

Virtual Scanning Electron Microscope: Learning and Training.

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Scanning Electron Microscopes (SEMs) are now routinely used in many research laboratories, as a means of analyzing materials with a very high magnification. SEM today is a basic tool in most of the science engineering research fields such as microelectronics, surface science and nanotechnology, thus calling for training graduate and even undergraduate students in operating it. However the cost of this instrument is relatively high and a supervision of an experienced operator is essentially required for instruction and training to safeguard the instrument. The situation is even more complicated by the restricted accessibility of most SEMs instruments thus limiting the number of students to one or two at a time in normal instrument environment. Yet the students need to receive a high quality training to gain the requisite skill.

Virtual Scanning Electron Microscope (VSEM) which has all the usual functions of a real SEM has been developed as part of a program package for distance learning. The VSEM is in fact client-server software designed to provide a realistic digital emulation of a real SEM (fig.1). The clients (trainee) use an image browser that runs on a user's PC or workstation. The raw data for such a system must be previously captured by real SEM and saved as collections of digital images. The system is required to provide interactive response in real time for the standard behavior of any physical SEM. These behaviors include the possibility of moving the stage, changing magnification, focusing, astigmatism correction, electron gun alignment, contrast and bright adjustment and pumping amongst other microscope parameters and functions. A simulation program for microscope teaching and training (fig.2) has been developed to allow students to practice the basic skill of observation and image analysis whilst freeing them from the time consuming preparation of specimens. Students are thus able to work independently on their own time using supporting courseware without the necessity for laboratory supervision.

This VSEM is a real training program and having also the feature of controlling teaching process. It is software which can be adapted to any kind of real SEM and enables one to add new modes of behavior that cannot be achieved with an old physical microscope, such as simultaneous viewing and manipulation of one image by multiple detectors. The scanning electron microscope software emulates both the behavior and the user interface of the virtual instrument, and provides training in scanning electron microscope operation. The new version of VSEM is discussed in light of some recent development in this field (1-6).

References

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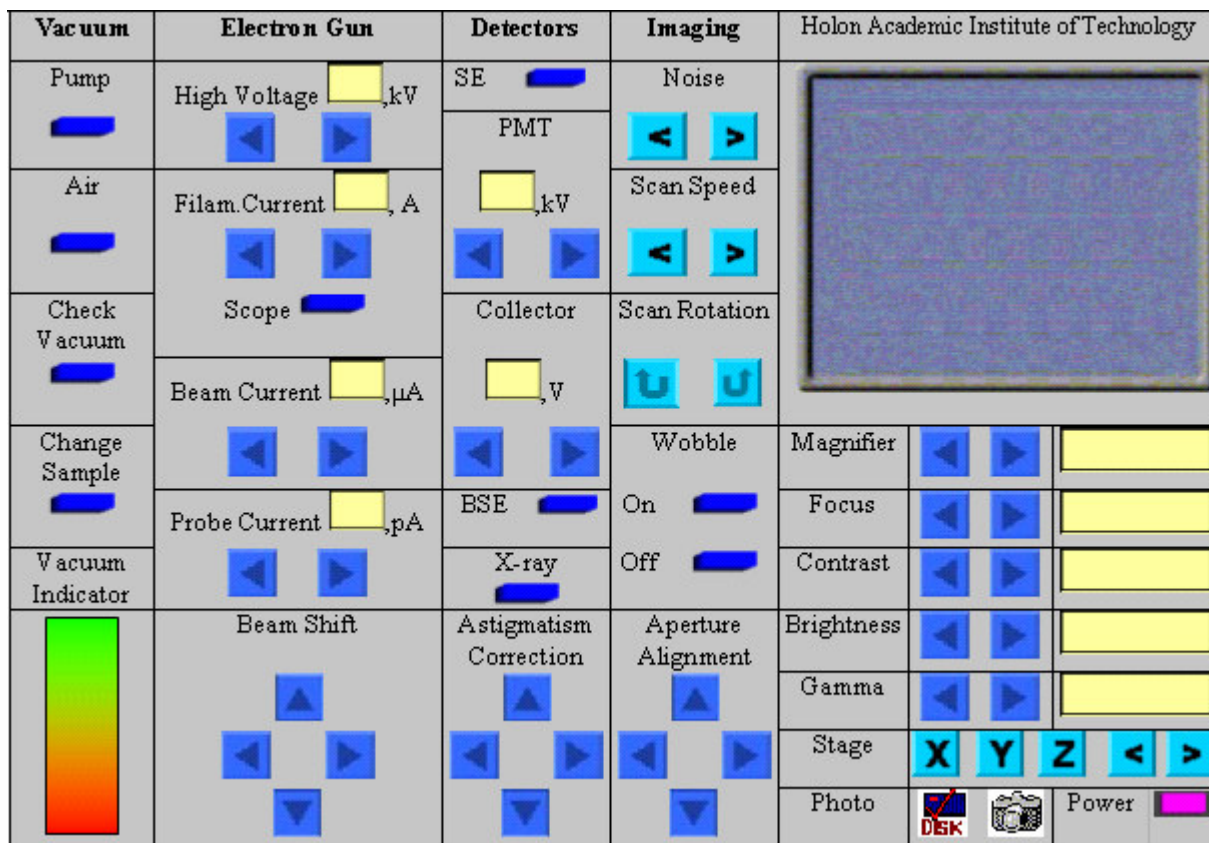


