Zeiss LSM780, confocal microscope system

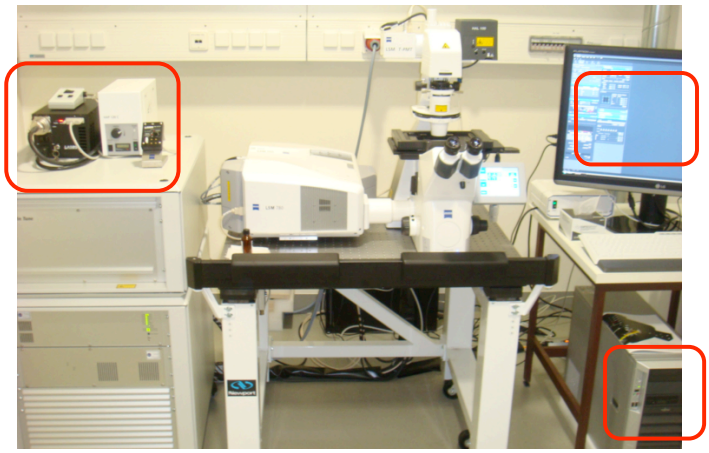
Short description:

- 34 simultaneous confocal fluorescence counting channels with highly sensitive low dark noise PMTs (2x) and GaAsP (32x) array
- 1 transmission PMT
- Conventional and photon counting
- Uni- and bidirectional scan, simultaneous and/or sequential image acquisition
- Software:
  - Lambda scan, linear unmixing
  - FRET plus
  - FRAP, FLIP
  - FCS, RICS
  - Multiple Time Series
  - VisArt plus

➢ Best suited for quantitative 3D confocal imaging

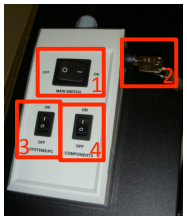
SWITCHING ON&OFF Procedures of the LSM 780

The only switches needed for switching the system ON & OFF are located here:

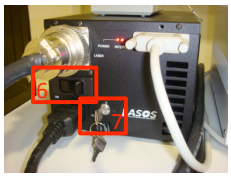


SWITCHING ON:

Follow the order!



- Switch ON the main switch (1) and the safety lock (2).
- Switch ON power remote switches for Systems/PC (3) and Components (4).



If the Argon multiline laser (458, 488 & 514 nm) is required:

- Make sure the idle-run switch (5) is set to idle.
- Switch ON the laser via the toggle switch (6), wait 30 s, and turn ON the key (7).
- The laser is automatically kept in standby mode for 5 minutes to warm up.
- Set the idle-run switch (5) to run.
- The laser is ready when the green LED is on (8).

(Optional)

- Switch ON the main switch (9) of the X-cite 120 for reflected light illumination (epifluorescence).

- Switch ON computer (10) and start ZEN software.

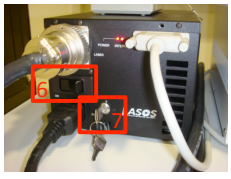
SWITCHING OFF:

Follow the order!

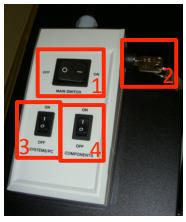
- Switch OFF DPSS 561, InTune and HeNe633 lasers (11) and exit the ZEN software.

- Shut down the computer.

- Switch OFF the Argon multiline laser with, first, the idle-run switch (back to idle!) (5) and, second, the key switch (7).
- Wait until the fan of the Argon laser has switched off (5 min approx.).



- Switch off the main power (6) **after the fan of the Argon laser has switched off.**

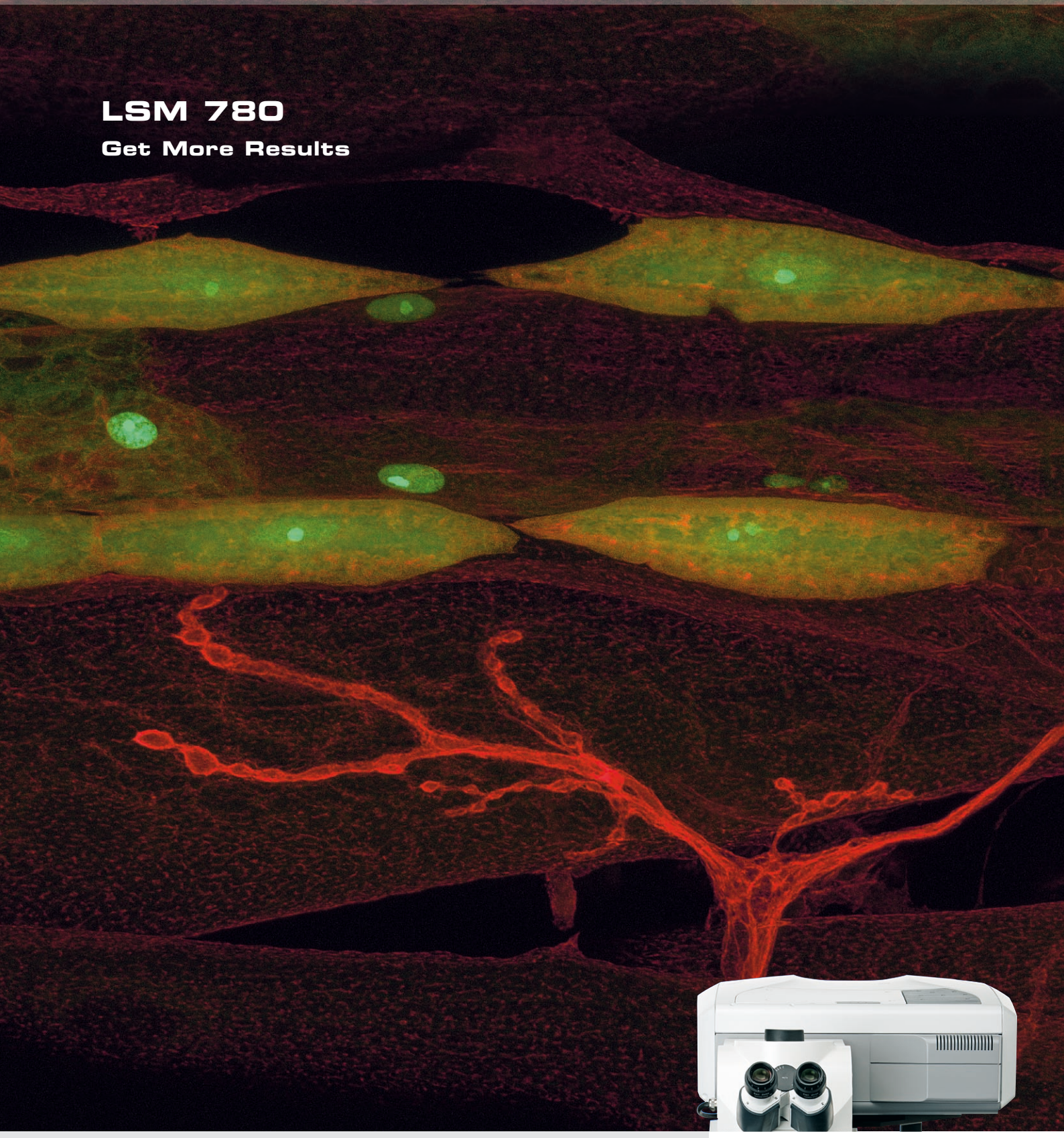


- On the power remote switch, turn OFF the Components switch (4) and the Systems/PC switch (3).
- Switch OFF the safety lock (2) and the main switch (1).

- Switch OFF the X-cite 120 lamp (9) at any time when not needed anymore.

LSM 780

Get More Results



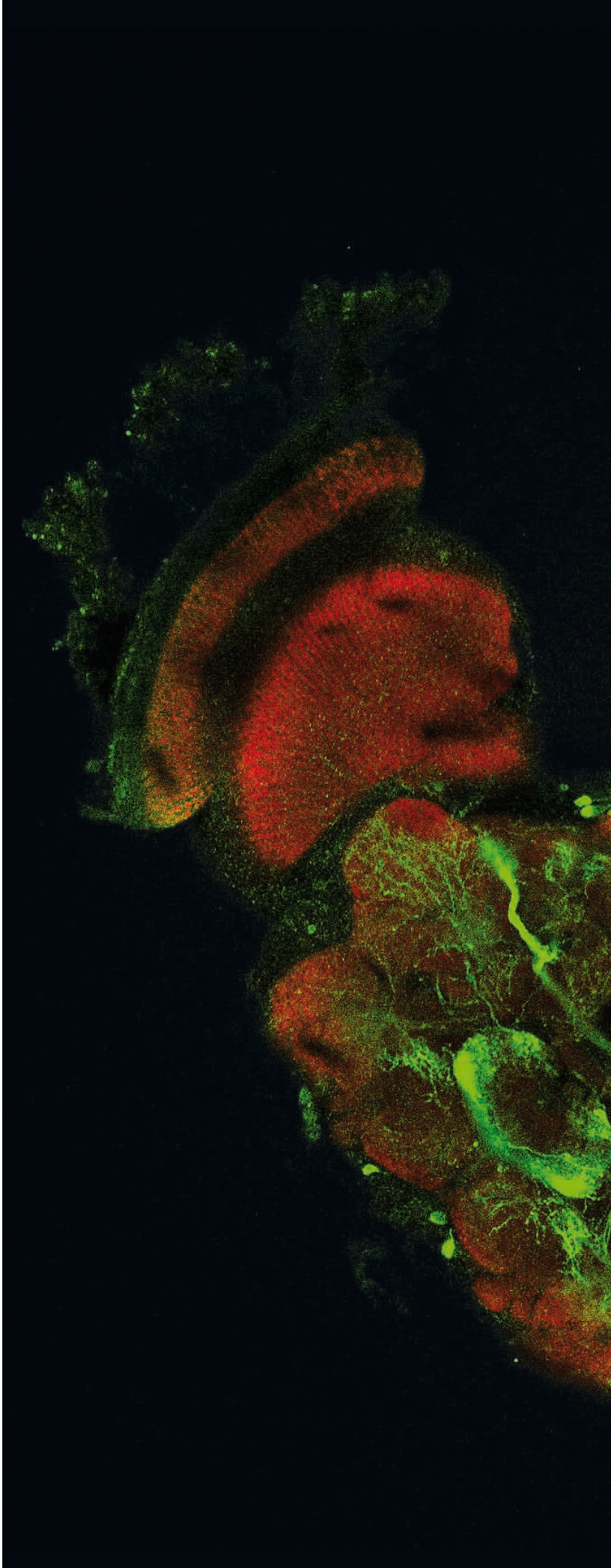
The New Detection Quality in Confocal Laser Scanning Microscopy.

ZEISS

We make it visible.

