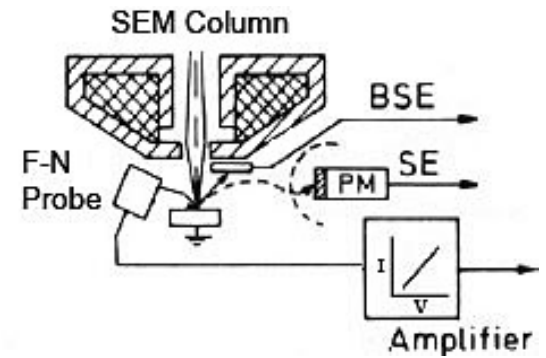


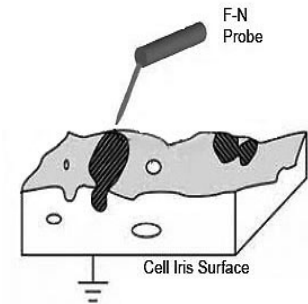
SEM Field Emission Study

L. Laurent, R. Kirby, A. Jensen, S. Tantawi,

*This research is funded by the SLAC LDRD Program



Modified Existing Scanning Electron Microscope (SEM)



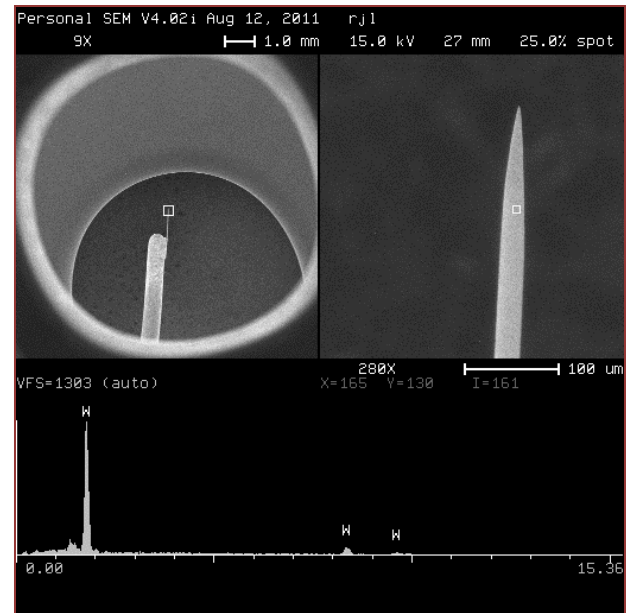
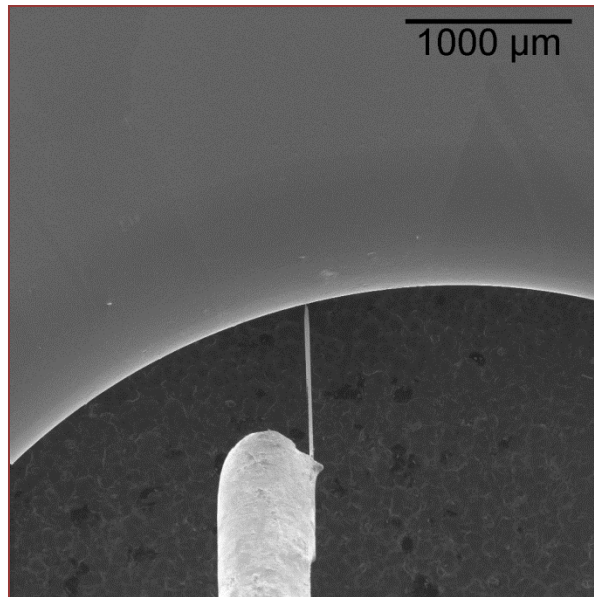
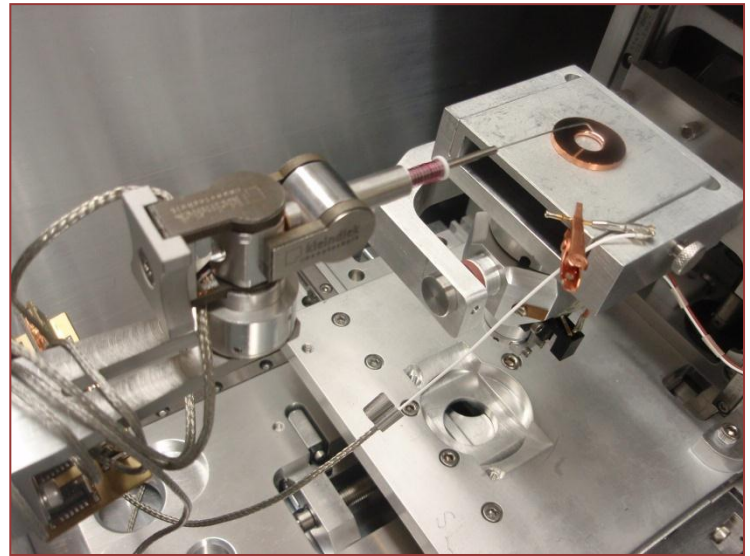
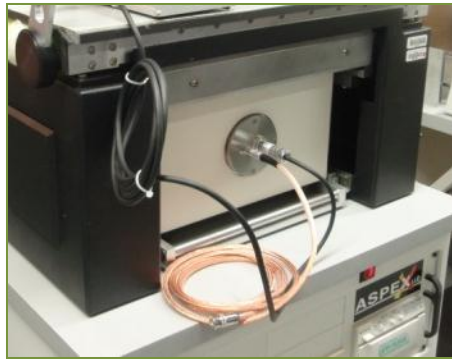
Two Year Program

Year 1:

