DualBeams (FIB-SEM) have been used for materials characterization and failure analysis for many years to prepare samples for cross-section analysis, TEM analysis or to image the ultrastructure [1]. The area of characterization is generally limited to 50 – 100 μm². Often times, specimens that arrive at the DualBeam are materials that require a multi-disciplinary approach for characterization or problem solving. DualBeam characterization for ultra- or extreme high resolution imaging, analytical characterization, and sample preparation for cross-section or TEM analysis is a step that happens near the end of sample characterization lifetime since FIB analysis is generally destructive. Automated large area, high resolution imaging extends the capability of a DualBeam or SEM for sample preparation or ultrastructure determination to become a correlative tool, bridging multiple techniques to provide a context to understand a sample feature at a higher resolution than traditional optical techniques.

MAPS is a modular software application that automates image acquisition over large areas, stitches the generated images using cross-correlation algorithms and allows correlative techniques for localization, identification and characterization. Data from any external source may be used for correlative purposes, including optical micrographs, EBSD, EDS and SPM techniques. There are no restrictions in the image resolution. The software application is released on most FEI SEMs and DualBeams, as well as offline, for stitching and correlative microscopy.

A Si-Ta-Fe witness slip exposed to super heated metals by laser bombardment to better understand kinetics of laser heating was mapped in high definition using large area SEM image acquisition for exploration and navigation. The resulting image was correlated to optical and elemental data for further characterization, including cross-section, 3D reconstruction, and STEM in SEM imaging. A 8.9 mm X 4.6 mm sample was imaged using MAPS, a directional backscatter detector and a 10 nm/pixel resolution with 2 keV on a FEI Nova NanoSEM 450 (FIG. 1) [2]. Using the backscatter electron image (BSE), specific regions of interest were identified and correlated to high-resolution optical micrographs (FIG. 2). Using a FEI Helios NanoLab 660 and EDS, the regions were elementally mapped for characterization (FIG. 3). This presentation will focus on how large scale imaging is used to explore regions of interest for subsequent analytical characterization including STEM sample preparation, EDS, FIB tomography for 3D reconstruction, and the ability to correlate other 2D data, such as optical micrographs and EDS maps.

Acknowledgement:

Fig. 1: 2.6 gigapixel BSE image acquired at 2 keV

Fig. 2: High-resolution optical micrograph correlated in MAPS to 2 keV BSE image

Fig. 3: 15 keV EDS maps correlated to 2 keV BSE image revealing compositional makeup of two regions of interest