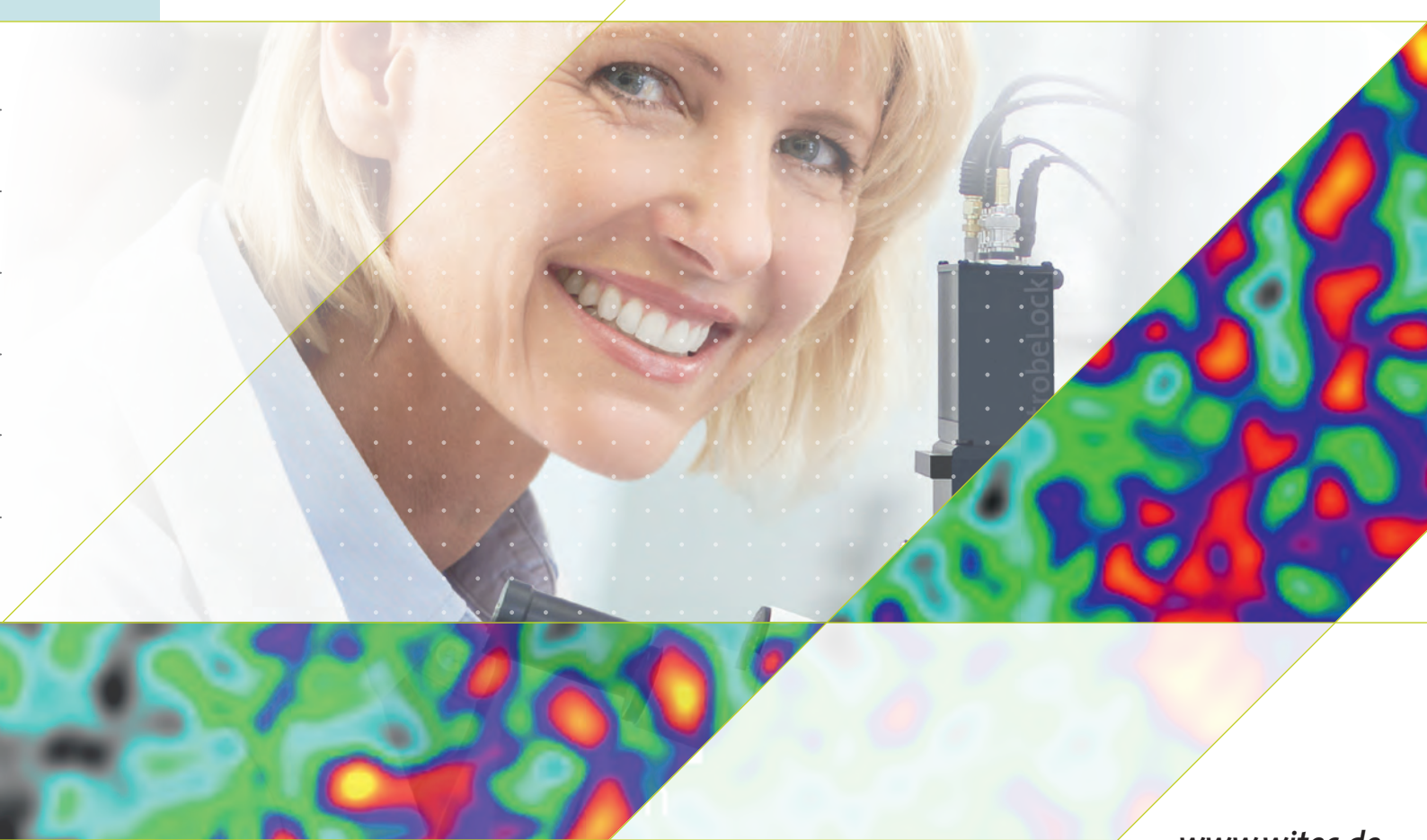
WITec
focus innovations

Time-Correlated Single Photon
Counting Module for FLIM and TLM

StrobeLock



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StrobeLock

Time-Correlated Single Photon Counting Module for FLIM and TLM

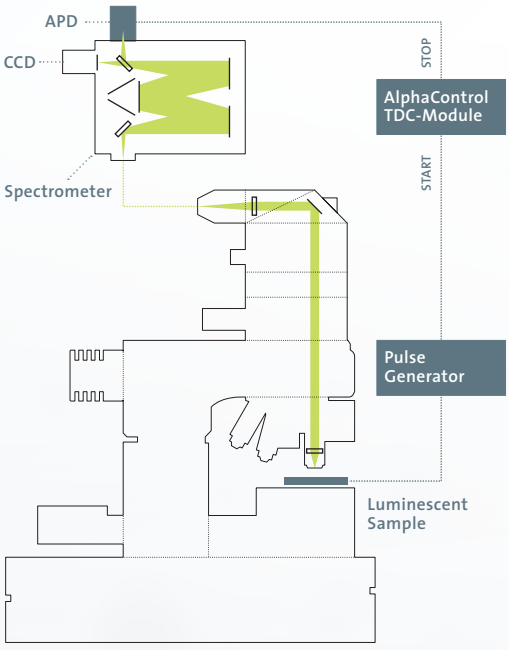
StrobeLock is a WITec extension that enables time-correlated single photon counting measurements of unprecedented accuracy. The available imaging modes include Fluorescence Lifetime Imaging and Time-resolved Luminescence Microscopy, which can be integrated with the WITec alpha300 and alpha500 microscope series.

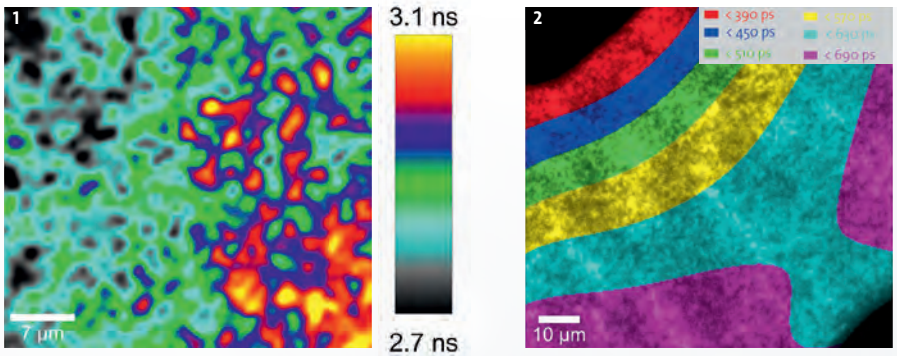
This combination facilitates the detection of additional material contrasts hidden in the temporal behavior of a fluorescence or luminescence signal and allows them to be correlated with Raman, SNOM or AFM imaging. It makes possible a variety of measurement modes for an improved and more comprehensive understanding of a sample's properties. StrobeLock is comprised of a pulsed excitation laser, a single photon detector and a time-to-digital converter module. The ability to switch between time-resolved and conventional modes offers the microscope user new found convenience and capability. StrobeLock