FIB-FESEM TRAINING POLICY

(LYRA AND FERA)

The training for LYRA/FERA will have two parts – Basic and Advanced training.

I.   **Basic training** will include:

- FIB milling (etching) or FIB deposition of well-defined micro and nano structures

- Milling surface cross section to investigate the structure or composition of the specimen on or just below the surface (typically like 10 micrometers); and

- Compositional analysis/mapping(EDS) (On LYRA only)

II. **Advanced training** will include: **(NOT AVAILABLE YET- installation and training not fully completed)**

- Preparation of TEM lamellae and in-situ lift out

- Gas-assisted FIB milling: Enhanced Etching (H_2O), Enhanced or selective etching of Si, SiO_2, Si_3N_4, W (XeF_2)

- Beam Deceleration Mode for imaging at low voltage

- STEM (scanning transmission electron microscopy) a complimentary method for image acquisition of the transmitted electrons for TEM comparable images (brightfield and darkfield imaging)

- 3D EDS software

- EBIC (electron beam induced conductivity) imaging for mapping electrical conductivity of a sample on the micron scale

- TOF, EBSD and 3D EBSD

The **Basic** training on the new systems (LYRA and FERA) will proceed in the following priority:

1) Students with prior FIB and SEM experience
2) Students with prior SEM experience
3) Students with no experience with SEM

The **Advanced** training will be available after the completion of installation/training of the items described under advanced training above. Users who have shown proficiency in performing the basic operation of the FIB-SEM can request advance training on as-needed basis.

I. Basic training

I.1 For those with prior FIB and SEM experience

1st session:
   - Orientation of the instrument (system description and control elements) and the software
   - Step-by-step hands-on training on both the SEM and FIB will be conducted using a Si wafer

2nd session:
   - Step-by-step hands-on training will continue with the FIB part of the instrument on Si wafer

3rd session:
   - Depending on the proficiency of the users, users will practice with supervision both SEM and FIB. Users may bring their own samples in this session or use Si wafer.

Remarks:
   More partially supervised sessions will be required for proficiency before users can be checked out.

I.2 Users with prior SEM experience

Users with previous SEM experience, either at the MCF, MIC or other labs, will be requested to go through 4 training sessions of hands-on training with more emphasis on the FIB aspect of the instrumentation.

1st session:
   - Orientation of the instrument (system description and control elements) and the software
   - Step-by-step hands-on training will be conducted for generating images of a Si wafer (emphasis will be given to the SEM part of the instrument)

2nd session:
   - Step-by-step hands-on training will continue with the FIB part of the instrument on Si wafer

3rd session:
   - Users will practice with supervision both SEM and FIB on Si wafer.

4th session:
   -   Depending on the proficiency of the users, users will practice with supervision both SEM and FIB. Users may bring their own samples in this session or use Si wafer.

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I.3 Users with no SEM or FIB experience

Those with no SEM experience will be required to get SEM training on VEGA –ESEM located at the MIC. Because the interface is the same as LYRA and FERA, training there first will make the process of training on either of the FIBs more efficient.

II. Advanced SEM training

The features listed under "Advanced training" will be available at a later time. The installation and training of most of the features is not yet completed.

III. Refresher training

If users find themselves not using the LYRA or FERA for more than 3month at a time after being checked out, they will be required to take refresher training.

Recommended reading material

1. Useful links about SEM especially for those with no SEM experience:

http://bama.ua.edu/~mweaver/courses/MTE481/Electron%20Microscopy.pdf

http://chem.ch.huji.ac.il/~porath/NST2/Lecture%202/Notes%20Lecture%202%20-%20Scanning-Transmission%20Electron%20Microscope%20(STEM).pdf

2. Some useful links about FIB

http://en.wikipedia.org/wiki/Focused_ion_beam

https://www.jyu.fi/science/muut_yksikot/nsc/en/studies/ngs/course/meeting09/suutala_esitys

http://www.fibics.com/fib/tutorials/introduction-focused-ion-beam-systems/4/

http://atseng.faculty.asu.edu/MillingPap4.pdf