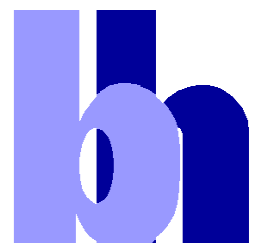


Becker & Hickl GmbH

Technology Leader in Photon Counting

Product Catalog

2022

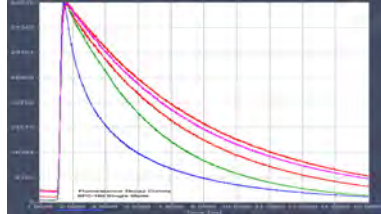
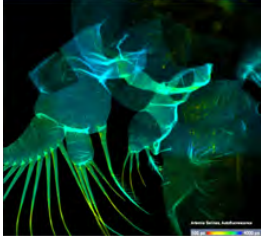
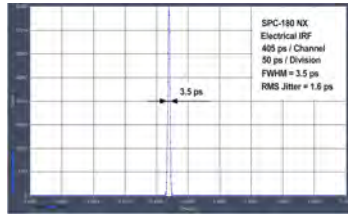


About bh

Founded in 1993, Becker & Hickl have introduced a proprietary time-correlated single-photon counting principle that made TCSPC more than 100 times faster than the existing devices. Moreover, bh introduced a multi-dimensional TCSPC process that records the photons not only versus the time in the signal period, but also versus other parameters, such as experiment time, wavelength, or spatial coordinates. The bh devices are designed to record multi-dimensional photon distributions, time-resolved images, sequences of photon distributions, or multi-dimensional time-tag data. The bh TCSPC products are complemented by bh picosecond diode lasers, detector modules, multi-spectral detector assemblies, and experiment control modules. Based on these components Becker & Hickl supply their own confocal fluorescence lifetime laser scanning microscope and FLIM upgrade kits for laser scanning microscopes of various manufacturers. Moreover, bh is supplier of TCSPC and lasers for clinical FLIM devices. Bh market activities include currently five workshops around the world yearly and the distribution of more than 1500 pages of TCSPC literature.

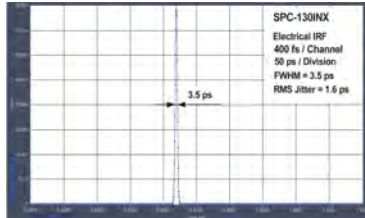
- 1993 Introduction of multidimensional TCSPC. Introduction of fast TAC/ADC conversion. TCSPC becomes 100 times faster than it was before.
- 1994 SPC-330 modules. Improved IRF width. Routers for parallel operation of detectors.
- 1995 SPC-430 modules. Continuous Flow mode for infinite sequential recording. Saturated count rate 8 MHz. First single-molecule applications.
- 1996 SPC-432 modules. Introduction of Time-Tag recording for single molecule spectroscopy. First version of PML-16 sixteen channel PMT module.
- 1996 SPC-535 modules. First implementation of TCSPC FLIM. First FLIM applications in laser scanning ophthalmology.
- 1997 SPC-630 modules. Introduction of PCI bus. Modules contain time-tag mode, standard photon distribution modes, and continuous flow mode.
- 1998 SPC-730 modules. Introduction of TCSPC FLIM. Scan Sync In and Scan Sync out mode. First applications in FLIM microscopy.
- 1999 SPC-130 TCSPC board. SPC-134 four-channel packages for optical tomography. Saturated sustained count rate 32 MHz.
- 2000 FLIM upgrade kits for Zeiss LSM 510 NLO microscopes. SPCImage FLIM data analysis software. BHL-600 red and NIR picosecond diode lasers.
- 2001 SPC-830 modules. For the first time, FLIM and single-molecule techniques were combined in one instrument.
DCC-100 detector controller solves the problem of detector overload.
- 2002 FLIM systems for Leica, Olympus, and Biorad laser scanning microscopes. First multi-spectral FLIM. First demonstration of double-exponential FRET imaging. BDL-405 UV picosecond diode lasers.
- 2003 BDL-375, 440, and 473 picosecond diode lasers. PML-16 multi-wavelength detector.
- 2004 Simple-Tau 140 and Simple-Tau 830 compact TCSPC systems. First multi-spectral NDD FLIM systems for multiphoton microscopes.
Macro-time synchronisation of several TCSPC modules. First full correlation down to the picosecond region.
- 2005 New PML-16 sixteen channel detector. Internal high-voltage generator, overload shutdown, control via DCC-100.
High-efficiency single-mode fiber coupling of BDL picosecond diode lasers. First edition of bh TCSPC Handbook.
- 2006 High-power CW mode for BDL-SMC picosecond diode lasers.
- 2007 DCS-120 confocal laser scanning systems. Complete fluorescence-lifetime laser scanning microscopes. DPC-230 16 channel photon correlator.
SPC-154 package and SPC-150 modules.
- 2008 FLIM systems for Zeiss LSM 710 microscopes. NDD FLIM systems for Leica SP2 MP and SP5 MP microscopes. Simple-Tau 152 and -154 two and four channel TCSPC systems.
- 2009 HPM-100-40 GaAsP hybrid detectors. 8-channel parallel TCSPC and TCSPC FLIM systems.
- 2010 Eight-channel SPAD detector. GaAsP hybrid detectors in all bh FLIM systems. Z stack FLIM. 4th edition of bh TCSPC Handbook.
- 2011 Phosphorescence Lifetime imaging (PLIM) in DCS-120 and Zeiss LSM 710 FLIM systems. Fluorescence Lifetime-Transient Scanning (FLITS).
DCS-120 Wideband, DCS-120 Multiphoton, and DCS-120 Macro FLIM systems
- 2012 DCS-120 electronic alignment, NIR FLIM, FLITS integrated in DCS-120 and LSM 710 FLIM systems, 5th edition of bh TCSPC Handbook.
- 2013 MW-FLIM and PML-16 GaAsP multi-wavelength detectors, SPC-150N TCSPC module, BDL-SMN series and BDS series picosecond diode lasers.
Single-molecule burst analysis software.
- 2014 64-bit SPCM software. Megapixel FLIM, Mosaic FLIM, triggered accumulation of time series by mosaic FLIM, Z stack recording by Mosaic FLIM. SPC-160 TCSPC modules. 6th edition of bh TCSPC Handbook.
- 2015 Imaging of Ca²⁺ transients in neurons. SPC-150NX module, world record in TCSPC time resolution with superconducting NbN detector. Fiber-based TCSPC systems for in vivo applications. W. Becker (ed.), Advanced Time-Correlated Single Photon Counting Applications.
- 2016 Fast Online FLIM, FLIM with Abberior STED microscopes, SPC-160PCIE, DCC-100PCIE, GVD-120PCIE PCI-Express TCSPC, Detector Control, and Scan Control modules. Simple Tau II TCSPC systems with Thunderbolt interface. FLIM for Sutter Instrument MOM microscopes.
- 2017 Sub-20 ps (FWHM) IRF width with new HPM-100-06 and -07 hybrid detectors. Spatial Mosaic FLIM with with DCS-120 confocal and multiphoton FLIM systems. Phasor analysis integrated in SPCImage. SPCM Software controls Ti:Sa laser, AOM, and motorised sample stage.
7th edition of bh TCSPC Handbook.
- 2018 FASTAC fast-acquisition FLIM system, 25 ps with fast HPM detectors.
- 2019 Metabolic FLIM with multiplexed diode lasers. Parallel detection of NADH and FAD fluorescence. SPCImage NG next-generation FLIM analysis software. MLE fit and GPU Processing. 4.4 ps FWHM with single-nanowire SSPD. New world record in TCSPC time resolution
- 2020 Metabolic FLIM with multiplexed 2p-excitation. SPCImage NG data analysis. Max-Tau 12-Channel TCSPC system. LHB-104 Laser Hub with four ps diode lasers, common single-mode fibre output.
- 2021 Ultra-Fast TCSPC/FLIM Modules with fast PCIe Interface: SPC-180NX and SPC-130INX. 9th edition of bh TCSPC Handbook.

bh Modular TCSPC Systems - Unsurpassed in Time Resolution



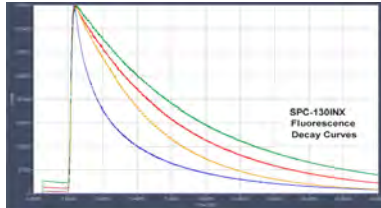
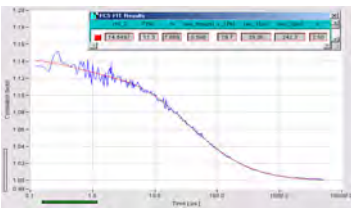
New: SPC-180N Series: Ultra-High Resolution TCSPC / FLIM Module - Fast PCIe Interface

SPC-180N: Electrical response 6.5 ps FWHM, timing jitter 2.5 ps RMS
 SPC-180NX: Electrical response 3.5 ps FWHM, timing jitter 1.5 ps RMS
 SPC-180NX: Electrical response 2.5 ps FWHM, timing jitter 1 ps RMS
 Ultra-fast discriminators, 5 GHz input bandwidth
 Ultra-fast timing for ultra-fast detectors
 Ideal for fast HPMS, SPADs, SSPDs
 Minimised low-frequency timing noise
 Minimum time channel width 813 fs / 407 fs / 203 fs
 Recording-time interval from 0.8 ns to 5 μ s, resolved into 4096 time channels
 Dead time 80 ns, saturated count rate 12 MHz
 Internal histogramming modes and Photon stream (parameter tag) modes
 Classic TCSPC, phosphorescence lifetime detection, FCS, Photon Correlation
 Multi-wavelength recording, Ultra-fast triggered time series,
 Laser-wavelength multiplexing
 Part of bh modular FLIM systems
 Four-Module packages available



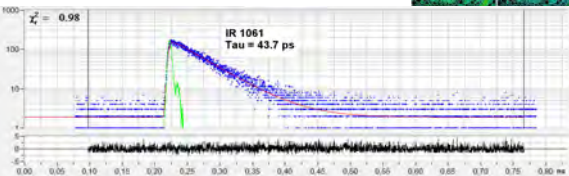
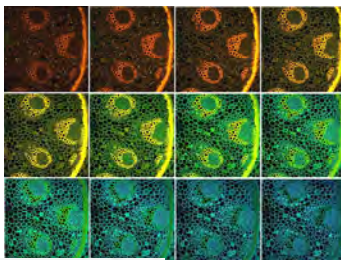
New: SPC-130IN Series: Ultra-High Resolution TCSPC Module - Fast PCIe Interface

The module for non-FLIM applications
 SPC-180N technology
 SPC-130IN: Electrical response 6.5 ps FWHM, timing jitter 2.5 ps RMS
 SPC-130INX: Electrical response 3.5 ps FWHM, timing jitter 1.5 ps RMS
 SPC-130INX: Electrical response 2.5 ps FWHM, timing jitter 1 ps RMS
 Ultra-fast discriminators, 5 GHz input bandwidth
 Ultra-fast timing for ultra-fast detectors
 Ideal for fast HPMS, SPADs, SSPDs
 Minimised low-frequency timing noise
 Minimum time channel width 813 fs / 407 fs / 203 fs
 Recording-time interval from 0.8 ns to 5 μ s, resolved into 4096 time channels
 Dead time 80 ns, saturated count rate 12 MHz
 Internal histogramming modes and Photon stream (parameter tag) modes
 Classic TCSPC, phosphorescence lifetime detection, FCS, Photon Correlation
 Multi-wavelength recording, Ultra-fast triggered time series,
 Laser-wavelength multiplexing
 Four-Module packages available



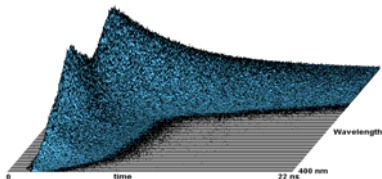
SPC-150N Series: Ultra-High Resolution TCSPC / FLIM Module - PCI Interface

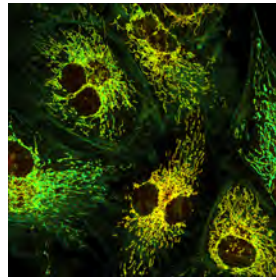
SPC-150N: Electrical response 6.6 ps FWHM, timing jitter 2.5 ps RMS
 SPC-150NX: Electrical response 3.5 ps FWHM, timing jitter 1.6 ps RMS
 SPC-150NX: Electrical response <3 ps FWHM, timing jitter 1.1 ps RMS
 Ultra-fast discriminators, 5 GHz input bandwidth
 Extra-low low-frequency timing noise
 Minimum time channel width 813 fs
 Minimum time channel width 813 fs / 407 fs / 203fs
 Recording-time interval from 0.8 ns to 5 μ s, resolved into 4096 time channels
 Internal histogramming modes and Photon stream (parameter tag) modes
 Multi-detector / multi-wavelength / laser multiplexing operation
 Triggered Multichannel Scaler (phosphorescence) mode
 High-speed FLIM / PLIM / FLITS for laser scanning microscopes
 Megapixel Technology: Mosaic, Time Series, Z-stack, Multi-spectral FLIM
 FCS / FCCS in combination with fluorescence lifetime
 Single-molecule multi-parameter burst analysis
 Unlimited fast sequential recording for DOT systems
 Dead time 100 ns, saturated count rate 10 MHz
 Part of bh modular FLIM systems
 Direct plug-in for older SPC-150 modules
 Four-Module packages available



