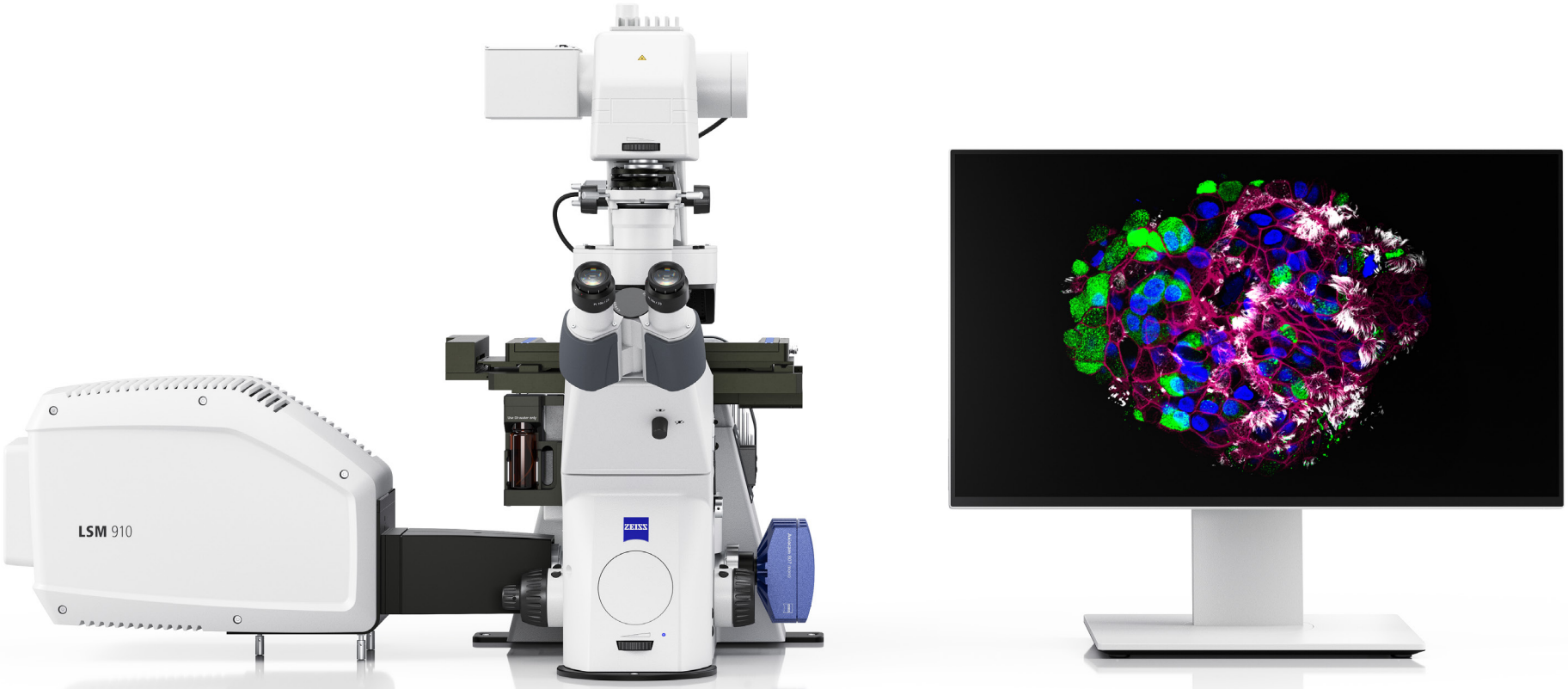
Understanding the fundamentals of life



ZEISS LSM 910

Your Compact Confocal Microscope for Innovative Imaging and Smart Analysis

zeiss.com/lsm-910

Seeing beyond

Understanding the fundamentals of life

Compact confocal microscope for innovative imaging and smart analysis

ZEISS LSM 910 isn't just about seeing; it's about understanding. This is the place where the essence of confocal imaging meets innovation to transform your research.

Perform your multi-color, live imaging experiments with top-tier image quality, thanks to an efficient beam path that offers spectral flexibility with nanometer precision. Integrate conventional confocal with super-resolution and high-speed 4D imaging to gain more structural information, delve into molecular details, or capture dynamic processes at the astonishing speed of 80 volumes per second.

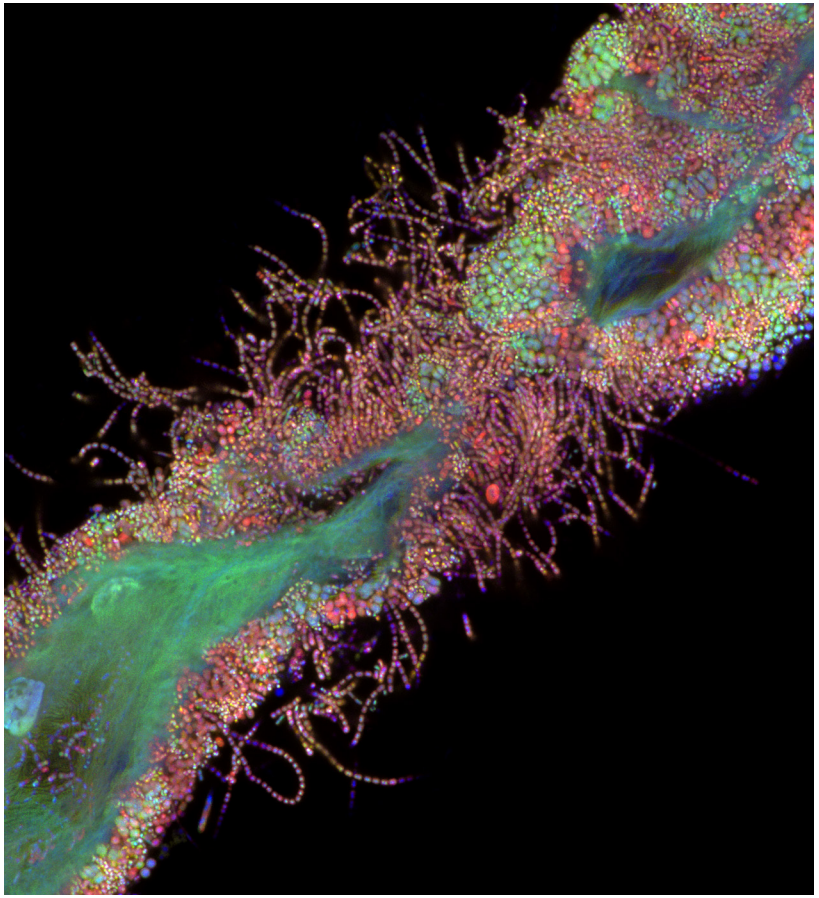
AI-assisted features simplify your experimental setup, ensuring quick, reproducible results. With intuitive helpers along your customized workflows and the Microscopy Copilot always by your side, you're not just conducting experiments; you're on a journey of discovery, where every image leads closer to your next scientific insight.

Focus on the success of your experiments

High-quality confocal imaging by design

To give you exceptional imaging quality and experimental flexibility, the confocal microscope ZEISS LSM 910 combines leading technology with smart design. Its efficient beam path ensures superb spectral flexibility for gentle imaging at the best signal-to-noise ratios.

Choose your desired spectral bandwidth providing nanometer precision to enable customized complex experiments and swift spectral unmixing workflows. Combine conventional confocal microscopy with efficient super-resolution imaging (Airyscan) and high-speed volume acquisition (Lightfield 4D), to focus your imaging efforts in the direction that will yield answers to your scientific questions.



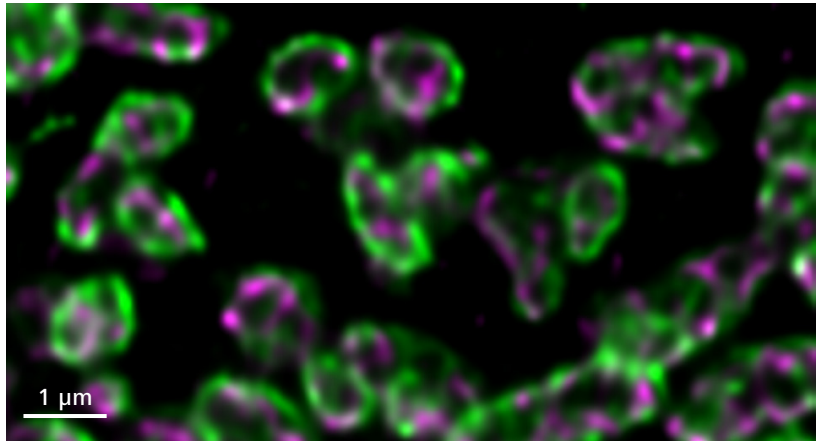
Oral bacteria bound to epithelial cells of the human tongue. Stained with DAPI, acridine orange and calcofluor white. Airyscan acquisition mode with a 63× objective.
Image courtesy of Tagide deCarvalho, University of Maryland, Baltimore County, USA

Focus on innovation

Everything at hand to advance your research

Laser scanning microscopes have long been extremely successful for one reason: they offer reliable confocal imaging and integrate innovative technologies time and time again. You will hardly find a system that combines the essence of confocal imaging with innovative possibilities in a more advantageous way than ZEISS LSM 910. Various imaging modes let you integrate information from molecules to large volumes within a single experimental session.

For example, Airyscan gathers more light and spatial information than conventional detectors, which can be utilized for gentle super-resolution, improved productivity, or even the measurement of molecular dynamics. Additionally, add Lightfield 4D to track high-speed dynamics or follow processes over time in large samples with up to 80 volumes per second without any time delay.



Airyscan: Super-resolution imaging of Cos7 cells stained for mitochondrial outer membrane protein Tom20 (Green, Alexa Fluor-488) and mitochondrial inner membrane protein ATP5a (Magenta, Alexa Fluor-647). Courtesy of Zhang Y, University of Science and Technology of China

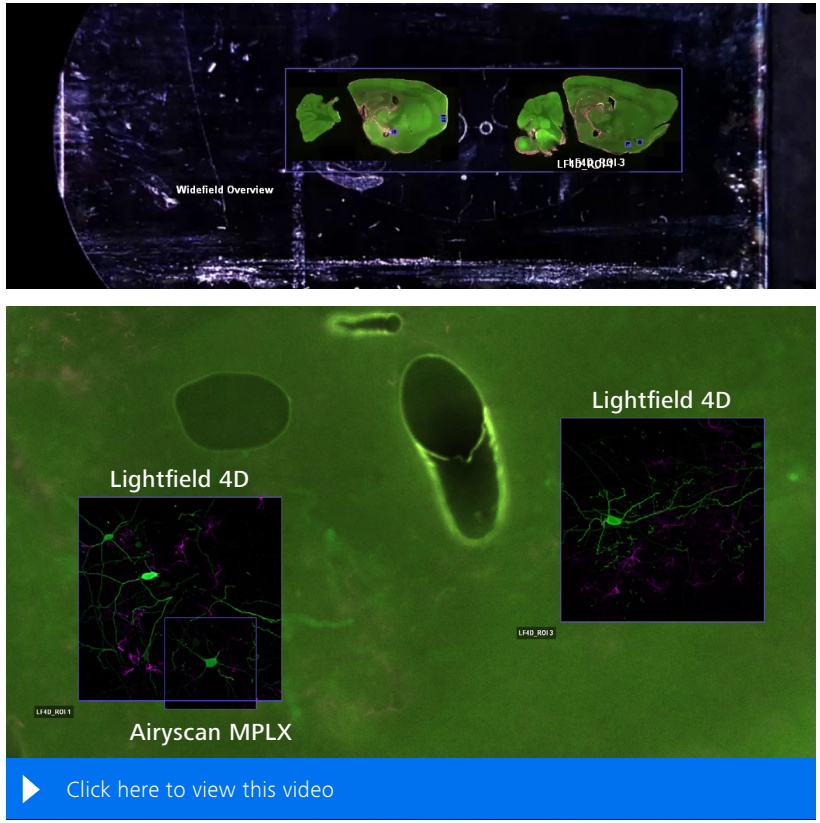
Lightfield 4D: Nuclear tracking in the beating heart of a zebrafish embryo. High-speed volumetric imaging enables zebrafish heartbeat data collection in real time for the first time in 3D. Courtesy of Toby Andrews and Rashmi Priya, The Francis Crick Institute, London, UK.

Focus on usability

A shorter path to relevant findings

Collecting scientifically relevant data requires a perfect interplay of various components. ZEISS LSM 910 comes with many helpers to keep training times short, support purposeful imaging, and gain reproducible results even from complex experiments. Quickly identify your sample holder and promising regions of interest with the support of AI.

Use smart setup features to apply optimal settings across all imaging modalities. Build your own processing pipelines and keep on top of all experimental elements, both during imaging and later when sharing the whole story with collaborators. Processing, analysis, and visualization options are all easily accessible with a few clicks. With the Microscopy Copilot at your side, interactively discover new possibilities to continuously evolve your research.



Neurons and astrocyte in thick brain sections. Different imaging modalities and data processing combined in one project using the Connect toolkit: Widefield overview for ROI definition; fast volume acquisition with ZEISS Lightfield 4D; sensitive super-resolution imaging with ZEISS Airyscan in Multiplex mode; Airyscan jDCV processing; 3D visualization with ZEISS arivis Pro. Sample courtesy of Luisa Cortes, Microscopy Imaging Center of Coimbra, CNC, University of Coimbra, Portugal

The ZEISS LSM 910 product family

Confocal innovation designed for scientific progress

More information:

Explore the ZEISS LSM product family

Your ZEISS LSM 910 can be configured in many different ways depending on your imaging requirements, from a pure confocal system to an imaging platform that integrates all available modalities. If you want to utilize specific strengths for your most demanding applications, we recommend choosing one of the following configurations – or combine them to your needs.