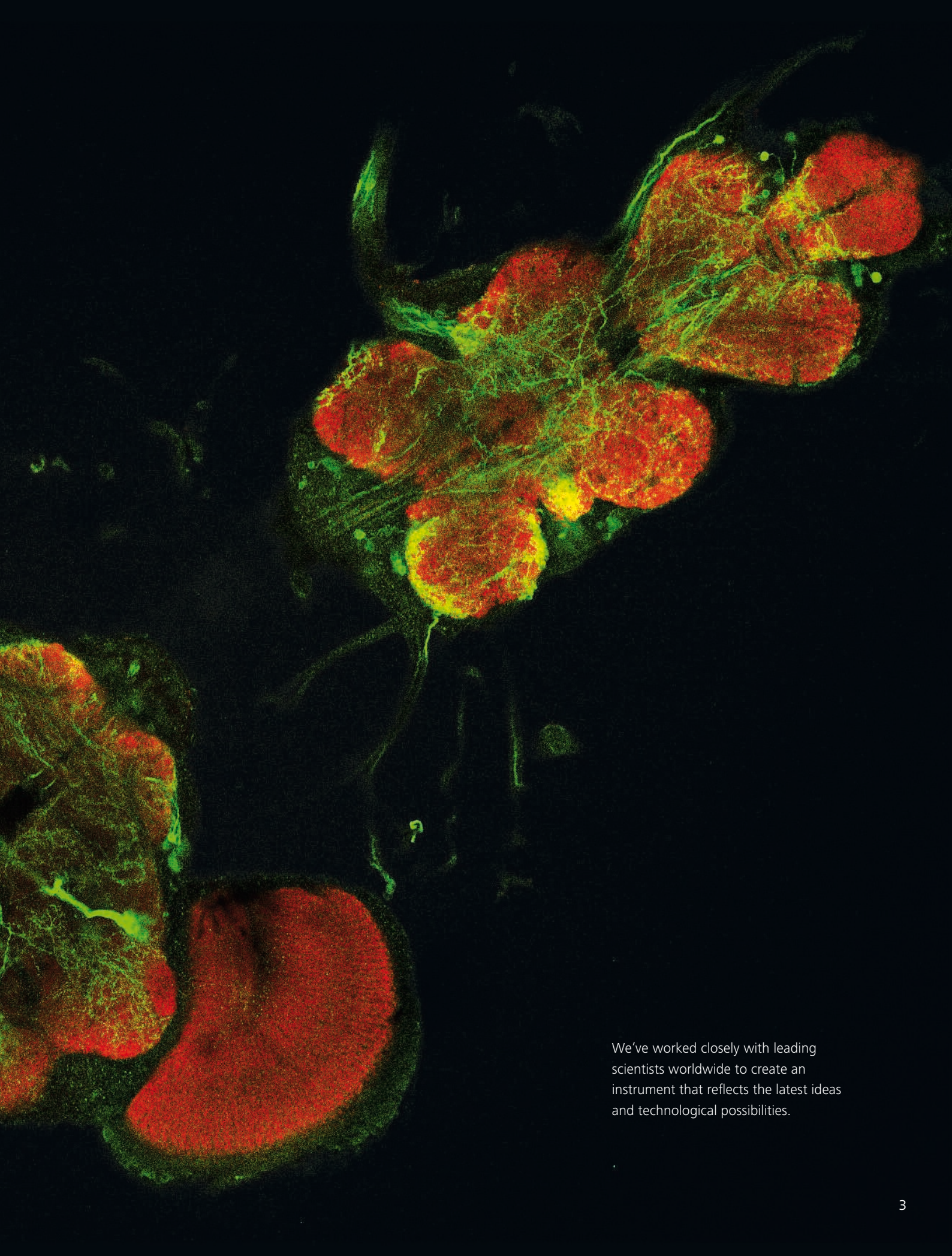
Get More Results Through Universal Detection

Just as you aim to advance scientific knowledge through your research, we are striving to equip you with the tools to make that breakthrough possible. Universal detection yields more results to drive forward your research in neurobiology, physiology, and developmental biology. This is ideal for cell and molecular biology too.



Title:
Innervation of dorsal body wall muscle next to the heart of Drosophila melanogaster larva. Red: anti-Spectrin staining. Green: GFP expressed in the heart. Ventral view. Sample: J. Sellin, University of Osnabrück, Germany.

Right:
Embryonic Drosophila melanogaster, Alexa anti-FP staining of brain structures.



We've worked closely with leading scientists worldwide to create an instrument that reflects the latest ideas and technological possibilities.

The LSM 780 with LSM *BiG*
on upright Axio Imager or Axio Examiner.

The LSM 780
on inverted Axio Observer.

Sensitivity, Spectral Imaging and Photon Counting

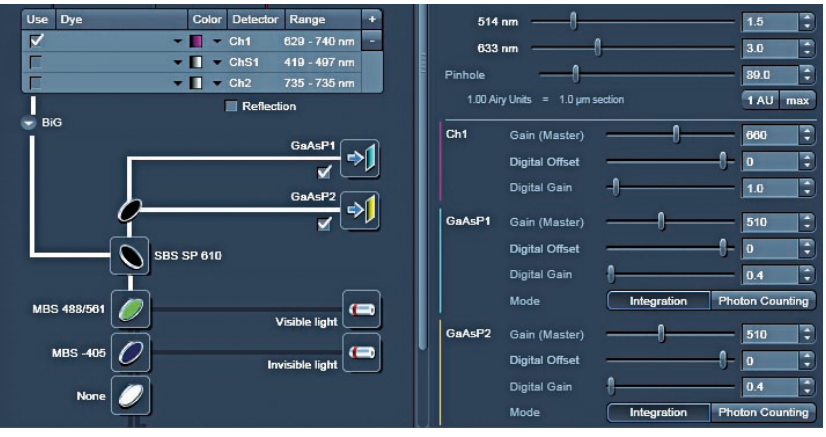
Challenging samples require more than just amplifying weak signals. You need a detector that's capable of dealing with high signal dynamics, provides low noise and allows for short pixel times.

The more demanding the application in laser scanning microscopy, the greater your need for sensitivity and reduced background noise. That's why we have taken the proven sensitivity of the LSM 710 an important step forward with the LSM 780's GaAsP spectral detector.

The group of 32+2 detectors allows you to reproduce spectral measurements reliably and without deviation. Since this is a parallel spectral detection design, it offers you simultaneous 34-channel readout in lambda mode. Up to 10 dyes can be acquired and separated at the same time. With the new GaAsP detectors, you get up to 2x better SNR for 2x faster acquisition.

With it comes a whole range of performance-enhancing improvements:

- 32-Ch GaAsP detector with 45% Quantum Efficiency (QE) typically
- Plus photon counting ability on the GaAsP and new side PMT
- Great dynamics especially to visualize weak signals
- Active cooling and oversampling photon counting mode for best SNR



The GaAsP detectors allow integration and counting detection modes.

"We haven't been able to image yeast cells on a confocal yet. With the GaAsP detector we can do this now."

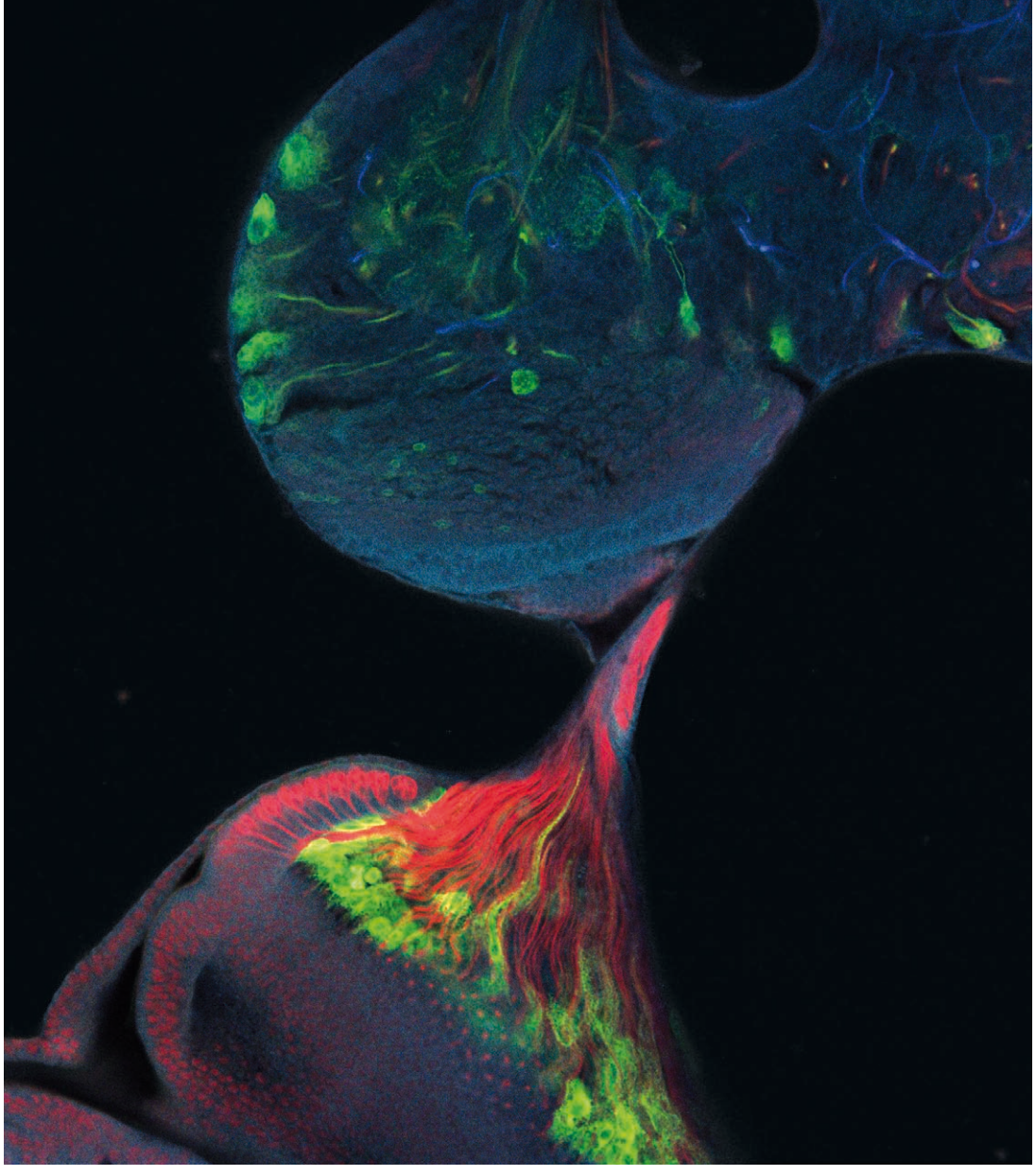
"…also, very low expressing fluorescent proteins in cultured cells can be imaged in a new quality class."

"The GaAsP detector allows to speed up acquisition by a factor of two, with the same superb image quality as usually achieved by averaging twice on the PMTs."

