Light sheet fluorescence microscopy for Multiview imaging of living and cleared specimens.

ZEISS Lightsheet 7

zeiss.com/lightsheet

ZEISS

Seeing beyond

ZEISS Lightsheet 7: Multiview Imaging of Living and Cleared Specimens

Flexible. Robust. Easy to Use.

Life sciences research can put big demands on your imaging capability, sometimes requiring you to image whole living model organisms, tissues and cells as they develop. Light sheet fluorescence microscopy (LSFM) with its unique illumination principle is ideal for fast and gentle imaging of such specimens. The exceptional stability of Lightsheet 7 lets you observe living samples over extended periods of time — even days — with less phototoxicity than ever before. What's more, you can employ this technique to image very large optically cleared specimens in toto, and with subcellular resolution. Enhance your Lightsheet 7 with dedicated optics, sample chambers and sample holders to accurately adjust to the refractive index of your chosen clearing method, and then image your large samples, even whole mouse brains. All of this flexibility comes in the proven and stable boxed light-sheet design from ZEISS.

Mouse brain cleared using CLARITY protocol with final imaging done in EasyIndex. Label: PV-tdtomato expressed in interneurons throughout the brain and in Purkinje cells in the cerebellum. Image data volume: 11 × 20 × 8.9 mm. Sample courtesy of E. Diel and D. Richardson, Harvard University, Cambridge, USA.

ZEISS Lightsheet 7: Simpler. More Intelligent. More Integrated.

Image Optically Cleared Specimens

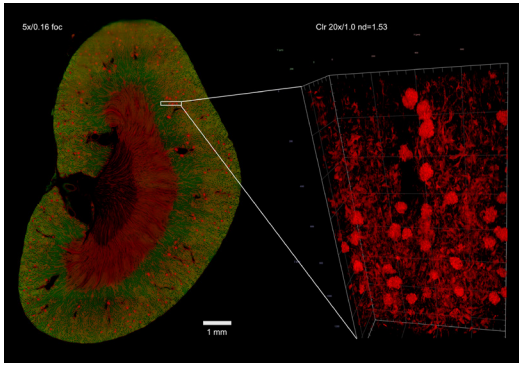
Which optical clearing method you choose will depend on the type of tissue you are imaging, your fluorescent labels and the size of the sample itself: Lightsheet 7 is designed to match all of these different conditions. You can now image specimens at up to 2 cm in size at any refractive index between 1.33 and 1.58, and in almost all clearing solutions. Just one stable turnkey system lets you acquire overview images and data with subcellular resolution. Whether you work with optically cleared organoids, spheroids, organs, brains or other specimens, Lightsheet 7 is your microscope of choice for fast, gentle LSFM imaging.

Get Best Image Quality and Stability

Take your LSFM imaging a step further to tackle a broad range of applications and achieve best image quality with your easy-to-use Lightsheet 7. Newly designed optics and sample chambers let you adjust to the perfect refractive index. The new sample holder makes mounting larger specimens simple. Smart software tools help you adjust imaging parameters, such as light sheet and sample positions, the right zoom settings, tiles and positions as well as data processing parameters. All of these new features go hand in hand with the reliable ZEISS combination of cylindrical lens optics and laser scanning to generate the illumination light sheet. Add the patented Pivot Scan technology and get artifact-free optical sections with best image quality.

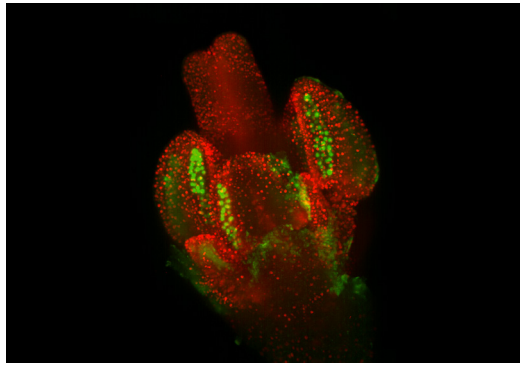
Observe Real Life – Fast and Sensitively

Lightsheet 7 now features the high quantum efficiency of pco.edge sCMOS detectors to enable observations of the fastest processes at the lowest illumination light levels. You'll get a real life view of your samples without the adverse effects of excitation light on their biology. For vertically oriented specimens and highest frame rates, opt for the CMOS detector Axiocam 702: a special sample chamber provides heating, cooling and CO_2 to maintain the perfect environment for your experiments. Add Multiview and triggering options to control external devices – Lightsheet 7 is your ideal system to observe live processes in an almost unlimited range of organisms.



Mouse kidney cleared with iDISCO, imaged in ethyl cinnamate with detection optics 5×/0.16 foc and Clr 20×/1.0 nd=1.53 (insert). Red: DyLight 594 for vasculature and glomeruli. Green: autofluorescence for tissue anatomy. Sample courtesy of U. Roostalu, Gubra, Denmark.

Dedicated optics for your ZEISS Lightsheet 7 allow to tackle a broad range of applications with best image quality.



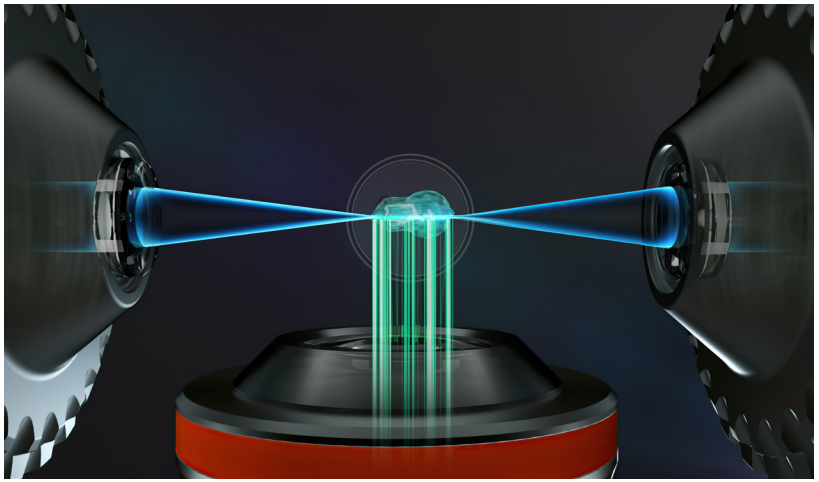
Development of Arabidopsis. *Red: H2B, mRuby for somatic nuclei. Green: ASY1, eYFP for meiocytes. Courtesy of S. Valuchova, P. Mikulkova and K. Riha, Central European Institute of Technology (CEITEC), Masaryk University, Brno, Czech Republic.*

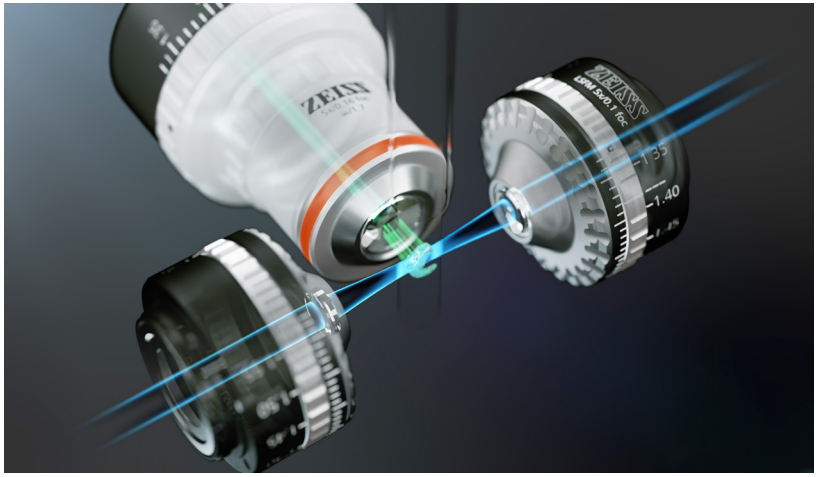
Your Insight into the Technology Behind It

Maximum Photon Efficiency. Maximum Speed.
Maximum Sample Size.

Light sheet fluorescence microscopy (LSFM) splits fluorescence excitation and detection into two separate light paths, with the axis of illumination perpendicular to the detection axis. That means you can illuminate a single thin section of the sample at one time, 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 collected on the pixels of a camera, rather than pixel by pixel as, for example, in confocal or other laser scanning microscopes. Parallelization of the image collection on a camera-based detector lets you collect images faster and with less excitation light than you would with many other microscope techniques. In summary, LSFM combines the optical sectioning effect with parallel image acquisition from the complete focal plane. This makes 3D imaging extremely fast and very light efficient.

The de-coupling of the detection optics from the illumination optics enables fluorescence excitation with dedicated lenses at low numerical aperture, without sacrificing detection resolution and sensitivity. This makes LSFM ideal for imaging of samples at the millimeter scale, such as developing organisms or large cleared tissue samples.





