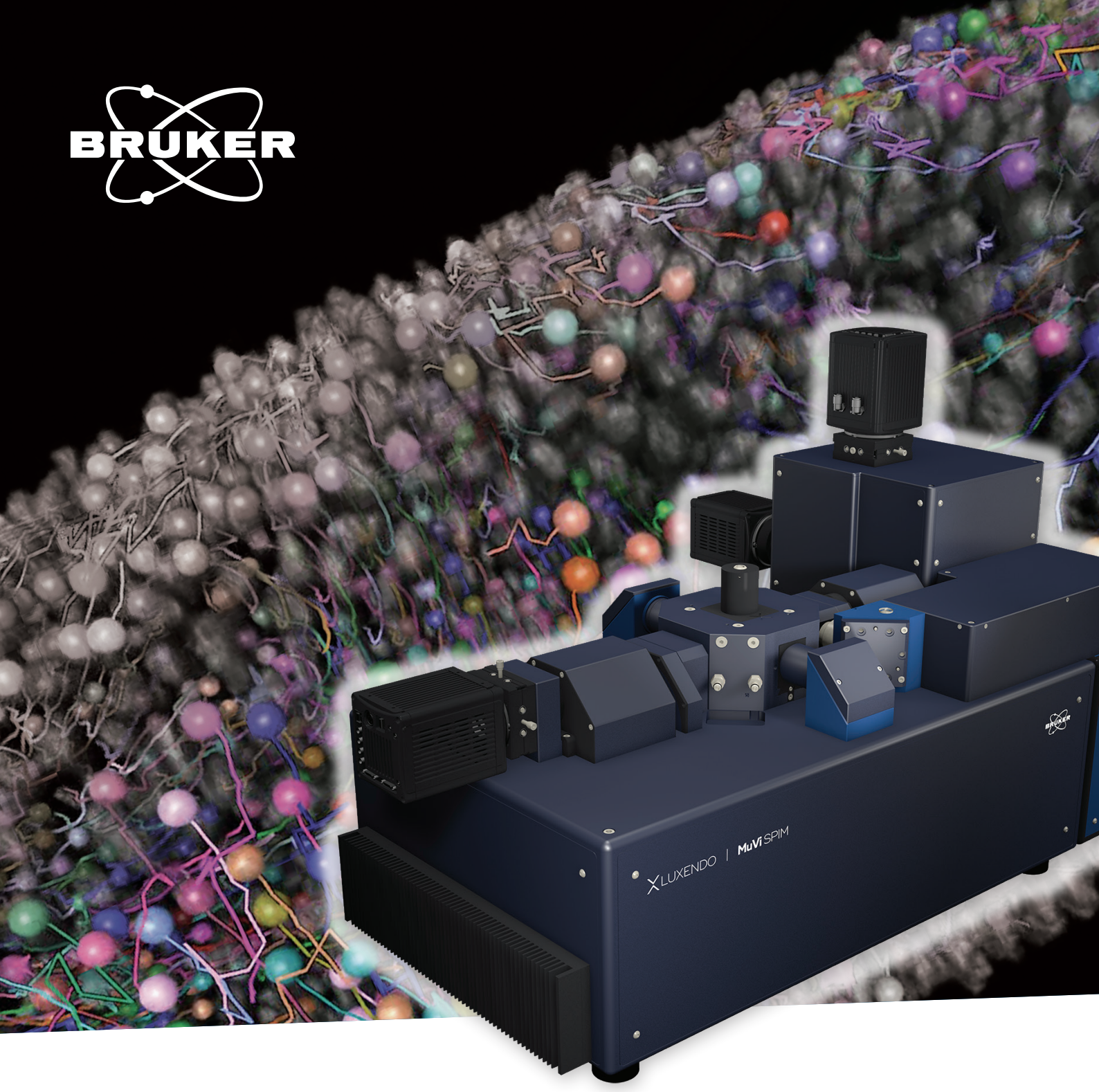


LIGHT-SHEET MICROSCOPY

Luxendo MuVi SPIM

Superior Multiview Imaging for Live and Cleared Samples

MuVi SPIM

Delivering Best-in-Class Multi-View Light-Sheet Capabilities

Bruker's Multi-View Selective-Plane Illumination Microscope (SPIM) is not only the fastest light-sheet system on the market, but also incorporates years of Luxendo imaging experience and innovation. Due to its modular concept, it facilitates both live-sample (LS) and cleared-sample (CS) imaging. MuVi SPIM uniquely allows for high-speed volumetric acquisition of dynamic processes in live specimens, as well as cleared sample imaging with any clearing method. This is achieved by a simple and fast objective swap.

