Università degli Studi di Ferrara

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GammaEDU: an innovative tool for sensitizing society to natural radioactivity

Matteo Albéri, Carlo Bottardi, Enrico Chiarelli, Kassandra Giulia Cristina Raptis, Andrea Serafini, Virginia Strati and Fabio Mantovani

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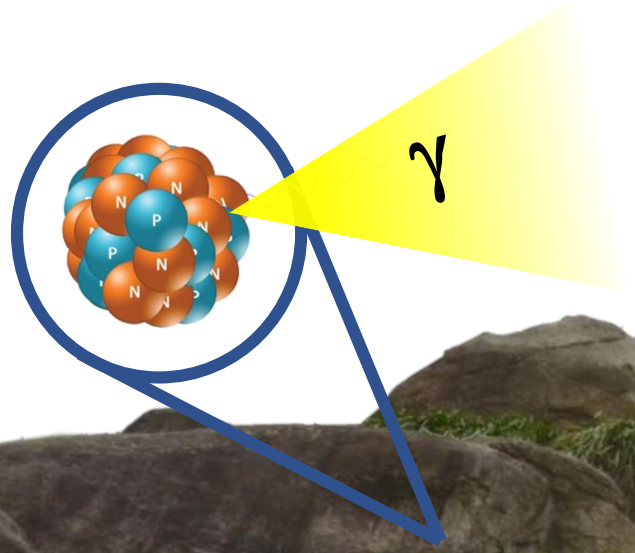
Natural radioactivity: the misperception of the hazard

- The public imagination often associates a negative feeling to this natural phenomenon.
- Sometimes the mere mention of the word “radiation” evokes hazard.
- Misconceptions and the shortage of didactic paths dealing effectively with the topic.
- New smart technological tools for promoting knowledge exchange between researchers, general public and students are needed.

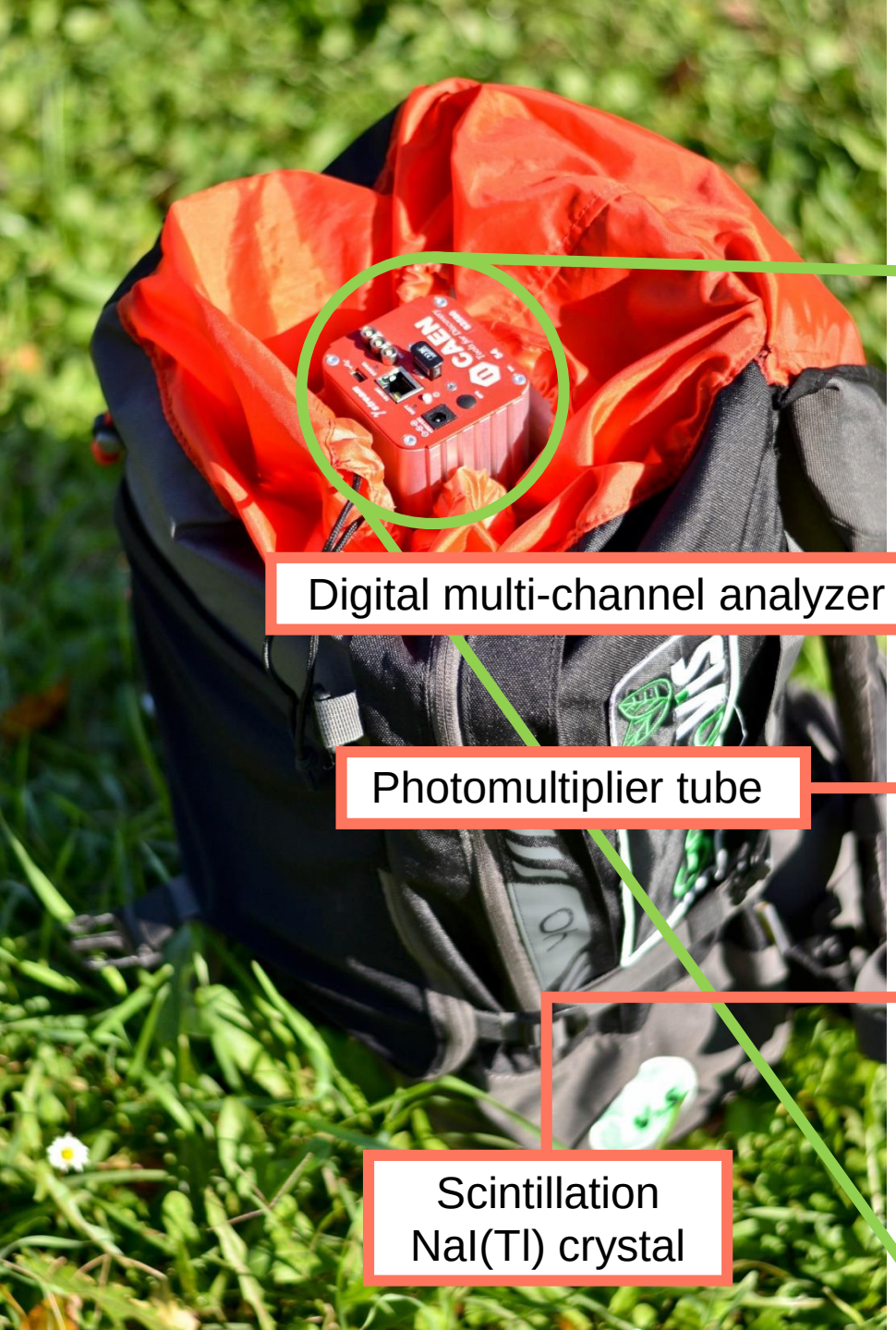
The terrestrial radioactivity surrounds us

