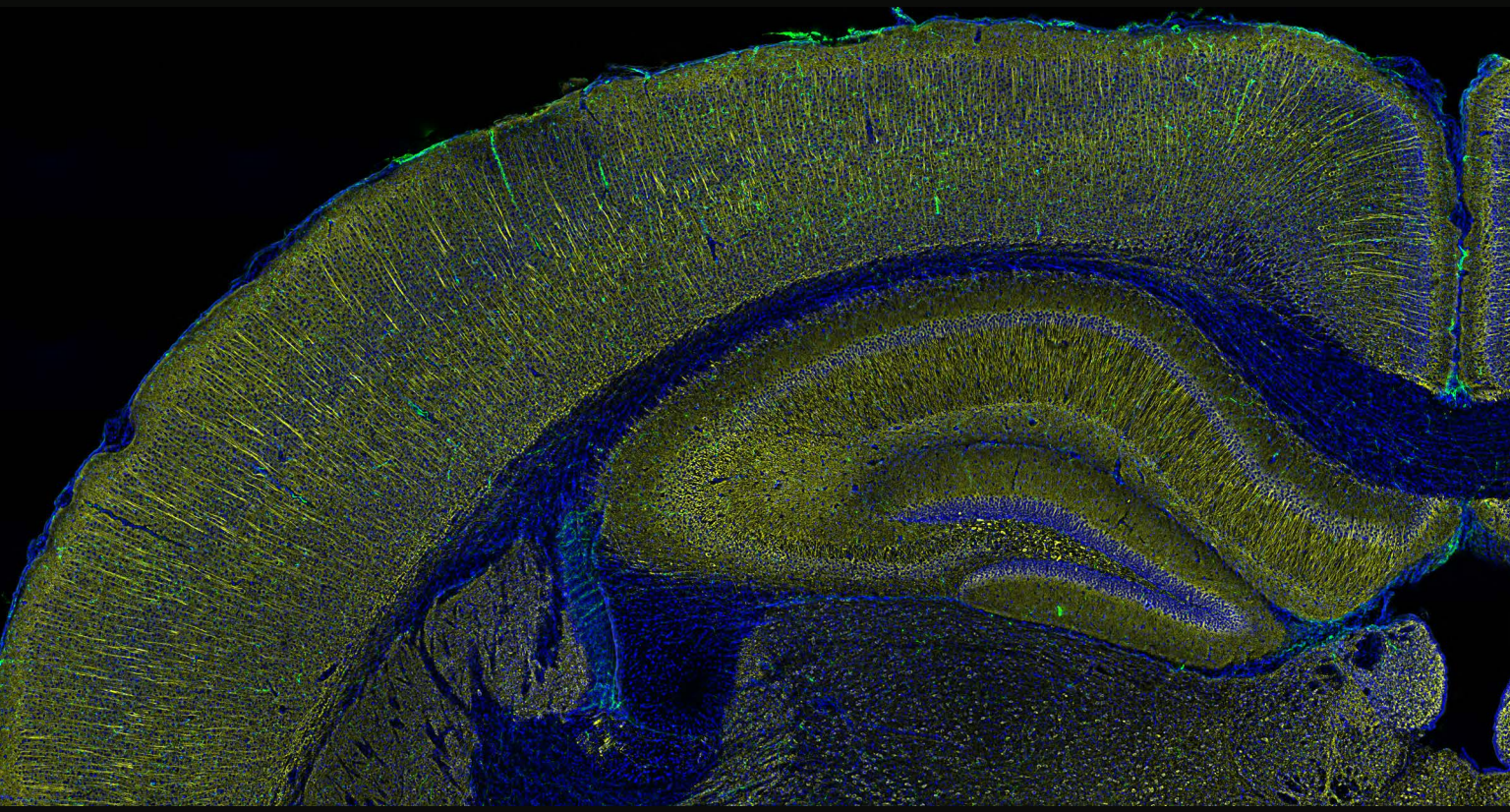


BliQ

PHOTONICS

Microscopists serving life science research

Cover image reference: *SPARQ image from a 200µm mouse brain section, acquired on the Evident VS200-SILA slide scanning system. Images courtesy of Evident Scientific.*

Bliq Photonics is a Canadian company founded and based in Quebec City, that designs and manufactures imaging systems for life science applications. Our growing portfolio, backed by patented technologies, supports a variety of experiments. Our technologies include multiphoton, real-time volumetric imaging, confocal and light sheet systems.

Bliq's team understands customer vision, and crafts each imaging and multiphoton solution to meet high standards of usability and reliability.

Fueled by many years of microscopy experience, we know that support and collaboration begins with a commitment to each customer.

Experience Bliq today!

Contact Us

OFFICES

1405 Boul. du Parc technologique
2nd floor
Quebec City, QC
Canada, G1P 4P5

LABORATORIES

2601 Chemin de la Canardière
Suite F-4434
Quebec City, QC
Canada, G1J 2G3

VMS *VIDEO-RATE MICROSCOPY SYSTEM*

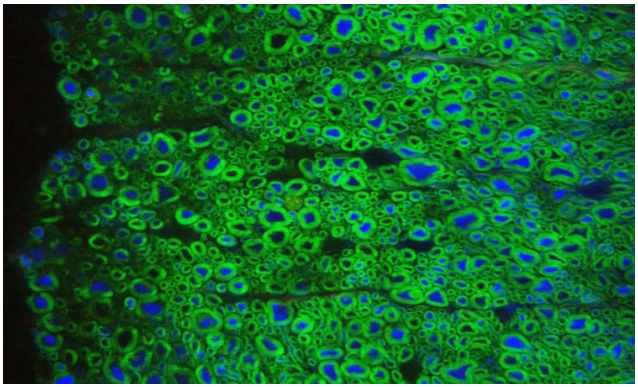
Modular multiphoton microscope optimized for *in vivo* experiments.

Scan me!

The **Video-rate Microscopy System (VMS)** from Bliq Photonics features a high speed polygonal scanner with an adjustable scan frequency. The VMS scan rate is adjustable from 9 KHz to 18 KHz and allows users to optimize the balance between system frame rate and S/N ratio for each application. The uniform direction and rate of this polygonal scanner design result in highly precise synchronization of detection and stimulation events during imaging that improves image quality while reducing system complexity.

Bliq Photonics' VMS is built for speed, sensitivity and flexibility, making it the perfect match for rapid and dynamic *in vivo* and *ex vivo* applications. The instrument combines perfectly with the Axicon Bessel beam imaging module to reduce respiration and vascular pulsation artifacts within continuously moving samples or to capture dynamic events that could be missed during traditional multiphoton optical sectioning.

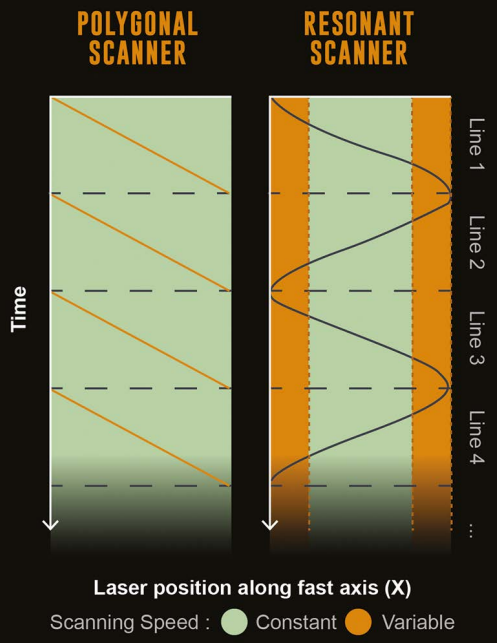
VMS is designed for a broad range of fluorescence-based applications. It also supports label-free techniques, including Coherent Anti-Stokes Raman Scattering (CARS), Second Harmonic Generation (SHG) and Third Harmonic Generation (THG).



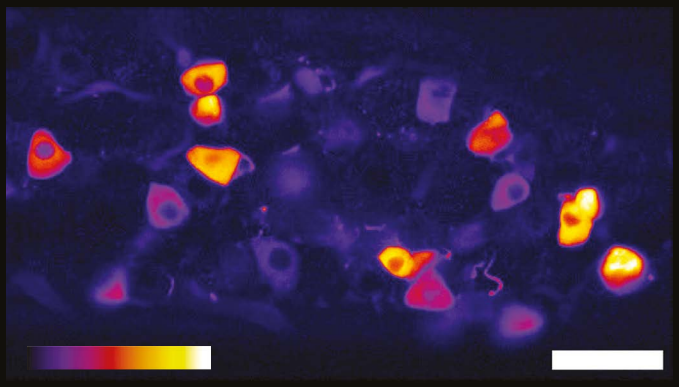
CARS microscopy to image myelin fibers in the spinal cord of a mouse with multiple sclerosis-like symptoms. Green (myelin fibers, CARS), blue (neurons, 2-photon). *Courtesy of Dr Daniel C. Côté, CERVO Research Center, Université Laval.*

EXPLORE A BROAD RANGE OF APPLICATIONS

With a speed of 32 to 900 fps (1024×512 and 1024×8, respectively), the VMS is great for calcium imaging, dynamic cellular behavior, migration under flow and optogenetics.