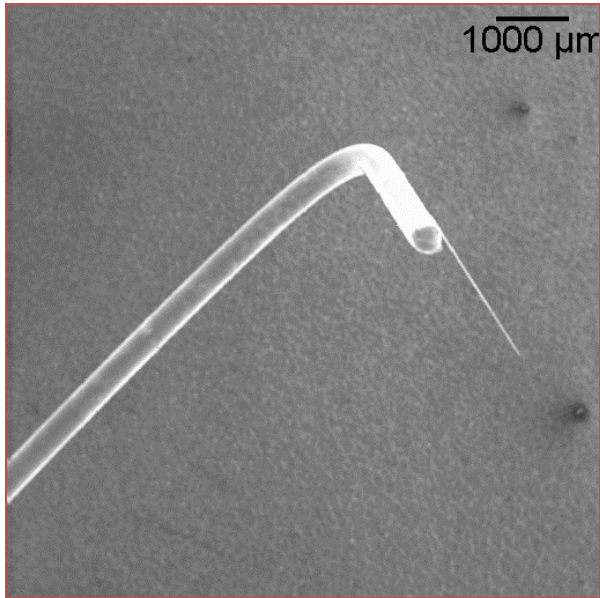
1. Design and develop an electron microscope-based high-electric-field current-emission probe to study topographic material features and their impact on cathodes and high gradient structures.
2. Evaluate planar test samples to calibrate and optimize system.

Year 2:

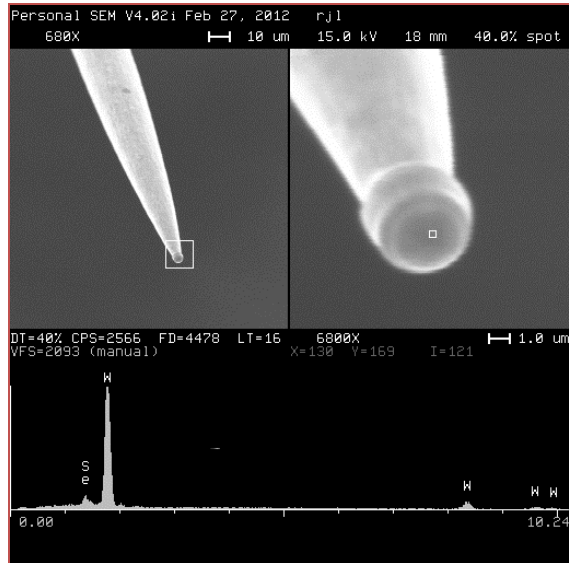
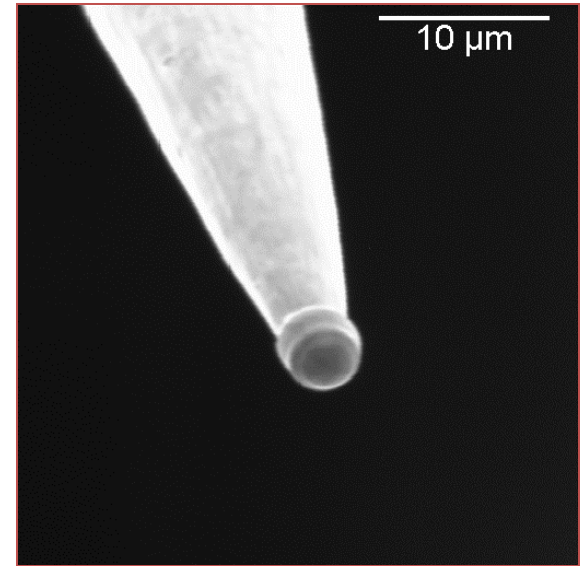
3. Work with planar and non-planar geometries using existing components.
4. Perform iterative analysis on pre and post tested components (e.g. cathodes and high gradient structures).



