Version 4.1

3D Imaging Systems

Your Guide to the Widest Selection of
Optical Sectioning, Electron Microscopy and X-ray Microscopy Techniques.

ZEISS

// INNOVATION
MADE BY ZEISS

The moment your data change scientific minds.

This is the moment we work for.

Identify Your Competitive Advantages

Simpler. More intelligent.
More integrated. Focused on results.

3D imaging is a key part of your most demanding experiments. Your microscopes should reflect that, whether you work in a multi-user facility or a one person laboratory. With ZEISS you will always have the best techniques to hand. From the largest family of 3D imaging systems. And with ZEISS, you will also have partners who can look at your questions with you. Who will take your needs and advise you in a straightforward way. Who are with you for the initial start-up of your microscope system and will continue to keep it up to date. The name ZEISS is your promise of products that are easy to use, intelligent, and fully integrated. Our passion is backed by over a century and a half of solid achievements, and it shows – recognize this in how deeply and comprehensively we support you before, during, and after you decide on ZEISS. Find out more about our support services on page 65.


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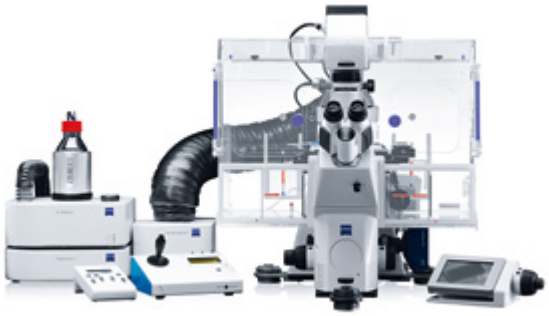
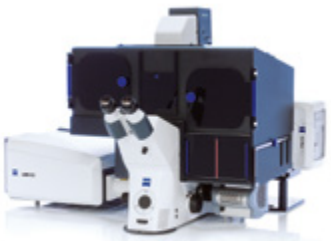
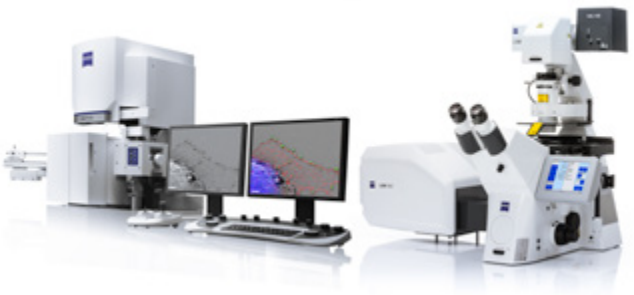




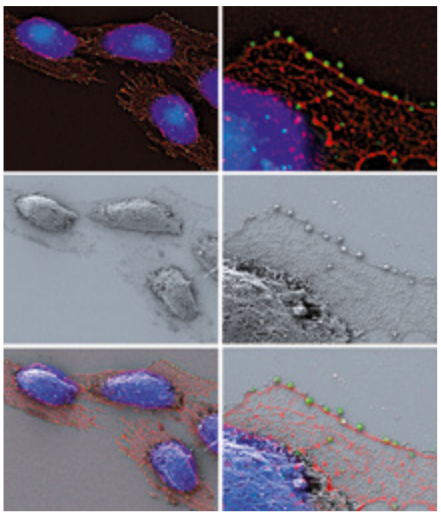



Xradia 520 Versa

Bridging the Micro and Nano Worlds

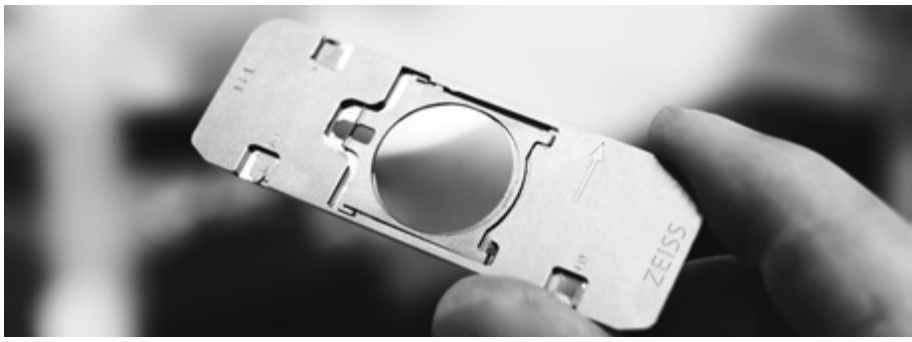
Maximize Your Options with Correlative Microscopy – More Flexibility. Greater Speed. Increased Throughput.

At ZEISS, correlative microscopy is not so much about the technology you are using as the questions you are asking. Essential questions that define your research in the life sciences. Questions that drive you to probe ever deeper into a specimen until you reveal the answers within. In these pages you will find a product portfolio that ranges from zoom microscopes to confocal Laser Scanning Microscopes (LSM) and superresolution systems to Scanning Electron Microscopes (SEM), Crossbeam (FIB-SEM) and X-ray microscopy (XRM) solutions. Simply transfer your specimens from one instrument to another and relocate the regions of interest (ROIs) in next to no time. Or image large areas and hundreds of sections across length scales and combine them into one single correlative volume data set. Use correlative solutions from ZEISS to connect microscopy techniques, resolution ranges and 3D imaging modalities to answer your scientific questions.



Build Your System to Your Exact Requirements.

In these pages, you will see the world's widest selection of light, electron and X-ray microscopes for 3D imaging and the different technologies behind it. Think about what matters to you. Then use this knowledge to select your ideal system.



Light Microscopy

Image your samples with 3D light microscopy techniques:

- Widefield Deconvolution
- Structured Illumination
- Light Sheet Fluorescence Microscopy
- Spinning Disk
- Laser Scanning Microscopy
- Multiphoton Microscopy
- Airyscanning
- Superresolution PALM
- Superresolution SIM

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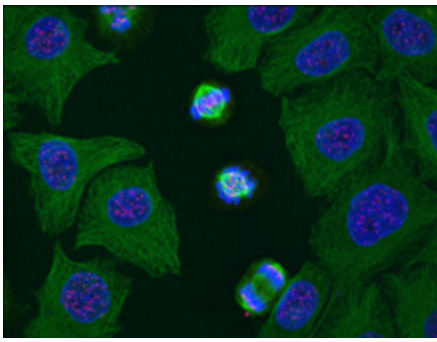

Correlative Microscopy

Combine structural and functional information of your biological samples:

- Shuttle & Find
- ZEN Correlative Array Tomography
- Atlas 5 Array Tomography

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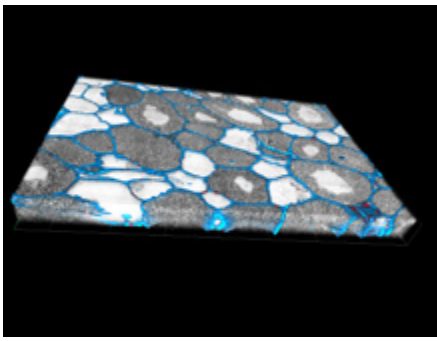

Electron Microscopy

Reconstruct your biological samples in 3D with nanometer resolution:

- Focused Ion Beam Scanning Electron Microscopy (FIB-SEM)
- Field Emission – SEM (FE-SEM) with integrated ultramicrotome
- Atlas 5 Array Tomography

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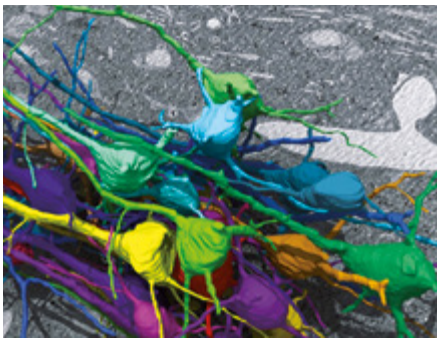

X-ray Microscopy

Visualize your biological samples in their native state in 3D:

- X-ray Microscopy

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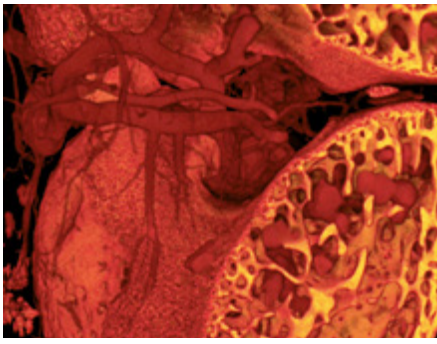
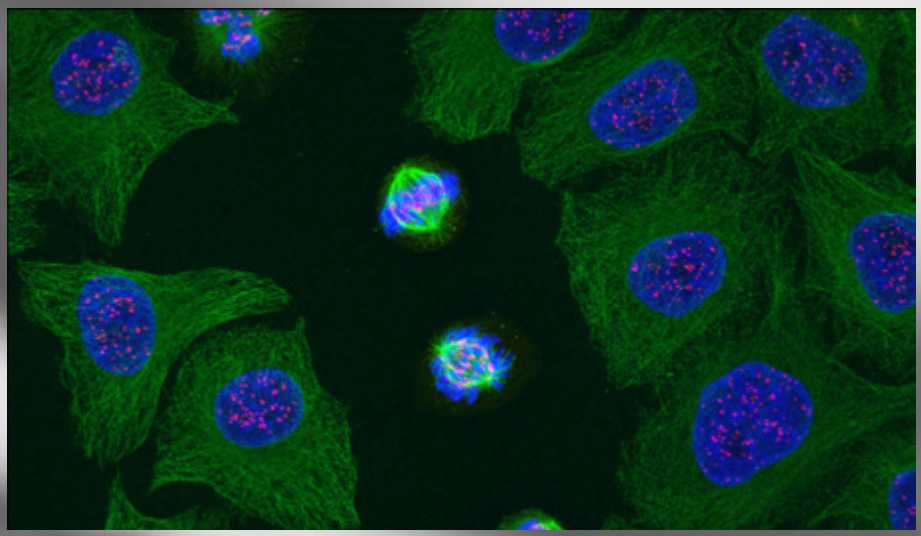
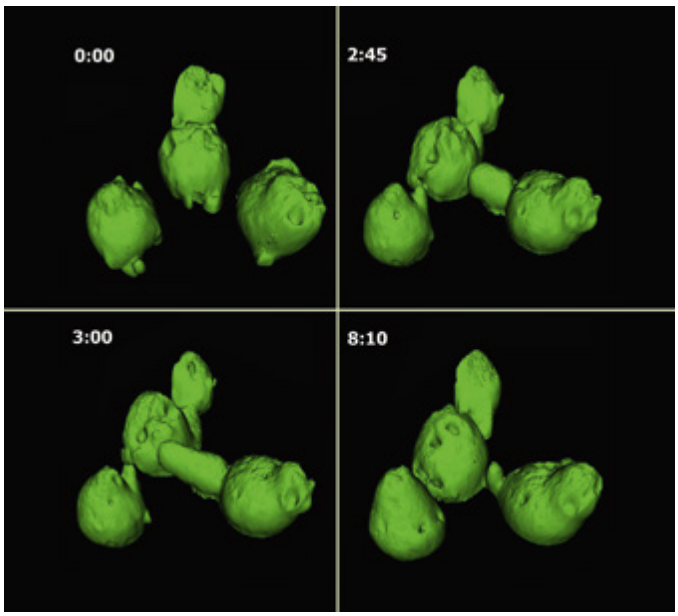


Image Your Samples with 3D Light Microscopy Techniques



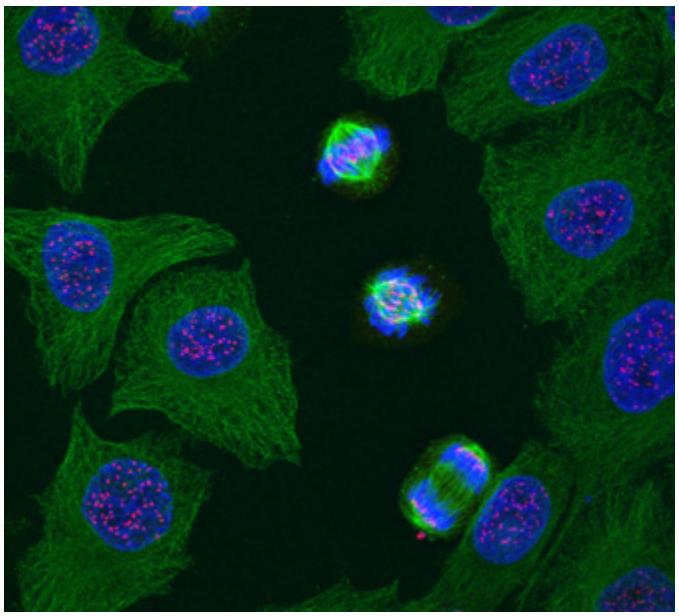
Light Microscopy

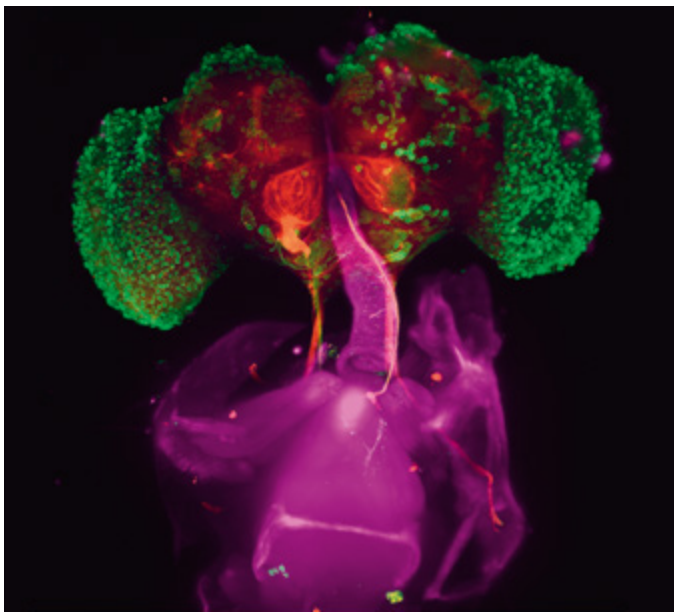
Light microscopes from ZEISS use advanced excitation and detection options to support even your most demanding experiments.



Widefield Deconvolution Uses All Emitted Light

Widefield deconvolution microscopes are one of the most sensitive solutions for live cell imaging and acquire both the in-focus and out-of-focus light contributions from a specimen.
Making use of knowledge of the point spread function (PSF), 3D deconvolution calculates light in image stacks back to its place of origin. This increases contrast and even the dimmest of structures are made visible.
3D deconvolution is both a very light efficient and cost-effective approach to generate 3D data.



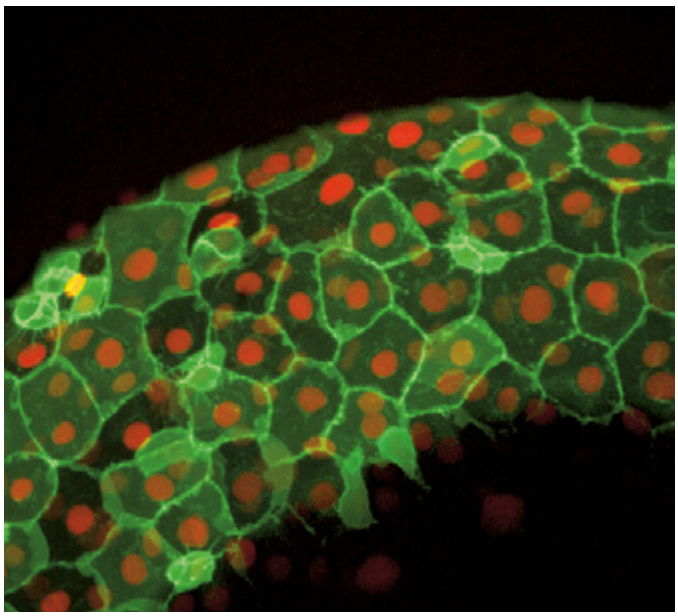


Structured Illumination with Grid Pattern Projection

In structured illumination microscopy a grid is projected into the focal plane of a widefield fluorescence microscope. The image of the grid is precisely moved in the lateral direction, and several images are acquired at the focal plane, each with the grid in a different position. Since fluorescence emission from areas in focus varies more significantly per position than emission from out-of-focus areas, it is possible to automatically create an optical section that is free from out-of-focus blur. While it takes more time to acquire a single focal plane than with the 3D widefield deconvolution approach, this technique does not require to collect image stacks. It also offers greater levels of out-of-focus discrimination.

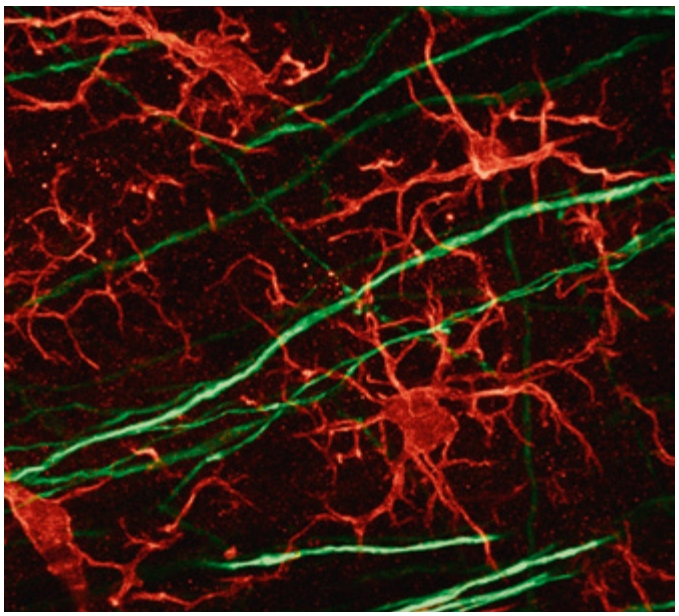
A Light Sheet Excites Only What You Image

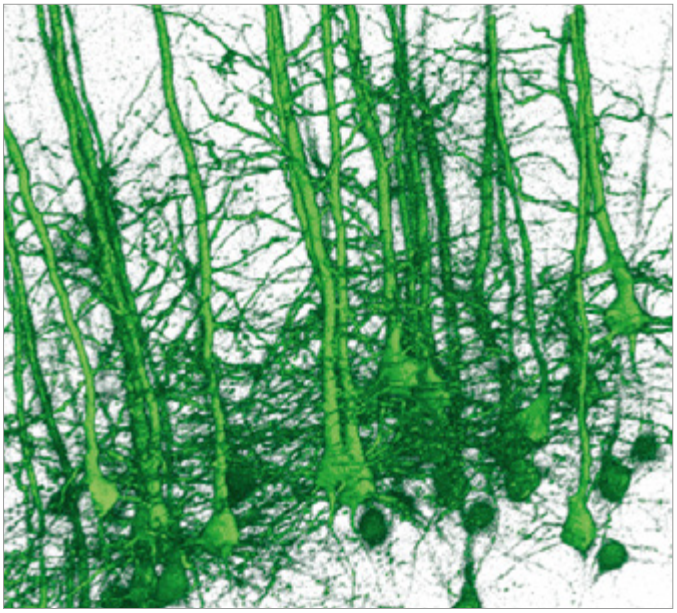
Light sheet microscopy lets you acquire images of your whole sample volume at sub-cellular resolution in a fraction of the time it takes with other techniques. Fluorescence excitation and detection is split into two separate light paths, with the axis of illumination perpendicular to the detection axis. That means only a single thin section of the sample is illuminated, generating an inherent optical section by exciting only fluorescence from the in-focus plane. No pinhole or image processing is required. Light from the in-focus plane is rapidly acquired by a sensitive camera. High speed acquisition combined with minimal laser excitation allow to image specimens in 3D over days with virtually no phototoxicity or photobleaching.



