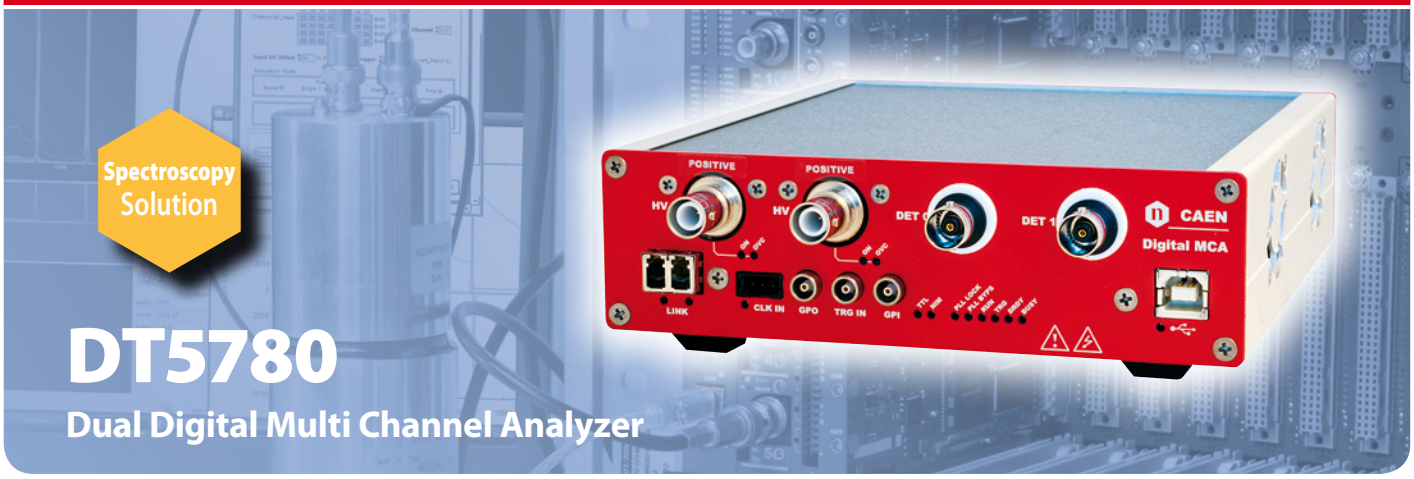
CAEN
Tools for Discovery

Product Overview



DT5780

Dual Digital Multi Channel Analyzer

Compact X-ray and Gamma-ray Spectrometer for Silicon, Germanium and Scintillator Detectors

General Features

- Dual Digital Multi Channel Analyzer based on 14-bit 100 MS/s Flash ADCs.
- Suited for high resolution γ-ray Spectroscopy with HPGe and Silicon detectors.
- Properly works directly connected to a PMT with NaI and CsI scintillators.
- No CSP needed in case of exponential input pulses with typical decay time > 200 ns.
- Decay time accepted range: 200 ns up to 5 ms time constant for exponentially decaying pulses.
- Selectable rise times in the range: 50 ns - 80 µs, equivalent to 22 ns - 36 µs shaping.
- Digital oscilloscope function to monitor input waveforms and internal filters digital output signals.
- Histogram function, the energy histogram being built by software.
- ICR up to 1 Mcps.
- Different output data saving options:
  - energy histograms
  - lists of energy & time stamp events
  - waveforms
  - energies, time stamps and shorter windows of the pulses (*)
  - histogram of the pulse timing distribution (Δt between pulses)
- Fine digital gain tuning.
- Included power supply for preamplifiers and high voltage for the detector.
- Coincidences & anti coincidences of 2 channels (*).
- Optional Rise Time Discriminator technique for advanced pile-up rejection management.
- Programmable hold-off windows for trigger and pile-up rejection in high counting rate acquisitions.
- No dead time due to conversion and spectrum live correction with respect to the piled-up events. The latter feature is very important in case unsteady radiation sources are used, e.g. short living isotopes or activity transients.

(*)Function already supported at hardware and firmware level, but still not implemented in the software.