FIG.1. The console form from the program developed to control the virtual microscope.

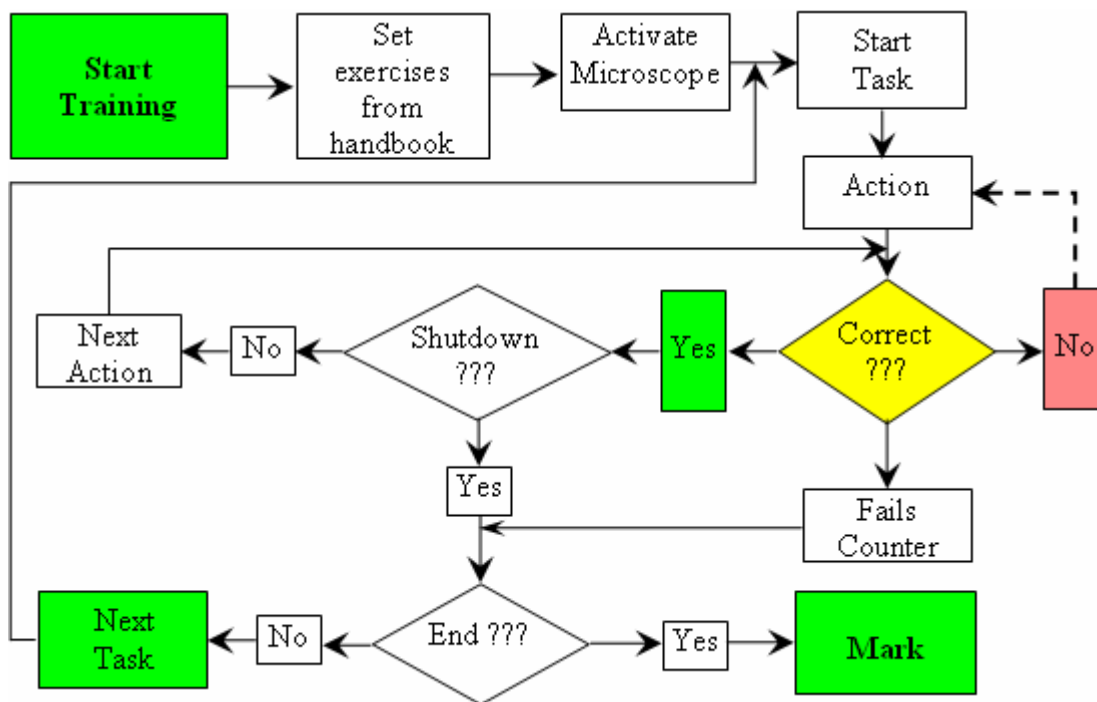


FIG.2. Schematic showing the logic scheme of training and task control.