Datasheet

Amira Software for FIB SEM

AI-based segmentation and image analysis for FIB-SEM datasets

Thermo Scientific™ Amira™ Software supports completion of the FIB-SEM imaging workflow by enabling conversion of large, complex, 3D FIB-SEM image stacks into quantitative biological insight through AI-based segmentation, advanced visualization, and morphometric analysis.

Amira Software supports researchers in maximizing the value of advanced FIB SEM instrumentation by connecting high resolution imaging with robust image analysis and quantitative interpretation.

From acquisition to insight: an end-to-end FIB-SEM workflow

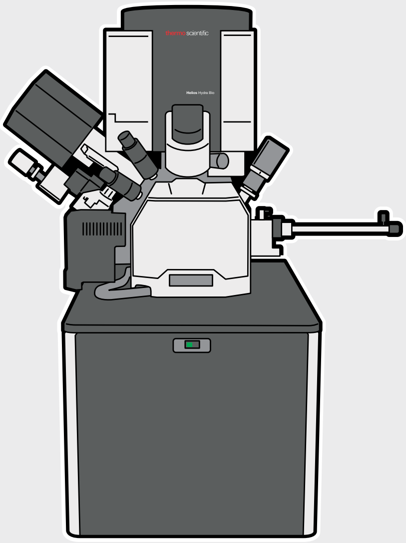
Advanced FIB-SEM instruments generate high-resolution, information-rich, 3D datasets while preserving ultrastructure in large sample volumes under both room-temperature and cryogenic conditions. These capabilities produce large, complex image stacks that are challenging to analyze. At the same time, the field is shifting from qualitative studies of a few samples to AI-enabled quantitative analysis of large cohorts with statistical evaluation.

Meeting these demands requires integrated software solutions for efficient and reliable data interpretation. Amira Software supports downstream workflows with tools for image enhancement, 3D visualization, AI-based object identification, and quantitative analysis of size, shape, and localization, enabling a seamless transition from data acquisition to biological insight across diverse life science applications.

Key features
Enables conversion of large 3D FIB-SEM datasets into quantitative biological insight
Reduces manual segmentation effort with AI deep learning tailored for EM
Supports analysis of noisy and low-contrast FIB-SEM and cryo-FIB-SEM data
Extracts robust, statistically meaningful, morphometric and spatial measurements at scale
Encompasses cell biology, virology, neuroscience, plant biology, and more

Mouse brain tissue acquired on the Hydra Bio Plasma-FIB. Data courtesy: Dr. Anastas Popratiloff, George Washington University.

Image acquisition with Thermo Scientific electron microscope



Hydra Bio Plasma-FIB

Helios Hydra 5+ PFIB-SEM

Aquilos 2 Cryo-FIB

Scios 3 FIB-SEM

Image processing workflow in Amira Software

Data import
Bring in and organize data

Pre-processing
Prepare and clean up data

Vizualization
Display data effectively

Segmentation
Identify and isolate regions

Quantitative analysis
Extract and measure structures

Animation
Create dynamic presentations

How Amira Software transforms raw data into reliable, analysis-ready datasets

Raw FIB-SEM datasets provide exceptional structural detail, enabling investigation of biological architecture at nanometer resolution. However, imaging artifacts such as mechanical drift, noise, shear distortions, and curtaining can degrade image quality and limit accurate analysis.

Therefore, image pre-processing is a critical step in the workflow. Systematic pre-processing enhances data quality and prepares datasets for reliable 3D reconstruction, quantitative analysis, and AI-driven segmentation.

Amira Software supports EM image pre-processing:

- Accurate stack alignment and 3D registration to compensate for drift and to help ensure spatial consistency
- Innovative AI-based noise reduction and image enhancement while preserving fine ultrastructural details
- Tools for correcting curtaining and further acquisition-related artifacts
- Reproducible, workflow-based processing to standardize data preparation across experiments

Together, these capabilities help researchers transform high-resolution FIB-SEM data into reliable, analysis-ready volumes suitable for visualization, segmentation, and quantitative interpretation.

