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HANDBOOK OF EXPERIMENTS

SG6153E Environmental Radioactivity Outdoor

Environmental detection as a function of the soil distance

Environmental radioactivity

EDUCATIONAL KIT

SP5640

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Environmental detection as a function of the soil distance

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 **SP5640** educational kit.

Equipment: SP5640 – Backpack Detector

Model	**SP5640**
Description	Backpack Detector

Purpose of the experiment

The main goal of the experiment is to understand how the measurement of the γ environmental radiation can be affect by the distance of the point of measurement.

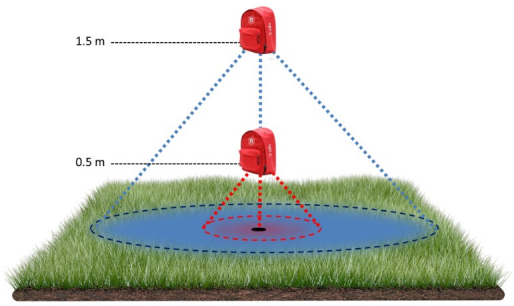
Fundamentals

The linear attenuation coefficient of gamma radiation μ represents the inverse of the distance at which the number of photons is reduced by a factor 1/e, as can be inferred by the following equation: $N = N_0 e^{-\mu x}$, where μ in cm^{-1}. This Equation is the key for understanding the lateral horizon of in-situ gamma ray spectroscopy. The horizontal field of view of a gamma-ray detector expresses the relative contribution to the total signal that is produced within a given radial distance from the detector vertical axis. The lateral horizon depends on the height of the detector: for instance, a spectrometer that was placed at ground level detect gammas coming from the first 25 cm of depth and it receives 90% of the signal from a radius of ~0.5 m. At a height of 0.5 m, 95% of the signal come from a radius of ~8 m and the maximum percentage contribution to the flux comes from the concentric hollow cylinder of soil having a ~0.6 m radius centered at the detector vertical axis. When it's carried on the shoulders of the operator (1.5 m of height) the signal reaches ~95% at ~20 m and the maximum percentage contribution to the flux comes from the concentric hollow cylinder with a radius of ~1.2 m.

Requirements

No other tools or instruments are needed.

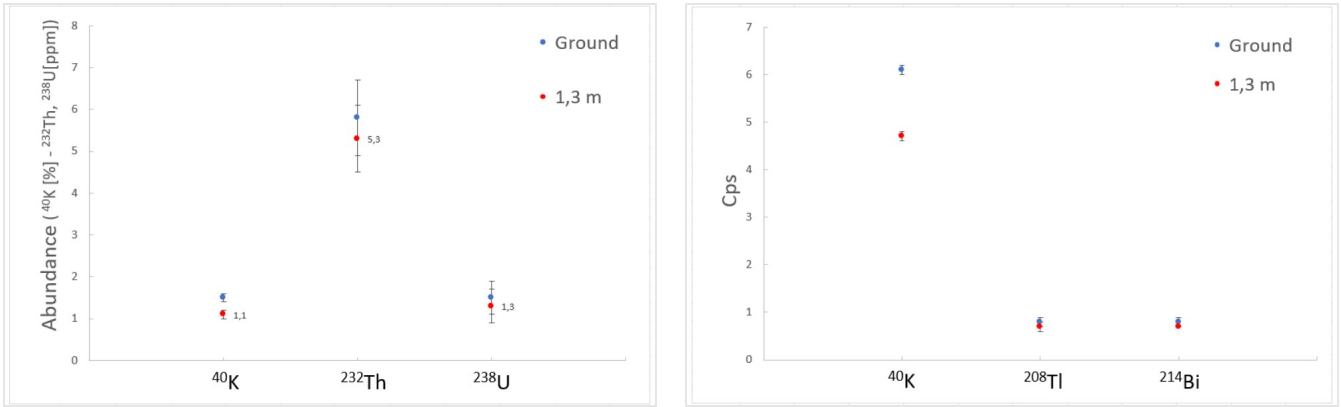
Carrying out the experiment



- Power on the γstream inside the red backpack.
- Power on the tablet and associate the two devices via Bluetooth.
- Take care that the γstream internal battery is charged, otherwise use the external power system.
- Start the experiment by placing the backpack on the floor/soil.
- Set the acquisition time to about 5 minutes and see the results. If the statistic is not enough increasing the acquisition time.
- Repeat the measurements at different heights/distances from soil and pay attention to perform the measurements in the same conditions exactly.

Results

The measurements results show a gamma detection decrease as a function of the soil distance.



a) b)

Result of the in-situ-y-ray measurements that were performed at different heights: the counts per second go three isotopes (plot on the right) and the abundance (plot on the left).

HEADQUARTERS

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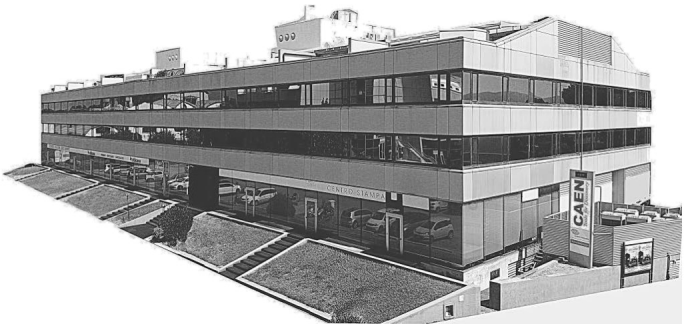

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