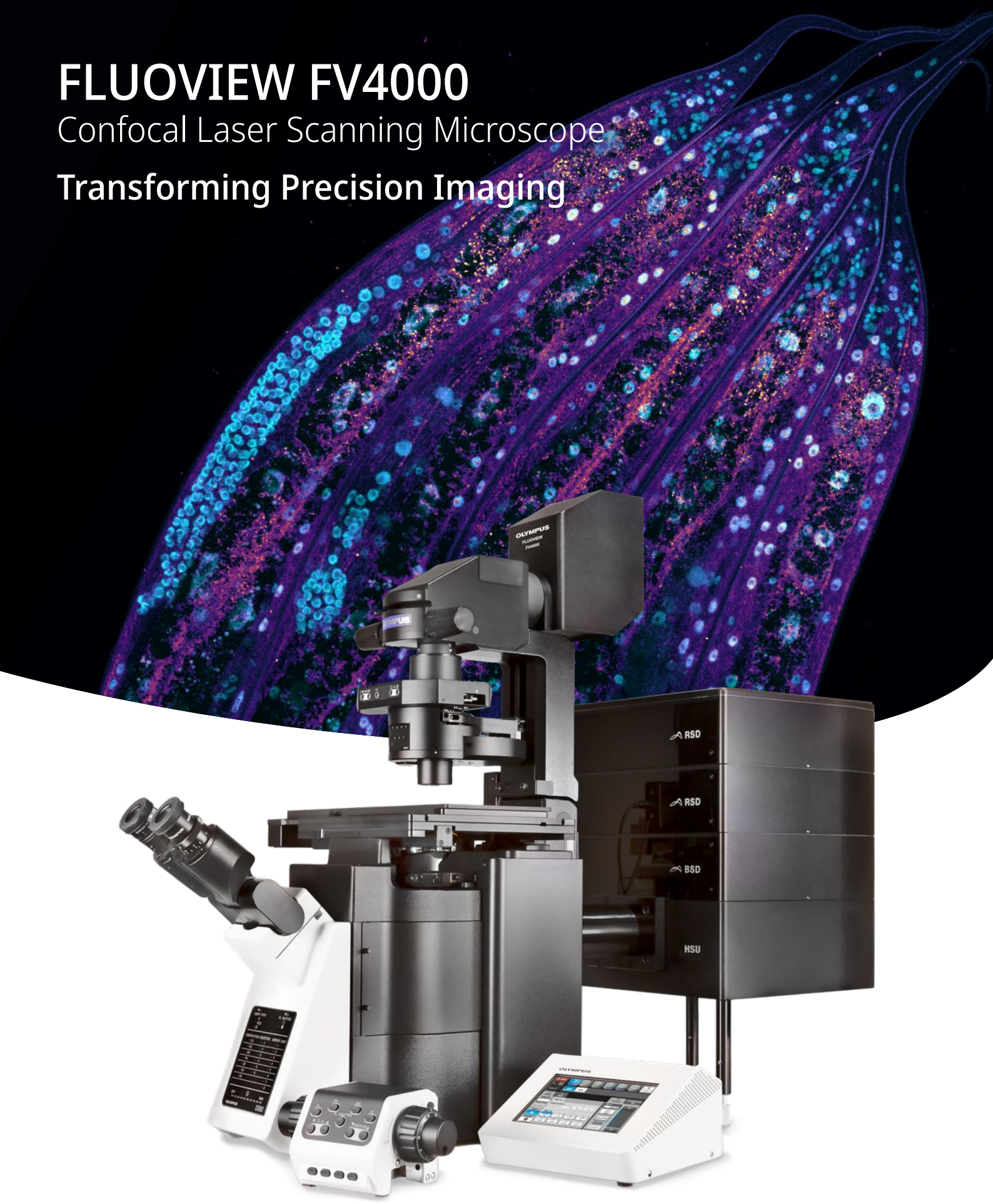
LIFE SCIENCE

FLUOVIEW FV4000

Confocal Laser Scanning Microscope

Transforming Precision Imaging



EVIDENT

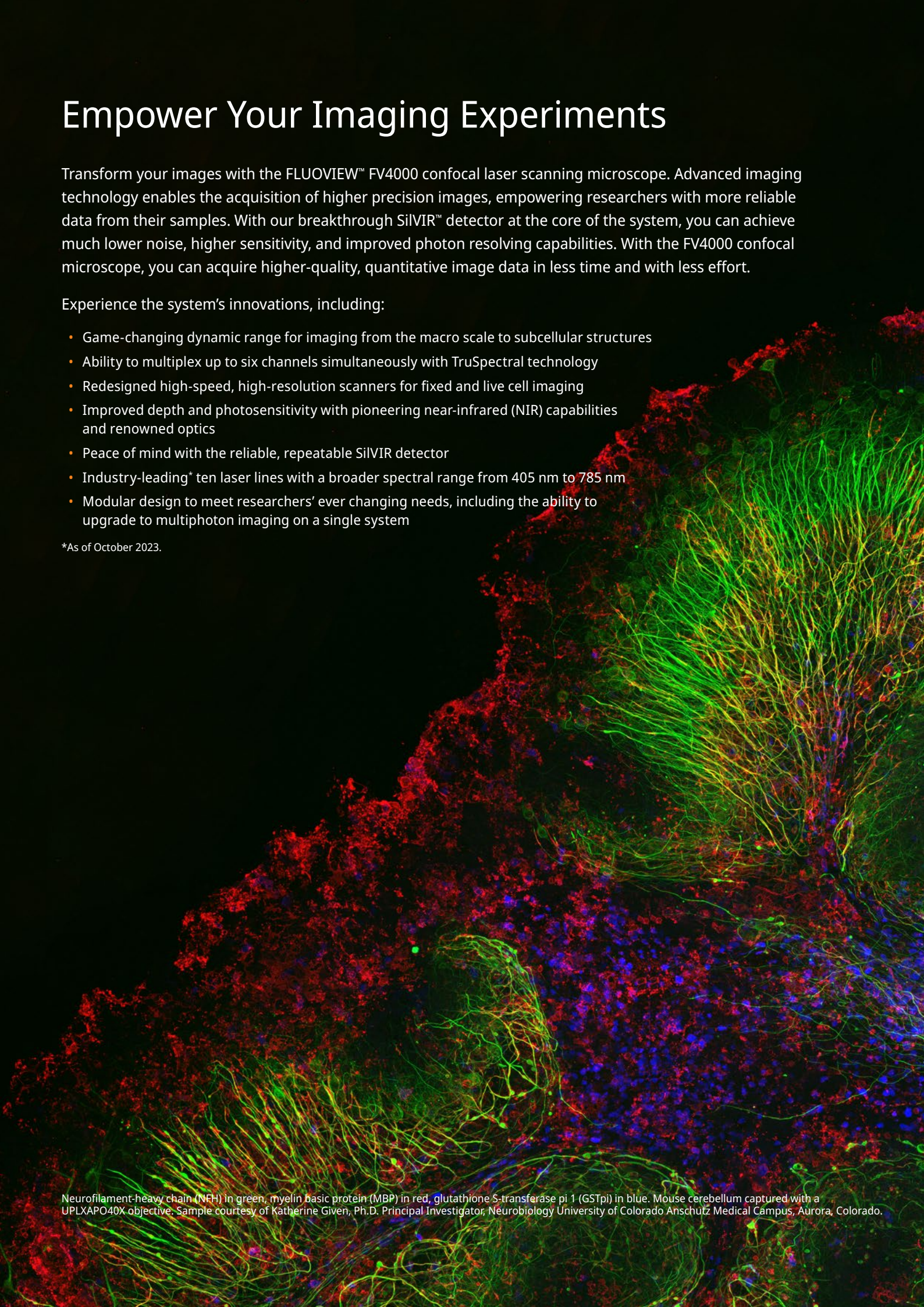
Empower Your Imaging Experiments

Transform your images with the FLUOVIEW™ FV4000 confocal laser scanning microscope. Advanced imaging technology enables the acquisition of higher precision images, empowering researchers with more reliable data from their samples. With our breakthrough SilVIR™ detector at the core of the system, you can achieve much lower noise, higher sensitivity, and improved photon resolving capabilities. With the FV4000 confocal microscope, you can acquire higher-quality, quantitative image data in less time and with less effort.

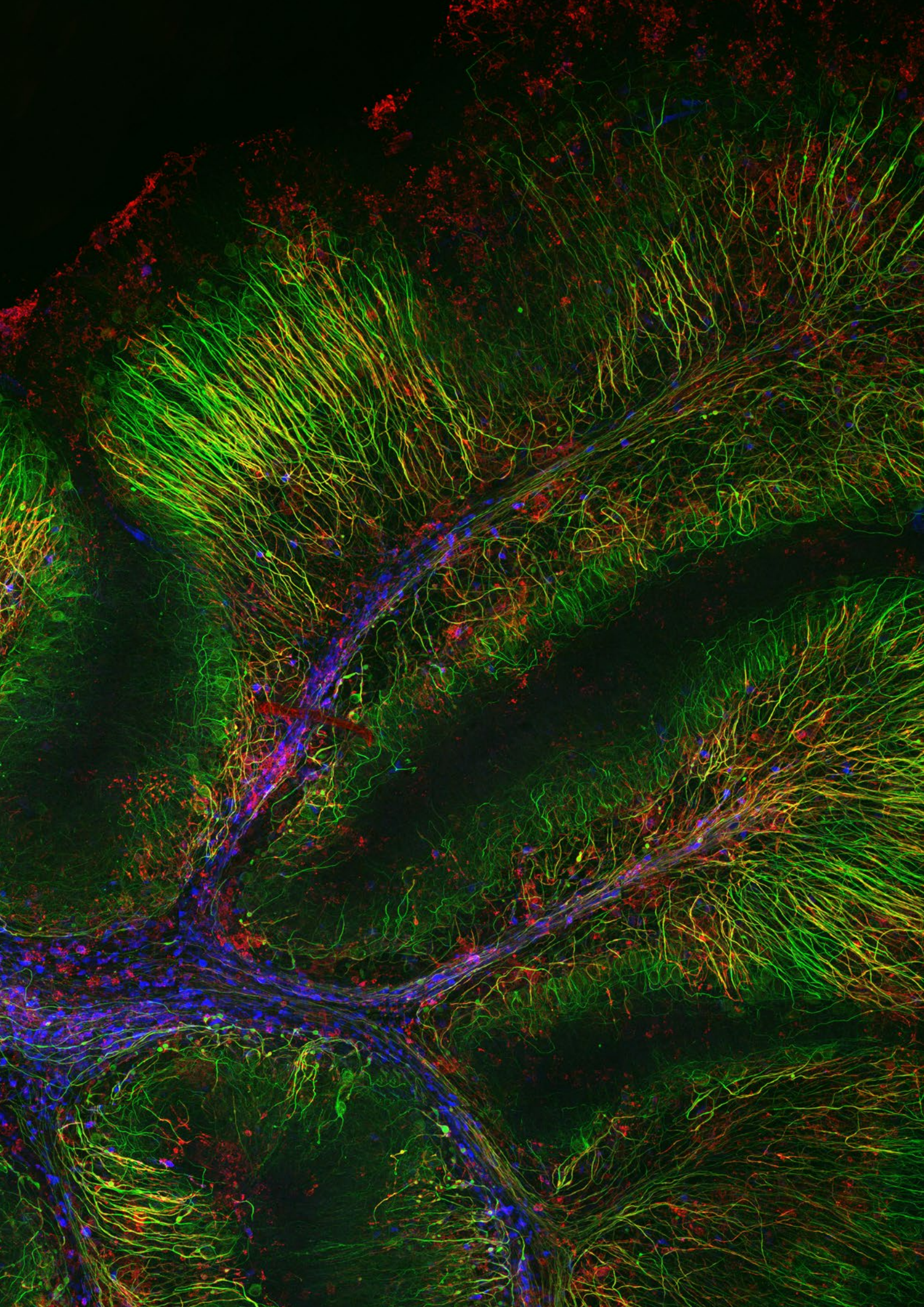
Experience the system's innovations, including:

- Game-changing dynamic range for imaging from the macro scale to subcellular structures
- Ability to multiplex up to six channels simultaneously with TruSpectral technology
- Redesigned high-speed, high-resolution scanners for fixed and live cell imaging
- Improved depth and photosensitivity with pioneering near-infrared (NIR) capabilities and renowned optics
- Peace of mind with the reliable, repeatable SilVIR detector
- Industry-leading* ten laser lines with a broader spectral range from 405 nm to 785 nm
- Modular design to meet researchers' ever changing needs, including the ability to upgrade to multiphoton imaging on a single system

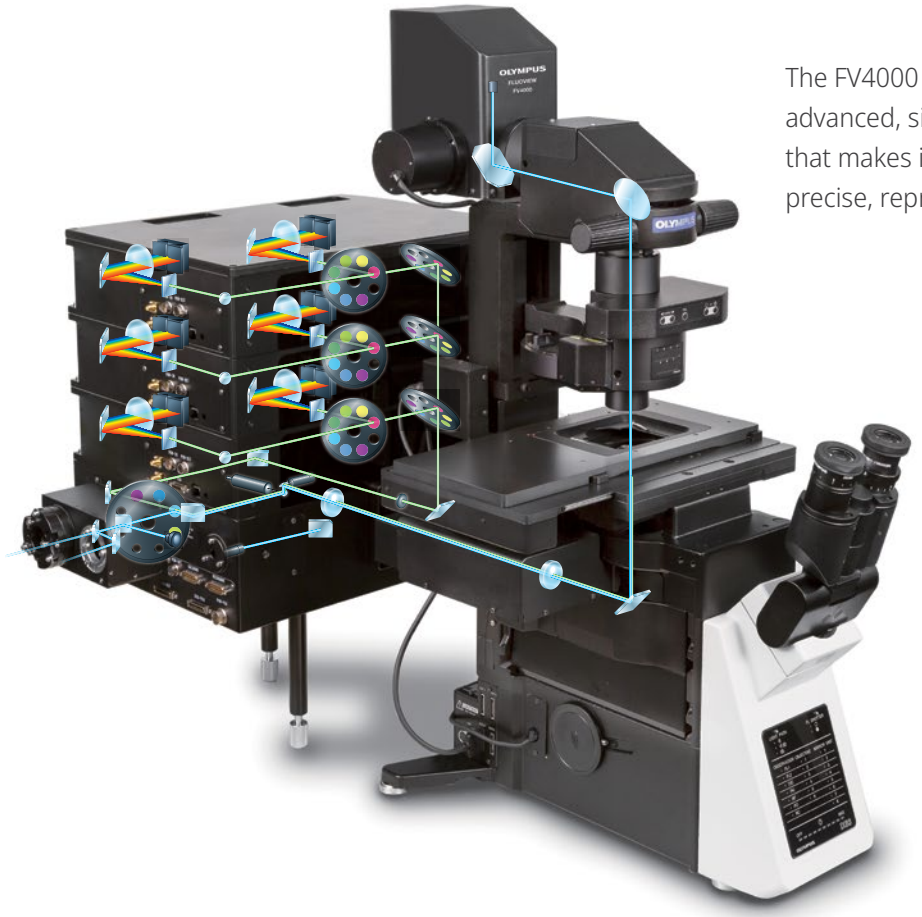
*As of October 2023.



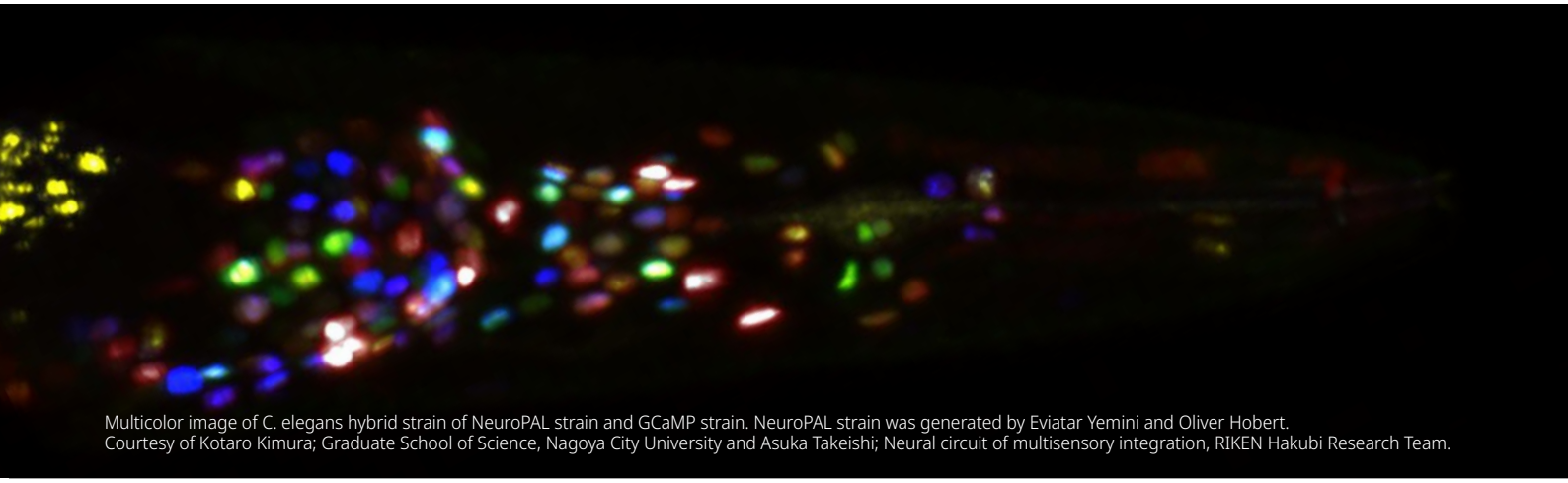
Neurofilament-heavy chain (NFH) in green, myelin basic protein (MBP) in red, glutathione S-transferase pi 1 (GSTpi) in blue. Mouse cerebellum captured with a UPLXAPO40X objective. Sample courtesy of Katherine Given, Ph.D. Principal Investigator, Neurobiology University of Colorado Anschutz Medical Campus, Aurora, Colorado.



Easy-to-Acquire, Quantitative Confocal Data



The FV4000 microscope uses our advanced, silicon-based SilVIR™ detector that makes it easier than ever to acquire precise, reproducible data.



Multicolor image of C. elegans hybrid strain of NeuroPAL strain and GCaMP strain. NeuroPAL strain was generated by Eviatar Yemini and Oliver Hobert.
Courtesy of Kotaro Kimura; Graduate School of Science, Nagoya City University and Asuka Takeishi; Neural circuit of multisensory integration, RIKEN Hakubi Research Team.

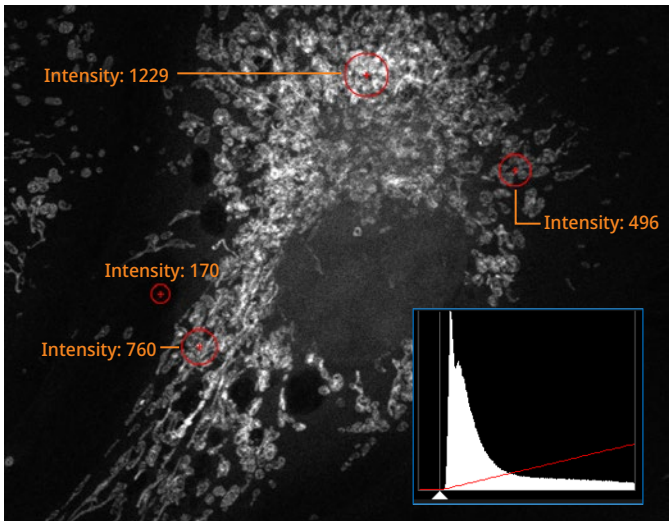
Tip of a Drosophila leg (42-hour pupation), stained with phalloidin (AlexaFluor 405, F-actin, Cyan), anti-phosphotyrosine antibody (AlexaFluor 555, cell surface, red), and anti-HRP antibody (AlexaFluor 647, axon, blue). Sample Courtesy of: Zhengkuan Sun, Shigeo Hayashi, Laboratory for Morphogenetic Signaling, RIKEN Center for Biosystems Dynamics Research, Japan.

Game-Changing Quantification

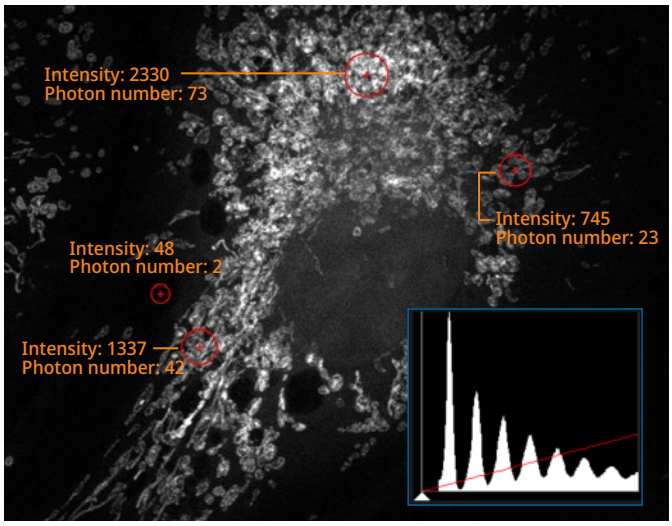
The technology behind our SilVIR detector enables you to precisely quantify image intensity for more reliable data. Imaging data can be displayed as to the number of photons, providing the absolute value of the fluorescence intensity for each image. The wider dynamic range provides accurate quantification of fluorescence intensity by photon number even at high intensity levels.

Cos-7 cells: anti-Tubulin (Alexa Fluor 488; green). Sample Courtesy of: Dr. Jana Döhner, Dr. Urs Ziegler, University of Zürich.

GaAsP 500 V



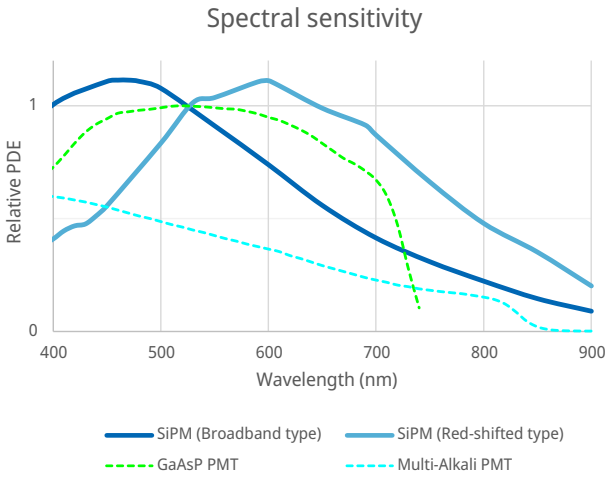
SilVIR

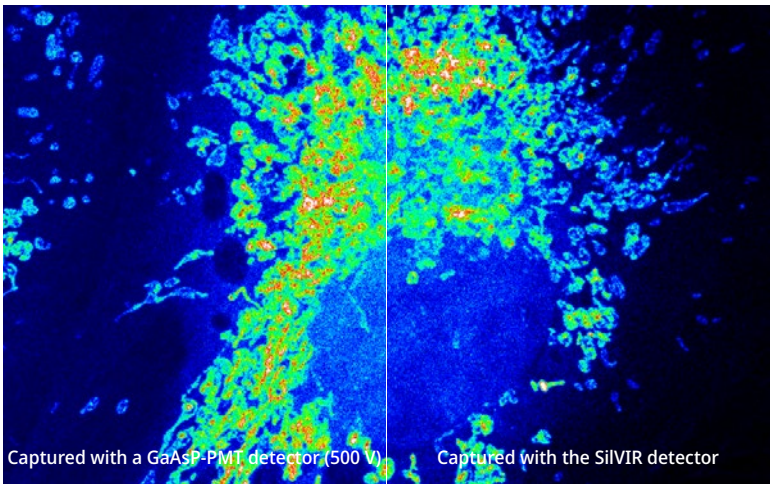


The histogram on the image captured using the SilVIR detector shows a discrete pattern where the intensity can be converted to the photon number. The detector's fluorescence intensity can be quantified as the photon number, and the background level is extremely low.

