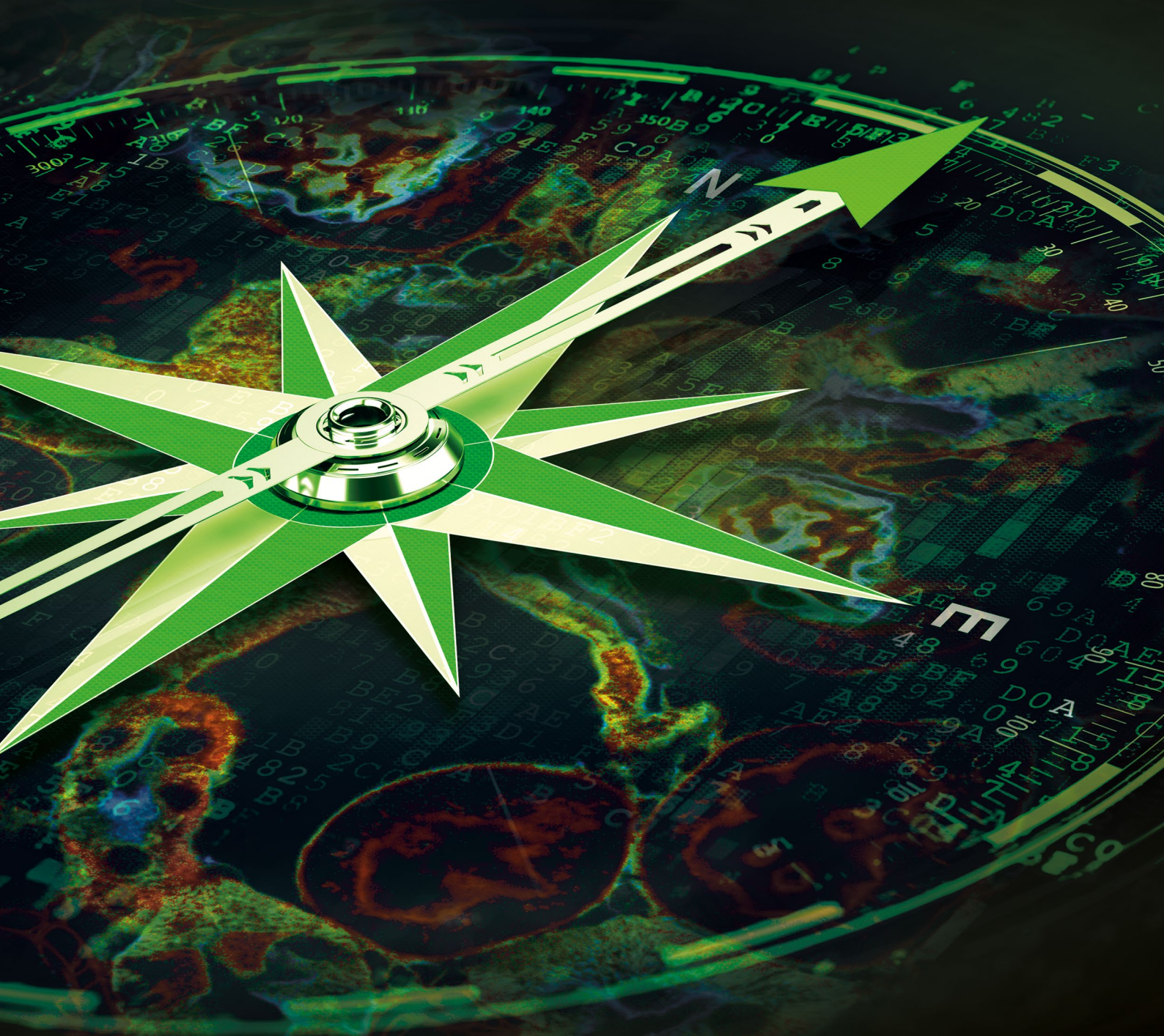
PicoQuant

Luminosa

Explore new paths in confocal microscopy



Vision

We want to assist more scientists to efficiently drive their research forward by using and developing quantitative methods in single molecule and time-resolved fluorescence microscopy.

