Discovering the subcellular dynamics of life

ZEISS Lattice Lightsheet 7

Long-term Volumetric Imaging of Living Cells

zeiss.com/lattice-lightsheet

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Seeing beyond

Lattice light sheet technology readily accessible for your live cell imaging

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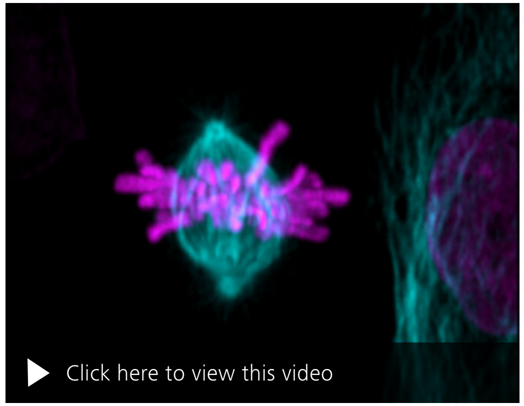
Light sheet fluorescence microscopy has become an established method for fast and unsurpassed gentle imaging of living specimens. By adding lattice structures to the light sheet, ZEISS Lattice Lightsheet 7 makes this technique available for live cell imaging at subcellular resolution – while also allowing you to use your standard sample carriers. With this automated, easy-to-use system the benefit of lattice light sheet microscopy – volumetric imaging of subcellular structures and dynamics over hours and days with best protection from photo damage – becomes available to everyone.

Thanks to the integrated auto-alignment procedure, you are ready to start your experiments within minutes. The inverted platform is compatible with all sample carriers commonly used for high-resolution optical microscopy. Examine the samples you already use for confocal microscopy experiments, without having to adjust your usual sample preparation. Discover the dynamics of life in unprecedented depth of detail – with the ease you never imagined possible!



LLC-PK1 cell undergoing mitosis. Cells are expressing H2B-mCherry (magenta) and a-Tubulin mEGFP (cyan).

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Simpler. More Intelligent. More Integrated.

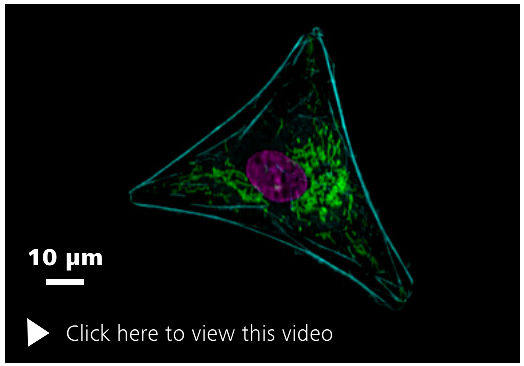
Lattice light sheet technology made accessible to everyone
The importance of gentle light sheet imaging at high resolution cannot be overestimated for the study of subcellular processes. With Lattice Lightsheet 7, ZEISS makes access to the benefits of this advanced technology amazingly simple. Without having to adapt your usual sample preparation, you can examine living specimens directly on the standard sample carriers you already use for confocal microscopy. Complex alignment processes are performed automatically in this system so that you can focus your full attention on your experiments.

Next to no phototoxicity and bleaching
You want to watch the dynamics of life at subcellular resolution to study how the finest structures change over time, but your conventional imaging systems quickly reach their limits because they are too invasive and destroy what you are observing. Instead, ZEISS Lattice Lightsheet 7 provides lattice-structured light that automatically adapts to your sensitive samples, resulting in a massive reduction of photobleaching and phototoxicity, to allow your experiments to continue over hours and even days. The controlled incubation environment and an integrated auto-immersion mechanism enable unattended long-term experiments.

High-speed volumetric imaging
The extremely fast image acquisition of ZEISS Lattice Lightsheet 7 enables up to three volume scans per second. Dynamic imaging of full sample volumes with this high temporal resolution means no longer missing an interesting event on your coverslip. Near-isotropic resolution along the X, Y and Z axes gives you a three-dimensional image of your sample that reveals structural details in their true proportions. Fast laser switching allows for imaging using up to three colors practically simultaneously, with minimized color crosstalk.

Access lattice light sheet imaging with your standard cell culture dishes and coverslips.

LLC-PK1 cell undergoing mitosis. Cells are expressing H2B-mCherry (cyan) and a-Tubulin mEGFP (magenta). Recording over a period of 25 hours.



Time lapse movie showing dynamics of a U2OS cell stably expressing Actin-GFP (cytoskeleton, cyan). Cells were also labeled with MitoTracker™ Red CMXRos (Mitochondria, green) and Draq 5 (Nucleus, magenta).

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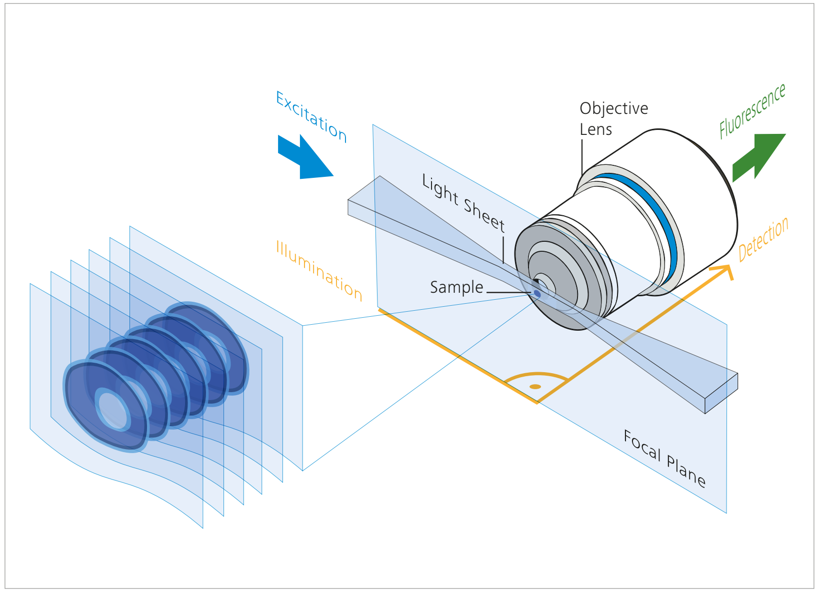
The principle of lattice light sheet microscopy

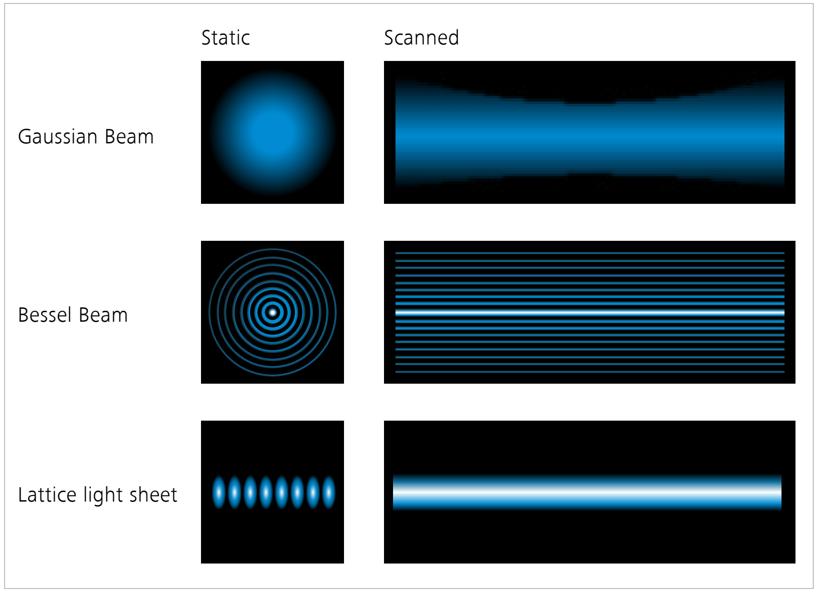
Light sheet microscopy in general (also called Gaussian light sheet microscopy) is well known for its gentle imaging conditions at superior imaging speed. The groundbreaking concept of decoupling excitation and detection allows illumination of only the part of the specimen that is in the focal plane of the detection objective lens. By moving the sheet with respect to the sample and recording one image per focal plane, you can acquire volumetric data without exposing the out-of-focus sample areas.

Lattice light sheet microscopy combines the advantages of light sheet microscopy with near-isotropic resolution in the confocal range. Advanced beam shaping technology creates lattice-shaped light sheets that are significantly thinner than standard Gaussian light sheets and thus provide increased resolution at comparable imaging speeds. The lattice structure of the light sheet is created using a Spatial Light Modulator (SLM), then projected onto the sample after passing scanners that dither the lattice structure to create a smooth light sheet.

To allow imaging of horizontal samples such as standard cell culture dishes, excitation and detection objectives are oriented at an angle with respect to the sample. As a result, the sample is being illuminated and imaged from this angle.



Conventional (Gaussian) light sheet microscopy splits fluorescence excitation and detection into two separate light paths, allowing to generate an inherent optical section by exciting only fluorescence from the in-focus plane.