LSM 910 Airyscan

Sensitive super-resolution imaging and molecular characterization

LSM 910 Airyscan enables experiments that push the boundaries of gentle super-resolution, high-speed acquisition, and molecular characterization of biological samples. By maximizing signal detection through the utilization of its unique area detector, Airyscan achieves a distinctive blend of sensitivity and enhanced spatial information. As a user-friendly technology that is fully integrated into ZEISS laser scanning microscopes, it offers you ever-evolving possibilities to go beyond traditional confocal imaging.

LSM 910 Lightfield 4D

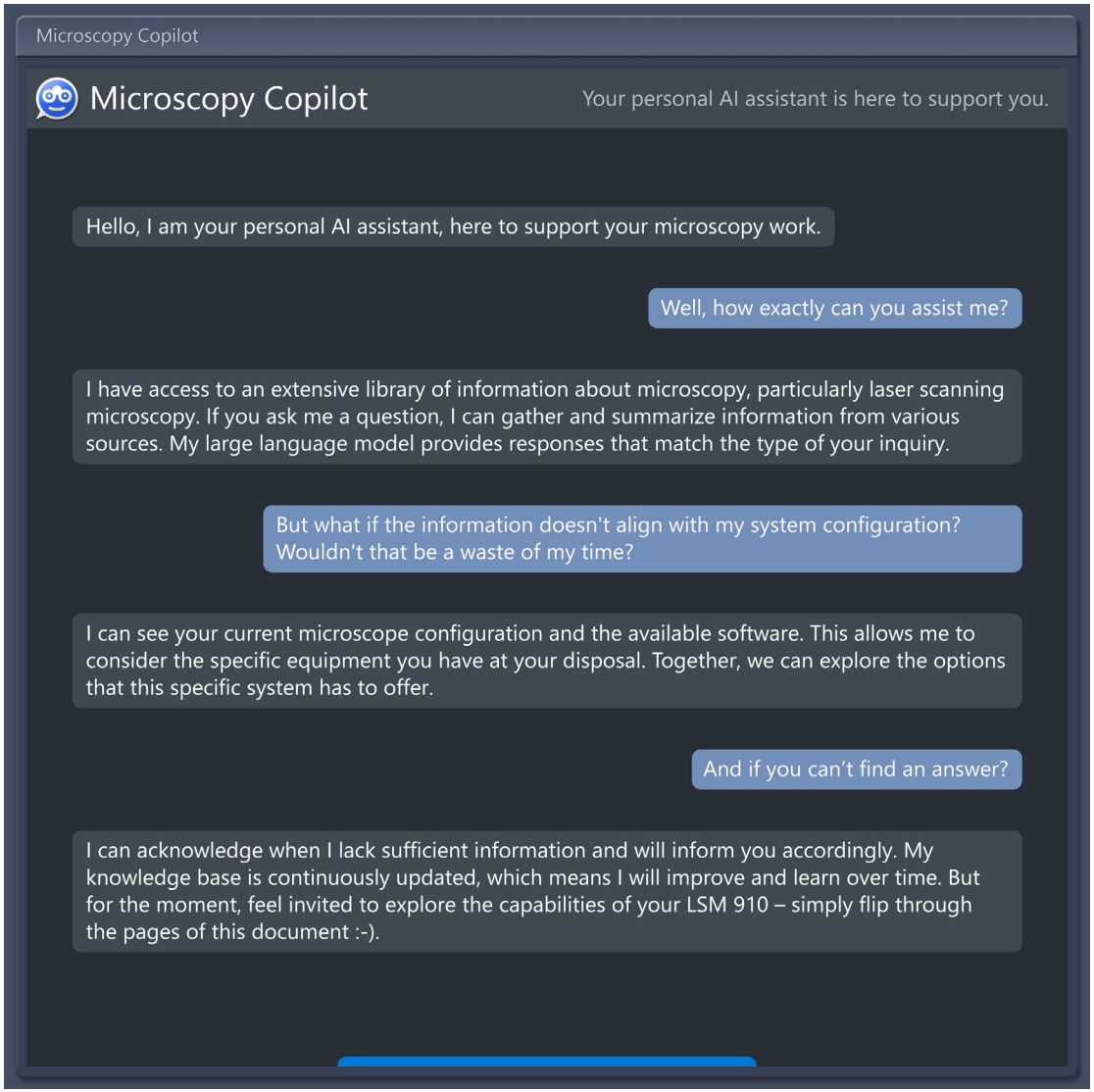
Instant volumetric high-speed imaging of living organisms

Employ light-field microscopy for instant volumetric imaging to study the dynamics of organisms at up to 80 volumes per second – with all spatiotemporal information intact. Acquire thousands of volumes over time without harming your living sample. Capture multiple positions of organisms, organoids or spheroids in a single run. Combine this unique one-snap-one-volume acquisition with any other imaging mode of your ZEISS confocal.

Microscopy Copilot

Interactively discover new approaches for your experiments.

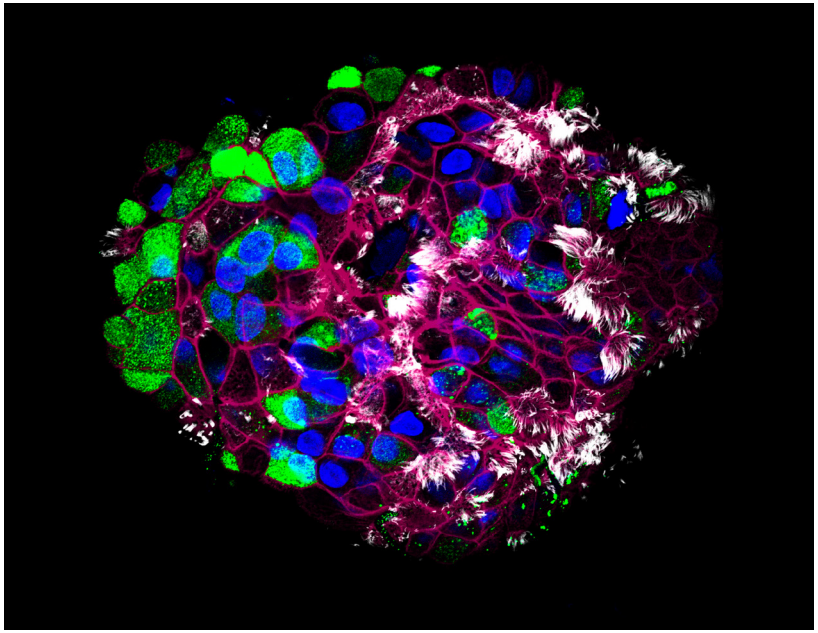
The Microscopy Copilot, your personal AI assistant, helps you to interactively discover new possibilities for your imaging experiments. Ask questions when they are relevant to your current work. Reduce training time by getting new information straight away. Constantly evolve your research and exploit the potential of your specific LSM system configuration.



ZEISS LSM 910 at work

The essence of confocal imaging

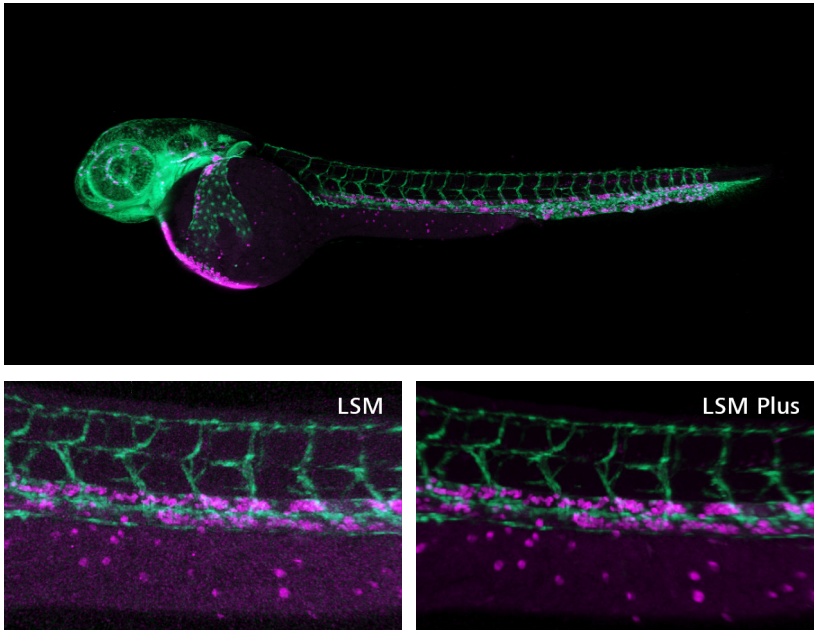
High-resolution optical sectioning of large samples



Human distal lung organoid showing club cells and ciliated cells, everted for 10 days. Courtesy of Prof. C. Kuo, Department of Medicine, Hematology Division, Stanford University, USA.

LSM Plus

Improving the confocal experience

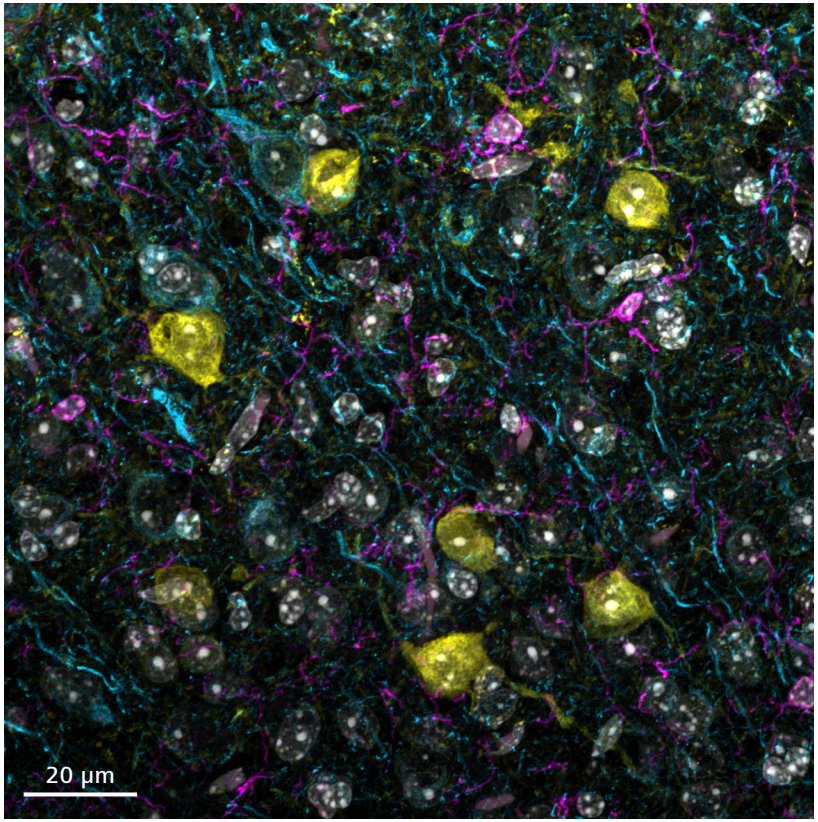


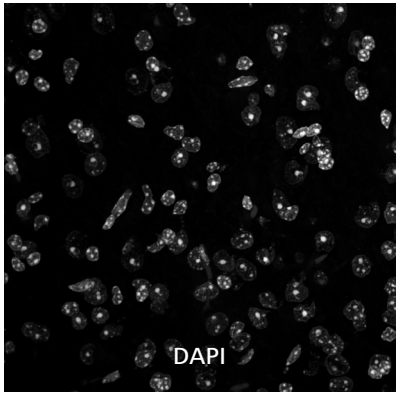
Zebrafish embryo (2 days), visualization of the vasculature (green) and red blood cells (magenta) by transgenic reporter expression. A 300 µm Z-stack with 81 planes over three tiles was imaged with LSM Plus applied. LSM Plus helps to improve signal-to-noise ratio when imaging large volumes to be rendered in 3D. Sample courtesy of B. Schmid, DZNE Munich, Germany

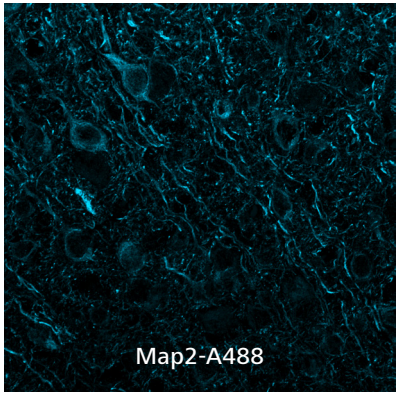
ZEISS LSM 910 at work

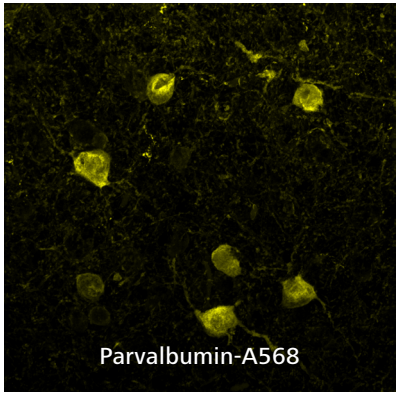
Advanced spectral imaging

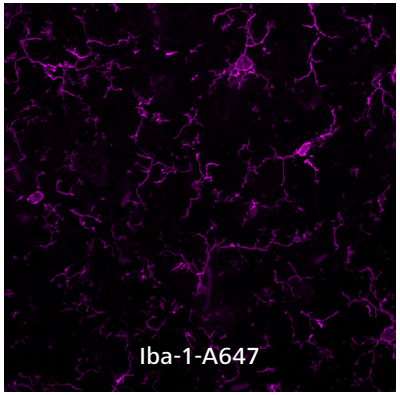
In-depth understanding of spatial biology











