

Living up to Life

Leica
MICROSYSTEMS

Leica TCS SPE

Simply Sophisticated – Your Personal Confocal



LEICA TCS SPE



Leica TCS SPE – Simply Sophisticated

Many exciting discoveries begin with a confocal from Leica Microsystems.

Here is one to start with – the Leica TCS SPE. Providing all the features needed for routine confocal techniques, it offers excellent quality imaging at an affordable price.

HIGH FIDELITY SPECTRAL IMAGING

The Leica TCS SPE is an affordable entry to the Leica family of confocals. It combines a straightforward design with high-end, true point-scanning confocal technology. The prism-based spectral detection – unique to all Leica confocal microscopes – and a highly dynamic photomultiplier offer extraordinary signal efficiency for gapless detection of even weak signals. A variety of robust solid-state lasers allow the use of a broad range of common dyes.

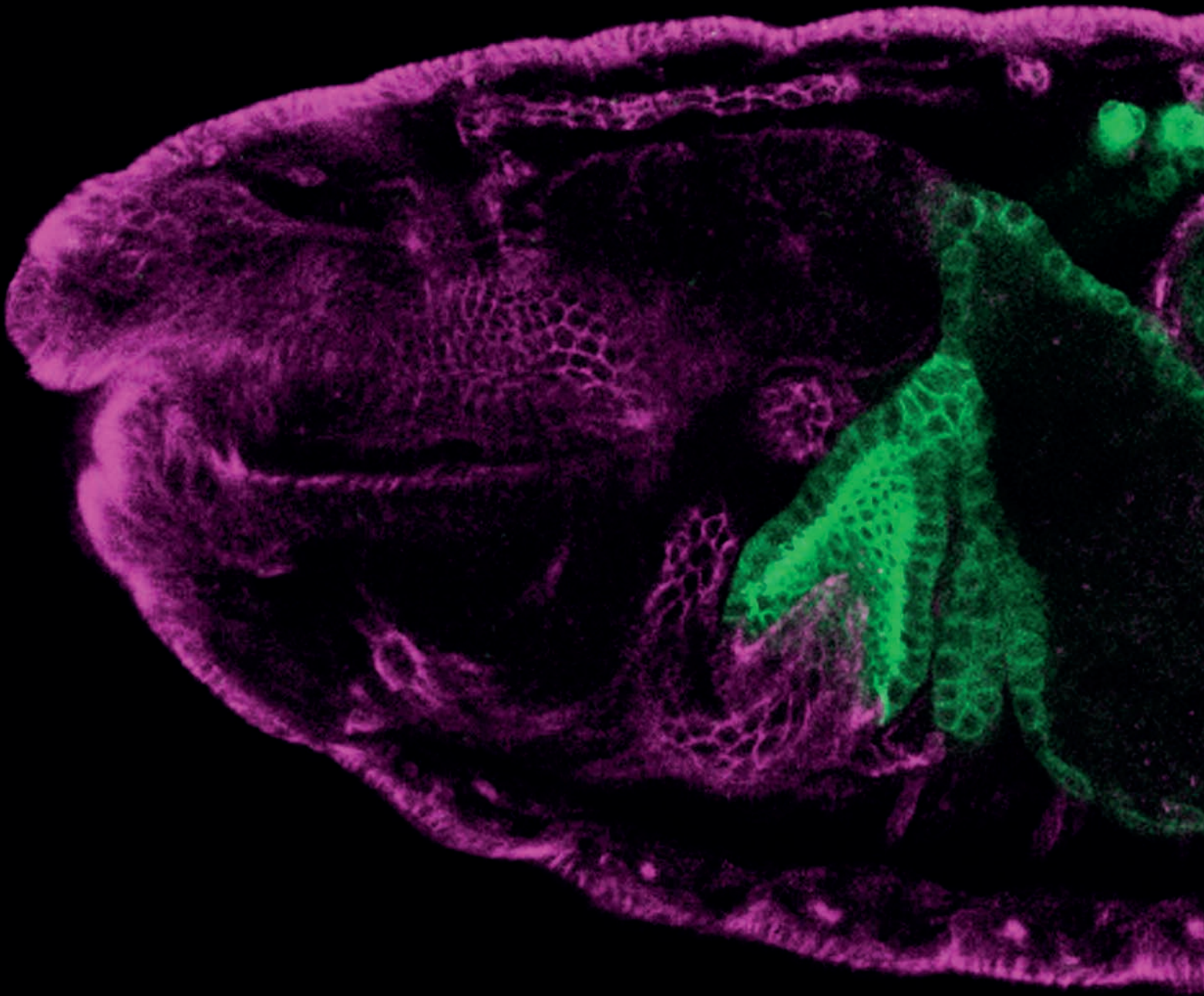
INTEGRATES ANYWHERE

The Leica TCS SPE is compact and fits in every laboratory. The system is intuitively controlled and even users, who are new to confocal microscopy, will get publication-quality results immediately. The software interface minimizes training time and allows the system to be up and running immediately.

VERSATILE WORKHORSE

Scientists worldwide know the Leica TCS SPE's proven reliability. Its many options include upright or inverted stands, comprehensive climate control, and many software options like FRAP imaging. Excellent dye separation allows the sequential imaging of multiple dyes per specimen using tunable spectral detection. The motorized confocal pinhole adjusts automatically to your best imaging conditions – however, manual adjusting is possible and offers great flexibility.

- › Confocal sectioning
- › Crosstalk-free 3D
- › Small footprint
- › Long-life lasers
- › Colocalization with 405 nm in x, y and z
- › Automated microscopy with camera and scanner



Drosophila embryo

Green: Mesh (Alexa 488), a smooth septate-junction-specific protein

Magenta: Kune (Cy3), a pleated septate-junction-specific protein

Mesh is required for smooth septate junction formation and the paracellular diffusion barrier in the *Drosophila* midgut.

