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HANDBOOK OF EXPERIMENTS

SG6151E Environmental Radioactivity Outdoor

Ground coverage Effect on the Environmental Monitoring

Environmental radioactivity

EDUCATIONAL KIT

SP5640

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Ground coverage Effect on the Environmental Monitoring

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 experimental activity aims to give to the user a critical understanding of environmental radioactivity phenomenon.

Fundamentals

The use of portable γ-ray spectrometers (NaI) as a probe for exploring the natural radioactivity allows the users to be able to grasp quantitative insights of the spatial distribution of the terrestrial radionuclides (i.e. U, Th and K) in the daily environment.

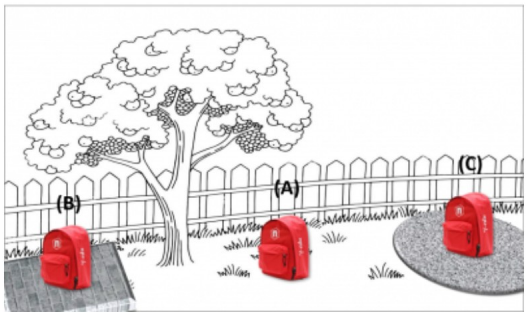
In the specific case of in-situ γ-ray spectroscopy, there are many variables that could interfere with the measurement, such as the presence of vegetation or buildings and the morphology of the area affecting the field of view of the spectrometer. In addition, soil humidity has an attenuating effect on γ-radiation and sources having weak intensities need longer acquisition times. Moreover, the different types of ground coverage (like asphalt, grass, or brick) affect the measurement considerably. It is interesting to observe and understand how some type of ground coverage can be most or least abundant in natural radioactivity terms.

Requirements

No other tools or instruments are needed.

Carrying out the experiment

- Power on the γ-stream 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 measurement campaign in field and place the backpack on the floor almost 1 m far from the trees, manhole or other construction.
- 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 for the different types of ground coverage, like asphalt, grass, or brick and compare the results.



Experimental setup.

Results

Different ground coverage types are investigated by recording in-situ γ-ray spectra. The mean and standard deviation of the ^{40}K, ^{238}U, and ^{232}Th concentrations can be compared and discussed critically.

Ground Coverage	Number of Measurements	^{40}K [10^{-2} g/g]	^{238}U [µg/g]	^{232}Th [µg/g]
Brick	7	0.82 ± 0.19	1.8 ± 0.5	4.1 ± 1.0
Grass	28	2.08 ± 0.32	1.7 ± 0.4	9.5 ± 1.8
Asphalt	7	1.20 ± 0.10	1.9 ± 0.4	5.1 ± 0.7

Mean and standard deviation of the K, U, and Th concentrations that were obtained from the in-situ γ-ray measurements distinguished according to the different ground coverage types (Data from University of Ferrara).

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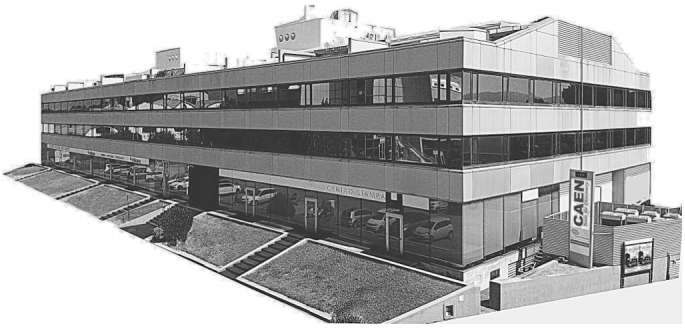

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