Indoor Radon Measurements

Jožef Stefan Institute, Exercise JSI-13

Main topic: Radiation detection

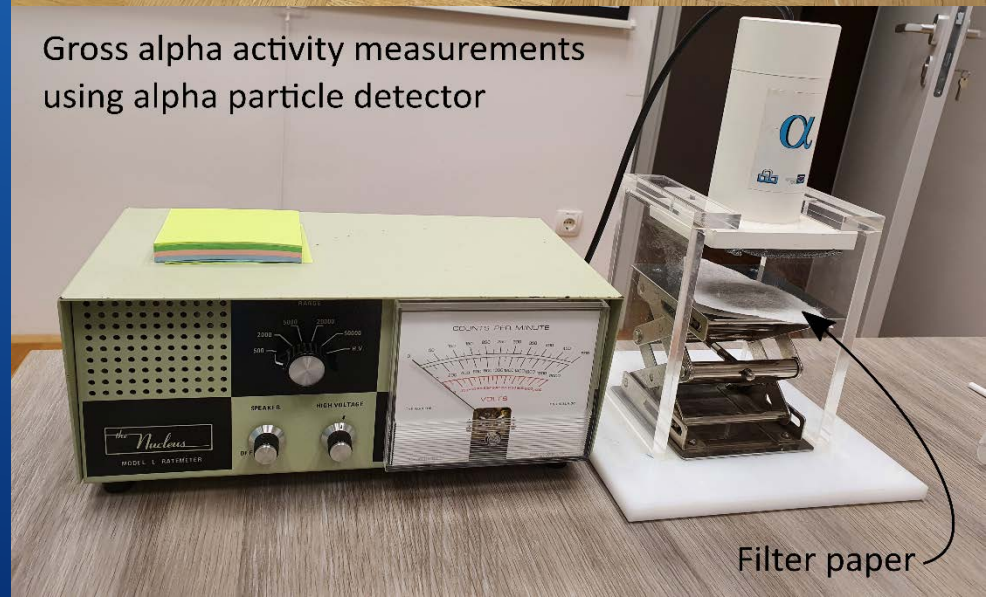
Keywords: Radioactive decay chain, radon progeny, radon detection

Purpose: The purpose of the exercise is to measure the activity of radon and radon progeny in an indoor environment. Radon is one of the products of the ^{238}U decay chain and it is the only one in gaseous form, and therefore the only one that can escape the out of the Earth's crust. Radon may represent a significant contribution to natural radiation exposure, especially in karstic terrain (for which Slovenia is renowned), and after smoking, is the second most important cause of lung cancer.

Level of exercise:	☐ Basic	☒ Advanced	☒ Complex
Level of education:	☒ BSc	☒ MSc	☒ PhD

What you will learn:
Students will discuss the formation of radon through radioactive decay and diffusion into the atmosphere perform simple experiments to demonstrate the presence of radon by detection of alpha radiation; perform radon concentration measurements using the Kuznetz method, by filtering radon progeny from the air and subsequent gamma spectrometry measurement.

Important information:
- Minimal size of student group: 4
- Maximal size of student group: 12
- Overall duration of the experiment (in wall clock hours): 3-4



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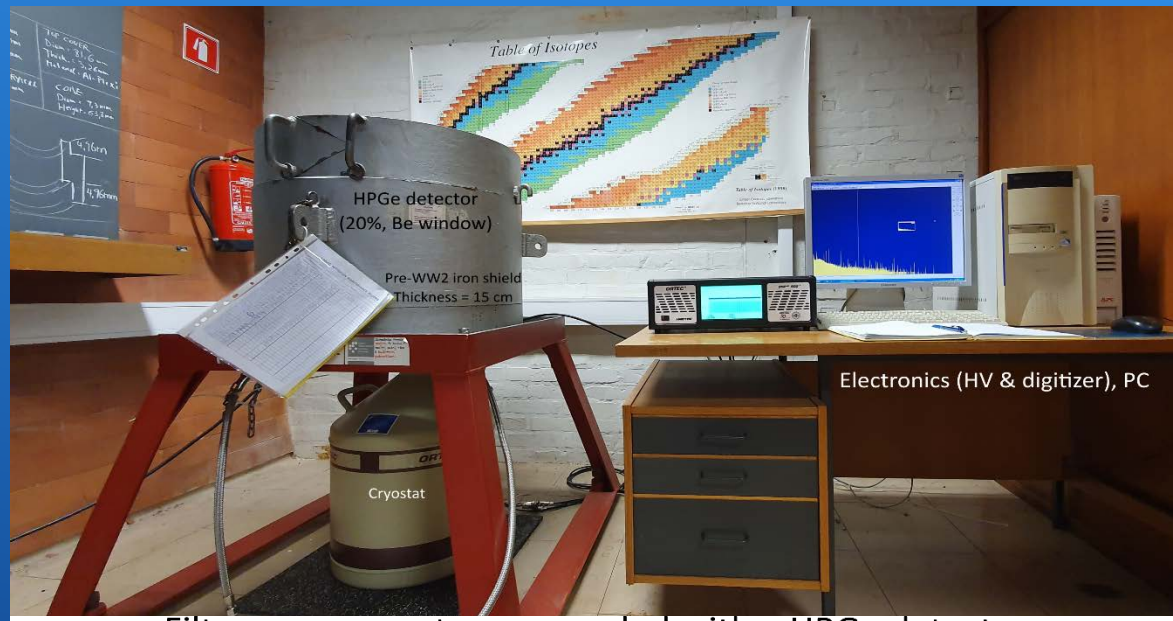
Possibility to perform experiment on demand: ☒ Yes ☐ No
Frequency of occurrence: on demand
Examination modalities: report
Teaching languages: English, Slovenian, Italian, Serbian

Pre-knowledge required: Basics on radioactivity, basics on decay chains, basics on radiation detection.

Instruments required for exercise:
- Ionizing radiation detector
- Gamma spectrometer
- Vacuum cleaner and filter paper

Execution:
- After a discussion on the formation of radon through radioactive decay and its diffusion into the atmosphere, students will capture radon progeny onto electrostatically charged balloons and measure the emitted alpha particles.
- Perform radon concentration measurements using the Kuznetz method by
  - filtering radon progeny from the air onto filter paper using a vacuum cleaner
  - gamma spectrometry measurements of the filter paper
  - analysis of the recorded gamma spectrum
  - determination of the radon concentration from the measured radon progeny activities

Limitations:
It is strongly advisable that prior to this exercise, students perform the "Gamma spectrometry" exercise in which the gamma spectrometry technique is explained and demonstrated.



Filter paper spectrum recorded with a HPGe detector