Format: 1024x1024 pixels, Objective: 20x, Zoom: 1x, Frame avg: 3

Courtesy of Dr. Yasushi Izumi

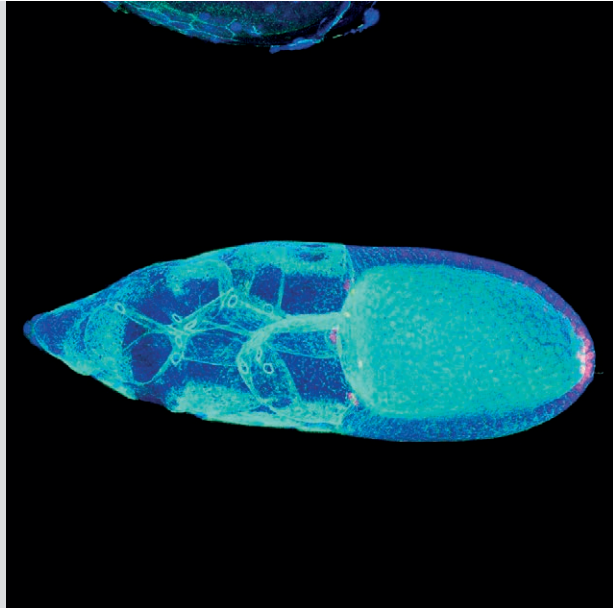
Division of Cell Biology, Department of Physiology and Cell Biology,
Graduate School of Medicine, Kobe University





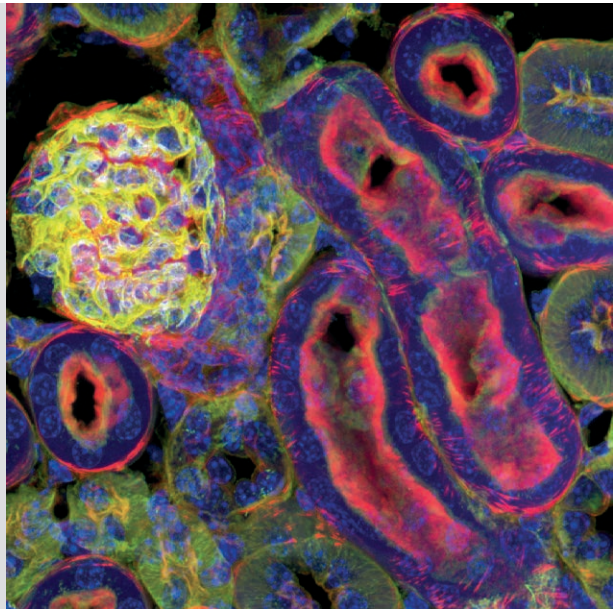
Versatile Confocal

- › Control box
- › Images without crosstalk
- › Automated filter control
- › Quadruple beamsplitter – no filter change necessary
- › Parallax-free scanner



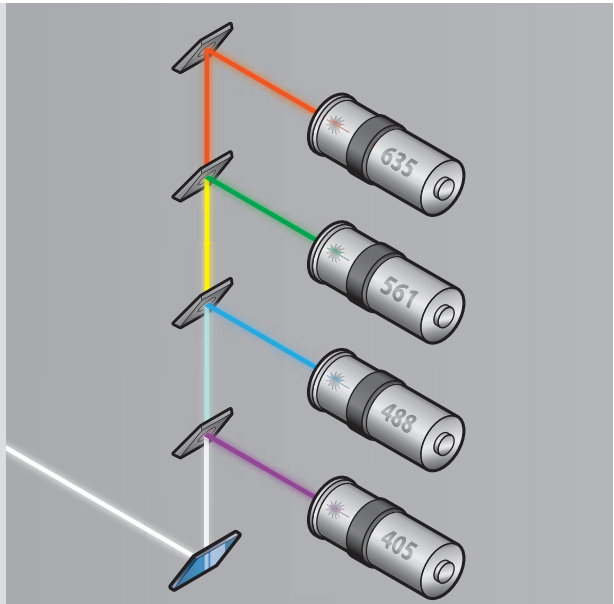
Spectral Detection (SP Detector)

- › Tunable from 430 to 750 nm
- › Multicolor imaging without crosstalk
- › Gapless spectral imaging
- › Prism-based dispersion gives highest light efficiency
- › Free from photon waste compared to a diffraction grating



Solid State Lasers

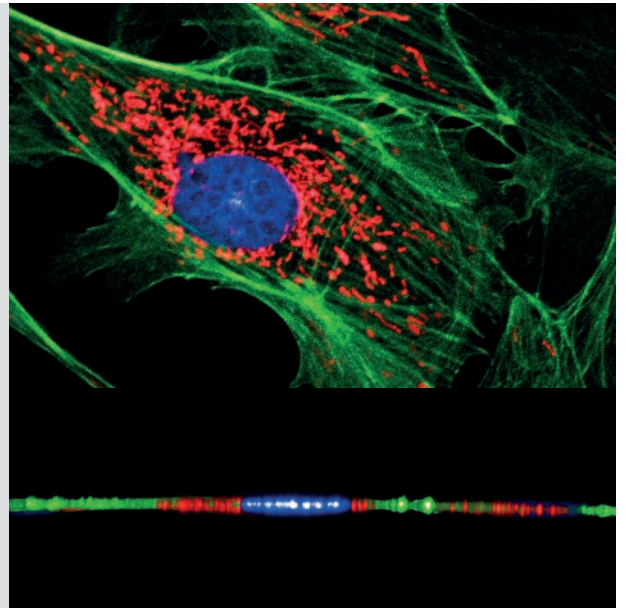
- › 405, 488, 532/561, 635 nm excitation
- › Optional 405 nm excitation
- › Supply unit with small footprint
- › Low maintenance cost
- › Longevity
- › Low laser noise





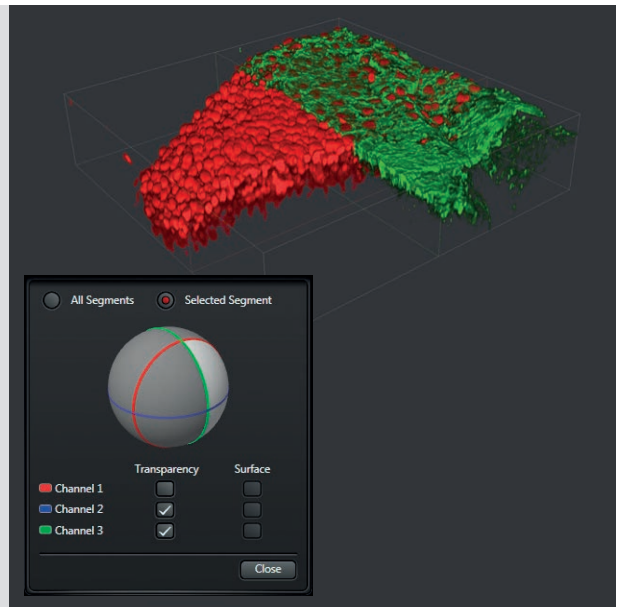
Advanced Correction System (ACS) Objectives

- › Perfect compensation of focus shift
- › Maximum transmission from 405 nm to infrared
- › Minimum of moving parts in the light path
- › CS objectives for imaging with visible light