The Spinning Disk
Rotates with Hundreds of Pinholes

A spinning disk system projects the excitation light simultaneously through hundreds of pinholes into your specimen and collects the returning emission through the same confocal apertures. Emission light is blocked by the disk and you get an optical section. Spinning disk systems are confocal systems working in parallel and record multiple spots of the specimen at high speed and increased resolution. They are ideal for observing cellular processes.



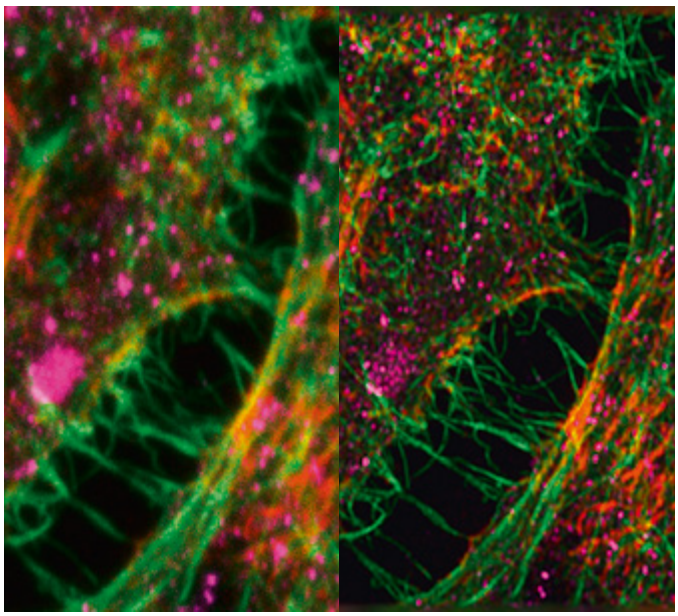


Confocal Laser Scanning Delivers Superb Optical Sectioning

With a laser scanning microscope, you create optical sections point by point as the system passes a point of light over the field of view at high speed. A pinhole allows only emission light from the focal plane to pass through and contribute to the image. While single-point scanning is slower than parallel scanning, it gives you great flexibility to choose experimental setups, image sizes and acquisition strategies. It also offers the highest out-of-focus discrimination of all routine optical sectioning techniques.

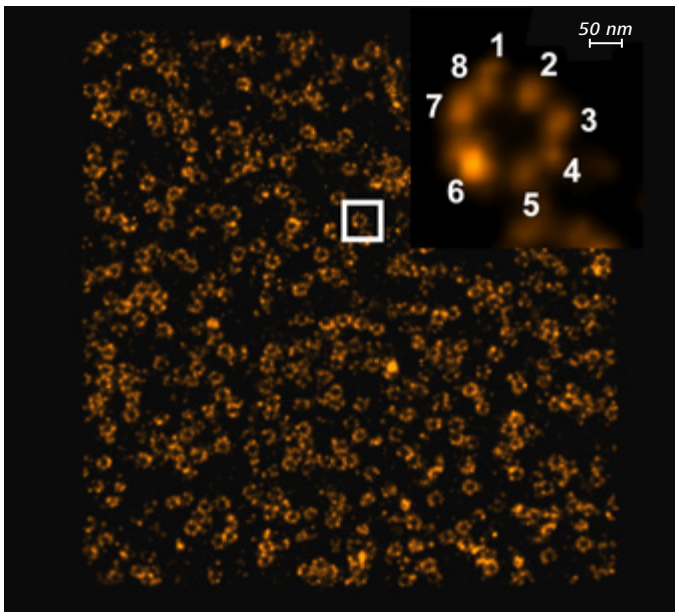
Multiphoton Excitation Concentrates the Light

Multiphoton Microscopes, or Non Linear Optics (NLO), rapidly scan the single beam of a pulsed, ultrafast and tunable laser across the sample. The IR excitation wavelengths range from about 700 nm to over 1,100 nm. It thus becomes highly probable only in the focal spot that two or more photons excite a fluorophore in a similar way to a single photon with typically half the wavelength. Outside the focus the laser intensity drops exponentially and does not excite fluorophores. Thus, the confocal aperture is no longer needed to reject out-of-focus light. The emitted light can be collected much more efficiently and the infrared wavelengths that are used can penetrate much deeper into tissue. Together, these aspects make multiphoton systems the state of the art for imaging deep tissue layers with subcellular resolution.



Enter a New World of Confocal Performance with Airyscanning

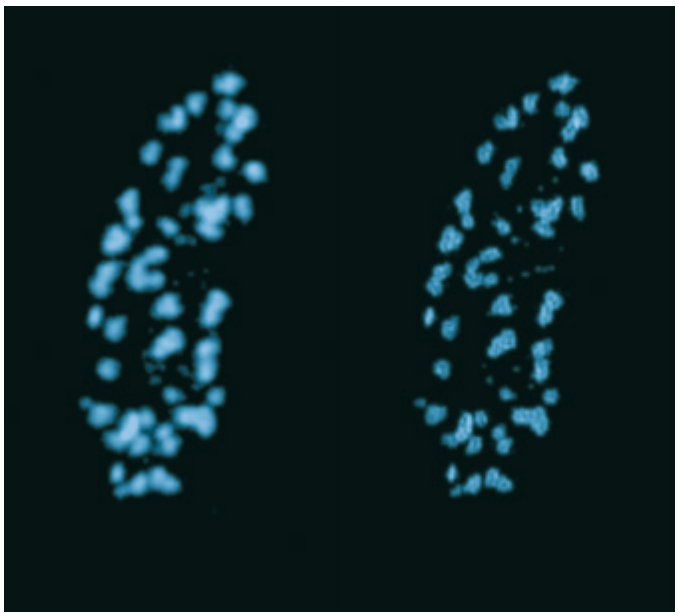
With Airyscan you get the unrivaled combination of fast super-resolution and sensitive image acquisition in a confocal system. Use multicolor samples with any label and get image quality like you've never seen before. Decide on this novel detector design and get a 4–8× improvement in signal-to-noise ratio (SNR) while simultaneously achieving a 1.7× increase in resolution. You will even profit from this unique combination of greater SNR and resolution at increased acquisition speeds of 27 fps at 480×480 pixels.



Xenopus laevis, *A6 cells (epithelial kidney cells). Stained for gp210, a nuclear pore complex protein with 8 fold radial symmetry with secondary antibody system conjugated to Alexa 647. Courtesy of A. Löschberger and M. Sauer, University of Würzburg, Germany*

PALM: Enjoy the Highest Resolution in Light Microscopy

Photoactivated Localization Microscopy (PALM) is your method of choice to explore ultrastructural details of cellular objects. Moreover, by localizing single molecules with high precision, their distribution as well as their abundance get accessible for analysis. TIRF or HILO illumination offer you the best possible signal in two or even three dimensions. You can achieve ten times higher resolution when using an optimally prepared sample.



Widefield image (left) and SIM image (right) of a Brp (Bruchpilot) antibody staining in neuromuscular junctions of Drosophila larvae.
Courtesy of H. Aberle and C. Klämbt, University of Münster, Germany

SR-SIM: Get Superresolution for All Standard Dyes

Superresolution Structured Illumination Microscopy (SR-SIM) is your ideal entry point to investigate your structure at double the resolution in all dimensions compared to classical widefield imaging. Unlike other superresolution techniques only minimal light doses are required so your sample will not be harmed by imaging. What's more, SR-SIM works with all established fluorophores or dyes.

ZEISS Cell Observer: Long-term Experiments with High Frame Rates

Your Technology: Widefield Deconvolution

Life sciences research demands high-performance imaging systems. You want to remain flexible and be able to operate each of the functions of your system easily.

Cell Observer from ZEISS lets you acquire simple time-lapse images and carry out multidimensional setups for your complex heterogeneous experiments. With just one platform, you can acquire long-term experiments reliably and achieve high frame rates, thanks to streaming and precise synchronization with your external devices.

As your requirements grow, you can upgrade your Cell Observer – for example, with the confocal spinning disk unit or with Apotome.2 for optical sectioning.

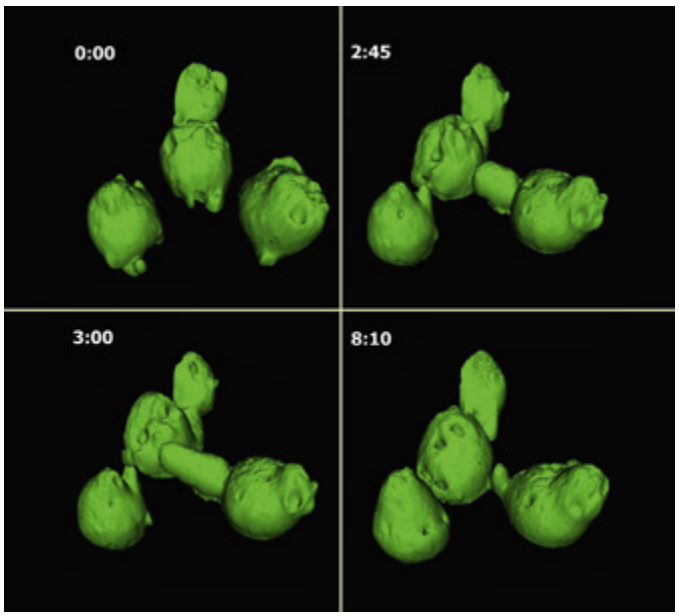
Configured to Your Requirements

Microscopes
Inverted: Axio Observer 7

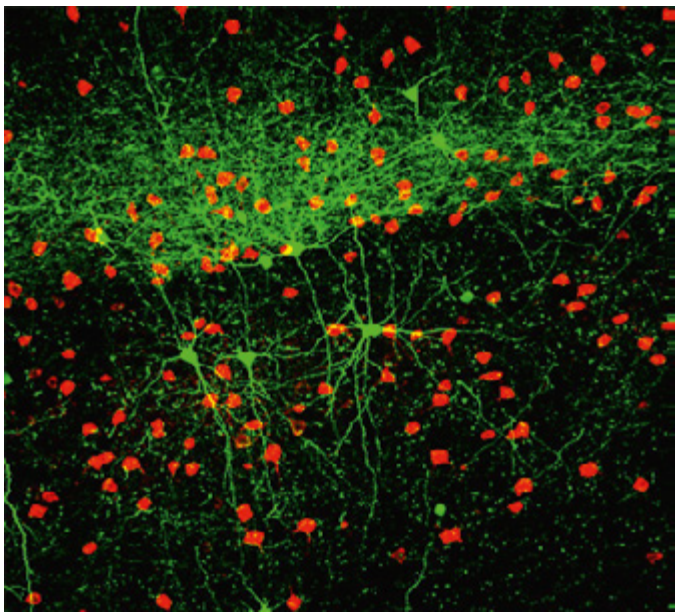
Excitation Options
HXP 120 V, HBO, XBO or Colibri 7,
fast switchable Xenon lamps (DG-4)

Accessories
Piezo focus, filter wheels, shutters, scanning stages, hardware focus stabilizer, flexible incubation setups, high-resolution and highly sensitive CCD cameras, EMCCD and sCMOS cameras for highest sensitivity, dual camera option for fastest speed and maximum efficiency

Software
ZEN system with additional modules: Tiles & Positions, Panorama, Experiment Designer, Deconvolution, 3D VisArt, Image Analyis, Macro Environment, Advanced Processing & Analysis, Physiology



Four Dictyostelium cells stably transformed with a GFP construct (imaged) shortly after spore germination in vegetative state. You can recognize the typical formation of pseudopodia for this stage. Courtesy of R. Gräf, University of Potsdam, Germany



Fixed brain sections from somatosensory cortex of GAD67-GFP transgenic mouse stained with antibodies to somatostatin and parvalbumin.

Simpler. More intelligent. More integrated.

- From long-term time-lapse imaging to fast 3D acquisition, a broad range of applications let you do it all with one single device.
- Acquire even the faintest signals in live cells at high frame rates. LEDs work as excitation light sources with the lowest possible phototoxicity. The TTL-controlled synchronization of the dual camera option makes sure both images are acquired at exactly the same time. You will work more efficiently in your processes and save time, too.
- Cell Observer combines fast acquisition, 3D deconvolution, 3D rendering, and important measurement tools.
  The system supports cameras from other manufacturers as well as Axiocams.

Created for Your Applications

- **Image live cells** with the whole spectrum of fluorescent proteins with highest sensitivity.
- Follow **intracellular trafficking** events at high speed in a quantitative representation.
- Take images with the dual camera option and perform simultaneous, **quantitative ion or FRET imaging**.
- Capture **morphological changes** at high spatial resolution using deconvolution.
- **Investigate cell cycles** quantitatively using long-term microscopy with minimal phototoxicity.

ZEISS Celldiscoverer 7: Your Automated Platform for Live Cell Imaging

Your Technology: Widefield Deconvolution

Often in life sciences research, the data you are after will only be revealed through multiple runs of experiments or complex assays. Automation and parallelization can be the only way to get there. Now, with Celldiscoverer 7, you can combine the easy-to-use automation of a boxed microscope with the image quality and flexibility of a classic inverted research microscope.

Celldiscoverer 7 calibrates itself, then detects and focuses on your samples while adaptive optics adjust themselves. Leaving you free to get on with other projects.

Whether working with 2D or 3D cell cultures, tissue sections or small model organisms, you will acquire better data in shorter times with this reliable automated research platform.

Configured to Your Requirements

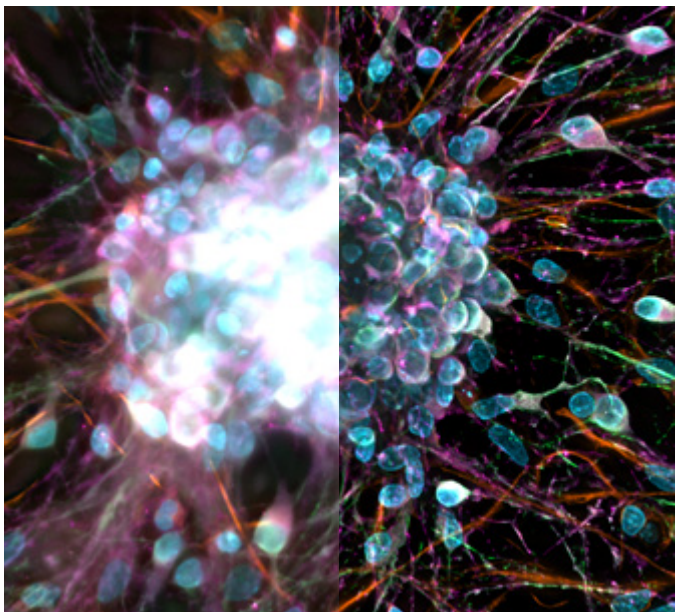
Microscopes
Boxed inverted: Celldiscoverer 7

Detection Options
Axiocam 503 mono, Axiocam 506 mono, Axiocam 512 mono, Axiocam 702 mono and a range of sCMOS and EMCCD cameras

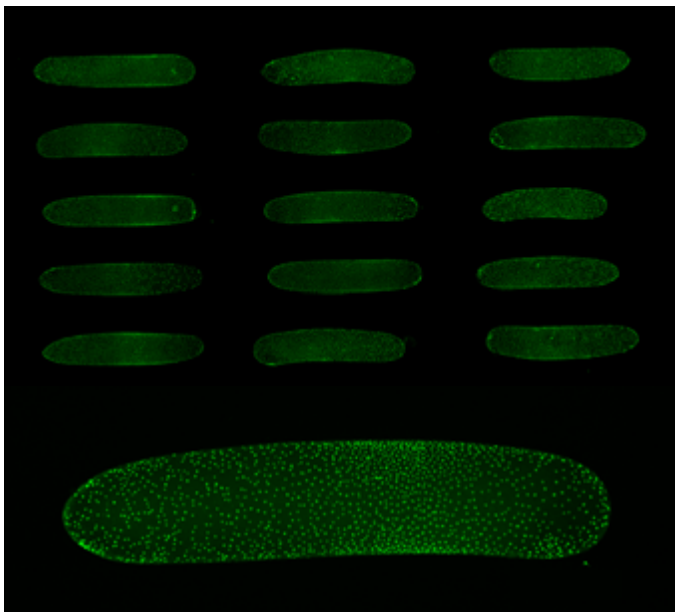
Accessories
Autoimmersion, various incubation options (incl. cooling, perfusion and dispensing), robotic plate loader

Software
ZEN celldiscoverer includes modules for multi-dimensional image acqusition, Tiles & Positions, Experiment Designer, advanced image processing and analysis tools

Recommended additional modules:
GPU-based deconvolution (GPU-DCV),
3Dxl Viewer – powered by arivis®,
Open application development (OAD)



Rat cortical primary neuron culture. Antibody-staining of bIII-tubulin (Cy2, green), Nestin (Cy3, red) and DCX (Cy5, purple). Nuclei Dapi-stained (blue). Maximum intensity projection of a Z-stack (left image: widefield, right image: deconvolved). Sample courtesy of H. Braun, LSM Bioanalytik GmbH, Magdeburg, Germany



Live cricket embryos (Gryllus bimaculatus). Nuclear-localized GFP. Movements and divisions of single cells throughout the embryo during development. Sample courtesy of S. Donoughe, Biological Labs,Harvard University, Cambridge, USA

Simpler. More intelligent. More integrated.

