



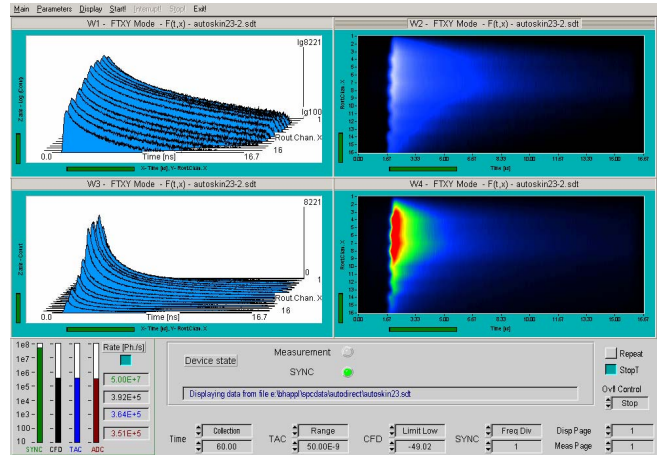
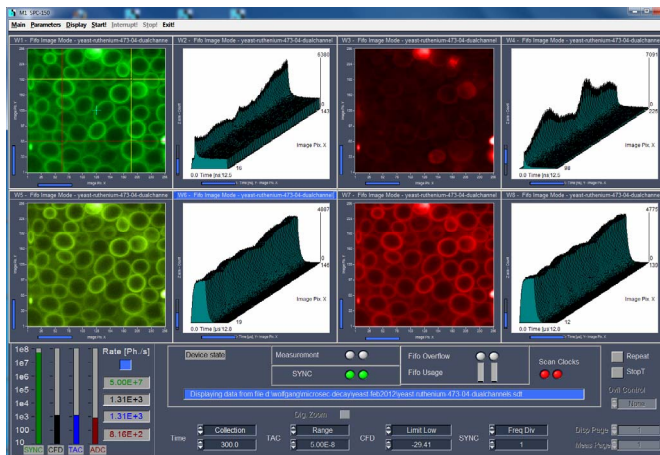
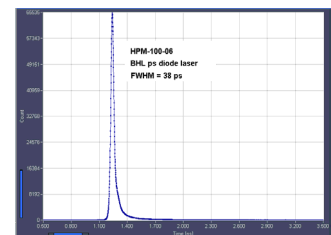
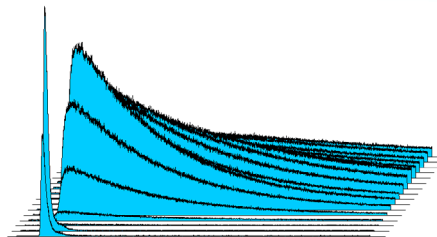
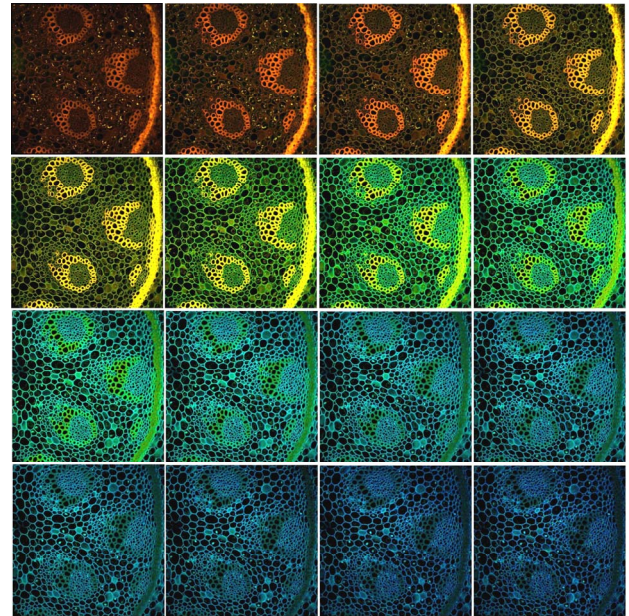
SPC-150N

