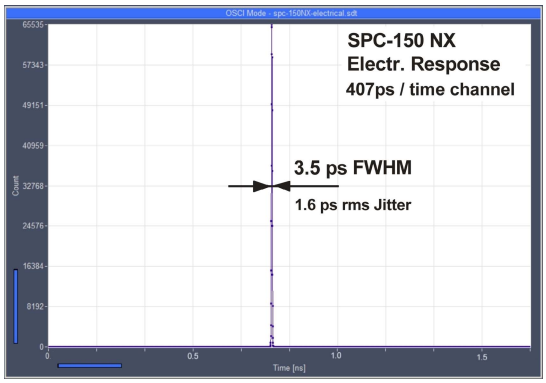
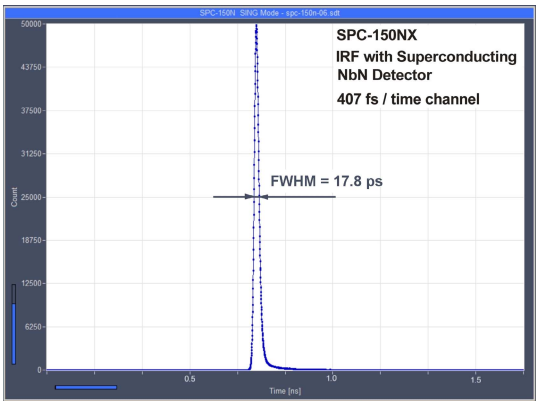
SPC-150NX TCSPC / FLIM Module

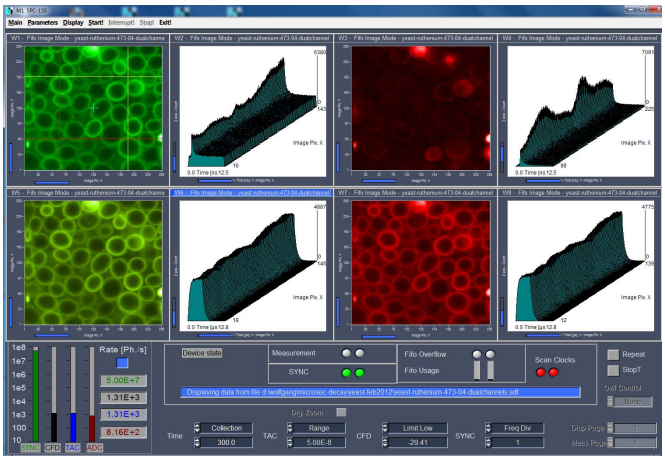
Time-Correlated Single Photon Counting Module for Ultra-Fast Detectors

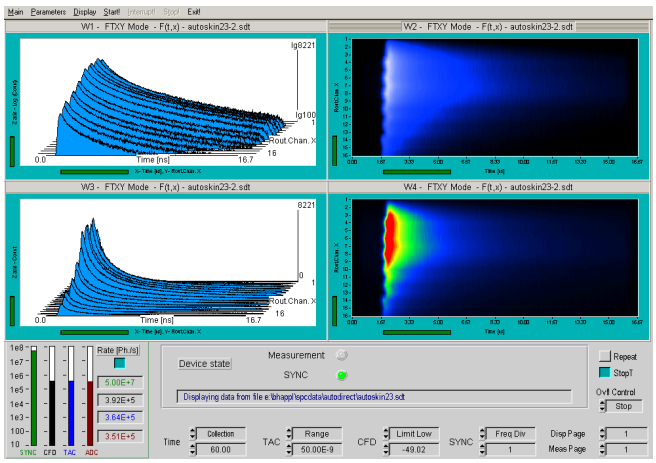
High-resolution version of SPC-150N TCSPC module
Improved resolution for ultra-fast detectors
Internal timing jitter 1.6 ps rms (3.5 ps fwhm)
Minimum time channel width 407 fs
Input discriminator bandwidth 4 GHz
Sub-ps low-frequency timing wobble
Photon distribution and parameter-tag modes
Multi-detector / multi-wavelength capability
FLIM by bh Megapixel Technology
Mosaic FLIM mode
Multiscaler imaging mode
Parallel operation of 2, 3 or 4 modules
Reversed start/stop: Laser repetition rates up to 150 MHz
Dead time 100 ns
Saturated count rate 10 MHz



