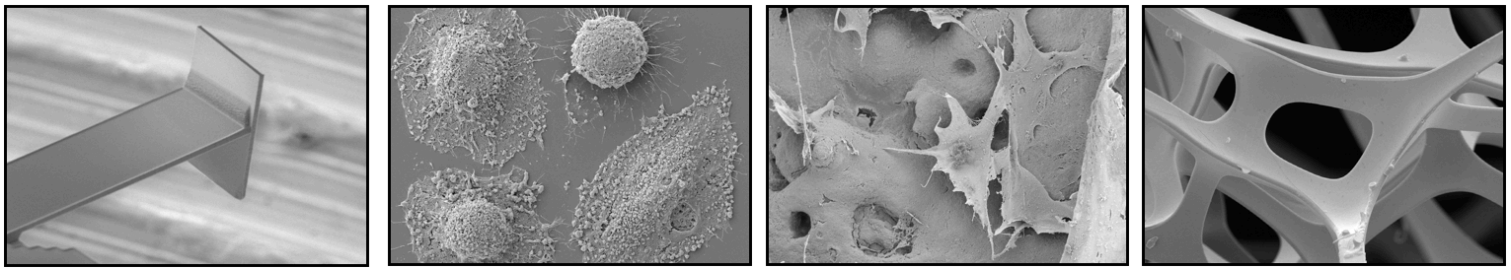
University of Basel
Swiss Nanoscience Institute