The uniform direction and rate of the polygonal scanner design result in highly precise synchronization of detection and stimulation events during imaging.



GCaMP6 fluorescence in mouse dorsal root ganglia (DRG) neurons after a paw stimulation. *Scale bar: 50 µm. Courtesy of Dr Daniel C. Côté and Dr Yves De Koninck, CERVO Research Center, Université Laval.*

Choose between our unique modules to extend the capabilities of the VMS:

AXICON
Enhance temporal resolution and stabilize optical signals using volumetric Bessel beam imaging.

CONFOCAL
Turn the VMS into a hybrid system with the addition of a confocal module.

SPARQ
Fast high contrast optical sectioning without a spinning disk or a pinhole for visible and NIR fluorescence.

FLIM/PLIM/ANISOTROPY:
Improve the capability of the VMS with other technology add-ons.

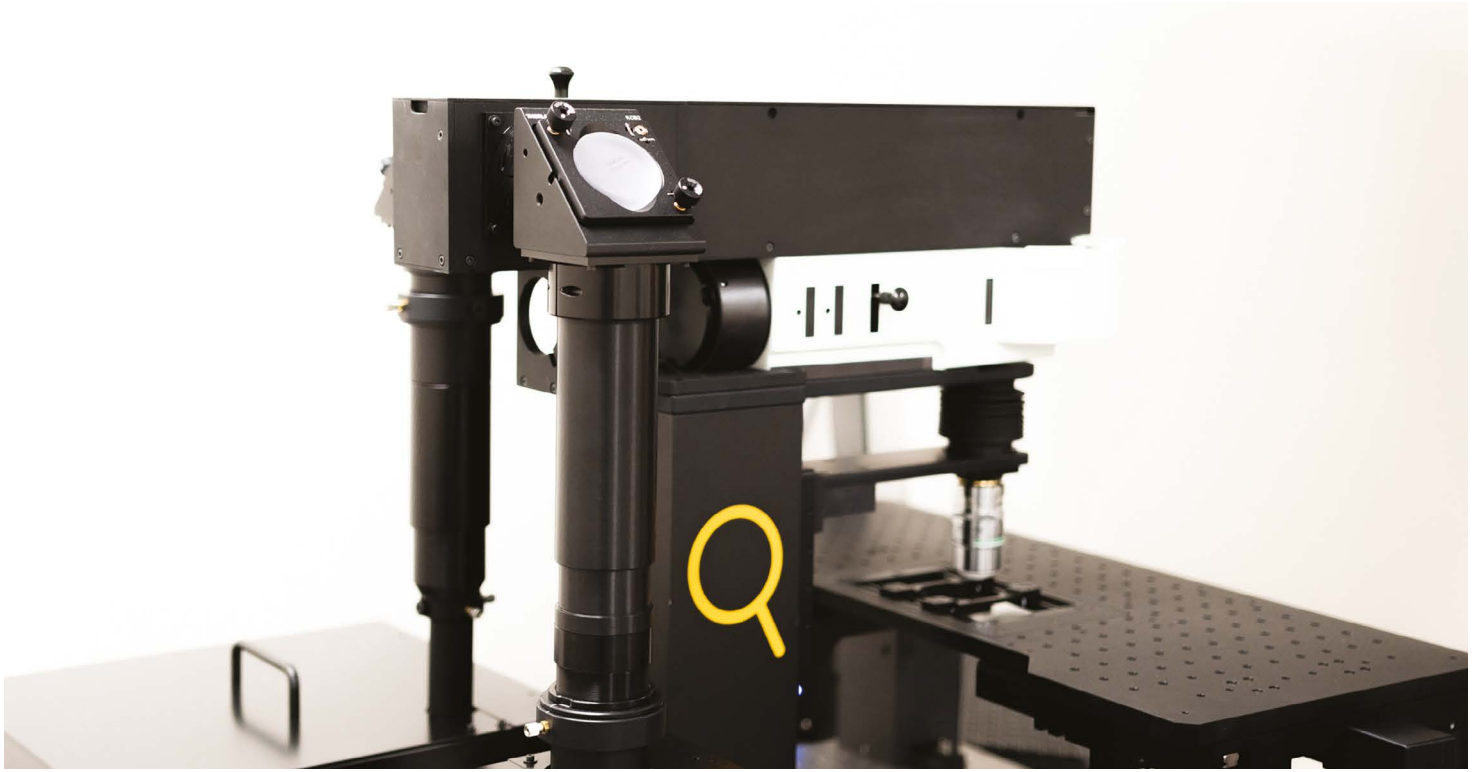
PHOTO-STIMULATION/OPTOGENETICS
Simultaneous imaging and stimulation using visible and IR lasers.

TRIGGER BOX
Precision device triggering on the VMS for lasers, shutters, optical or pharmaceutical stimulation protocols and components switching.

Let Bliq Photonics customize your VMS according to your specific needs.
Contact us to learn more about what we can do for you!

Specifications

- Integration of 1-4 multiphoton laser lines for imaging;
- 32 fps at 1024 x 512 pixels and up to 900 fps at 1024 x 8 pixels;
- High precision polygonal scanner with friction-less air bearing for unrivaled durability and timing;
- Polygonal scanner speed modulation from 9KHz to 18KHz;
- Laser power modulation options to match the requirements of each application;
- Up to 6 non-descanned detectors in a nosepiece configuration for optimal photon collection;
- Nirvana software designed for high-end Apple computers;
- Visible and/or multiphoton photo-stimulation (optional);
- Volumetric imaging, FLIM, PLIM, anisotropy, bone ablation, confocal and CARS add-ons (optional).



Polygonal scanner

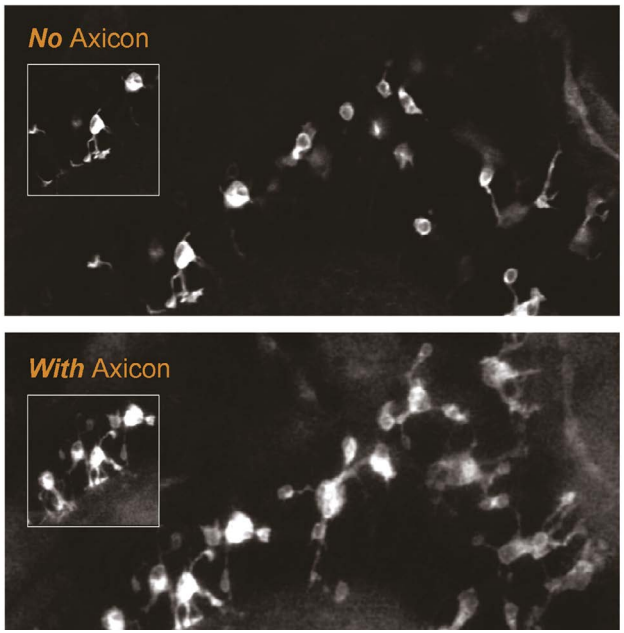
AXICON *FAST VOLUMETRIC IMAGING*

Summarize your volume instantly!
Accelerate optical sectioning.

The patented **Axicon** creates a scalable needle-like multiphoton Bessel beam that results in fast high depth of field (DOF) 2D summary projections of scanned volumes. The Axicon module is ideal for simultaneous imaging of rapid events that occur at different focal planes and can compensate for motion artifacts caused by tissue movement. The VMS / Axicon combination scans volumes as large as 540x270x30 µm at a rate of 32 volumes per second at full 2P lateral resolution.

