Automation of the gamma-ray spectrometry setup of the environmental radioactivity laboratory

Project: MSc level
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Project Aim / Scope:
The aim of the study is to develop an automation program (via python and/ roots) to do full gamma-ray spectrometry analysis of environmental samples

Abstract:

Mining activities may lead to an increase in the radioactivity levels in any area by bringing naturally occurring radioactive material to the surface of the earth. Mining areas that are not rehabilitated after the mines have ceased operations usually result in areas that are covered with mine dumps. These areas are sometimes in close proximity to towns or are used for informal settlements. Studies of mine dumps in South Africa [1,2,3] have shown that the rivers that run close to the mine areas are polluted, due to seepages of various elements from the underground water [4].

Radioactivity levels at these areas and where there are sources of man-made sources of radiation such as nuclear power plants, must be monitored for radiation levels for the benefits of human beings, animals and plants.

Research into the levels of radionuclides (natural and man-made) of various samples (powder, soil, water etc.) is conducted at iThemba LABS using the Environmental Radioactivity Laboratory (ERL) instruments. Gamma-ray spectrometry is a basic tool used to quantify the activity concentrations of various gamma-emitting radionuclides present in samples.

For this study, the aim is to use available programming language (preferably python) to automate the analysis process after the sample spectrum has been counted. This will have to benchmarked for various sample matrix, in terms of geometry, density, etc.

Relevant References:

[1] R. Lindsay et al. Applied Radiation and Isotopes 66 (2008) 1611-1614.
[2] M.B. Ajani et al, Radiation Protection and Environment (2020), 43, 70-76
[3] J.N Ongori et al, Journal of Environmental Radioactivity 140 (2015) 16-24.
[4] G. Madvizire et al, Journal of Environmental Management 133 (2014) 12–17.