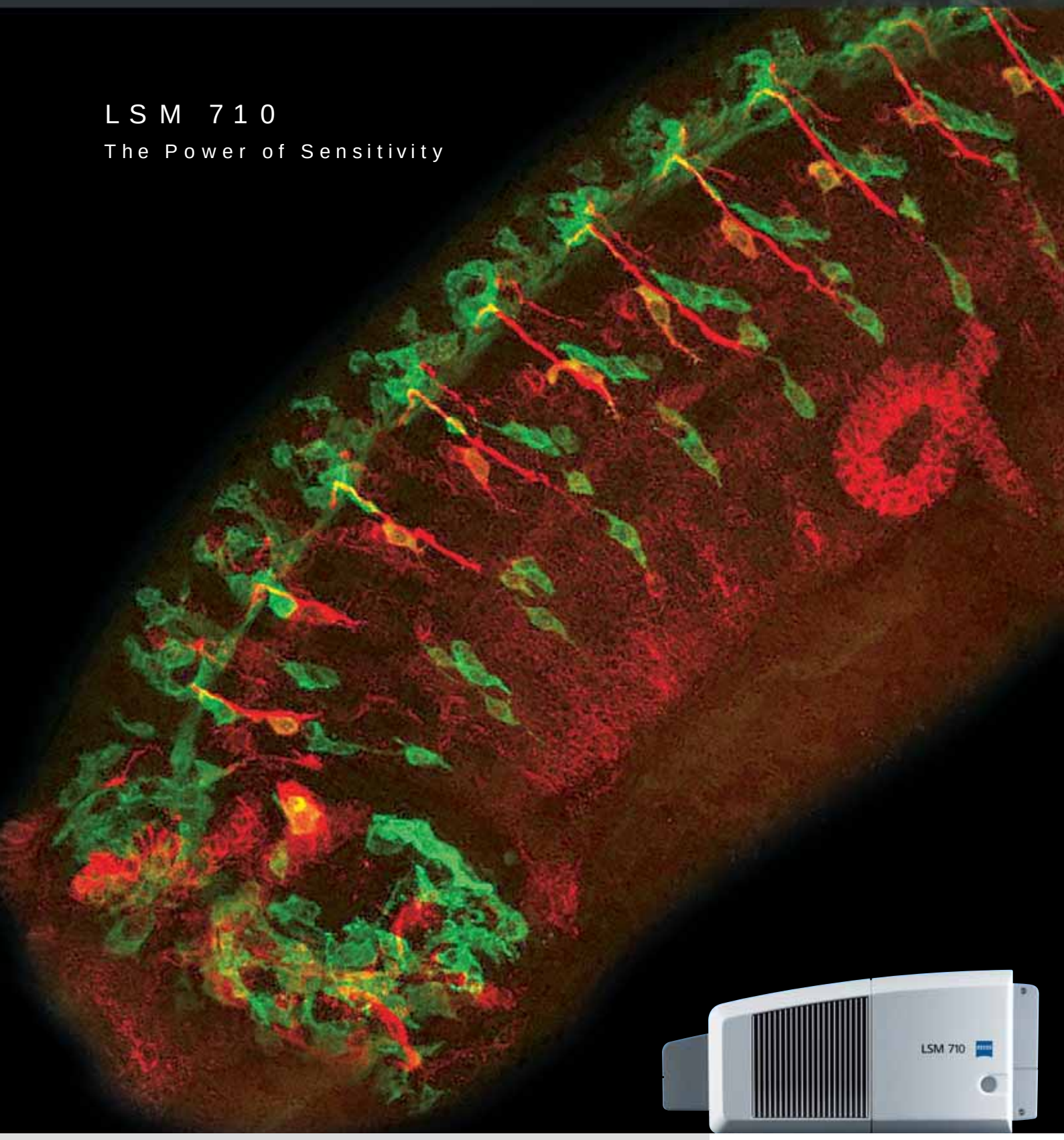
LSM 710

The Power of Sensitivity



A New Dimension in
Confocal Laser Scanning Microscopy

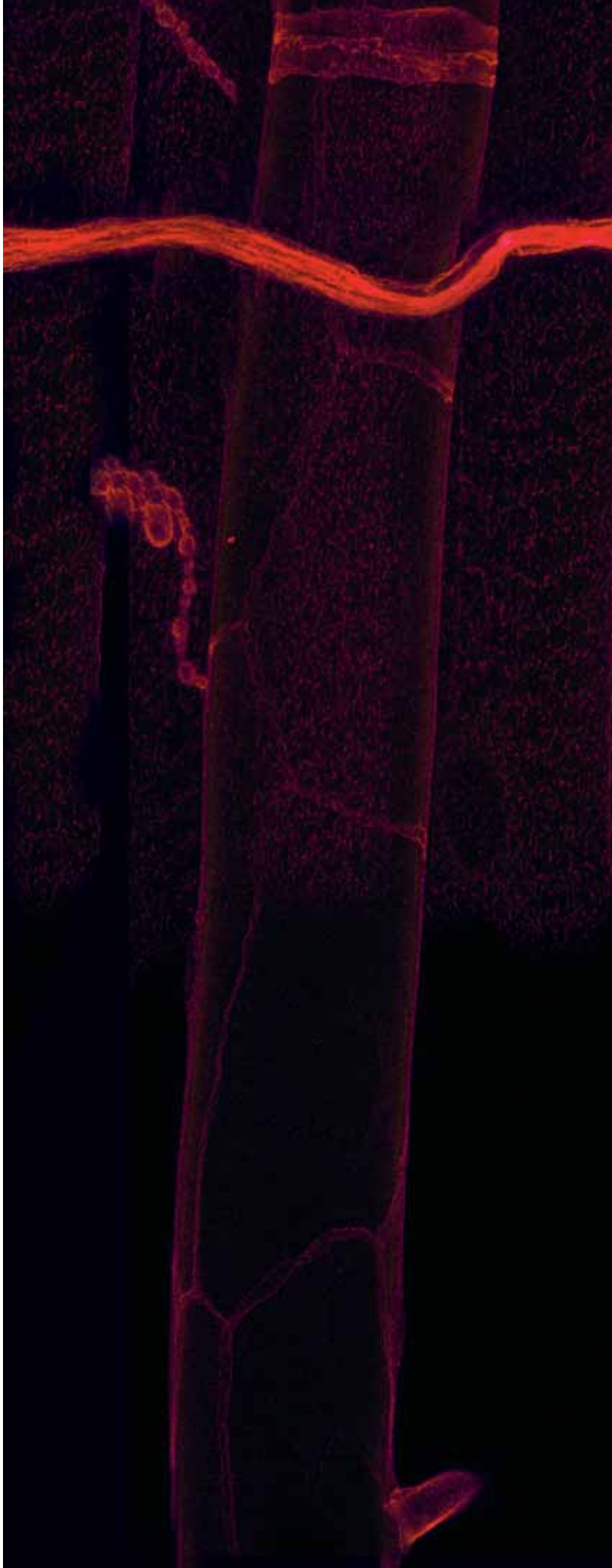
ZEISS

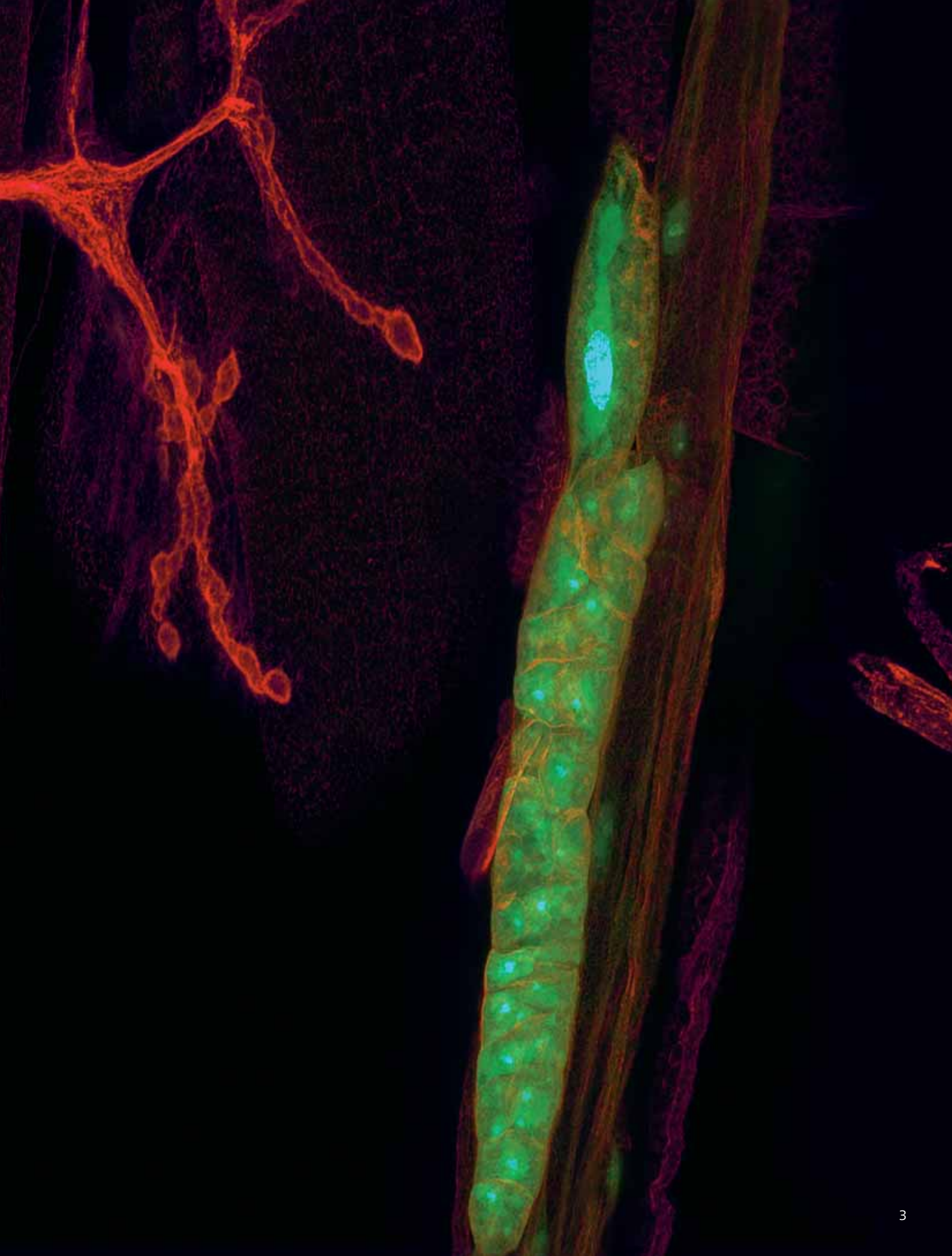
We make it visible.

Content

Title illustration:
Drosophila Embryo, colored with CD8-GFP (green, Glia cells) and Cy3 (red, motor neurons). Specimen: H. Aberle, University of Münster, Institute for Neurobiology, Germany

Page 3:
Innervation of dorsal body musculature close to the heart of Drosophila melanogaster. Red: anti-a Spectrin coloring. Green: GFP expressed in heart. Ventral view. Specimen: J. Sellin, University of Osnabrück, Germany





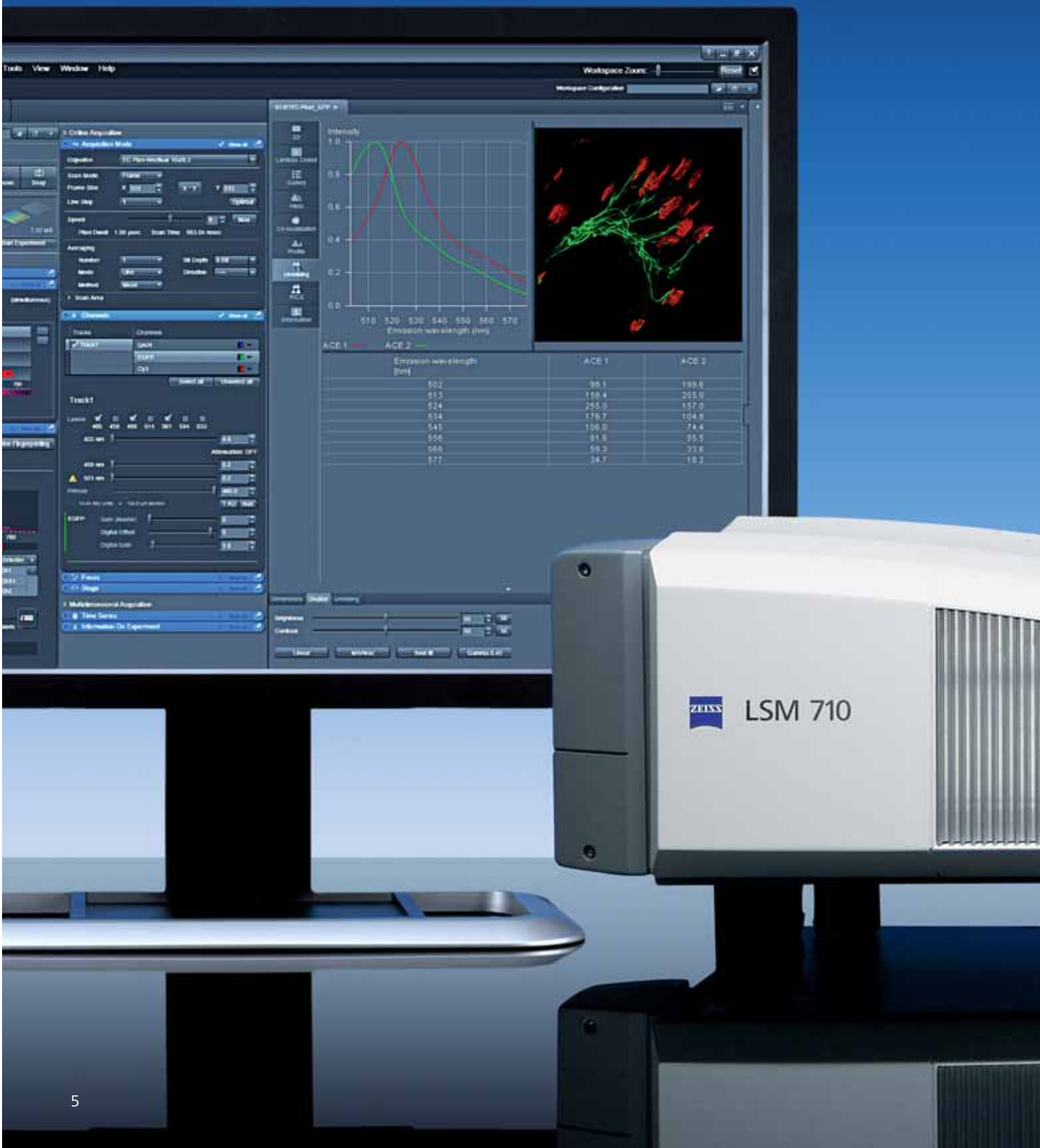
LSM 710 – Providing Support for Progress and Innovation

Taking advantage of increasingly powerful technologies, the biomedical sciences are leading the way to a deeper understanding of the complex mechanisms that are the foundation of living systems at the molecular, cellular, and tissue levels.

