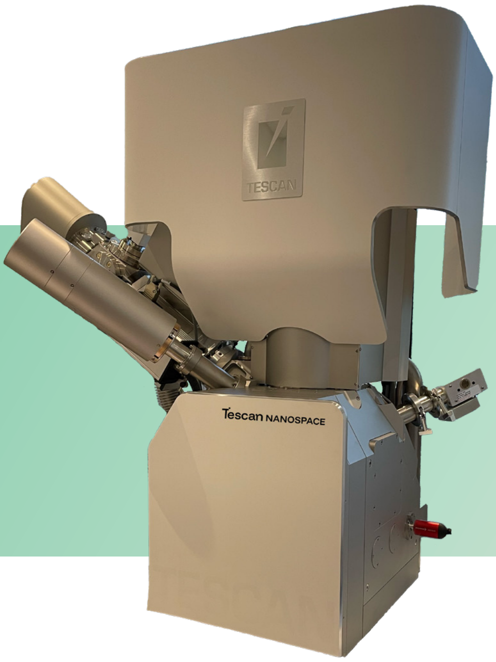
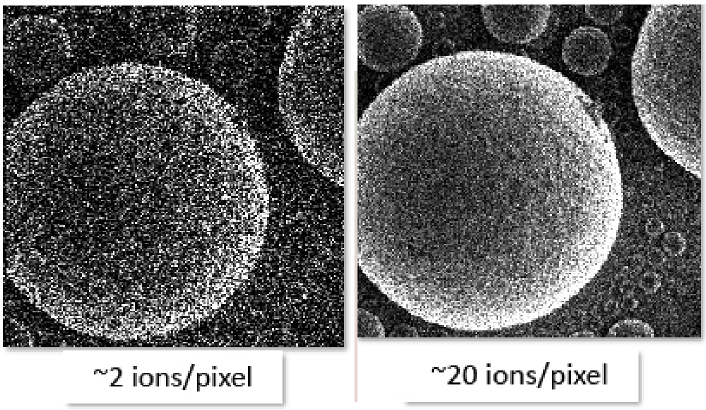
Tescan Nanospace GM

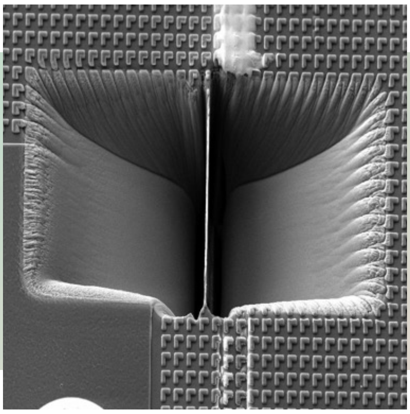
Flexible and customized FIB SEM system, Orsay Physics's platform for various special FIBs

As the first company in the world to originate a FIB SEM system, Orsay Physics has developed focused ion beam as its core technology for more than 30 years. In addition to manufacturing FIBs for substructive processing for integration into Tescan standard dual-beam electron microscopes, Orsay Physics has also developed some special FIBs for special applications to meet the needs of different FIB technologies. Now, thanks to Nanospace GM, Orsay Physics could integrate these unique FIB columns on a flexible platform to meet different application demands.

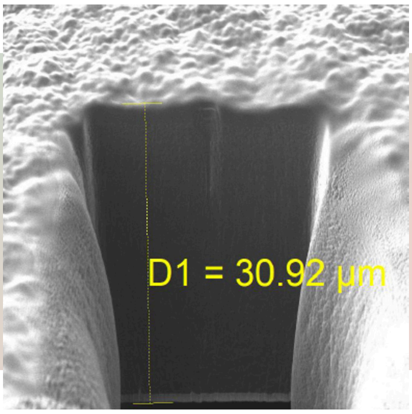




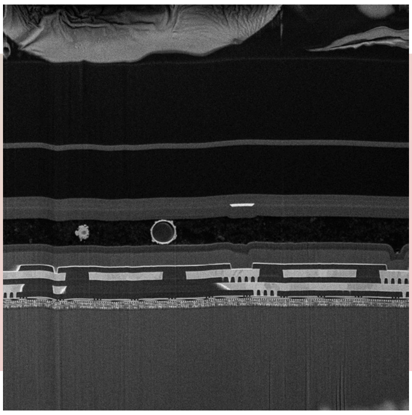
SE images of tin on carbon captured with two different dwell time 3.2 µs/pixel (left) and at 32 µs/pixel (right) with a current of 106 fA and a landing energy of 30 kV. A clear image of the tin particles are visible even with only 2 ions/pixel



SEM image of 150 µm TEM lamela prepared using Xe source



SEM image of a 30 µm cross section done on a graphite sample using oxygen source



SEM image of a 200 × 150 × 100 µm cross section done in 40 min on a semiconductor sample using Ar source

