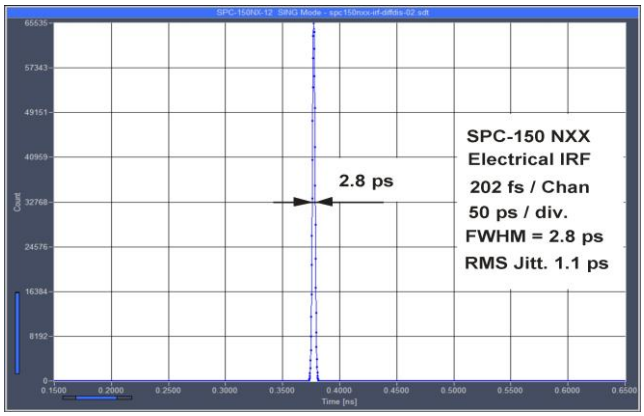
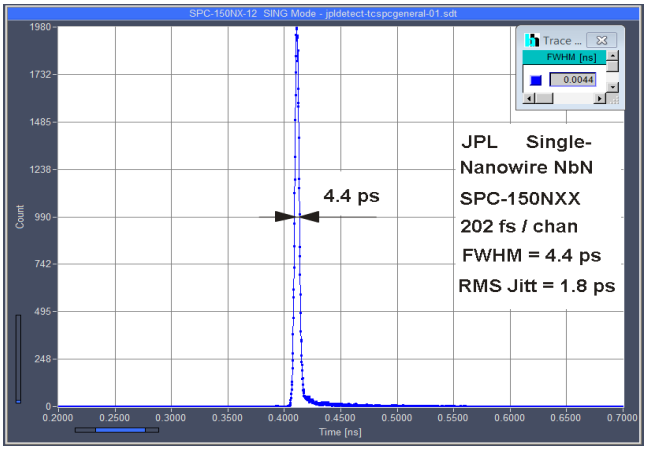
SPC-150NXX Ultrafast TCSPC Module

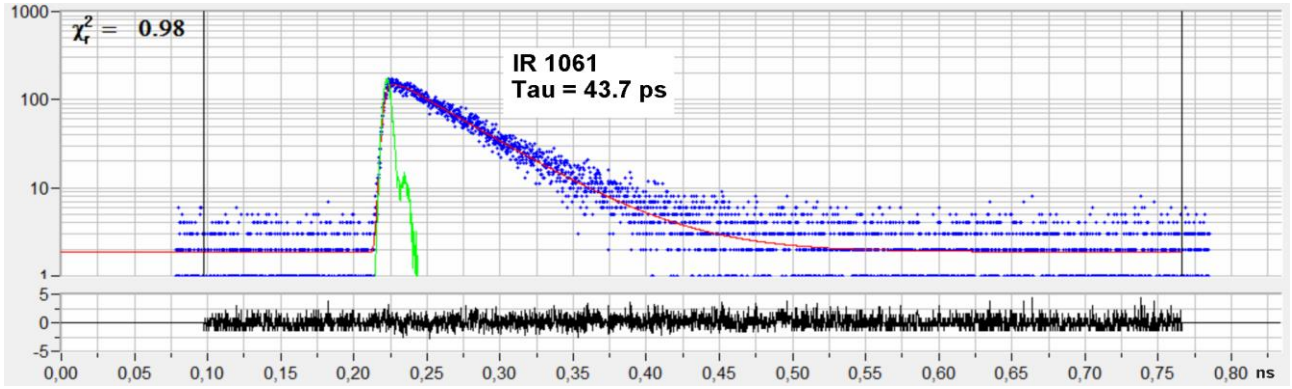
Time-Correlated Single Photon Counting Module for Ultra-Fast Detectors

Ultra-high time resolution
Electrical IRF width < 3 ps FWHM
Internal RMS timing jitter 1.1 ps
IRF with nanowire NbN detectors < 5 ps FWHM
Minimum time channel width 203 fs
Ultra-high IRF stability
Input discriminator bandwidth 4 GHz
Photon distribution and parameter-tag modes
Multi-detector / multi-wavelength capability
Dual time-base operation
Parallel operation of modules
Laser repetition rates up to 150 MHz
Saturated count rate 10 MHz