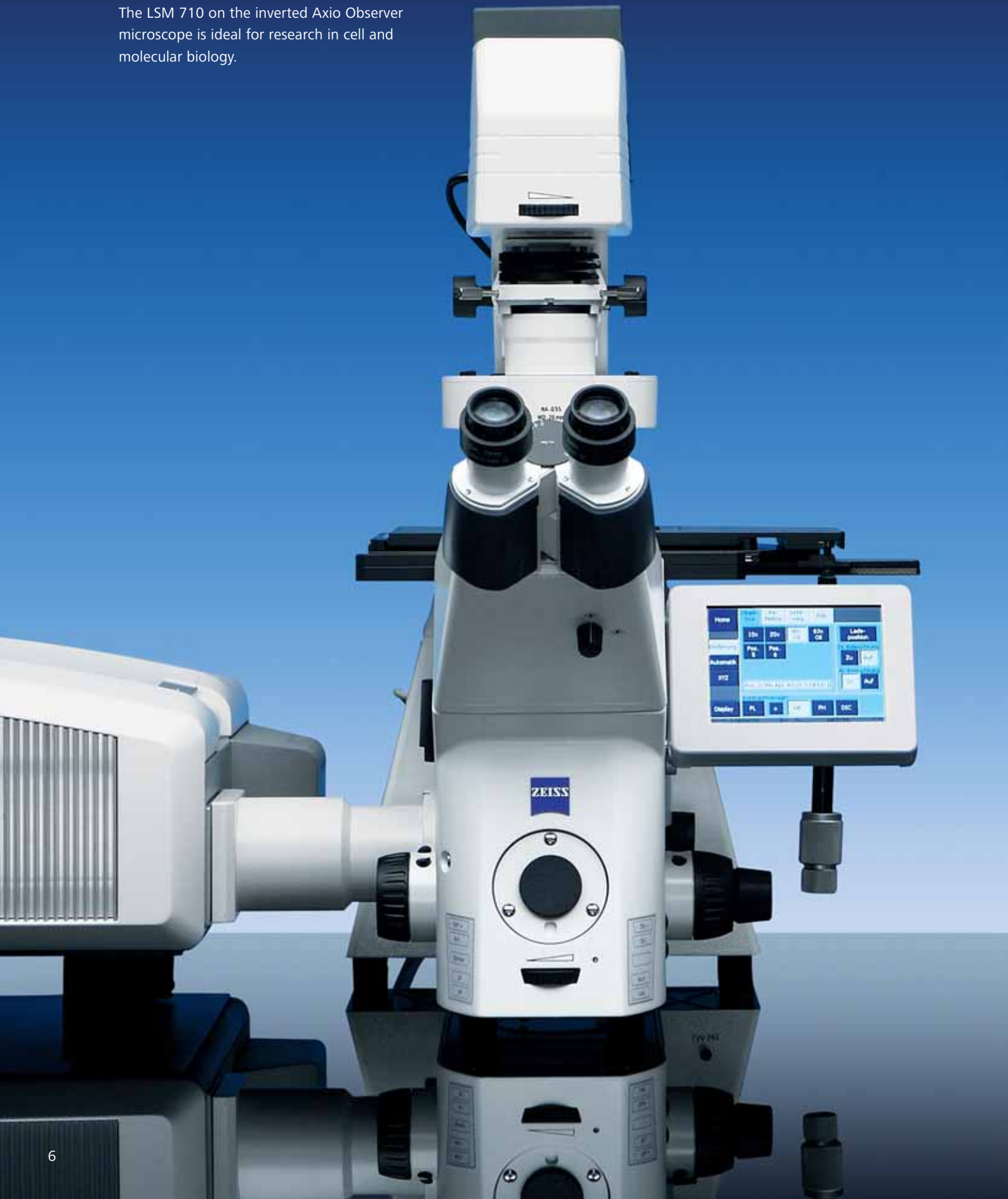
The LSM 710 is the logical evolution of the successful LSM-Series from Carl Zeiss. It combines and surpasses the advantages and capabilities of all existing confocal systems. Working closely together with leading scientists worldwide, we have created an instrument that reflects the latest ideas and technological possibilities – an entire orchestra of innovations to accompany your research experiments.

For more than 160 years, Carl Zeiss has provided the scientific community with the best technological instruments and related know-how. By means of professional consulting – and especially via system solutions tailored to users' exact needs – we have created the ideal conditions for modern research.

ZEN Software: The perfect user interface
for your applications.



The LSM 710 on the inverted Axio Observer microscope is ideal for research in cell and molecular biology.



The LSM 710 on upright microscopes,
such as the Axio Imager or the Axio Examiner,
is ideal for research in neurobiology,
physiology, and developmental biology.

Sensitivity is the Key

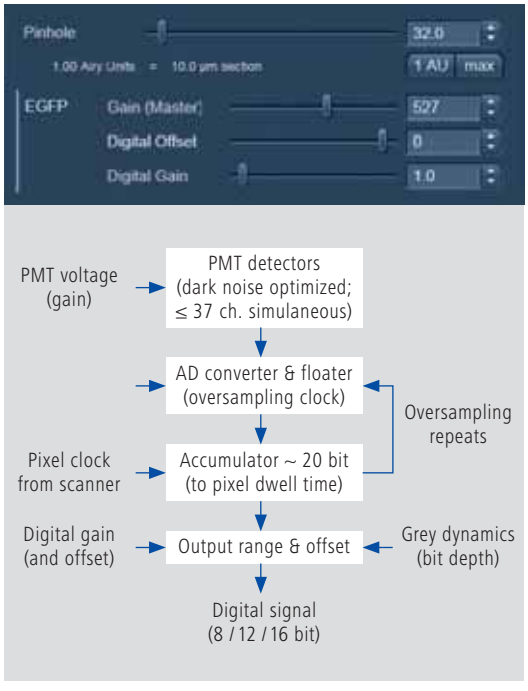
Whether it is in live cell imaging, single molecule analysis, or imaging of minute structures such as yeast or DNA, the LSM 710 creates detailed, high-contrast images.

For every demanding application in laser-scanning microscopy, the prerequisite is enhanced sensitivity and reduced background noise. The excellent sensitivity of the LSM 710 is combined with outstanding noise and excitation laser light suppression to deliver the best results, even with tricky preparations such as those with dense 3D tissue or cells growing directly on metallic substrates (e.g., gold).

To achieve such performance, we have implemented a whole range of improvements:

- low-noise electronics with up to 30% longer sampling time per pixel via oversampling
- excellent contrast due to improved laser suppression by 100 to 1000 times (even with mirror-like samples)
- an increase in sensitivity due to a new spectral grating and spectral-recycling loop design (efficiency ≥ 90%)
- an array detector with three times lower dark noise
- parallel 34-channel imaging over the entire wavelength range
- APD-imaging and photon counting

Digital gain function for extended sensitivity and perfect signal balance of up to 10 detection channels.

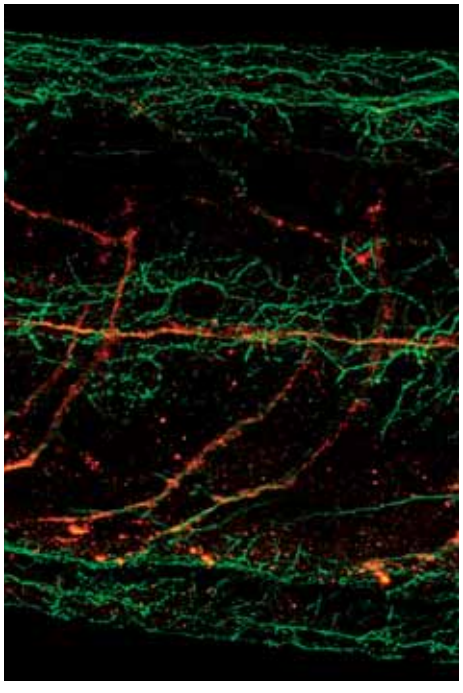


»Sensitivity is the key feature in a confocal microscope. The LSM 710 achieves a high sensitive image acquisition with low noise level and provides reduced phototoxicity for experiments with living cells.«

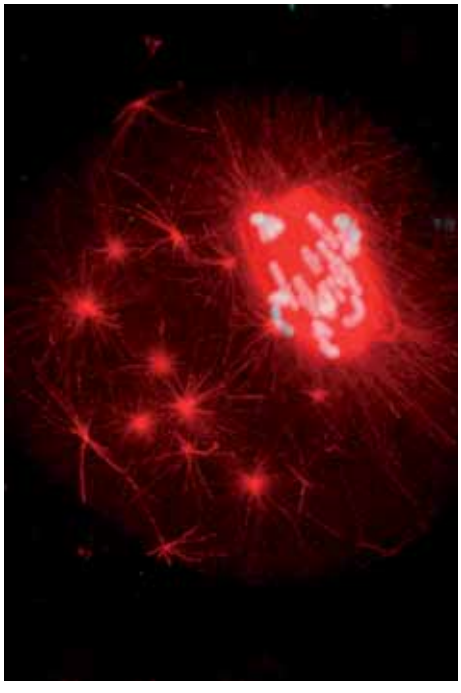
Dr. Hideaki Mizuno, Brain Science Institute, Riken, Wako, Japan

Nerve bundles innervating muscle in a transgenic mouse, labeled with kusabira-orange, CFP and YFP.
Dr. J. Carlos, MCD, Harvard University, Boston, USA

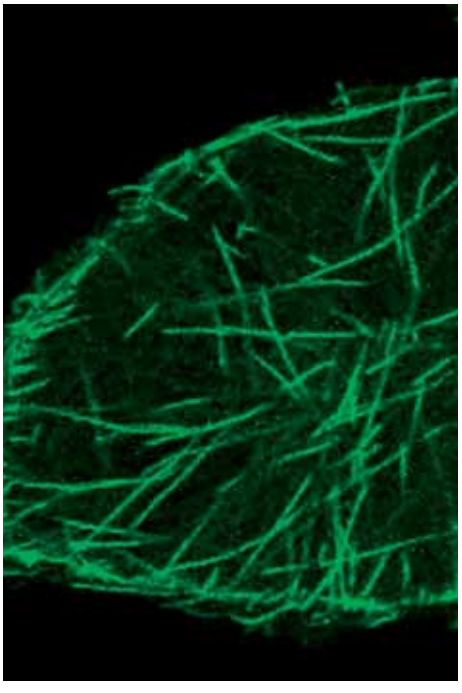
Nerve fibers in tail of a zebrafish embryo, labeled with Alexa 488, CY3, CY5.



Spindle formation in mouse oocyte, labeled with Hoechst, Alexa 680.
M. Schuh, EMBL, Heidelberg, Germany



Growing microtubules in Hela cells, labeled with GFP.
Dr. L. Sironi, EMBL, Heidelberg, Germany



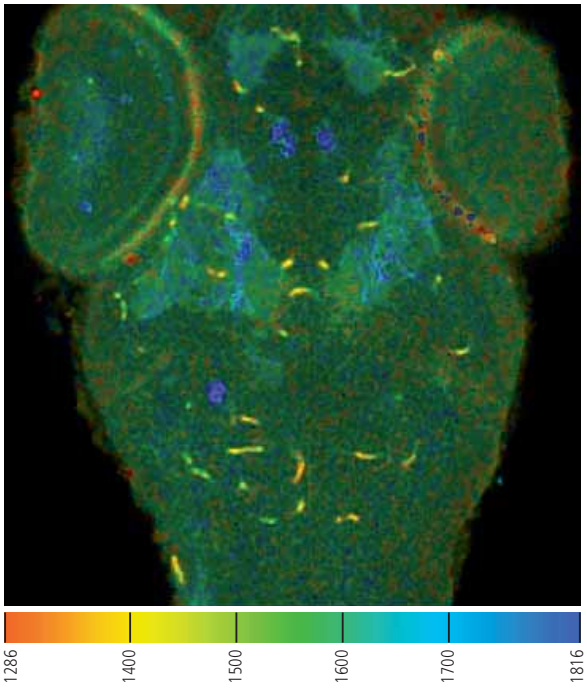
Flexibility in All Areas

The LSM 710 allows you to use more dyes and look deeper into cells and tissues.

The new illumination and detection design gives you ultimate freedom for fluorescence microscopy. Capable of continuous spectral detection over the whole wavelength range with up to 10 dyes used simultaneously, the LSM 710 can perform virtually any application.

