

Specifications

Analog acquisition (TR 40-xx):

Signal input range:	0...-20, -100, -500mV
A/D resolution:	12bit
Sampling rate:	40MSPS
Bandwidth:	DC-20MHz
A/D differential nonlinearity:	typ. 0.3LSB max. 1.0LSB @ 25°C
A/D integral nonlinearity:	typ. ±0.75LSB @ 25°C
Spurious free dynamic range:	81dB
S/N single shot:	66dB @ 100mV input range (50µV)
Memory depth:	256 to 16384 bins
Summation memory:	2 channels 4094 acquisitions
Max. repetition rate:	200Hz for 16Kbin signals, 10kHz for 512bin signals
Protection:	Diode clamped
Input impedance:	50Ω
Coupling:	DC
Trigger delay and jitter:	25 ±7ns

In/Outputs:

Signal input:	BNC, 50Ω, front panel
Trigger A:	BNC, 50Ω, front panel
Trigger B:	BNC, 50Ω, front panel
Host I/O:	50-pol. bus., back panel

Photon counting acquisition:

Max. count rate:	250MHz
Temporal resolution:	25ns
Threshold:	0...-20mV 0...-100mV
Discriminator:	64 levels for each input range, software-controlled
Memory depth:	8192 or 16384 bins
Summation memory:	2 channels, 4094 acquisitions
Input impedance:	50Ω
Bandwidth:	10MHz-250MHz no deadtime or overlap between bins

Trigger:

2 trigger inputs to acquire signals in 2 separate summation memories	
Impedance:	50Ω
Threshold and slope	2.5V, positive

Product Selection Chart

Application	Sample rate	Number of bins	Signal length	Max. repetition rate	Model number
High repetition rate	10MHz	512	5.12µs	11 kHz	TR 10-05
High temporal resolution	40MHz	8192	204.8µs	600Hz	TR 40-80
Long signal duration	20MHz	16384	819.2µs	300Hz	TR 20-160



Photonic Solutions

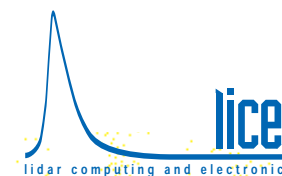
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Optical Transient Recorder

Simultaneous analog and photon counting acquisition for detection of optical signals



- 12bit-40MHz A/D acquisition
- 250MHz single photon count rate
- Up to 18kHz repetition rate
- 800KB/s data transfer
- Integrated preamplifiers
- 10⁵ dynamic range by combination of A/D and photon counting detection
- 4094 shots on board summation
- 2 alternate summation channels
- Complete acquisition software

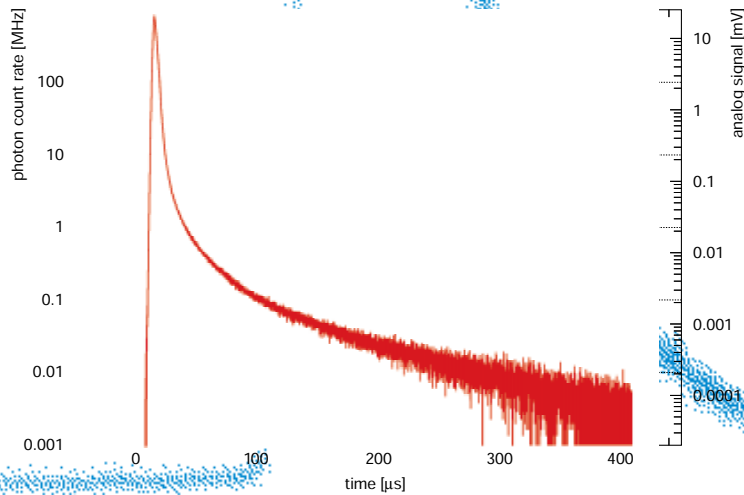


Concept

The licel transient recorder is a powerful data acquisition system, designed especially for optical signal detection. A new concept was developed to reach the best dynamic range together with high temporal resolution at fast signal repetition rates. For the first time, analog detection of the photomultiplier current and single photon counting are integrated into one acquisition system. The licel transient recorder comprises a fast transient digitizer with on-board signal averaging, a discriminator for single photon detection and a multichannel scaler together with preamplifiers for both systems.