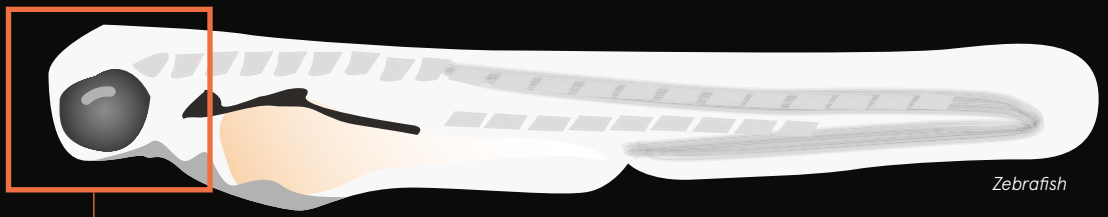
Sample movements result in imaging artifacts within and between frames. The fast acquisition of Bliq's VMS microscope together with the volumetric imaging capabilities of the Axicon compensate for X, Y and Z displacements. Axicon improves image acquisition whenever artifacts coming from the following events are present:

- Breathing Blood pressure/flow
- Peristalsis
- Muscle movement
- Sample drift

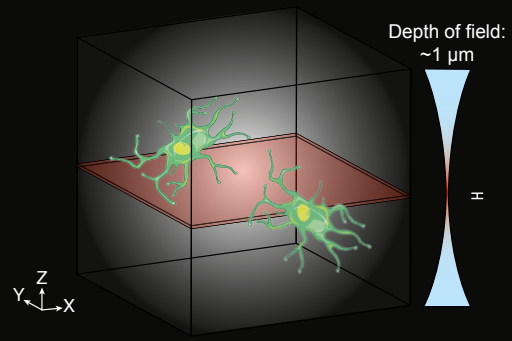


***In vivo* imaging of GFP-labeled microglial cells in zebrafish.** Single plane image (top) and Axicon image (bottom) covering 30 µm of specimen thickness.

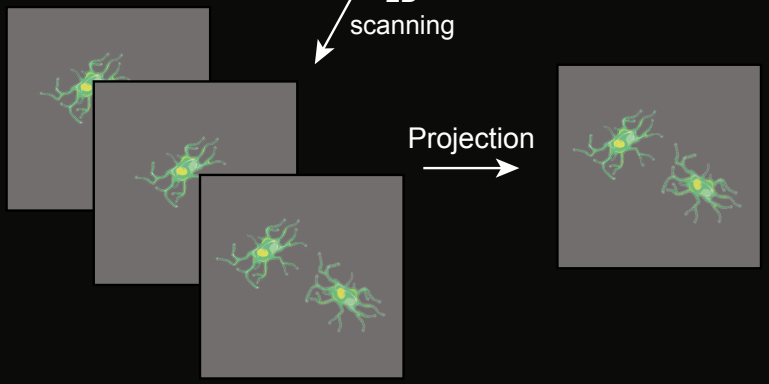
The Axicon is 30 times faster!



2D SCANNING

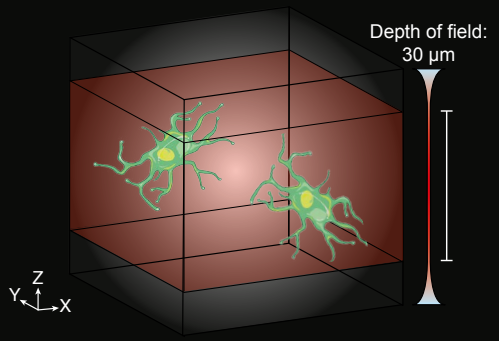


2D scanning

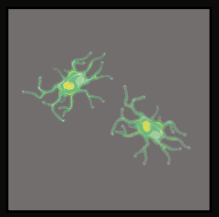


Acquisition time without Bliq's Axicon (with VMS):
32 frames per second
DOF to image: 150 µm
Number of Z planes required: 150
Total scanning time: 4.70 seconds

AXICON

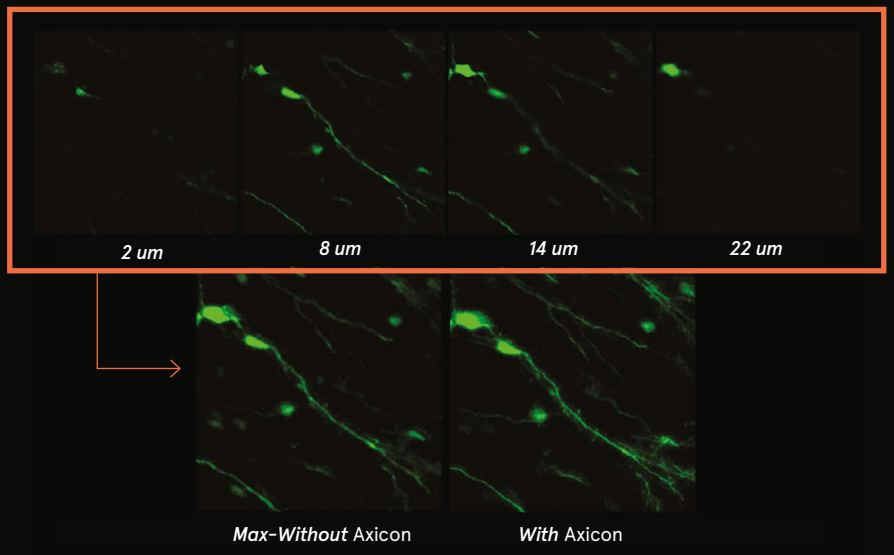


3D scanning



Acquisition time with Bliq's Axicon (with VMS):
32 volumes per second
DOF to image: 150 µm
Number of Z planes required: 5 volumes of 30 µm
Total scanning time: 0.16 seconds

Ask Bliq about integrating Axicon into your existing multiphoton microscope. The Axicon module can be installed on most commercial and home-made systems.



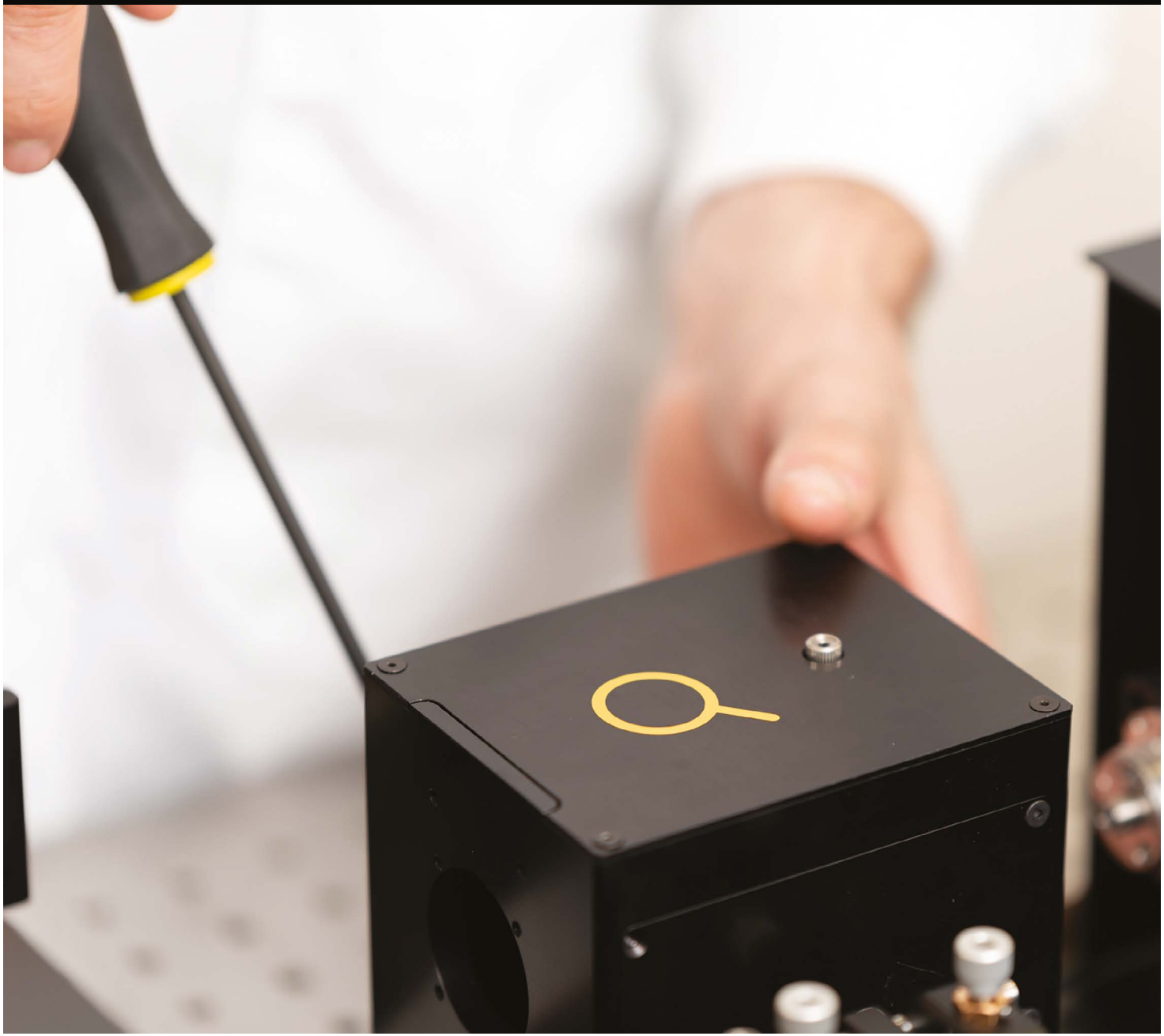
Axicon offers resolution and intensity comparable to that of a conventional multiphoton system, but with a reduced acquisition time.