Overview

The DT5780 is a compact spectrometer providing a complete desktop digital solution for Gamma and X spectroscopy. It is ideally suited for high energy resolution semiconductor detectors, like HPGe and Silicon, connected to a Charge Sensitive Preamplifier (CSP). It can also properly work directly connected to a PMT with inorganic scintillators (NaI, CsI) and other types of crystal, provided that the pulse shape is exponential and the decay time is long enough (typ. > 200 ns).

The DT5780 implements two acquisition modes: "Oscilloscope" mode, where digitized waveforms, as well as the outputs of the internal filters, can be monitored. An optional FFT algorithm can be applied by the software. "Histogram" mode, where parameters like energy and time stamp are extracted from the pulses by means of an on-board Digital Pulse Processing for Pulse Height Analysis (PHA) using trapezoidal and trigger-and-timing filters. The energy histogram is built by the software. Saving options let the data readout to be stored as energy histograms and/or as a list of events (energy and time stamp) or, alternatively, as waveforms. It is also possible to store at the same time energy, time stamp and a shorter window of the digitized pulse (e.g. the rising edge region) in order to perform further offline analysis, such as the pulse shape discrimination, digital CFD for better timing resolution, or other.

The DT5780 is also equipped with two (2) HV channels and preamplifier power supply.

SPECIFICATIONS

Acquisition Section

Input dynamic range: 0.5, 1.3, 3.4 and 8.5 Vpp software selectable options.

Channel input connections: BNC connector, 1 kΩ.

Channel DC Offset: adjustable in the full input range.

Digital inputs/outputs:

- TRG-IN external trigger input (NIM/TTL, Zin=50 Ω).
- GPI programmable input (NIM/TTL, Zin=50 Ω); can be used to reset the time stamp or to start/stop the acquisition.
- GPO programmable output (NIM/TTL across 50 Ω); can provide out the individual trigger as well as propagate the GPI to other boards connected in Daisy chain.

Power Supply section

High Voltage Supply: 2 channels 5 kV/300 µA (Negative, Positive or Mixed polarity available), SHV connector, on/off ramp programmable by software: 1 to 500 V/s in steps of 1 V/s.

Vset/Vmon Resolution: 100 mV

Iset/Imon Resolution: 5 nA

Voltage Ripple: <5 mVpp

Preamp Supply: +/-24 V @50 mA, +/-12 V @100 mA, DB9 female connector.

HV Inhibit: configurable logic for HV shut down as input from the preamplifier and selectable through a dedicated switch:

- Positive Polarity: enable condition is an open circuit or active high (+2 V ÷ +24 V); inhibit condition is ground or active low (-24 V ÷ -2 V).
- Negative Polarity: enable condition is ground or active low (-24 V ÷ -2 V); inhibit condition is an open circuit or active high (+2 V ÷ +24 V).

The external inhibit is duplicated on a BNC connector.

HV Overcurrent and ON/OFF LEDs

Communication

USB 2.0

CONET: CAEN proprietary optical link controlled by A2818 PCI or A3818 PCIe cards with a transfer rate up to 100 MB/s. Optical Daisy chain let 8 boards (A2818) up to 32 (A3818) to be managed.

Digital controls and Pulse Processing

Decimation: programmable with 1, 2, 4, 8 allowed values.

Gain: input signal programmable digital gain (1 to 8 in powers of 2).

Pulse Height Analysis: Digital trapezoidal filter for pulse energy calculation and trigger-and-timing filter for the detection of the input pulses and calculation of the relevant time stamp. Wide selection of programmable filter parameters:

- **Decay time** for pole-zero cancellation.
- **Shaping time,** i.e. the rise time of the trapezoid coming out of the digital shaping filter
- **Flat top** to reduce the ballistic deficit.
- **Baseline mean** to compensate low frequency fluctuations in the trapezoid baseline.
- **Trigger threshold** for self-triggering setting.
- **Trapezoid digital gain** finely tunable.
- **Additional parameters for advanced setting**.

FURTHER SPECIFICATIONS

Dimensions (mm): 140 W x 160 L x 43.50 H.

