

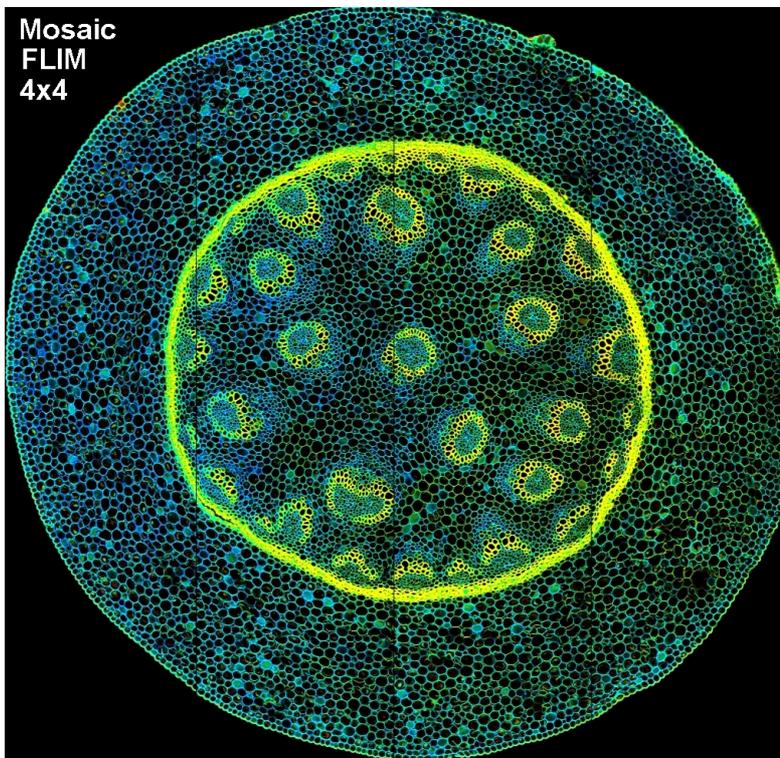
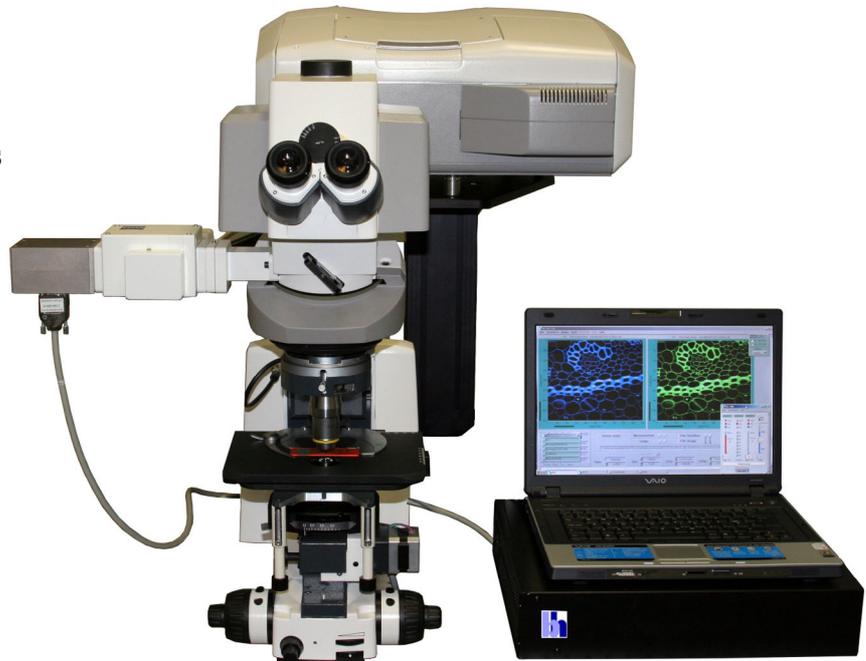


FLIM Systems for Zeiss LSM-710 / 780 / 880

Based on bh's Multidimensional Megapixel FLIM Technology

Unprecedented Time Resolution
Ultra-high sensitivity
Multiphoton NDD FLIM
Confocal FLIM
Upright and Inverted Microscopes
OPO FLIM