“Expert tools accessible in an easy and intuitive way.”

Prof. Jörg Enderlein
Georg-August-University Göttingen

Remarkably simple.
Precisely yours.

Luminosa pairs highest data quality with remarkably simple day-to-day operation. It easily integrates into any researcher’s toolbox and becomes a time-efficient, reliable companion for scientists starting to explore the use of time-resolved fluorescence methodologies as well as experts wanting to push the limits.
Truly a microscopy system that everybody can trust.

Quality and precision you can trust

Optimal performance for single molecule investigations in every measurement context: One-click autoalignment procedure even without requiring a sample. Galvo scanning (maximum speed) and objective scanning (maximum photon detection efficiency) on the same microscope.

Save time and simply focus on your samples

Context-based, intuitive workflows guide you to efficiently harness the full power of smFRET, FCS and FLIM with confidence. Get analysis results with minimal user interaction. GPU-based algorithms provide fast and reliable results.

Advanced flexibility

Adjust the observation volume to match the dynamics of your FCS and smFRET assays with a single click.
An open mode of operation is available for full access to every optomechanical component via software.

Explore new paths in confocal microscopy

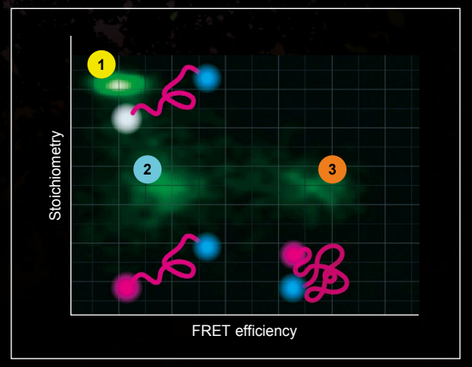
Methods and Applications

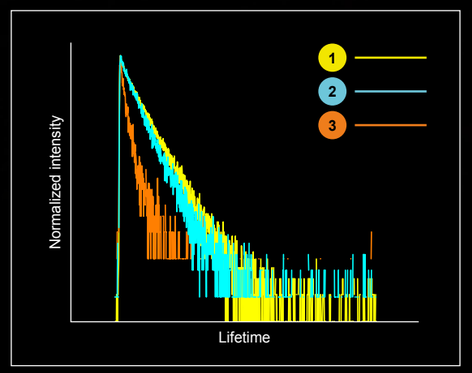
One toolbox, many possibilities

Luminosa offers access to advanced quantitative methods in single-molecule and time-resolved fluorescence that can be incorporated into your research toolbox in a simple, time efficient, and robust manner.

Dynamic structural biology at the single molecule level

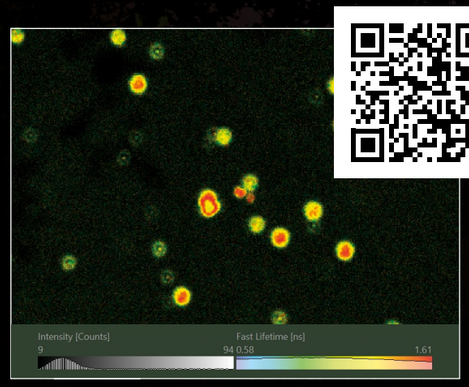
- Observing dynamic conformational changes of proteins as they are performing their tasks
- Discriminating subpopulations
- Revealing reconfigurations of intrinsically disordered proteins