SPC-130-EMN Series

Module for non-FLIM applications
 Improved SPC-130 with larger memory
 SPC-150N technology
 SPC-130-EMN: Electrical response 6.6 ps FWHM, timing jitter 2.5 ps RMS
 SPC-130-EMNX: Electrical response 3.5 ps FWHM, timing jitter 1.6 ps RMS
 SPC-130-EMNXX: Electrical response <3 ps FWHM, timing jitter 1.1 ps RMS
 Photon distribution, parameter-tag, sequential-recording modes
 Standard fluorescence and phosphorescence lifetime, diffuse optical tomography, single-molecule spectroscopy, FCS, photon correlation
 Fluorescence decay with ultra-fast detectors
 Rugged design
 Direct plug-in for older SPC-130 modules
 Four-Module packages available





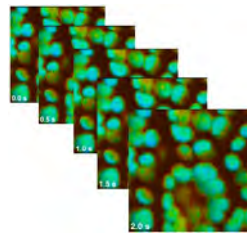
SPC-160: High Performance in All TCSPC Applications

Internal histogramming modes and photon stream (parameter tag) modes
 Multi-detector / multi-wavelength / laser multiplexing operation
 Triggered multichannel scaler (phosphorescence) mode
 High-speed FLIM / PLIM / FLITS for laser scanning microscopes
 Megapixel Technology: Mosaic, Time Series, Z-stack, Multi-spectral FLIM
 High-speed parallel imaging channel
 FCS / FCCS in combination with fluorescence lifetime
 Single-molecule multi-parameter burst analysis
 Unlimited fast sequential recording for fNIRS / DOT systems
 Dead time 80 ns, saturated count rate 12.5 MHz
 Ultra-fast discriminators, 5 GHz input bandwidth
 Extra-low low-frequency timing noise
 Part of bh modular FLIM systems

SPC-160PCIe TCSPC Module with PCI Express Interface

Functions and parameters see SPC-160
 Part of Simple-Tau II system

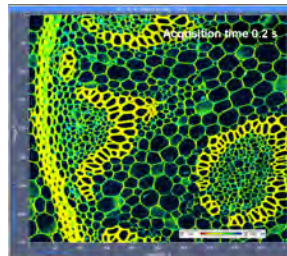
Four-Module TCSPC / FLIM Packages



Four Parallel SPC-180N, NX, or NXX modules
Four Parallel SPC-130IN, INX, or INXX modules
Four Parallel SPC-150N, NX, or NXX modules
Four Parallel SPC-130EMN, EMNX, or EMNXX modules

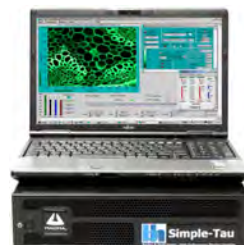
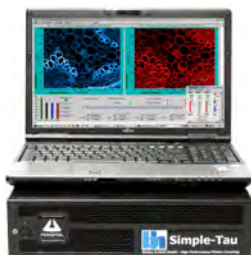
High count rate, high data throughput
 Multi-dimensional photon distribution mode
 Multi-detector / multi-wavelength operation / laser multiplexing operation
 Photon stream (parameter tag) mode; buffer size 2 M photons
 Triggered MCS (phosphorescence) mode
 Synchronisation of channels for photon correlation
 High-speed FLIM / PLIM / FLITS for laser scanning microscopes
 Single-molecule multi-parameter burst analysis
 Unlimited fast sequential recording for fNIRS / DOT systems
 Total recordable count rate 24 MHz, saturated count rate 48 MHz
 Each channel expandable for up to 8 detectors
 Part of bh FASTAC Fast-Acquisition FLIM System

FASTAC Fast-Acquisition FLIM System



Photons distributed into four parallel SPC-150NX or SPC-180NX Modules
 Count rates up to 40 MHz
 Acquisition times down to 100 ms
 Image rate up to 10/s
 No compromise in time resolution and time channel width
 IRF width 25 ps FWHM with fast HPM detectors
 Time-channel width down to 407 fs
 Images up to 2014 x 2024 pixels, 1024 time channels
 Acquisition time down to 100 ms for 256 x 256 pixel images
 Fast acquisition FLIM or Precision FLIM
 Temporal and Lateral Mosaic FLIM
 Simultaneous FLIM / PLIM
 Works with DCS-120, DCS-120 MACRO, and Zeiss LSM 880 / 980

Simple-Tau Compact TCSPC and TCSPC-FLIM Systems

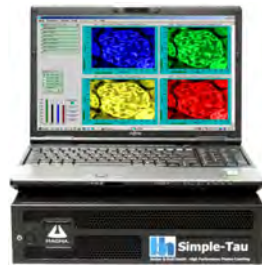


Simple-Tau 150N, and -160 Compact TCSPC Systems

One SPC-150N, or SPC-160 TCSPC channel
 One DCC-100 detector controller
 Portable DOT systems
 High-Speed FLIM systems
 Compatible with bh multispectral FLIM detectors
 Part of bh DCS-120 confocal scanning FLIM systems
 Part of bh FLIM systems for Zeiss LSM 510 and LSM 710 family
 Part of bh NDD FLIM systems for Leica SP2 and SP5 MP
 Can be upgraded with additional SPC-150N or measurement control cards

Simple-Tau 152N, and -162 Compact TCSPC Systems

Two parallel SPC-150N, or SPC-160 TCSPC channels
 One DCC-100 detector controller
 Portable DOT systems
 High-Speed FLIM systems
 Part of bh DCS-120 confocal scanning FLIM systems
 Part of bh FLIM systems for Zeiss LSM 510 and LSM 710 family
 Can be upgraded with additional SPC-150N or measurement control cards

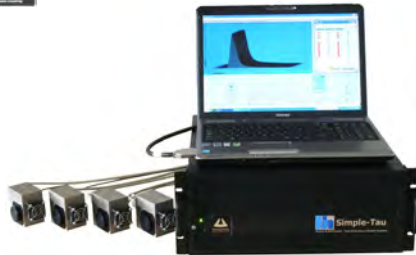


Simple-Tau 154N, and -164 Compact TCSPC Systems

Four parallel SPC-150N, or SPC-160 TCSPC channels
 Portable DOT systems
 Ultra-High-Speed parallel multispectral FLIM systems

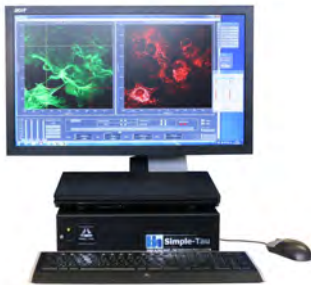
Simple-Tau 130-EMN Compact TCSPC Systems

One SPC-130-EMN TCSPC channel
 One DCC-100 detector controller
 Standard fluorescence lifetime applications
 Anti-bunching measurements
 Can be upgraded with additional SPC-130-EMN or measurement control cards



Simple-Tau 'Big' Versions

Up to seven TCSPC and measurement control cards
 User-specific hardware and software configuration
 High speed parallel FLIM systems
 Portable DOT systems



Simple-Tau 'Large Screen' Versions

Combines large screen area with small size of TCSPC system
 FLIM and other TCSPC Imaging applications
 High-resolution FLIM in combination with 64 bit SPCM software



Multi-Tau 8-Channel TCSPC Systems

Eight SPC-150N or SPC-130-EMN TCSPC modules controlled from a standard Pentium PC
 Portable DOT systems
 Ultra-High-Speed FLIM systems



Power-Tau TCSPC Systems

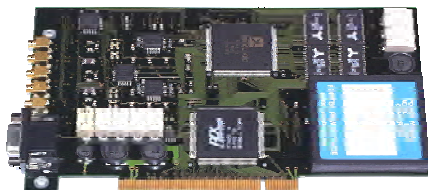
Up to six TCSPC or measurement control cards in high performance PC
 Highly modular systems
 User-specific hardware and software configuration
 Large system memory for megapixel FLIM applications and DOT
 High data transfer rate
 High on-line computation power



Max-Tau TCSPC Systems

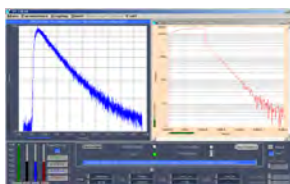
Up to 12 TCSPC or measurement control cards
 Available with Power-Tau or Laptop based TCSPC system
 Highly modular system
 User-specific hardware and software configuration
 High data transfer rate
 High on-line computation power

Multichannel Scalers



PMS-400 Gated Photon Counter and Multichannel Scaler

Dated detection of optical signals
 Luminescence decay in the μs and ms range
 Chemoluminescence
 Two parallel recording channels
 Gating down to 1 ns
 Multiscaler operation down to 300 ns per channel

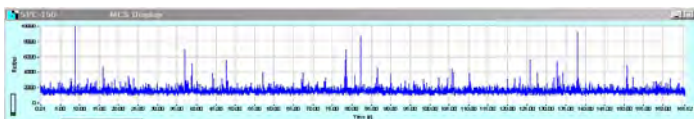


SPC-130-EMN, SPC-150N, SPC-160 TCSPC Systems

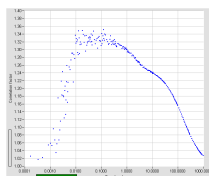
All SPC-130-EMN, SPC-150N, SPC-160 and SPC-160PCIe TCSPC Systems have a multichannel-scaler function implemented. The MCS function works simultaneously with the TCSPC process.

Applications:
 Recording of photon bursts from single molecules
 Single-molecule spectroscopy
 FCS
 Simultaneous phosphorescence and fluorescence decay recording
 Simultaneous FLIM and PLIM

Please see bh TCSPC Handbook, available on www.becker-hickl.com

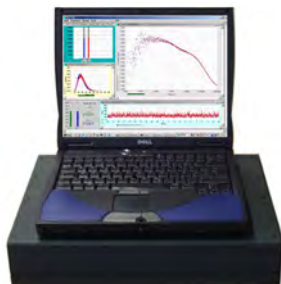
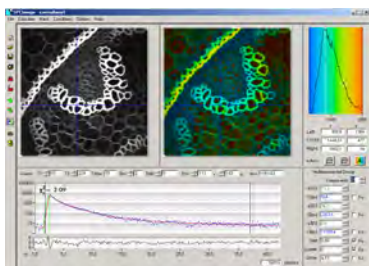


Picosecond Photon Correlators



DPC-230 - 16 Channel Picosecond Photon Correlator

Recording of absolute photon times in 16 channels
 Fluorescence correlation down to ps times
 FCS combined with fluorescence decay
 3-channel reversed-start-stop TCSPC mode for PMT inputs
 15-channel reversed start-stop mode for LVTTTL SPAD inputs
 15-channel multiscaler mode
 TCSPC FLIM Mode
 Multiscaler FLIM mode
 Autocorrelation / Cross correlation within 16 LVTTTL or 4 CFD channels

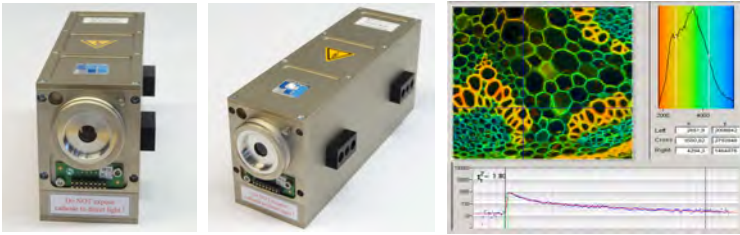


Simple-Tau DPC System

Lap-top based compact system
 DPC-230 - 16 Channel Picosecond Photon Correlator
 Optional:
 DCC-100 detector controller card
 GVD-120 scan controller card

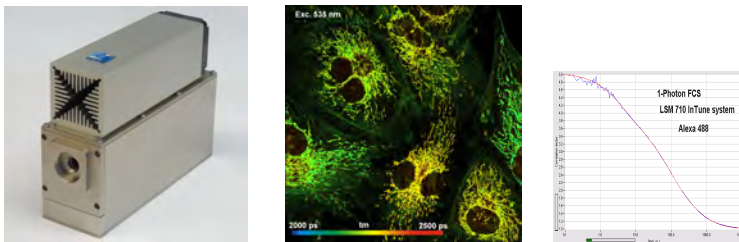
Detectors and Detector Assemblies

bh guarantee that their TCSPC devices work with any photon counting detector



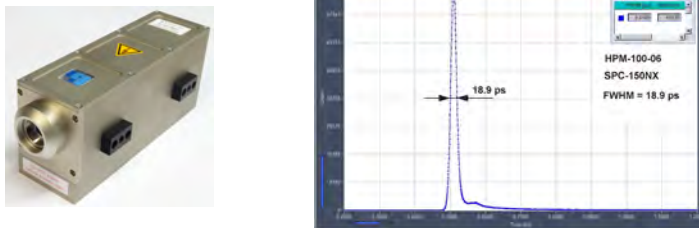
HPM-100-40 and -50 Hybrid Detector Modules