High-Quality Images, Even with Weak Fluorescence

The FV4000 system's ability to capture weak fluorescence images surpasses that of previous-generation laser scanning systems. The SilVIR detector has very low noise and higher photon detection efficiency than traditional GaAsP-PMT detectors across the violet to near-infrared wavelength range, delivering better image quality, especially when acquiring dim fluorescence. A vivid fluorescence image with clear background can easily be acquired without adjusting the offset. And the higher sensitivity means you need less laser power, reducing photodamage to your samples. When combined with our redesigned resonant scanner you can acquire high-quality, fast-frame-rate images in less time.

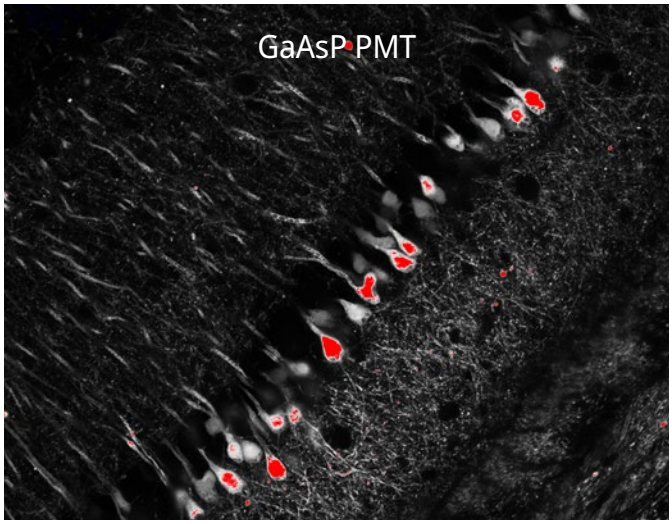


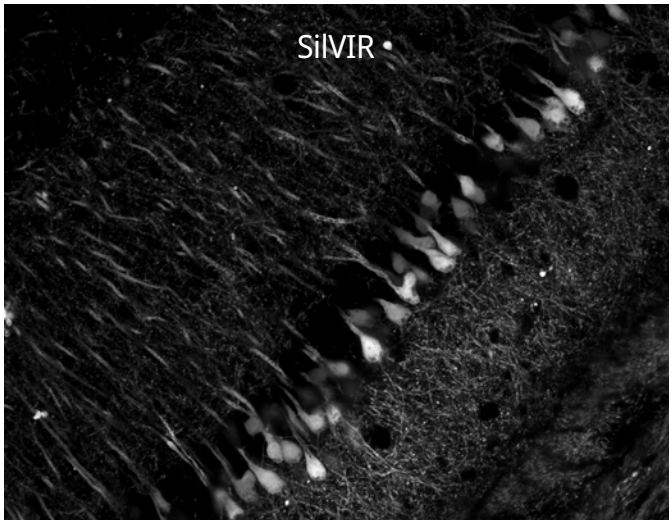


The image captured using the SilVIR detector has extremely low background noise compared to the image captured using a GaAsP-PMT.

Experience the Full Dynamic Range of Fluorescence

Instead of choosing to focus on either dim or bright fluorescence areas, the FV4000 microscope can capture both in one image without saturation or loss of information thanks to the SilVIR detector's high dynamic range. This allows accurate image analysis and processing with less work.



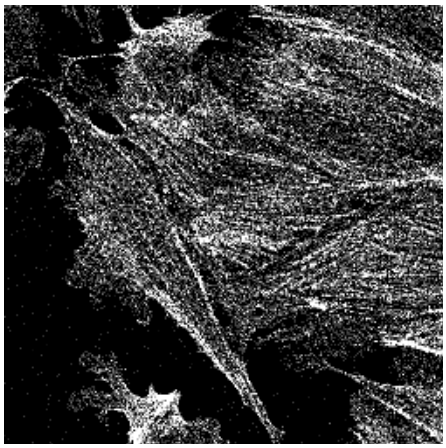


Intuitive User Interface and Workflows

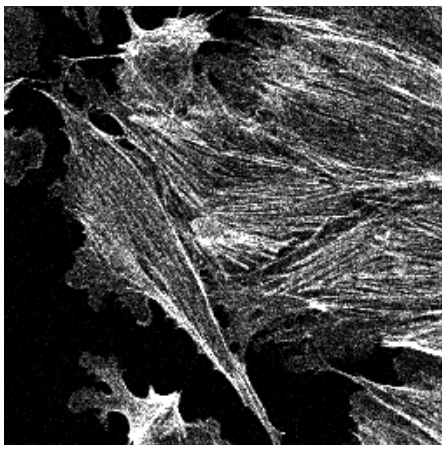
The photomultiplier tubes traditionally used in confocal imaging require voltage adjustments depending on the sample's brightness level as well as an offset adjustment to reduce signal noise. This requires expert knowledge and experience to make proper adjustments to acquire high-quality confocal images.

The SilVIR detector's voltage is optimized for sensitivity and low noise at the factory, so you don't need to make any voltage and offset adjustments—all you need to adjust is the laser power to achieve a certain photon number. Because the S/N ratio is proportional to the photon number, the image quality will be consistent if the photon number remains constant. This enables you to easily acquire images with the same level of quality.

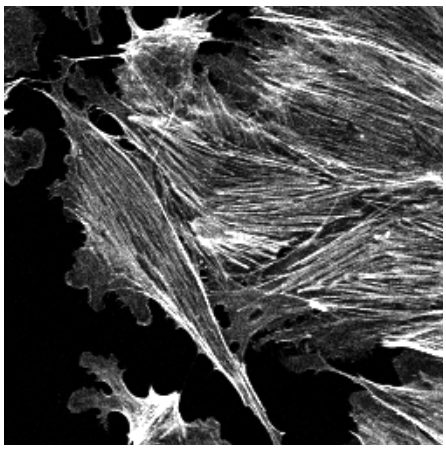
Quantitative Image Quality Control



4 photons S/N=2



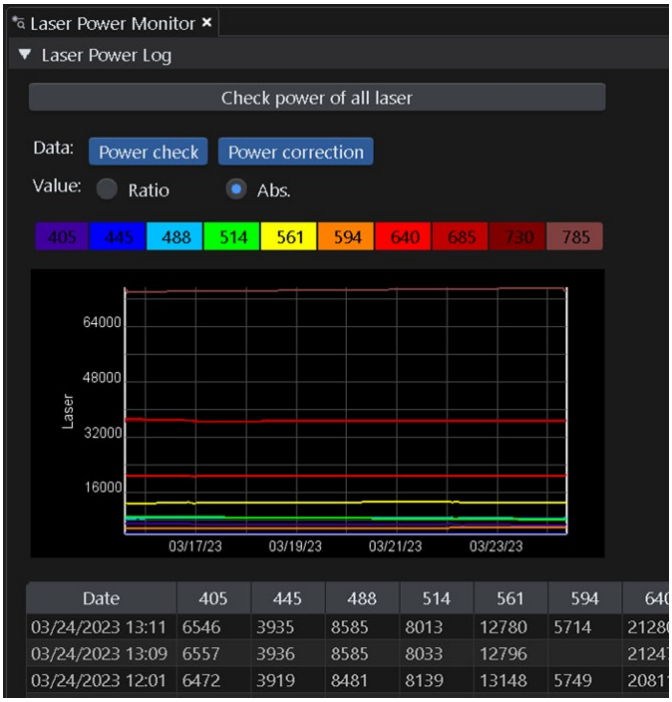
27 photons S/N=5.2



107 photons S/N=10.3

Reproducible Image Data Between Users and Systems

The SilVIR detector has less sensitivity loss over time than previous-generation detector technologies. With our laser power monitor (LPM) and TruFocus™ Z-drift compensator, achieve reproducible images under consistent conditions for better reproducibility. Different users on different days can acquire the same precise images using the same settings. Even the images acquired by different FV4000 microscopes can be compared and discussed using the same photon number intensity scale.



Date	405	445	488	514	561	594	640
03/24/2023 13:11	6546	3935	8585	8013	12780	5714	2128
03/24/2023 13:09	6557	3936	8585	8033	12796		2124
03/24/2023 12:01	6472	3919	8481	8139	13148	5749	2081

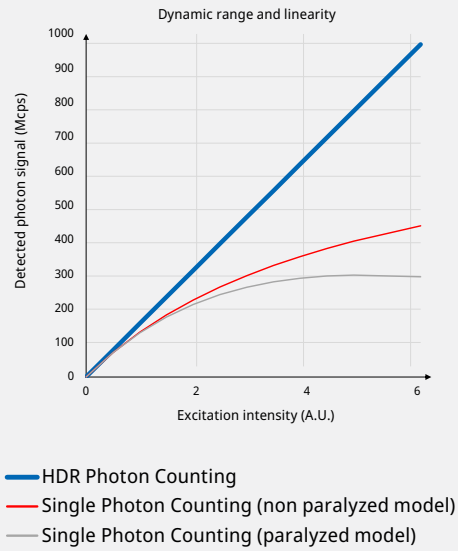
SilVIR Next-Generation Detector Technology

The SilVIR detector combines two advanced technologies—a silicon photomultiplier (SiPM) and our patented* fast signal processing technology.

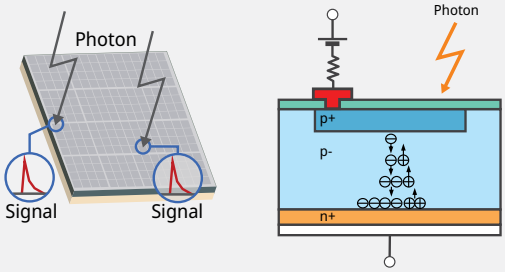
The SiPM can detect random incident photons simultaneously, enabling a higher photon detection efficiency for a wider range of wavelengths and dynamic range. Combined with our patented* fast signal processing technology, the SilVIR detector can quantify the detected number of photons and delivers exceptionally low background noise and high dynamic range photon counting detection up to 2,000 photons/2 µs with linearity.

As SilVIR detectors are based on semiconductor technology, their sensitivity does not degrade and individual differences between different detectors are very small, helping ensure reliable, consistent results across time and users.

*US11237047

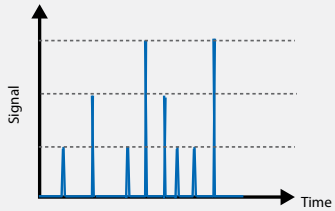


Semiconductor sensor
multi-pixel Geiger-mode avalanche photodiode



- High dynamic range
- Low noise
- No degradation of sensitivity
- Less sensitivity variation among other detectors

Photon quantification



- The height of the response pulse corresponds to the detected photon number

More Information from Your Images

See Further with NIR Capabilities

The system's enhanced technologies enable expanded multiplexing to see more in one image.