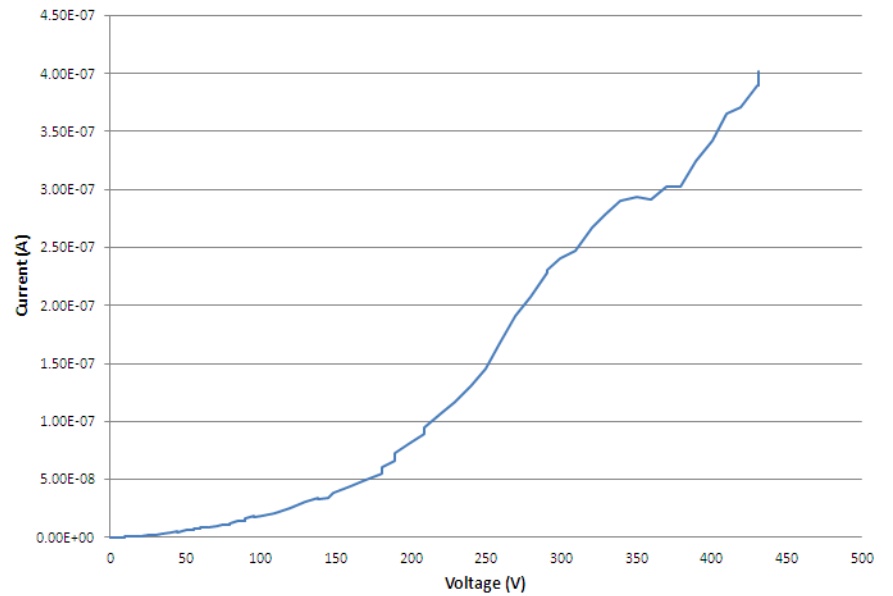
FE Probe on Tip of Iris



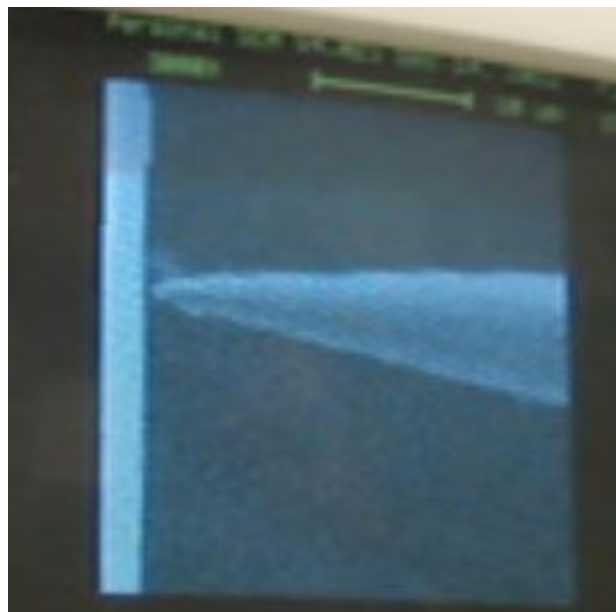
Tip T-4-22-a



T-4-22-a



410 Volts



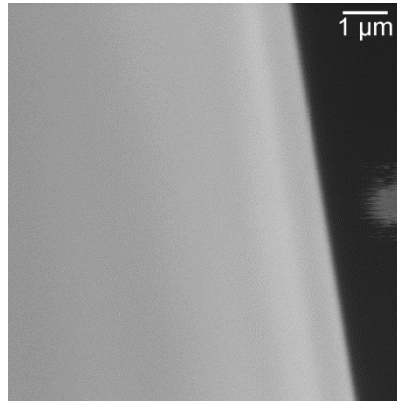
432 Volts



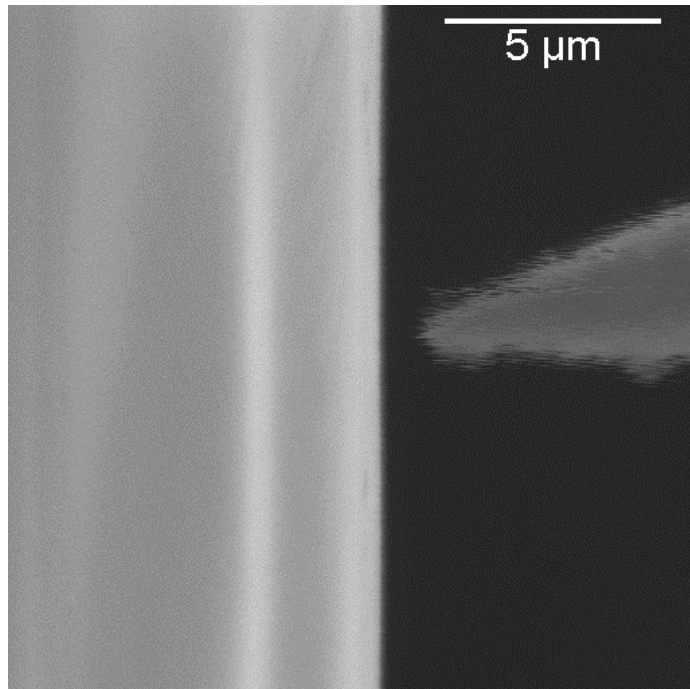