- Terrestrial radioactivity is due to naturally occurring radioactive elements with half-lives comparable to the Earth's age.
- Potassium and some radioisotopes in the uranium and thorium decay chains emit γ-rays having energy of the order of MeV and can be easily detected via γ-rays spectroscopy.
- We can quantify the presence of radioactive elements using a scintillator detector.



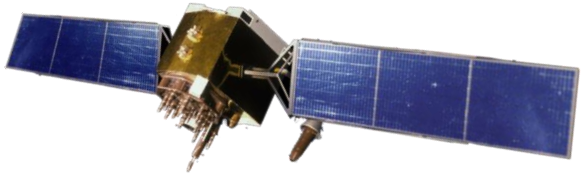
Element	Radioisotope	Isotopic abundance	Half life	Typical abundance
Potassium	^{40}K	0.012%	1.3×10^9 years	0.02 g/g [2%]
Uranium	^{238}U	99.3 %	4.5×10^9 years	3 µg/g [ppm]
Thorium	^{232}Th	100 %	14.1×10^9 years	10 µg/g [ppm]

GammaEDU: an easy-to-use portable gamma detection backpack



- High sensitivity radionuclide identification and quantification.
- Full stand-alone operation with embedded CPU, data storage (SSD) unit.
- Power supply for up to 8 hours of operation.
- Wireless connectivity through Bluetooth interfaces.
- Automatic synchronization with GPS navigation.
- The high-efficiency NaI(Tl) scintillator detector allows to perform a measurement in ~3 minutes.

GammaEDU app: let's start the gamma acquisition!



Take the GPS coordinates

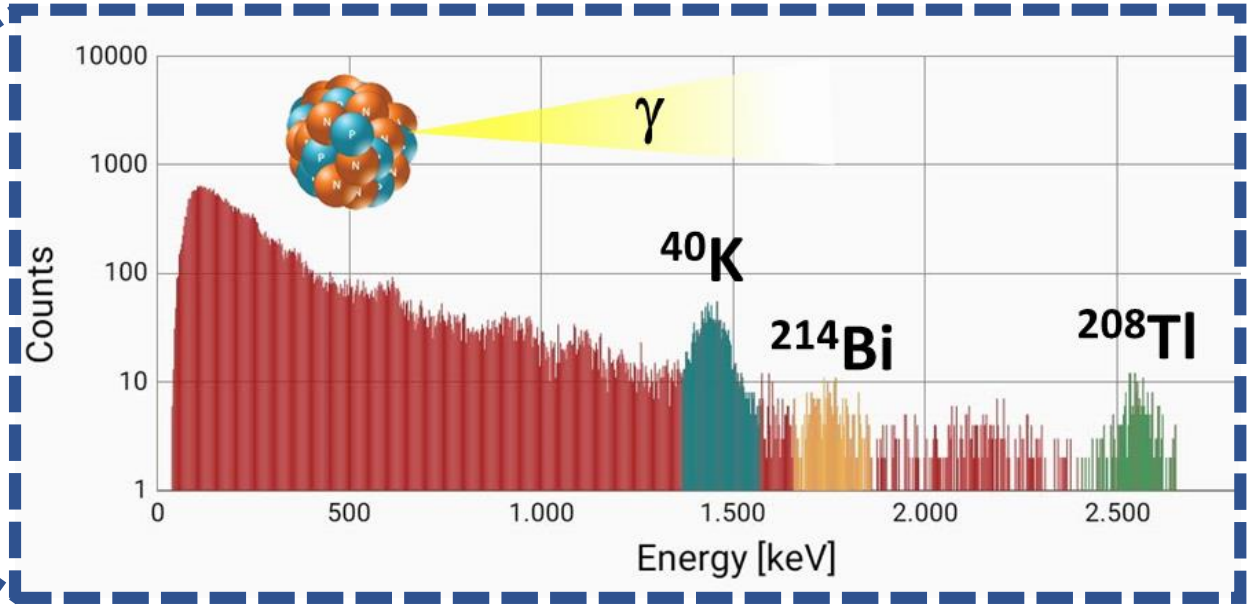
Take note of the surrounding environment