Based on Hamamatsu R10467 hybrid detector tubes
 GaAsP versions: 40 % detection efficiency throughout visible spectrum
 GaAs versions: 15 % detection efficiency up to 850 nm
 GaAsP versions: typ. 120 ps IRF width
 No afterpulsing
 Internal high-voltage generator, power supply and control via DCC-100, DCU-400 or DCU-800
 Active area 3 mm diameter
 C-Mount adapter
 Adapter to bh DCS-120 confocal scanning FLIM system
 Adapter to NDD and BIG port of Zeiss LSM 710 NLO microscopes
 Adapter to RLD port of Leica SP2 MP and SP5 MP microscopes
 SMA and FC multi-mode fiber adapters



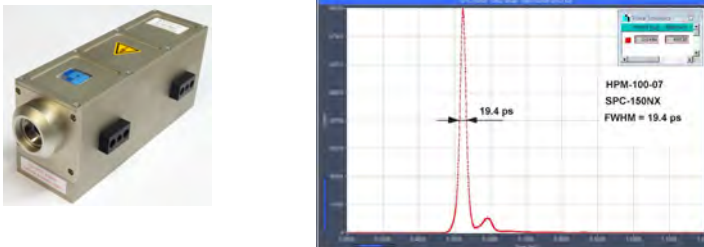
HPM-100-40C and -50C Cooled Hybrid Detector Modules

Based on Hamamatsu R10467 hybrid detector tubes
 GaAsP versions: 40 % detection efficiency throughout visible spectrum
 GaAs versions: 15 % detection efficiency up to 850 nm
 GaAsP versions: typ. 120 ps IRF width
 No afterpulsing
 Reduced dark count rate by cooling
 Internal high-voltage generator, power supply and control via DCC-100, DCU-400 or DCU-800
 Active area 3 mm diameter
 C-Mount adapter
 Adapter to bh DCS-120 confocal scanning FLIM system
 Adapter to BIG port of Zeiss LSM 710 NLO microscopes
 Adapter to RLD port of Leica SP2 MP and SP5 MP microscopes
 SMA and FC multi-mode fiber adapters



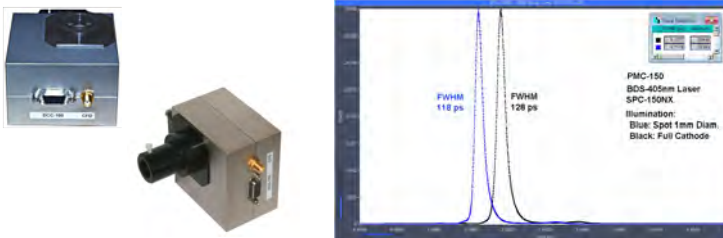
HPM-100-06 and -06C Ultra-Fast Hybrid Detector Modules

Based on Hamamatsu R10467-06 hybrid detector tubes
 Bi-alkali cathode, 220 to 650 nm
 Clean TCSPC response, no tails and bumps
 < 20 ps IRF width with SPC-150NX, -NXX, SPC-180NX, -NXX
 No afterpulsing
 Cooled version: HPM-100-06C



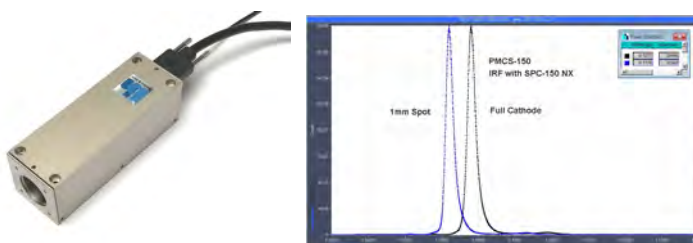
HPM-100-07 and -07C Ultra-Fast Hybrid Detector Modules

Based on Hamamatsu R10467-07 hybrid detector tubes
 Multialkali cathode, 220 to 850 nm
 Clean TCSPC response, no tails and bumps
 < 20 ps IRF width with SPC-150NX, -NXX, SPC-180NX, -NXX
 No afterpulsing
 Cooled version: HPM-100-07C



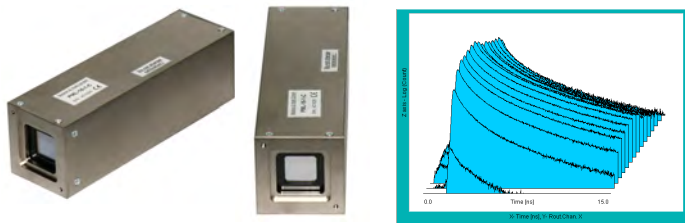
PMC-150 Cooled PMT Modules

Cathode versions for UV to NIR region
 Internal PMT voltage generation
 IRF width typ. 130 ps
 Ultra-stable IRF up to recorded count rates of 5 MHz
 Internal preamplifier
 Overload shutdown
 Power supply and control via DCC-100, DCU-400 or DCU-800
 Adapters for Zeiss LSM NDD ports, Zeiss LSM confocal ports, Leica SP2 and SP5 RLD Ports, bh DCS-120 confocal FLIM system
 Replaces older PMC-100 detector



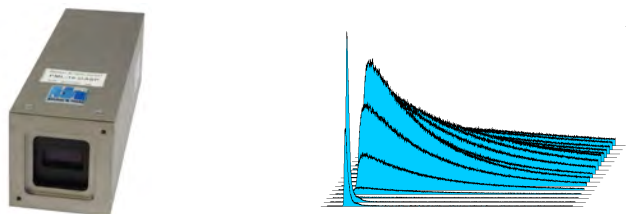
PMCS-150 Cooled PMT Modules

Pre-set gain
 Internal preamplifier
 Internal overload shutdown
 IRF width 130 ps
 Ultra-stable IRF up to recorded count rates of 5 MHz
 +12 V Power supply



PML-16 C - 16-Channel TCSPC Detectors

16-channel detector with routing electronics and internal HV power supply
 Based on Hamamatsu R5900-L16 multi-anode PMT
 Simultaneous detection in 16 channels
 Connects directly to all bh SPC modules
 Power supply and control via DCC-100, DCU-400 or DCU-800
 IRF width typ. value 180 to 240 ps
 Part of bh multispectral TCSPC FLIM detectors



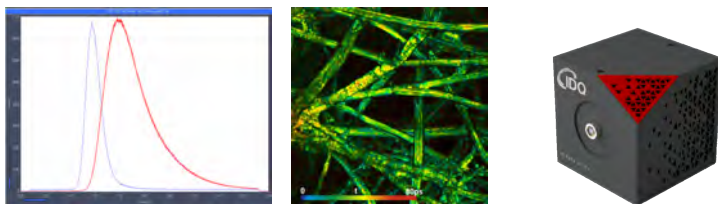
PML-16 GaAsP - 16-Channel TCSPC Detectors

16-channel detector with high-sensitivity GaAsP cathode
 Based on Hamamatsu GaAsP multi-anode PMT
 Simultaneous detection in 16 channels
 Internal Routing electronics and HV power supply
 Connects directly to all bh SPC modules
 Power supply and control via DCC-100, DCU-400 or DCU-800
 IRF width typ. value 280 ps
 Part of bh multispectral TCSPC FLIM detectors



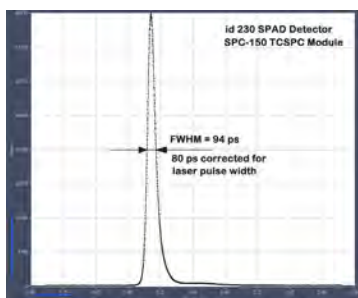
Single-Photon Avalanche Photodiode Modules (SPADs)

Manufacturer: ID Quantique
 Direct-coupled and fiber-coupled versions
 Active area $d = 20 \mu\text{m}$ and $d = 50 \mu\text{m}$
 Ultra-high efficiency in visible region
 IRF width typ. 40 ps, max. 60 ps
 Active areas of $20 \mu\text{m}$, $50 \mu\text{m}$
 Stable IRF over count rate
 Dark count rates $< 7 \text{ s}^{-1}$ (ID100-20 ULN) and $< 60 \text{ s}^{-1}$ (ID100-50 ULN)
 Detector count rates up to 20 MHz (pulsed light)
 Direct-coupled and fiber-coupled versions
 Focusing and alignment adapters



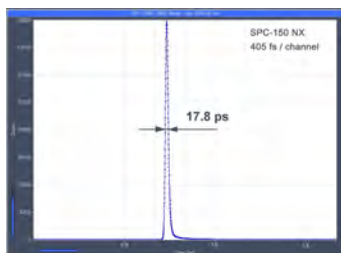
ID-Qube-NIR-FR InGaAs IR SPAD Detectors

Manufacturer: ID Quantique
 Detection from 900 nm to 1700 nm
 Quantum efficiency up to 20 %
 Continuous operation - no gating required
 Compatible with all bh TCSPC devices
 IRF width 90 ps FWHM
 Fiber coupling, FC/PC connector
 Fluorescence and phosphorescence decay recording
 Photon correlation
 FLIM, PLIM



ID-230 InGaAs IR SPAD Detectors

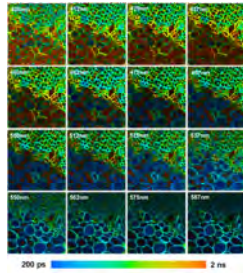
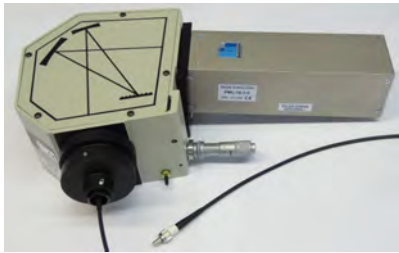
Manufacturer: ID Quantique
 Detection from 900 nm to 1700 nm
 Quantum efficiency up to 25 %
 Extremely low dark count rate - down to 50 – 80 counts / s
 Continuous operation - no gating required
 Compatible with all bh TCSPC devices
 IRF width typ. 90 ps
 Fiber coupling, SMA connector
 Fluorescence and phosphorescence decay recording
 Photon correlation
 FLIM, PLIM



SCONTEL Superconducting NbN Detectors

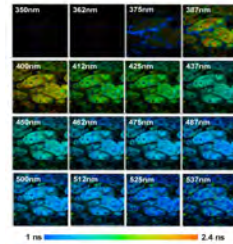
Manufacturer: SCONTEL, Moscow
 Detection from 400 nm to 1700 nm
 IRF width down to 17.8 ps FWHM with SPC-150NX
 Timing Jitter with SPC-150NX 7.8 ps RMS

Multi-Spectral TCSPC / FLIM Detectors



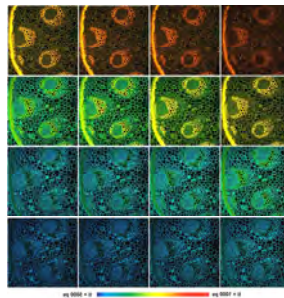
PML-SPEC and PML-SPEC GaAsP Multi-Wavelength Detection Modules

Simultaneous fluorescence decay detection in 16 wavelength channels
 SMA 905 or FC fiber adapter
 Fiber diameter up to 1 mm
 Multi-spectral FLIM for confocal laser scanning microscopes
 IRF width 180 ps – 280 ps FWHM
 Works with all bh TCSPC modules
 Internal high-voltage power supply
 Internal routing electronics
 Overload shutdown
 Full control via DCC-100, DCU-400 or DCU-800
 Part of the bh multi-wavelength FLIM systems for laser scanning microscopes
 Adapter for DCS-120 confocal scanning FLIM system



MW FLIM Multi-Spectral FLIM Detection Modules for Multiphoton Microscopes

Multi-spectral FLIM in 16 wavelength channels
 Fiber bundle for large area detection and area transformation
 Non-descanned (NDD) detection or confocal detection
 Adapters for Zeiss, Leica, Olympus, Nikon, bh DCS-120
 IRF width 180 ps – 240 ps FWHM
 Works with all bh TCSPC modules
 Internal high-voltage power supply
 Internal routing electronics
 Protected by overload shutdown
 Shutter for input protection available
 Full control via DCC-100, DCU-400 or DCU-800
 Part of the bh multi-wavelength FLIM systems for laser scanning microscopes



MW FLIM GaAsP Multi-Spectral NDD FLIM Detection Systems for Multiphoton Microscopes

Multi-spectral FLIM in 16 wavelength channels
 High-efficiency GaAsP cathode
 Fiber bundle for large area detection and area transformation
 Non-descanned (direct) detection or confocal detection
 Adapters for Zeiss, Leica, Olympus, bh DCS-120
 IRF width 280 ps FWHM
 Works with all bh TCSPC modules
 Internal high-voltage power supply
 Internal routing electronics
 Protected by overload shutdown
 Shutter for input protection available
 Full control via DCC-100, DCU-400 or DCU-800
 Part of the bh multi-wavelength FLIM systems for laser scanning microscopes