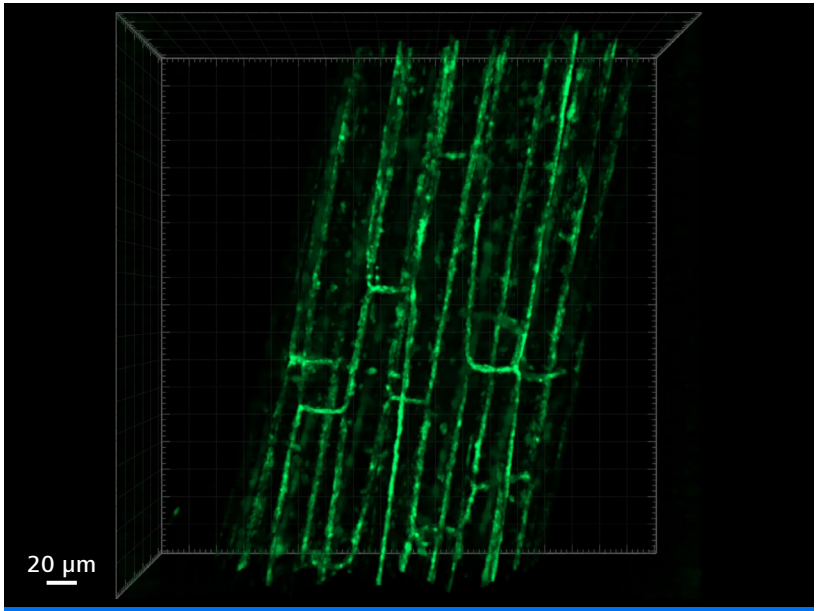
4-color brain slice sample acquired by multi-color scan and processed with LSM Plus. Channels are spectrally separated by Channel Unmixing: DAPI, Map2-A488, Parvalbumin-A568, Iba-1-A647

ZEISS LSM 910 at work

Lightfield 4D

Capturing highly mobile intracellular structures with high-speed volume imaging

Temporal and spatial information about the protein structures in the stem of *Arabidopsis thaliana* enables enhanced understanding of plant light-responsive protein behavior and function.



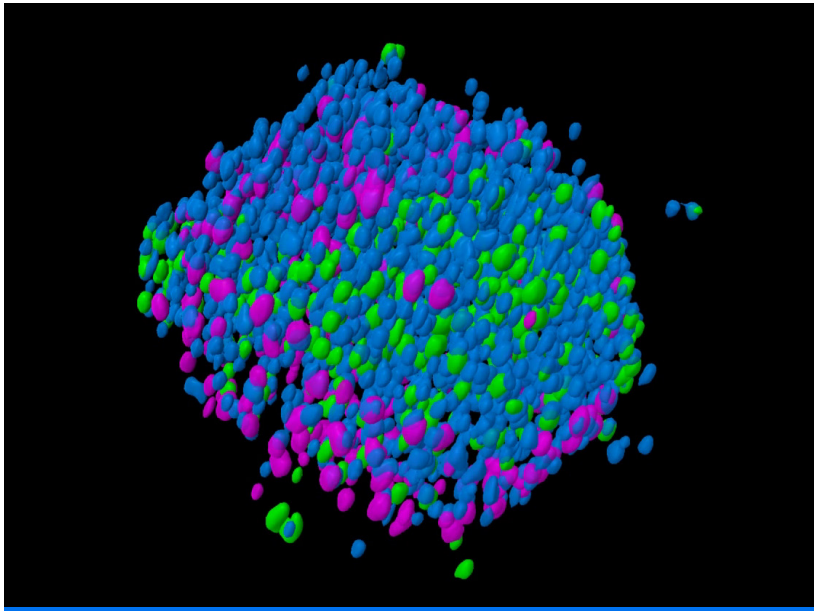
Click here to view this video

Transgenic, 3-day old Arabidopsis thaliana *hypocotyl (stem) tagged with a mobile photoreceptor-regulated protein labelled in GFP. Video shows 5 minutes of 50 ms exposures taken every 200 ms, acquired upon initial blue-light stimulation. Courtesy of Hannah Walters, Cellular Analysis Facility, MVLS-Shared Research Facilities, University of Glasgow. Data acquired at the Cellular Analysis Facility, University of Glasgow, UK.*

Lightfield 4D

Efficient imaging of organoids and spheroids

Fast volume acquisition of cleared spheroids enables 3D screening applications with increased throughput. Cellular resolution is sufficient to count individual cells / nuclei.



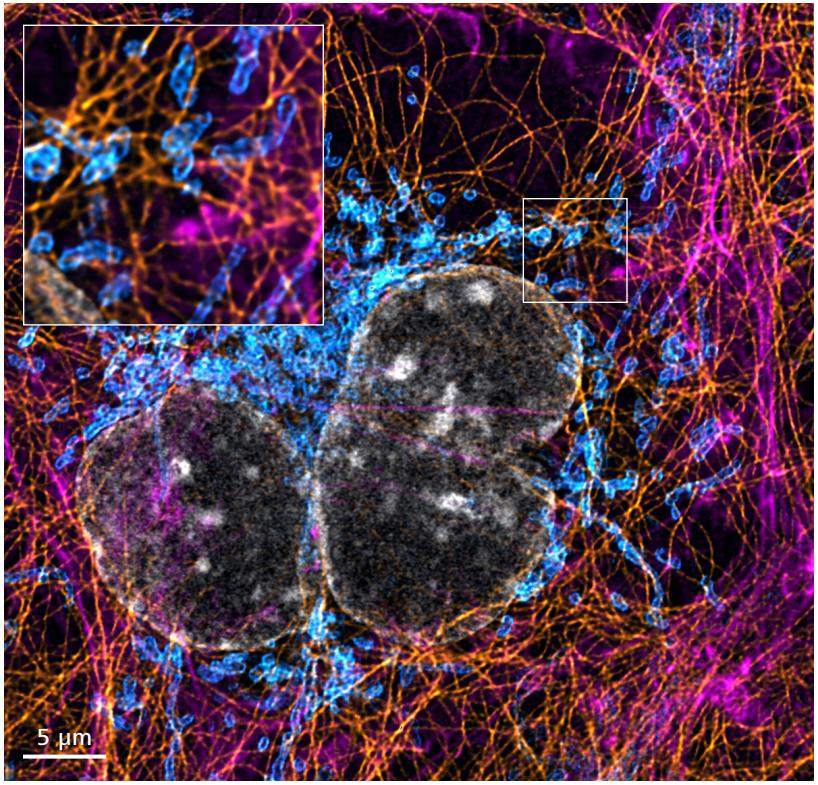
Click here to view this video

Cleared spheroid of a co-culture of HCT-116-GFP (colon cancer) / NIH-3T3-RFP (fibroblasts) cells stained with Hoechst for nuclei. Imaged in an InSphero Akura plate. Dataset was segmented using arivis Pro. Sample courtesy of InSphero AG. Schlieren, Switzerland

ZEISS LSM 910 at work

Airyscan SR

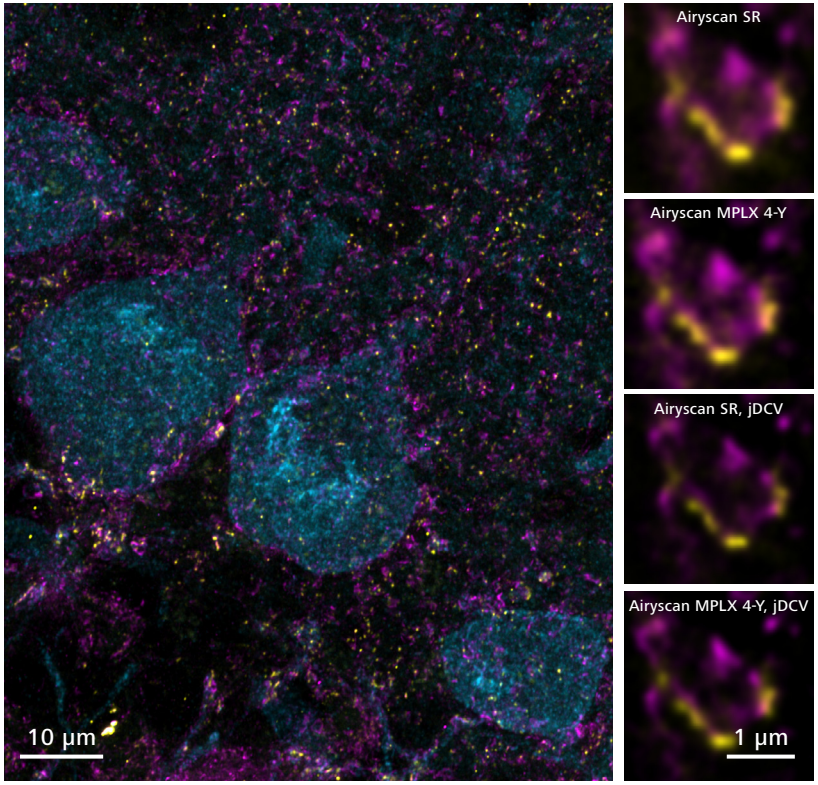
Gentle super-resolution imaging of the smallest structures



Cos-7 cells labelled with DAPI (nuclei, white), Anti-TOM 20 (Alexa 488, blue), Anti-Tubulin (Alexa 555, orange), and Actin-SiR (Actin, magenta).

Airyscan Multiplex

Efficient super-resolution imaging through parallelization



10 µm mouse brain section, Calbindin-A488 (blue), Gephyrin-A568 (yellow), VGAT-A647 (magenta). Sample courtesy of Luisa Cortes, Microscopy Imaging Center of Coimbra, CNC, University of Coimbra, Portugal

ZEISS LSM 910 at work

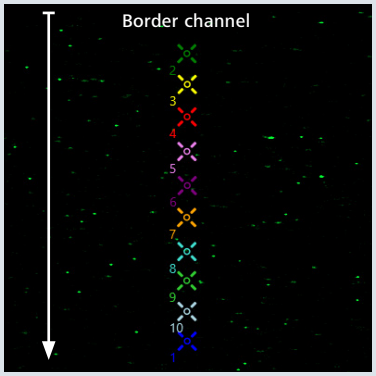
Dynamics Profiler

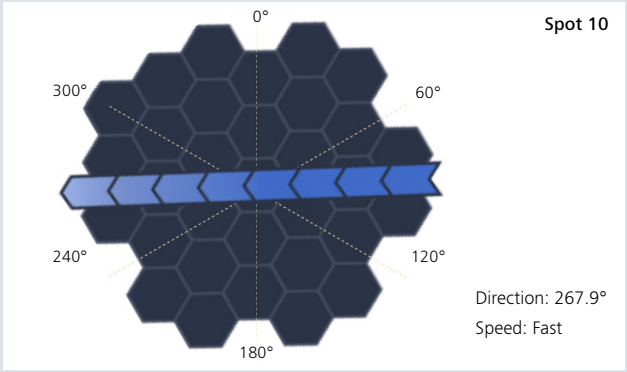
Add a new dimension to live imaging

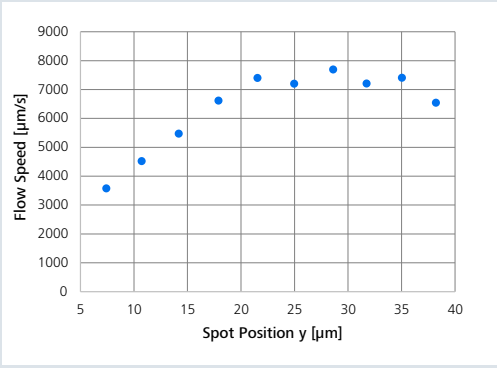
ZEISS Dynamics Profiler uncovers molecular concentration, diffusion, and flow dynamics of fluorescent proteins in your living samples in a single, easy measurement.

Flow speed and direction of active movement in liquids can be determined for defined spots across a microfluidics channel. Here, an in-house fabricated pressure-based microfluidic flow cell (50 mbar, 50 µm channel width) was used through which a solution flows that contains green fluorescent 100-nm beads. Laminar flow can thus be characterized.

Flow







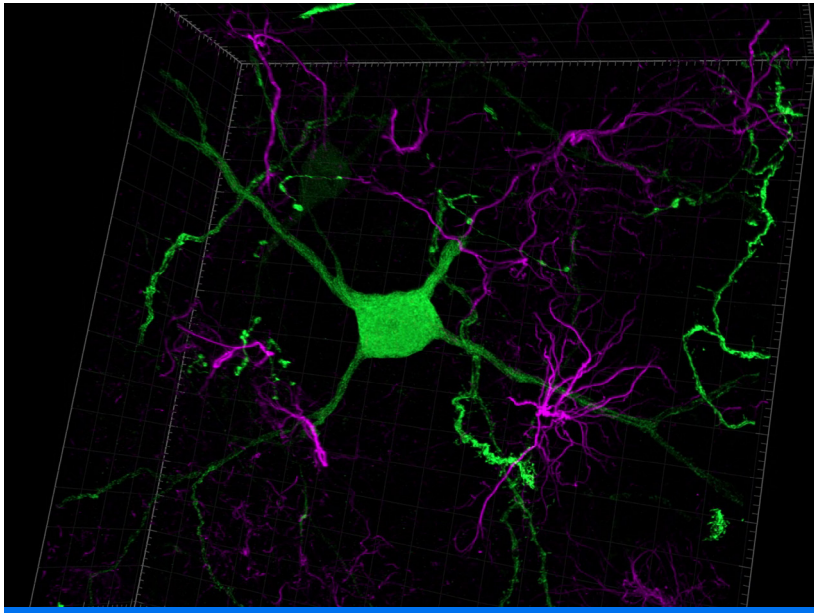
ID	Flow Direction [°]	Flow Speed [µm/s]
1	269.11	6543.78
2	266.97	3571.54
3	268.09	4518.62
4	267.85	5468.81
5	267.64	6613.50
6	267.73	7395.74
7	267.71	7200.19
8	268.03	7693.98
9	268.33	7202.56
10	267.91	7407.19

Sample courtesy: PhD student Stijn Dilissen, under supervision of Prof. Jelle Hendrix (www.uhasselt.be/dbi, Dynamic Bioimaging Lab, Advanced Optical Microscopy Centre, Biomedical Research Institute, Hasselt University).

