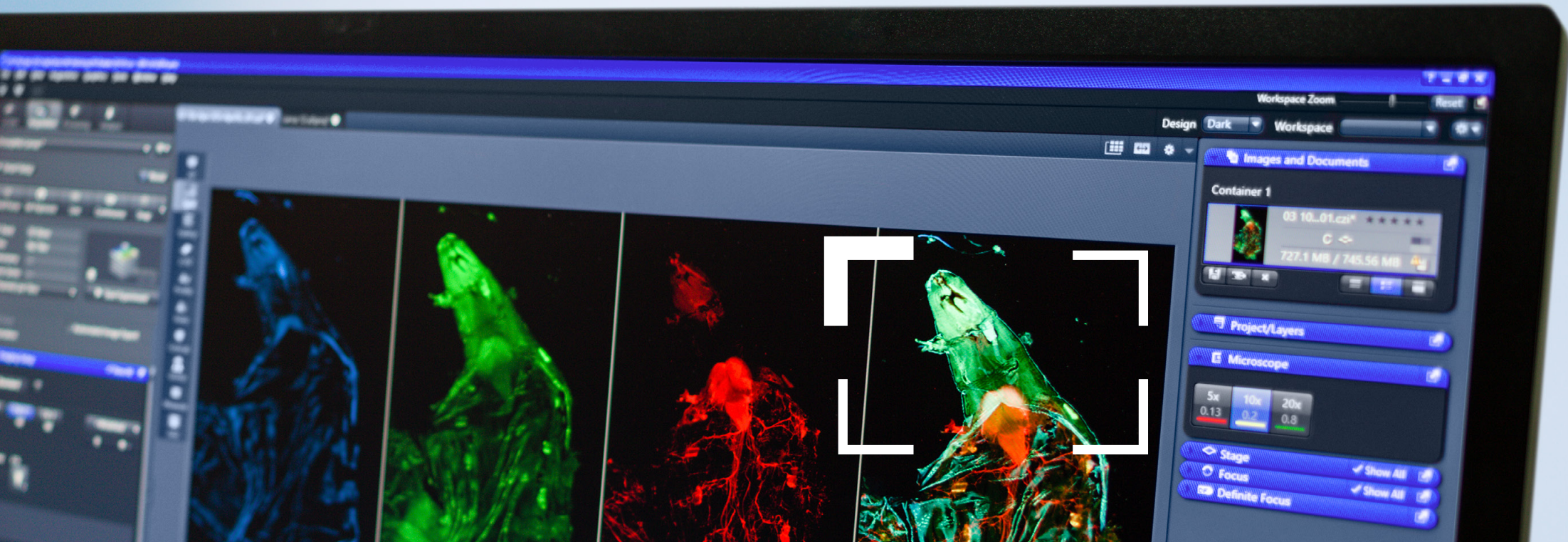


Acquire. Process. Visualize. Analyze. Correlate. Store.



ZEN Microscopy Software

Your Complete Solution from Sample to Knowledge

zeiss.com/zen



Seeing beyond

Experience the End-To-End Microscopy Software

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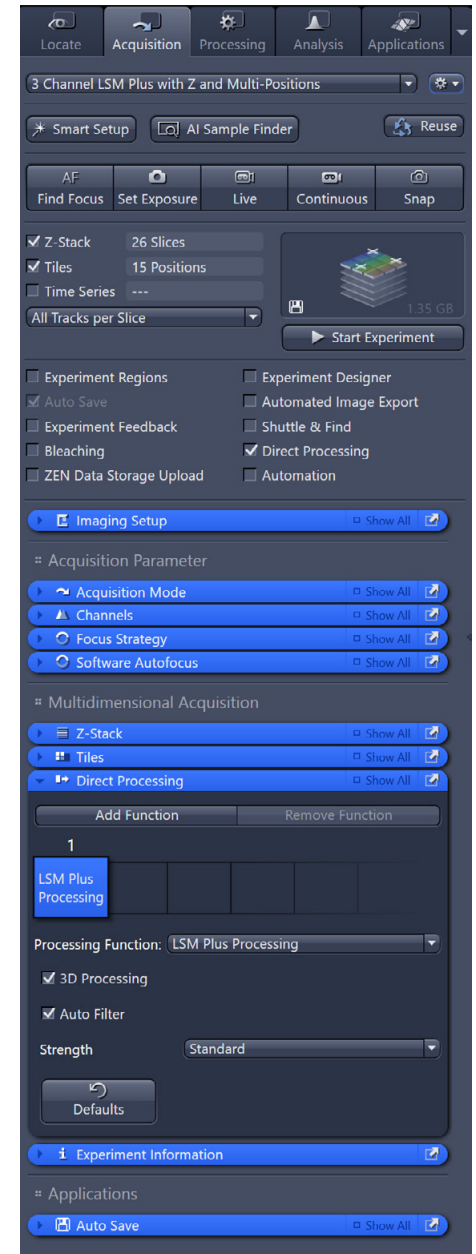
ZEISS Efficient Navigation – ZEN, for short – is the universal user interface you will see on every imaging system from ZEISS. No matter what microscopy task you have, you will find intuitive tools and modules to assist you:

- **Acquire** images using smart automation
- **Process** images with scientifically proven algorithms
- **Visualize** big data by GPU powered 3D engine
- **Analyze** images via Machine Learning-based tools
- **Correlate** between light-light or light-electron microscopes
- **Store** raw data in a secure format locally or in the cloud

For simple and routine works, ZEN leads you straight to result. The universal user interface lets you operate any ZEISS microscopes with the same graphical elements and workflows. You'll save time and reduce costs for training and support.

For complex research experiments, ZEN offers the flexibility to design multi-dimensional workflows the way you wanted. The "Optimal" buttons let you quickly start with default parameters, and the "Show All" buttons open endless possibilities. You'll never run out of ideas when designing experiments.

ZEN provides a comprehensive end-to-end solution for any microscopy user. The wide selection of software modules brings you from sample to knowledge. To simplify the options and make ZEN more accessible, the modules are grouped into dedicated acquisition, toolkit and application packages according to their intended use.



Acquire. Process. Visualize.

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Smart Acquisition

Make your most complex experiments a success.

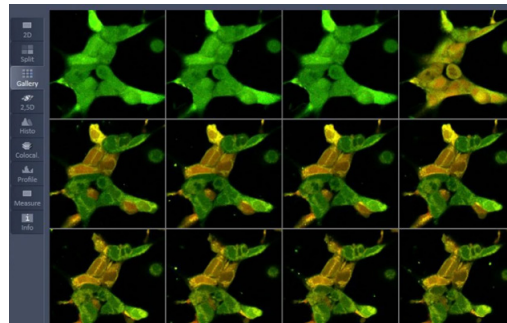
ZEN controls all ZEISS imaging systems so you can operate every one of your devices with the same convenient interface. As a researcher, you might not be familiar with all microscope components, but you surely know your sample and the dyes used. With “Smart Setup”, the intelligent control center, simply search and select the dyes and ZEN will automatically generate the settings for you, regardless of the microscope types. Aiming for reproducible experiments? So long as you have one raw image from a previous acquisition, a simple click lets you replicate the exact experiment precisely. And that’s just the start of ZEN’s smart acquisition. You will find plenty of other smart automation, some guide you for rare events detection, and others assist you with hardware calibration.



Quantitative Processing

Obtain reliable and reproducible results.

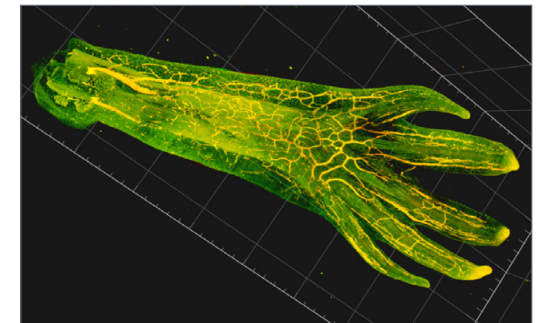
Acquiring stunning microscopy images is just the beginning of the experimental journey. More than 180 image processing tools, using transparent and scientifically proven algorithms, help you transform and manage your data. Simply search the keyword of your intended method, e.g., kymograph or deconvolution, ZEN will lead you straight to it. Not familiar with those processing settings? ZEN will read the metadata of the input image, then display only the logical processing steps, and optimize the default parameters automatically. You can even process images from other platforms using ZEN third-party import tools. With a dedicated workspace, you can also batch process multiple images with ease for quantitative and unbiased results. With many of those processing tools in our free version, ZEN lite, you can comfortably carry on working on your laptops at home.



Powerful Visualization

Interact with your big data confidently.

Advances in microscopy automation, camera technology, and light-sheet microscopy have fueled the exponential growth of data size and the challenge of big data visualization. Using ZEISS Axioscan 7 slide scanner, you can quickly generate a huge 2D tile scan with multi-channels at high magnification. The powerful ZEN pyramid data structure enables you to smoothly zoom in and out of such 2D data with a simple mouse scroll, just like using a map application on your smartphone. Having 200 GB of cleared mouse brain data from ZEISS Lightsheet 7? Just load it in ZEN – you will be amazed by the speed and clarity of the various 3D rendering methods. Powered by arivis ImageCore technology and efficient use of system resources, you can view your large 3D images even on regular consumer hardware.



Sample courtesy of Wouter Masselink and Elly Margaret Tanaka, IMP, Vienna

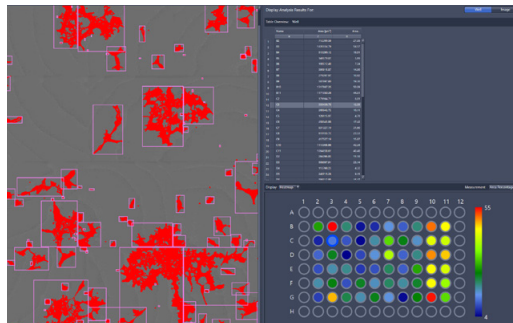
Analyze. Correlate. Store.

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Effortless Analysis

Gain insight into your research efficiently.

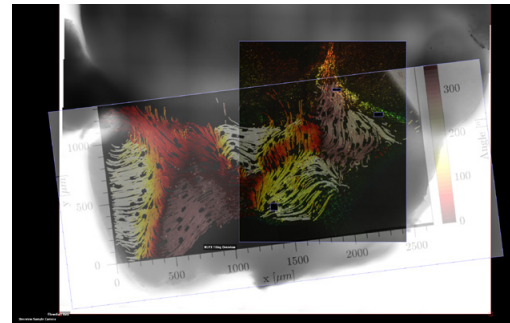
Image analysis is essential to extract meaningful information from your microscopy images, via digital tools of segmentation and registration. However, building a specific image analysis workflow that adapts to one's application is not an easy task. It requires knowledge of image processing, and the ability to assemble a series of operations. ZEN addresses this imbalance with the simple and modular Bio Applications. Each of them is optimized for one type of application, e.g., cell counting or confluency measurement, with tailored segmentation settings and streamlined data presentation. Needing to build a special workflow? The wizard-based ZEN Image Analysis module guides you step by step to create your unique measurements. You can also integrate our machine learning-based segmentation tool, Intellesis, into the workflow for the easy and accurate analysis of noisy images.



Unique Correlative Microscopy

Combine perspectives across scales and modalities.