GaAsP hybrid detectors
Dual-detector systems
Fully parallel recording channels
Multi-spectral FLIM systems
Mosaic FLIM, PLIM, FLITS
FCS



Mosaic FLIM, 2048 x 2048 pixels, 256 time channels

Fully parallel TCSPC channels
Extremely large images
Unprecedented count rate
Short acquisition time
Online-FLIM display
Time-series FLIM
Z-Stack FLIM
Mosaic FLIM
Near-Infrared FLIM
FLITS
PLIM simultaneously with FLIM
Parameter-tag and histogram modes
FCS recording, online correlation and fit
Single-molecule burst recording
Fast preview in all FLIM modes
Multi-exponential decay analysis
Multi-spectral decay analysis
FRET measurement
Autofluorescence of cells and tissue
Ion concentration measurements
C²⁺ transient recording



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Covered by patents DE 43 39 784 and DE 43 39 787



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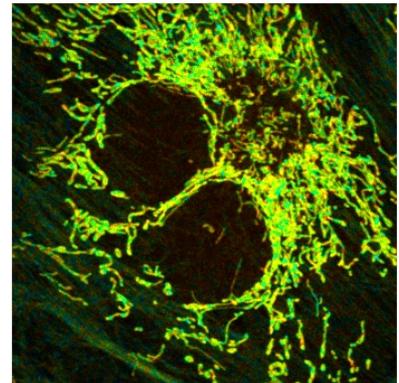
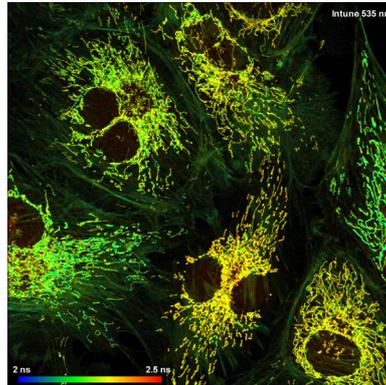
Megapixel Technology

Extremely large images

Image size up to 4096x4096 pixels

Record a large number of cells under identical conditions

Select cells of interest from recorded data



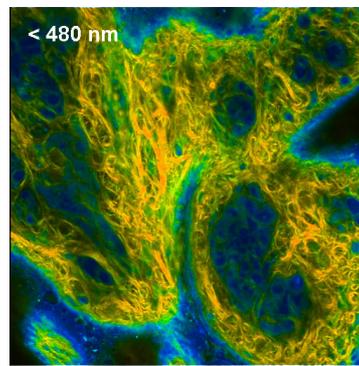
Multiphoton NDD FLIM

Ultra-high sensitivity combined with deep-tissue imaging capability

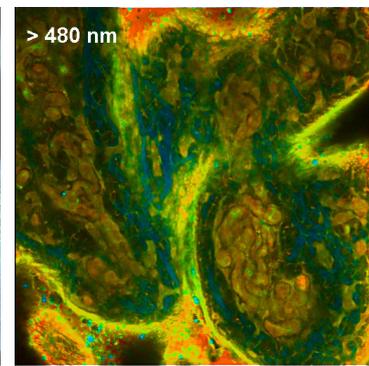
Simultaneous, fully parallel detection in two wavelength channels