Opto-Mechanical Detector Components



Detector / Shutter Assemblies for Various PMTs

For NDD ports of multiphoton laser scanning microscopes
 Shutter operation via DCC-100, DCU-400 or DCU-800
 Overload shutdown of PMT
 Input field lens
 For bh PMC-150 and HPM-100 modules, Hamamatsu R3809U, Hamamatsu H7422
 Part of bh modular FLIM systems



Beamsplitter / Detector Assemblies

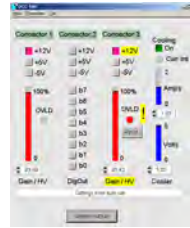
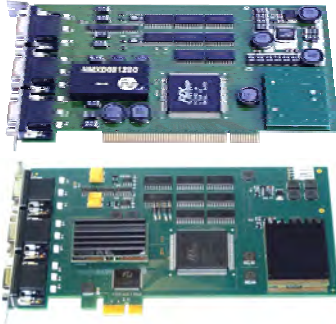
For HPM-100, PMC-150, R3809U and H7422 detectors
 Dichroic beamsplitters, polarising beamsplitters
 Input filter, bandpass filters in front of detectors
 Compatible with NDD ports of multiphoton laser scanning microscopes
 Part of bh modular FLIM systems



Detectors and Detector Assemblies with Fiber Adapters

For HPM-100, PMC-150, R3809U and H7422 detectors
 Input filter, bandpass filters in front of detectors

Detector Electronics



DCC-100 Detector Controller DCC-100PCIe Detector Controller with PCI Express Interface

- Power supply for two detectors
- Power supply of thermoelectric coolers of detectors
- Power supply of preamplifiers
- Detector gain control
- Detector overload shutdown
- Control of shutters or actuators
- Control of bh detector / shutter assemblies
- Intensity control of bh BDL and BDS ps diode lasers
- Integrated in SPCM TCSPC software package
- Part of the bh modular FLIM, modular DOT systems
- Part of bh Simple-Tau TCSPC systems



DCU-400 / DCU-800 Detector Controller Unit with USB Interface

- Power supply for 4 / 8 detectors
- Power supply of thermoelectric coolers of detectors
- Power supply of preamplifiers
- Detector gain control
- Detector overload shutdown
- Control of shutters or actuators
- Control of bh detector / shutter assemblies
- Intensity control of bh BDL and BDS ps diode lasers
- Integrated in SPCM TCSPC software package
- Part of the bh modular FLIM, modular DOT systems
- Part of bh TCSPC systems



HRT-41 Four-Channel Router

Connects up to four PMC-150, H7422 or R3809U detectors to one TCSPC channel
All detectors are detecting simultaneously

HRT-81 Eight-Channel Router

Connects up to eight PMC-150, H7422 or R3809U detectors to one TCSPC channel
All detectors are detecting simultaneously

HRT-82 Eight-Channel Router

Connects up to eight SPAD modules to one TCSPC channel
All detectors are detecting simultaneously



HFAC-26 Preamplifiers

For R3809U MCP PMT, H7422 modules, and other PMTs
Power supply from SPC or DCC module
Overload shutdown in conjunction with DCC-100 controller
Overload thresholds 0.1 μ A, 0.3 μ A, 1 μ A, 2 μ A, 3 μ A, 10 μ A, 100 μ A

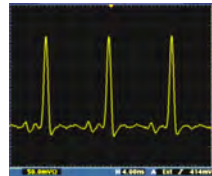
HFAH-26 Preamplifiers

Low-noise
For R3809U MCP PMT, H7422 modules, and other PMTs
Power supply from SPC or DCC module
Overload shutdown in conjunction with DCC-100 controller



HPM-CON-02 Frequency-to-Analog Converter for PMT Pulses

Converts single-photon-pulse signals of photon-counting detectors into an intensity-proportional analog signal
Analog output independent of single-photon pulse amplitude
Inserts directly in detector output pulse line
Provides photon pulses to TCSPC modules and intensity signal to analog electronics
Input pulse amplitude -30 mV to -200 mV, input pulse width down to 500 ps
Input pulse rate up to 10^7 pulses per second
Output voltage range 0 to +4.9 V
Power supply \pm 5 V from bh SPC or DCC module



APS-100 TCSPC Synchronisation Module

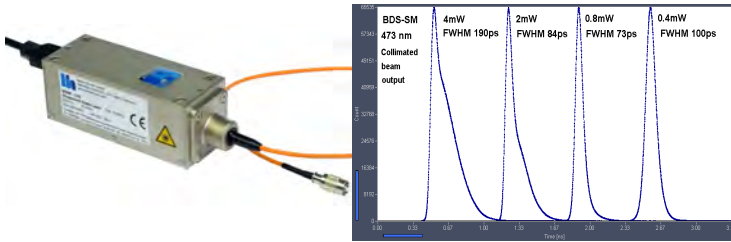
For synchronisation of TCSPC experiments with Ti:Sapphire lasers
Output amplitude widely independent of laser intensity and laser wavelength
Intensity range 1:100
Power supply from SPC, DCC or DCU module



PHD-400 PIN Photodiode Modules

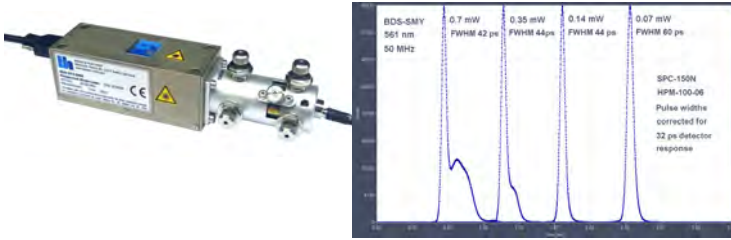
For synchronisation of TCSPC experiments with lasers
Power supply from SPC, DCC or DCU module
Detector area 0.25 mm²
Current indicator for easy alignment

Picosecond Diode Lasers



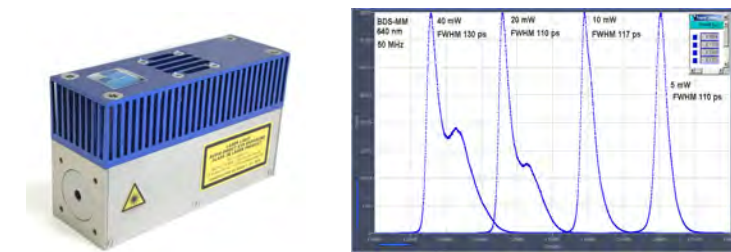
BDS-SM series picosecond diode lasers

Small-size Module, single-mode output
 Dimensions 40 mm x 70 mm x 120 mm (40 mm x 40 mm x 120 mm OEM version)
 Wavelengths 375, 405, 445, 473, 488, 515, 640, 685, 785, 1064 nm
 Single-Mode free-beam or single-mode fiber output
 Fibres permanently attached (pig-tailed) or via fibre coupler
 Pulse width down to 40 ps
 Pulse repetition rate 20 MHz / 50 MHz / 80 MHz and CW
 CW equivalent power up to 1.3 / 3 / 5 mW @ 20 / 50 / 80 MHz
 CW mode with up to 50 mW power
 Fast ON / OFF / multiplexing capability
 Ext. Trigger input (single pulse to 80 MHz), Trigger output
 Internal power stabilisation
 All electronics integrated, no external driver unit required
 Operation from simple +12 V power supply
 Part of the bh modular FLIM systems for laser scanning microscopes



BDS-SMY series green / yellow picosecond diode lasers

Small-size Module, single mode output
 Dimensions 40 mm x 70 mm x 120 mm (40 mm x 40 mm x 120 mm OEM version)
 Wavelength 532 nm, 561 nm and 594 nm
 Single-Mode free-beam or single-mode fiber output
 Fibres permanently attached (pig-tailed) or via fibre coupler
 Pulse width down to 50 ps
 Pulse repetition rate 50 MHz (20 MHz on request)
 CW equivalent power up to 0.5 mW @ 50 MHz
 Operation from simple +12 V power supply



BDS-MM series picosecond diode lasers

Small-size Module, multi-mode output
 Dimensions 40 mm x 70 mm x 120 mm (40 mm x 40 mm x 120 mm OEM version)
 Wavelengths 405, 445, 525, 640, 685, 785, 915 nm
 Multi-Mode free-beam or multi-mode fiber output
 Pulse width down to 65 ps
 Pulse repetition rate 20 MHz and 50 MHz
 CW equivalent power up to 50 mW
 Fast ON / OFF / multiplexing capability
 Ext. Trigger input (single pulse to 50 MHz), Trigger output
 Internal power stabilisation
 All electronics integrated, no external driver unit required
 Operation from simple +12 V power supply



Laser Power Supply and Control

Power supply from +12V AC/DC adapter
 Key switch, frequency switch, and power control via LSB laser switch module
 Laser switch modules for one laser or for two lasers
 Interface to DCC-100 and DCU-400, -800 laser/detector controllers
 Manual control or Software control from bh SPCM data acquisition software

OEM Operation of Lasers

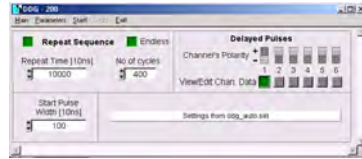
Lasers can be operated directly from a +12V power supply
 Control signals can be applied directly to the laser



New! Laser-Hub

Up to 4 diode lasers from BDS family
 Flexible wavelength configurations
 Wavelength range from 405 to 640 (other on request)
 Outputs combined into single beam
 Free beam or single-mode fiber output
 Fast ON / OFF / Multiplexing
 All electronics integrated
 No external driver unit
 Manual control or control from bh SPCM data acquisition software
 Simple +12 V Power Supply from AC/DC adapter

Experiment Control and Connecting Electronics



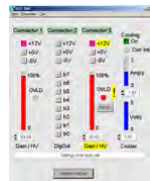
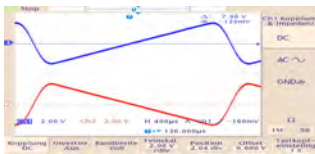
DDG-210 Digital Delay Generator

Multiplexing of lasers and routing to TCSPC Modules
 Multiplexing rate up to 1 MHz
 Laser on/off modulation for PLIM
 Non-overlapping laser multiplexing
 On-times programmable individually
 Part of bh modular DOT systems
 Part of bh FLIM / PLIM systems for Zeiss LSM 710 / 780 / 880 family
 Integrated in bh SPCM TCSPC instrument control software



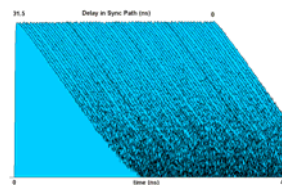
GVD-120 Scan Controller Card GVD-120PCIe Scan Controller Card

Generation of scan signals for galvanometer scanners and piezo stages
 Dual-axis control
 Frame scan, line scan, high-stability point operation
 Laser ON / OFF modulation for PLIM
 Linear x scan with cycloid flyback
 Sinusoidal x scan option
 Extremely high scan rates
 Controls also two bh BDL-SMN, or BDS ps diode lasers
 Laser beam blanking
 Laser multiplexing, Laser on/off modulation for PLIM
 Fully digital signal generation
 Independent of software response times
 Pixel times down to 0.5 μ s
 Pixel numbers up to 4048 x 4048
 Fully integrated in bh SPCM TCSPC software
 Part of bh DCS-120 confocal scanning systems



DCC-100 and DCC-100PCIe detector controllers

Control of two bh TCSPC detectors or two BDS lasers
 Intensity control of bh picosecond diode lasers
 For details, please see 'Detector Electronics'



Delay-Box-32N

32 step passive delay line
 Delay from 0 to 31.5 ns in 0.5 ns steps
 Selection of one of two signal sources
 Transmits any signal waveform
 Signal bandwidth 1 GHz
 No noise, no jitter
 No external power supply needed
 Settings persist when box is disconnected from USB
 Easy adjustment of TCSPC SYNC path length
 Control integrated in bh SPCM TCSPC operating software



BOB-104 Signal Distribution Box

Distributes scan clock signals to four SPC modules
 Combines routing signals and other control signals into 15-pin control inputs of four SPC-130-EMN, -150N, and -160 modules
 Auxiliary +12 V input for power supply of amplifiers, routers, detectors



BOB-101 Signal Distribution Box

Combines routing signals and other control signals into 15-pin control inputs of one SPC-130-EMN, -150N, and -160 modules
 Auxiliary +12 V input for power supply of amplifiers, routers, detectors



DCS Connection Box

Power supply and control of two bh BDS or BDL-SMN ps diode lasers
 Connects scan clocks and laser multiplexing signals of GVD-120 scan controller into two SPC-150N or SPC-160 modules and two BDS or BDL-SMN diode lasers
 Connects routing signals of two bh multi-spectral FLIM detectors into SPC modules
 Configurable by SPCM software