The fascinating variety of microscopy imaging technologies allows observing the same specimen faster, deeper, longer, and at a greater level of detail from different perspectives. Imagine the possibilities for answering your scientific questions when you combine these images from multiple instruments, ZEISS or third-party. ZEN Connect is your unique correlative microscopy solution that overlays, navigates, and organizes your multimodal data. Spending days painfully locating synapses between two special neurons for the ultrastructural information? You can substantially improve your efficiency by combining the large field of view of a widefield fluorescent microscope, and the high resolving power of a field emission electron microscope. ZEN Connect lets you quickly overview the whole brain slice with fluorescent markers, identifying and relocating ROIs for EM imaging.

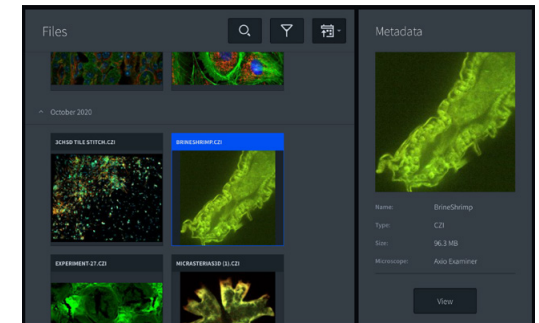


Courtesy of G. Eichele, Department of Genes and Behavior, Max Planck Institute for Biophysical Chemistry, Göttingen

Secure Storage

Stay confident when dealing with complex data.

Data security gets top priority as ZEN stores each of your valuable experiments with all its metadata (476 entries and counting). The proprietary .czi file format is comprehensive, easy-to-work-with, big data-supported, yet open. It is Bio-Formats compatible and can be read directly by ImageJ, and many other third-party software. With a single click, you can also export them into OME-TIFF, the image format specification of the Open Microscopy Environment, to further facilitate cross-platform image data exchange. Managing massive amounts of data in your facility? ZEN Data Storage provides you a server-based central platform to store and organize your raw data and manage user access right; while ZEN Data Explorer grants user browser-based access from anywhere.



What's New: ZEN 3.6 Highlights

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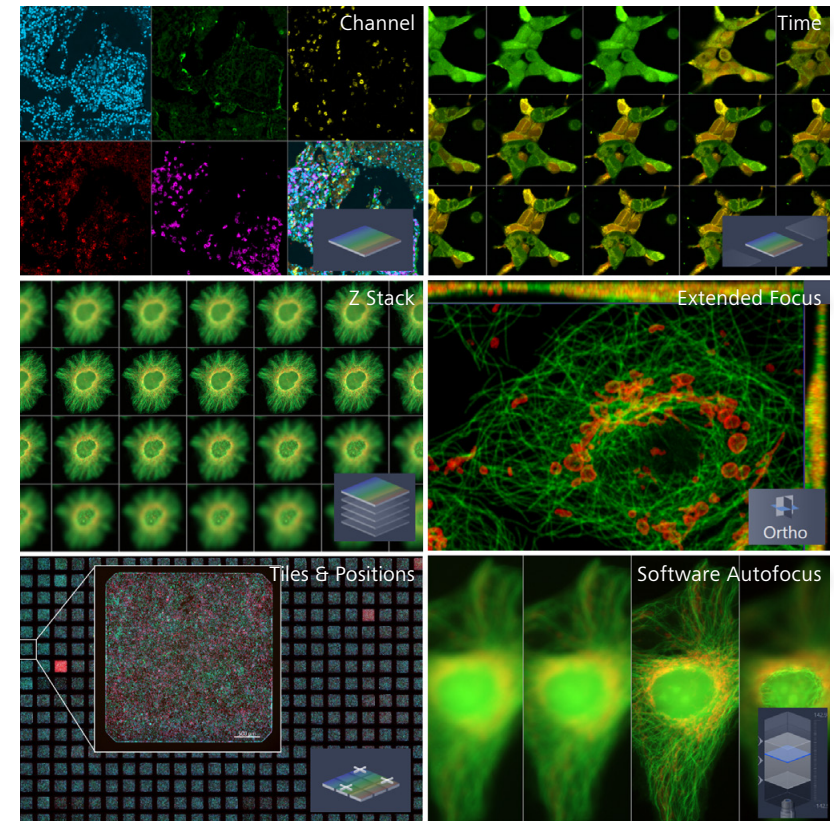
The ZEN Toolkit Structure

Simplified access to endless possibilities

ZEN software provides a comprehensive end-to-end solution for any microscopy user, continuously evolving to address emerging life science applications with added features, e.g., automated smart acquisition, intuitive image analysis, and cloud-based data management. However, the increased capabilities also make the ZEN ecosystem complex. With the ZEN Toolkit structure, you get simplified options that make the numerous capabilities more accessible.

Tailor your ZEN installation with toolkits for acquisition, analysis, and special features according to the needs of your experiments.

i See page 7 for an overview of the simplified ZEN structure.



Example of Motorized Acquisition Toolkit (additionally including Direct Processing)

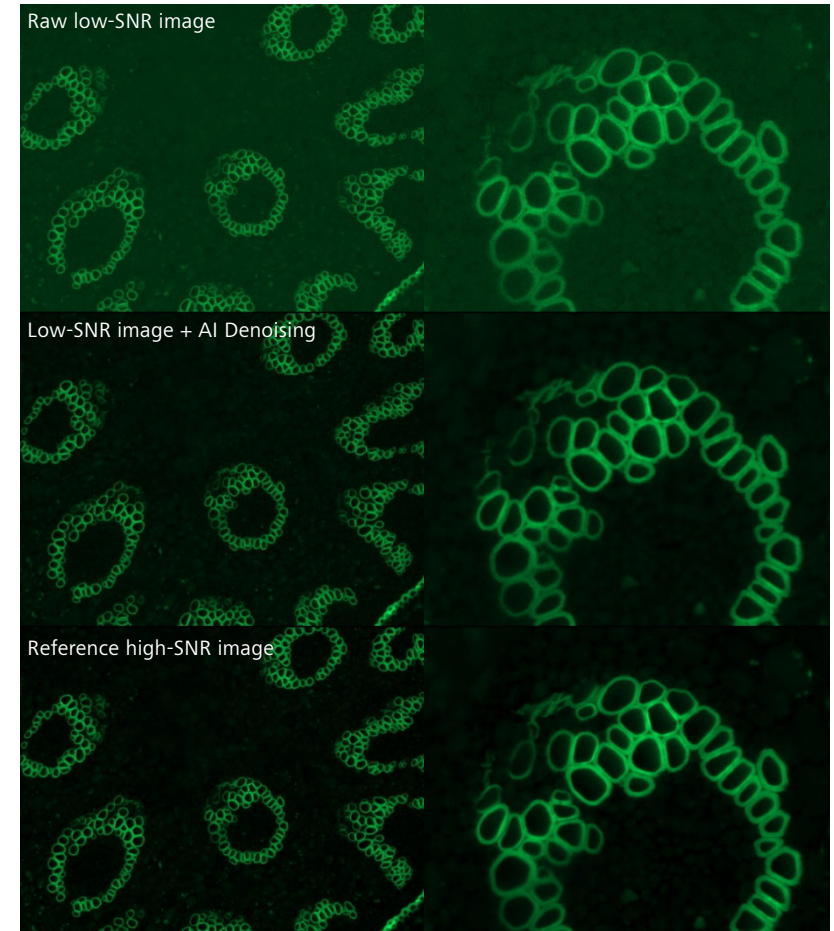
The Motorized Acquisition Toolkit will fulfill all your needs for flexible multi-dimensional image acquisition: multi-channels, time series, z-stacks, tiles, multi-positions, and the combination of any of the above dimensions. Additional tools of software autofocus, direct processing, and extended depth of focus provide extra creativity when designing your next experiments.

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AI Denoising is the latest addition to the AI Toolkit package. It is based on the popular Noise2Void Deep Learning algorithm. It comes with a dedicated ZEN training environment and is extremely easy to use, all you need is the noisy input image. Trained models can be re-applied to an unlimited number of images with a dedicated IP function. The algorithm is GPU-compatible, which makes it reasonably fast, but can also run on CPU, if needed. The method especially performs when applied to low signal-to-noise imagery of any kind, light microscopy as well as electron microscopy – well suited for dealing with difficult imaging conditions such as weak staining or phototoxicity problems. Simplified workflows make parameter setup (for background subtraction and image smoothing methods) obsolete. Combine AI Denoising with other analysis tools and get improved results of adjacent segmentation or object classification methods.

APEER, the Deep Learning platform for microscope image analysis, is also becoming more and more convenient to use, which is simultaneously good news for ZEN. Seamlessly import trained models into the Intellesis Segmentation tool to make full use of the modern Annotation and Training Pipeline in APEER. Conveniently annotate difficult data sets to semantic and instance segmentation –without any need for expensive hardware. Options for overlapping classes, on-the-fly predictions for iterative user interaction and clean documentation of all data sets and training runs make this tool a joy to work with.



Convularia, acquired with ZEISS Axio Imager 2

A short acquisition time (5 ms) results in a noisy raw image (upper section), but the signal-to-noise ratio (SNR) can be improved significantly by AI Denoising post-processing (center section). A high-SNR image is shown as reference (lower section).

Your Simple and Affordable ZEN Toolkits

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	Manual Microscopes	Motorized Microscopes	Laser-Based Systems	Analysis Workstation
Base Software	ZEN lite	ZEN ¹		ZEN Desk ²
Acquisition Toolkits	Base	Motorized ³	Advanced	
		Smart Acquisition ⁴		

Analysis and Visualization Toolkits	2D	3D	AI	Connect
	Developer	Deconvolution	Molecular Quantification	Bio Applications

Special Features	LSM Plus	Airyscan & jDCV	Single Molecule Imaging ⁵	AI Sample Finder
	SIM Processing	Lightsheet & Lattice Lightsheet	Correlative Array Tomography	Dynamics Profiler

[1] Includes Base Acquisition [2] No device control and acquisition features [3] Two variants available: with tiling for a motorized stage and without tiling for a manual stage
 [4] Requires 2D Toolkit [5] RICS, FCS, Photon Counting

ZEN Toolkit Details

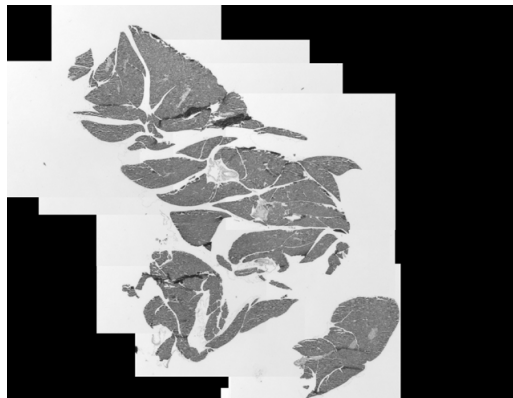
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Panorama

Generate precise, high-resolution overview images from manually-acquired individual 2D images:

- Acquire overlapping individual multi-channel images interactively and combine them to form a panorama image on microscopes with an encoded or motorized stage.
- 3D panorama images can be acquired on stands with a motorized Z-drive.
- Live Panorama: ZEN automatically takes images and stitches them during sample navigation.