In addition, you have the option of adding more laser lines if your experiments require new excitation possibilities. Multicolor imaging can be performed to perfection, allowing you to use the latest fluorescent proteins without spectral crosstalk. Molecules, such as proteins, and their interactions can be analyzed using all current imaging methods.

Choose a wavelength from the drop down menu to use the InTune for imaging.



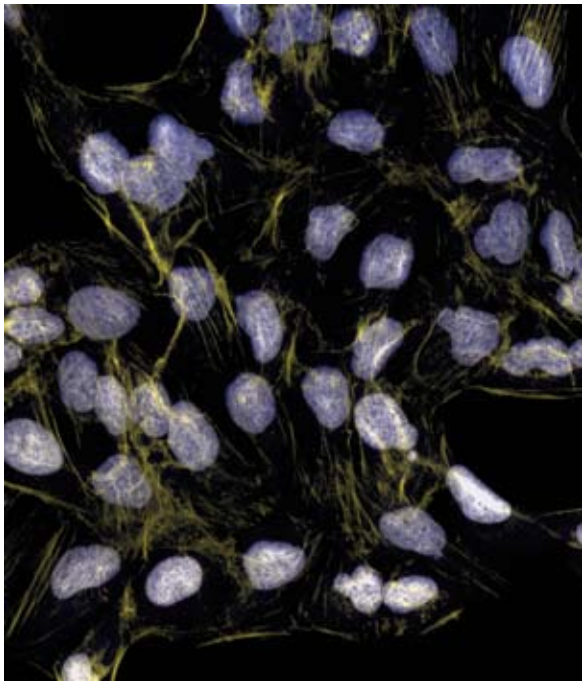
Color coded FLIM image (ps) of a 3-day-old zebrafish embryo. Whole mount stained for GFP transgene (Alexa Fluor 488), catecholaminergic systems (Alexa Fluor 555) and serotonergic cells (Alexa Fluor 594). Lifetime image acquired using 562 nm for excitation.
Specimen: T. L. Tay and R. Nitschke, University of Freiburg, Department of Developmental Biology and Life Imaging Center, Germany

Use the latest dyes with extreme spectral properties.

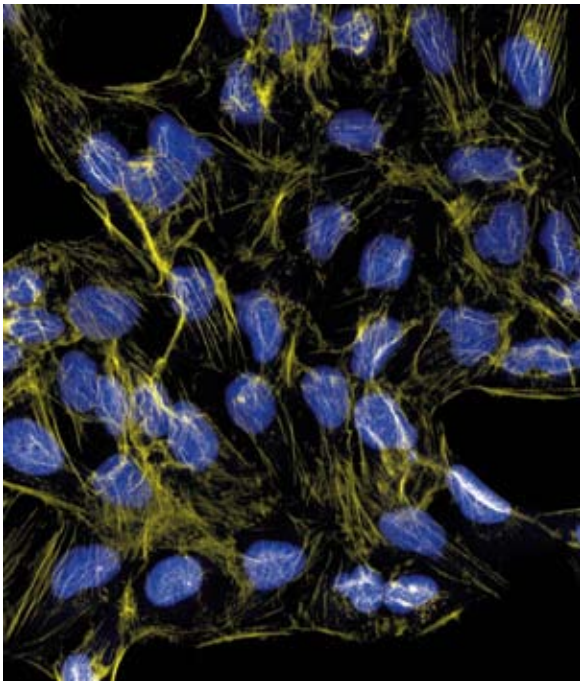
The fast and flexible detection technology of the LSM 710 combined with the high performing In *Tune* (488 to 640 nm, > 1,5 mW per wavelength) means the fluorescence signal can be detected very close to the excitation wavelength. In addition, In *Tune* is the perfect flexible laser system for measuring fluorescence lifetimes of dyes (Pulse < 5 ps, 40 MHz) that couldn't be examined before. Also, with In *Tune*, you no longer need to consider the excitation wavelength when searching for a FRET pair. The wavelength range of the laser lets you measure the lifetime of any dye excited within the spectral range of 488 to 640 nm. Because of its low noise characteristics and stability, In *Tune* can be combined and used simultaneously with any additional laser available in the system, from near UV to far red.

The flexible beampath with the innovative TwinGate main beamsplitter provides up to 50 combinations of excitation laser lines and can be exchanged by the user. On the detection side, emission bands can be flexibly selected without emission filters or secondary dichroics due to new bandpass sliders in front of 2, 3 or 34 spectral detectors. Additional external detectors can be attached to the coupling port. The optics are designed for a range of 350 to 1100 nm and, as a result, lasers – including pulsed lasers and powerful bleach lasers – can be freely combined from near UV (405 nm), VIS, and IR (Ti:Sa) ranges.

Human Osteosarcoma labeled for Actin (Phalloidin-Alexa 532) and nuclei (Hoechst 33258). Using simultaneous excitation with 405 and 520 nm, no clear separation of the signals can be achieved. The signal intensity of the actin stain is not maximal.



Human Osteosarcoma labeled for Actin (Phalloidin-Alexa 532) and nuclei (Hoechst 33258). Using simultaneous excitation with 405 and 538 nm, you can achieve a clear separation of the signals with maximal signal intensity.

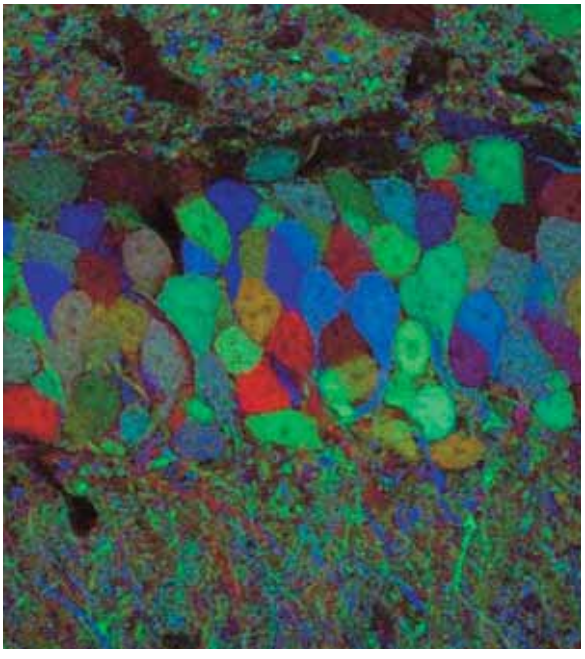


Unique Precision and Reproducibility

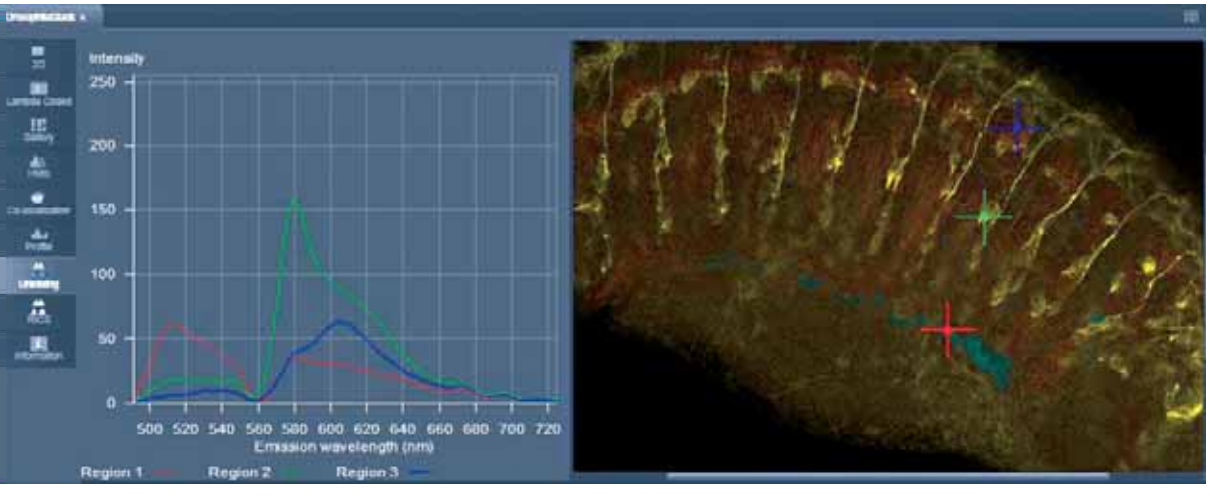
The LSM 710 provides efficient, consistently verifiable results due to a more stable design with less mechanical tolerances, especially in spectral imaging.

The whole group of 2, 3, or 34 detectors is fixed, reproducing your spectral measurements reliably and without deviations. The new parallel spectral detection offers simultaneous 34-channel readout in lambda mode. Plus, a sequential acquisition mode is now available to increase the spectral resolution to 3 nm.

To get the best image data possible, we have conducted extensive research towards improving our unmixing software. By implementing the ideas published by leading scientists on how to optimize the spectral unmixing logic and reduce the effect of noise on the unmixing result, we have improved both the precision and the signal strength of the resulting crosstalk-free images. Up to 10 dyes can be acquired and separated at the same time. Systems with 2 or 3 channels also offer the same outstanding linear unmixing technology.



Hippocampus neurons in a Brainbow transgenic mouse, labeled with multiple hues of fluorescent proteins. Dr. J. Livet, MCB, Harvard University, Boston, US



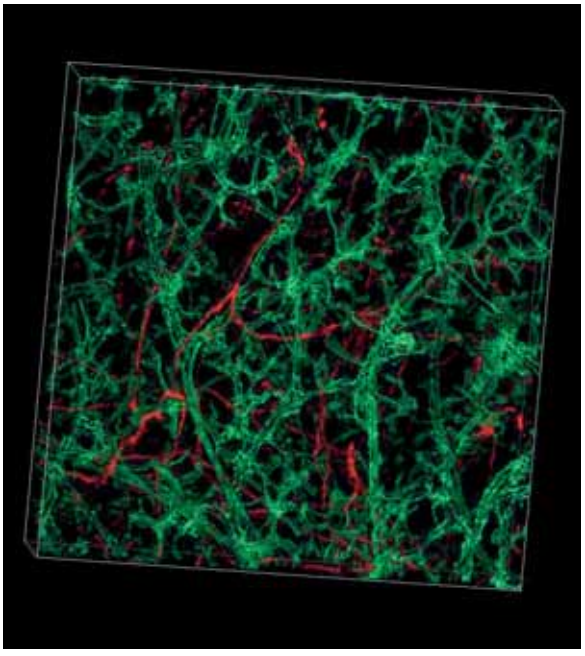
Linear unmixing of 34 channels simultaneously and with calibrated detectors achieve perfect balance, even with vastly different signal intensities.

Literature: Neher R., Neher E.: *Optimizing imaging parameters for the separation of multiple labels in a fluorescence image*, J Microsc. 2004 Jan; 213(Pt 1): 46–62.

Maximum Ease of Use

The LSM 710 offers more efficient workflows and excellent ease of use. Improved serviceability means faster maintenance and reduced downtime for upgrades or repairs.

With its smaller size and reduced installation times, set up of the system is much less effort. Improved diagnostics tools, a new self-test software and an integrated calibration tool will let you keep it in optimal condition. Should you wish to invest in new methods later, there are simple paths for upgrading both the hardware components, and the ZEN 2008 software with its fantastic ergonomy and ease of use.



Perfect 3D results in superior samples resulting from perfect adjustment; Submandibular gland of a mouse, labeled with ZO-1 antibody and YFP, S. Sheu, MCB, Harvard University, Boston, USA

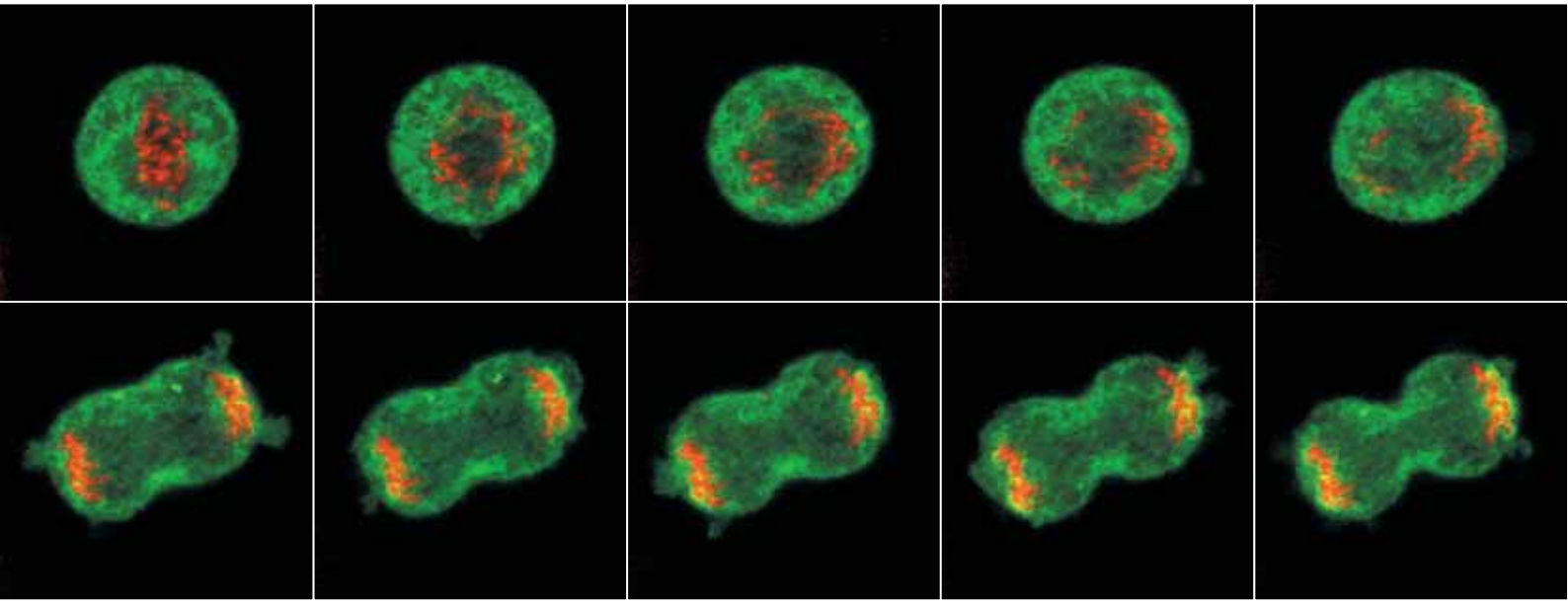
Smart acquisition setup for easiest possible scan parameter setup by selecting dyes and experimental needs.

