

Measurement of the neutron emission rate by the Manganese sulphate bath technique

Slovak University of Technology in Bratislava, Exercise STU-01

Main topic: Radionuclide neutron sources

Keywords: Neutron emission rate, Manganese sulphate bath technique, activation analysis, gamma measurement, correction factors, Monte Carlo simulation

Purpose: The experiment introduces to the fundamentals of neutron radionuclide sources, their construction and possible utilization in the industry and demonstrates a specific practical application. Within the measurement the students go through processes such as the activation analyses, gamma spectroscopy, Monte Carlo simulation and measurements' uncertainty propagation. Inherent part of the experiment is the Monte Carlo simulation, which is used for calculation of the correction factors. The main objective is to provide knowledge that makes the students able to quantitatively characterize the main parameter of neutron radionuclide sources.

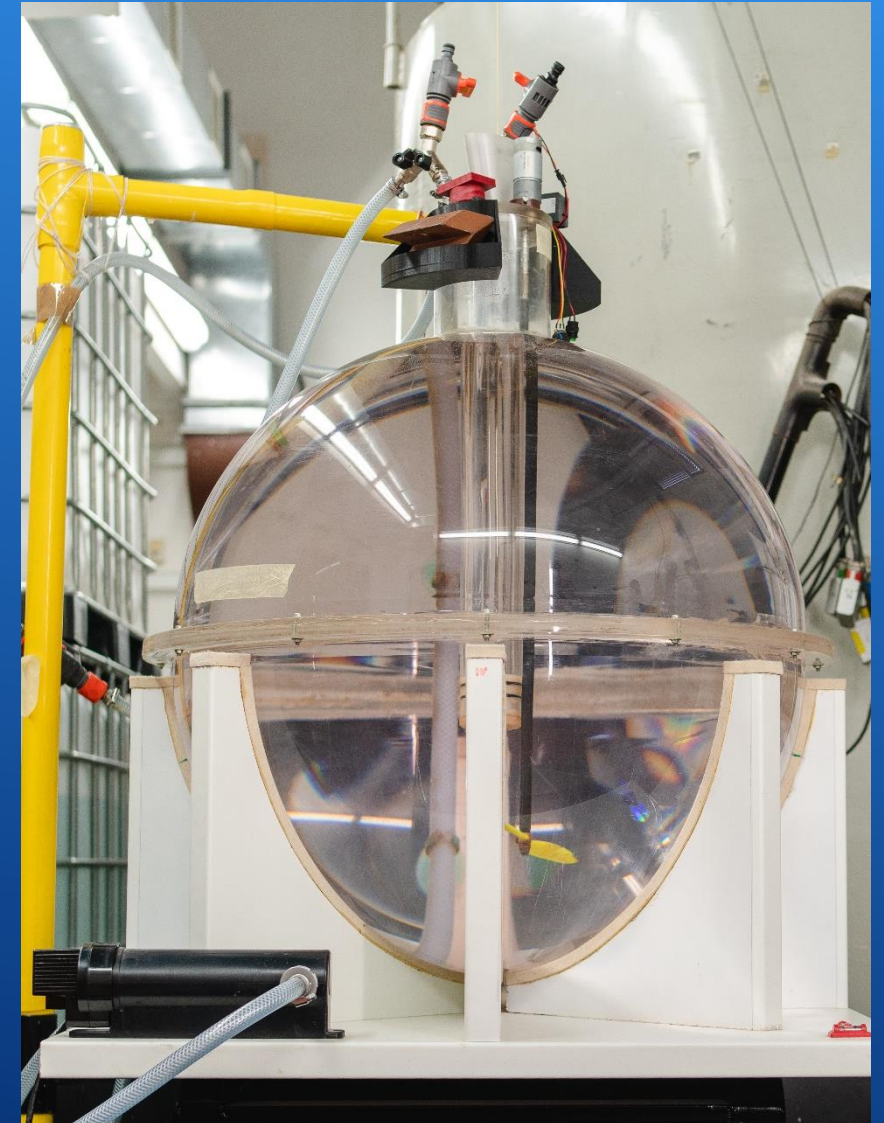
Level of exercise: Basic Advanced Complex
Level of education: BSc MSc PhD

What you will learn:

The students will learn how to work with liquid radioactive materials, determine their activity and transfer a secondary activity to a primary activity of the investigated source.

Important information:

- Minimal size of student group: 2
- Maximal size of student group: 4
- 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: 2-3 times per year

Examination modalities: report

Teaching languages: English, Slovak

Pre-knowledge required: Basic in nuclear physics, detection of radiation, measurement techniques, nuclear data, numerical simulations, data processing, and evaluation of uncertainties

Instruments required for exercise:

- MCNP5 Monte Carlo code / Monaco Monte Carlo code
- NaI(Tl) detector
- Manganese sulphate bath with Marinelli beaker
- Low background chamber and Multi-channel analyzer

Execution:

- The neutron source is loaded, the solution of the MnSO_4 in water is activated and the activated solution is homogenized
- Then a sample of solution is taken to Marinelli beaker and is placed under the detector to perform the measurement of the Mn-56 decay gamma spectrum to estimate its activity
- The simulation model is created and the calculation of correction factors is performed
- The neutron emission rate is based on the measured activity and calculated correction factors

Limitations:

Pregnant and breastfeeding women are not allowed to enter the controlled radiation area. Legal age (18) is required. For more information please visit <http://www.ujfi.fe.i.stuba.sk/kontakt.php>