ZEISS LSM 910 at work

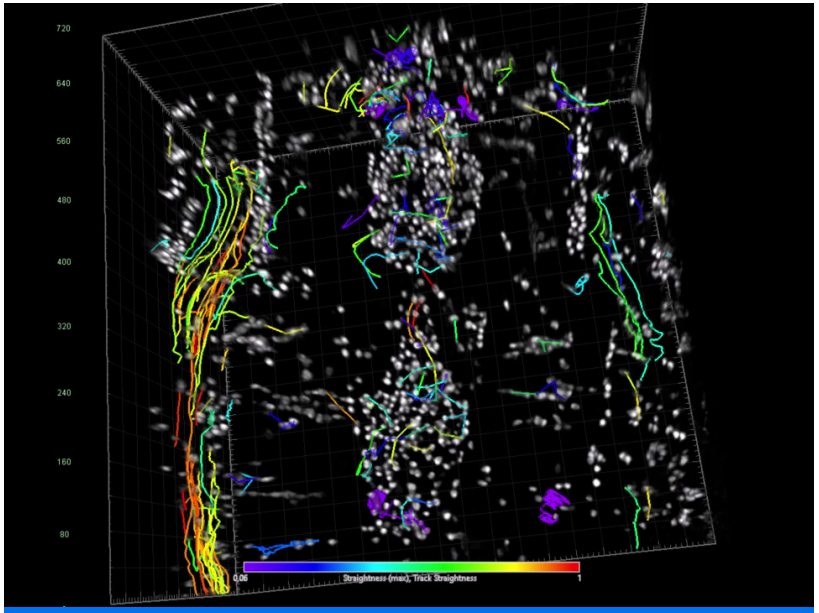
ZEISS arivis Pro

From simple 3D visualization to advanced segmentation, tracking, and data analysis



Click here to view this video

Neurons and astrocyte in thick brain sections imaged with Airyscan MPLX 4Y mode and rendered with ZEISS arivis Pro. Spines and other details of neuron morphology are visible. Sample courtesy of Luisa Cortes, Microscopy Imaging Center of Coimbra, CNC, University of Coimbra, Portugal



Click here to view this video

Flow of GFP-labelled hemocytes (insect blood cells) in the hemolymph of Drosophila melanogaster white pre-pupae. ZEISS Lightfield 4D in combination with ZEISS arivis Pro offers the unique opportunity to image and analyze the blood flow under physiological in vivo *conditions. Lightfield 4D with its unparalleled speed of 80 volumes per second allows to image a large volume fast enough to follow this process. The 3D algorithms of arivis Pro then allow to segment and track the blood cells throughout a timelapse. Sample courtesy of Iwan Robert Evans, University of Sheffield, UK. Data acquired at Wolfson Light Microscopy Facility in the School of Biosciences at the University of Sheffield.*

Beam path design and detector architecture

Advanced light preservation, sensitivity, and spectral flexibility

The premium components and design of the LSM 910 beam path, along with its high-bandwidth electronics, guarantee optimal light preservation and sensitivity, which provide the foundation for innovative enhancements and enable the visualization of a wide dynamic range of signals.

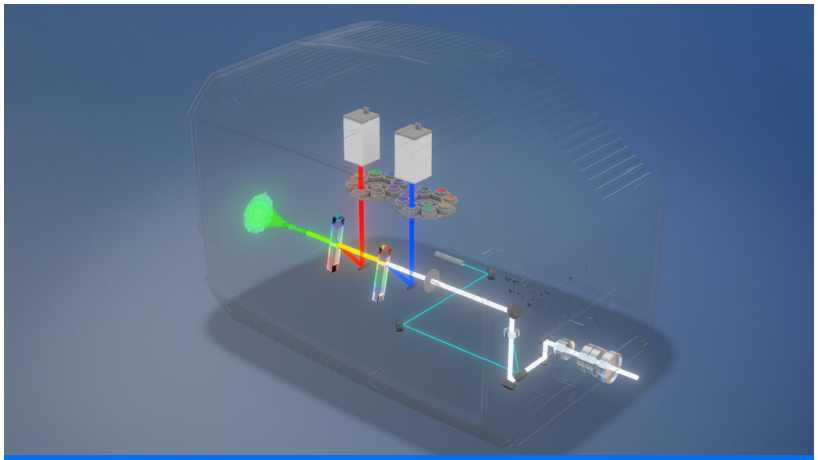
Its effective scanner movement allows more than 85 % of frame time for signal collection, while linear galvo scanners provide equal time contribution to each pixel, for all speeds and scanning routines, essential for quantitative imaging.

The low-angle Fix-Gate beam splitter directs excitation laser light to the sample and efficiently separates it from the emission signal, preventing laser reflection light in your images.

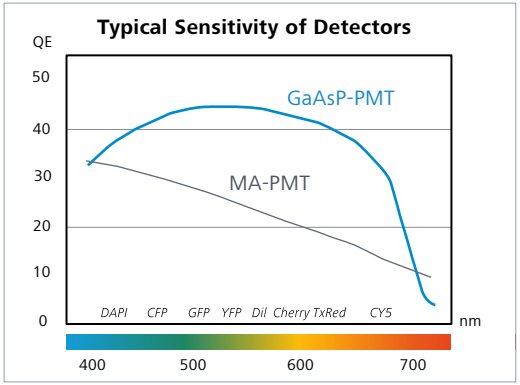
After passing through the apochromatic pinhole, the emission signal is spectrally separated by Variable Secondary Dichroics (VSD). These allow full spectral flexibility with step sizes of 1 nm, efficiently combining multi-color imaging of current and future fluorescent labels with advanced spectral information acquisition.

MA-PMTs* or high-sensitive GaAsP* detectors are calibrated to optimally perform in all multi-color and spectral experiments. For truly gentle and quantifiable imaging the directly modulated lasers can be controlled in a linear manner down well below 1 % of their total power capacity.

* Multi-Alkaline Photomultiplier Tube
** Gallium Arsenide Phosphide



A streamlined light path with surprising flexibility: The compact light path with a minimum of optical elements is designed for highest efficiency. Fluorescence emission light travels through the main dichroic beam splitter with its outstanding laser suppression to deliver supreme contrast. Up to two patented variable beam splitter dichroics (VSDs) divert the spectral part of the light. You can define up to three detectors (multialkali, GaAsP or Airyscan 2).



Typical spectral quantum efficiency (QE) of multi-alkali (MA-) PMT and GaAsP-PMT detectors.

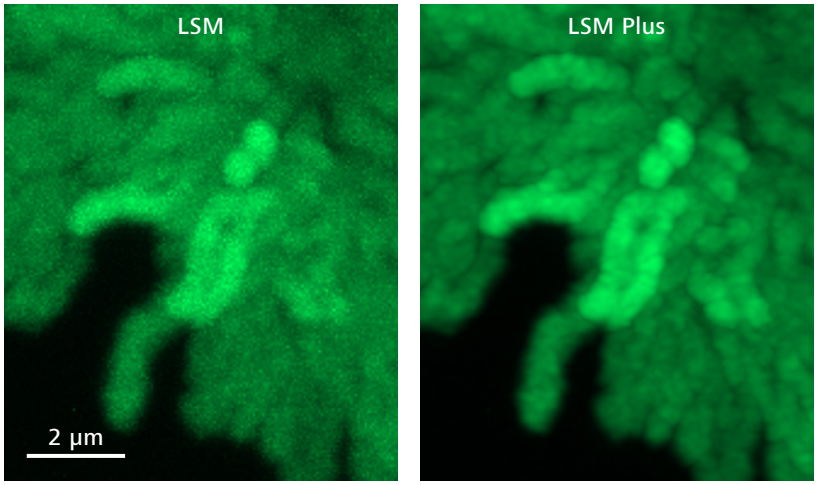
LSM Plus

Improving the confocal experience

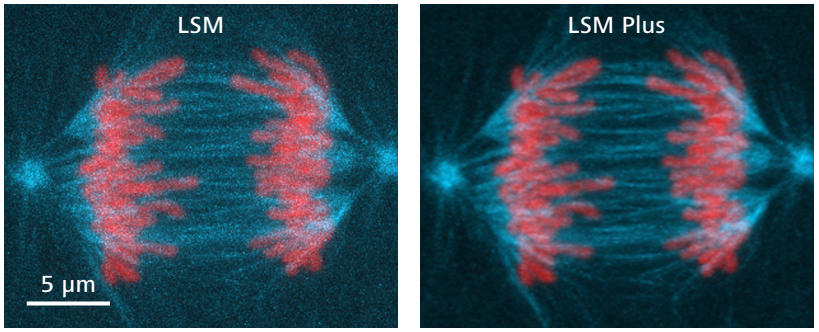
LSM Plus improves any confocal experiment with ease, independent of detection mode or emission range. Its linear Wiener filter deconvolution needs next to no manual interaction while still ensuring a reliable quantitative result. The system's underlying optical property information such as objective lens, refractive index, and emission range is used to automatically adapt processing parameters for best results.

Apply LSM Plus or add it into your Direct Processing workflow and benefit from:

- **Enhanced signal-to-noise ratio** at high acquisition speeds and low laser powers—particularly useful for live cell imaging with low expression levels
- **Improved resolution** of all acquired confocal data sets, multi-color and spectral
- **More spatial information** and even greater resolution enhancement for bright samples, enabling reduction of the pinhole size
- **Integrated workflows** to combine the advantages of LSM Plus with Airyscan super-resolution imaging



RPE1 cells transfected with H2B-GFP plasmid. Maximum intensity projection of 117 Z-planes. Comparison of without (left) and with LSM Plus (right). Courtesy of Tingsheng Liu, Mitosis Lab, Singapore



Live imaging of LLC-PK1 dividing cell (porcine kidney), expressing H2B-mCherry (red) and α-Tubulin-mEGFP (cyan). Maximum intensity projection of 37 Z-planes. Comparing without (left) and with LSM Plus (right).

Airyscan 2

Experimental possibilities beyond confocal standards

More information:

LSM Airyscan
Experimental possibilities beyond confocal standards

Airyscan takes the confocal idea beyond its conventional implementation: Instead of light passing through a pinhole to reach a single detector, Airyscan consists of 32 detector elements that act as very small pinholes, taking a pinhole-plane image at every scanned position. By combining 32 such small pinhole-like detectors into a large area detector, Airyscan allows more light to be collected and higher spatial frequency information of a structure to be captured. Its fully integrated linear Wiener filter deconvolution needs next to no interaction while ensuring reliable quantitative results.

Airyscan SR: Gentle super-resolution imaging

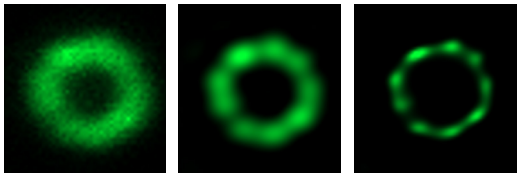
With Airyscan, you capture more structural information and collect the available fluorescence signal more efficiently, which makes this super-resolution method particularly gentle for your delicate samples. Choose from a variety of processing options and easily customize them to get reliable and quantifiable data. Lateral resolution down to 90 nm is made possible by Joint Deconvolution – utilizing the additional information that only Airyscan can provide.

Airyscan Multiplex: Productivity through parallelization

In the Multiplex modes, adapted readout schemes give you a choice of different parallelization options to speed up your super-resolution acquisition. Knowledge of the shape of the excitation beam allows to image up to 4 lines simultaneously, granting highly parallel signal acquisition. The area detector elements provide all the information needed to improve final image resolution far beyond the sampling steps.

Airyscan jDCV: More information from all Airyscan imaging modes

Each of the 32 Airyscan detector elements has a slightly different view on the sample, providing additional spatial information that makes Joint Deconvolution possible for all Airyscan imaging modes. The distance between objects that can be resolved is reduced even further—down to 90 nm, without changing anything during sample preparation or the image acquisition processes. Your super-resolution experiments will benefit from an improved separation of single or multiple labels.



HeLa cell, 4× expanded and labelled with acetylated alpha tubulin (green). Comparison of confocal image with Airyscan SR and Airyscan jDCV. Courtesy of S. Zhang, Prof. Liou Yih-Cherng's lab, Singapore

Cell division of LLC-PK1 cells, alpha-tubulin (mEmerald, magenta) and H2B (mCherry, green). With the Multiplex mode for ZEISS Airyscan 2 a Z-stack of 52 slices was captured every 40 seconds for a total of 40 minutes.

Dynamics Profiler

Your easy access to underlying molecular dynamics in living samples

More information:

Dynamics Profiler
Add a new dimension to live imaging

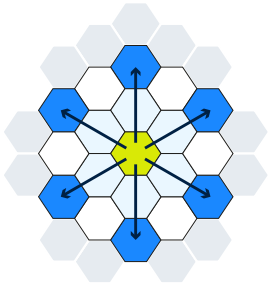
Molecular data offers new, and often overlooked, insights about living samples. Fluorescence Correlation Spectroscopy (FCS) is an established method to investigate molecular characteristics. While a precise and very sensitive method, traditionally it is limited to extremely low expression levels or molecule concentrations that can be well below the experimental expression levels in live research samples.