Ideal for superconducting NbN detectors
Ultra-fast fluorescence lifetime experiments
Ultra-fast light scattering 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
Simultaneous PLIM and FLIM
FLITS
Double-exponential FRET imaging
Recording of Ca^{2+} transients
fNIRS and NIRS experiments
Single-molecule spectroscopy
FCS, FCCS, PCH





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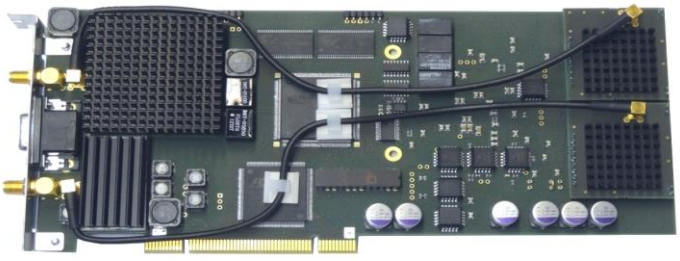
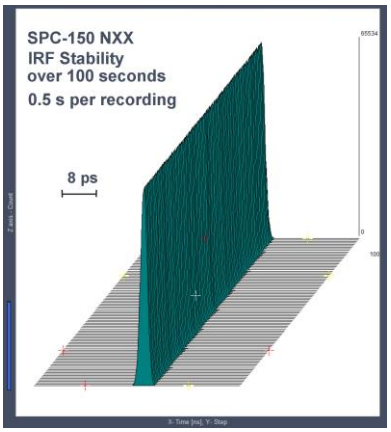
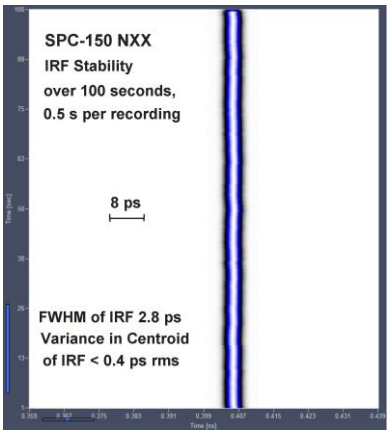


More than 25 years experience in TCSPC. More than 2000 TCSPC systems worldwide.

SPC-150NXX Ultrafast TCSPC Module





Photon Channel

Principle	Constant Fraction Discriminator (CFD)
Discriminator Input Bandwidth	4 GHz
IRF width, FWHM	<3 ps, FWHM
RMS tming jitter	1.1 ps, RMS
Variance in time of IRF centroid	<0.4 ps RMS over 100 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 Channel

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	12.5 ns, 25 ns, 50 ns
Biased Amplifier Gain	1 to 15
Biased Amplifier Offset	0 to 50% of TAC Range
Time Range incl. Biased Amplifier	0.834 ns to 50 ns
min. Time / Channel	203 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
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	10 ms to 100,000 s
Repeat Time	0.1 us to 100,000 s
Sequential Recording	Unlimited recording by memory swapping
Synchronisation with Scanning	pixel, line and frame clocks from scanning device
Routing	7 bit TTL
Count Enable	1 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 channel (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
Count Enable control	1 bit TTL
External event markers	4 bit, TTL
Experiment trigger	TTL

FLIM Data Acquisition, FIFO Imaging Mode

Method	Buildup of images from time- and wavelength tagged data			
Online display	up to 8 images in different time and wavelength windows or from different modules			
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, Windows 10
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, SPC-150NX 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-150 cooled PMT modules	BDS-SM, -SMY, -MM picosecond diode lasers

Related Literature

4.4 ps IRF width of TCSPC with an NbN Superconducting Nanowire Single Photon Detector. Application note, please see www.becker-hickl.com
W. Becker, The bh TCSPC Handbook, 7th edition (2017). Available on www.becker-hickl.com. Contact bh for printed copies.

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