Tip T-4-22-a

Tip T-4-22-b

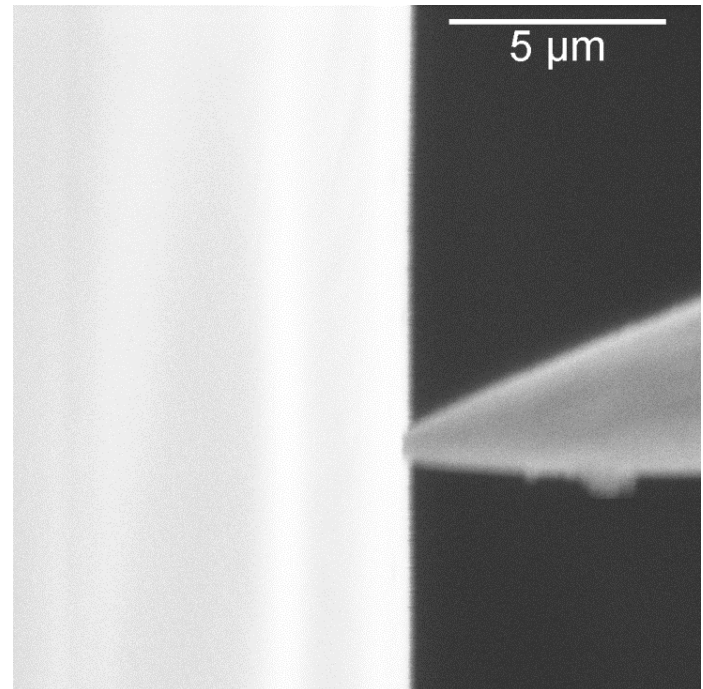
FE Probe on Tip of Iris

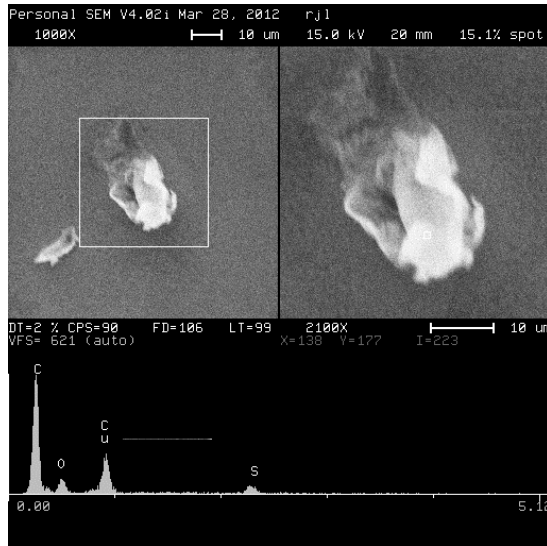


Before Applying Voltage

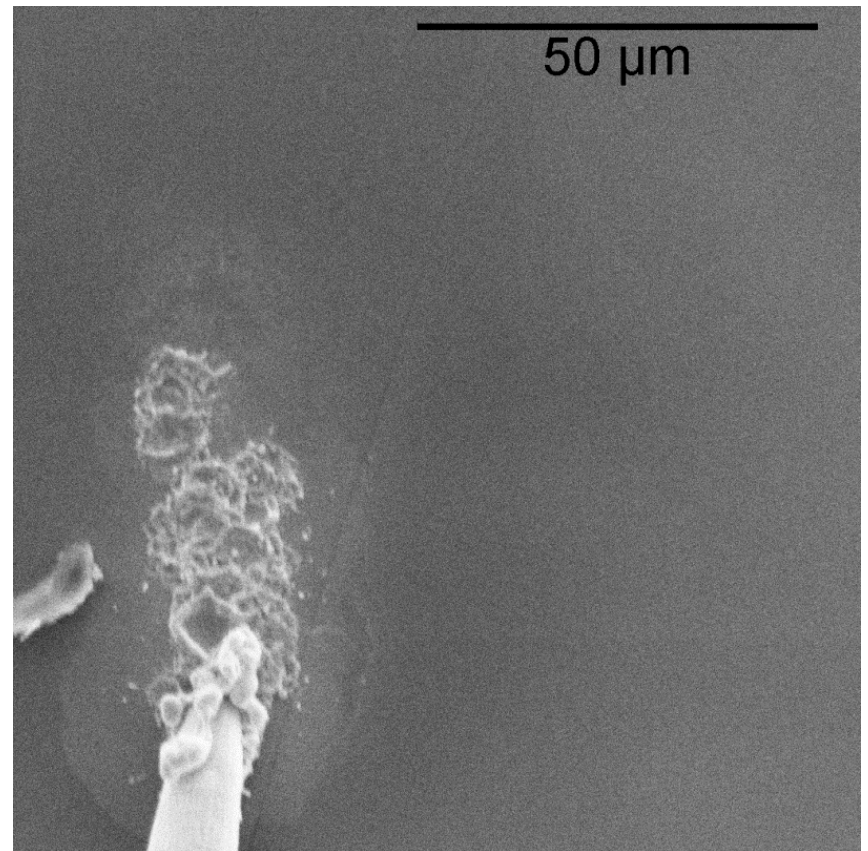
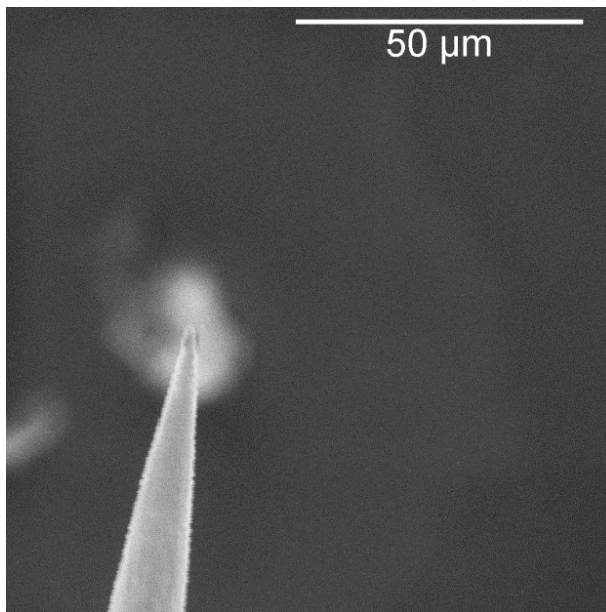