Your Insight into the Technology Behind It

The Patented Pivot Scanner Delivers Homogeneous Illumination

When the light sheet is passing through the sample, some structures of the specimen, e.g. nuclei, will absorb or scatter the excitation light. This will cast shadows along the illumination axis, as you see in Figure 1. This effect occurs in all fluorescence microscopes, but the illumination axis in light sheet fluorescence microscopy is perpendicular to the observation axis and so this effect is more obvious.

In Lightsheet 7, a patented Pivot Scanner alters the angle of the light sheet upwards and downwards during image acquisition. By altering the illumination angle the shadows will be cast in different directions and excitation light will also reach regions behind opaque structures, as you see in Figure 2. This patented Pivot Scanner is a perfect way to acquire artifact-free images and to improve downstream processing and analysis steps. It is always better to tackle artifacts right at their origin.

Figure 1: Without Pivot Scanner

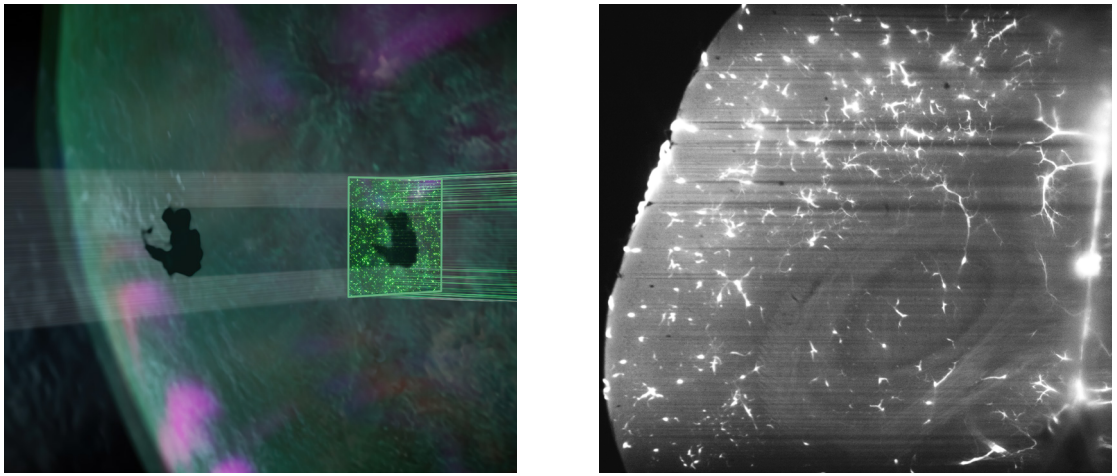
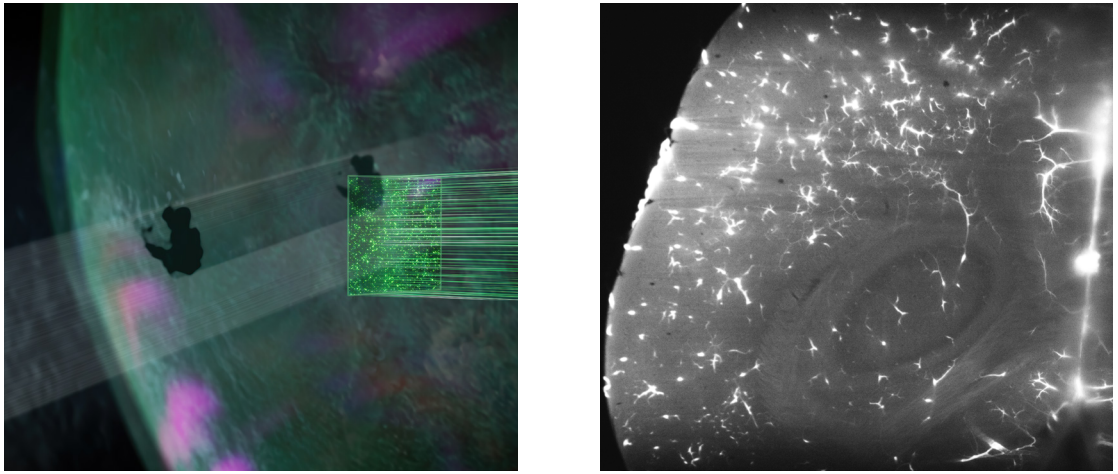


Figure 2: With Pivot Scanner



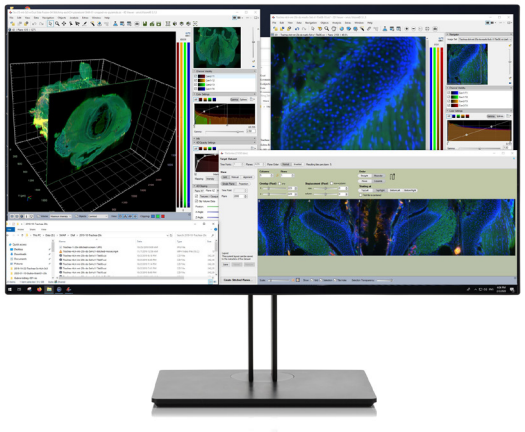
Expand Your Possibilities

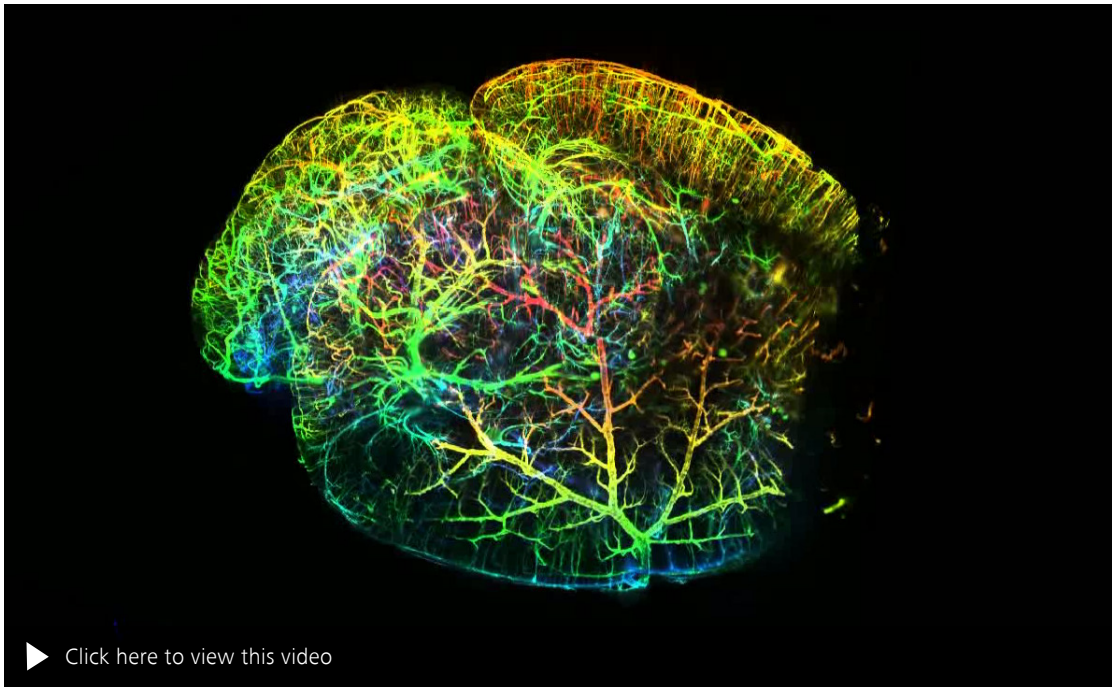
Image Data Processing & Analysis

Your Lightsheet 7 uses ZEN (blue edition) imaging software for data processing, giving you the advantage of the platform's rich portfolio of image processing functionality. This includes ZEISS Multiview reconstruction algorithms, deconvolution, fusion of dual side illumination acquisitions and many other benefits. With ZEN (blue edition) you can also stitch tiled image datasets with ease.