Ultra-fast fluorescence lifetime experiments
Anti-bunching 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
FLITS
Simultaneous PLIM and FLIM
Double-exponential FRET imaging
Recording of Ca^{2+} transients
fNIRS and NIRS experiments
Single-molecule spectroscopy
FCS, FCCS, PCH







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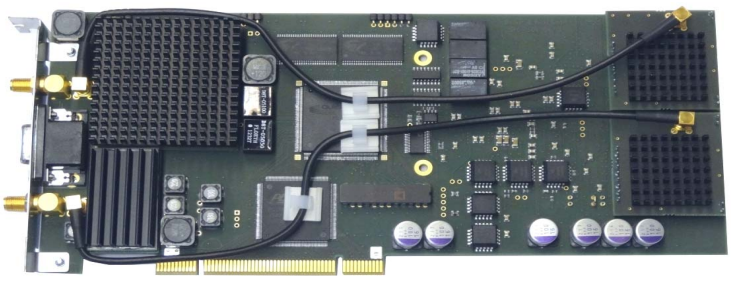

More than 20 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.

SPC-150N TCSPC / FLIM Module

Photon Channel

Principle	Constant Fraction Discriminator (CFD)
Discriminator Input Bandwidth	4 GHz
Time Resolution (FWHM / RMS, electr.)	3.3 ps / 1.6 ps
Variance in time of IRF maximum	<1 ps over 50 seconds
Optimum Input Voltage Range	- 30 mV to - 500 mV
Min. Input Pulse Width	200 ps
Threshold	0 to - 250 mV
Zero Cross Adjust	- 100 mV to + 100 mV

Synchronisation Channels

Principle	Constant Fraction Discriminator (CFD)
Discriminator Input Bandwidth	4 GHz
Optimal Input Voltage Range	- 30 mV to - 500 mV
Min. Input Pulse Width	200 ps
Threshold	0 to -250 mV
Frequency Range	0 to 150 MHz
SYNC 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	25 ns to 2.5 us
Biased Amplifier Gain	1 to 15
Biased Amplifier Offset	0 to 50% of TAC Range
Time Range incl. Biased Amplifier	1.67 ns to 2.5 us
min. Time / Channel	407 fs
ADC Principle	50 ns Flash ADC with Error Correction
Diff. Nonlinearity, electrical	< 0.5% rms, typ. <1% peak-peak

Data Acquisition (Histogram Modes)

Method	on-board multi-dimensional hardware histogramming process
Dead Time	100 ns, independent of computer speed
Saturated Count Rate	10 MHz
Useful count rate	5 MHz
max. Counts / Time Channel (counting depth)	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
Routing	7 bit TTL
Experiment Trigger	TTL

Data Acquisition (FIFO / Parameter-Tag Mode)

Method	Parameter-tagging of individual photons and continuous writing to disk
Online display	Decay function, FCS, Cross-FCS, PCH, MCS traces
FCS 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
max. counts / time cChannel (counting depth)	unlimited
Output Data Format (ADC / Macrotime / Routing)	12 / 12 / 4 bit
FIFO buffer Capacity (photons)	$2 \cdot 10^6$
Macro Timer Resolution, internal clock	50 ns, 12 bit, overflows marked by MTOF entry in data stream
Macro Timer Resolution, clock from SYNC input	10 ns to 100 ns, 12 bit, overflows marked by MTOF entry in data stream
Routing	4 bit TTL
External event markers	4 bit, TTL
Experiment trigger	TTL

Data Acquisition, FIFO / Parameter-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, >8GB RAM and 64 bit operating system recommended
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-150N 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 ps diode lasers
Simple-Tau 154 compact 4-channel TCSPC systems	PMC-100 cooled PMT modules	BDS-SM, -SMY, -MM picosecond diode lasers
DCS-120 confocal scanning FLIM system	id-100 SPAD detector modules	

Related Literature

World Record in TCSPC Time Resolution: Combination of bh SPC-150NX with SCONTEL NbN Detector yields 17.8 ps FWHM. Application note, please see www.becker-hickl.com
W. Becker, Advanced time-correlated single photon counting techniques. Springer 2005. Please contact bh for availability.
W. Becker, The bh TCSPC Handbook, 6th edition (2015). Available on www.becker-hickl.com. Contact bh for printed copies.

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