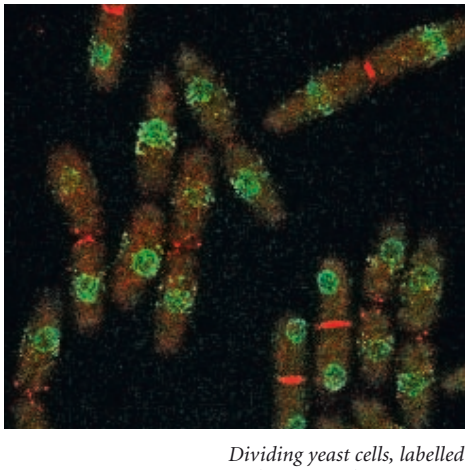
"It's a great system, we really like the image quality."

"ROI-HDR is extremely useful, especially it is implemented in such a flexible and intelligent way."

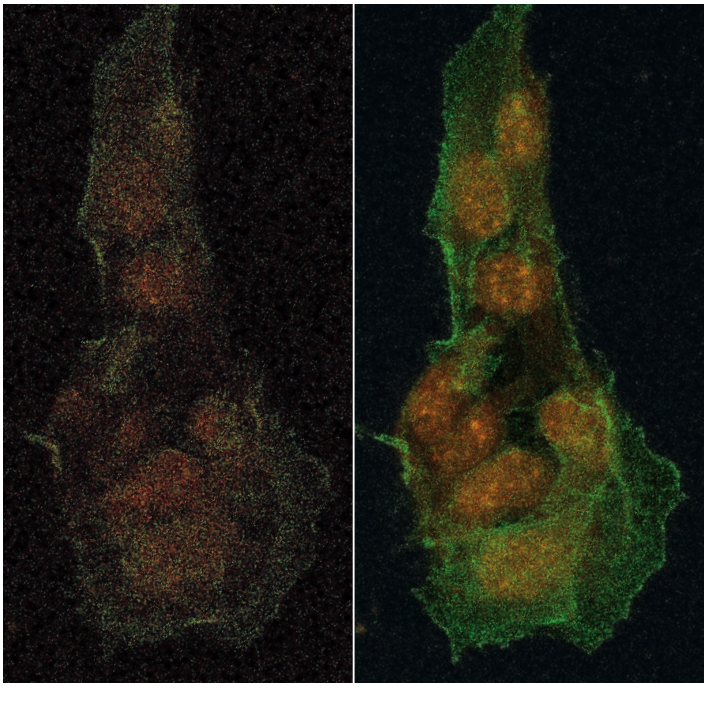
Comments of LSM 780 and LSM BiG beta testers from labs in France, the United Kingdom, and Germany.



Drosophila melanogaster larvae, developing brain and eye neuronal structures labelled with three FPs in blue, green, and red.



Dividing yeast cells, labelled with eGFP and Tomato. Sample: I. Jourdain, Cancer Research, London, UK.



Cultured 2h8 cells labelled with extremely low expressing GFP and mCherry; left PMT (almost invisible), right GaAsP. Sample: A. Bruckbauer, Cancer Research, London, UK.

Integrated FCS and FCCS

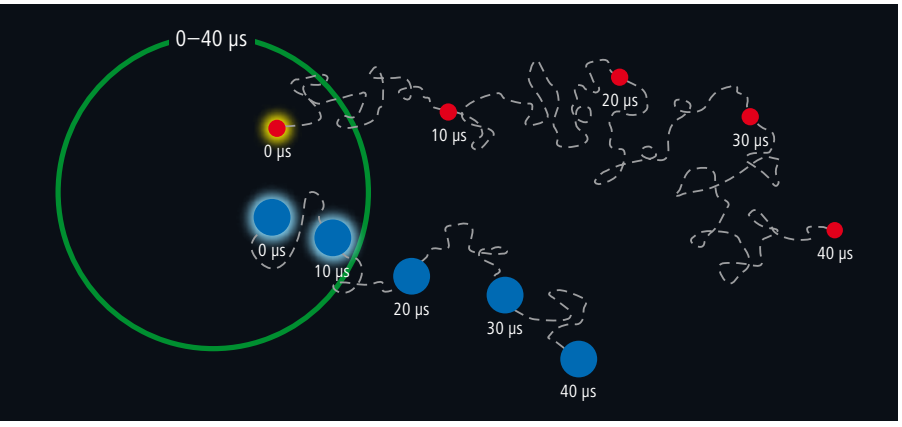
Thanks to its excellent sensitivity and counting ability, the LSM 780 lets you tap into the power of integrated spectral FCS (Fluorescence Correlation Spectroscopy) to analyze single molecule dynamics.

Fluorescence Correlation Spectroscopy (FCS) lets you analyze single molecules at a new level, using its revolutionary GaAsP detector. Up to 6 channels can be used in FCS mode, providing great flexibility in your stainings and samples.

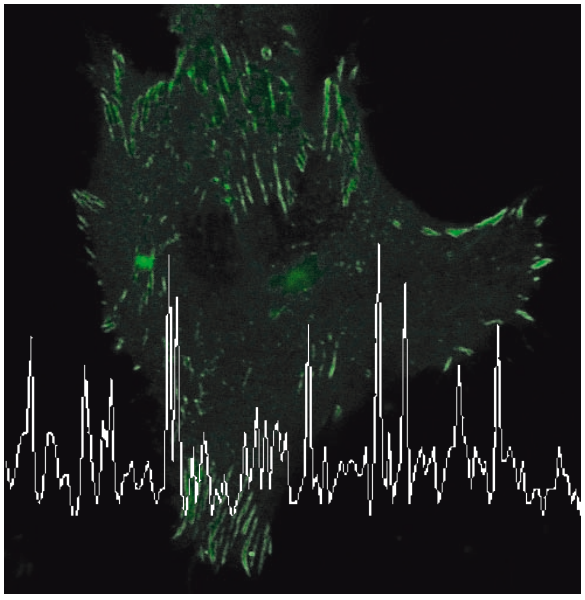
Until now, this technology required expensive external detectors. With its internal spectral detector, the LSM 780 is able to perform FCS analysis with an actively cooled, photon counting GaAsP detector.

Until now, your choice of a high sensitivity detector was limited by its ability to deal with the color of dye you were using. As a result of the spectral capability of the GaAsP detector, the dyes you choose can now be located anywhere in the whole color spectrum. That makes the LSM 780 much more versatile.

Until now, you had to compromise between very strong and very weak signals. The GaAsP detector is highly sensitive towards light and has greater dynamics as e.g. APDs, enabling you to deal with both extremes at the same time without extra settings. As a result, you save time and data volumes.

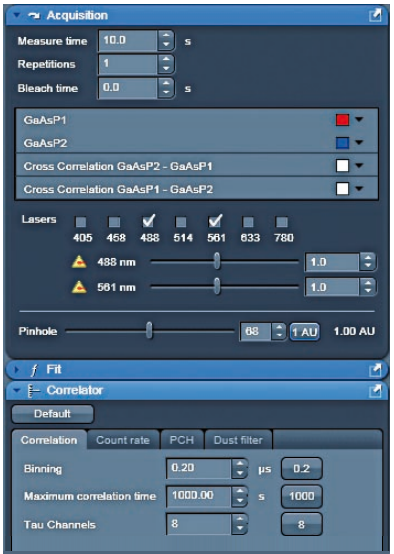


Snapshot of diffusion of particles. Spatial and time correlation can be analyzed to obtain number and speed of the molecule populations.



Areas with the best count rate or interesting regions can be chosen in the image.

Auto- and cross-correlation analysis using the GaAsP detectors.



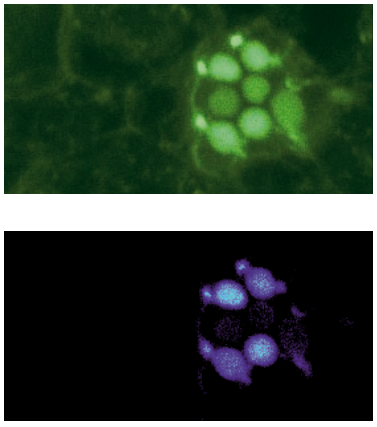
Quantitative Imaging Extensions

The spectral GaAsP detector of the LSM 780 can also be retrofitted to the LSM 710, bringing this great technology to your lab. But there are more powerful methods that can extend the data from your sample.

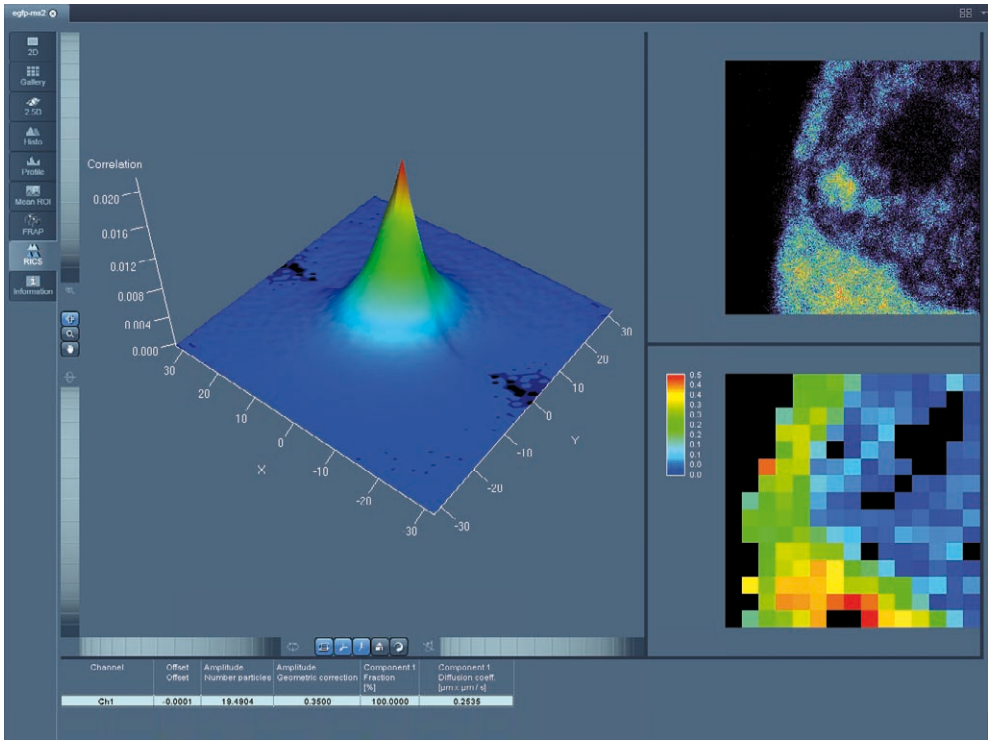
Even without the internal GaAsP detector, LSM 710 and LSM 780 systems offer possibilities that go beyond conventional imaging. The detectors in every LSM 710 and LSM 780 system offer Raster Image Correlation Spectroscopy (RICS), a method developed by E. Gratton and P. Wiseman for measuring fast protein dynamics and concentrations. RICS requires no special hardware detectors: its analysis is done in the normal scanned image and provides precise analysis of many fast-moving molecules.

