Determination of neutron's Fermi age

Czech Technical University in Prague, Experiment CTU15

Main topic: Experimental neutron physics

Keywords: Neutron transport, neutron slowing-down, Fermi age

Purpose: Understanding of neutron transport is crucial for both neutron and reactor physics. 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. Fermi age represents an area that will be covered by a neutron movement during its slowing-down processes.

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 its related equations. The experiment will provide the measured data for calculation of Fermi age in water and/or graphite material. After that the calculated values can be compared with the tabular ones. Determination of neutron's Fermi age 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

Determination of neutron's Fermi ages

Czech Technical University in Prague, Experiment CTU15

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 interaction with other materials. In order to understand the experiment 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:
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 neutron's Fermi ages in water and/or graphite material. After that the calculated values can be compared with the tabular ones. Determination of neutron's Fermi ages is highly suitable for students studying nuclear engineering as their major curriculum.

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.