Essential Specifications

BrightBeam SEM Column

- Schottky electron electron emitter (expected lifetime min. 2 years)
- Electron beam landing energy range: 50 eV – 30 keV
- Probe current: few pA to more than 350 nA
- Resolution : 1.6 nm at 15 keV

Focused Ion Beam Columns

Choice of configuration:

iVeloce focused Ion Beam Column

- Plasma ion source (ECR type)
- Source lifetime not limited
- Gaz species: Xe, O, Ar, He, N, gas mixture
- 90 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 3 kV – 30 kV
- Total probe current: < 1 pA – 250nA
- Filtered current: <20 fA to 35 nA ($^{14}N^{2+}$)
- Maximum field of view: 1 mm (± 10 %)
- Resolution @ 12 mm WD : 40 nm @ 1 pA and 30 kV

Veloce

- Liquid alloy metal ion source (AuGe / AuSi), Au^{2+}, Ge^{2+}, Si^{2+}
- Ion species: Ga^+, Ge^+, Au^+, Si^+, Au cluster
- 90 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 3 kV – 30 kV
- Total probe current: < 1 pA – 50 nA
- Maximum field of view: 1 mm (± 10 %)
- Resolution @ 12 mm WD : 6.5 nm @ 1 pA and 30 keV

i-FIB

- Ion source : Plasma
- Ion species: Xe^+, O_2^+, Ar^+, N^+, O^+, N_2^+
- 60 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 0.5 kV – 30 kV
- Probe current: < 1 pA – > 3.3 μA
- Maximum field of view: 1 mm (± 10 %)
- Resolution @ 12 mm WD and 30 keV :

--> Xe : 10 nm
--> O : 20nm
--> Ar : 10 nm
--> N : 15nm

Deep FIB

- Ion source : LMIS (Ga)
- Ion species: Ga^+
- 30 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 0.5 kV – 35 kV
- Probe current: < 1 pA – 135 nA
- Maximum field of view: 1 mm (± 10 %)
- Resolution @ 12 mm WD and 30 kV : 2.5 nm < 1 pA

Motorized, 5-Axis Stage

- X & Y axis travel range: 130 mm
- Z axis travel range: 96 mm
- Tilt range: -70° to +90°
- Rotation: 360 degrees (continuous) (without heating stage)
- Max. specimen height: 92 mm (without heating stage)
- Maximum specimen size: 180 mm diameter with full XY moves, rotation, no tilt (larger specimen possible with limited stage travel and rotation)
- Maximum specimen weight: 8000 g
  - Full XYZRT moves: 1000 g
  - Full XYZ moves: 8000 g

Note: The range of movements is dependent on the configuration WD or Z.

Vacuum Chamber

- Width: 340 mm
- Depth: 315 mm
- Ports: 20+
- Suspension type: active
- Chamber view (IR) camera
- 2nd chamber view (IR) camera

Vacuum System

- High vacuum: < 9×10^{-3} Pa
- Pump types: all oil-free
- Load lock*

Detectors and Analyzers

- pA meter incl. touch alarm function
- Secondary Electron Detector (SED)
- Secondary Ion Detector (SID*)
- EDS* (3rd party

Gas Injection Systems*

Energis*: a single line GIS with 3 reservoirs (retractable);
Up to 3 different and selectable precursors

Choice of Precursors

- Platinum deposition (Pt)*
- Tungsten deposition (W)*
- Carbon deposition (C)*
- Insulator deposition (SiO_x)*
- Enhanced etch (H_2O)*
- Enhanced etch (XeF_2)*
- Other precursors upon request*

Accessories

- Electron flood gun (for FIB charge neutralization)*

Scanning Systems

Independent scanning systems for SEM and FIB:
- Dwell time: 40 ns–10 ms, in steps or continuously adjustable
- Full frame, selected area, line or point
- Image shift, scan rotation, tilt correction
- Pathern creator digital nanopatterning engine, 16–bit DAC

Image Acquisition

- Max. frame size: 8k x 8k
- Dynamic range: 8 or 16 bits

User Interface

- Keyboard and mouse
- ORSAY PHYSICS Pegasus Graphical User Interface

Microscope Control PC

- High Performance PC: Intel Core i7 or equivalent, 32 GB RAM, 4 TB HDD, Nvidia GTX 1660 or equivalent, Windows 11 Pro 64–bit (details available upon request)
- 32" QHD Monitor

ORSAY PHYSICS Pegasus Software

- Customizable GUI layout
- Multi-user account management
- Quick search bar
- Single, dual live image(s) display

ORSAY PHYSICS Pegasus modules

- SEM and FIB emission control
- Electron gun and column alignment
- Contrast and brightness
- GIS nozzle positioning and injection method
- Measurement
- Presets
- Histogram and LUT
- Remote Control API*

*Optional equipment

www.orsayphysics.com

Microscope Installation

Installation Requirements[1]

