B.3.1 Enviromental monitoring in field

SG6150E

Dedicated kit	
Description	pp.
SP5640 GammaEDU	183

Difficulty	Execution Time	Data Analysis	Radioactive Sources
		NO	NO

Requirements

No other tools are needed.

Equipment

SP5640 - Backpack Detector

Model	SP5640
Description	Backpack Detector

p. 183

Purpose of the experiment

Increase of the familiarity with environmental radioactivity topic via measurements in field which combine nuclear engineering and computer science for a better comprehension of basic physics concepts.

See the Application

Fundamentals

Radioactivity is a physical phenomenon occurring when an unstable nucleus undergoes a transition from one energy state to another. In addition to the cosmogenic radionuclides, natural sources include the so-called primordial radionuclides existing since the Earth formed and that have not completely decayed due to their long half-life (~109 years and longer). The most common isotopes in the Earth responsible for the so-called terrestrial radiation are Uranium (^{238}U), Thorium (^{232}Th), and Potassium (^{40}K), together with their multiple daughter products. It is estimated that 80% of the average annual dose for the world's population comes from natural background radiation. While ^{40}K undergoes one single decay, ^{238}U and ^{232}Th produce

decay chains that comprise α, β, and/or γ decays.

In the outside environment, especially in 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.

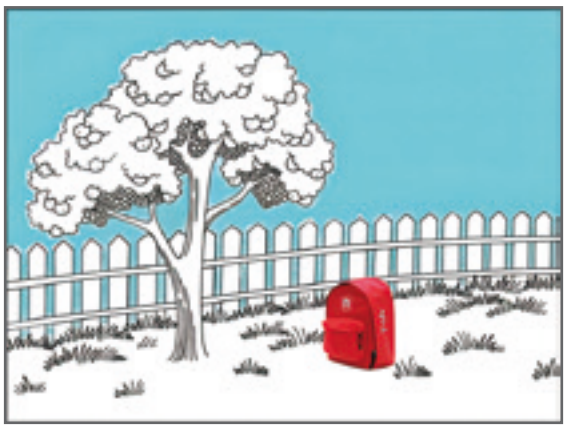
Carrying out the experiment

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 measurement campaign in land field and place the backpack on the floor almost 1m 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.

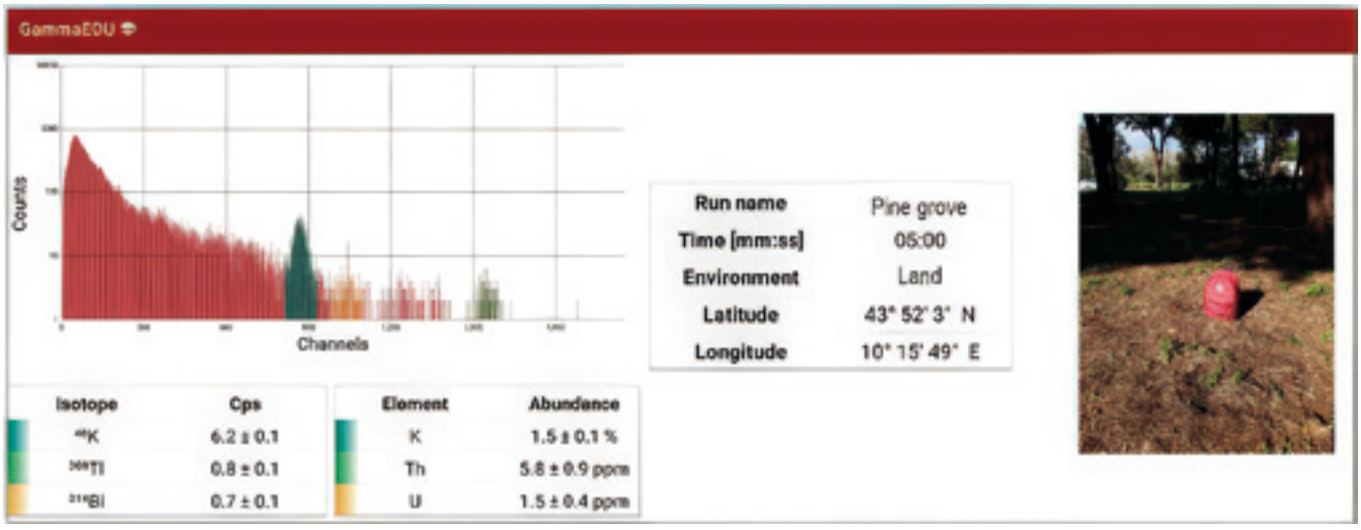
It is good practice to repeat the measurement in order to obtain the mean and standard deviation of the result.



Experimental setup block diagram.

Results

The measurement results are compared to the reference values in the terrestrial crust. The discrepancy in the reference levels can be explained by the building material, distance from soil and more. This kind of measurement is important for the evaluation of natural radiation exposure from building materials [2013/59/ Euratom Directive and by UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation)].



Experimental result of in-situ γ-ray spectroscopy taken place in Viareggio, Italy.