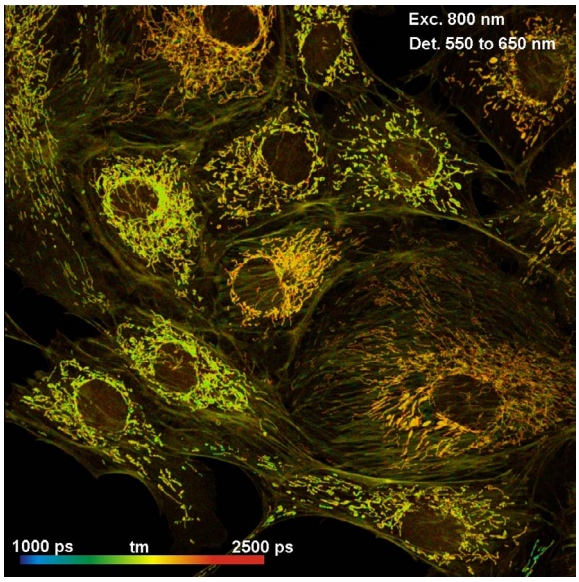
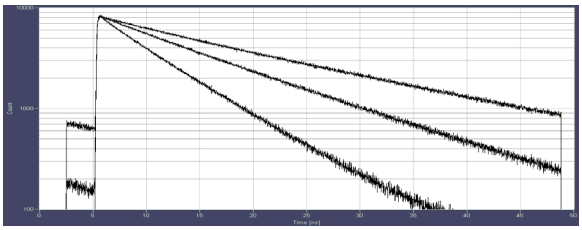
SPC-150 TCSPC / FLIM Module

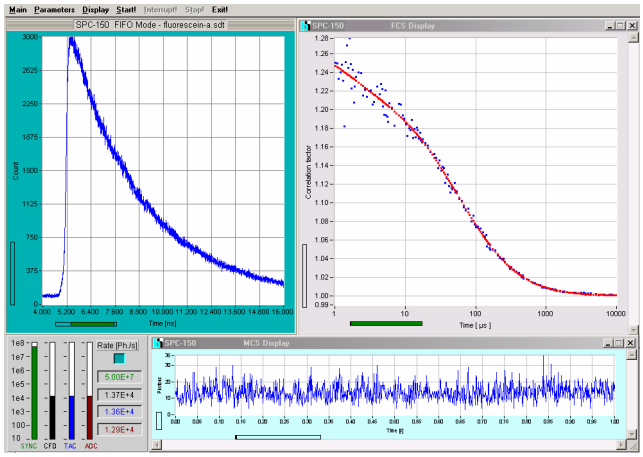
Time-Correlated Single Photon Counting Module

Picosecond time resolution
Ultra-high sensitivity
Multi-detector / multi-wavelength capability
FLIM by bh Megapixel Technology
Mosaic FLIM mode
Multiscaler imaging mode
Photon distribution and parameter-tag modes
Unlimited sequential recording of curves or images
Imaging in histogram mode and in parameter-tag mode
Time channel width down to 813 fs
Electrical time resolution (Jitter) 6.6 ps fwhm / 2.5 ps rms
Reversed start/stop: Laser repetition rates up to 150 MHz
Saturated count rate 10 MHz
Total useful recorded count rate up to 5 MHz

Standard fluorescence lifetime experiments
Multi-wavelength lifetime experiments
Recording of transient fluorescence lifetime effects
Single-wavelength FLIM, multi-wavelength FLIM
Fast-Acquisition FLIM, time-Series FLIM
Mosaic FLIM, lateral, longitudinal, temporal mosaics
Simultaneous PLIM and FLIM
FLITS
Single and double-exponential FRET imaging
Recording of Ca^{2+} transients
fNIRS and NIRS experiments
Single-molecule spectroscopy
FCS, FCCS, Photon Counting Histograms
Anti-bunching experiments







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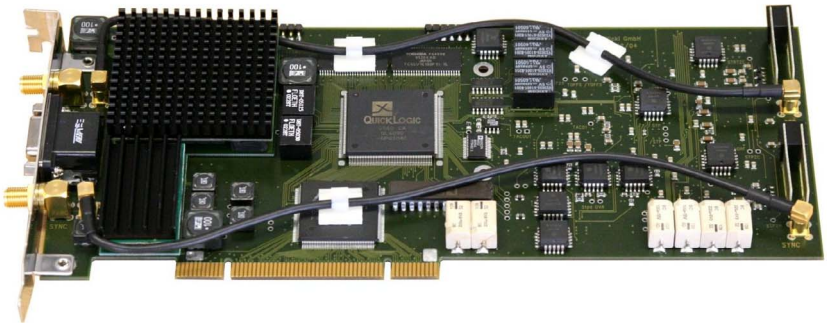
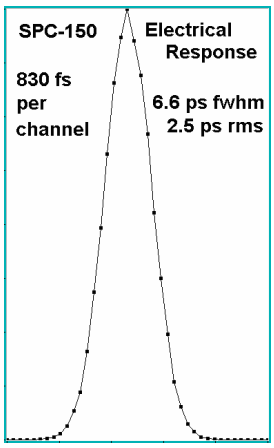


