ZEISS Atlas 5 Array Tomography
Image Your Serial Sections Fast and Efficiently – with Nanoresolution
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Now you can image thousands of serial sections of biological tissue or other large specimens automatically – down to nanometer resolution.

Atlas 5 Array Tomography is your unique, easy-to-use hardware and software package for your electron microscope (EM) which has been specifically designed for automated imaging of serial sections to enable 3D visualizations of large volumes. A workflow guides you effortlessly through all imaging tasks while its many automated functions let you acquire data easier and faster than ever before.

Use any kind of optical image including 3D ZEISS X-ray data to navigate and correlate your sample – even a screenshot or photo from your smartphone works. Atlas 5 Array Tomography is an optional module of Atlas 5.

Tailored to Biological EM Array Tomography Applications
Use the software module of Atlas 5 to image both large areas and large numbers of serial sections in the shortest possible time to enable 3D visualizations of large volumes. Use Atlas 5 Array Tomography and the unique GEMINI column design of your FE-SEM from ZEISS to efficiently collect large, aberration free images. The high degree of automation and workflows are tailored to your biological application and reduce your time to results.

Easy to Use. Workflow Oriented.
Atlas 5 Array Tomography’s workflow dramatically reduces the time you spend on setup and data acquisition of hundreds of sections. Using pre-defined imaging protocols and intelligent software algorithms, image acquisition runs independently for hours, even days. Built in functions such as automated stage motion, autostigmation and autofocus result in precise, crisp images of your specific site of interest throughout the entire acquisition process.

Explore Your Data. Intuitively.
Zoom seamlessly through your image data – from centimeter-scale optical imagery all the way down to nanometer scale EM-imagery. It’s just as easy to import, align and correlate images from other sources, too – for example, images from light or X-ray microscopes or your digital camera. Visualize correlations across all images of your sample. The result is a multilayered workspace that covers your entire sample down to the nanometer resolution delivered by your EM from ZEISS.

Speed up your data acquisition: the graphical user interface of ZEISS Atlas 5 Array Tomography matches the workflow of imaging biological serial sections. Sample: courtesy of J. Lichtman, Harvard University, USA.

Live imaging and predefined protocols let you focus on the sample (Mouse kidney). Sample: courtesy of F. Macaluso, Albert Einstein College of Medicine, New York, USA.

Perform automated imaging of serial ultrathin sections, prepared on a wafer with automated tape collecting ultramicrotome. Sample: courtesy of J. Lichtman, Harvard University, USA.
Minimize Setup Effort. Maximize Sample Throughput.
Using computer-assisted tools, you can define unlimited regions of interest with any shape over hundreds and hundreds of serial sections. Easy to use drawing tools let you select, clone, trace and edit the exact portion of the sample you wish to image (xROI: exact regions of interest). Use automated section identification with image correlation tools specifically developed for ATUMtome section preparations. Tailoring your data acquisition precisely to the region you need to image will reduce your imaging time.

Intelligent Protocols Let You Keep Your Eye on Results
Now you can put sophisticated imaging protocols in place to define your acquisition. With a streamlined Live Acquisition tool and firm control of EM functionality, you will soon be developing protocols to manage ideal imaging conditions efficiently across resolutions, sample types and multiple users in an imaging facility. Choose from the whole range of detectors, including STEM and BSE detectors, and set imaging parameters to suit your sample.

Atlas 5 Array Tomography’s Features

- xROI functionality for shorter imaging time
- Predefined multi resolution imaging protocols, protocol management, intelligent parameter selection
- Enhanced, robust autofocus and autostigmation functions anywhere in the sample, with optimized parameters
- Sequential, multi-job lists, with the possibility of resuming and reacquiring any site you wish, at any time, using the very same or improved parameters
Your Insight into the Technology Behind It

Large Area Images with Nanometer Resolution – Scaled for the Naked Eye

Exploit ZEISS Atlas 5 Advantages

Image millimeter-scale regions at nanometer-scale resolutions across hundreds of sections, all within reasonable timeframes. The software module Atlas 5 Array Tomography is compatible with scanning electron microscopes from ZEISS. You combine a 16-bit scan generator and dual super-sampling signal acquisition hardware with easy-to-use control software, sophisticated automation and powerful image processing tools. Sit back and get on with your work while the system automatically images your regions efficiently, using either a large single frame or a multi-image mosaic for each section.

