Adding efficiency to fluorescence imaging

ZEISS Celldiscoverer 7

Your Automated Platform for Live Cell Imaging

zeiss.com/celldiscoverer

Seeing beyond

Your Automated Platform for Live Cell Imaging

Often in life sciences research, the data you are after will only be revealed using multiple runs of experiments and complex equipment. Automation can be the only way to get there. With Celldiscoverer 7, you can combine the easy-to-use automation of a boxed microscope with the image quality and flexibility of a classic inverted research microscope. Celldiscoverer 7 calibrates itself, then detects and focuses on your samples while the optics adjust themselves. Leaving you free to get on with other projects. Whether working with 2D or 3D cell cultures, tissue sections or small model organisms, you will acquire better data in shorter times with this reliable automated research platform. What's more, you can enhance your Celldiscoverer 7 with optical sectioning to get more information from your three-dimensional samples. It's your choice whether you opt for confocal imaging with LSM 900 and Airyscan 2 or fast GPU deconvolution.

Simpler. More Intelligent. More Integrated.

A Flexible Platform

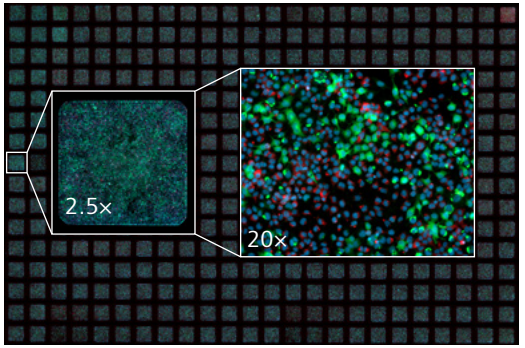
Celldiscoverer 7 is a fully integrated high-end imaging system. It comes with various incubation and detection options so you can tailor the system to your applications. Go for fast, sensitive sCMOS cameras when performing your most demanding live cell experiments and rapid time-lapse recordings. To get better data from your 3D samples, simply add the optional LSM 900 with Airyscan 2 for confocal imaging,
or fast GPU-based deconvolution. Get all these benefits and more with the in-built flexibility of Celldiscoverer 7.

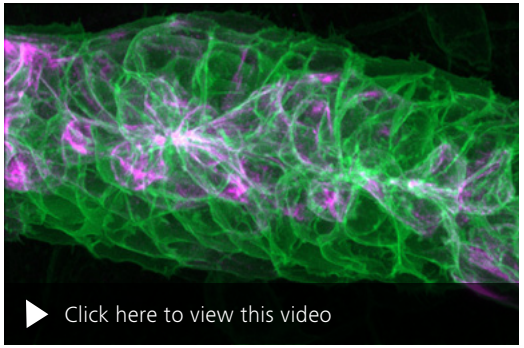
Top Quality Data from Your Samples

For demanding long-term, time-lapse imaging, Celldiscoverer 7 gives you the advantage of Autoimmersion and a hardware-based focus that finds and keeps the focus automatically after detecting the thickness and optical properties of the sample carrier. Autocorr objectives then correct spherical aberrations to deliver crisp contrast and high resolution every time. Get image quality like you've never seen before – no need to adjust manually. Keep your cells happy and they'll deliver unbiased data: Celldiscoverer 7 provides a range of integrated incubation options to create just the right environment. The improved optical design resolves more details in large fields of view.

Reproducible Results Made Easy

As soon as you start imaging, automatic calibration routines take over to ensure reproducible results. Check the current status and follow progress of your experiments on the touchscreen.
With barcode recognition you can identify your sample, sample carrier and even the type of experiment. If you don't work with barcodes, an automatic preview scan will identify the sample carrier and calibrate it. ZEISS predictive service offers lasting and optimal instrument performance for increased system uptime and reliable results.



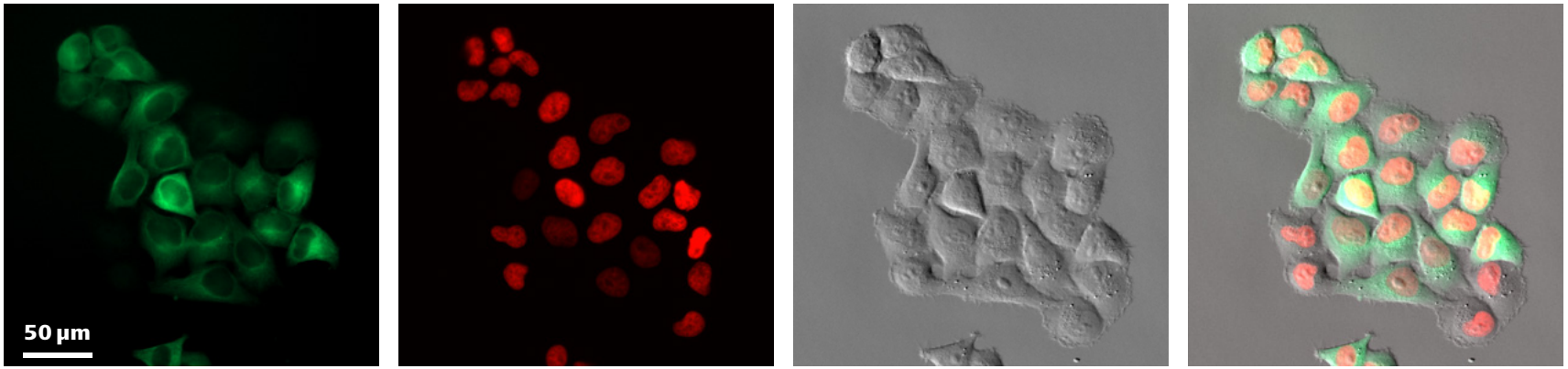


Your Insight into the Technology Behind It

An Easy-to-Use Integrated Microscope

Observing live samples over a number of days or imaging lots of multiwell plates really puts your microscope through its paces. To get reproducible, unbiased data, you must control environmental conditions such as light, temperature, CO_2 etc. That's why Celldiscoverer 7 brings you a unique combination of a stable box, darkroom and integrated inverted research microscope with optional incubation. It simplifies your laboratory setup and makes work more comfortable.

All Celldiscoverer 7 components are optimized for hassle-free automated imaging. New users and multi-user facilities especially will enjoy the in-built automation and usability features when setting up complex experiments. You'll systematically avoid accidental hardware changes that might lead to biased data or even damage your microscope. And Celldiscoverer 7 can make you more productive, too: expect better data in shorter times, with less training and maintenance. What's more, as your needs grow you can expand Celldiscoverer 7 with confocal technology, external cameras, deconvolution, additional environmental control – whatever you need for the challenge of live cell observation.

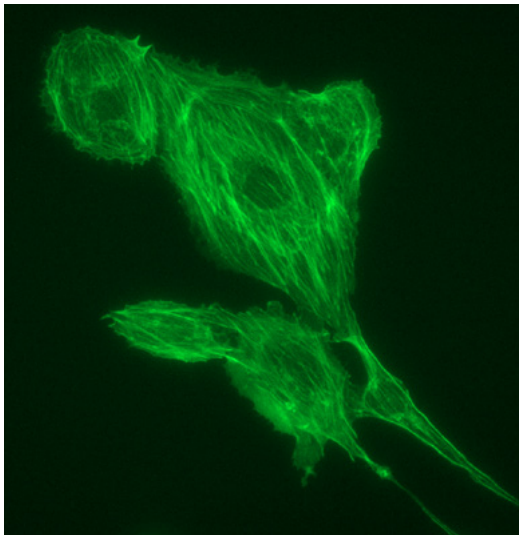


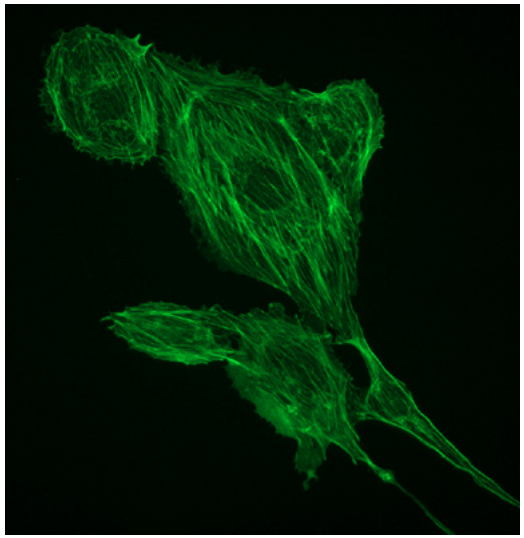
72 h cell growth assay using a waterimmersion objective. HeLa Kyoto cells expressing H2B-mCherry Tubulin eGFP (Neumann et al., Nature 2010 Apr.1.; 464(7289):721-7) imaged every 15 minutes for 72 hours using Autoimmersion; individual channels of the green (eGFP) and red (mCherry) fluorescence and the phase-gradient-contrast as well as an overlay. Sample courtesy of I. Charapitsa, Chemical Biology Core Facility, EMBL, Heidelberg, Germany

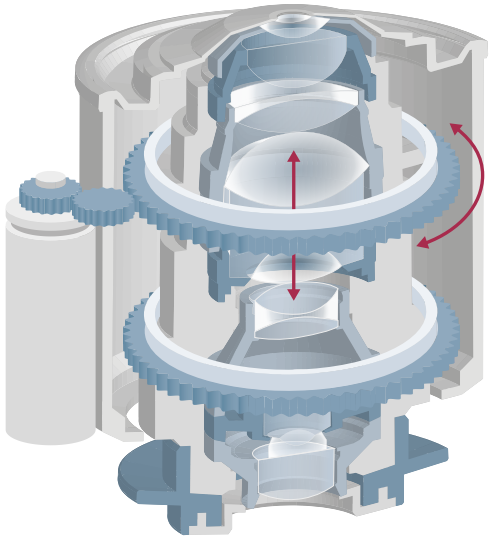
Your Insight into the Technology Behind It

ZEISS Celldiscoverer 7 Recognizes and Adapts Automatically to Your Samples

Live cell imaging requires objectives with high numerical apertures. Those objectives will only deliver high contrast and sensitivity if their optics can adapt to variations in bottom thickness or to the material of different sample carriers. With Celldiscoverer 7 you're now free to use Petri dishes, chamber slides, multi-well plates, plastic or glass, thin or thick vessel bottoms, low skirt or high skirt plates. Automatic sample recognition detects all relevant vessel features while loading your sample. Then Autocorr adjusts the correction ring of the objective to compensate for spherical aberrations. The Find Focus function automatically places your sample in focus and Definite Focus keeps it there. It's never been easier to get crisp images with low phototoxicity from deep inside your sample.







Left image shows spherical aberration due to unadjusted optics. Right image shows the same structure using an Autocorr objective. The correction results in increased contrast, resolution and intensity, providing low phototoxicity. The images show tubulin in FluoCell prepared slide #1. Sample courtesy of Invitrogen, Thermo Fisher Scientific Inc.

Your Insight into the Technology Behind It

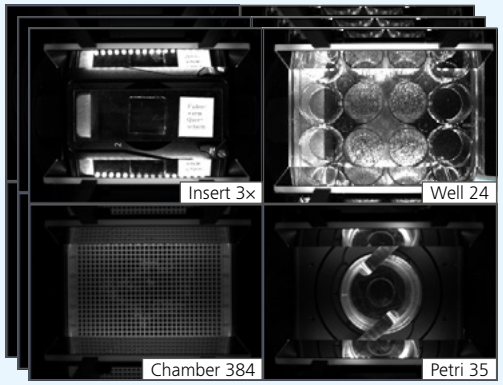
Automatic Detection of Multiple Sample Carrier Types

A large variety of sample carriers such as multi-well plates, petri dishes, chamber slides, and object slides can be imaged using Celldiscoverer 7.

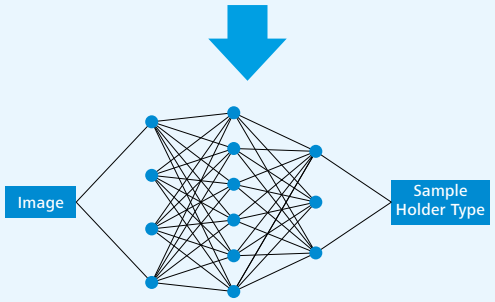
Sample carriers from different manufacturers, which may differ in design, are reliably recognized by the system using AI and neural networks specially trained by supervised machine learning with thousands of images representing all sample carrier types under various conditions.

The automatic sample carrier detection lasts only milliseconds. It automatically adjusts all microscope settings to prevent sample collision and ensure optimal imaging conditions.

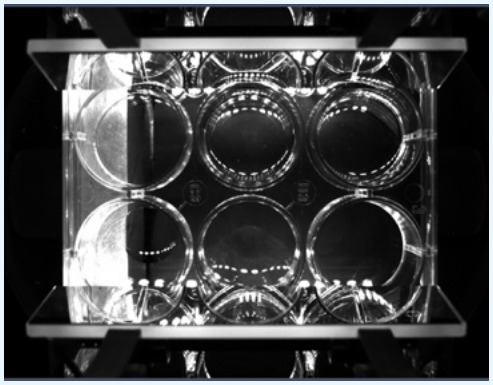
Training

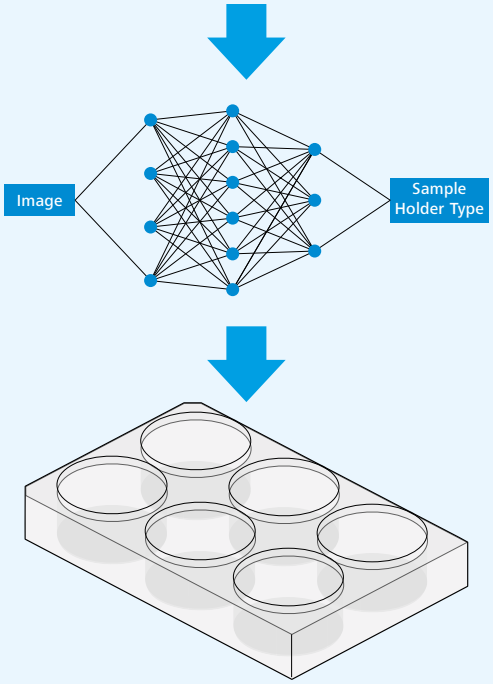


Dataset of ca. 3300 images representing all sample holder types under various conditions



Classification





Your Insight into the Technology Behind It

There Is No Life Without Water …

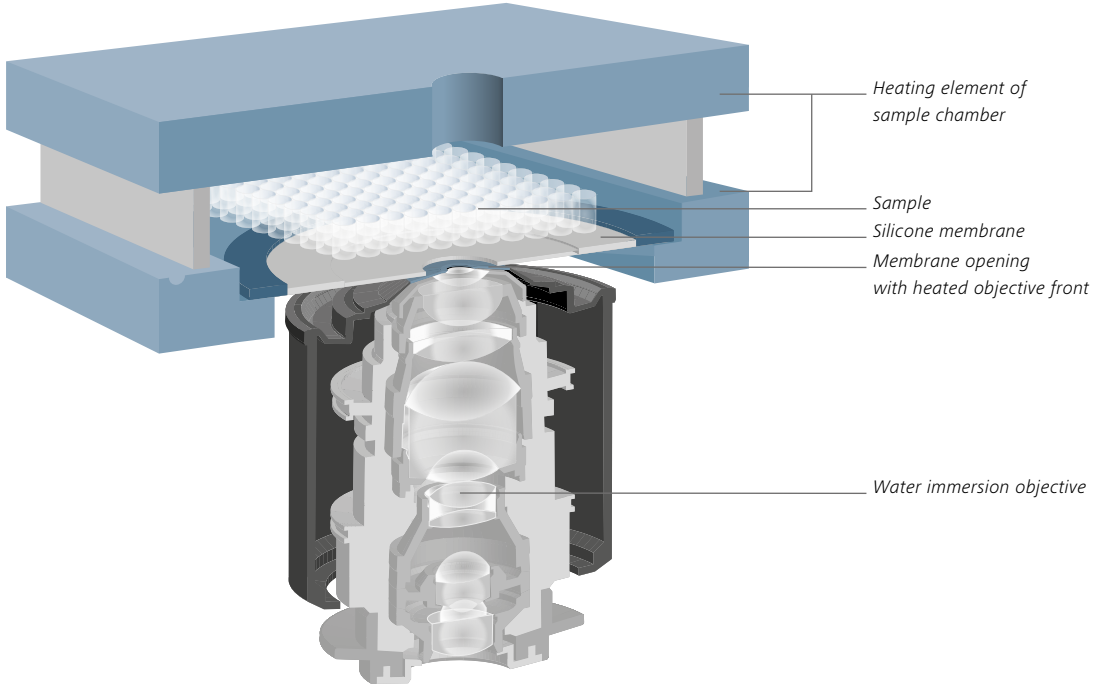
… and no live cell imaging without water immersion. In life sciences, cell biology or screening applications, your samples mostly consist of water and / or will be mounted in aqueous solutions. Celldiscoverer 7 combines an outstanding water immersion objective with rapid automated immersion supply and removal.

A unique elastic silicon membrane fits perfectly between the objective and sample chamber. The silicon membrane simultaneously seals the sample chamber to avoid unnecessary airflow while protecting the system from potential liquid spillage. Just select the water immersion objective and water is supplied instantly to the front lens. Within seconds the immersion is building up and the lens is ready to use. When you switch back to one of Celldiscoverer 7's dry objectives, the immersion water is automatically removed.

Until now, automated imaging systems often struggled as the immersion water quickly evaporated. Celldiscoverer 7 solves that problem by automatically monitoring the immersion and adding water in regular intervals, as needed.

With Celldiscoverer 7 you can perform unbiased live cell experiments at 37 °C over several days or carry out extensive scanning processes on multiwell plates.

By adapting the refractive index of your imaging system to the samples, you'll achieve more efficient light collection and increased sensitivity. And less phototoxicity significantly increases viability of even your most challenging living samples.



A silicone membrane allows automatic water immersion and seals the sample chamber.

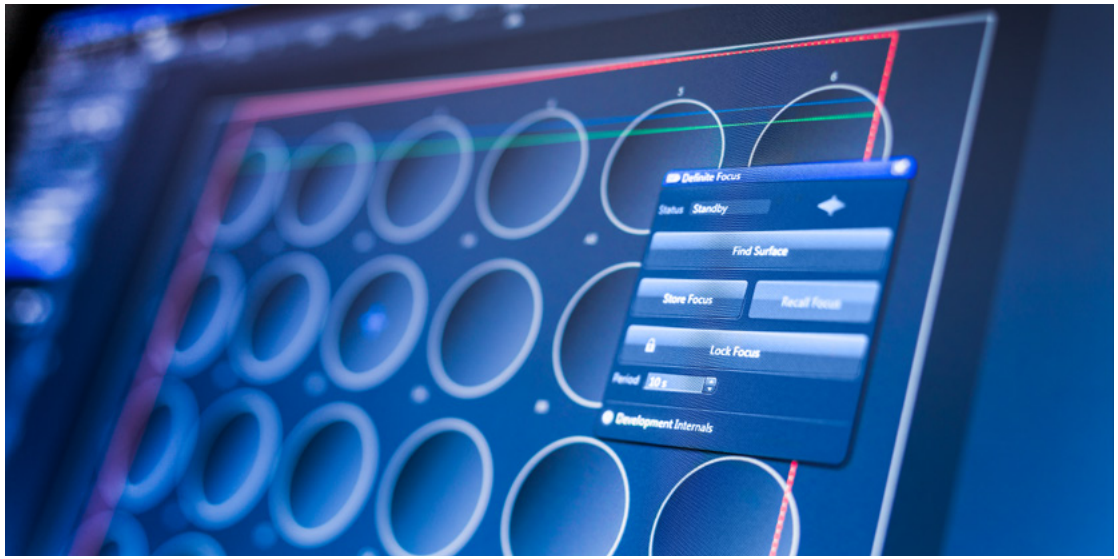
Your Insight into the Technology Behind It

Get in Focus, Then Stay in Focus

Use the hardware-based Find Focus function to automatically focus your sample and find your region of interest quickly with just a single click. This significantly reduces the time to your first image and minimizes sample illumination.
Then select Definite Focus to maintain the focal position throughout your experiments, whether it takes a few seconds or several days.
Or combine both methods with the powerful content-based autofocus of ZEN imaging software. Celldiscoverer 7 can automatically create focus maps for multiple positions in long-term time-lapse experiments. Simply choose the best focus strategy for the experiment at hand.

Move to the Edge …

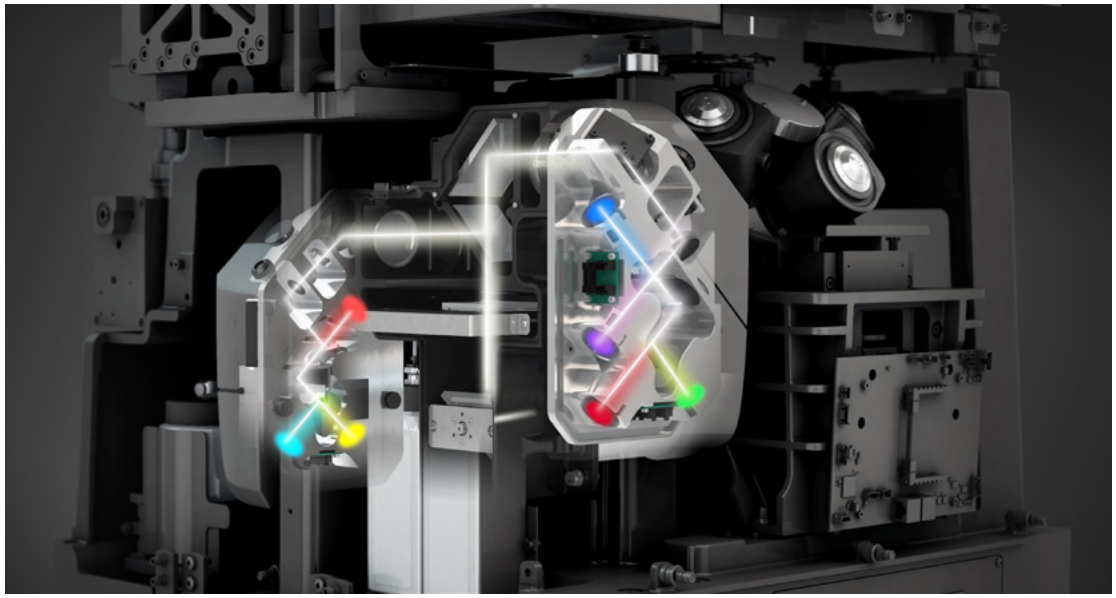
… but not one step more, thanks to the Adaptive Lens Guard. High optical performance often compromises on the possible scanning area. Celldiscoverer 7 with its Adaptive Lens Guard protects the objective from collisions with your sample vessel or hardware components, automatically maximizing the available scanning area. Bottom thickness, skirt height and lateral dimensions are important geometrical features of the different sample carrier types – especially when working with multiwell plates. Celldiscoverer 7 automatically detects these features and adapts accordingly. It also calculates the maximal possible scanning area automatically, depending on the individual sample carrier, objective and current focus position in your experiment. The available scanning area is always indicated on your monitor. Change your experimental parameters and the scanning area will adapt automatically, in real time.