Airyscan uniquely employs all its detector elements to collect 32 individual FCS intensity traces per measurement. The mean value of the inner 19 elements provides robust and reliable measurements on molecular concentration and dynamics, even for bright samples.

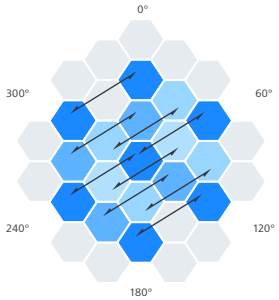
Moreover, the area detector allows a variety of spatial cross-correlation analyses by using combinations of single detector elements. Asymmetric diffusion analysis is calculated by cross correlating the center element of the detector with the elements of the outer rings, uncovering heterogenous characteristics within one excitation volume, perfect to investigate samples such as cellular condensates. Cross-correlation of detector pairs that are grouped and aligned in multiple directions along the excitation volume can measure speed and direction of actively moved molecules, such as fluorophores in microfluidic systems or within the bloodstream.

Furthermore, raw data of all 32 detector elements is saved with every single measurement, enabling you to perform your customized analysis as needed, either immediately or when the scientific question arises later.

Molecular concentration and diffusion data are collected with the innermost 19 elements of the Airyscan detector. The read-out of separate detectors permits measurements at much higher total intensities (brightness) than conventional FCS would allow.



To measure asymmetric diffusion, single Airyscan detector elements of the third ring are cross-correlated with the center element. Polar heatmaps visualize asymmetric diffusion behavior within a measurement spot.



To determine the flow direction and speed within a liquid, a total of 27 detector element pairs are cross-correlated along 3 different axes of the Airyscan detector.

Lightfield 4D

Instant volumetric high-speed imaging of living organisms

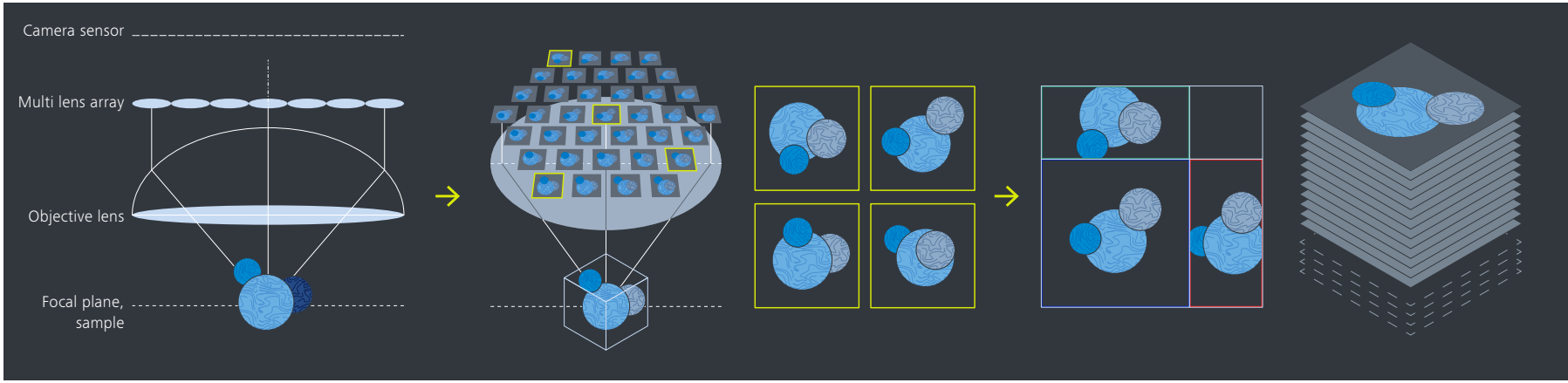
More information:

Lightfield 4D
Keeping pace with
the pulse of life

To truly capture the essence of biological processes, imaging must be done in 4D, as both volume and time are essential for investigating living systems. Lightfield 4D offers a unique solution by imaging an entire volume at an exact point in time, without any time delay. Instead of capturing single 2D images at different time points, a micro lens array positioned in between objective and camera generates 37 individual images, collecting all of the 3D information at the same instant. Each of these different views provides both spatial and angular information which serves as the foundation for creating a Z-stack through deconvolution-based processing. In this way, Lightfield 4D can generate 80 volume Z-stacks per second.

In addition to the uniquely high speed of volume acquisition, this method is notably gentle on living samples. By utilizing a single illumination event for each generated volume, it eliminates the need for repeated illumination to capture individual image pixels or 2D images in order to acquire a sample volume, keeping light exposure short and to a minimum. This combination makes Lightfield 4D the perfect method to capture fast processes, as well as image data from multiple living samples, over long periods of time.

The generated Z-stacks are saved in the standard .czi file format used by ZEN, allowing for all the same rendering and analysis options as for any other Z-stack created in ZEN. For reproducible, reliable, and trusted research, all 37 individual images are saved as raw data for your instant and future access.



A micro lens array positioned in between objective and camera generates 37 individual images, collecting all of the 3D information at the same instant.

Each of 37 different views provides both spatial and angular information which contributes to the volumetric information of the sample. Lightfield 4D can generate 80 of such volumes per second.

Through deconvolution-based processing, Z-stacks are generated and saved in the .czi file format, allowing for all rendering and analysis options available in ZEN and arivis Pro.

Clearing

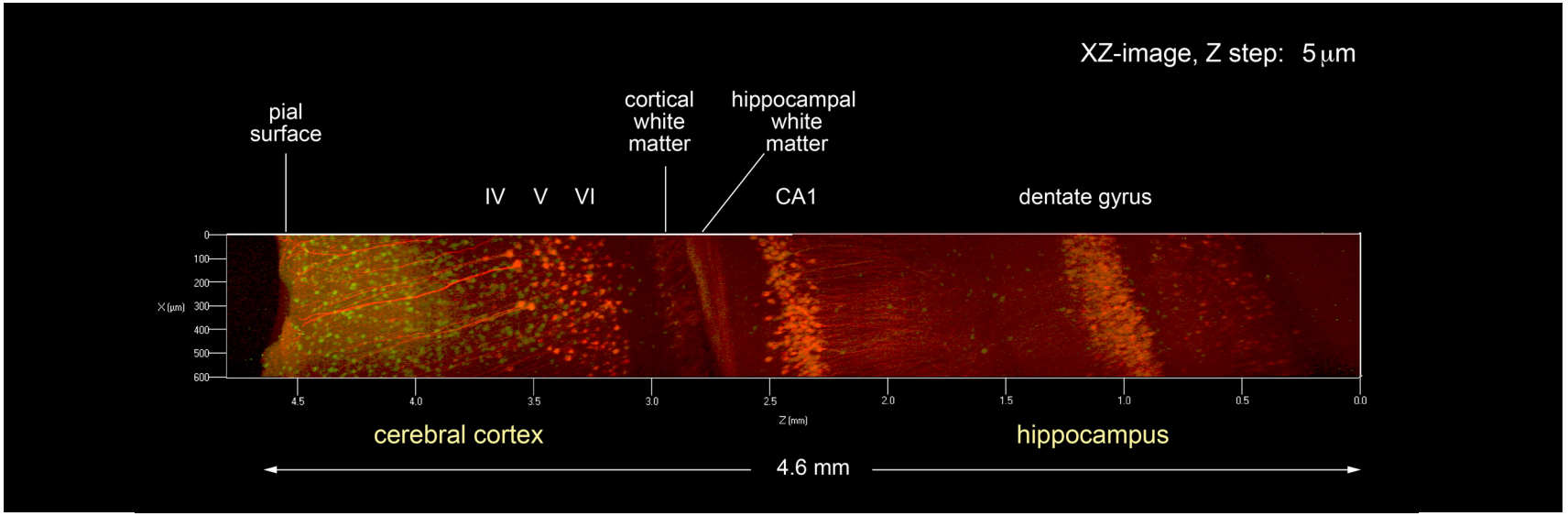
Transparent information from the deepest layers

Clearing dramatically increases optical penetration depth into biological samples such as spheroids, organoids, tissue sections, mouse brains, whole organisms, or organs. The cleared tissue becomes almost transparent, and clearing objectives adjust to match the refractive index of the clearing media and the immersion medium, delivering crisp contrast. Imaging cleared samples with optimized clearing objectives enables up to six times deeper imaging than with a multi-photon microscope, and up to 60 times deeper imaging than with a conventional laser scanning microscope.

Get ready to be impressed by the quality of structural information you will retrieve from the deepest layers.

With LSM 910 based on the ZEISS Axio Examiner platform and special objectives optimized for different clearing media, you can look up to 5.6 mm deep into tissue:

- Clr Plan-Apochromat 10×/0.5 nd=1.38
- Clr Plan- Apochromat 20×/1.0 Corr nd=1.38
- Clr Plan-Neofluar 20×/1.0 Corr nd=1.45
- Clr Plan-Neofluar 20×/1.0 Corr nd=1.53



Maximum intensity projection, brain of 7-week old YFP-H mouse, fixed and cleared with Scale clearing technique (Hama et al, Nat Neurosci. 2011).
Courtesy of H. Hama, F. Ishidate, A. Miyawaki, RIKEN BSI, Wako, Japan

ZEISS Correlative Cryo Workflow

Image the near-to-native state

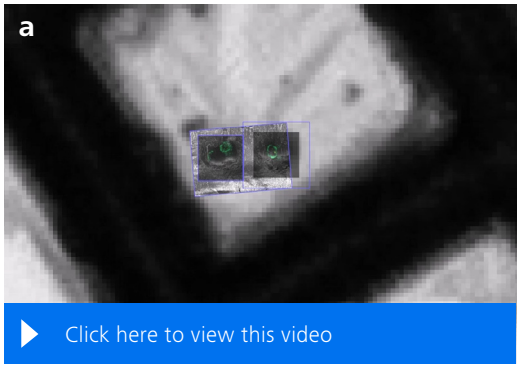
More information:

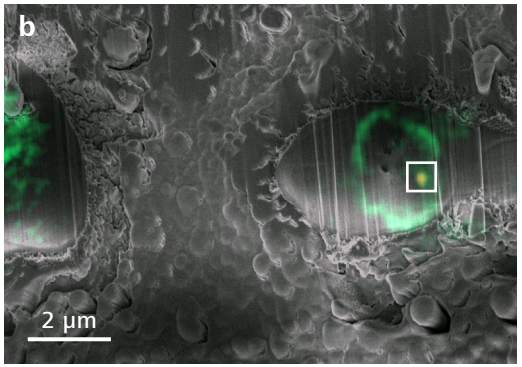
Correlative Cryo Workflow
Image the near-to-native state

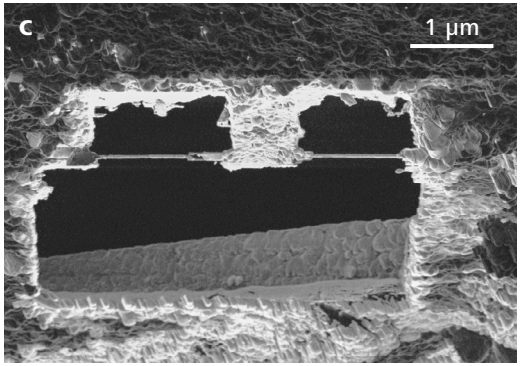
TEM lamella preparation and volume imaging under cryogenic conditions

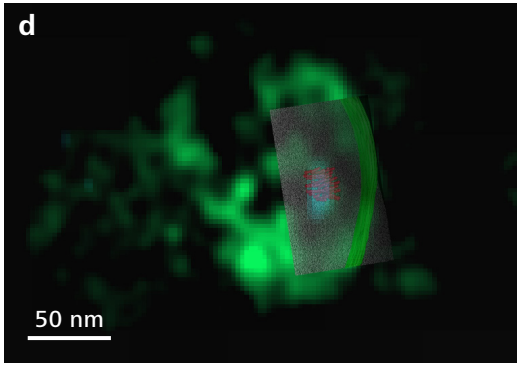
Spindle pole bodies are difficult to localize within yeast cells. They are small and rarely occurring structures. ZEISS Correlative Cryo Workflow lets you precisely identify and image such cellular structures in the near-to-native state. The LSM with the Airyscan detector makes the identification of these structures even easier so further details can be imaged. All images – from a large overview of the entire cell to high-resolution images of these tiny structures – are organized in a ZEN Connect project, providing all data needed to re-locate these cellular structures in the FIB-SEM.

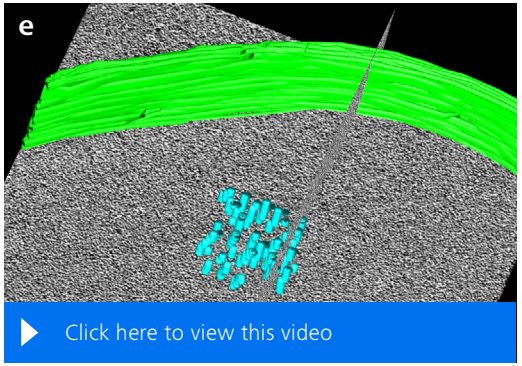
Using ZEISS Crossbeam, TEM lamella of the identified regions can be prepared for cryo electron tomography. Volume imaging is possible as well. Furthermore, the workflow solution allows you to reconnect all data after image acquisition. Images from the Crossbeam or tomograms from the TEM can be combined with the LSM data and can be rendered in three-dimensional context.