Our updated TruSpectral™ technology combined with high-sensitivity SilVIR detectors enable you to multiplex up to six channels simultaneously. The upgraded spectral system is comprised of our highly efficient volume phase hologram (VPH) grating and slit and can detect an industry-leading 400 nm to 900 nm wavelength range* with a minimum step of 1 nm. Add up to six channels with your choice of broadband and red-shifted detectors. This setup expands your fluorochrome choices to minimize damage during live cell imaging and reduce autofluorescence. Our modular laser combiners allow up to 10 laser lines from 405 nm to 785 nm in parallel.

NIR imaging offers greater multiplexing capabilities by extending the excitation (λ_Ex) and detection (λ_Em) spectral profile of the FV4000 system. This enables additional dyes to be used to help minimize emission signal overlapping.

Laser	Fluorescent dye	λ_Ex (nm)	λ_Em (nm)
LD685	Alexa Fluor 680	679	702
	DyLight 680	692	712
	Alexa Fluor 700	696	719
	iRFP720	702	720
LD730	ATTO 740	743	763
	DiR	750	782
	Alexa Fluor 750	752	779
	Cy7	753	775
	DyLight 755	754	776
LD785	DyLight 800	777	794
	IR Dye 800CW	778	794
	Alexa Fluor 790	782	805
	Cy7.5	790	810

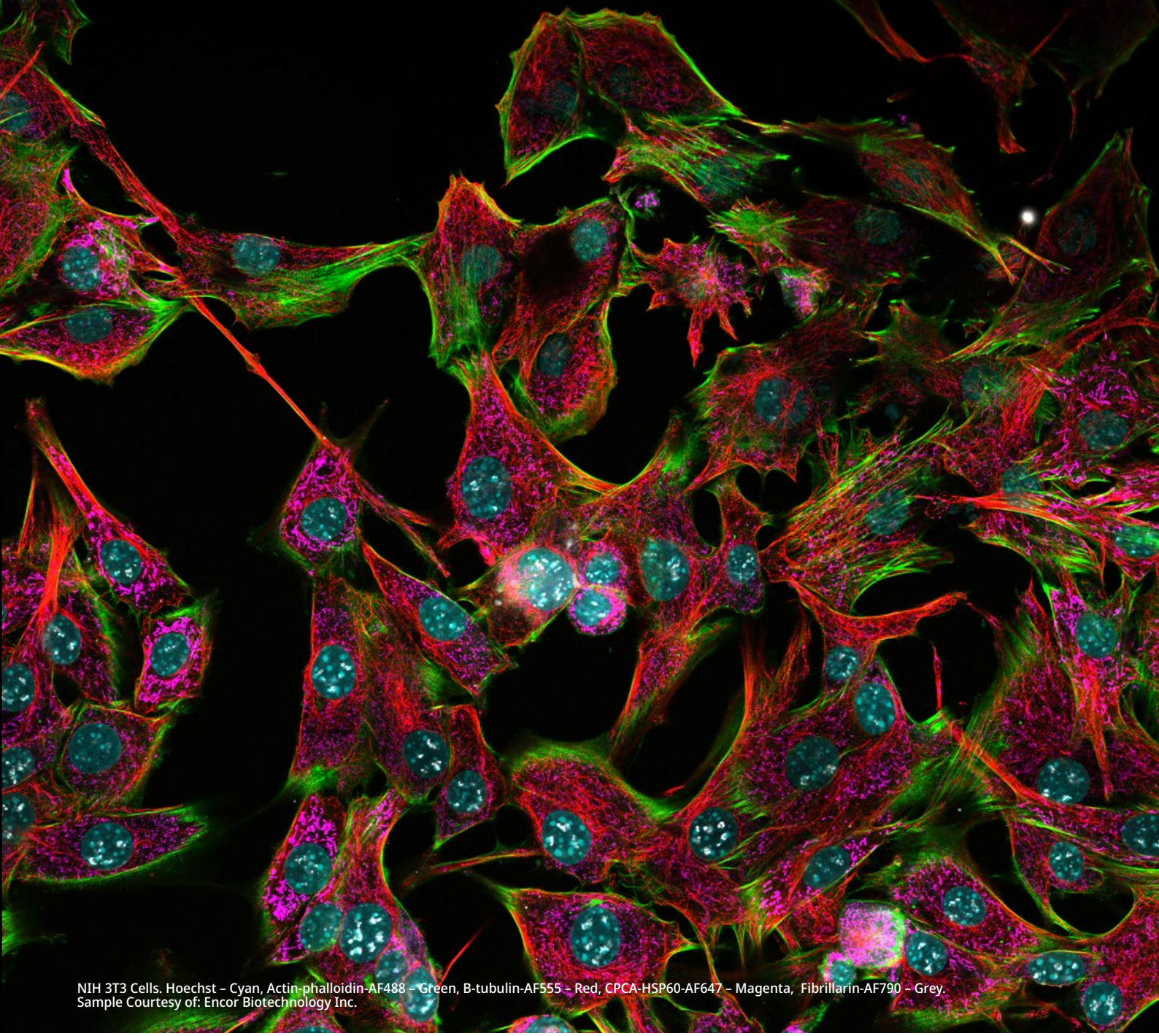
High-Quality Optics for Efficient NIR Imaging

The FV4000 system's optical elements have a high transmission from 400 nm to 1300 nm, including the galvanometer and resonant scanners, which are coated in silver rather than aluminum.

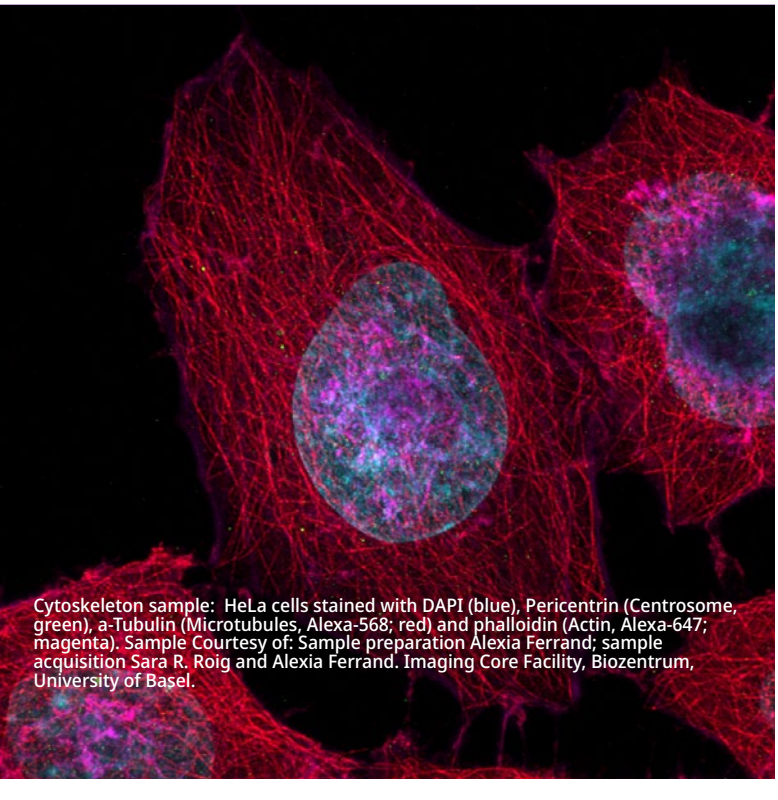
Our award-winning X Line™ objectives work well for multiplexed imaging as they are corrected for chromatic aberrations between 400–1000 nm. They also have a higher numerical aperture, excellent flatness, and very high transmittance from UV to NIR, increasing the multiplexing capabilities.

X LINE

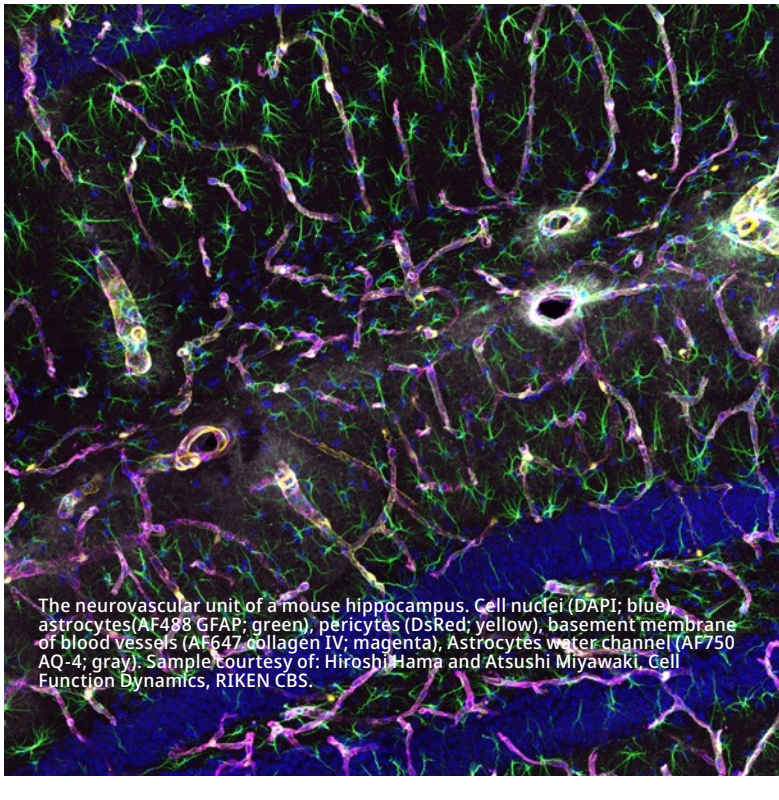
*As of March 2023.



NIH 3T3 Cells. Hoechst – Cyan, Actin-phalloidin-AF488 – Green, B-tubulin-AF555 – Red, CPCA-HSP60-AF647 – Magenta, Fibrillarin-AF790 – Grey. Sample Courtesy of: Encor Biotechnology Inc.



Cytoskeleton sample: HeLa cells stained with DAPI (blue), Pericentrin (Centrosome, green), a-Tubulin (Microtubules, Alexa-568; red) and phalloidin (Actin, Alexa-647; magenta). Sample Courtesy of: Sample preparation Alexia Ferrand; sample acquisition Sara R. Roig and Alexia Ferrand. Imaging Core Facility, Biozentrum, University of Basel.



The neurovascular unit of a mouse hippocampus. Cell nuclei (DAPI; blue), astrocytes(AF488 GFAP; green), pericytes (DsRed; yellow), basement membrane of blood vessels (AF647 collagen IV; magenta), Astrocytes water channel (AF750 AQ-4; gray). Sample courtesy of: Hiroshi Hama and Atsushi Miyawaki, Cell Function Dynamics, RIKEN CBS.