GFP-labeled cortical neurons imaged with the Axicon (bottom right) and a maximum intensity projection of the same volume (DOF of 22 µm) acquired using a commercial multiphoton system (bottom left). *Images courtesy of Dr Daniel Côté, CERVO Research Center, Université Laval.*

Specifications

- Automatic DOF adjustment from 10 µm-30 µm, with 5 µm step size;
- In VMS: 32 volumes of 540 X 270 X 10-30 µm per second (1024 x 512; 16X);
- Bypass to switch between Bessel and Gaussian illumination modes;
- As an upgrade: Compatible with most commercial and custom multiphoton systems, scan speed and FOV are not affected (same as without Axicon);
- Axicon transmission: 600-1800 nm;
- Dimensions (L x W x H; mm): 250 x 175 x 115.

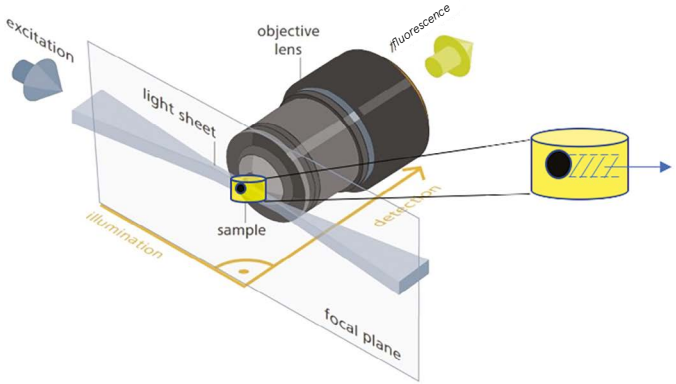
An animation of the Axicon technology can be found here:



LIGHT SHEET *MULTIPHOTON BESSEL BEAM SYSTEM*

Large field of view, high resolution,
low phototoxicity imaging system.

Light sheet microscopy is generally performed using a visible Gaussian beam scanned in parallel to a camera detector plane (Fig 1). Since the Depth of Field (DOF) and the beam waist are closely related, the technology becomes challenging when there is a need to image large sample and increase the field of illumination (determined by the beam length), without compromising on the axial resolution (determined by the diameter of the beam).



Shading: Structures behind an occlusion may be not be detected when using conventional light sheet microscopy.

Fig 1 : Principle of a light sheet microscope. Huisken and al.2013.
Photonik international. ***© Cléophace Akitegetse, Université Laval, 2018***

One way to overcome this challenge is to use an axicon lens that modulates the excitation from a Gaussian to a Bessel beam, to raster scan this beam in a single axis, and thus, creating a sheet of light. The main advantage of using a Bessel beam in this context resides in its capacity to create a light sheet of uniform thickness along its longitudinal profile. Using Bessel beam unidimensional scanning also improves image quality at greater depth because the beam shape is less distorted after travelling through scattering tissue compared to a Gaussian beam.

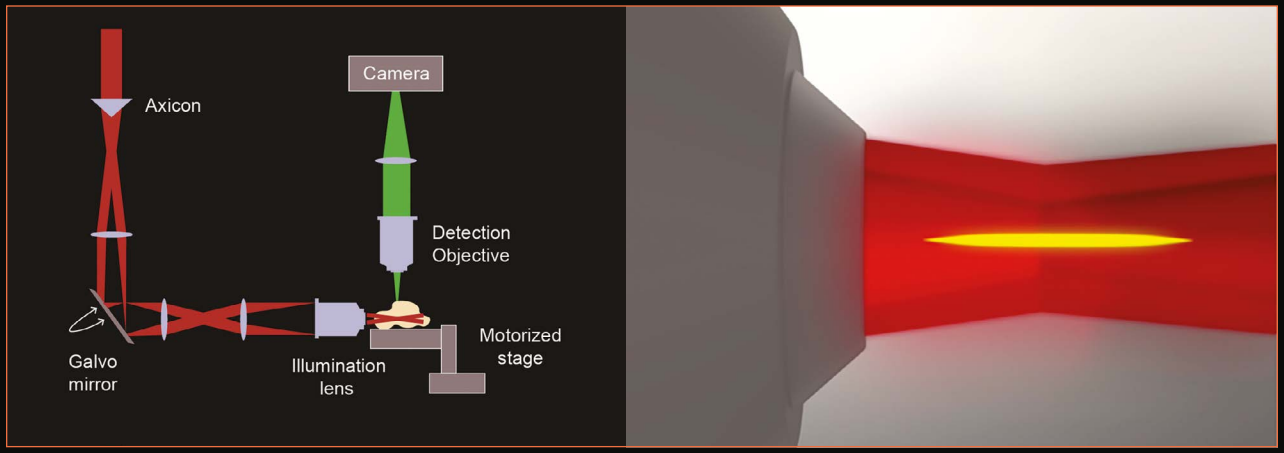


Diagram of the Bessel light sheet Imaging system.
© Akitegetse et al, 2023.

Bessel beams are imperfect by nature and they possess secondary lobes that are quite noticeable when using visible lasers (1-photon, Fig 2). These lobes increase in number with the length of the beam (Fig 2). In order to reduce the contribution of the side lobes and to provide the power necessary for the generation of fluorescence over the entire length of the beam, Bliq's **light sheet system** uses an amplified multiphoton laser. Consequently, the low optical power density of the side lobes of the Bessel beam makes their contribution negligible.

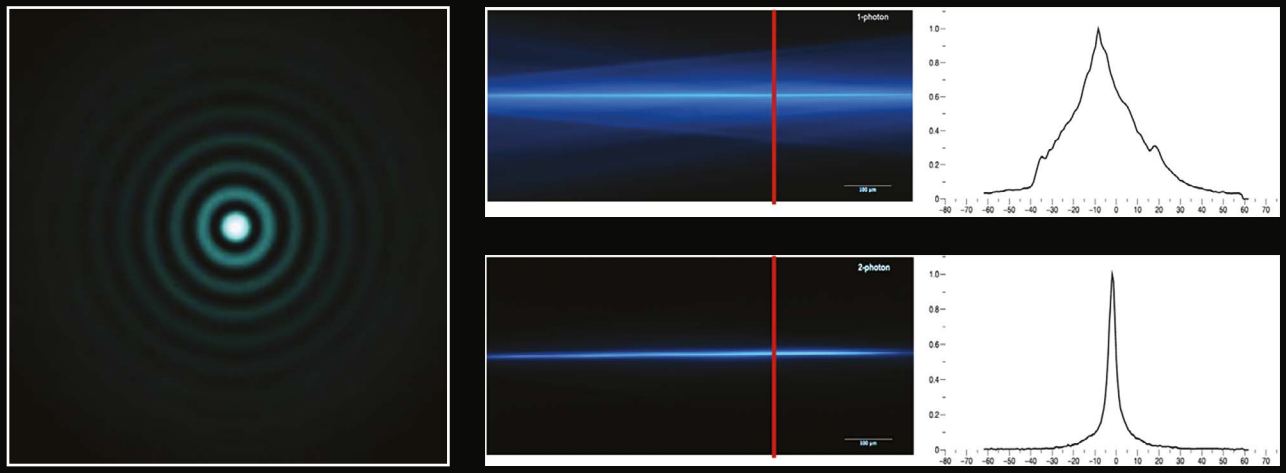
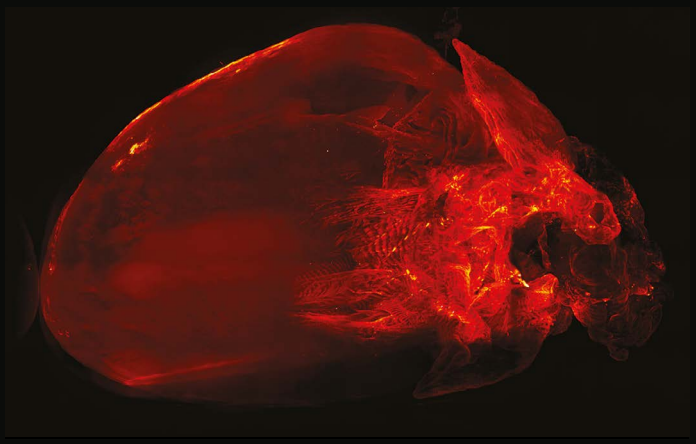


Fig 2: Cross section and lateral view of a Bessel beam.
© Cléophace Akitegetse, Université Laval, 2018