Yeast cells labeled with NUP (nuclear pore complex)-GFP and CNM67-tdTomato. Sample and tomogram courtesy of M. Pilhofer, ETH Zürich, Switzerland

a) Overlay of an LM and EM dataset – from the grid overview to the region of interest identified for further TEM tomography.
b) Early state of the milling process: Lamella is prepared around the marked region which was identified at the LSM.
c) FIB image of the prepared lamella; lamella thickness: 230 nm
d) 3D overlay of the reconstructed and segmented tomogram with LSM dataset (Spindle pole body is false-colored in cyan); nuclear membrane and microtubules were segmented using IMOD.
e) Segmented and reconstructed tomogram

ZEN

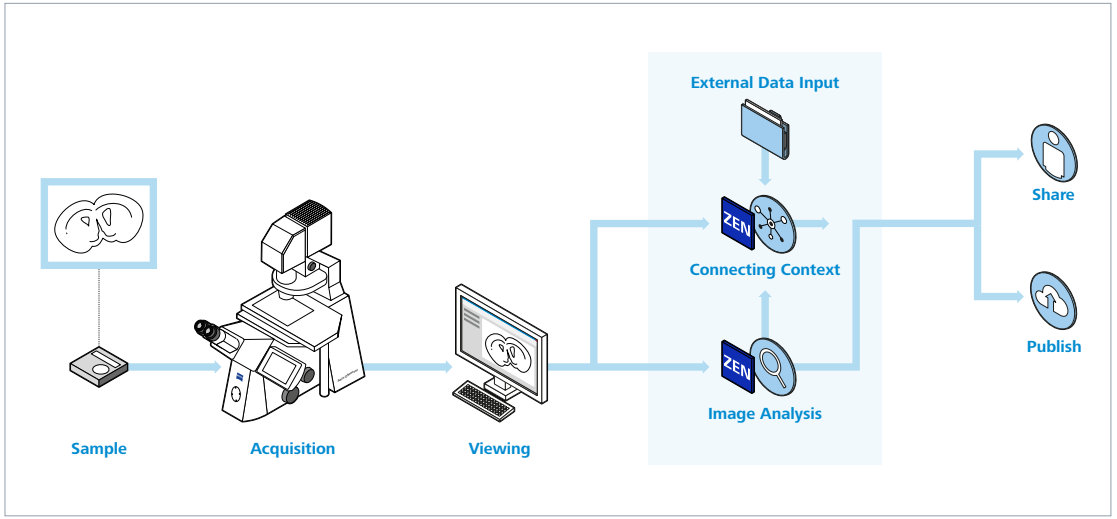
Your complete microscopy software solution from sample to knowledge

More information:

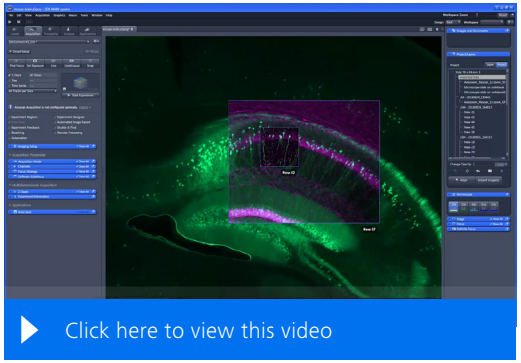
ZEN
Your complete solution from sample to knowledge

ZEN is the universal user interface you will see on every imaging system from ZEISS. For simple and routine work, ZEN leads you straight to results. For complex research experiments, ZEN offers the flexibility to design multi-dimensional workflows the way you want. No matter what microscopy task you have, you will find intuitive tools and modules to assist you:

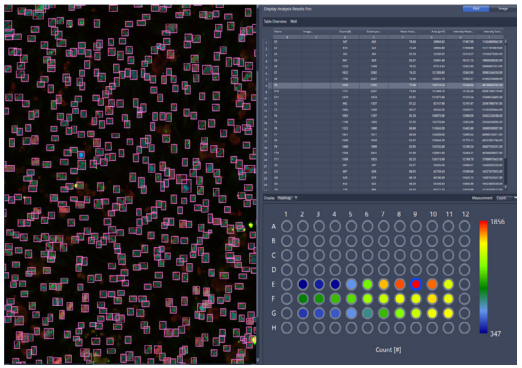
- Acquire images using smart automation
- Process images with scientifically proven algorithms
- Visualize big data by a GPU powered 3D engine
- Analyze images via Machine Learning-based tools
- Correlate image data between light and electron microscopes
- Compress data without loss to speed up file transfer and save storage space costs



ZEN microscopy software integrates all steps from your sample to reproducible data for publication.



Connect all your imagery: With the Connect Toolkit you bring images and data from any system or modality together. You always keep the context and the overview about all data from your sample.



Bio Apps Toolkit: From beautiful images to valuable data – analyze your images efficiently.

arivis Pro

Your end-to-end scientific image analysis platform

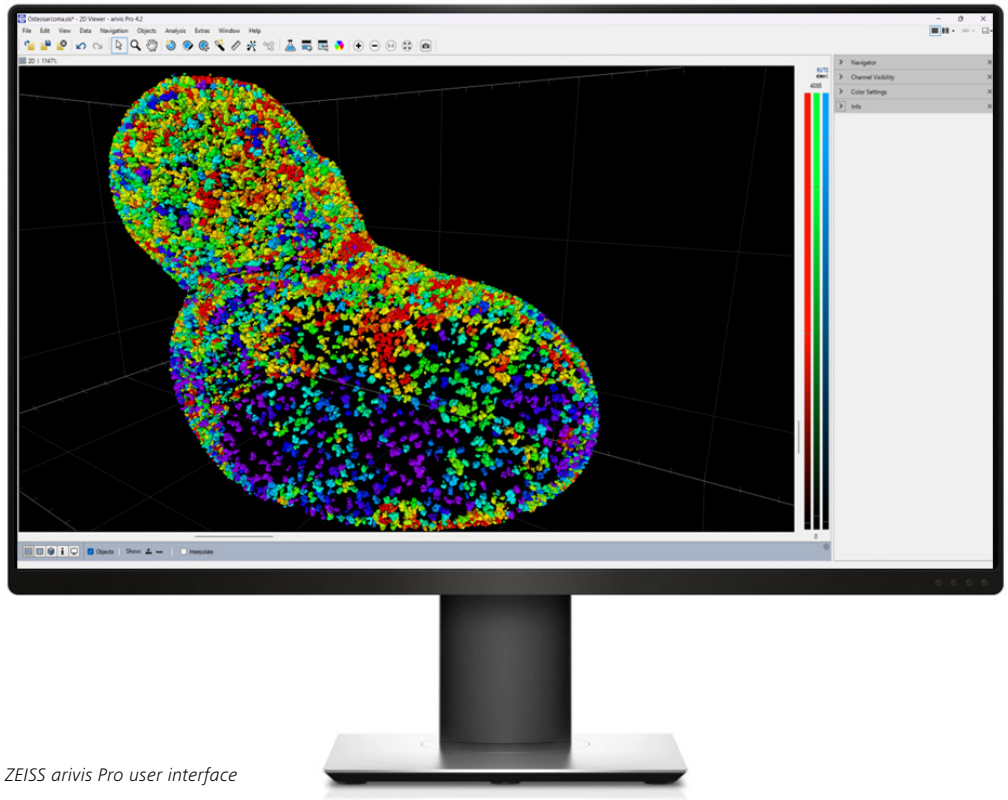
More information:

arivis Pro

Your solution for advanced image analysis and visualization

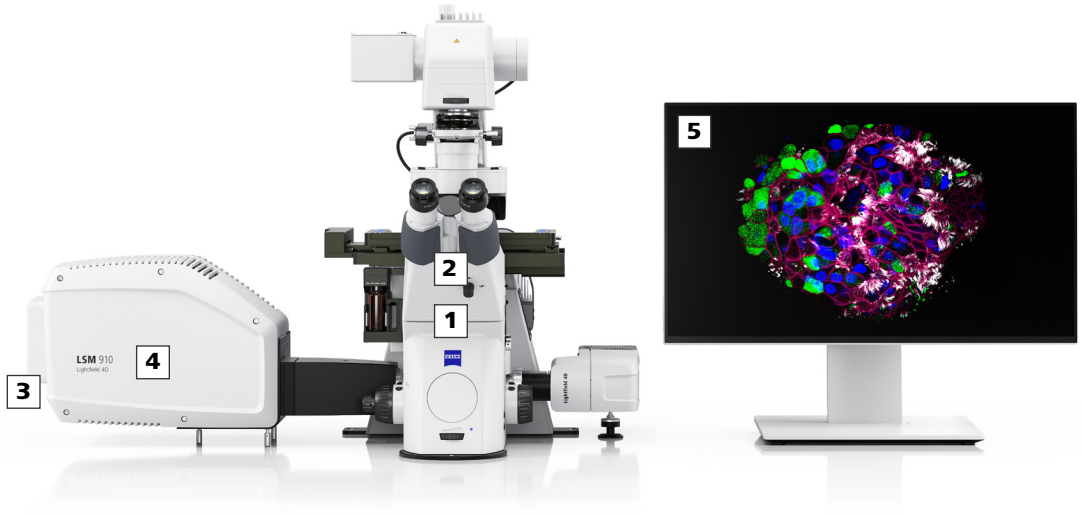
ZEISS arivis Pro empowers you to automate image analysis and visualization pipelines. Leverage traditional methods or AI models effortlessly to create pipelines for any image size, dimension, or modality without the need to code yourself. The heart of arivis Pro is the easy handling of very large image files. It supports and manages over 30 commercial file formats so that you can always take advantage of its benefits. Pre-configured pipelines and standard assays are available for both simple and demanding analysis tasks. Alternatively, you can build customized pipelines for your specific goals. It takes just one click to repeat your same analysis on further datasets for quantitative and reproducible results. Boost productivity for these and more analyses:

- Advanced 3D analysis
- High content analysis
- Tracking and lineage
- Neurobiology: neuron tracing



ZEISS arivis Pro user interface

Your flexible choice of components



1 Microscope

- Inverted stands: Axio Observer 7, Celldiscoverer 7
- Upright stands: Axio Imager.M2, Axio Imager.Z2, Axio Examiner.Z1
- AI Sample Finder for Axio Observer
- Camera port
- Manual or motorized stages
- Incubation solutions
- Fast Z piezo inserts (for inverted stands)
- Definite Focus

2 Objectives

- C-Apochromat, C Plan-Apochromat
- Plan-Apochromat
- LD LCI Plan-Apochromat
- EC Plan-Neofluar
- W Plan-Apochromat, Clr Plan-Apochromat, Clr Plan-Neofluar

3 Illumination

- Diode lasers: 405, 488, 561 and 640 nm

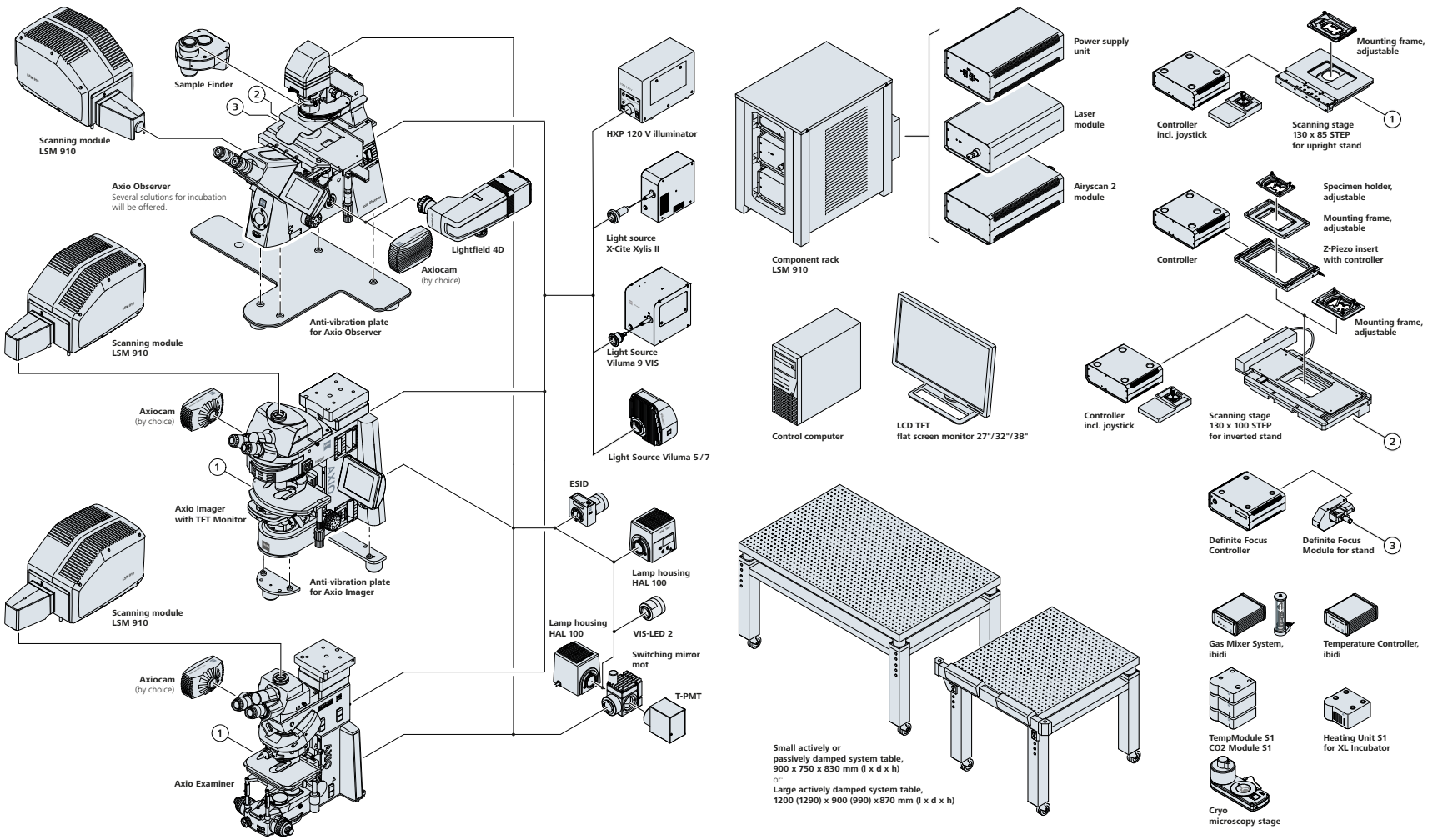
4 Detection

- 2 channel GaAsP PMT, or 2 channel multialkali (MA) PMT; 1 additional GaAsP PMT, MA PMT,
- or 40× / 63× / 100× Airyscan 2 detector
- Lightfield 4D for Axio Observer
- Electronically switchable illumination and detection module (ESID) or transmitted light detector (T-PMT).