Simultaneous FLIM and SHG imaging

Extraction of SHG component from FLIM data



% SHG 50 100

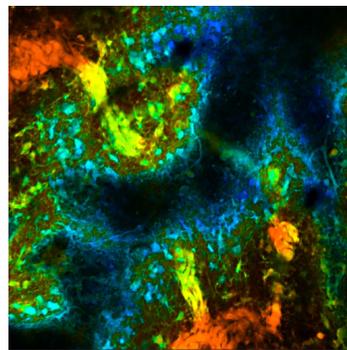


tm 500ps 1200ps

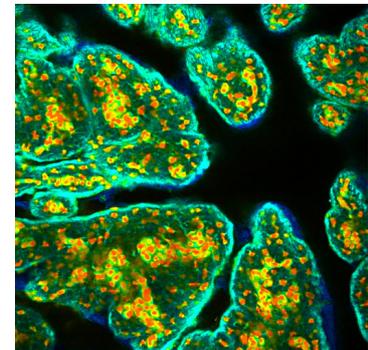
OPO FLIM

Multiphoton FLIM at excitation wavelengths > 100 nm

Record deep-tissue images with NIR fluorophores



tm 900 ps 1800 ps



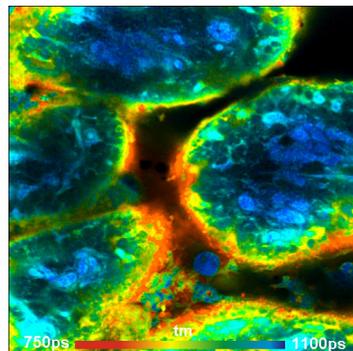
tm 400ps 800 ps

NIR FLIM

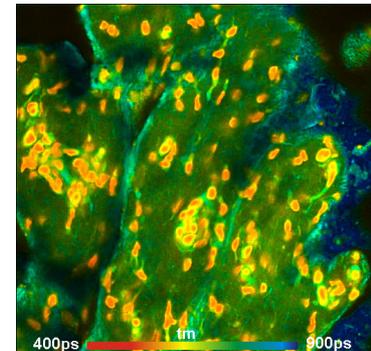
One-photon FLIM with NIR fluorophores

Ti:Sa laser used as 1p excitation source

No autofluorescence background



750ps tm 1100ps



400ps tm 900ps



More than 25 years experience in multi-dimensional TCSPC. More than 1800 TCSPC systems worldwide



