B.2.1 SG6140C Energy calibration of System based on LYSO crystal and Fertilizer sample

Ordering Options

Equipment	
Code	**Description**
WK5630ENAAAA	SP5630EN - Environmental Kit
or the Kit Plus	
WK5630XENAAA	SP5630ENP - Environmental Kit Plus

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. See for example the SP5600C and SP5600AN kits.

Marie Skłodowska Curie was a Polish and naturalized-French physicist and chemist who conducted pioneering research on radioactivity. She was the first woman to win a Nobel Prize, the first person and only woman to win twice in multiple sciences. Together with her husband, she was awarded half of the Nobel Prize for Physics in 1903, for their study into the spontaneous radiation discovered by Becquerel, who was awarded the other half of the Prize. In 1911 she received a second Nobel Prize, this time in Chemistry, in recognition of her work in radioactivity. Radium discovery opened the door to deep changes in the way scientists think about matter and energy. She also led the way to a new era for medical knowledge and the treatment of diseases.

https://www.aip.org/history/exhibits/curie/brief/index.html

Equipment

SP5630EN - Environmental Kit

Model	i-Spector - S2570B	Samples
Description	Intelligent Silicon Photomultiplier Tube	Samples
		
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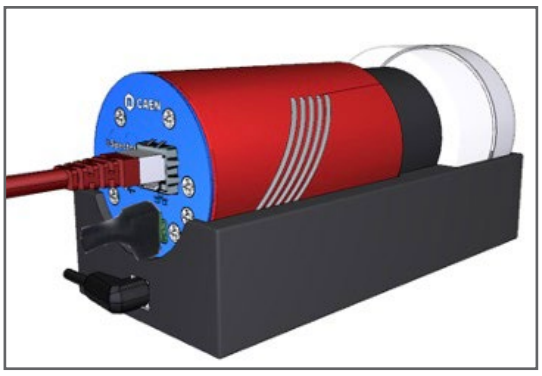
Requirements

No other tool is needed



Experimental setup block diagram

Carrying out the experiment

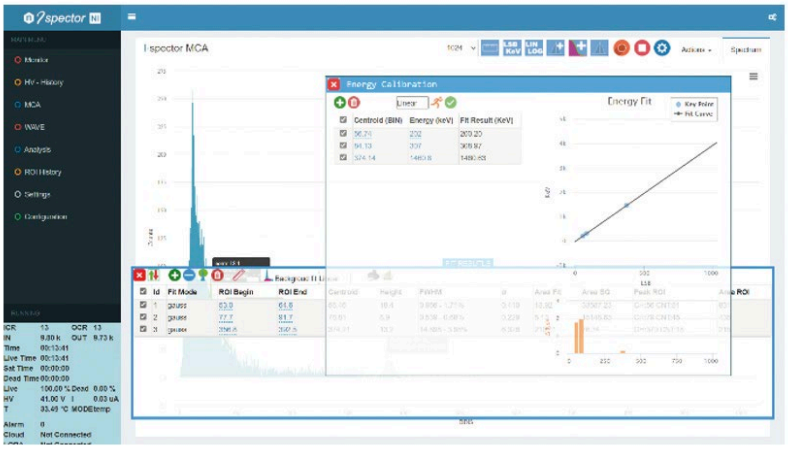
Put the i-Spector digital into the base and place, one at a time, the radioactive sources to be used for the calibration, like, for example, the LYSO crystal and the Fertilizer to have two/three points for calibration. Power on the i-Spector and connect the Ethernet cable. Wait until the temperature 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