Atlas 5 Array Tomography Features

- Dual super-sampling signal acquisition
- 16-bit scan generator
- Complements GEMINI lens design on ZEISS FE-SEMs, enabling distortion-free high resolution imaging of large areas
- Image resolutions up to 32k x 32k pixels with high resolution even at the edges
- Continuously adjustable imaging speeds down to 50 ns dwell time per pixel
- Enhanced semi-automated mosaic stitching, flexible image corrections and processing
- Acquire, view, review and export terabyte sized datasets

Automatically acquired large scale image of the brain vasculature of a monkey. Preparation of brain blood vessels using the corrosion cast technology. Field of view 3700 nm.

Stitched mosaic of >1000 images showing the brain of a monkey. Each tile image is 4096 x 4096 pixels, with a pixel size of 150 nm.

Automated stitching of tile images to calculate one image with a large field of view.
Your Insight into the Technology Behind It

Correlative Approaches

Use Atlas 5 Array Tomography to navigate your sample with semi-automated registration on your Shuttle & Find correlative holder. Or import overview and overlay images from any source, including 3D data from X-ray microscopes. Correlate structures in your sample across all the imagery you imported and acquired. You can image a sample on the same microscope at various times when beam time is available, or move your sample to different microscopes as required. Survey a sample in your SEM, then move it to your Crossbeam to perform FIB-SEM 3D data collection at precise locations based on SEM imagery. You can do all of this as a single project in Atlas 5.

Efficient Handling of Gigapixel Images and Terapixel Datasets

As demand increases for analyzing large numbers of serial sections at nanometer resolution, you will need a fast solution that generates and processes huge amounts of data. Given suitable samples, you can set up unattended image acquisition to be carried out over a period of days, automatically acquiring terabytes of image data at rates of up to 30 gigabytes of image data per hour. Use sophisticated mosaic tools to open, stitch, navigate, review and intelligently re-render large datasets.

Atlas 5 Array Tomography lets you export and share your data the way that suits you best.

Atlas 5 Array Tomography Features

- Correlative workflows
- Easy access and organization of large data
- Project browser
- Background data acquisition
- Enhanced stitching and correction of large mosaic images
- Integrated image processing tools
- Powerful export functions

In Brief

The Advantages

The Applications

Technology and Details

Service
Tailored Precisely to Your Applications

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<td><strong>Array tomography:</strong> Acquire images of tape mounted, automatically prepared serial sections on serial sections prepared by ATUMtome sample preparation of brain tissue to perform a 3D reconstruction. Datasets may include sections several mm in size, with hundreds of sections on a solid substrate such as a wafer.</td>
<td>With Atlas 5 Array Tomography you can automatically acquire overview images and control an automated run over all sections. Following a predefined image acquisition protocol, user-defined sites within the sections are imaged unattended from the first to the last section on the holder. Using the Atlas 5 Array Tomography software, the section identification can be automated with image correlation tools specifically developed for ATUMtome section preparations. Individual two-dimensional EM image shows sufficient resolution for the investigation of ultrastructural details. It is possible to identify subcellular details in high resolution over a large number of serial sections. Atlas 5 Array Tomography software allows you to explore and correlate your data over a full range of resolutions. You can export acquired images to render 3D visualizations using commercially available software and investigate the 3D ultrastructure of your tissue sample.</td>
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Automate image acquisition on manually sectioned slices.

|                                       | Use standard EM sample preparation techniques to section your sample onto grids, ITO-coated cover glasses or wafers. Save setup time on automated runs. Adapt predefined protocols to manage ideal imaging conditions of various samples efficiently. Investigate the ultra-structure of your tissue sample in different imaging modalities. With Atlas 5 Array Tomography you can use light microscope images to guide navigation on your sample or register a correlative Shuttle & Find holder. You can preserve your sample and re-image selected regions again at any time. |
Serial Sections
Choose specific areas within an ultrathin section and then image with multiple user-defined resolutions based on predefined imaging protocols.

Use an automated and intuitive workflow to acquire image data from hundreds of sections on a carrier. This datastack can then be computed into a 3D model.

This animation shows a visualization of a selected area on an ultrathin section. It can be used for 3D reconstruction with commercially available software.

Serial ultrathin sections of a mouse brain prepared on a wafer with an automated tape collecting ultramicrotome.
Sample: courtesy of J. Lichtman, Harvard University, USA.
ZEISS Atlas 5 Array Tomography at Work

Automatically collected serial section ribbons on tape, mounted on a 4 inch silicon wafer for highest stability during imaging.

Automated data acquisition of the volume of interest within a sample across 378 sections. With Atlas 5 Array Tomography you choose, modify and add new features of interest for imaging on your sample without interrupting image acquisition.