»As a multiuser facility, stability and reliability have always been at the forefront of our needs. Downtime and time used to ensure that the systems are performing to specification can be costly and very frustrating to our users. Prealignment and self test tools are a huge step forward and will not only free up experimental time but will also give me greater confidence in the scientific excellence being produced by our regular users.«

Dr. Peter O'Toole, Technology Facility, Biology, University of York, United Kingdom

More Possibilities with Living Cells

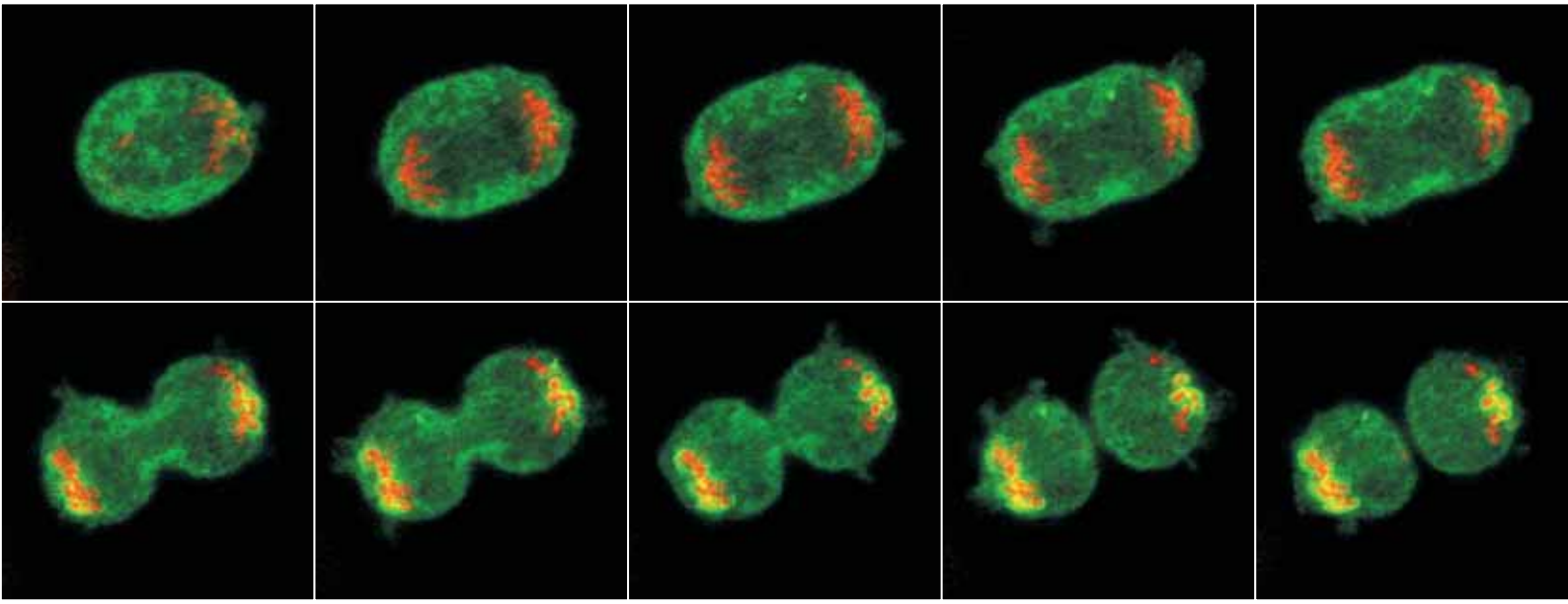
Get more valid results in live cell imaging with the LSM 710 –
thanks to less damaging and more stable conditions for your living cells.

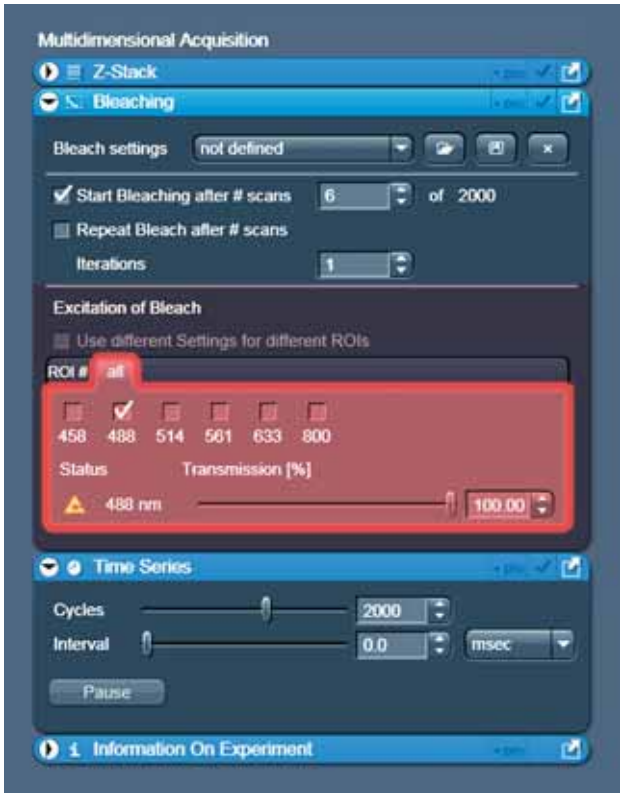


As a result of such improved capabilities you can observe your cells longer and at higher spatial and temporal resolutions. The LSM 710 ushers in improvements in almost every aspect, whether it involves faster scan speeds at lower zoom factors (i.e., larger fields of view with a field number of up to 20 mm in the intermediate plane) or more consistent imaging conditions with, for example, stable laser excitation or control of the focus plane using the Definite Focus attachment on the Axio Observer microscope stand.

The trend towards more representative experiments with living cells also means analyzing the interactions of structures. Freely definable ROIs are essential for bleach and photoactivation experiments, whether it involves cancer research, cell death, the analysis of DNA repair proteins, protein synthesis or the detailed mechanisms of cell division. The LSM 710 offers ideal tools for manipulation of single and multiple ROIs with individual settings – at the fastest speeds possible.

Time lapse imaging of dividing NRK cells, labeled with GFP and HcRed.
Specimen: E. Dultz, EMBL, Heidelberg, Germany





Flexible bleach and photoactivation functions.

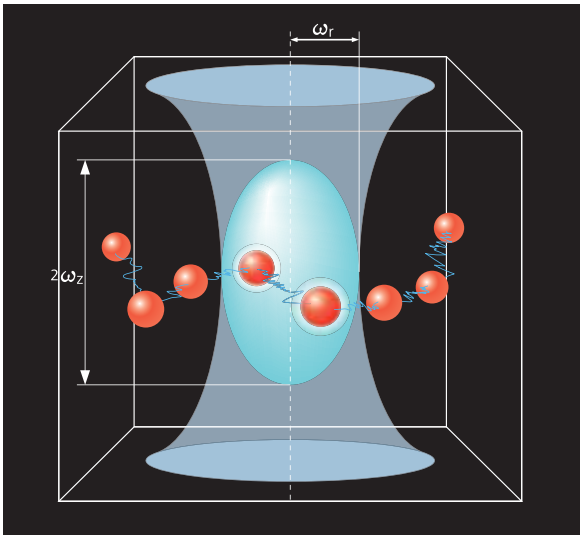
»Fast photoactivation experiments used to be very difficult with point scanning confocal microscopes. The faster scan rates and improved signal to noise of the LSM 710 now make it possible to analyze diffusion even of small soluble proteins with such a microscope.«

Dr. Jan Ellenberg, EMBL, Heidelberg, Germany

Integrated Special Imaging Modes

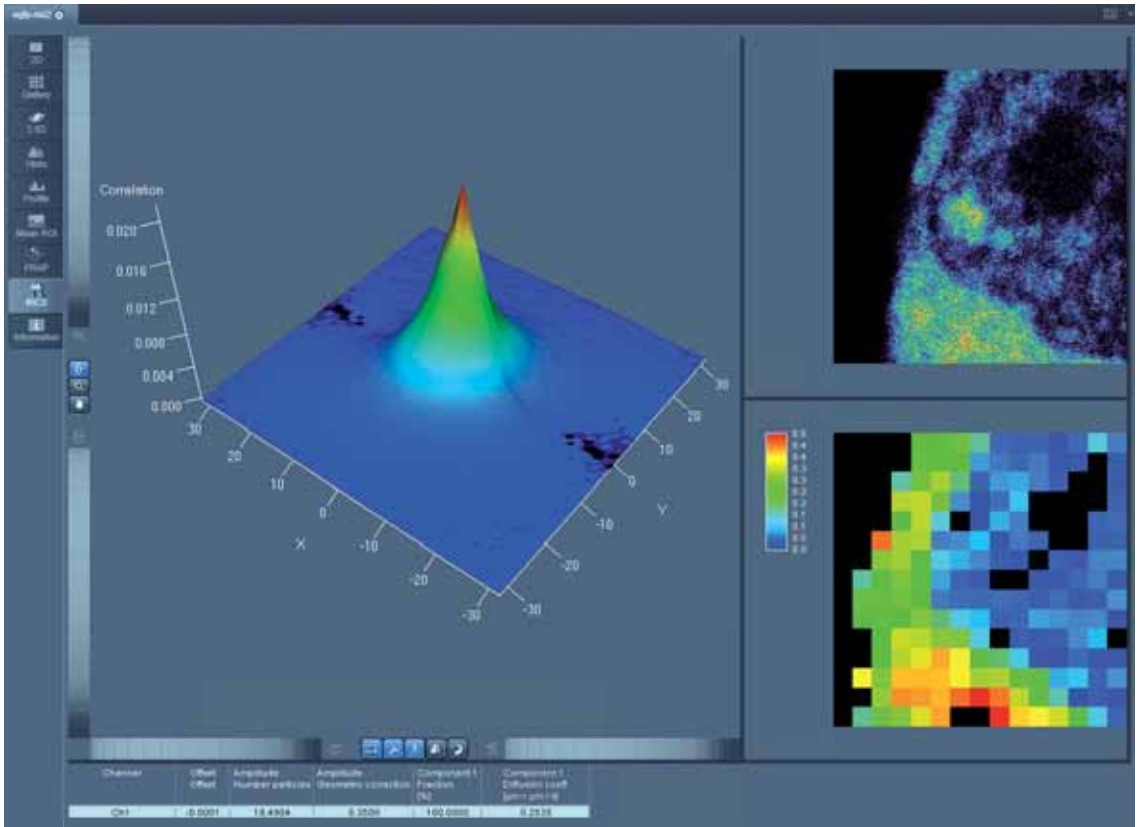
With its SNR and image quality, the LSM 710 offers possibilities beyond conventional imaging – such as Fluoresence Correlation Spectroscopy (FCS) and Image Correlation Spectroscopy (RICS) – allowing single molecules to be analyzed at a new level.

The new system is the first turnkey system to offer RICS, a method developed by E. Gratton and P. Wiseman. Unlike FCS, RICS requires no special hardware or APD detectors, and its analysis is done in the normal scanned image. Again unlike FCS, RICS produces a real image as a result. Nevertheless, both methods are complementary: FCS is more sensitive and gives higher count rates when molecule concentrations are low while RICS provides more precise analysis of many fast-moving molecules.

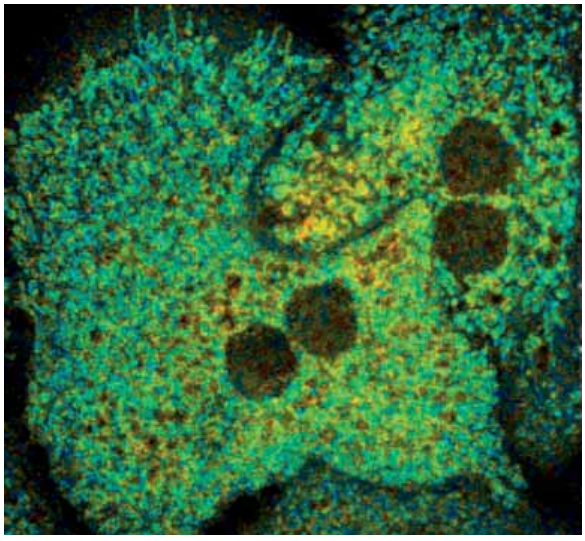


FCS and RICS use the confocal volume to trace single molecules.

ZEN software for RICS analysis of single molecule dynamics.



Color coded FLIM image (ps) of hepatocytes stained for Cytochrome C (Alexa 488) and Mirochondria (Alexa 564). Lifetime image acquired using 568 nm for excitation. Specimen: R. Pick and R. Nitschke; University of Freiburg, Germany



FLIM allows for the analysis of the fluorescence lifetime, making it the ideal method for undertaking FRET experiments to analyze whether proteins are located closer than 10 nm apart and are thereby capable of interacting. The LSM 710 offers a direct coupling port so matching Becker & Hickl FLIM detectors can be mounted to it.