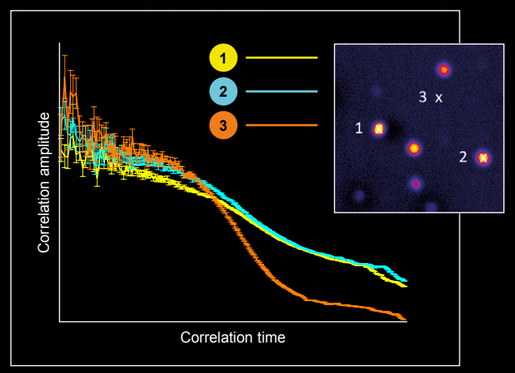


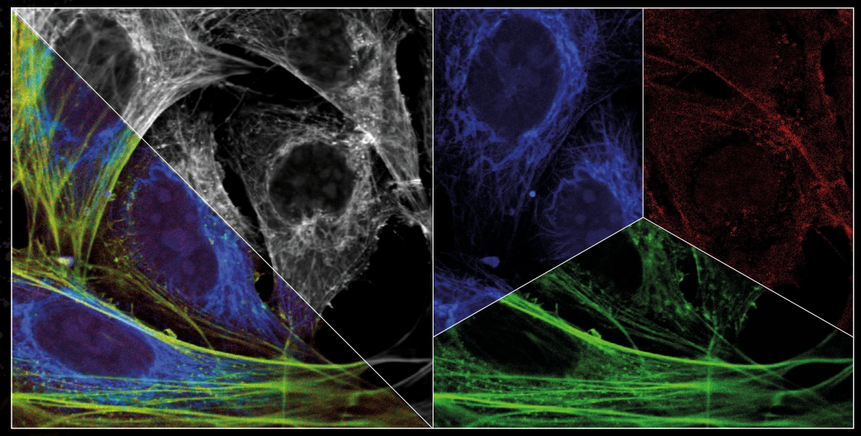


Cellular mechanisms driven by phase separation

- Visualize formation and dynamics of phase-separated condensates
- Unravel behavior of molecules inside and outside condensates
- Assess ensemble heterogeneity



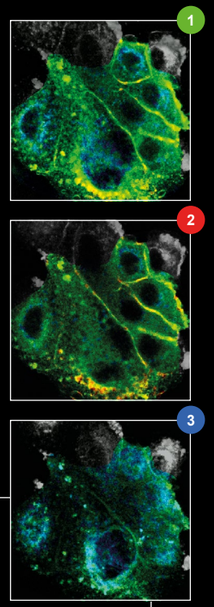


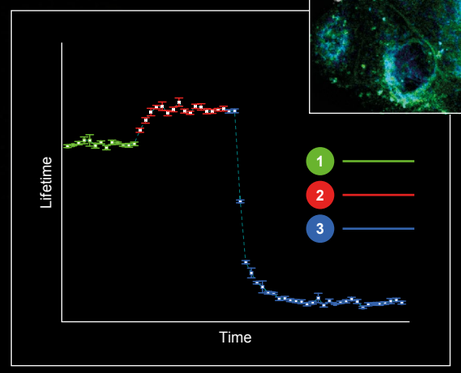


Lifetime based marker separation: Fixed cells labeled with three markers. All markers detected in one spectral channel and separated by fluorescence lifetime differences.