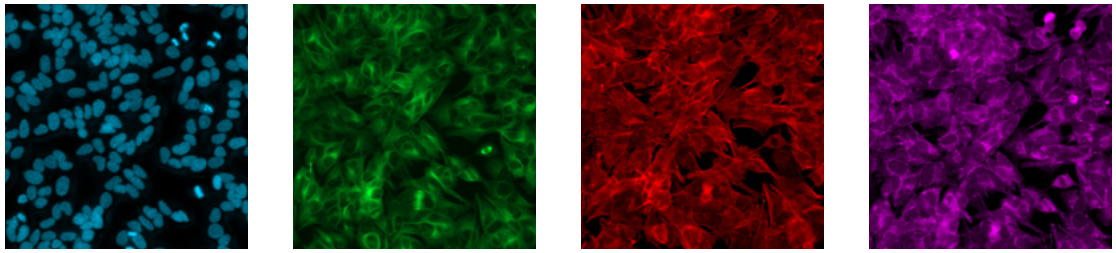


Your Insight into the Technology Behind It

Capitalize on LED-Technology for Live Cell Imaging

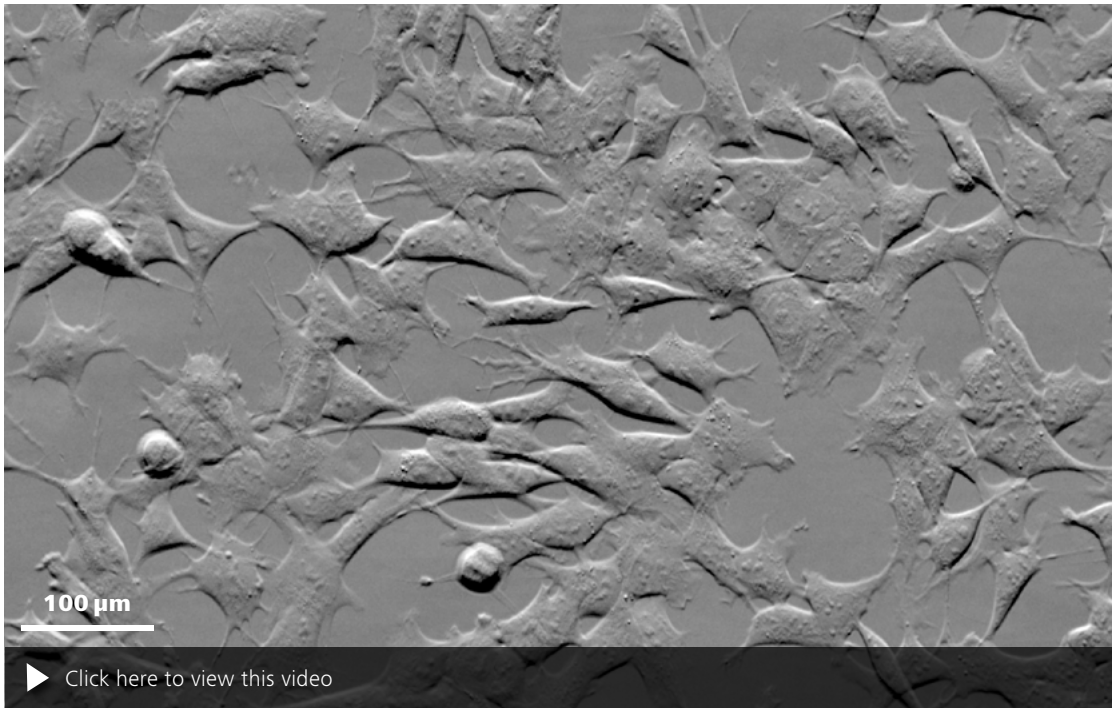
Celldiscoverer 7 brings you all the advantages of LED-technology for efficient widefield illumination with low phototoxicity, fast switching times and long-term stability. That's what delivers gentle imaging, increased throughput and reproducible results. The fluorescence excitation unit combines up to seven LEDs for maximum flexibility in the choice of dyes – from deep blue to far red.
All LEDs are hardware-triggered for precise, fast illumination. During sample navigation LEDs are tightly synchronized with camera frame rates.
An automated rectangular excitation field stop illuminates only the active field of view, greatly reducing phototoxicity and fluorescence bleaching.
Use high-efficiency multi-bandpass filter sets for fast acquisition of multiple fluorescent channels.
Celldiscoverer 7 simply switches LEDs on / off – without moving any mechanical parts – so you get high-speed multi-channel imaging, even when combined with transmitted light.





SH-SY5Y cells cultured on a 384 microwell plate. Multichannel image at a single position using the 20×/0.95 objective. Extended depth of focus from Z-stack. Hoechst – Chromatin (blue), anti-alpha-tubulin antibody FITC for alphas tubulin (green), Phalloidine for actin (red), MitoTracker Deep Red for mitochondria (purple). Sample courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

Your Insight into the Technology Behind It



SH-SY5Y cells cultured on a 384 microwell plate. Timelapse has been acquired using 20× magnification and phase gradient contrast. Sample and assay courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

Use a Novel Transmitted Light Contrast

With Celldiscoverer 7 you can use transmitted light brightfield, oblique and phase gradient contrast. This novel relief contrast adapts automatically to the sample carrier geometry, providing excellent contrast to the very edge of the vessel. It's fully compatible with all objectives, filter sets and sample carriers. This contrasting method stays robust, even against liquid meniscus or plastic lids. Use the far-red transmitted light LED for gentle imaging at very high speeds. You can perform applications based on label-free assays or let the system automatically combine transmitted light with multiple fluorescence channels. All multi-bandpass filter sets support the combination of transmitted light and fluorescence, without reducing sensitivity or speed. On top of that, this unique motorized transmitted light unit allows dispensing directly on the optical axis, without disturbing the environmental conditions. The dispensing unit is always integrated. As soon as you open the hatch on top of your Celldiscoverer 7, the transmitted light unit will automatically change place with the dispensing unit. You now have direct on-axis access to the specimen for pipetting. You can add agents while maintaining continuous physiological conditions.

Expand Your Possibilities

ZEISS Plan-Apochromat 5×/0.35 Objective
This objective is your choice for efficient sample navigation. It creates impressive overview images by delivering an unparalleled information density in a single shot, especially in combination with the microscope camera Axiocam 712 mono. Many screening applications will strongly benefit from the high resolution on large fields. The objective easily handles thin and thick vessel bottom made of glass or plastic.
In combination with the built-in magnification changer it combines the benefits of three different objectives into one: 2.5×/0.12, 5×/0.25 and 10×/0.35 – at a fixed working distance.

ZEISS Plan-Apochromat 20×/0.7 Autocorr Objective
From thin to thick, from plastic to glass – this objective adapts automatically to every sample you load on your Celldiscoverer 7. It delivers an unparalleled numerical aperture of 0.7 through 1.2 mm plastic bottom without compromising image resolution and contrast. This tremendous flexibility will make the lens your multipurpose objective, especially if you would like to image cells, which can only grow on plastic bottom.
In combination with the built-in magnification changer this objective combines the benefits of three different objectives into one: 10×/0.35, 20×/0.7 and a 40×/0.7 – at a fixed working distance.

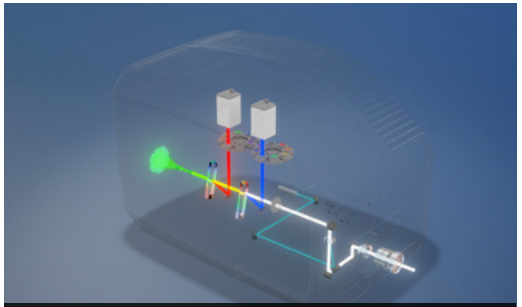
ZEISS Plan-Apochromat 20×/0.95 Autocorr Objective
This objective delivers high numerical apertures without applying immersion. It is optimized for thin vessel bottoms. No matter if your cells prefer glass or plastic – this objective will adapt to bottom material and thickness variations. With the increased sensitivity this objective is ideal to generate crisp images on large areas or multiple positions at high speed. In combination with the built-in magnification changer this objective combines the benefits of three different objectives into one: 10×/0.5, 20×/0.8 and 40×/0.95 – at a fixed working distance.

ZEISS Plan-Apochromat 50×/1.2 W Autocorr and Autoimmersion Objective
This objective delivers high light collection efficiency and resolution. In combination with the Autoimmersion function it matches perfectly to samples in aqueous solution. Since it reduces phototoxicity to a minimum, it's your choice for your most demanding life cell imaging applications, e.g. long-term imaging of subcellular structures. Optimized for thin bottoms it adapts automatically to the bottom material and thickness. No matter which field of view you prefer, this objective will deliver a constant numerical aperture of 1.2 and combines the benefits of three different objectives into one: 25×/1.2, 50×/1.2 and 100×/1.2 – at a fixed working distance.

Expand Your Possibilities

LSM 900: Automated Confocal 3D Imaging

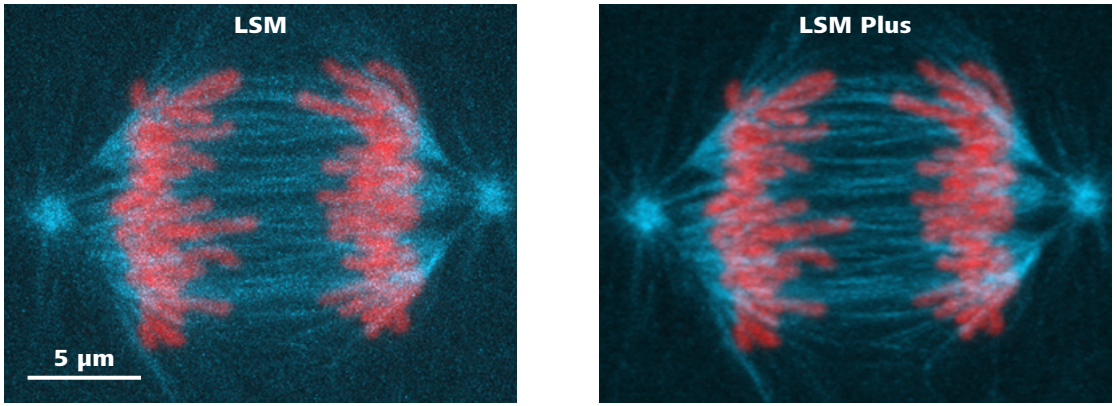
Life happens in 3D – and your research often calls for optical sectioning to image your samples with best possible contrast and resolution. When combining Celldiscoverer 7 and LSM 900 you get the best of both worlds: ease of use and automation from a fully integrated microscope platform and the superb confocal image quality and flexibility. You easily separate multiple labels with spectral imaging. Automatically analyze dynamic processes with photomanipulation for FRAP, FRET or related techniques. It's never been easier to precisely connect widefield and confocal imaging with fast mixed-mode acquisition or combine both imaging modalities into advanced workflows. LSM Plus lets you easily optimize the results of your multi-color and live cell experiments and increases the resolution of your confocal images by a factor of 1.3- to 1.4-fold.



LSM Plus: Improving the Whole Confocal Experience

LSM Plus improves literally any confocal experiment with ease, independent of detection mode or emission range. Its linear Wiener filter deconvolution needs next to no interaction while still ensuring a reliable quantitative result. Apply LSM Plus with no extra effort and benefit from:

- **Enhanced signal to noise** at high acquisition speed and low laser power—particularly useful for live cell imaging with low expression levels
- **More spatial information** and even greater resolution enhancement for bright samples that allow to close the pinhole of the LSM
- **Integrated workflows** to combine the advantages of LSM Plus with Airyscan super-resolution imaging



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).

Learn more about LSM 900 and LSM Plus
Download LSM 900 product information brochure

Expand Your Possibilities

Airyscan 2: A Unique Combination of Super-resolution Imaging and High Sensitivity

Airyscan 2 is an area detector with 32 circularly arranged detection elements. Each of these acts as a small pinhole, contributing to super-resolution information, while the complete detector area collects more light than the standard confocal setting. This produces much greater light efficiency while capturing enhanced structural information. All Airyscan modes are optimized for fast and gentle life cell imaging, perfectly serving the main purpose of ZEISS Celldiscoverer 7, to treat your sensitive samples gently. The unique High Sensitivity (HS) mode leads to a 4–8× improved SNR accompanied by 1.5× resolution improvement.

32 Views Mean More Information: Powerful Deconvolution with Airyscan jDCV

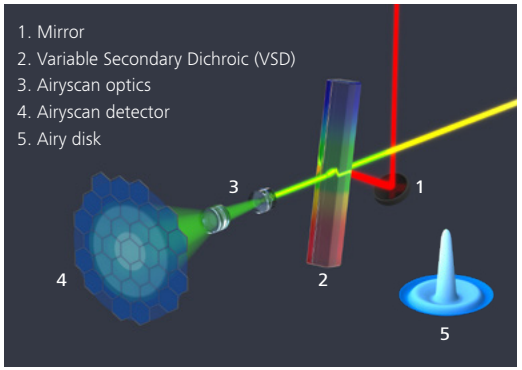
Each of the 32 detector elements has a slightly different view on the sample, providing additional spatial information that makes Joint Deconvolution possible. You can push resolution and acquisition speed to discover more structural information in less time. Super-resolution 3D imaging with up to 1.9× resolution improvement at 4–8× improved SNR becomes possible.

Airyscan Multiplex: Your Turbo for Confocal Acquisition

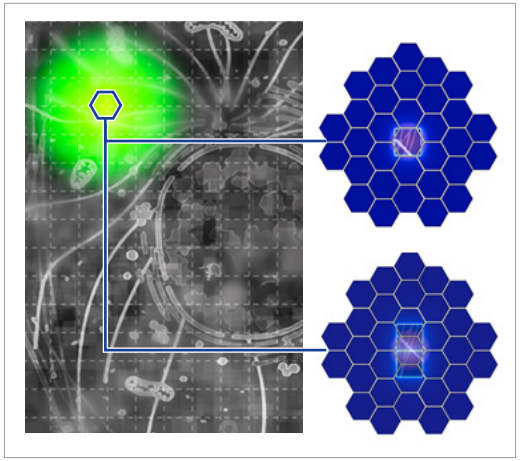
The Multiplex mode for Airyscan 2 employs smart detection schemes that enable two times faster imaging through parallelization while maintaining best resolution and SNR. Use this mode to image dynamic processes, or to achieve higher throughput and productivity.

Airyscan 2 in Multiplex modes HS-2Y / CO-2Y scans two super-resolution image lines with high SNR in a single sweep for rapid tiling of large areas, efficient live cell imaging, or for fast volumetric imaging.

Learn more about Airyscan 2 and Airyscan jDCV
Download LSM 900 product information brochure



Schematic beam path of ZEISS Airyscan 2.



For each illumination position, Airyscan HS mode generates one superresolution image pixel. The spatial information provided by Airyscan 2 in the Multiplex modes HS-2Y and CO-2Y allows to scan 2 lines in a single sweep.

Expand Your Possibilities

Easily achieve stable environmental conditions for your demanding live-cell experiments. You can control the temperature with the optional heating unit or a Julabo cooling circulator. In combination with a humidifier, optional CO_2 and/or O_2 module you control athmospheric conditions.

Depending on your most common imaging needs, you can now choose between Axiocam 506 mono or Axiocam 712 mono.

No matter if you choose a ZEISS Axiocam or a third party camera – if you have to increase acquisition speed and sensitivity for special applications, Celldiscoverer's additional camera port provides the flexibility you need.

Your Celldiscoverer 7 can load multiwell plates, dishes, chamber-slides or standard slides.
All sample holders are optimized for large scanning areas, fully compatible with water immersion and autoclavable.

Celldiscoverer 7 allows you to run perfusion experiments efficiently, while maintaining homogenous and stable environmental conditions.

Celldiscoverer 7 offers an effective way to keep the sample chamber clean. The insert plate for UV disinfection is automatically recognized by the system and you start the disinfection workflow via the touchscreen.

Expand Your Possibilities

ZEN Imaging Software Shortens the Path to Your Goal

ZEN – ZEISS Efficient Navigation – is the single user interface you will see on all imaging systems from ZEISS. ZEN imaging software leads you simply and quickly to the result.
At all times you see which options the system is making available to you and which step is appropriate to take next. ZEN makes it easy to operate every imaging system from ZEISS correctly and intuitively. As a result you save time, reduce training and support costs, and get faster answers to your questions.

With Celldiscoverer 7 you profit from advanced automation features:

- Simple and intuitive carrier-based navigation via mouse and keyboard
- A dedicated automation wizard to create scan profiles for routine or reoccurring tasks
- A range of hardware- and software-based focus strategies to set up even complex multi-position experiments
- Fast overview images. Create an overview of your cells just once, then there's no need to expose them to unnecessary light doses during experiment setup.
- Cell viability put first with samples illuminated only as long as the camera acquires an image
- An optimized CZI file format for large datasets and seamless integration into existing image analysis workflows
- Open interfaces. Use your CZI dataset in all major software packages that use the BioFormats library, e.g., Fiji, Python, Matlab, Icy, Knime, Imaris, Arivis.

Expand Your Possibilities

Automated microscopy is your solution to create unbiased and statistically relevant high-quality data. Dedicated ZEN software modules and workflows increase your productivity, and minimize the time required for user training.

Automated and reproducible data acquisition

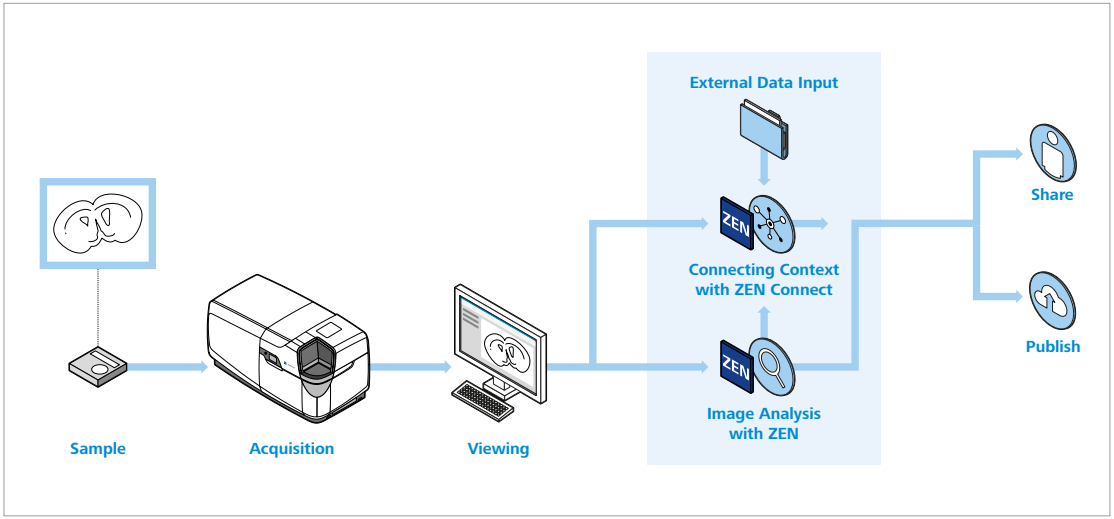
Use the ZEN modules Experiment Designer, Guided Acquisition and Automated Photomanipulation to automate repetitive acquisition tasks. With ZEN Connect, you keep the context between your sample and images acquired from different sample areas.

Shorter time to result with simultaneous data processing

Perform time-consuming image processing tasks simultaneously during image acquisition with the Direct Processing module.

Out-of-the-box image analysis

The modules from our BioApps portfolio optimized for specific types of application, e.g., cell counting or confluency measurement, shorten your time to result.



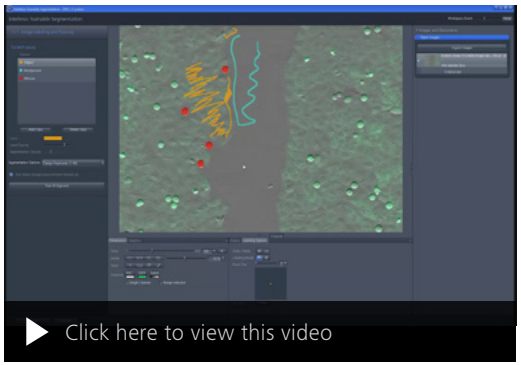
ZEN microscopy software integrates all steps from your sample to reproducible data for publication.

Workflow customization

The wizard-based module ZEN Image Analysis guides you to build analysis workflows that adapt to your specific applications. For advanced segmentation, you can integrate ZEN Intellesis.

Advanced processing and analysis

Use APEER to create new processing modules and to recombine existing ones. Use Arivis Vision 4D for sophisticated analysis in 3D and Arivis Vision Hub to scale up your analysis tasks.



ZEN Intellesis: Use the power of machine learning to easily segment your images.

Expand Your Possibilities

Smart Data Acquisition

Guided Acquisition

Perform fully automated targeted acquisition of objects of interest:

- Save time and storage space by focusing the image acquisition on objects of interest (e.g., rare events) only.
- Automate your workflow comprising of overview scan, object detection via automated image analysis, and high-resolution, multi-dimensional image acquisition for each detected object.

Experiment Designer

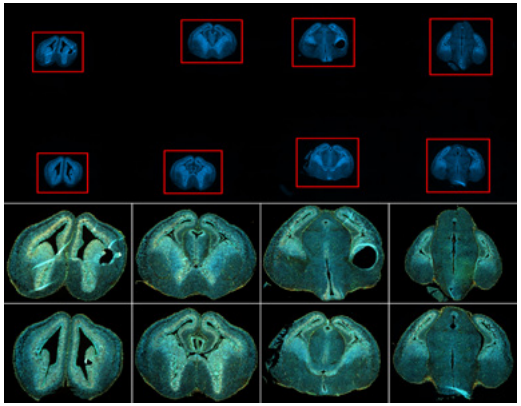
Configure inhomogeneous acquisition experiments:

- Support for all experiment dimensions: time series, Z stacks, tile images and channels.
- Synchronous or asynchronous control of hardware actions during the experiment.
- Definition of a number of iteration loops.
- Set of powerful processing functions to extract or fuse multiblock images.

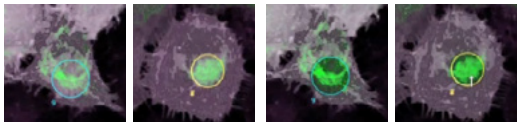
Automated Photomanipulation

Execute fully automated photoactivation and bleaching experiments. Automate your workflow comprising:

- Image acquisition at multiple predefined positions
- ROI definition for automated photomanipulation at multiple positions via image analysis
- Automatic execution of the photomanipulation experiment



Sample courtesy of P. Grigaravicius, FLI – Leibniz Institute on Aging, Jena, Germany



Expand Your Possibilities

Efficient Data Processing

Direct Processing

Perform time-consuming image processing tasks simultaneously during image acquisition:

- Deblurring for fast and easy 2D background removal with truly quantitative output.
- Supports a selection of processing methods, such as deconvolution, Airyscan processing, raw convert, denoising or unsharp mask.
- Employs pipeline to set up a sequence of image processing functions.
- Remote processing to maximize computational resources during acquisition.
- Instantaneous side-by-side comparison of raw and processed data.