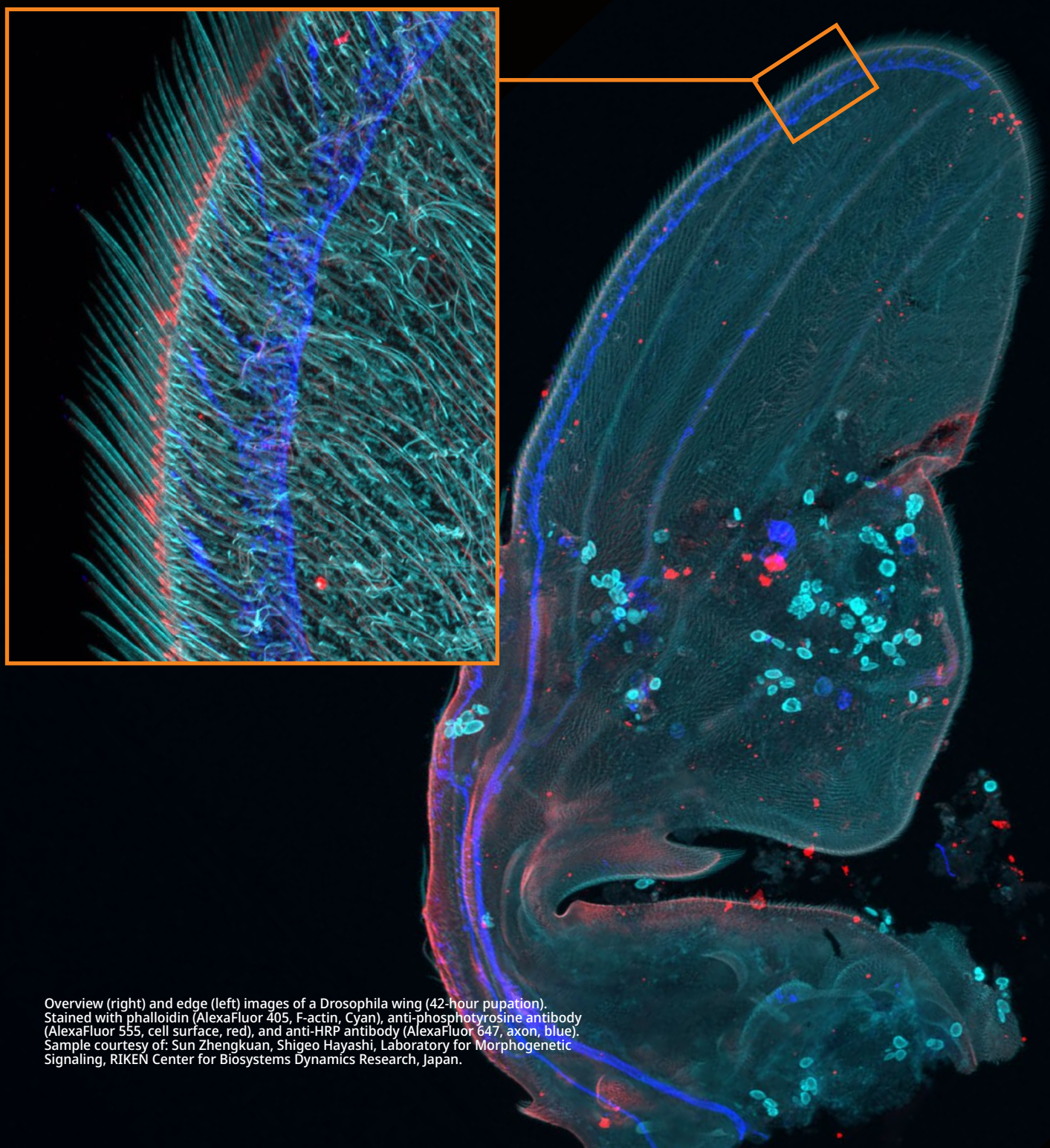
Flexible Macro to Micro Imaging

Fast, Efficient Multiscale Observation

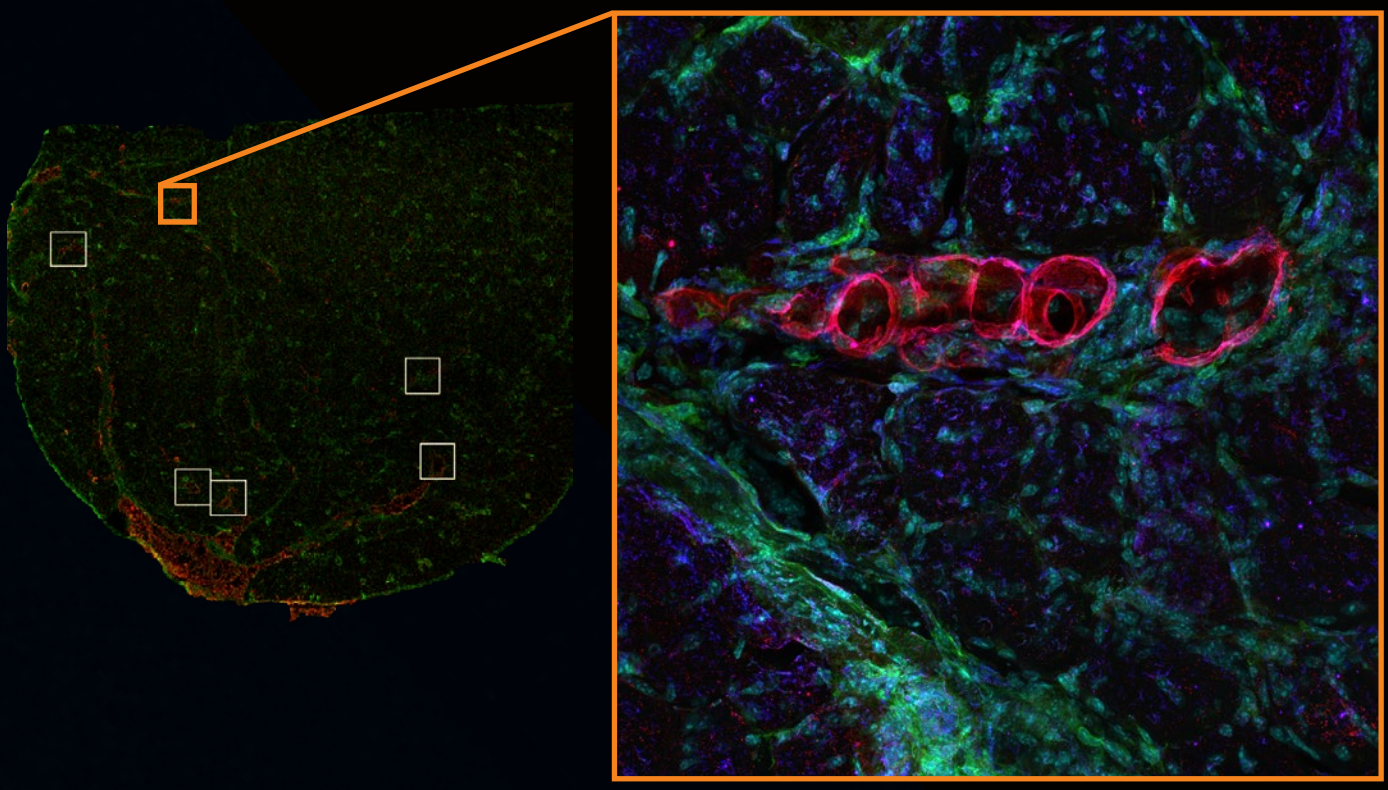
The macro-to-micro workflow enables you to easily observe the target sample from the macro level—whole body or tissue—down to the cellular or subcellular level.

High Image Quality at High Speed

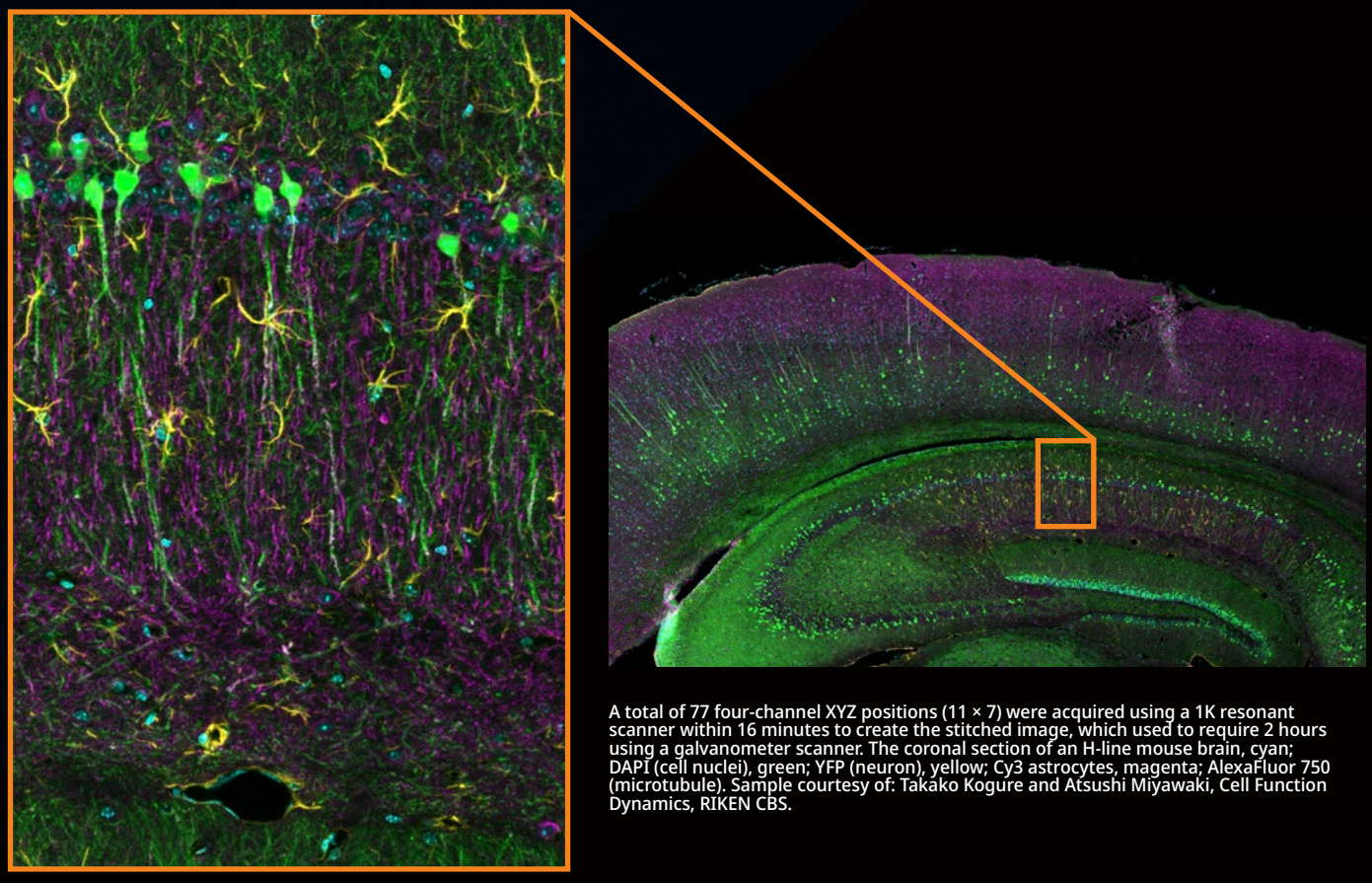
The system's unique combination of advanced technologies delivers high-quality images faster than conventional laser scanning microscope systems. The 1k × 1k resonant scanner at FN20 with 0.033 µs per pixel enables you to rapidly acquire high-resolution images with minimal noise using the SilVIR detector. The result is that you can quickly acquire stitched macro scale images with exceptional quality to maximize your time and research potential.



Overview (right) and edge (left) images of a Drosophila wing (42-hour pupation). Stained with phalloidin (AlexaFluor 405, F-actin, Cyan), anti-phosphotyrosine antibody (AlexaFluor 555, cell surface, red), and anti-HRP antibody (AlexaFluor 647, axon, blue). Sample courtesy of: Sun Zhengkuan, Shigeo Hayashi, Laboratory for Morphogenetic Signaling, RIKEN Center for Biosystems Dynamics Research, Japan.