Anisotropy imaging is another method that offers you an additional parameter of the emission light to investigate proteins: polarization. Because fluorescence polarization and hence anisotropy will vary according to the distance and bond of the molecules, this method tells you about the spatial proximity properties of the molecules in your sample (e.g. FRET). The polarization filters required for anisotropy can be supplied with, or retrofitted to any LSM 710 or LSM 780.

While the internal GaAsP detector is exclusive to the LSM 780, you can also enjoy many of its advances by adding the LSM *BiG* (binary GaAsP) external module to the direct coupling port. This brings authentic GaAsP performance to your LSM 710 system with its two channels allowing both sensitive imaging and FCS analysis.



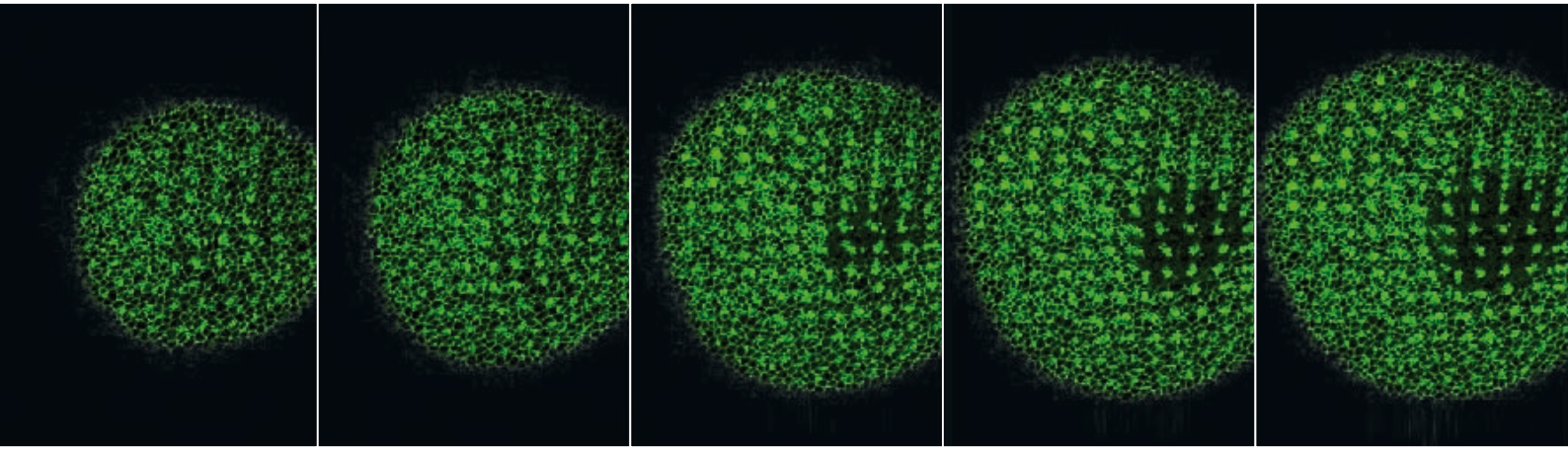
Actin filaments labelled with Alexa Fluor 488-phalloidin in the Drosophila eye, showing the Anisotropy. Only in some rhabdomers filaments are similarly oriented. Sample: O. Baumann, University of Potsdam, Institute for Biochemistry and Biology, Germany.



RICS image of GFP labelled U2OS cells with display of correlation in 2.5 D (big window) and diffusion map (bottom right). Specimen: U. Schmidt and E. Bertrand, IGMM-CNRS, Montpellier, France.

Fast OSCiscan

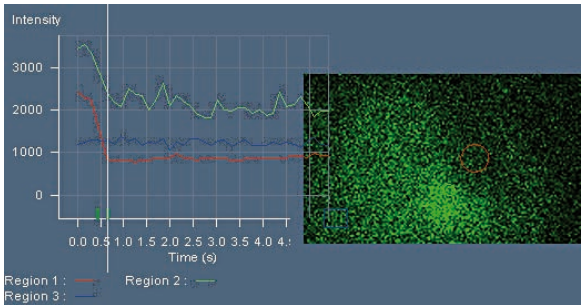
The LSM 780 and LSM 710 are both excellent live cell imaging systems. Now, with the OSCiscan, you have the fastest point scanning solution ever.



Developing Drosophila melanogaster, eye differentiation labelled with GFP e-Cadherin, 4D time lapse acquisition with fast Z-stacks. Sample: E. Chan, Cancer Research, London, UK.

Fast point scanning is usually restricted to 4-5 frames per second at full formats. Until recently the only way to go faster was in the resonance mode, which allows scanning at one resonance frequency of the scan mirrors. Since this speed is fixed at a non-ideal pixel time, the image outcome will usually be compromised by high noise.

Nuclei of yeast cells labelled with GFP, fast FRAP/FLIP time series of rapid diffusion. Sample: F. Bollet-Quivogne, Cancer Research, London, UK.



Time [s]	Intensity Region 1	Intensity Region 2	Intensity Region 3
0.000	2430.4	3435.6	1193.9
0.148	2299.3	3534.4	1244.5
0.296	2233.5	3352.4	1285.7
0.652	810.6	2390.7	1258.6
0.800	809.4	2191.2	1204.8
0.948	816.4	2089.2	1363.0
1.097	819.8	2495.8	1262.1
1.245	782.7	2381.8	1314.0
1.393	818.5	2344.0	1153.5
1.541	835.7	2015.2	1233.6
1.689	845.0	2218.4	1225.2
1.837	858.5	2619.2	1333.4
1.985	873.0	2117.9	1069.7

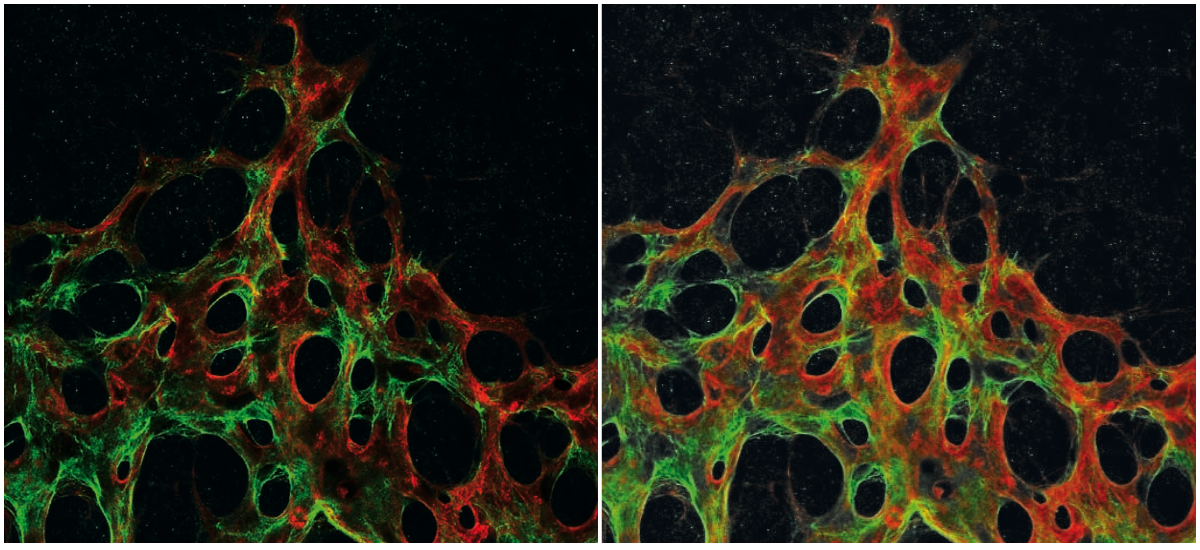
The LSM 780 and LSM 710 have now overcome this problem via the OSCimode, which allows 8 frames per second at full format or 250 fps at 512x16 pixels. The key to the OSCimode is the Online Scanner Calibration, where the position and movement of the scan mirrors are corrected on the fly during scanning. This achieves a perfect linear movement at extremely high speeds, along with the ability to choose the precise pixel time and speed your sample requires.

The absence of any annoying resonance sound is an added bonus.

Freely definable regions of interest (ROIs) are essential for bleach and photo activation experiments, whether they involve cancer research, cell death, the analysis of DNA repair proteins, protein synthesis, or the detailed mechanisms of cell division. Both the LSM 780 and LSM 710 offer ideal tools for manipulation of single and multiple ROIs with individual settings – at the fastest speeds possible.

ROI-HDR Imaging

Less damaging laser powers and higher detection dynamics yield more valid results in live cell imaging.

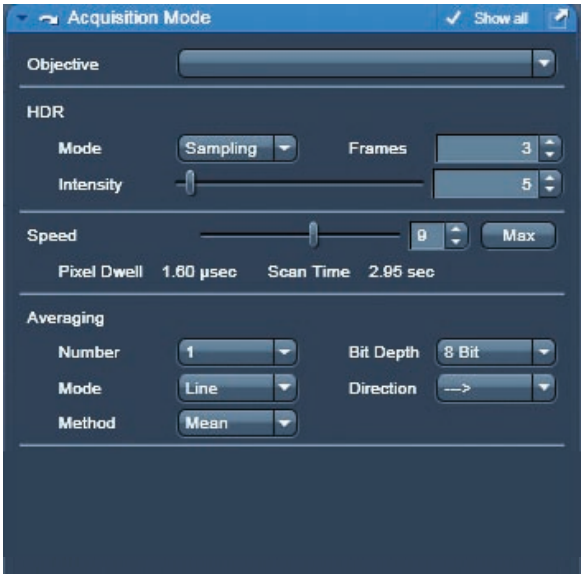


Non-neuronal retina structures labelled with Cyano-dyes, very high signal dynamics; left conventional, right HDR acquisition. Sample: F. Tatin, Cancer Research, London, UK.

High dynamic range (HDR) imaging is well known from still photography. In a live imaging system, it seems to be a bad idea to obtain multiple images and expose your sample to repeated laser illumination. However, in biological samples the fluorescence dynamics are often bigger than the capacity of the detection system. The ROI-HDR mode of the LSM 780 and LSM 710 allows you to image the weak and bright portions of a frame in the first shot (or line) and then acquire the weak signal subregions (ROIs) with a second shot to amplify them. The software lets you choose between an adapted mode or a linear mode which even allows quantitative analysis of the signals.