Only the versatile and customizable MuVi SPIM provides:

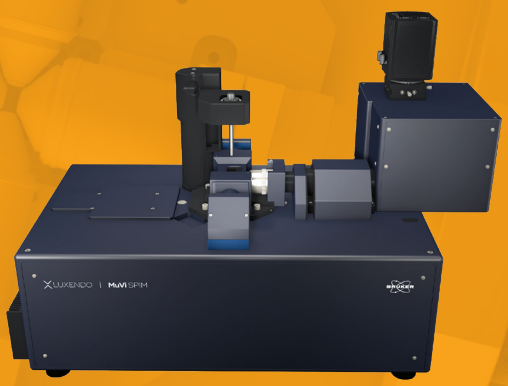
- 360° high-resolution artifact-free imaging
- Simultaneous dual-color detection and up to six laser lines 405-to-785 nm
- Add-on photomanipulation module
- Full software support for image fusion, registration, tile stitching, and 3D visualization

MuVi SPIM LS

Optimized for live, long-term imaging with full environmental control and an optional photomanipulation module

MuVi SPIM CS

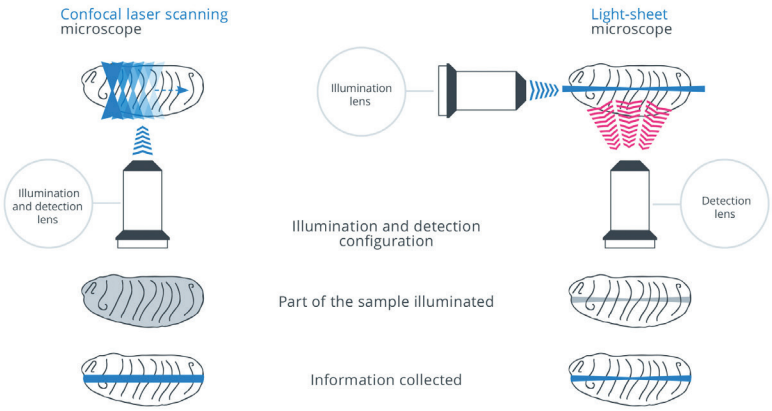
Optimized for cleared samples and supports any kind of clearing solution to maintain optimal image quality



Why Choose Light-Sheet Microscopy

Light-sheet microscopy is a fluorescence imaging technique that utilizes a sheet of laser light to illuminate only a thin slice of the sample, enabling inherent optical sectioning. The fluorescence signal of the entire illuminated 2D plane is then detected by a full-frame camera. This creates distinct imaging advantages:

- Fast imaging speed
- High-temporal and 3D-spatial resolution
- Low photobleaching and phototoxicity
- Excellent signal-to-noise ratio

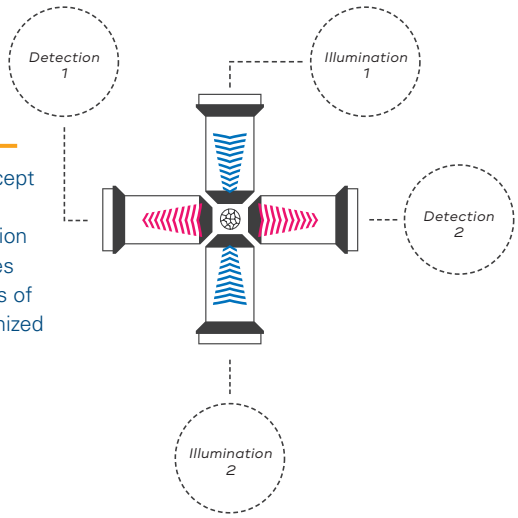


In confocal microscopy the sample is illuminated repeatedly with out-of-focus light leading to phototoxic effects and photobleaching. In light-sheet microscopy only the focal region is illuminated, and no unnecessary out-of-focus light is generated.