TCSPC / FLIM Module

Time-Correlated Single Photon Counting Module

Improved version of SPC-150 TCSPC module
 Input discriminator bandwidth 4 GHz
 Improved resolution for ultra-fast detectors
 Sub-ps low-frequency timing wobble
 Multi-detector / multi-wavelength capability
 FLIM by bh Megapixel Technology
 Mosaic FLIM mode
 Multiscaler imaging mode
 Photon distribution and parameter-tag modes
 Parallel operation of 2, 3 or 4 modules
 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
 Dead time 100 ns
 Saturated count rate 10 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
 FLITS
 Simultaneous PLIM and FLIM
 Double-exponential FRET imaging
 Recording of Ca^{2+} transients
 fNIRS and NIRS experiments
 Single-molecule spectroscopy
 FCS, FCCS, PCH
 Anti-bunching experiments



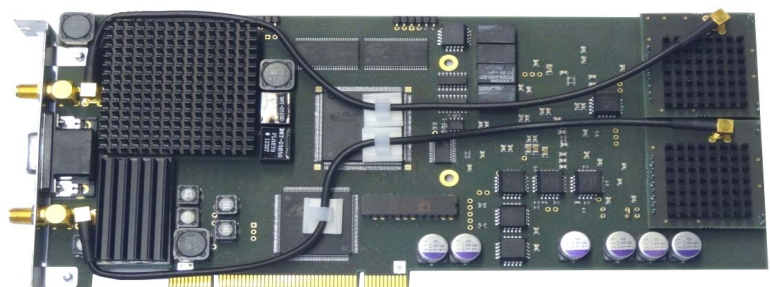
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SPC-150N

TCSPC / FLIM Module

Photon Channel

Principle
 Discriminator Input Bandwidth
 Time Resolution (FWHM / RMS, electr.)
 Variance in time of IRF maximum
 Optimum Input Voltage Range
 Min. Input Pulse Width
 Threshold
 Zero Cross Adjust

Constant Fraction Discriminator (CFD)
 4 GHz
 6.6 ps / 2.5 ps
 <1 ps over 50 seconds
 - 30 mV to - 500 mV
 200 ps
 0 to - 250 mV
 - 100 mV to + 100 mV

Synchronisation Channels

Principle
 Discriminator Input Bandwidth
 Optimal Input Voltage Range
 Min. Input Pulse Width
 Threshold
 Frequency Range
 Frequency Divider
 Zero Cross Adjust

Constant Fraction Discriminator (CFD)
 4 GHz
 - 30 mV to - 500 mV
 200 ps
 0 to -250 mV
 0 to 150 MHz
 1-2-4
 -100 mV to + 100 mV

Time-to-Amplitude Converters / ADCs

Principle
 TAC Range
 Biased Amplifier Gain
 Biased Amplifier Offset
 Time Range incl. Biased Amplifier
 min. Time / Channel
 ADC Principle
 Diff. Nonlinearity, electrical

Ramp Generator / Biased Amplifier
 50 ns to 5 us
 1 to 15
 0 to 100% of TAC Range
 3.3 ns to 5 us
 813 fs
 50 ns Flash ADC with Error Correction
 < 0.5% rms, typ. <1% peak-peak

Data Acquisition (Histogram Mode)

Method
 Dead Time
 Saturated Count Rate
 Useful count rate
 Channels / Pixel
 max. Scanning Area
 max. Counts / Time Channel
 Overflow Control
 Collection Time
 Display Interval Time
 Repeat Time
 Sequential Recording
 Synchronisation with Scanning
 Count Enable Control
 Experiment Trigger

on-board multi-dimensional histogramming process
 100ns, independent of computer speed
 10 MHz
 5 MHz

4096	1024	256	64	16	4	1
16x16	64x64	128 x 128	256x256	512x512	1024x1024	2048x2048

 2^{16-1}
 none / stop / repeat and correct
 0.1 us to 100,000 s
 0.1 us to 100,000 s
 0.1 us to 100,000 s
 Programmable Hardware Sequencer, unlimited recording by memory swapping, in curve mode and scan mode
 pixel, line and frame clocks from scanning device
 1 bit TTL
 TTL

