

Maps 3 Software

Visual context for high-resolution microscopy

Correlate data across optical, SEM, FIB-SEM and TEM instruments for high-throughput data collection

Maps software automates the acquisition of large overviews at high resolution.

Most biological samples prepared for microscopic analysis are much bigger than the field of view of the microscope. Therefore, a crucial first step for data acquisition in life sciences is the precise understanding of the nature of the sample under investigation—finding the sample itself on the sample carrier and localizing the region or structure of interest.

Thermo Scientific™ Maps™ Software facilitates this first step by automating the acquisition of a series of tiled images to create an overview of the sample. The resulting images can be stitched together automatically to form a single overview image.

Once acquired, individual images and tile sets are superimposed on top of each other and organized in an editable layer structure. Layers can be selectively hidden, displayed, transparently overlaid, and aligned with other images or layers. Users can freely zoom and pan to explore the acquired data and make annotations.

The area encompassed by the tile set can be as large as the travel range of the sample stage. This process allows for the capture of images from areas as large as square centimeters at a resolution level down to the point resolution of the microscope in use. Thus, it is possible to create a low magnification overview image of the entire sample and use it to guide subsequent high-resolution acquisitions to the sites that are most interesting for analysis, effectively delivering results more quickly.

Key Benefits

Compatibility with current Thermo Scientific SEM, FIB-SEM, and TEM platforms; providing a unified user experience across all instrument types.

Integrated approach to data acquisition, annotation and storage.

Automated acquisition of large overviews at any magnification (tile and stitch); multiple acquisitions can be set up for unsupervised batch data collection.

Setup and coordination of experiments across multiple microscopes.

Correlation of images from different microscopes, including imported images from 3rd party instruments using the integrated Bio-Formats library.

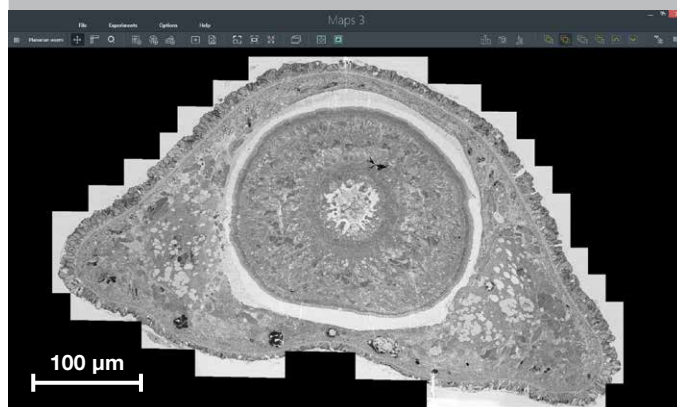


Figure 1. Maps software automates the acquisition of large overviews at high resolution and stitches the resulting tile set. Users can zoom between an overview and the native image resolution seamlessly. Section of a planarian worm, imaged on a Verios SEM in STEM mode. Sample courtesy of Melainia McClain, Stowers Institute for Medical Research.

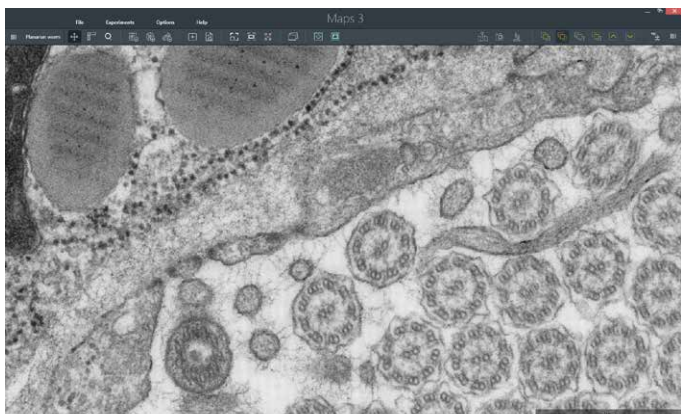


Figure 2. Lower magnification overviews help to target high magnification image acquisition. Section of a planarian worm, imaged on a Verios SEM in STEM mode. Sample courtesy of Melainia McClain, Stowers Institute for Medical Research.