Environmental sensing

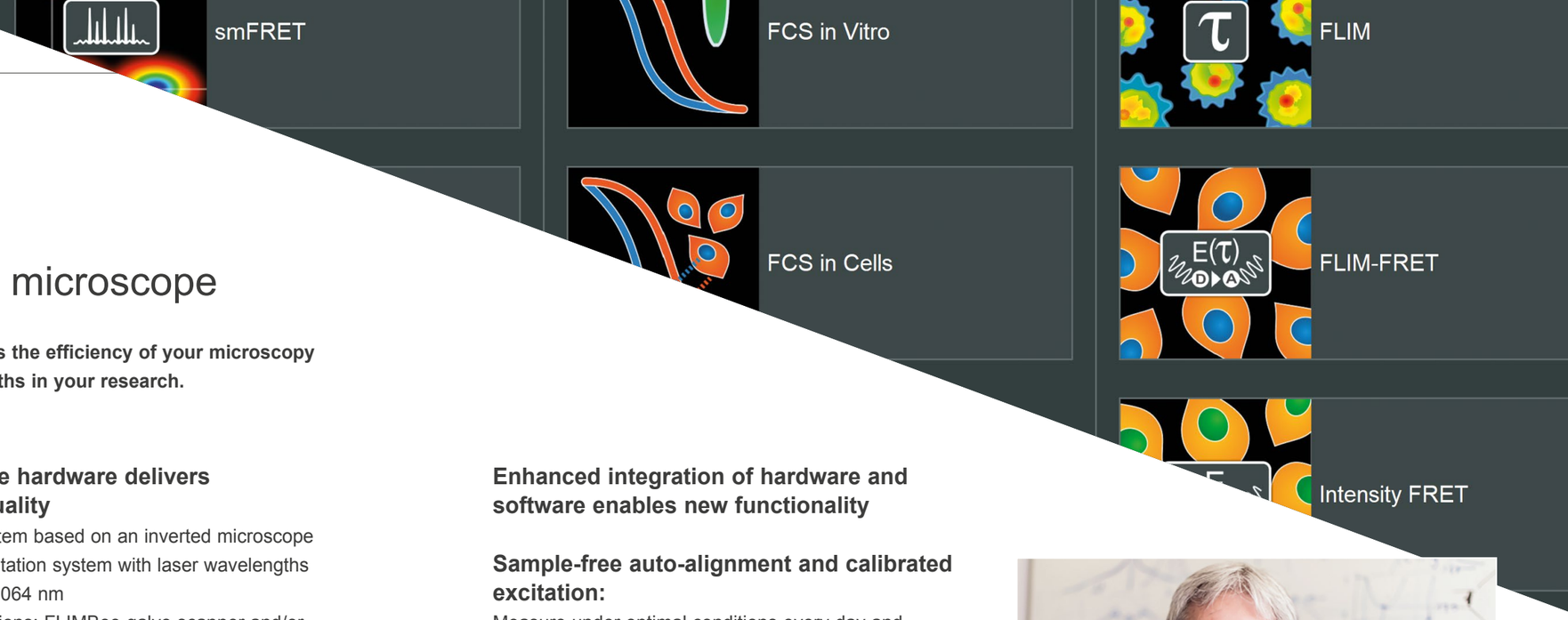
- Visualize properties of a protein`s native environment, such as molecular crowding, pH fluctuations, or membrane alterations
- Understand protein function and regulation





Core methodologies

- **Single-molecule FRET (burst and time trace analysis)**
- **Fluorescence Lifetime Imaging (FLIM)**
- **rapidFLIM^{HiRes} for fast processes**
- **Lifetime-based and intensity-based FRET imaging**
- **Fluorescence Correlation Spectroscopy (FCS)**
- **Anisotropy imaging**
- **Imaging Scanning Microscopy (ISM-FLIM)**
- **Differential Interface Contrast (DIC imaging)**



Luminosa

The single photon counting confocal microscope

Pairing highest data quality with remarkable simplicity: Luminosa boosts the efficiency of your microscopy related workflows and is a reliable companion while you explore new paths in your research.

New software concepts increase ease-of-use and reliability

- *Fast results with minimal user interaction thanks to GPU accelerated algorithms*
- *Context-based workflows for FCS, FLIM, and single molecule detection*

Software feature highlights

InstaFLIM:
- Species separation based on lifetime information without user interaction
- 4 different analysis routines run in parallel: multi-exponential decay fit, phasor plot, pattern matching, and lifetime histogram

InstaFCS:
- Live calculation of auto- and cross-correlation curves
- Online FCS fitting with automatic suggestions for models and parameters

FRETcompass:
- Online preview of efficiency vs. stoichiometry histogram
- Automated determination of correction factors used in single molecule FRET experiments
- FRET population-specific lifetime analysis

LumiFinder:
- Automated detection and measurement of immobilized emitters
- Point measurements at identified locations, with definable duration

Cutting-edge hardware delivers best data quality

- Confocal system based on an inverted microscope
- Versatile excitation system with laser wavelengths from 375 to 1064 nm
- Scanning options: FLIMBee galvo scanner and/or piezo objective scanning (speed for imaging or highest sensitivity for single molecule studies)
- Up to 6 truly parallel detection channels with SPAD (highest sensitivity in VIS and NIR range) and/or Hybrid PMTs (high timing resolution and linearity at high count rates)