Muscle tissue, blue; DAPI, green; FDGFR, red; F4/80. Sample courtesy of: Marshall Hogarth and Jyoti Jaiswal, Center for Genetic Medicine Research, Children's National Research Institute.

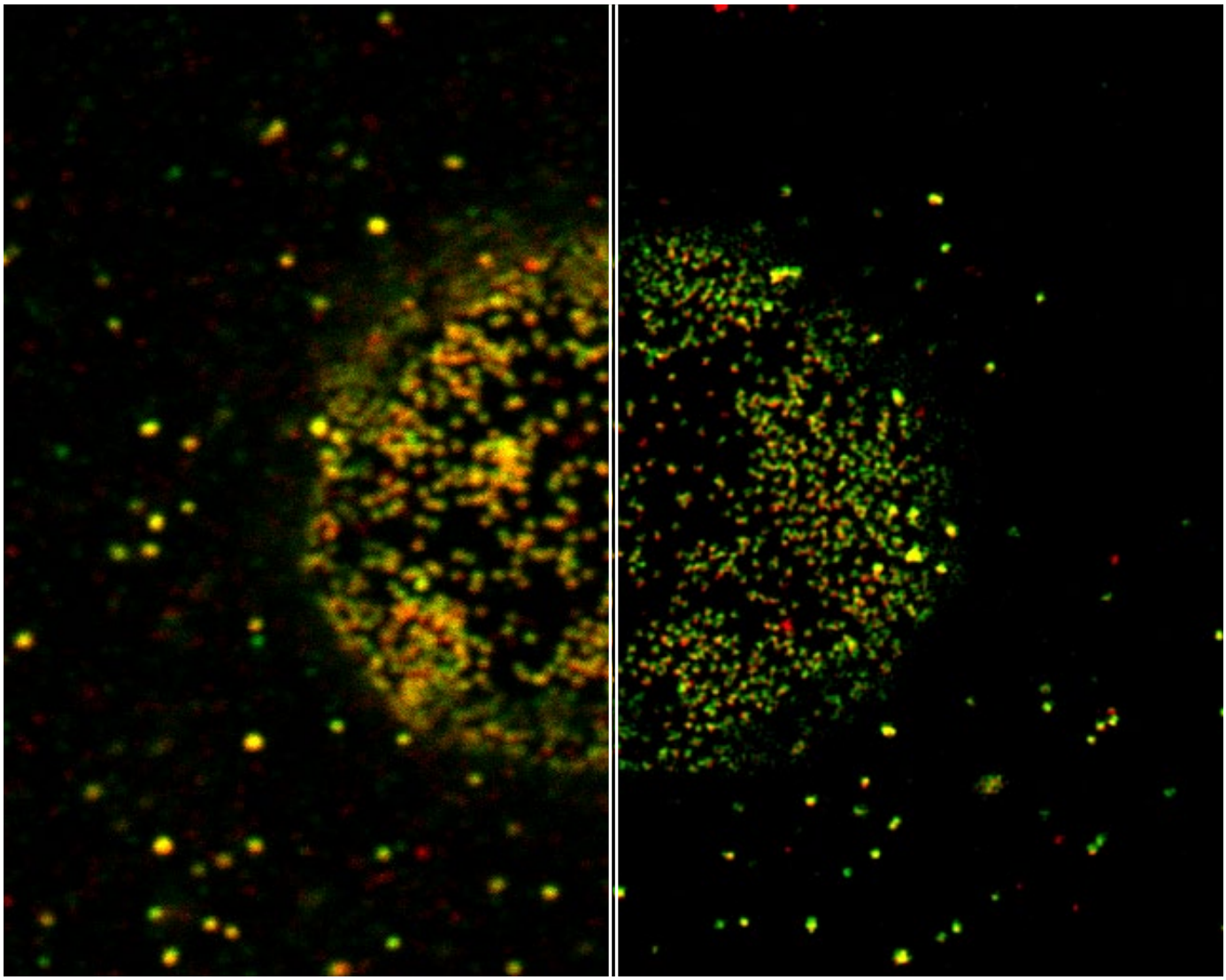


A total of 77 four-channel XYZ positions (11 × 7) were acquired using a 1K resonant scanner within 16 minutes to create the stitched image, which used to require 2 hours using a galvanometer scanner. The coronal section of an H-line mouse brain, cyan; DAPI (cell nuclei), green; YFP (neuron), yellow; Cy3 astrocytes, magenta; AlexaFluor 750 (microtubule). Sample courtesy of: Takako Kogure and Atsushi Miyawaki, Cell Function Dynamics, RIKEN CBS.

Simple, Precise Super Resolution Imaging

Capture super resolution images using the FV4000 microscope with no dedicated hardware. Using high NA objectives—such as our A Line™ HR objectives—and our super resolution software (FV-OSR), you can easily acquire super resolution images to observe subcellular structures. The FV-OSR software automatically optimizes the confocal aperture to detect high-frequency components and enhances their contrast to achieve a 120 nm XY resolution. With the improved sensitivity of SilVIR detector technology and on-the-fly processing, achieve super resolution images 8x faster than previous-generation systems.

Acquired using confocal mode (1AU) | Acquired using super resolution mode



Nucleopores of a HeLa cell. Green; AF 488 anti-Ran BP2, Red; AF 555 anti-Nup62.

High-Resolution 3D Images in Thick Samples

When imaging thicker samples, the FV4000 microscope enables you to capture high-resolution, 3D images. The SilVIR detector's exceptionally wide dynamic range provides high sensitivity, even in the near-infrared region, so you can take advantage of NIR's longer wavelength to penetrate deep in tissue samples.

With the system's NIR excitation capabilities you can image deeper with less scattering and absorption by taking advantage of a critical optical window in tissue, wherein light-scattering compounds such as melanin and heme absorb less light between 700–1500 nm. Less scattering means more light reaches the focal plane. The 685 nm, 730 nm, and 785 nm diode lasers on the FV4000 system enable you to image significantly deeper compared to imaging depths achieved with visible lasers.

The overall image quality and Z resolution can be improved using TruSight deconvolution for stunning 3D images of thick samples. Specialized cellSens™ algorithms for the system enable a seamless workflow from acquisition to publication with the click of a button. Take advantage of GPU processing for even faster results.

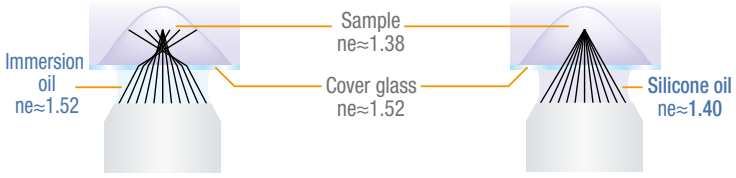
Clear Images at Depth

Use our silicone immersion objectives with the FV4000 microscope and achieve clear images of features and structures deep within your sample. Silicone oil has a refractive index close to that of live cells or tissue, greatly reducing the spherical aberration as compared to air, water, or other oils. With less aberration, you can achieve clearer images of your sample at depth. And silicone immersion oil does not dry out at 37 °C (98.6 °F), making it effective for long-term time-lapse imaging.

Objectives	Working Distance (WD) [mm]	Numerical Aperture (NA)
UPLSAPO30XS	0.8	1.05
UPLSAPO40XS	0.3	1.25
UPLSAPO60XS2	0.3	1.3
UPLSAPO100XS	0.2	1.35

Refractive Index Is Important with Deep Tissue Observation

In deep tissue observation, image quality depends on keeping the refractive index of the sample and immersion medium as close to each other as possible.

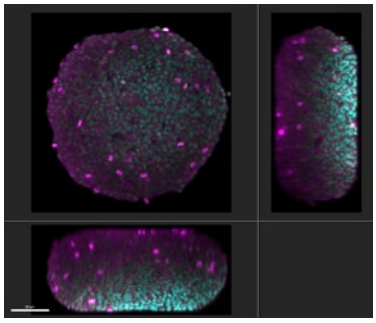


Oil immersion objective

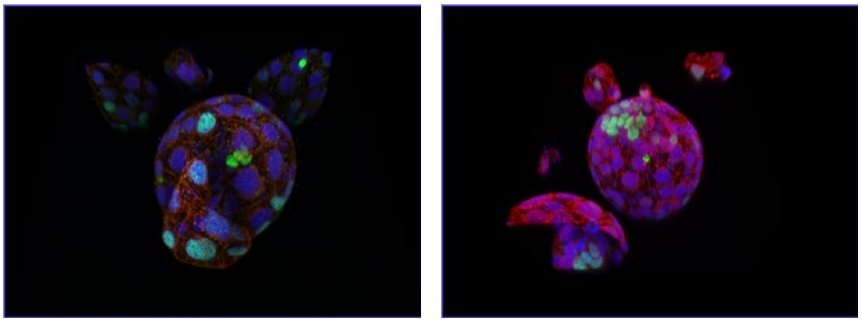
When working with an oil immersion objective, the difference between the refractive index of the samples and immersion oil results in spherical aberration in deep tissue, causing resolution to deteriorate and fluorescence to become dim.

Silicone oil immersion objective

When working with a silicone oil immersion objective, the difference between the refractive index of the samples and silicone oil is minimal, so it achieves brighter fluorescence images with higher resolution for deep tissue observation.



HeLa cell spheroid labeled by DAPI (cyan, cell nuclei) and AlexaFluor790 (magenta, Ki-67). Imaging of the spheroid's whole volume was possible by NIR 785 nm, although only surface area cell nuclei observation was possible using a 405 nm laser.



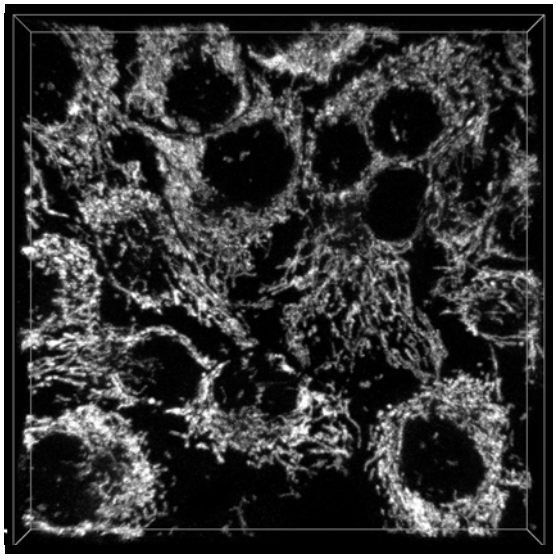
Wide-type mouse embryo. Green; Nanog-Alexa Fluor 488 (Epiblasyt cells), red; gata6-Alexa Flour 568 (PrE cells), blue; DNA-Alxea Fluor 647. Sample courtesy of: Dr. Shoma Nakagawa, Cosma Lab and Dr. Nadia Halidi, Advanced Light Microscopy Unit, Centre for Genomic Regulation, Barcelona, Spain.