Included in: **ZEN lite** (free)

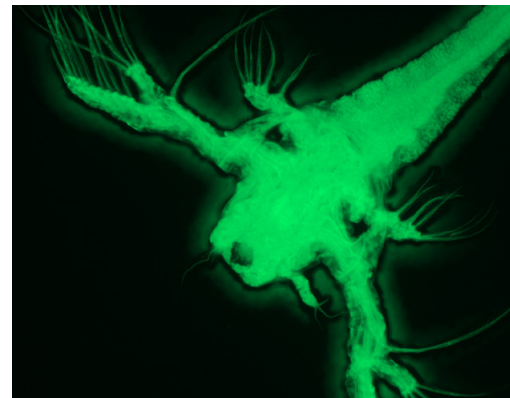


Manual Extended Focus

Generate images manually with no limit on depth of field:

- Extract sharp details from individual images at various focus positions and combine them into an image with extended depth of field.
- Works with images acquired interactively. Images can be added to the intermediate result via a time interval function or key function
- Wavelet algorithm allows use in transmitted light, reflected light and fluorescence

Included in: **ZEN lite** (free)



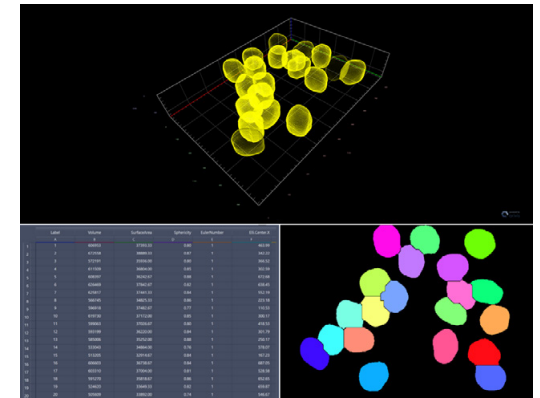
APEER On-site Basic

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.
- Remote execution within your local IT infrastructure is supported
- Customized and open-source image analysis functions in ZEN, provided via APEER
- Further ZEN integration of processing and analysis via APEER On-site Advanced module

Contact us: apeer-solutions@zeiss.com

Included in: **ZEN lite** (free)



ZEN Toolkit Details

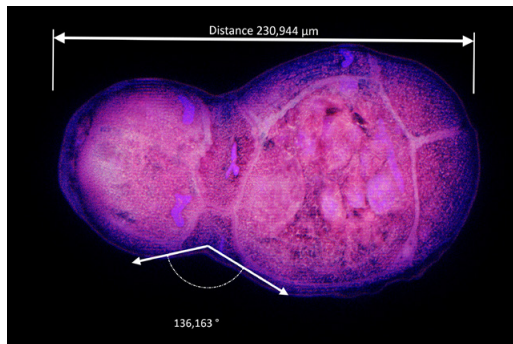
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Measurements

Perform interactive measurements:

- Morphological parameters of interactively defined contours: area, orientation angle, perimeter, diameter, center of gravity, radius of circle with equal area, shape factor, bounding box, projections, etc.
- Intensity values for rectangles and contours
- Free configuration of all interactive measurement tools displays desired parameters in tables, lists or graphs
- Interactive measurement in online images

Included in: **ZEN lite** (free), **ZEN**, **ZEN desk**

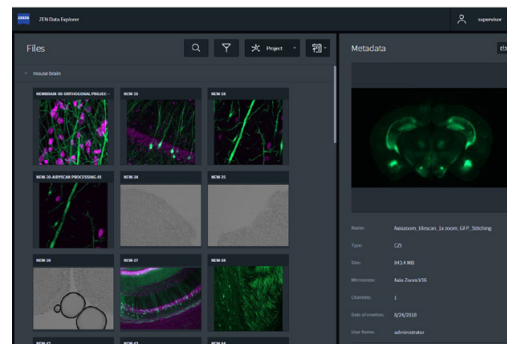


Data Storage Client

Get access to the connected laboratory solution
ZEN Data Storage:

- Centralized storage and flexible concurrent access for your images and data
- Central, intelligent data management including access management and sharing of data
- Centralized user management with role-based permissions
- Separation of image acquisition and analysis
- Web-based access to the data from anywhere via the included ZEN Data Explorer
- ZEN Data Explorer smartphone and tablet app available for Apple and Android

Included in: **ZEN**, **ZEN desk**

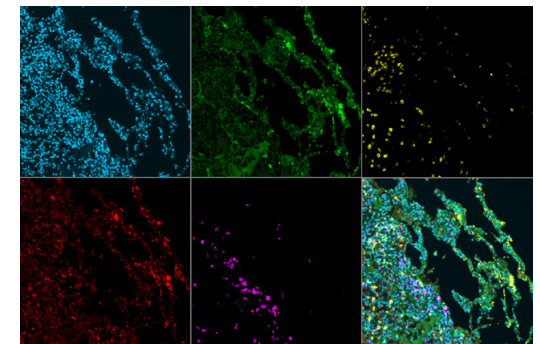


Spectral Unmixing

Extract single fluorescence dyes from strongly overlapping multi-channel or Lambda stack data:

- Widefield multi-channel acquisition and LSM Lambda stack acquisition
- Export and import of single component reference spectra
- Interactive mode: user-selection of regions
- Fully automatic mode with Automatic Component Extraction (ACE)
- Weighted unmixing for channels with low signal-to-noise ratio
- Residual channel calculation

Included in: **ZEN**, **ZEN desk**



ZEN Toolkit Details

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Third Party Import

Import third-party microscopy images into ZEN:

- Third-party images in native format including extraction of relevant metadata
- Metadata extraction depending on the original format (powered by Bio-Formats)

Direct Processing

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

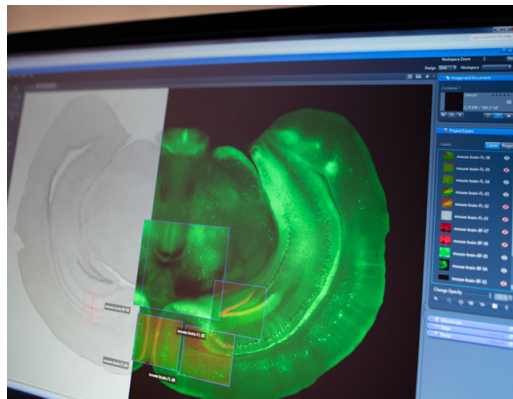
- Deblurring for fast and easy 2D background removal with truly quantitative output
- Processing methods: deconvolution, Airyscan processing, raw convert, denoising, unsharp mask
- Pipelines to set up sequences of image processing functions
- Remote processing to maximize computational resources during acquisition.
- Instantaneous side-by-side comparison of raw and processed data

Extended Focus

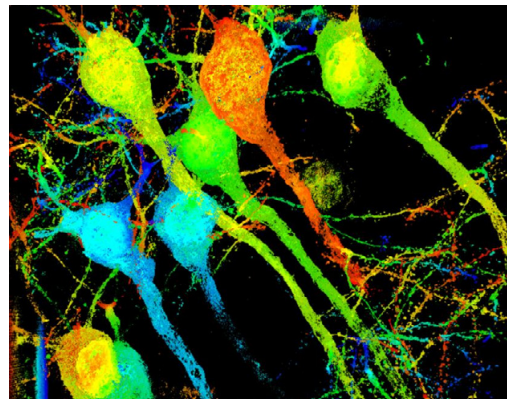
Generate images with no limitation of depth of field:

- Extraction of the sharp details from individual images at various focus positions, combination into an image with high depth of field
- Processing of already acquired Z stacks
- Wavelet algorithm allows use in transmitted light, reflected light and fluorescence

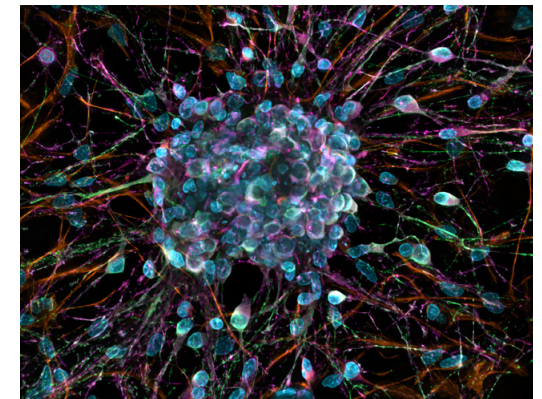
Included in: **ZEN desk, Connect Toolkit**



Included in: **ZEN desk, Motorized Acquisition, Advanced Acquisition**



Included in: **ZEN desk, Motorized Acquisition, Advanced Acquisition**



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

ZEN Toolkit Details

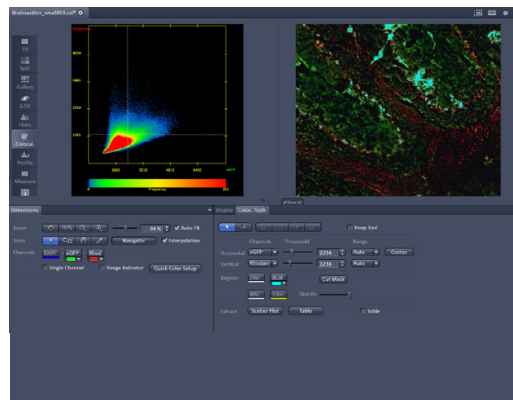
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Colocalization

Quantify colocalization in two channels:

- The gray value pixel distribution is displayed in two channels with the help of a scatter plot with four quadrants. Link scatter plot, image and data table.
- Draw multiple regions into the image. Data table shows measured values dynamically for both - the entire image and the individual regions.
- Display and export 17 measured values in a data table that can be exported for further analysis.

Included in: **ZEN desk, Advanced Acquisition**

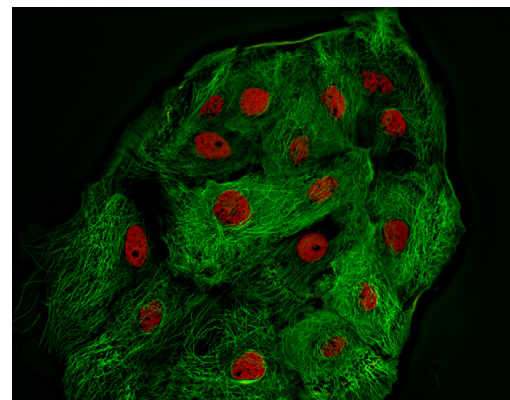


Multi-Channel

Acquire fluorescence and transmitted light images in independent channels:

- Technically unlimited number of independent channels for reflected light and transmitted light techniques
- Fully automatic generation of the required microscope setting for a channel with the possibility of adjusting the setting manually for the channel
- Independent exposure times and shading corrections for each channel
- Simultaneous acquisition of two channels using two synchronized cameras

Included in: **Base Acquisition, ZEN**

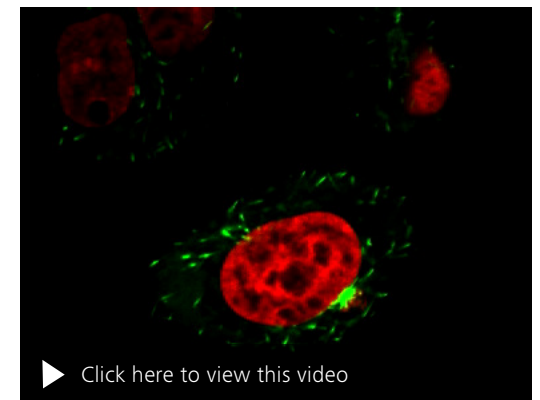


Time Lapse

Acquire images over a period of time:

- Images acquired at maximum possible speed
- Definition of intervals between images, total acquisition duration and number of time points
- Acquisition can be interrupted to analyze already acquired images or change experiment parameters.
- Experiment size limited only by free space on the hard drive
- Time series can be started and stopped manually, at fixed times, after a waiting period or by input (trigger) signal.