FLIM Systems for Zeiss LSM-710 / 780 / 880

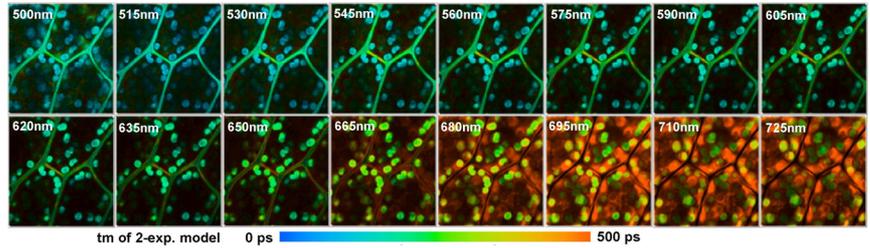
Multiphoton NDD Multispectral FLIM

The world's first multiphoton, multispectral NDD FLIM system

Simultaneous detection in 16 wavelength channels

No wavelength scanning, no time gating

Near-ideal recording efficiency



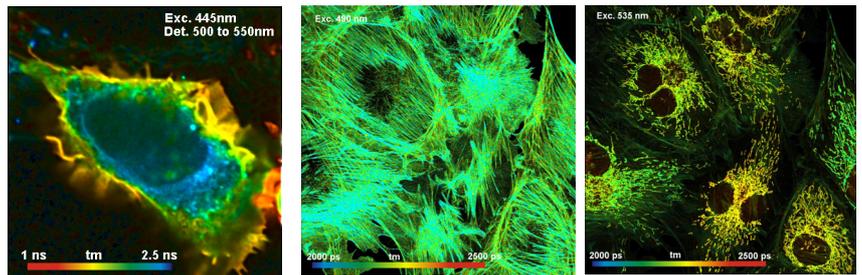
Confocal FLIM

Excitation by picosecond diode lasers or tuneable excitation by 'Intune' laser

Hybrid detectors: SPAD-like sensitivity

No afterpulsing, no diffusion tail

Efficient collection of light even from large pinholes



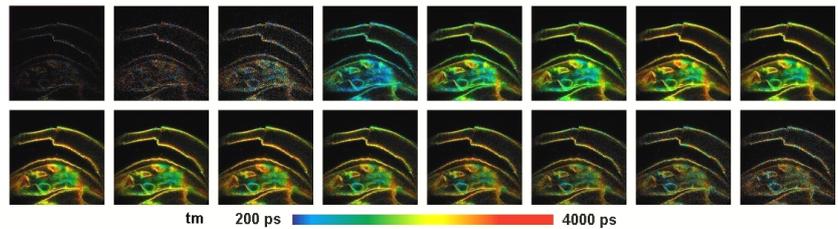
Confocal Multispectral FLIM

Simultaneous detection in 16 wavelength channels

Near-ideal recording efficiency

No wavelength scanning, no time gating

Maximum SNR at minimum sample exposure

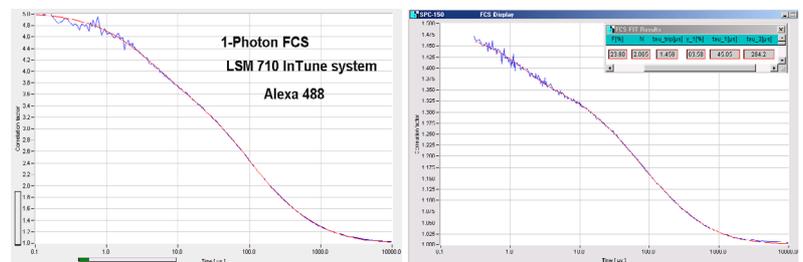


Highly Efficient FCS and FCCS

No afterpulsing peak in autocorrelation

Cross-correlation between independent TCSPC channels

One-photon pulsed excitation, two photon excitation, excitation with CW lasers

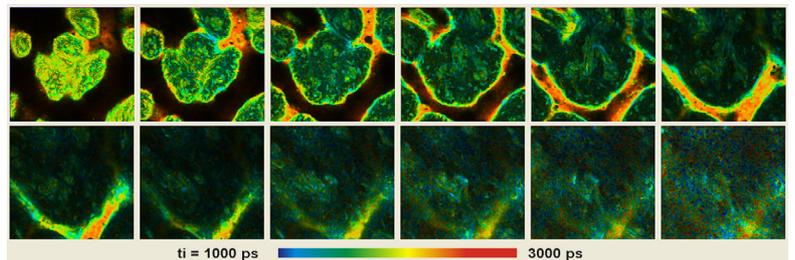


Z Stack FLIM

Automatic FLIM acquisition in consecutive Z planes

Multiphoton NDD FLIM

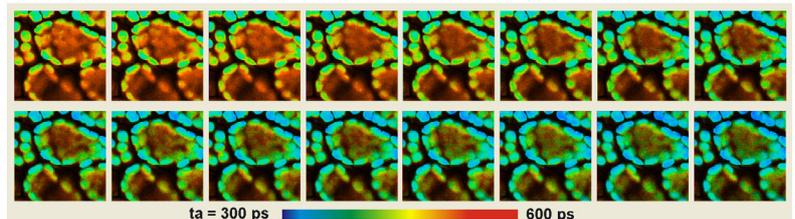
Confocal FLIM



Time-Series FLIM

Time-series down to 2 images per second

Microscope-controlled time series



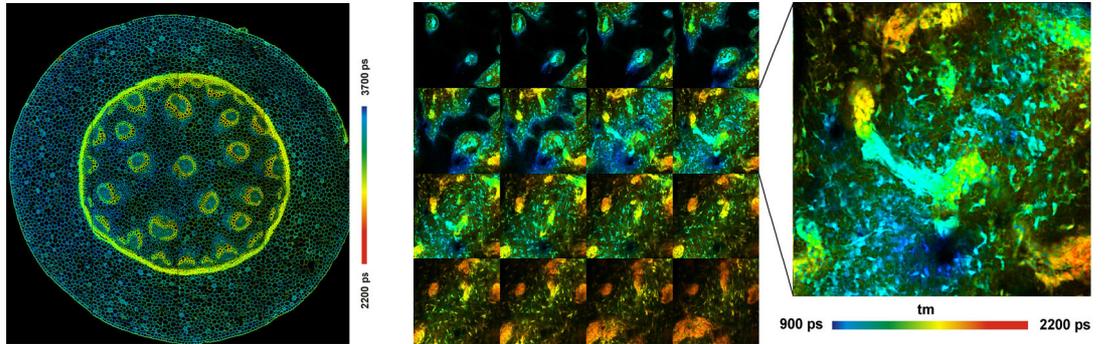
More than 25 years experience in multi-dimensional TCSPC. More than 1800 TCSPC systems worldwide