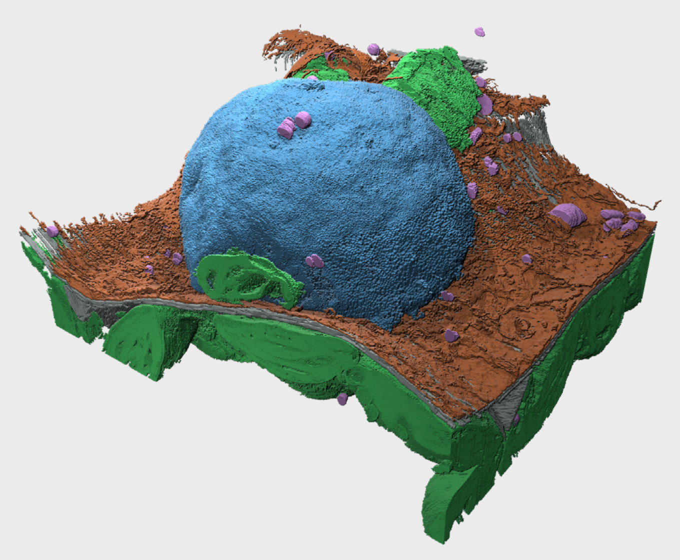
How Amira Software cuts segmentation time from weeks to hours

Cell biologists studying cellular processes and organelle interactions face two major challenges: preserving cellular ultrastructure during imaging and time-efficiently extracting meaningful insights from large, complex datasets. When paired with Thermo Scientific FIB-SEM platforms, Amira Software addresses the latter through advanced AI-driven deep learning.

Amira Software offers:

- Intuitive, code-free, user-friendly workflow for annotation, model training, and segmentation
- Simultaneous multi class segmentation of organelles, membranes, viruses, and further structures of interest
- Deep learning models optimized for electron microscopy image characteristics
- Robust performance on noisy or low-contrast datasets including cryo-FIB-SEM data

With minimal manual annotation, you can train AI models to accurately identify dozens of different structures across large volumes, substantially reducing analysis time from several weeks to a few hours while improving reproducibility and consistency.



Nicotiana benthamiana epidermal cell sample acquired on the Hydra Bio Plasma-FIB. Sample courtesy: Tessa Burch-Smith, Kirk Czymmek, and Lolita Rotkina, Donald Danforth Plant Science Center.

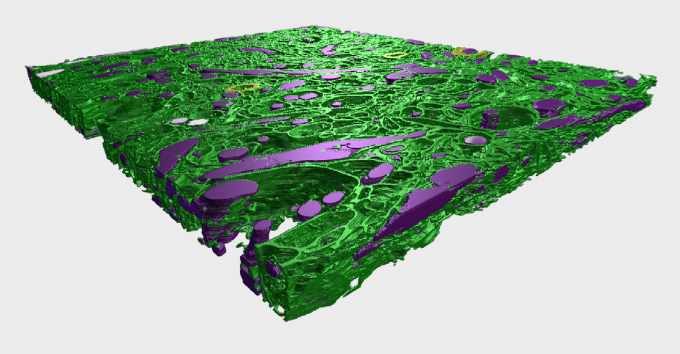
How Amira Software extracts quantitative insights from complex ultrastructure

After performing segmentation, Amira Software enables comprehensive 3D quantitative analysis. Researchers can measure volumes, surface areas, spatial distributions, and morphological parameters across thousands of features within a single dataset. AI-based classification enables you to distinguish between different phenotypes of the same species, e.g., mature and immature virus particles.

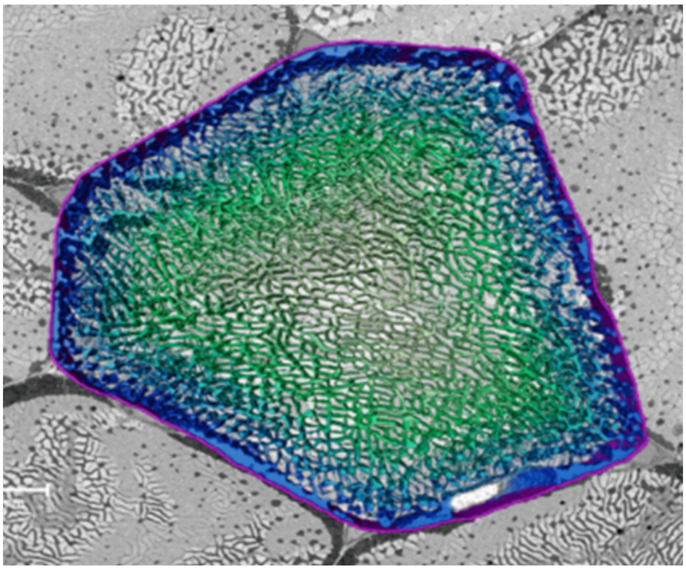
Examples include:

- Particle-level quantitative analysis, such as spatial distribution and encapsulation states of thousands of viral particles within infected cells.
- Large-volume structural analysis of tissues and cells, enabling 3D reconstruction and morphometric assessment of complex biological architectures across extended regions.
- Whole-cell quantitative analysis under native conditions, using AI-based multi-class segmentation to measure and characterize numerous organelle types within cryo-FIB-SEM datasets.