When using pulsed lasers on the LSM 710 (e.g., with NLO systems), other methods can be used to trace molecules and even their spatial interaction.

Anisotropy imaging is another imaging method that offers you, in addition to intensity differences and the signal spectrum, another parameter of the emission light to investigate proteins. The filters required for this method can be supplied with, or retrofitted to, any LSM 710.

When excited by laser light, structured, fluorescence-labeled proteins show a directed emission depending on the polarizing direction of the laser. Anisotropy and fluorescence light may vary according to the distance and bond of the molecules. Special filters ensure a very high extinction ratio of the respective other polarizing direction of the emission and, thus, images are of exceptional contrast and information content.

Actin filaments labeled with AlexaFluor488-phalloidin in the Drosophila eye.

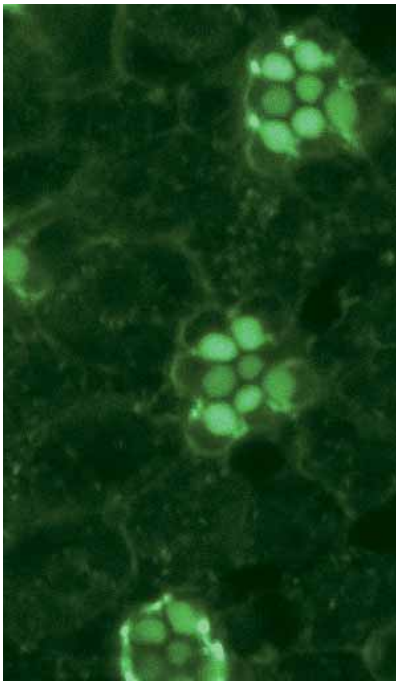
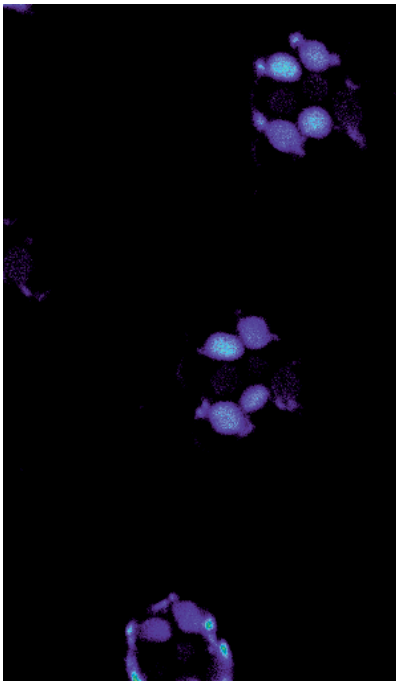


Image showing the result of the evaluation of the Anisotropy of the specimen. Only in some rhabdomers the actin filaments are similarly oriented. Specimen: O. Baumann, University of Potsdam, Institute for Biochemy und Biology, Germany



Literature:

Digman M.A.; Brown C.M.; Sengupta P.; Wiseman P.W.; Horwitz A.R.; Gratton E.: *Measuring fast dynamics in solutions and cells with a laser scanning microscope.* Biophys Journal, 2005 Aug; 89(2): 1317–27.

Raub C.B.; Unruh J.; Suresh V.; Krasieva T.; Lindmo T.; Gratton E.; Tromberg B.J.; George S.C.: *Image correlation spectroscopy of multiphoton images correlates with collagen mechanical properties.* Biophys Journal, 2007 Dec 7.

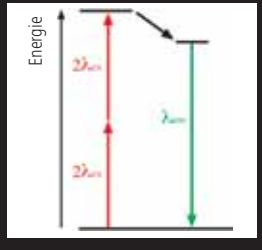
Multiphoton Imaging Without Compromise

As a physiologist or neurobiologist, you need to be able to get deeper images of three-dimensional samples, e.g., brain tissue. The LSM 710 NLO lets you penetrate deeper and detect more light.

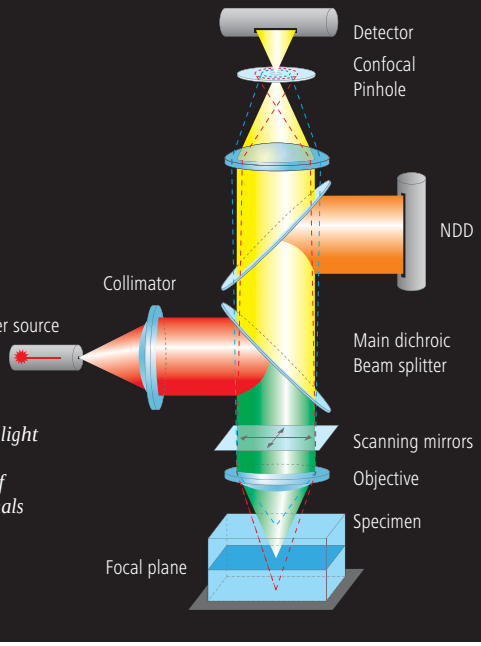
Improved femtosecond multiphoton technology lets you go from flat "caricatures" to a three-dimensional context so you can understand interrelations in complex biological systems. Improved NDD electronics and cascadable NDD modules allow spectral flexibility for multicolor NLO experiments.

The LSM 710 NLO was co-developed with a matching fixed-stage microscope, the Axio Examiner. This lets us optimize our NDD technology to detect even the faintest signals. The tube lens of the Axio Examiner is specially designed to optimize the beam conditions for our Plan-Apochromat 20 × / 1,0 W objective, which provides an ideal solution for NLO imaging. The LSM 710 NLO goes even further, by offering you a unique GaAsP NDD unit integrated in the objective holder to provide the shortest beampath – with excellent quantum efficiency and twice as good SNR.

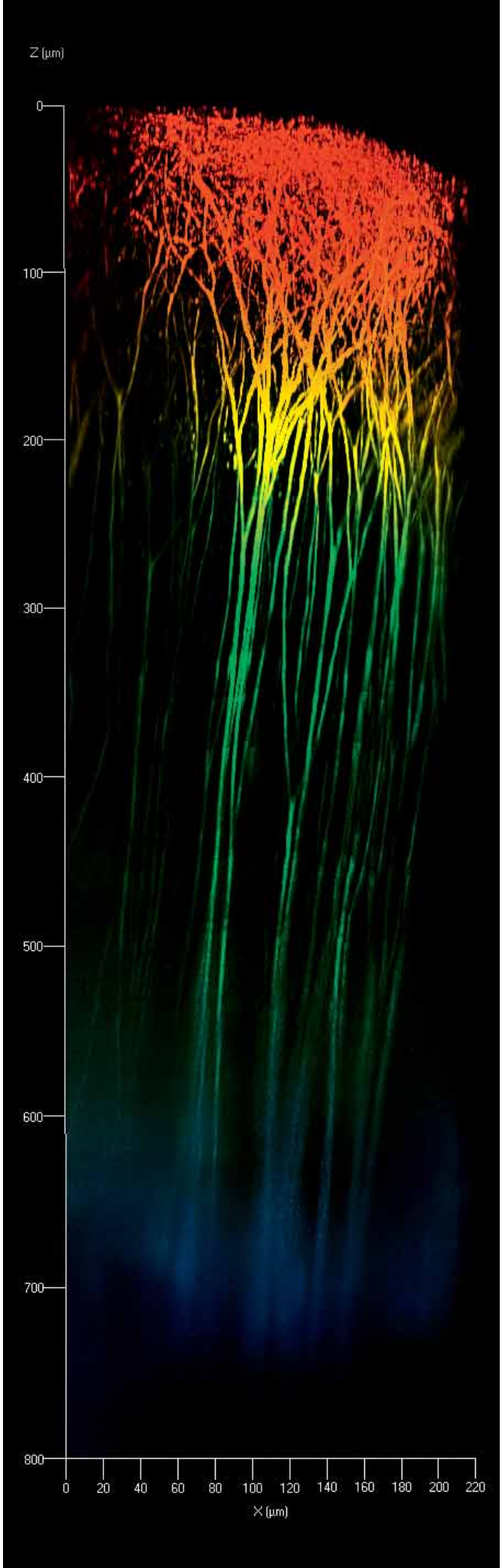
Femtosecond lasers excite the fluochrome only at the focus.



Energy diagram of fluorescence generation with multiphoton excitation.



Beam path of the excitation and emission light in a confocal laser scanning microscope. The confocal pinhole allows the creation of optical sections by hiding fluorescence signals of non-focal levels.



Mouse: EYFP-expressing cortical pyramidal neurons from layer V. Excitation with 920 nm. 3D-projection of an intravitally acquired stack of 600 single pictures. Specimen: F. Nadrigny, F. Kirchhoff, MPI for Experimental Medicine, Göttingen, Germany

LSM 710 NLO with Axio Examiner.

» Multiphoton imaging requires an efficient NDD light path. The LSM 710 NLO offers many improvements that result in brighter images and deeper penetration. Also, the configuration of NDD modules is very flexible, allowing simultaneous acquisition of many channels for multicolor imaging.«

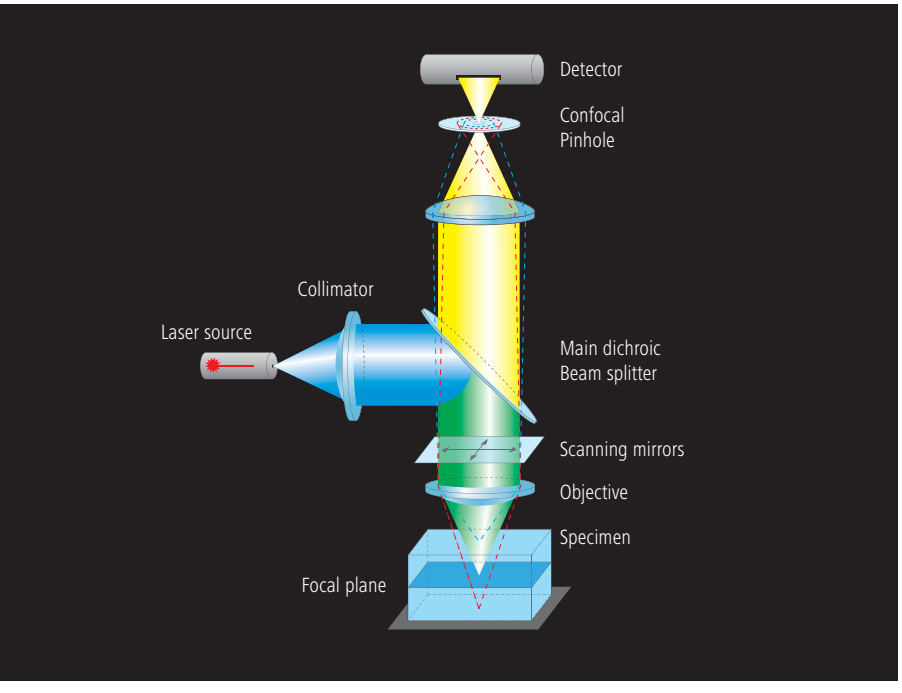
Dr. Stephen Turney, MCB, Harvard University, Boston, USA

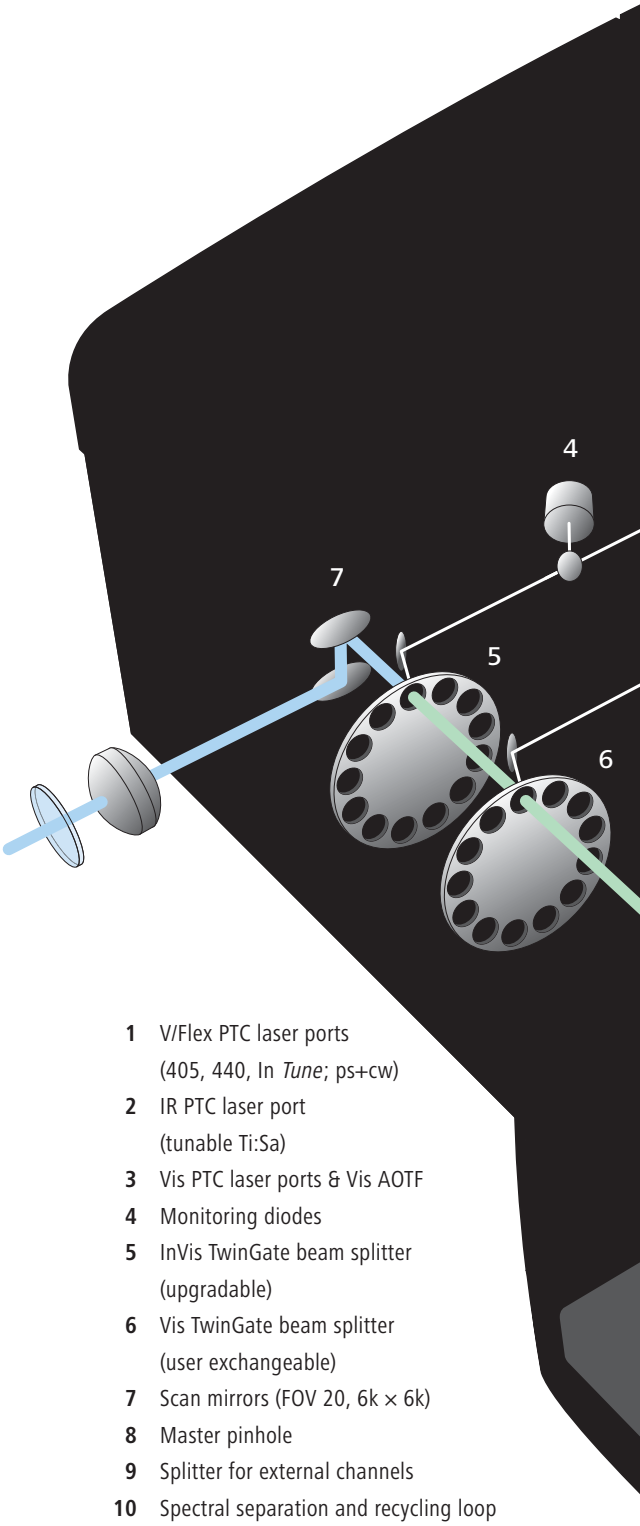
Confocal Microscopy

The advantage of confocal light microscopy: capturing the light emitted by a single plane of a sample.