Lattice light sheet microscopy overcomes the limitations of Gaussian beams (limited optical sectioning, limited field of view) and Bessel beams (strong rings, excitation of out-of-focus fluorescence) by generating long and thin light sheets to achieve subcellular resolution.

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The ZEISS implementation of lattice light sheet microscopy

During the development of Lattice Lightsheet 7, ZEISS gave special attention to user-friendliness and compatibility with conventional sample preparation techniques. An inverse configuration is the most important prerequisite to allow the use of standard sample carriers for high-resolution microscopy.

The challenges resulting from an inverse configuration are mainly refractive index mismatches as fluorescence is emitted from the sample, passes through aqueous cell culture media, a tilted glass coverslip and water immersion, then into the detection objective.

Special ZEISS proprietary optical elements in the detection beam path compensate for refractive index mismatches and enable you to image samples as easily and quickly as with a confocal microscope.

Schematic of sample carrier and core optics module with excitation objective (1), meniscus lens (2) and detection objective with free-form optics (3). Examples show imaging without (A) and with correction of refractive index changes (B).

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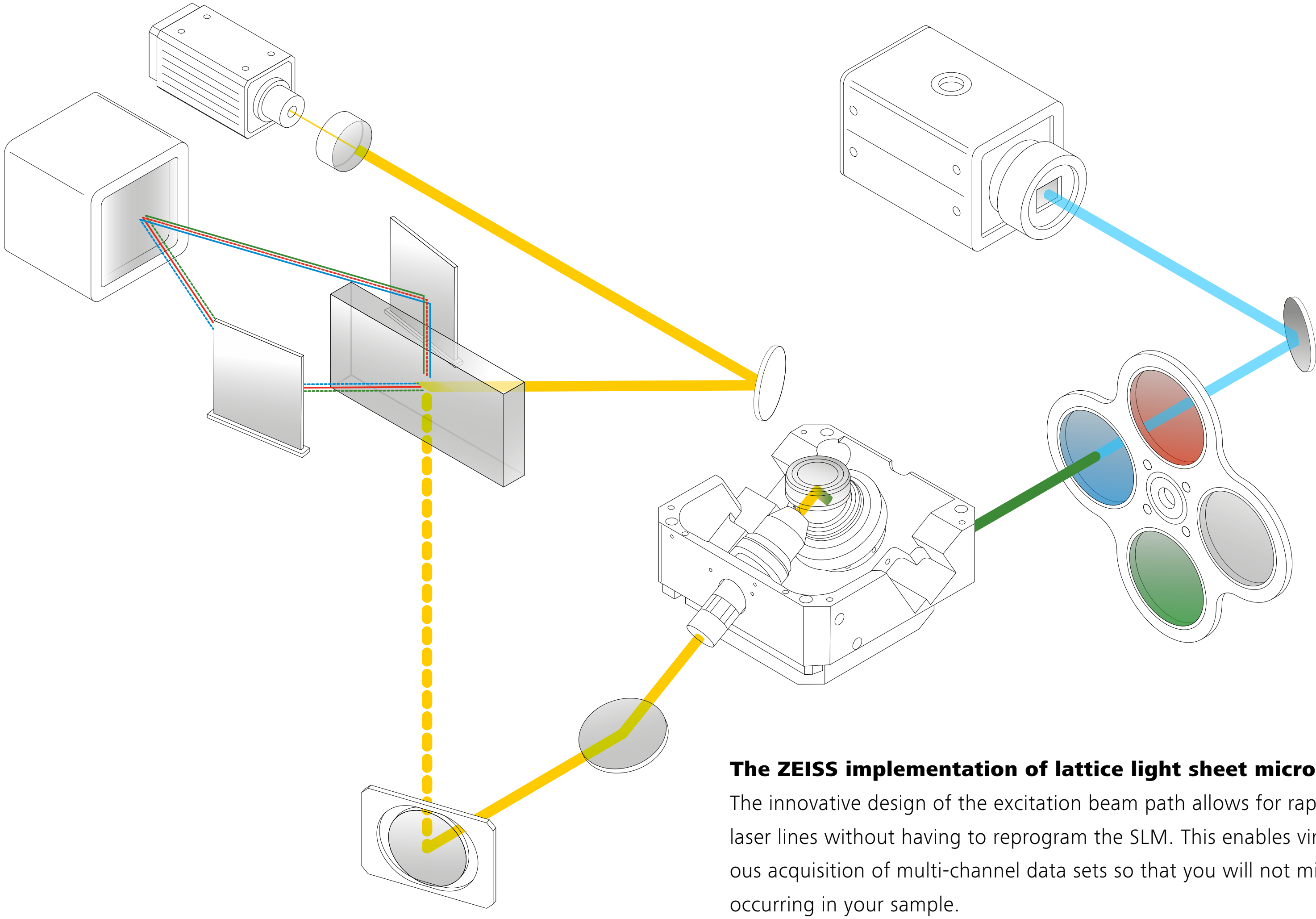

The ZEISS implementation of lattice light sheet microscopy
The innovative design of the excitation beam path allows for rapidly changing laser lines without having to reprogram the SLM. This enables virtually simultaneous acquisition of multi-channel data sets so that you will not miss any events occurring in your sample.

Schematic of excitation beampath

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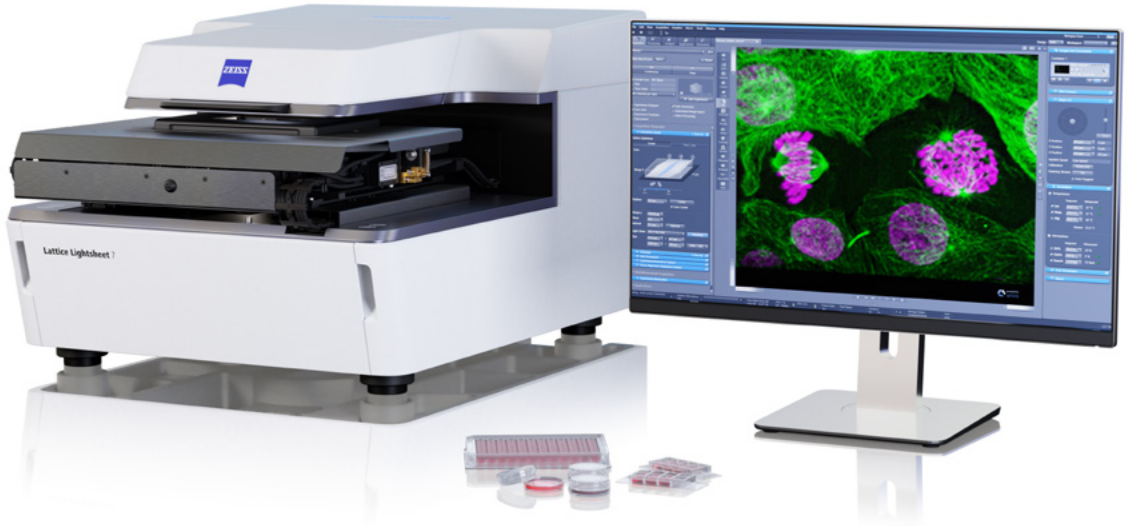
A system that adapts to your samples – not the other way around

ZEISS Lattice Lightsheet 7 can be used with all standard sample carriers that come with a no. 1.5 coverslip for the bottom. With the integrated transmission LEDs and oblique detection, which provide a DIC-like contrast, you can easily locate your sample. Change from white to red transmission LEDs for more gentle illumination if necessary.



Specifically designed for this system, the unique 5-axis stage not only allows movement along the X, Y and Z axes, but also tilting with the highest precision in X and Y. Leveling your sample is done automatically, which relieves you of tedious manual procedures.

For the best imaging results, the lattice light sheet must be adapted to each sample; therefore, ZEISS has implemented automatic alignment of all optical elements to eliminate time-consuming manual adjustments. The system is ready for imaging at the push of a button, ensuring a consistently efficient workflow. Your experiment startup procedure is accelerated, so you can spend your time on the more valuable data acquisition.

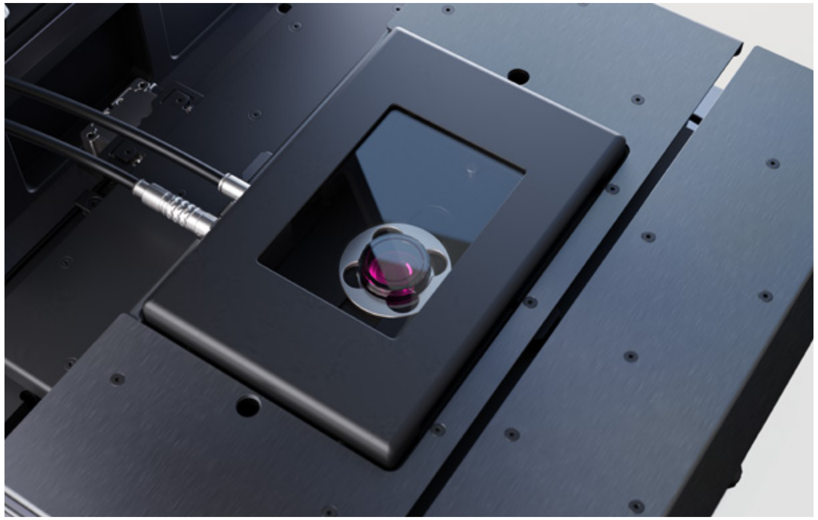
ZEISS Lattice Lightsheet 7 operates with our proven imaging software platform ZEN (blue edition). All features of this platform, such as advanced tiling and a powerful deconvolution algorithm, are conveniently at hand. The Direct Processing module allows you to process data during acquisition by streaming it to a separate PC.