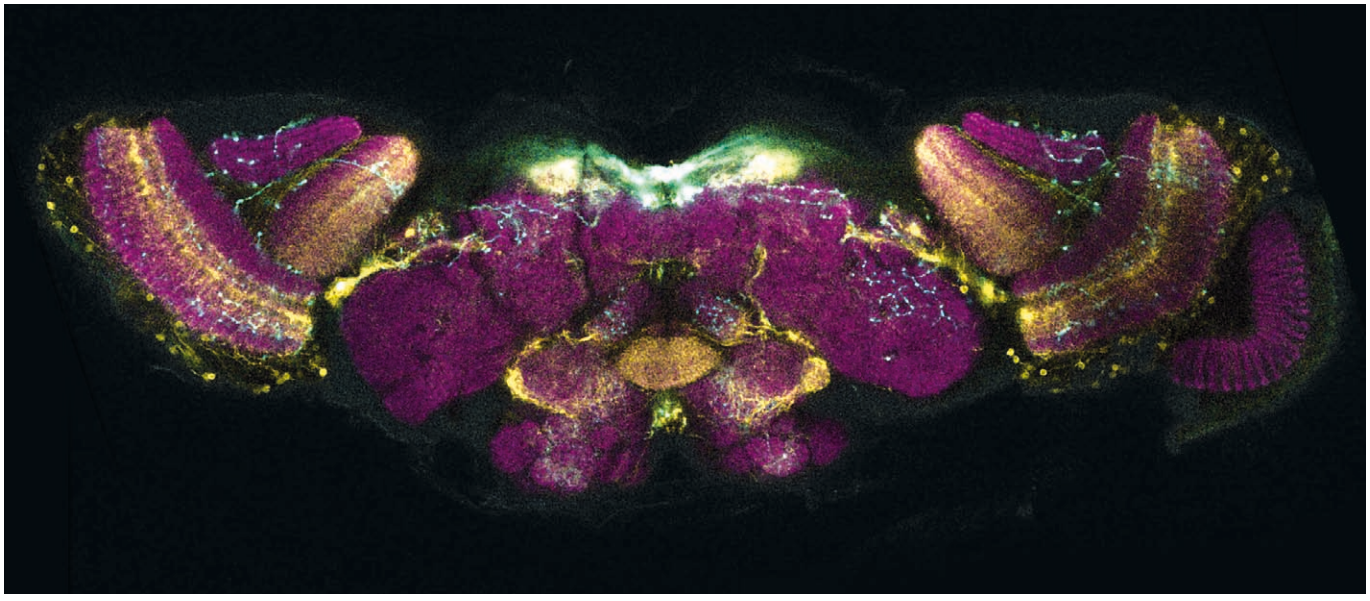
The result is an increased dynamics of the detection, without superfluous laser exposure to the sample. Without saturation, for example, a bright soma of a nerve cell can be imaged together with the weak and faint dendrites so it's altogether easier on your specimen.

The number of frames and illumination variations can be set freely for the HDR acquisition.



Ideal Acquisition Strategies with Smart Setup

By choosing the right acquisition strategy,
you can use more dyes than ever before without crosstalk.



Frontal section of Drosophila melanogaster brain, triple antibody labelled for synapses and neurons.

Smart setup allows automatic setting of imaging parameters depending on your preferences for acquisition speed and signal quality.

Carl Zeiss offers a unique tool to improve your imaging: the Smart Setup function. With the spectral properties of several hundred dyes known by the system, Smart Setup can recommend an acquisition strategy that will increase acquisition speed or signal outcome without crosstalk, depending on which dyes you use. This knowledge database is constantly updated.

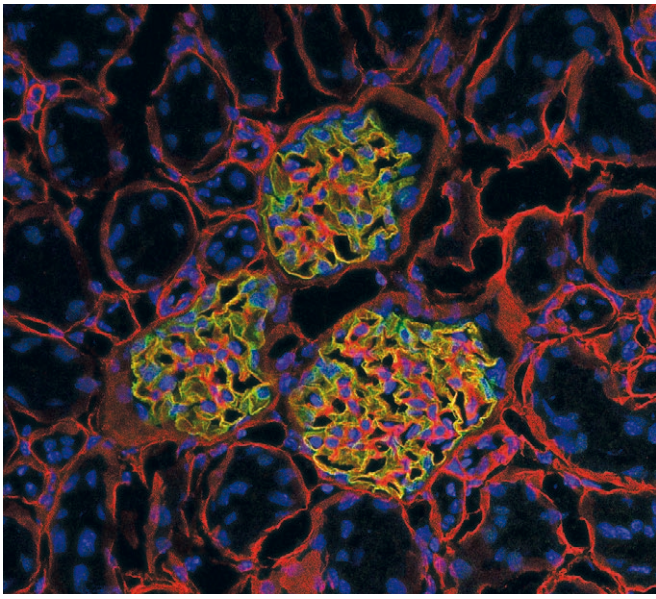
One valuable side effect is the excellent training those who are less experienced in imaging facilities will get on the properties of their samples and how to set up a modern confocal system.

In *Tune* and TwinGate

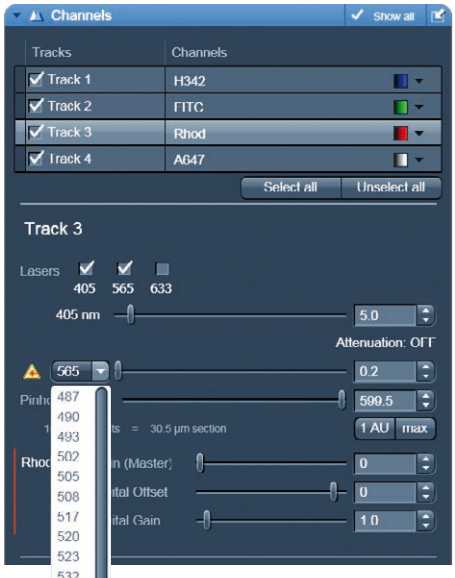
Use the latest dyes with extreme spectral properties and obtain lifetime data at any wavelength.

The fast and flexible detection technology of the LSM 780 and LSM 710, combined with our high performing In *Tune* laser, gives you additional freedom in excitation. This flexibility in excitation (488 to 640 nm > 1.5 mW per wavelength) means the fluorescence signal can be detected very close to the excitation wavelength. In *Tune* can be used simultaneously with any laser available in the system.

This is the perfect flexible laser system for measuring fluorescence lifetimes of dyes (Pulse < 5 ps, 40 MHz) that couldn't be examined before. Also, you no longer need to compromise when searching for a FRET pair. In *Tune*'s wavelength range lets you measure the lifetime of any dye excited within the spectral range of 488 to 640 nm.



Mouse kidney section stained for podocyte (Alexa 488, green), membrane Nidogen (Alexa 555, red) and Nuclei (Topro-3, blue). Sample: B. Hartleben, R. Nitschke; University of Freiburg, Medical Clinic IV and Life Imaging Center, Germany.



In Tune wavelengths can be selected easily from a drop down list, while the matching MBS is set automatically.

The innovative TwinGate low angle main beamsplitter provides up to 100 combinations of excitation laser lines which you can exchange at will. The lasers – including pulsed lasers and powerful bleach lasers – can be combined freely from near UV (355, 405 nm), VIS, and IR (Ti:Sa) ranges. On the detection side, emission bands can be flexibly selected without emission filters or secondary dichroics.

The LSM 780 is prepared to accept new 355 nm DPSS UV lasers which will be available later in 2010. This allows you to image UV excitable dyes without sacrificing the blue-green detection range. On LSM 710 systems, the optics for such lasers can be retrofitted.

NLO with LSM *BiG* NDD

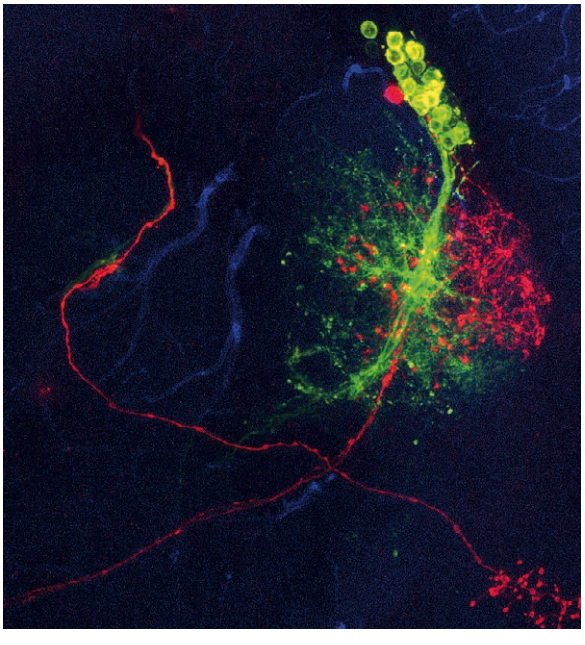
Multiphoton imaging puts a powerful technology at your disposal because not only physiologists and neurobiologists need to be able to get extended depth imaging of three-dimensional samples.

LSM BiG non-descanned detector (NDD) with 2 GaAsP channels on the Axio Observer.

The new GaAsP detector technology is not confined to visual light excitation. The LSM *BiG* (binary GaAsP) now also offers you multicolor multiphoton imaging with GaAsP performance. Two LSM *BiG* modules can be added to NLO systems as transmitted and incident light NDDs, providing 4 ultrasensitive detection channels. The LSM 780 NLO and LSM 710 NLO let you penetrate deeper and detect more light.

Improved femtosecond multiphoton technology lets you move from flat 'caricatures' into a three-dimensional context so you can understand interrelations in complex biological systems. The enhanced sensitivity of the *BiG* helps you penetrate even deeper into your samples.

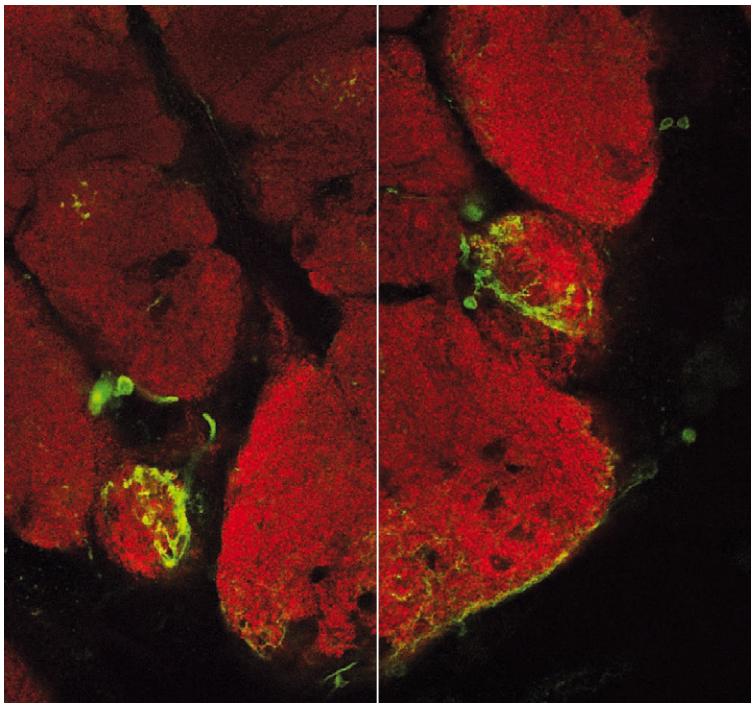
Together with our multiphoton special objectives W Plan-Apochromat 20×/1,0 and C-Achromat 32x/0,85 W IR, you get ideal solutions for nonlinear optical (NLO) imaging. In addition to the Axio Examiner stand for physiologists, cell biologists can also use such IR objectives and the LSM *BiG* on the inverted Axio Observer stand.