Images at 34 nm pixel size resolution zoomed from large field of view overview images. The BSD detector provides excellent contrast of the stained embedded biological tissue. With the virtually magnetic field-free low kV performance of the GEMINI column you image your samples distortion-free and with high resolution.
Array Tomography Workflow

3D Visualizations from Serial Sections

Choose specific areas within an ultrathin section and then image with multiple user-defined resolutions based on predefined imaging protocols. Sample: courtesy of J. Lichtman, Harvard University, USA.

The SEM dataset can be computed into a 3D model. Atlas 5 Array Tomography’s ability to provide key structural data at high-resolution and over large areas serves as a powerful tool to understand the 3D spatial symbiotic relationships between nitrogen-fixing bacteria rhizobia and the host legume plant, Medicago sp. in root nodules. Sample: courtesy of J. Sherrier, J. Caplan and S. Modla, University of Delaware, USA.

3D visualization of a selected area can be done with commercially available software, for example ORS Visual SI Advanced.

3D reconstruction from serial sections of root nodules at ultrastructural resolution. Alignment, processing, segmentation and visualization of data was done using ORS Visual SI Advanced. Sample: courtesy of J. Sherrier, J. Caplan and S. Modla, University of Delaware, USA.
# Technical Specifications

ZEISS Atlas 5 Array Tomography configured within ZEISS Atlas 5 modular software structure.

## In Brief

- **SEM**
- **FIB-SEM**
- **Offline**

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- Option

ZEISS Atlas 5 Array Tomography is an optional software module of Atlas 5. Requires Atlas 5 Base and Advanced Toolkit module. It is available as a field upgrade for ZEISS SEMs, FE-SEMs and FIB-SEMs, and will run on any ZEISS EM that has SmartSEM API options and SmartSEM V05.07 or later. The retrofit must be performed by an authorized service engineer from Carl Zeiss Microscopy GmbH.

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### Tools for Array Tomography Setup

- **Clone Tool** for section definition, **Snap Section tool** for automated section definition, **Site Management** functions for efficient sub-site definition across sections. Image stack viewer and image stack export options.

### Image Characteristics

- Continuously selectable up to 32k x 32k (50k x 40k on ZEISS FIB-SEMs).
- Save image data as 8 or 16 bit TIFF files.

### Dwell Time

- Flexible, from 100 ns to > 100 s (with line averaging). Continuously selectable for optimized imaging.
- A 50 ns option is available.

### Autofocus & Autostigmation

- Independent of FOV, image size and resolution, user tunable for sample characteristics.
- Configurable to minimize impact on staining samples.

### Exact Regions of Interest (xROI)

- Any shape, arbitrary polygonal, elliptical or rectangular regions adjustable ‘on the fly’.
- Direction of scan rotation adjusted to shape of site. Precise control of scanned area.

### Data Acquisition

- Designed for automated acquisition of large field of view overview images and multi-image mosaics at multiple sites. Sequential multi-job lists. Possible to resume and reacquire any desired site at any time, using the very same parameters. Predefined imaging protocols for common sample preparations.

### Correlative Approaches

- Import of optical images for navigation, overlay and correlation of LM with EM data.
- Support for ZEISS Shuttle & Find correlative holders is integrated.
- Import and correlate ZEISS 3D X-ray microscope volumetric datasets.

### Data Review

- Integrated image review. Efficient review of acquired data and automated reacquisition of problematic images.

### Mosaic Stitching

- Per image stitching integrated image correlation algorithms for mosaic stitching.

### Image Processing

- Shading correction, radial corrections, contrast inversions, brightness and contrast adjustments, handling of large image montages.

### Export Functionalities

- Supported formats: Import 2D images from CZI, ZVI, TIFF, JPG and BMP formats. Import ZEISS TXM 3D X-ray volumes. Export CZI, TIFF, JPG and MRC formats.
- Export to browser based viewer included.
- Export at imaging resolution or resample.
- Merge mosaics into single images on export.
Count on Service in the True Sense of the Word

Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What’s more, we’ll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

**Repair. Maintain. Optimize.**
Attain maximum uptime with your microscope. A ZEISS Protect Service Agreement lets you budget for operating costs, all the while reducing costly downtime and achieving the best results through the improved performance of your system. Choose from service agreements designed to give you a range of options and control levels. We’ll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization’s standard practices.

Our service on-demand also brings you distinct advantages. ZEISS service staff will analyze issues at hand and resolve them – whether using remote maintenance software or working on site.

**Enhance Your Microscope System.**
Your ZEISS microscope system is designed for a variety of updates: open interfaces allow you to maintain a high technological level at all times. As a result you’ll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.

Profit from the optimized performance of your microscope system with services from ZEISS – now and for years to come.

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