Pulse experiment

Jožef Stefan Institute, Exercise JSI-09

Main topic: Reactor Physics

Keywords: Pulse mode operation, prompt supercriticality, Fuchs-Hansen model

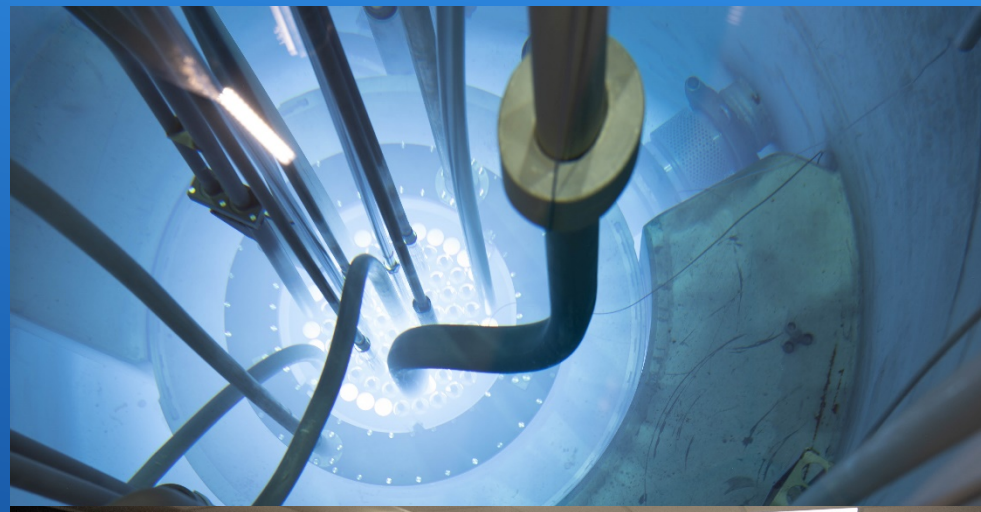
Purpose: The pulse experiment is a demonstration of a reactor transient in a supercritical state, made possible by the inherently safe design of the TRIGA reactor. The aim of the experiment is to perform several pulses by rapidly withdrawing a control rod, measuring basic pulse parameters and experimentally validating the Fuchs-Hansen model.

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

What you will learn: Students will observe and understand the reactor response to a large sudden reactivity increase following the ejection of a control rod out of the reactor core and experimentally verify the physical models describing the pulse experiment (the Fuchs-Hansen model).

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



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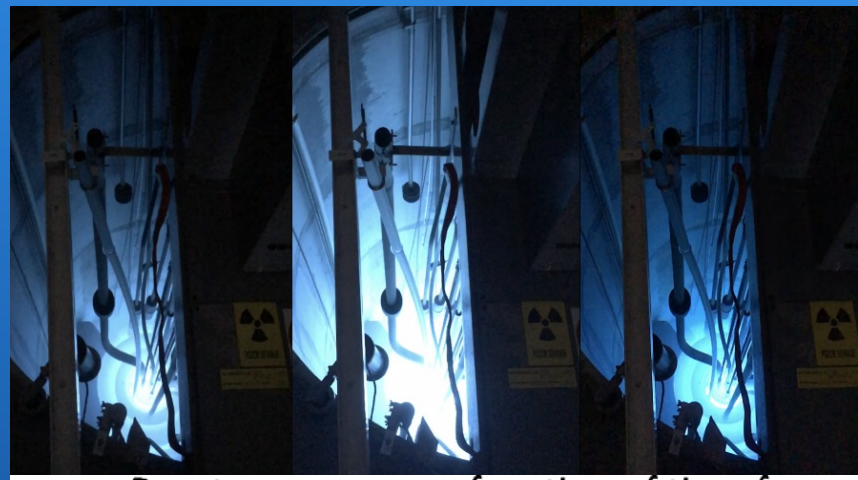
Possibility to perform experiment on demand: ☒ Yes ☐ No
Frequency of occurrence: on demand
Examination modalities: report
Teaching languages: English, Slovenian, Serbian/Croatian, Italian, French

Pre-knowledge required: Familiarity with prompt negative feedback effects on fuel temperature at TRIGA reactors, basics in reactor operation.

Instruments required for exercise:
- Reactor instrumentation
- Dedicated software developed by JSI

Execution:
- After a discussion on the temperature reactivity effects and the Fuchs-Hansen model, students observe the behaviour of the reactor power and fuel temperature following sudden large insertions of reactivity, caused by the ejection of a control rod out of the reactor core.
- Students measure three pulse parameters: the maximum power, released energy and maximum fuel temperature, and observe their dependence to the prompt reactivity, thereby experimentally validating the Fuchs-Hansen model.

Limitations:
Pulse mode operation has to be authorized in advance by the JSI TRIGA Reactor Safety Committee.



Reactor power as a function of time for reactor pulses with varying inserted reactivity