APEER On-site

Use APEER modules fully integrated in ZEN

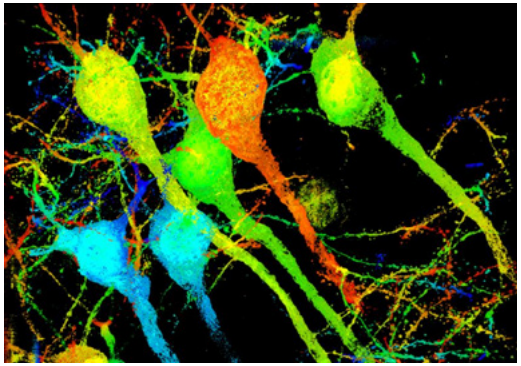
- Use public and private APEER modules to enable additional processing and analysis features and workflows in ZEN incl. Python scripting.
- Package your own tools into an APEER module and use them inside ZEN.
- Remote execution within your local IT infrastructure is supported.
- Execute customized and open-source image analysis functions in ZEN (on-site), provided via APEER, the cloud-based image and data processing platform.**

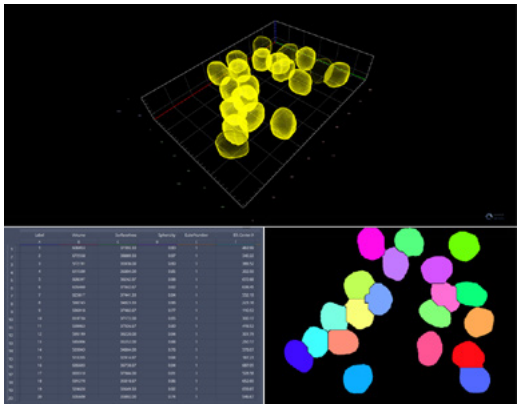
Contact us: apeer-solutions@zeiss.com

Macro Environment

Customize and automate ZEN using powerful Python scripts:

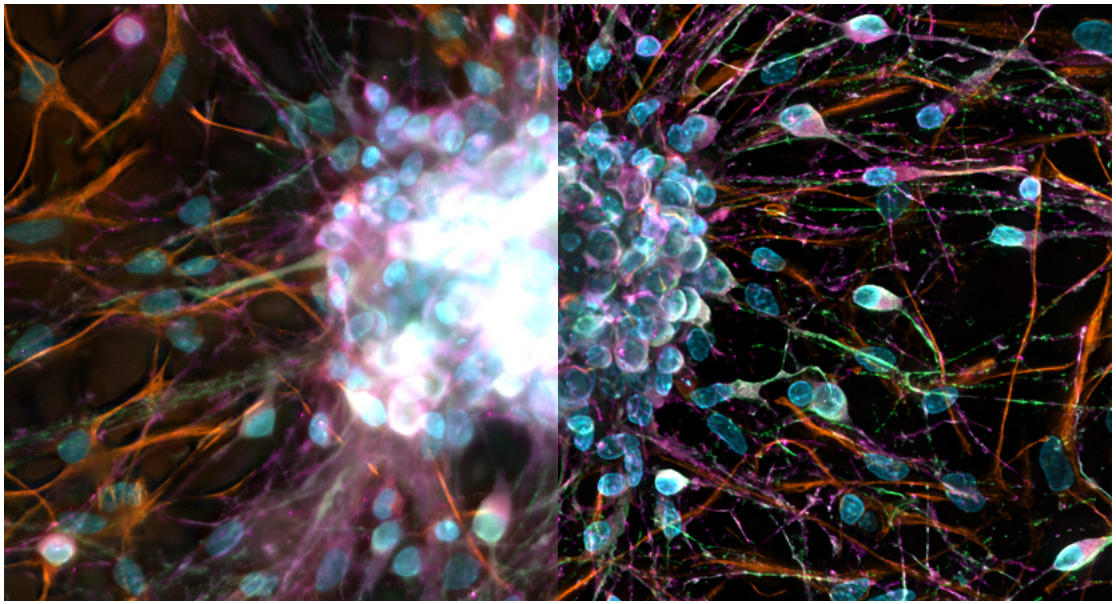
- Integrated script editor with debugging, recording and code completion.
- Integration of APEER modules and external software packages like Python, MATLAB or Fiji in an automated workflow is easily possible.
- Uses IronPython in order to integrate .NET-based functions.



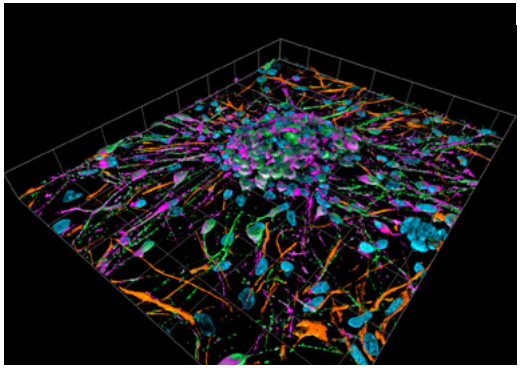


** If you need support developing customized solutions, we have a team of data scientists to rapidly develop applications using traditional and machine learning tools.

Expand Your Possibilities



Comparison between widefield (left) and deconvolved (right) Z-stack projection using GPU-based Deconvolution.



Rat cortical primary culture. Antibody staining of bIII-tubulin (Cy2, green), Nestin (Cy3, red) and DCX (Cy5, purple), nuclei stained with DAPI (blue). 3D reconstruction of the deconvolved Z-stack (shadow projection). Sample courtesy of H. Braun, LSM Bioanalytik GmbH, Magdeburg, Germany.

Get More Details with Deconvolution

When imaging three-dimensional samples, out-of-focus light sometimes blurs your structure of interest. For these images, you need deconvolution – a combined optical and mathematical method – to increase contrast and improve the signal-to-noise ratio and resolution. With Celldiscoverer 7 it is easier than ever before to first acquire a Z-stack of your samples and then deconvolve the image to reassign all detected photons to their origin. With ZEN imaging software you use advanced deconvolution algorithms, including a novel approach with depth variant point-spread-functions for deep imaging. Combine this with Celldiscoverer 7's unique Autocorr objectives and you will get excellent results from thicker samples, e.g. 3D-cell culture. And you will get them up to 30 times faster than with the traditional technology that works on your processing PC's RAM, thanks to Celldiscoverer 7's GPU-accelerated, parallel CUDA processing. Use the increased speed to extract maximum information from the large datasets you acquired in those demanding long-term, time-lapse or multiwell screening applications.

Expand Your Possibilities

Smart and Powerful Image Analysis and Visualization

BioApps

Execute out-of-the-box image analysis and tailored results presentation with interactive measurement tables, heatmaps and plots optimized for measurements in screening applications with multi-well setups.

- Cell counting
- Automated spot detection
- Confluency
- Gene and protein expression

Intellesis / Intellesis Object Classification

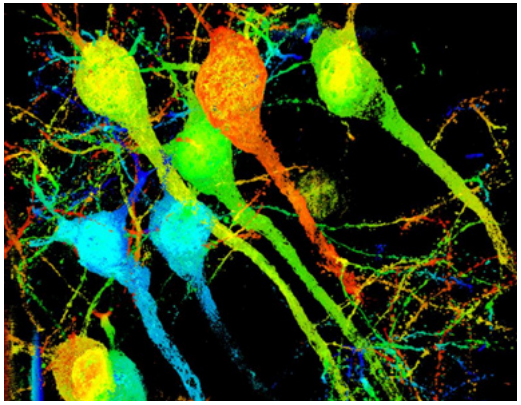
Enable machine-learning algorithms to segment images or to classify segmented objects:

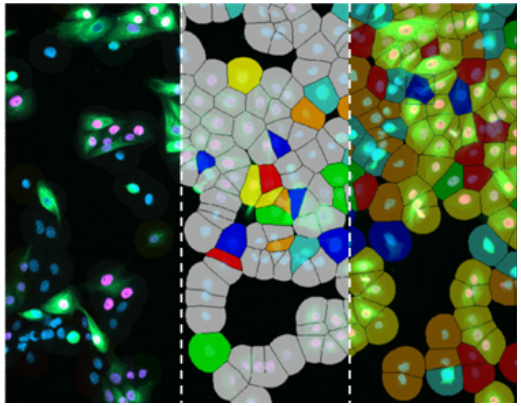
- Train a simple image segmentation model by labelling your data or import pre-trained deep neural networks.
- Train an object classification model in an environment with intuitive class assignment, compatible with objects obtained by conventional segmentation or Intellesis segmentation.
- Fully supports any multidimensional datasets including tiles, Z stacks or multi-channel images.
- Compatible with most common image formats such as CZI, OME-TIFF and imported third-party formats.

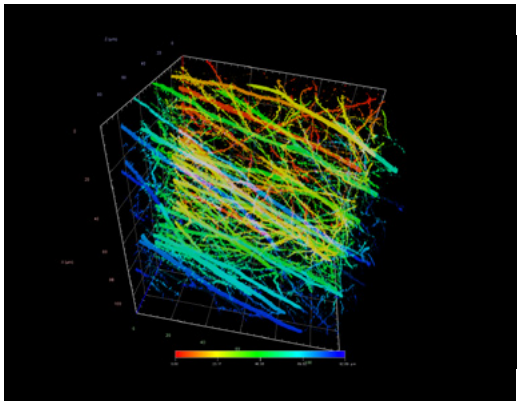
3Dxl*

Visualize 3D/4D image stacks:

- Display 3D volume models using efficient ray tracing technology, even for large data.
- Display up to 6 channels and time series.
- Choose from five rendering methods: Transparency, Volume, Max Intensity Projection, Surface, mixed and with up to three clipping planes.
- Improved transparency mode for better visualization of dense structures, such as dense fluorescent data.
- Bridge functionality: Send to arivis vision4D with saved settings and sample pipelines for fast and easy 3D analysis.
- Generate animations.







* powered by arivis

Expand Your Possibilities

Connect All Your Multimodal Data to Keep the Whole Picture

Expanding classic correlative microscopy, ZEN Connect is open to all your images: you can load complex multidimensional images as easily as simple overview images. It makes no difference whether your imaging technology is from ZEISS or from third parties.

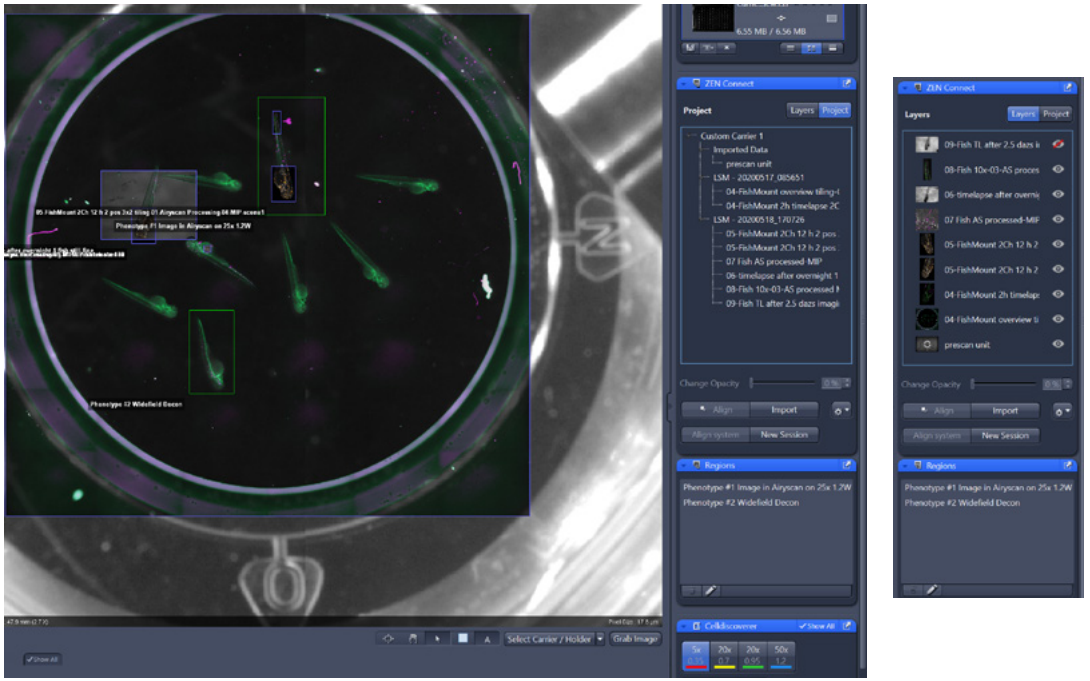
All image data can be aligned, overlayed and shown in context. So long as your external images adhere to the well-established Bio-Formats standard, ZEN Connect will even keep their metadata.

Acquire Overview Images for Easy Navigation

Image your sample at low magnification. Then switch to your high-resolution image acquisition of choice. With ZEN Connect you only need to align it once, then use the overview image to navigate and find your ROIs. All subsequent high-resolution images will be shown in context as you zoom in and out across the borders of resolution domains and imaging technologies. A single click on the overview image brings your stage to the right position to examine or reevaluate any of your ROIs with the full image overlay.

Smart Data Management

All the images you acquire with ZEN Connect are saved in well-structured database projects, complete with an intuitive label attached automatically to each image file. You'll always stay on top of things – during your experiments as well as months afterwards when analyzing your work. It's easy to find all your overlay images and their connected datasets. You can even search for imaging parameters with the new filter function of ZEN Connect.



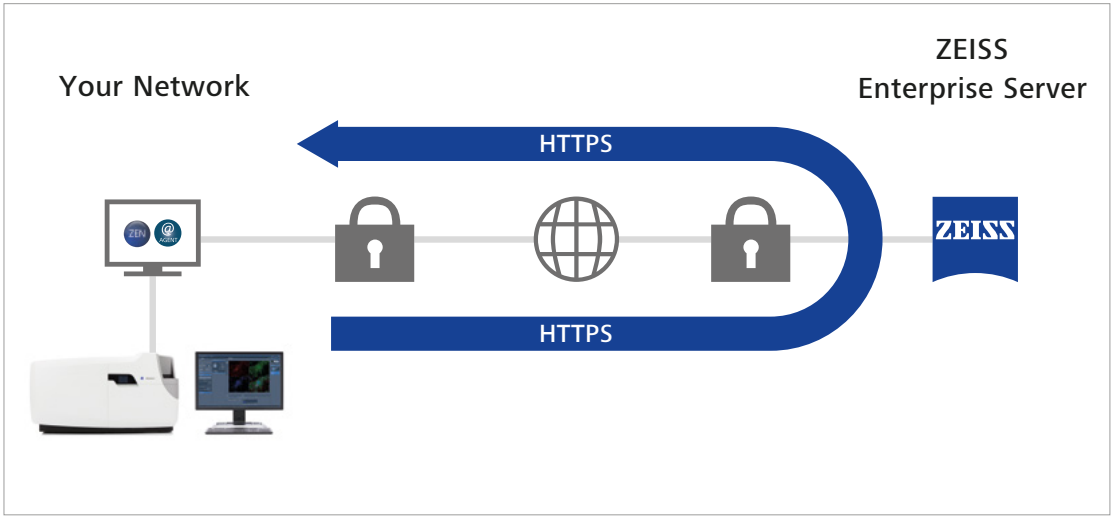
Expand Your Possibilities

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

Tailored Precisely to Your Applications

Typical Applications	Task	ZEISS Celldiscoverer 7 Offers
Multiwell plates for Live Cell or fixed endpoint assays	Evaluate and document cell culture from multiwell plates.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
		Up to 7 LED excitation wavelengths
		Low magnification, large field of view – high numerical aperture lenses
		Automatic sample carrier detection and calibration
	Scan the maximum area of a multiwell plate at different magnifications and resolutions.	Adaptive Lens Guard and automatic sample carrier calibration ensure maximized scan area depending on the plate type 100 % plate scanning from 2.5× to 100× is possible whole well – single shot
Label free assays	Perform label free growth curve assays over several days.	Transmitted light source: high-speed IR-LED (725 nm) offering low phototoxicity
		Stable Incubation with temperature (heating / cooling), CO_2 and O_2 control
		Simple and reproducible Hardware Autofocus for focus drift compensation
		Autoimmerson for water immersion lens
High-Content Screening	Acquire high resolution images of multi-labelled cell culture from multiwell plates quickly.	Up to 7 LED excitation wavelengths
		Autocorr objectives for automated aberration correction
		Adaptive Lens Guard and automatic sample carrier calibration ensure maximized Scan area
		Barcode reader for easy sample identificiation
		Preview Scan
		Open Application Developement for Python scripting – open access to third party analysis tools
		Fast Multibandpass Main Beam Splitter and Emmission Filter Wheels
		Large working distance enables higher / better 3D content screening
	Pharmacological or chemical or drug screening.	Option to add a plate loader
Transfected and non-modified Live Cell Cultures	Evaluate and document transfection rate and transfection stability using fluorescent markers.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
		Stable Temperature and O_2 / CO_2 controlled enviroment
		Autoimmerson for water immersion lens
	Work with different sample carriers.	Automatic measurement of sample carrier bottom thickness and Autocorr Objectives for enhanced contrast and resolution
		Adaptive Lens Guard and automatic sample carrier calibration ensure maximized scan area

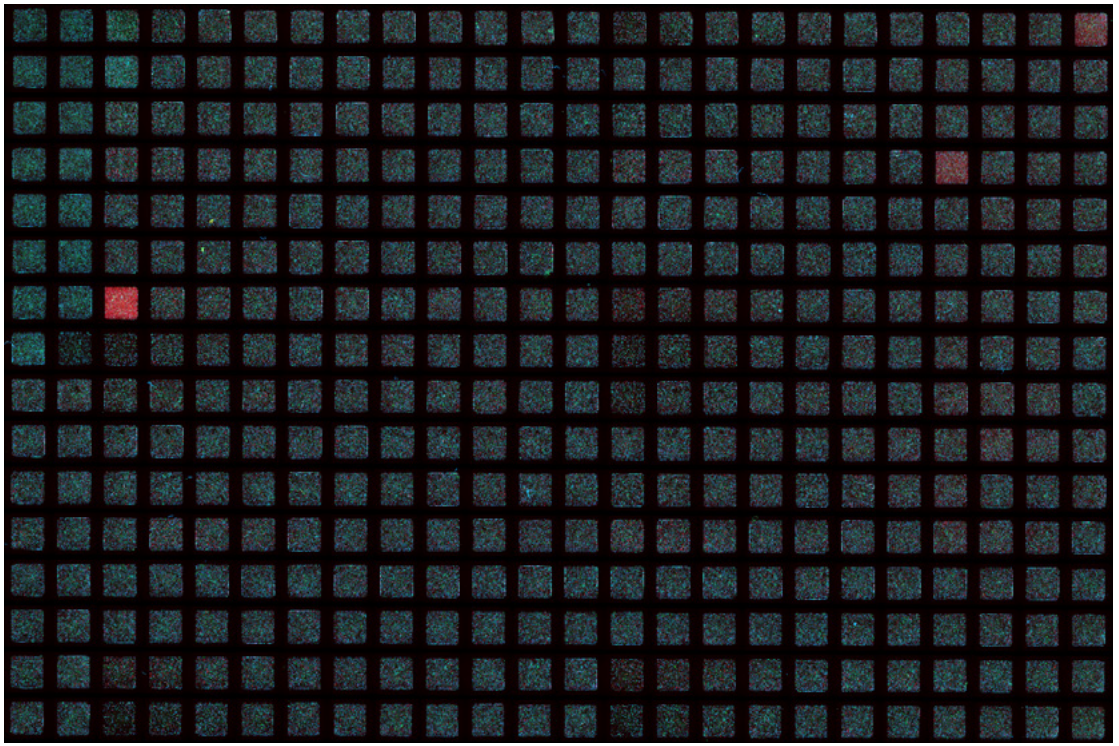
Tailored Precisely to Your Applications

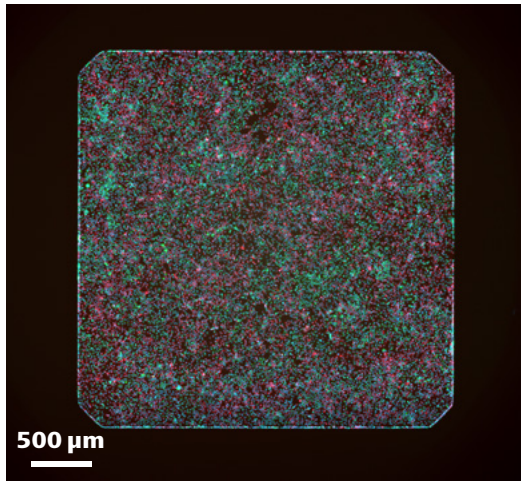
Typical Applications	Task	ZEISS Celldiscoverer 7 Offers
Label-free fixed and thin tissue slices or small organisms	Document and evaluate cell and tissue morphology and growth state.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
	Change quickly between large overview scans and high resolution imaging.	Quick change of field of view using triple magnification changer
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
Fixed fluorescently labelled tissue, cell culture samples or small organisms	Identification, quantification and qualification of cell types, pathological and pharmacological pathways using cell-, tissue and protein markers in 2D and 3D samples.	Up to 7 LED excitation wavelengths
		GPU-accelerated 3D-Deconvolution
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
Multi-labelled living tissue section, organs, small organisms, organotypic-, spheriod or cell culture preparations	Short-term or long-term observation of physiological and morphological parameters in 2D/3D during growth, differentiation, motility and interaction.	Autoimmerson for water immersion lense
		Autocorr objectives for automated aberration correction
		Stable incubation with temperature (heating/cooling), CO_2 and O_2 control
		LED illumination unit with up to 7 excitation wavelengths
		Experiment Feedback for adaptive experiments
		GPU-accelerated 3D-Deconvolution
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
	Analyse the embryogenesis of small model organisms.	Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
		GPU-accelerated 3D-Deconvolution
Stimulus-induced responses of cells, tissue or whole organisms	Observation of stimulus-induced responses of cells, tissue or organisms without disturbing the environmental control.	Semi-automatic dispensing work flow
		Dispensing unit allows to add compounds into the field of view
		Option to install a perfusion chamber

Tailored Precisely to Your Applications

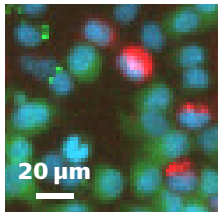
Typical Applications, Typical Samples	Task	ZEISS Celldiscoverer 7 with LSM 900 Offers
Antibody stained tissue slices	Document morphological relations of structures	Airyscan 2 with GaAsP detector for imaging
	Resolve morphological structures at high resolution while avoiding photobleaching.	Airyscan 2 HS mode with Joint Deconvolution for efficient and gentle super-resolution imaging.
	Image large field of views and conduct tiling experiments for large specimen.	Use low magnification lenses for a large field of view combined with LSM Plus for high image quality at fast acquisition.
		Use Airyscan 2 Multiplex modes to combine high resolution and high-speed acquisition.
Live cell culture	Study the motility of vesicles and organelles	Up to 8 frames per second confocal time lapse imaging
Live cell culture with two labels	Study the motility of subcellular structures	Airyscan 2 with GaAsP detector and Multiplex mode for time lapse imaging in 2D or 3D at up to 8 frames per second
	Explore the interaction of two proteins exploiting the Förster Resonance Energy Transfer effect	FRET analysis tool, available in ZEN (black edition)
Live cells with multiple labels	Image over a long time in an automated way	Experiment Designer or Guided Acquisition software tool combined with three parallel spectral channels
		Combine different acquisition modes,via mixed mode.
		Combine the experiment in ZEN Connect
	Conduct time laps experiments of cell culture or whole organisms using multiple labels to follow morphological changes.	Capture all your signals simultaneously and use LSM Plus to improve structural information, even at lowered laser power.
Live or fixed cells with multiple labels and overlapping emission signals	Examine the interplay of multiple proteins	Parallel acquisition of all signals with three spectral channels and linear unmixing, combined with LSM Plus for enhanced image quality
Cellular structures with weak labels	Image subcellular structures at physiological expression levels	LSM 900 with GaAsP detector or Airyscan 2 at best sensitivity, pushing structural information even further with Joint Deconvolution.
Study molecular dynamics	Photomanipulation	Use Automated Photomanipulation for bleaching or photocativation
Plant roots	Follow the changes of subcellular structures over time with high resolution	Airyscan 2 with GaAsP detector for high resolution imaging beyond 40 µm deep into tissue with up to 6 full frames per second (512 × 512 pixel)
	Follow morphological changes over time while avoiding phototoxic effects on the living plant sample.	Capture your signals simultaneously on up to 3 GaAsP detectors and use LSM Plus to improve structural information even at lowered laser power
Model organisms, e.g. Zebrafish, *Drosophila* or *C. elegans, Arabidopsis*	See fine details of the organization and dynamics of endogeneously expressed FP proteins	Airyscan with GaAsP detector for high sensitivity imaging and increased resolution beyond 40 µm deep into tissue.
	Image large fields of view at high volume rates to capture developmental processes	Flexibly adjust the required resolution. Ensure reduced laser exposure for all your labels and high image quality with LSM Plus.
Cleared samples	Image whole organs or entire organisms	Specialized objective with long working distance and autocorrection for bottom material and thickness available (20× 0,7)

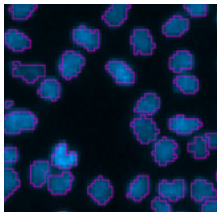
ZEISS Celldiscoverer 7 at Work

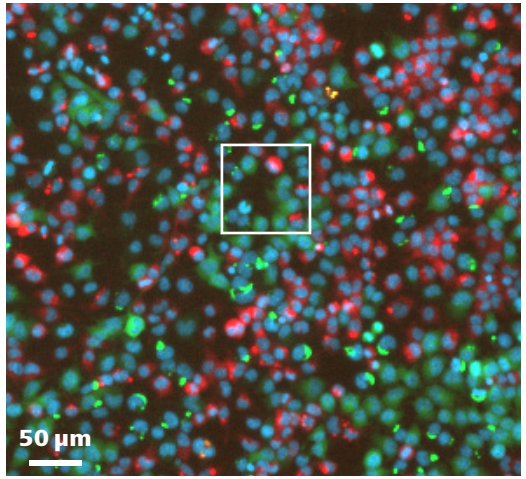




Whole well, single shot.
384 microwell plate imaged with 2.5× magnification in 3 channels. Each well fits into one single image. You avoid time-consuming scanning of wells and subsequent stitching and increase your throughput. The overall image quality and resolution allows e.g., segmentation of single cell nuclei and therefore counting of cells.

