



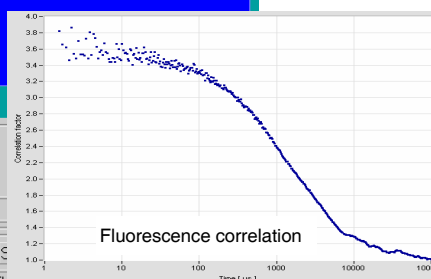
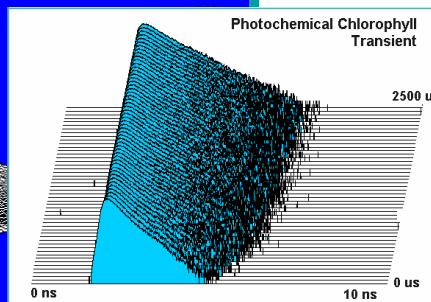
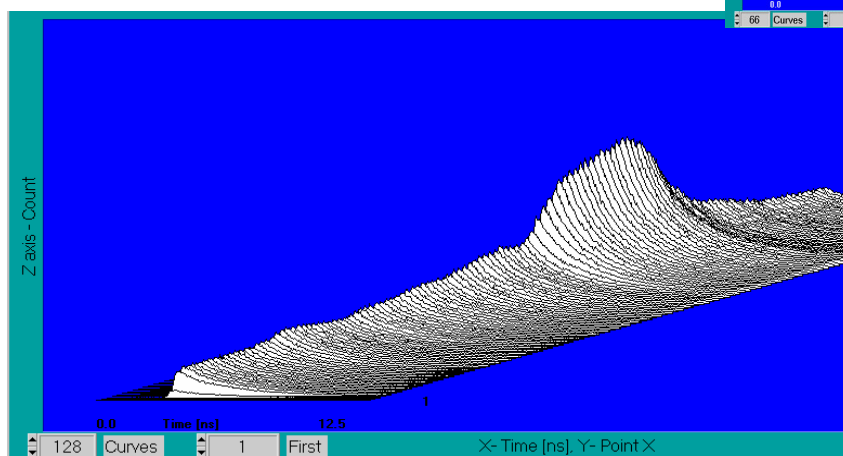
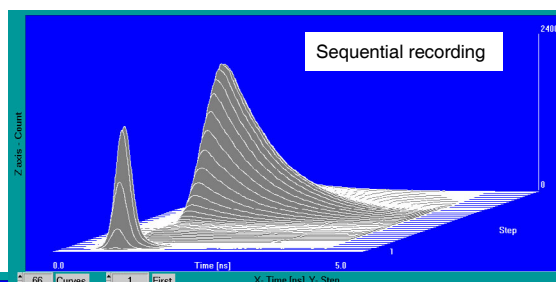
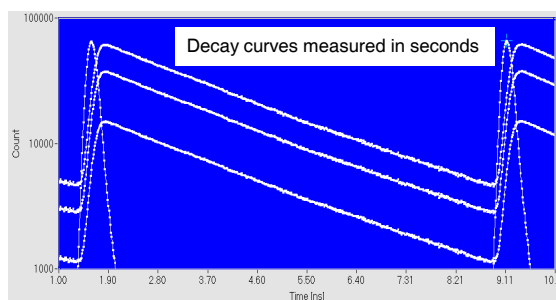
TCSPC Module

SPC-130 EM

General-Purpose Time-Correlated Single Photon Counting Module

- Picosecond resolution
- Ultra-high sensitivity
- Multi-detector / multi-wavelength capability
- High-speed on-board data acquisition
- Photon distribution and time-tag modes
- Unlimited sequential recording of curves or images
- 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
- Dead time 100 ns

- Standard fluorescence lifetime experiments
- Multi-wavelength lifetime experiments
- Transient fluorescence lifetime effects
- Fluorescence correlation
- Anti-bunching experiments
- Single-molecule spectroscopy



128 Curves 1 First X- Time [ns], Y- Point X

Rate [Ph./s]

5.50E+5

4.95E+5

3.85E+5

2.70E+5

Device state: Measurement in progress SYNC OK

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Time: Collection Range TAC: 50.00E-9 CF: Limit Low -100.00

Step,ICFD -49.02



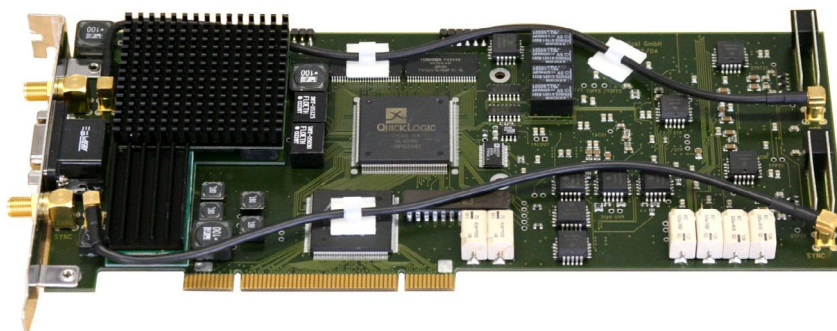
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Covered by patents DE 43 39 784 and DE 43 39 787