5 Software

- ZEN microscopy software, highlighted modules: LSM Plus, Airyscan Joint Deconvolution, Dynamics Profiler, Tiles & Positions, Experiment Designer, Sample Navigator, FRAP, FRET, Direct Processing, 3D Toolkit

System overview

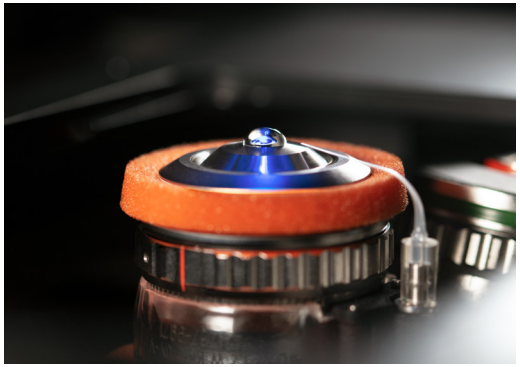


Expand your possibilities

As your needs grow, LSM 910 grows with you, forming the basis for a number of enhancements. Like every system from ZEISS, LSM 910 comes with open interfaces and a modular architecture to guarantee the seamless interaction of all components, now and in the future.

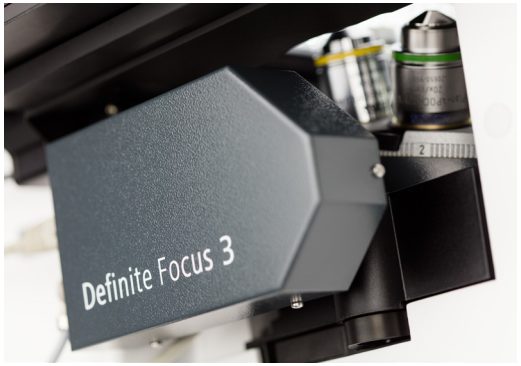
Combine your ZEISS LSM 910 with integrated incubation modules to create the perfect environment for long-term live cell imaging with stable temperature conditions.

Add a choice of sensitive ZEISS Axiocams to your ZEISS LSM 910. It's very easy to acquire overview images for your multiposition experiments or to perform light efficient widefield imaging.



The Autoimmersion Module automates the application of immersion media for water immersion objectives. The immersion media is applied while maintaining objective focus and position, leaving your experiments undisturbed.

Z piezo stage and a leveling insert guarantee the precision needed for super-resolution applications using ZEISS Airyscan 2.



Definite Focus 3 stabilizes the focal position of your sample compensating Z-drift. You can now perform long-term experiments that can last for multiple days.

Enhance your microscope with ZEISS Viluma 7. This flexible and efficient LED light source allows to screen and image your delicate fluorescent samples very gently. You profit from stable illumination and extremely long lamp life.

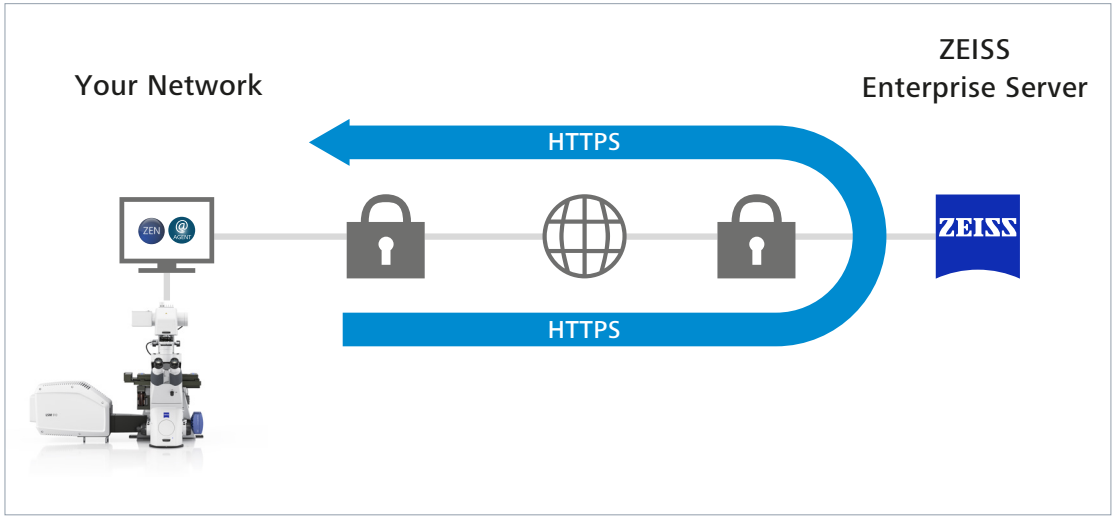
Expand your possibilities

ZEISS Predictive Service Maximizes System Uptime

Once connected to your network and activated, this advanced technology will automatically track the health status of your instrument and collect system log files in the background to improve remote diagnosis.

Relevant technical data such as operating hours, cycle counts or voltages are periodically monitored via a secure connection to our data center. The ZEISS Predictive Service application evaluates the performance of your microscope as system data can be received and analyzed.

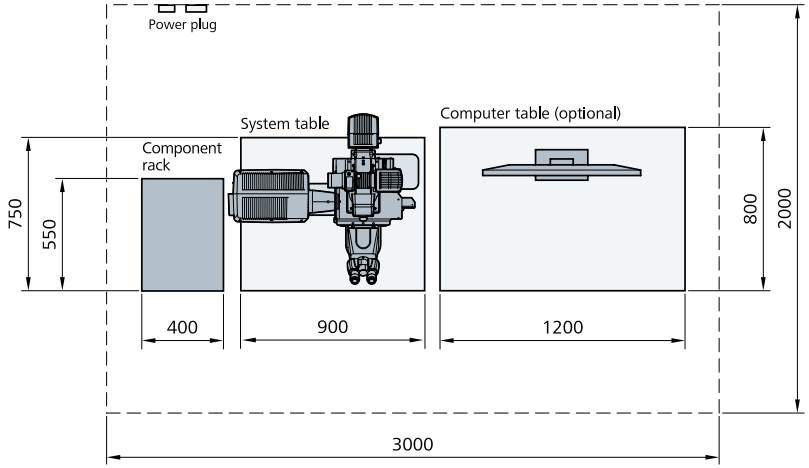
Our support engineers will diagnose any issues by analyzing data on the Enterprise Server – remotely and without interruption to your operation.



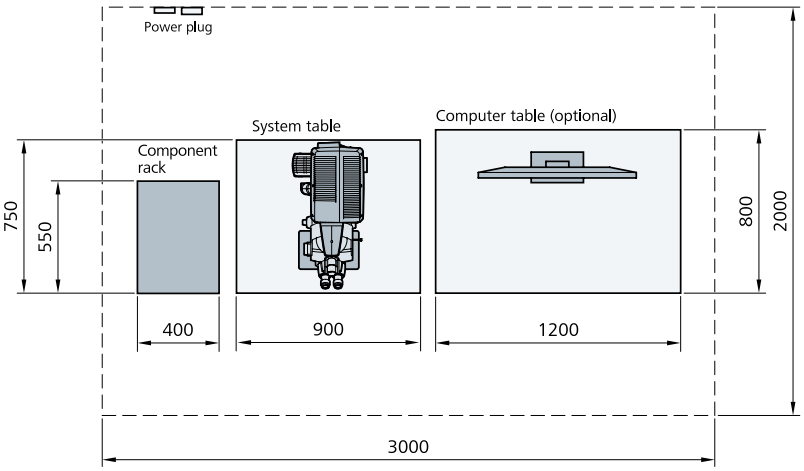
- **Maintain highest system availability**
  Increase your uptime through close monitoring of the system's condition as remote support can often provide immediate solutions.
- **Data security**
  Ensure highest data security standards using well established technologies like PTC Thingworx and Microsoft Azure Cloud. No personal or image data is uploaded, only machine data.
- **Fast and competent support**
  Use secure remote desktop sharing to easily get an expert connected.
- **Optimum instrument performance**
  As the status of your system is monitored, necessary actions can be planned before they become urgent.

Technical specifications

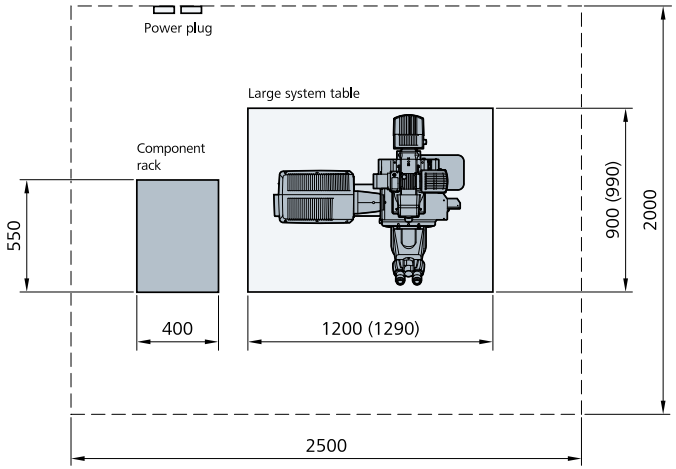
LSM 910 with Axio Observer on small system table



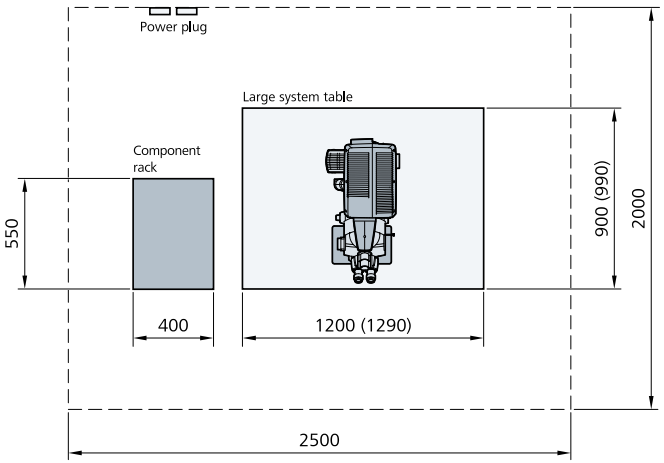
LSM 910 with Axio Imager or Axio Examiner on small system table



LSM 910 with Axio Observer on large system table



LSM 910 with Axio Imager or Axio Examiner on large system table



Technical specifications

Physical Dimensions	Length (cm)	Width (cm)	Height (cm)	Weight (kg)
Small actively and passively damped system table	90	75	83	130
Large actively damped system table (incl. corner pieces)	120 (129)	90 (99)	87	180
Vibraplate for Axio Imager (consists of three pedestals)	32	30	4.5	1.5
Vibraplate for Axio Observer	52.5	80	4.5	7
Scanning Module LSM 910	40	25.5	28	15
Axio Imager.Z2; Axio Imager.M2	56	39	70	40
Axio Examiner.Z1	70	39	82	24
Axio Observer 7	29.5	80.5	70.7	36
Component rack	55	40	60	35
Laser module (LM)	40	25	14.5	10
Airyscan 2 (40×, 63×, 100×)	40	25	14.5	5
Power supply unit (PSU)	40	25	14.5	5
Fiber optic cable, VIS	300			
Cables	300			

Microscopes	
Stands	Upright: Axio Imager.Z2, Axio Imager.M2, Axio Examiner.Z1 Inverted: Axio Observer 7 with side port, AI Sample Finder (optional); Celldiscoverer 7
Z Drive	Smallest increment Axio Imager.Z2: 10 nm; Axio Observer 7: 10 nm; Axio Examiner.Z1: 25 nm; Z-Piezo stage available; Definite Focus 3 for Axio Observer 7
XY Stage (optional)	Motorized XY scanning stage, for Mark & Find function (xy) as well as Tile Scan (Mosaic Scan); smallest increment of 0.25 µm (Axio Observer 7), 0.2 µm (Axio Imager.Z2), 0.25 µm (Axio Examiner.Z1)

Technical specifications

Scanning Module	
Scanner	Two independent, galvanometric scanning mirrors with ultrashort line and frame flyback
Scanning Resolution	32 × 1 to 6,144 × 6,144 pixels (Airyscan 2 5,120 × 5,120 pixels), also for multiple channels, continuously adjustable (for each axis)
Scanning Speed	At 512 × 512 pixels: confocal – up to 8 fps; Airyscan SR – up to 4 fps; Multiplex SR-2Y – 8.4 fps; Multiplex SR-4Y – 18.9 fps; SR-4Y at 580 × 448 – 19.5 fps At 512 × 64 pixels: confocal – up to 64 fps
Scanning Zoom	0.45 × to 40 ×; continuously adjustable
Scanning Rotation	Can be rotated freely (360°), adjustable in increments of 0.1°, freely adjustable xy offset
Scanning Field	20 mm diagonal in the intermediate image plane, with full pupil illumination
Pinhole	Master pinhole with preset size and position; can be adjusted as desired for multitracking and short wavelengths (such as 405 nm); automatic alignment
Beam Path	One major beam splitter for four laser lines (405, 488, 561 and 640 nm) at 10 degree with excellent laser line suppression. The 640 nm laser line can be used for internal autofocusing. Depending on the system, either one or two patented Variable Secondary Dichroics (VSD) can be used to flexibly divert the respective spectral range of light to chosen channels. Emission filters can be used to clean up the signal when imaging autofluorescent or highly scattering samples.