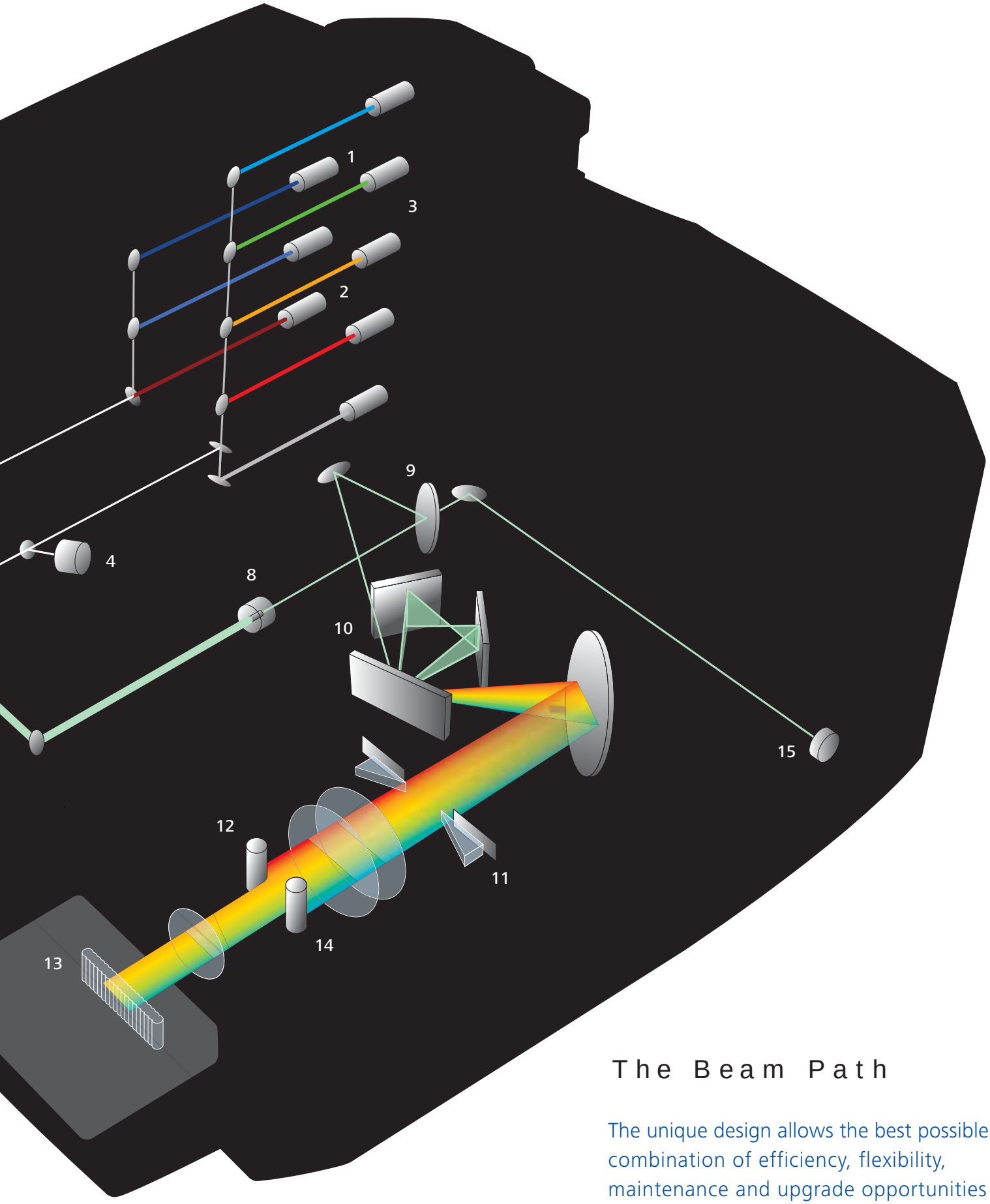
A laser beam scans the specimen pixel by pixel and line by line. A pinhole conjugated to the focal plane obstructs the light emerging from objects outside that plane so that only light from objects that are in focus can reach the detector.

The pixel data gathered using this method are then assembled to form an image that represents an optical section of the specimen and is distinguished by high contrast and high resolution in the X, Y and Z planes. Several images generated by means of shifting the focal plane can be combined into a 3D image stack.





1 V/Flex PTC laser ports (405, 440, In *Tune*; ps+cw)
2 IR PTC laser port (tunable Ti:Sa)
3 Vis PTC laser ports & Vis AOTF
4 Monitoring diodes
5 InVis TwinGate beam splitter (upgradable)
6 Vis TwinGate beam splitter (user exchangeable)
7 Scan mirrors (FOV 20, 6k × 6k)
8 Master pinhole
9 Splitter for external channels
10 Spectral separation and recycling loop
11 Spectral beam guides
12 QUASAR PMT spectral channel # 1
13 QUASAR PMT spectral channels # 2–33 (or # 2)
14 QUASAR PMT spectral channel # 34 (or # 3)
15 Ext. channels (# 4 + 5: APDs, FLIM, FCS etc.)

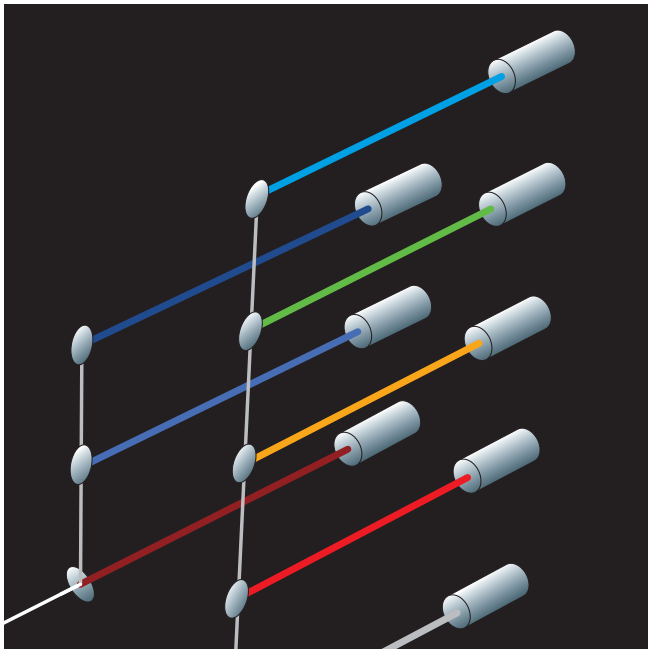


The Beam Path

The unique design allows the best possible combination of efficiency, flexibility, maintenance and upgrade opportunities in a compact construction.

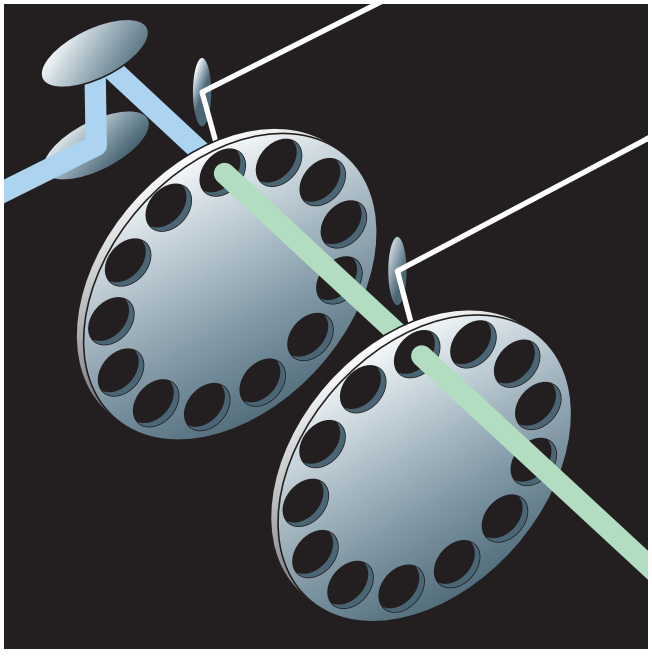
Innovations in Detail

Besides an optimized overall-design, the LSM 710 introduces four outstanding innovations to create the best conditions for quality and sensitivity of the fluorescence signals, from the laser source to the final detection.



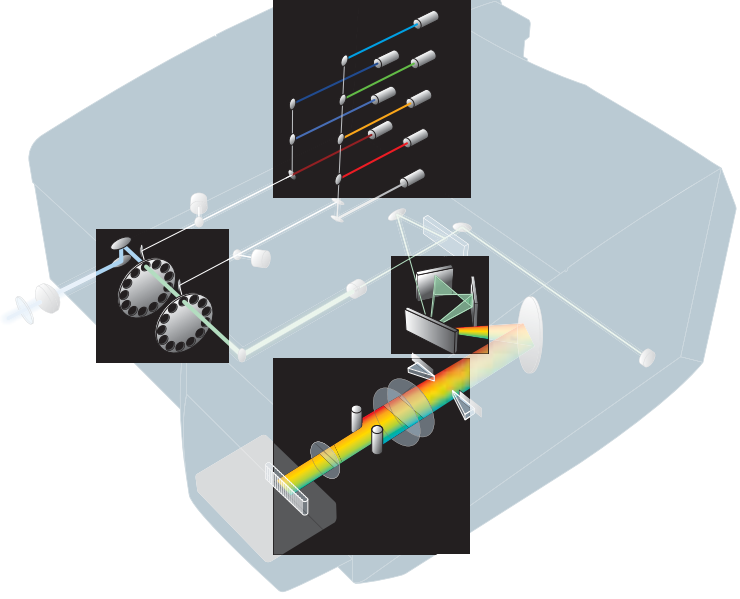
PTC Laser Concept

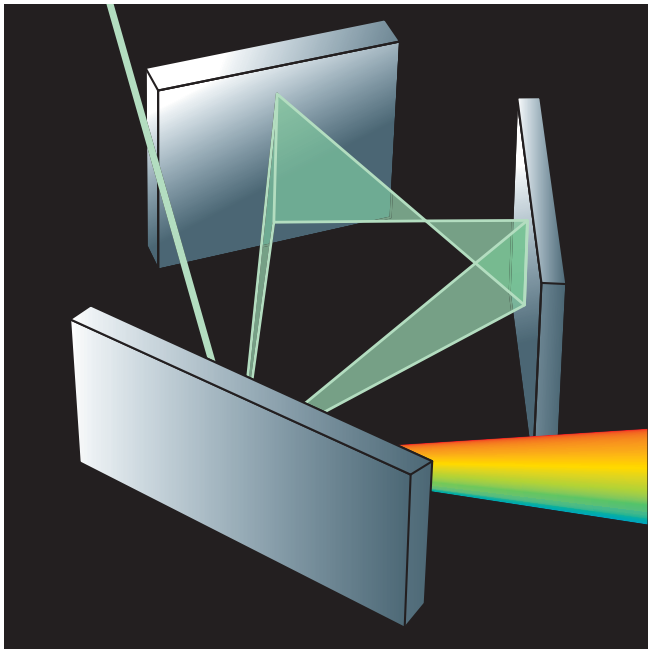
The LSM 710 features a revolutionary PTC laser concept: there is no longer any laser module. Instead, all lasers are so-called "pigtailed" versions, which can be plugged directly into the scanning module. Up to eight ports in the LSM 710 scanning module allow direct coupling for near-UV, VIS and IR-lasers in free combinations. As a fortunate by-product, you save space in your lab and reduce the heat generated by the lasers. Upgrades of future laser lines are easy and cost-effective.

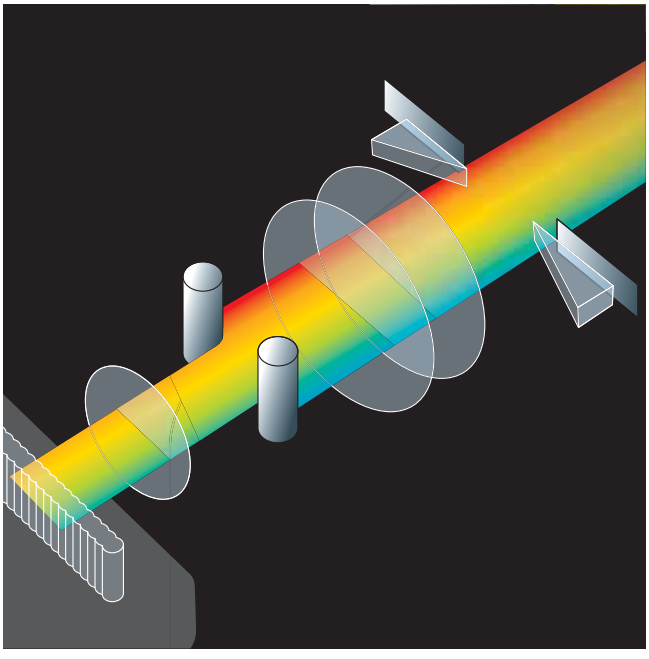


TwinGate Main Beamsplitter

The LSM 710 incorporates the new TwinGate main beam splitter to permit almost infinite excitation combinations. This combination of two high-transmission dichroic filter wheels lets you choose up to 100 combinations of laser lines for fluorescence excitation. Since four lines can be used simultaneously, this guarantees complete flexibility for your experiments. You can also exchange Vis-range filters for future laser upgrades, but that's not all – the new shape results in an absolutely outstanding suppression of the excitation laser light for improved SNR.