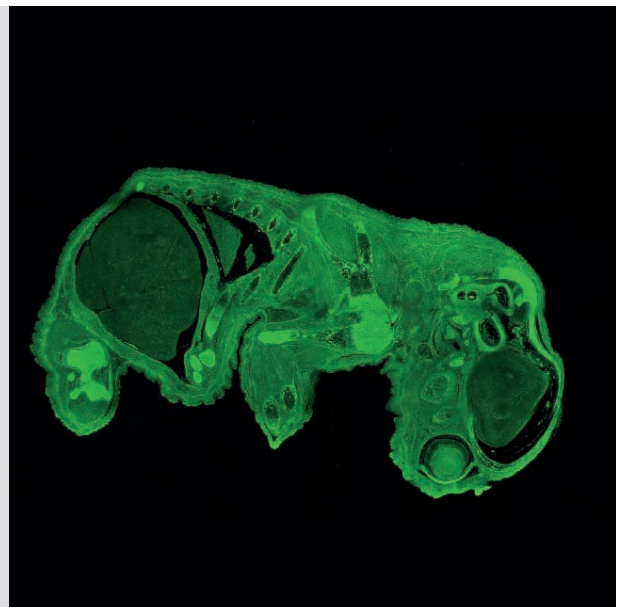
LAS X Software

- › Intuitive workflow
- › FRAP wizard
- › Live Data Mode controls live cell experiments
- › Additional software packages for 3D visualization, 2D and 3D analysis



High Content Screening with Leica HCS A

- › Large scale mosaics
- › One-click templates for multiwell plates
- › Open data formats support OME-TIFF
- › Computer-aided microscopy interface with online image analysis
- › Combine camera and confocal for simultaneous primary and secondary screens



SP Detection – Gapless Photon Efficiency

Affordable, but comprehensive – the Leica TCS SPE is the instrument for highly resolved images. The filter-free spectral detection technology ensures the highest light efficiency for gapless spectral imaging. The result: brilliant images containing a maximum signal per-fluorophore-ratio with perfectly separated dyes.

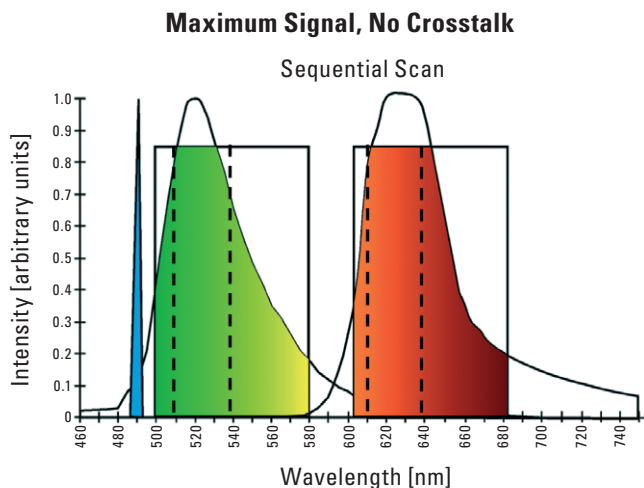
A TRUE CONFOCAL SCANNER

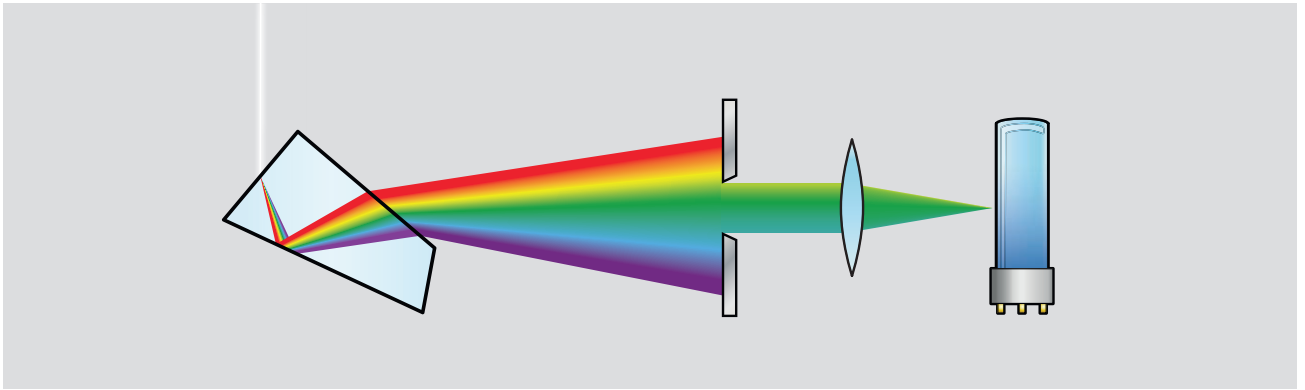
Equipped with a true confocal point scanner, the Leica TCS SPE delivers images of the highest resolution by scanning the specimen in thin optical layers. Leica Microsystems' patented three-mirror scanner achieves parallax-free scanning in a large field of view and even illumination.

A variety of solid state lasers in the spectrum from 405 to 635 nm make a wide range of common dyes and fluorescent proteins accessible for imaging, and support many applications. Due to the acousto-optical tuning filter (AOTF), laser intensity is freely adjustable without moving filters, which provides fast, perfect balancing of the excitation intensity.

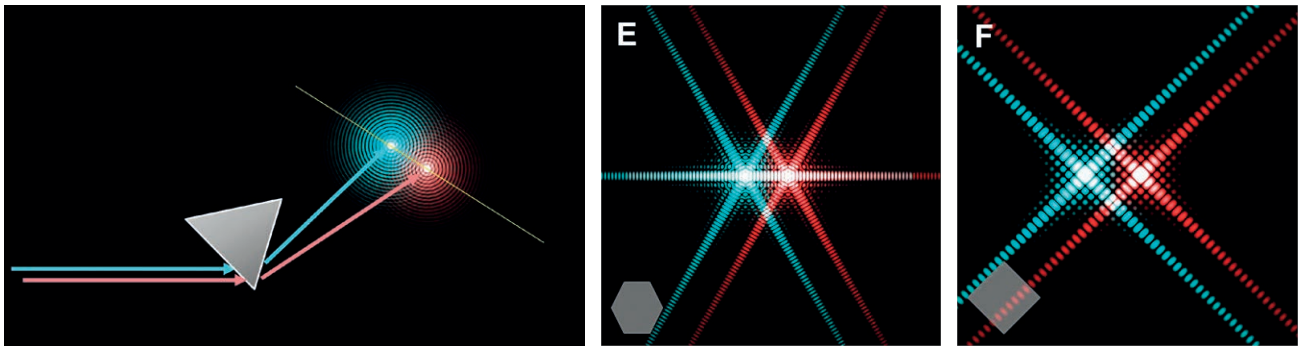
SPECTRAL DETECTOR

As in every Leica confocal microscope, the dispersive element in the Leica TCS SPE is a highly transmissive prism that diffracts the light into its constituent wavelengths. An adjustable mechanical slit selects a narrow band of wavelengths from the spectrum for detection. The patented prism design allows the highest efficiency across all wavelengths. Fluorescence photons from your sample are not recycled but preserved. In combination with the highly dynamic photomultiplier tube detector, sequential scanning of multiple dyes is possible with superior spectral separation, without crosstalk. The emission maximum of a chosen dye is determined – quickly and easily by performing a lambda scan. The 45° rotated square pinhole for confocal imaging leads to superior spectral separation for brilliant multi-color imagery.