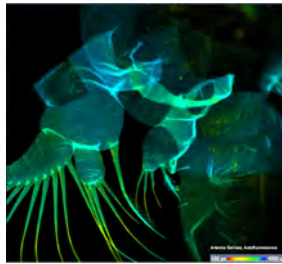
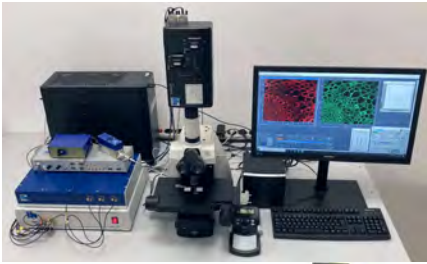


Cables and Adapters

A-PPI-D passive pulse inverters
 1:3, 1:4 power splitters and combiners
 Attenuators
 SMA cables
 SMA-to-SMA adapters
 SMA-to-BNC adapters
 Power supply cables for detectors
 Interface cables for bh FLIM systems for various laser scanning microscopes

A reasonable set of cables and adapters is delivered with each bh SPC module or Simple-Tau system

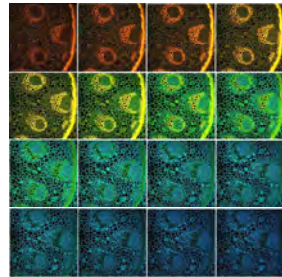
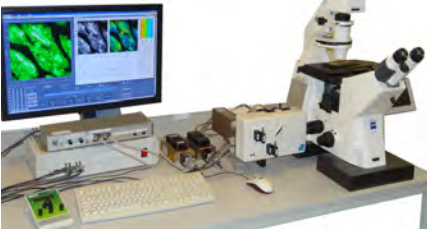
Fluorescence Lifetime Microscopy



New! DCS-120 Black FLIM System

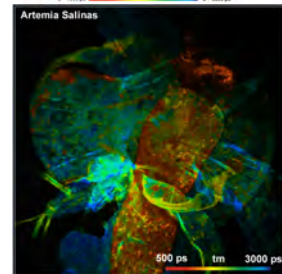
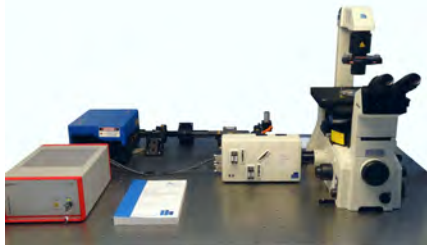
DCS-120 Confocal Scanning FLIM Systems Based on bh's 64-bit megapixel FLIM technology

FLIM with up to 2048 x 2048 pixels
Complete Confocal Laser Scanning FLIM microscopes
FLIM upgrade for existing conventional microscopes
Scanning by fast galvanometer mirrors
Two fully confocal detection channels
One or two BDS or BDL-SMN picosecond diode lasers
Laser wavelengths 375, 405, 445, 473, 488, 515, 640, 685, 785 nm
Tuneable excitation by super-continuum laser with AOTF
One or two confocal detection channels, parallel acquisition
Channel separation by dichroic or polarising beamsplitters
Individually selectable pinholes, individually selectable filters
GaAsP hybrid detectors for visible range, GaAs hybrid detectors for NIR range
16-channel multi-wavelength GaAsP detector module
Z-stack FLIM acquisition with Zeiss Axio Observer Z1
Spatial Mosaic FLIM via motorised sample stage (optional)
Simultaneous fluorescence and phosphorescence lifetime imaging (PLIM)
Fluorescence lifetime-transient scanning (FLITS)
Ultrafast time-series recording by temporal mosaic FLIM function
Wideband (WB) version, compatible with tuneable lasers
Electronic pinhole alignment



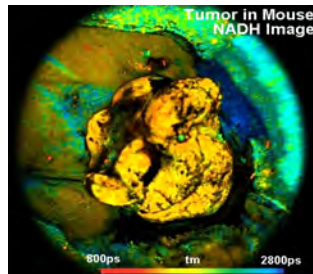
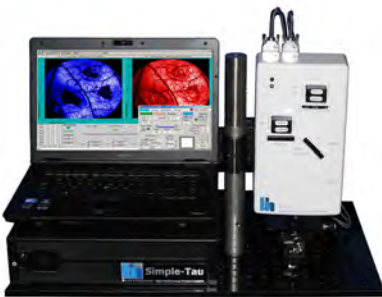
DCS-120 MP Multiphoton FLIM Systems

Multiphoton version of DCS-120 scanning system
Excitation by Ti:Sa laser of femtosecond fibre laser
IRF width <20 ps FWHM with HPM-100-06 detectors
Laser control integrated in SPCM data acquisition software
Laser intensity control and PLIM laser modulation by AOM
One or two non-descanned detection channels
Clear Images from deep tissue layers
Excellent spatial and temporal resolution
Images up to 2048 x 2048 pixels, 256 time channels
Full field of view of microscope lens scanned
Optional 16-channel multi-wavelength GaAsP detector module
Z-stack FLIM acquisition with Zeiss Axio Observer Z1
Spatial Mosaic FLIM via motorised sample stage (optional)
Simultaneous fluorescence and phosphorescence lifetime imaging (PLIM)
Fluorescence lifetime-transient scanning (FLITS)
Ultrafast time-series recording by temporal mosaic FLIM function

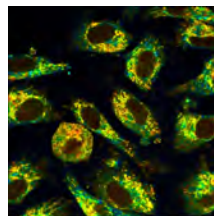


DCS-120 Macro System

FLIM of macroscopic objects
Scan field up to 15 mm diameter
FLIM with up to 2048 x 2048 pixels
Scanning by fast galvano mirrors
Two fully confocal detection channels
One or two BDS or BDL-SMN picosecond diode lasers
Laser wavelengths 375, 405, 445, 473, 488, 515, 640, 685, 785 nm
Tuneable excitation by super-continuum laser with AOTF
One or two confocal detection channels, parallel acquisition
Channel separation by dichroic or polarising beamsplitters
Individually selectable pinholes, individually selectable filters
GaAsP hybrid detectors for visible range, GaAs hybrid detectors for NIR range
Optional 16-channel multi-wavelength GaAsP detector module
Spatial Mosaic FLIM via motorised sample stage (optional)
Simultaneous fluorescence and phosphorescence lifetime imaging (PLIM)
Fluorescence lifetime-transient scanning (FLITS)
Ultrafast time-series recording by temporal mosaic FLIM function
Wideband (WB) version, compatible with tuneable lasers
Electronic pinhole alignment

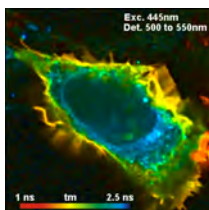
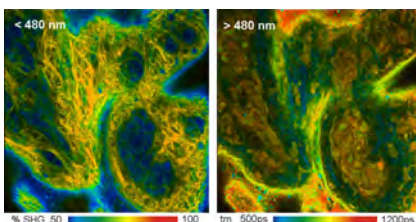


Please see handbook:
DCS-120 Confocal Scanning FLIM Systems, 9th Edition, December 2021
Overview brochure DCS-120 Confocal Scanning FLIM Systems

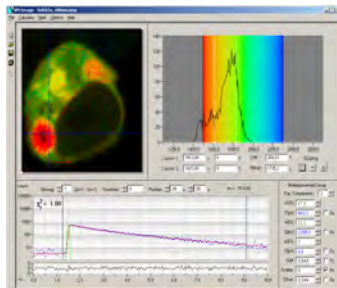
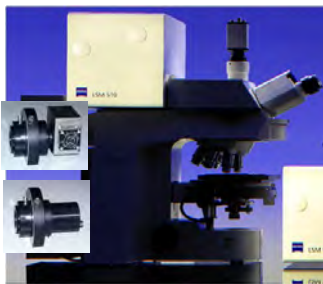


FLIM Systems for Zeiss LSM 710, 780, 880, 980 LSM 710 / 780 / 880 / 980 NLO, LSM 7MP Multiphoton Microscopes LSM 710, LSM 780, LSM 880, LSM 980 Confocal Microscopes

Based on bh's 64-bit megapixel FLIM technology
FLIM with up to 2048 x 2048 pixels
Multiphoton FLIM, PLIM, multispectral FLIM, FCS
Confocal FLIM, PLIM, multispectral FLIM, FCS
FLIM with bh HPM hybrid detectors or Zeiss BIG-2 detectors
Fast preview mode, both for intensity and lifetime
Mosaic FLIM, Z Stack FLIM, Fast Time-series FLIM
Acquisition by 1, 2, 3 or 4 parallel TCSPC FLIM channels
Simultaneous fluorescence and phosphorescence lifetime imaging (PLIM)
Fluorescence lifetime-transient scanning (FLITS) fully integrated
Ultrafast time-series recording by temporal mosaic FLIM function
Confocal NIR FLIM up to 900 nm detection wavelength
Two-Photon OPO FLIM up to 900 nm detection wavelength

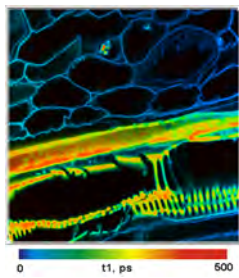
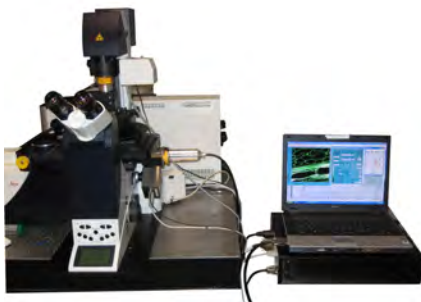


Please see:
Handbook Modular FLIM Systems for Zeiss LSM 710 / 780 / 880 Family Laser Scanning Microscopes, 7th ed.
FLIM systems for Zeiss LSM 980 Microscopes, Addendum to 7th ed. of handbook



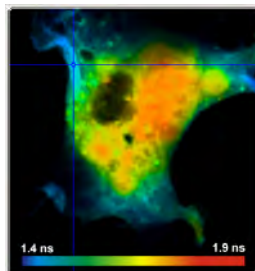
Still available: FLIM Systems for Zeiss LSM 510 NLO

- Multiphoton Microscopes**
 FLIM with up to 2048 x 2048 pixels
 Multiphoton excitation with non-descanned detection
 Detectors connected to Zeiss NDD switch box
 Single-wavelength NDD FLIM
 Dual-wavelength NDD FLIM
 Multi-spectral NDD FLIM
 Fast preview mode
 Mosaic FLIM
 Z Stack FLIM
 Fast time-series FLIM
 HPM-100-40 hybrid detectors
 One or two parallel SPC-150N TCSPC channels
 PC-based systems or Simple-Tau TCSPC systems



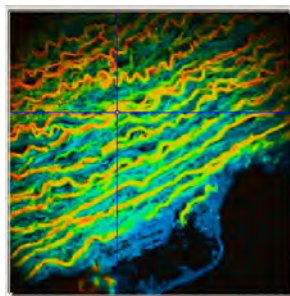
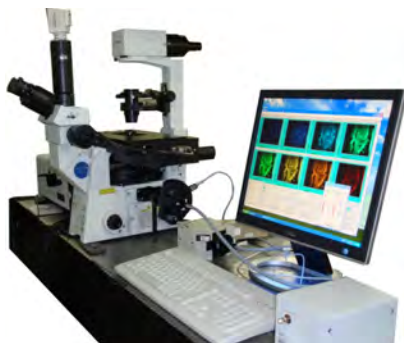
Non-Descanned FLIM Systems for Leica SP2 MP, SP5 MP, SP8 MP Microscopes

- 64-bit megapixel FLIM technology**
 Non-descanned detection via Leica RLD port
 1 detector coupled directly to RLD port
 2 detectors via external beamsplitter
 Simple-Tau 150N or -152N TCSPC systems
 Acquisition in 1 or 2 parallel TCSPC FLIM channels
 bh HPM-100-40 hybrid detectors or Leica HYD detectors
 Multi-spectral FLIM with 16-channel GaAsP detector
 Works at any scan rate of SP2 and SP5
 Fast acquisition, fast preview mode
 Megapixel FLIM, 2048 x 2048 pixels
 Fluorescence lifetime-transient scanning (FLITS)
 Ultra-fast time series by temporal mosaic FLIM
 Simultaneous FLIM / PLIM



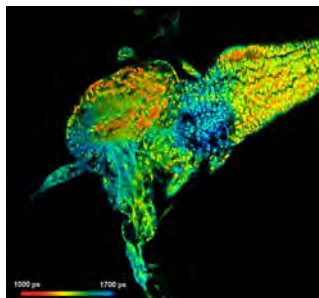
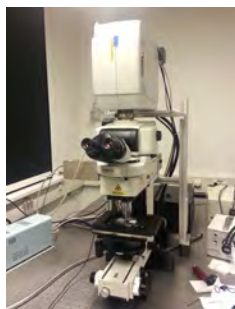
FLIM Systems for Olympus FV1000 and FV300 Confocals

- 64-bit megapixel FLIM technology**
 Excitation by bh BDS-405-SM or BDS-473-SM picosecond diode laser
 High efficiency by direct coupling of detectors
 Single-wavelength detection: PMT, MCP-PMT, or Hybrid PMT
 Multi-wavelength detection: bh PML-SPEC detector
 Full overload protection of detectors
 ROI and Zoom functions of FV1000 or FV300 available
 Works at any scan rate
 FCS capability
 Megapixel FLIM
 Fluorescence lifetime-transient scanning (FLITS)