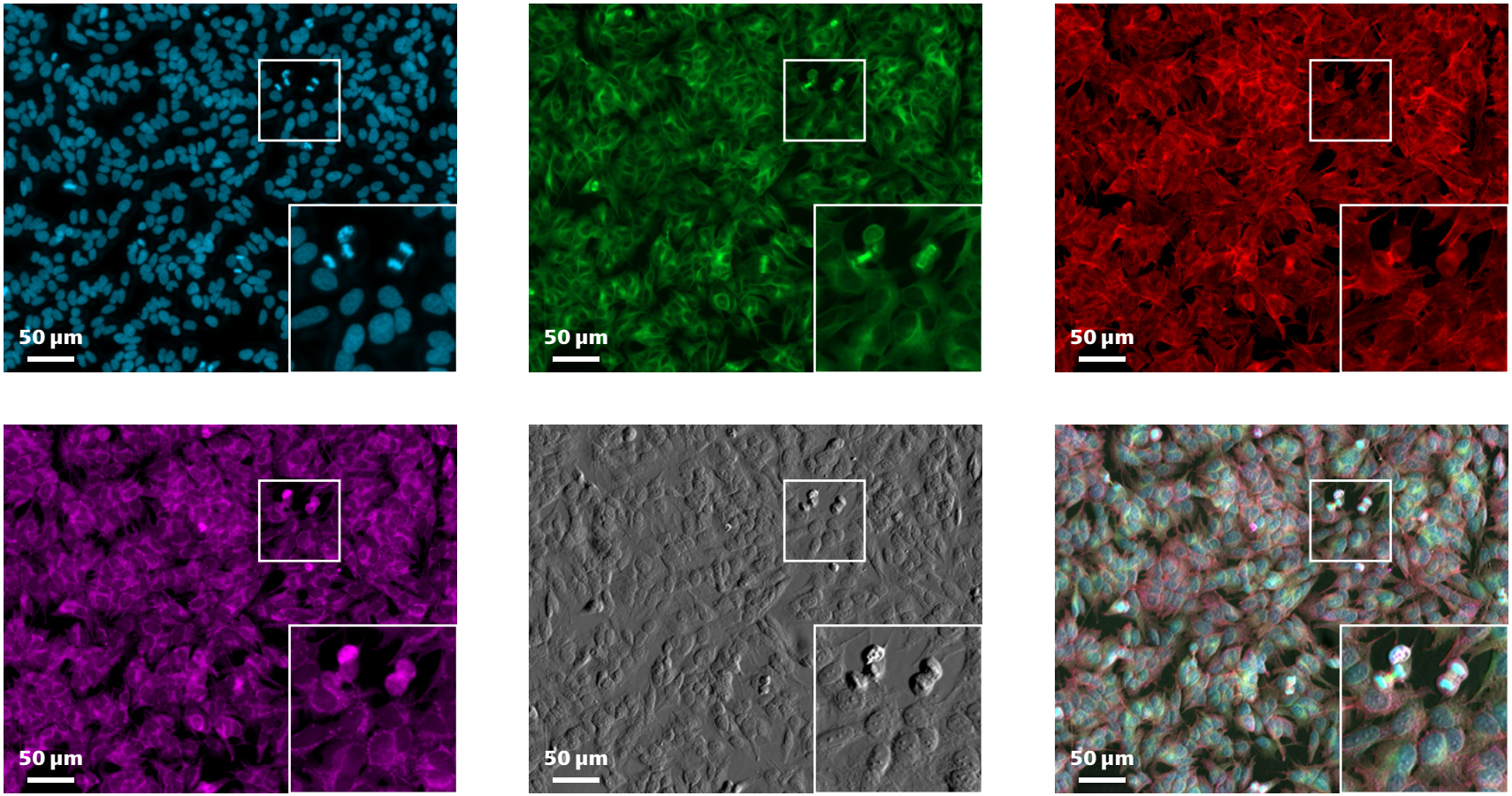






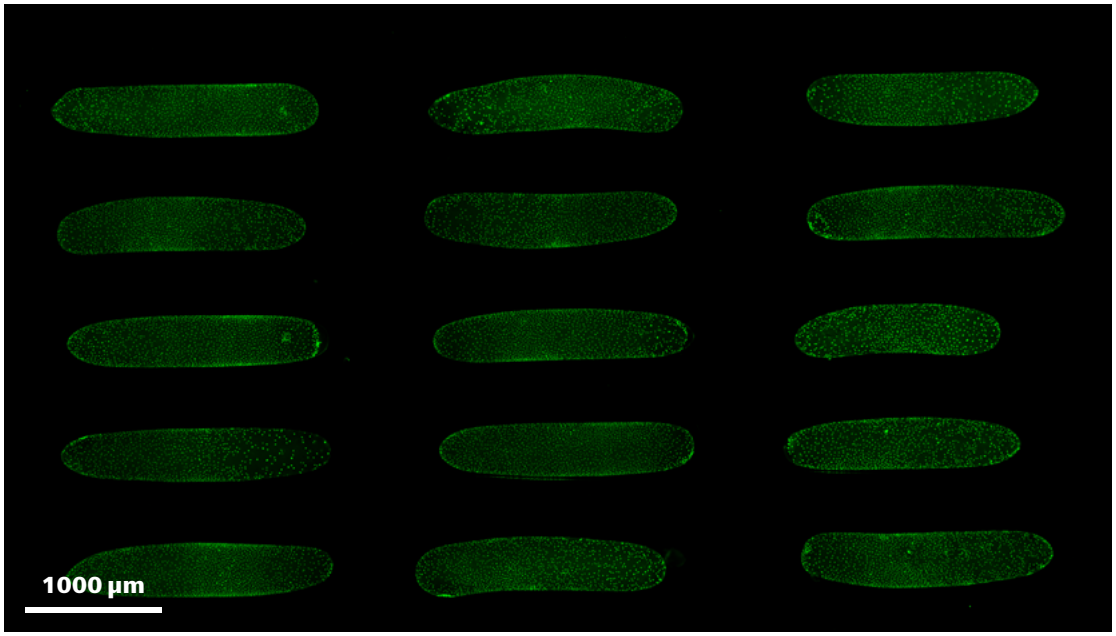
Sample courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

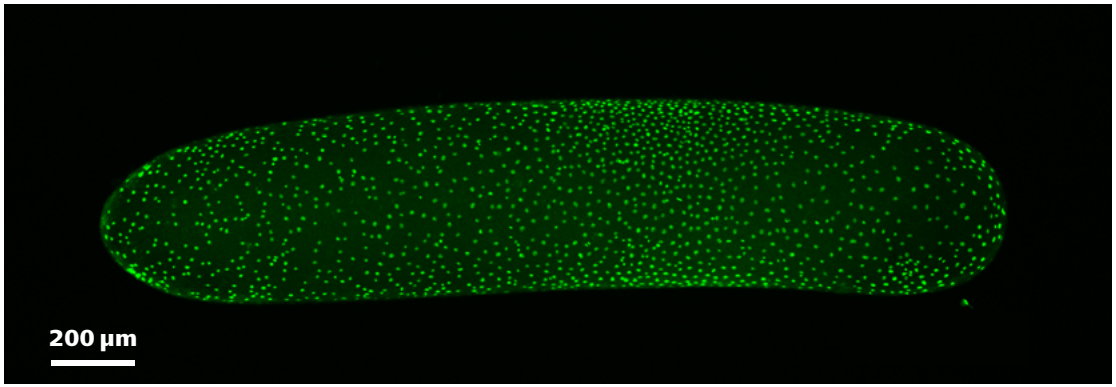
ZEISS Celldiscoverer 7 at Work



SH-SY5Y cells cultured on a 384 microwell plate. Five channel image at a single position using Plan-Apochromat 20×/0.95; EDF from Z-stack; Hoechst-Chromatin (blue), anti-alpha-tubulin antibody FITC for alpha tubulin (green), Phalloidine for actin (red), MitoTracker deepRed for mitochondria (purple), phase gradient contrast, overlay image. Sample courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

ZEISS Celldiscoverer 7 at Work

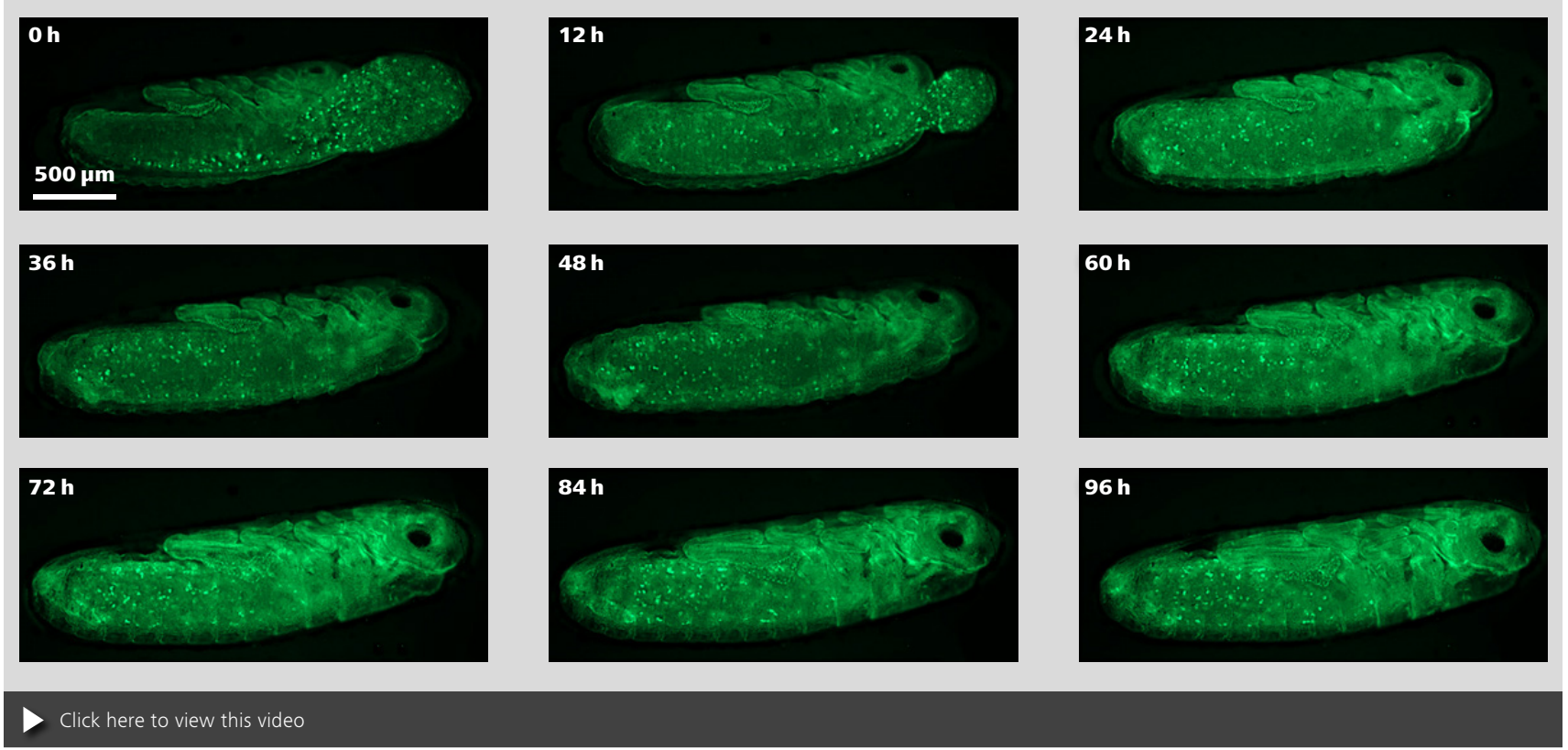




Sample courtesy of S. Donoughe, Biological Labs, Harvard University, Cambridge, USA

15 (out of 24) living cricket embryos mounted in low-melt agarose. Cells are expressing nuclear-localized GFP. The overview image shows a multi-position experiment. At each position two embryos fit into the field of view. Acquired within 30 seconds incl. Z-stacks of 17 images each (thickness 350 µm, 2.3 seconds). This enables imaging of multiple crickets in a synchronized way.
The resulting spatio-temporal image resolution allows characterization of movement and division of single cells throughout the embryo during development. Magnification: 2.5× using short exposure times of 35 ms.

ZEISS Celldiscoverer 7 at Work



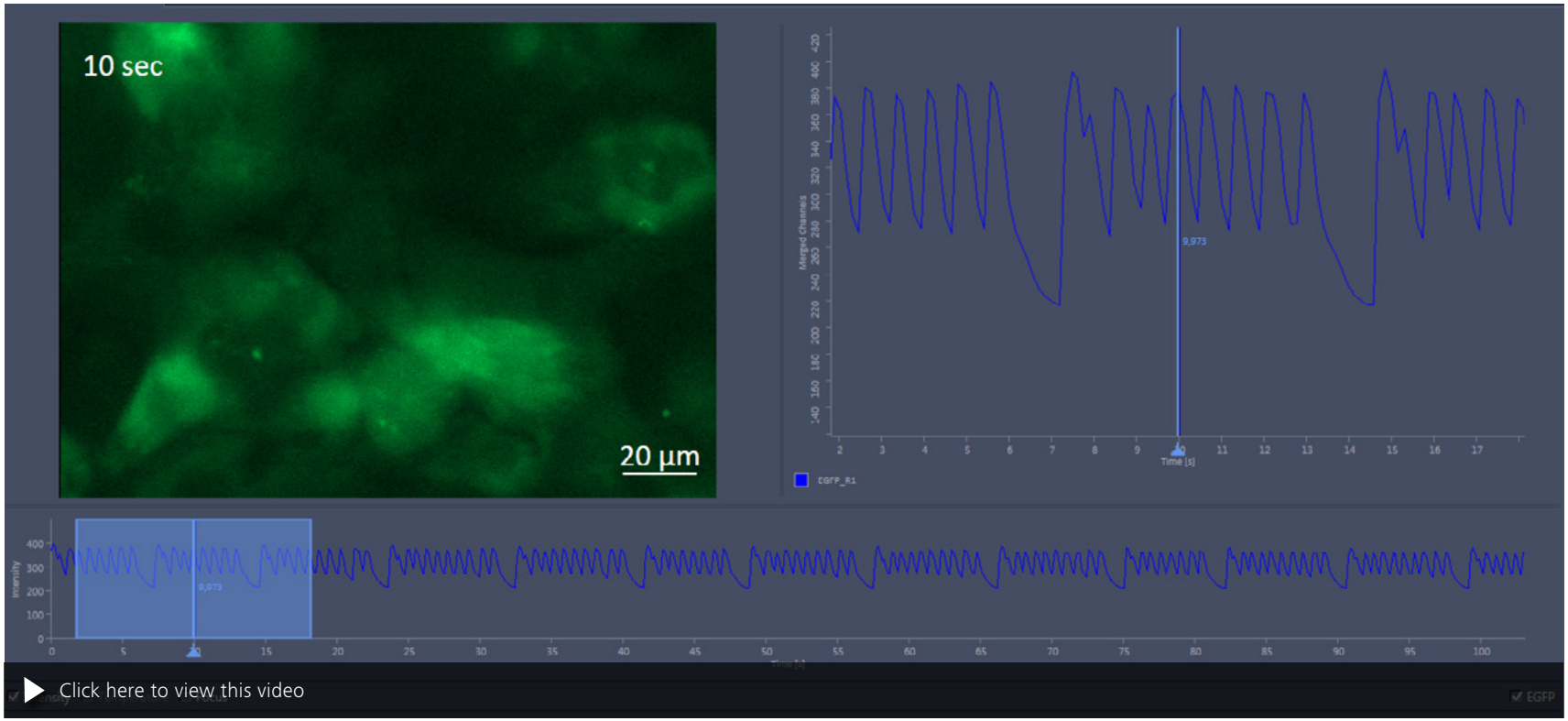
Click here to view this video

Five days long-term imaging of cricket embryogenesis. The development of an eGFP-expressing cricket embryo mounted in low-melt agarose was imaged every 5 minutes for a total length of 5 days.

During the first day the retraction of the yolk and dorsal closure can be seen followed by further growing of the embryo. EDF-images created from Z-stacks; acquired with 2.5× magnification using short exposure times of 35 ms.
Z-stacks were 350 µm thick and were acquired within 2.3 seconds.

Sample courtesy of S. Donoughe, BioLabs Building 2087, Harvard University, Cambridge, USA

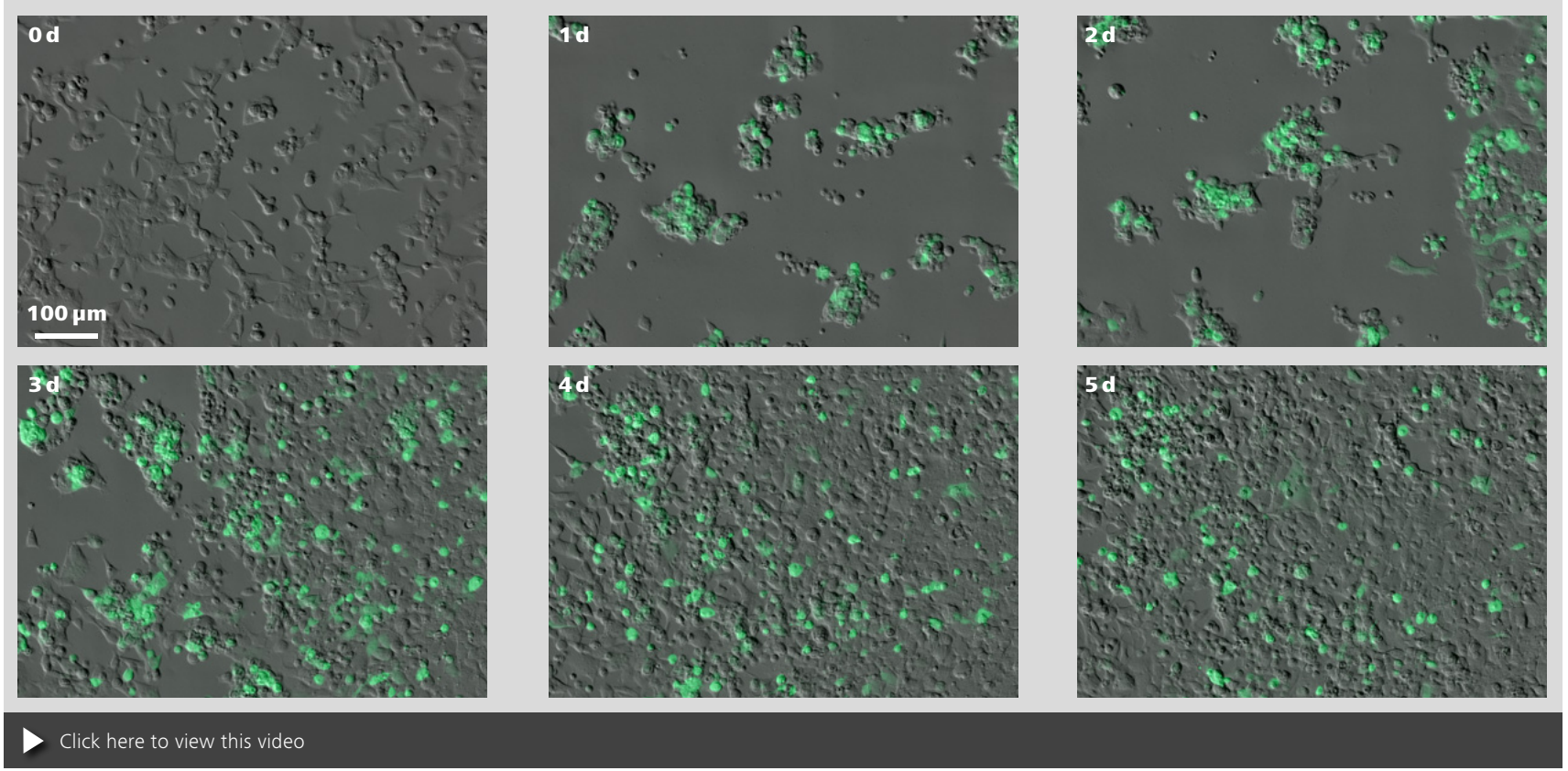
ZEISS Celldiscoverer 7 at Work



Calcium imaging in beating cardiomyocytes stained in green using a Calcium kit; imaging with 8 fps using Plan-Apochromat 50×/1.2 W with Autoimmersion; the green fluorescence changes intensity upon contraction of the cells; frequency of individual contractions analyzed with ZEN MeanROI tool; diagram shows delayed contraction in regular intervals caused by component given to the cells.

