

Training Overview for the JEOL JEM 3200FS

Training on the JEOL JEM 3200FS is done in small units, where the goal of each step of the training is to present a particular skill set to a new user. Many of the 3200FS's operations depend upon mastery of multiple and often sequential skills, and both the order and timing of training reflects this inter-relatedness. Training sessions are short (usually two hours) but frequent enough that users develop long term memory for the procedures and proper habits of microscope use. For some training, the lessons are actually multiple sessions with direct supervision by the EM Center staff, while others are a single session with staff followed by user practice to develop the skill being learned. In all cases, the staff expect a user both to ask questions before wasting large amounts of time trying to sort things out on his/her own and also to use the written descriptions that are included with different training sessions. These documents are always available on the EM Center website, and several are posted in the Simon Hall EM room.

Initial Training: The initial training on the 3200FS is intended to introduce a new user to the instrument and its environment, and to the proper procedures for starting and ending sessions on the 3200FS. Part of this initial training involves learning the locations of the most commonly used instrument controls and ways a user can determine the state of the 3200FS (magnification, vacuum status, *etc.*). This training also shows a new user how to change and load several of the most commonly used specimen holders and how to operate the instrument to record and save TEM images using the Gatan CCD camera. New users should expect to spend a minimum of three or four training sessions when first learning to use the 3200FS, with less and less staff supervision as users gain skill and confidence. When

both the new user and the staff are satisfied that the user can independently and safely operate the 3200FS, these initial, highly-supervised training sessions end and the user is free (and encouraged) to use the instrument whenever it is needed. At this point, a new user should be able to record publication quality images of many samples with minimal help from anyone.

More Advanced Training

The 3200FS can be used in a great many different ways, including scanning transmission EM (STEM), electron diffraction, minimal dose EM for radiation sensitive materials, low temperature EM (cryoEM) and elemental analysis using energy-dispersive x-ray spectroscopy (EDS, EDX or XEDS). All these advanced techniques require that the microscope be carefully calibrated and aligned in order to perform properly. The EM Center staff takes care of various calibrations and will align the instrument for new users who are learning the basics of how to operate the 3200FS. However, because of subtle changes in the instrument from day to day, users who want to use the 3200FS for its more advanced operations must be able to align the 3200FS at the beginning of each session on the instrument. For this reason, any advanced training in the use of the 3200FS starts with learning to align the instrument in TEM mode. Only after a user can align the 3200FS in TEM mode will further training occur.

TEM Alignment: Because the TEM alignment training introduces new microscope controls and new uses for controls that have been used in the past, users who want to learn to align the 3200 should demonstrate the following competencies:

- Start a session on the 3200FS without help from others and without the use of annotated notes. This includes things like obtaining liquid nitrogen, filling the ACD, loading and unloading

- specimen holders and inserting and removing specimen holders with minimal disturbance of the column vacuum.
- End a session on the 3200FS, again without help from other sources. This includes returning the waffle grid to the microscope, filling out the log book, properly saving CCD images and leaving the 3200FS in its standard “not in use” state. This will also include starting the ACD bake-out cycle when no-one else is using the instrument on a given day.
 - Exhibit “best practices” while imaging a sample. This includes maintaining the specimen at or near the eucentric height, keeping apertures aligned, adjusting both condenser and objective lens stigmatism and adjusting beam tilt before recording images. As proof of proficiency for these skills, the EM Center asks each user who wants to learn to align the 3200FS to acquire a series of images of the waffle grid at 25,000x, 50,000x, 100,000x and 200,000x.

After exhibiting these skills to the EM Center staff, a training session for TEM alignment of the 3200FS will be arranged. Although learning to align the 3200FS in TEM mode is done in a single, two hour training session, users should expect to practice the alignment multiple times in order for it to become second nature, and should not expect additional training until this step has been mastered.