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Tools for Discovery

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HANDBOOK OF EXPERIMENTS

SG6140C Environmental Radioactivity Indoor

Energy calibration of System based on LYSO crystal and Fertilizer sample

Environmental radioactivity

EDUCATIONAL KIT

SP5630EN

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Energy calibration of System based on LYSO crystal and Fertilizer sample

Categories: CAEN Experiments, Environmental radioactivity | Tags: Energy calibration, Energy Resolution, Gamma detection, Gamma rays, Nuclear Physics, γ Spectroscopy

Difficult	Execution Time	Data Analysis	Radioactive Sources
		Yes	No

Hardware setup

This experiment guide is referred to the **SP5630EN** educational kit.

Equipment: SP5630EN – Environmental kit

Model	**i-Spector – S2570B**	**Samples**
Description	Intelligent Silicon Photomultiplier Tube	Empty Beaker & Test Sample, Fertilizer and Rock, Canisters of Activated Carbon, Calibration Crystal

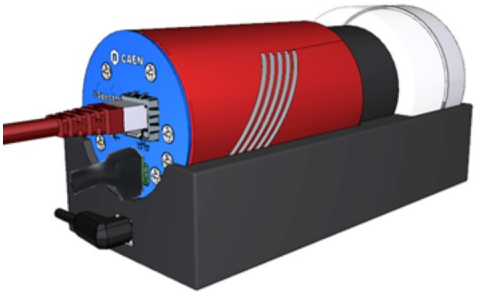
Purpose of the experiment

Recording γ energy spectra of several radioactive sources and detecting the photo-peaks to calibrate the response of the system is the main goal of the experiment.

Fundamentals

The calibration of the spectrum is the first step to be done in a typical experiment. The settings, like the trigger threshold, gate width, etc., used in the calibration should be used in the following measurements proposed in the Environmental kit. It is usually convenient to use radioactive sources with a wide range of energies, from hundreds keV to MeV. In the proposed experiment we take advantage of the LYSO(Ce) (Cerium-doped Lutetium Yttrium Orthosilicate) crystal (202 keV and 307 keV) and the Fertilizer sample (1468 keV) to have a calibration curve for the full spectrum range. The LYSO is also a scintillator material which can be coupled with SiPM or PMTs to detect gamma rays.

Carrying out the experiment



Experimental setup

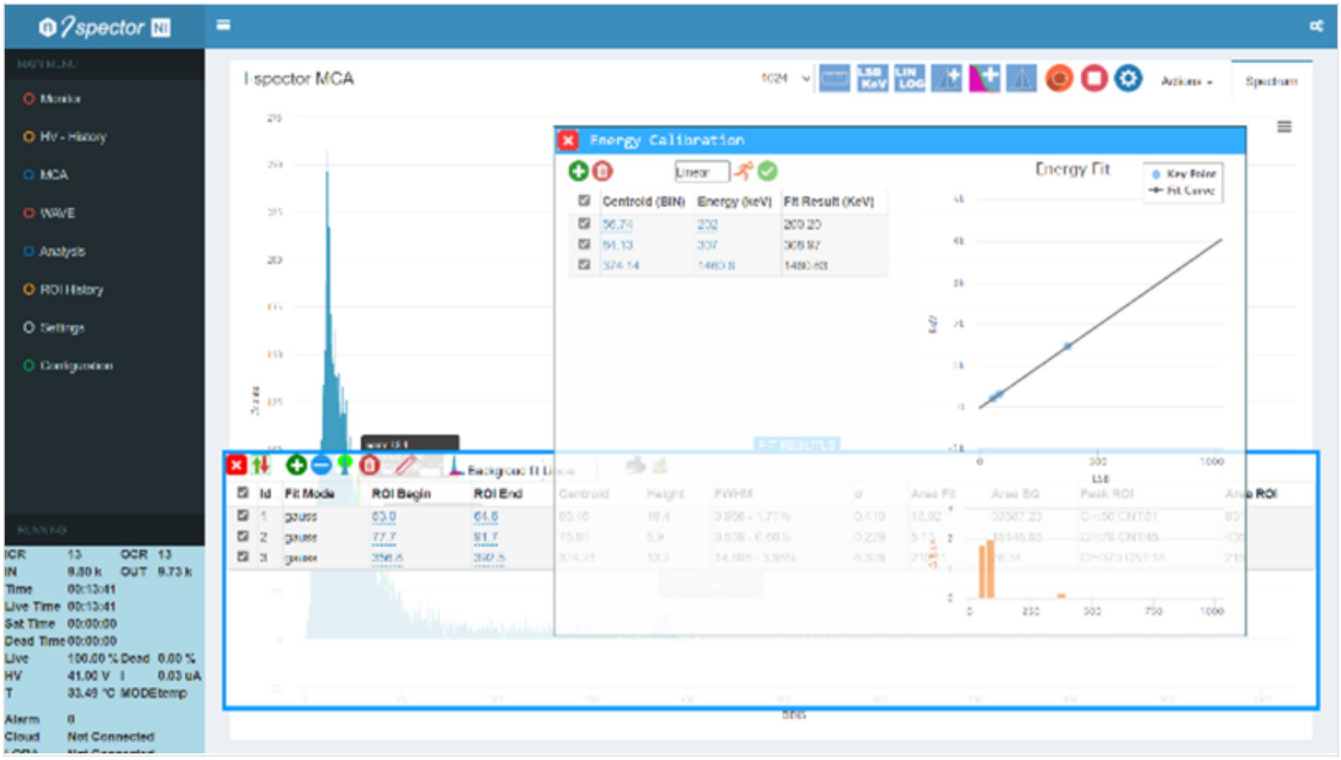
Put the i-Spector digital into the base and place, one at a time, the radioactive sources to be used for the calibration, like, for example, the LYSO crystal and the Fertilizer to have two/three points for calibration. Power on the i-Spector and connect the Ethernet cable. Wait until the temperature is stable from the web interface (it can take half an hour from power on).

Check the waveform, modify the threshold and gate width, if needed, then start the measurement of the energy spectrum.

Take for example 5 minutes of acquisition with the LYSO crystal sample and 30 minutes of acquisition with the Fertilizer. Acquisition time with laboratory radioactive sources can be reduced according to the source activity. Select the ROIs and use the calibration tool to calibrate the spectrum.

Results

By fitting the photo-peaks with a Gaussian curve, the system linearity as a function of energy is verified. The final calibration function is used for the consecutive activities.



Linear dependency in the Energy Calibration.

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