Your Insight into the Technology Behind It

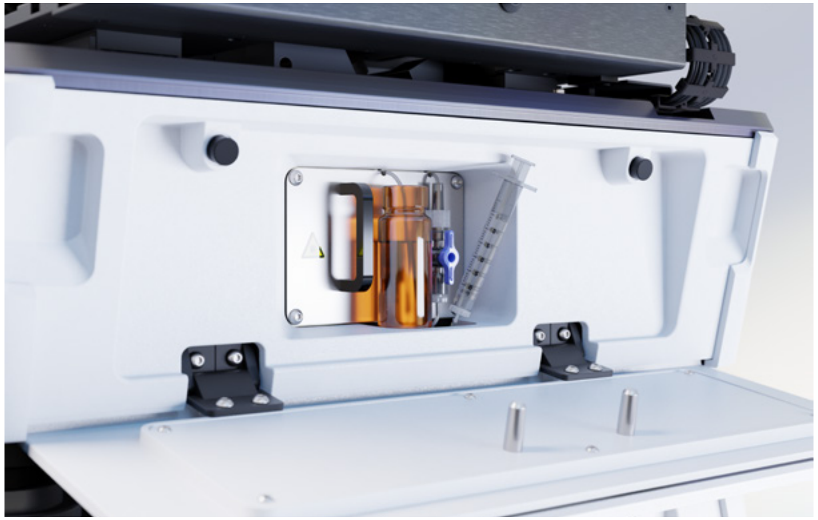
Ready for unattended long-term experiments

An *ibidi* stage top incubation system is integrated into Lattice Lightsheet 7. This system provides long-term stability throughout varying environmental conditions. The microscope controls and monitors temperature, CO_2 and O_2 levels, and humidity automatically, to preserve the integrity of your sample throughout the experiments. The lid with glass window allows quick and easy access to the sample to facilitate its inspection during an experimental run. And you can choose to include transmitted light illumination during long-term observations.

Prime the system to release any air, then a supply of immersion media tailored to the needs of your experiments is released automatically. Replenishing the immersion media is software-controlled, so you don't have to worry about interfering with image acquisition. The reservoir is protected from illumination to keep bacterial growth at bay. Objectives are shielded from immersion supply; hence they remain dry, even if excess immersion media is applied.



ZEISS Lattice Lightsheet 7 incubation chamber loaded with a standard 35 mm dish



ZEISS Lattice Lightsheet 7 autoimmersion equipment

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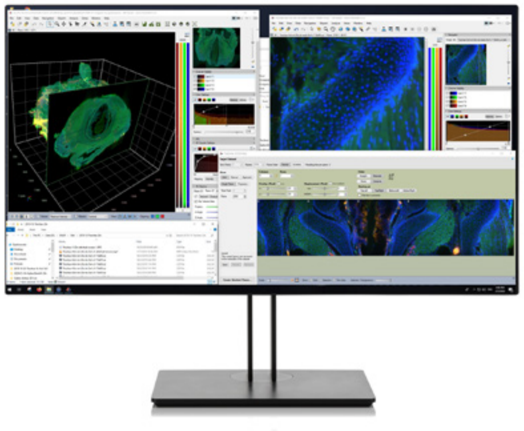
Image Data Processing & Analysis

Your Lattice 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 Lattice Lightsheet Processing tool including Deskewing, Cover Glass Transformation and DCV that can be arranged in a pipeline at your needs and many other benefits. With ZEN (blue edition) you can also easily image an extended area by tiles.

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 Lattice 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.



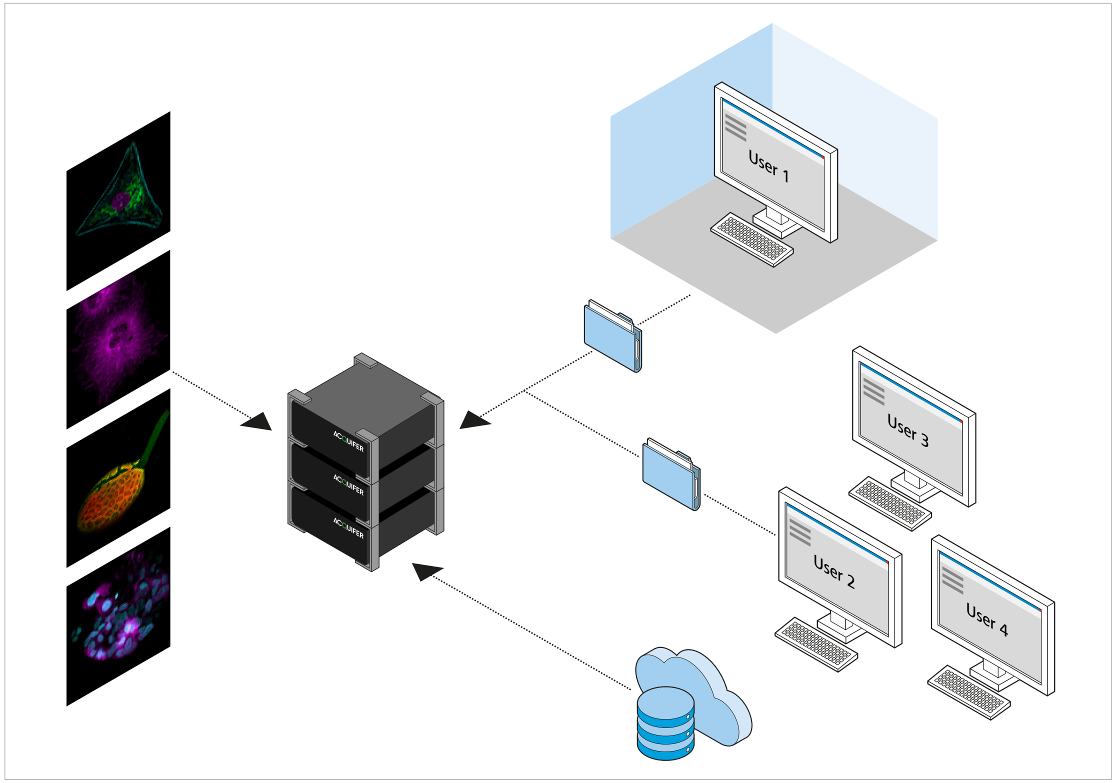
Human induced pluripotent stem cells. Images generated using AICS-0013 (LMNB1-mEGFP) from the Allen Institute for Cell Science.

Your Insight into the Technology Behind It

Large data storage and processing
With its high resolution and imaging speed, ZEISS Lattice Lightsheet 7 generates large datasets in a short period of time, which can place significant demands on your hardware. Data acquisition is supported by the same familiar storage system you know from our Lightsheet 7 instrument. Powerful Direct Processing and Batch Processing modules allow you to automate the processing task, so you can move on to other tasks and return when your imaging work is complete.

If more space is needed, the Lattice Lightsheet system can be connected to your local server structure, or a scalable storage device like the HIVE from Acquifer, via the 10 GB data transfer lines. The HIVE offers the advantage of running ZEN image processing software, so its utility extends beyond simply image storage.

Imaging the sample at an angle requires that the data must be transformed before visualization and analysis. This process, commonly known as deskewing, is implemented in ZEN (blue edition). The Lattice Lightsheet Processing module allows you to combine individual processing steps into one task. You can customize the arrangement of and perform the required steps based on your experiment needs. For example, select a coordinate transformation step to render the data set into a format familiar from your confocal and classical widefield imaging work so you never lose track of sample orientation. Or, choose the deconvolution feature to improve image quality especially when you have chosen a thinner light sheet with pronounced side lobes. By arranging your choice of processing steps into individual pipelines within the Lattice Lightsheet Processing module, you are able to work faster for subsequent experiments.



Tailored Precisely to Your Applications

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Perform experiments you would never have attempted before. ZEISS Lattice Lightsheet 7 with its large field of view and high-resolution detail allows you to observe subcellular structures and dynamics with high temporal resolution over extended time periods. Its unsurpassed gentle illumination ensures that your living samples are not damaged by phototoxicity and your experiments are not affected by photobleaching.