Maps software enables correlative workflows that span multiple instruments.

Maps software not only aligns images at different magnifications and resolutions to each other, but it can also combine images from different detectors—for example, backscattered and secondary electron imaging—to be correlated and compared.

Modern research in life sciences integrates an increasing amount of imaging modalities into its experimental workflows; therefore, Maps software runs on Thermo Scientific SEM, DualBeam™ (FIB-SEM), and TEM platforms. This interoperability creates a unified user experience and allows for the combination

and correlation of data from multiple microscopes within Maps software using the optional correlative workflow package. Using the Bio-Formats library, the Maps correlative workflow can also import over 100 proprietary image formats.

Correlative light and electron microscopy (CLEM) is an example of a workflow spanning multiple instruments that greatly benefits from this capability. Light microscopy (LM), with its comparably large field of view, can be used to scan broad areas of fixed or living specimens in search of a region or event of interest. Moreover, the use of fluorescent dyes and labels provides excellent specificity for marking these regions or events. Although the maximal resolution that can be obtained through light microscopy imaging has increased significantly in recent years, it is still necessary to use electron microscopy (EM) to obtain subcellular ultrastructural information.

Given the substantial difference between fluorescence and EM images concerning their resolution and labeled structures, correlating both modalities can pose a significant challenge. Maps correlative workflow aims to overcome this challenge:

The alignment wizard can be used for manual, multi-point, feature-based correlation. Viewing LM and EM data side by side, the user is asked to identify corresponding features in both data sets (e.g. parts of a finder grid, scratches on a block face, or features of the biological sample itself).

After the data from both modalities have been aligned, the LM images can be used to navigate across the surface area of the sample and subsequently to drive the EM stage to a region of interest for the acquisition of a high-resolution image.