Projecting neurons in Drosophila melanogaster, antibody triple staining showing synaptic connectivity.

NLO and Uncaging with OSCiscan

As a physiologist and neurobiologist, you need powerful imaging to analyze the interaction of cells in a tissue context.

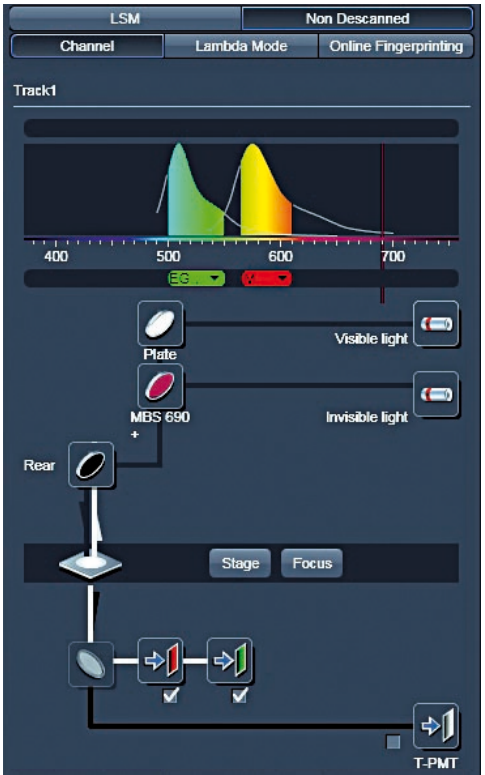


Synapses and selected neurons in Drosophila melanogaster, labelled with Alexa anti-xFPs. Multiphoton imaging with PMT-NDD detector (left) and internal spectral GaAsP detector with open pinhole (right).

The LSM 780 NLO and LSM 710 NLO offer you all the ingredients you need: efficient multiphoton imaging with specialized objectives, short beampaths and LSM *BiG* – plus fast scanning with the OSCimode and additional uncaging or photomanipulation.

This package allows you to, for example, uncage neurotransmitters at the synapses and image the reaction of the cell deeper in the tissue via IR with multiphoton imaging.

The LSM 780 NLO and LSM 710 NLO are prepared for multiple system extensions: if imaging is semi deep, but photomanipulation needs to be very deep in the sample, an LSM 7 *LIVE* fast linescanning unit can be added to image at hundreds or even thousands of frames per second, while the multiphoton laser manipulates deep in the sample. In addition, the LSM 780 NLO is prepared to accept the new 355 nm DPSS UV laser which will be available later in 2010, to image deep in the sample while uncaging can occur at upper layers.



Versatile multiphoton imaging with GaAsP detectors.

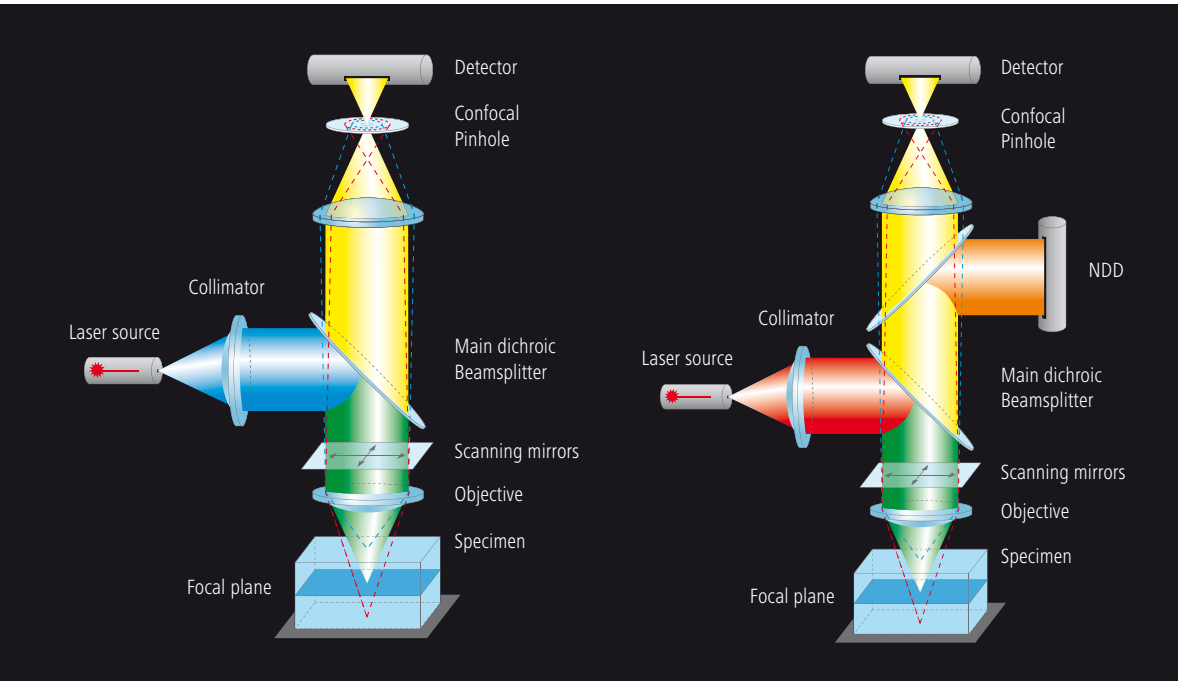
Confocal Principle and Beampath Scanning Module

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

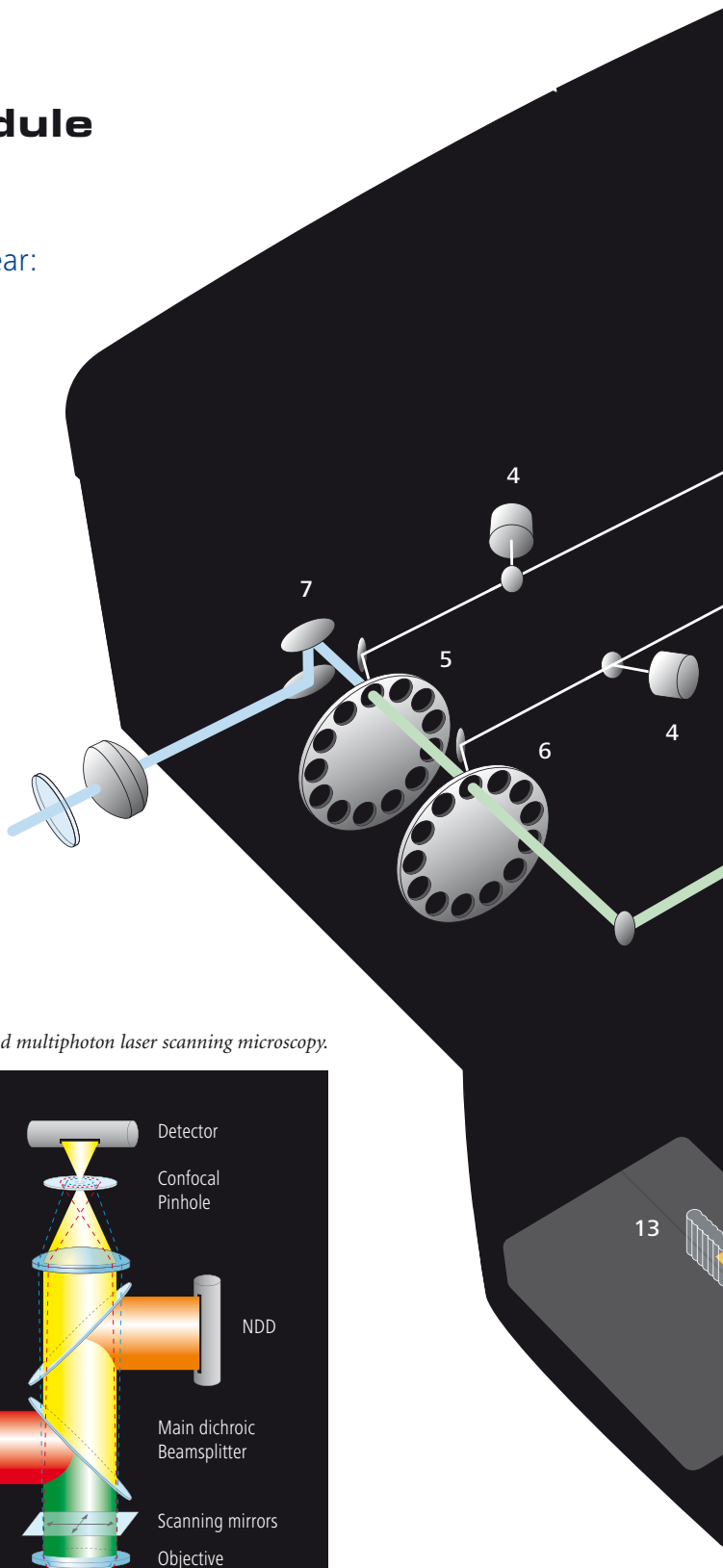
A laser beam scans the specimen pixel by pixel and line by line. A pinhole conjugated to the focal plane obstructs the light emerging from objects outside that plane so that only light from objects that are in focus can reach the detector.