For the efficient handling of extremely large datasets and complex workflows, you can use arivis Vision4D®, bringing you added advantage of processing functions like advanced stitching, channel shift, high resolution volume rendering and much more so you can visualize and quantify your data in a quick, professional manner. arivis Vision4D® is a modular software solution for working with multichannel 2D, 3D and 4D images of almost unlimited size, independent of available RAM. Your Lightsheet 7 generates huge multichannel datasets that can be handled without constraints by arivis Vision4D®, which runs on both the ZEISS Storage & Analysis PC and ACQUIFER HIVE.

arivis

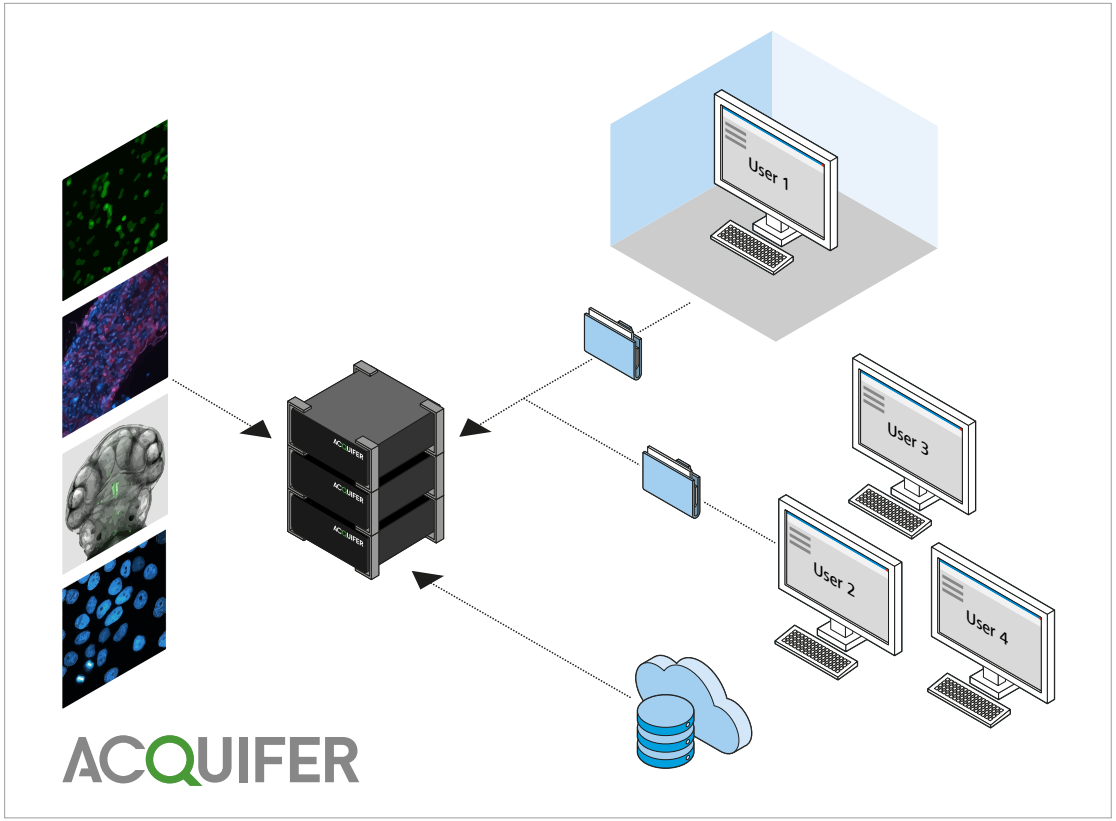




Expand Your Possibilities

Large Data Storage and Processing

Because light sheet fluorescence microscopy (LSFM) can image large three-dimensional samples and / or very long time series, it can also generate large datasets in a short period of time. As a consequence, you will often be advised to review your data storage as well as data handling and processing pipelines when establishing this technique in your lab. Storage and computing hardware work best when they are configured and tuned to the microscope they serve. It's important to store the acquired images directly to a safe, fast volume where they can be managed without further time consuming or expensive copy processes. In particular, cloud services cannot deal with typical data rates of light sheet and other microscopy techniques, thus making on-premise solutions indispensable. Your Lightsheet 7 comes with its own ZEISS Storage & Analysis PC, complete with 36 TB storage and computing hardware of a reasonable size for smaller labs.
For larger labs, including core facilities and multi-user environments, you can complement your Lightsheet 7 with the ACQUIFER HIVE data platform. This Windows-based, all-in-one solution is easy-to-use and includes network and batteries.



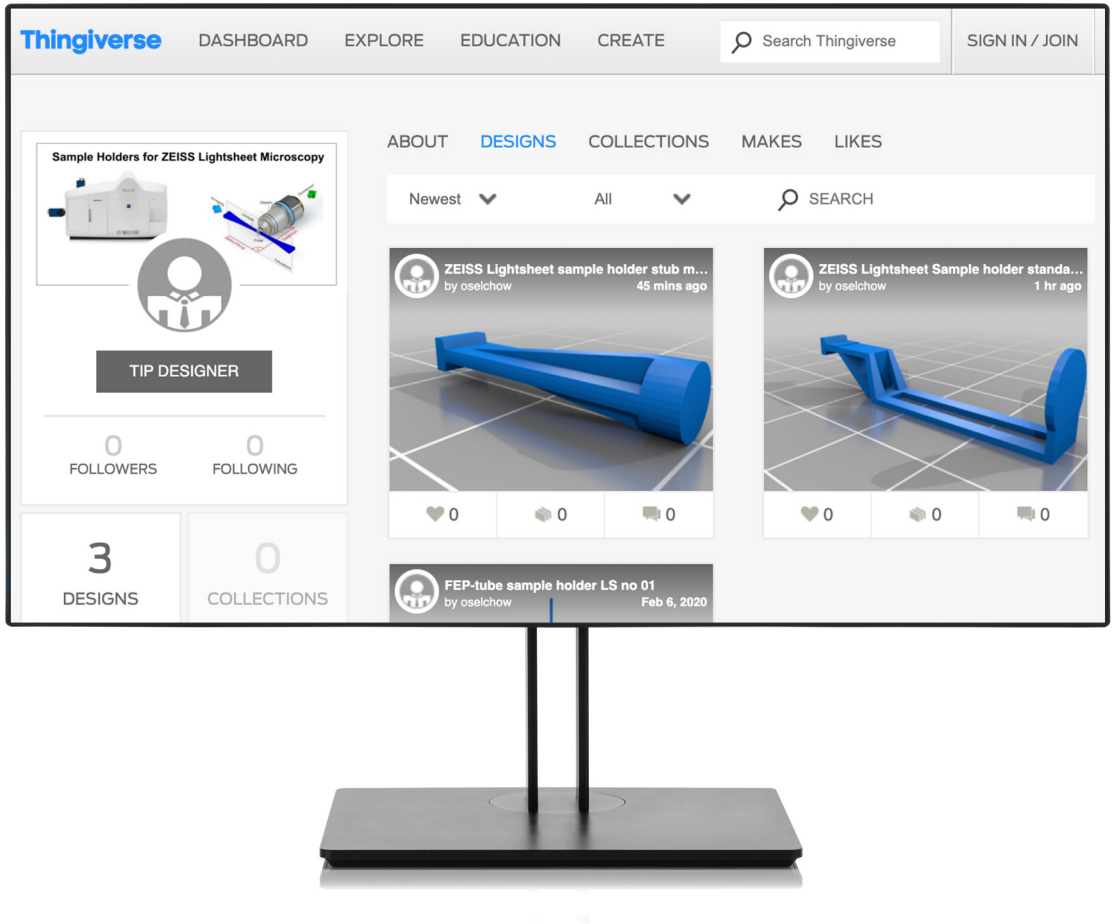
It has proven to be a very good match for ZEISS LSFM solutions. The basic unit is a 50 terabyte storage block with a directly-attached processing unit and an autonomous 10 Gbit network infrastructure that connects to microscopy systems. It can be expanded or upgraded easily should the need arise.

Expand Your Possibilities

Flexible Sample Holder Design

Custom designed sample holders can be very beneficial for your LSFM imaging. Your Lightsheet 7 is virtually built around your sample, with its holder designed to best support your experiment's purpose. The new smart sample holder design for Lightsheet 7 allows to quickly change the front end of each holder – depending on your sample at hand. This interface is open both to custom design and machining and 3D printing of your own sample holder.

Visit www.zeiss.com/sampleholder for tricks and tips and to discuss and download custom sample holders for your most demanding experiments.