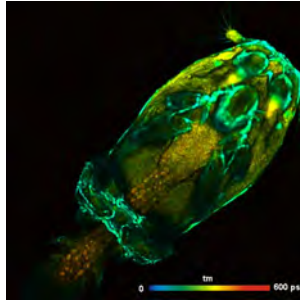
Non-descanned FLIM Systems for Olympus FV1000 and FV300 Multiphoton Microscopes

- 64-bit megapixel FLIM technology**
 Multiphoton FV1000 and FV300 systems with inverted microscopes
 High efficiency by non-descanned FLIM detection
 Deep-tissue imaging capability
 Single-wavelength detection: PMT, MCP-PMT, or Hybrid PMT
 Multi-spectral FLIM with 16-channel GaAsP detector
 Full overload protection of FLIM detectors
 ROI and Zoom functions of FV1000 or FV300 available
 Works at any scan rate
 Megapixel FLIM
 Fluorescence lifetime-transient scanning (FLITS)



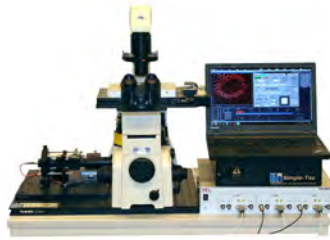
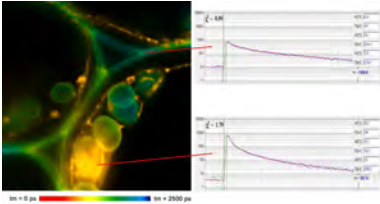
FLIM Systems for Nikon A1+ Microscopes

- 64-bit megapixel FLIM technology**
New! Nikon-integrated version available
 One FLIM channel or two parallel FLIM channels
 High-efficiency HPM-100 hybrid detectors
 Non-descanned detection for multiphoton microscopes
 Confocal detection for one-photon microscopes
 Multi-spectral FLIM with 16-channel GaAsP detector
 Works at any scan rate
 Megapixel FLIM
 Fluorescence lifetime-transient scanning (FLITS)
 Ultra-fast time series by temporal mosaic FLIM
 Simultaneous FLIM / PLIM



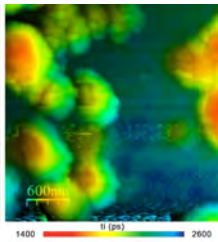
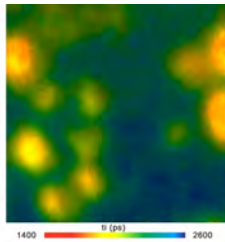
FLIM Systems for Sutter Instrument MOM Microscopes

Up to four parallel FLIM channels
 Multiphoton excitation by Ti:Sa laser
 Non-descanned detection for deep-tissue imaging
 Overload protection of FLIM detectors
 Up to 1024 x 1024 pixels, 1024 time channels
 High efficiency
 Fast acquisition
 SPCM Online FLIM function available
 Simultaneous FLIM / PLIM



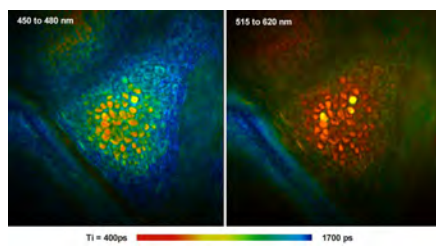
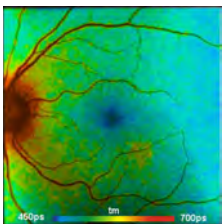
PZ-FLIM-110 Stage-Scanning FLIM System

Sample scanning by piezo scan stage
 Excitation by BDL or BDS series ps diode lasers
 Confocal detection
 HPM-100 hybrid detector
 Optional PML-SPEC GaAsP multi-spectral detector
 Excellent contrast and resolution
 Fully controlled by bh SPCM TCSPC/FLIM data acquisition software
 Compact electronics, integrated in bh Simple-Tau system
 Megapixel FLIM technology - images up to 2048 x 2048 pixels
 Lateral (x-y) and vertical (z) scanning
 Simultaneous FLIM / PLIM



FLIM for NSOM Systems

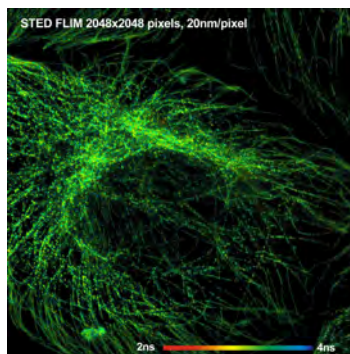
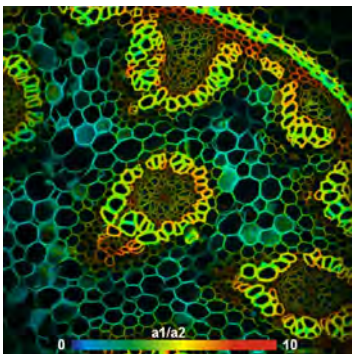
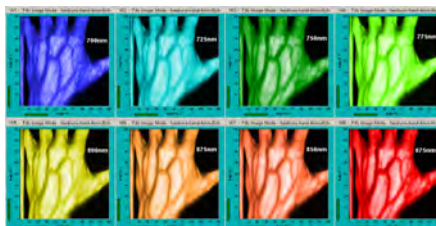
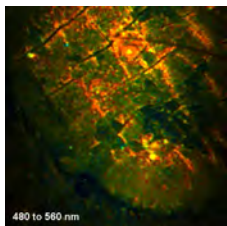
For NSOM systems of Nanonics and NT-MDT
 Combines atomic-force and fluorescence lifetime information
 High sensitivity by HPM-100 hybrid detectors
 Fluorescence and phosphorescence lifetime imaging
 Single-point transient-lifetime recording
 Please see bh TCSPC Handbook or contact bh.



FLIM Systems for Clinical Imaging

64-bit megapixel FLIM technology

FLIM systems for ophthalmology
 FLIM systems for dermatology
 FLIM systems for tissue imaging
 FLIM through endoscopes
 Time-resolved NIRS and fNIRS Imaging
 Online FLIM at rates of up to 10 images per second
 Please see bh TCSPC Handbook or contact bh



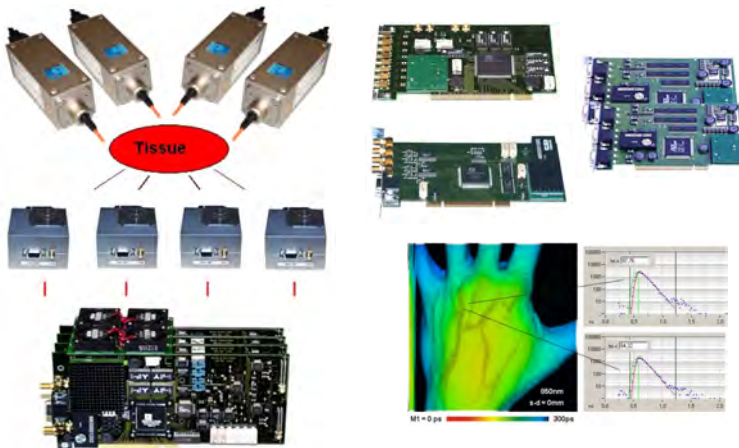
FLIM for other Scanning Systems

bh FLIM systems can be configured for almost any conceivable laser scanning system. They work with galvanometer scanners, polygon scanners, resonance scanners, and motor-driven and piezo-driven scan stages.

Left: FLIM recorded with Lucid Vivascope, ultra-fast polygon scanner
 Right: STED FLIM recorded with STED microscope of Abberior Systems, Göttingen

Please see bh TCSPC Handbook or contact bh.

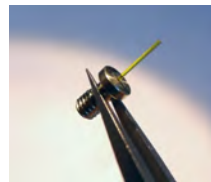
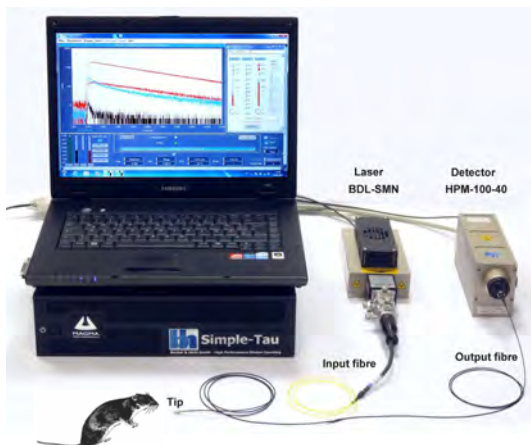
TCSPC Systems for Time-Domain Diffuse Optical Tomography



Modular DOT systems

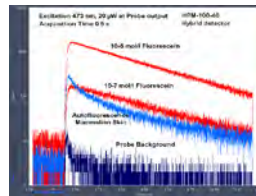
- Up to 8 parallel TCSPC channels
 - Up to 32 detector channels
 - Up to 8 BDS-MM lasers with wavelength multiplexing
 - Up to 8 wavelengths multiplexed with supercontinuum laser
 - Recording with multiplexed source position
 - Time-of-flight distributions for all combinations of wavelength, source, and detection channels
 - Diffuse correlation in 16 channels
 - Recording by SPC-134-EMN, SPC-154N, or SPC-164 TCSPC packages
 - Laser control by DDG-210 digital delay generator
 - Detector control via DCC-100 cards
 - Saturated count rates up to 40 MHz
 - Multiplexing periods of lasers individually programmable
 - Unlimited sequential recording by continuous flow mode
 - Acquisition rate up to 20 time-of-flight distributions per second
- Non-contact scanning by galvanometer scanner controlled by GVD-120 card

Fiber-Based Fluorescence-Lifetime Systems for *in-vivo* Applications

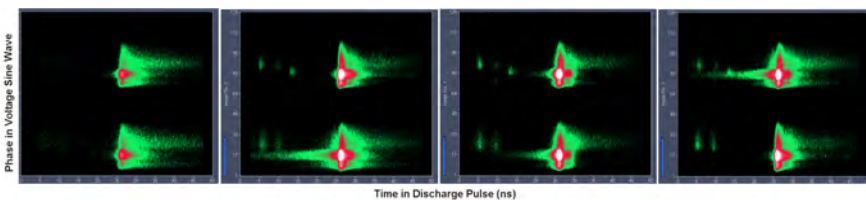


Fiber-based TCSPC system for *in-vivo* application

- Implantable fiber tip, removable from fiber system
- Single mode excitation, multi-mode detection
- Excitation by BDL or BDS ps diode lasers
- Detection by hybrid detectors or SPAD detectors
- Multi-wavelength detector option
- Excellent sensitivity
- Excellent time resolution
- Low background fluorescence
- Detection of NADH, FAD, or exogenous fluorophores
- Ca²⁺ detection in neuronal tissue
- pO₂ measurement in live tissue

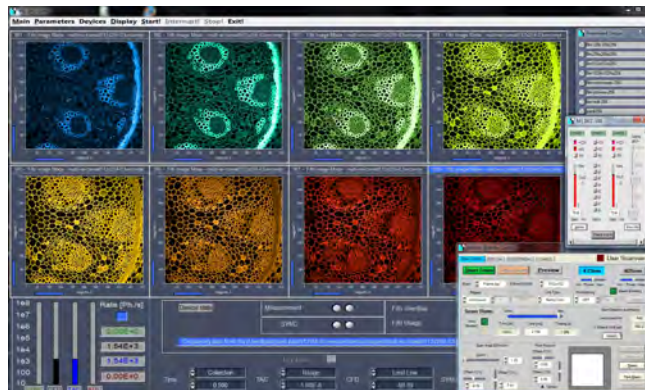
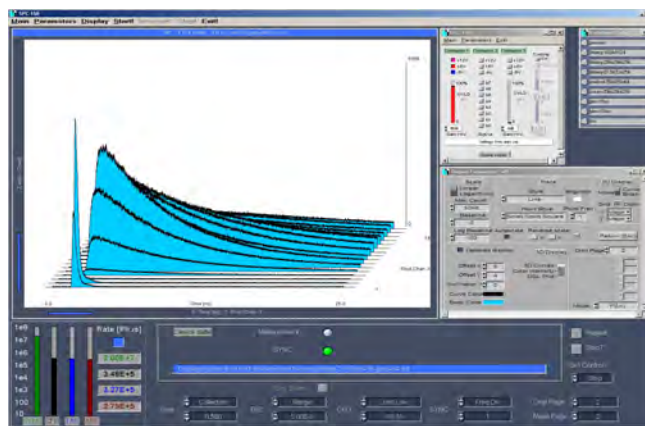
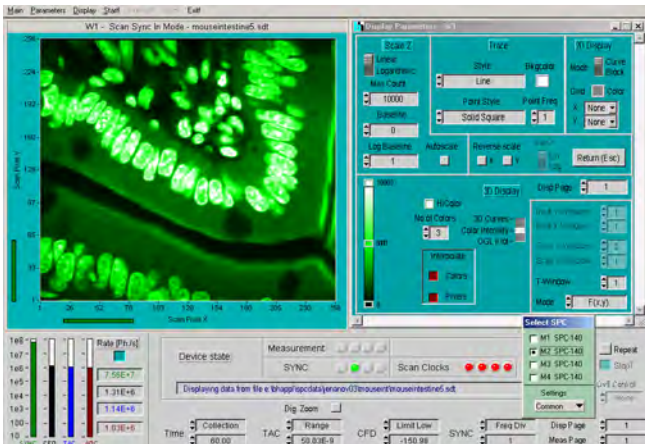
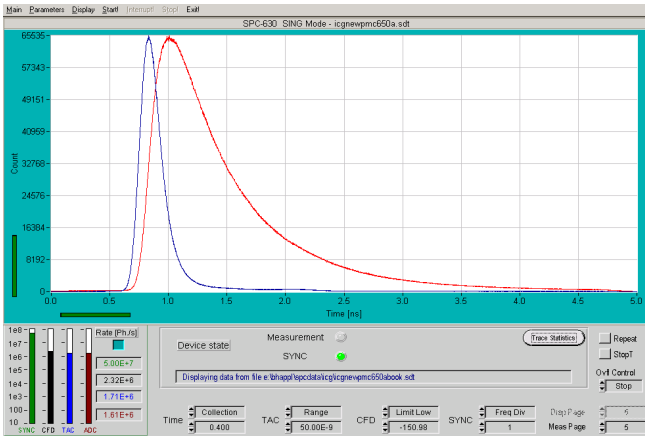