Detection Options	
Detectors	2 spectral detection channels, GaAsP (typical QE 45 %) or multialkali (MA) PMT (typical QE 25 %); LSM Plus: resolution down to 160* nm lateral, 500** nm axial with pinhole at 0.8 AU; resolution down to 120* nm lateral, 500** nm axial with pinhole at 0.3 AU
	1 additional GaAsP PMT, MA PMT or Airyscan 2 detector
	Airyscan 2 for spatial detection (GaAsP) with 40×, or 63×, or 100× objectives; for super-resolution (120* nm lateral, 350** nm axial; with jDCV down to 90* nm lateral (80*** nm), 200*** nm axial) or Multiplex acquisition (CO-2Y: 180* nm lateral, 550** nm axial / SR-2Y and SR-4Y: 140* nm lateral, 450** nm axial; with jDCV down to 120* nm lateral (80*** nm), 250*** nm axial)
	Transmitted light detector (ESID or T-PMT); unique transmitted fluorescence Sample Navigation with T-PMT
Spectral detection	>8 sequential confocal fluorescence channels, up to three parallel confocal fluorescence channels, based on low-noise GaAsP or MA PMTs; adjustable in increments of 1 nm
Data depth	8-bit and 16-bit available
Real-time electronics	Microscope, laser, scanning module and additional accessory control; data acquisition and synchronization management by highest bandwidth real-time electronics; oversampling read-out logic for best sensitivity; data transfer between real-time electronics and user PC via LVDS with the ability to evaluate the data online during image acquisition

* Measured with respective nanoruler samples
** Measured with 100 nm Beads
*** Measured with 23 nm Beads

Technical specifications

Lasers	
Laser module URGB (pigtailed; 405, 488, 561, 640 nm)	Single-mode polarization preserving fiber
	Typical total dynamic range of 10.000:1; direct modulation 500:1
	Diode laser 405 nm (15 mW nominal power of laser before fiber coupling, 5 mW ex fiber); laser class 3B
	Diode laser 488 nm (25 mW nominal power of laser before fiber coupling, 10 mW ex fiber); laser class 3B
	Diode (SHG) laser 561 nm (25 mW nominal power of laser before fiber coupling, 10 mW ex fiber); laser class 3B
	Diode laser 640 nm (15 mW nominal power of laser before fiber coupling, 5 mW ex fiber); laser class 3B

Lightfield 4D					
Magnification	40×	25×	20×	10×	
RI Immersion	1.333	1.333	1	1	
Field of View	20.4 mm	20.4 mm	20.4 mm	20.4 mm	
Object Field Size	361×361 µm²	585×585 µm²	720×720 µm²	1444×1444 µm²	Variance of up to 2 % from system to system
Z-Stack Range	109 µm	278 µm	430 µm	1712 µm	calculated
Aquisiton Speed	up to 80 Volumes per Second				
Excitation Wavelength Range	405–740 nm	405–740 nm	405–740 nm	405–740 nm	
X/Y Resolution *	2.2 µm	3.5 µm	4.4 µm	8.8 µm	measured, deconvolved
Z Resolution *	2.8 µm	8.4 µm	13.6 µm	57 µm	measured, deconvolved with optimal number of iterations
Voxel Size XYZ	0.7×0.7×0.9 µm³	1.12×1.12×2.7 µm³	1.4×1.4×4.4 µm³	2.8×2.8×18 µm³	
Stack Size XYZ *	512×512×121 Pixel³	512×512×103 Pixel³	512×512×99 Pixel³	512×512×95 Pixel³	

Recommended Objectives for Lightfield 4D
C-Apochromat 40×/1.2 W Corr M27
Plan-Apochromat 40×/1.3 Oil DIC M27
LD LCI Plan-Apochromat 40×/1.2 DIC M27
LD C-Apochromat 40×/1.1 W Corr
LD LCI Plan-Apochromat 25×/0.8 Imm Corr DIC M27
Plan-Apochromat 20×/0.8 M27
EC Plan-Neofluar 20×/0.50 M27
Plan-Apochromat 10×/0.45 M27
Plan-Apochromat 10×/0.3 M27
EC Plan-Neofluar 10×/0.3 M27

* Measured with beads in agarose (RI =1.378) with air or water immerson respectively and excitation/detection wavelength (label) 488 nm/525 nm (eGFP)

Technical specifications

ZEN Microscopy Software	
GUI configuration	Workspace to conveniently configure all of the motorized functions of the scanning module, laser and microscope; save and restore application configurations as experiment settings or use acquired images (Reuse)
Maintenance and calibration tools	Calibration objective and software tools to calibrate the system
Recording modes, Smart Setup	Z-Stack, Lambda Stack, Time Series and all combinations (xyz, lambda, t), online calculation of signal intensities, average and summation (by line/image, adjustable), Step Scan (for higher image frame rates); quick set up of imaging conditions using Smart Setup by simply selecting the labelling dye; Direct Processing: Processing of large data during acquisition by streaming, including e.g., Airyscan, LSM Plus, Spectral Unmixing; Analysis and storage on second PC
Crop function	Easily select scanning areas (simultaneously select zoom, offset, rotation)
Real ROI Scan	Scan of designated ROIs (regions of interest) as desired and pixel-by-pixel laser blanking
ROI bleaching	Localized bleaching in bleach ROIs for applications such as uncaging; use of different speeds for bleaching and imaging, use of different laser lines for different ROIs; flexibly define your bleaching experiments during the acquisition with Interactive Bleaching
Multitracking	Rapidly change excitation lines when recording multiple fluorescences for the purpose of minimizing signal crosstalk and increasing dynamic range
Airyscan Module	Permits processing and post-processing of acquired SR and MPLX data. Includes Joint Iterative methods, providing increased lateral resolution for Airyscan SR / MPLX data (requires Multiplex Mode) down to 90/120 nm Export of Airyscan RAW data.
Airyscan Multiplex Mode	Multiplex mode scan with 4× parallelisation in Y-direction, detection by Airyscan 2
Lambda Scan	Sequential acquisition of image stacks with spectral information for every pixel
Linear Unmixing	Acquisition of crosstalk-free, multiple fluorescence images using simultaneous excitation; offline unmixing; advanced unmixing logic with indication of reliability
Visualization	XY, orthogonal (XY, XZ, YZ), Cut (3D section); 2.5D for time series of line scans, projections (maximum intensity); animations; depth coding (inverse colors), brightness, gamma and contrast settings; color table selection and modification (LUT), character functions
Image analysis and operations	Co-localization and histogram analysis with individual parameters, profile measurement along user-defined lines, measurement of lengths, angles, areas, intensities and much more; operations: addition, subtraction, multiplication, division, ratio, shift, filters (low-pass, median, high-pass, etc., also user-definable)
Image Management	Features for managing images and the corresponding imaging parameters
Advanced Acquisition Toolkit	Z-stack and enhanced depth of focus functionality
	Tiles & Positions: Scanning of predefined sample areas (tiles) and / or position lists
	Software Autofocus: Determination of the optimal focus position in the sample
3D Toolkit	Combined 2D and 3D visualization in one screen
	Rapid 3D and 4D reconstructions and animations
	3D segmentation to quantify 3D microscopy data based on thresholding and machine learning models

Technical specifications

Optional Software	
Direct Processing	Processing of large data during acquisition by streaming, including e.g., Airyscan, LSM Plus, Spectral Unmixing; analysis and storage on second PC
Deconvolution Toolkit	3D image restoration based on calculated point-spread functions (modes: nearest neighbor, maximum likelihood, constrained iterative)
Molecular Quantification Toolkit	Physiology (Dynamics): Comprehensive evaluation software for online and offline ratio imaging with various pre-defined formulas
	Acquisition of FRET (Förster resonance energy transfer) image data with subsequent evaluation;
	Acceptor Photobleaching and Sensitized Emission methods supported
	Acquisition of FRAP (fluorescence recovery after photobleaching) experiments with subsequent evaluation of intensity kinetics
Developer Toolkit	Python scripting interface for automation & customization; experiment feedback for Smart Experiments and open interface to third party software (e.g. ImageJ)
Smart Acquisition Toolkit	Experiment Designer: Definition of advanced automated imaging
	Guided Acquisition: Automated and targeted acquisition of objects of interest
Connect Toolkit	Exchange and alignment of image data from multiple image acquisition systems in 2D and 3D, enabling correlative workflows
AI Toolkit	Image analysis and structure detection via computational self learning technology
AI Sample Finder, Sample Navigator (requires additional HW)	Easy to perform sample overview scan with autofocus function using Axiocam or transmitted fluorescence with T-PMT (AI Sample Finder requires Axio Observer)
Bio Apps Toolkit	Easy-to-use and modular image analysis for common assays
LSM Plus	Increased resolution for confocal/spectral datasets down to 160 nm lateral (120 nm with closed pinhole = 0.3 AU), preview and Auto strength
Dynamics Profiler	Easy-to-use Airyscan-based data collection that captures the underlying dynamics of living samples to provide molecular concentration, asymmetric diffusion, and flow information (Axio Observer)

Technical specifications

Power Requirements		
LSM 910 has two country specific main power supply cords.		
Line Nominal AC voltage	1/N/PE 100V AC (±10%) or 115V AC (±10%)	1/N/PE 230 V AC (±10%)
Line frequency	50/60 Hz	50/60 Hz
Max. current	1 phase at 9.5 A (100 V)	1 phase at 4.5 A (230 V)
Leakage current (relevant for Residual Current Device)	max. 3.5 mA at 115 V	max. 7.3 mA at 230 V
Power plug	NEMA 5/15	Country specific connectors
Power consumption	1100 VA (continuous operation; maximum)	1100 VA (continuous operation; maximum)
	260 VA (standby operation)	280 VA (standby operation)
	0.011 VA (off mode)	0.025 VA (off mode)
Heat Emission	1000 W, maximum	1000 W, maximum

EMC Test
according to DIN EN 61326-1 - Noise emission according to CISPR 11 / DIN EN 55011 - Noise immunity according to table 2 (industrial sector)

Environmental Requirements	
For operation, the system has to be placed in a closed room.	
1. Operation, specified performance	T = 22 °C ±3 °C without interruption (24 h a day independently whether system is operated or switched off) It has to be ensured that the airflow of the air-conditioning is not directed at the system.
2. Operation, reduced performance	T = 15 to 19°C and 25 to 30°C
3. Storage, less than 16 h	T = −20 °C to 55 °C
4. Temperature gradient	±0.5 °C/h
5. Warm-up time	1 h for standard imaging; ≥2 h for high-precision and/or long-term measurements
6. Relative humidity	<65 % at 30 °C
7. Operation altitude	max. 2000 m
8. Loss of heat	1000 W, maximum

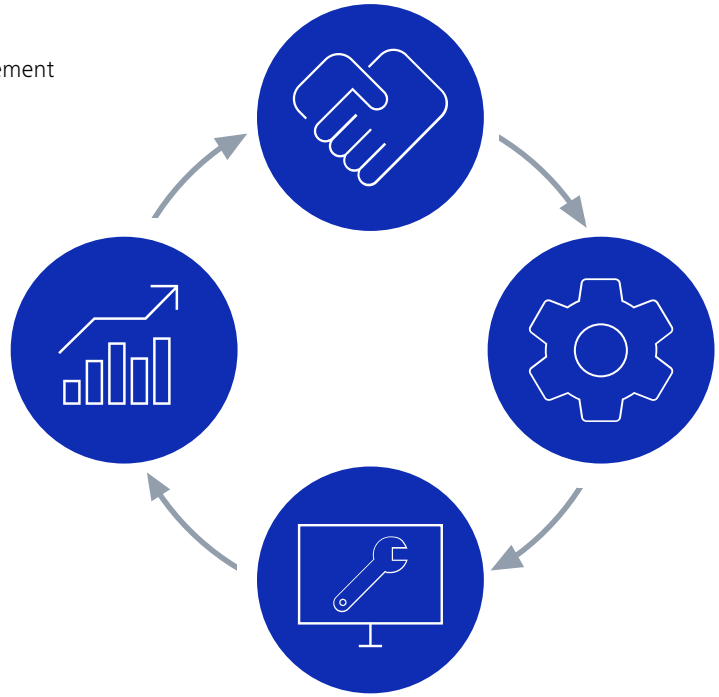
LSM 910 meets the requirements according to IEC 60825-1:2014

ZEISS Service – Your Partner at All Times

Your microscope system from ZEISS is one of your most important tools. For over 175 years, the ZEISS brand and our experience have stood for reliable equipment with a long life in the field of microscopy. You can count on superior service and support – before and after installation. Our skilled ZEISS service team makes sure that your microscope is always ready for use.

Procurement

- Lab Planning & Construction Site Management
- Site Inspection & Environmental Analysis
- GMP-Qualification IQ/OQ
- Installation & Handover
- IT Integration Support
- Startup Training



Operation

- Predictive Service Remote Monitoring
- Inspection & Preventive Maintenance
- Software Maintenance Agreements
- Operation & Application Training
- Expert Phone & Remote Support
- Protect Service Agreements
- Metrological Calibration
- Instrument Relocation
- Consumables
- Repairs

New Investment

- Decommissioning
- Trade In

Retrofit

- Customized Engineering
- Upgrades & Modernization
- Customized Workflows via ZEISS arivis Cloud

Please note: Availability of services depends on product line and location

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