Included in: **Base Acquisition, ZEN**



ZEN Toolkit Details

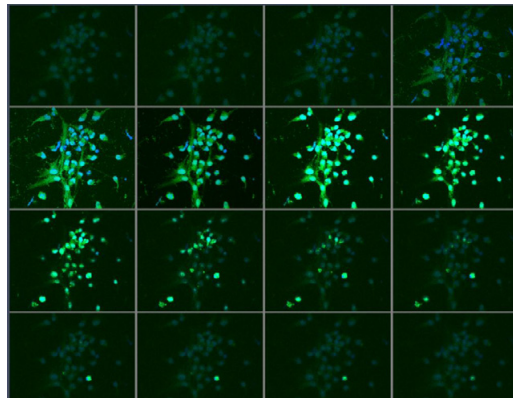
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Z stack

Acquire Z stacks with the help of a motorized focus drive:

- Definition of the Z stack in first and last or center mode
- Z stack limited only by the travel range of the system and minimum increments
- Optimum Distance button sets the correct increment to satisfy the Nyquist criterion.
- Integrated Z-drive backlash compensation for maximum precision
- Z stack can be acquired at relative or absolute focus positions in the experiment.

Included in: **Motorized Acquisition, Advanced Acquisition**

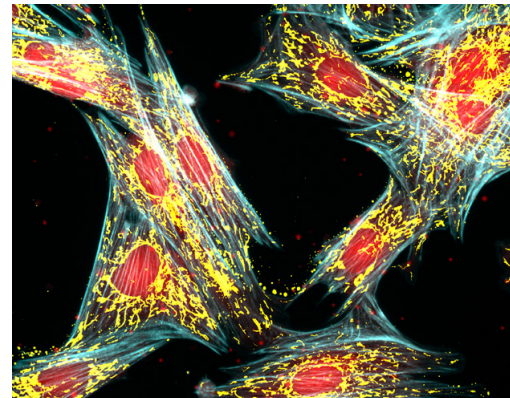


Software Autofocus

Determine the optimum focus position of the specimen:

- For transmitted light, reflected light and fluorescence
- Calibration-free operation for all objectives and filter sets
- Quality, search area, and sampling rate adjustment of the autofocus to the application
- Automatic Autofocus activation during the experiment at defined time intervals and channels and at predefined tile positions or individual positions

Included in: **Motorized Acquisition, Advanced Acquisition**

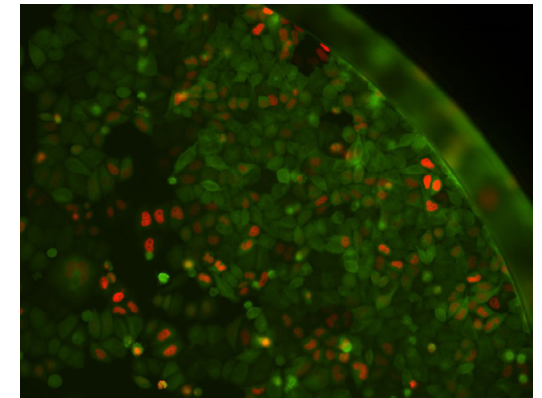


Tiles & Positions

Generate precise, high-resolution images through automatic scanning of predefined regions and positions of a sample:

- Regions of tile images and individual positions can be combined freely
- Automatic scanning with a motorized stage
- Overlapping individual images can be combined into an overview image using "stitching" algorithms
- Predefined or customized multi-well plates, multi-chamber slides, slides and dishes
- Focus Strategy Wizard for best focusing results

Included in: **Motorized Acquisition, Advanced Acquisition**



ZEN Toolkit Details

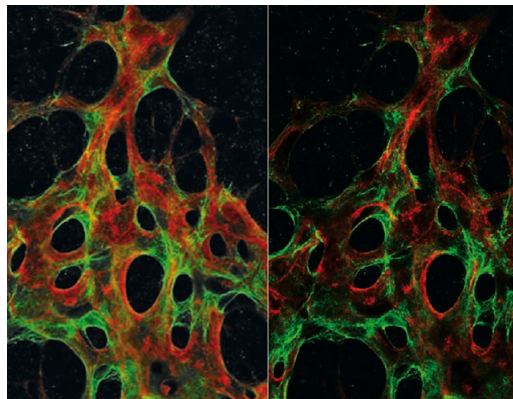
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HDR-Confocal

High dynamic range imaging by automatic acquisition and merging of images with different excitation intensities:

- Single-click operation
- Optimal representation of the morphology of weak and bright objects within the same image
- Automatic triple scan with increasing excitation intensity and processing on the fly

Included in: **Advanced Acquisition**



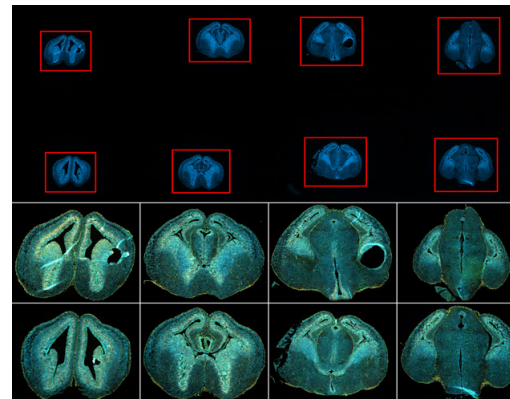
Sample courtesy of F. Tatin, Cancer Research, London

Guided Acquisition*

Perform targeted acquisition of objects of interest fully automatically:

- Save time and storage space by focusing the acquisition on objects of interest 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
- Customize focusing strategies for both overview scan and detailed acquisition
- Automatically save all images, tables and settings in one folder for easy access and reuse

Included in: **Smart Acquisition**



Sample courtesy of Dr. L. Lim, Katholieke Universiteit, Belgium

* requires Image Analysis

Experiment Designer

Configure inhomogeneous acquisition experiments:

- All experiment dimensions supported: time series, Z stacks, tile images, channels
- Operation via a simple graphical interface using four different types of experiment blocks along a timeline: Acquisition, Execute, Pause and Interaction blocks
- Synchronous or asynchronous control of hardware actions during the experiment
- Definition of a number of iteration loops
- Powerful processing functions to extract or fuse multiblock images

Included in: **Smart Acquisition**



ZEN Toolkit Details

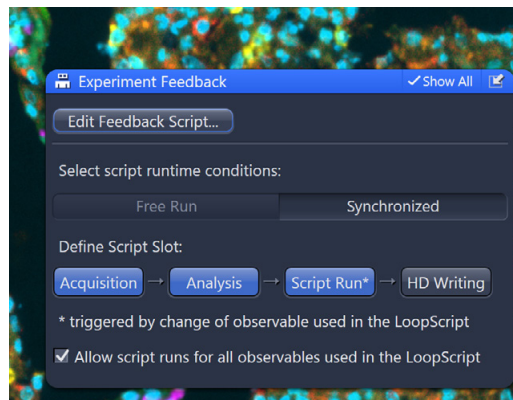
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Experiment Feedback*

Experiment Feedback (also known as conditional or adaptive experiment) allows the definition of specific rules and actions to be performed during an experiment:

- Change the course of the experiment depending on the current system status or the nature of the acquired data on runtime
- Integrate tasks such as data logging or starting an external application (e.g., Python or MATLAB) directly into the experiment
- The feedback script uses Python and ZEN specific commands

Included in: **Smart Acquisition**



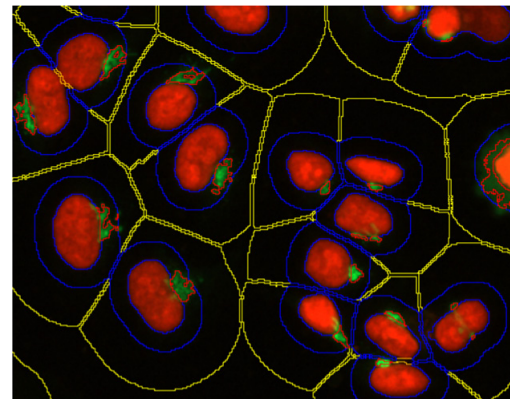
* requires Image Analysis; is part of Advanced Processing & Analysis

Image Analysis

Create automated measurement programs guided by an intuitive software wizard:

- Flexible class and subclass definition
- Objects selection either by a few reference objects, by automatic thresholding, or based on machine learning
- Refine results with object separation and filters
- Measure geometric and intensity features of individual objects or in the entire image
- Examine results at one glance using interactive plotting, with a direct link between images, tables and graphs
- Export results for further analysis.

Included in: **2D Toolkit**

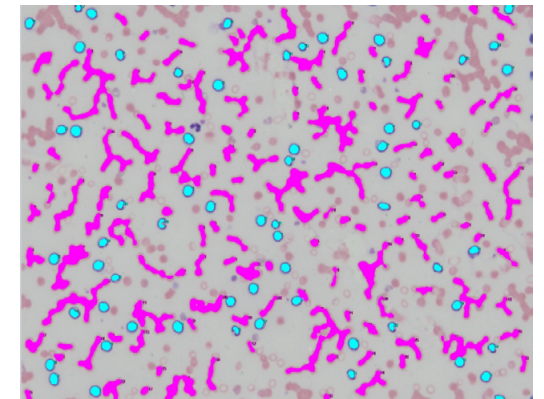


Advanced Processing & Analysis*

Extend the processing functions and perform feedback experiments:

- Add more collections of image processing functions: Edges, Arithmetics, Morphology, Segmentation, Binary
- Adaption and modification of running experiments using Python scripts
- Access to results from the online image analysis during the experiment runtime
- Access to the current system status
- Data Logging or starting of external applications like Python, Fiji or MATLAB directly from within the imaging experiment

Included in: **2D Toolkit, 3D Toolkit**



* requires Image Analysis

ZEN Toolkit Details

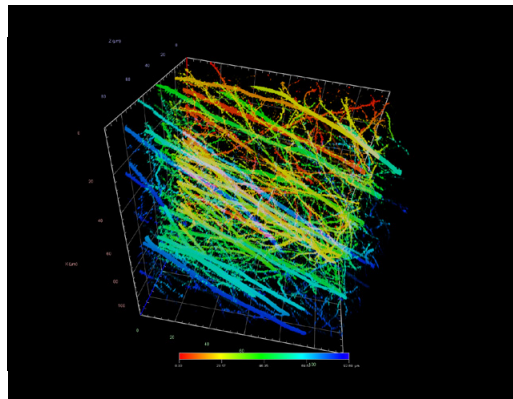
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3D Visualization*

Visualize 3D and 4D image stacks:

- Display of 3D volume models using efficient ray tracing technology, even for large data
- Display of up to six channels and time series
- Rendering methods: Transparency, Volume, Max Intensity Projection, Surface, Mixed, with up to three clipping planes
- Visualization of dense structures, such as EM, XRM and dense fluorescent data
- Send to arivis Vision4D with saved settings and sample pipelines for easy 3D analysis
- Generate animations

Included in: **3D Toolkit**



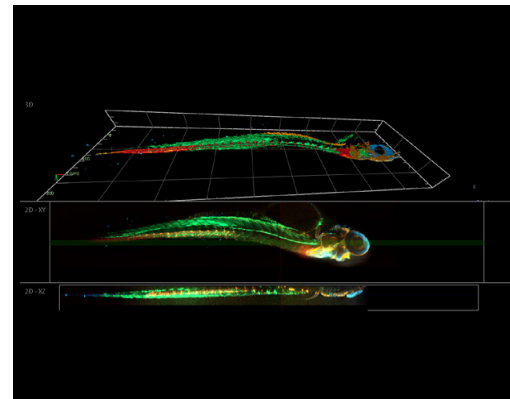
* powered by arivis

Advanced 3D Visualization*

This module introduces the Tomo3D viewer:

- Rendering of up to three 2D and one 3D view panes together
- Ray-casting-based volume rendering with transparency, volume and maximum intensity modes
- Flexible channel-wise adjustment of 3D view, background color and lighting
- The position of the three orthogonal 2D view panes are synchronized with the 3D view
- Navigation through the sample and projection views via colored cut lines

Included in: **3D Toolkit**



Courtesy of H. Reuter, Leibniz-Institute on Aging – Fritz-Lipmann-Institut e.V. (FLI), Germany

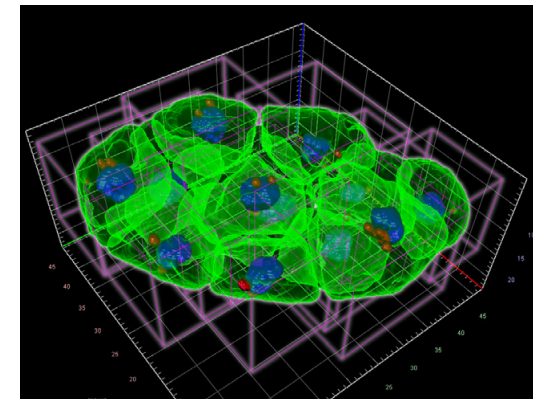
* powered by arivis

3D Analysis

Enable analysis of 3D image objects:

- Integrated with Image Analysis Wizard
- Compatible with various segmentation methods: threshold-based, Intellesis segmentation, APEER semantic segmentation
- 3D morphological operations for post-processing
- Multi-class object table for display, quantification, and .csv export of object features, including 3D parameters
- Sorting and publication-grade visualization of objects with different transparency modes

Included in: **3D Toolkit**



Sample courtesy of William Okafornta, Core Facility Cellular Imaging (CFCI), TU Dresden

ZEN Toolkit Details

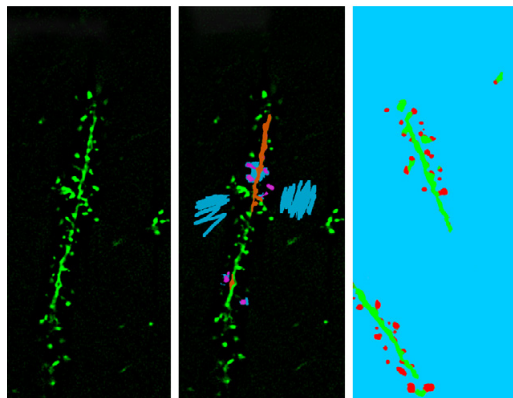
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Intellesis Segmentation

Machine-learning algorithms to segment images:

- Train a simple image segmentation model or import pre-trained deep neural networks.
- Support of any multi-dimensional 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 from other vendors
- Fully integrated with the ZEN Image Analysis pipeline and scripting interface
- Open-Source PyPi package to enable usage of externally trained networks inside ZEN

Included in: **AI Toolkit**

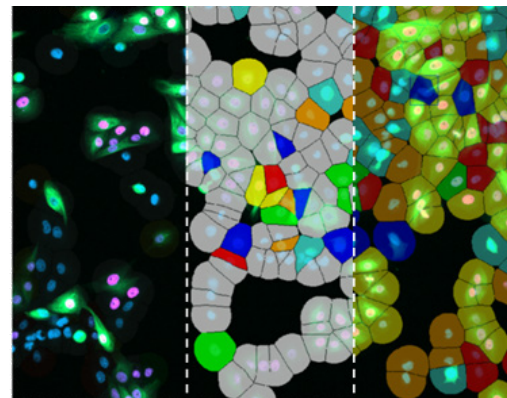


Intellesis Object Classification

Classify segmented objects with Machine Learning:

- Training environment with class assignment
- Compatible with objects obtained by conventional or Intellesis segmentation
- Support of any multi-dimensional 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 from other vendors
- Well-established open-source machine-learning algorithms, powered by Python, TensorFlow, ONNX, Scikit-Learn, and Dask

Included in: **AI Toolkit**

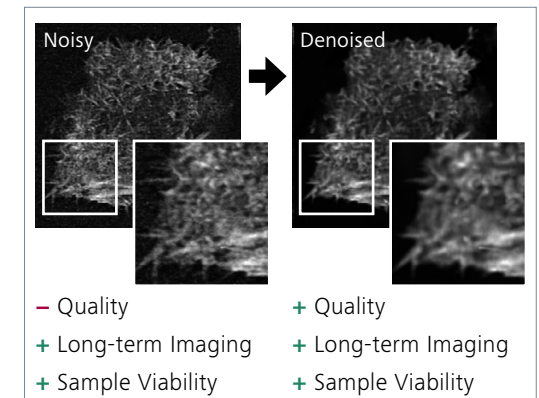


Intellesis Denoising

Apply Noise2Void-based image denoising:

- Improve signal-to-noise ratio of images
- Suitable for fast frame-rate, low-phototoxicity, low-photobleaching or low-staining intensity experimental conditions
- Deep Learning training and inference completely from within ZEN
- Unsupervised algorithm for training based on raw input, no additional reference images needed
- No parameter setup necessary
- Runs on any CPU, but also GPU-compatibility for acceleration

Included in: **AI Toolkit**



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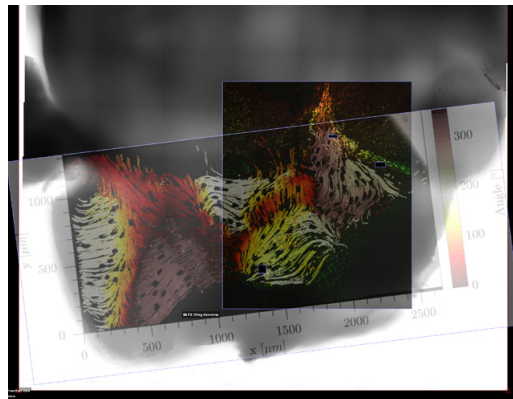
Connect*

Acquire and correlate images from different instruments like light or electron microscopes to enable a sample-centric workflow:

- Interactive control of stage movement from the ZEN Connect workspace
- Import of images into projects
- Import of third-party microscopy images powered by Bio-Formats
- Export of merged project view as image or fly-through video
- Export to SerialEM

* Add-ons to extend functionality of ZEN Connect available.
For more information, please see separate product info.

Included in: **Connect Toolkit**



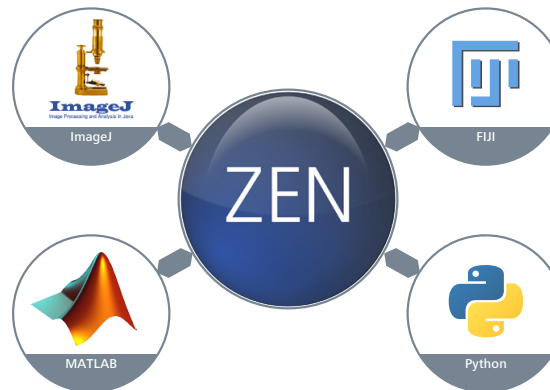
Courtesy of G. Eichele, Department of Genes and Behavior, Max Planck Institute for Biophysical Chemistry, Göttingen, Germany

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
- Uses IronPython in order to integrate
- .NET-based functions

Included in: **Developer Toolkit**

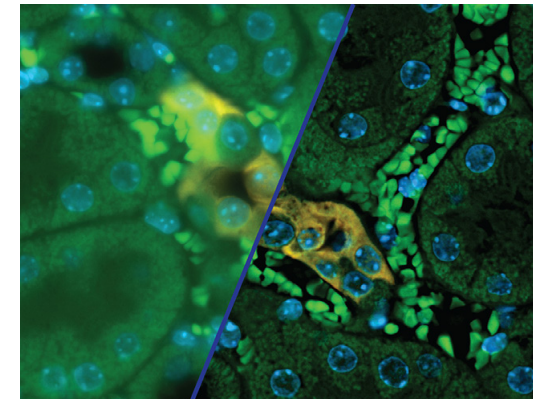


Deconvolution

Enhance your 3D image stacks with deconvolution algorithms:

- Efficient multi-CPU based processing
- Additional speed gain via GPU acceleration with multiple CUDA-compatible graphics cards
- Improvements in resolution down to 120 nm (depending on imaging system)
- Compatible with conventional widefield, Apotome, Lightsheet 7, Lattice Lightsheet 7, confocal, or multi-photon microscopes.
- Four primary methods, plus more than 15 published methods (e.g., Richardson-Lucy)

Included in: **Deconvolution Toolkit**



ZEN Toolkit Details

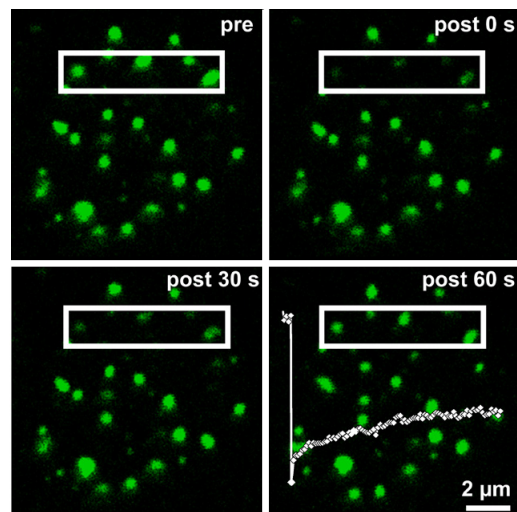
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FRAP Efficiency Analysis

Analyze FRAP/FLIP or similar time series acquisitions:

- Analysis of time series acquisitions with bleach events to determine the half time of recovery / decrease of fluorescent signals
- Support of mono or bi-exponential fit algorithms including options for background correction and correction of imaging-induced photo-bleaching
- Evaluation of grouped ROIs