Spectral detection module of the Leica TCS SPE



Diffraction patterns for two colors after passing through a prism. In multi-spectral imaging spectral specificity is influenced by the ability to resolve two adjacent diffraction patterns. Separation of two adjacent patterns, such as caused by different colors for circular (left), hexagonal (middle) and square (right) geometries. A 45° rotated pinhole is ideal for prism-dispersed light.

ACS OBJECTIVES FOR OPTIMAL COLOCALIZATION

With the unique Advanced Correction System (ACS) objectives, Leica Microsystems offers dedicated objectives that are chromatically corrected across the entire visible spectrum. Maximum transmission is achieved within the entire light band from 405 nm to near infrared. The result is an outstanding colocalization of images acquired with different wavelengths – ready for immediate quantification.

Leica ACS Technology: Perfect Colocalization

Wavelength [nm]	Other Objectives (Shift)	Leica ACS Objective Design (Shift)
400	~0.45	~0.05
500	~0.05	~0.05
600	~0.15	~0.05
700	~0.25	~0.05
800	~0.40	~0.05
900	~0.50	~0.05

The graph shows that while other objectives have a significant focal shift (up to 0.5) across the wavelength range, the Leica ACS design maintains a constant focal shift of approximately 0.05, which is within the 'Extended Region for Confocal Imaging'.

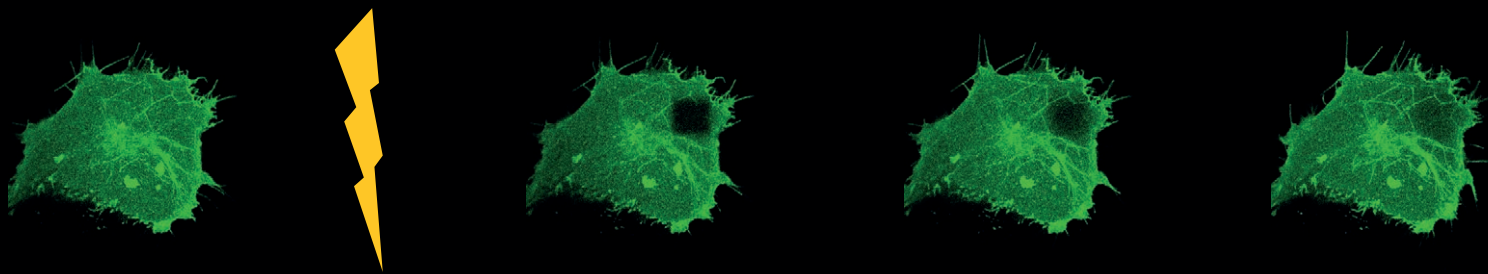
Keep Living Cells Alive

Imaging living specimens is essential to understanding cell dynamics in detail. The Leica TCS SPE is an ideal instrument for fast live cell imaging at full resolution. Comprehensive climate accessories keep your cells alive and healthy, and intuitive software packages even allow photo manipulation experiments.

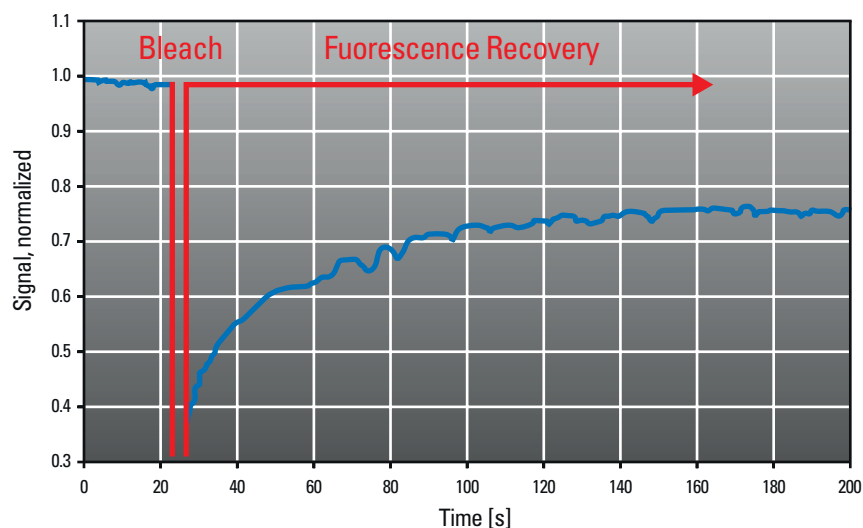
ENVIRONMENTAL CONTROL

Fitting incubators to a Leica microscope stand creates a healthy environment for your cells. Users gain full control of the experimental conditions with the LAS AF Environmental Control module. The logged environmental data can be monitored during the experiment. All environmental conditions can be set within one interface and can run temperature profiles, for example, for heat shock experiments.





Fluorescence Recovery After Photobleaching – FRAP



FRAP experiment with Leica TCS SPE. Pre-bleach, bleach, and fluorescence recovery with quantification. HeLa cells expressing Glycosylphosphatidylinositol anchored protein (gpi) fused to YFP, which is localized in the plasma. Sample courtesy: Stefan Terjung, EMBL, Heidelberg, Germany

LIVE DATA MODE – TAKE CONTROL

The Live Data Mode tool in LAS X is designed for live cell experiments and dynamic investigations: Scientists can define an experiment before data acquisition to carry out manipulations on the live specimen, e.g., application of a drug, switching of external devices or pausing. Automated switching between camera and confocal allows high speed and 3D sectioning. Live Data Mode is the starting point for stringent experimental control.

UNDERSTANDING CELL DYNAMICS MADE EASY

Living processes mean continuous change. To understand them, it is important to measure cell dynamics and motility. Due to the Leica TCS SPE's confocal laser scanner, photo manipulation experiments are possible at an affordable price. FRAP experiments with the Leica TCS SPE help you to understand biochemical reaction kinetics in cells. For photo manipulation experiments LAS X offers a FRAP wizard for reproducible results.