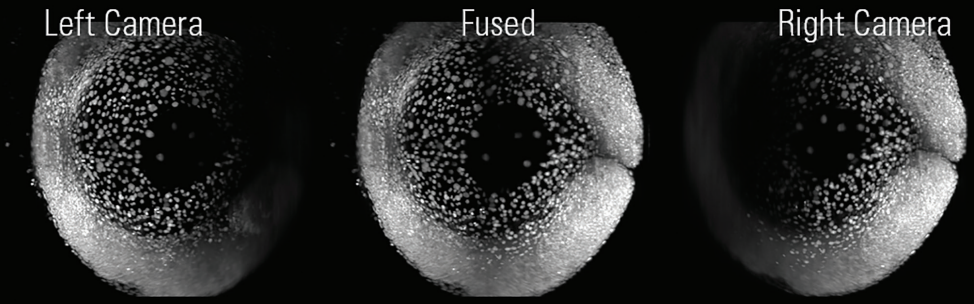
Convenient Multiview Imaging

When imaging large samples, absorption and light scattering degrade the signal and image quality, thus preventing high-quality imaging. MuVi SPIM features a unique 4-axis concept and is available in various configurations to enable unique attributes, including:

- Simultaneous illumination and detection from two opposing directions without rotation
- Free rotation axis for optimal sample positioning
- Isotropic resolution with single 90° rotation
- Unparalleled acquisition speed



MuVi SPIM 4-axis concept with two opposing detection and illumination objectives. This provides four independent views of the sample, each optimized for one quadrant.



Zebrafish expressing H2A::GFP acquired simultaneously from two opposing directions (left, right). Data fusion of the two views yields a high-quality in-toto image of the sample (middle).

MuVi SPIM LS

Pure Live Imaging

Native and Natural Environment

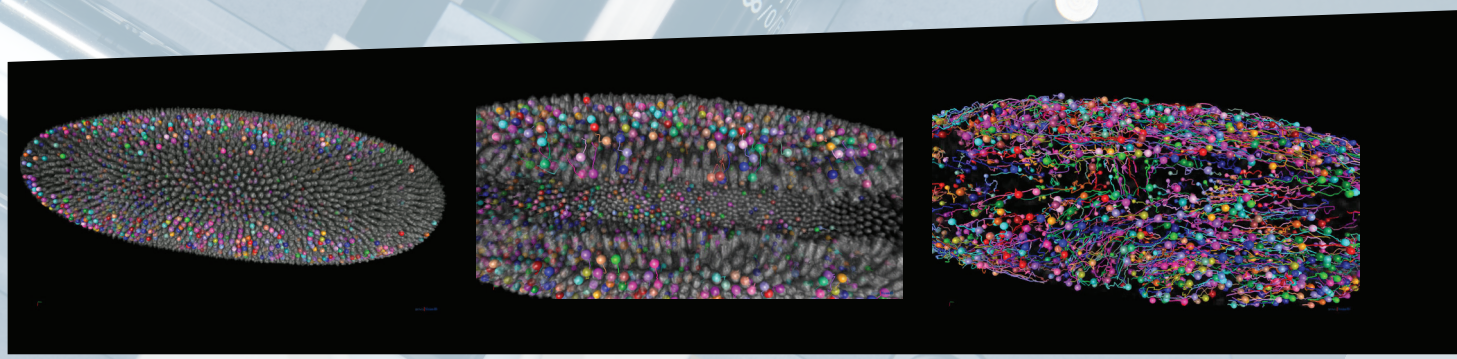
Equipped with an environmental control module, MuVi SPIM supports imaging of live specimens over hours and days without altering the biology. This is achieved by controlling temperature (20-37 °C), gas concentrations (CO2 , O2 , N2) and humidity, enabling research in:

- Developmental biology
- Marine biology
- Neurobiology and neurodevelopment
- Oncology

Unparalleled Imaging Speed for in-toto Imaging

With its exceptional imaging speed, the MuVi SPIM LS can capture a high number of biological events. This makes it:

- Four combinations of illumination and detection
- One hundred to a thousand times faster than confocal microscopy
- Ideal for functional imaging
- Perfect for cellular and subcellular tracking

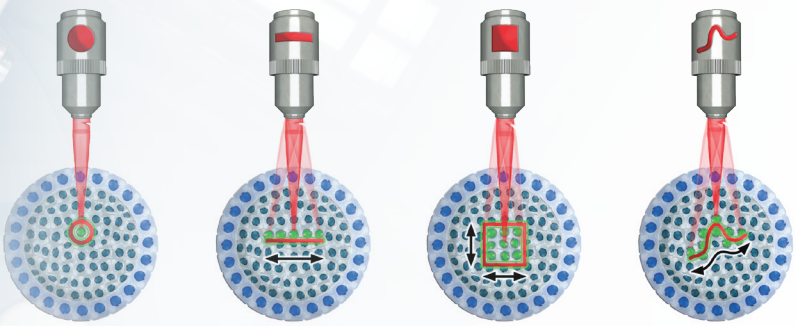


Time series of drosophila development.
Cell tracking created with Arivis Vision4D 3D visualization and analysis software.
Image courtesy of Celia Smits and Stanislav Y. Shvartsman. Department of Molecular Biology at Princeton University, NJ.

Optional Photomanipulation

The ability to spatiotemporally control, manipulate, and alter biological processes is key to revealing underlying mechanisms. A photomanipulation (PM) module can be added to MuVi SPIM, which allows for advanced experiments in photoablation, cauterization, optogenetics, and fluorescence recovery after photobleaching (FRAP) with:

- Beam coupled into detection objective
- Diffraction-limited illumination spot
- Flexible ROI generation (point, straight line, freeform, and square)



MuVi SPIM provides a variety of excitation schemes and patterns for photomanipulation. CW and pulsed lasers from UV to IR.

MuVi SPIM CS

Comprehensive Cleared-Sample Imaging

Advanced Cleared-Sample Applications

The MuVi SPIM CS is optimized for cleared samples, allowing comprehensive visualization of large, in-toto cleared specimens.

MuVi SPIM CS is valuable for various applications and structures, including:

- 3D microstructure analysis of tissues
- Brain and central nervous system tissues
- Organ development
- Tumorigenesis

High Flexibility of Sample Size and Clearing Method

MuVi SPIM CS supports imaging of a variety of cleared samples with different sizes, ranging from 3D organoids up to cleared mouse brains. This is accomplished by:

- Innovative optical design compatible with all clearing solutions
- Different configurations of detection lenses to match the properties of your samples
- 10x10 mm area accessible for imaging

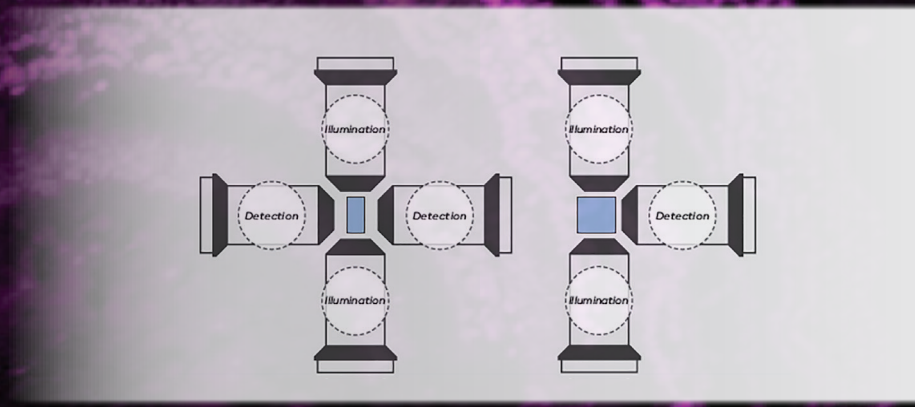
Innovative and Easy Sample Handling

MuVi SPIM CS provides an innovative solution for sample mounting, minimizing the exposure of the user to clearing reagents. This is accomplished by:

- Overhead 3D translation/rotation unit for sample mounting from the top
- Support of various mounting methods (e.g. hook, plate, pin, cuvette, etc.)
- Easy maintenance and cleaning of objectives and chamber

Background image:

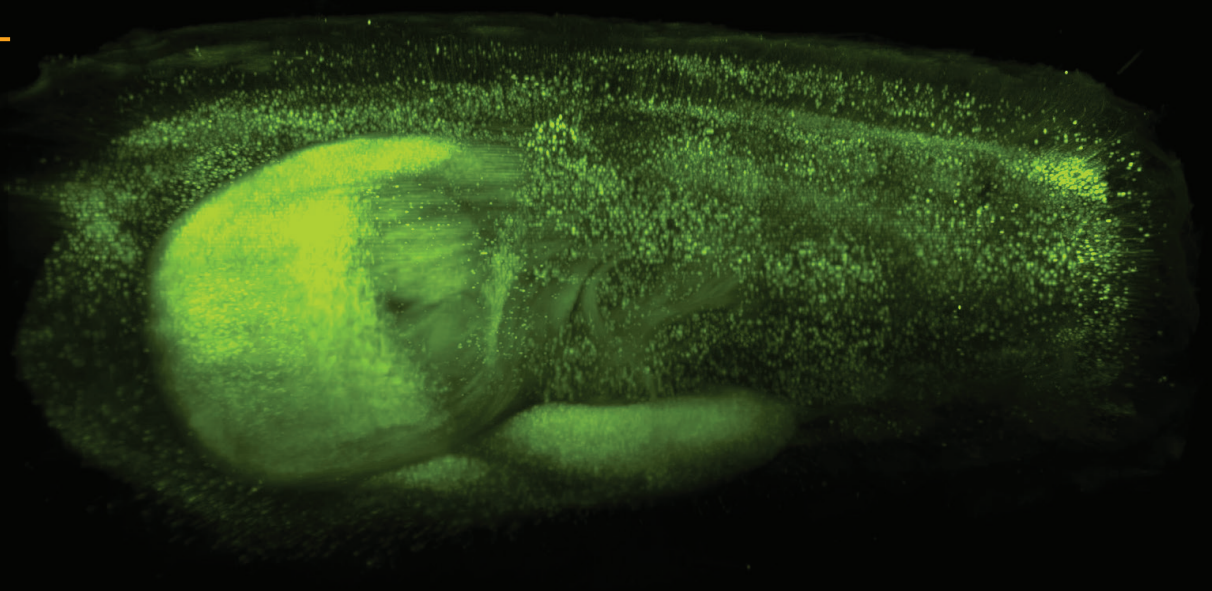
Antibody labeled supporting cells of guineapig cochlea cleared with Cubic. Visualization of cochlea enables investigation of mechanisms leading to hearing loss. Image courtesy of Prof. Löwenheim, Uniklinikum Tübingen



Dual- or single-sided detection combined with dual-sided illumination can be configured according to the experimental needs.

Background image:

Neurons of a transgenic mouse expressing YFP with the brain being cleared with Clarity. Image courtesy of Dr. Zhang Dan, Tsinghuan University, China.