Spectral Recycling Loop

As a result of their even separation of colors, gratings are ideal for splitting light into its spectrum. The LSM 710 has another revolutionary feature: the spectral recycling loop, which provides a boost in signal by feeding any non-separated portion of the signal through the grating a second time. The resulting spectral signal is ideal for high resolution spectral imaging (up to 3 nm) or the simultaneous detection of up to 10 dyes. The LSM 710 also offers ultimate freedom since any portion of the spectrum can be guided to any detector unit.

QUASAR Detector

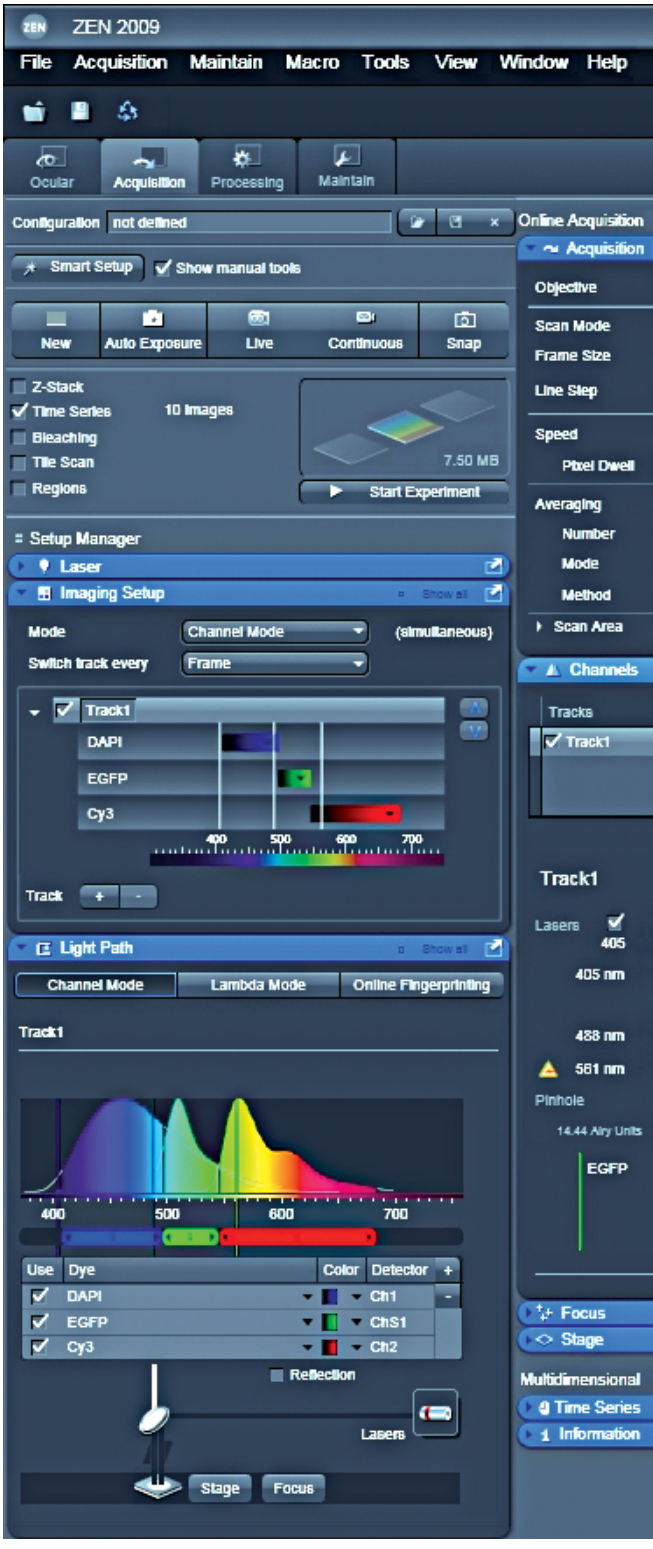
The LSM 710 employs a next generation QUASAR detector (Quiet Spectral Array) that offers two innovations. First, the sensitivity of our PMT array has been greatly enhanced by using a brand new model with three times lower dark noise. Part of this achievement comes from the improved match of the detection area with the beam dimensions. Second, there is not just one spectral detector but a choice between a two-channel, three-channel or full 34-channel configuration. All three offer excellent sensitivity, the lowest dark noise possible and 3–10 noise-free digital gains to adjust the balance of even the most extreme dye combinations.

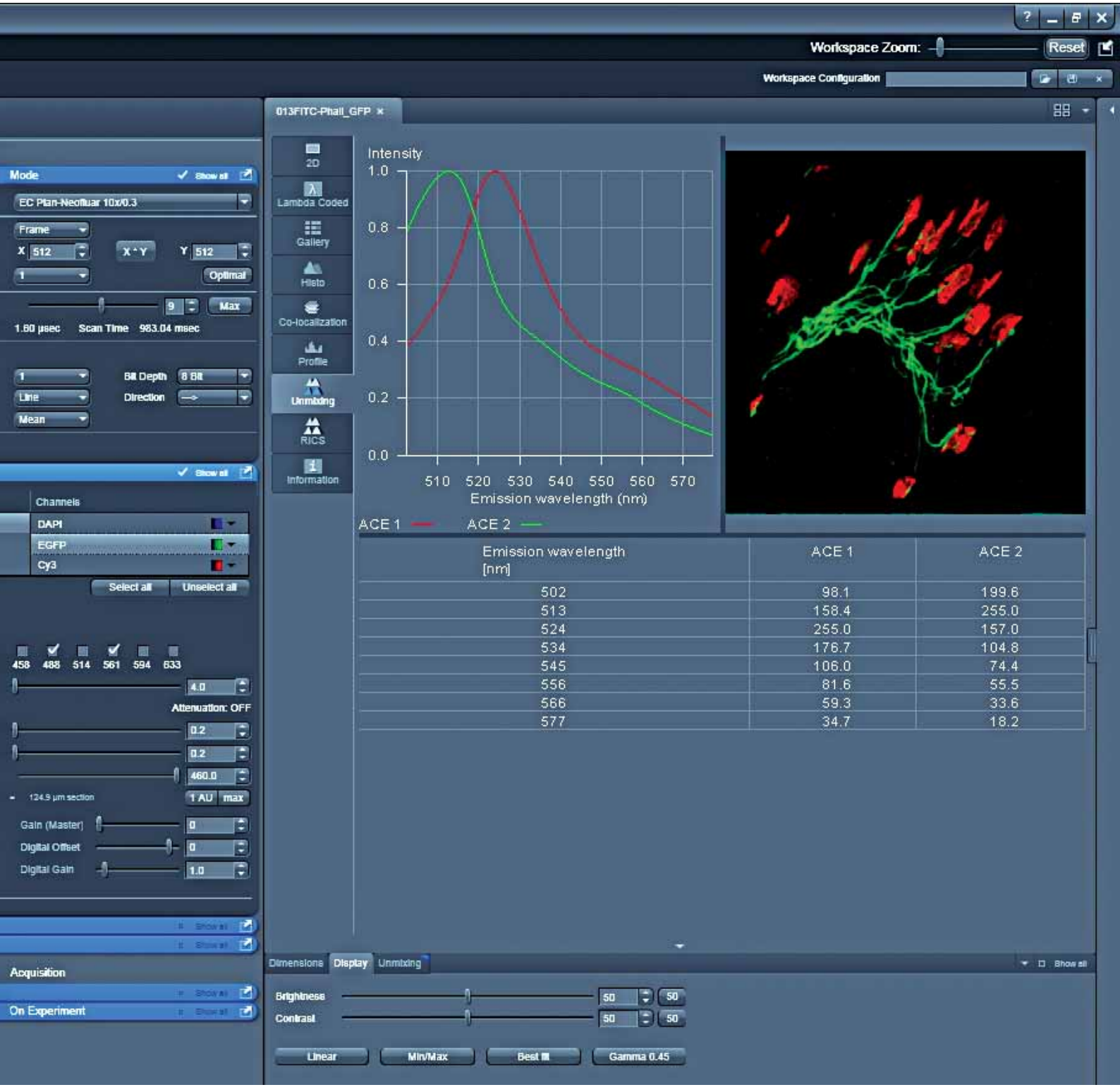
ZEN Software: The Perfect User Interface for Your Applications

The LSM 710 uses ZEN, ZEISS's efficient navigation software.

ZEN offers not only a logical, easy-to-understand user interface but also an improved color scheme for work that involves microscopy.

In this way, the monitor won't be a "floodlight" in your laboratory, constraining experiments with weak fluorescences and challenging the eye with a contrast bath. The ZEN workflow meets your intuitive, natural expectations. It offers exactly the tools you need for each step, presented in a clearly arranged way.





Emission wavelength [nm]	ACE 1	ACE 2
502	98.1	199.6
513	158.4	255.0
524	255.0	157.0
534	176.7	104.8
545	106.0	74.4
556	81.6	55.5
566	59.3	33.6
577	34.7	18.2

LSM 710
Technical Data

Microscopes	
Stands	Upright: Axio Imager.Z2, Axio Imager.M2p, Axio Examiner.Z1, with tube or rear port; Inverted: Axio Observer.Z1 with side port or rear port
Z drive	Smallest increments: Axio Imager.Z2, Axio Imager.M2p: < 25 nm; Axio Observer.Z1: < 25 nm; Axio Examiner: < 30 nm; fast Piezo objective or stage focus accessory; Definite Focus unit for stand
XY stage (option)	Motorized XY-scanning stage, with Mark & Find function (xyz) and Tile Scan (mosaic scan); smallest increments 1 µm (Axio Observer) or 0.2 µm (Axio Imager)
Accessories	Digital microscope camera AxioCam; integration of incubation chambers; micromanipulators; etc

Scanning Module	
Models	Scanning module with 2, 3, or 34 spectral detection channels; high QE, 3 × lower dark noise; up to 10 individual, adjustable digital gains; prepared for lasers from V (405) to IR
Scanners	Two independent, galvanometric scan mirrors with ultra-short line and frame flyback
Scan resolution	4 × 1 to 6144 × 6144 pixels; also for multiple channels; continuously variable
Scanning speed	14 × 2 speed stages; up to 12.5 frames/sec with 256 × 256 pixels; 5 frames/sec with 512 × 512 pixels (max. 77 frames/sec 512 × 32); min 0.38 ms for a line of 512 pixels; up to 2619 lines per second
Scan zoom	0.6 × to 40 ×; digital variable in steps of 0.1 (on Axio Examiner 0.67 × to 40 ×)
Scan rotation	Free rotation (360 degrees), in steps of 1 degree variable; free xy offset
Scan field	20 mm field diagonal (max.) in the intermediate plan, with full pupil illumination
Pinholes	Master-pinhole pre-adjusted in size and position, individually variable for multi-tracking and short wavelengths (e.g. 405 nm)
Beam path	Exchangeable TwinGate main beamsplitter with up to 100 combinations of excitation wavelengths and outstanding laser light suppression; optional laser notch filters for fluorescence imaging on mirror-like substrates (on request); outcoupling for external detection modules (e.g., FCS, B&H FLIM); low-loss spectral separation with recycling loop for internal detection
Spectral detection	Standard: 2, 3, or 34 simultaneous confocal fluorescence channels with highly sensitive low dark noise PMTs; spectral detection range freely selectable (resolution down to 3 nm); in addition, two incident light channels with APDs for imaging and single photon measurements; transmitted light channel with PMT; cascadable non-descanned detectors (NDD) with PMT or GaAsP NDD unit for Axio Examiner
Data depth	8-bit, 12-bit or 16-bit selectable; up to 37 channels simultaneously detectable