electronics are integrated with WITec's alphaControl, allowing the seamless linkage of time-correlated measurements. Detectors and excitation lasers are optimized in the WITec microscope series for imaging sensitivity and ease-of-use.

TLM

Time-resolved Luminescence Microscopy (TLM)

Time-resolved Luminescence Microscopy (TLM) determines luminescence decay over time after stimulation. This technique holds many advantages in, for example, the characterization and quality evaluation of a sample.





TLM on a blue light-emitting diode (LED)

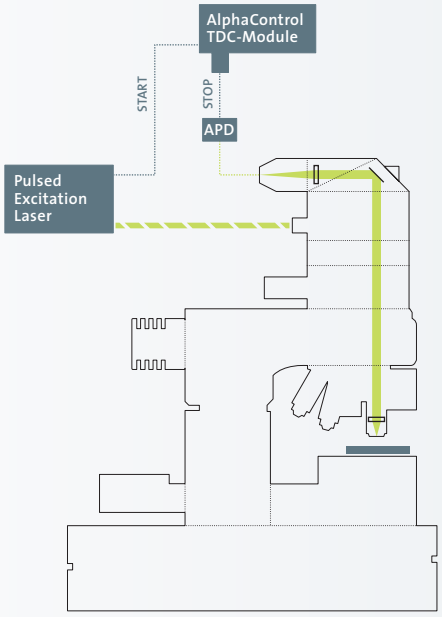
1 Map of local relaxation times of the LED aquired through spatially-resolved time spectra measurement.

2 Counter plot of the temporal luminescence emission start of the LED.

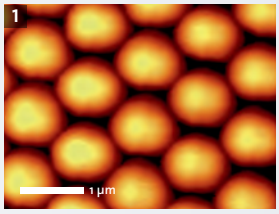
Microscopic setup for Time-resolved Luminescence Microscopy (TLM)

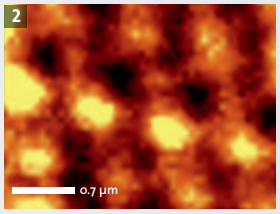
Fluorescence Lifetime Imaging (FLIM)

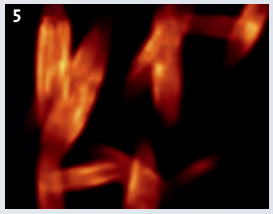
Fluorescence Lifetime Imaging (FLIM) determines fluorescence decay over time after pulsed optical excitation. In combination with other WITec imaging techniques it greatly extends the amount of information acquired from one sample and is well suited for materials science applications.