- Controlled environment allows uncompromised live cell imaging.
- Acquire even the faintest signals in live cells at high frame rates. Use LEDs for imaging with low phototoxicity. Experience the best performance in keeping your samples healthy over extended periods of time.
- Celldiscoverer 7 combines advanced automation, high performance dedicated optics, fast acquisition, 3D deconvolution, 3D rendering, measurement tools and interfaces for external software and hardware components.

Created for Your Applications

- **Investigate cellular processes** quantitatively using long-term microscopy with minimal phototoxicity.
- Follow **intracellular trafficking** events at high speed in a quantitative representation.
- **Image live cells** with the whole spectrum of fluorescent proteins with highest sensitivity.
- **Analyze cell cultures in 2D and 3D** with elevated throughput in a variety of different sample carriers.
- Capture **morphological changes** at high spatial resolution using deconvolution.

ZEISS Apotome.2 Delivers Crisp Optical Sections

Your Technology: Structured Illumination

Simply insert Apotome.2 into the field stop position – it's that easy to create optical sections with your widefield fluorescence system.

Apotome.2 uses structured illumination to create optical sections. As the module projects a grid pattern into the focal plane, the system calculates your optical section from three or more images with different grid positions. Apotome.2 also removes out-of-focus blur, even in thicker samples.

Apotome.2 is your system of choice if you want a convenient way to acquire multichannel images from tissue sections. It also creates perfect 3D images of whole organisms. You get brilliant images with optimal contrast in the best possible resolution. Yet your widefield system remains as easy to operate as always.

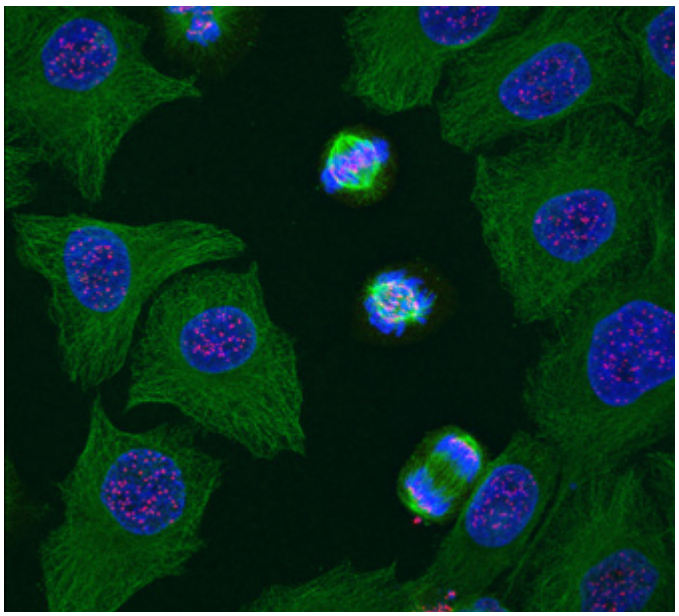
Configured to Your Requirements

Microscopes
Upright: Axio Imager.Z2, Axio Imager.M2, Axio Imager.A2, Axio Zoom.V16
Inverted: Axio Observer 7, Axio Observer 5, Axio Observer 3

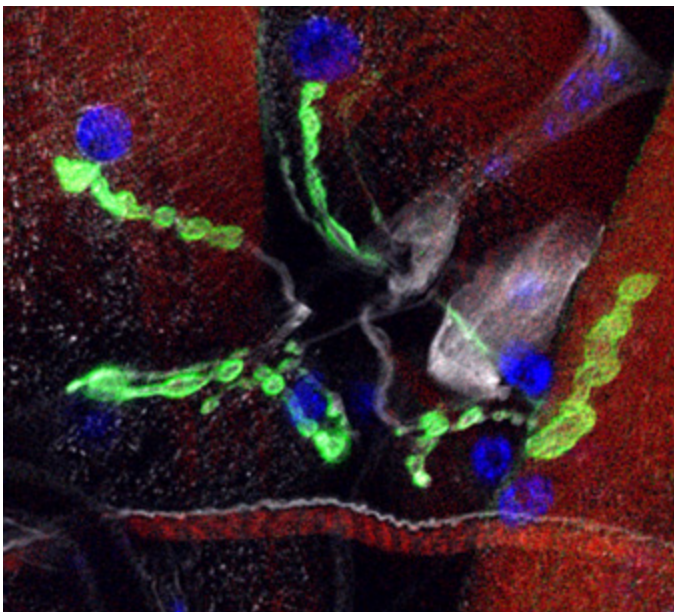
Excitation Options
HXP 120 V or Colibri 7
Free choice of fluorescence filter sets

Accessories
Three grids matching the chosen objectives;
3D Deconvolution module for ZEN imaging software included for resolution improvement

Software
ZEN system with additional modules: Tiles & Positions, Experiment Designer, Colocalisation, 3Dxl Viewer – powered by arivis®, Image Analysis, TimeLapse, Z Stack



Mitotoc HeLa cells. Blue: DNA, stained with Hoechst 33342; Green: Tubulin, stained with Alexa 488; Red: ACA, stained with Alexa 568.



Neuromuscular junctions of Drosophila*. Green: synapses, stained with Alexa 488; red: muscles, stained with Alexa 568; white: motor neurons, stained with Alexa 647; blue: nucleus, stained with Hoechst 33258. Courtesy of K. VijayRaghavan, National Centre for Biological Sciences, TIFR Centre, Bangalore, India*

Simpler. More intelligent. More integrated.

- Just insert Apotome.2 into the field stop position to produce optical sections.
- These optical sections are calculated and displayed online.
- With the fully-automatic grid selection you get optical sections with optimal thickness for all objective magnifications.
- It works with most standard white-light sources for fluorophores ranging from UV to near infrared – or use the Colibri 7 LED light source and achieve unsurpassed contrast.
- Use the Deconvolution module (included) to make a significant improvement in resolution of raw data.

Created for Your Applications

- Display multicolor neuronal branching in **brain sections**.
- Research the formation of **tissue in embryos** with low phototoxicity.
- Scan large objects automatically with the ZEN module Tiles & Positions.
- Capture **subcellular structures** in three dimensions with an easy-to-use setup and short acquisition times.
- Analyze **the localization of multiple** fluorescence markers in **pathological sections** without out-of-focus blur.
- Increase the **image resolution** by up to 30 % using the Deconvolution module.

ZEISS LSM 800 with Airyscan: Your Compact Confocal for High-End Imaging

Your Technology: Single-point Laser Scanning

Confocal imaging demands the very best imaging quality. With LSM 800 you are choosing a flexible and compact confocal laser scanning microscope, complete with highly sensitive GaAsP detector technology and fast linear scanning. Add Airyscan, the revolutionary detection concept from ZEISS, and you will gain 1.7× higher resolution in all three dimensions – resulting in a 5× smaller confocal volume. And you will be pushing sensitivity beyond the limits of all conventional confocals.

LSM 800 is your entry into the world of high-end confocal imaging. Simply decide which options your system needs today, then upgrade in the future as your needs grow.

(*available on request)

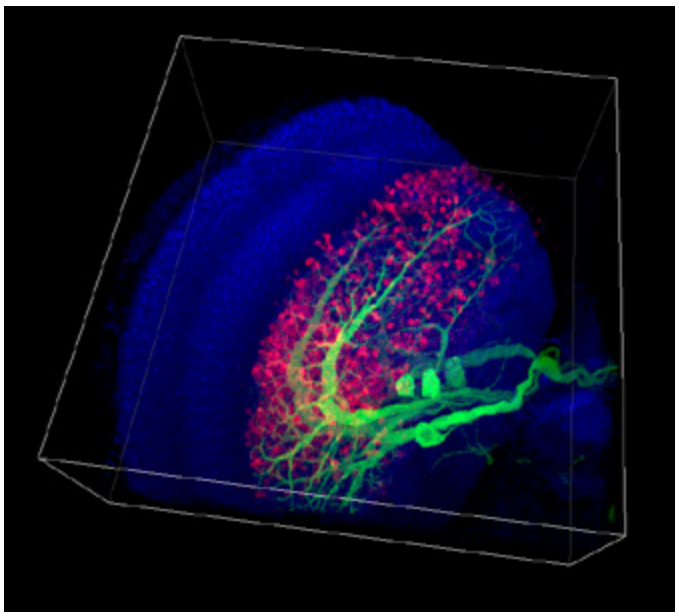
Configured to Your Requirements

Microscopes
Upright: Axio Imager.Z2, Axio Imager.M2, Axio Examiner.Z1*
Inverted: Axio Observer 7

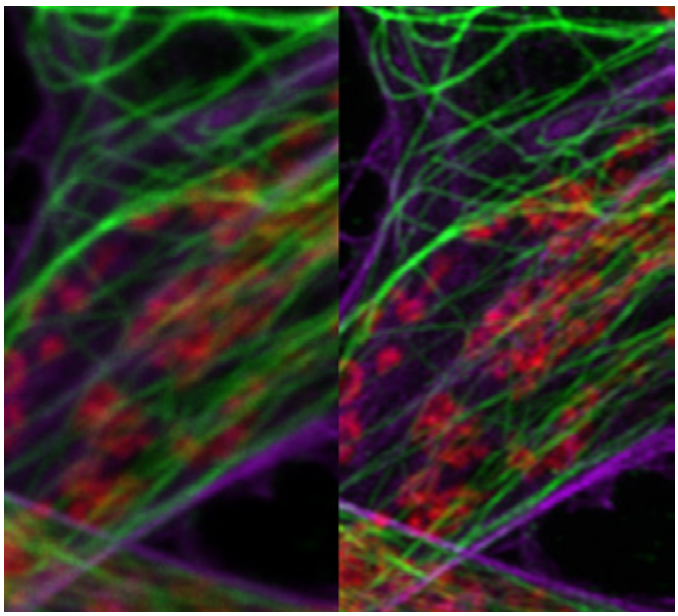
Excitation Options
Use either two (488/561 nm) or
four laser lines (405, 488, 561 and 640 nm),
use HXP 120 or Colibri 7 for widefield excitation

Scanning Modules and Accessories
LSM 800 with two or three confocal detectors and built-in spectral flexibility;
Options: Airyscan for LSM 800, transmitted light detection, Definite Focus.2, Autocorr objectives;

Software
ZEN with additional modules: Tiles & Positions, Experiment Designer, 3Dxl Viewer – powered by arivis®, Deconvolution, Macro Environment, Experiment Feedback, FRET/FRAP Analysis, Shuttle & Find



3D dataset of an optical lobe of the Drosophila *brain; labelled with three antibodies: Alexa 488, 568 and 633. Sample: courtesy of D. Reiff, Insitute of Biology, Albert-Ludwigs-University Freiburg, Germany*



Comparison between confocal (left) and Airyscan (right) image. HeLa cells, red: mitochondria membrane, green: microtubuli, magenta: actin fibers. Sample: courtesy of A. Seitz, BioImaging and Optics Core Facility, EPFL, Lausanne, Switzerland

Simpler. More intelligent. More integrated.

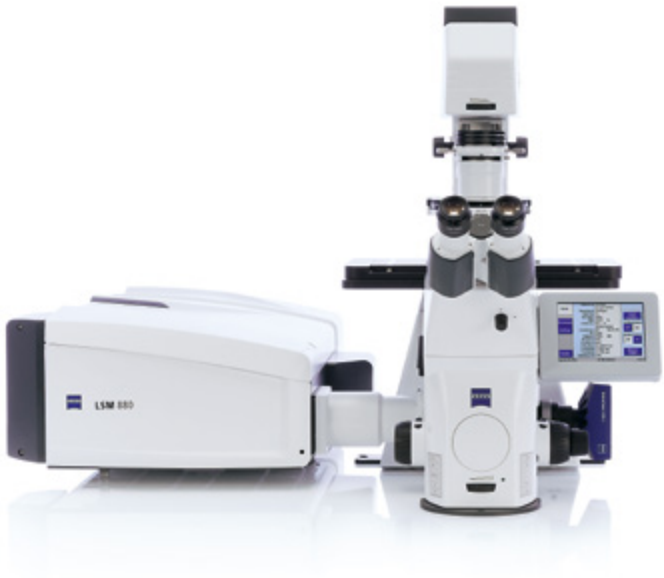
- The compact design delivers the superb image quality of the LSM 8 family with a small footprint and an excellent price/performance ratio.
- Airyscan delivers 1.7× higher resolution in x, y and z without sacrificing sensitivity or speed.
- Up to three GaAsP detectors give you the greatest flexibility for live cell imaging.
- Well defined interfaces to third party software and the integrated OAD platform for scripting allow seamless integration into existing infrastructure and a high degree of personalization.

Created for Your Applications

- Acquire up to 3 channels simultaneously for **multi-fluorescence colocalization** analyses.
- Perform long-term 3D **live cell imaging** with highly sensitive GaAsP detectors or Airyscan at minimal laser exposure.
- **Analyze molecule** interaction and dynamics with FRET and FRAP including photoactivation and photoconversion.
- **Correlate functional data** from LSM 800 with ultrastructural information from your ZEISS SEM with the ZEN module Shuttle & Find.

ZEISS LSM 880 with Airyscan:
Your New Standard for Fast and Gentle Confocal Imaging

Your Technology: Single-point Laser Scanning



To get ahead in your research you may want to image the smallest structures, catch the faintest signal or track the fastest processes – or do all of that at once. When it comes to getting accurate data from live cells or other weakly-labeled samples, there is no such thing as too much sensitivity, resolution or speed. Each photon of emission light is precious.
With Airyscan you have the unrivaled combination of superresolution and sensitive confocal image acquisition at hand. Airyscan in Fast mode combines unrivaled image quality and superresolution with high acquisition speed to answer your scientific questions.

Use multicolor samples with any label and get a 4–8× improvement in signal-to-noise ratio (SNR) as compared to imaging with conventional confocal GaAsP detectors. And 1.7× higher resolution for your single photon or multi-photon experiments.

(*available on request)

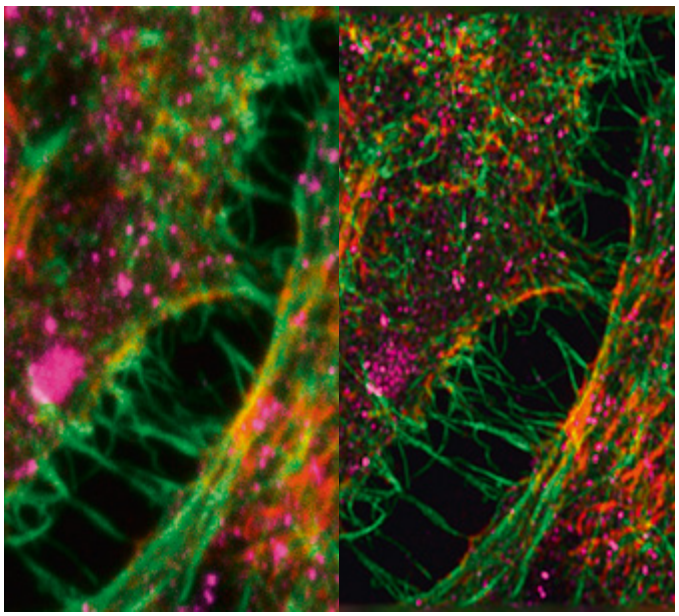
Configured to Your Requirements

Microscopes
Upright: Axio Imager.Z2, Axio Imager.M2; Axio Examiner.Z1
Inverted: Axio Observer 7

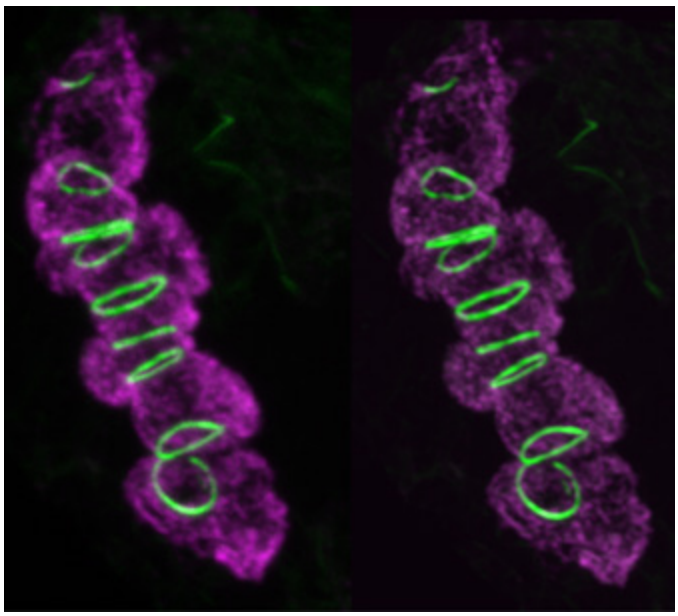
Excitation Options
UV laser: 355 nm, 405 nm
VIS laser: 440 nm, 458 nm, 488 nm, 514 nm, 543 nm, 561 nm, 594 nm, 633 nm
NIR laser for multiphoton imaging: Ti:Sa: 690 nm – 1,080 nm
OPO, InSight Deep See, Discovery or second TiSa Laser*

Scanning Modules and Accessories
3 or 34 descanned spectral channels (GaAsP and/or PMT); Airyscan detector with optional Fast module; 2 additional GaAsP channels (BiG.2); Definite Focus.2; up to 12 non-descanned GaAsP or PMT detectors; Transmitted light detector (T-PMT); Autocorr objectives

Software
ZEN with additional modules: Tiles & Positions, Experiment Designer, FRAP, FRET, RICS, FCS, Deconvolution, 3Dxl Viewer – powered by arivis®



HeLa cells, Actin stained with Phalloidin-Alexa 546, AP3 with Alexa 488, DAPI. Left: state-of-the-art GaAsP detection; right: Airyscan detection. Courtesy of S. Traikov, BIOTEC, TU Dresden, Germany



Apis mellifera. *Hypopharyngeal gland secretory cell, cryosectioned and labelled with AlexaFluor 488-phalloidin (green) and 2°AB-Cy$_3$ membrane marker (magenta). The ring-like structures (green) have a diameter of about 2.5 µm. Courtesy of O. Baumann, University of Potsdam, Germany*

Simpler. More intelligent. More integrated.

