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HANDBOOK OF EXPERIMENTS

SG6141C Environmental Radioactivity Indoor

Background Measurements

Environmental radioactivity

EDUCATIONAL KIT

SP5630EN

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Background Measurements

Categories: CAEN Experiments, Environmental radioactivity | Tags: 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

Measurement of the background radioactivity to be subtracted from the energy spectra of the samples.

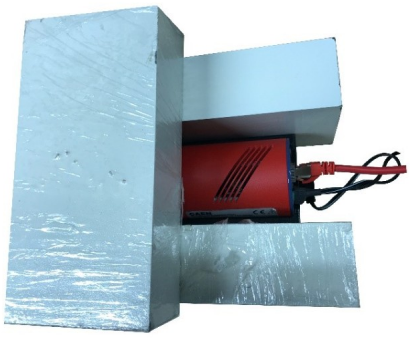
Fundamentals

The main contributors to the background energy spectrum are the gamma radiations that originate from naturally occurring radioactive isotopes dispersed in the environment and the materials that surround the detector, and the radiations whose origin can be traced to cosmic rays. To properly identify the radioactive source and its activity, the background must be acquainted. The background spectrum is obtained by removing the radioactive source and must be acquired in the same conditions of the desired spectra. A possibility is to use lead blocks to cover the system and reject as much as possible environmental radioactivity that could hide interesting peaks.

Requirements

Lead blocks are strongly suggested.

Carrying out the experiment



Experimental setup block with Lead blocks covering the active scintillator of i-Spector digital

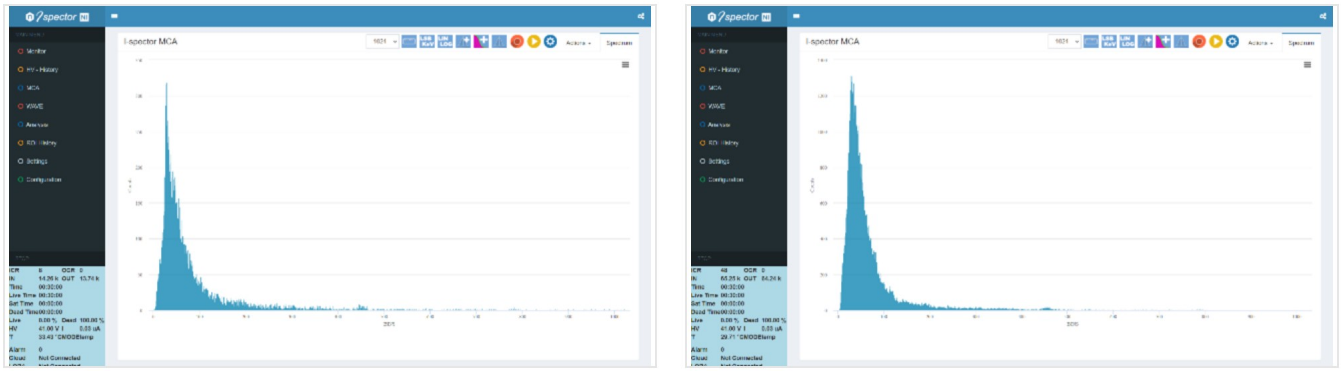
Decide whether or not to use the Lead blocks to cover the system. The entire system can be covered by lead blocks, as shown in the figure below, just taking care to leave air flow for the i-Spector base fans. In any case, it is important to make all the measurements on the same conditions of the background one, so that the background subtraction can be made easily. The same software settings must be applied as well, including the acquisition time, so that the background subtraction can be done bin-by-bin in the energy spectrum.

Put the i-Spector digital into the base. No sample is required in this experience. 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 30 minutes of spectra acquisition.

Results

The user can easily check how lead blocks reduce the gamma radioactivity, by comparing the spectra with and without lead blocks (left and right respectively). A factor of 4 in the background reduction is visible when using the Lead blocks.



Environmental background acquired without Lead blocks (top) and with Lead blocks (down). Note the different scale on the y-axis. The radioactivity is reduced by a factor of about 4 when using the blocks.

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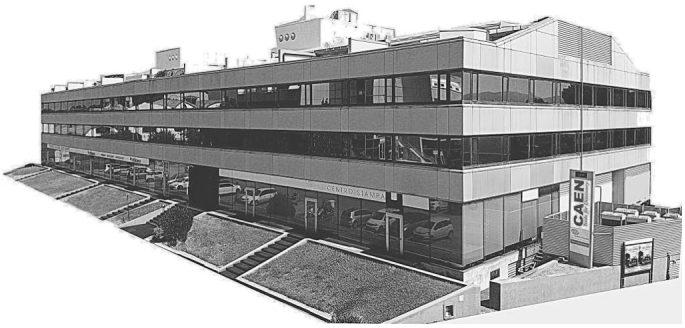

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