Typical Applications / Typical Samples	Task
Live cell imaging of ■ **Adherent cells** ■ **Suspension cells**	Volumetric imaging of subcellular processes with high speed: organelle morphology and dynamics, organelle-organelle interactions, vesicle trafficking
	Volumetric imaging of membrane dynamics
	Volumetric imaging of immune cells such as T cell mobility and activation
	Gentle imaging of live cells for hours up to days with minimal phototoxicity and photobleaching
	Cell proliferation and apoptosis assays
3D cell culture ■ **Spheroids** ■ **Organoids** ■ **Cysts** ■ **Cells in Hydrogel**	Live imaging of spheroids or organoids with diameters up to 200 µm
	Organoid self-organization
	Cell migration and proliferation within organoids
	Imaging of cell-cell interactions, 3D organization, migration and morphology
	In vitro imaging of neuronal activity
Small evolving organisms, e.g. ■ **Zebrafish embryos** ■ **C. elegans embryos** ■ **Drosophila embryos**	Resolving structural detail in 3D with close to isotropic resolution
	Fast imaging of cellular and subcellular dynamics in embryos and small organisms up to 100 µm in diameter
	Cell migration, cell-cell interaction, cell cycle, vesicle trafficking
Oocytes	Live imaging of whole oocytes in 3D with subcellular detail
Expanded samples	Water based gel expanded small samples

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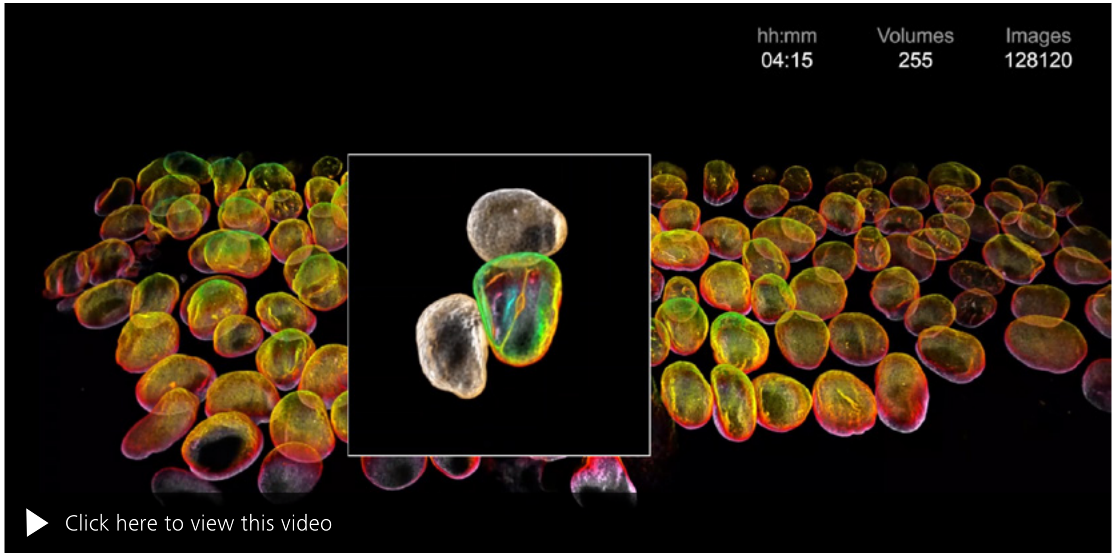
Lamin B1 in action

Lamin B1 localizes to the nuclear envelope and is involved in disassembling and reforming the nuclear envelope during mitosis. The formation of so-called 'nuclear invaginations' has been reported frequently for many different cell types during mitotic events at different stages of the cell cycle. Nuclear invaginations can manifest as tubular structures that extend from the nuclear envelope and cross through the nucleus. Although these unique structures have been reported frequently, most research so far has been done with fixed cells. Consequently, the function of these structures is largely unknown even though plenty of hypotheses have been proposed.

This data set was recorded with a cell line from the Allen Institute for Cell Science in Seattle: human induced pluripotent stem cells which endogenously express mEGFP-tagged lamin B1 (AICS-0013). The overnight experiment was recorded for close to 8 hours with one volume imaged every 1.5 min. Cells going through mitosis can be observed throughout the whole duration. Formation and dynamics of nuclear invaginations can clearly be observed in most of the cells, throughout the complete cell cycle.



Human induced pluripotent stem cells which endogenously express mEGFP-tagged lamin B1 (AICS-0013). Images generated using AICS-0013 (LMNB1-mEGFP) from the Allen Institute for Cell Science.

Gentle illumination is crucial for imaging mitosis as this process is extremely delicate and light sensitive. To prevent replication of damaged DNA, cells arrest mitosis as soon as there is any damage from excitation light. The gentleness of Lattice Lightsheet 7 imaging and an extremely stable system is required for imaging mitotic events over longer time periods. Fast volumetric imaging in combination with near-isotropic resolution allows for looking at the sample from every angle and investigating unique subcellular structures in every detail.

ZEISS Lattice Lightsheet 7 is the perfect tool for challenging experiments like this. Applications that were impossible before turn into reality – and with its ease of use, they can also become real for your research.

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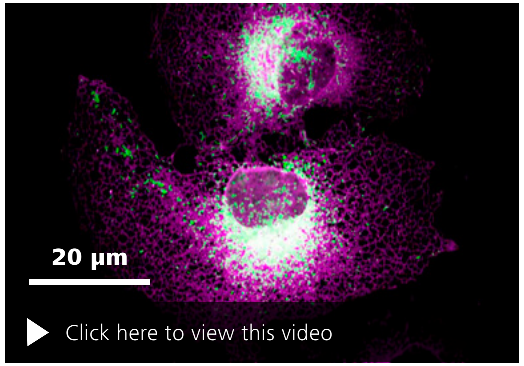
Gently image subcellular dynamics at highest volume speed

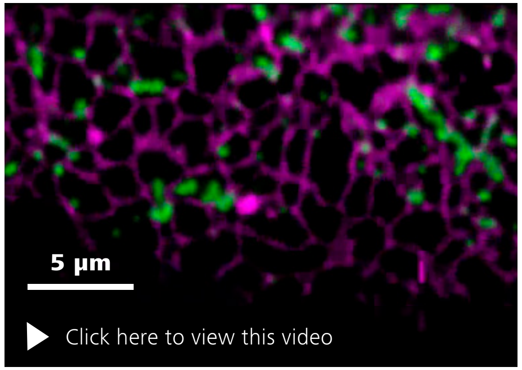
Get the best of both worlds: lattice light sheet technology combines the speed and gentleness of light sheet microscopy with the resolution of confocal microscopy. The lattice light sheet illumination technique allows for extremely efficient illumination and, as a consequence, the gentlest imaging conditions.

Cos 7 cell transiently transfected with Tomm20-mEmerald and Calreticulin-tdTomato. Tomm20 labels the outer membrane of mitochondria, Calreticulin is a protein of the ER where proteins are synthesized. Both are extremely delicate and light-sensitive organelles that are difficult to image with conventional methods.

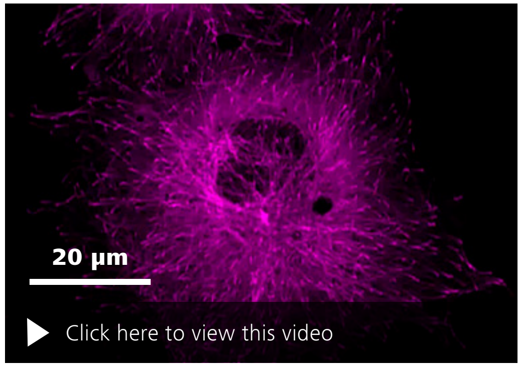
One volume every 30 secs, imaged for 1 hr 15 mins, imaged volume: 175 × 210 × 20 µm³. A total of 85,800 images was recorded; 572 volume planes for 150 time points.



One volume every 1 sec, imaged for 7 mins, imaged volume: 85 × 15 × 20 µm³. A total of 9,300 images was recorded; 31 volume planes for 300 time points.



Cos 7 cells transiently transfected with Calnexin-mEmerald and EB3-tdTomato. EB3 labels the growing ends of microtubules and is necessary for the regulation of microtubule dynamics. Calnexin is a protein of the ER where proteins are synthesized. Cells were imaged for 1.5 hrs every 80 secs, imaged volume: 175 × 120 × 70 µm³.



