

Main topic: Reactor Physics

Keywords: Neutron activation, activation products, gamma spectrometry, HPGe detector, LaBr detector

Purpose: The water activation experiment serves as a demonstration of the creation of radioactive isotopes from nuclear reactions with fast neutrons in pure water. The main reaction product, N-16, is important from the radiation protection standpoint, as it emits energetic and highly penetrating gamma rays, in water-cooled fission and fusion devices. Conversely, measurements of the activities of the product radioactive isotopes represent an independent method of monitoring of the reactor power, leak detection, etc.

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

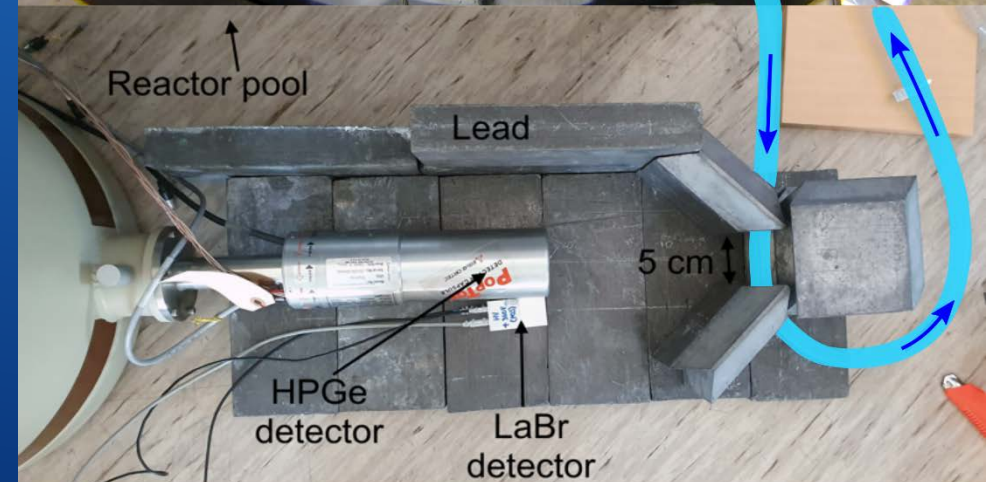
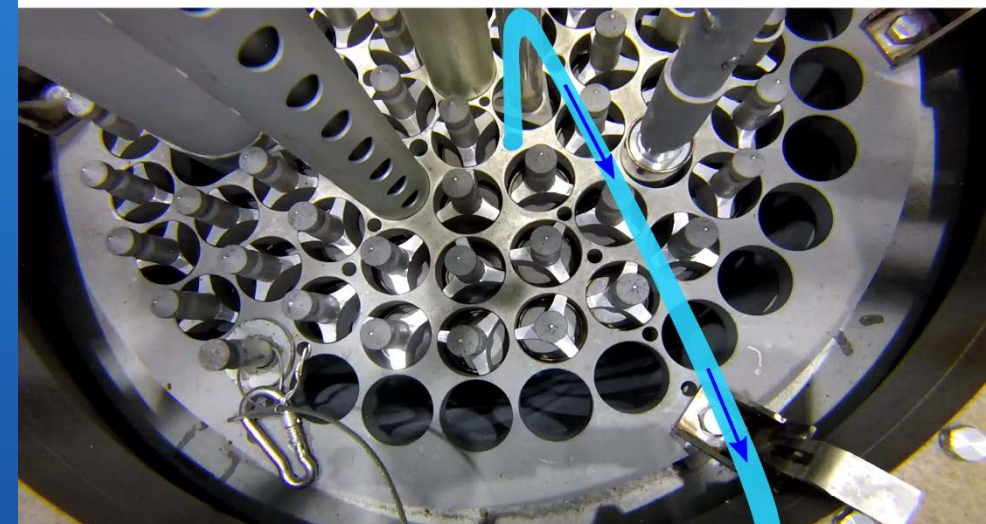
What you will learn:

Students will observe methods for measuring the activation of the primary water and measure the activity of primary water as a function of the reactor power.

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

Reactor core



Detectors on reactor platform

Possibility to perform experiment on demand: Yes No

Frequency of occurrence: on demand

Examination modalities: report

Teaching languages: English, Slovenian, Serbian/Croatian, Italian, French

Pre-knowledge required: Basics on neutron activation and radiation detection.

Instruments required for exercise:

- Reactor instrumentation
- Water activation loop
- HPGe and LaBr gamma spectrometers
- Handheld dosimeter

Execution:

- Set up of the experiment on the reactor platform (installation of water activation loop, lead shielding, detectors)
- Discussion on the detectors
- Detector energy calibration using radioactive calibration sources
- Measurements of the activity of individual radionuclides due to water activations and the total dose rate as a function of reactor power
- Discussion of the results.

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.