Shoot a picture of the measurement site

Set the acquisition live time

Discover environmental radioactivity

Interpretation of the distinct features of the gamma spectrum

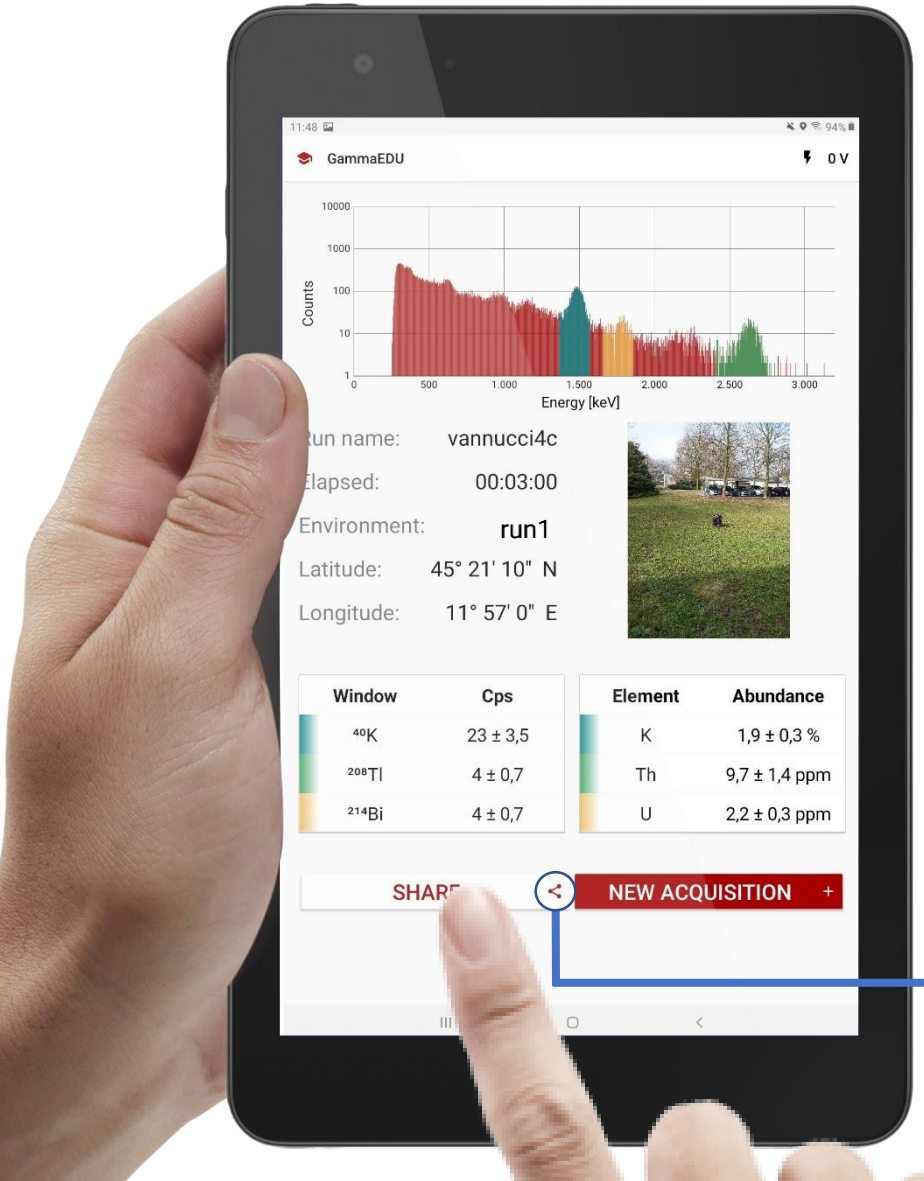


Element	Abundance