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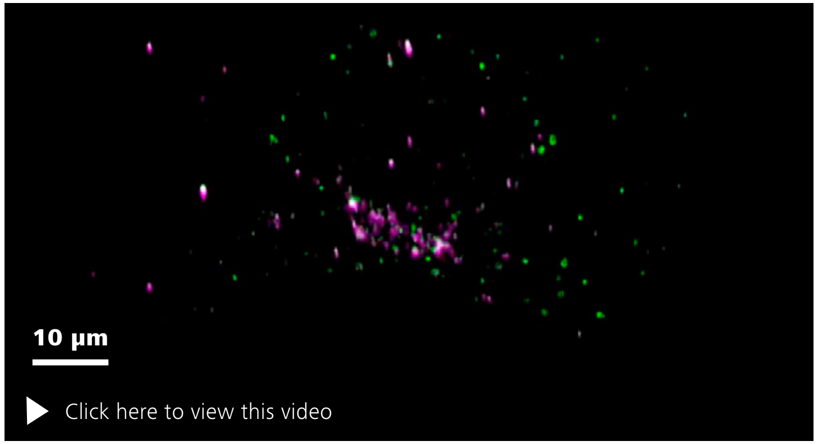
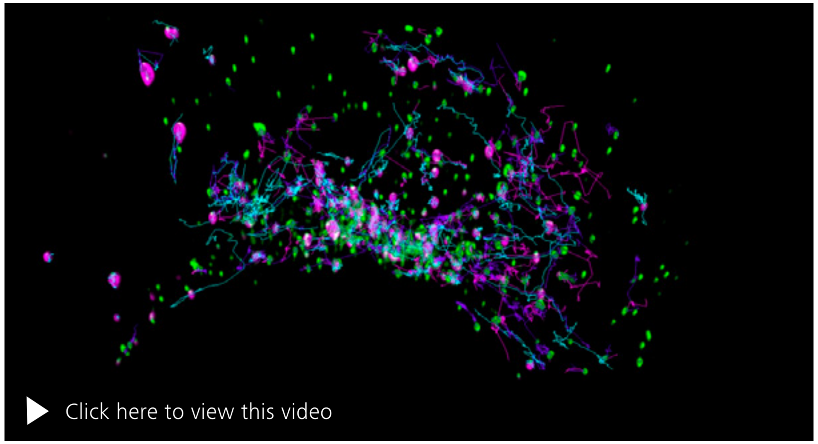
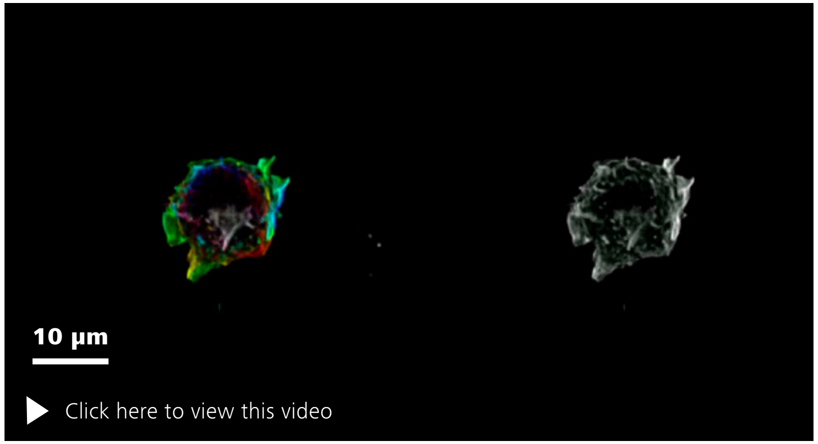
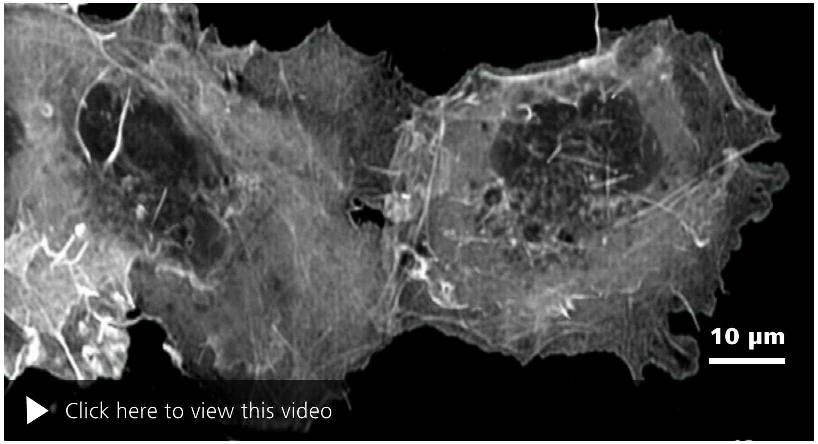




Cos 7 cells transiently transfected with mEmerald-Rab5a and Golgi7-tdTomato. Golgi7 is a protein associated to the Golgi and Golgi vesicles. Rab5a is an early endosome marker. Tracking of vesicles in 3D with near-isotropic resolution becomes reality. Tracking was performed in arivis Vision4D®.



T cell expressing Lifeact-GFP. Color-coded depth projection and maximum intensity projection side-by-side. The T cell was imaged constantly for over 1 hr; one volume every 2.5 secs. Sample courtesy of M. Fritzsche, University of Oxford, UK.



Cos 7 cell expressing Lifeact-GFP. Maximum intensity projection. The cell was imaged constantly for 9 hrs; one volume (115 × 60 × 25 µm³) every 10 secs. A total of 1,005,000 images was recorded; 201 volume planes for 5,000 time points.

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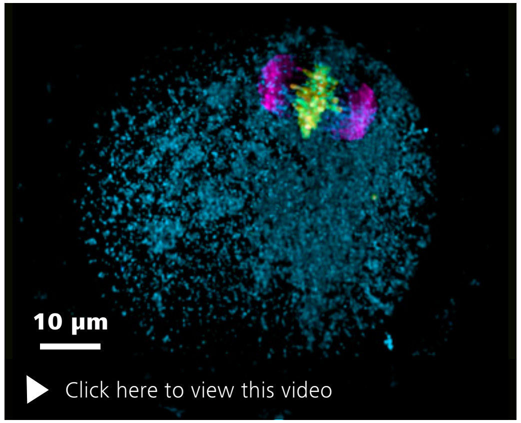
Image developing life at early stages

Imaging of live oocytes is particularly challenging as this earliest stage in life is extremely delicate and sensitive to light. Lattice light sheet microscopy is the perfect tool to observe life at its earliest stage without disturbing the process.

Mouse metaphase II oocyte

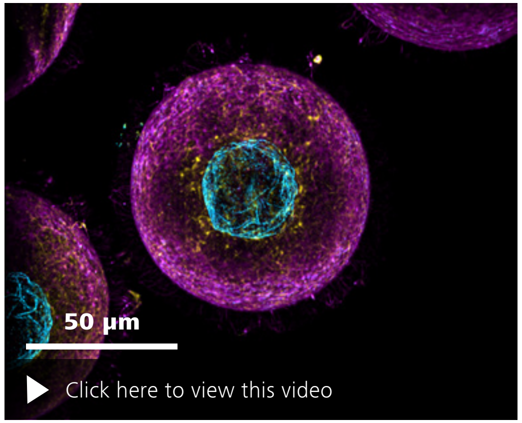
Live mouse oocytes arrested in metaphase II and stained for mitochondria (cyan), microtubules (magenta) and chromosomes (yellow).



Sample courtesy of C. So, MPI Göttingen, Germany

Mouse germinal vesicle oocytes

Fixed mouse germinal vesicle oocytes stained for the nuclear envelope (anti-lamin, cyan), actin (phalloidin, magenta), and microtubules (anti-tubulin, yellow). The Sinc3 100 × 1,800 lattice light sheet was used for imaging of the whole oocyte.



Sample courtesy of C. So, MPI Göttingen, Germany

Mouse germinal vesicle oocyte

Fixed mouse germinal vesicle oocytes stained for the nuclear envelope (anti-lamin, cyan), actin (phalloidin, magenta), and microtubules (anti-tubulin, yellow). The Sinc3 15 × 650 lattice light sheet was used for high-resolution imaging of microtubule and actin structures. Follow the 3D structure of the microtubules in the movie.

