CAEN Electronic Instrumentation

After more than 30 years of collaboration with the most important Universities and Physics experiments in the world, CAEN makes this long-lasting experience available in Undergraduates Labs with a brand new tool made of the most updated detectors and acquisition techniques: The CAEN Educational Kit.

Educational Kit

A modern, digital and flexible platform for teaching the fundamentals of Statistics & Particles Detection

Developed together with the University of Insubria, Como, the Educational Kit is ideal for advanced Physics teaching methods, thanks to its extraordinary features:

- SiPMs as light sensors: Silicon Photomultipliers (SiPM) are state-of-the-art light detectors featuring single photon sensitivity and a unique photon number resolving capability, with a significant potential in high energy physics, astrophysics, medical imaging, cultural heritage, homeland security and LIDAR.
- A fast digitizer for Data Acquisition: the CAEN DT5720A digitizer (2 Channels, 250 MS/s, 12 bit) running the DPP-CI Firmware is the heart of the experimental set-up. Thanks to this board the teacher will be able to show how real experiments in the world are nowadays developing their DAQ.
- Three different light sources: an ultra-fast Led Driver, three different scintillating crystals (LYSO, BGO, CsI) and a two channels plastic scintillating tile make the kit ideal for teaching very different Physics fundamental aspects, from statistics to spectroscopy.
- A Labview based Control SW and a MATLAB analysis tool: full control of the system (from the SiPMs power supply and amplification to the digitizer parameters) is easily performed thanks to an user-friendly GUI LabVIEW based software. Data analysis will be supported by advanced tools developed in MATLAB.
- Educational Notes: several Educational Notes will be provided and continuously developed for covering different Physics topics and helping the tutor in exploiting the most advanced capabilities of the kit.

No Need of High Voltage!

Let the digital revolution start in your lab!

Multidisciplinar

A complete software suite for remote control of the system and data analysis

Be part of the project: develop your own experiment and make it available for the user community!

The CAEN Educational kit is indeed an all in one solution to perform a series of experiments for undergraduates in Physics and Engineering, addressing a plurality of topics in statistics and basic Nuclear Science. Here is a set of proposed experiences:

Poisson statistics

Poisson statistics is explored at increasing level of complexity: at entry level, the distribution in the number of dark pulses in a well defined time window is analyzed, as a pure counting exercise. As a further step, the statistics of the number of photons emitted by a LED source is considered, accounting for the Poisson character of light emission and detector effects modifying the underlying model. As a final step, the distribution of the time of arrival of the dark pulses or cosmic rays is analyzed.

Gamma spectrometry

The kit comprises two spectrometry heads, engineered coupling scintillating crystals (LYSO, BGO, CsI) to SiPM and enabling students to perform basic experiments on gamma spectrometry (system linearity, energy resolution, relative light yield of the different scintillators, volume effects in the peak-to-total ratio). A software for background subtraction and optimal spectra fit is provided in MATLAB.

Positron Annihilation

Positron Annihilation studies, as a primer on the principle of PET scanners, based on the use of a ^{22}Na source and two spectrometry heads positioned back-to-back around the source. An advanced investigation may also address the principle of TOF-PET, recording the time-of-arrival of gammas resulting by the positron annihilation.

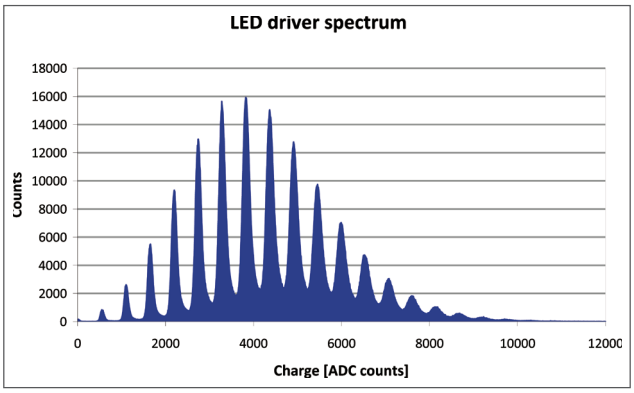
Cosmic ray

Cosmic ray studies, relying on the plastic scintillator tile provided with the kit.

X-Rays

Study of the response of a SiPM to a constant X-ray flux illuminating a scintillating tile or fiber, studying the sensitivity interposing different water equivalent absorbing layers, as a primer on beam profilometry and dosimetry.