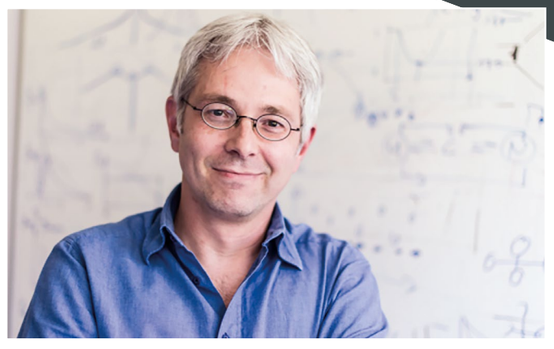
WINNER
of Laser World of Photonics Innovation Award 2023 for the category of „Biophotonics and medical engineering“

Enhanced integration of hardware and software enables new functionality

Sample-free auto-alignment and calibrated excitation:
Measure under optimal conditions every day and increase the reproducibility of your experiments.

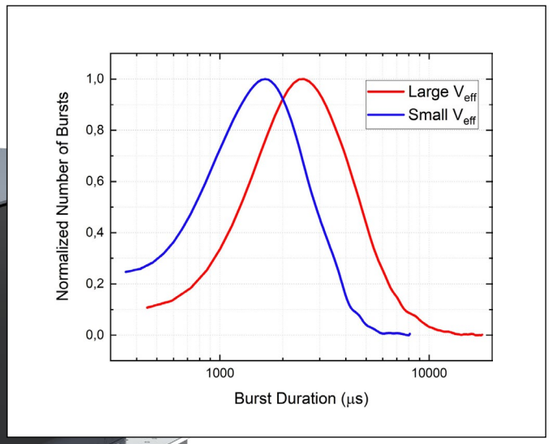
Imaging large samples:
Create an overview in DIC, epi-illumination, or transmission mode in just a few seconds and use it as a global reference map for further measurements.

Variable PSF:
Switch between diffraction limited and larger observation volume to:
- Increase the observation time window to check for dynamic transitions between states
- Study diffusion properties of larger particles



“The variable PSF offers a very convenient way of fine-tuning single molecule FRET and FCS measurements.”