Only Three Steps Away From Your Confocal Image

The Leica TCS SPE's streamlined approach makes it accessible to every user, beginners and experts alike. With the LAS X control software, Leica Microsystems offers an interface, which shows all you need to know about your confocal on one screen. The Leica TCS SPE gets the job done.

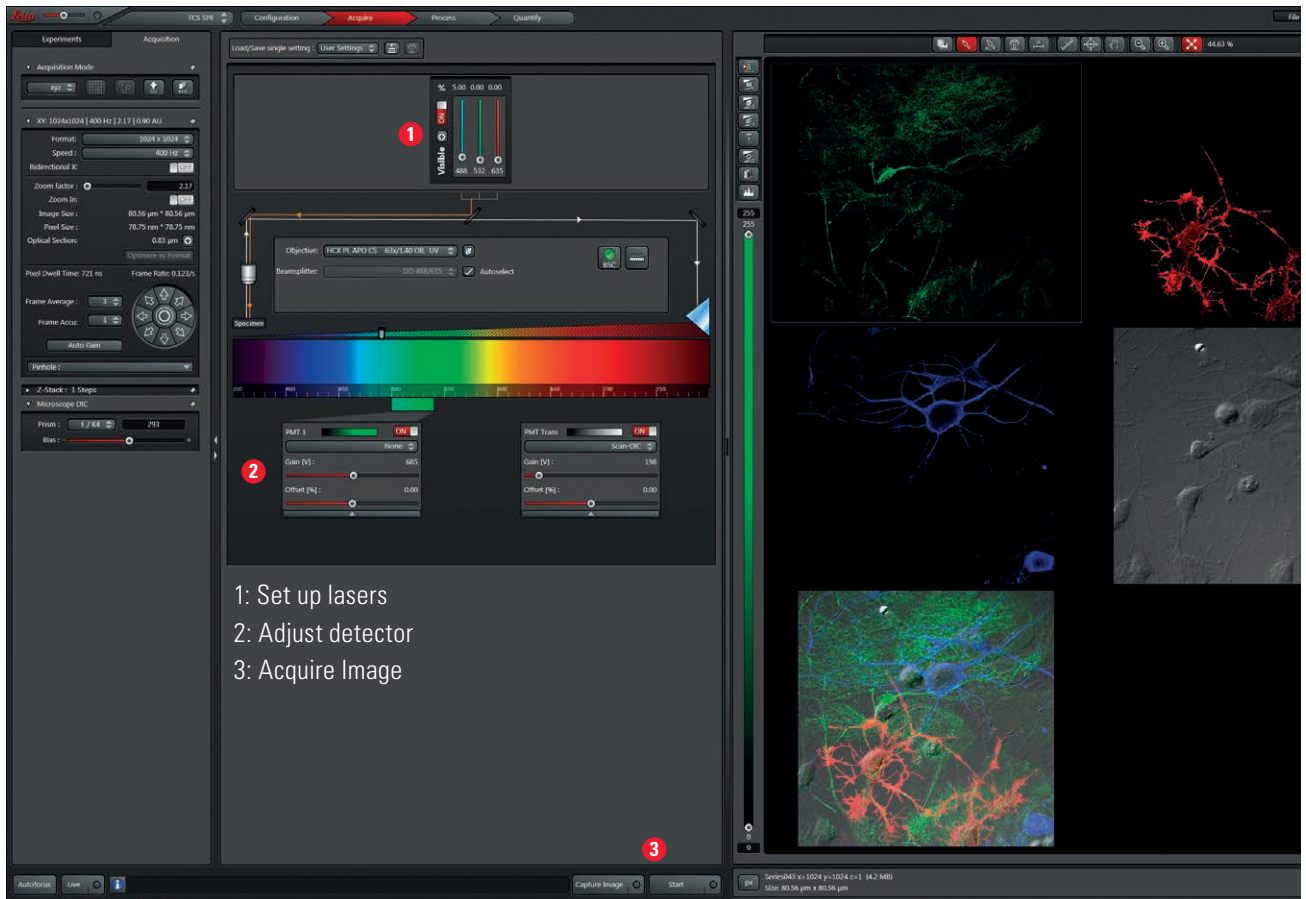
ONE, TWO, THREE ... CONFOCAL

The LAS X control software guides users step by step through data recording and evaluation. The workflow design helps you to use the Leica TCS SPE more efficiently. It offers full control over the microscope hardware and provides all necessary information at a glance. You are only three steps away from your confocal image: Set up your lasers, the detector, and capture the image – done!

SET-UP WITH A TWIST

The optional control panel adds smart features to your confocal. Smart Gain and Smart Offset, for example, make setting up your detector a breeze while using your other hand to control laser power with the mouse. The control panel is freely configurable and displays all major imaging parameters it controls on a separate display. This way you are always informed about the status of the system.





Intuitive LAS AF user interface

MODULAR SOFTWARE PLATFORM

In addition to basic image acquisition such as lambda scan, sequential scan, time series and z stacks, LAS X can extend your research with a range of additional software packages like FRAP imaging, 3D visualization and 2D or 3D analysis. Live Data Mode is a tool for the easy set-up of complex, interactive time-lapse experiments. Leica HCS A provides a tool for automated multi-dimensional imaging. Software wizards reduce the time spent on configuring tools, and even less experienced users can perform complex experiments within a short time.

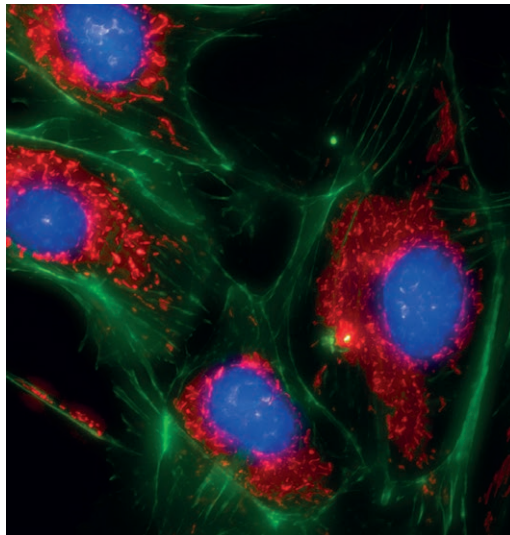


“High precision, robust technique and easy-to-use software is what we have always looked for. Leica Microsystems' confocal will become our workhorse for routine research.”