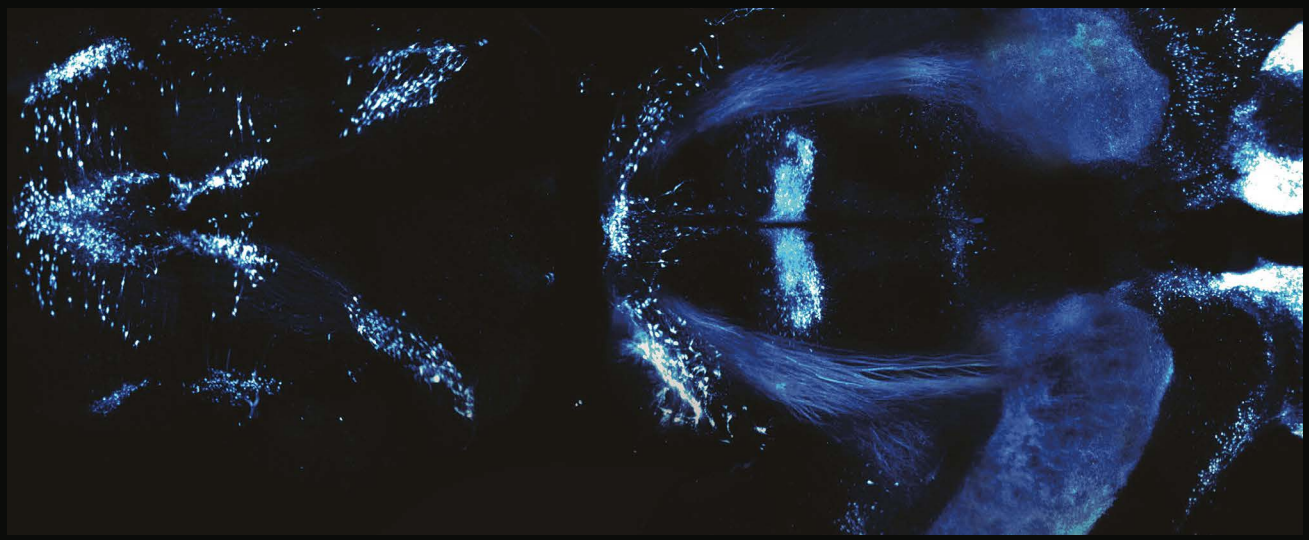
The complex Bessel-Gauss interference pattern creates uniform illumination along the full length of the beam. An interesting feature of Bessel beam imaging is that the illumination profile remains undisturbed when there is an obstruction within the sample. This property greatly reduces shading compared to standard Gaussian beam light sheet technology (Fig 1).

Bliq's light sheet technology allows for a choice of 1 to 4 low noise, high resolution sCMOS cameras for simultaneous multicolor imaging. Thanks to the long and even profile of the Bessel beam, the system offers isotropic resolution over the entire field of view (1.6 mm x 1.6 mm). The imaging cuvette can be interchanged very easily to suit a wide variety of specimens, and together with the microscope's specialized high NA and long working distance dry objectives, samples up to 25 mm x 15 mm x 65 mm can be imaged without having to be rotated.



DESMINE-594 EXPRESSION IN A iDISCO CLEARED MOUSE HEART.

© Cléophace Akitegetse, Université Laval, 2018



TH-ALEXA594-DOPAMINERGIC NEURONS IN AN ENTIRE iDISCO CLEARED P1 MOUSE BRAIN.

Courtesy of Dr. Martin Lévesque, CERVO Research Center, Université Laval.

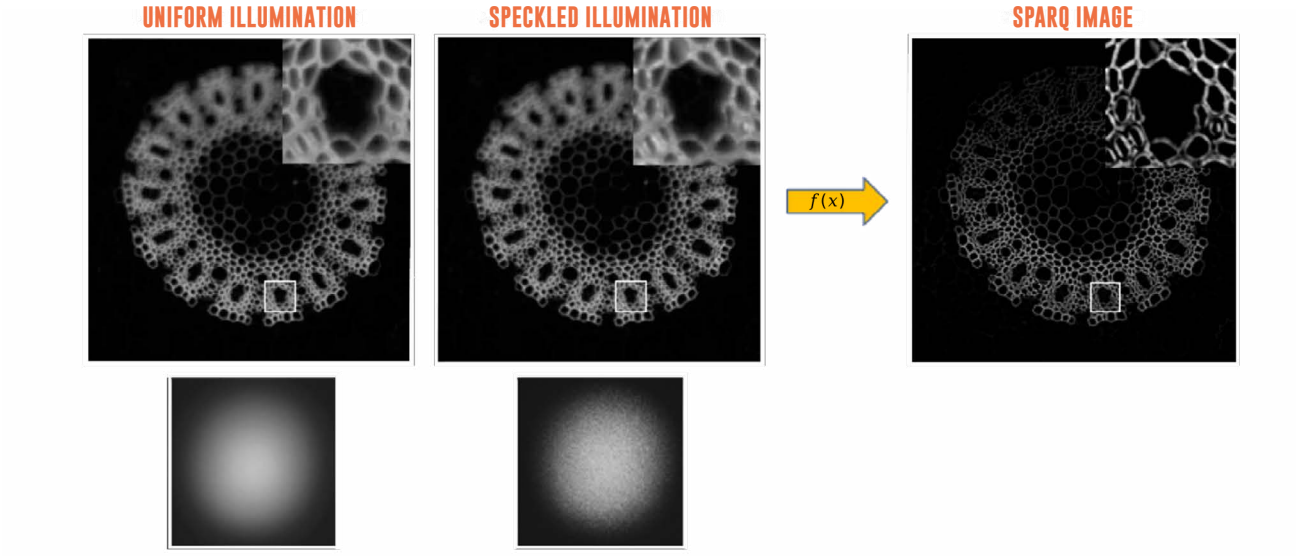
Specifications

- Image samples up to 25mm x 15mm x 65mm (XYZ) without rotation;
- Excitation objective: 20x: NA 0.4, WD: 25.5 mm;
- Detection objective: 10X: NA 0.42, WD 15 mm;
- Optical zoom for 8X or 16X magnification without having to change the objective or remove the sample;
- Resolution: **Lateral:** 790 nm, **axial:** 2 µm;
- FOV: 1.6 mm x 1.6 mm;
- Acquisition speed per FOV: Up to 100 fps;
- Axicon lens for Bessel beam illumination;
- Camera splitter for 1 to 4 sCMOS cameras for multi-color imaging;
- Tunable dual-line femtosecond IR laser: 650-920nm and 1200-2500nm;
- No alignment required;
- Acquisition computer and storage: Apple iMac Pro, 4,2GHz, 128GB SDRAM, 4TB SSD, VEGA 16GB video, 80TB of storage, 27" 5K monitor.

SPARQ

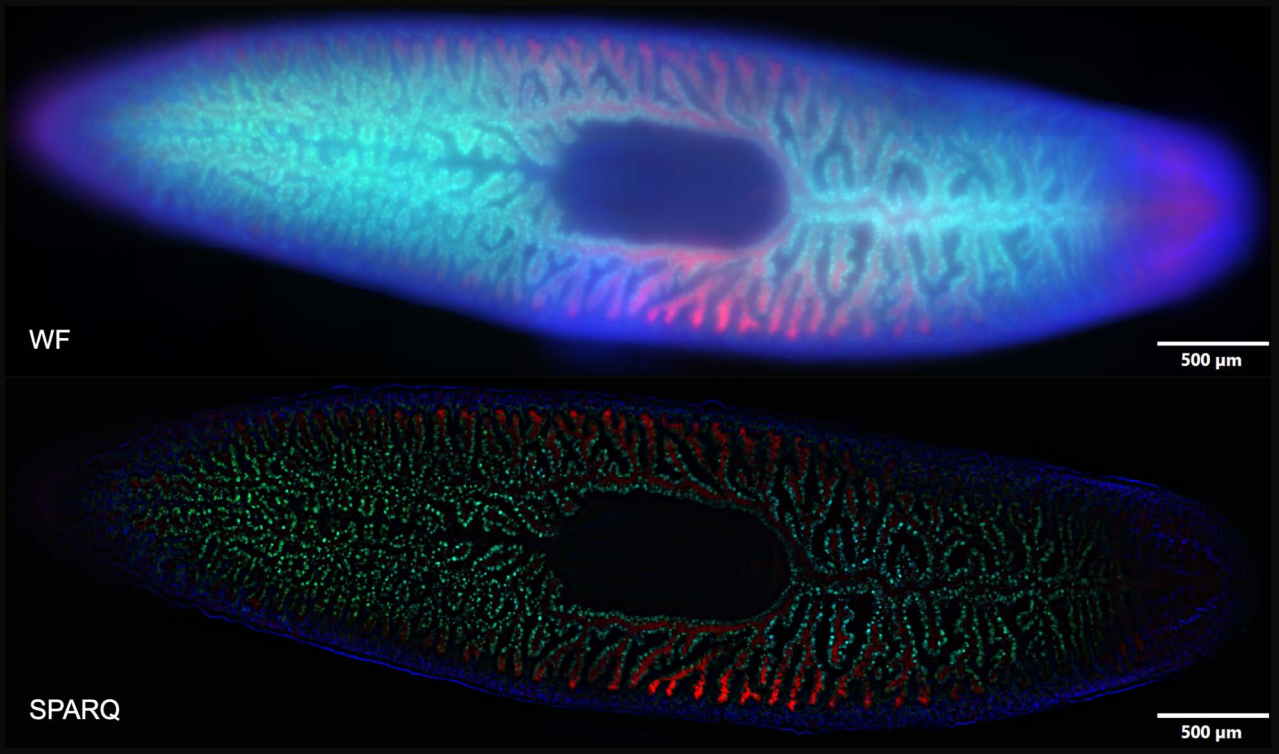
Confocal-like imaging without paying the confocal-like price.
Rapid widefield optical sectioning!