Prof. Benjamin Schuler, University of Zurich

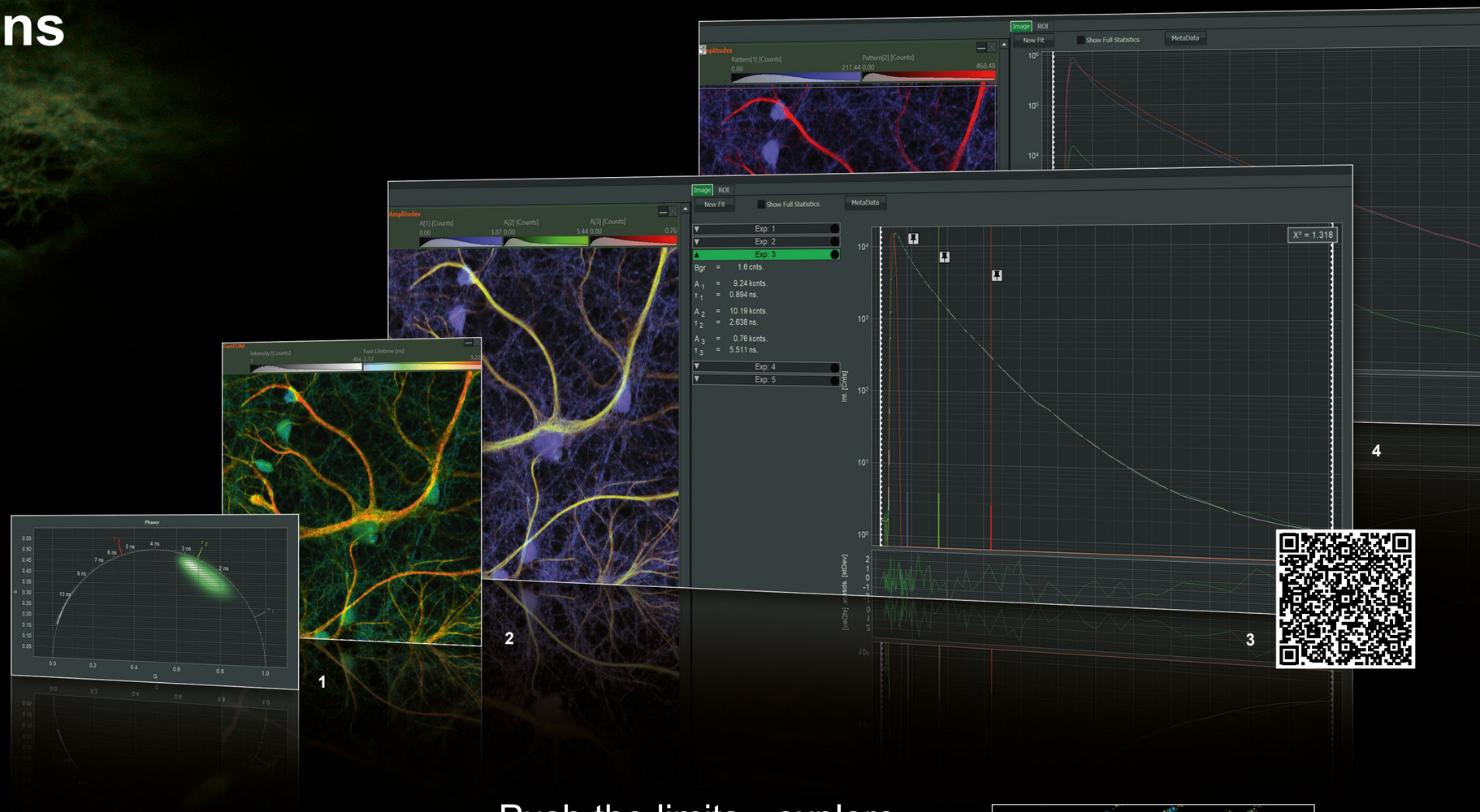


Luminosa Impressions

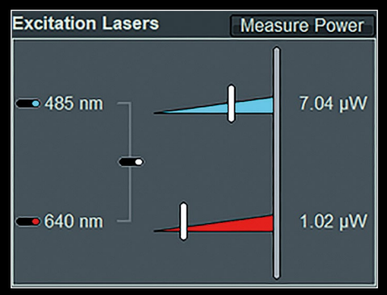
InstaFLIM analysis

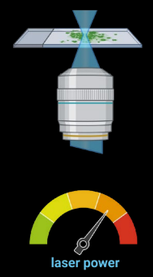
Analyze FLIM images in just a few seconds with minimal user interaction and get the full picture by combining complementary FLIM analysis methods.

1. **Phasor plot**
   Select region of interest to locate associated structures in the image.
2. **Live FastFLIM contrast**
3. **Multi-exponential decay fit with up to five lifetimes**
   A suitable fit model is automatically selected and the corresponding overlay image created.
4. **Pattern matching with up to five patterns**
   The corresponding overlay image is automatically created.



Calibrated Excitation (CalEx)



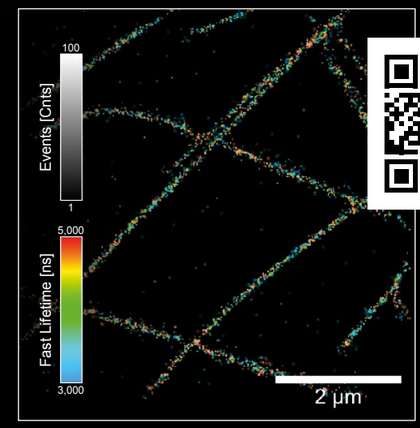


- Avoid fluorophore saturation, photobleaching and phototoxicity
- Increase the health of your sample and consistency of your biological results
- Excitation laser power calibration allows setting and displaying excitation intensity in µW
- No external power meter required

Push the limits - explore new possibilities

Showcase: Development of FLIM-SMLM

- Spatial super-resolution with PAINT or dSTORM
- Confocal sectioning ability
- Additional lifetime contrast due to FLIM, for multiplexing or FRET



PDA-23 Detection

Confocal time-resolved detection with a SPAD array

The SPAD Array Module is not just an addition to your Luminosa microscope; it is a transformative upgrade that redefines the boundaries of time-resolved confocal fluorescence microscopy.