Dr. Markus Dürrenberger
Microcopy Center (ZMB), University of Basel
Basel, Switzerland

Move Up to the Next Level

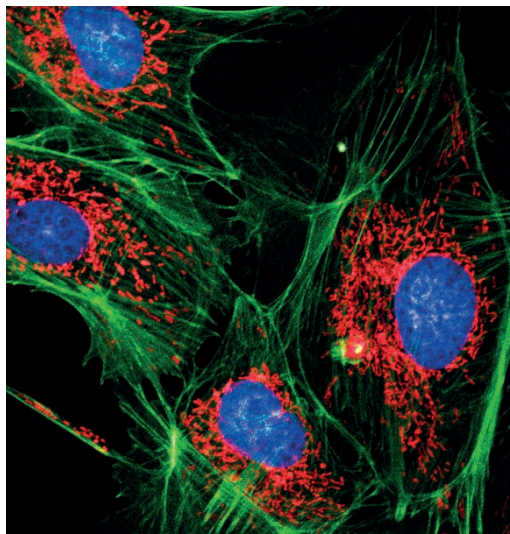
Do you sometimes wish you could improve the resolution of your fluorescence microscope? No problem – the Leica TCS SPE adds a confocal to your prepared fluorescence microscope.



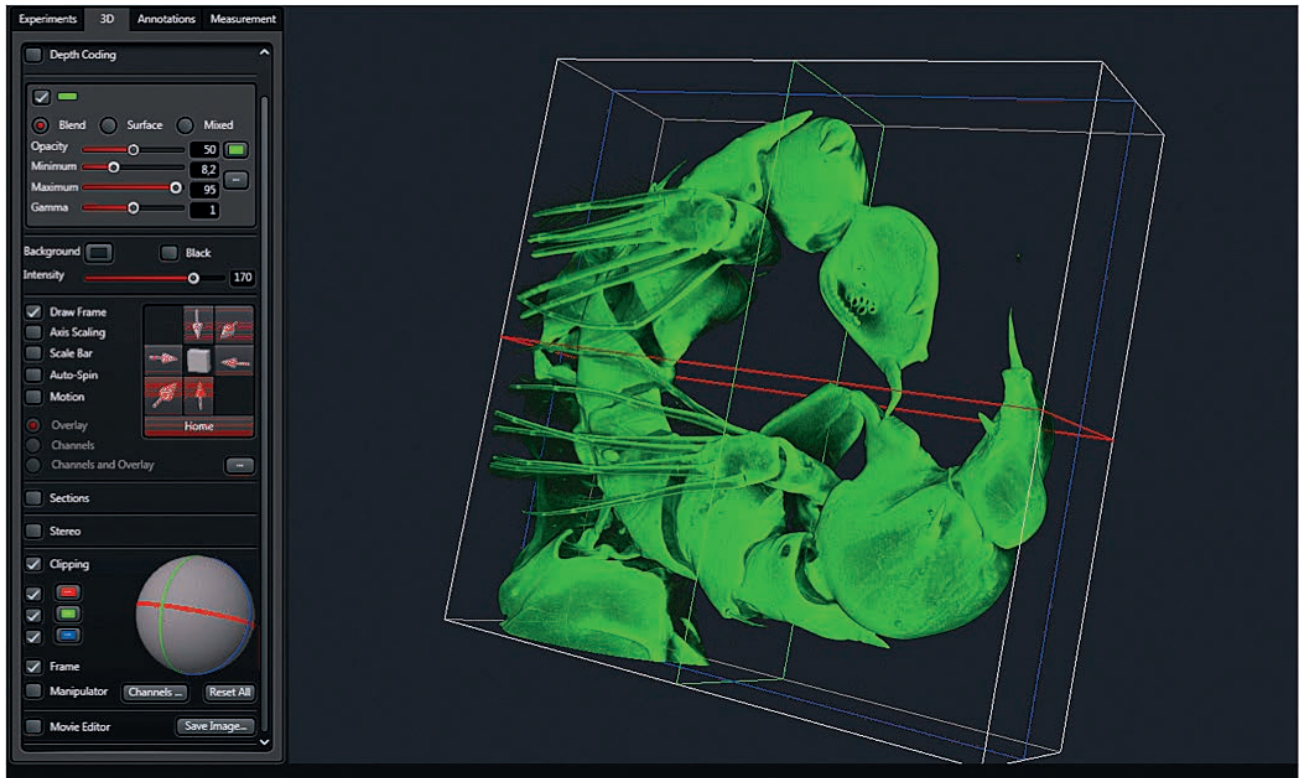
COMBINE TWO WORLDS

The Leica TCS SPE is based on our high-end widefield fluorescence microscopes. Inverted or upright? Automated or manual? You choose the platform on which you build the confocal functionality. The Leica SPE scanhead seamlessly integrates into your system with moderate additional room requirements.

High-resolution confocal imaging can easily be combined with camera measurements for high-speed imaging. Predefined kits offer maximum dynamics in speed and precision. The Leica TCS SPE is the confocal channel on top of your widefield fluorescence microscope.



Molecular Probes F 36924 FluoCells prep slide #1
BPAE cells with MitoTracker Red CMX Ros,
Alexa Fluor 488 phalloidin, DAPI.



Marine crab pincers. 3D reconstruction. Sample courtesy: Dr. Jan Michels, Alfred Wegener Institute, Bremerhaven, Germany.

SEE CLEARLY

With the confocal scan head you get two additional channels to your fluorescence microscope. By z-sectioning, confocal imaging resolves your specimen in the third dimension and allows you to see in depth. The spectral laser-scanning detection channel offers high flexibility. Combination with the TLD (Transmitted Light Detector) results in clear transmitted light images of your specimen.

SEE IN DEPTH

The LAS AF 3D Visualization software module offers a wide variety of real-time 3D rendering options. Functions include orthogonal sectioning, a 3D crop tool, isosurface rendering and interactive shadow projection. 3D images can be displayed on stereoscopic displays. Produce impressive animated movie sequences by editing your 4D data sets. All of this is possible at an affordable price.

Advanced 3D Imaging Analysis Made Easy

Life is three-dimensional – so are your specimens. The LAS X 3D Analysis package offers tools to quantify the topology of your sample.

INTERACTIVE 3D MEASUREMENTS

With the software module LAS X 3D Analysis you can understand the topology of your 3D image. You can also quantify various aspects of intracellular structures such as structure volume, surface or distances. Comprehensive segmentation tools are available to define individual objects – often one click is enough.

A guided workflow for 3D image processing is optionally available. This way, beginners are guided while full flexibility for advanced users is preserved. All measured parameters are available for reporting or further analysis by external tools.