- Use Airyscan to get superresolution imaging with high sensitivity at 140 nm laterally and 400 nm axially. This transcends the deconvolution approach by preserving precious emission light normally rejected at a closed pinhole.
- Speed up your imaging by a factor of four - with Airyscan's unique Fast mode. This will propel you into the traditional domain of resonant scanning confocals without sacrificing sensitivity or resolution.
- Image deep within tissue using gentle multiphoton excitation and get the benefits of increased sensitivity and resolution with GaAsP – NDDs, Airyscan or Airyscan Fast mode.
- Working with identical pixel times and continuous scanner monitoring, you can perform quantitative imaging at all speeds and scan modes at any scan field rotation.
- Collect all your fluorescent signals in one go. Parallel acquisition lets you investigate multiple labels in minimum time, equipped with the highest number of detectors of any confocal.

Created for Your Applications

- Acquire multi-fluorescence images and analyze colocalization at the same time as you are performing **spectral imaging of fluorescent proteins.**
- Perform 3D live cell imaging with enhanced resolution and SNR over long periods of time.
- **Analyze molecule** interaction and dynamics with FRET, FRAP, and FLIP, **including photoactivation and photoconversion**.
- Use the innovative RICS software to **analyze individual molecules**. Use FLIM with pulsed lasers in the 405/440 nm range, tuneable from 488 to 640 nm, and anisotropy imaging.

ZEISS Lightsheet Z.1 for Multiview Imaging of Large Specimens

Your Technology: Light Sheet Fluorescence Microscopy

Lightsheet Z.1 uses a pure form of optical sectioning microscopy to capture stunning images from very large volumes with gentle illumination of the focal plane only. Every aspect of Lightsheet Z.1 has been tailored to create the ultimate platform for both imaging of large cleared tissues and long-term observation of live samples. The unique sample handling allows the collection of Z-stacks from the perfect angle of viewing – or from a number of different angles, in multiple positions and with different zoom factors. Streaming of data to storage and processing computers allows to handle large data sets and makes processing easy. You can image whole organisms faster and longer than ever before.

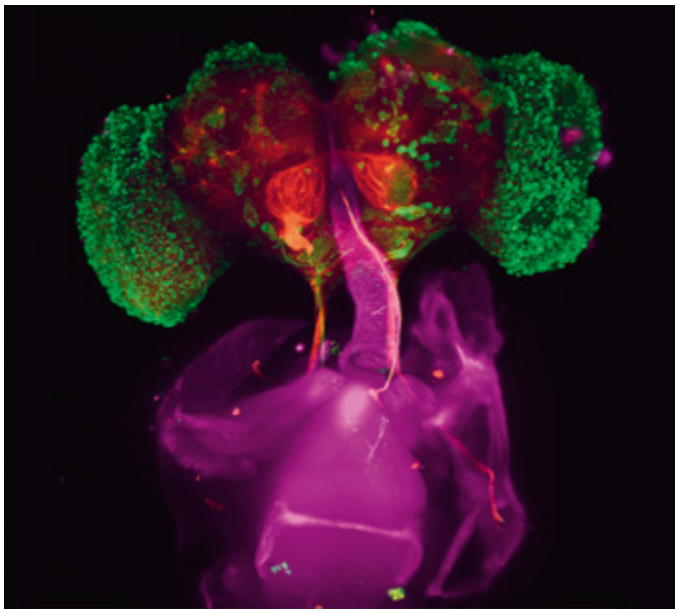
Configured to Your Requirements

Microscopes
Dedicated boxed horizontal system

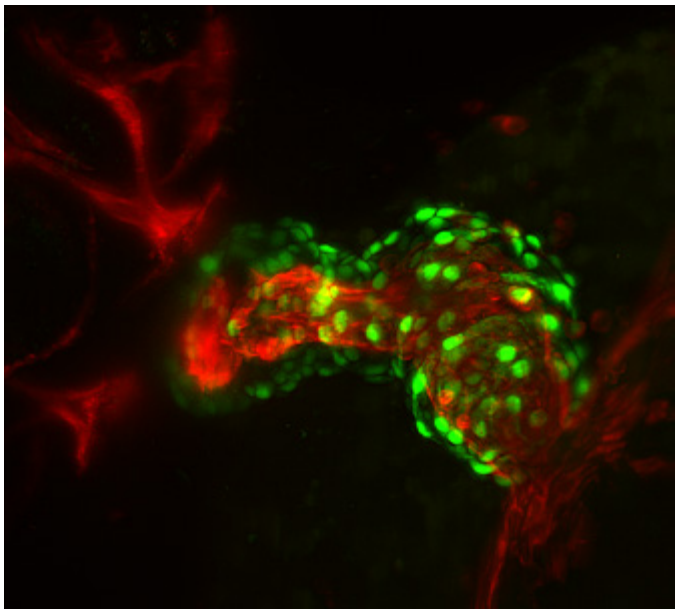
Excitation Options
Up to 6 laser lines: 405, 445, 488, 515, 561 and 638 nm; choose from lasers with different power levels

Detection Modules and Accessories
Single or dual camera acquisition with sCMOS cameras for best speed and sensitivity, scalable integrated incubation solution, sample holders and sample chambers

Software
ZEN system with additional modules: MultiView Acquisition and Reconstruction, Deconvolution, 3Dxl Viewer – powered by arivis®, arivis Vision4D



Brain of an adult Drosophila*, Maximum intensity projection rendered from 4 views. Magenta: proboscis muscles, stained with Rhodamine phalloidin; red: neuroglian, stained with Alexa 647; green: GFP-neurons, stained with Alexa 488. Courtesy of A.A. Bohra and K. V. Raghavan, NCBS, Bangalore, India*



Maximum intensity projection of a 3D rendering of a 2 day old living Zebrafish heart. The 2 channel fluorescence image dataset shows the blood vessels and the endocardium labeled in red. The myocardium is labeled in green. Courtesy of M. Mickoleit, Huisken lab, MPI CBG, Dresden, Germany

Simpler. More intelligent. More integrated.

- Perform parallel or sequential imaging with single or dual camera solutions.
- Image your fluorescent specimens with the sealed system in open and well-lit laboratories.
- It's easy to handle and process large amounts of data with the integrated offline workstation.
- Control all environmental conditions with ZEN imaging software and adjust to the needs of even your most demanding samples.

Created for Your Applications

- Image the development of **whole organisms** in 3D over days.
- Perform **long-term time-lapse imaging** with virtually no phototoxicity or photobleaching.
- Visualize dynamic **subcellular organelles** with fast acquisitions.
- Image **3D cell cultures** without the constraint of a coverslip.
- Image **optically cleared specimens.**

ZEISS Cell Observer SD Captures the Pulse of Life

Your Technology: Spinning Disk

With Cell Observer SD, you have it all. The image quality of Axio Observer and Axio Examiner. Spinning disk technology from Yokogawa CSU-X1. And the dual camera technology of ZEN imaging software. This symbiosis of optics, hardware and software in one system makes your confocal live cell imaging uniquely accurate: you can control your Cell Observer SD precisely in the millisecond range. By streaming image data, you will acquire your images in breathtakingly short times. You can also document two fluorescence channels of your sensitive samples simultaneously and get even more valuable data.

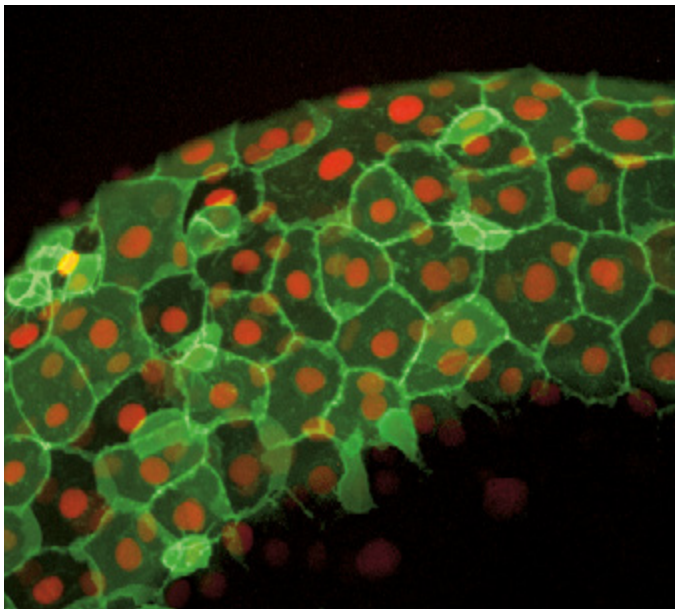
Configured to Your Requirements

Microscopes
Upright: Axio Examiner.Z1
Inverted: Axio Observer 7

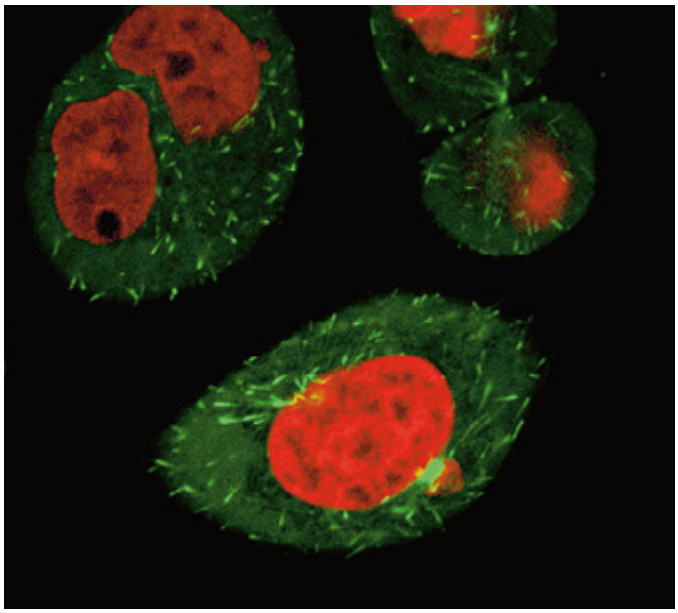
Excitation Options
Up to 6 laser lines: 405, 445, 488, 515, 568, 640 nm;
each laser module can be equipped with either a single or fast switching triple fiber output

Accessories
Fast emission filter wheel, dual camera acquisition with CCD, EMCCD and sCMOS cameras, various EMCCD cameras for the best detection sensitivity, scalable and laser-safe incubation solutions, DirectFRAP laser manipulation slider for dynamic photoactivation and photobleaching, fast switching laser module, hardware focus stabilizer (for inverted microscope only)

Software
ZEN system with additional modules: Tiles & Positions, Panorama, Experiment Designer, Deconvolution, 3Dxl Viewer – powered by arivis®, Image Analysis, Macro Environment, Advanced Processing & Analysis, Dynamics



Zebrafish embryo development. Maximum intensity projection from a single time point of a 10-hour time-lapse acquisition. Plan-APOCHROMAT 25×/0.8 LD LCI. Membrane stained with Tg (-8.0cldnb:lynGFP) (green), nuclei are labeled with mCherry (red). Courtesy of J. Otte, M. Takamiya, and U. Strähle, Karlsruhe Institute of Technology, Germany



HeLa cells. Plan-APOCHROMAT 63×/1.4. Microtubuli end-binding protein: EGFP (green), H2B: mCherry (red)

Simpler. More intelligent. More integrated.

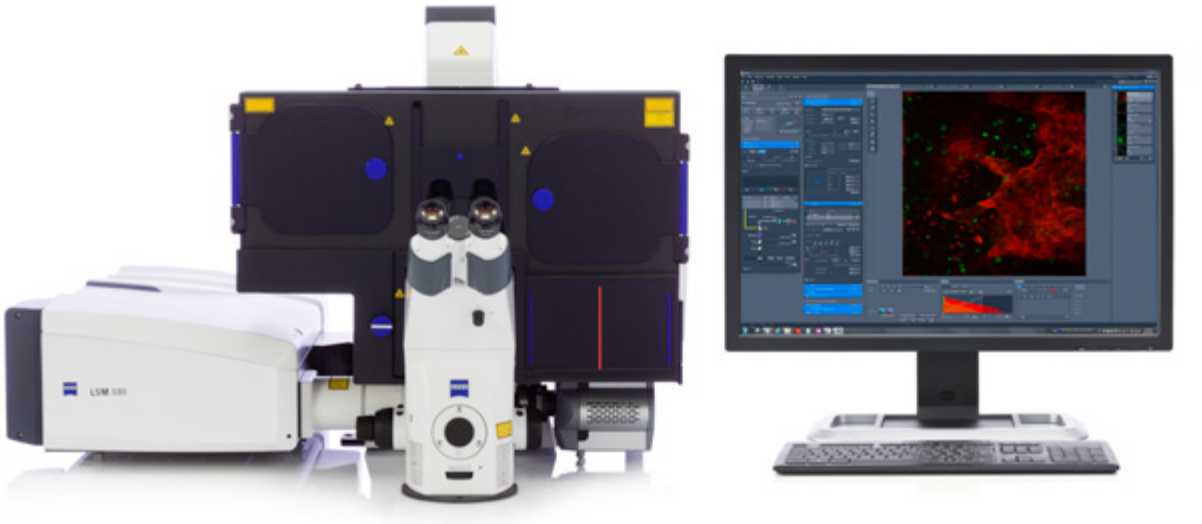
- Use software-controlled incubation to manage environmental conditions for displaying live cells.
- Streaming technology lets you observe dynamic cell processes at high frame rates.
- All components are seamlessly integrated and controlled with millisecond accuracy.
- Parallel or sequential imaging, and one or two camera solutions available.

Created for Your Applications

- Image **subcellular trafficking** in 3D over time with maximum acquisition speed.
- Visualize **cytoskeletal dynamics** with the highest sensitivity.
- Carry out **photobleaching experiments** with the optional DirectFRAP unit.
- Perform functional imaging of **cellular signal transduction** at high temporal resolution.
- Accomplish **long-term confocal live cell imaging** with lowest phototoxicity.

ZEISS Elyra P.1: Investigate Ultrastructural Details at the Single Molecule Level

Your Technology: Photoactivated Localization Microscopy (PALM)



With Elyra P.1 you can analyze structures within sections and cultured cells down to the molecular level. Image single molecule fluorescence with highest sensitivity and at well beyond the diffraction limit.

Use TIRF illumination for best signal-to-noise in 2D PALM imaging. For 3D PALM experiments, it's easy to switch to HILO illumination. Or, use PRLIM (Phase Ramp Localization Imaging Microscopy) method for a high capture range.

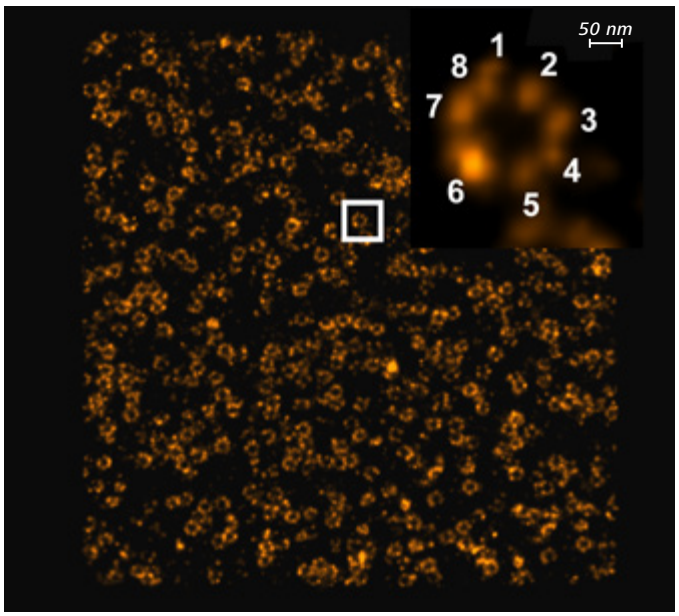
Configured to Your Requirements

Microscopes
Inverted: Axio Observer 7

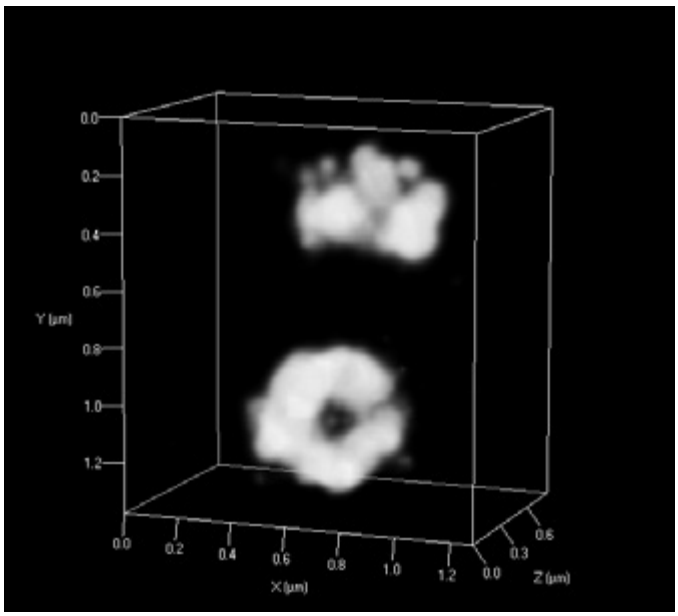
Excitation Options
Laser lines 405 nm (50 mW), 488 nm (100 or 200 mW), 561 nm (100 or 200 mW), and 642 nm (150 mW); HXP 120 for widefield excitation

Accessories
Laser-safe incubation solutions, special TIRF objective with extra-high NA (1.57), combination with Elyra S.1, combination with LSM 880 with Airyscan, many customized filter configurations, fully mechanically controlled phase ramp slider

Software
ZEN system and additional modules: 3Dxl Viewer – powered by arivis®, Deconvolution, Photoactivated Localization Microscopy



Xenopus laevis, *A6 cells (epithelial kidney cells). Stained for gp210, a nuclear pore complex protein with 8 fold radial symmetry) with secondary antibody system conjugated to Alexa 647. Courtesy of A. Löschberger and M. Sauer, University of Würzburg, Germany*



U2OS (human Osteosarcoma) cell. Stained for centriolar protein CEP152 with a secondary antibody system conjugated to Alexa 647. Courtesy of T. Klein, University of Würzburg, Germany

Simpler. More intelligent. More integrated.