K	1,9 ± 0,3 %
Th	9,7 ± 1,4 ppm
U	2,2 ± 0,3 ppm

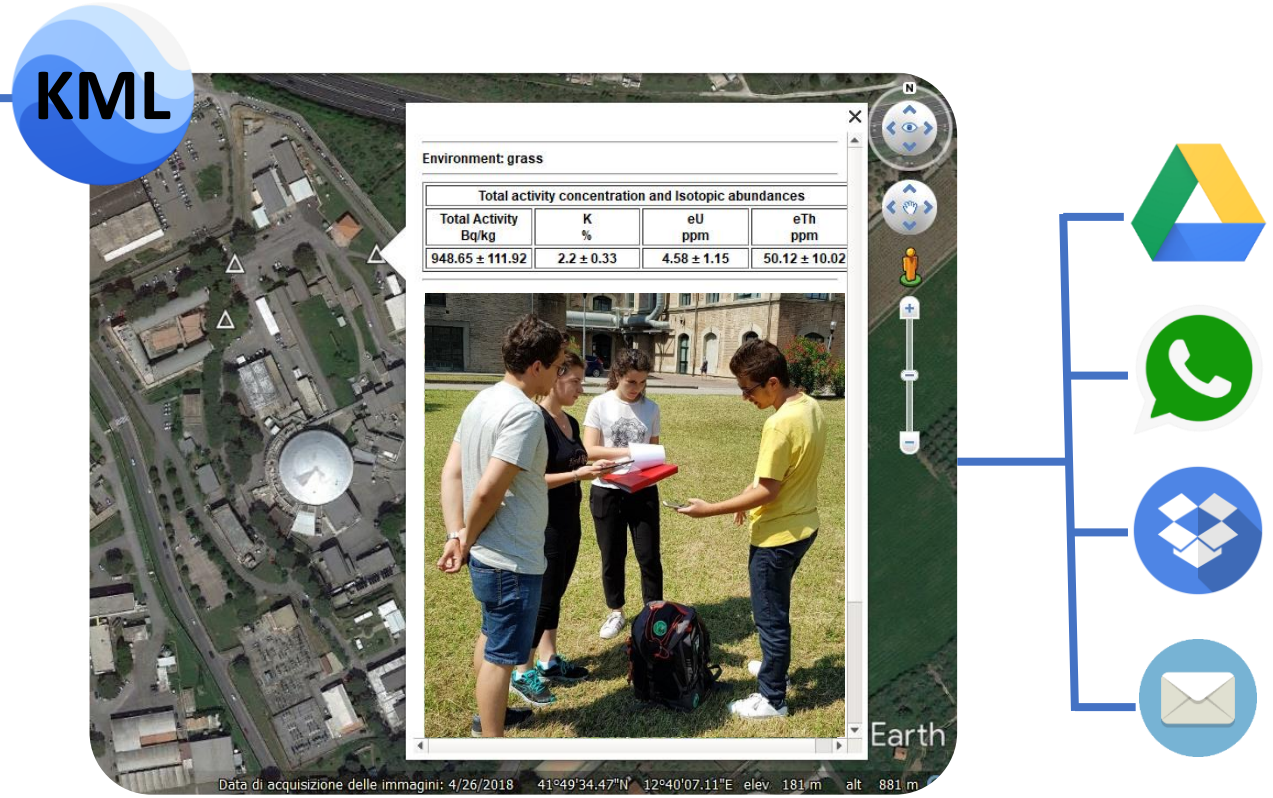
The operator can acquire and analyze in real time a γ-ray spectrum to get the K, U and Th abundances

GammaEDU stimulates interdisciplinary discussions!