Detection of light signals ranging over five orders of magnitude

In remote sensing applications like LIDAR (Light Detection and Ranging) a photomultiplier looking at a laser pulse sent out into the atmosphere is driven close to saturation by the backscattered light from the vicinity, but a few hundred microseconds later it is required to detect single photons returning from 50 or 100km apart. Such a high dynamic range of up to five orders of magnitude is one of the challenges in detection of LIDAR signals as well as in other techniques such as LIF (Laser Induced Fluorescence) and many other optical methods. Usually, the detection systems are optimized for measuring low-level light intensities using the single photon counting technique, but at higher light levels this approach gives a nonlinear signal response. An analog measurement of the photomultiplier current is therefore necessary to increase the dynamic range.



Combined analog and photon counting signal. Analog detection allows signal acquisition up to virtual count rates of 1GHz. Nonlinearities in the photon counting mode become significant at count rates between 1 and 10MHz. At this signal level the photomultiplier is still far below the maximum cw-anode current of 100 μ A (5mV at 50 \square) and analog detection can therefore increase the dynamic range significantly.

Combined acquisition

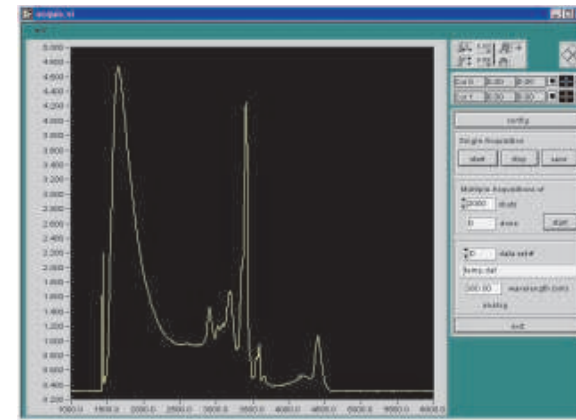
Analog and photon counting detection techniques require different signal conditioning: a high-speed, high-gain amplification for photon counting and a strictly linear amplification below the Nyquist frequency of the A/D converter for analog measurement. Only the integration of two complete acquisition chains from the preamplifier to the summation memory will therefore enable you to combine both techniques for increased linear dynamic range. This has been done in the licel transient recorder.

High-end analog acquisition

The best 12-bit A/D converter available at 40MHz sampling frequency was used to build a high-end transient digitizer with a spurious free dynamic range of 81dB up to the Nyquist frequency of 20MHz. Carefully shielded preamplifiers for three different input ranges and a fast hardware adder can average up to 4094 shots of 200 μ s or 400 μ s signals to a maximum resolution of 0.03 μ V (500mV input range). Each sample is checked for overrange to control clipping in the average signal.

Fast photon counting

The photon counting acquisition system includes a fast three-stage preamplifier and a discriminator with 64 threshold levels, controlled by the host computer. A maximum count rate of 250MHz pushes the limits of single photon counting when selected photomultipliers are used. A time resolution of 25ns without any deadtime or overlap between two memory bins is achieved by using a continuous counter together with a multichannel scaler burnt into the silicon of a custom-designed ASIC.



Complete acquisition software

The licel transient recorder is completely software-controlled. Input ranges for analog and photon counting acquisition, discriminator levels and the number of active bins can be selected. The acquired analog and photon counting signals for both summation memories can be read out separately. Data are transferred via a 2 x 16-bit interface to a National Instruments interface card (AT, PCI or PCMCIA). Up to 16 transient re-corders can be controlled by one interface card. A ready-to-use LabView[®] Interface comes with each licel transient recorder. C-software drivers and acquisition programs for DOS or Linux are supplied.