For every topic, an accompanying suite is being developed, including an instructor's guide, indications on the analysis and a library of routines in MATLAB, a platform widely distributed in the academic community.



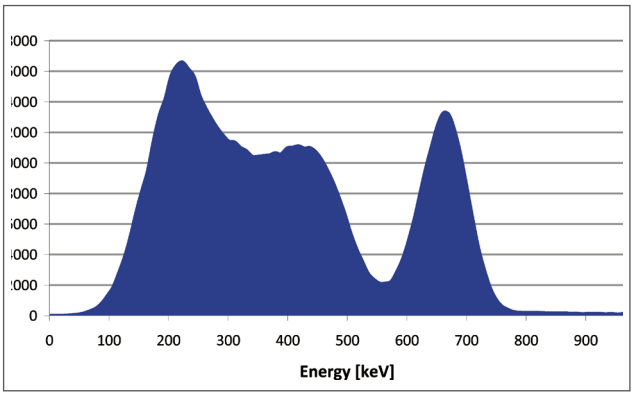
Spectrum of the photons emitted by the LED Driver and detected by a SiPM at room temperature.

Educational Kit LabVIEW Control Software

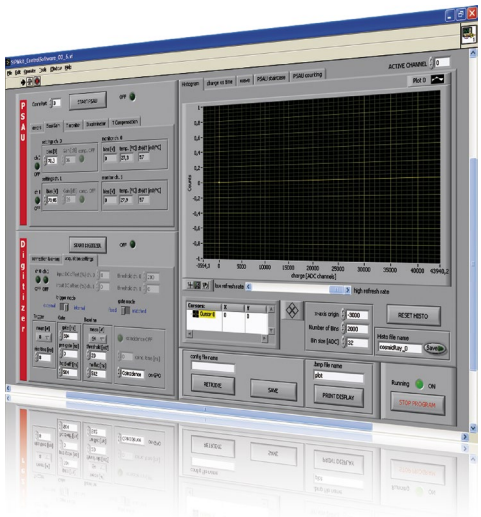
CAEN developed a dedicated control software for the control of the Silicon Photomultiplier Kit. Through a simple graphical interface the user can manage all the parameters of both the Power Supply, the Amplification Unit and the Digitizer in a single window. With few easy steps the user can control the Bias and the Gain of the SiPM. The user can also easily modify the thresholds and the digital outputs. In the same window the digitized signals can be monitored, for a real time fine tuning of the set-up. Energy spectra, Charge Vs. Time and Staircase plots are also displayed in the plot tab.

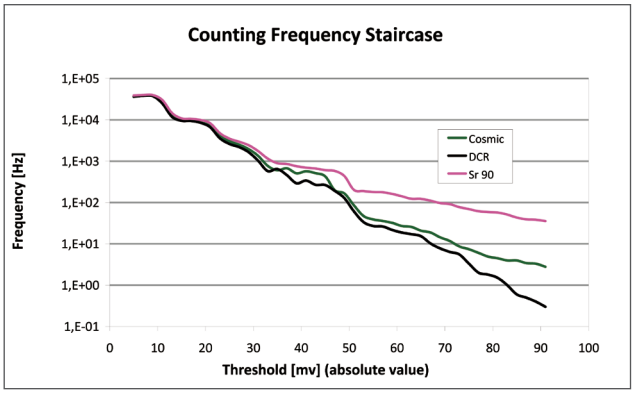
The possibility to save the data to file has been implemented for further data analysis.

- No programming required
- Simultaneous control of the digitizer and of the SP5600 Unit
- User friendly all-in-a window graphical interface
- Data saving in two formats: ASCII, Binary
- 6 plots available: Wave, Histogram, Charge Vs. Time, 2D Histogram, Staircase, Counting