Expand Your Possibilities

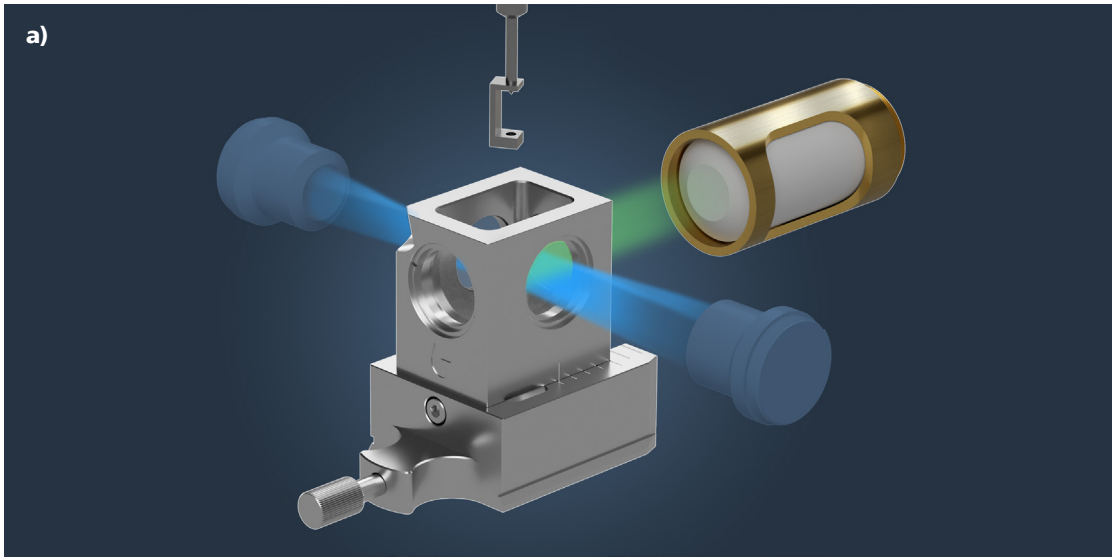
Mesoscopic Imaging

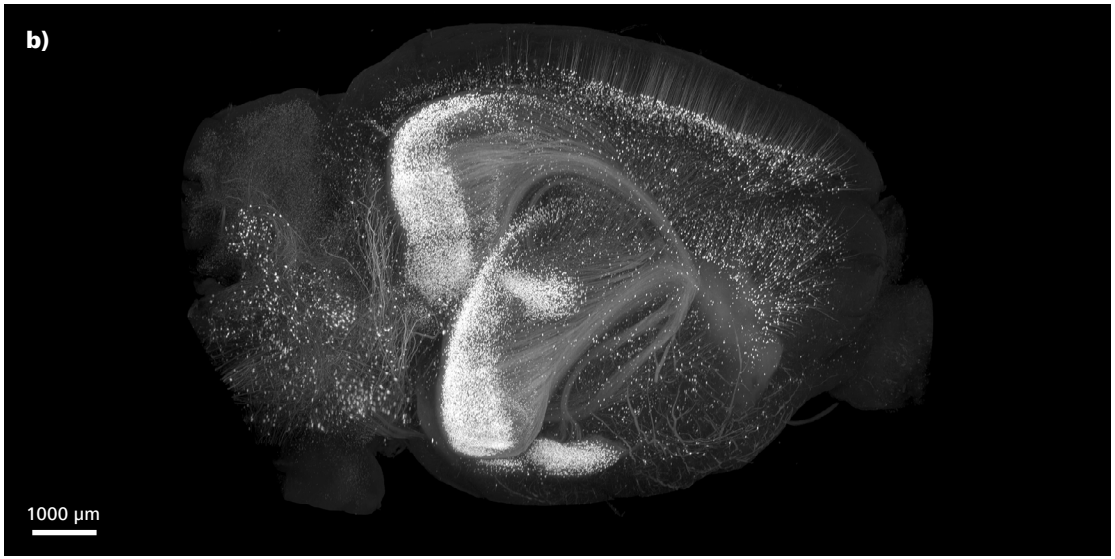
To make your Lightsheet 7 compatible with even larger specimens and low magnification imaging, you can expand your system with the Mesoscale Imaging System from Translucence Biosystems. It consists of three components: imaging chamber, specimen holder and safety collar / objective adapter. You can now use the excellent optics of Lightsheet 7 for sample volume sizes in the range of 3.5 cm^3 to perform mesoscopic tissue imaging. The principle of light sheet illumination allows you to use widefield low-magnification objectives to achieve high quality images in a fraction of the time it would take with other approaches. For example, using a Fluar 2.5×/0.12 objective, you can image an entire mouse brain with a voxel size of 1.8×1.8×12 µm in less than 40 minutes.

TRANSLUCENCE
BIOSYSTEMS

a) shows a sketch of the Translucence Mesoscale Imaging System mounted to Lightsheet 7.

b) shows a Thy1-EGFP mouse brain cleared and stained with a modified version of iDISCO, imaged in a high refractive index solution (RI = 1.56) with Fluar 2.5×/0.12 detection optics. Courtesy of S. Gandhi, UC Irvine, USA and Translucence Biosystems.





Tailored Precisely to Your Applications

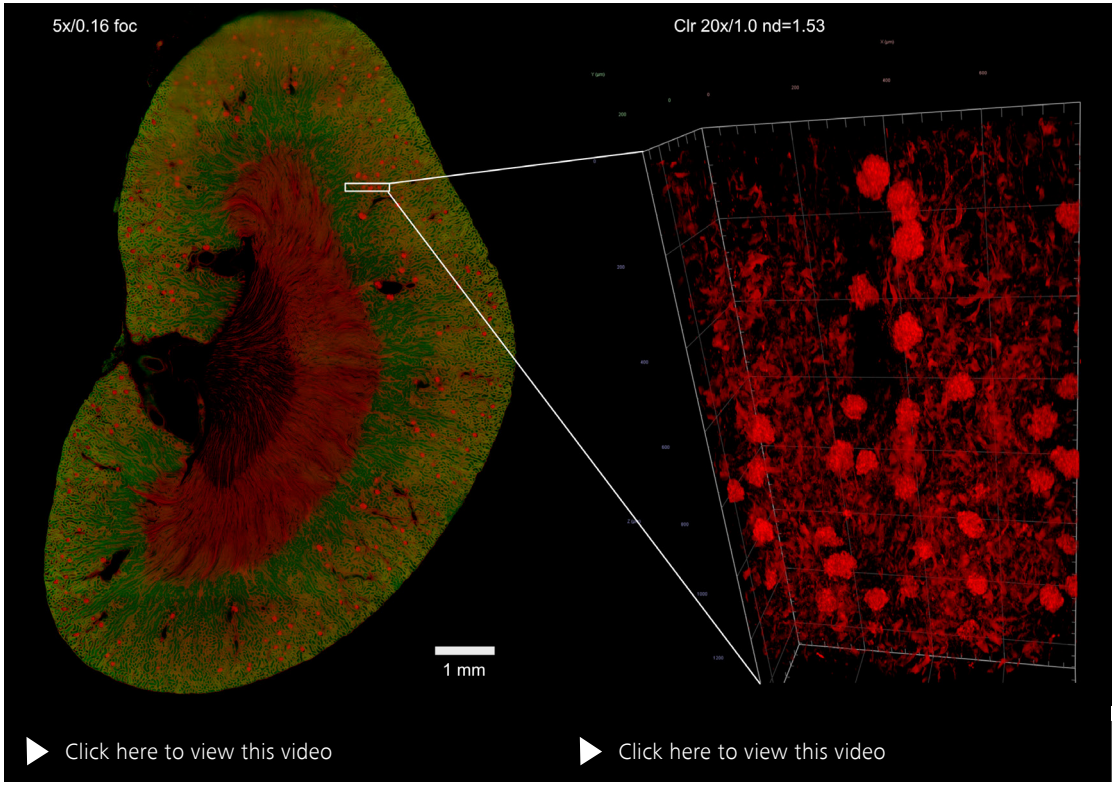
Now you can perform experiments you would never have attempted before. Lightsheet 7 delivers speed in volume imaging. It's the gentlest way to observe the development of complete embryos of your model organism and to monitor the fastest physiological processes deep inside the specimen.
Furthermore, Lightsheet 7 is the most universal and easy to use microscope to approach a vast range of volume imaging of optically cleared specimens.

Typical Applications / Typical Samples	Task
Morphogenesis and Embryogenesis in Developmental Biology and Systems Biology	Fluorescence imaging of spatio-temporal patterns of gene expression, cell origin and migration, and organogenesis during embryogenesis. Ideal for use with a variety of organisms in developmental biology, providing you with complete imaging of samples such as *Drosophila melanogaster*, zebrafish, *C. elegans* and others.
Organogenesis and Cell Dynamics	Fast imaging of cellular dynamics in embryos and small organisms (cell migration, cardiac development, blood flow, vascular development, neuro-development, calcium imaging)
3D Cell Culture	Live imaging of 3D cell culture, spheroids and cysts, tissue culture, organotypic cultures. Analysis of, e.g., cell migration, expression patterns, cell proliferation.
Plants	Developmental processes, physiological measurements
Imaging of Marine Organisms	Fluorescence imaging of marine organisms (e.g., ciona, squid, plankton, flatworms)
Structural Imaging of Fixed, Large (mm-sized) Specimens	Fluorescence volume imaging of fixed specimens (e.g., early mouse embryos, zebrafish & medaka fish, tissue)
Imaging of Optically Cleared Specimens	Imaging of fluorescently labeled fixed specimen (tissue sections, mouse brain, embryos, organs, spheroids and biopsies) that are optically cleared with almost any of the common clearing media with a refractive index between n = 1.33 (water) up to n = 1.58. Optical properties for high magnification 20× objectives are optimized for Scale A2, (nd = 1.38, Hama et al, Nat Neurosci. 2011), FocusClear™ (by CelExplorer Labs, http://www.celexplorer.com) nd = 1.45, the embedding medium for CLARITY (Chung et al, Nature 2013) and U.Clear (nd = 1.53, Zhuhao Wu, Icahn School of Medicine, Mount Sinai)

ZEISS Lightsheet 7 at Work

Nephrology

Mouse kidney cleared with iDISCO protocol and imaged in ethyl cinnamate with ZEISS Lightsheet 7 detection optics 5×/0.16 foc and Clr 20×/1.0 nd=1.53 (insert). The mouse was perfused with DyLight 594 conjugated tomato lectin to visualize vasculature and glomeruli (red).
In green: auto-fluorescence to visualize tissue anatomy. 3D whole organ imaging and computational image analysis of glomerular size and number helps to gain a better understanding of the mechanisms of diverse kidney diseases, e.g. diabetic nephropathy. Processed with arivis Vision4D® on ACQUIFER HIVE.

