TVIPS Software Package for Electron Microscopy Solutions

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TVIPS, an experienced manufacturer of high-end CCD-cameras for electron microscopic solution primarily for transmission electron microscopes (TEM), has introduced a complete software package including advanced data acquisition and data evaluation (EM-MENU), energy filtered TEM-imaging (EM-SPECTRΩ) and tomographic tilt series acquisition including single particle data collection tools (EM-TOOL).

EM-MENU is an excellent software for image acquisition and data analysis in research of both materials science and life sciences. With its variety of tools, such as „Navigation" for low-dose applications, beam-sensitive specimens can be intuitively investigated. Furthermore, different kind of TEMs (JEOL, FEI, Zeiss, Hitachi and Selmi) can be completely operated by remote control. Among other things a fully automatic adjustment of TEM parameters, such as image shift, focus and stage, are assured by EM-MENU.

The second software named „EM-SPECTRΩ" has been specially developed for JEOL-TEMs equipped with an in-column energy filter for energy loss imaging methods (Figure 1). This software module facilitates acquisition and processing of energy filtered image series (EFTEM), such as „Element Map", „Thickness Map" and „Plasmon". Different background correction methods have been integrated in EM-SPECTRΩ („2-Windows", „3-Windows" and „White-Line"). In addition to EFTEM imaging, EM-SPECTRΩ is also used for acquisition and advanced analysis of EEL spectra (EELS: Electron Energy Loss Spectroscopy), such as „Fourier Deconvolution". Furthermore, EM-SPECTRΩ provides an EELS atlas as library representing reference spectra of almost all elements of the periodic table.

The module „NAVIGATION" was developed for low-dose applications, in order to avoid any unnecessary exposure during searching or focusing (Figure 2). It allows the collection of an automatically acquired tiled image of the complete grid. The size of the image is typically 10,000 x 10,000 pixels or even more. Using this image, the stage can be moved with a typical precision of around 1 μm (depending on the stage type). For defining the various areas, e.g. for tomography or single particle data collection further navigation at higher magnifications is carried out by image shift.

The module TOMO allows the automated acquisition of tomographic tilt series under low-dose conditions for almost all newer TEM types and some older TEM types are supported as well, e.g. Philips CM-100/120/200/300, JEM-2010/3010, LEO-910/912. Limited TEM image shift range is compensated by automated goniometer correction. In order to start a tilt series at 0 degree, multiple series acquisition can be realized by using previous recorded images as „anchor images". The accumulated electron dose is estimated prior to the tilt series acquisition.