FLIM Systems for Zeiss LSM-710 / 780 / 880

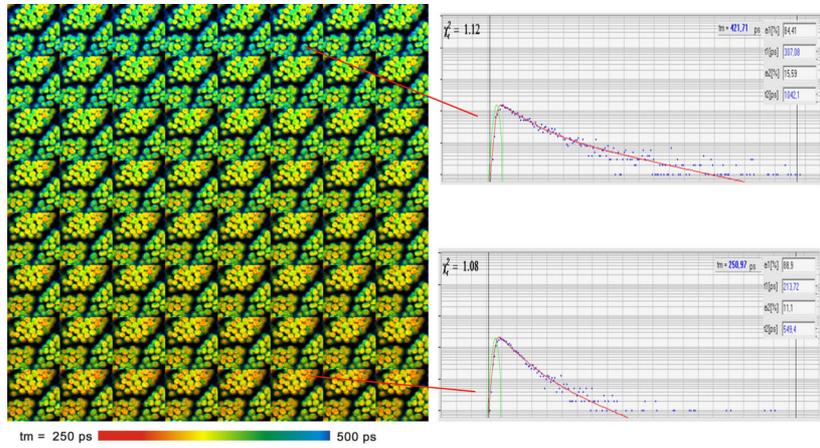
Mosaic FLIM

Lateral Mosaic FLIM
Z Stack mosaic FLIM



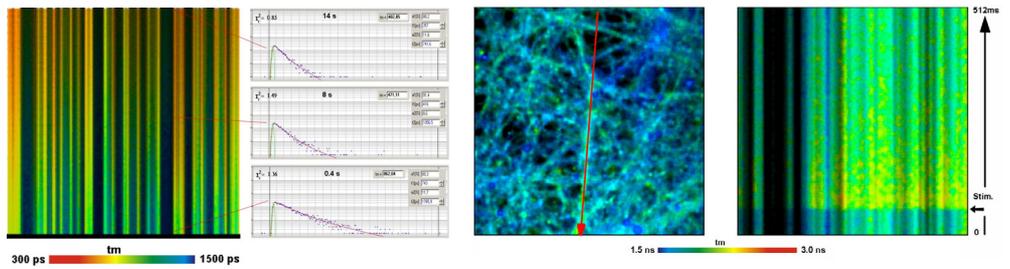
Temporal Mosaic FLIM

Time series at rates
down to 40 ms
per image
Record Ca²⁺ transients by FLIM
Record chlorophyll transients



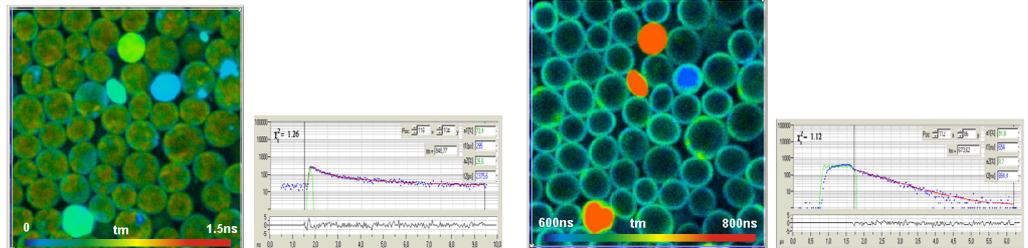
FLITS

Resolve transient
lifetime effects down
to 1 millisecond
by line scanning
Record photochemical
chlorophyll transients
Record Ca²⁺ transients in live
neurons



PLIM

Simultaneous recording of
phosphorescence and
fluorescence lifetime images
Record metabolic effects
by FLIM and track O₂
concentration by PLIM



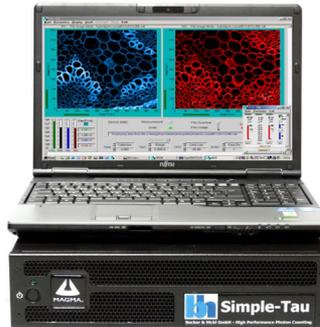
More than 25 years experience in multi-dimensional TCSPC. More than 1800 TCSPC systems worldwide



