



CAEN Educational Handbook

Nuclear and Particle Physics Experiments



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MEASUREMENT OF PHOTOMULTIPLIER PLATEAU CURVES

SG6020E

SP5640 - GAMMAEDU

Difficulty



Execution Time



Purpose of the experiment

The goal of this experiment 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 in 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

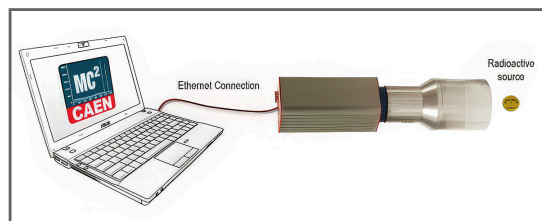
one, described in this experimental activity, is the counting method. Plateau characteristics are measured by setting a threshold value and counting all pulses with amplitudes greater than that value while changing the supply voltage for the photomultiplier tube. The plateau region is such that the count 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}Cs source but the background can be used in replacement. ☢

Carrying out the experiment

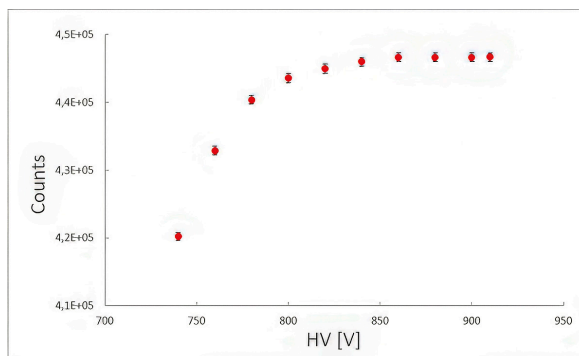
The experiment can be performed both by taking off the instrumentation from the backpack and using the backpack with the open zipper. To power ON ystream, press the ON/OFF button. Take care that the ystream internal battery is charged, otherwise use the external power system. Connect the Ethernet cable from ystream to the PC and configure the Ethernet network of your PC. Connect ystream 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.



Experimental setup block diagram.

Results

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



Example of plateau characteristics.