After Applying Voltage ~380V

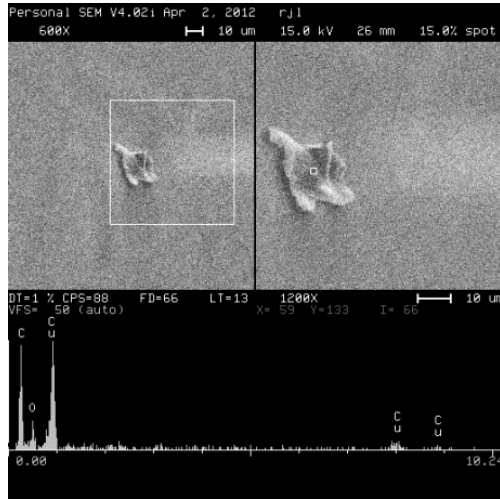




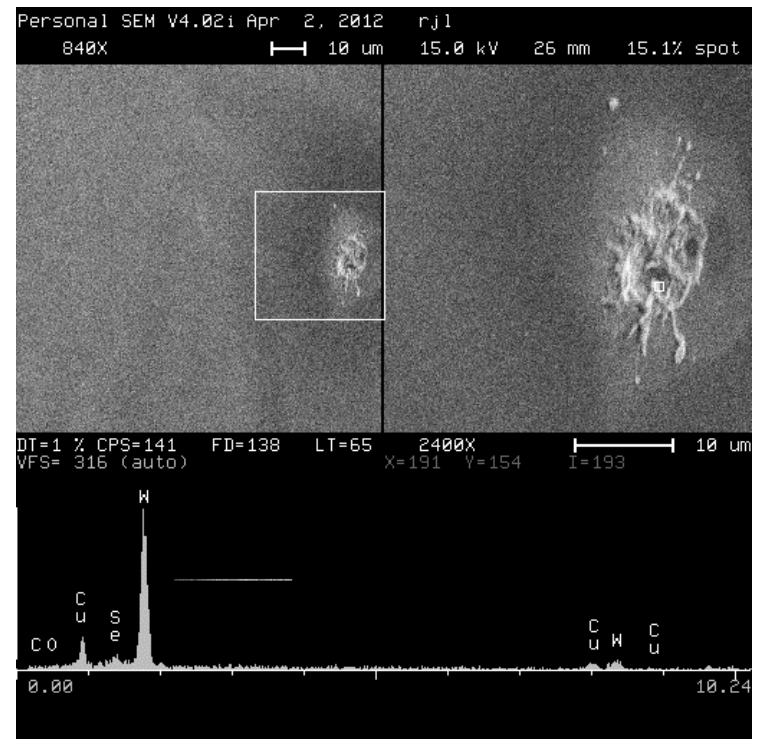
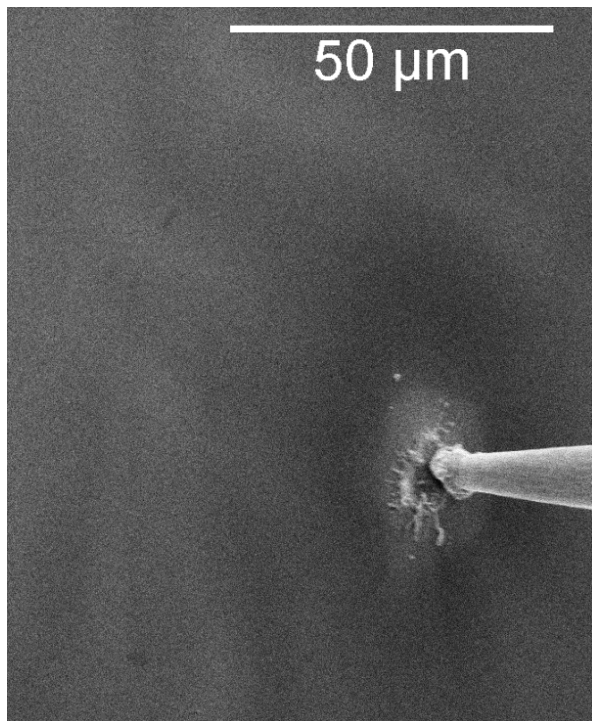
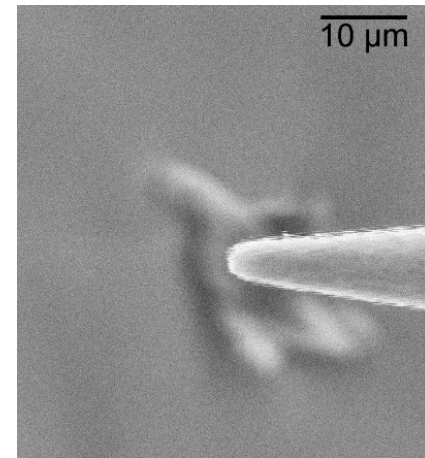
FE Probe Tip on Flat Section of Iris