SNI SWISS NANOSCIENCE INSTITUTE
EINE INITIATIVE DER UNIVERSITÄT BASEL UND DES KANTONS AARGAU

NANO IMAGING LAB

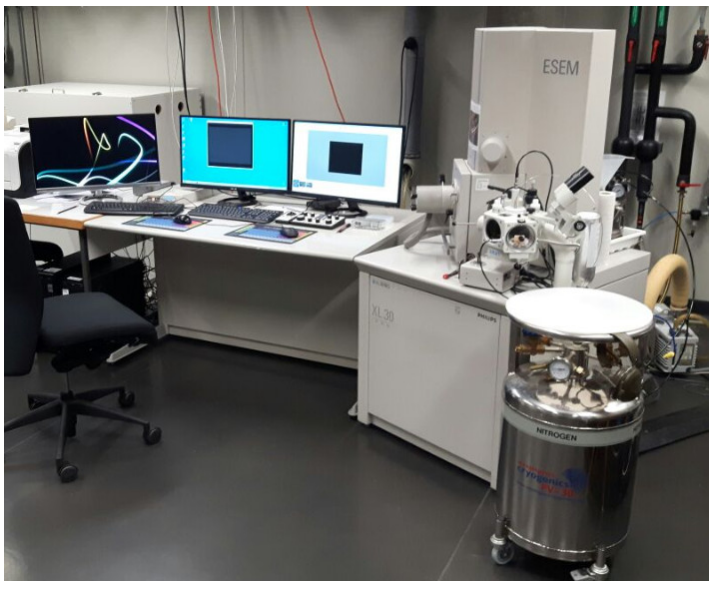
Newsletter

VOLUME IV, October 9, 2017



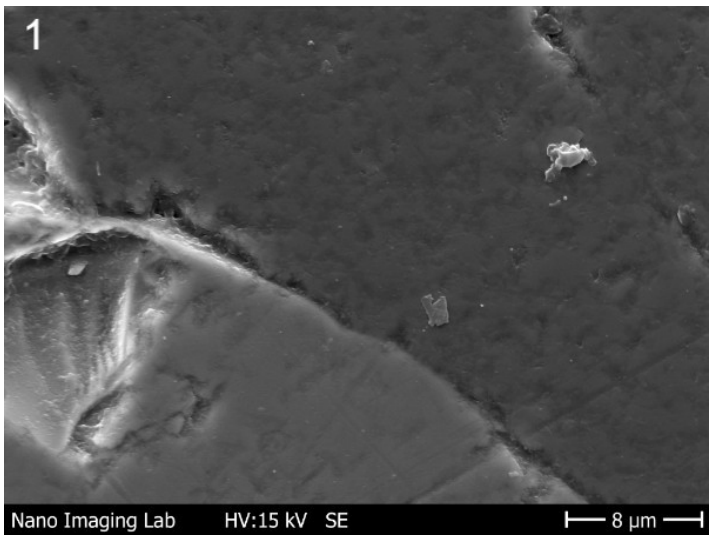
Upgrading of the Philips XL30 FEG ESEM

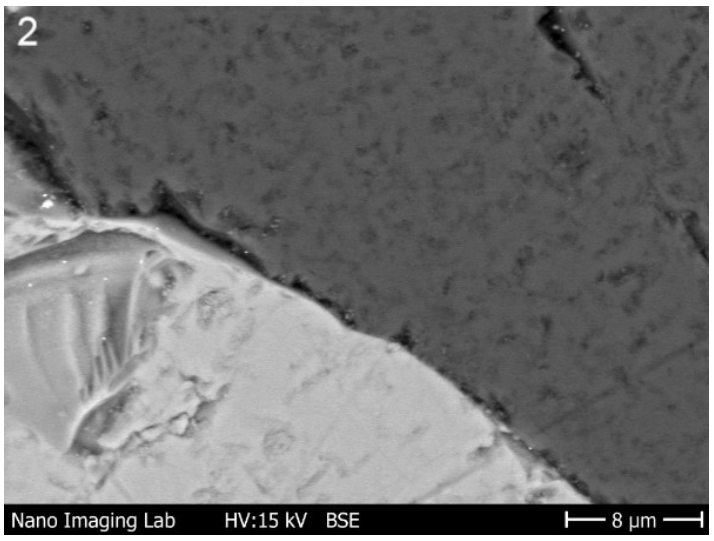
At the beginning of this year we decided to refurbish our 21 year old, but very reliably running XL30 ESEM from Philips. The control electronics were substituted by a new system from RemX. The column and its mechanical parts were kept and all interfaces and the computer were replaced.

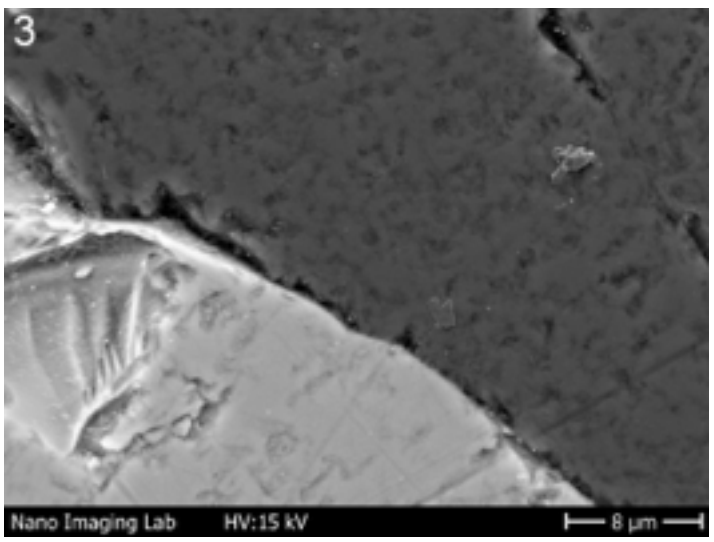


In April the new system was installed and our first experiences in working with this new setup are clearly positive: the power consumption was reduced by more than 50% and the volume of controller and power supplies were also reduced by about 50%. This results in a tidy and comfortable working space. The software interface (DISS5) is very easy to understand and can be used intuitively.

There are some new interesting features for the imaging:
The user now has the possibility to mix the images from two signals e.g. backscattered electrons (showing material density) and secondary electrons (showing topography of the specimen). Giving two different colours to the two signals results in a very nice effect.







Secondary Electron Channel (SE; topography) (1), and Backscattered Electron Channel (BSE; size of atomic nuclei) (2), show different information. In the BSE channel the dirt on the surface is missing.

To place the beam for EDX analysis properly, it is an advantage to have a simultaneous image of both channels (3). Normally there is only one detector at a time available.

Furthermore an annular backscatter electron detector has been installed. It can be read out in four sectors. This is leading to an interesting pseudo-contrast phenomenon, if one or several sectors are turned off.
The pixel size of images can be varied and stitching of images can be done. It is feasible to average points, lines and frames to form an image in many varieties.
The signal to noise ratio of the life image has considerably been increased, because there is no digital-analog and analog-digital conversion of the detector signals any more. This enormously facilitates the operation of the instrument
Overall working with this microscope is now much easier and at the same time the operator feels like sitting at a recently developed SEM.