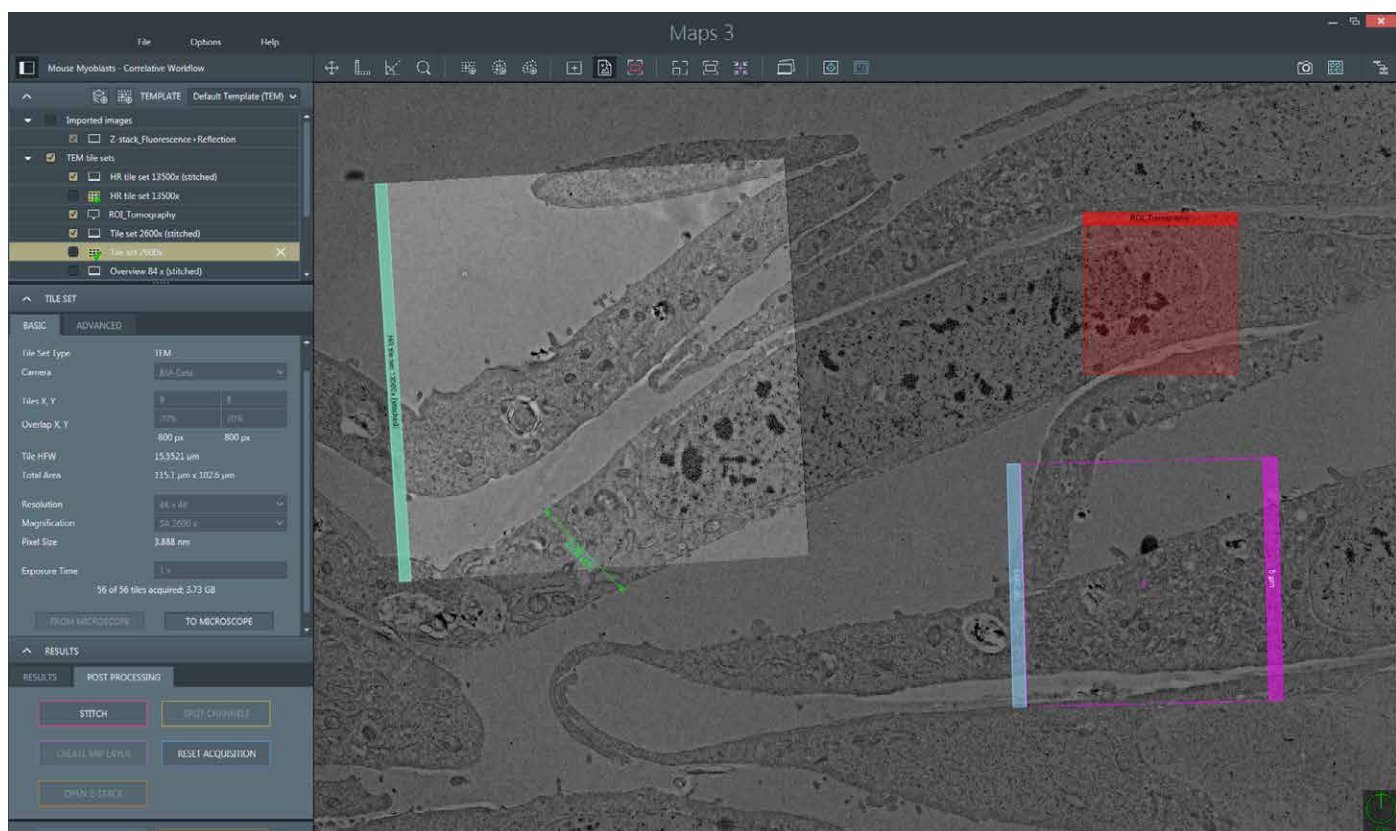


Figure 3. Maps software integrates data acquisition, annotation and storage. Sample: TEM images of mouse myoblasts. Overlay of tilesets acquired using different magnifications.