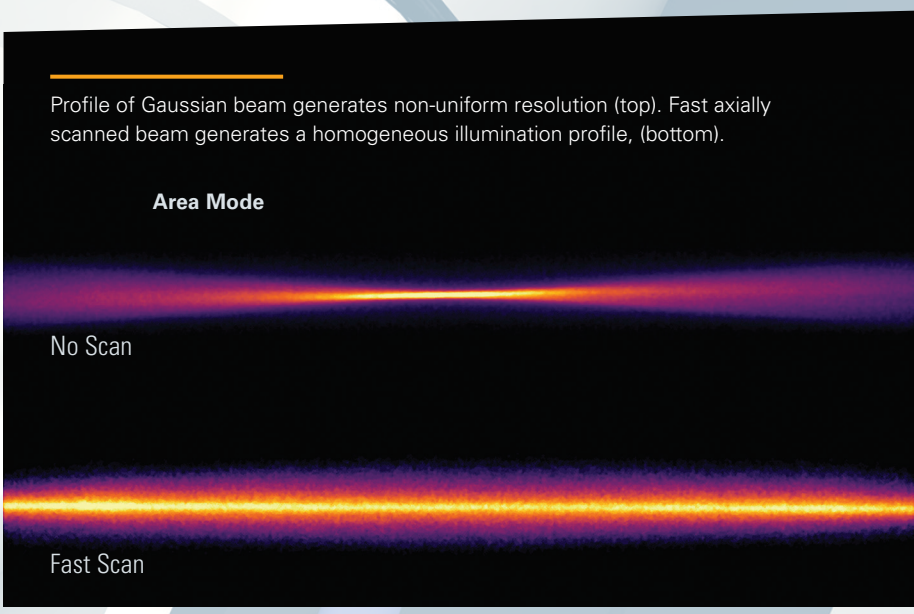


Next-Generation Advances

Larger Field-of-View (FOV) and Superior Axial Resolution

MuVi SPIM obtains large FOV images at high 3D spatial resolution by using a tightly focused Gaussian beam swept at a high speed along the illumination axis. Integration over time and space leads to an elongated, uniform, and thin light-sheet to provide axial resolution over large FOV.

Profile of Gaussian beam generates non-uniform resolution (top). Fast axially scanned beam generates a homogeneous illumination profile, (bottom).

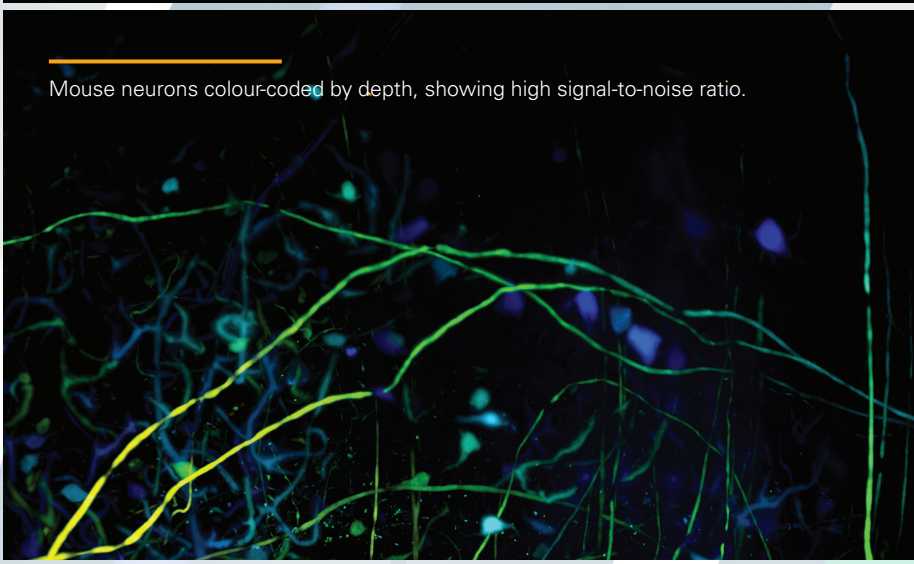


Improved Signal-to-Noise

When imaging thicker samples or opaque specimens, light scattering can lead to reduced contrast and image blur. MuVi SPIM has implemented an elegant approach to enhance image contrast by offering:

- Scanned light-sheet
- Robust aberration tolerance (even in complex samples)
- Line illumination for improved background suppression