This years SYPT winners visit the Nano Imaging Lab

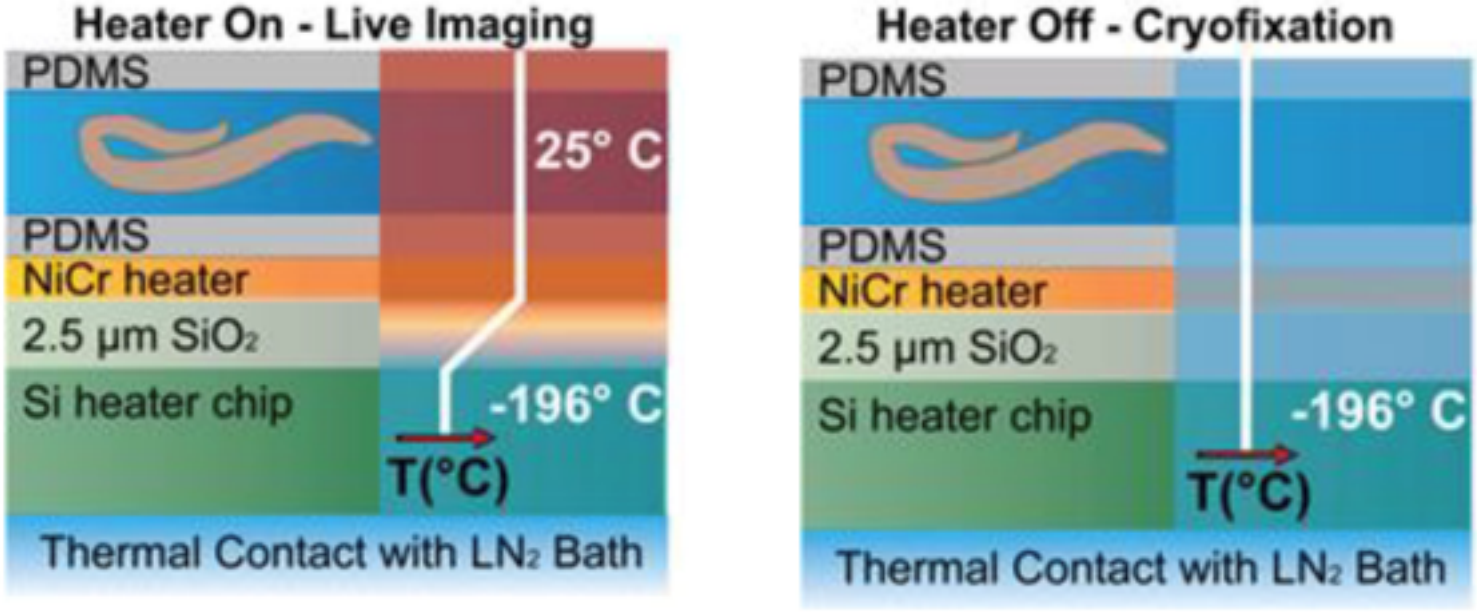
Three students of a secondary school in Kanton Zürich won the Swiss Young Physicist Tournament (SYPT) this year. The first price was a two weeks stay in the Department of Physics at the University of Basel.
During this event, Alain Bouddat, Johann Schwabe and Florian Wirth visited the Nano Imaging Lab from September 4th to 6th. In the course of these days the three Physics enthusiasts were introduced into the operation of a Scanning Electron Microscope (SEM), a Confocal Laser Scanning Microscope (CLSM) and an Atomic Force Microscope (AFM). They got insights into EDX- analysis, cryo SEM and the Focussed Ion Beam (FIB) - technique.

On their first morning the students got a theoretical and practical introduction into SEM and prepared samples of water repellent paint in order to investigate how the lotus effect of plants is utilized in Industry. In the afternoon they examined the surface structure of paint and a leave of Monks Cress (Kapuzinerkresse) by CLSM and AFM.
The second day was filled with taking SEM pictures of their prepared samples (paint and plant leave) in the various picture modi at the XL30 ESEM. They also performed cryo SEM and EDX-analysis.
On their third day the students were introduced to the FIB-method on the dual beam instrument. They were fascinated on how material can be manipulated in nano scale and how nano devices are being constructed.
At the end of their stay in the NI Lab the three high school graduates were very happy and considered this event a highlight before they go off to start their new phase of life at University.