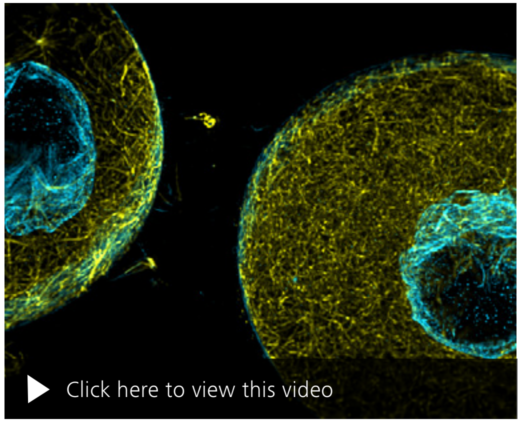


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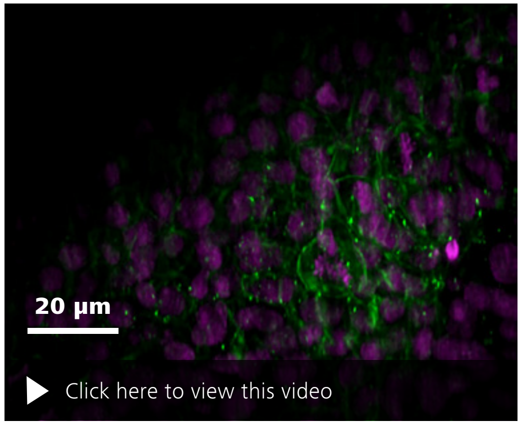
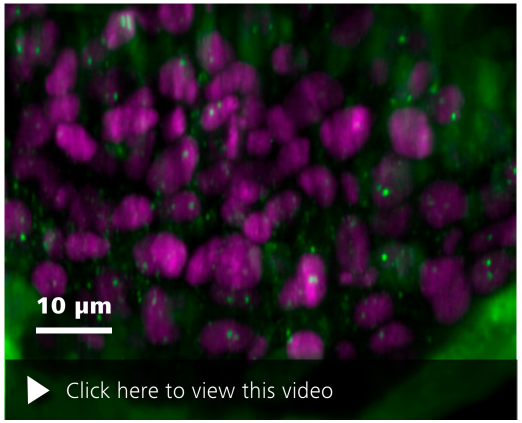
Image developing life of small evolving organisms

Zebrafish embryo
DeltaD-YFP transgenic zebrafish embryo (Liao et al. 2016, Nature Communications). Fusion protein driven by a transgene containing the endogenous regulatory regions, expression in the tailbud and pre-somitic mesoderm. Signal visible in the cell cortex, and in puncta corresponding to trafficking vesicles (green). Nuclei in magenta. The embryo was imaged for 5 minutes constantly; one volume (150 × 50 × 90 µm³) every 8 sec.



Sample courtesy of Prof. A. Oates, EPFL, Switzerland

Zebrafish embryo
High-speed movie of zebrafish embryo. Volumetric imaging of trafficking mRNA molecules (green). Nuclei are shown in magenta. Data is displayed as maximum intensity projection. One volume (86 × 80 × 12 µm³) was recorded every 2.5 sec.



Sample courtesy of Prof. A. Oates, EPFL, Switzerland

Zebrafish embryo
Trafficking mRNA molecules were tracked in arivis Vision4D®. The movement of the zebrafish embryo was first corrected using a nucleus reference track. Then individual mRNA molecules were tracked over time to result statistics such as speed and directionality.

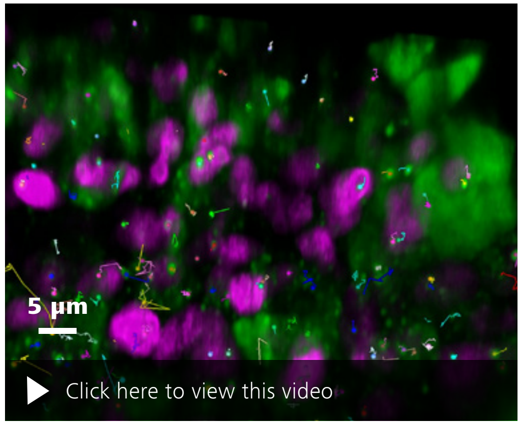


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Image developing life of small evolving organisms

C. elegans embryo
C. elegans embryo stained for nuclei. The movie shows a color-coded depth projection of the embryo. The embryo was imaged for 10+ minutes constantly; one volume every 700 msec.

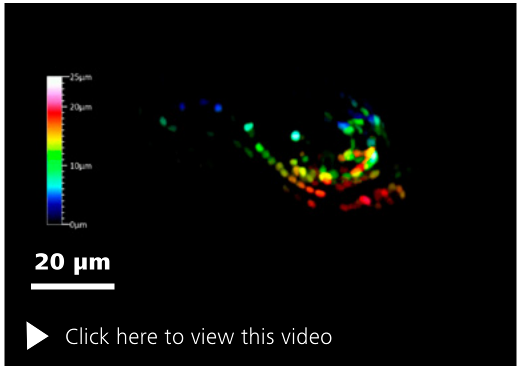
Imaged volume: 115 × 50 × 30 µm³. A total of 101,000 images was recorded; 101 volume planes for 1,000 time points.

C. elegans embryo
C. elegans embryo stained for nuclei. The movie shows a color-coded depth projection of the embryo. The embryo was imaged for 19+ hrs every 5 mins and can be observed going through its normal sleep-wake cycle.

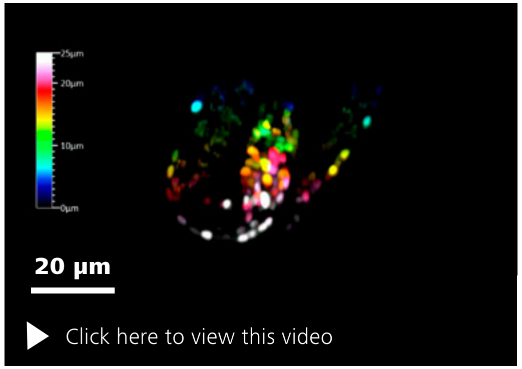
Imaged volume: 115 × 50 × 30 µm³. A total of 23,836 images was recorded; 101 volume planes for 236 time points.

C. elegans embryo
C. elegans embryo at the late bean stage (~400 min post fertilization) with ~560 nuclei marked with HIS-58::mCherry (magenta) and centrioles marked by GFP::SAS-7 (green).

Cells in mitosis show condensed signal of HIS-58::mCherry and centrioles at spindle poles.



Customer sample



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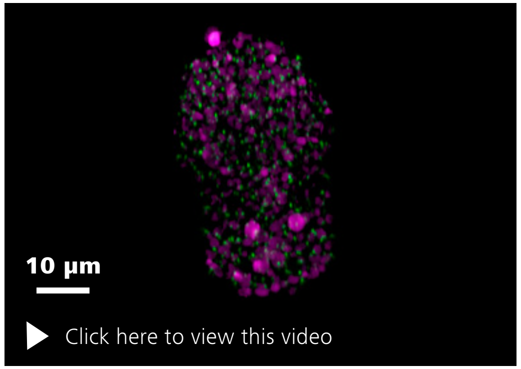

Sample courtesy of N. Kalbfuss, Göncy Lab, EPFL, Switzerland

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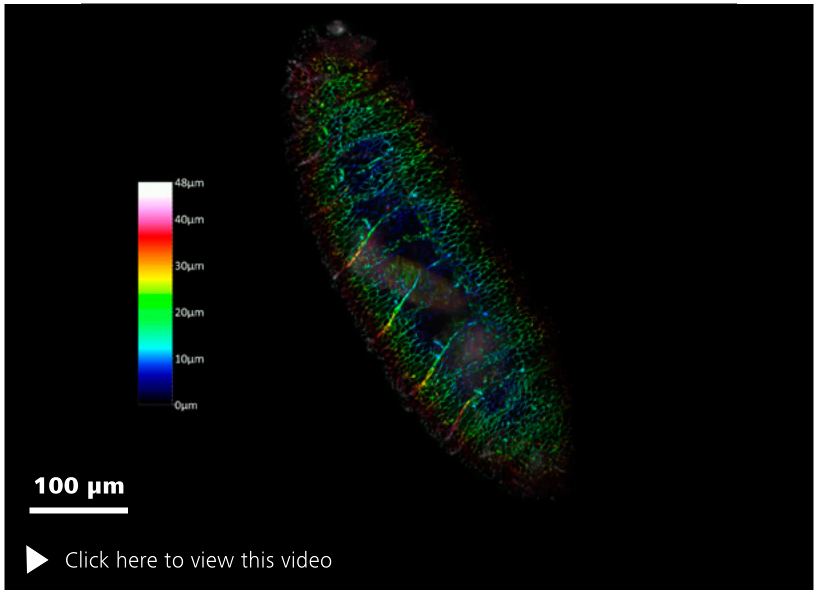
Image developing life of small evolving organisms

Drosophila embryo

Drosophila melanogaster is a model organisms in many research fields such as biomedical research. Many genetically modified variants are available to researchers. This video shows a drosophila embryo with GFP labeling as it moves over time. A total of 91,100 images were taken, 911 volume planes, 100 time points. One volume, every 15 secs; imaging duration 25 mins, imaging volume: 300 × 455 × 145 µm³.

Maximum intensity projection of a Drosophila embryo with GPF labeling.



Color-coded depth projection of a Drosophila embryo with GPF labeling.