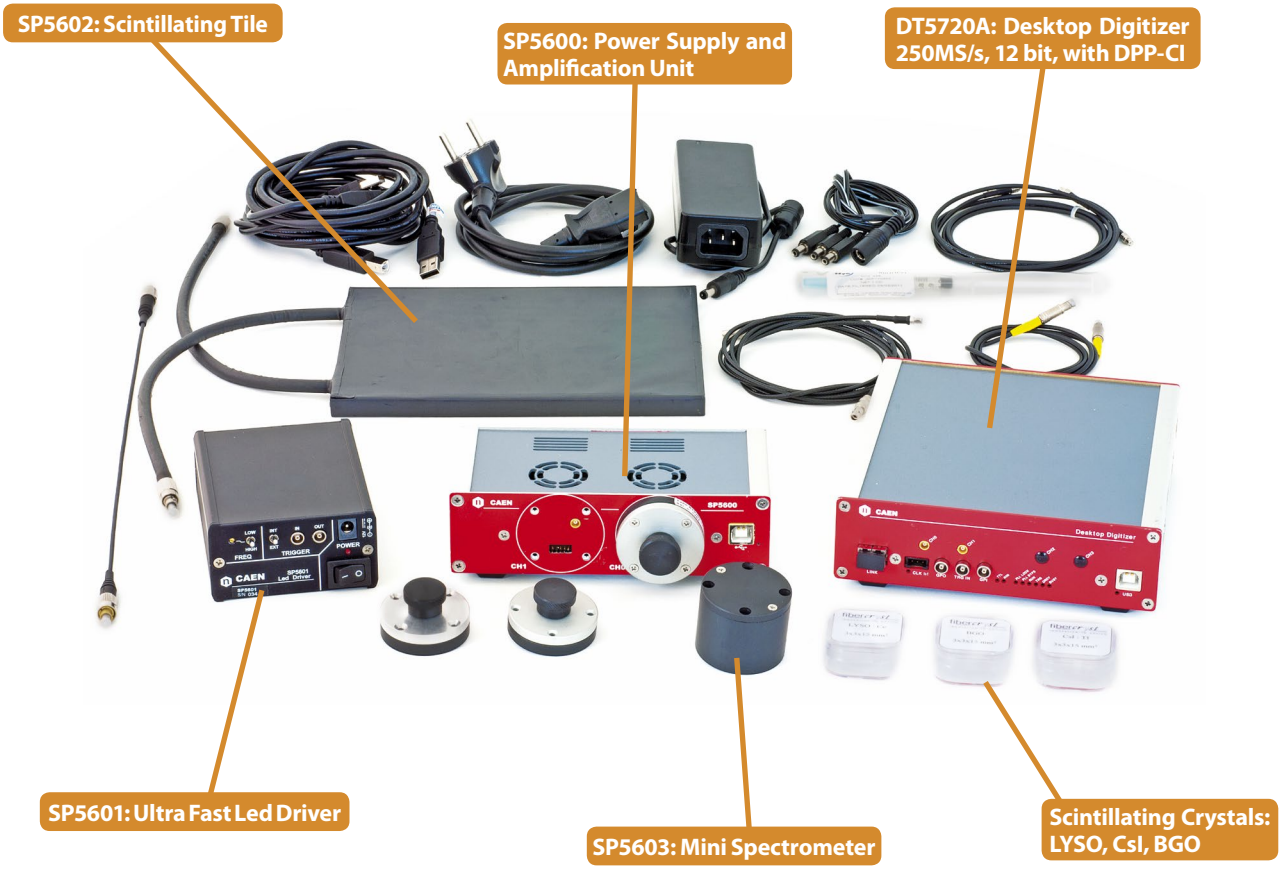


^{137}Cs spectrum obtained with a CsI crystal. The resolution on the 662 keV peak corresponds to a FWHM ~10% of the peak.





Two channel coincidence rate versus discrimination threshold. The black data correspond to the random coincidence rate of the two sensors.



Educational Kit Content	
Rugged Case	nr. 1
DT5720A 250 MS/s, 12 Bit Desktop Digitizer with DPP-CI	nr. 1
SP5600 General Purpose Power Supply and Amplification Unit	nr. 1
SP5601 LED Driver	nr. 1
SP5602 Scintillating Tile	nr. 1
SP5603 Mini Spectrometer with Hamamatsu MPPC S10362-33-50C 3x3 mm^2 and scintillating crystals 3x3x15 mm^3: CsI, BGO and LYSO	nr. 1
SP5604 Mini Spectrometer with 6x6 mm^2 sensor and CsI (Tl) crystal 3x3x30 mm^3	Optional
SP5650A Sensor Holders with Hamamatsu MPPC S10362-11-100C 1x1 mm^2 embedded	nr. 2
LEMO-LEMO cable	nr. 1
MCX-LEMO cables	nr. 2
MCX-MCX cables	nr. 2
Optical Fiber FC terminated	nr. 1
Optical grease	nr. 1
USB cables	nr. 2
AC/DC adapter (+12 V out) with a 3-cord adapter	nr. 1
Quick Start Guide and Documentation	nr. 1

Did you Know?

All the parts composing the kit are available separately, to be used in different applications and to expand the kit capability.

CAEN *Tools for Discovery*

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