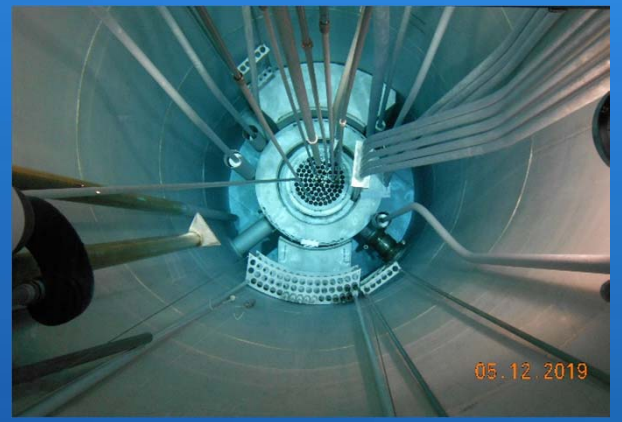
Critical experiment

TU Wien, Exercise TUW-01

Main topic: Reactor Physics

Keywords: critical mass, criticality condition, fuel elements, fuel handling, neutron detector

Purpose: When a reactor is initially loaded with fuel, the amount of fuel necessary for reactor criticality is usually not known very accurately. Therefore, the prediction of the critical mass by neutronics calculations based on reactor theory is necessary for the safe loading of fuel. The physical characteristics of a nuclear reactor as well as the validation of the calculation methods and the nuclear data employed may also be better understood by the comparison of the predicted and measured critical mass.
The critical experiment is performed directly in the reactor core and involves the removal and reloading of about 10 fuel elements.



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

What you will learn:
During this experiment the participants will learn the importance of the criticality condition in a nuclear reactor and how to acquire this information.

Important information:
- Minimal size of student group: 4
- Maximal size of student group: 8
- Overall duration of the experiment (in wall clock hours): 3

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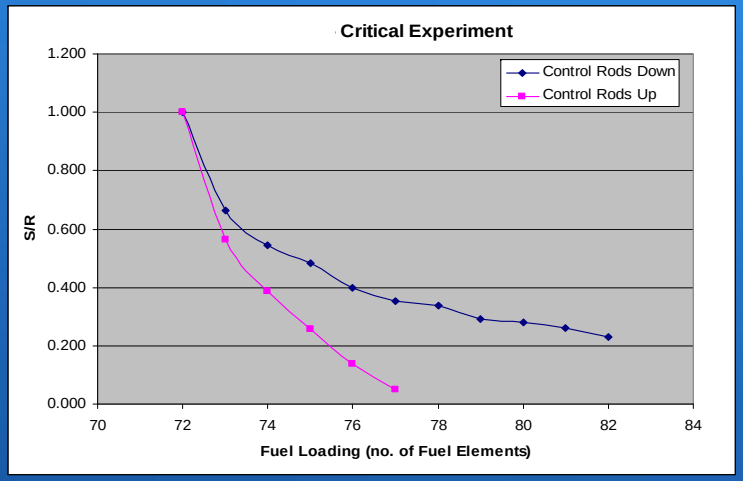
Possibility to perform experiment on demand: ☐Yes ☒ No
Frequency of occurrence: Once a year
Examination modalities: Participation in the experiment, protocol and final written test
Teaching languages: English/German

Pre-knowledge required: understanding in reactor physics, radiation physics and protection, theory of neutron detector.

Instruments required for exercise:

- Reactor I&C system;
- Fuel handling tool for the operator;
- Corona Boron neutron detector;
- A contamination monitor.



Execution:

- 10 fuel elements are removed from the core
- The fuel elements are sequentially loaded to their respective core positions one by one
- When a certain number of fuel elements have been added, the reactor core achieves its critical state.
- The same experimental procedure is performed keeping all control rods in fully withdrawn positions and completely in the core.

Limitations:
This experiment will be conducted in a controlled radiation area. Hence. controlled radiation area limitations apply.