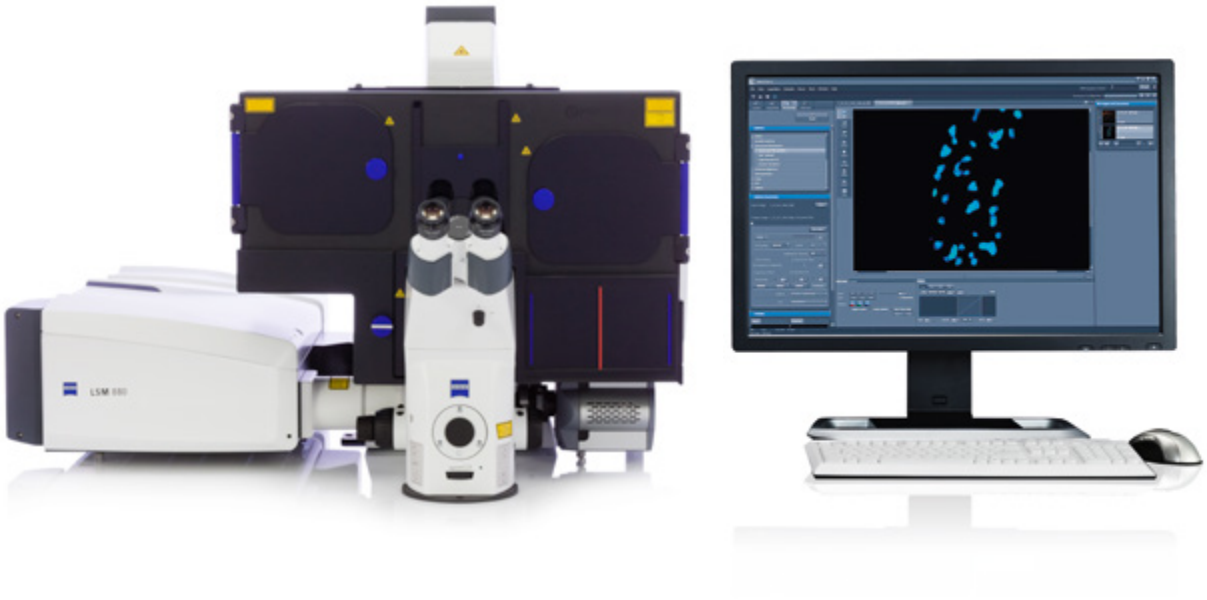
- Capture quantitative data with inherent single molecule analysis for each image.
- Match the power density to the needs of your experiment.
- Choose your illumination scheme for best sensitivity (TIRF, HILO, EPI).
- Detect structural details as fine as 20–40 nm in lateral and 60–80 nm in axial direction.
- Combine PALM with SR-SIM and confocal systems.

Created for Your Applications

- Analyze the **ultrastructure of subcellular compartments**.
- Measure **molecule numbers** and their **proximity** within a structure.
- **Track molecules** to derive their dynamics.
- Map **molecule distribution and clustering** with a structural context.

ZEISS Elyra S.1: Double the Resolution in 3 Dimensions

Your Technology: Superresolution Structured Illumination Microscopy (SR-SIM)



Elyra S.1 achieves up to twice the resolution compared to conventional systems for optical sectioning. Using SR-SIM you will gain new insights into your regular samples. A rotating light pattern is the core of this superresolution technique. From a small stack of widefield data, your system calculates images with a resolution improvement in both xy as well as z directions.

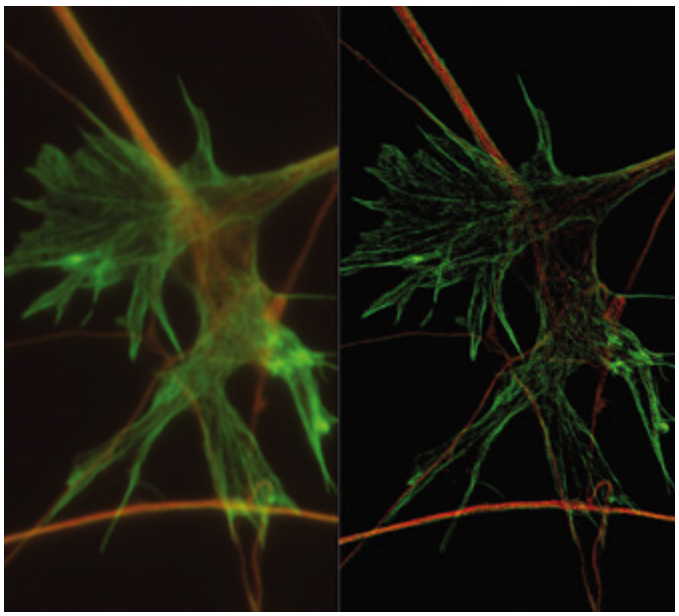
Configured to Your Requirements

Microscopes
Inverted: Axio Observer 7

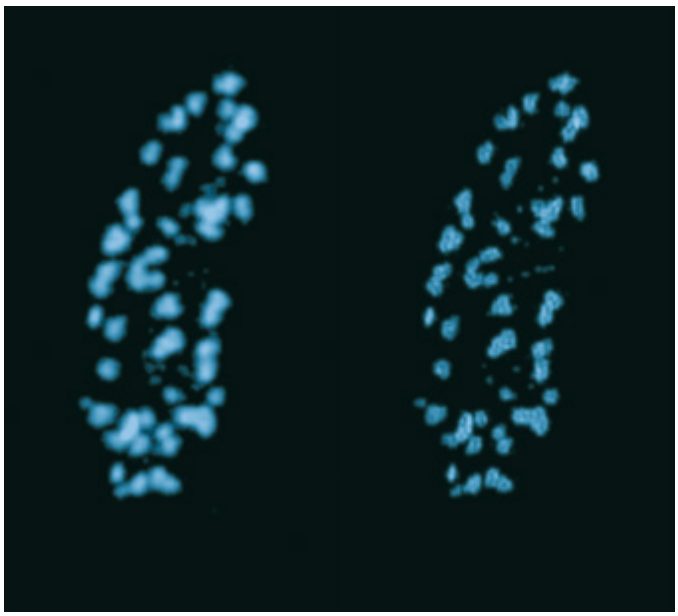
Excitation Options
Laser lines 405 nm (50 mW), 488 nm (100 or 200 mW), 561 nm (100 or 200 mW), and 642 nm (150 mW); HXP 120 for widefield excitation

Accessories
Laser-safe incubation solutions, combination with Elyra P.1, combination with LSM 880, customized filter configurations

Software
ZEN system and additional modules: 3Dxl Viewer – powered by arivis®, Tiles & Positions, Deconvolution, Structured Illumination



Widefield image (left) and SIM image (right) of neuronal growth cones stained for tubulin (red) and F-actin (green).
Courtesy of M. Fritz and M. Bastmeyer, University of Karlsruhe, Germany



Widefield image (left) and SIM image (right) of a Brp (Bruchpilot) antibody staining in neuromuscular junctions of Drosophila *larvae.*
Courtesy of H. Aberle and C. Klämbt, University of Münster, Germany

Simpler. More intelligent. More integrated.

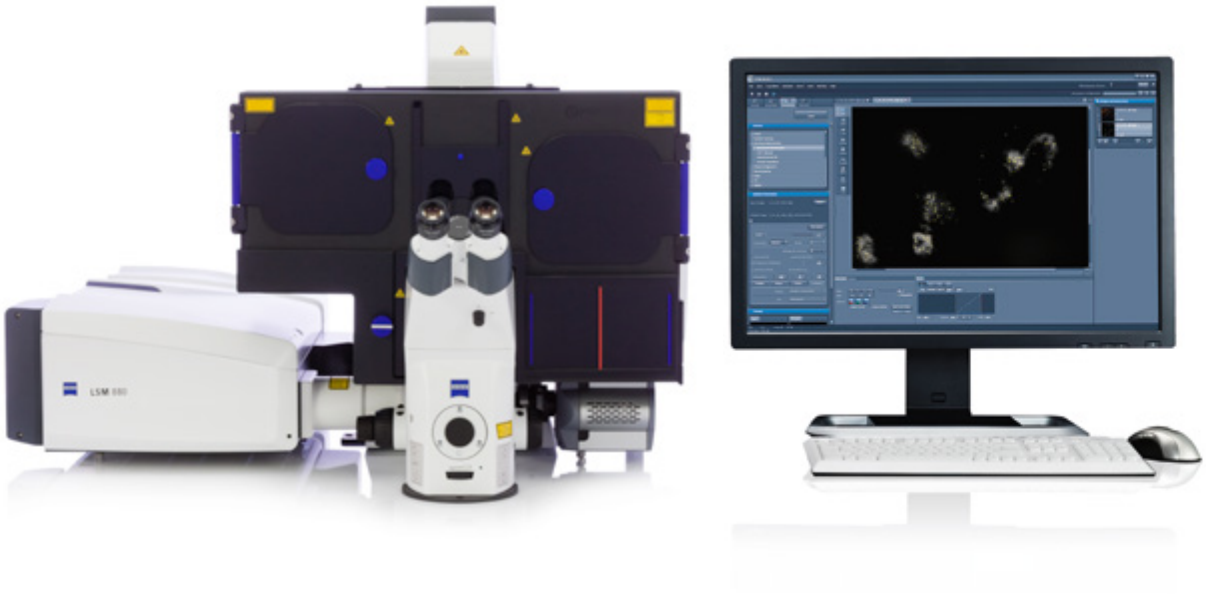
- Choose freely from among all common fluorescent proteins and dyes to achieve superresolution.
- Create Z-stacks with improved axial resolution – up to twice as much as is possible with conventional microscopes for optical sectioning.
- Display colors with up to four channels in superresolution.
- Combine Elyra S.1 with Elyra P.1 and confocal systems to enjoy total flexibility.

Created for Your Applications

- Image multiple fluorophores and **analyze colocalizations**.
- Analyze cells and small **whole-mount or sectioned samples** with **3D superresolution**.
- Analyze **chromatin structures** with DAPI and up to three additional **3D super-resolved** channels for immunostaining or fluorescence in-situ hybridization (FISH).
- Display fluorescent protein expression inside **yeast** with **outstanding resolution**.

ZEISS LSM 880 with Airyscan and Elyra PS.1: Your Platform for Far-reaching Answers

Your Technology: Confocal and Superresolution Microscopy



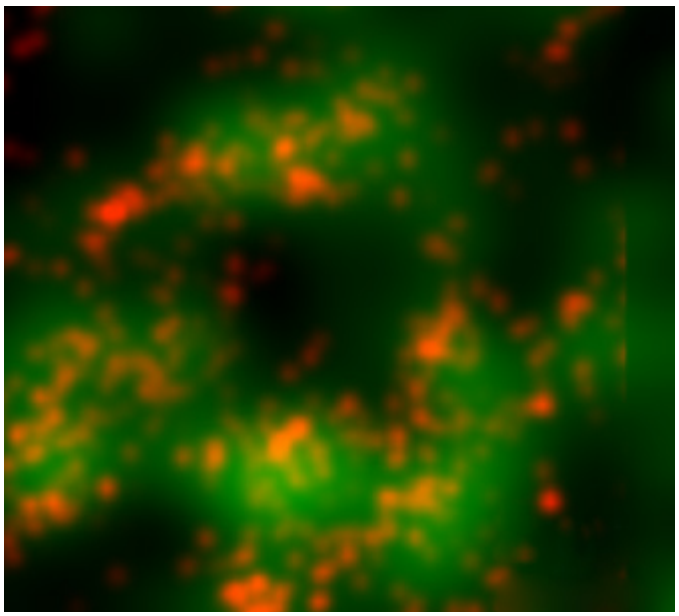
With Elyra PS.1 you benefit from the synergy of two powerful superresolution techniques. Determine the distribution of proteins within a structural context or get quantitative data by counting single molecules.
Add Airyscan to combine three powerful superresolution techniques on one platform. You will have the advantages of true optical sectioning and now you can even image samples in superresolution which are too thick or dense to be analyzed with PALM or SIM.

Configured to Your Requirements

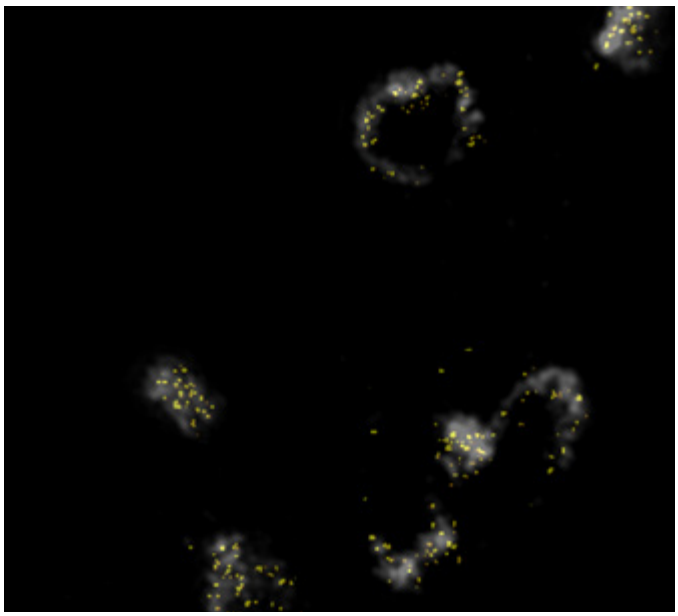
Microscopes
Inverted: Axio Observer 7

Excitation Options
Laser lines 405 nm (50 mW), 488 nm (100 or 200 mW), 561 nm (100 or 200 mW), and 642 nm (150 mW);
laser module shared between PALM and SR-SIM;
HXP 120 for widefield excitation

Accessories
Laser-safe incubation solutions, customized filter configurations



8C nucleus of Arabidopsis *leaf cell stained with Alexa 647 for active non-phosphorylated RNA polymerase II (Pol II). The SIM image (in green) reveals a reticulate structure of Pol II within the Chromatin. The PALM image (in red) demonstrates clustering of the molecule. Courtesy of V. Schubert, IPK Gatersleben, Germany*



8C interphase nucleus of Arabidopsis *stained for centromeric repeats by FISH using Alexa 488. Imaging by SIM (white) gives the distribution of the repeats, whereas counting by PALM (yellow) reveals their abundance. Veit Schubert, IPK Gatersleben, Germany*

Simpler. More intelligent. More integrated.

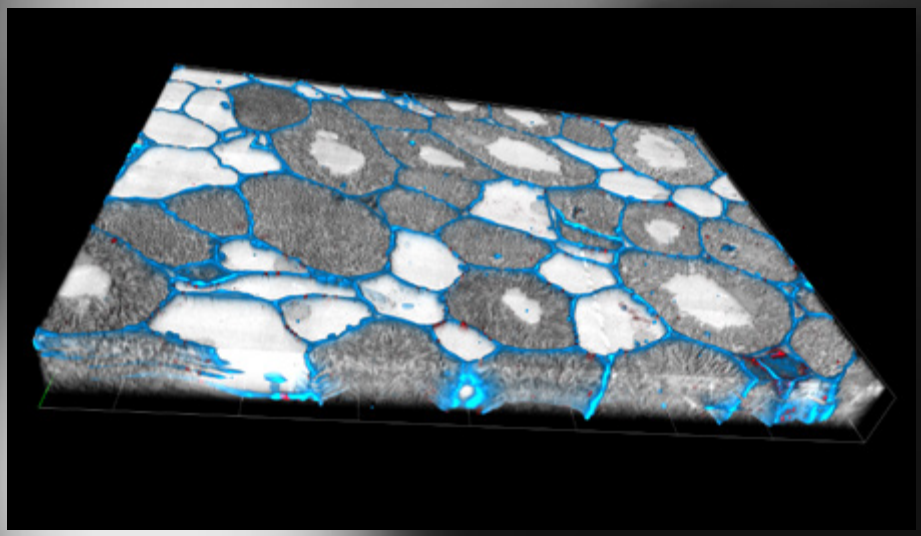
- Choose the superresolution technique that best answers your question.
- Combine the power of two of the best superresolution techniques for optimum information gain.
- Combine Elyra PS.1 with LSM 880 and Airyscan to join the worlds of widefield and confocal superresolution techniques.

Created for Your Applications

- Analyze the distribition of molecules within a structural context.
- Reveal the precise location of single molecules on cellular structures.
- Analyze a substructure within an object and observe finest details.
- Map the contribution of different classes of proteins to the make-up of an organelle.