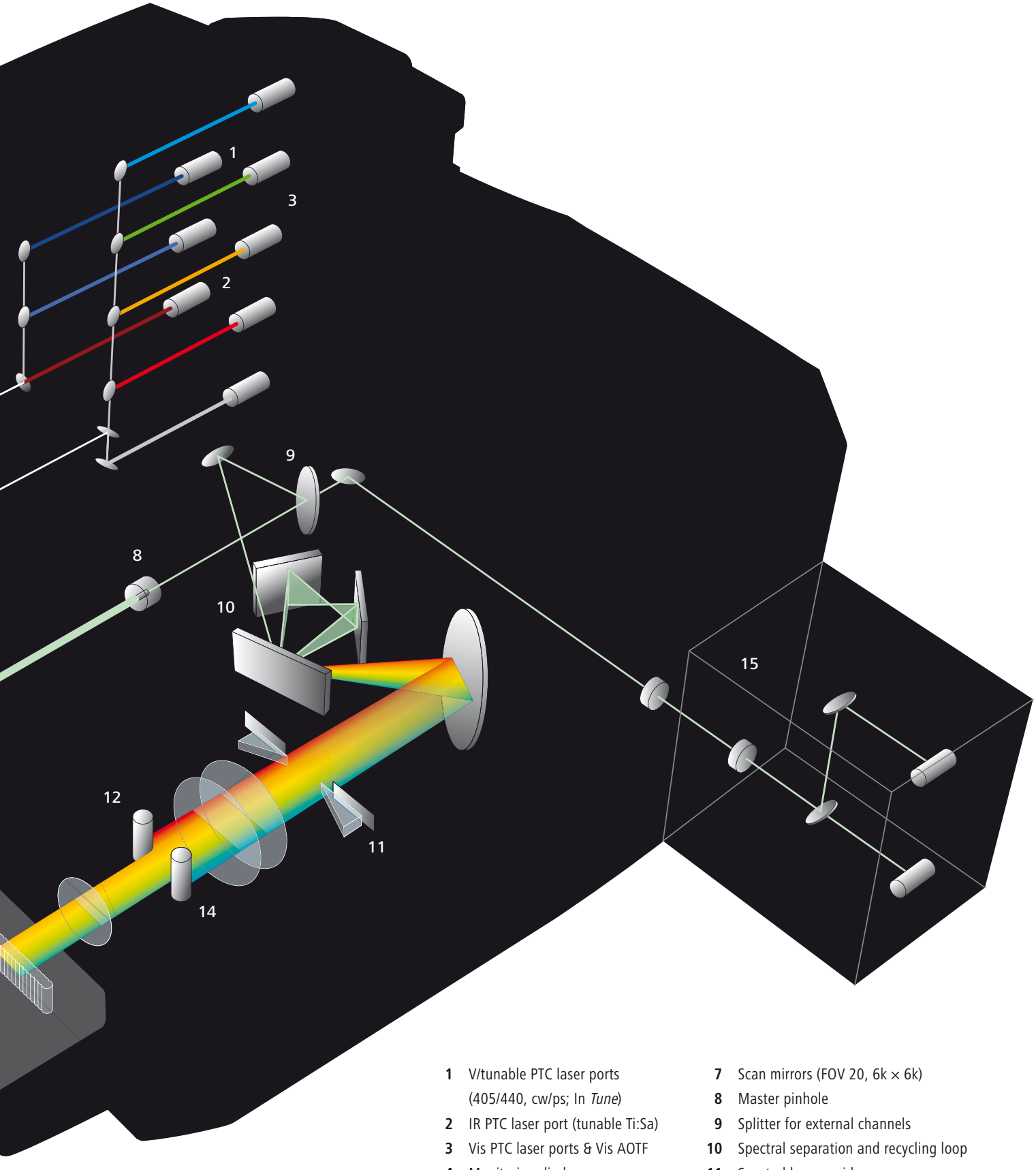
The pixel data gathered using this method are then assembled to form an image that represents an optical section of the specimen and is distinguished by high contrast and high resolution in the X, Y, and Z planes. Several images generated by means of shifting the focal plane can be combined into a 3D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

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



Principles of confocal and multiphoton laser scanning microscopy.





1 V/tunable PTC laser ports (405/440, cw/ps; In *Tune*)
2 IR PTC laser port (tunable Ti:Sa)
3 Vis PTC laser ports & Vis AOTF
4 Monitoring diodes
5 InVis TwinGate beamsplitter (upgradable)
6 Vis TwinGate beamsplitter (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 GaAsP spectral channels # 2–33
14 QUASAR PMT spectral channel # 34
15 Ext. channels (APDs, *BiG*, FLIM, FCS etc.)

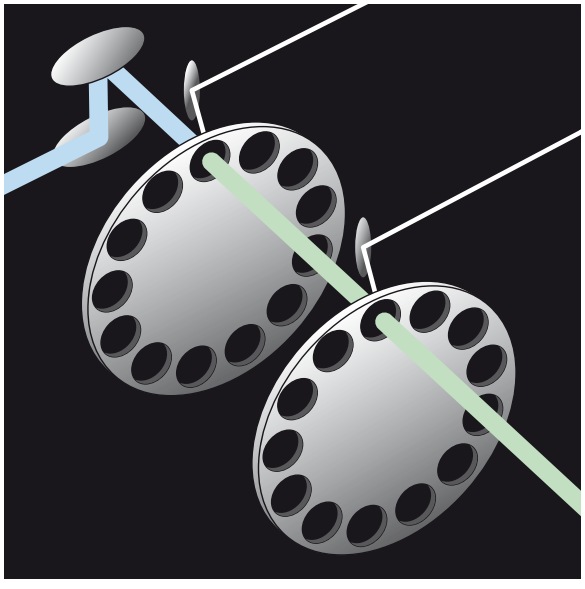
LSM 7 Innovations – Pushing Out the Very Boundaries of Technology

There is a lot the LSM 780 and LSM 710 can do, but only you can tell us what power they may bring to your work. Step up and enter whole new fields of research: If you can imagine it, you can visualize it.

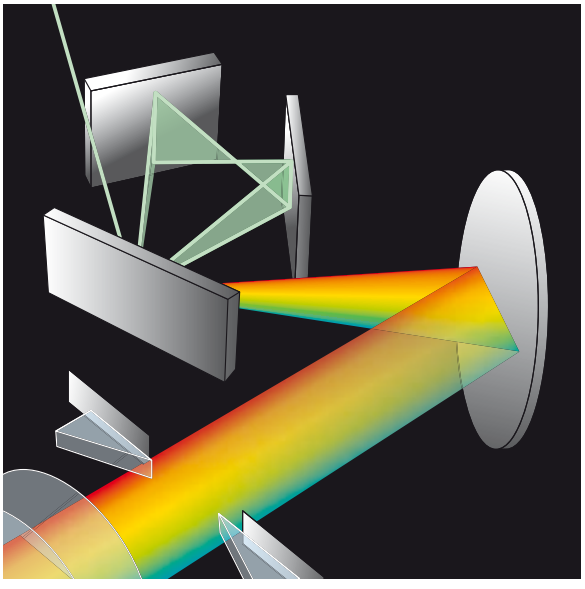
The revolutionary PTC laser concept means there is no longer any laser module. Instead, all lasers are so-called "pigtailed" versions which can be plugged directly into the scanning module. Up to eight ports in the LSM 710 scanning module allow direct coupling for near-UV, VIS and IR-lasers in free combinations. As a happy 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.

The TwinGate Main Beamsplitter permits almost infinite excitation combinations. Together, the two high-transmission dichroic filter wheels let 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, and that's not all – the new shape results in an absolutely outstanding suppression of the excitation laser light for improved SNR.

Gratings are ideal for splitting light into its spectrum because of their even separation of colors. The spectral recycling loop 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. Both the LSM 780 and LSM 710 offer ultimate freedom since any portion of the spectrum can be guided to any detector unit.



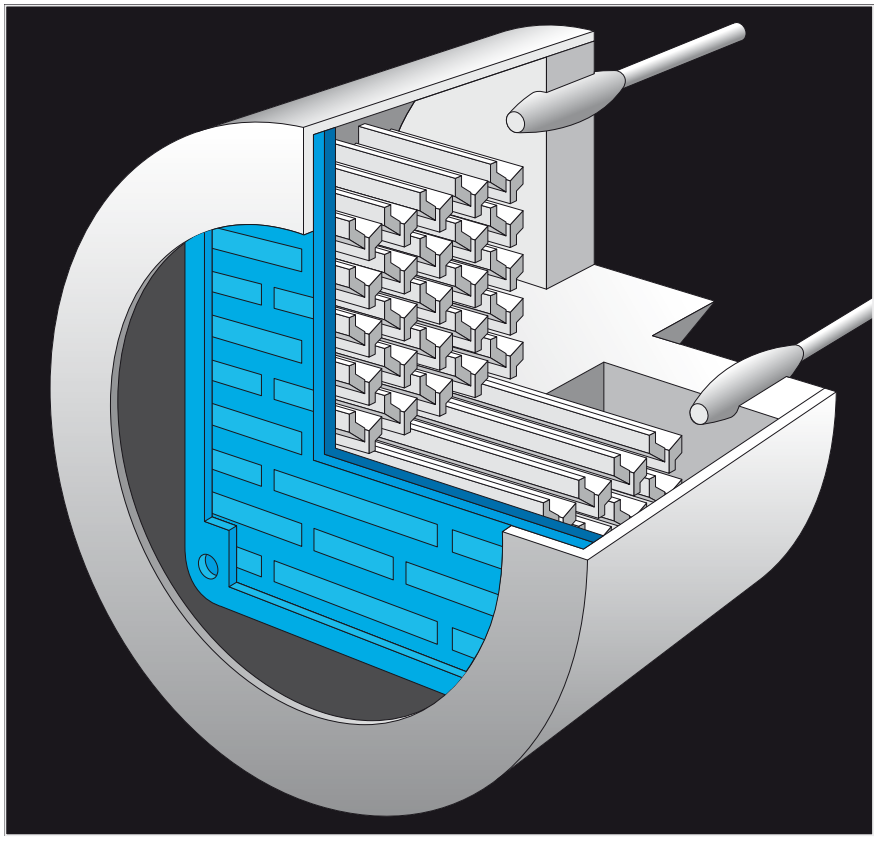
TwinGate main beamsplitter
Great flexibility and suppression of laser reflections due to narrow angle geometry.



Spectral recycling loop
Almost lossless separation of colors and free selection of detection bands.

GaAsP Technology
QE Doubled

Besides an optimized overall design, the LSM 780 introduces an outstanding innovation to confocal microscopy: a spectral array detector in GaAsP technology.

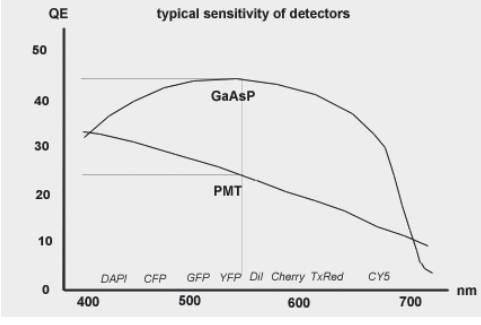


The GaAsP material is the ideal solution to convert photons into electronic signals.

GaAsP QUASAR detector

The LSM 710 employs a next generation QUASAR detector (Quiet Spectral Array) for great sensitivity for imaging while the GaAsP detector in the LSM 780 goes another step further: actively cooled and photon counting with almost twice the Quantum Efficiency (45% QE typically). To complement this detector, two side PMTs expand the spectral working range and allow additional imaging of very strong signals for higher dynamics.

Patents:
www.zeiss.de/micro-patents



Typical spectral Quantum Efficiency (QE) of conventional PMT and GaAsP detectors.