Functional imaging with more resolution and higher contrast:

More spatial resolution, more temporal resolution, enhanced contrast, higher information content. Combine ISM's resolution enhancement and increased contrast with the functional imaging information of FLIM.

Customizable research tools:

Leverage the open hardware and (.ptu) data format to create and adapt new time-resolved methodologies for your research goals with confidence built upon 25 years of experience in time-resolved photon detection.

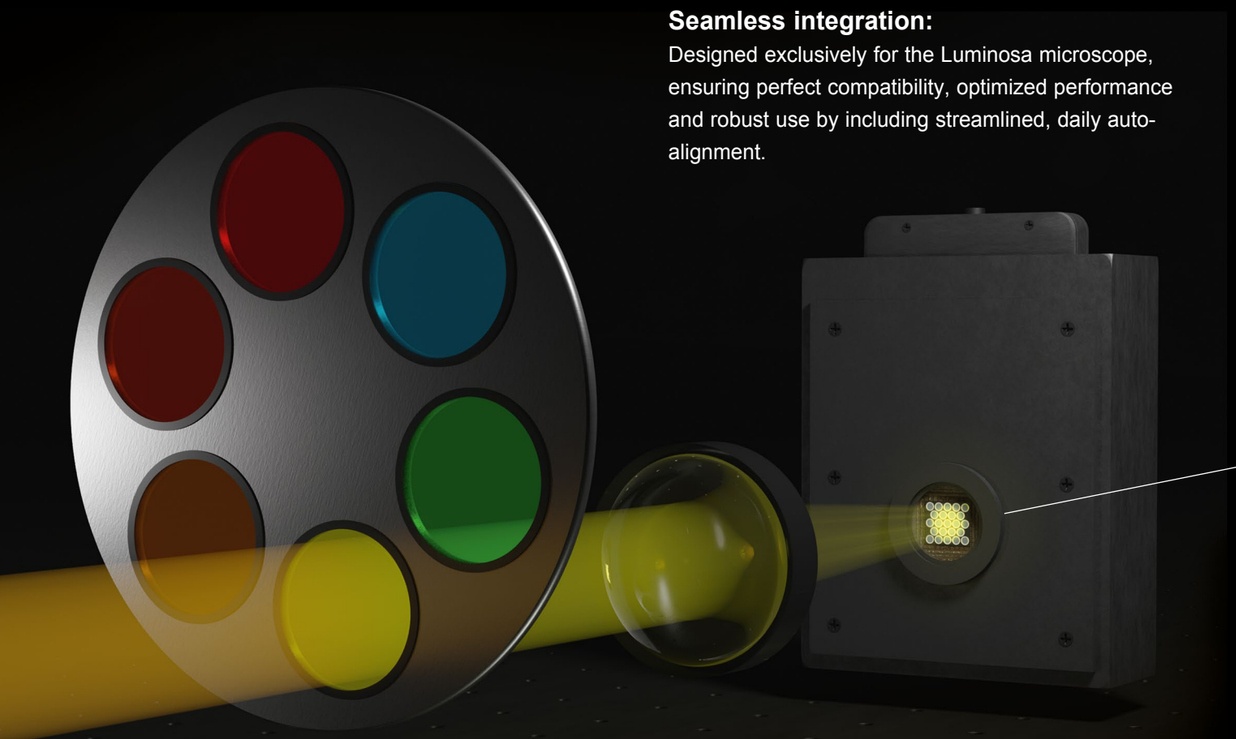
Explore what the SPAD array can bring: from imaging to fluctuation analysis and single molecule fluorescence modalities.