Based on patented HiLo technology, SPARQ rapidly removes out-of-focus elements using two differently illuminated images that are mathematically processed. SPARQ utilizes/leverages the structure inherent to the speckle that naturally occurs when illuminating with coherent light to achieve high quality optical sectioning. SPARQ is an optional imaging mode for Bliq's VMS and can easily be added to any upright or inverted microscope or macroscope. Imaging at frame rates of up to 10 fps, SPARQ is a camera-based optical sectioning technology that can be used to quickly acquire large FOV images.



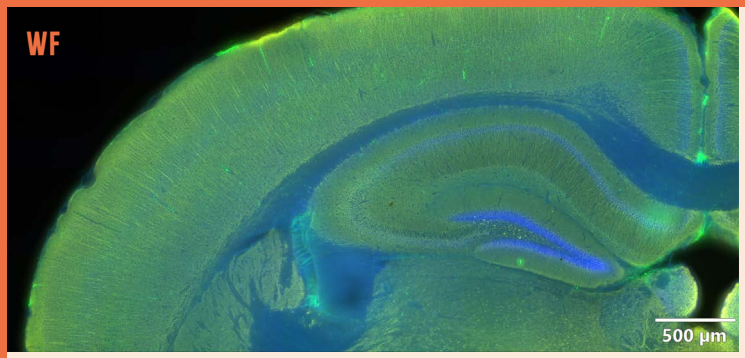
During SPARQ imaging, two raw images are collected and processed to extract the high- and low-frequency information. As a result, out-of-focus light is eliminated and sharp optical sections are obtained, making SPARQ particularly useful for imaging thicker samples.

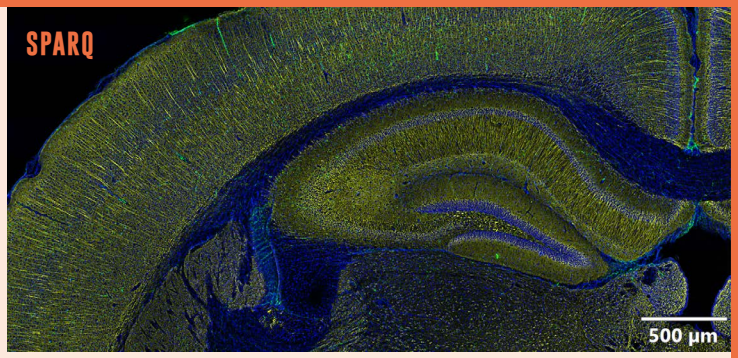
HIGH-THROUGHPUT OPTICAL SECTIONING IMAGES OF THICK SAMPLES WITH SPARQ COMBINED WITH A SLIDE SCANNER



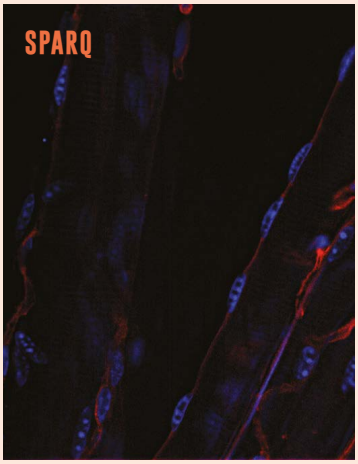
Whole planarian flatworm Schmidtea mediterranea acquired with the Evident VS200-SILA slide scanner, showing the intestines. Blue: DAPI. Green: inner intestine cells. Red: outer intestine cells. 20X objective.

Sample by Amrutha Palavalli, Department for Tissue Dynamics and Regeneration, Max Planck Institute, Goettingen, Germany.

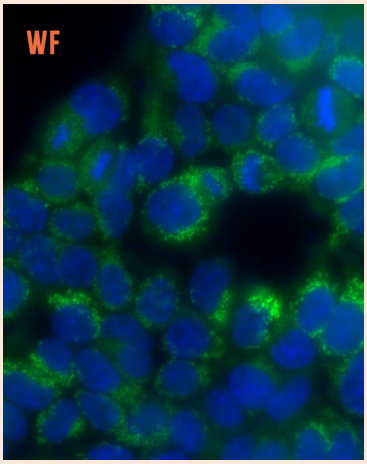


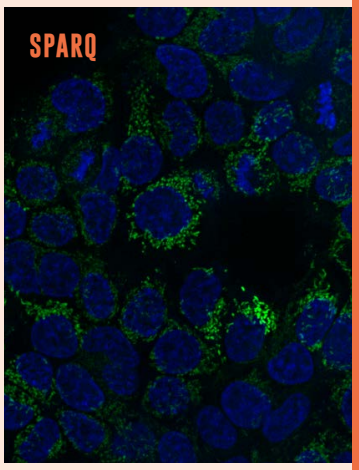


Extended focal image (EFI) of a 200µm mouse brain section. Blue: DAPI, Green: GFAP (glia), Yellow: MAP2 (neurons). *Courtesy of Evident Scientific.*

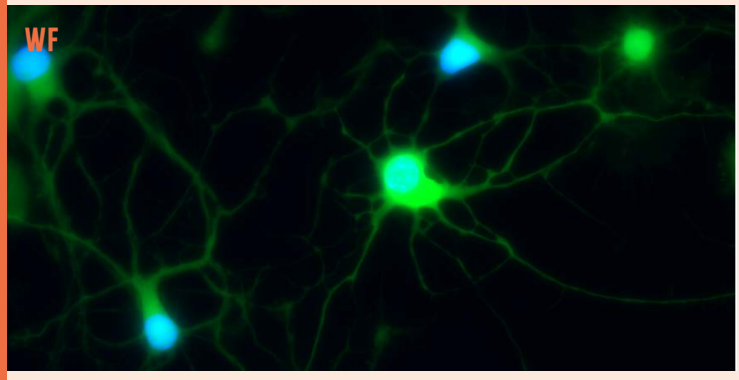


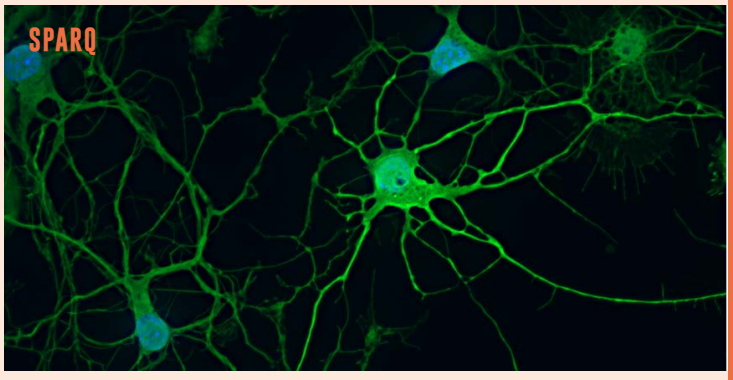
Single plane of mouse extensor digitorum longus muscle fibers. DAPI/blue (nuclei) and Alexa-546/red (Wheat germ Agglutinin). *Courtesy of Dr. Michael Rudnicki, Ottawa Hospital Research Institute, University of Ottawa.*





Maximum intensity projection (MIP) of cultured HEK cells. Hoechst/blue (nuclei), MitoSOX/green (mitochondria).



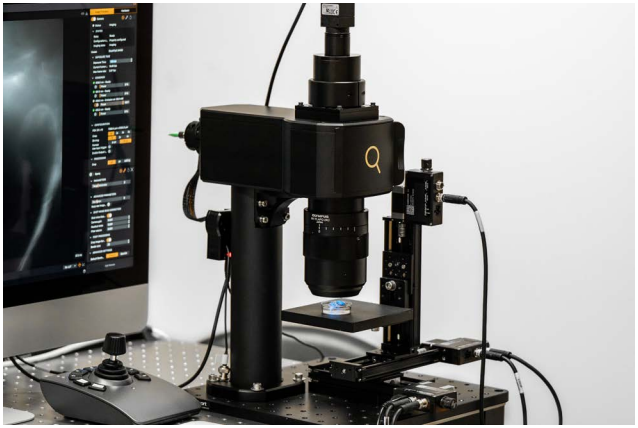


MIP of cultured primary cortical neurons. Hoechst/blue (nuclei), Calcein/green.