LSM 780
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 34 spectral detection channels; high QE (45% for GaAsP typically), 3 × lower dark noise; up to 10 individual, adjustable digital gains; prepared for lasers from UV 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	15 × 2 speed stages; up to 8 frames/sec with 512 × 512 pixels (max. 250 frames/sec 512 × 16); up to 4000 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: 34 simultaneous confocal fluorescence counting channels with highly sensitive low dark noise PMTs (2x) and GaAsP (32x); 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 and Axio Observer
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 in the scanning module; 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 (pre-fiber manufacturer specification)
External lasers (NLO, VIS, UV/V)	Prepared laser ports for system extensions; direct coupling of pulsed NIR lasers of various manufacturers (including models with prechirp compensation); fast intensity control via AOM; NIR-optimized objectives and collimation; fiber coupling (single-mode polarization preserving) of external In *Tune* Laser, (488-640nm, <3nm width, pulsed) 1,5mW and prepared for UV laser (355nm, 60mW), manipulation lasers of high power in the VIS range 488–561 nm (e.g., LSM 7 DUO-systems)

Electronics Module

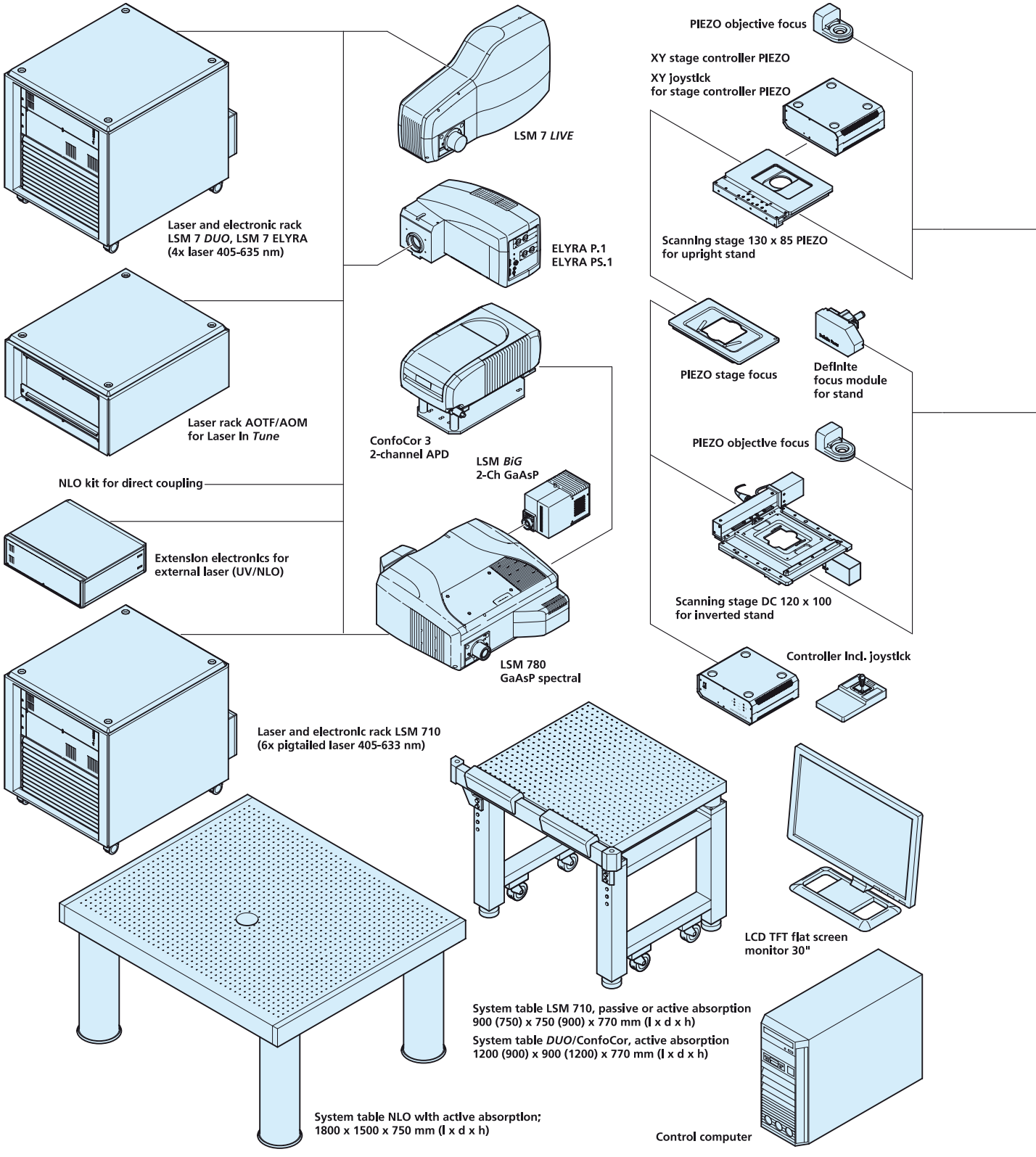
Real-time electronics	Control of the microscope, the lasers, the scan module and other accessory components; control of the data acquisition and synchronization by real-time electronics; oversampling readout logic for best sensitivity and 2 × better SNR; data communication between real-time electronics 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

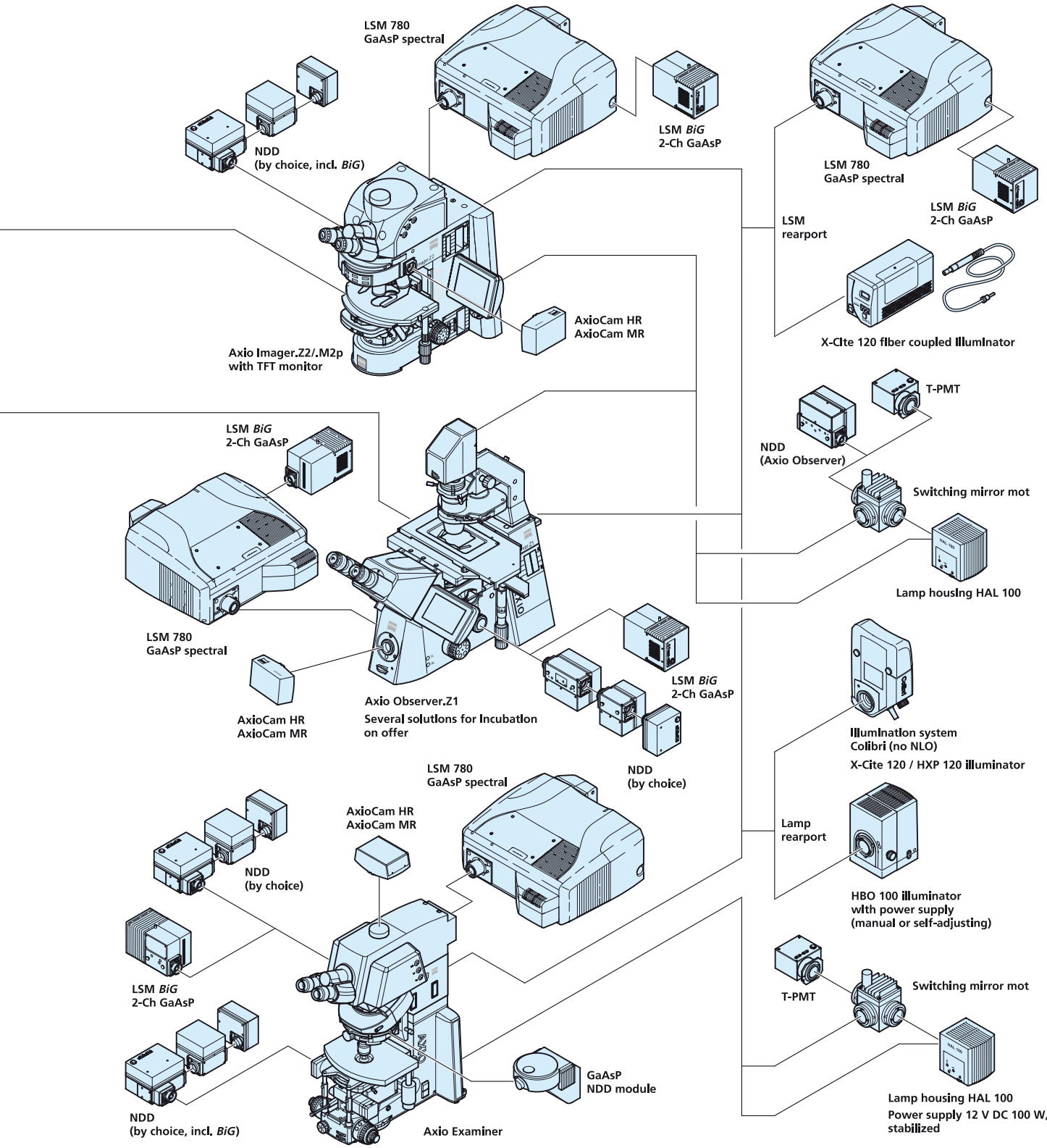
ZEN Software: User Interface for Your Applications

ZEN Standard Software	
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
Aquisition modes, Smart setup	Spot, line / spline, frame, tile, 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); OSCiscan and 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 and for increased dynamics without global increase of laser exposure
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 images and respective recording parameters; multi-print function; over 20 file formats (e.g. TIF, BMP, JPG, PSD, PCX, GIF, AVI, Quicktime) 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 deconvolution	Image restoration on the basis of calculated point-spread function (modes: nearest neighbor, maximum likelihood, constraint iterative)
ROI-HDR	High dynamic range imaging mode with intelligent local improvement of signal dynamics, free choice of gain or laser power modulation
Physiology / 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
VBA macro editor	Recording and editing of routines for the automation of scanning and analysis functions
Topography package	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
RICS image correlation	Spectroscopic single molecule imaging and analysis for all LSM 710 systems with PMT detectors (published by Gratton)
FCS basic, diffusion, fitting	FCS and FCCS single molecule analysis for systems with LSM 780, *BiG* and ConfoCor 3 (APD)
FCS module PCH	Photon counting histogram extension for systems with LSM 780, *BiG* and ConfoCor 3 (APD)

LSM 780
System Overview




LSM 780
GaAsP spectral
LSM *BiG*
2-Ch GaAsP
NDD
(by choice, incl. *BiG*)
Axio Imager.Z2/.M2p
with TFT monitor
AxioCam HR
AxioCam MR
LSM 780
GaAsP spectral
LSM *BiG*
2-Ch GaAsP
LSM
rearport
X-Cite 120 fiber coupled illuminator
T-PMT
NDD
(Axio Observer)
Switching mirror mot
Lamp housing HAL 100
LSM *BiG*
2-Ch GaAsP
LSM 780
GaAsP spectral
AxioCam HR
AxioCam MR
Axio Observer.Z1
Several solutions for Incubation
on offer
LSM *BiG*
2-Ch GaAsP
NDD
(by choice)
Illumination system
Colibri (no NLO)
X-Cite 120 / HXP 120 illuminator
LSM 780
GaAsP spectral
AxioCam HR
AxioCam MR
NDD
(by choice)
Lamp
rearport
HBO 100 illuminator
with power supply
(manual or self-adjusting)
LSM *BiG*
2-Ch GaAsP
T-PMT
Switching mirror mot
GaAsP
NDD module
NDD
(by choice, incl. *BiG*)
Axio Examiner
Lamp housing HAL 100
Power supply 12 V DC 100 W,
stabilized

Technology beyond the limits of traditional confocal systems:

- 3D examinations
- Multifluorescence
- Colocalization
- Spectral imaging, Unmixing
- Excitation Fingerprinting
- Live cell imaging
- Ion imaging
- FLIM, RGB range
- FRET and Anisotropy
- FRAP and FLIP
- Photoactivation/-conversion
- Uncaging
- In vivo examinations
- 3D in-depth imaging
- RICS, spectral FCS
- FCS auto-correlation
- FCS cross-correlation

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