



In-core gamma field mapping



Jožef Stefan Institute, Exercise JSI-07

Main topic: Reactor Physics

Keywords: Gamma field, delayed gamma radiation, miniature ionization chamber

Purpose: A nuclear reactor in operation is a source of a mixed neutron and gamma field, a shut-down nuclear reactor is a source of a gamma field. The purpose of the exercise is the measurement of the gamma field intensity in the vicinity of the fuel elements in the reactor core and in locations outside the reactor core, during reactor operation and in shutdown conditions. The fraction of the delayed gamma field magnitude vs. the total (composed of prompt and delayed gamma rays) during reactor operation is estimated by measurements following a rapid reactor shutdown (SCRAM).

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

What you will learn:

Students will learn about prompt and delayed gamma radiation, become familiar with miniature ionization chambers, characterize gamma field intensity distribution inside the reactor core and in ex-core locations and estimate the fraction of the delayed gamma field magnitude during reactor operation.

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



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 gamma detection, basics on the origin of gamma rays during and after reactor operation, basics on neutron and gamma flux distribution inside the reactor core.

Instruments required for exercise:

- Reactor instrumentation
- Miniature ionization chamber and acquisition system
- JSI designed pneumatic positioning system
- JSI developed dedicated software

Execution:

- Measure the ionization chamber leakage current and background
- Measure the ionization chamber current dependence on the reactor power (0 – 250 kW).
- Measure axial and radial gamma profiles in the reactor core at a fixed power level (10 kW)
- Measure gamma field intensity after a rapid reactor shutdown (SCRAM) and estimate the delayed gamma field magnitude fraction during reactor operation.

Limitations:

None