Covered by patents DE 43 39 784 and DE 43 39 787

SPC-150 TCSPC / FLIM Module



Photon Channel

Principle	Constant Fraction Discriminator (CFD)
Time Resolution (FWHM / RMS, electr.)	6.6 ps / 2.5 ps
Optimal Input Voltage Range	- 30 mV to - 1 V
Min. Input Pulse Width	400 ps
Threshold	0 to - 500 mV
Zero Cross Adjust	- 100 mV to + 100 mV

Synchronisation Channels

Principle	Constant Fraction Discriminator (CFD)
Optimal Input Voltage Range	- 30 mV to - 1 V
Min. Input Pulse Width	400 ps
Threshold	0 to -500 mV
Frequency Range	0 to 150 MHz
Frequency Divider	1-2-4
Zero Cross Adjust	-100 mV to + 100 mV

Time-to-Amplitude Converters / ADCs

Principle	Ramp Generator / Biased Amplifier
TAC Range	50 ns to 5 us
Biased Amplifier Gain	1 to 15
Biased Amplifier Offset	0 to 100% of TAC Range
Time Range incl. Biased Amplifier	3.3 ns to 5 us
min. Time / Channel	813 fs
Max. No. of Time Channels	4096
ADC Principle	50 ns Flash ADC with Error Correction
Diff. Nonlinearity	< 0.5% rms, typ. <1% peak-peak

Data Acquisition (Histogram Mode)

Method	on-board multi-dimensional histogramming process						
Dead Time	100ns, independent of computer speed						
Saturated Count Rate	10 MHz						
Useful count rate	5 MHz						
Time channels / Pixel	4096	1024	256	64	16	4	1
max. Scanning Area	16x16	64x64	128 x 128	256x256	512x512	1024x1024	2048x2048
max. Counts / Time Channel	2^{16}-1						
Overflow Control	none / stop / repeat and correct						
Collection Time	0.1 us to 100,000 s						
Display Interval Time	0.1 us to 100,000 s						
Repeat Time	0.1 us to 100,000 s						
Sequential Recording	Programmable Hardware Sequencer, unlimited recording by memory swapping, in curve mode and scan mode						
Synchronisation with Scanning	pixel, line and frame clocks from scanning device						
Count Enable Control	1 bit TTL						
Experiment Trigger	TTL						

Data Acquisition (FIFO / Time-Tag Mode)

Method	Parameter-tagging of individual photons and continuous transfer into computer
Online display	Decay function, FCS, Cross-FCS, PCH, MCS traces
FCS and FCCS calculation	Multi-tau algorithm, online calculation and online fit
Number of counts of decay / waveform recording	unlimited
Dead Time	100 ns
Saturated count rate, peak	10 MHz
Sustained count rate (bus-transfer limited)	typ. 4 MHz
Output Data Format (ADC / Macrotime / Routing)	12 / 12 / 4
FIFO buffer Capacity (photons)	2 M
Macro Timer Resolution, internal clock	50ns, 12 bit, overflows marked by MTOF entry in data stream
Macro Timer Resolution, clock from SYNC input	10ns to 100ns, 12 bit, overflows marked by MTOF entry in data stream
Curve Control (external Routing)	4 bit TTL
External event markers	4 bit, TTL
Count Enable Control	1 bit TTL
Experiment trigger	TTL

Data Acquisition, FIFO / Time-Tag Imaging Mode

Method	Buildup of images from time- and wavelength tagged data			
Online display	up to 8 images in different time and wavelength windows			
Synchronisation with scanner	via Frame Clock, Line Clock, and Pixel Clock pulses			
Detector / Wavelength Channels	1 to 16			
Image resolution, 64-bit SPCM software				
No of time channels	64	256	1024	4096
No. of pixels, 1 detector channel	4096 x 4096	2048 x 2048	1024 x 1024	512 x 512
No. of pixels, 16 detector channels	1024 x 1024	512 x 512	256 x 256	128 x 128

Operation Environment

Computer System	PC Pentium, multi-core CPU recommended or Simple Tau extension box
Bus Connectors	PCI
Used PCI Slots	1
Total power Consumption	approx. 12 W from +5V, 0.7 W from +12V
Dimensions	240 mm x 130 mm x 15 mm

Related Products

SPC-154 4-channel TCSPC modules	HPM-100 GaAsP and GaAs hybrid detectors	DCC-100 detector controller
Simple-Tau 150 compact TCSPC systems	PML-SPEC and MW-FLIM multi-wavelength detectors	BDL-SMN and -SMC ps diode lasers
Simple-Tau 154 compact 4-channel TCSPC systems	PMC-100 cooled PMT modules	BDS-SM picosecond diode lasers
DCS-120 confocal scanning FLIM system	id-100 SPAD detector modules	

Related Literature

W. Becker, Advanced time-correlated single photon counting techniques. Springer 2005. Please contact bh for availability.
W. Becker, The bh TCSPC Handbook, 6th edition. Available on www.becker-hickl.com
PML-16-C 16 channel detector head for time-correlated single photon counting. User handbook. Available on www.becker-hickl.com
DCS-120 Confocal Scanning FLIM Systems, user handbook. Available on www.becker-hickl.com
Modular FLIM systems for Zeiss LSM 510 and LSM 710 / 780 / 880 family laser scanning microscopes, handbook. Available on www.becker-hickl.com
BDL-SMN series picosecond diode lasers, user handbook. Available on www.becker-hickl.com
Please see also www.becker-hickl.com, 'Literature', 'Application notes'

More than 20 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.