SPC-130 EM

Photon Channel (Start Input)

Principle
Time Resolution (Jitter, FWHM / RMS, electrical)
Optimum Input Voltage Range
Min. Input Pulse Width
Threshold
Zero Cross Adjust

Constant Fraction Discriminator (CFD)
6.6 ps / 2.5 ps
- 30 mV to - 1 V
400 ps
- 20 mV to - 500 mV
- 100 mV to + 100 mV

Synchronisation Channel (Stop Input)

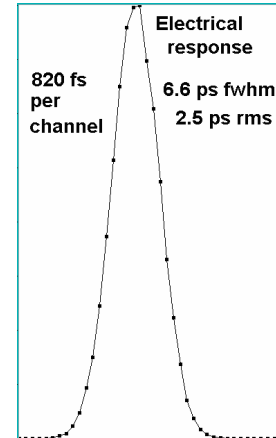
Principle
Optimum Input Voltage Range
Min. Input Pulse Width
Threshold
Frequency Range
Frequency Divider
Zero Cross Adjust

Constant Fraction Discriminator (CFD)
- 30 mV to - 1 V
400 ps
- 20 mV to - 500 mV
0 to 200 MHz
1-2-4
-100 mV to + 100 mV

Time-to-Amplitude Converter / ADC

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

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
40 ns Flash ADC with Error Correction
< 0.5% rms, typ. <1% peak-peak



Data Acquisition (Histogram Mode)

Method
Online display
Dead Time
Saturated count rate
Sustained count rate
Maximum useful count rate (50% loss)
max. Number of Curves in Memory
Number of Time Channels / Curve
max. Counts / Channel
Overflow Control
Collection Time
Display Interval Time
Repeat Time
Curve Control (Internal sequencing)
Curve Control (Routing)
Count Enable Control
External event markers
Experiment Trigger

on-board 2-dimensional histogramming process
Decay curves (waveforms)
100 ns, independent of computer speed
10 MHz
10 MHz
5 MHz
65536 16384 4096 1024 256 64
4 16 64 256 1024 4096
 $2^{16}-1$
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
4 bit, TTL
1 bit, TTL
4 bit, TTL
TTL

Data Acquisition (FIFO / Time-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)
Count Enable Control
Experiment trigger

Time and wavelength 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
1 bit TTL
TTL

Operation Environment

Computer System
Bus Connectors
Used PCI Slots
Power Consumption
Dimensions

PC Pentium, multi-core CPU recommended
PCI
1
approx. 45 W at +5V, 2 W at +12V
225 mm x 115 mm x 25 mm

Related Products

SPC-134 EM 4-channel TCSPC modules
SPC-150 TCSPC modules
SPC-154 4-channel TCSPC modules
SPC-830 TCSPC modules
Simple-Tau 130 compact TCSPC systems
Simple-Tau 150 compact TCSPC systems
Simple-Tau 134 compact 4-channel TCSPC systems
Simple-Tau 154 compact 4-channel TCSPC systems
Simple-Tau 830 TCSPC compact systems
DPC-230 16-channel ps photon correlator module

PMC-100 cooled PMT modules
HPM-100 GaAsP and GaAs hybrid detectors
PML-SPEC and MW-FLIM multi-wavelength detectors
R3809U MCP PMTs, with HVM-100 power supply module
id-100 SPAD detector modules
DCC-100 detector controller
HRT-41, HRT-81, HRT-82 routing modules
HFAC and HFAH preamplifiers
A-PPI-D pulse inverters
Detector / shutter assemblies

BDL-SMC picosecond diode lasers
BHL-600 picosecond diode lasers
BHLP-700 picosecond diode lasers
DDG-200 laser multiplexing controller
GVD-100 scan controller
Pin-photodiode modules for sync to laser
SPCImage decay analysis
Optispec decay analysis

Related Literature

W. Becker, Advanced time-correlated single photon counting techniques. Springer 2005.
W. Becker, The bh TCSPC Handbook, 3rd edition. 466 pages, 503 references. 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
Becker & Hickl GmbH, SPCImage Data Analysis Software for Fluorescence Lifetime Imaging Microscopy, handbook. Available on www.becker-hickl.com
BDL-375-SMC, BDL-405-SPC, BDL-440-SMC, BDL-473-SMC UV and blue picosecond diode lasers, handbook. Available on www.becker-hickl.com
Please see also www.becker-hickl.com, 'Literature', 'Application notes'



More than 15 years experience in multi-dimensional TCSPC. More than 1300 TCSPC systems worldwide.