FLIM Systems for Zeiss LSM-710 / 780 / 880

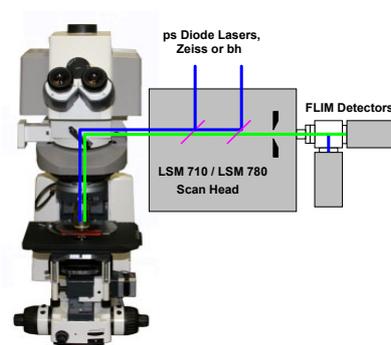
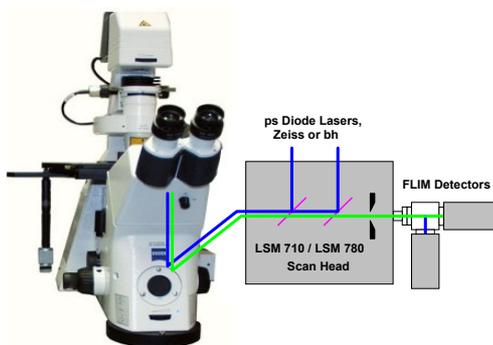
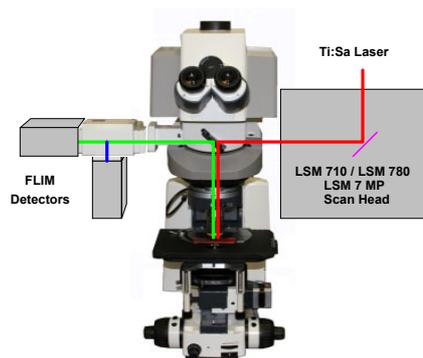
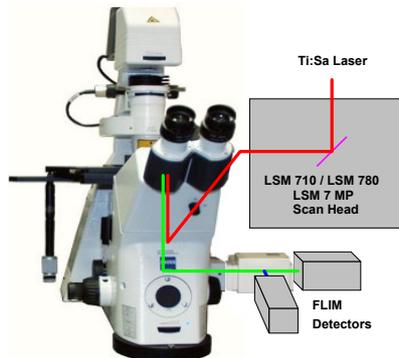
Simple-Tau 150/152 TCSPC system

Highly flexible. Modular. Upgradeable. Small and portable. Single or dual-channel FLIM. Confocal FLIM, multiphoton FLIM, NDD FLIM, multispectral FLIM, time-series FLIM, Mosaic FLIM, NIR FLIM, OPO FLIM, FLITS, PLIM, FCS. No matter what kind of FLIM, the TCSPC systems are compatible.



Optical Configurations

Non-descanned detection with upright and inverted microscopes, descanned (confocal) detection with upright and inverted microscopes



More than 25 years experience in multi-dimensional TCSPC. More than 1800 TCSPC systems worldwide



FLIM Systems for Zeiss LSM-710 / 780 / 880

bh HPM-100-40 GaAsP hybrid detector modules

The ultimate FLIM detector

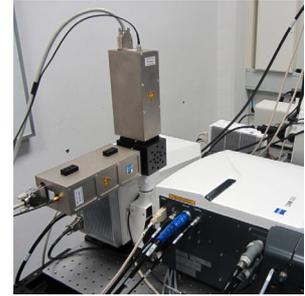
Combines SPAD-like sensitivity with the large active area of a PMT