- Power supply: 230 V ± 10% / 50 Hz (or 120 V/60 Hz-optional), power 2300 VA, 2 kW UPS delivered with the system
- Compressed air: 5–7 bar (73–102 psi), clean, dry, oil free
- Compressed nitrogen for venting: 1 bar (15 psi), 99.99% purity (4.0 purity level)
- Room for installation: min. 4.2 × 3.1 m; minimum door width 2.05 m

Environmental Requirements[1]

- Temperature of environment: 17–24 °C with stability better than 2 °C with a rate of change 1 °C/hour
- Relative humidity: < 65 %
- Background magnetic field: synchronous < 300 nT, asynchronous < 100 nT
- Vibrations: < 10 µm/s below 30 Hz, < 20 µm/s above 30 Hz
- Acoustic noise: Less than 60 dBC
- Altitude: max. 3000 m above sea level

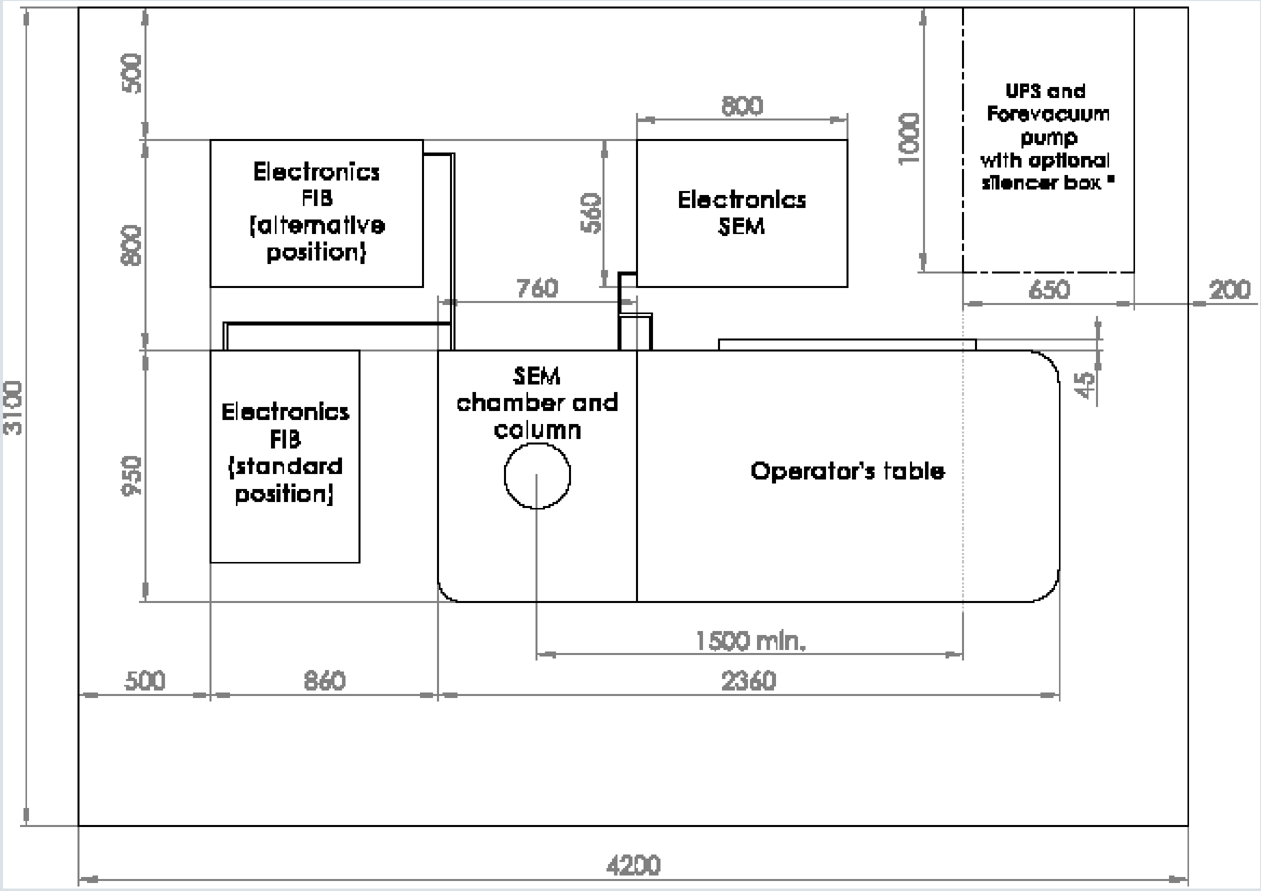
[1] Request site-survey by Tescan authorized technician Specification of background magnetic field is subject to actual acceleration voltage. Specified values are for 20 kV acceleration voltage.

Training

- **Introductory:** by Tescan engineer after installation
- **Advanced (option):** on-site

Footprint of the microscope (all dimensions in mm):

If a forevacuum pump is to be placed in the same room as Tescan NanoSpace GM microscope, then the forevacuum pump must be placed in silencer box supplied by TESCAN. The silencer box is optional and must be ordered separately.



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