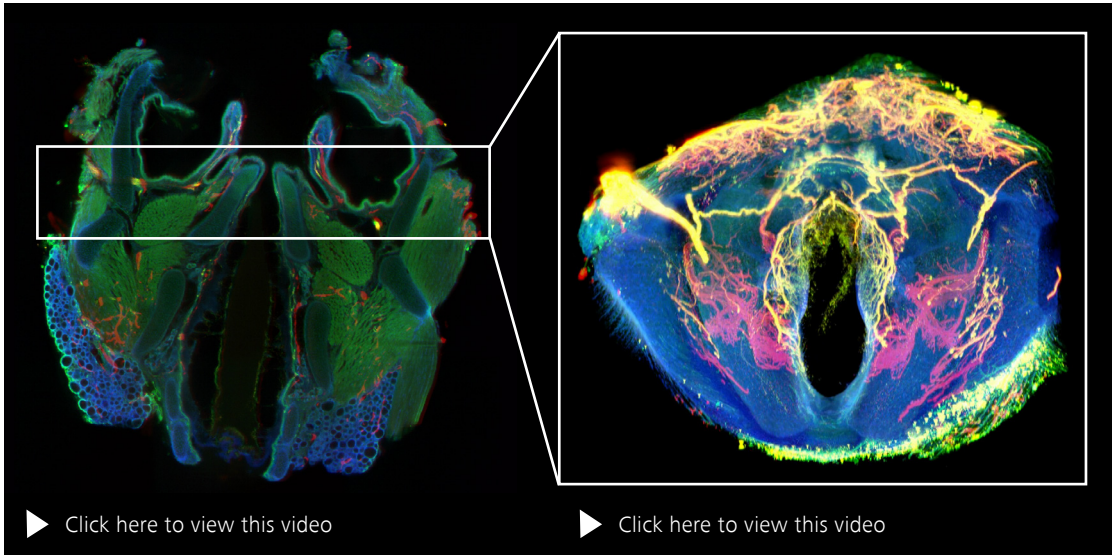


Sample courtesy of U. Roostalu, Gubra, Denmark.

ZEISS Lightsheet 7 at Work

Developmental Biology

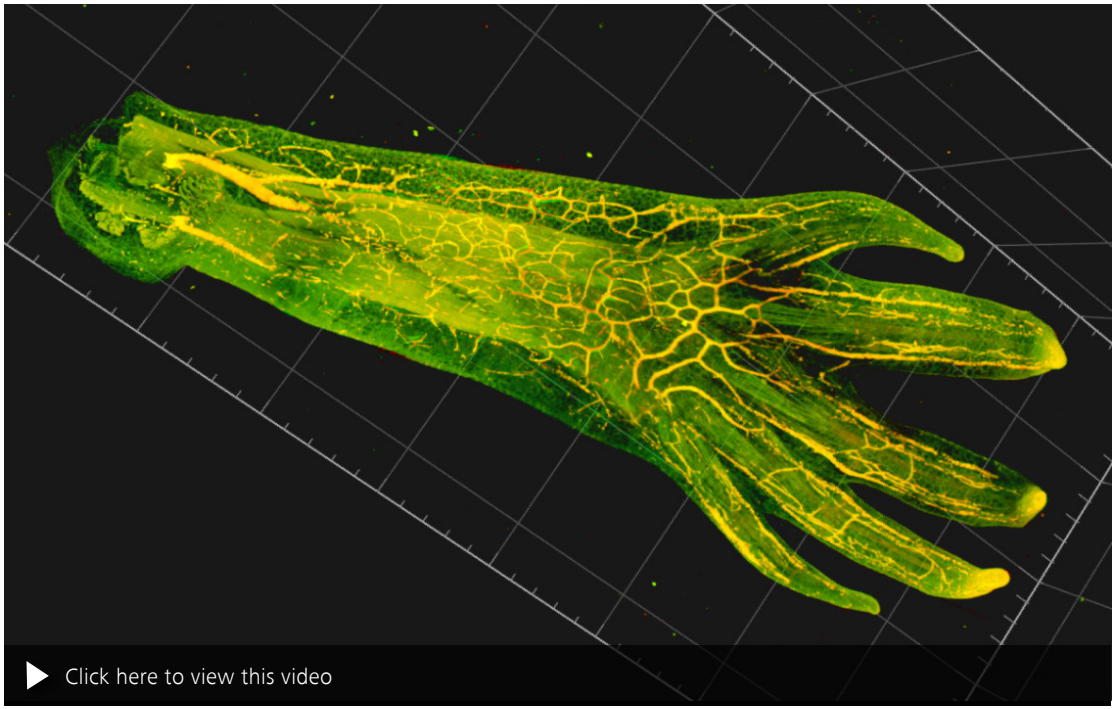
3D Data set of a P10 mouse trachea displaying the anatomical organization of mechanosensory nerve fibers. Staining: DAPI, Collagen IV (Alexa 488 antibody), sensorial fibers (reporter strain expressing tdTomato, Alexa 555 antibody), neurofilament protein NF200 (myelinated s nerve fibers, Alexa 647 antibody). The sample was cleared in PEGASOS (Jing et al:, 2018, Cell Research) imaged in BB-PEG at RI of 1.54 with 5×/0.16 foc detection optics and Clr 20×/1.0 nd = 1.53 respectively. 5× magnification data set: pixel scaling 0.61 × 0.61 × 1.63 micron, 3×3 tiles, Zoom 1.5×, 1230 z-sections, volume 2.57 × 2.58 × 2 mm 20× magnification data set: pixel scaling 0.23 µm × 0.23 × 0.58 micron, 1×5 tiles, Zoom 1.0×, 4206 z-sections, volume 2.0 × 0.45 × 1.82 mm.



Sample courtesy of P.-L. Ruffault, C. Birchmeier, Laboratory of Developmental Biology / Signal Transduction; A. Sporbert, M. Richter, Advanced Light Microscopy; M. Delbrück Center for Molecular Medicine, Berlin, Germany

ZEISS Lightsheet 7 at Work

Vertebrate Limb, Spinal Cord Regeneration
Salamanders have the remarkable capability to regenerate their limbs and spinal cords. Molecular genetics tools allow to identify the stem cells responsible for this complex regeneration, and the injury-responsive signals that initiate their proliferation. This axolotl forearm has been cleared in ethyl cinnamate (Masselink, W. et al. Development 146, (2019)) and imaged with 5×/0.16 foc detection optics at a refractive index of 1.57. The multi-tile data set was aligned, fused and rendered with ZEN imaging software and arivis Vision4D® software on an ACQUIFER HIVE data platform.

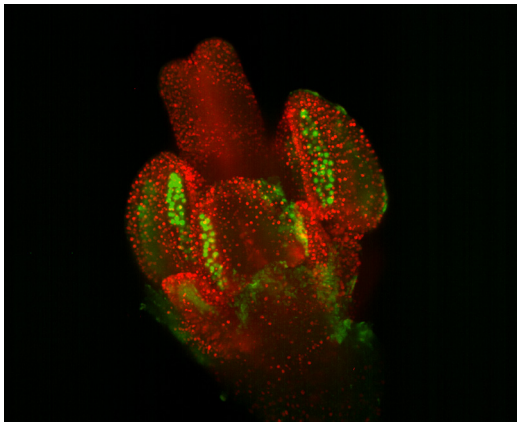


Sample courtesy of W. Masselink, Tanaka lab, Research Institute of Molecular Pathology, IMP.
Image courtesy of P. Pasierbek, K. Aumayr, IMP BioOptics, Vienna, Austria.