Data Acquisition (FIFO / Parameter-Tag Mode)

Method
 Online display
 FCS calculation
 Number of counts of decay / waveform recording
 Dead Time
 Saturated count rate, peak
 Sustained count rate (bus-transfer limited)
 Output Data Format (ADC / Macrotime / Routing)
 FIFO buffer Capacity (photons)
 Macro Timer Resolution, internal clock
 Macro Timer Resolution, clock from SYNC input
 Curve Control (external Routing)
 External event markers
 Count Enable Control
 Experiment trigger

Parameter-tagging of individual photons and continuous writing to disk
 Decay function, FCS, Cross-FCS, PCH, MCS traces
 Multi-tau algorithm, online calculation and online fit
 unlimited
 100 ns
 10 MHz
 typ. 4 MHz
 12 / 12 / 4
 2 M
 50ns, 12 bit, overflows marked by MTOF entry in data stream
 10ns to 100ns, 12 bit, overflows marked by MTOF entry in data stream
 4 bit TTL
 4 bit, TTL
 1 bit TTL
 TTL

Data Acquisition, FIFO / Parameter-Tag Imaging Mode

Method
 Online display
 Synchronisation with scanner
 Detector / Wavelength Channels
 Image resolution, 64-bit SPCM software
 No. of time channels
 No. of pixels, 1 detector channel
 No. of pixels, 16 detector channels

Buildup of images from time- and wavelength tagged data
 up to 8 images in different time and wavelength windows
 via Frame Clock, Line Clock, and Pixel Clock pulses
 1 to 16

64	256	1024	4096
4096 x 4096	2048 x 2048	1024 x 1024	512 x 512
1024 x 1024	512 x 512	256 x 256	128 x 128

Operation Environment

Computer System
 Bus Connectors
 Used PCI Slots
 Total power Consumption
 Dimensions

PC Pentium, multi-core, >8GB RAM and 64 bit operating system recommended
 PCI
 1
 approx. 12 W from +5V, 0.7 W from +12V
 240 mm x 130 mm x 15 mm

Related Products

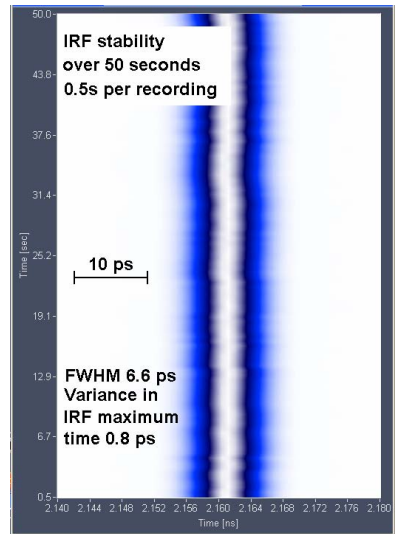
SPC-154 4-channel TCSPC modules
 Simple-Tau 150 compact TCSPC systems
 Simple-Tau 154 compact 4-channel TCSPC systems
 DCS-120 confocal scanning FLIM system

HPM-100 GaAsP and GaAs hybrid detectors
 PML-SPEC and MW-FLIM multi-wavelength detectors
 PMC-100 cooled PMT modules
 id-100 SPAD detector modules

DCC-100 detector controller
 BDL-SMN and -SMC ps diode lasers
 BDS-SM picosecond diode lasers

Related Literature

W. Becker, Advanced time-correlated single photon counting techniques. Springer 2005. Please contact bh for availability.
 W. Becker, The bh TCSPC Handbook, 5th edition. 690 pages, 823 references. Available on www.becker-hickl.com. Contact bh for printed copies.
 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, handbook. Available on www.becker-hickl.com
 Modular FLIM systems for Zeiss LSM 510 and LSM 710 laser scanning microscopes, handbook. Available on www.becker-hickl.com. Contact bh for printed copies.
 BDL-SMN picosecond diode lasers, 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.