Sample courtesy of Sanofi-Aventis Deutschland GmbH, R&D IDD / in vitro Biology, Frankfurt, Germany

ZEISS Celldiscoverer 7 at Work

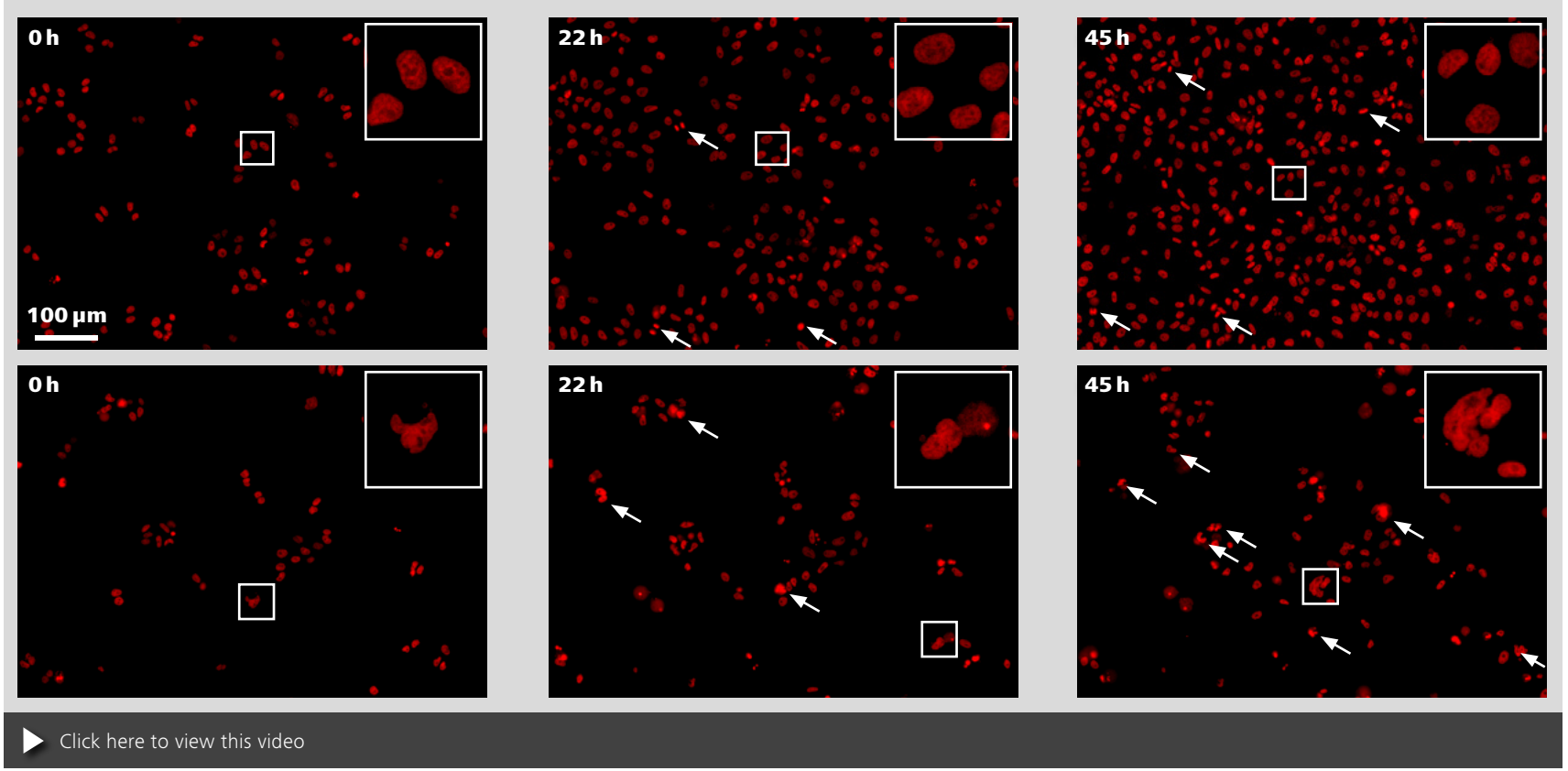


GFP HEK (Human Embryonic Kidney) cells, transiently expressing eGFP. Imaged through a 1 mm plastic bottom; images taken every 5 minutes for a total of 5 days; imaging started shortly after induction of the expression via Tetracyclin treatment. Overlay of phase gradient contrast and green (eGFP) fluorescence:

- After one day: cells are subconfluent and start to express eGFP. Due to the transient transfection and the Tetracyclin treatment some round and dead cells are visible.
- After two days: cells have recovered from the transfection and start to grow again.
- At the end of the time series: cells are confluent and bright green due to eGFP expression.

Sample courtesy of Sanofi-Aventis Deutschland GmbH; R&D IDD / in vitro Biology, Frankfurt, Germany

ZEISS Celldiscoverer 7 at Work



Click here to view this video

48 h Cell Proliferation Assay Control vs. AuroroB Kinase siRNA Knockdown
HeLa Kyoto cells (Neumann et. Al., Nature 2010 Apr.1.; 464(7289):721-7) expressing H2B-mCherry were imaged every 30 minutes for 48 hours in a 96 well plate using Plan-Apochromat 10×/0.5.

Top row: A series of images showing untreated control cells. The lack of dead cells and the healthy shape of the nuclei (arrows indicate methodic cells) clearly demonstrates the stability and homogeneity of the incubation, the stable focus, low phototoxicity as well as virtually no photobleaching.

Bottom Row: A series of images showing cells treated 24 h before acquisition with a siRNA against AuroraB Kinase on the same plate as the control (top row). The slower proliferation and the misshaped nuclei (arrows and insets) demonstrate the mitotic defects caused by the knockdown.

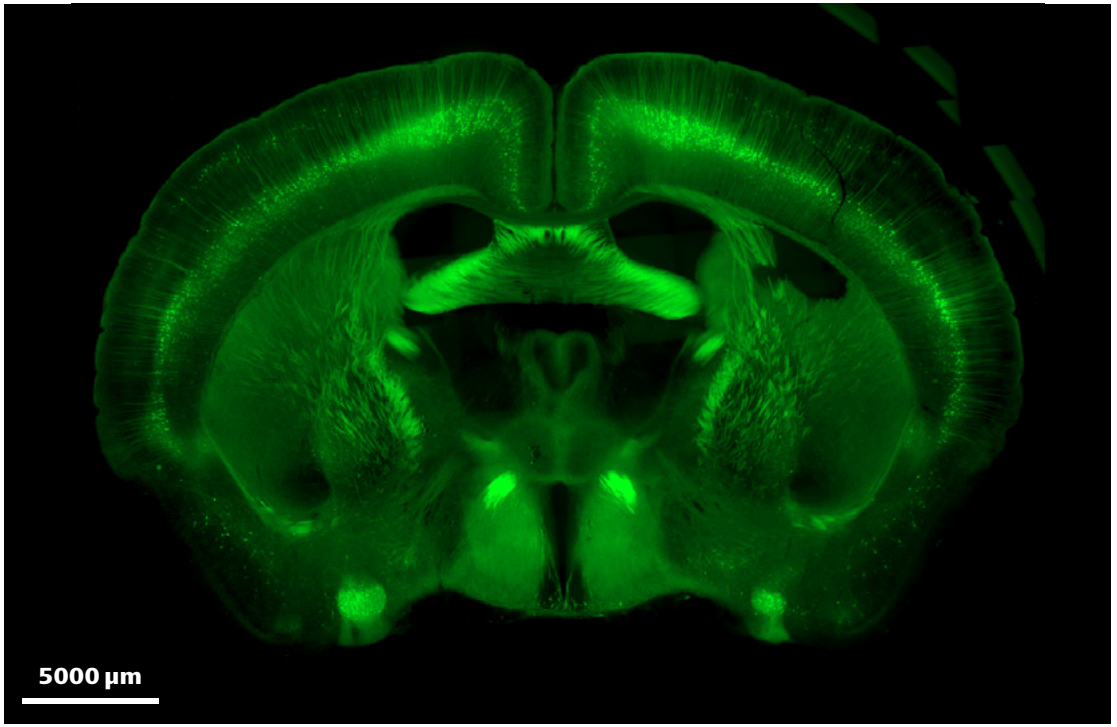
Sample courtesy of S. Reither, Advanced Light Microscopy Facility, EMBL, Heidelberg, Germany

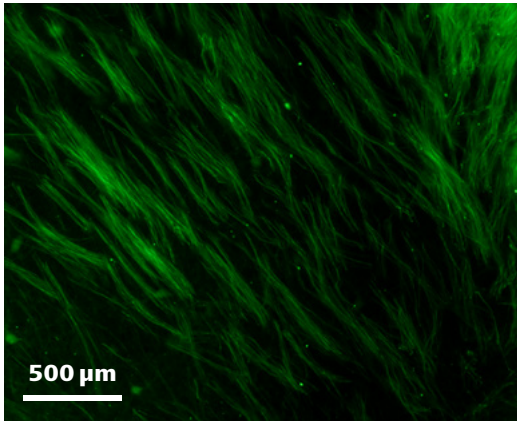
ZEISS Celldiscoverer 7 at Work

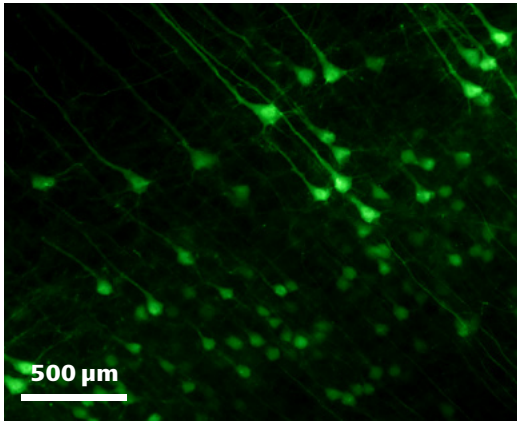
Expansion Microscopy in Mouse Brain
The goal of Expansion Microscopy is to make small structures visible that could otherwise not be observed with conventional or superresolution microscopy. Here, a protein-retention expansion technique was applied to expand the tissue. The sample is enlarged by a factor of 4.5 to 5 – up to several mm in X/Y dimensions and several hundred µm in the Z dimension. Especially the 5×/0.35 and the 20×/0.7 objectives of Celldiscoverer 7 are well suited to image such samples as they have a large field of view, high resolution and a large working distance.

Top: Whole brain
Bottom left: Axon bundles
Bottom right: Pyramidal cells

The images shown here are extended-depth-of-focus images created from Z-stacks acquired with a 2.5× magnification imaged through 1.2 mm of polystyrene. Staining: YFP expressing neurons.

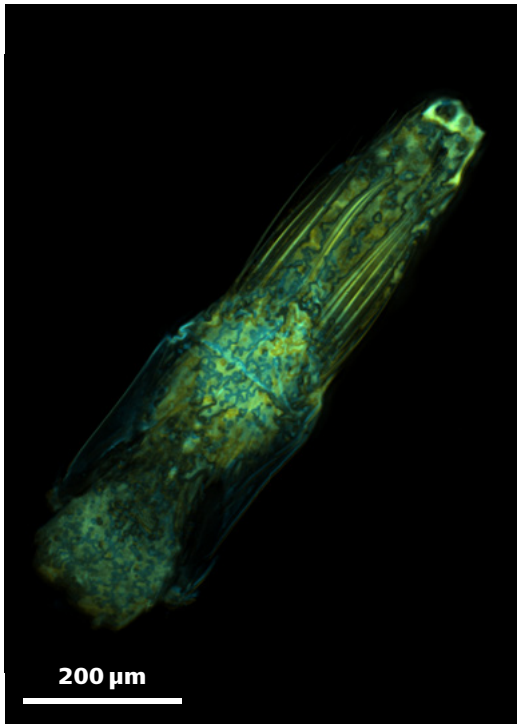


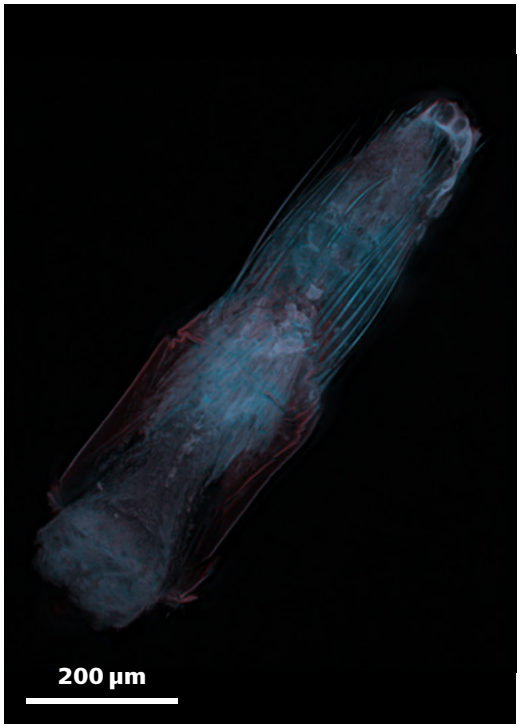


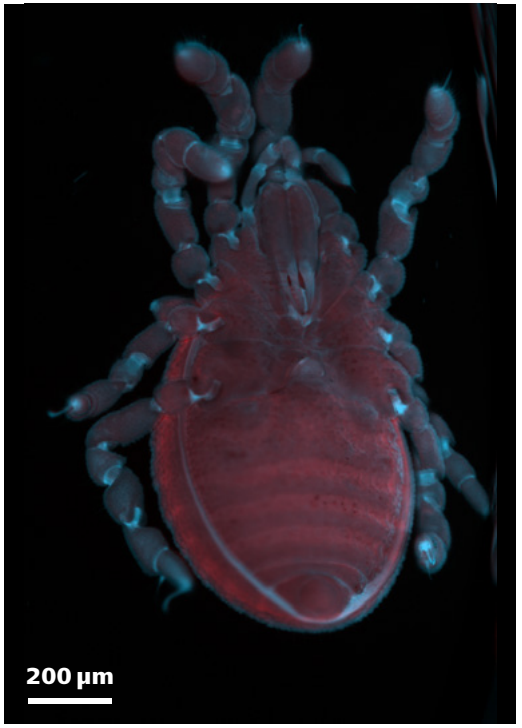


Sample courtesy of S. Asano, Boyden lab, MIT, Cambridge, USA

ZEISS Celldiscoverer 7 at Work







Autofluorescence Imaging of Arachnids
Small Arachnids where collected from tropical leaves in South America. Imaging with Celldiscoverer 7 saves time, since the low magnification objectives (5×/0.35 and 20×/0.7) deliver finest details in large fields of view.
A combination of several wavelengths was used to observe autofluorescence. The images shown here are extended-depth-of-focus images created from Z-stacks.

Left: Genital of the third leg of Huitaca sp. imaged with a 20× magnification.
Center: Same as before but excited with a different combination of wavelengths.
Right: *Microgavia oviformis* imaged with 2.5× magnification.

Sample courtesy of L. Benavides, Giribet Lab, Harvard University, Cambridge, USA

ZEISS Celldiscoverer 7 at Work

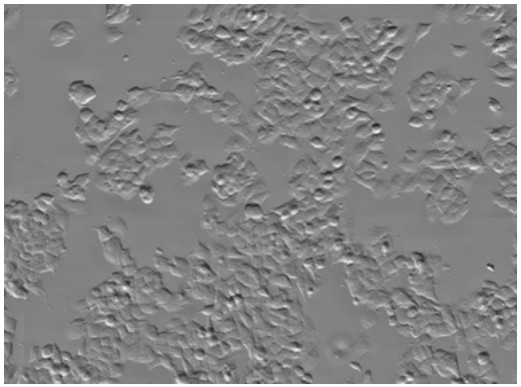
Application for Label-Free Measurement of Cell Proliferation

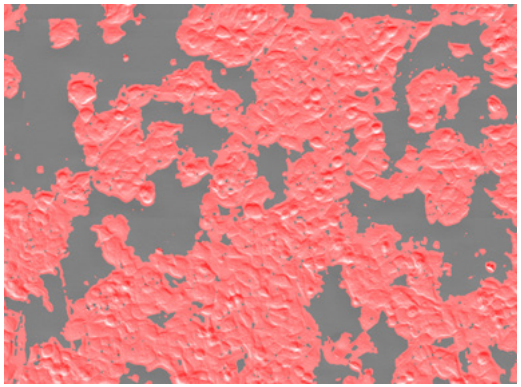
The growth of cultured cells has been imaged in long-term time-lapse movies over 72 hours using phase gradient contrast (image 1).
To quantify proliferation, cell region (image 2, red overlay) was detected automatically using supervised machine learning (random forests) in each time frame.

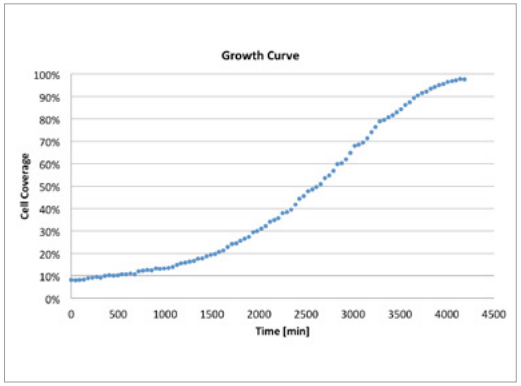
The growth curve (image 3) shows the relative cell coverage over time, averaged for all images in one well. The assay allows image based cell proliferation measurements.
By using label-free imaging in phase gradient contrast, cell growth is not affected by phototoxicity or any further sample processing.

This approach offers several advantages:

- Very low disturbance, non-invasive monitoring of cells.
- Kinetic live cell data, no single end point.
- Compatible to standard micro-well plates (e.g. 96well or 384well).
- Applicable for screening cell-based applications.

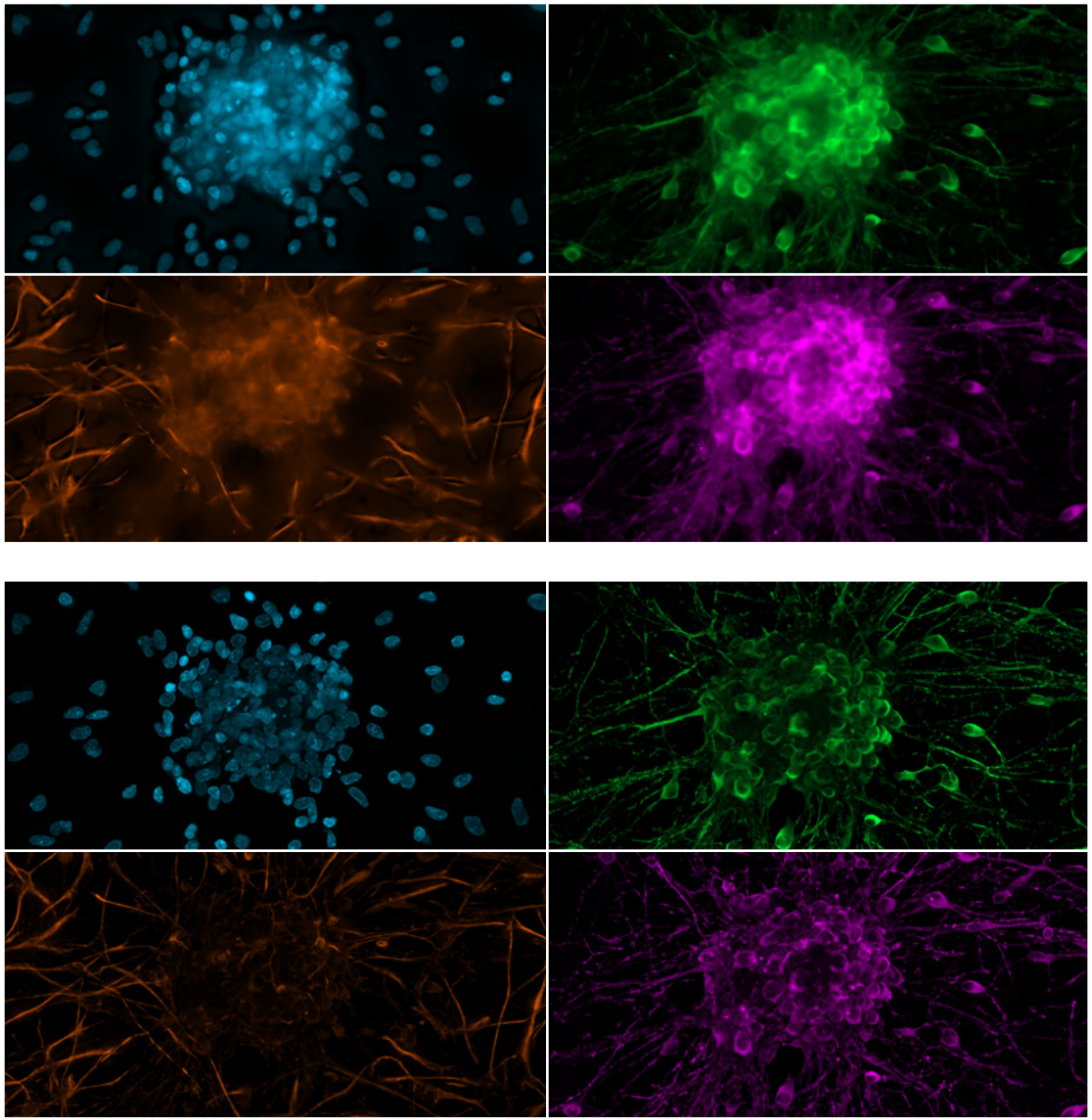






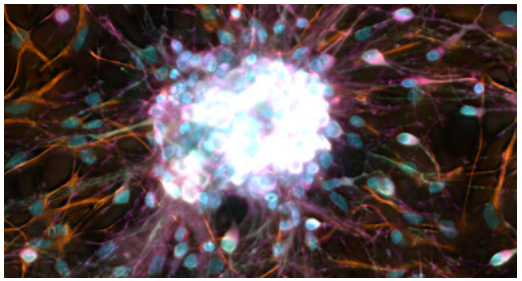
Sample and assay courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

ZEISS Celldiscoverer 7 at Work



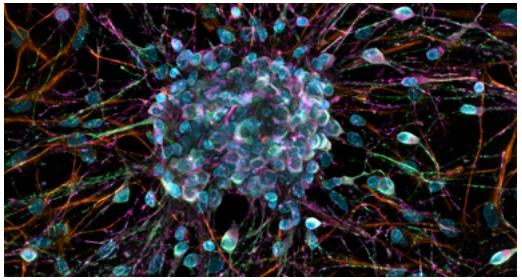
Rat cortical primary neuron culture. Antibody staining of bIII-tubulin (Cy2, green), Nestin (Cy3, red) and DCX (Cy5, purple), nuclei stained with DAPI (blue). Maximum intensity projection of a Z-stack.

Top row: Conventional widefield images.



Bottom row: Deconvolved images using GPU-based deconvolution. Deconvolution algorithm: constrained iterative using a depth variant point-spread function.

Sample courtesy of H. Braun, LSM Bioanalytik GmbH, Magdeburg, Germany.