ZEISS Lattice Lightsheet 7 at Work

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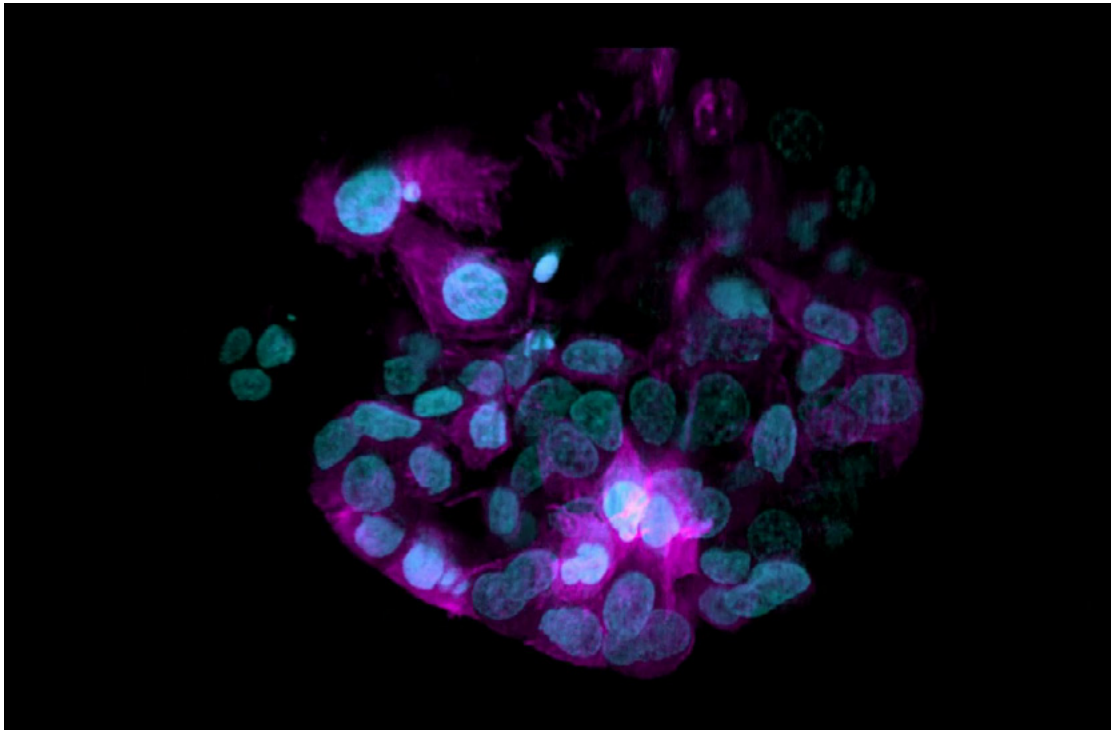
Image developing 3D cell models

Spheroids and organoids are in vitro models of organs – much smaller and simpler but easy to produce and thus for developmental biologists an invaluable tool to study organ development. Unlike cell cultures, which usually consist of a monolayer of cells only, cells in spheroids / organoids form three-dimensional structures, allowing for the investigation of cell migration and differentiation inside 3D cell models. With lattice light sheet microscopy, imaging the development and self-organization of organoids becomes reality. Here, we can see a 3D rendering of a spheroid consisting of cells expressing H2B-mCherry (cyan) and α-Tubulin-mEGFP (magenta). Not every cell is labelled.



Click here to view this video

3D rendering of a spheroid consisting of cells expressing H2B-mCherry (cyan) and α-Tubulin-mEGFP (magenta). Not every cell is labelled.

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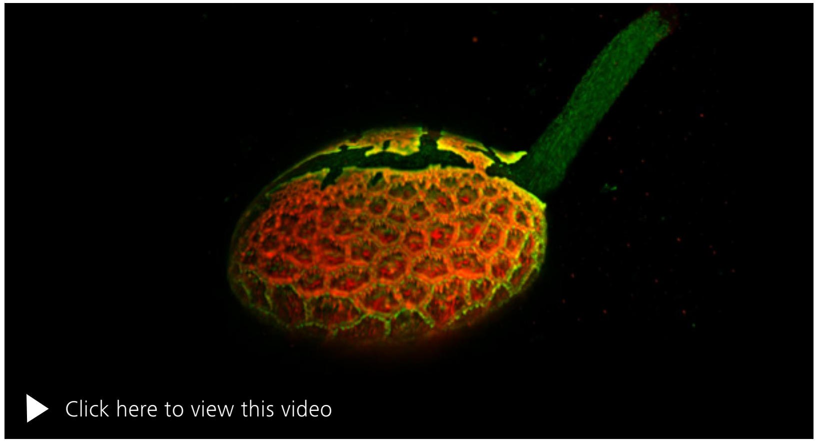
Imaging developing plants and plant seeds

Pollen Grain

Pollen tube stained for mitochondria (MitoTracker Green, green) and Lysosomes (Lysotracker Red, red). Watch the pollen tube extend from the crack in the pollen grain (visualized by its autofluorescence).

Mitochondria don't quite advance to the very tip of the pollen tube but stop a few microns before the tip. Rendering of the data set was performed in arivis Vision4D®.

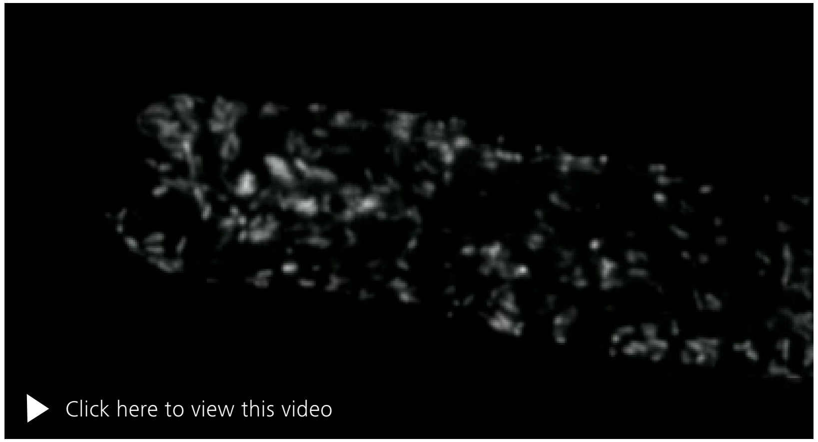


Sample courtesy of R. Whan, UNSW, Sydney, Australia

Pollen Tube

Watch mitochondrial dynamics inside the pollen tube. Mitochondria move towards the tip at the edges and back in the middle of the tube.

While trafficking, mitochondria constantly fuse and divide for repair processes and to share and distribute biological molecules.



Sample courtesy of R. Whan, UNSW, Sydney, Australia

Your Flexible Choice of Components

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1 Microscope
- Lattice Lightsheet 7

2 Objectives
- Illumination: 13.3× / NA 0.4
- Detection: 44.83× / NA 1.0

3 Illumination
- LED (white & red) for transmitted light
- Laser (488 nm, 561 nm, 640 nm) for reflected light & epi-fluorescence

4 Cameras
- Pco.edge 4.2 CLHS

5 Filters
- LBF 405 / 488 / 561 / 642
- BP 495-550 / BP 570-620
- BP 495-550+LP655
- BP 570-620+LP655
- EF LP 570
- EF LP 488
- Empty
- ND filter

6 Software
- ZEN 3.3 (blue edition)
- Lattice Lightsheet Processing Module

ZEISS Lattice Lightsheet 7: System Overview

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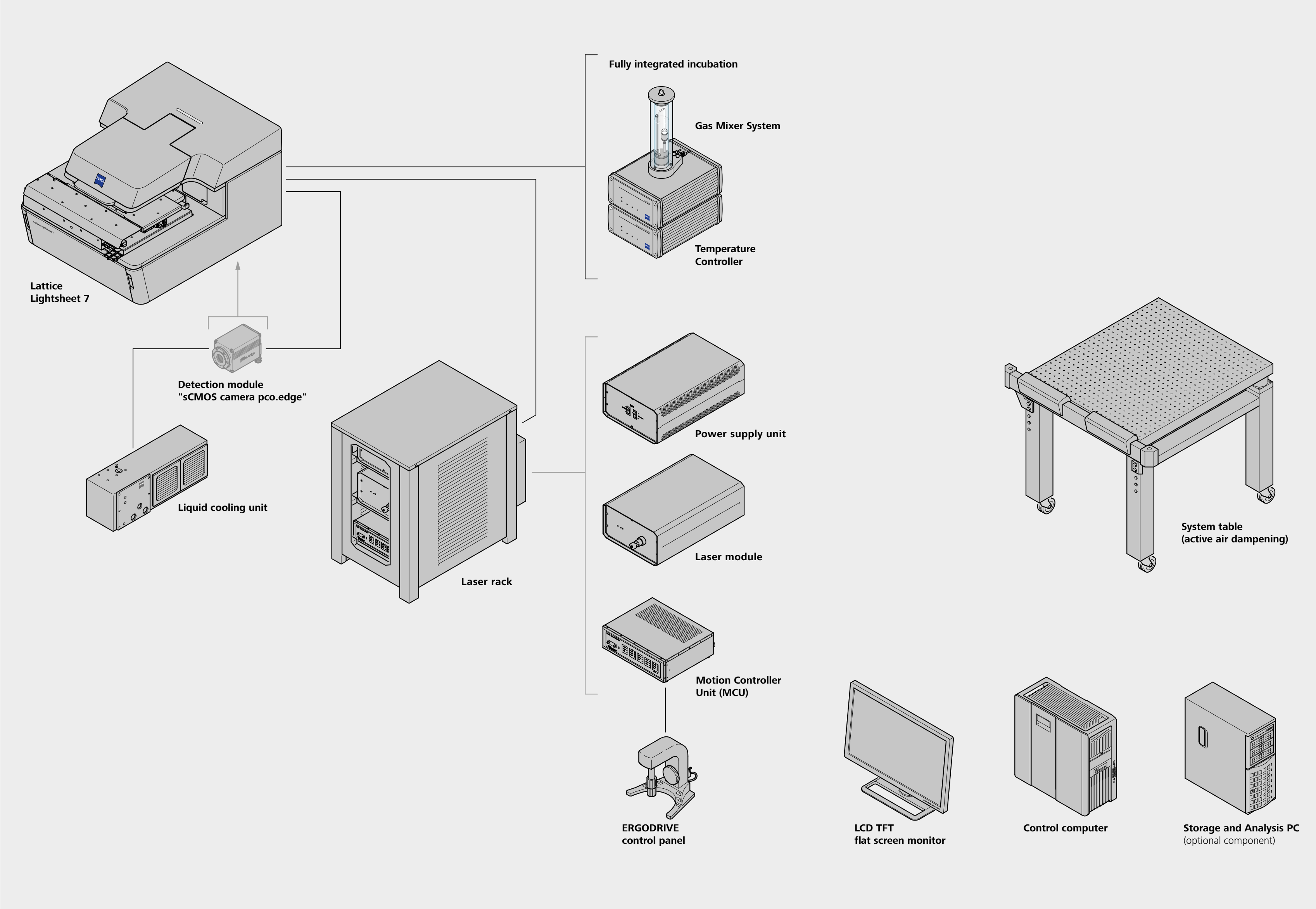