Systems for Recording Optical Emission from Barrier Discharges



- Recording of full spatio-temporal pulse profiles
- Multi-dimensional TCSPC process
- Sinusoidal discharge voltage, 5 to 15 kHz
- Fast galvanometer scanning along discharge gap
- Control by GVD-120 scan controller
- Fully integrated in SPCM software
- Detection of optical signals by one or two detectors
- Optional 16-wavelength detector
- Recording by one or two parallel SPC-150N TCSPC modules
- Online display of data
- Please see bh TCSPC Handbook, 9th edition

TCSPC Instrument Software

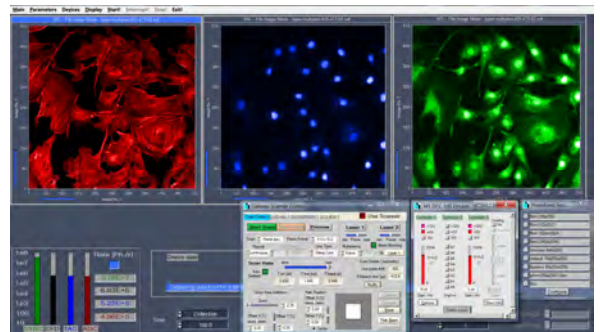
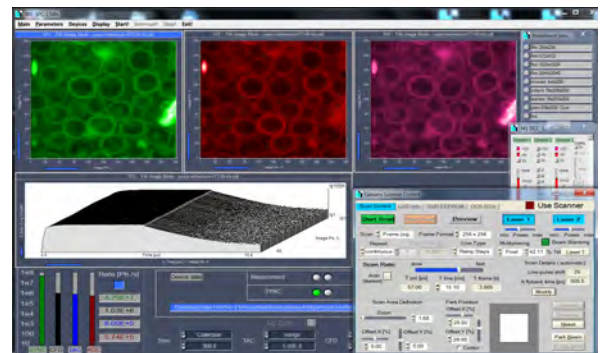


SPCM Data Acquisition Software for all bh TCSPC Modules and DPC-230 Photon Correlator

True 64 bit software for Windows 8 / 10 / 11 Megapixel FLIM Technology

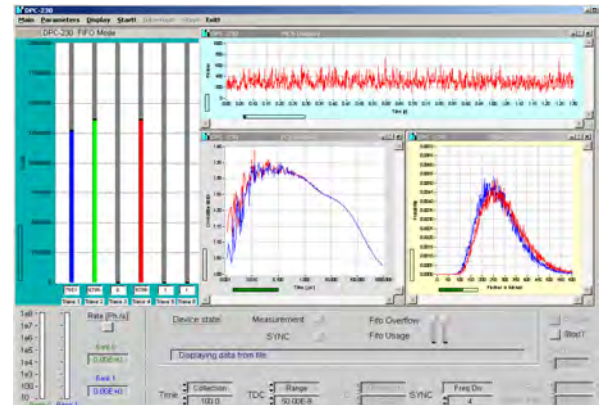
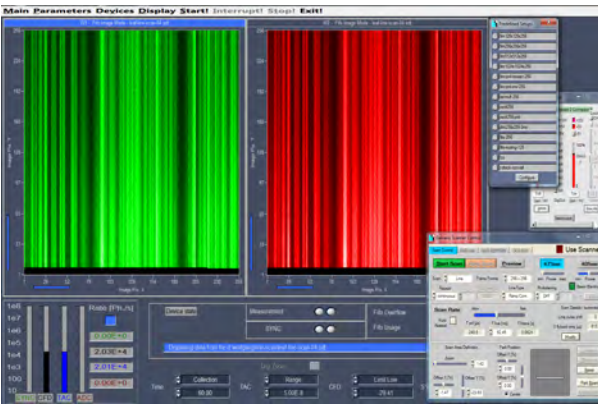
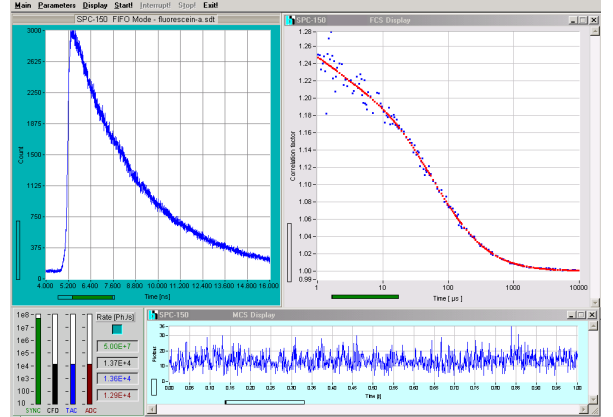
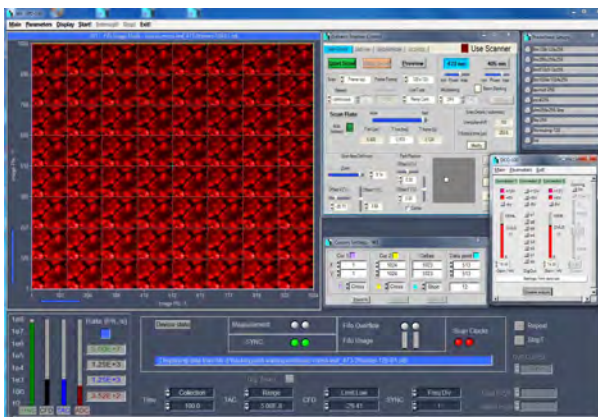
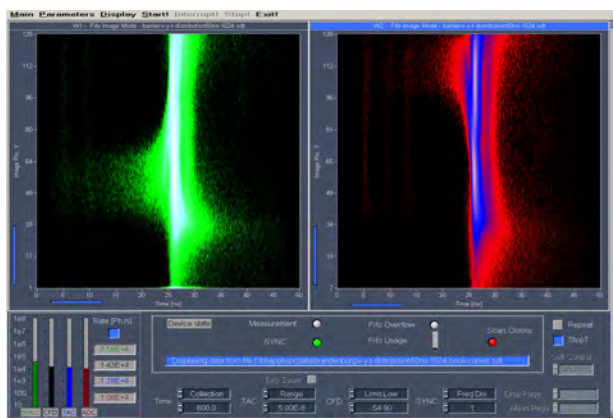
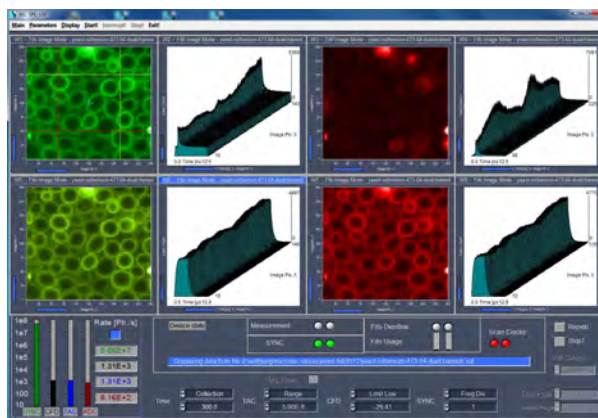
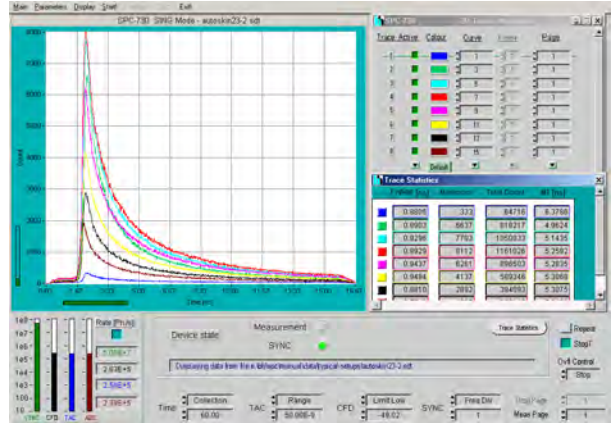
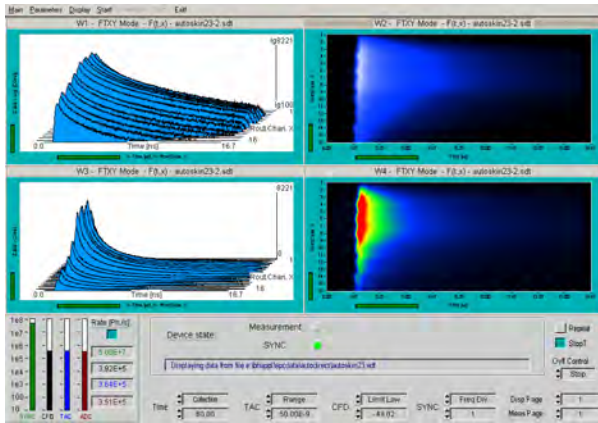
- Same software for all bh TCSPC modules and DPC-230 card
- One software for all operation modes
- Full access to all functions of the boards
- Configurable for different instrument configurations
- Parallel operation of up to four SPC or DPC modules
- Online display of images and curves
- Online display of lifetime images
- Online calculation of FCS, PCH, and MCS traces
- Online fit of FCS curves
- Cycle function
- Page stepping
- Autosave functions
- Oscilloscope mode
- Multi-wavelength fluorescence decay recording
- Single and repeat mode
- Sequential modes
- Imaging modes
- Single photon parameter-tag mode
- Hardware-accumulation FLIM mode
- Software-accumulation (parameter tag) FLIM mode
- Multi-wavelength FLIM
- Spatial Mosaic FLIM
- Temporal mosaic FLIM for accumulation of ultrafast time series
- Fluorescence lifetime transient scanning (FLITS)
- Simultaneous recording of FLIM and PLIM
- Integrated scanner control
- Integrated detector control
- Integrated laser control for PLIM
- Integrated control of Ti:Sa laser and AOM
- Integrated control of motorised sample stage
- Integrated control of Zeiss Axio Observer Z1 microscope
- 2D and 3D display modes
- Online display of lifetime images
- Image display with software gating
- Display of multi-wavelength FLIM images
- 3D Curve mode, colour-intensity display of multi-dimensional data
- Saving, loading, and conversion of photon distributions, images, and time-tag data
- Loading of instrument configuration via predefined setups
- 2D and 3D data processing functions
- Automatic interaction with SPImage FLIM data analysis
- Runs under Windows 8, Windows 10, and Windows 11

The SPCM software is free. Please downloaded from www.becker-hickl.com.