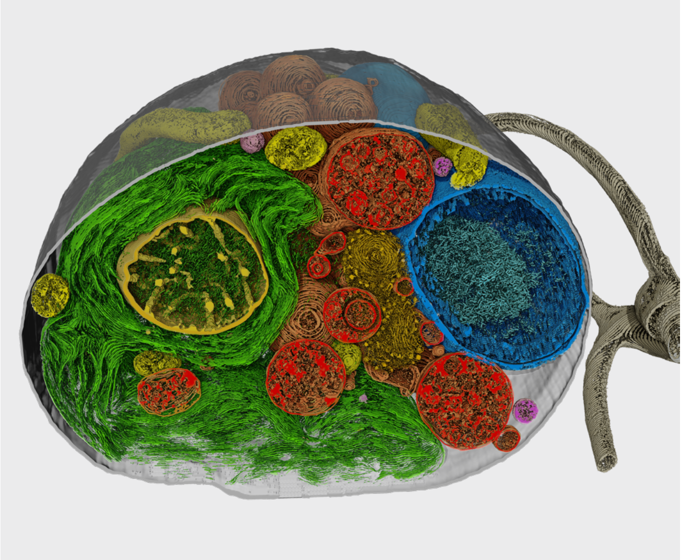
These capabilities allow scientists to extract statistically meaningful measurements from datasets that were previously too large or complex to analyze comprehensively.



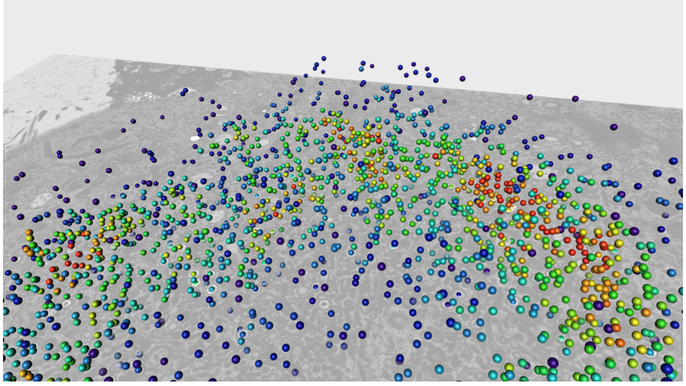
Brain tissue sample acquired on the Scios 3 FIB SEM.



Cardiac muscle dataset captured using SpinMill technique on the Helios Hydra 5 UX DualBeam. Data courtesy: Brian Glancy and EM Core, NHLBI/NIH.



Entire *Chlamydomonas* imaged under cryogenic conditions. AI Deep Learning segmentation identified various organelles.



Fibroblast monolayer infected by HCMV. Sample acquired on Hydra Bio Plasma-FIB. Sample courtesy: Dr. Clarissa Read (Ulm University) and Prof Dr. Jens von Einem (Ulm University Hospital).

Features

Data import and handling

- Import and analysis of 2D to 5D datasets from electron microscopy, light microscopy, CT, and MRI
- Support for large datasets and most established microscopy file formats

Filtering and pre-processing

- Image alignment, filtering, noise reduction, and artifact correction
- Multi-scale data preparation from subcellular structures to large tissue volumes
- AI-based denoising

AI-based segmentation

- AI-driven segmentation for complex 2D and 3D microscopy data
- Deep learning workflows with minimal ground-truth annotation
- Multi-class segmentation of organelles, membranes, particles, and biological structures
- Robust performance on noisy and low-contrast datasets, including cryo-FIB-SEM

Measurement and analysis

- More than 200 built-in quantitative measurements
- Custom, user-defined measurements for application-specific analysis
- Extraction of volumes, surface areas, shapes, and spatial relationships at scale

Visualization and presentation

- High-resolution 2D and 3D visualization of volumetric datasets
- Animation and movie generation for communication and reporting

Workflow automation and usability

- Recipe-based automated workflows for efficiency and reproducibility
- Intuitive user interface for both novice and experienced users

Applications and support

- Applicable across cell biology, neuroscience, structural biology, plant science, pharma, and biotech
- Professional training, consulting, and custom development services

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