Correlative Microscopy

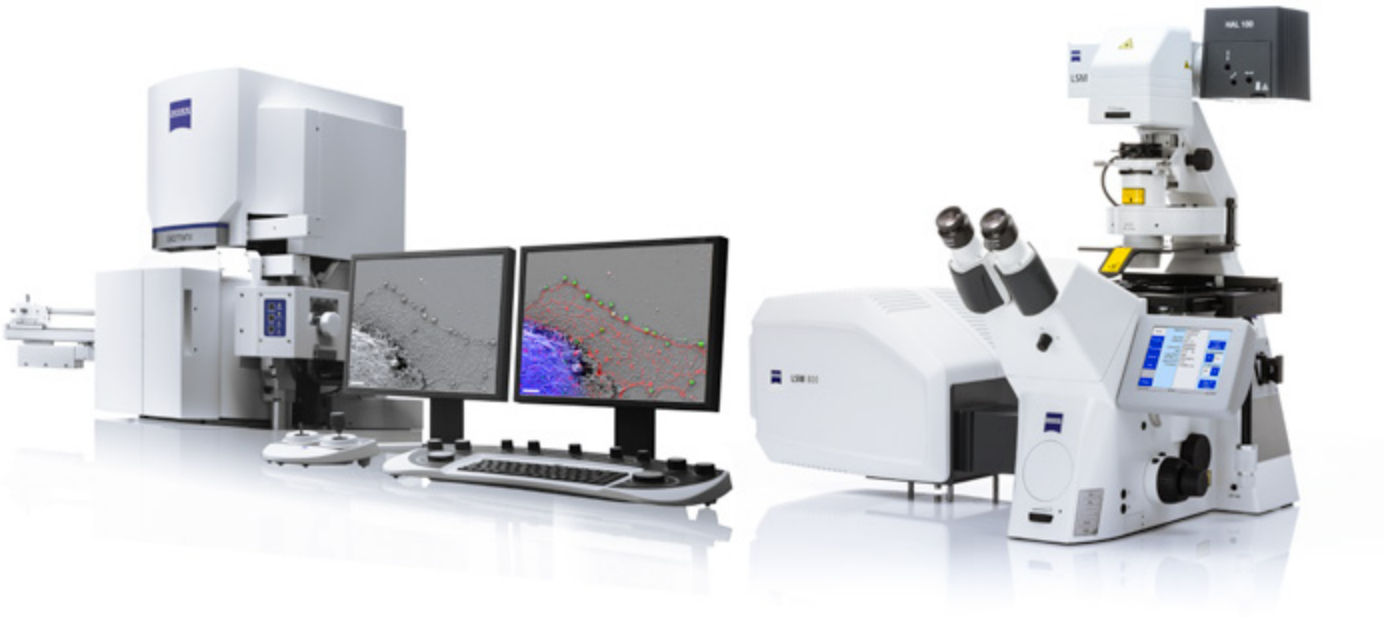
Combine Structural and Functional Information from Your Biological Samples




ZEISS

ZEISS Shuttle & Find: Combine Functional and Structural Information

Your Technology: Correlative Microscopy



All you need is a sample such as fluorescent-labeled cells, ultrathin sections or whole blocks of tissue.

Complement images of fluorescent-labeled cellular components acquired in a light microscope with ultrastructural information from your electron microscope.

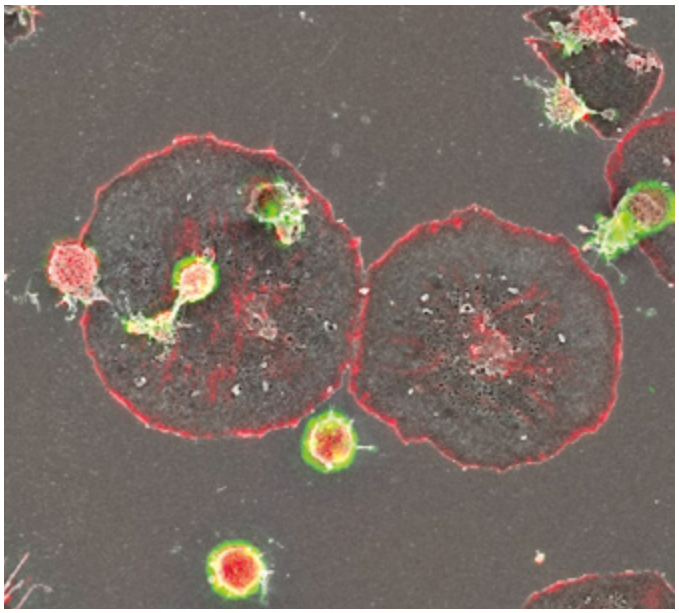
Shuttle & Find, the correlative approach from ZEISS, lets you decide which imaging solutions are best suited to your needs. Using specifically-designed correlative holders or coverslips with dedicated software, it's easy to transfer the sample and correlated your data, making the relocation of selected regions of interests (ROIs) fast and easy.

Configured to Your Requirements

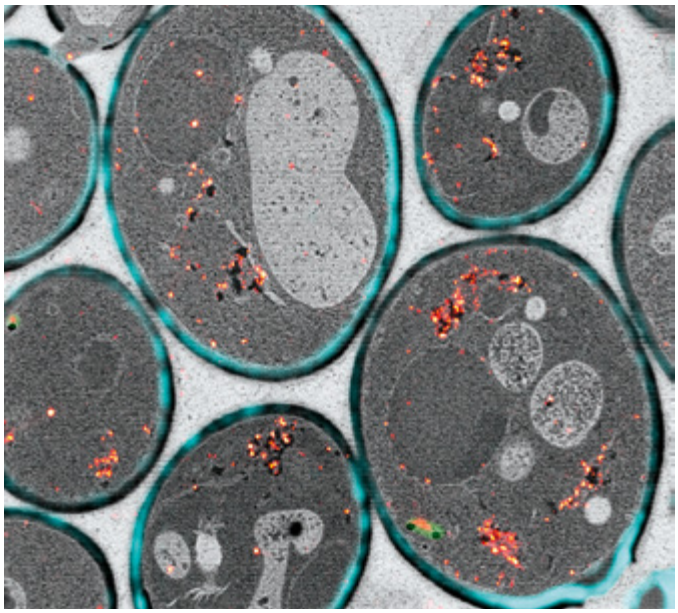
Microscopes
Light microscopes: Stereo, zoom and widefield microscopes with motorized stage, LSM 8 family, Elyra
Electron microscopes: SEM family

Accessories
SEM Adapter
Sample holder for coverslips or TEM grids

Software
Light microscopes: ZEN Shuttle & Find
Electron Microscopes: ZEN Shuttle & Find, SmartSEM



Makrophages feeding on fluorescent beads ranging in size from 5 to 1 µm, cell culture on ITO glass coverslip. Overlay image: LM DIC and fluorescencewith SEM, SE2 image. Courtesy of K. Czymmek and J. Caplan, Delaware Biotechnology Institute, University of Delaware, USA



Correlation of SIM-, dSTORM and SEM images after automated recovery with Shuttle & Find. High pressure freezing, resin embedded, ultrathin sections, ultramicrotome, on ITO cover slips. Courtesy of K. Czymmek, J. Caplan, Delaware Biotechnology Insitute, University of Delaware, USA

Simpler. More intelligent. More integrated.

- Increase productivity with Shuttle & Find. In just a few easy steps you can relocate ROIs within the two microscope systems. The software module stores ROIs marked in the light microscope together with their coordinates and then finds them in seconds in the electron microscope.
- Combine data from your Elyra superresolution system with data from your SEM.
- The modular approach of Shuttle & Find lets you capitalize on the full flexibility of both your light microscope and SEM.

Created for Your Applications

- **Investigate the ultrastructure** of your specimens.
- Extract information from even smallest yeast cells.
- Image **ultrathin sections**.
- Analyze **subcellular structures**.

ZEN Correlative Array Tomography:
3D Correlative Light and Electron Microscopy For Serial Sections

Your Technology: Correlative Microscopy

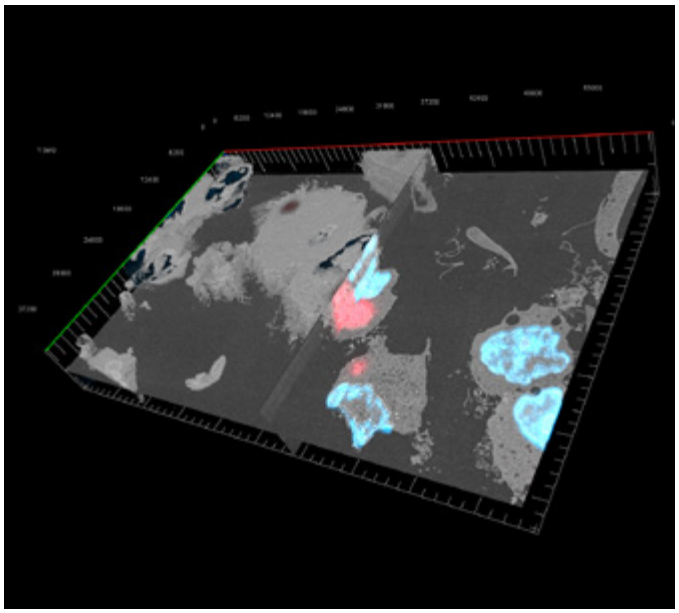
Array Tomography uses serial sections to reconstruct your sample volume. Use an ultramicrotome to cut your resin-embedded tissue samples into consecutive sections and image them. Precise automatic alignment of the secion images allows 3D reconstruction of your sample. The section thickness determines the z-resolution. The unique software module ZEN Correlative Array Tomography enables you to connect your light and electron microscopes. After automated image acquisition in the light microscope, you can transfer the sample to your electron microscope where you find the same software tools. Then you can automatically image hundreds of sections across length scales and combine them into one single correlative volume dataset.

Configured to Your Requirements

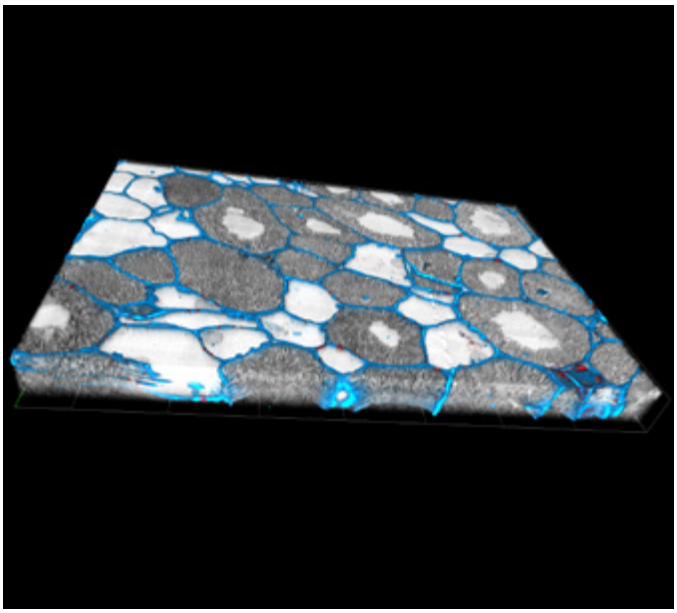
Microscopes
Light Microscopes: Axio Imager.Z2, Axio Observer 7,
Electron Microscopes: GeminiSEM 300/500, Sigma 300/500, Merlin, Merlin Compact, Auriga, Supra, Ultra

Accessories
Specimen holder CorrMic Life Sciences for cover glasses 22 × 22 mm,
SEM Adapter for Specimen holder CorrMic Life Sciences,
ZEISS Cover Glasses with Fiducials

Software
Light microscopes: ZEN (blue edition), ZEN module Correlative Array Tomography, ZEN 3Dxl Viewer – powered by arivis®
Electron Microscopes: SmartSEM, ZEN SEM (Basis software),
ZEN SEM Module Correlative Array Tomography



Correlation of the LM z-stack with the SEM z-stack. The distribution of the huntingtin plaques and the location of the nucleus is clearly visible in 3D.



3D reconstruction of serial sections from root nodules with the distribution of plasmodesmata. Cell wall: blue (Calcofluor white); Plasmodesmata: red (anti-ß-Glucan). Courtesy of D. Sherrier, J. Caplan, and S. Modla, University of Delaware, USA

Simpler. More intelligent. More integrated.

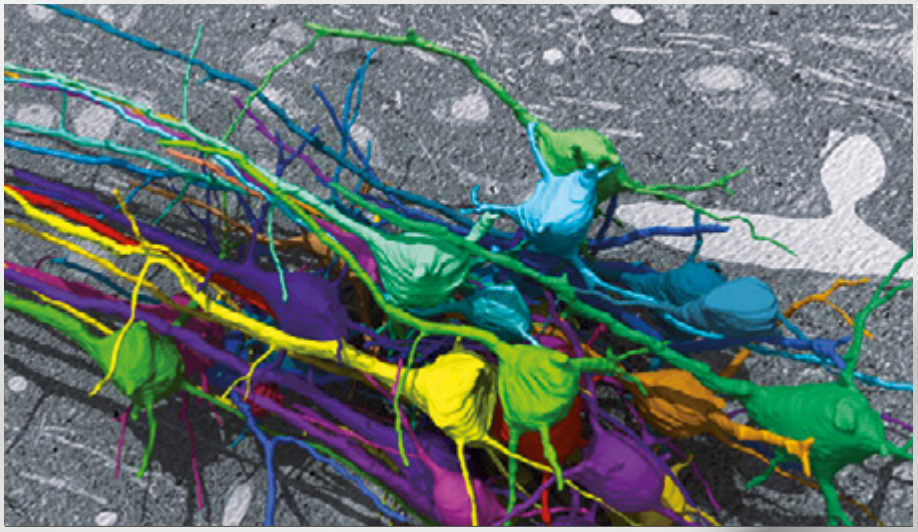
- Perform large-scale 3D correlative microscopy.
- Simply outline one of the sections in your ribbon and ZEN Correlative Array Tomography will detect and mark all other sections automatically.
- Outline the region of interest (ROI) in any of your sections. The software suggests the optimal tiling setup and automatically transfers the ROI to all other sections.

Created for Your Applications

- **Investigate the ultrastructure** of your specimens in 3D.
- Image tens to hundreds of **ultrathin sections**.
- Analyze **subcellular structures in their 3D context**.

Electron Microscopy

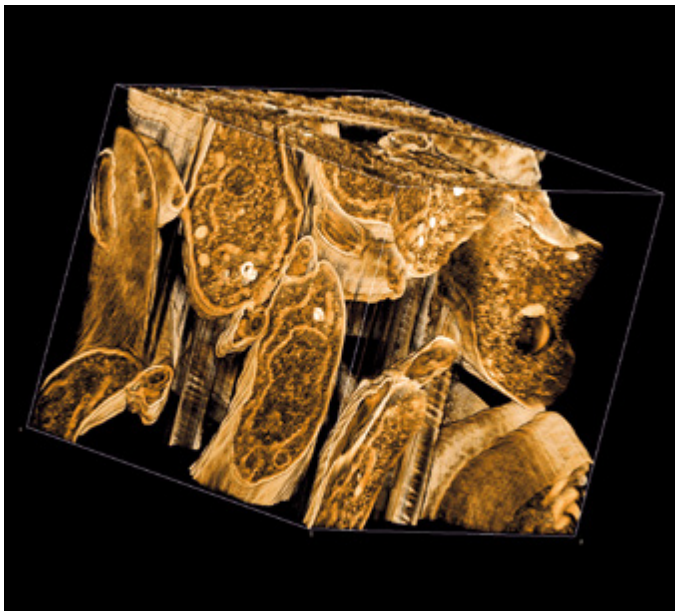
Reconstruct Your Biological Samples in 3D with Nanometer Resolution




Gemini

Electron Microscopy

Electron microscopy is your method of choice for 3D imaging of tissues, cells and molecules at nanometer resolution.
Depending on the application you have several options for acquiring 3D data. You can cut your sample into ultrathin sections and image them individually. Or use Array Tomography for fully automated imaging. Perform block-face imaging with a focused ion beam (FIB-SEM). Or use the integrated ultramicrotome to remove the surface of the sample slice by slice directly in your scanning electron microscope (SEM).

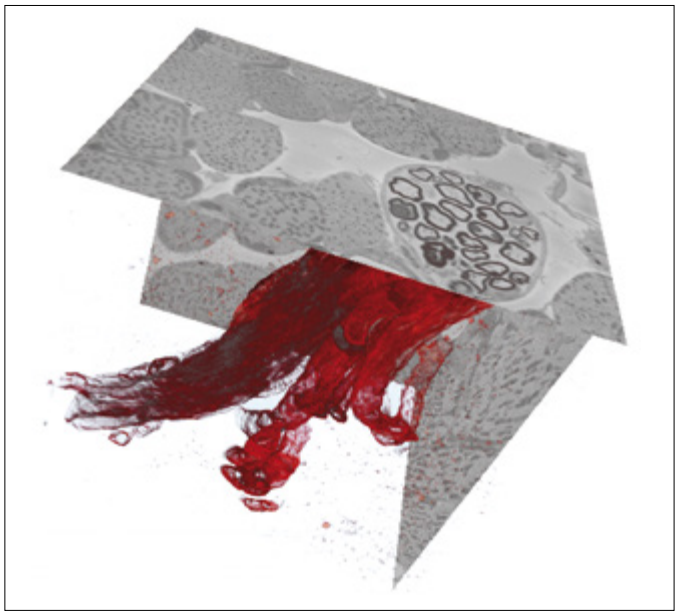


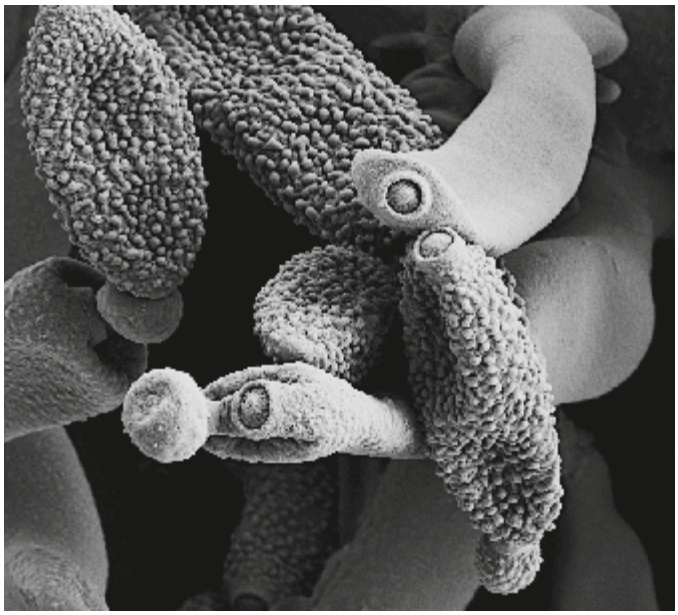
FIB-SEM

Whether you work with resin-embedded or vitrified cryo samples, nanotomography simplifies your life. Use the ion beam to cut into your sample and uncover information lying in the depth.

Just define a cutting region and let the ion beam do the rest. The ion beam removes slices as thin as 5 nm or even less from the surface, giving you full control of your section thickness when acquiring 3D image stacks.

Take advantage of Crossbeam's simultaneous milling and imaging capability. You can correlate results observed in your light microscope by relocating your region of interest and acquiring 3D Crossbeam data at the same location – no additional ultramicrotomy required. In addition, it's easy to access subvolumes identified for further TEM or STEM investigation by preparing thin lamellas.