Confocal and NDD versions

No afterpulsing, no diffusion tail

Extremely low background

Clean FCS from single detector



bh HPM-100-06 and -07 ultra-fast hybrid detectors

IRF width <20 ps FWHM

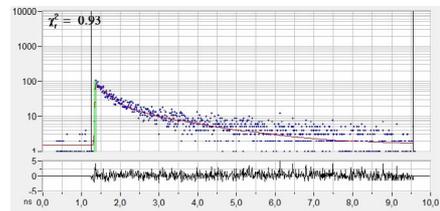
Fastest on the planet

No afterpulsing

Extremely low background

Confocal and NDD versions

Ideal for NAD(P)H FLIM

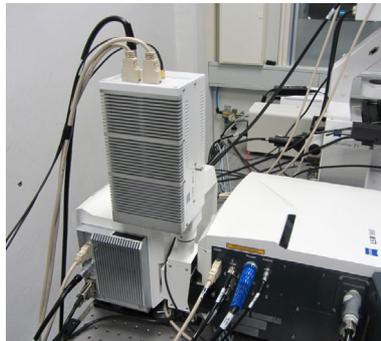


Zeiss BiG 2 detectors

Two wavelength channels in one detector

No need to swap detectors or cables

Direct interface to bh FLIM system



MW FLIM GaAsP multi-wavelength detector

Detect simultaneously in 16 wavelength channels

Adapters to confocal and NDD ports



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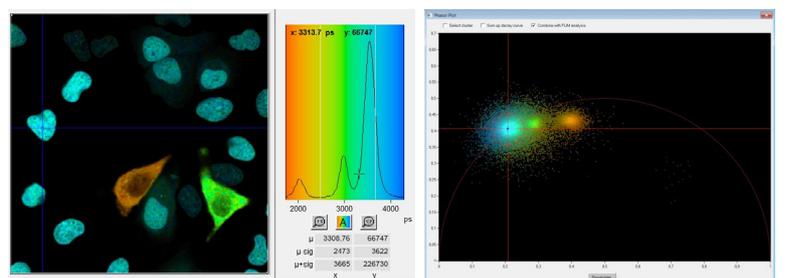
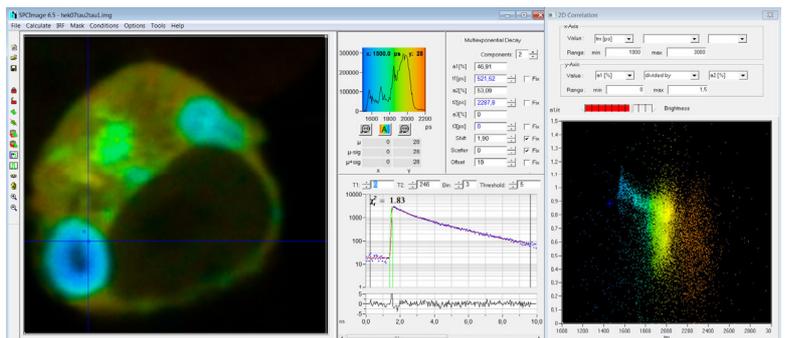
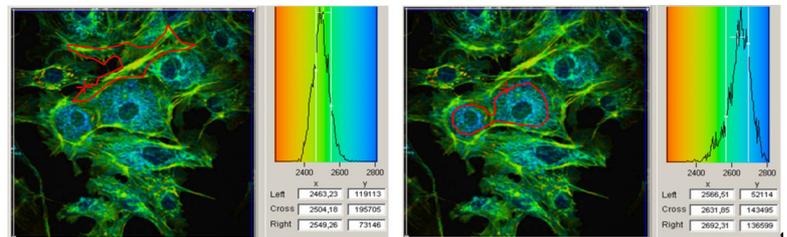
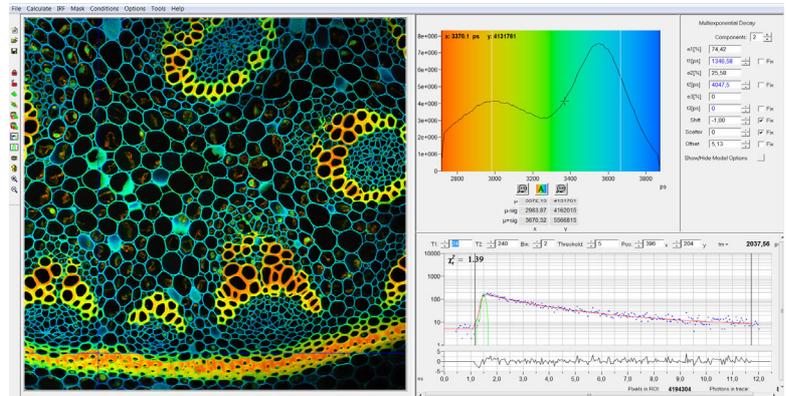