M-SPARQ

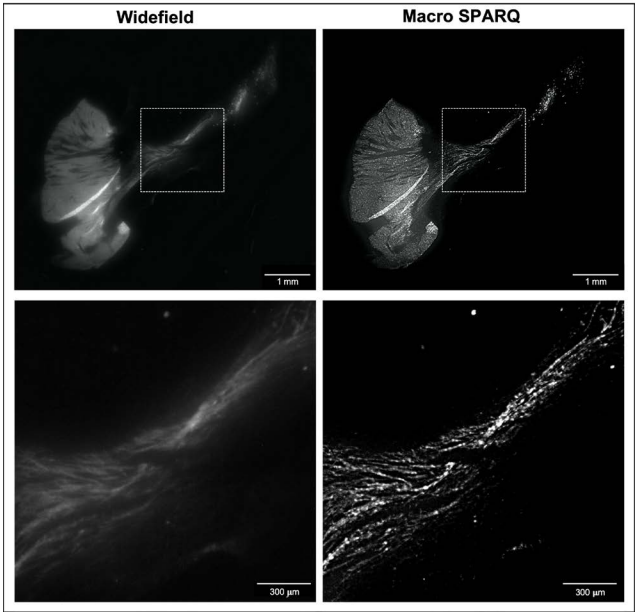
Use the SPARQ technology on a macroscope and rapidly acquire images of large size samples with great resolution!

Large field of view macroscopic imaging of intact samples provides a unique perspective that informs further imaging at higher magnification and resolution. The combination of the macroscopic and microscopic views can lead to improved understanding of disease that spans affected organs. **M-SPARQ** speeds the acquisition of high content macroscopic imaging and dramatically reduces data complexity and image size.



Bliq Photonics single photon M-SPARQ technology provides great speed and a very large FOV. The optical simplicity, speed, precision and robustness of M-SPARQ makes it an ideal tool for imaging cleared and expanded tissues and can be used on traditional fixed and living preparations.

The M-SPARQ FOV of 8 mm x 7 mm allows optical sectioning of this entire area in one snapshot with a lateral resolution of 3 µm and an axial resolution of 5 µm.



MIP of a sagittal adult mouse brain slice (TH-Alexa561-Dopaminergic neurons) using widefield (left) and M-SPARQ (right).

Specifications

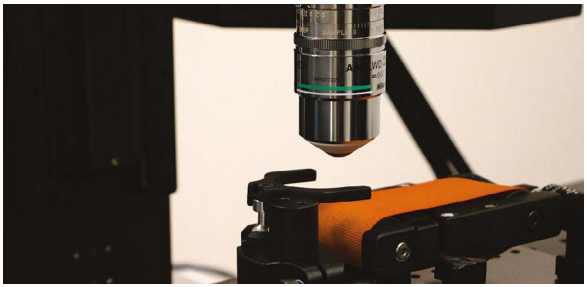
- Acquisition speed up to 10 fps;
- Only 2 images are needed to generate a SPARQ image;
- Suitable for all types of specimen, fixed or live;
- Speckles remain sharp at depth, allowing for better optical sectioning;
- Adjust the target thickness parameter to modify sectioning;
- Can be used with any camera, objective and fluorophore;
- No calibration needed;
- Alignment done once during installation;
- SPARQ image parameters can be modified after acquisition;
- SPARQ upgrade compatible with most commercial widefield microscopes.

ACCESSORIES

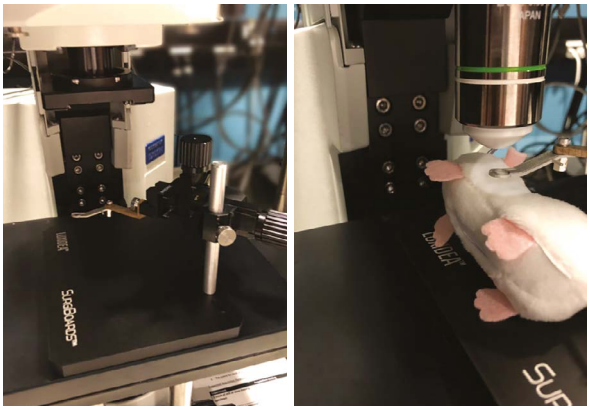
SIMPLIFY YOUR IMAGING PROTOCOLS

MOUSE HOLDER FOR *IN VIVO* IMAGING

Our **mouse holders** are optimized for usability, versatility and small footprint. They can be easily assembled, disassembled, cleaned and stored. They are ideal for experiments in which animals are anesthetized or awake. Custom models are also available!



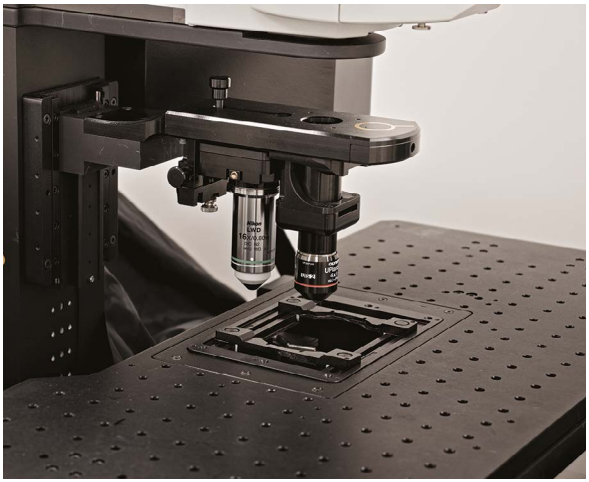
Bliq's treadmill



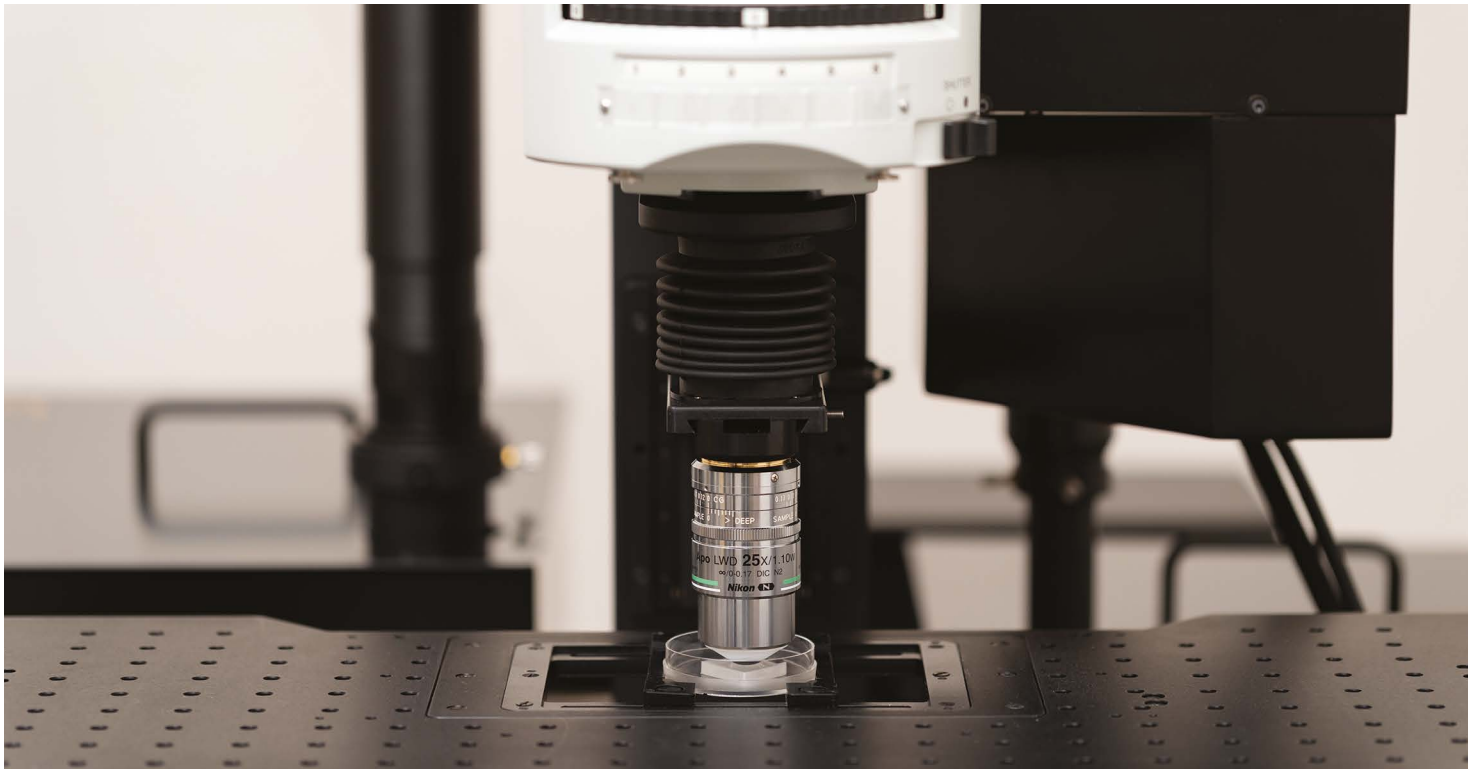
Lung Imaging SurgiBoard, a product from Luxidea™ Incorporated.