ZEISS Lightsheet 7 at Work

Arabidopis Flower Development

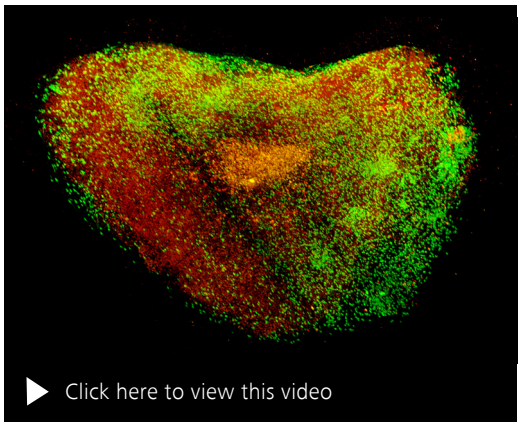
Lightsheet 7 allowed to visualize and study the structural development of entire *Arabidopsis* flowers at subcellular resolution over 5 days. This is an excellent example of gentle long term live imaging with Light Sheet Florescence Microscopy (LSFM). Labels: H2B:mRuby2 for visualization of somatic nuclei. ASY1:eYFP expressed specifically in meiocytes. Imaged with W Plan Apo 10×/0.5 and customized sample mounting and incubation chamber. Image volume: 587×587×80 µm.



Sample courtesy of S. Valuchova, P. Mikulkova and K. Riha, Central European Institute of Technology (CEITEC), Masaryk University, Brno, Czech Republic.

Neuronal Morphology

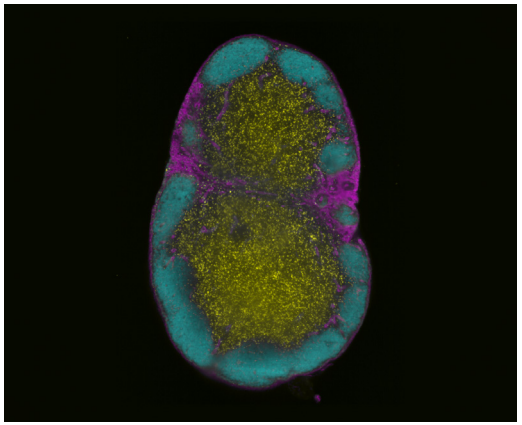
Imaging entire cells in the human brain is a task close to impossible, due to the tremendously sophisticated morphology of neurons- and their spread throughout the entire organ. Organoids allow the recapitulation of the human brain to a certain extent, including the production of neurons from neuronal stem cell cultures. With ECi clearing, neuronal morphology can be studied from the local to global level, which opens up fascinating possibilities for the study of neuronal morphology in 3D. 35 day old neuronal organoids sparsely labeled with GFP/tdtomato (3% GFP and 3% tdtomato) imaged with Clr 20×/1.0 nd=1.53 objective. Pixel scaling: 222×222×567 nm. Image volume: 1.66×0.66×1.6 mm.



Sample courtesy of D. Reumann and J. Knoblich, IMBA, Vienna, Austria.

Immunology

Imaging intact lymphoid organs in 3D allows to analyze and quantify the immune response to viral infection. T cells were transferred into wildtype host mice prior to harvest. The node was cleaned, fixed and cleared using Ce3D (Li et al. PNAS 163, 2017) prior to imaging at RI=1.49 (ph 7) with a 5×/0.16 detection optics (volume 2.5×2.5×1.6 mm). The image shows GFP labelled native CD8+ T cells (yellow), B cell follicles are stained using B220 (cyan) and the CD31 vasculature network (magenta).



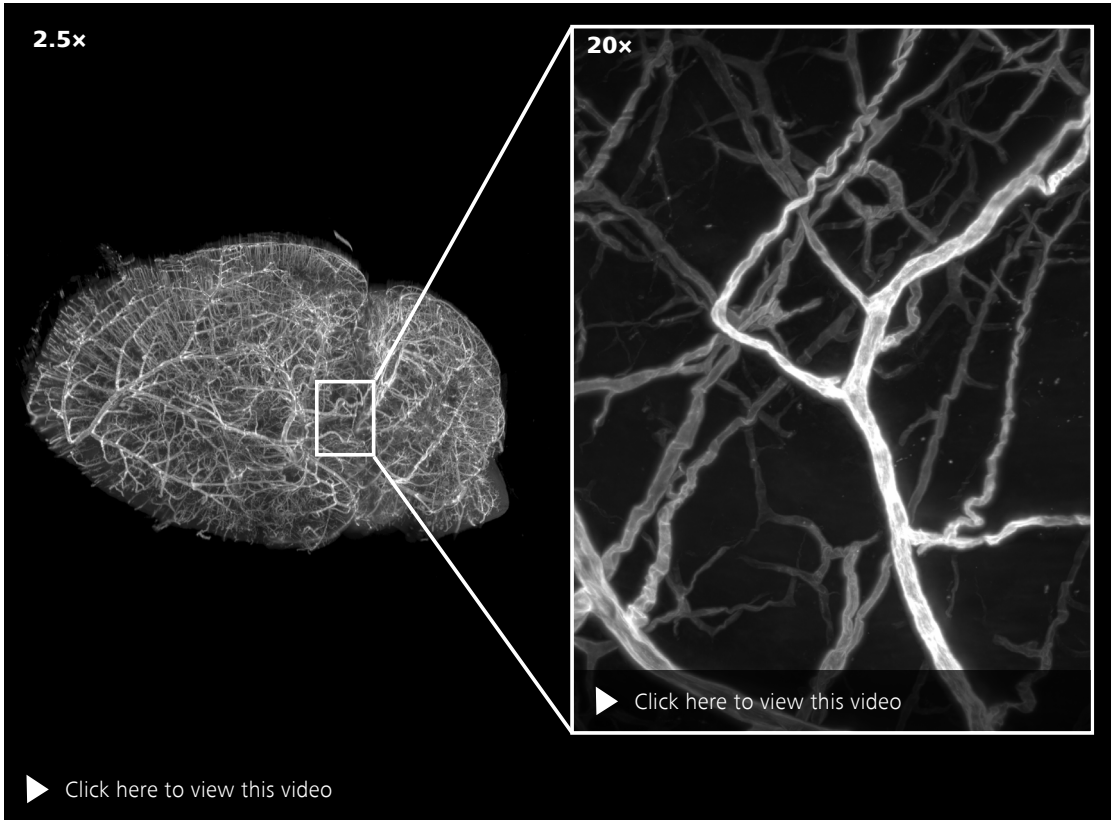
Sample courtesy of J. Groom, B. Duckworth, The Walter and Eliza Hall Institute of Medical Research, Parkville, Australia.

ZEISS Lightsheet 7 at Work

Mapping Vasculature of Entire Mouse Brain

A C57 BL6J mouse was perfused with PBS and 4% PFA. The brain was stained perfusing CellTracker™ CM-DiI Dye – a lipid dye to label the vasculature membranes. The sample was cleared using iDISCO+ protocol, equilibrated in ethyl cinnamate as final RIMS. It was then imaged in ethyl cinnamate at RI = 1.565 with detection optics Fluar 2.5×/0.12 in a Translucence Mesoscale Imaging Chamber. The high resolution insert image on the right was acquired with Clr Plan-Neofluar 20×/1.0 Corr nd = 1.53.

Image volume is 13.1 × 13.1 × 6 mm at a pixel resolution of 1.83 × 1.83 × 6.77 µm. It was acquired in about 40 minutes in 4×4 tiles, 866 z-sections. Data volume is 93 GB. Data processed with ZEN imaging software and arivis Vision4D® on an ACQUIFER HIVE data platform.

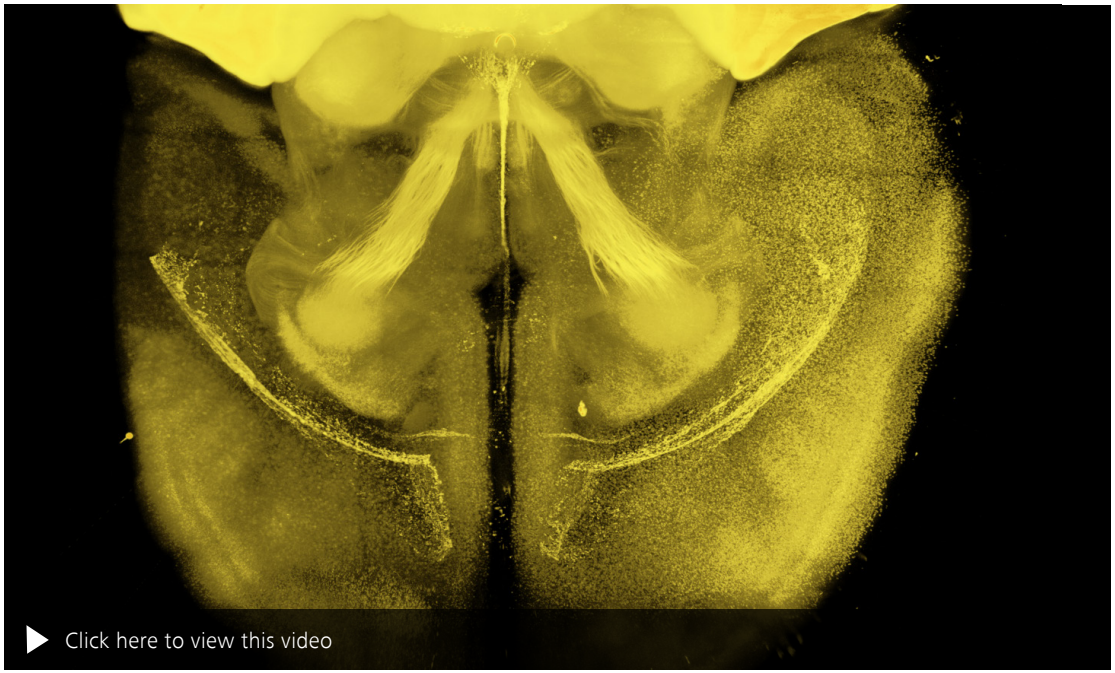


Sample courtesy of E. Diel, D. Richardson, Harvard University, Cambridge, USA.