Ultramicrotome Integrated in the SEM Chamber

For larger samples, take advantage of the speed and ease-of-use of the ultramicrotome inside the chamber of your SEM.
Use it to remove a slice from the surface of your resin-embedded tissue sample. Afterwards an image of the block-face will be acquired automatically using the FE-SEM – at a resolution of just a few nm. This process is then repeated automatically for thousands of sections. The microtome operates without interruption for hours or even days, acquiring volume data of your sample in a fully automated process.

Investigate Near-to-Native Biological Samples

Native morphology can only be observed when you freeze your sample instead of using chemical fixatives. The main objective in cryo electron microscopy is to prepare a biological sample in its hydrated state. Vitrification at liquid nitrogen temperature keeps the ultrastructure fully intact. Thus your sample remains completely hydrated. No additional fixation or embedding is needed.
Plunge freezing and high pressure freezing are well-established methods to fix your biological sample for further investigations in the electron microscope. ZEISS supports all necessary equipment for transferring the sample at cryo conditions into the electron microscope.

ZEISS Crossbeam: Block-Face Imaging for Tissue Samples Using a Focused Ion Beam

Your Technology: Focused Ion Beam Scanning Electron Microscopy

Crossbeam technology provides a complete 3D imaging system for your biological samples. It combines the imaging performance of the renowned GEMINI column with the milling capability of a superior FIB. Designed for high throughput and high resolution, Crossbeam brings you all the benefits of a modular platform with an open software architecture.

Configured to Your Requirements

Electron Microscopes
Crossbeam 550, Crossbeam 540, Crossbeam 340

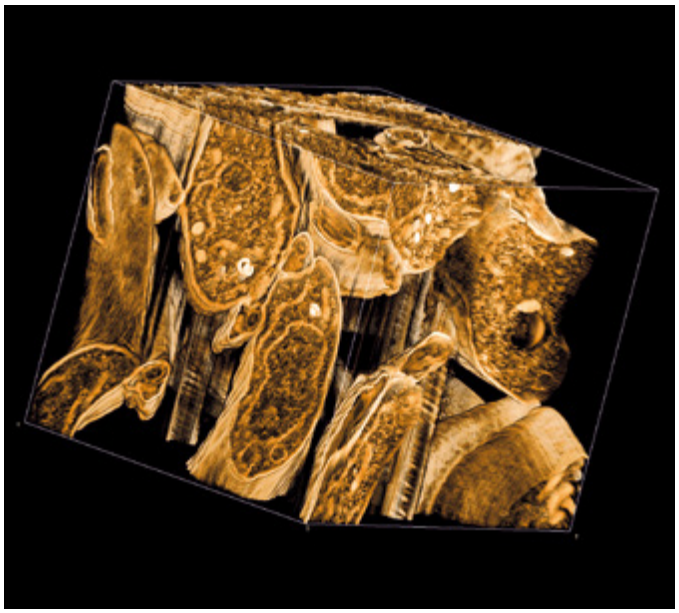
Technology
GEMINI based Field-Emission Scanning Electron Microscopy (FE-SEM)

Detection Possibilities
Various detection modes for secondary electron imaging, secondary ion imaging, analytical imaging, energy selective backscatter imaging

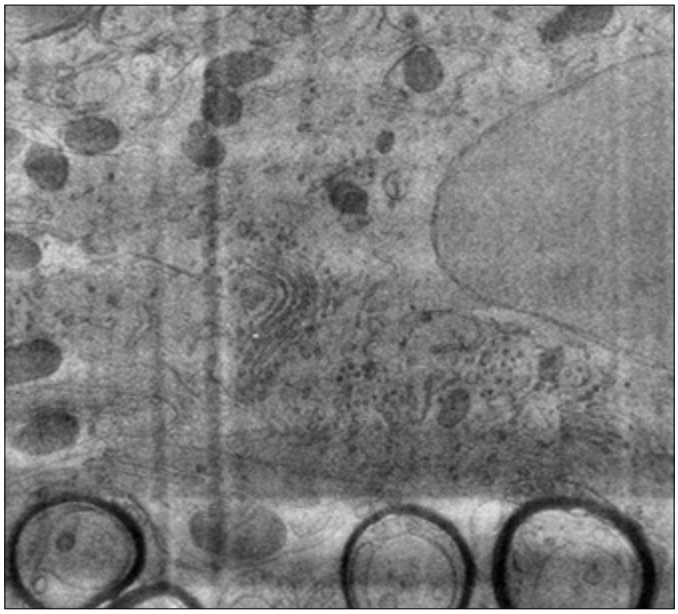
Milling Technology
Capella column for multi-purpose applications and best FIB resolution

Options
Local Charge Compensation for imaging of non-conductive samples, Inlens EsB detector for finest z resolution without topographic artifacts, Airlock for fast and efficient sample transfer, flood gun, variable pressure mode

Software
SmartSEM, Atlas 5



3D nanotomogram generated from ~300 consecutive, 10 nm thick FIB-SEM sections of resin embedded Trypanosoma brucei. *Courtesy of S. Vaughan, Brookes University, Research Group "Cell biology of trypanosomes", Oxford, UK*



Cryo FIB-SEM of a vitrified mouse optic nerve. The image represents a slice out of a 3D volume of 127 consecutive FIB sections covering 7.5 µm × 5.7 µm × 3.8 µm (pixel size 7.5 nm × 7.5 nm with 30 nm slice thickness). Courtesy of W. Möbius, MPI Göttingen, Germany

Simpler. More intelligent. More integrated.

- Its modular platform concept lets you configure the Crossbeam precisely to your applications.
- Image your samples with high resolution and magnetic-field free with the unique GEMINI technology.
- Innovative FIB-technology gives you access to up to five orders of magnitude of beam current, enabling fast and precise material removal and a milling process with best z-resolution.
- Capitalize on live FE-SEM monitoring for perfect control of your entire FIB-processing.
- Use local charge compensation for imaging of non-conductive biological samples.
- Speed up your 3D data acquisition with Atlas 5. Take advantage of flexible definition of regions of interest within a frame of 50 k × 40 k pixel per slice at variable resolutions including 3D drift tracking.

Created for Your Applications

- Get isotropic structural information from your biological sample in 3D with voxel sizes smaller than 5 nm in each direction.
- Speed up your 3D data acquisition by selectively imaging regions.
- Identify the native structure of your biological sample by imaging the specimen in a frozen state under cryo conditions.
- Investigate interfaces in samples with different material hardness for biomedical engineering.

ZEISS Sigma 3View and ZEISS Merlin 3View: Block-Face Imaging for Tissue Samples Using an Ultramicrotome

Your Technology: Field Emission Scanning Electron Microscopy (FE-SEM)

Combine your Merlin or Sigma VP with 3View® technology from Gatan Inc. to acquire high resolution 3D data from resin-embedded cell and tissue samples. You'll get results in the shortest possible time and the most convenient way. 3View® is an ultramicrotome inside the SEM chamber.

The block sample is positioned under the SEM column. After imaging the block face, move the sample up a small step, down to 15 nm. The ultramicrotome knife cuts the top of the sample and retracts, exposing a new block face. You can produce thousands of serial images in a single day – each perfectly aligned because they are all generated from one fixed block.

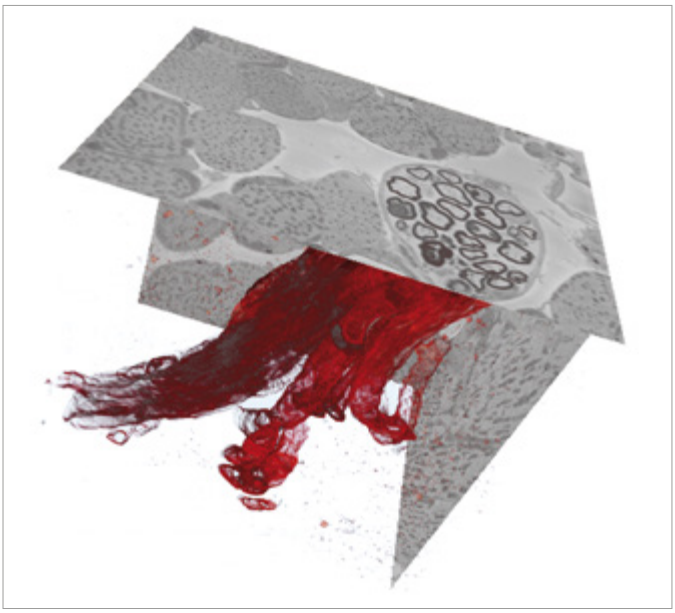
(* further electron microscopes available on request)

Configured to Your Requirements

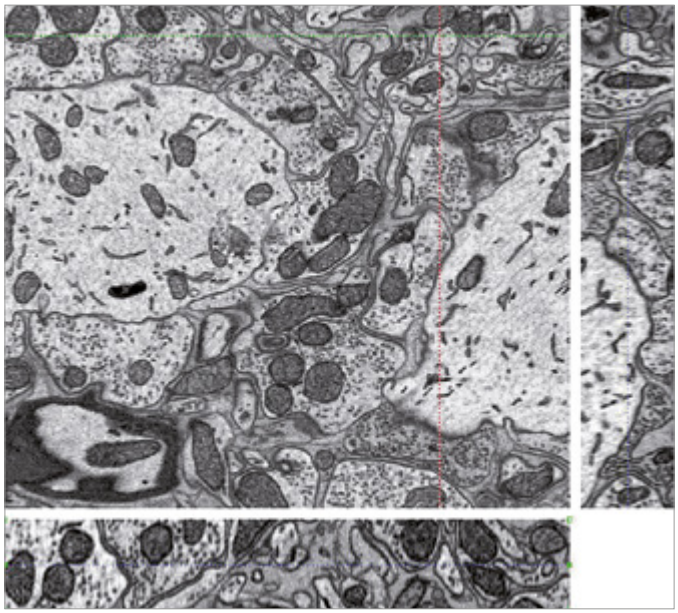
Electron Microscopes
Sigma 300 VP, GeminiSEM 300, Merlin *

Sectioning Technique Hardware
Ultramicrotome 3View® XP:
Cut thickness down to 15 nm, automated image acquisition of the whole 3D data stack, up to 32 k × 24 k image size, Gatan detector for high BSE signal, high vacuum compatible, motorized xy-movement of the 3View® stage, allows two additional imaging modes: Montage: automated volume acquisition of adjacent areas, Multi ROI: imaging of several user defined regions of interest.
Ultramicrotome 3View® (only Sigma VP):
Cut thickness down to 30 nm, automated image acquisition of the whole 3D data stack, up to 32 k × 24 k image size, Gatan detector for high BSE signal.

Software
SmartSEM, Gatan Microscopy Suite®



Mouse extraocular muscle with reconstructed peripheral nerves, 100 × 100 × 100 micrometer 3D dataset with 1,000 slices. Courtesy of P. Munro, University College London, UK



Mouse brain imaged with Sigma 3View, stack of 75 images with 7 nm pixels, microtome set to remove 15 nm/slice. Courtesy of N. Kamasawa, Max Planck Florida Institute, USA and R. Shigemoto, National Institute for Physiological Sciences, Okazaki, Japan

Simpler. More Intelligent. More Integrated.

- Enjoy the advantages of unmatched low voltage performance.
- Operate in high vacuum mode without charging or use the variable pressure (VP) mode for charge neutralization.
- Eliminate unwanted signals from the depth of the sample.
- Avoid stage biasing.
- The large fields of view without distortions (32 k × 24 k) reduce time-consuming stitching of many small images.
- You will never need to compromise in resolution when using high current modes.
- Get your 3D data up to 10 times faster – overnight instead of over the week.

Created for Your Applications

- Get high resolution 3D data of whole cells overnight.
- Investigate the neuronal network and synapses of neurobiological samples.
- Enter the field of brain mapping by imaging huge sample volumes in the shortest possible time.
- Acquire 3D images of your model organisms at different stages of development.

ZEISS Atlas 5 Array Tomography: The Fast and Easy Way to Image Your Serial Sections

Your Technology: Correlative Microscopy

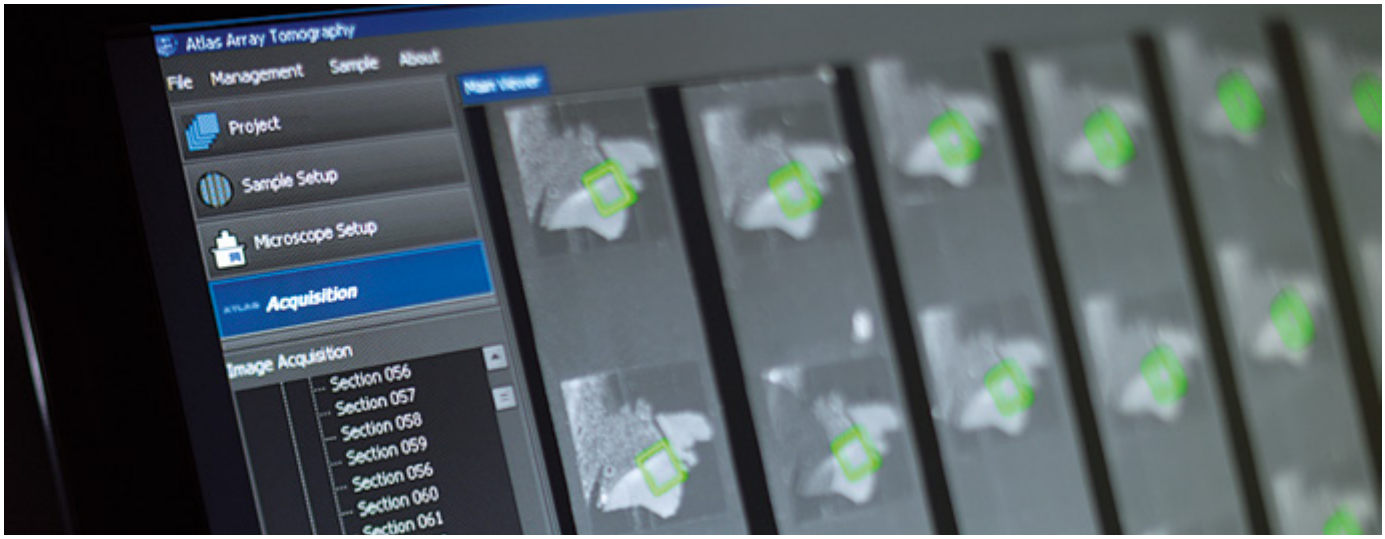


Image large areas and large amounts of serial sections in the shortest possible time – it's fully automated with Atlas 5 Array Tomography.

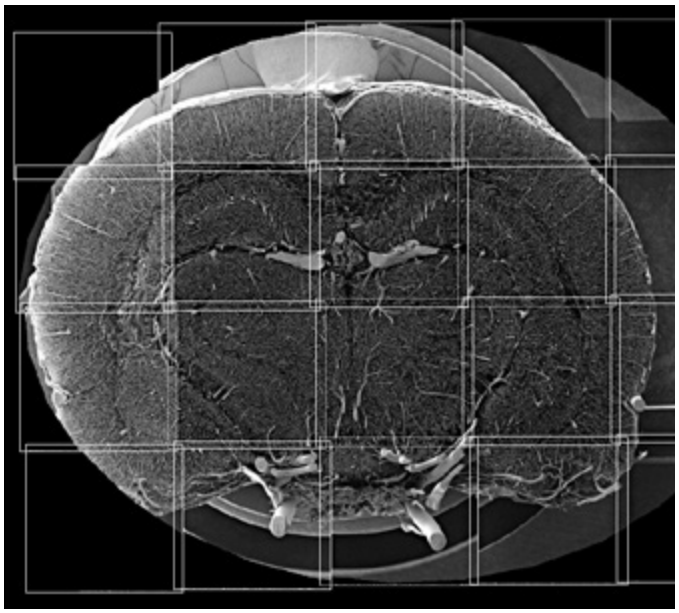
Use its workflow-oriented graphical user interface to determine which areas of the sample you want to image automatically. Define unlimited regions of interest with an arbitrary shape and assign different acquisition protocols. Pre-defined protocols help you acquire images easily at optimum conditions – even for different resolutions and sample types. Use Atlas 5 Array Tomography's viewer to zoom seamlessly through your image data – from nanometers to centimeters – always at the most appropriate resolution. And it's just as easy to import and align images from other sources, such as light optical images.

Configured to Your Requirements

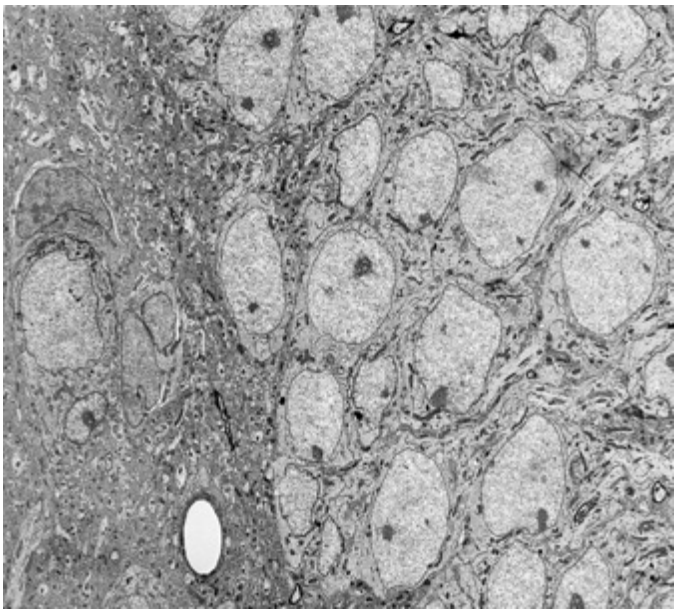
Electron Microscopes
Atlas 5 Array Tomography is available for all ZEISS SEMs.
Recommended systems:
Sigma 300/500, GeminiSEM 300/500, Merlin,
Crossbeam 340/540/550

Hardware
Stand alone scan generator and image acquisiton module,
PC, Monitor

Software
Atlas 5 Array Tomography
SmartSEM



Large scale mosaic of a thick section of a rat brain, prepared with corrosion cast technique to reveal the blood vessels and their enveloping endothelium.



Detail of large area image of a mosaic of ultrathin sectioned mouse brain on wafer, acquired with Atlas 5 Array Tomography.