Start Thinking Big

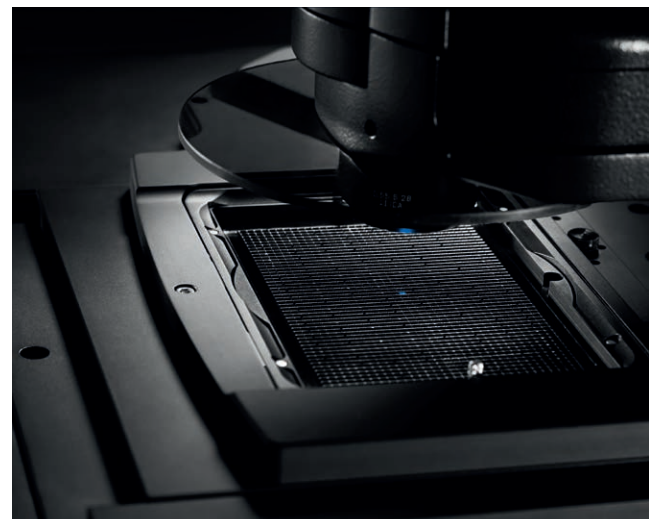
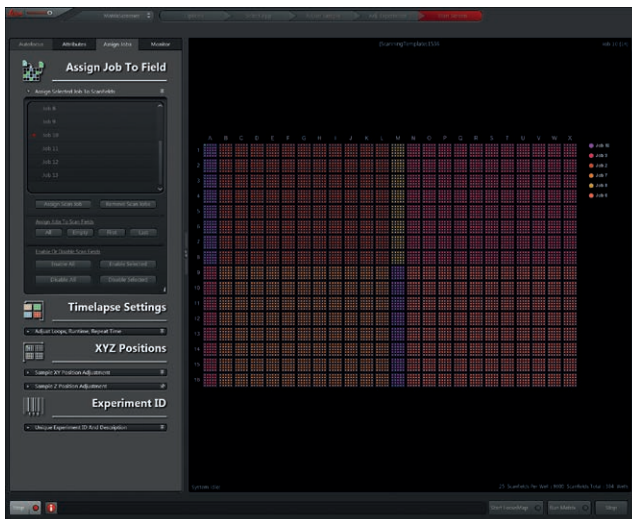
Breakthrough discoveries can happen when you are in the right place at the right time. Leica HCS A can speed up the process of discovery through high content screening. The integration of Leica HCS A into the Leica TCS SPE allows you to standardize biological applications for rapid and reproducible results.

MORE CONTENT IN YOUR SCREEN

Leica HCS A supports screening of a large number of samples or conditions for robust statistics. Standard sample dishes or multiwell plates are support stage automation by adjustable scanning templates. Tissues or organs typically won't fit into one field of view. Leica HCS A offers a powerful stitching solution called Mosaic. You can combine these large images with time series, multiwell formats or custom positions.

By manually sifting through a large number of specimens, rare events, e.g., a dividing cell among others can easily be missed.

Computer Aided Microscopy (CAM) allows detection of these events by external image analysis software for maximum flexibility. Data is continuously streamed to external storage devices using the highly compatible and scalable OME-TIFF format. Therefore image analysis takes place in parallel with image acquisition. In conjunction with CAM, Leica HCS A can respond to feedback from the analysis software about an event detected during acquisition. This powerful approach has been proven to simplify large collaborative screening campaigns.



All the Information You Want

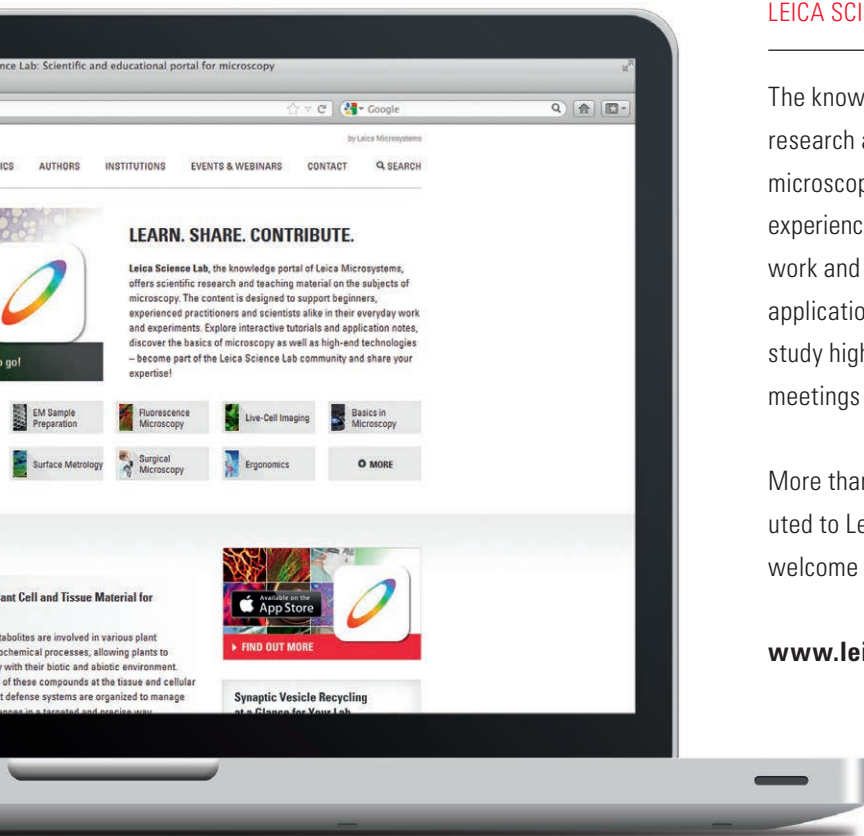
Would you like to delve into the world of microscopy? Do you need expert advice? Or do you wish to know more about our confocal products? Get in touch with Leica Microsystems – connect with us on our online platforms!