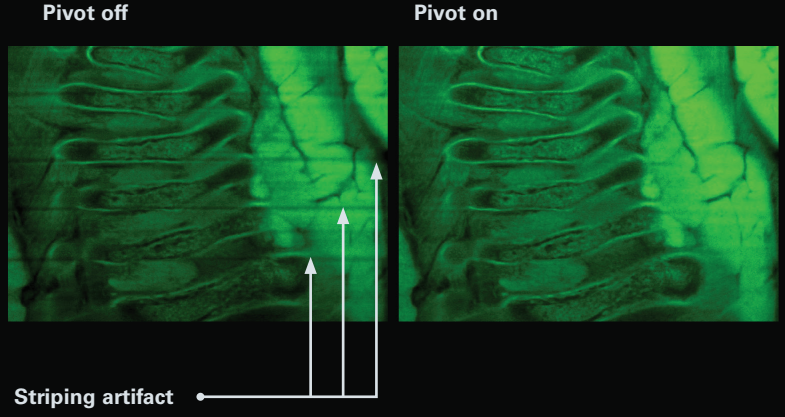
Mouse neurons colour-coded by depth, showing high signal-to-noise ratio.



Effective Elimination of Striping Artifacts

When imaging live, cleared, or fixed biological samples, obstacles like pigments or cell nuclei can absorb or scatter light, leading to images with shadows and striping artifacts. The next-generation MuVi SPIM employs a dual de-striping via pivot scanning, which generates a homogenous illumination profile without compromising acquisition speed.

Cleared mouse embryo shows striping artifacts without pivot scanning (left). With pivot scanning, artifacts can be successfully removed, (right).



All-in-One Software

Intuitive design

Bruker's intuitive LuxControl software offers simple set up and execution of multidimensional experiments by providing:

- All-in-one intuitive user interface: acquisition, viewer, image processor
- High reproducibility of experiments: parameters and configurations are saved in metadata
- Data formats (.tiff, .hdf5, .ims) compatible with common image processing software
- Fully scriptable microscope control and processing via open interface

Features include:

- Multi-color alignment
- Tile stitching of hundreds of tiles for large samples
- Multi-view image fusion and deconvolution

LuxControl image acquisition tab with experimental settings.

3D Data Viewer

LuxControl has an integrated 3D data viewer that allows researchers to inspect the entire dataset directly after acquisition.

- Ability to turn stitching of tiles on or off
- Both raw and post-processed images
- Fast viewing of multi-terabyte data sets
- Flexible options to draw and annotate

Image viewer and user ROI selection.

Impressive Image Processor

With MuVi SPIM, the sample is recorded from different views and composed of multiple tiles. The LuxControl software takes care of image post processing, including registration and fusion, that compensate for absorption and scattering, delivering high-quality data.

Cleared mouse embryo labeled with methylene blue (cyan) and showing autofluorescence (magenta). Image composed of 12 tiles with 920 planes, processed and stitched using the LuxBundle Image Processor. Image courtesy of Montserrat Coll Lladó, European Molecular Biology Laboratory, Barcelona, Spain.

Specifications

MuVi LS

Detection Objective	Effective Magnification	Field of View µm*	Pixel Size nm
20x 1.0NA	11.1x	1198	585
	22.2x	599	293
	33.3x	399	195
	44.4x	299	146
16x 0.8NA	8x	1664	812
	16x	832	406
	24x	554	271
	32x	416	203

* Calculated based on chip size.

MuVi CS

Detection Objective	Effective Magnification	Field of View µm*	Pixel Size nm
20x 1.0NA	10x	1331	650
	20x	665	325
	30x	444	217
	40x	333	163
10x 0.5NA	5x	2662	1300
	10x	1331	650
	15x	887	433
	20x	666	325
4x 0.28NA	2.2x	5990	2925
	4.4x	2995	1463
	6.7x	1997	975
	8.9x	1497	731

* Calculated based on chip size.

Bruker Fluorescence Microscopy

Heidelberg • Germany
Phone +49 6221 187 31 50

productinfo@bruker.com

Light-Sheet Fluorescence Microscopy | See Biology Across All Scales

www.bruker.com/MuVi