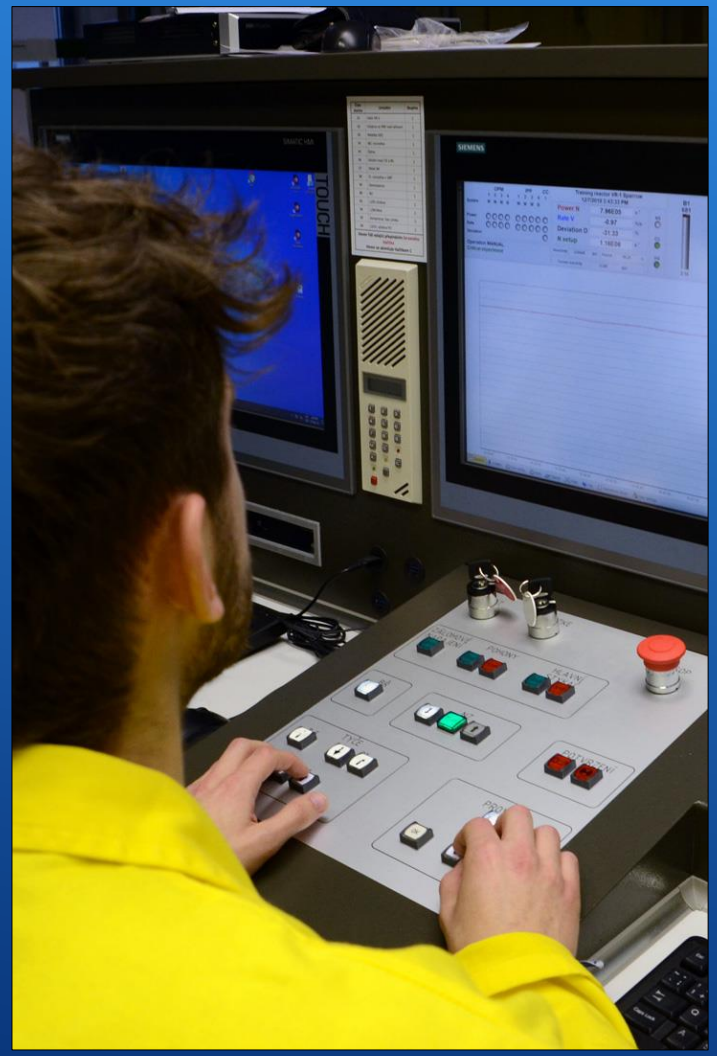
Determination of neutron's diffusion length

Czech Technical University in Prague, Experiment CTU14

Main topic: Experimental reactor physics

Keywords: Neutron transport, neutron diffusion

Purpose: Understanding of neutron transport is crucial for both neutron and reactor physics. The whole concept of neutron lifetime is a necessary background for any experimental and theoretical research. Generally accepted idea of neutron lifetime distinguishes two different sections based on neutron energy, i.e. fast and thermal section. Each energy section is affected by the surrounding materials in significantly different ways. Neutron diffusion is connected to the neutron transport in the thermal energy section.



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

What you will learn:

Students will learn the concept of neutron lifetime, slowing-down processes, and the related equations. The experiment will provide the measured data for calculation of diffusion length in water and/or graphite material. After that the calculated values can be compared with the tabular ones. Determination of neutron's diffusion length is highly suitable for students studying nuclear engineering as their major curriculum.

Important information:

- Minimal size of student group: 3
- Maximal size of student group: 6
- Overall duration of the experiment (in wall clock hours): 3

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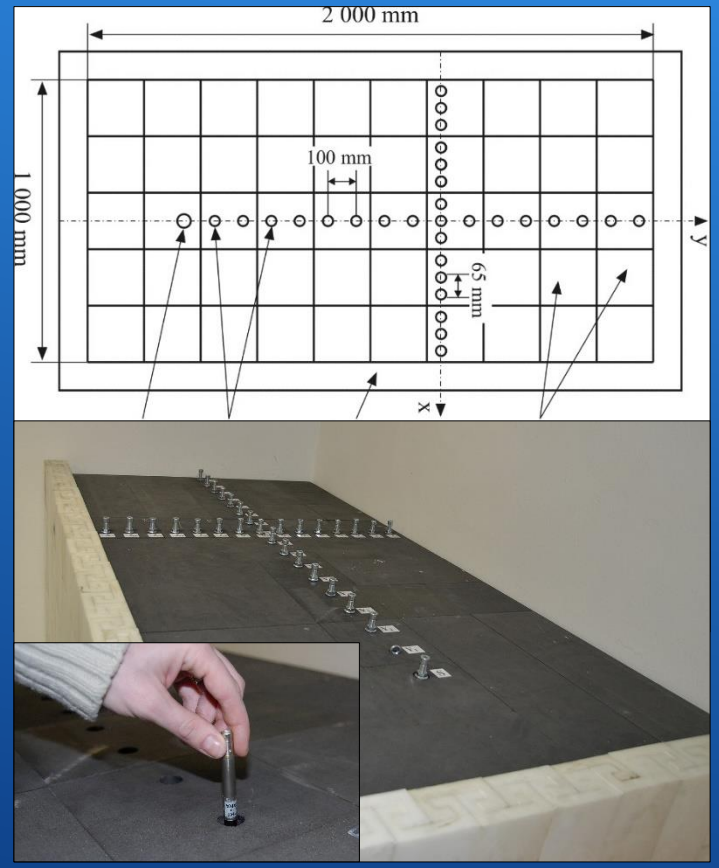
Possibility to perform experiment on demand: ☒ Yes ☐ No
Frequency of occurrence: On demand, ca 30 times/year
Examination modalities: Protocol, evaluation, discussion
Teaching languages: English, Czech



Pre-knowledge required: The students should be familiar with introduction to the neutron physics, particularly with basic concept of neutron interactions with materials. In order to understand the experiment, the students should also have knowledge of neutron detection. Prior to this experiment, CTU02 - Neutron detection should be performed.

Instruments required for exercise:

- Neutron source
- Water and/or graphite blocks
- Neutron detection system

Execution:
Measurement of neutron's diffusion length in water requires placement of the AmBe neutron source inside a water pool. Neutron response should be measured in different positions inside the water pool in order to evaluate the behaviour of spatial neutron flux. The system with graphite material is, in general, very similar, but the students must place the detector directly into the drilled holes in a graphite block.

Limitations:
No particular limitation for this experiment, only general requirements for entry to research nuclear installation according to the Czech nuclear legislation should be fulfilled.