ZEISS Lightsheet 7 at Work

Mapping Interneurons and Purkinje Cells of Entire Mouse Brain

PV-tdtomato mouse brain was cleared using CLARITY protocol with final imaging done in EasyIndex at a refractive index of RI = 1.46. Parvalbumin-Cre yielding expression of tdtomato - Parvalbumin is expressed in a population of interneurons throughout the brain and in Purkinje cells in the cerebellum. The whole brain data set was acquired on ZEISS Lightsheet 7 with detection optics 5×/0.16 foc. Image volume is 11 × 20 × 8.8 mm at a pixel resolution of 0.91 × 0.91 × 5.35 µm (12028 × 22149 × 1621 voxels). It was acquired in 6×10 tiles, 1621 z-sections. Data volume is 1.2 TB (805 GB after stitching). Data was processed with ZEN imaging software and arivis Vision4D® on an ACQUIFER HIVE data platform.



Sample courtesy of E. Diel, D. Richardson. Harvard University, Cambridge, USA.

Your Flexible Choice of Components

1 Microscope

- Standalone sealed box system: laser safe, no eyepieces, sample chamber, sample holder
- Incubation and temperature control options (cooling and heating)
- CO_2-Module

2 Objectives

- Lightsheet 7 detection optics 5×/0.16 foc (water, clearing n=1.33 – 1.58)
- Lightsheet 7 detection optics 10×/0.5 (water immersion)
- Lightsheet 7 detection optics 20×/1.0 (water immersion)
- 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
- Lightsheet 7 detection optics 40×/1.0 (water immersion)

3 Illumination

- Lightsheet 7 illumination optics 5×/0.1 foc
- Lightsheet 7 illumination optics 10×/0.2 foc
- Flexible choice of laser lines: 405 nm, 445 nm, 488 nm, 515 nm, 561 nm, 638 nm
- Transmission LED for sample positioning and overview

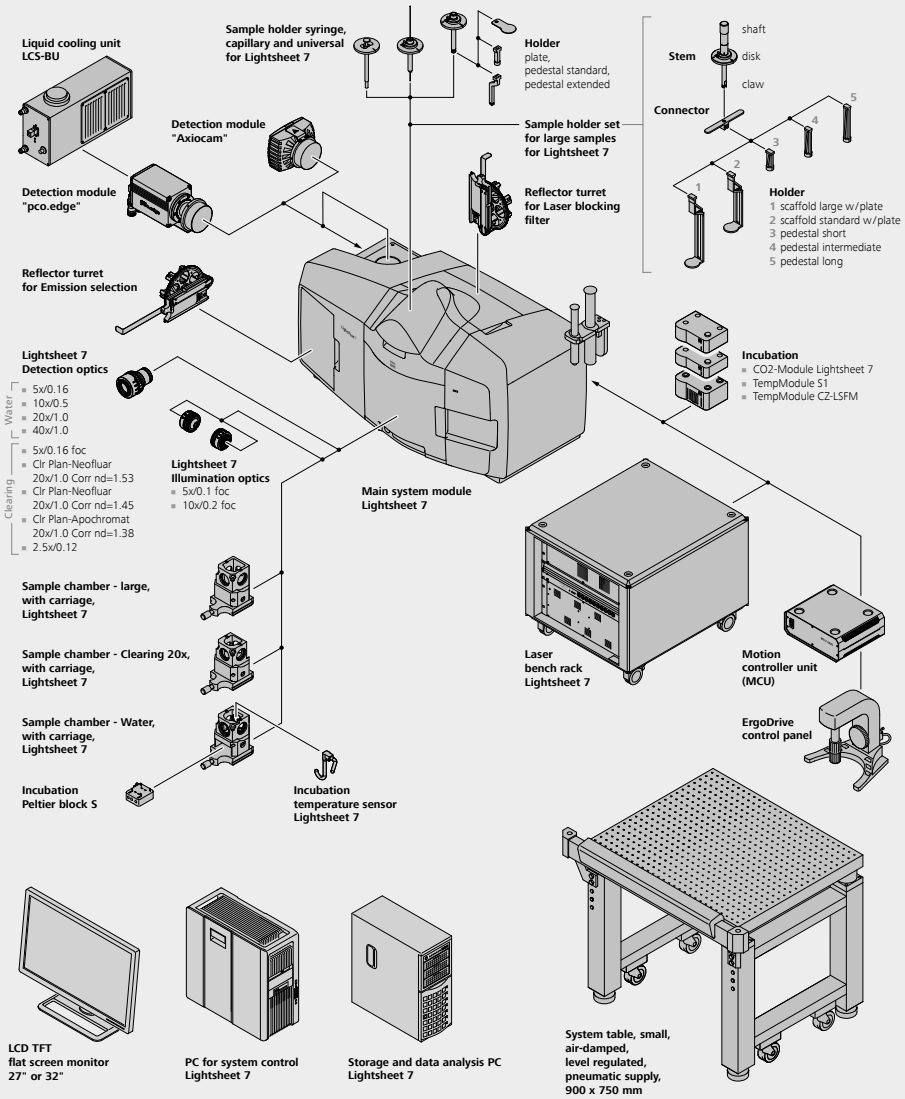
4 Cameras

- Lightsheet 7 detection module “Axiocam”
- Lightsheet 7 detection module “pco.edge”
- Selected emission filters and beam splitters

5 Software

- ZEN 3.1 LS (black edition) for image acquisition
- ZEN 3.1 (blue edition) for image processing and analysis
- Lightsheet 7 Multiview Processing
- 3DXL
- Deconvolution
- arivis Vision4D®

ZEISS Lightsheet 7: System Overview



Technical Specifications

Component	Description
Illumination Optics	Lightsheet 7 illumination optics 5× / 0.1 foc
	Lightsheet 7 illumination optics 10× / 0.2 foc
Illumination	Transmission LED for sample positioning and overview
	Flexible choice of laser lines: 405 nm, 445 nm, 488 nm, 515 nm, 561 nm, 638 nm at various output power levels
Detection Modules	Detection Module "Axiocam", Axiocam 702 sCMOS with QE up to 78%, 1216 × 1920 pixels, pixel size 5.86 µm × 5.86 µm
	Detection Module "pco.edge", pco.edge 4.2 CLHS with up to 82% QE, sCMOS, 1920 × 1920 pixels, pixel size 6.5 µm × 6.5 µm (requires liquid cooling)
Detection Optics	Lightsheet 7 detection optics 5× / 0.16 (water immersion, WD = 5.1 mm) Lightsheet 7 detection optics 5× / 0.16 foc (clearing immersion nd = 1.33 – 1.58), WD = 10.5 mm)
	Lightsheet 7 detection optics 10×/0.5 (water immersion, WD=3.7 mm)
	Lightsheet 7 detection optics 20×/1.0 (water immersion, WD=2.4 mm) Clr Plan-Apochromat 20×/1.0 Corr nd=1.38 (clearing immersion, WD=5.6 mm) Clr Plan-Neofluar 20×/1.0 Corr nd=1.45 (clearing immersion, WD=5.6 mm) Clr Plan-Neofluor 20×/1.0 Corr nd=1.53 (clearing immersion, WD=6.4 mm)
	Lightsheet 7 detection optics 40×/1.0 (water immersion, WD=2.5 mm)
Sample Chamber, Sample Holder, Consumables	Starter kits and all necessary accessories for your experiments
	The following chambers are available: ■ Water chamber (n=1.33) to be used with 5×, 10×, 20× and 40× water immersion lenses ■ 20× Clearing chamber (n=1.35–1.58) to be used with Clr 20× immersion lenses ■ Large sample chamber (n=1.33–1.58) to be used with 5× foc objective ■ Translucence chamber to be used with 2.5× and 5× detection optics
Software Processing	Lightsheet 7 Multiview Processing, Dual side Fusion, Stiching
	3DXL, arivis Vision4D®
	Deconvolution
Software Acquisition	Multidimensional imaging (time, postions, tiles, multiview)
	Combination of multidimensions possible with the exception of Multiview and Tiling)
	Semi-automatic z-offset compensation
	Mean and maximum fusion for dual side illumination and multiview
	RI compensation for optical sectioning and image size