Simpler. More Intelligent. More Integrated.

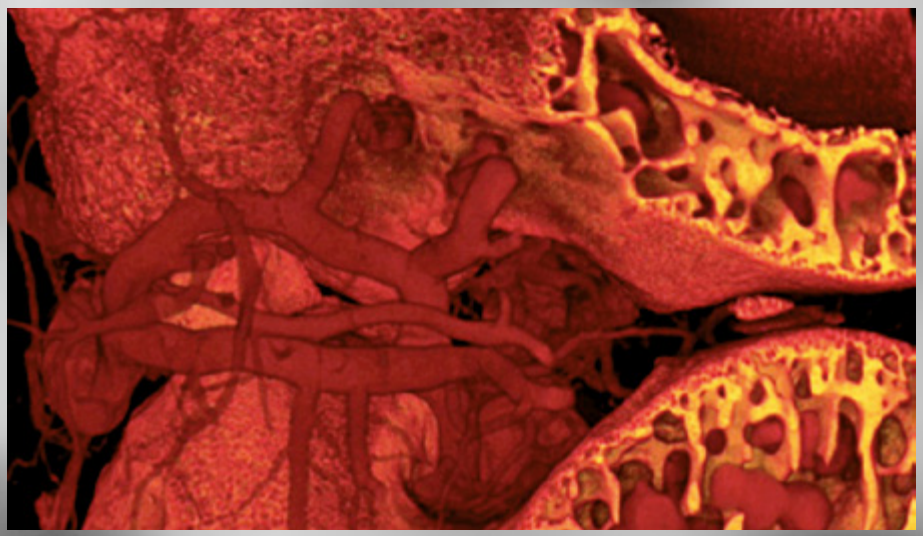
- Define regions of interest over hundreds of serial sections with different protocols – computer-assisted.
- Choose from the whole range of detectors including STEM and BSE detectors.
- Acquire highly automated serial section images with automated stage motion, focus, stigmation, brightness and contrast adjustment.
- Image resolutions up to 32 k × 32 k pixels for the largest fields of view with high resolution – even at the edges.
- Use high imaging speed down to 25 ns dwell time per pixel.
- The integrated Atlas 5 Array Tomography viewer lets you handle gigapixel images and terapixel datasets efficiently with seamless navigation and tools to align mosaics and correct image aberrations.

Created for Your Applications

- Use standard sample preparation techniques to section your sample onto grids, ITO-coated cover glasses or wafers.
- Histology: Investigate the 3D ultrastructure of tissue sample in different imaging modalities. You can preserve your sample and re-image selected regions at any time.
- Develop protocols to manage ideal imaging conditions efficiently across resolutions and sample types. Ensure reproducibility and the best possible images from your sample.
- Use light microscope images to guide navigation on your sample, then choose the most interesting regions for electron microscopy imaging. Overlay LM and EM data directly in Atlas 5 Array Tomography.

X-ray Microscopy

Visualize Your Biological Specimens in Their Native State in 3D




100
skin
100
multi

X-ray Microscopy

ZEISS Xradia Versa: Unparalleled Resolution and Contrast

Your Technology: X-ray Microscopy

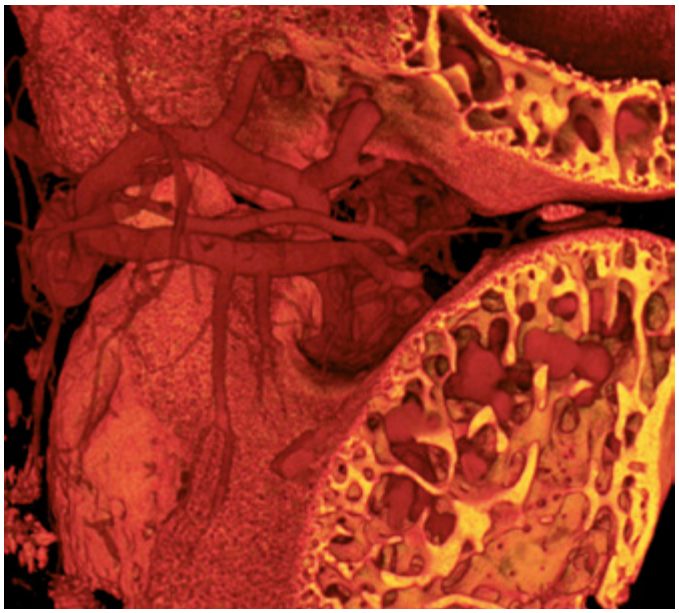
X-ray microscopy (XRM) lets you carry out vital analysis of hierarchical structures using non-destructive multi-length scale or multimodal imaging of your sample. Examine internal structures at true submicron-to-nanometer spatial resolution. You will achieve high contrast in soft tissues and cells – often without requiring samples to be stained. Explore new applications using a technology that is unique in the field of life sciences. 3D X-ray microscopes let you create a contextual 3D map to guide FIB-SEM and ultramicrotome-based SEM techniques with great efficiency. Indeed, the emerging 3D EM techniques will gain a significant boost in efficiency by imaging only the regions of interest.

Configured to Your Requirements

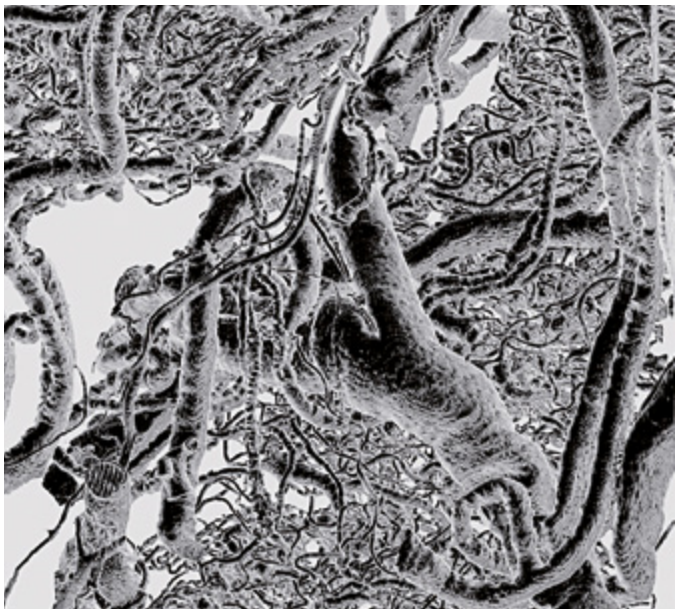
Microscopes
Xradia 520 Versa, Xradia 510 Versa, Xradia 410 Versa

Technique
X-ray microscopy

Advanced Features
Dual Scan Contrast Visualizer to image a sample at two different X-ray spectra or in two different states, Automated Filter Changer (AFC), *In situ* Interface Kit to image materials under variable environments with controlled conditions



Vasculature of intact mouse knee visible at high resolution at large working distance



Overall structure mapped at 50 µm, reduced to 0.5 µm to view surface of 20 µm vessels

Simpler. More intelligent. More integrated.

- Profit from a spatial resolution of up to 700 nm.
- With its powerful correlative capability, X-ray microscopy bridges light and electron microscopy.
- Image stained and unstained tissue using both absorption and phase contrast.
- Avoid tedious physical cross-sectioning and the risk of introducing artifacts or destroying information.
- Image samples under real world conditions, such as under tensile loading or in hydrated environments.
- Maintain highest resolution 3D X-ray imaging at large working distances for a wide range of sample sizes and shapes.

Created for Your Applications

- In osteoporosis research, see **variations in bone structure** at the same scale as individual cells. Understand how those cells decide where to remove bone.
- Study structural changes in **environmental models**, including fish, insects, and fossils, to understand the **impact of toxins** in the environment and to help identify and confirm bioremediation responses.
- Demonstrate the effectiveness of **bio-scaffolding** materials and the ability for tissue to attach to **implants**.
- Investigate the **impact of pharmaceutical** solutions on cells and even dentin.
- Correlate functional information to ultrastructure information **non-destructively**.


Carl Zeiss
1
DAPI
2
GFP

Light Microscopy Combi Systems: Individual Solutions for Challenging Research

Combining different optical sectioning and imaging techniques offers you a unique route to gaining more information from your sample. The modular concept and the broad range of techniques available within the portfolio make ZEISS a perfect choice for finding the solution for your individual experimental design. To safeguard your investment, many optical sectioning technologies are also available as upgrades.

ZEISS Elyra PS.1
SR-SIM and PALM are complementary superresolution techniques with different pre-requirements for sample preparation. Combining them offers you the ability to overlay the results of both imaging techniques to get a deeper understanding of your sample.

ZEISS LSM 8 Family with Airyscan and Elyra:
This combination offers maximum flexibility in terms of resolution and 3D acquisition. Select the imaging technique required for your experiment without technical limitation. This is the perfect instrument for a multi-user facility.
See page 36 for further information.

ZEISS Cell Observer SD and ZEISS DirectFRAP:
Full flexibility in live cell imaging with photomanipulation is available from the fast wide-field laser sectioning systems on our powerful Axio Observer microscope.

Correlated Light and Electron Microscopy:
The optional Shuttle & Find module for correlative microscopy make it easy for you to mark an of interest in a light microscope and relocate it under a scanning electron micro-scope, unlocking their full analytical power and highest resolution for your samples.
See page 40 for further information.

Compare Light Microscopy Techniques to Advance Your Research

Optical sectioning systems in light microscopy are flexible by definition, designed to handle a wide range of sample types. Yet their capacity for a particular application does not lend itself easily to direct comparison in tables. It's impossible to say, for example, that the resolution of a multiphoton image will always be three times higher than that of an Apotome.2 image. You might be able to compare images of a clear sample, but not one from a dense, highly scattering tissue: a multiphoton system will be capturing images at a depth that is scarcely possible with Apotome.2. Thus tables can suggest how various microscopes perform, but conditions differ from sample to sample and so will the relative performance. The table on this page shows the relative performance of the light microscopy technique from a technical perspective, highlighting the performance that the system is designed for. The scale is not linear so two points will be better than one, but not necessarily twice as good. Scores are comparable within the same row.

Relative Performances of the Techniques

	DCV	Structured Illumination	LSM		Airyscanning	Light Sheet Illumination	Superreso-lution PALM	Superreso-lution SIM	Spinning Disk
ZEISS System	Cell Observer with DCV	Apotome.2	LSM 800	LSM 880		Lightsheet Z.1	Elyra P.1	Elyra S.1	Cell Observer SD
Performance for									
Out-of-focus discrimination	●●●	●●●	●●●●	●●●●	●●●●●	●●●	●●●●●●	●●●	●●
Simultaneous multichannel acquisition	●●	●●	●●●●●	●●●●●●	●●	●●	●	●●	●●
Depth penetration	●	●●	●●●●●	●●●●●●	●●●●●	●●●●●		●	●●
Thin samples – lateral resolution	●●●●●	●●●●●	●●●●	●●●●	●●●●●	●	●●●●●●	●●●●●	●●●
Thin samples – axial resolution	●●●●●	●●●●	●●●●	●●●●	●●●●●	●	●●●●●●	●●●●●●	●●●
Thick samples – lateral resolution	●●●	●●●	●●●●●	●●●●●	●●●●●●	●●●●		●●●	●●●
Thick samples – axial resolution	●	●●●	●●●●●	●●●●●	●●●●●●	●●●●●		●●●	●●●
Acquisition speed	●●●●●●	●●	●●●	●●●	●●●●	●●●●●●	●	●●	●●●●●
Simple operation	●●●●	●●●●	●●●●	●●●	●●●	●●●	●	●●	●●●

● Suitable

●●●●●● Particularly suitable

Expect This Level of Performance for Typical Experiments

This table shows which light microscope systems are suitable for your experiments, but the relative scores can vary, depending on conditions. Think of them as guidelines. Your regional ZEISS representative is ready to work with you to determine which systems will deliver the best all-round performance for your specific samples, applications and area of research.

Experiments Compared

	DCV	Structured Illumination	LSM		Airyscanning	Light Sheet Illumination	Superreso-lution PALM	Superreso-lution SIM	Spinning Disk
ZEISS system	Cell Observer with DCV	Apotome.2	LSM 800	LSM 880		Lightsheet Z.1	Elyra P.1	Elyra S.1	Cell Observer SD
Performance for									
High-speed time-lapse for vesicle tracking	●●●●●		●●	●●	●●●●●	●●			●●●●●●
Colocalization studies in 30 µm tissue sections	●●●	●●●●	●●●●●	●●●●●	●●●●●●	●●●		●●●	●●●●
4D imaging of mitotic spindle division	●●●●●●	●●	●●●	●●●	●●●●●●	●●●●●		●●	●●●●●
Structural imaging of Zebrafish or *Drosophila*	●	●●●	●●●●	●●●●	●●●●	●●●●●●		●	●●●
Simultaneous FRET imaging	●		●●●	●●●●●		●		●	●●●●
Very high-speed ion imaging, e.g., calcium imaging	●		●●	●●●	●●●●	●●●●●			●●●●●●
Spectral flexibility and removal of auto-fluorescence	●	●	●●●●	●●●●●●	●	●	●	●	●
Neuronal imaging in deep live brain tissue			●●●	●●●	●●●●				●
Photoactivation and/or bleaching, e.g., FRAP			●●●	●●●●●●	●●●				●●●
Ultrastructural analysis	●	●●	●●●	●●●	●●●●	●	●●●●●●	●●●●	●
Cleared tissue imaging		●●	●●●	●●●●	●●●●	●●●●●●			●●

● Suitable

●●●●●● Particularly suitable

Technical Specifications

This table shows your numerous options for excitation, detection and photomanipulation of your fluorescent samples with the respective light microscope system for optical sectioning.

	DCV	Structured Illumination	CLSM		Airyscanning
	Cell Observer	Apotome.2	LSM 800	LSM 880	
Detector type					
Camera, e.g., Axiocam MRm, HS, EMCCD and sCMOS	●	●			
Photomultiplier tubes (PMT)			●	●	●
Non-descanned detector (NDD)				●	
Number of detection channels	1–2	1–2	2–3	3–36	1
Excitation source					
VIS laser			●	●	●
Widefield sources, e.g., HBO, Colibri	●	●			
Femtosecond pulsed IR laser				●	●
Spectral detection					
Sequential spectral imaging	●	●	●	●	●
Sequential spectral detection and unmixing			●	●	● (*)
Simultaneous spectral detection and unmixing				●	
Photomanipulation					
Sequential arbitrary regions of interest (ROI) with scanners			●	●	●
Optional simultaneous photomanipulation of whole ROI with DirectFRAP					

(* LSM 800 only)

	Light Sheet Illumination	Superreso-lution PALM	Superreso-lution SIM	Spinning Disk
	Lightsheet Z.1	Elyra P.1	Elyra S.1	Cell Observer SD
Detector type				
Camera, e.g., Axiocam MRm, HS, EMCCD and sCMOS	●	●	●	●
Photomultiplier tubes (PMT)				
Non-descanned detector (NDD)				
Number of detection channels	1–2	1–2	1–2	1–2
Excitation source				
VIS laser	●	●	●	●
Widefield sources, e.g., HBO, Colibri				
Femtosecond pulsed IR laser				
Spectral detection				
Sequential spectral imaging	●		●	●
Sequential spectral detection and unmixing				
Simultaneous spectral detection and unmixing				
Photomanipulation				
Sequential arbitrary regions of interest (ROI) with scanners				
Optional simultaneous photomanipulation of whole ROI with DirectFRAP				●

Service and Support for Your ZEISS Microscope System

ZEISS Moments are about passion. The same passion that drives us to support and accompany you and your ZEISS microscope over its life cycle makes sure that your work will lead systematically to success.

You Work Hard: We Make Sure Your Microscope Keeps Pace with You.
High imaging quality, reliable results and instrument availability are the parameters of your day-to-day working life. Your ZEISS microscope integrates seamlessly into this demanding workflow. It provides you with insights and results that you can trust: thorough, comprehensive and reproducible. With ZEISS Life Cycle Management we help you to keep your microscope in optimum condition to get these optimum results.

Life Cycle Management Comes with Your Microscope
Life Cycle Management from ZEISS backs up our solutions throughout the working life of your ZEISS microscope system. From the procurement phase onward, you can count on our support, starting with site surveys to optimize the location for your microscope system. Throughout the operational phase we will complement our service with support for relocations and upgrade opportunities that enhance or expand your possibilities. As soon as you think about replacing your long-serving microscope with a new one, we will take care of the disassembly and disposal of systems that are no longer needed. Rely on our service features: our employees analyse the status of your system and solve problems via remote maintenance or directly at your location.

From Expert to Expert
Never hesitate to ask our application specialists to support your specific tasks. And be sure to tap into our training sessions for any colleagues or employees who will be working with your ZEISS microscope.

Peace of Mind and Availability with Regular Maintenance
Your service plan is tailor-made for you. Make sure you take advantage of all the opportunities your ZEISS microscope system offers. Get optimized performance, instrument reliability and availability at predictable costs. Choose from different service levels of our Protect Service Plans, ranging from Protect preventive, via Protect advanced, to Protect premium. We look forward to discussing your ideal service plan personally.


// INSIGHT
MADE BY ZEISS

The moment you see something that has been hidden from you until now. **This is the moment we work for.**

How will doctors treat their patients in the future? How far can we go with the miniaturization of semiconductor structures? What role will photographs and videos play in the way we communicate in years to come? These and many other questions are what drive us every day at ZEISS. Only those who ask will find the answers.

As pioneers in the industry and one of today's worldwide leaders in the field of optics and optoelectronics, we have always pushed the limits of the imagination at ZEISS.

The questions for medicine in the future are already being worked on by our people – with boldness, passion, and innovation. From this impetus will come medical instruments that optimize the success of treatments and laboratory devices that will underpin medical advances.

The many challenges that industry faces also motivate us to continue setting new standards in technology. As we do, quality in all components is being safeguarded by ZEISS. Just as it will be in the smaller, higher-performance and low-priced microchip of the future.

ZEISS researchers and developers are working with equal determination to realize their quality standards for moving and fixed images. Whether in the largest planetarium in the world or in the smallest smartphone that has ever been built, it's going to happen and you will see it. This passion for topmost performance links all business areas at ZEISS. That's how we create advantages for our customers and inspire the world to look for things that have been hidden until now.

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