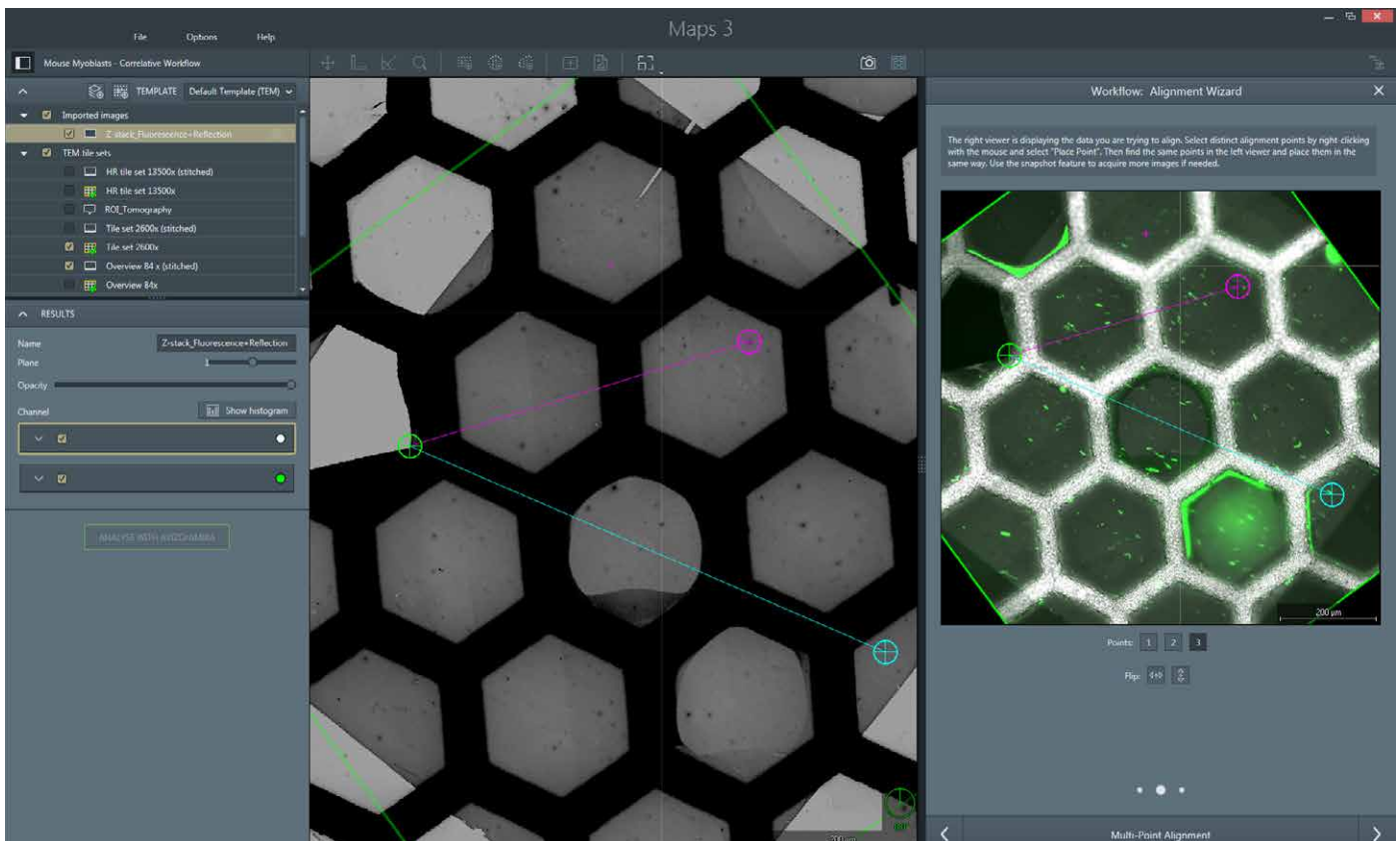


Figure 4. Maps software uses the Bio-Formats library to import over 100 proprietary file formats e.g. from 3rd party light microscopes. Images are scaled according to their metadata and a multi-point routine is used to align them with the electron microscope. Sample: mouse myoblast sections on a grid (TEM) labeled with Alexa Fluor 488 (imported fluorescence image).

Maps software guides the acquisition of 3D volumes for serial block face imaging and array tomography.

When a user employs an SEM-based method for 3D reconstruction, the total acquisition time can quickly become impractical if the selected volume is unnecessarily large. In that case, the ability to precisely identify an area of interest becomes particularly important.

Given the capacity to create large overviews at high resolution and the correlation with fluorescent images described above, Maps provides the 2D map to target 3D acquisitions (e.g. using Thermo Scientific Auto Slice & View™ software on a DualBeam), thus delivering results more quickly.

Additionally, the modular architecture of Maps software allows integration of more complex, SEM-based, 3D acquisition schemes. Running on the Thermo Scientific VolumeScope™ platform, Maps software features controls for setting up serial block face imaging experiments. Maps software allows users to define multiple imaging areas on the block face and guides the user through the setup of slicing and imaging parameters.

With the optional array tomography plugin for SEM/DualBeam systems, Maps software assists the user in imaging serial sections for 3D reconstruction.

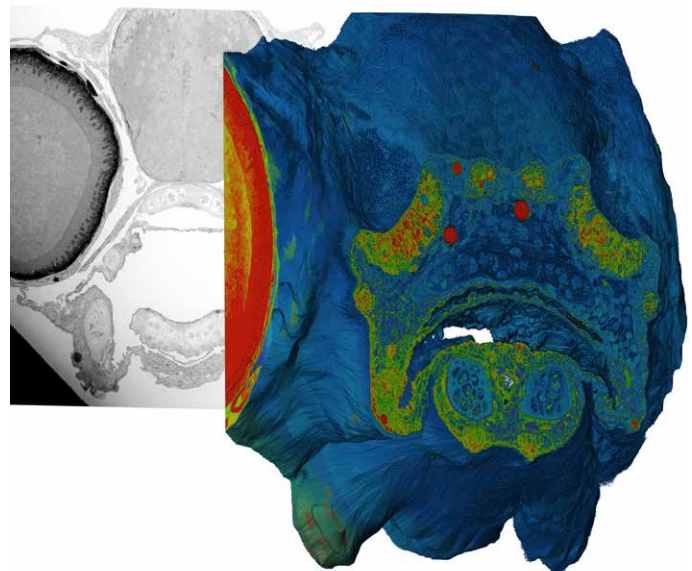


Figure 5. Maps software is an integral part of the VolumeScope for serial blockface imaging. Sample: zebrafish embryo courtesy of Robbert Creton, Brown University.

Notes

Find out more at [thermofisher.com/EM-Sales](https://www.thermofisher.com/EM-Sales)