nanoFAB Public Seminar:
micro-CT and FIB-SEM Dual Beam

As part of our new equipment purchases, the nanoFAB centre at the University of Alberta cordially invites you to attend an advanced microscopy seminar, evaluating the features of micro-CT and FIB-SEM Dual Beam systems. ThermoFisher Scientific application Team will present **Heliscan™ microCT**, **Helios™ Hydra Plasma Focused Ion Beam/SEM Dual Beam System** and **Automated Multi-Scale Workflows** for the application in Material and Life Science:

Helios™ Hydra Plasma FIB/SEM Dual Beam System
Brandon Van Leer, Business Development & Product Marketing Engineer

HeliScan™ microCT
Dirk Laeveren, Product Marketing Manager micro CT

Toward Automated Multi-Scale Workflows: From microCT to TEM
Eric Goergen, Product Marketing Manager - Digital Science

Light refreshments will be provided prior to the seminar.

Time: **9:30-12:00am**
Date: **Wednesday, April 3rd, 2019**
Location: **DICE 7-395**

Please REGISTER to confirm your attendance.

If you have any questions, please contact:

Peng Li, nanoFAB (Peng.Li@ualberta.ca)
Steve Dalakoudis, SFR/ThermoFisher Scientific (steve@sfr.ca)

Helios™ Hydra PFIB: Pushing the limits of extreme high resolution, characterization and sample preparation

Brandon Van Leer, Business Development & Product Marketing Engineer

The combination of Focused Ion Beams withScanning Electron Microscopes (FIB/SEM) haveenabled accessing microstructural information at and below the surface in 3D, micro-fabrication and S/TEM sample preparation. Until recently, the availabletechnologies have limited the volumes anddepths of materials that can be analyzed at highresolution, ultimately restricting the insight intostructural, crystallographic, and chemicalproperties. This is no longer the case. The introduction of Xe^+ Plasma DualBeam FIB/SEM technology offers access to regions of interest deep below the surface – combining serial section tomography with statistically relevant data analysis. PFIB technology offer an alternative ion species for FIB milling and increased milling rates because of its ability to deliver 30 – 40 times more current compared to Ga^+ FIBs.

While the measured sputter rate of aluminum using Ga^+ and Xe^+ differs by about 25% (0.31 μm^3/nC [Ga] and 0.41 μm^3/nC [Xe]), the ability to prepare gallium free thin sections for S/TEM analysis or large area cross-sections offers a solution to FIB milling artifacts seen with a Ga^+ FIB as well as improving statistical analysis of grain populations. Nowadays, new column and source technologies allow for multiple ion species to be employed for sputtering at high and low accelerating voltages, so that a researcher can tailor the choice of ion to achieve the best quality thin section for HR-STEM.

Here, we present the latest generation of plasma FIB technology supporting multiple ion species as a primary ion beam on Thermo Fisher's newest DualBeam, the Helios Hydra PFIB. Next to xenon, the Helios Hydra provides researchers with 3 additional ion species beyond xenon – argon, oxygen and nitrogen. A single ion source can deliver all 4-ion species independently with a patented, automated, fast and easy switching capability, operating at high and low accelerating voltages for best-in-class S/TEM sample preparation.

HeliScan™ microCT

Dirk Laeveren, Product Marketing Manager micro CT

HeliScan™ pioneers a new generation of micro CT technology for a variety of applications: Unique helical scanning and iterative reconstruction method produce unsurpassed image fidelity and deliver the highest signal to noise ratio compared to conventional circular scanning technology.

Capture high-fidelity images by using a single continuous scan to completely eliminate artifacts common to multi-scan stitching methods. Create a high flux by using a large X-ray cone angle and prevent well-known motion deformation from taking effect with an advanced artifacts correction technique to flatten the helical trajectory.

HeliScan now comes with the option for 400 nm resolution. Recently phase retrieval reconstruction was added for low X-ray absorbing samples.

The HeliScan™ microCT system is capable of imaging a large variety of types and sizes of samples, such as polymers, batteries, additive manufactured parts, life science specimens or geological samples.

HeliScan™ is a valuable component of a multi-scale, multi-modal workflow that may progress through higher-resolution imaging with a focused ion beam/scanning electron microscope to atomic-scale analysis in a transmission electron microscope

Toward Automated Multi-Scale Workflows: From micro CT to TEM

Eric Goergen, Product Marketing Manager - Digital Science

Correlative microscopy and tomography in material science provided by Thermo Fisher Scientific takes advantage of various experimental multi-scale, multi-modal imaging techniques, x-platform holder kits and analytical software packages to be brought to bear on the same region of interest.

Thermo Scientific™ Maps™ is the microscope automation and correlative microscopy/tomography software package for Thermo Scientific's line of electron microscopy equipment (SEM, Helios PFIB DualBeam, and TEM). Maps is a project based software platform that automates imaging acquisition as well as providing an intuitive platform to bring all imagery collected on a sample together, in one place for correlative investigations of multi-scale and multi-modal microstructural data.

Thermo Scientific™ Avizo™ is an ultimate 3D data visualization and analytical package for Correlative Microscopy, Tomography, MRI and more techniques. It is optimized for Thermo Scientific's line of electron microscopy and micro x-ray Computed Tomography (HeliScan™ micro CT) instruments. From a straightforward visualizations and measurements to complex image processing and skeletization, Avizo brings a comprehensive, multimodality digital laboratory for advanced 2D, 3D and temporal visualizations, materials characterizations, 3D model generation for Finite-Element Analysis, and calculations of physical properties.

We illustrate how the correlative workflow for material science enabled by Maps, Avizo, automated serial sectioning by Auto Slice & View™, automated TEM lamella preparation by AutoTEM4™ and dedicated x-platform correlative holder kit for dualbeam and tri-beam makes characterization of multi-scale, multi-modal datasets easy and efficient. We are focusing on sample preparation and transfer across different systems, as supported by exploration of a region of mechanical failure within an Inconel 718 test turbine component created using a high power settings of blown powder direct laser additive manufacturing.