Technical Specifications

Component	Description
System PC	HP Z6 G4 workstation Chipset: Intel C622 Memory: max. 192 GB RAM SSD: 1×512 GB M.2 NVMe Hard Drives: 2×4 TB SATA 7200 rpm (configured as 4 TB RAID 1 hard drive); increase capacity from 4 TB (RAID 1) to 8 TB (RAID 10) Processor: Intel® Xeon® Gold 6134 (3.2 GHz, 24.75 MB cache, 8 cores) Graphics Card: NVIDIA Quadro P4000 8GB DP Network Adapter: 2×10 GbE RJ45 (hp Z6); additional network adapter 2×10 GbE RJ45 (hp Z6) e.g. for connection of storage systems Operating system: Windows 10 IoT Enterprise 2016 LTSC Embedded x64
Storage and Data Analysis PC	CPU: Intel P XEON E5-2620V3 2,4 GHz LGA2011 L3 15MB Box Graphics Card: NVIDIA Quadro P4000 8GB DP or NVIDIA Quadro P6000 24GB DP Memory: 64 GB (4× 16 GB) included, max. 256 GB RAM; Memory slots: 16× DIMM slots Hard Drives: 6× HDD 8 TB, RAID 5 configured to 36 TB data storage volume; 2× Solid State Drive 240 GB for pagefile and operating system 10 Gbit Ethernet on motherboard and 10 GbE cable to connect with PC for system control (high speed data streaming) Network Adapter: LAN: 2× 10 GbE 5× USB 3.0, 4× USB 2.0 ports Operating system: Windows 10
Incubation	Peltierblock Sample Chamber with Temperature Sensor with controller TempModule S1 and TempModule CZ-LSFM
	CO_2-Module
	Heating Device Humidity
Trigger	Trigger-out signal via BNC connector. High level of 3.3 V (nominal value of the high level: > 3.2 V < 4.0 V, and nominal value of the low level: 0 V ±0.4 V). The minimal working resistance is 5 kΩ.

Technical Specifications

Microscope	Standalone box system, sealed, turnkey, laser safe, no eyepieces	
Physical Dimensions	**Approx. Width × Depth × Height**	**Approx. Weight**
Main System Module Lightsheet 7	800 mm × 450 mm × 500 mm	75 kg
Laser Rack "LB Rack Lightsheet"	600 mm × 700 mm × 550 mm	80 kg
System Table for main System Module Lightsheet 7, Level regulated	900 mm × 750 mm × 770 mm	90 kg
Transmission Contrast for Overview	IR LED illumination, no Köhler Illumination, not specified for high quality imaging	
Spectral Range of Detection	400 – 740 nm	
Dual Camera Port for simultaneous 2 Channel Detection		
Detection zoom	0.36× – 2.5×, continuous	For imaging, the zoom range of 0.7× – 2.5× is recommended, 0.36× – 0.7× for sample positioning only
Field of View	123 µm to 3.5 mm	2.8 mm image diagonal, 5× detection lens, zoom 0.7×, for sample positioning (zoom 0.36×) > 5 mm
Embedded Specimen Size	From < 1 µm to 10×10×20 mm	
Sample Mounting	Dedicated sample chambers for live or cleared samples of up to 10 × 10 × 20 mm^3 in size (approximation: an ellipsoid shape). Universal sample holder for embedded samples; Sample holder with claw and flexible adapters for large or cleared samples.	
Immersion and Incubation Media	Sample chambers and optics designed for aqueous media (nd = 1.33) or clearing media nd = 1.35 – 1.58 for Clr 20× sample chamber; 1.33 – 1.58 for large sample chamber.	
Light sheet thickness	2 µm – approx. 14 µm	Depending on sample, at 488 nm

Technical Specifications

Detection Modules	Up to two detection modules of the same type can be connected to the dual camera port		
Detection Module “Axiocam“	Axiocam 702 mono, Sony MX 174 sensor, aligned on a C-mount for optimized image alignment on dual camera port		
	Pixel size	5.86 µm	
	Max. pixel format	1216 × 1920 pixel, (2.3 Megapixel)	
	Bit depth	14 bit	
	Max. frame rate QE up to 78%	100 fps at 1024 × 1024 pixel, in continuous z-drive mode	
Detection Module “pco.edge“	pco.edge 4.2 CLHS, sCMOS sensor, requires liquid cooling, aligned on a special C-mount for optimized image alignment on dual camera port		
	Pixel size	6.5 µm	
	Max. pixel format	1920 x 1920 (3.7 Megapixel)	
	Bit depth	15 bit	
	Max. frame rate QE up to 82%	57 fps at 1024 × 1024 pixel, in continuous z-drive mode	
Data Acquisition Rate	With dedicated Lightsheet 7 storage module	Up to 200 Mbyte/sec	
Incubation			
Peltier Block	Heating and cooling of sample chamber	10 °C to 42 °C	Up to 1.5 °/min heating, up to 1.0 °/min cooling
Temperature Stability	± 0.1 °C		
CO_2-Module	Requires CO_2 supply, adjustable concentration		0 % to 10 %

Technical Specifications

Sample Positioning	Four-axis multi-coordinate stage with stepper motors	Specifications: x / y / z / α
Travel Range		10 mm / 50 mm / 10 mm / 360°
Reproducibility (±)		200 nm / 650 nm / 200 nm / 0.1°
Smallest Increment		50 nm / 1 µm / 50 nm / 0.05°
Speed of Rotation Motor		90° / sec
Max. z Travel Rate		2 mm / sec
Laser Module		
Laser Class	All Lasers are class 3B	
	The installed system as a whole is laser class 1	
Laser Wavelengths and Power (Power: pre-Fiber)	405 nm	20 mW or 50 mW
	445 nm	25 mW
	488 nm	30 mW or 50 mW
	515 nm	20 mW
	561 nm	20 mW or 50 mW
	638 nm	75 mW

Technical Specifications

Environmental Conditions			
Operation	Permissible ambient temperature (specified performance)	22 °C ± 3 °C	(Constant, if fluctuating, warm-up time applies)
	Permissible ambient temperature (reduced performance)	15 °C to 30 °C	
	Permissible relative air humidity (no condensation)	< 65 % at 30 °C	
	Max. altitude of installation site	Max. 2000 m	
Warm-up Time	60 min	For high precision and/or long-term measurements ≥ 3 h	
Vibrations	To be operated in conformance with Vibration Class C. VC-C, 12,5 µm/s RMS amplitude of frequency band 8 – 80 Hz (RMS = root mean square) according to ISO 10811.		

Electrics and Power			
Mains Voltage		220 V AC to 240 V AC (±10 %)	100 V AC to 125 V AC (±10 %)
Supply Frequency		50 to 60 Hz	50 to 60 Hz
Lightsheet 7 System	Max. current	Single 3.5 A phase	Single 8 A phase
	Power consumption	800 VA max.	750 VA max.
Data Analysis PC	Power consumption	400 VA max.	400 VA max.
Protection Class / Protection Type		I / IP 20	
Overvoltage Category		II	
EMC Inspection		According to DIN EN 61326-1 (10/2006)	
Emitted Interference		According to CISPR 11/DIN EN 55011 (05/2010)	

Heat Loss	
System Lightsheet 7 (incl. Lasers and Accessories)	700 W
Data Analysis PC	350 W

Patents which apply for Lightsheet 7	US6037583, US6392796, US7554725, US7787179, US8214561, EP1576404

Count on Service in the True Sense of the Word

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

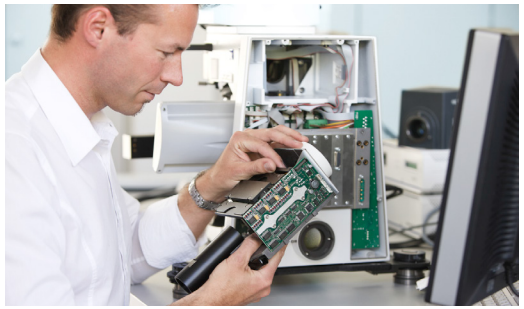
Repair. Maintain. Optimize.

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

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

Enhance Your Microscope System.

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



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

>> www.zeiss.com/microservice

Carl Zeiss Microscopy GmbH
07745 Jena, Germany
microscopy@zeiss.com
www.zeiss.com/lightsheet