



CAEN Educational Handbook

Nuclear and Particle Physics Experiments



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Purpose of the experiment

This experiment investigates the impact of a reflective coating on the light collection efficiency in a plastic scintillating tile.

Fundamentals

Scintillating materials are commonly used in high energy physics and medical applications because of their capability to convert high energy radiation into optical photons and they are usually coupled with a photosensor. Scintillator has a key role in the detection chains and it is often mandatory to extract and detect the generated scintillation light as efficiently as possible. The amount of light generated during the scintillation process is, in

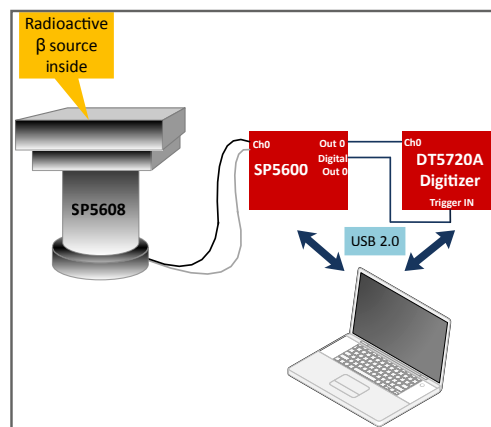
standard configurations, only a small percentage of this light reaches the photodetector. Extracting as much light as possible from the crystal becomes this crucial, given that both energy and time resolution depend strongly on the amount of detected light. Indeed, extracting more light enables a more accurate estimation of the energy absorption in the scintillator itself, and, moreover, if not covered by any material, the scintillator can let light escape through its lateral surfaces, thus losing a significant number of optical photons.

Requirements

Beta Radioactive Source.

Carrying out the experiment

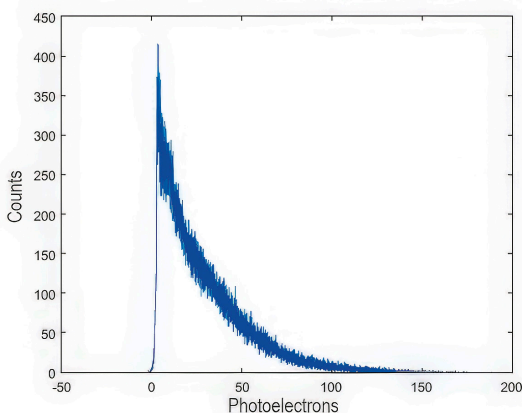
Connect the power and the MCX cables of the SP5608 tile to one channel of the SP5600. Connect the two channel outputs to DT5720A: the analog output to channel 0 and the digital output to "trigger IN" of the digitizer. Use the default software values or optimize the parameters to evaluate the contribution not coming from the beta source and choose the discrimination threshold in mV. After that, switch off the power supply, open the SP5608 top and place the beta source on the scintillating tile. Close the support top, switch ON the power supply and acquire the beta spectrum. Repeat the spectrum acquisition after having uniformly covered the scintillator with the Teflon tape leaving only a window open for the optical coupling with the SiPM.



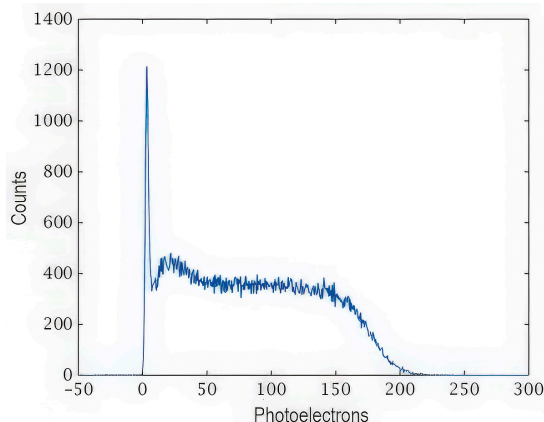
Experimental setup block diagram.

Results

The presence of a white coating allows the user to observe the improvement of the light collection via the acquisition of ^{90}Sr spectrum.



^{90}Sr spectrum acquired just by using optical grease as coupling between scintillator and SiPM.



^{90}Sr spectrum acquired by using Teflon coating and Optical interface sheet between scintillator and SiPM.