Input Power Supply: +12 Vdc 30 W, AC-DC desktop adapter (100-240 Vac @50/60 Hz nominal) provided.

Software: DT5780 is provided with a control software for configuration, acquisition, data plotting (histograms are built by the software) and HV management. As far as data analysis is concerned, the output data format is compliant with third-party spectroscopy-oriented software tools. To users who wants to develop their own software, CAEN provides a high-level library to configure the hardware, handle the acquisition and retrieve the acquired data (in form of energy histograms). System main requirements are a host computer running Microsoft Windows or Linux OS with USB 2.0 or CONET (optical link) CAEN drivers installed.

NOTES

For special applications, CAEN offers digitizer boards of different form factor, like Desktop DT5724, VME V1724 and NIM N6724. These boards run DPP software for PHA and provide enhanced functionalities, although external HV power supply is needed. For instance, the V1724 is a 8-channel 14-bit 100 MS/s digitizer featuring 16 I/Os which can be used to propagate the individual trigger of each channel to or from the others. This high-level trigger logic implementation suits for applications with segmented detectors.

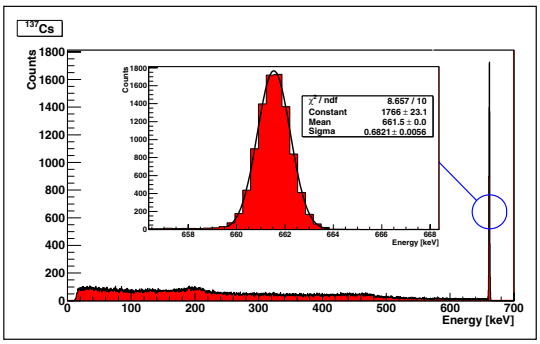


Fig. 1: ^{137}Cs spectrum obtained with Trapezoid Rise Time = 9 µs, ICR 1.1 kcps and Zoom of the 661.7 keV photopeak. A resolution of 1.60 keV was obtained.

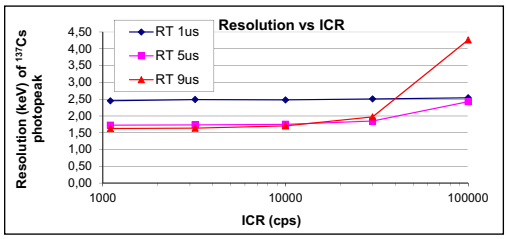


Fig. 2: Resolution of the 661.7 keV ^{137}Cs photopeak as a function of the Input Counting Rate (ICR) for different values of Trapezoid Rise Time (RT).

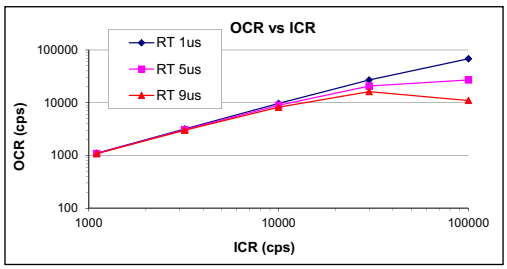


Fig. 3: Output Counting Rate vs Input Counting Rate for different values of Trapezoid Rise Time.

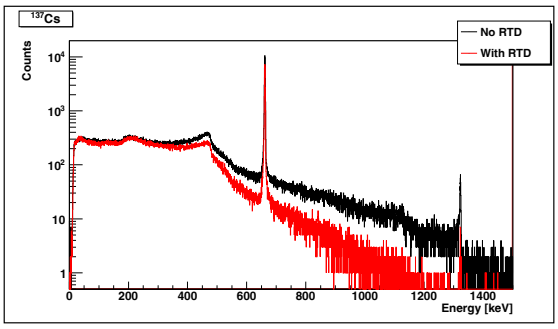


Fig. 4: ^{137}Cs spectra with ICR 110 kcps. The black spectrum was collected without Rise Time Discriminator, the red one was obtained using RTD. The measurements was performed with Trapezoid Rise Time set to 1 µs.

Fig. 5: Back view of the DT5780.

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