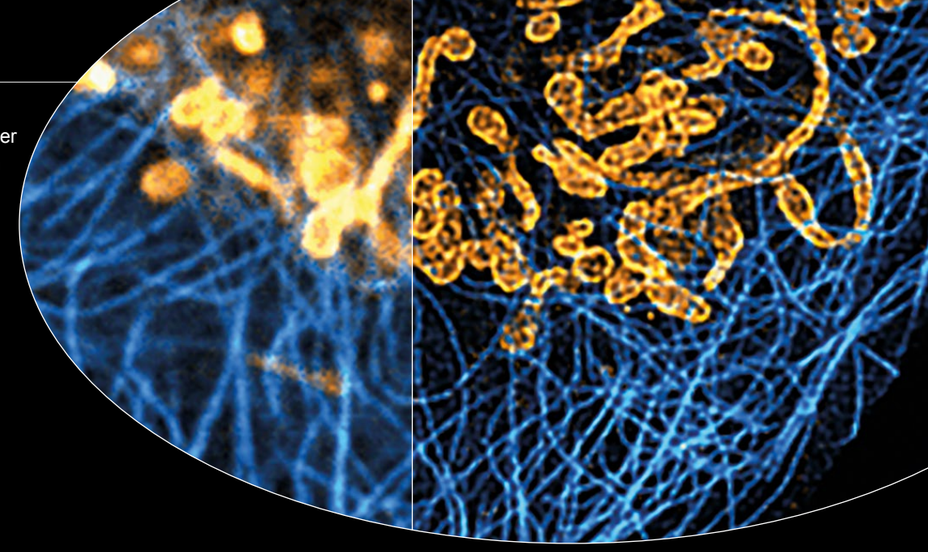
Precision meets compatibility:

The PDA-23 is perfectly matched with PicoQuant`s MultiHarp 160 time-correlated single photon counting module. Each pixel of the SPAD array is detecting photons in an asynchronous way, with a timing below 100 ps. Best-in-class dark counts via cooling, and microlenses in front of the detector for an optimised fill-factor offer unique advantages, in applications for which signal-to-noise ratio is critical.

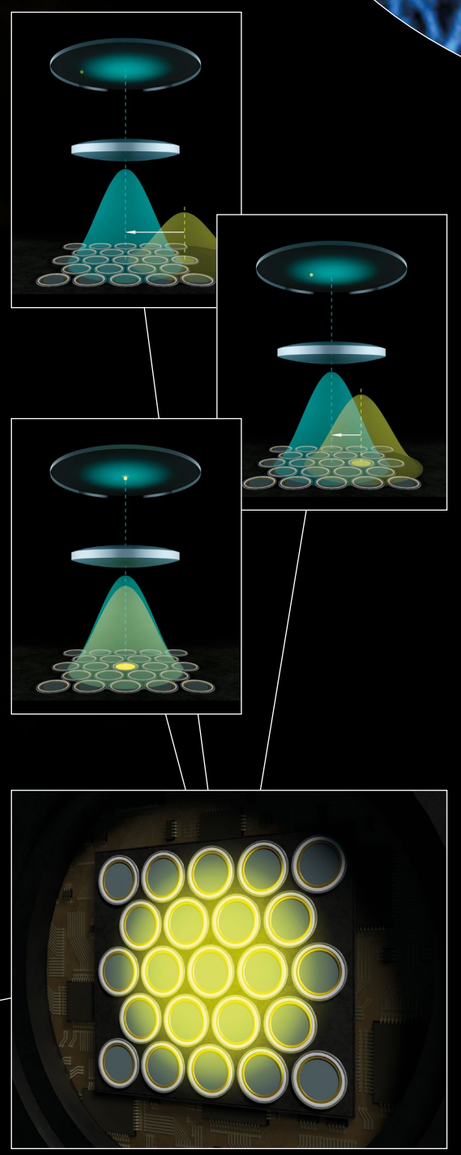
Seamless integration:

Designed exclusively for the Luminosa microscope, ensuring perfect compatibility, optimized performance and robust use by including streamlined, daily auto-alignment.





Lifetime-based marker separation in confocal (left) and ISM-FLIM image (right).



How ISM works:

- Each array element approximates zero-size confocal pinhole
- Maximum optical sectioning by each array element
- Resolution increase of about 30 % after pixel re-assignment
- For 485 nm excitation: resolution down to 155 nm FWHM after pixel re-assignment and 120 nm FWHM after deconvolution. (Performance may vary based on properties of your samples.)
- Focus ISM: improved contrast

Software features include:

- Online pixel re-assignment
- Shift vectors automatically determined
- Online lifetime contrast
- FLIM analysis for marker multiplexing

PDA-23 detector with breakout box.
More about PDA-23

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