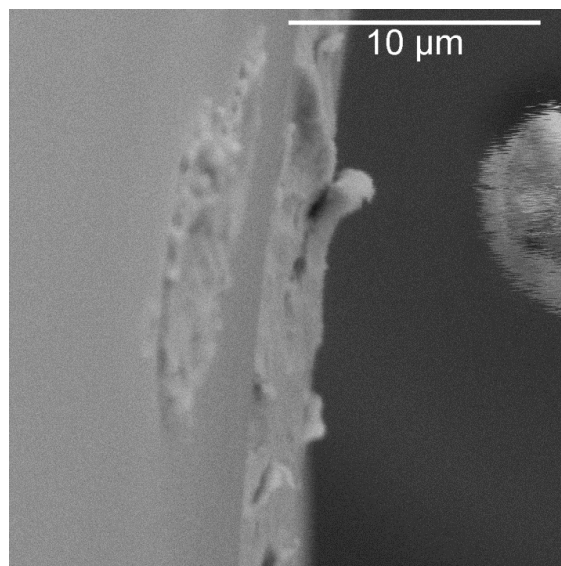
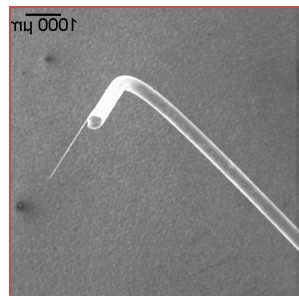
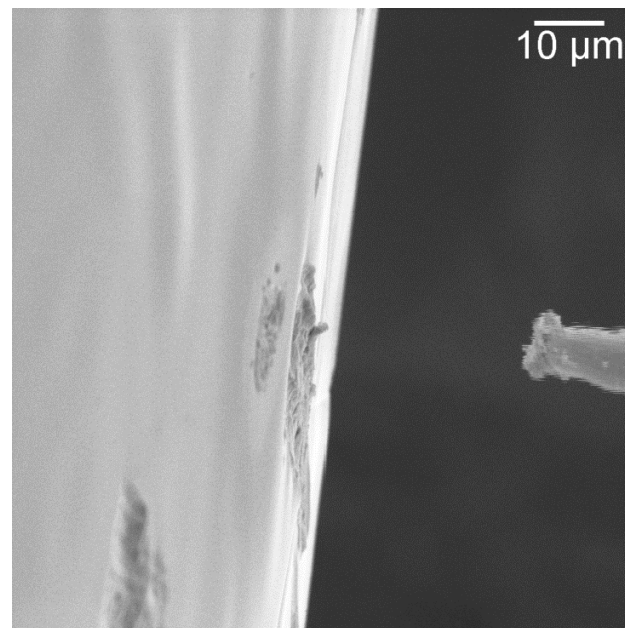
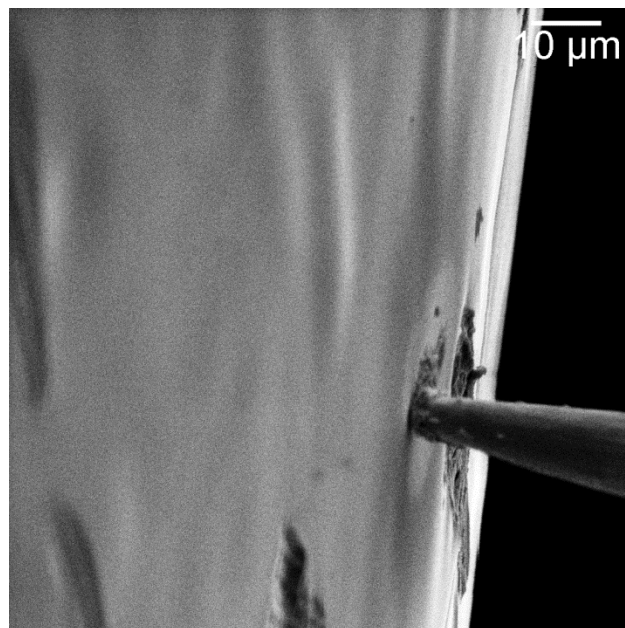
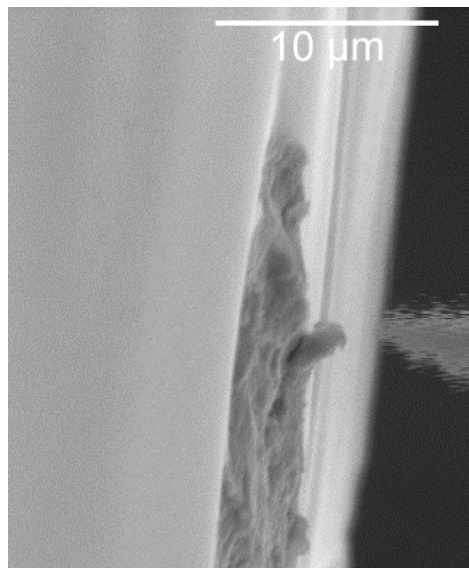
FE Probe Tip on Flat Section of Iris