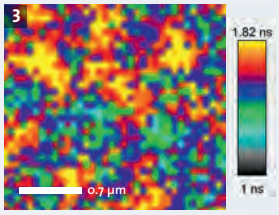


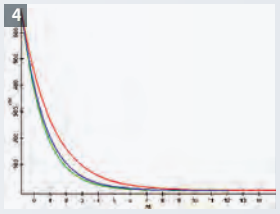
Microscopic setup for Fluorescence Lifetime Imaging (FLIM).

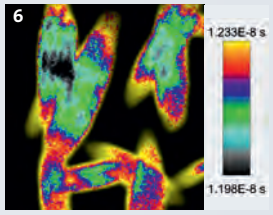










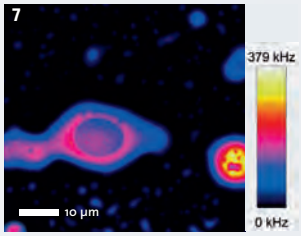


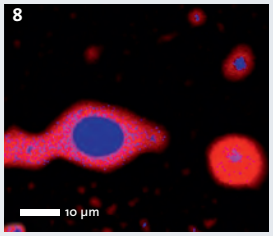
Cadmium selenite nano crystals on a patterned Au substrate

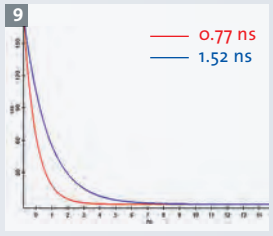
1 AFM topographic image
2 Total fluorescence intensity
3 FLIM
4 Corresponding FLIM decay curves

EPPTC crystal needles*

5 Total fluorescence intensity
6 FLIM







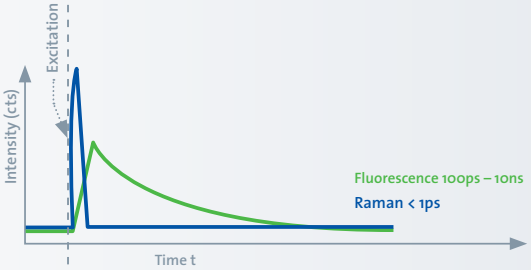
Mixture of nano materials and dyes

7 Total fluorescence intensity
8 Average lifetime (FLIM)
9 Average decay curves

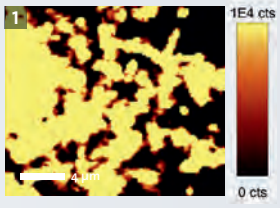
Images courtesy of Xingping Zhang, Institute of Information Photonics Technology and College of Applied Sciences, Beijing University of Technology

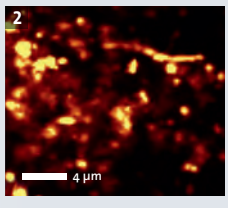
Raman Fluorescence Separation (RFS)

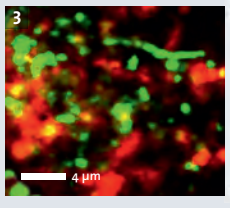
StrobeLock's highly accurate and sensitive measurement features allow the separation of a Raman signal from the fluorescence signal. While the emission time of a fluorescence signal is between 100ps and 10ns, the Raman signal shows a faster emission time of less than 1ps. This difference enables Raman Fluorescence Separation (RFS) to effectively detect the Raman signal. The technique has already been successfully demonstrated on a variety of samples.



Raman intensity over time compared to the fluorescence intensity.







Raman Fluorescence Separation (RFS) on cadmium sulfite nanowires. The slow fluorescence **(1)** and fast Raman **(2)** signal can be detected separately. The merged picture **(3)** shows the Raman image (green) combined with the fluorescence image (red).

FEATURES & BENEFITS

- Extension for alpha300 and alpha500 microscope series: Time-Correlated Single Photon Counting Module for FLIM and TLM
- Developed for advanced materials research to detect additional material characteristics
- User-friendly combination options with Raman, SNOM and AFM for enhanced measurement techniques
- Ease-of-use inherent through full integration with the alphaControl hardware and WITec Suite Project *FOUR* software environment
- Microscope configurations, types of lasers and detectors, and applied frequencies are highly adjustable according to the user's requirements
- Flexible laser pulse frequencies for FLIM and TLM matched to the sample properties (up to 100 MHz)
- Instrument response time typically below 120ps for high measurement sensitivity and accuracy

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