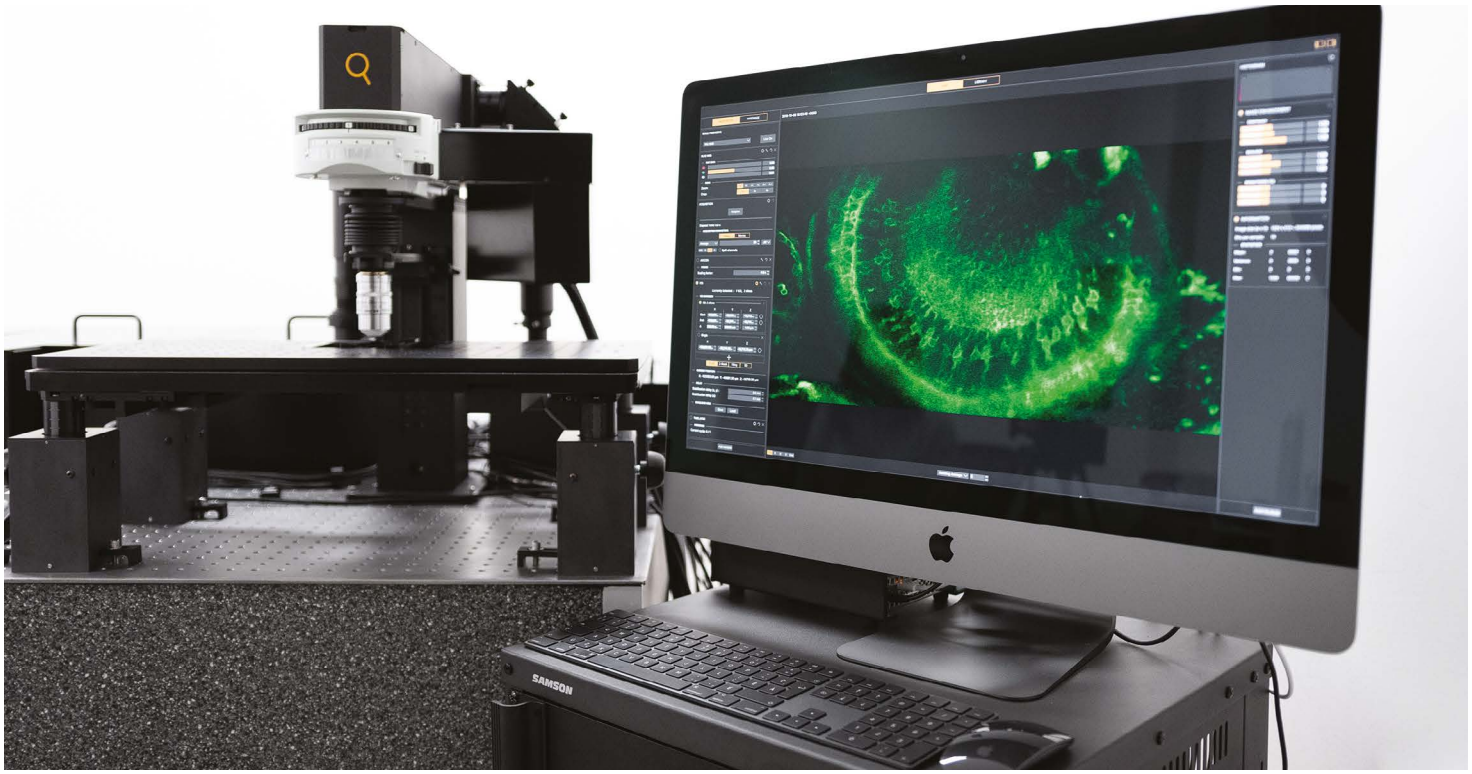
DUAL NOSEPIECE FOR 2P IMAGING

This **dual nosepiece** has been designed to combine a specialized objective for 2P imaging and a standard objective for positioning electrophysiology pipettes or for other imaging needs. Ready to easily and smoothly switch from different imaging modes!



Our team of expert engineers is available to help design the animal holder that best fits your needs. **Contact us and let us simplify your imaging protocols!**


DEEP
LWD 25X/1.10W
Nikon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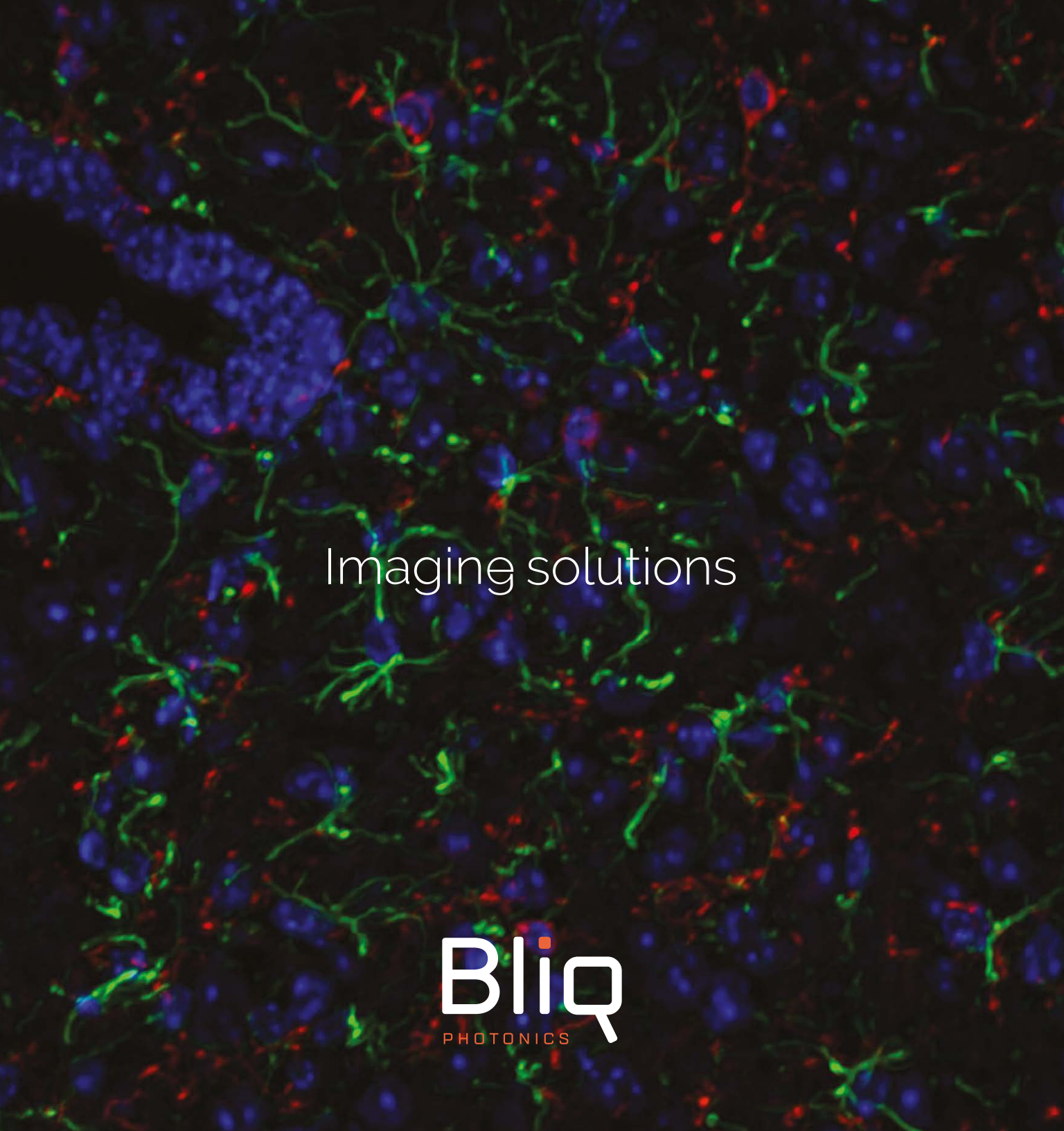
Back Cover image reference: Courtesy of Dr Steve Lacroix, CHUL research center, Université Laval.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