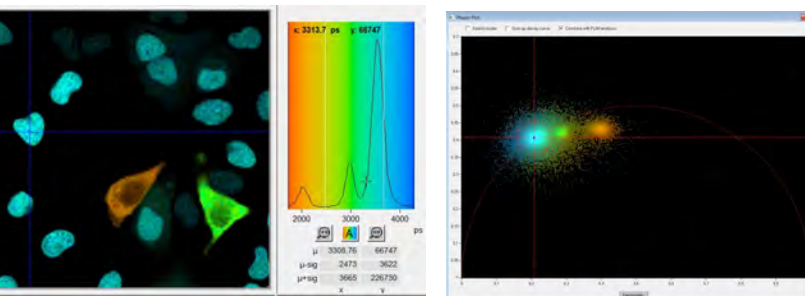
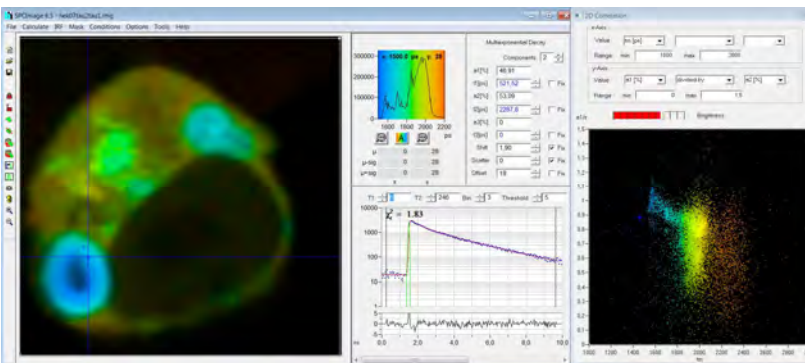
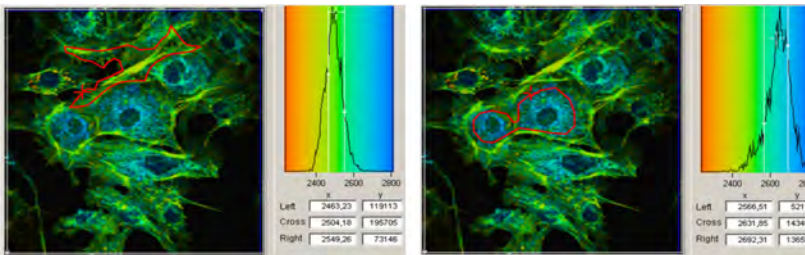
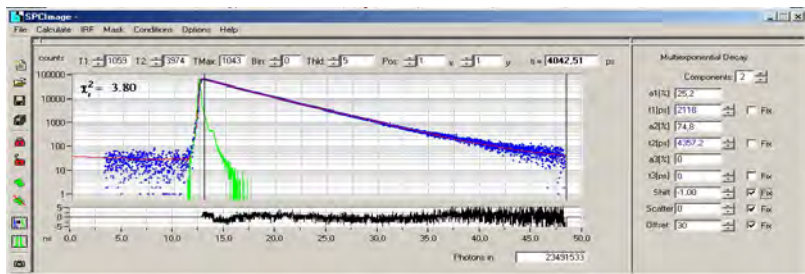
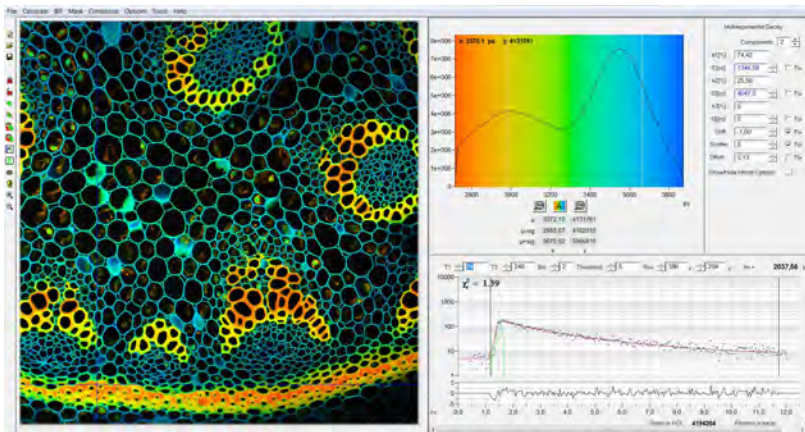


SPCM Data Acquisition Software for bh TCSPC Modules and DPC-230 Photon Correlator

One Software - Multiple Applications



TCSPC Data FLIM Analysis Software



SPCImage NG FLIM Data Analysis Software

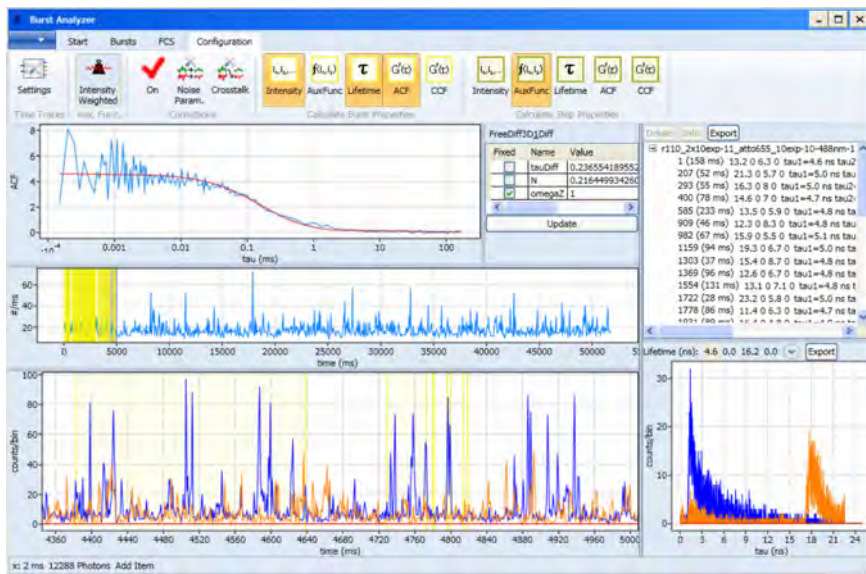
- FLIM data analysis within seconds
- Maximum-likelihood algorithm
- GPU processing
- Combination of time-domain analysis and phasor analysis
- Analysis of FLIM data
- Analysis of PLIM data
- Analysis of single FLIM or PLIM channels
- Analysis of multiple FLIM or PLIM channels
- Analysis of single-curve fluorescence data
- Analysis of single-curve phosphorescence data
- Analysis by iterative convolution and fit procedure
- Analysis by first moment of photon distribution
- 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
- Automatic IRF modelling
- Extraction of IRF from SHG components in FLIM image
- Region-of-interest selection
- Image segmentation by phasor plot and 2D histogramming
- Single and double-exponential FRET
- Display of lifetime images
- Display of FRET images
- Display of lifetimes, amplitudes, intensities or ratios of parameters
- Calculation of FRET efficiencies
- Histograms of lifetimes, amplitudes, intensities or ratios of these parameters
- 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

Multiple region of interest definition

Two-dimensional histograms of decay parameters
 Histograms of pixel frequency over two selected parameters of the fluorescence decay
 Coloured annotation of pixels in 2D histograms
 Back-annotation of 2D parameter ranges in FLIM images

Combination of time-domain analysis with phasor plot
 Fourier transform of decay data
 Histograms of amplitude and phase of decay data in frequency space
 Coloured annotation of pixels in phasor plot
 Back-annotation of parameter ranges in FLIM images
 Cluster selection in phasor plot
 Combination of corresponding decay data in single curve

TCSPC Single-Molecule Burst-Analysis Software



Single-Molecule Burst-Analysis Software

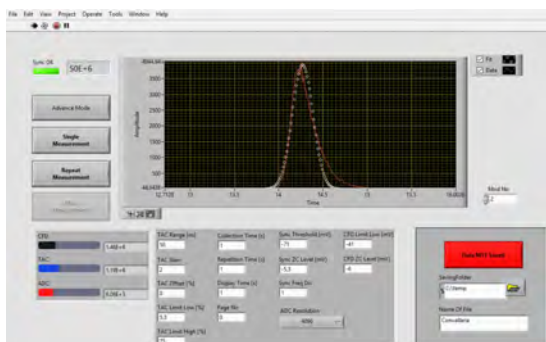
- Identification of single-molecule photon bursts in parameter-tag data
- Analysis of fluorescence intensity within photon bursts
- Analysis of fluorescence lifetime within photon bursts
- One- and two-dimensional histograms of burst parameters
- Filtered histograms of burst parameters
- Discrimination of different fluorescent species
- Determination of FRET efficiencies
- Discrimination of different FRET states
- Calculation of FCS and cross-FCS
- FCS fit with user-defined model functions
- Exclusion of artefacts in intensity traces
- Time-gating
- Selection of excitation channels in PIE data

DLL Libraries for TCSPC and Multiscaler Modules



DLL libraries are available for most bh data acquisition and experiment control modules. Please contact bh for details.

Lab View Library for TCSPC / FLIM Modules



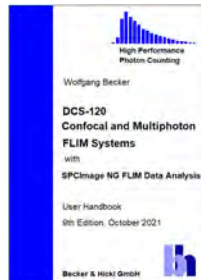
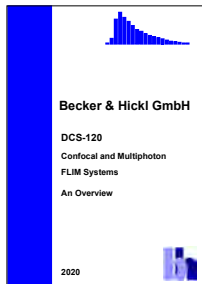
Lab View modules for basic functions of bh TCSPC / FLIM modules
 Measurement and measurement control functions
 Parameter setup functions
 Display functions
 Load and save functions

Example programs

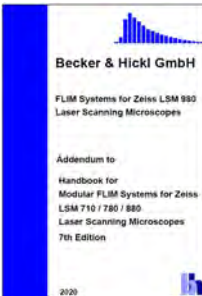
TCSPC Literature from the Technology Leader



Wolfgang Becker
The bh TCSPC Handbook
 9th Edition, September 2021,
 981 pages, 1283 references, 1220 figures
 Available from www.becker-hickl.com
 Please contact bh for printed copies

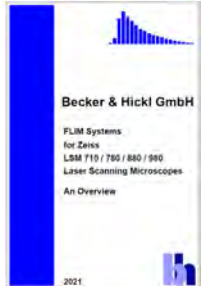


DCS-120 Confocal and Multiphoton FLIM Systems
User handbook
 9th Edition, October 2021
 453 pages, 601 references, 610 figures
 Available from www.becker-hickl.com
 Please contact bh for printed copies

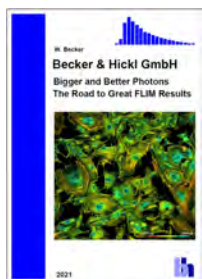


DCS-120 Confocal Scanning Systems
Overview brochure
 Edition 2021
 44 pages, 85 references, 63 figures
 Available from www.becker-hickl.com

Modular FLIM Systems for Zeiss LSM 710 / 780 / 880 Family Laser Scanning Microscopes
Laser Scanning Microscopes
with appendix for LSM 510 systems
 7th edition, November 2017
 357 pages, 531 references, 458 figures,
 Available from www.becker-hickl.com
 Please contact bh for printed copies

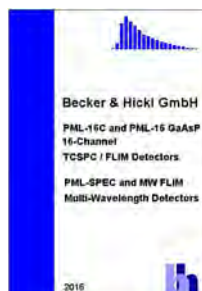


FLIM Systems for Zeiss LSM 980 Laser Scanning Microscopes.
Addendum to: Handbook for modular FLIM systems for Zeiss LSM 710 / 780 / 880 family laser scanning microscopes.
 February 2020, 24 pages
 Available from www.becker-hickl.com
 Please contact bh for printed copies



FLIM for Zeiss LSM 710 / 780 / 880 Family Laser Scanning Microscopes
Overview brochure
 60 pages, 206 references, 67 figures
 Available from www.becker-hickl.com

SPCImage Next Generation FLIM Data Analysis Software
Overview Brochure
 19 pages
 Available from www.becker-hickl.com



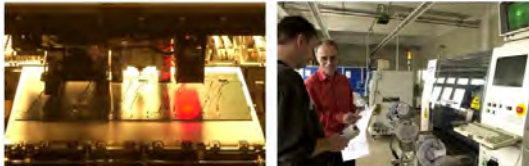
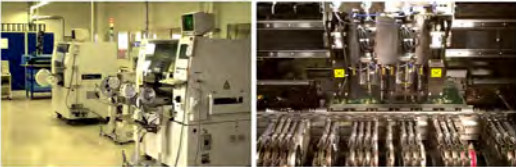
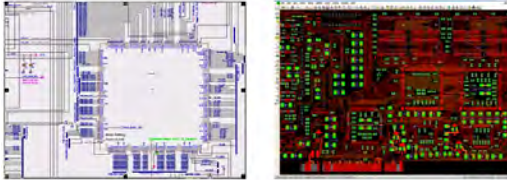
The bh TCSPC Technique Principles and Applications
Overview Brochure
 27 pages, 46 references
 Available from www.becker-hickl.com

Bigger and Better Photons
 The Road to Great FLIM Results
 Jan. 2021, 39 pages

DPC-230 16 Channel Photon Correlator
User Handbook
 April 2008
 66 pages, 89 figures, 31 references
 Available from www.becker-hickl.com

PML-16-C 16 and PML-16 GaAsP 16 Channel TCSPC / FLIM Detectors
PML-SPEC and MW FLIM Multi-Wavelength Detectors
User Handbook
 61 pages, 75 figures, 99 references
 Available from www.becker-hickl.com

Design, Manufacturing and Quality Management



A Strong Partnership

bh and Dorazil form an alliance since 1993. Located in the same building, our companies closely cooperate at all stages through schematics design, hybrid circuit design, board layout, and computer-aided manufacturing and testing. Continuous quality management through the complete design and manufacturing flow results in high reliability and short delivery time both for prototypes and large order quantities.

Continuous flow from design into manufacturing

Hybrid-circuit, FPGA, and PCB design

Electronics running off the mill

High-density automatic SMD placement
Automatic soldering
ROHS lead-free

Thin film and thick film hybrid circuits

In-house manufacturing
Automatic placement of components
Automatic chip bonding

ISO 9001 and ISO 14001 certified

Quality management through entire manufacturing process
Uncompromised quality at any number of pieces

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