Tip T-4-22-d



Tip T-4-22-e



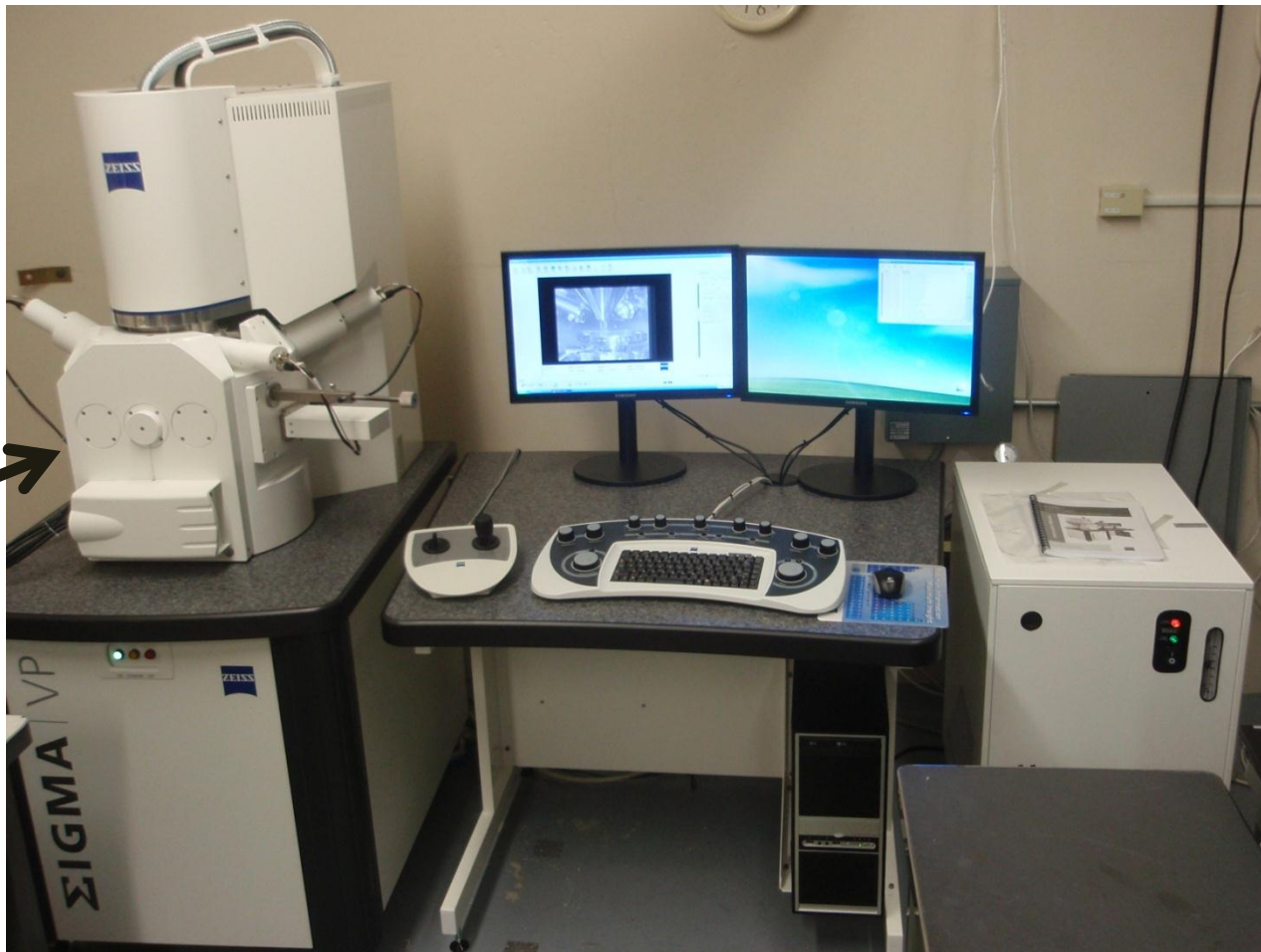
Summary and Future Plans

- Determine how to overcome electrostatic forces pulling the probe into the surface. In the next experiment we will use “straight” FE probe tip which will require electrostatic forces to overcome the motor control support for the probe tip.
- We will install the field emission probe system into the new higher resolution Zeiss Sigma SEM as soon as quirks are worked out and after we have obtained viewports for new SEM.
- Continue with Step 3 and Step 4 of Two Year Plan.

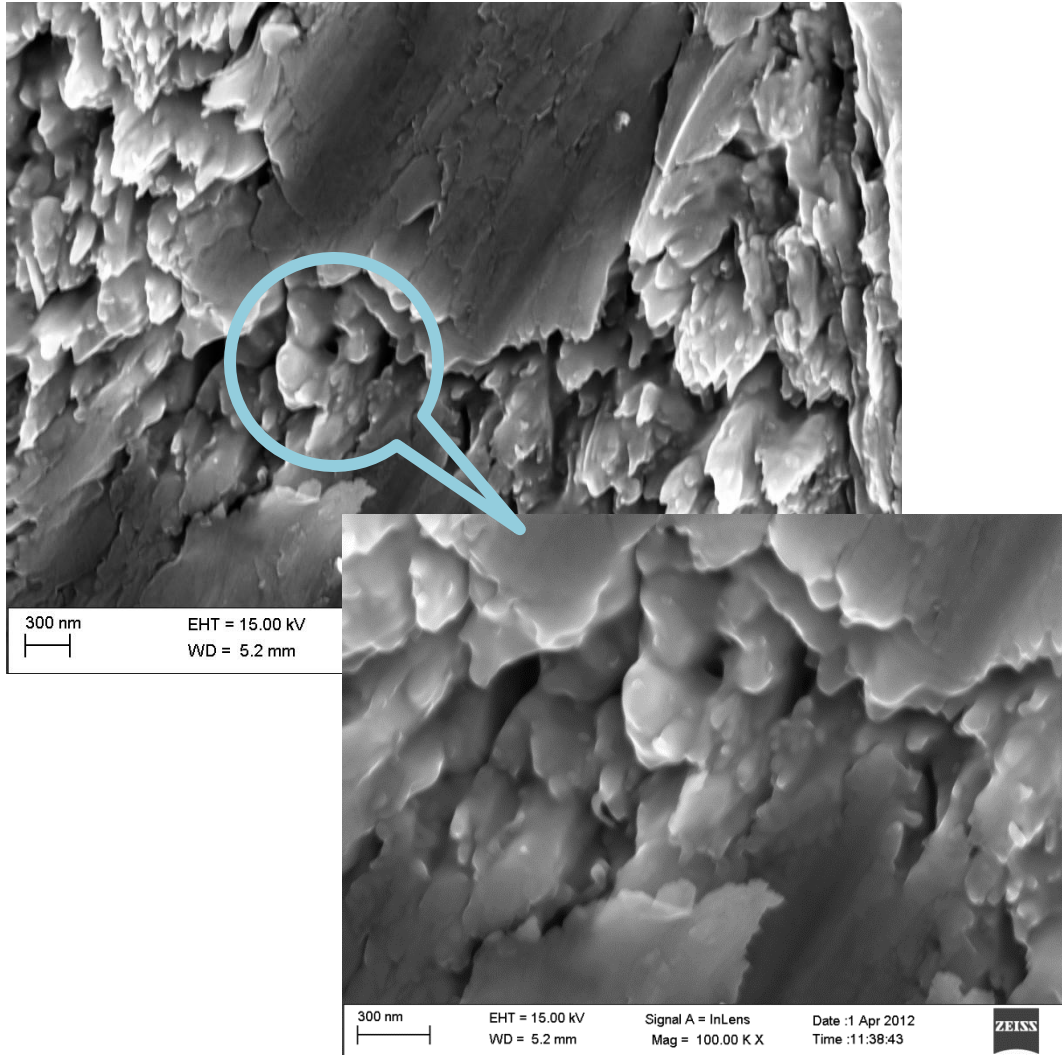
New Zeiss Sigma VP SEM arrived March 2012

We will optimize the system in SLAC's ASPEX SEM and then move the system into the Zeiss Sigma SEM.

