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Tools for Discovery

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HANDBOOK OF EXPERIMENTS

SG6020E Photomultiplier Tube (PMT)

Measurement of photomultiplier plateau curves

Particle Detector Characterization

EDUCATIONAL KIT

SP5600E

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CAEN EDUCATIONAL · SG6020E

Measurement of photomultiplier plateau curves

Categories: CAEN Experiments, Particle Detector Characterization | Tags: Gamma detection, Gamma rays, Nuclear Physics, γ Spectroscopy

Difficult	Execution Time	Data Analysis	Radioactive Sources
		No	Yes

Hardware setup

This experiment guide is referred to the **SP5600E** educational kit.

Equipment: SP5600E – Educational Kit

Model	**SP5600E**
Description	Backpack Detector

Purpose of the experiment

The goal of this experience is the identification of the working point of a photomultiplier by determining the plateau curve.

Fundamentals

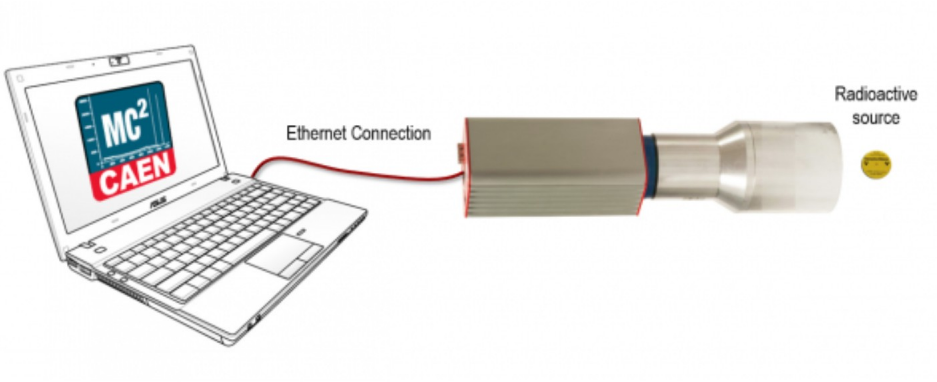
Photomultiplier tubes (often abbreviated as PMT) are widely used Physics, in medical equipment, analytical instruments and industrial measurement systems. The PMTs make use of the photoelectric effect and have good response speed and sensitivity (low-light-level detection).

Photomultiplier tubes are usually tested in combination with a ^{137}Cs radiation source and a NaI(Tl) scintillator. There are two characterization measurement methods in scintillation counting. One is the spectrum method which uses a pulse height analyzer to measure an energy spectrum. The other one, described in this experimental activity, is the counting method. Plateau characteristics are measured by setting a threshold value and counting all pulses with amplitudes greater than that value while changing the supply voltage for the photomultiplier tube. The plateau region is such that the count rate will not vary even if the supply voltage is changed within this region. The importance of operating the photomultiplier in the plateau zone is then understood for a correct use of each particle detection apparatus that includes this instrument.

Requirements

The present experiment was performed using ^{137}CsI source but the background can be use in replacement.

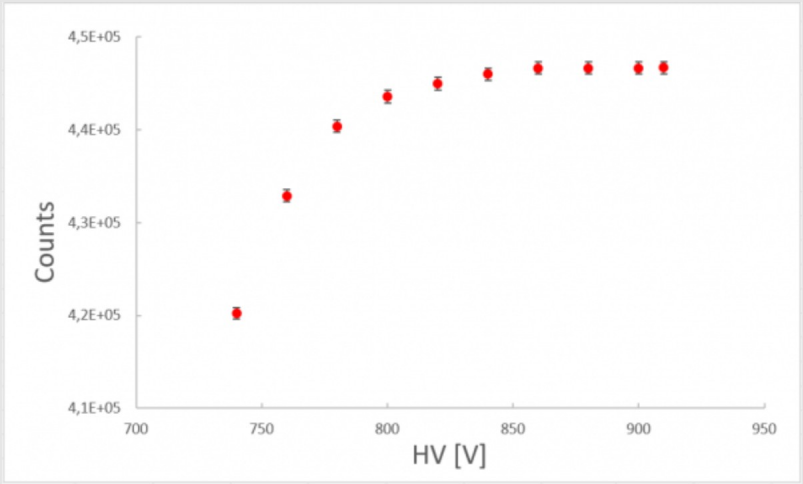
Carrying out the experiment



Experimental setup block diagram

- The experiment can be performed both by taking off the instrumentation from the backpack and using the backpack with the open zipper. To power ON γstream, press the ON/OFF button.
- Take care that the γ-stream internal battery is charged, otherwise use the external power system.
- Connect the Ethernet cable from γstream to the PC and configure the Ethernet network of your PC.
- Connect γ-stream to the MC2Analyzer software through Ethernet connection.
- Place the radioactive source close to the scintillator/under the central part of the backpack and run the software.
- Set the threshold value and keep it fixed for the whole measurement time, by varying the PMT supply voltage.

Results



Example of plateau characteristics.

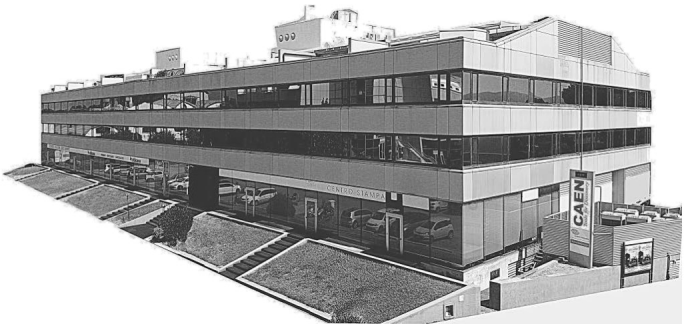
The identification of the working point where the output signals of the photomultiplier are less affected by variations in the power supply voltage.

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