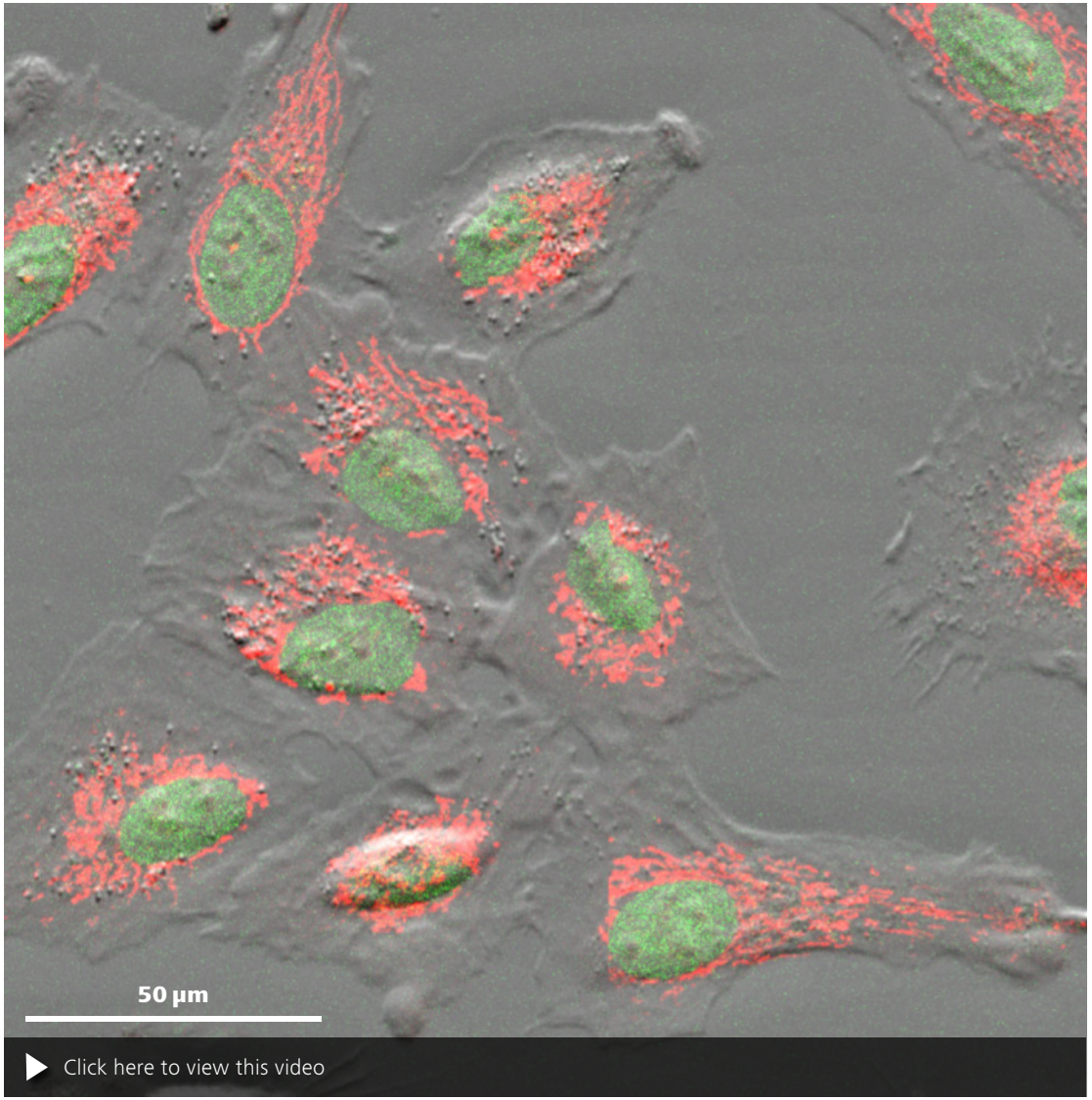


ZEISS Celldiscoverer 7 at Work

Primary lung fibroblasts stained with mitotracker red (mitochondria) and a DNA marker (nuclei).

The acquisition with the unique Mixed Mode seemlessly combines two imaging modes – the fluorescent channels where captured in confocal mode using highly sensitive GaAsP detectors while the Phase Gradient Contrast is camera based.

A timelapse of 2.5 h was acquired using a 40× magnification with a numerical aperture of 0.95.

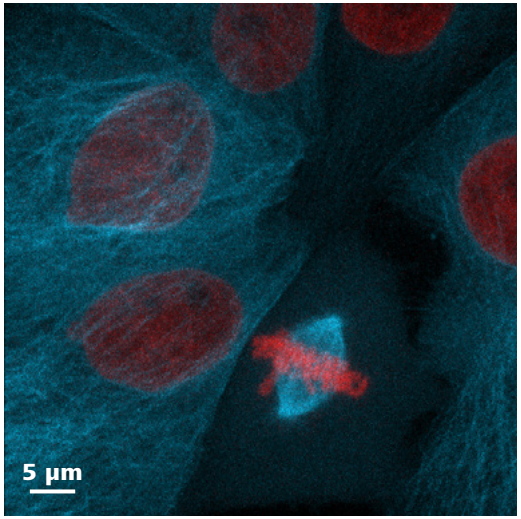


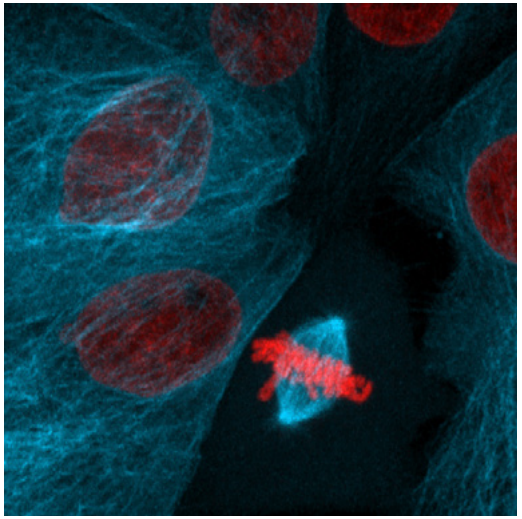
Sample courtesy of A.C. Hocke, Charité, Berlin, Germany

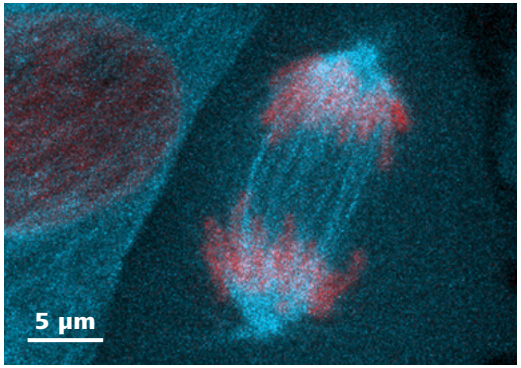
ZEISS Celldiscoverer 7 at Work

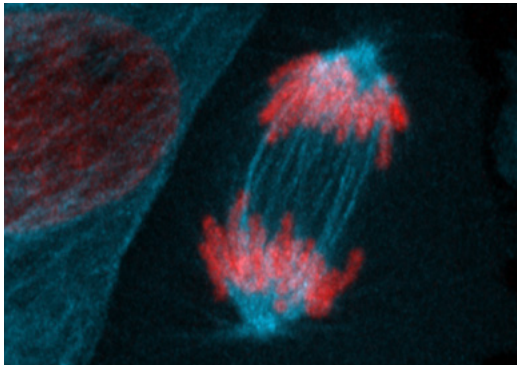
Cell Division of LLC-PK1 (Porcine Kidney)
To minimize photobleaching and damage to a live sample, it is useful to reduce acquisition time and to use minimal laser power. LSM Plus helps to improve the signal-to-noise ratio as well as the resolution of structures such as spindle fibers.

In this example, 100 Z-stacks were acquired with LSM 900 on Celldiscoverer 7 over 29 minutes. The images show a maximum intensity projection of 38 Z-planes. Cells expressing H2B-mCherry (red) and α-Tubulin-mEGFP (cyan).









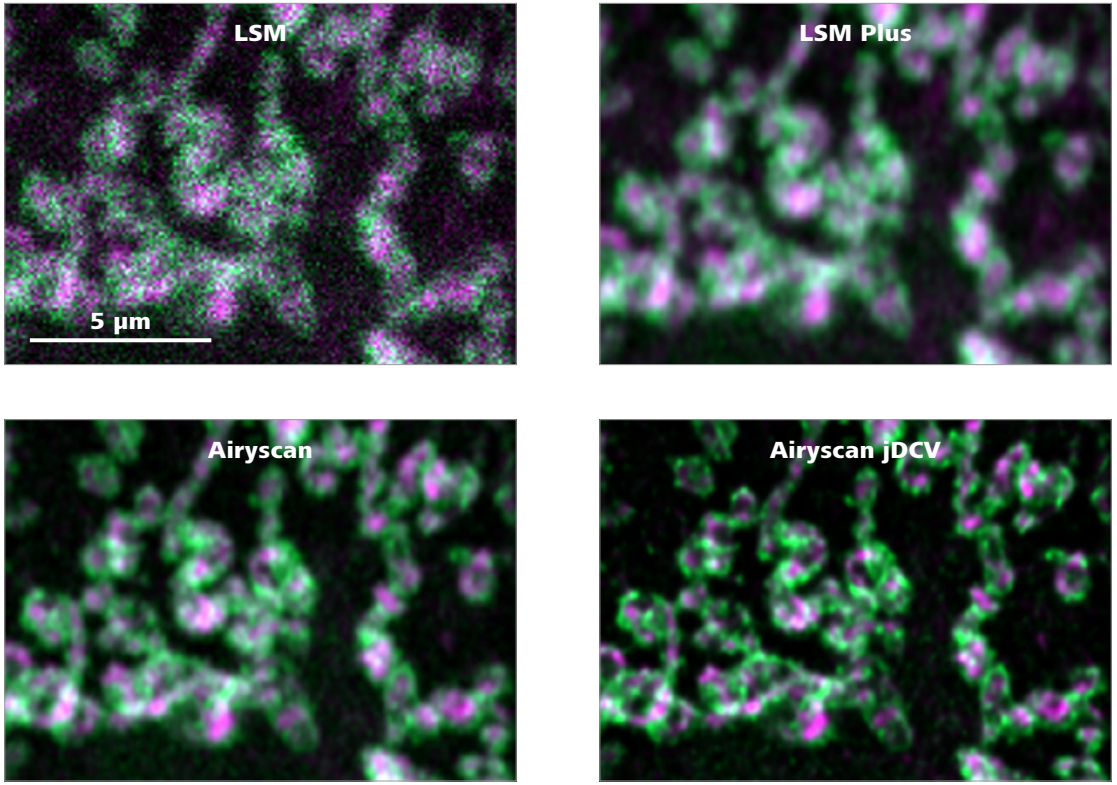
Click here to view this video

ZEISS Celldiscoverer 7 at Work

Cos7 cells stained for mitochondrial outer membrane protein Tom20 (Green, Alexa Fluor-488) and mitochondrial inner membrane protein ATP5a (Magenta, Alexa Fluor-647).

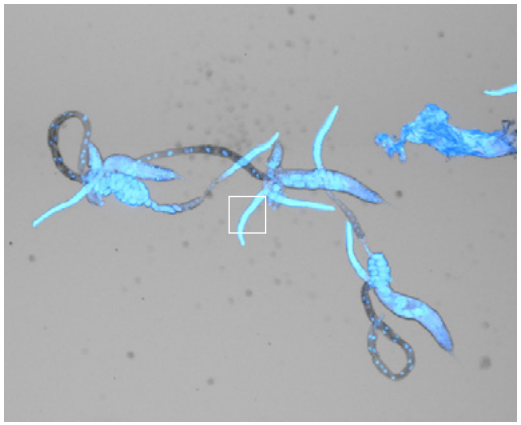
Images were acquired with LSM 900 on ZEISS Celldiscoverer 7 using confocal GaAsP detectors (top row) and Airyscan 2 in HS mode (bottom row). Confocal images with LSM Plus (top, right) enhancing SNR and improving resolution of mitochondrial structures. Airyscan Joint Deconvolution (bottom, right) resolves the inner and outer membrane architecture even better compared to Airyscan HS (bottom left).

Sample courtesy of Zhang Y, University of Science and Technology of China, China

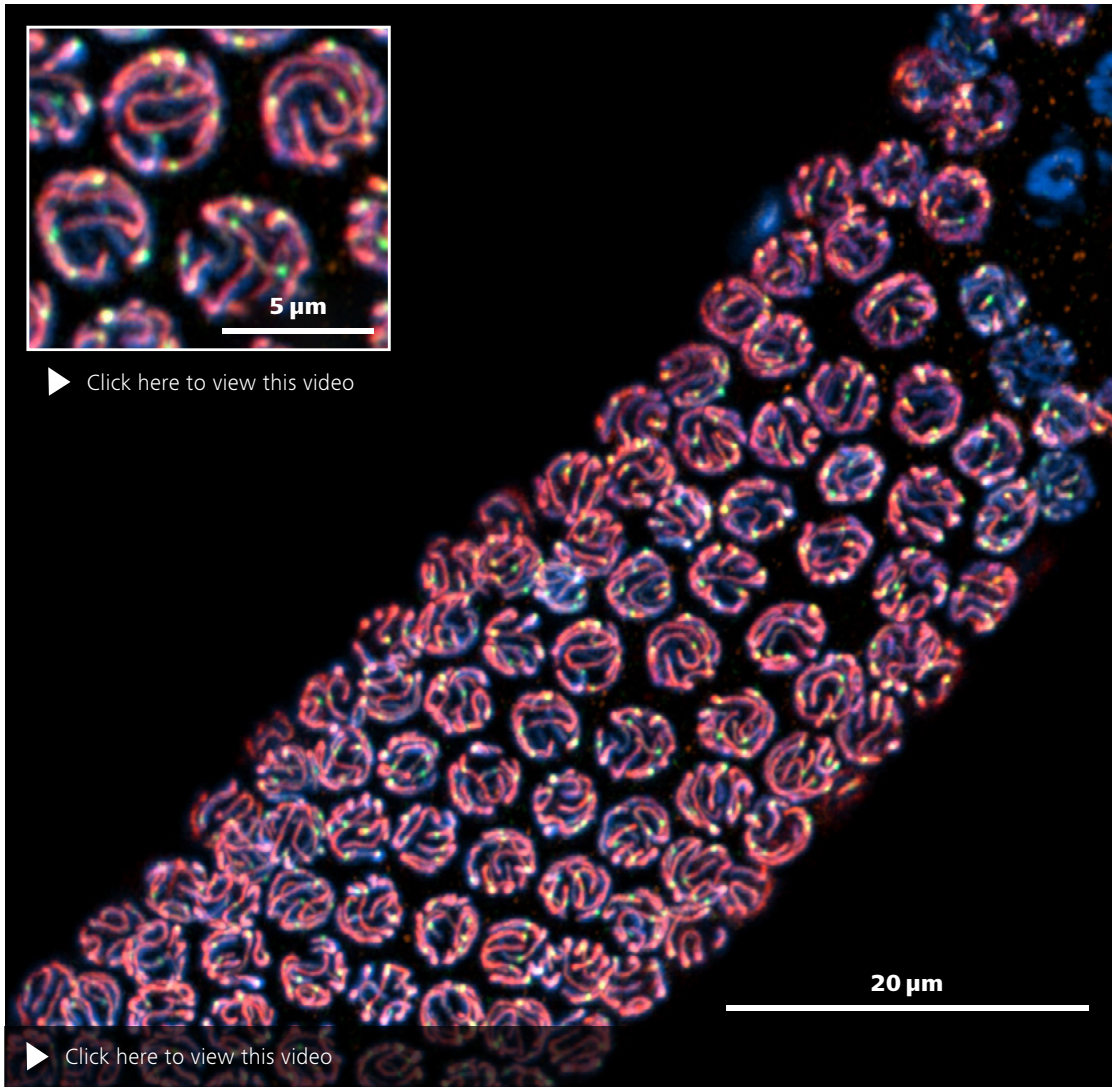


ZEISS Celldiscoverer 7 at Work

Caenorhabditis elegans germline. Decapitated nematodes where localized in widefield mode using a low magnification of 2.5× (transmitted light and fluorescence, DAPI; left). This allowed for an easy and convenient automated workflow (Guided Acquisition) to identify areas of interest for subsequent fast high resolution imaging in Multiplex mode for ZEISS Celldiscoverer 7 with LSM 900 and Airyscan 2 (right). A 25× magnifaction with water immersion and NA 1.2 was used to generate a z-stack of 62 planes.
Individual chromosomes in different meiotic cells are clearly distinguishable – see magnified box.
Blue: DAPI (DNA);
Green: Alexa 488 (cross-over sites);
Orange: Alexa 546 (synaptonemal complex);
Red: Alexa 647 (chromosome axis).

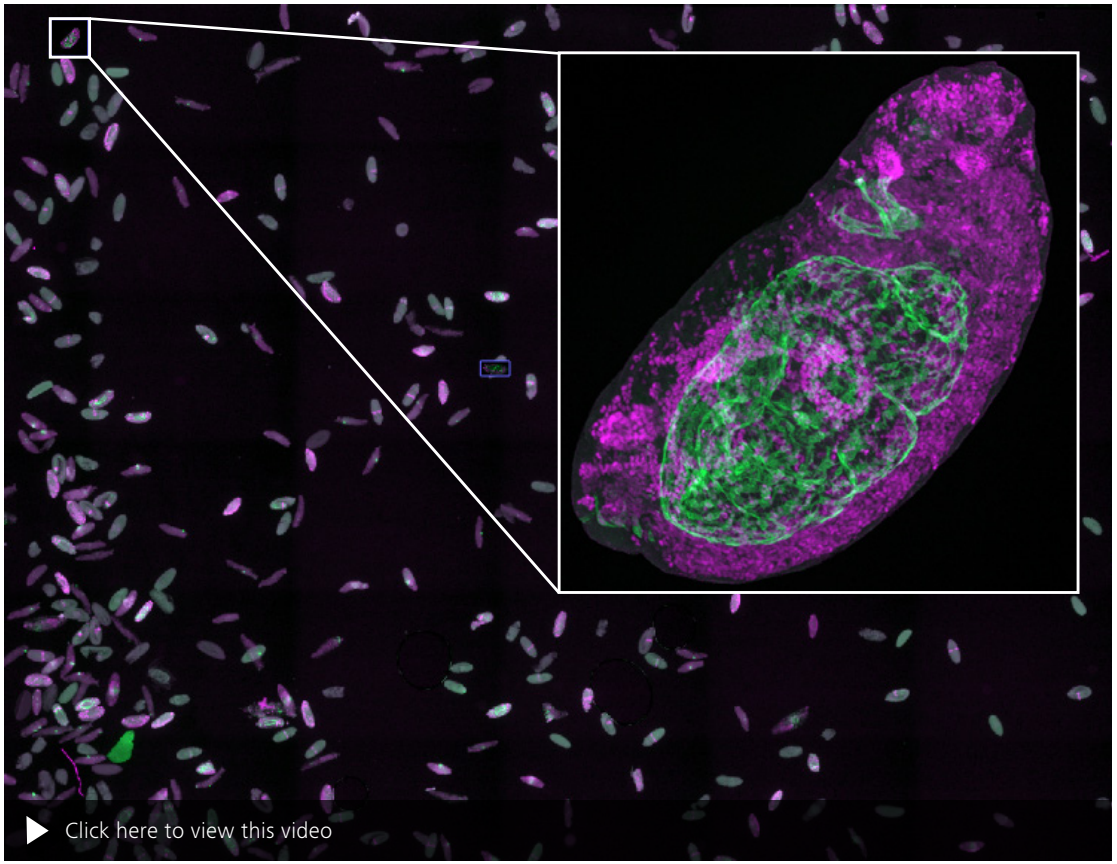


Sample courtesy of S. Köhler, EMBL, Heidelberg, Germany



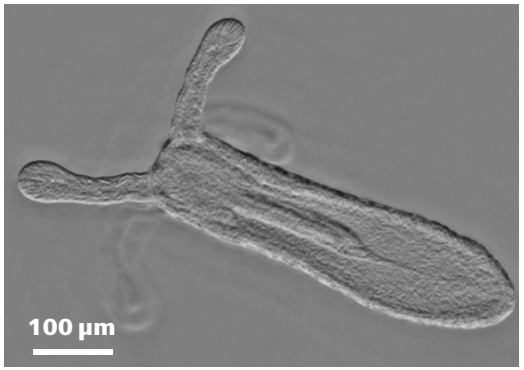
ZEISS Celldiscoverer 7 at Work

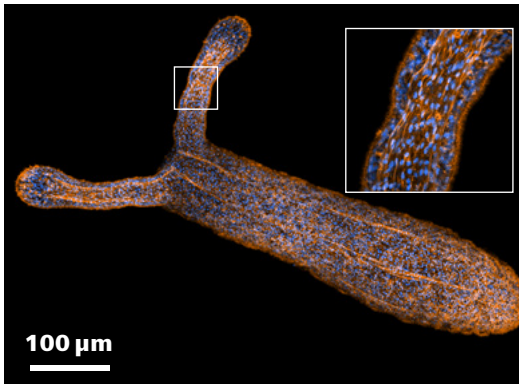
The guided acquisition module was used to automatically identify and image a subset from a group of fixed drosophila embryos prepared on a standard microscope glass slide. Longitudinal visceral muscles (one type of gut muscles) were labeled with Alexa 488, and Cut (one type of homeodomain transcription factor) with Cy3. The overview scan was acquired with a 2.5× magnification (Plan-Apochromat 5×/0.35 objective, 0.5× magnification changer) and the Axiocam 506 mono; the detailed acquisition was performed with a 10× magnification (Plan-Apochromat 20×/0.95 objective, 0.5× magnification changer) Airyscan MPLX HS mode, and Z-stacks (figure shows maximum intensity projection of the detected embryo). Image analysis was performed on the gut structure, where green positive embryos were detected first by mean intensity, then filtered by geometric features to identify those with preferred lateral orientation.



Sample courtesy of Dr. G. Wolfstetter, University of Gothenburg, Germany

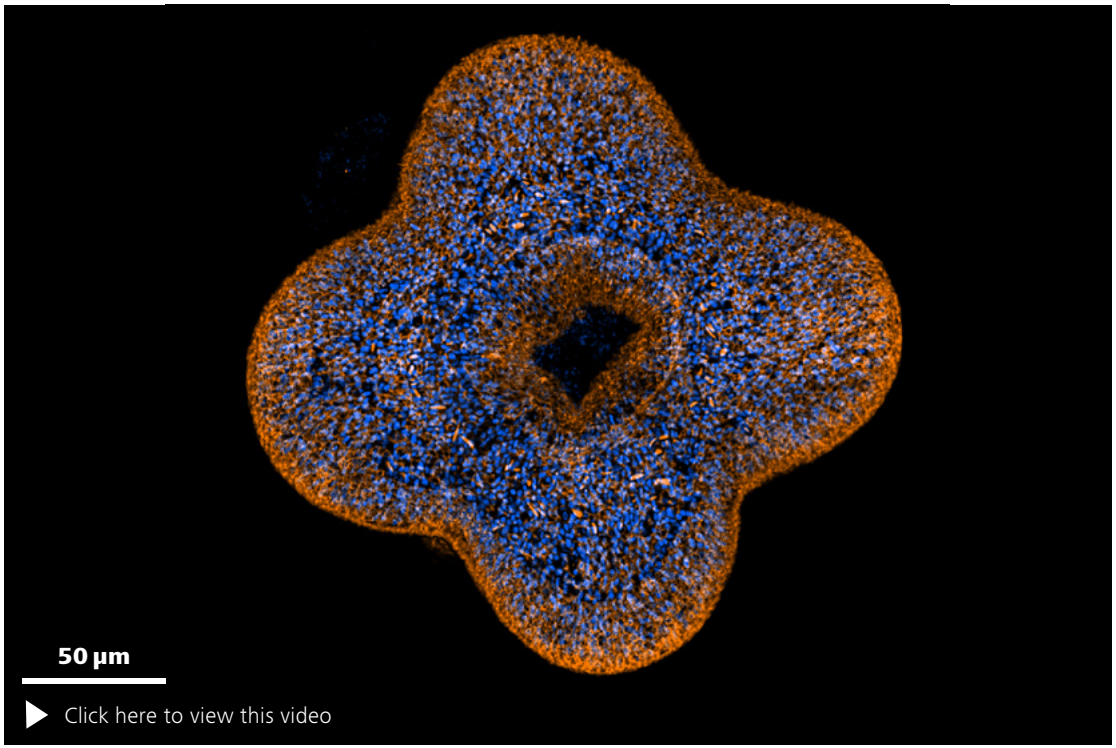
ZEISS Celldiscoverer 7 at Work





Fixed starlet sea anemone *(Nematostella vectensis)* stained with Hoechst (nuclei) and Phalloidin (actin). Side view imaged with a combination of camera based phase gradient contrast mode (top) and high sensitivity mode with Airyscan 2 (bottom). Maximum intensity projection of 19 z-planes.