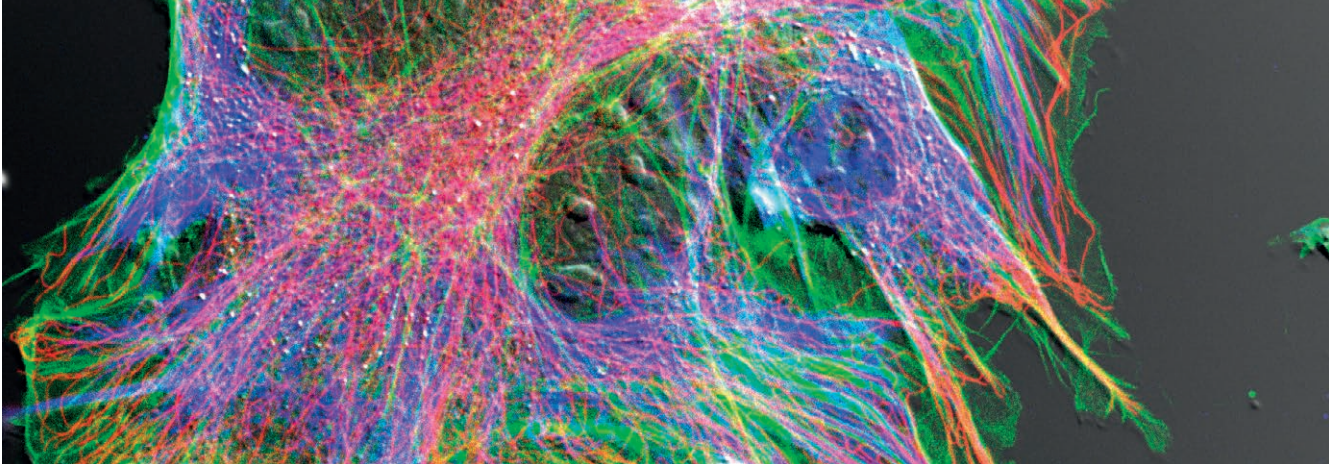
LEICA SCIENCE LAB: LEARN. SHARE. CONTRIBUTE.

The knowledge portal of Leica Microsystems offers scientific research and educational material on the many subjects of microscopy. The platform is designed to support beginners, experienced practitioners and scientists alike in their everyday work and experiments. Explore interactive tutorials and application notes, understand the basics of microscopy and study high-end technologies. Stay informed about interesting meetings and attend free webinars.

More than 450 authors from all over the world have contributed to Leica Science Lab and there will be more. You are very welcome to join this community and share your expertise!

www.leica-microsystems.com/science-lab





LEARN MORE ON SPE?

Detailed information on the Leica TCS SPE and confocal solutions of Leica Microsystems is available online.

**CONNECT
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<http://www.leica-microsystems.com/spe>

HOW CAN WE HELP YOU?

No matter if you have a demo request, questions about your existing Leica system or any other topic, contact us via our website.

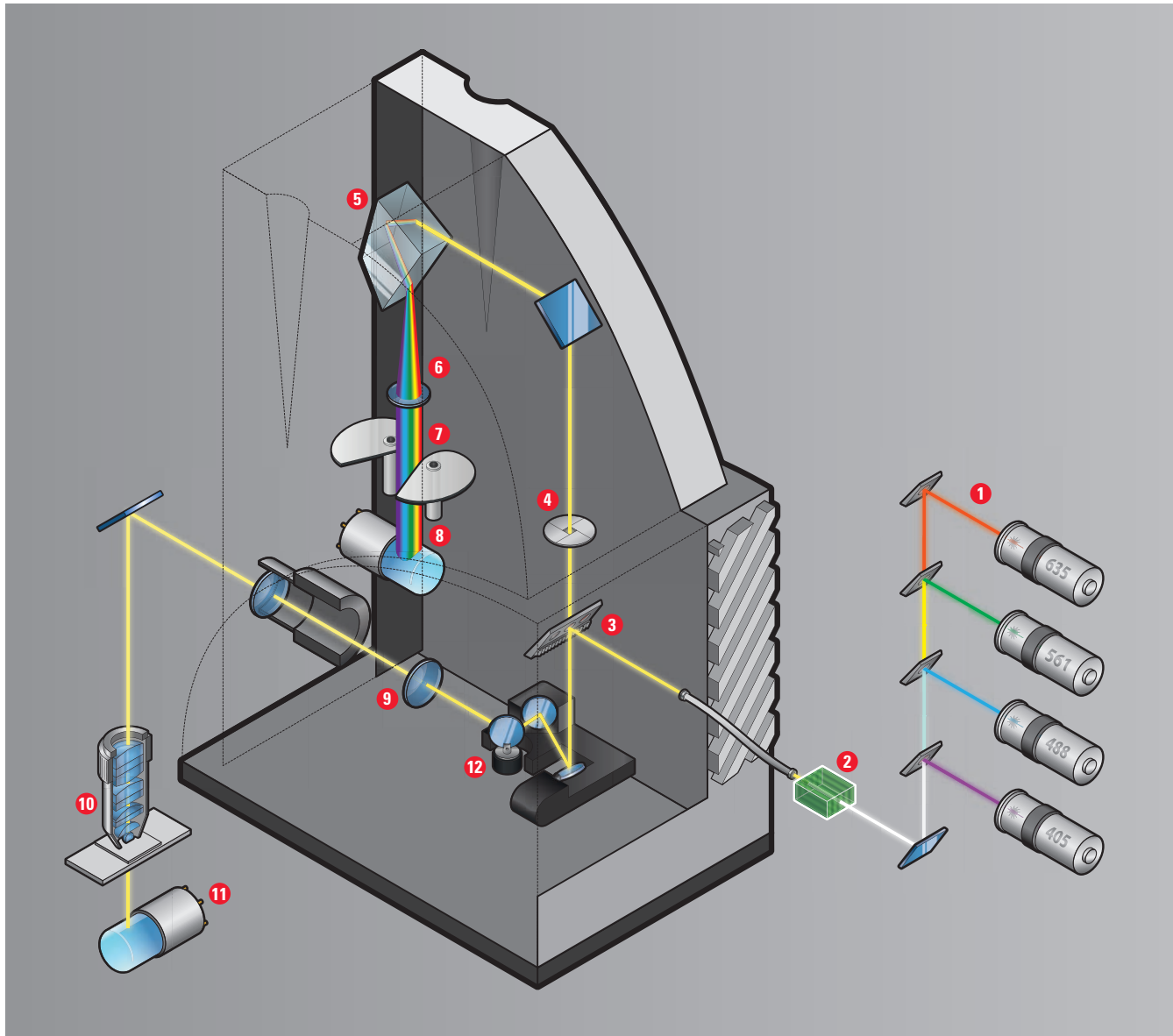
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Leica TCS SPE Scan Head

- | | | |
|---|---------------------------|-------------------------------|
| 1 Solid state lasers | 5 Spectrophotometer prism | 9 Scan lens |
| 2 Acousto-optical tunable filter (AOTF) | 6 Collimation lens | 10 Objective lens |
| 3 Beam splitter, motorized | 7 Spectral selector | 11 Transmitted light detector |
| 4 Confocal detection pinhole, motorized | 8 Photomultiplier | 12 K scanner |

LASER RADIATION
 VISIBLE AND INVISIBLE - CLASS 3B
 AVOID DIRECT EXPOSURE TO BEAM
 < 500mW 350-700nm
 IEC 60825-1: 2007