News from the Microscopy Conference MC2017 in Lausanne

Three members of the Nano Imaging Lab team visited the Microscopy Conference 2017 in Lausanne from August 21th-25th.
Two contributions in the section Instrumentation & Methods were especially interesting and inspiring for our work:

Marie Fuest from the Max Planck Institute for Biophysical Chemistry, Göttingen, Germany, introduced a device for ultra rapid freezing of small specimen for Electron Microscopy. It consists of a multilayered Si Heater Chip. The silicon chip at the bottom is in contact with liquid nitrogen and serves as a cold reservoir. On top of that there is a 2.5 micron layer of Silicium-Dioxide, followed by a 2 micron Nickle-Chrome heating layer. To protect the heater, a 2 micron PDMS layer is added. When the heater is turned on and regulated to 25° Celsius, the specimen (e.g. a TEM-Grid or a coverglass with cells turned upside down) can be brought into contact with this unit. Simply turning off the heating freezes the specimen within milliseconds.
This really simple method could be very helpful in constructing an ultra rapid freeze drying device for our TEM unit.

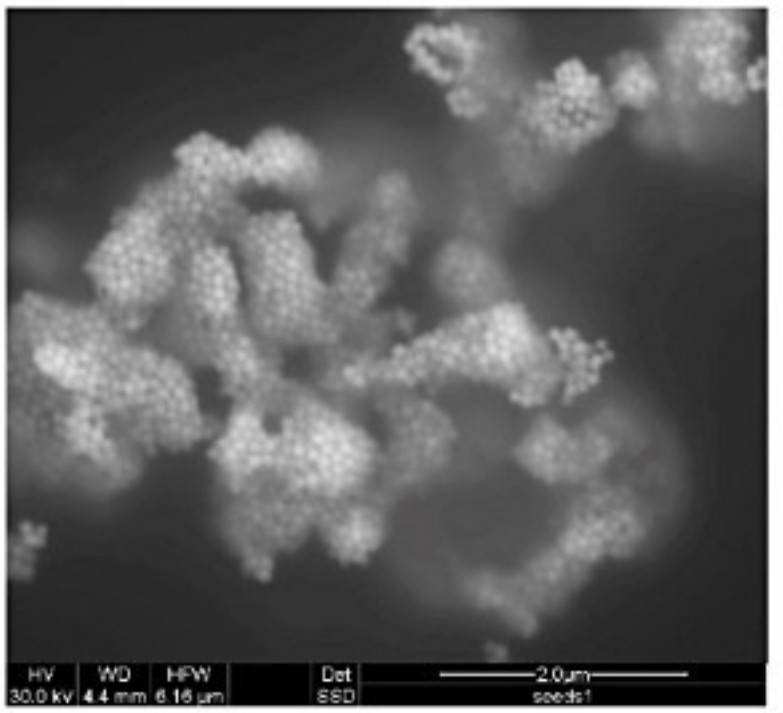


Cryofixation of C.elegans within a microchannel.

Illustrated from abstract (IM1.008 Advances in microfluidic cryofixation for correlative light and electron microscopy. Page 415).

The second contribution from Ferdinand Hofers Lab at the Graz University of Technology was presented by Johannes Rattenberger. He significantly improved the ESEM technology from FEI:
  At the end of the column are two Pressure Limiting Apertures (PLA) to enable the pressure difference between sample chamber and column optics. By optimizing shape, diameter and distance of the setup, he was able to

considerably reduce the scattering effect between incident beam and rest air molecules.
Furthermore he added a modified secondary electron detector (needle shaped) designed for high chamber pressure, which operates at ideal conditions regardless of pressure and working distance.
With these modifications he achieved to show an increased signal to noise ratio and enabled the new SE detector to work in two channels at the same time, recording the back scattered and the secondary electrons simultanously.
Since the Nano Imaging Lab also runs an ESEM from FEI we are considering to get these modified parts from Graz.



Gold nanoparticles in oil at 10kPa chamber pressure.

Illustrated from abstract (IM1.012 Universal pressure scanning electron microscopy (UPSEM)-electron microscop from high vacuum to atmospheric pressure. Page 426).