The module SPC (Single Particle Collection) is a semi-automated tool, i.e. the areas for acquisition and focusing will manually be defined with a single mouse click and the subsequent data acquisition (including tracking, drift measurement, focusing) will run automatically.
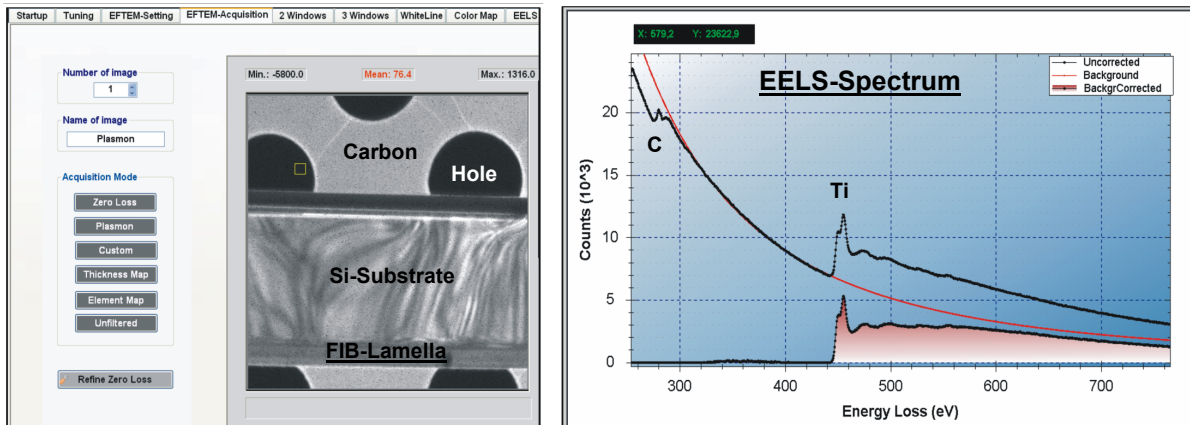
Figure 1. Left: A screenshot section of EM-SPECTRΩ demonstrates an energy loss image at 40 eV of a FIB-Lamella placed on a Carbon Quantifoil grid. Right: An original and its background corrected EELS-Spectrum of the same specimen containing titanium and carbon. These TEM-micrographs were acquired by a TVIPS-8k camera (F816) installed on a JEM-3200FSC with an in-column Omega filter (MPI-Dortmund, Germany).
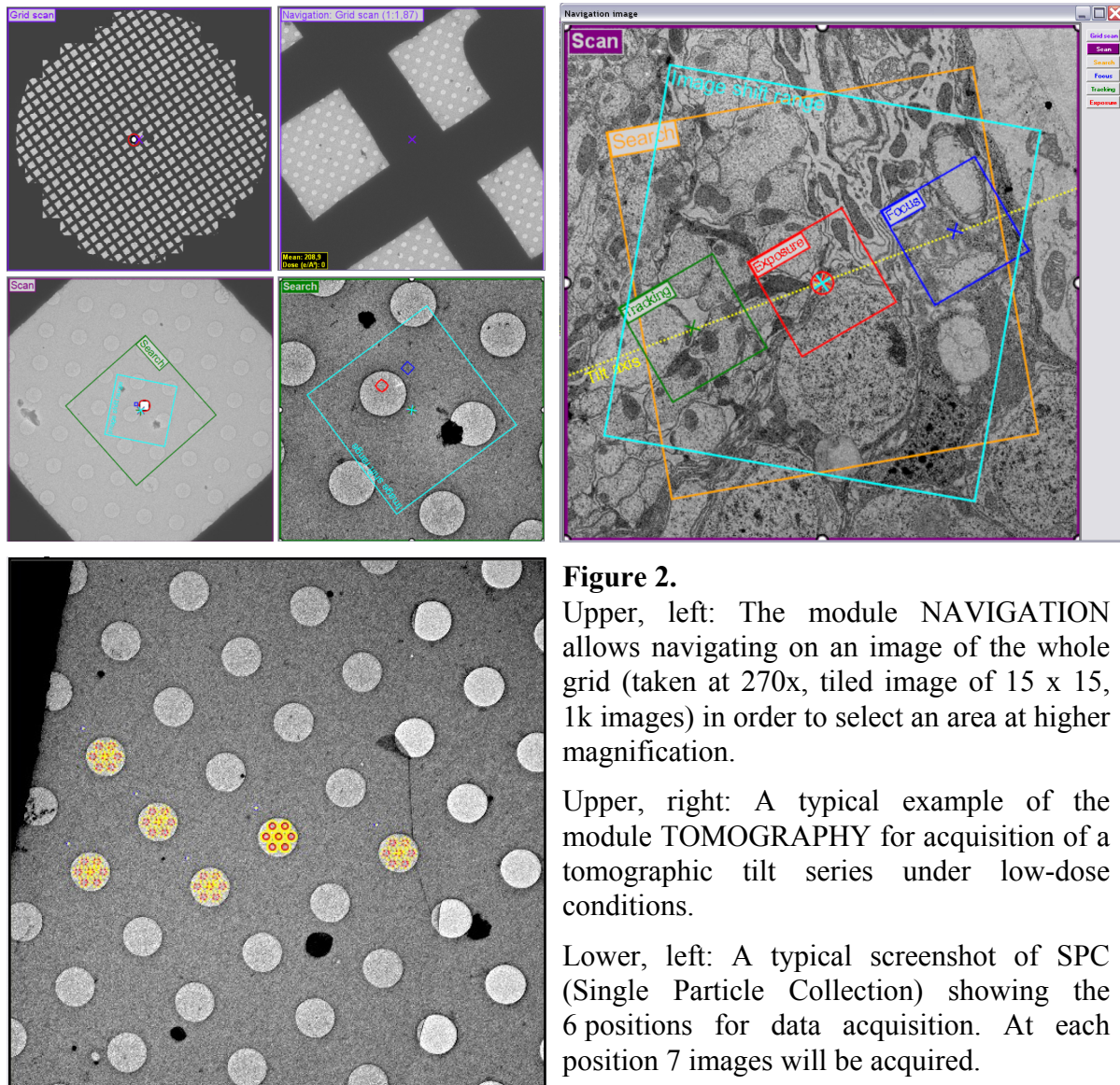

Figure 2.

Upper, left: The module NAVIGATION allows navigating on an image of the whole grid (taken at 270x, tiled image of 15 x 15, 1k images) in order to select an area at higher magnification.

Upper, right: A typical example of the module TOMOGRAPHY for acquisition of a tomographic tilt series under low-dose conditions.

Lower, left: A typical screenshot of SPC (Single Particle Collection) showing the 6 positions for data acquisition. At each position 7 images will be acquired.