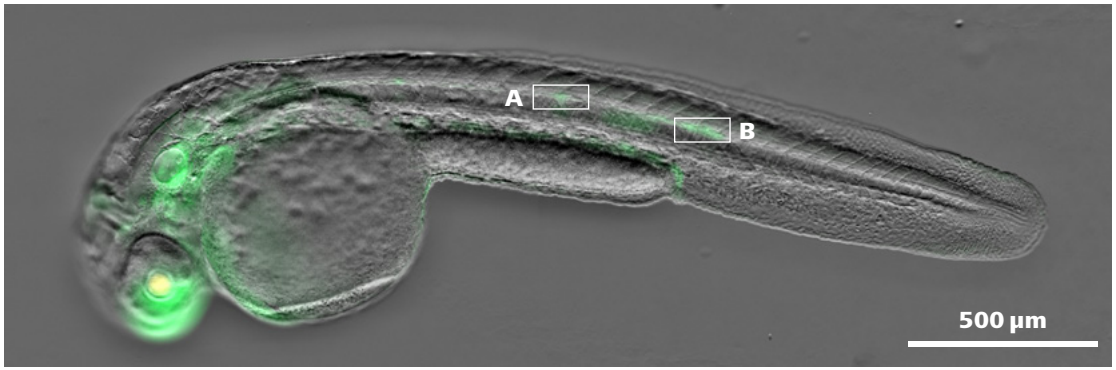
Fine image details and high signal to noise ratio can clearly be seen on the insert in the top right image, showing an enlarged view of a tentacle area.

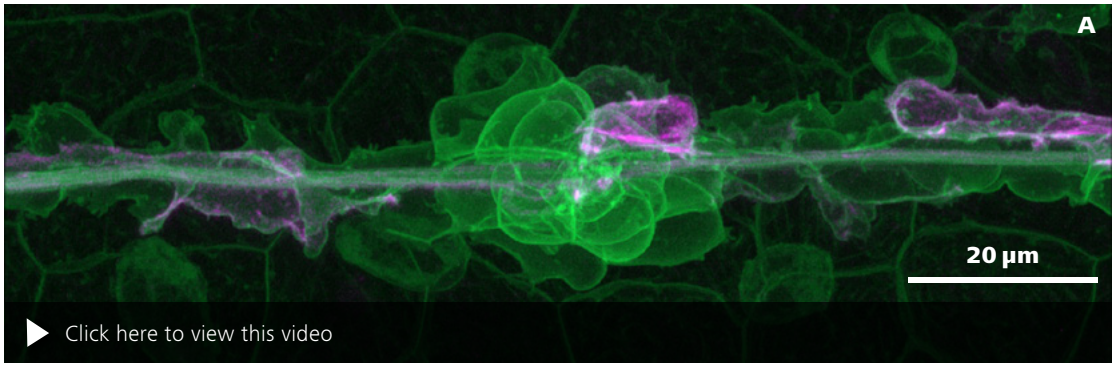


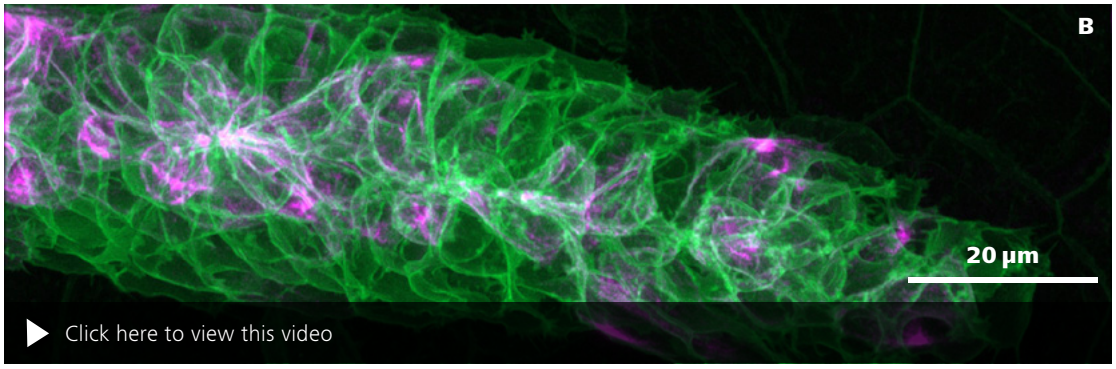
Sample courtesy of A. Stokkermans, Ikmi Group, EMBL, Heidelberg, Germany

Video: Top view of a young animal, showing mouth and four tentacle buds. Maximum intensity projection of 69 z planes imaged with Airyscan 2 Multiplex. Images were acquired using the water immersion objective with a total magnication of 25× and a numerical aperture of 1.2.

ZEISS Celldiscoverer 7 at Work







Lateral line primordium migration and deposition of immature neuromasts in a Zebrafish embryo *(Danio rerio)*. Animals were anesthetized and embedded using low concentrated agarose in a glass bottom petridish.

Initial camera based imaging allowed for a quick and easy sample navigation (top) combining Phase Gradient Contrast with fluorescence acquisition.

Subsequent high resolution imaging with Airyscan 2 in Multiplex mode was done on individual positions identified in the widefield image (white boxes).

A) Maximum intensity projections of an immature neuromast (127 z planes).

B) Maximum intensity projections of the lateral line primordium tip migrating through the animal (155 z-planes).

Green: LYN-eGFP (mebranes);

Red: tagRFP-T-UTRCH (actin).

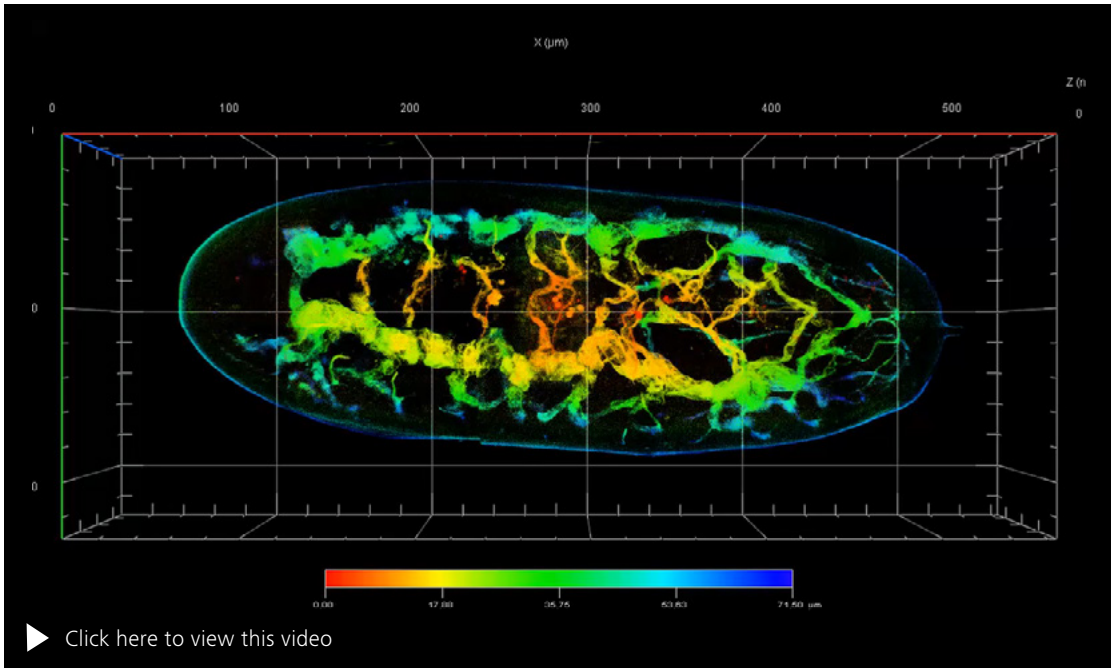
The gentle and fast image acquisition that is inherent to the Airyscan 2 Multiplex mode is very benificial for this kind of application. The animal is unperturbed by the imaging while images with a very high signal to noise ratio as well as level of detail can be acquired at the same time.

Sample courtesy of J. Hartmann and D. Gilmour, EMBL, Heidelberg, Germany

ZEISS Celldiscoverer 7 at Work

Trachea system in a living fruitfly embryo *(Drosophila melanogaster)* imaged using ZEISS Celldiscoverer 7 with LSM 900 and Airyscan 2 in Multiplex mode. A water immersion objective with a magnification of 25× and numerical aperture of 1.2. in combination with multi-tile acquisition (8 tiles, 143 z-planes) was used.

CD4-mIFP under a tracheal promoter color coded for depth.



Sample courtesy of D. Rios-Barrera, Leptin Group, EMBL, Heidelberg, Germany

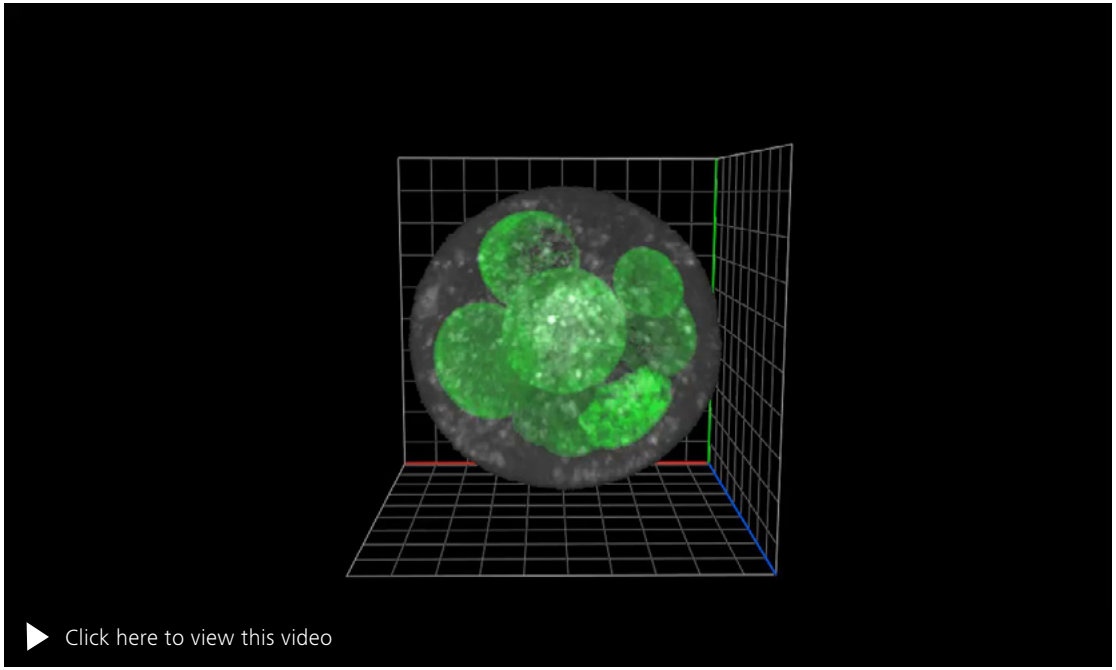
ZEISS Celldiscoverer 7 at Work

Organoid from a human breast cancer cell line. The cells express GFP-labeled H2B (nucelei) and mCherry (cytoplasmic staining depicted here in grey for better visualization).

Several organoids where grown in a multiwell plate with Matrigel. Initial sample navigation was performed using the transmitted light at a low magnification of 2.5× to identify interesting organoids.

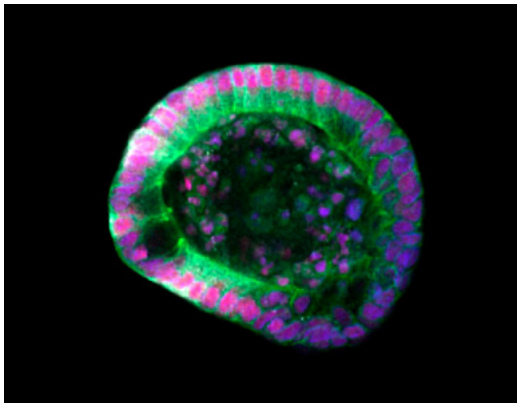
Subsequently, high resolution images were acquired using the water immersion objective with a total magnification of 50×. 61 z-planes were acquired using ZEISS Celldiscoverer 7 with LSM 900 and Airyscan 2 in Multiplex mode.

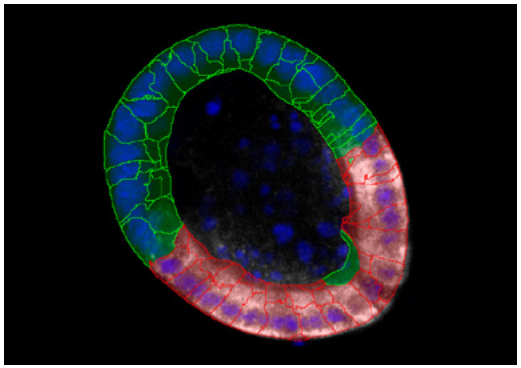
One can clearly appreciate the robustness of the imaging given that Matrigel is not an ideal optical medium and the organoid was imaged at a distance of several micrometers from the coverglass.



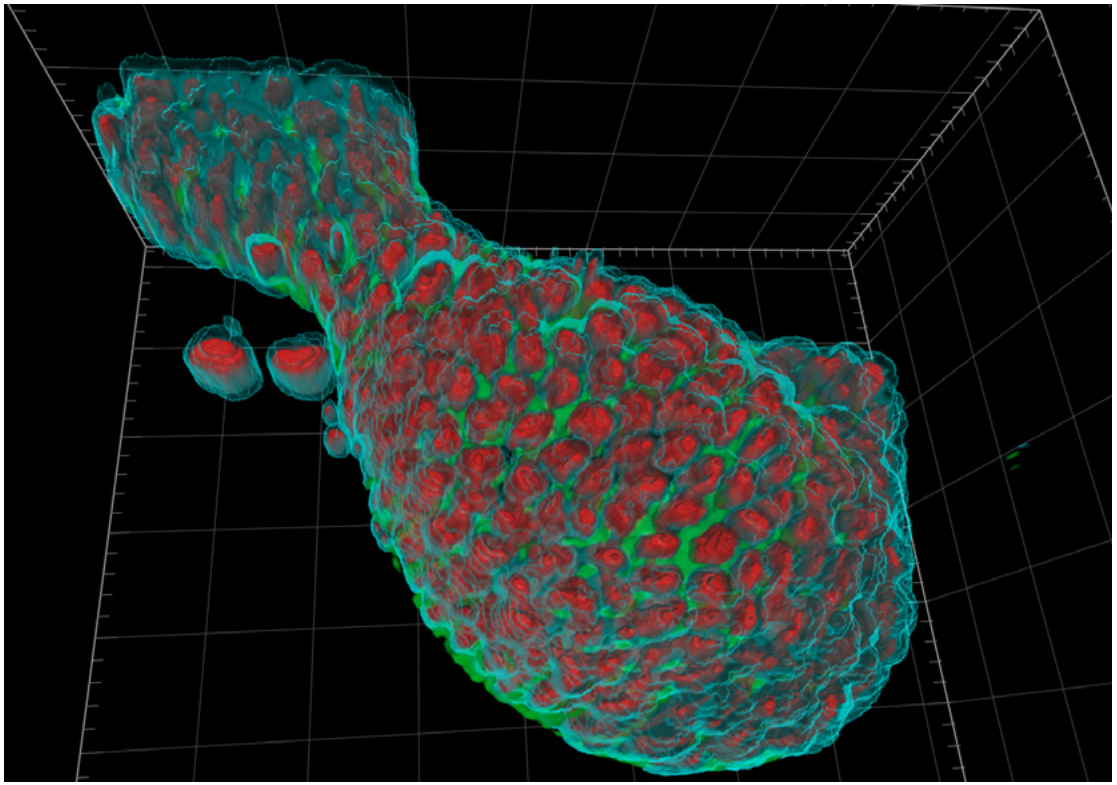
Sample courtesy of S. Gawrzak and M. Jechlinger, EMBL, Heidelberg, Germany

ZEISS Celldiscoverer 7 at Work





The Guided Acquisition module was used to automatically identify and image murine small intestinal organoids that were grown from isolated single cells and fixed on day 5 of organoid cultures treated with and without a Wnt-inhibiting drug (IWP-2).



The individual cells expressed a fluorescent membrane protein (mem9-GFP), developed organoids were stained with a fluorescently labeled (Alexa 647) antibody against Aldolase B, which is a marker for differentiated enterocytes and DAPI. The Airyscan MPLX HS mode was used to acquire high resolution Z-stacks of individual organoids with a water immersion lens (50× 1.2, 0.5× magnification changer).

The analysis software Arivis Vision 4D allowed for visualization and quantification of sizes and volumes of the organoids and the internal cavities (lumens) as well as morphology: Organoids appeared either spherical or irregular depending on the IWP-2 treatment.

Your Flexible Choice of Components

1 Microscope
- ZEISS Celldiscoverer 7
- Automatic sample container recognition
- Barcode reader
- Focus stabilization
- Magnification changer 0.5×/1×/2×
- Apochromatic FL beampath with adaptive field stop
- ZEISS Axiocam 506 mono or Axiocam 712 mono
- Additional camera port
- On-axis access for dispensing
- UV-disinfection

2 Objectives
- Plan-Apochromat 5×/0.35
- Plan-Apochromat 20×/0.7 autocorr
- Plan-Apochromat 20×/0.95 autocorr
- Plan-Apochromat 50×/1.2 W autocorr autoimmersion

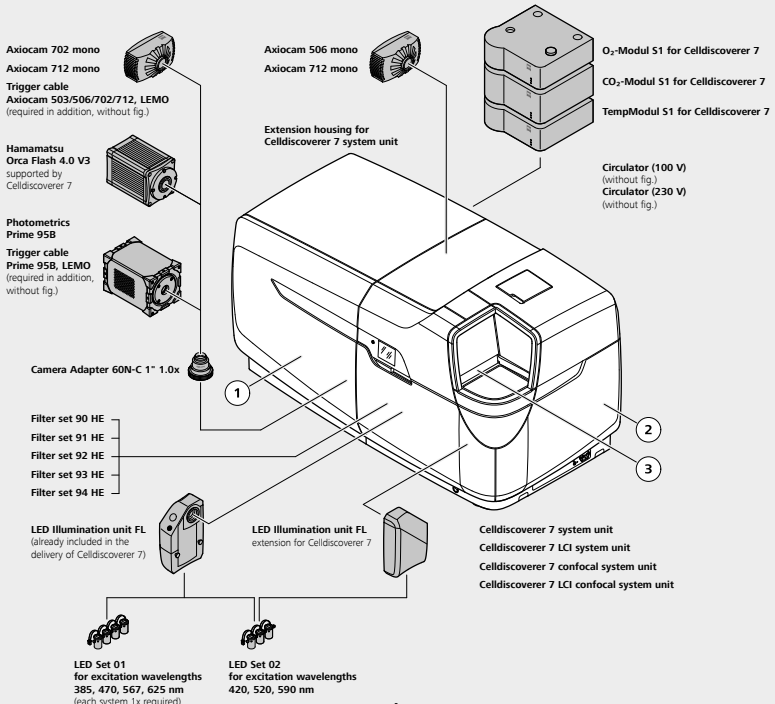
3 Illumination
- Transmitted light unit:
  IR-LED (725 nm) brightfield, oblique contrast, phase gradient contrast
- Fluorescence:
  LEDs 385, 420, 470, 520, 567, 590 and 625 nm
  High-efficiency multibandpass filter sets
  Additional emission filter wheel

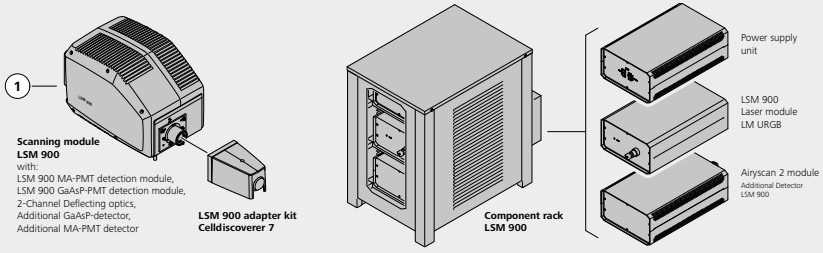
4 Imaging Systems
- LSM 900 with Airyscan 2
- Option: LSM Plus, Airyscan jDCV

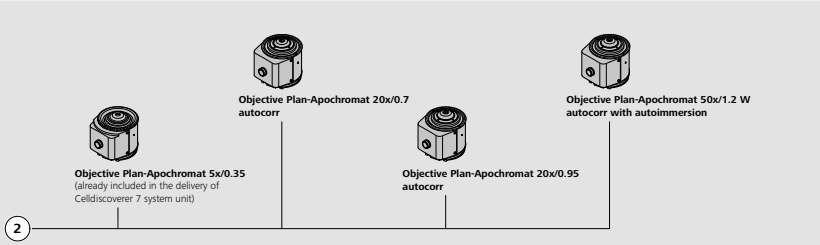
5 Accessories
- Temperature and atmospheric control (heating/cooling; CO_2, O_2)
- Insert plates and perfusion chambers for dishes, multi-chamber slides and standard slides
- Additional recommended cameras
  - ZEISS Axiocam 702 mono
  - Hamamatsu Orca Flash 4.0
  - Photometrics Prime 95B

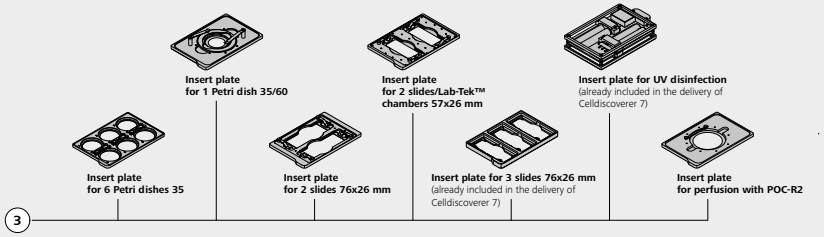
6 Software
- ZEN celldiscoverer includes modules for multi-dimensional image acqusition, Tiles & Positions, Experiment Designer, advanced image processing and analysis tools
- Recommended additional modules:
  - GPU-based deconvolution (GPU-DCV)
  - Guided Acquisition
  - BioApps
  - ZEN connect
  - 3Dxl Viewer – powered by arivis®
  - Open application development (OAD)

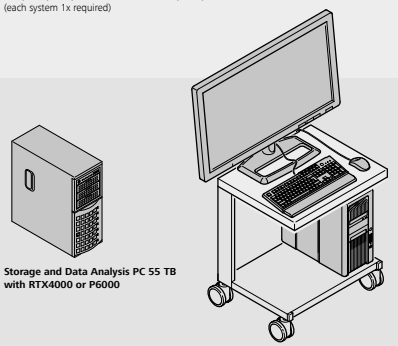
System Overview



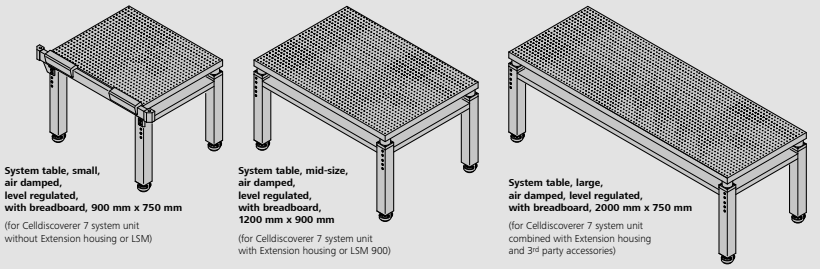








Microscopy Workstation Premium hp Z6 G4 Rev. 2 multilingual,
System configuration 5c Windows 10 LTSC 2019,
Processor Intel Xeon Gold 5222,
Memory 32 GB (registered RAM),
Graphics Card NVIDIA Quadro RTX4000 8 GB DP
or Graphics Card NVIDIA Quadro RTX6000 24 GB,
PC-Interface Microscope and Trigger,
Hard Drive Extension 12TB RAID10,
Network Adapter 2x10 GbE RJ45,
Monitor TFT 32" HP Z32