Included in: **Molecular Quantification Toolkit**

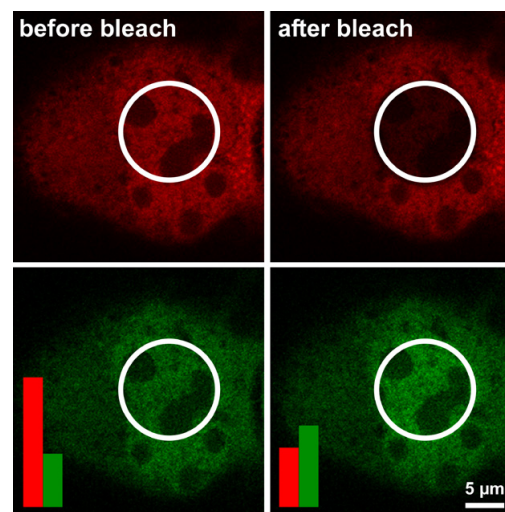


FRET

Analyze FRET datasets:

- Support of Sensitized Emission and Acceptor Photobleaching
- Special FRET view with calculation of control parameters, a color-coded display of the resulting images, and the intensity changes of selected image regions
- Supported methods: Gordon, Xia, Youvan

Included in: **Molecular Quantification Toolkit**

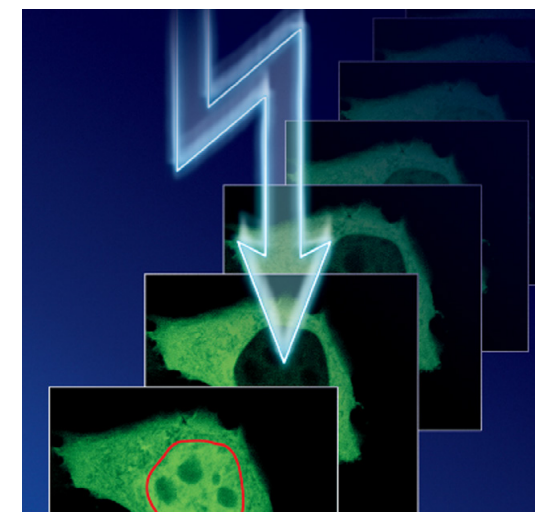


Automated Photomanipulation*

Automate photoactivation or photobleaching at multiple positions based on image analysis. The system executes the following steps without user interaction:

- Acquisition of a multi-position image defined in Tiles & Positions tools
- Identification of photomanipulation ROIs based on a customized, pre-defined image analysis
- Photomanipulation experiment as defined for bleaching and time series tools
- For LSM 910, LSM 990 and Celldiscoverer 7 with LSM 910

Included in: **Molecular Quantification Toolkit**



* requires Image Analysis

ZEN Toolkit Details

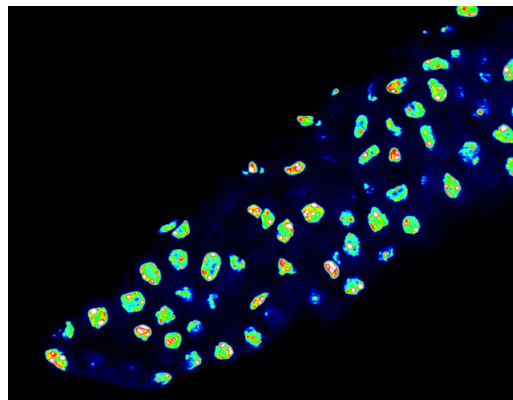
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Physiology

Measure fast ion fluctuations such as intracellular calcium in living specimens interactively:

- Imaging with single wavelength (e.g., Fluo-4) and dual wavelength dyes (e.g., Fura-2)
- Online ratio calculation and ratio image display
- Flexible charting and image display
- Off-line data table display with data export functionality
- Definable switches for online annotations and change of acquisition speed
- Pausing and refocusing via a live camera view
- Freely configurable TTL triggers

Included in: **Molecular Quantification Toolkit**

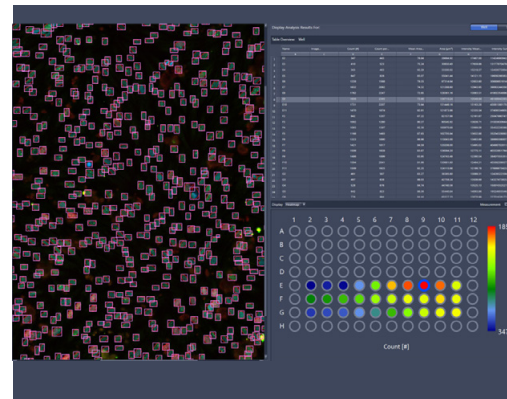


Cell Counting

From our **Bio Applications** portfolio delivering out-of-the-box image analysis, tailored result presentation with interactive measurement tables, heatmaps and plots:

- Automatically detect fluorescently labelled cell nuclei in biological samples
- Suitable for measuring proliferation or survival
- Measure cell counts, nuclear intensities, mean intensities and mean areas
- Optimized for measurements in screening applications with multi-well setups

Included in: **Bio Applications**

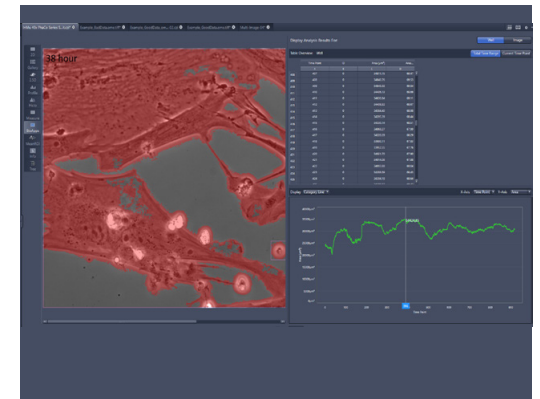


Confluency

From our **Bio Applications** portfolio delivering out-of-the-box image analysis, tailored result presentation with interactive measurement tables, heatmaps and plots:

- Automatically quantify cell confluency directly from transmitted light or fluorescent images
- Applicable for quality control in cell-based assays and read-out in wound healing assays
- Measure the area covered by cells or the area percentage
- Optimized for measurements in screening applications with multi-well setups

Included in: **Bio Applications**



ZEN Toolkit Details

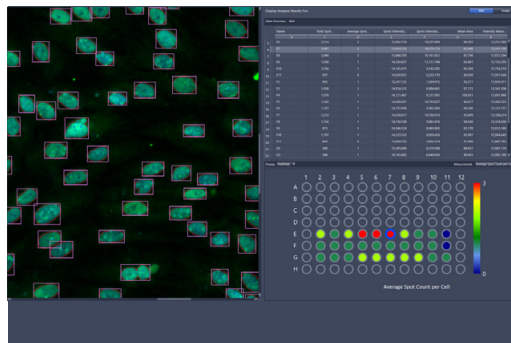
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Automated Spot Detection

The Bio Applications portfolio delivers out-of-the-box image analysis and tailored result presentation:

- Automatic quantification of spots in the cell nuclei
- Applicable for FISH applications, telomere / centromere analysis or focus counting
- Measurement of the total number of spots, the average number of spots per cell or the mean intensity of spots
- Optimized for measurements in screening applications with multi-well setups

Included in: **Bio Applications**

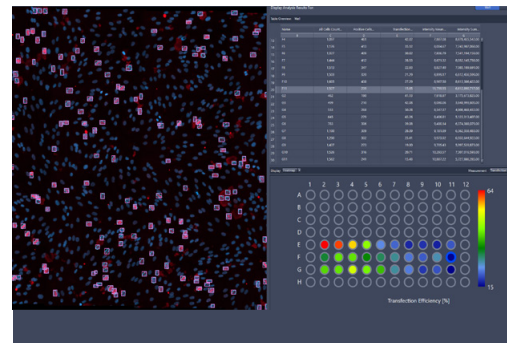


Gene and Protein Expression

The Bio Applications portfolio delivers out-of-the-box image analysis and tailored result presentation:

- Automatic quantification of the transfection efficiency in 2D cell culture
- Applicable for transfection protocols or picking positive clones
- Measurement of the distribution of labelled molecules in a cell population
- Quantification of viral or bacterial infections
- Total number and percentage of positive cells and the mean signal intensity
- Optimized for measurements in screening applications with multi-well setups

Included in: **Bio Applications**



ZEN Toolkit Details

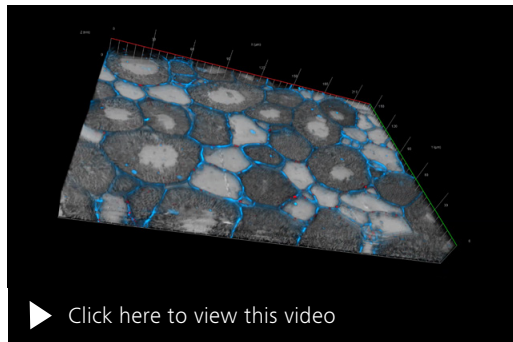
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Special Feature:

Correlative Array Tomography (CAT)

Image ultrathin serial sections automatically in widefield and scanning electron microscopes:

- Regions of interest manually defined in one section will be automatically propagated to all following sections.
- Imaging of selected regions of interest with light and electron microscopes
- 2D image sequences are aligned into a 3D Z stack, resulting in a correlative dataset, combining information from the light and electron microscopes into one image volume

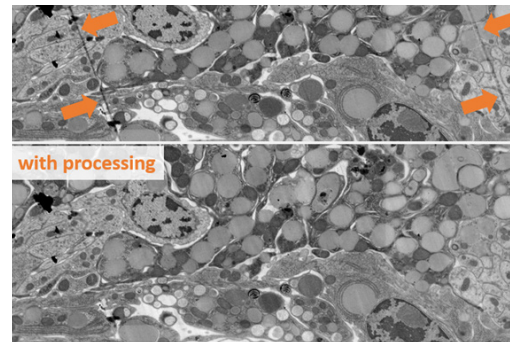


Special Feature:

EM Processing Toolbox

Improve your EM datasets:

- Easy import of EM images acquired with SmartSEM
- Removal of artifacts such as noise and stripes
- Reconstruction of 3D datasets out of subsequent 2D images: automatic dataset equalization and alignment with z-alignment tool
- Replacement of individual slices of poor quality within the 3D Z stack
- Cut out free-form 3D regions of interest to remove unwanted areas from the EM dataset for a customized 3D visualization



For more information about the following special features, please refer to the respective product information brochures:

- Peripheral Device Control
- LSM Plus
- Airyscan
- Airyscan jDCV
- Photon Counting & FCS
- Sample Navigator
- Lightsheet Processing
- Lattice Lightsheet Processing

General Features of ZEN

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General Features of ZEN

Graphical user interface can be switched between bright and dark design to adapt to ambient brightness

Step-less scaling and zooming of the user interface for optimal adjustment to the screen size

Essential functions are always displayed, while advanced options are auto-hidden under "Show All"

Full integration with ZEISS microscopes, Axiocam cameras, and 3rd party accessories using intuitive MicroToolbox (MTB) software

Interactive and automatic control of the individual motorized microscope components

Transfer of information from encoded components into the software

Complex acquisition experiments can be configured, saved and reused easily

Many powerful microscopy tools freely available, e.g., Axiocam control, movie recorder, manual panorama, 3D rendering, and more

Sequence of acquisition dimensions can be selected (depending on active dimensions)

Hardware settings can be created with the help of a graphical light path

Sequences of commands can be easily combined to create hardware settings:

- Contains the Smart Setup function for the fully automatic creation of experiments to acquire multichannel fluorescence and transmitted light images using motorized systems
- Image acquisition with b/w, color, high-resolution and high-sensitivity cameras, b/w images with up to 16 bits, color images with up to 3 × 16 bits

Display parameters can be adjusted without changing the pixel values

Assignment of scaling is fully automatic when acquiring an image (depending on the microscope configuration)

Acquisition history is recorded and saved as metadata in CZI image format. This format has been developed in consideration of the standards of the OME-TIFF and OME-XML format of the Open Microscopy Environment. This allows far-reaching compatibility with the Bio-Formats Reader of the Open Microscopy Environment

Acquired images are automatically saved in CZI or other image formats (including metadata). Saving in CZI format is also possible with advanced compression algorithm

Full integration into the Windows multi-user functionality (separation of user data and program installation, user-specific configurations, etc.)