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Component	Description
Core Optics	Illumination objective lens 10× / 0.4 (at 30° angle to cover glass) with static phase element
	Detection objective lens 48× / 1.0 (at 60° angle to cover glass) with Alvarez manipulator
	Meniscus lens; relay of core optics to cover slip of sample carrier
	Autoimmersion: water, motorized dispenser
Illumination	Transmitted light: LED (white centered and side, red centered illumination) with oblique contrast for sample positioning and overview; no Köhler Illumination, not specified for high quality imaging
	Reflected light and epifluorescence: laser (488 nm, 561 nm, 640 nm) for beam adjustment and fluorescence imaging
Detection Modules	Pco.edge 4.2 CLHS sCMOS camera; requires liquid cooling; single camera port
	Pixel size: 6.5 µm; Max. pixel format: 2,048 × 2,048 (4.2 Megapixel); Bit depth: 16 bit; QE: up to 82%
Image Acquisition Speed	Volume: 3 Vol/s @ 300 µm × 50 µm × 20 µm
	Plane: 400 frames/s @ 300 µm × 20 µm
	Up to 3 colors fast sequential (framewise or stackwise switch)
Light Sheets	Beam shaping by cylinder lens and spatial light modulator (SLM)
	Pre-defined Sinc3 beams with length [µm] x thickness [nm]: ■ 15 × 550 (w/side lobes) & 15 × 650 (w/o side lobes) ■ 30 × 700 (w/side lobes) & 30 × 1,000 (w/o side lobes) ■ 100 × 1,400 (w/side lobes) & 100 × 1,800 (w/o side lobes)
Immersion and Incubation Media	Sample carriers and optics designed for aqueous media (n_d = 1.33)
Sample Mounting	Standard glass bottom cell culture dishes and multi-well plates (glass 1.5; 0.15 µm – 0.19 µm); skirt <0.5 mm
Sample Carrier Frames	■ Sample carrier frame Dish 35: for 35 mm cell culture dishes ■ Sample carrier frame Slide: for slides 26 mm × 76 mm; also suitable for multi-well glass-bottom slides 26 mm × 76 mm ■ Sample carrier frame Chamber slide: for LabTekR chambers 25 mm × 57 mm; also suitable for multi-well glass-bottom slides 25 mm × 57 mm ■ Sample carrier frame Multiwell: for multiwell microplates 85.48 mm × 127.76 mm
Resolution (xyz)	Light sheet selection (from 6 pre-defined sheets)
	Deskewed: 330 nm × 330 nm × 500−1000 nm; Deskewed w/DCV: 290 nm × 290 nm × 450 nm−900 nm (z-res. = light sheet thickness if ≤1,000 nm)
Voxel size (xyz)	■ Skewed image: 145 nm × step size × 145 nm ■ Deskewed image: 145 nm × step size/2 × 145 nm ■ Glass cover tranformed image: 145 nm × 145 nm × 145 nm ■ Step-size for Nyquist sampling: 200 nm
Penetration Depth	Up to 200 µm
Field of View (FOV)	x: 300 µm; y: defined by scan range
Spectral Range of Detection	490 nm – 740 nm

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Component	Description
Filters	1. LBF 405/488/561/642 2. BP 495-550/BP 570-620 3. BP 495-550+LP655 4. BP 570-620+LP655 5. EF LP 570 6. EF LP 488 7. Empty 8. ND filter (accessible by service only)
System PC / Workstation	HP Z6 G4 Rev2 workstation Chipset: Intel C622 Memory: max. 192 GB RAM SSD: 1× 512 GB M.2 NVMe Hard Drives: 2× 6 TB SATA 7,200 rpm (configured as 6 TB RAID 10 hard drive); increase capacity from 6 TB (RAID 10) to 12 TB (RAID 10) Processor: Intel® Xeon® Gold 6234 (3.2 GHz, 24.75 MB cache, 8 cores) Graphics Card: NVIDIA Quadro RTX6000 24 GB DB 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 2019 LTSC Embedded ×64
Storage and Data Analysis PC	CPU: Intel P XEON E5-2620V3 2,4 GHz LGA2011 L3 15MB Box Graphics Card: NVIDIA Quadro P4000 8 GB DP or NVIDIA Quadro P6000 24 GB 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
Monitor	TFT 27" HP Z27n G2 (68 cm)
	TFT 32" HP Dream color Z32x (80 cm)
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.
Data Acquisition Rate	With dedicated Lattice Lightsheet 7 storage module > 400 Mb/s
Software Processing	Lattice Lightsheet 7 Processing (Deconvolution, Deskew, Cover glass Transformation)
	3DXL, arivis Vision4D® (optional)
	Direct and Batch Processing
Software Acquisition	Multidimensional imaging (time, postions, tiles); combination of multidimensions possible
	Light sheet selection (from 6 pre-defined sheets)
	Autoimmersion
	Environmental control (temperature, CO_2 and humidity; O_2 via N_2 optional)

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Microscope	Standalone box system, sealed, turnkey, laser safe, no eyepieces, inverted

Physical Dimensions	Approx. Width × Depth × Height	Approx. Weight
Main System Module Lightsheet 7	600 mm × 425 mm × 380 mm	48 kg
Component Rack (houses Laser module, Power supply unit & Stage Motion Controller)	550 mm × 740 mm × 600 mm	56 kg
System Table for main System Module Lattice Lightsheet 7, Level regulated	900 mm × 750 mm × 830 mm	130 kg

Incubation		
Heating System	Heating of sample chamber (no cooling) T: ambient to 42 °C ± 0.1 °C; up to 1.5 °C/min heating, up to 1.0 °C/min cooling	
Gas Mixer System	Requires compressed air, CO_2 (and N_2) supply; adjustable concentration	CO_2: 0 % to 15 % ±0.35 % O_2: 1 % to 21 % ±0.20 % Humidity: 20 % – 99 % ±2.50 %

Stage	Five-axis multi-coordinate stage with Piezo motors	Specifications: x / y / z / x-tilt / y-tilt (after homing)
Travel Range		±36 mm / ±54 mm / ±0.5 mm / ±0.5° / ±0.5°
Reproducibility (±)		400 nm / 400 nm / 200 nm / 0.1° / 0.1°
Smallest Increment		200 nm / 200 nm / 100 nm / 0.05° / 0.05°

Laser Module			
Laser Class	All Lasers are class 3B		
	The installed system as a whole is laser class 2		
Laser Wavelengths, Type and Power (Power: pre-Fiber)	Laser line	Type	Power output (in pupil)
	488 nm	diode	10 mW (2 mW)
	561 nm	diode (SHG)	10 mW (2 mW)
	640 nm	diode	5 mW (1 mW)

RoHS COMPLIANT

CE

LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
AS PER EN 60825-1:2014
405nm max.1mW

CAUTION
LASER RADIATION
DO NOT STARE INTO BEAM
CLASS II LASER PRODUCT
405nm max.1mW

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Environmental Conditions			
Operation	Permissible ambient temperature (specified performance)	22 °C ± 1 °C	
	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. 2,000 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
Lattice Lightsheet 7 System	Max. current	Single 4.5 A phase	Single 9 A phase
	Power consumption	800 VA max.	800 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 Lattice Lightsheet 7 (incl. Lasers and Accessories)	700 W
Data Analysis PC	350 W

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

Count on Service in the True Sense of the Word

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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/lattice-lightsheet