System table, small,
air damped,
level regulated,
with breadboard, 900 mm x 750 mm
(for Celldiscoverer 7 system unit
without Extension housing or LSM)

System table, mid-size,
air damped,
level regulated,
with breadboard,
1200 mm x 900 mm
(for Celldiscoverer 7 system unit
with Extension housing or LSM 900)

System table, large,
air damped, level regulated,
with breadboard, 2000 mm x 750 mm
(for Celldiscoverer 7 system unit
combined with Extension housing
and 3rd party accessories)

Technical Specifications

Dimensions	Width (approx.)	Depth (approx.)	Height (approx.)	Weight (approx.)
Celldiscoverer 7	710 mm	640 mm	700 mm	136 kg
Footprint Celldiscoverer 7	585 mm	560 mm		
Incl. Extension housing	1270 mm	640 mm	700 mm	187 kg
Footprint incl. Extension housing	1170 mm	560 mm		
Celldiscoverer 7 incl. LSM 900	1310 mm	690 mm	705 mm	
Component rack	400 mm	550 mm	600 mm	35 kg
Airyscan 2	400 mm	250 mm	145 mm	5 kg
Power Supply	400 mm	250 mm	145 mm	6 kg
Laser module	400 mm	250 mm	145 mm	10 kg

Technical data

Celldiscoverer 7 and Extension housing	Noise emission	According to EN 55011 class A
	Noise immunity	According to DIN EN 61326-1
	Protection class	1
	Ingress protection rating	IP 20
	Radio interference suppression	To EN 55011 Class A
	Type of operating site	Closed room facility
	Electrical safety	To DIN EN 61010-1 (IEC 61010-1) conforming to CSA and UL regulations
	Degree of pollution	2
	Overvoltage category	II
Celldiscoverer 7	Line input voltage; max. current	100 V to 240 V ± 10 %; 6A~
	Line frequency	50 Hz – 60 Hz
Celldiscoverer 7 incl. LSM 900 / Extension housing	Input for connection of Celldiscoverer 7	100 V to 240 V ± 10 %, 50 Hz – 60 Hz, max. 4.0 A~
	Output to internal 6 sockets	100 V to 240 V ± 10 %, 50 Hz – 60 Hz
	Permissible total current on 6 internal sockets	Max. 4.0 A~
		The internal sockets can be connected via the software
		The extension housing is powered by Celldiscoverer 7

Technical Specifications

Environmental requirements

Storage (in packaging)	Permissible ambient temperature	+5 °C to +40 °C
	Permissible relative air humidity (no condensation)	max. 75 % at +35 °C
Transport (in packaging)	Permissible ambient temperature	–20 °C to +55 °C
	Permissible relative air humidity (no condensation)	max. 75 % at +35 °C
Operation	Permissible ambient temperature	+15 °C to +35 °C
	Recommended ambient temperature (e.g. for incubation)	+18 °C to +25 °C, optimally +22 °C
	Warm-up time	1 h for standard imaging; ≥ 4 h for high-precision and/or long-term measurements
	Permissible relative air humidity	max. 65 % at 30 °C
	Atmospheric pressure	800 hPa to 1060 hPa

XYZ motorization

Motorized xy-scanning stage	●	Travelling range	300 mm × 140 mm
		Reproducibility	± 1 µm
		Absolute precision	± 5 µm
		Resolution	0.1 µm
Motorized z-drive	●	Reproducibility	± 0.025 µm
		Absolute precision	0.14 µm
		Resolution	± 0.01 µm

Optical specifications

Nosepiece	●	■ 4× motorized nosepiece ■ in combination with the 3× magnification changer this offers the functionality of 12 objectives
Magnification changer, afocal	●	■ 0.5×, 1×, 2× magnification, providing three different magnifications for each objective ■ depending on the objective configuration it offers a magnification range from 2.5× – 100× ■ switching between magnifications ~1 sec ■ enables constant working distances for each magnification

● Component always included O Component optionally available

Technical Specifications

Optical specifications

		Magnification changer 0.5×	Magnification changer 1×	Magnification changer 2×	Auto-correction	Auto-immersion	Temperature control	Thick vessel bottom up to 1.2 mm PS [2]	Thin vessel bottom 0.13 – 0.21 mm glass/COC [1] 0.15 – 0.21 mm PS [2]	Working distance	Effective penetration depth (in water)
Plan-Apochromat 5×/0.35	●	M = 2.5× NA = 0.12	M = 5× NA = 0.25	M = 10× NA = 0.35	–	–	●	●	●	5.10 mm	3.99 mm @ 0.17 mm thickness; 2.66 mm @ 1 mm thickness
Plan-Apochromat 20×/0.7 autocorr	○	M = 10× NA = 0.35	M = 20× NA = 0.7	M = 40× NA = 0.7	●	–	●	●	●	2.20 mm	1.33 mm @ 0.17 mm thickness; 0.4 mm @ 1 mm thickness
Plan-Apochromat 20×/0.95 autocorr	○	M = 10× NA = 0.5	M = 20× NA = 0.8	M = 40× NA = 0.95	●	–	●	–	●	0.76 mm	0.4 mm @ 0.17 mm thickness
Plan-Apochromat 50×/1.2 W autocorr, autoimm.	○	M = 25× NA = 1.2	M = 50× NA = 1.2	M = 100× NA = 1.2	●	●	●	–	●	0.84 mm	0.4 mm @ 0.17 mm thickness

Adaptive Lens Guard	●	■ automatically maximizes scanning area, while protecting the objectives from collisions with other hardware or sample vessels ■ scanning range is indicated and updated automatically via control software
Temperature control	●	■ all objectives are equipped with heating elements for temperature control ■ in combination with the optional heating unit, objective temperature is adjusted automatically, depending on the user-defined sample temperature ■ enables stable and homogeneous temperature within the sample chamber
Adaptive Autocorr	●	■ automatic correction of aberrations (for high magnification objectives) ■ adapts objectives automatically to vessel bottom material and thickness ■ enables correction of aberration due to high penetration depths and refrective index mismatch of the sample (5× objective is not sensitive to variations of bottom thickness and material and does not require a correction)
Autoimmersion, water	●	■ comes along with the Plan-Apochromat 50×/1.2 W objective ■ enables automatic supply and removal of water immersion ■ water level is automatically indicated in the control software and on the display ■ upgradable in the field

● Component always included ○ Component optionally available [1] Cycloolefincopolymer [2] Polystyrene

Technical Specifications

Objective compatibility with Airyscan 2

Objective	Plan-Apochromat 5×/0.35			Plan-Apochromat 20×/0.7			Plan-Apochromat 20×/0.95			Plan-Apochromat 50×/1.2 W		
Magnification changer	0.5×	1×	2×	0.5×	1×	2×	0.5×	1×	2×	0.5×	1×	2×
Usage with Airyscan MPLX	+	+	+	+	+	-	+	++	++	++	++	-
Usage with Airyscan HS	+	+	+	+	+	+	+	++	++	++	++	+

Focus		
Hardware-based focus finder	●	■ automatically focusses on the sample (lower side of sample) ■ a user-defined offset can be used to change the default position ■ enables automatic generation of focus maps for microwell plates ■ compatible with every objective and filter set ■ can be combined with focus stabilization and ZEN blue software autofocus
Hardware-based focus stabillization	●	■ focus stabilization system maintains focus position over long-term ■ compatible with every objective and filter set ■ hardware and software support for multi-position and multi-offset stabilization ■ can be combined with focus finder and ZEN blue software autofocus
Software-based autofocus	●	■ focusses automatically on user-defined structures and regions of interest based on the image content ■ can be combined with focus finder and focus stabilization

Transmitted light and contrasting techniques		
Transmitted light unit	●	■ fully compatible with fluorescent applications, environmental control, dispensing and perfusion option ■ enables label-free imaging or provides additional information in combination with fluorescent applications
Lightsource	●	■ high-speed IR-LED (725 nm) offering low phototoxicity
Contrast techniques	●	■ brightfield ■ oblique contrast ■ adaptive phase gradient: adapts automatically to vessel geometry providing excellent contrast to the edges of the vessels ■ all contrast techniques are compatible with all objectives, filter sets and sample vessels, i.e. plastic and glass incl. lids

● Component always included O Component optionally available

Technical Specifications

Fluorescence illumination		
Fluorescence illumination unit	●	■ apochromatic excitation beampath incl. adaptive field stop ■ up to seven LEDs (385 / 420 / 470 / 520 / 567 / 590 / 625 nm) ■ life time of LEDs >10,000 h ■ switching between LEDs <1 ms
LEDs are synchronized with image acquisition	●	Sample is only exposed during image acqusition (acquisition trigger mode) thus reducing phototoxicity.
LEDs are synchronized with the live-window	●	Sample is only exposed during live-window update (live-window trigger mode), significantly reducing phototoxicity during sample navigation.
Automated excitation field stop	●	A motorized field stop adapts automatically to the current field of view thus reducing phototoxicity effectively.
Switching time between FL channels		■ switching between fluorescence channels using high-efficient multi-bandpass filter sets <1 ms ■ switching 5-position beamsplitter wheel <80 ms
5-position beamsplitter wheel	●	■ 5× position beamsplitter wheel ■ switching time <80ms
Emission filter wheel	●	■ 7× motorized emission filter wheel ■ user accessible ■ fits 25 mm emission filters ■ switching emission filter wheel <80 ms
Filter sets	●	Filter set 90 HE ■ quad-band filter set for 385 nm, 470 nm, 567 nm, 625 nm LED and IR-TL LED ■ beamsplitter RQFT 405+493+575+653; emission filter QBP 425/30+514/30+592/25+709/100 ■ additional band for transmitted light
	○	Filter set 91 HE ■ triple-band filter set for 420 nm, 520 nm, 590 nm LED and IR-TL LED ■ beamsplitter RTFT 450+538+610; emission filter TBP 467/24+555/25+687/145 ■ additional band for transmitted light
	○	Filter set 92 HE ■ triple filter set for 385 nm, 470 nm, 590 nm LED and IR-TL LED ■ beamsplitter RTFT 405+493+610; emission filter TBP 425/30+524/50+688/145 ■ additional band for transmitted light
	○	Filter set 93 HE ■ double bandpass for 470 nm, 567 nm and IR-TL LED ■ beamsplitter RDFT 493+575; emission filter TBP 514/32+605/50+730/60 ■ additional band for transmitted light
	○	Filter set 94 HE ■ double filter set for 385 nm, 520 nm and IR-TL LED ■ beamsplitter RDFT 405+538; emission filter TBP 444/69+581/77+730/60 ■ additional band for transmitted light

● Component always included ○ Component optionally available

Technical Specifications

Fluorescence illumination

		Filter sets LEDs [nm]	90 HE quad	91 HE triple	92 HE triple	93 HE dual	94 HE dual	
LED Set 1	●	LED 385 BP 385/30	×		×		×	DAPI, Hoechst 33342 & 33258, Alexa 350 & 405, ATTO 390, True Blue, EBFP, T-Sapphire, CellTracker Blue, LysoTracker Blue, wtGFP (uv), Aminocoumarin, Cascade Yellow
		LED 470 BP 469/38	×		×	×		Alexa 488, Fluorescein, eGFP, Calcein, Fluo-4, Fluo-8, JC-1, mKaede, NBD, TagGFP, LysoTracker Green, ATTO 465, ATTO 490, Oregon Green Bapta, BOBO-1, Cytox Green, MitoTracker Green, YoYo-1, YoPro-1
		LED 567 BP 555/30	×			×		Cy3, Bodipy TMR, mBanana, mOrange, TurboRFP, tdTomato, TagRFP, DsRed2 ("RFP"), TRITC, PAmCherry, PATagRFP, Alexa Fluor 555 & 546, DsRed monomer, SNARF, PO-PRO-3, Magnesium Orange, SYTO 82
		LED 625 BP 631/33	×					Cy5, Alexa Fluor 610, 633, 635 & 647, ATTO 610 to 647N, ATTO Oxa12, ATTO Rho14, Bodipy 630/650-X, Bodipy 650/665-X, CF™ 620R, CF™ 633, CF™ 640R, DyLight 633, DyLight 649, PSmOrange (red), iRFP670
LED Set 2	○	LED 420 BP 423/44		×				Alexa Fluor 430, ECFP, ATTO 425, ATTO 430LS, SpectrumAqua, Cerulean, mCFP, CyPet, Y66W, mKeima-Red, LysoSensor™ Green DND-153, SYTOX Blue, Chromomycin A3, POPO-1, PO-PRO-1, SYTO 40, SYTO 41, SYTO 42, SYTO 43
		LED 520 BP 511/44		×			×	Alexa 514 & 532, eYFP, Calcein, Fluo-4, Fluo-8, Bodipy 515, YoPro-1, YoYo-1, Calcium Green, Syto 23, Thiazole Orange, LysoTracker® Green DND-26, mEos3.2 (green), mEOS2.0, mCitrine, mVenus, Topaz
		LED 590 BP 591/27		×	×			Alexa Fluor 594, Cy3.5, mPlum, mRaspberry, mNeptune, mCherry, pa-mRFP1, KFP1, mEos2 (red), mEos3.2 (red), LipidTOX™ Red, Calcein red-orange, CellTracker Red, ER-Tracker Red, CellTrace BODIPY® TR
TL IR Channel	●	IR LED 725/50	×	×	×	×	×	All filter sets offer an IR transmitted light bandpass. This bandpass enables IR-brightfield contrast without switching any filter components and without affecting FL-efficiency.

Lasers for LSM 900

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, 5 mW)
		Diode laser (488 nm, 10 mW)
		Diode (SHG) laser (561 nm, 10 mW)
		Diode laser (640 nm, 5 mW)

● Component always included × Component compatible ○ Component optionally available

Technical Specifications

Sample mounting		
Insert plate for 1 Petri dish 35/60	○	■ for mounting of Petri dishes ■ fits one Petri dish d = 35 mm or d = 60 mm, autoclavable
Insert plate for 6 Petri dishes 35	○	■ for mounting of Petri dishes ■ fits six Petri dishes d = 35 mm, autoclavable
Insert plate for 2 slides 76 × 26 mm	○	■ for mounting of slides ■ fits two slides 76 × 26 mm, autoclavable
Insert plate for 3 slides 76 × 26 mm	○	■ for mounting of slides ■ fits three slides 76 × 26 mm, autoclavable
Insert plate for 2 slides/Lab-Tek™ chambers 57 × 26 mm	○	■ fits two Lab-Tek™ chambers 57 × 26 mm, autoclavable
Insert plate for perfusion with POC-R2	○	■ fits for perfusion with POC-R2

Detection options		
Internal camera*	●	Axiocam 506 mono, Axiocam 712 mono
External camera port **	●	■ external, user accessible camera port to mount additional cameras ■ motorized switching between internal and external camera <200 ms
Additional/optional cameras	○	Axiocam 702 mono
	○	Axiocam 712 mono
	○	Hamamatsu Orca Flash 4.0 V3
	○	Photometrics Prime 95B
LSM 900	○	■ two spectral detection channels, GaAsP (typical QE 45 %) or multialkali (MA) PMT (typical QE 25 %) ■ LSM Plus: resolution improvement 1.3× (pinhole at 0.8 AU) up to 1.4× (pinhole at 0.3 AU)
	○	■ one additional GaAsP PMT, MA PMT, or Airyscan detector
	○	■ Airyscan 2 with spatial detection (32 channels GaAsP) with up to 1.5× improved resolution and 4–8× improved SNR. ■ Airyscan Multiplex [HS-2Y]: up to 8 images/sec with 512 × 512 pixels ■ Airyscan Joint Deconvolution with up to 1.9× improved resolution

● Component always included ○ Component optionally available * Select one internal camera ** Not available on systems with LSM 900

Technical Specifications

Airyscan 2

	Airyscan HS	Airyscan HS jDCV	Multiplex HS-2Y	Multiplex CO-2Y
Parallelization	1	1	2	2
Resolution improvement factor	1.5×	1.9×	1.4×	1.2x
Max. FPS @512×512	4.3	4.3	8.4 (524×524)	7.4 (532×532)
FPS @ maxFOV	1.7	1.7	3.5	6.4
Antibody labeling, fine structures	+++++	+++++	++++	++
Antibody labeling, tiling	++	++	+++	+++
Live cell imaging	++	++	+++	+++++

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 max. 4,096 × 4,096 pixels), also for multiple channels, continuously adjustable (for each axis)
Scanning speed	At 512 × 512 pixels confocal – up to 9 fps; Airyscan HS – up to 4.3 fps; Multiplex HS-2Y – 8.4 fps; Multiplex CO-2Y – 7.4 fps
	At 512 × 64 pixels: confocal – up to 64 fps
Scanning zoom	0.5× to 40×; continuously adjustable
Scanning rotation	Can be rotated freely (360°), adjustable in increments of 0.1°, freely adjustable xy offset (not for mixed mode and Airyscan Multiplex)
Scanning field	11 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. 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

Resolution and speed (examples)

Pixel resolution	■ depending on the magnification and camera: ■ 1.82 µm @ 2.5× using Axiocam 506 ■ 0.18 µm @ 25× with Axiocam 506 ■ 1.38 µm @ 2.5× using Axiocam 712 ■ 0.14 µm @ 25× using Axiocam 712
Typical scan speeds	■ 96 well plate, four channels, exposure 50 ms per channel, full resolution, one position per well: <4 min ■ 96 well plate, three confocal channels simultaneously (multicolor track), image size 512 × 512 px, bidirectional scan at max. speed, one position per well: <2.5 min. (with optional LSM 900) ■ 384 well plate, single channel, exposure 100 ms, full resolution, 1 position per well (e.g. whole well single shot): < 6 min ■ 384 well plate, whole well using a high resolution 20× objective, four channels, exposure 50 ms per channel, full resolution: <2.5 min

Technical Specifications

Automatic sample recognition		
Pre-scan unit (incl. barcode reader)	●	■ automatically detects vessel types before final mounting: ■ slides ■ Petri dishes (35/60 mm) ■ LabTek-chamber slides (incl. number of wells) ■ microwell plates incl. plate type, i.e. number of wells ■ The following 1D barcodes are detected on slides and wellplates: ■ Code 39 (3of9 und W/MOD43) ■ Code128 Auto, Code128 A, Code128 B, Code128 C ■ Interleaved 2of5 ■ UPC A und UPC E ■ EAN 8 und EAN 13 ■ Codebar ■ UCC/EAN 128 ■ on slides the following 2D barcodes are detected: ■ DataMatrix ■ QR-Code
Automatic vessel bottom recognition	●	■ automatic detection of vessel bottom material (glass/COC [1] and PS [2]) ■ automatically adjusts autocorr objectives to the material ■ automatic detection of vessel bottom thickness ■ automatically adjusts autocorr objectives to the thickness ■ automatically measures vessel skirt height, e.g. the distance between the support area and the actual sample bottom ■ delivers the skirt height to the Adaptive Lens Guard to update the scanning area
Automatic plate calibration	●	■ automatically calibrates individual plates, i.e. well diameter and distance, plate length, height and rotation

● Component always included O Component optionally available [1] Cycloolefincopolymer [2] Polystyrene

Technical Specifications

Environmental control		
TempModule S1	O	■ controls temperature of bottom and top plate of sample chamber ■ temperature range within sample chamber: 30 – 45 °C ■ temperature homogenity across a whole microwell plate: ± 0.6 @ 37 °C ■ operated by ZEN blue control software
CO_2 Module S1	O	■ generates a stable, user defined CO_2 concentration within the sample chamber ■ ensures an optimal and stable pH value in cell culture media over long term ■ a built-in CO_2 sensor permanently monitors the CO_2 concentration ■ operated by ZEN blue control software
O_2 Module S1	O	■ O_2-control device to achieve a stable, controlled decrease of the O_2 concentration by displacement with N_2 within the sample chamber ■ a built-in O_2 sensor permanently monitors the O_2 concentration. ■ operated by ZEN blue control software
Humidifier unit	O	■ prevents evaporation of culture medium during long-term experiments ■ liquid level is indicated automatically
Circulator S1	O	■ cooling unit controls temperature of top plate of sample chamber ■ temperature range = 14 – 28 °C ■ temperature homogenity (microwell plate) = ± 2 °C available for air objectives only
Dispensing unit	●	■ offers on-axis access to specimen ■ enables pipetting without disturbing environmental conditions ■ allows sequential, semi-automatic pipetting of multi-positions
Insert plate for UV disinfection	●	■ incl. two UV bulbs, 1.0 W each ■ emitting 254 nm ■ fully automated disinfection process takes 23 min ■ can be used on-demand or for preventive maintenance

● Component always included O Component optionally available

Celldiscoverer 7 meets the requirements according to IEC 60825-1:2014 and is a laser class 1 device.
Interlocks on customer interfaces prevent access to the laser radiation.

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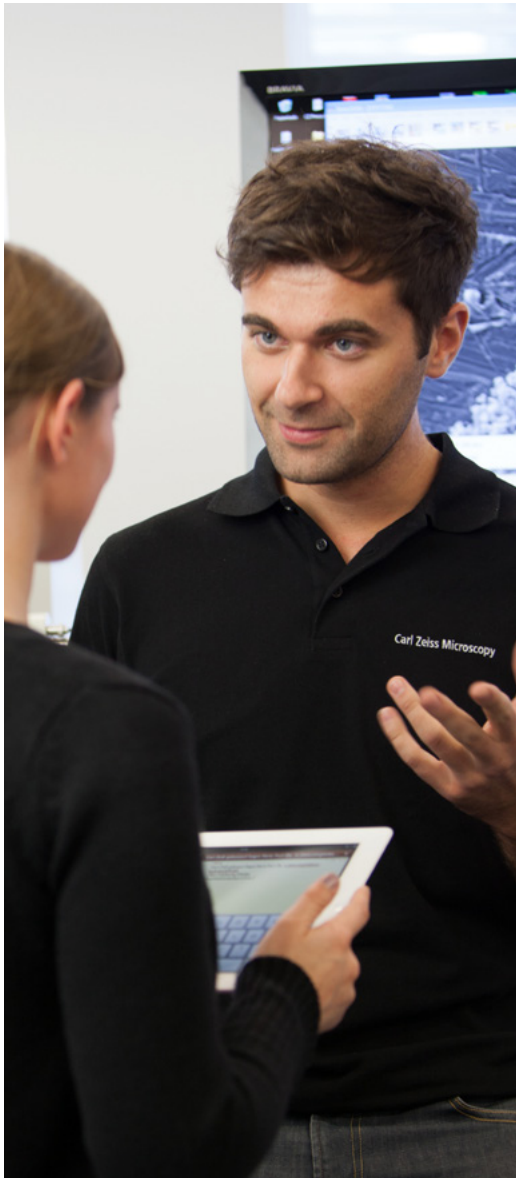

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Carl Zeiss Microscopy GmbH
07745 Jena, Germany
microscopy@zeiss.com
www.zeiss.com/celldiscoverer