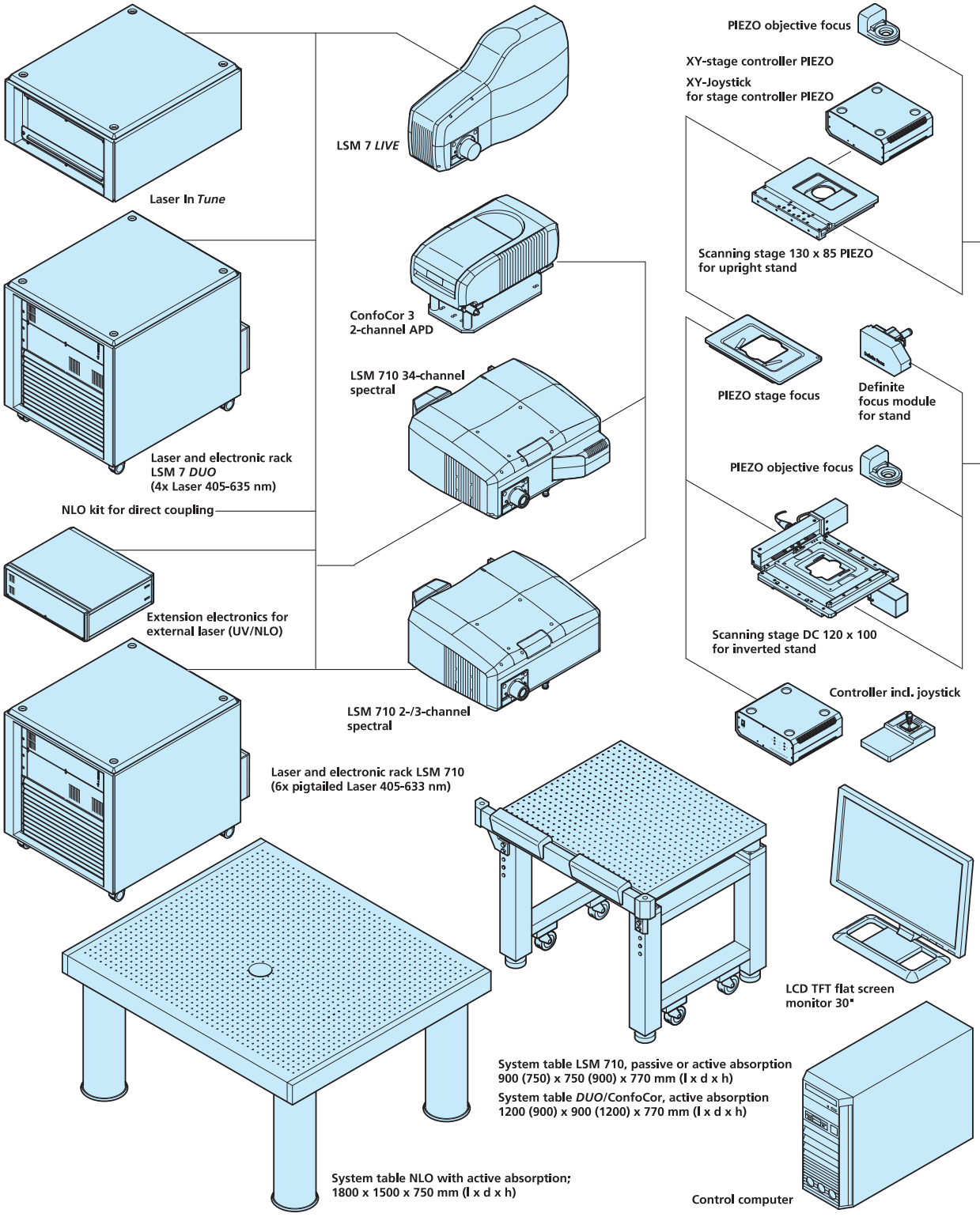
Laser Inserts	
Laser inserts (VIS, V)	(VIS, V, In *Tune*) pigtail-coupled lasers with polarization preserving single-mode fibers; stabilized VIS-AOTF for simultaneous intensity control; switching time < 5 µs, or direct modulation; up to 6 V/VIS-laser directly mountable into the scanhead; diode laser (405 nm, CW/pulsed) 30 mW; diode laser (440 nm, CW+pulsed) 25 mW; Ar-laser (458, 488, 514 nm) 25 mW or 35 mW; HeNe-laser (543 nm) 1 mW; DPSS-laser (561 nm) 20 mW; HeNe-laser (594 nm) 2 mW; HeNe-laser (633 nm) 5 mW, In *Tune* Laser, (488-640nm, <3nm width, pulsed) 1,5mW, (pre-fiber manufacturer specification)
External lasers (NLO, VIS, V)	Prepared laser ports for system extensions; direct coupling of pulsed NIR lasers of various makes (including models with prechirp compensation); fast intensity control via AOM; NIR-optimized objectives and collimation; fiber coupling (single-mode polarization preserving) of external manipulation lasers of high power in the VIS range 488–561 nm (e.g., LSM 7 DUO-systems)

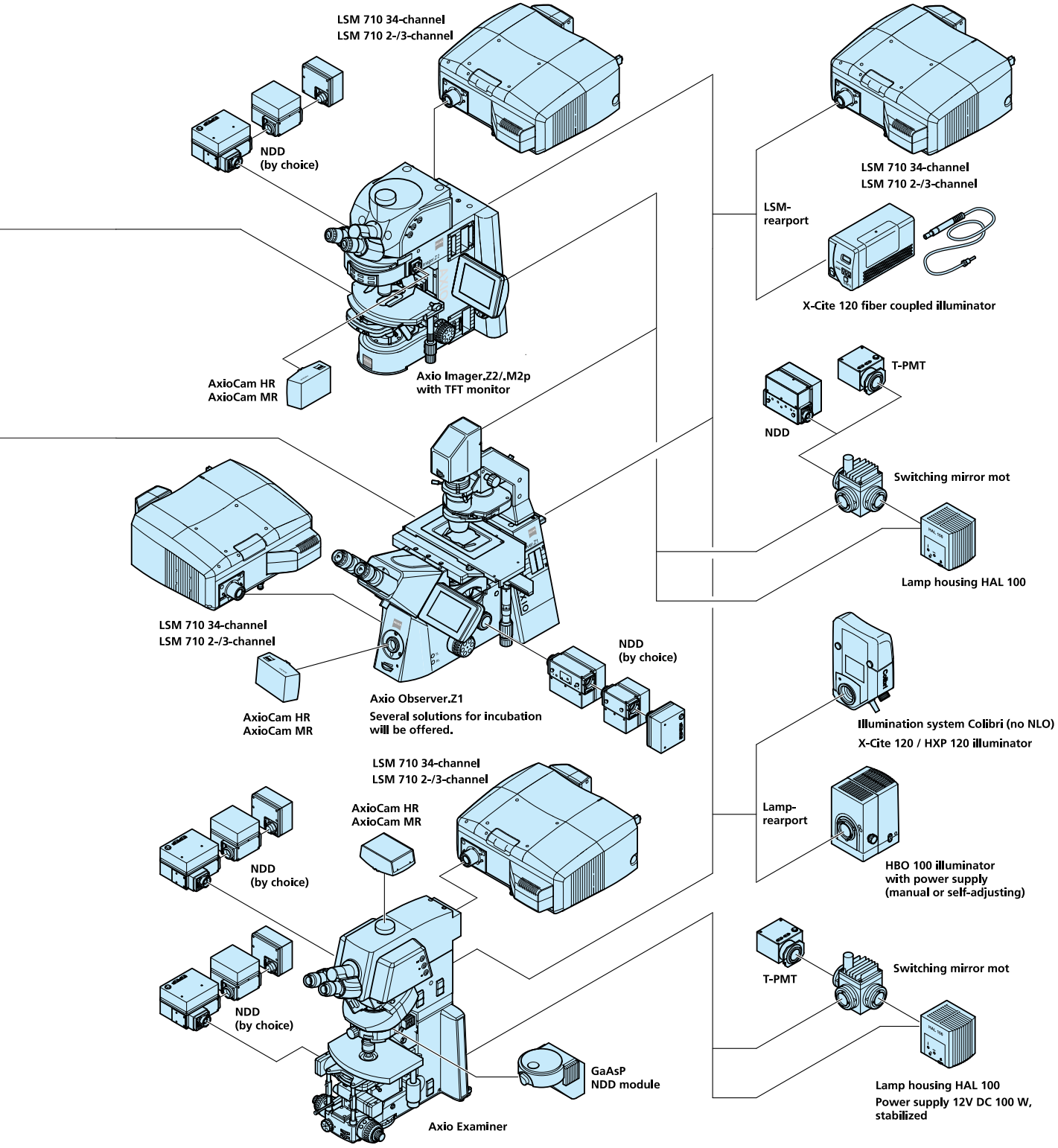
Electronics Module	
Real-time electronics	Control of the microscope, the lasers, the scan module and other accessory components; control of the data acquisition and synchronization by real-time electronics; oversampling readout logic for best sensitivity and 2 × better SNR; data communication between real-time electronics and user PC via Gigabit-Ethernet interface with the possibility of online data analysis during image acquisition
User PC	Workstation PC with abundant main and hard disk memory space; ergonomic, high-resolving 16:10 TFT flat panel display; various accessories; operating system Windows VISTA 32 or 64-bit; multi-user capable

Standard Software ZEN	
System configuration	Workspace for comfortable configuration of all motorized functions of the scanning module, the lasers and the microscope; saving and restoring of application-specific configurations (ReUse)
System self-test	Calibration and testing tool for the automatic verification and optimal adjustment of the system
Acquisition modes, Smart setup	Spot, line / spline, frame, z-stack, lambda stack, time series and all combinations (xyz l t); online calculation and display of ratio images; averaging and summation (line / framewise, configurable); step scan (for higher frame rates); smart acquisition setup by selection of dyes
Crop function	Convenient and simultaneous selection of scanning areas (zoom, offset, rotation)
RealROI scan, spline scan	Scanning of up to 99 arbitrarily shaped ROIs (regions of interest); pixel precise switching of the laser; ROI definition in z (volume); scan along a freely defined line
ROI bleach	Localized bleaching of up to 99 bleach ROIs for applications such as FRAP (fluorescence recovery after photobleaching) or uncaging; use of different speeds for bleaching and image acquisition; use of different laser lines for different ROIs
Multitracking	Fast change of excitation lines at sequential acquisition of multicolor fluorescence for reduction of signal crosstalk
Lambda scan	Parallel or sequential acquisition of image stacks with spectral information for each pixel
Linear unmixing	Generation of crosstalk-free multi-fluorescence images with simultaneous excitation; spectral unmixing – online or offline, automatically or interactively; advanced logic with reliability figure
Visualization	XY, orthogonal (xy, xz, yz); cut (3D section); 2.5D for time series of line scans; projections (maximum intensity); animations; depth coding (false colors); brightness; contrast and gamma settings; color selection tables and modification (LUT); drawing functions
Image analysis and operations	Colocalization and histogram analysis with individual parameters; profile measurements on any line; measurement of lengths, angles, surfaces, intensities etc; operations: addition, subtraction, multiplication, division, ratio, shift, filtering (low pass, median, high-pass, etc; also customizable)
Image archiving, exporting & importing	Functions for managing of images and respective recording parameters; multi-print function; over 20 file formats (TIF, BMP, JPG, PSD, PCX, GIF, AVI, Quicktime, etc) for export

Optional Software	
LSM Image VisArt plus	Fast 3D and 4D reconstruction; animation (different modes: shadow projection, transparency projection, surface rendering); package 3D for LSM with measurement functions upon request
3D-Dekonvolution	Image restoration on the basis of calculated point-spread function (modes: nearest neighbor, maximum likelihood, constraint iterative)
Physiologie / Ion concentration	Extensive analysis software for time series images; graphical means of ROI analysis; online and offline calibration of ion concentrations
FRET plus	Recording of FRET (fluorescence resonance energy transfer) image data with subsequent evaluation; supports both the methods acceptor photobleaching and sensitized emission
FRAP	Wizard for recording of FRAP (fluorescence recovery after photobleaching) experiments with subsequent analysis of the intensity kinetics
Visual Macro Editor	Creation and editing of macros based on representative symbols for programming of routine image acquisitions; package multiple time series with enhanced programming functions upon request
VBA-Macro-Editor	Recording and editing of routines for the automation of scanning and analysis functions
Topographie-Paket	Visualization of 3D surfaces (fast rendering modes) plus numerous measurement functions (roughness, surfaces, volumes)
StitchArt plus	Mosaic scan for large surfaces (multiple XZ profiles and XYZ stacks) in brightfield and fluorescence mode
ICS Image Correlation Spectroscopy (PMT)	Single molecule imaging and analysis for all LSM 710 systems with PMT detectors (published by Gratton)
FCS/ConfoCor Basic, Diffusion, Fitting	FCS and FCCS single molecule analysis for systems with ConfoCor 3 (APD) extension
FCS Module PCH	Photon counting histogram extension for systems with ConfoCor 3 (APD) extension

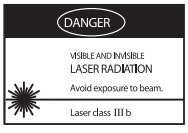
LSM 710
System Overview




LSM 710 34-channel
LSM 710 2-/3-channel
NDD
(by choice)
AxioCam HR
AxioCam MR
Axio Imager.Z2/.M2p
with TFT monitor
LSM 710 34-channel
LSM 710 2-/3-channel
LSM-
rearport
X-Cite 120 fiber coupled illuminator
T-PMT
NDD
Switching mirror mot
Lamp housing HAL 100
LSM 710 34-channel
LSM 710 2-/3-channel
AxioCam HR
AxioCam MR
Axio Observer.Z1
Several solutions for incubation
will be offered.
NDD
(by choice)
Illumination system Colibri (no NLO)
X-Cite 120 / HXP 120 illuminator
LSM 710 34-channel
LSM 710 2-/3-channel
AxioCam HR
AxioCam MR
NDD
(by choice)
Lamp-
rearport
HBO 100 illuminator
with power supply
(manual or self-adjusting)
NDD
(by choice)
T-PMT
Switching mirror mot
GaAsP
NDD module
Lamp housing HAL 100
Power supply 12V DC 100 W,
stabilized
Axio Examiner

Patents:
www.zeiss.de/micro-patents

Literature:
www.zeiss.de/lsm



The Universal System for All Applications

	2–/3–channel	34–channel	DUO extension	NLO extension	APD extension
3D examinations	● ● ●	● ● ●			
Multifluorescence	● ● ●	● ● ●			
Colocalization	● ● ●	● ● ●			
Spectral imaging	● ●	● ● ●			
Live cell imaging	● ● ●	● ● ●			
Ion imaging	● ● ●	● ● ●			
RICS	● ● ●	● ● ●			
FLIM (by Becker & Hickl)	● ● ●	● ● ●			
FRET (various methods)	● ● ●	● ● ●			
FRAP und FLIP	● ●	● ●	● ● ●		
Photoactivation/-conversion	● ●	● ●	● ● ●		
Uncaging	●	●	● ● ●	● ●	
***In-vivo* examinations**				● ● ●	
3D in-depth imaging				● ● ●	
FCS auto-correlation					● ● ●
FCS cross-correlation					● ● ●

Technology beyond the limits of traditional confocal systems

- PTC lasers – upgradeable ports for outstanding excitation flexibility
- Ideal geometry main beam splitter for outstanding laser light suppression
- TwinGate – exchangeable main beam splitter with >50 combinations
- Definite focus unit on microscope stand for focus stability
- Cascadable NDDs 2–8 on the microscope stand for multicolor NLO detection
- Coupling port for extension units, e.g., for FCS, FLIM and photon counting
- Spectral recycling loop for low-loss spectral separation and ultimate stability
- QUASAR: parallel spectral detector with best SNR
- RICS for quantitative single molecule analysis in standard images

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

Information subject to change.
Printed on environmentally friendly paper bleached without chlorine.
60-1-0014/e – printed 05.09