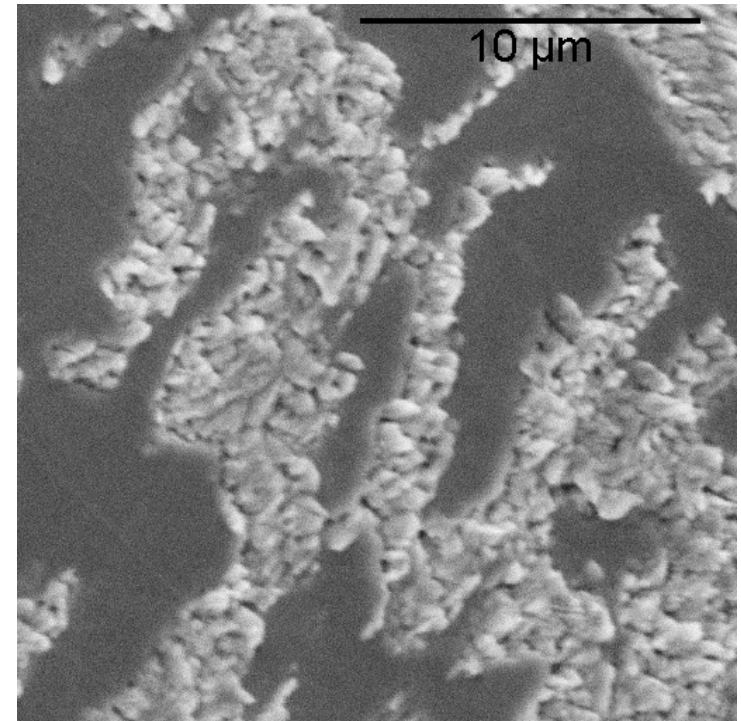
Extra
ports
available
in
vacuum
chamber



Zeiss Sigma SEM
(Pulsed Heating Sample)



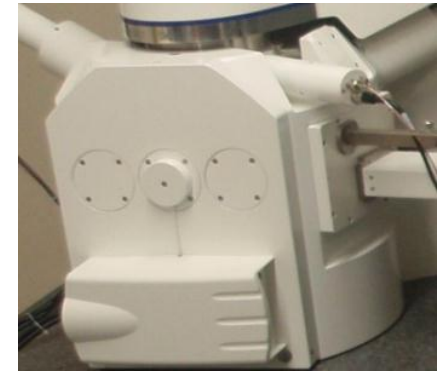
Aspex SEM
(Pulsed Heating Sample)



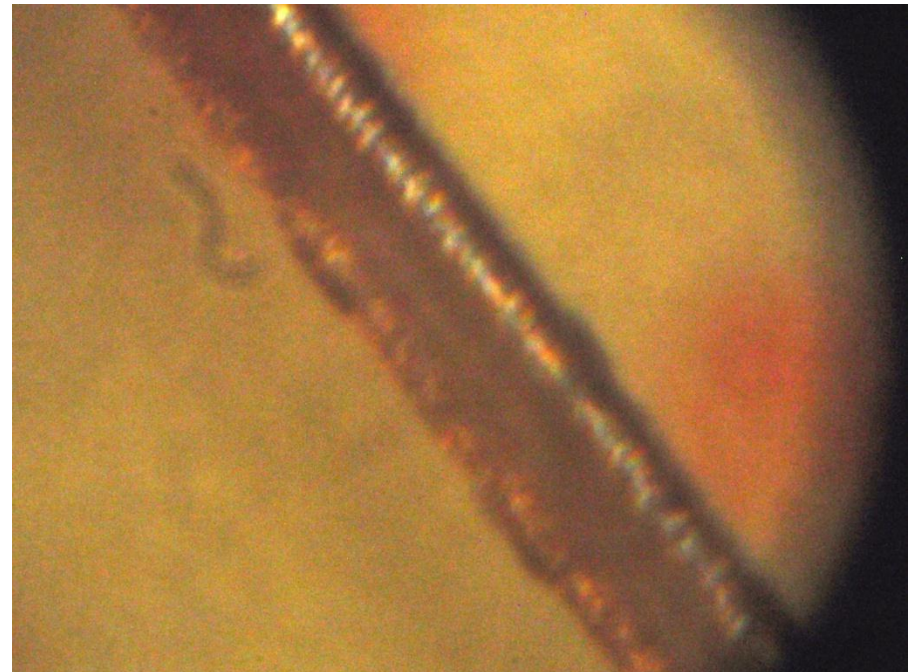
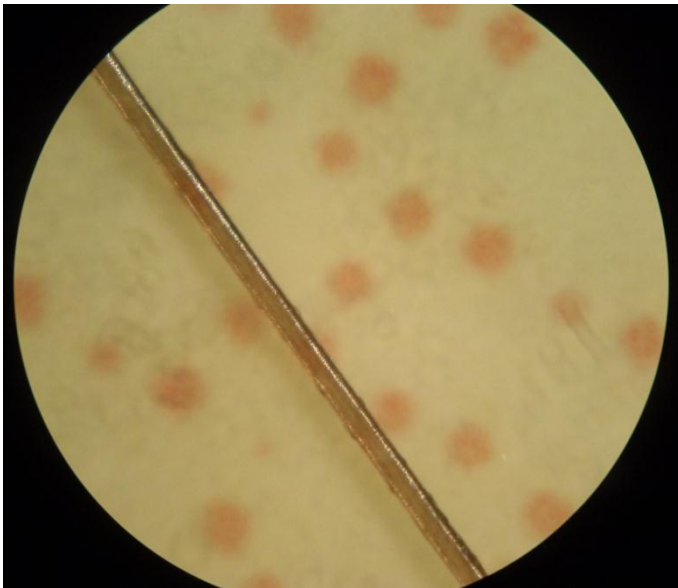
Res: 1.3 μ m at 6 inches



QM 100
Long-Distance
Microscope
(#30003)



Human Hair



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