PicoHarp 300

Stand Alone TCSPC Module with USB Interface

- Two identical synchronized but independent input channels
- 65536 histogram time bins, minimum width 4 ps
- Count rate up to 10 million counts/sec
- Multi-stop capability for efficiency at low repetition rates
- Adjustable input delay for sync channel with 4 ps resolution
- Histogrammer measurement range from 260 ns to 33 µs
- Multichannel routing capability*
- Time-Tagged Time-Resolved (TTTR) mode*
- External sync signals for imaging or other control events*

*add-on options

Applications

- Time-resolved fluorescence and luminescence spectroscopy
- Fluorescence Lifetime Imaging (FLIM)
- Single Molecule Spectroscopy (SMS)
- Quantum optics
- Time response characterization of optoelectronic devices
- Coincidence correlation / Antibunching
- Time-of-Flight (ToF) measurements / Ranging

The PicoHarp 300 is a high-end, easy to use, plug and play Time-Correlated Single Photon Counting (TCSPC) system. It is connected to a PC through a USB 2.0 interface.

Independent channels, 4 ps resolution

A special design approach provides identical and synchronized but independent input channels. They can be used as detector inputs for coincidence correlation experiments or as a pair of start and stop inputs for TCSPC. It allows a forward start-stop operation even at full repetition rate of mode locked lasers with stable repetition rate up to 84 MHz. Experiments with low repetition rate benefit from the PicoHarp's multi-stop capability. The design allows high measurement rates up to 10 million counts/sec and provides a highly stable, crystal calibrated time resolution of 4 ps. The instrument's timing resolution is well matched to even the fastest detectors currently available: the SPAD detectors of the PDM series or micro-channel plate Photomultiplier Tubes (MCP). Both input channels are equipped with Constant Fraction Discriminators (CFD), sensitive on the falling edge.

Adjustable delay in sync channel

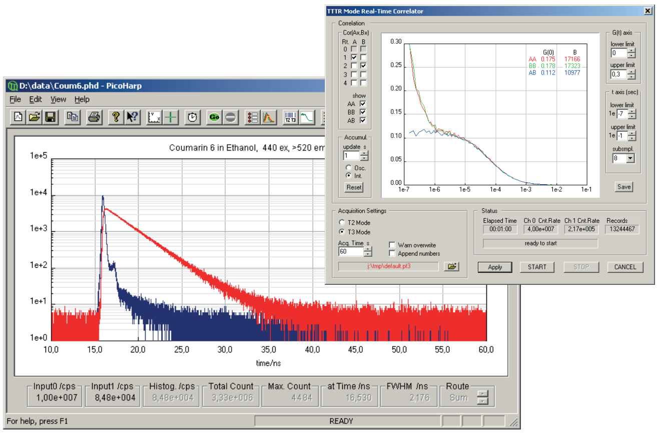
The sync channel of the PicoHarp 300 even has an internal adjustable delay with ± 100 ns range at 4 ps resolution. This unique feature eliminates the need for specially adapted cable lengths or cable delays for different experimental set-ups.

Time-Tagged Time-Resolved modes

A Time-tagged mode for recording of individual photon events with their arrival time on both channels is available as an option, allowing the most sophisticated offline analysis of the photon dynamics. TTTR data can be correlated in real-time for monitoring of FCS experiments at count rates up to 500.000 counts/sec. External marker signals can be used to synchronize the device with other hardware such as scanners, e.g., for Fluorescence Lifetime Imaging (FLIM). In TTTR mode, the PicoHarp 300 can also be used as a generic event timer, e.g., for Satellite Laser Ranging (SLR).

Multichannel routing

As accessories external routers such as the PHR 800 for connection of up to four detectors are available. Each router channel includes an internal adjustable delay with ± 8 ns range at 4 ps resolution to tune for relative delays. External hardware such as monochromators can be controlled via CAN or serial bus (currently supported: Sciencetech 9030, Sciencetech 9055, Acton Research SP-2155 and Acton Research SP-275).



Easy to use software and custom programming

The PicoHarp 300 software for Windows provides functions such as the setting of measurement parameters, display of results, loading and saving of measurement parameters and measurement curves. Important measurement characteristics such as count rate, count maximum, position and peak width are displayed continuously. A comprehensive online help function shortens the users‘ learning curve. A library for custom programming, e.g., with LabVIEW is also available as an option. Software upgrades for extended functionality will be available with further product development.

Measurement data from the PicoHarp 300 can be analyzed by different software packages. For multi-exponential reconvolution the FluoFit software is an ideal tool. For the analysis of TTTR data (e.g., FLIM, FCS, FLCS, FRET, BIFL, etc.) the SymPhoTime 64 software suite is the tool of choice.

The PicoHarp 300 can be used in different operation modes:
Integration mode, oscilloscope mode, Time-Resolved Emission Spectra (TRES), Time-Tagged Time-Resolved (TTTR) mode (listing each event pair arrival time)*, on-line („real-time“) correlator for FCS*

* available as an option

Specifications

Measurement channels	Constant Fraction Discriminator (CFD) in both channels, software adjustable
Input voltage range	0 to -800 mV, optimum: -200 mV to -400 mV
Trigger point	falling edge
Trigger pulse width	0.5 to 30 ns
Trigger pulse rise/fall time	2 ns max.
Time to Digital Converter (TDC)	
Minimum time bin width	4 ps
Timing precision*	< 12 ps rms
Timing precision / √2*	< 8.5 ps rms
Adjustable delay range for sync channel	± 100 ns, resolution 4 ps
Full scale range - histogram mode	260 ns to 33 μs (depending on chosen resolution: 4, 8, 16, ..., 512 ps)
Full scale range - time-tagged mode	infinite
Maximum count rate	10×10^6 counts/sec
Maximum sync rate	84 MHz
Sustained throughput time-tagged mode**	typ. 5×10^6 events/sec
Dead time	< 95 ns
Differential non-linearity	< 5 % peak, < 1 % rms
Histogrammer	
Count depth	16 bit
Maximum number of time bins	65536
Acquitistion time	1 ms to 100 hours
Operation	
PC interface	USB 2.0 high speed
PC requirements	1 GHz min. CPU clock, 512 MB memory
Operating system	Windows™ 7/8/8.1/10
Power consumption	25 W at 100 to 240 VAC

* In order to determine the timing precision it is necessary to repeatedly measure a time difference and to calculate the standard deviation (rms error) of these measurements. This is done by splitting an electrical signal from a pulse generator and feeding the two signals each to a separate input channel. The differences of the measured pulse arrival times are calculated along with the corresponding standard deviation. This latter value is the rms jitter which we use to specify the timing precision. However, calculating such a time difference requires two time measurements. Therefore, following from error propagation laws, the single channel rms error is obtained by dividing the previously calculated standard deviation by sqrt(2). We also specify this single channel rms error here for comparison with other products.

** Sustained throughput depends on configuration and performance of host PC.

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