Configuration options for the graphical user interface enable creation of menu bars, saving of workplace configurations, and definition of properties of standard graphic elements

Export into OME-TIFF (image format specification of the Open Microscopy Environment which enables the exchange of microscopic image data)

Export into ZVI, BMP, GIF, JPG, PNG, TIFF, HDP image formats; export into AVI and Windows Media video formats; batch export of images and videos

Image import (LSM, ZVI, BMP, TIFF, JPG, GIF, PNG) and function to convert images (TIFF, JPG, BMP) into CZI format

Navigator window available for easy navigation of large tile images

Interactive measurement: length, contour-based measurement data (area, box, perimeter, gray values), angle

ZEN Connect workspace with project-based file architecture: Zoom in from the full macroscopic view of a sample down to nanoscale details. Combination of data from any image source and view of multiple layers with adjustable transparency. Manual alignment of images allows correction of xy-shift, rotation, re-scaling, shearing and mirroring.

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Base Software	Name	Content	Description
	ZEN lite	Panorama	For basic offline data processing and control of manual microscopes/Axiocams Optional toolkits limited to Base Acquisition only
		Manual Extended Focus	
		Data Storage Client	
		Measurements	
		APEER On-site Basic	
		3D viewing Basic	
		Connect Basic	
	ZEN	All ZEN lite Contents	For control of motorized microscopes, Axiocams, lasers, and 3 rd party components, as well as offline data processing Can be upgraded with all toolkits and special features
		Base Acquisition	
		Motorized Microscope Control	
		Spectral Unmixing	
		APEER On-site Advanced	
	ZEN desk	All ZEN lite Contents	For offline data processing only (no device control). Can be upgraded with all non-acquisition toolkits and non-device control special features
		Spectral Unmixing	
		APEER On-site Advanced	
		3rd Party Import	
		Direct Processing	
		Extended Focus	
		Colocalization	

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Acquisition Toolkits	Name	Content	Description
	Base	Multi-Channel	Included in ZEN and optional for ZEN lite Base Software
		Time Lapse	
	Motorized	Acquisition Base	Optional for ZEN Base Software
		Z Stack	
		Extended Focus	
		Software Autofocus	
		Tiles & Positions	
		Direct Processing	
	Advanced	Acquisition Motorized	Optional for ZEN Base Software, includes content of Motorized Acquisition Toolkit
		Colocalization	
		HDR-Confocal	
	Smart	Guided Acquisition	Optional for ZEN Base Software, requires Motorized/Advanced Acquisition Toolkit and 2D Toolkit Toolkit
		Experiment Designer	
		Experiment Feedback	
Analysis and Visualization Toolkits	Name	Content	Description
	2D	Image Analysis	Optional for ZEN and ZEN desk Base Software. AI ready (pre-trained models can be executed)
		Advanced Processing	
	3D	3D Visualization	Optional for ZEN and ZEN desk Base Software. AI ready (pre-trained models can be executed)
		Advanced 3D Visualization	
		3D Analysis	
		Advanced Processing	
	AI	Intellesis Segmentation	Optional for ZEN and ZEN desk Base Software Machine Learning- and Deep Learning-based algorithms with user training interface
		Intellesis Object Classification	
		Intellesis Denoising	
	Connect	Connect	Optional for ZEN and ZEN desk Base Software For light-light and light-electron correlative microscopy with advanced calibration, acquisition and visualization tools
		Connect 2D Add-on	
		Connect 3D Add-on	
		3 rd Party Import	
	Developer	Macro Environment	Optional for ZEN and ZEN desk Base Software, for Python based scripting functions
	Molecular Quantification	FRAP Efficiency Analysis	Optional for ZEN and ZEN desk Base Software, for advanced fluorescence-based molecular quantification functions
		FRET	
		Physiology	
		Automated Photomanipulation	

ZEN Toolkit Details

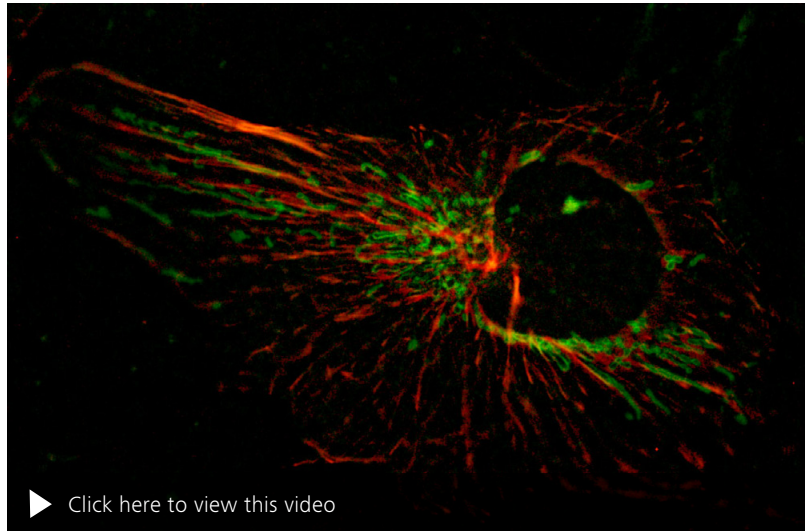
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Analysis and Visualization Toolkit	Name	Content	Description
	Deconvolution	Deconvolution	Optional for ZEN and ZEN desk Base Software
	Bio Applications	Cell Counting	Optional for ZEN and ZEN desk Base Software, AI ready (pre-trained models can be executed)
		Confluency	
		Automated Spot Detection	
		Gene and Protein Expression	
Special Features	Content		Description
	Peripheral Device Drivers		Optional for ZEN Base Software, for control of ASI, Ludl, PIFOC, Sutter and Uniblitz devices
	LSM Plus		Optional for LSM 910 and LSM 990 systems
	Airyscan 8 jDCV		Optional for LSM 910 and LSM 990 with Airyscan systems
	Photon Counting, FCS and RICS		Optional for LSM 990 system
	Sample Navigator		Optional for LSM 910 and LSM 990 systems
	Lightsheet Processing		Optional for Lightsheet 7 system
	Lattice Lightsheet Processing		Optional for Lattice Lightsheet 7 system
	EM Processing		Optional for ZEN and ZEN desk Base Software

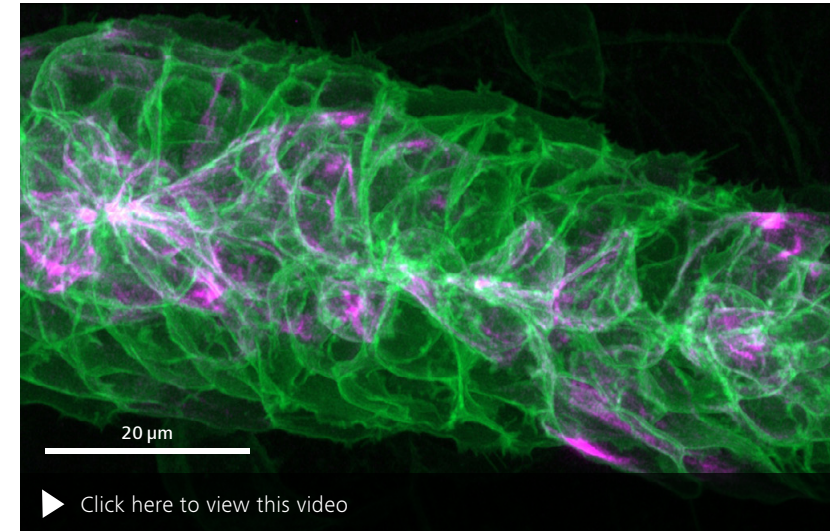
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Time Lapse Imaging



Living cell with mitochondria in green and microtubule tips in red (EB3). ZEN allows to gain insights into fast dynamic cellular processes while providing you with tools to process your data in the same familiar user interface.



*Lateral line primordium migration and deposition of immature neuromasts in a Zebrafish embryo (*Danio rerio*). Maximum intensity projection of 155 z-planes, acquired with Airyscan 2. Membranes in green, actin in violet.*

ZEN allows you to observe your specimen longer and under more natural conditions than ever before, as it precisely controls acquisition in widefield or LSM modes. No photons are wasted and images are processed and restored to yield the highest signal to noise ratio.

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

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Large Area Imaging



Tiled image of a mouse kidney section with four labels. ZEN provides you with the best strategy to optimize sample focus across large areas at high resolution. You get better images in shorter time.

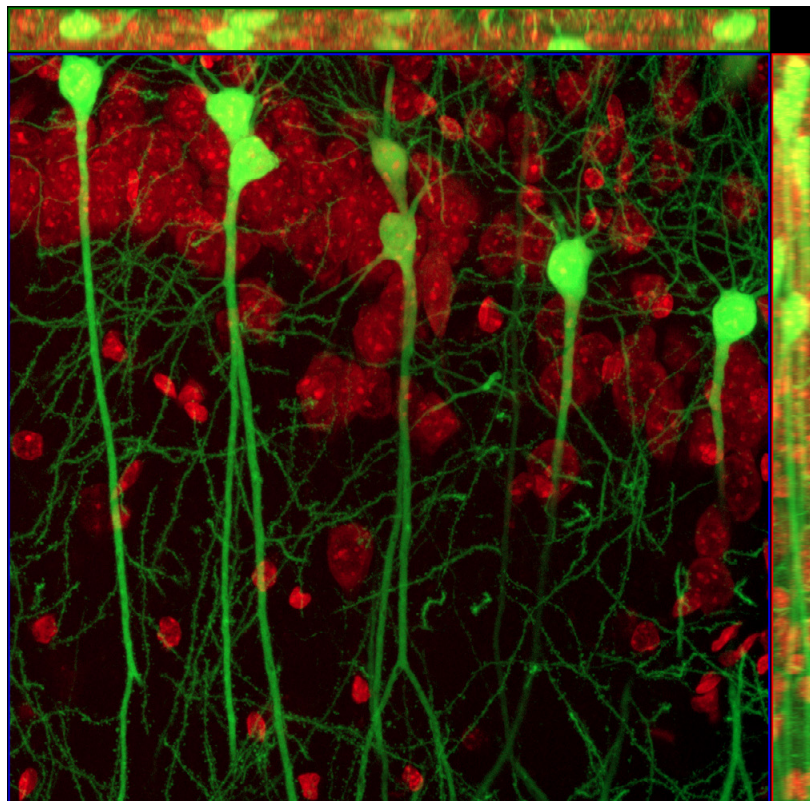


Brightfield images of a tissue section acquired using Live Panorama. ZEN automatically takes images and stitches them, while you manually navigate the area of interest on your sample.