FLIM Systems for Zeiss LSM-710 / 780 / 880

SPCImage FLIM Data analysis

The gold standard in FLIM analysis

- Analysis of FLIM and PLIM data
- Analysis by iterative convolution and fit procedure
- Analysis by first moment of photon distribution
- Combination of time-domain analysis and phasor plot
- Automatic IRF determination
- Multi-tread calculation procedure
- Single, double, and triple-exponential decay models
- Incomplete decay models
- Baseline correction
- Free or fixed lifetimes of decay components
- Pseudo-global analysis
- Synthetic, measured or manually defined IRF
- Extraction of IRF from SHG components in FLIM image
- Region-of-interest selection
- Single and double-exponential FRET
- Display of lifetime images
- Display of FRET images
- Display of lifetimes, amplitudes, intensities
- Display of ratios of parameters
- Calculation of FRET efficiencies
- Histograms of lifetimes, amplitudes, or parameter ratios
- Multiple region of interest definition
- Two-dimensional histograms of decay parameters
- Phasor plot
- Export of lifetime data
- Export of images
- Direct interaction with SPCM software
- Automatic transfer of SPCM data to SPCImage
- Transfer of data of selected channels or of all channels
- Processing of Megapixel FLIM data
- Processing of Mosaic FLIM data
- Batch processing of multiple FLIM files
- Batch processing of multi-wavelength FLIM data
- Batch export of FLIM images and decay data



For detailed description please see:

FLIM Systems for Zeiss LSM 710 / 780 / 880 family laser scanning microscopes, user handbook, 7th edition (2017), www.becker-hickl.com



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FLIM Systems for Zeiss LSM-710 / 780 / 880

TCSPC Technique

	Single-Detector Systems	Dual-Detector Systems	Multi-Spectral Systems
TCSPC system	Simple-Tau 150	Simple-Tau 152	Simple-Tau 150
Components	Lap-top computer PCI extension box SPC-150 TCSPC module DCC-100 detector controller	Lap-top computer PCI extension box Two SPC-150 TCSPC modules DCC-100 detector controller	Lap-top computer PCI extension box SPC-150 TCSPC module DCC-100 detector controller
Saturated count rate	10 MHz	20 MHz	10 MHz
Sustained count rate			
Scan Sync In mode	10 MHz	20 MHz	10 MHz
FIFO Imaging Mode	4 MHz	4 MHz	4 MHz
Scan rate	any	any	any
Scan synchronisation	via pixel clock, line clock and frame clock in all imaging modes		
Zoom	automatic zoom with zoom in microscope		
Online display	in programmable intervals, 1 second or larger		
Max. image size, 64 bit SPCm software			
$pxl_x \times pxl_y \times \Delta t$	4096x4096x64	2x 4096x4096x64	16x 512x512x64
(examples)	2048x2048x256	2x 2048x2048x256	16x 512x512x256
	1024x1024x1024	2x 1024x1024x1024	16x 256x256x1024
	512x512x4096	2x 512x512x4096	

Requirements to Microscope

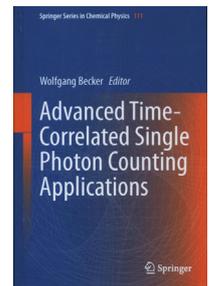
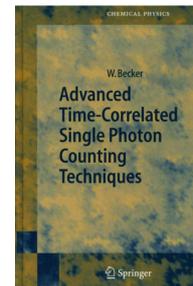
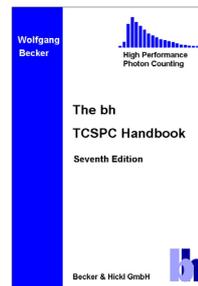
Multiphoton NDD FLIM	LSM 710, 780, or 880 NLO with NDD port
Dual-channel MP NDD FLIM	Zeiss NDD T-Adapter
Confocal (VIS) FLIM	Confocal BiG port, Zeiss ps diode lasers or external bh diode lasers
	LSM 880: Beam switch between scan haed and Airy-Scan detector

Detailed Specifications: Please see [1] and [2]

Other FLIM configurations: Please note that the bh FLIM systems are highly modular. Therefore a large number of different FLIM system configurations are possible. Please see [1] for details or contact bh.

Literature:

- [1] FLIM Systems for Zeiss LSM 710 / 780 / 880 family laser scanning microscopes, user handbook. 7th edition (2017), www.becker-hickl.com
- [2] FLIM systems for Zeiss LSM 710 / 780 / 880 family laser scanning microscopes. Overview brochure. www.becker-hickl.com
- [3] The bh TCSPC Handbook, www.becker-hickl.com
- [4] W. Becker, Advanced Time-correlated single photon counting techniques. Springer 2005
- [5] W. Becker (ed.), Advanced Time-correlated single photon counting applications. Springer 2015



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