

Measurement of thermal diffusion length in graphite

BME Training Reactor, Exercise BME-06

Main topic: Reactor Physics /Neutron diffusion

Keywords: diffusion length, moderator materials, thermal neutrons, reflector

Purpose: The experiment is aimed at the determination of the diffusion length of thermal neutrons in graphite. The diffusion length is determined by the application of activation foils placed inside the thermal column, which is located in the irradiation tunnel. After irradiation, the activity of the foils, which is proportional to the activating neutron flux is measured using a beta counter. The obtained results are analyzed and compared to the predictions of diffusion theory.

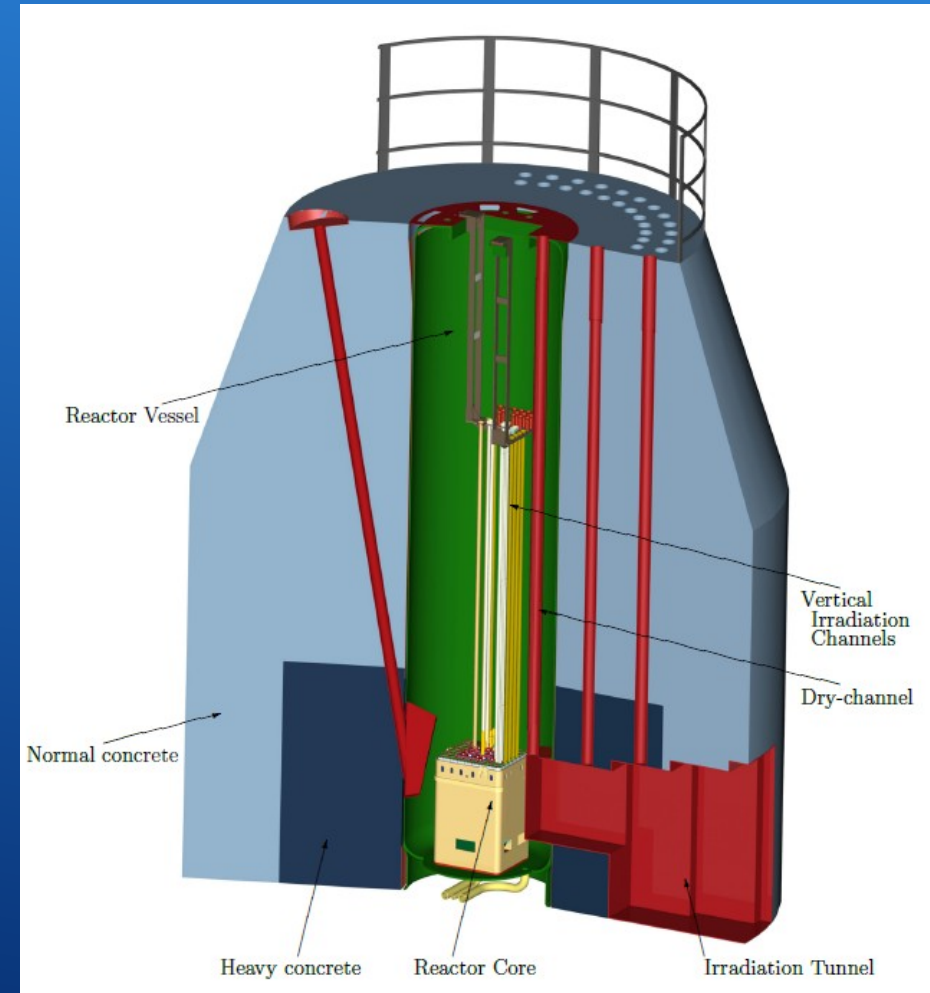
Level of exercise: Basic Advanced Complex
 Level of education: BSc MSc PhD

What you will learn:

Students learn how to measure the spatial distribution of thermal and epithermal neutrons in a reactor environment. They also learn the safety and radiation protection rules of working with activated material in the immediate vicinity of a reactor.

Important information:

- Minimal size of student group: 2
- Maximal size of student group: 6
- Overall duration of the experiment (in wall clock hours): 4



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Possibility to perform experiment on demand: Yes No

Frequency of occurrence: 10-12 times per year

Examination modalities: short test before measurement, experiment report after

Teaching languages: English, Hungarian

Pre-knowledge required: Fundamentals of nuclear and reactor physics and nuclear measurement techniques.

Instruments required for exercise:

- Reactor (the measurement is made in the graphite thermal column in the irradiation tunnel)
- Dy-Al and In activation detectors (in the form of thin foils)
- Cd capsules for covering the In foils
- Beta scintillation counter with electronics

Execution:

- Bare and cadmium covered Dy and In activation detectors are placed at several locations inside the graphite columns in a horizontal line perpendicular to the source plane.
- After the irradiation at 20 kW reactor power, the irradiation tunnel is opened and the activation detectors are removed.
- The activity of the reaction products is measured by means of a beta scintillation counter.
- Based on the relative activities, the diffusion length of neutrons in graphite is determined.

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.