Gentler High-Speed Time-Lapse Imaging

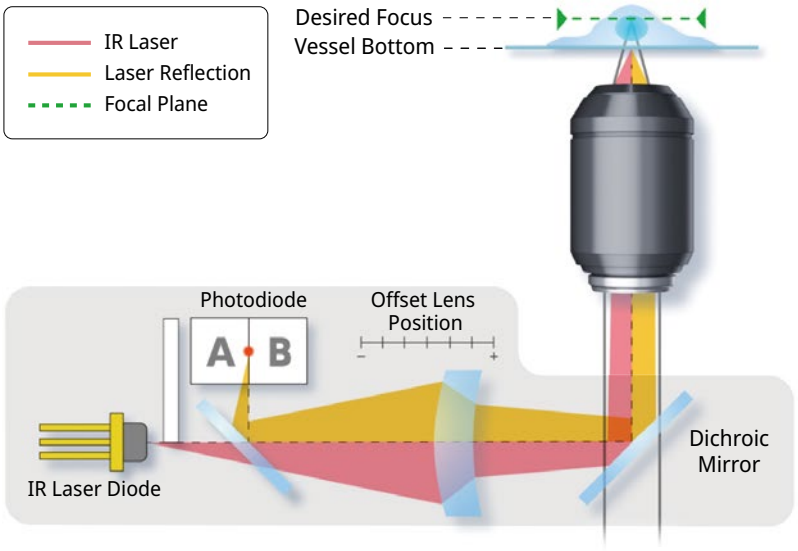
Precise Dynamics of Live Cells with Less Damage

Typically, using longer wavelengths for fluorescence excitation for shorter periods of time is better for overall sample health. Using less phototoxic light means you can image for longer periods, enabling you to obtain more consistent and reproducible data from live cell imaging experiments. The FV4000 system not only provides gentle time-lapse imaging via the 685 nm, 730 nm, and 785 nm lasers, but it also features a dedicated TruFocus Red Z-drift compensator to maintain the focus position. This upgraded TruFocus Red unit supports a larger range of wavelengths and is compatible with a wide range of objectives, including our high-performing X Line™ and A Line™ series.

To capture every moment of the dynamics of live cells, our resonant scanner can acquire high-resolution images over a wider area. The system also minimizes phototoxicity thanks to the scanner's short pixel dwell time, which reduces the time the focused laser beam rests on a single spot. The SilVIR detector's high sensitivity delivers a better signal-to-noise ratio than other detector types, producing higher quality images at higher speeds. For even greater precision, the microscope's rolling average processing maintains qualifications and time resolution.



HeLa cells labeled by MitoView 720. XYZT imaging by 1K resonant scanner for 30 min.

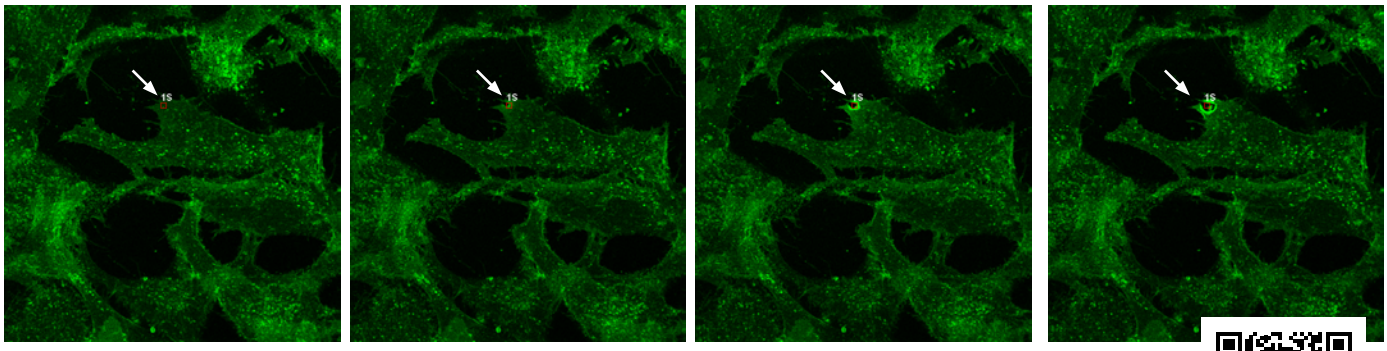


See It in Action

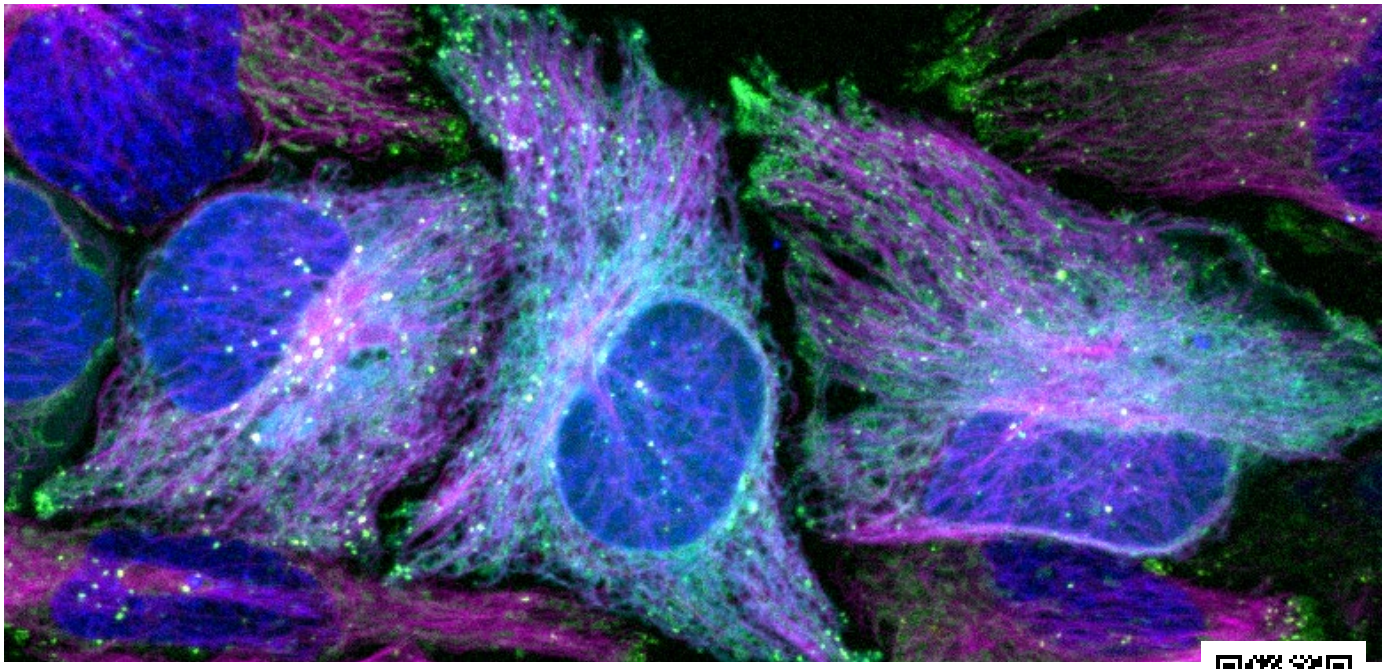
Learn More

Quantify Cellular Dynamics in High Dynamic Range

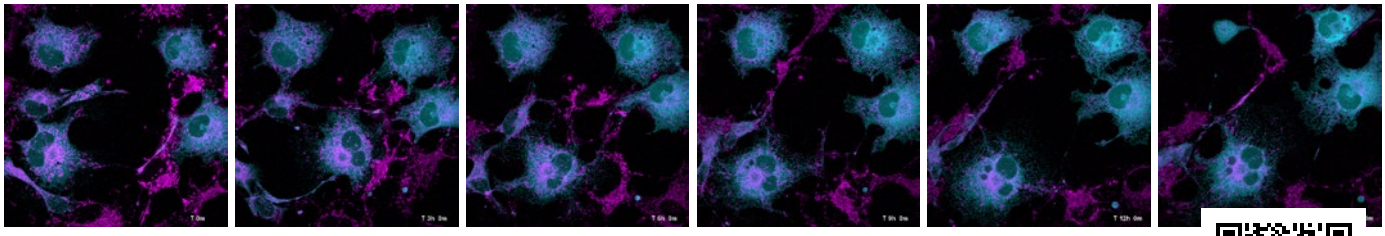
Since the SilVIR detector enables you to measure the image intensity in photons, small changes of fluorescence intensity can be precisely measured, enabling you to measure calcium ion and other metabolic processes in living cells.



Time-lapse photo stimulation: the laser injury was performed on C2C12 cells. The green pseudocolor represents the application of an FM 1-43 bath. The image was acquired with a 2 µs galvo scanner and a UPLSAPO60XOHR objective. A 405 nm laser was used for photodamage and a 488 was used to image. Sample courtesy of: Daniel Bittel and Jyoti Jaiswal, Center for Genetic Medicine Research, Children's National Research Institute.



Time-lapse image of HeLa cells stained with Hoechst33342 (nuclear, blue), MitoTracker Green (mitochondria, green), LysoTracker Red (Lysosome, yellow), SiR-Tubulin (tubulin, magenta), POR-SA-Halo (ER, cyan).
Sample courtesy of: Masayasu Taki, Ph.D., Institute of Transformative Bio-Molecules (WPI-ITbM), Nagoya University, Japan, Yuichi Asada and Ryusei Aruga, Graduate School of Science, Nagoya University, Japan.



A 17-hour, time-lapse image of HeLa cells stained with MitoTracker Red (mitochondria, magenta), POR-SA-Halo (ER, cyan).
MitoTracker Red: Ex 561nm/Em, POR-SA-Halo: Ex 730nm/Em,
Sample Courtesy of: Masayasu Taki, Ph.D., Institute of Transformative Bio-Molecules (WPI-ITbM), Nagoya University, Japan, Yuichi Asada and Ryusei Aruga, Graduate School of Science, Nagoya University, Japan.

Enhance Your Confocal Imaging with AI

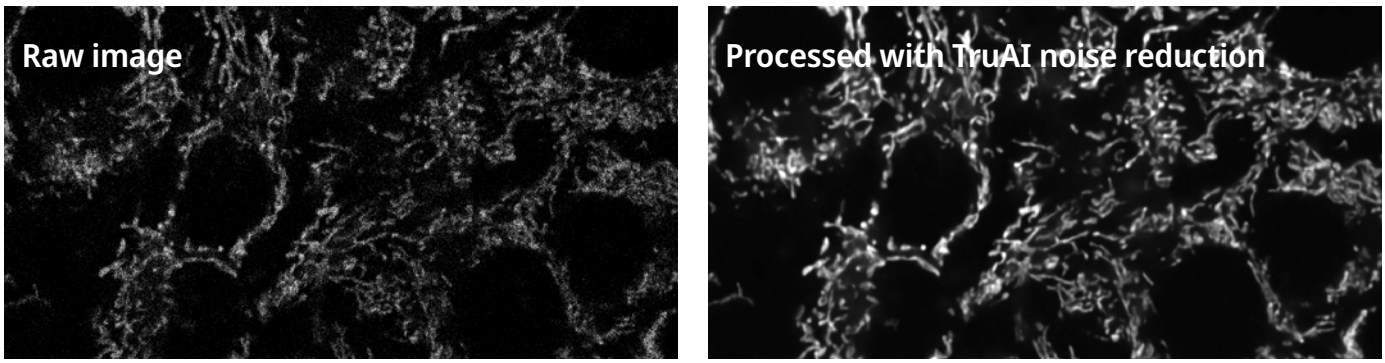
TRU AI

Our AI tools enable you to take your confocal imaging to the next level and save time during data analysis. While the microscope's signal-to-noise ratio is already exceptional, TruAI technology denoise can further reduce the noise for stunning, data-rich resonant images.