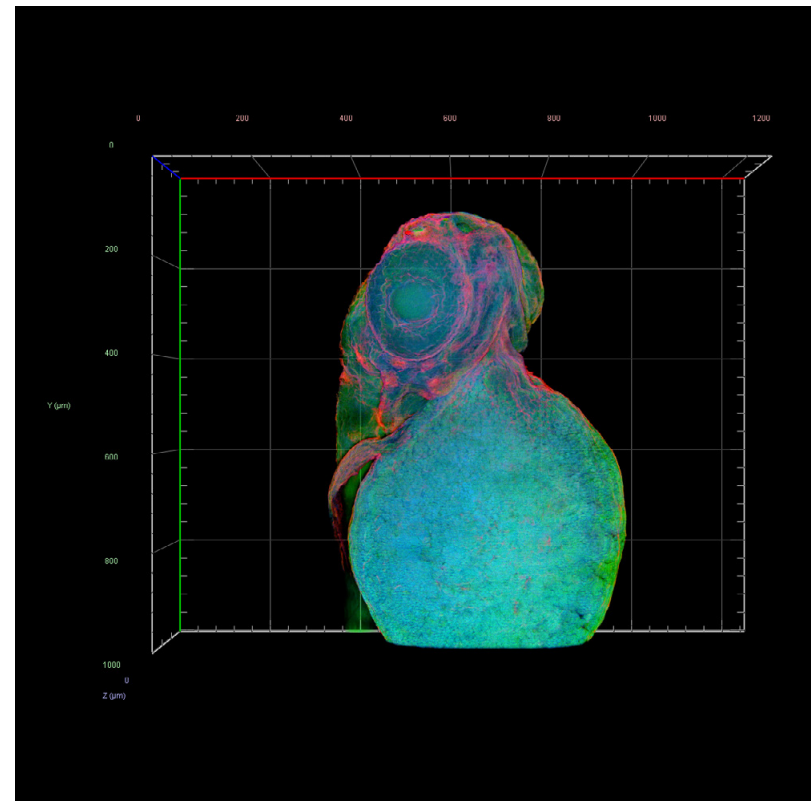
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3D Imaging



Ortho view of mouse brain slice, acquired with LSM 900.
Z stack of the hippocampus area of a brain slide with neurons (green) and nuclei (red)
ZEN assists you in finding the perfect spot in your sample and effortlessly handles large files so that you can always concentrate on examining your data.

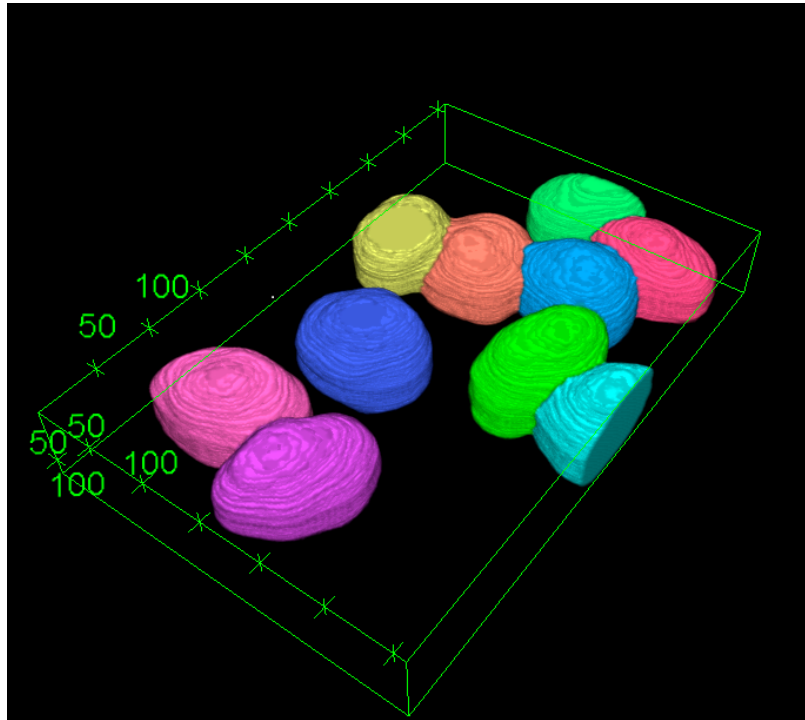


3D rendering of a Zebrafish embryo. Deconvolved Apotome Z stack.
With its powerful viewing and processing options ZEN gives you the insights into your specimen that you need to draw conclusions and to plan further experiments.

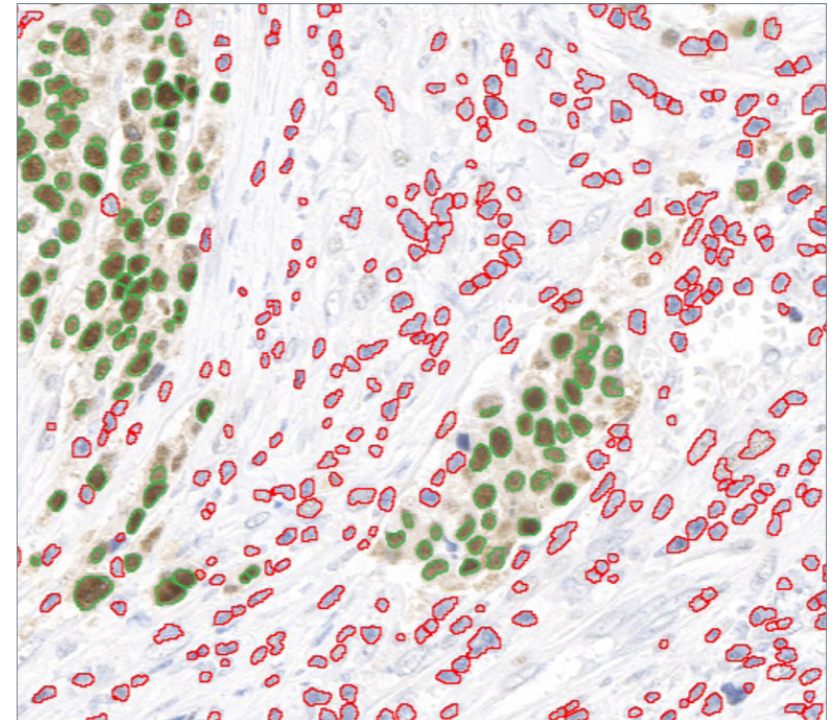
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Image Analysis



A 129 slice Z stack of cell nuclei, fully segmented and quantified, using APEER on-site in ZEN.

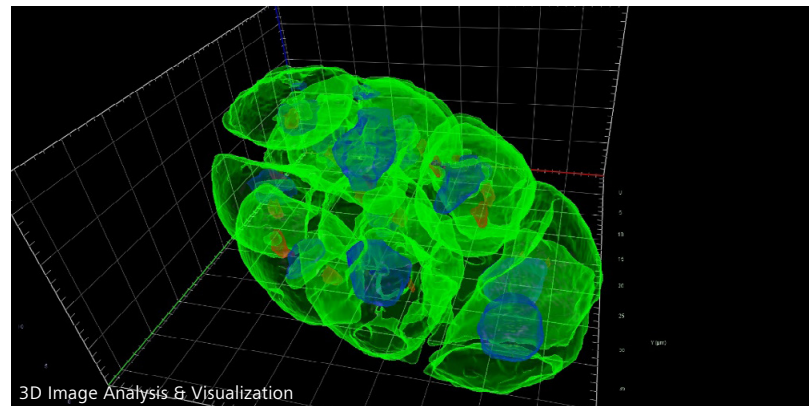
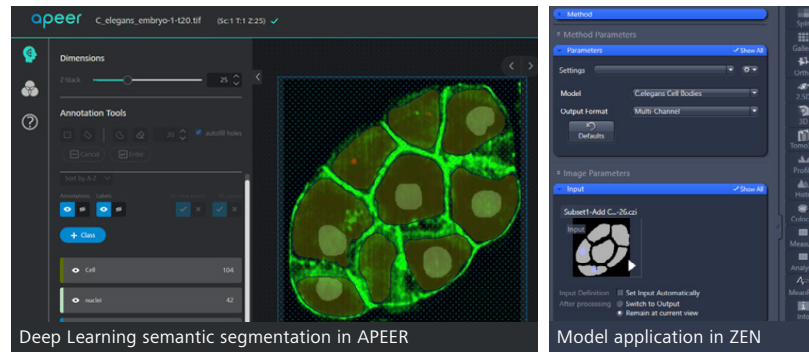


Counting of DAB-positive (brown with green outline) cells in tissue sections and calculation of percentage of total cells (blue and brown): 36 %.

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AI Toolkit



C.elegans embryo, acquired with Lattice Lightsheet 7. Sample courtesy of William Okafornta, Core Facility Cellular Imaging (CFCI), TU Dresden

Segmentation of cell bodies (green), nuclei (blue) and microtubule-organizing centers (red). Cell bodies and nuclei were segmented by Deep Learning semantic segmentation employing annotation and model training in APEER, and then applying the model directly in ZEN; 3D object segmentation in ZEN with 3D image analysis and visualization via 3Dxl.



Drosophila embryo images recorded with ZEISS Celldiscoverer 7 and Airyscan 2. Images Courtesy of University of Gothenburg

Segmentation of embryos with Intellesis Segmentation is shown in upper left panel. Selection of embryos suitable for further analysis with Intellesis Object Classification is shown in upper right panel. Correct segmentation and classification results are shown in lower panel.

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ZEISS Service – Your Partner at All Times

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

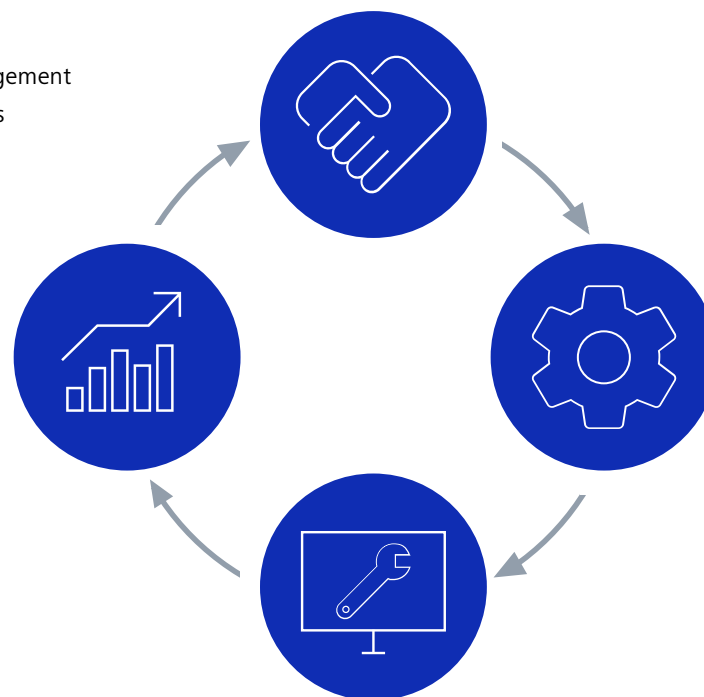
that your microscope is always ready for use.

Procurement

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

New Investment

- Decommissioning
- Trade In



Operation

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

Retrofit

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

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

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

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