Share the results

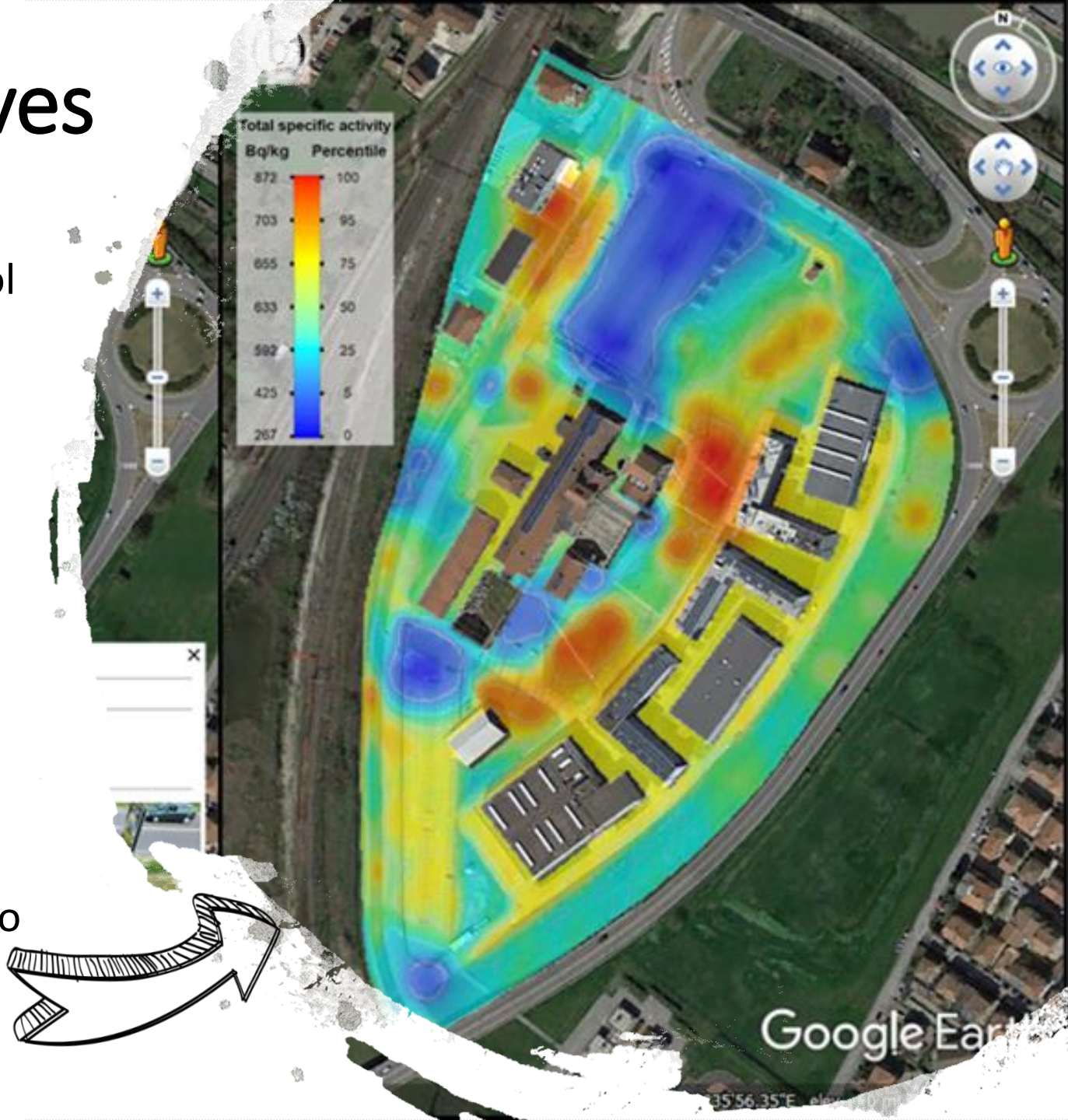


- The kml file reports the measurement points, each one assigned with the corresponding radionuclide abundances and a picture of the acquisition location.
- The file is ready to be visualized on Google Earth and shared for producing a radioactivity map of the area.

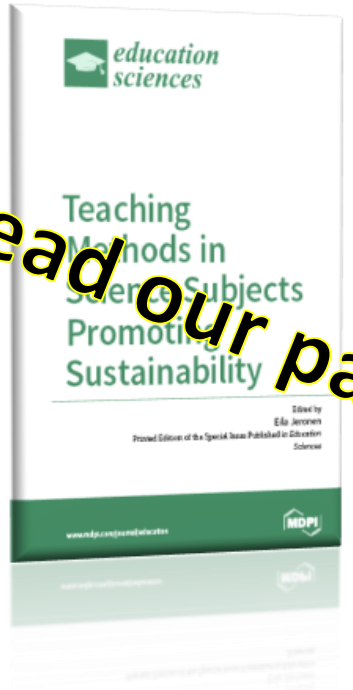


Conclusions & perspectives

- GammaEDU is a powerful and easy-to-use tool to explore in-situ environmental radioactivity.
- It was successfully tested during several educational activities.
- It stimulates critical understanding of environmental radioactivity and heighten awareness of possible natural hazards.
- The measurements could be post-processed to create the map of the natural radioactivity.



Let's start the discussion



Read our paper!

Training future engineers to be ghostbusters: hunting for the spectral environmental radioactivity.

Albéri, M., M. Baldoncini, C. Bottardi, E. Chiarelli, S. Landsberger, K. Raptis, A. Serafini, V. Strati and F. Mantovani. Education Sciences, 9, 15 (2019). DOI: 10.3390/educsci9010015 (download pdf here)

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Discovering Environmental Radioactivity

Education for students and teachers on in-situ gamma-ray spectroscopy

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