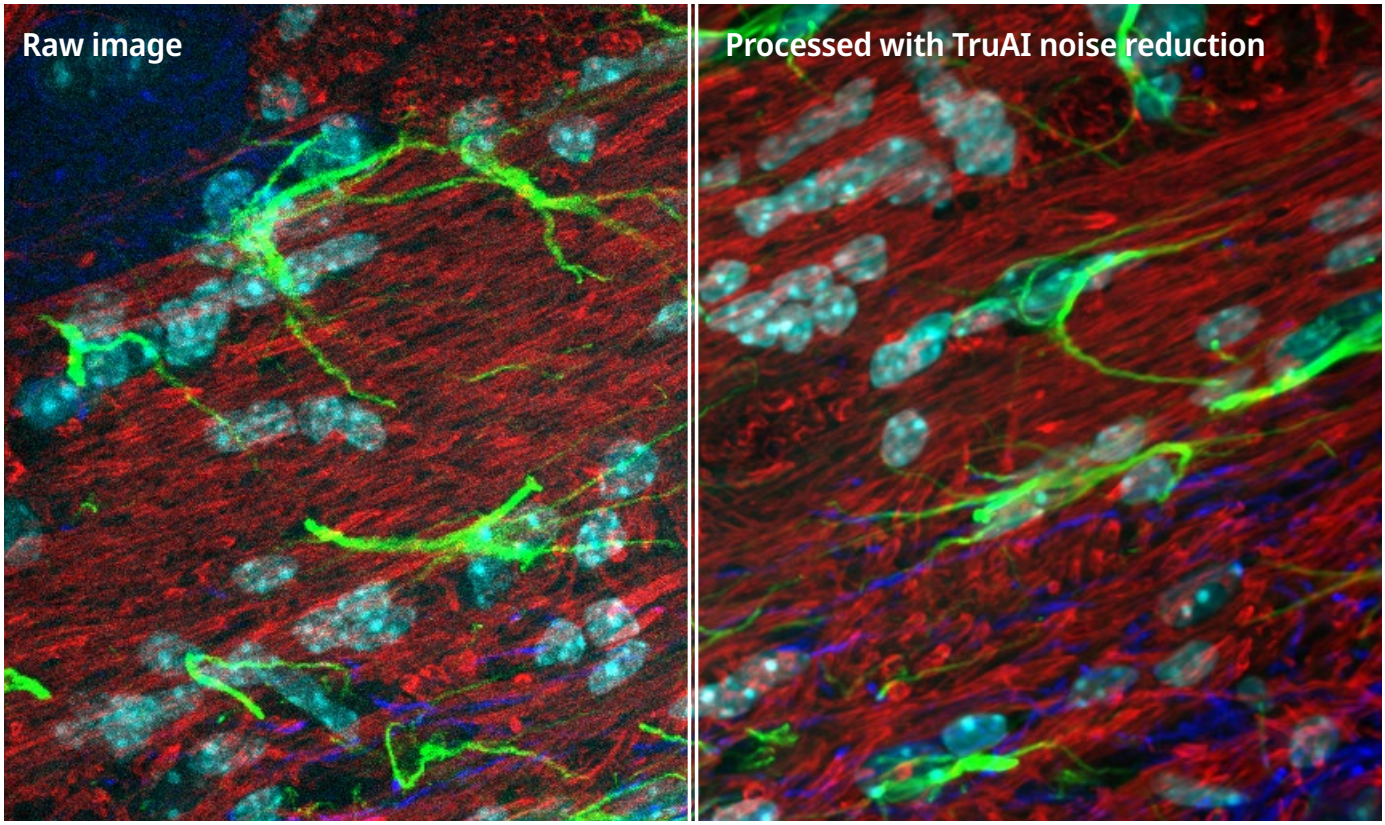
To speed up image analysis, you can pretrain an AI model so that the system can automatically segment your image data, greatly reducing the workload of this often time-consuming manual process. Then, TruAI technology further streamlines the analysis so that you can get your data quickly.

TruAI Noise Reduction

Improve your resonant scanner image quality by incorporating TruAI noise reduction. Although resonant scanner images are effective in capturing cellular dynamics at high speeds with low damage, this usually causes a compromise in the S/N ratio. TruAI noise reduction can improve these images without sacrificing time resolution using pre-trained neural networks based on the noise pattern of the SilVIR detectors. These pre-trained TruAI noise reduction algorithms can be used for on-the-fly processing as well as post processing.



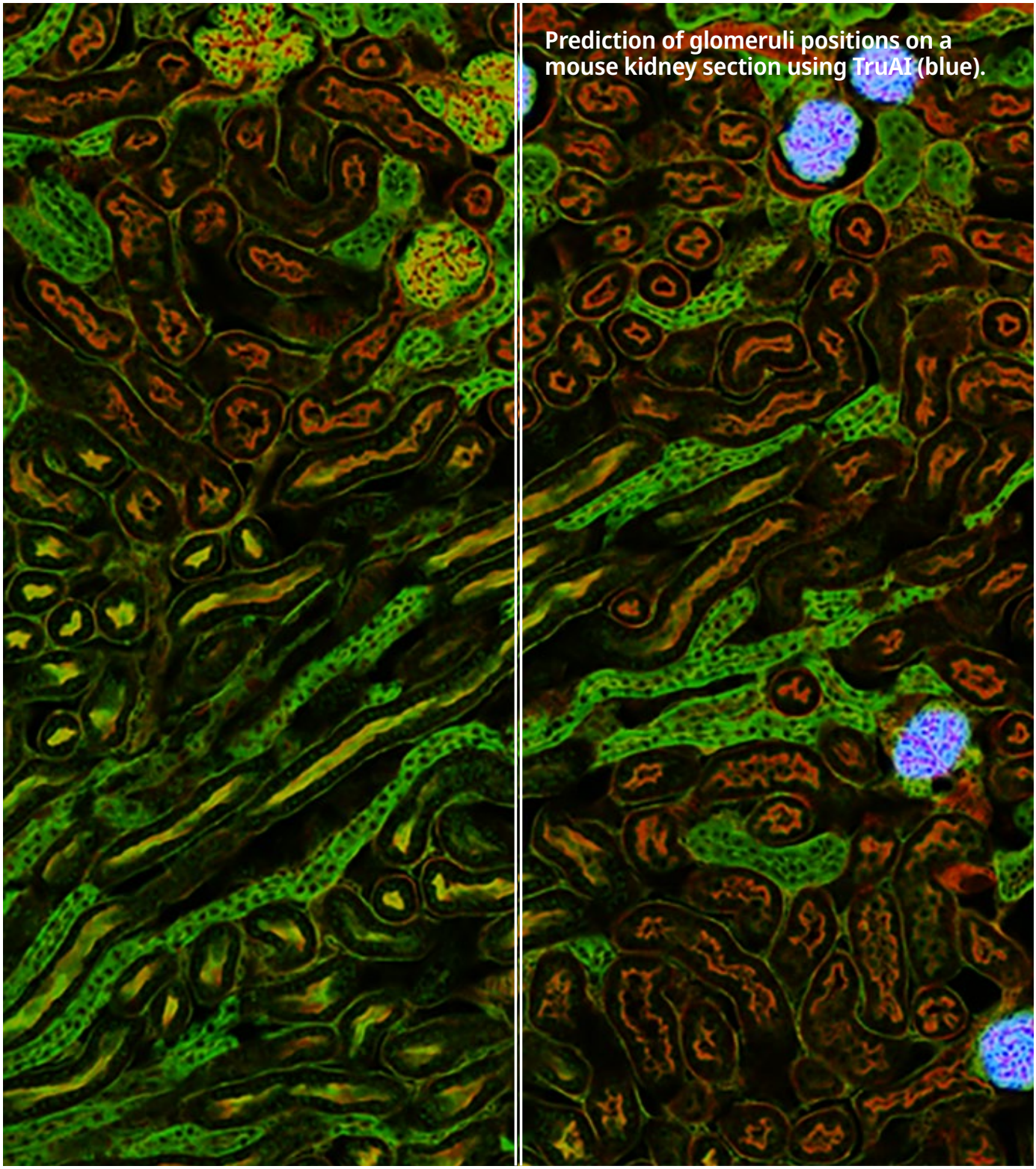
HeLa cell mictochondia labeled by MitoView 720 acquired using a 1K resonant scanner. The maximum photon number was 3 photons.



Brain sample: coronal section (50 µm) of a mouse brain stained with DAPI (nuclei, cyan), GFAP (astrocytes, green/488), MAP2 (microtubule-associated protein 2, neurons, and dendritic processes, cyan/647) and MBP (myelin basic protein, red/568). Sample courtesy of: Sample preparation Alexia Ferrand; sample acquisition Sara R. Roig and Alexia Ferrand. Imaging Core Facility, Biozentrum, University of Basel.

TruAI Image Segmentation

Image analysis requires data extraction using segmentation techniques based on intensity value thresholds. However, this can be a time-consuming process that is affected by the sample conditions. TruAI image segmentation using deep learning helps streamline image processing and minimizes sample variables for more accurate image analysis. TruAI image segmentation enables you to segment very weak fluorescence images or tissues that are usually difficult to extract using the simple thresholding method.



Prediction of glomeruli positions on a mouse kidney section using TruAI (blue).

One Platform for Your Research Needs

The FV4000 microscope is engineered to be modular, making it easy for you to configure the system based on your applications and budget. You can start with a standard FV4000 and easily upgrade to multiphoton imaging by adding the MPE module as your research changes.

Multiphoton and single-photon combination imaging in one sample is also possible. The FV4000MPE microscope is capable of second and third harmonic generation imaging, so different researchers or users can make the most out of the system. If your research requires a custom setup, the microscope's modularity and optional ports enable you to customize the system to add extra lasers, cameras, detectors, and more.

Inverted Microscope Frame

Upgrade to FV4000MPE

Upright Microscope Frame
for Documentation

Gantry Microscope Frame

Upright Microscope Frame
for Electrophysiology

Support and Service You Can Count On

The FV4000 system is easy to maintain. Since the SilVIR detector is based on semiconductor technology, it is both stable and durable. The laser power monitor continuously checks the illumination conditions and makes adjustments to maintain the same laser power. The system administrator can view the log file to keep track of the service maintenance schedule.

We stand behind our products with a commitment to fast service and technical support to help our customers achieve their goals. We offer various support plans to keep your microscope running at peak performance at a predictable cost as well as remote support*, so you don't need to wait for an engineer or specialist to visit if you're having an issue.

*The remote support requires an internet connection.

FV4000 Specifications

Scanner	Galvanometer scanner	64 × 64–4096 × 4096 pixels, 1 µs/pixel–1000 µs/pixel
	Resonant scanner	512 × 512 pixels, 1024 × 1024 pixels
	Field number	20
Spectral confocal detector	Detector	SilVIR detector (cooled SiPM, broadband type/red-shifted type)
	Maximum channels	Six channels
	Spectral method	VPH, detectable wavelength range 400 nm–900 nm
Laser	VIS laser	405 nm, 445 nm, 488 nm, 514 nm, 561 nm, 594 nm, 640 nm
	NIR laser	685 nm, 730 nm, 785 nm
	Laser power monitor	Built in
Image	High dynamic range photon counting (1G cps, 16-bit)	

Cover image: Caenorhabditis elegans, nuclear structures marked with EGFP (cyan LUT) and cytoplasmic structures marked with mRuby (purple LUT). Sample Courtesy of: Dr. Jeremy Vicencio, Stroustrup Lab and Dr. Nadia Halidi, Advanced Light Microscopy Unit, Centre for Genomic Regulation, Barcelona, Spain.

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- Specifications and appearances are subject to change without any notice or obligation on the part of the manufacturer.
- Illumination devices for microscope have suggested lifetimes.
- Periodic inspections are required. Please visit our website for details.
- This product is designed for use in industrial environments for the EMC performance. Using it in a residential environment may affect other equipment in the environment.
- HeLa cells are one of the most important and well known cell strains for medical research and scientific development. They have contributed to major discoveries in immunology, infectious diseases, and cancer research, and have raised serious questions about ethics in the medical field. Visit henriettalacksfoundation.org for more information on the life of Henrietta Lacks and her contributions to modern medicine.

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EVIDENT CORPORATION
Shinjuku Monolith, 2-3-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-0910, Japan

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