Reactor power calibration and temperature reactivity coefficient

TU Wien, Exercise TUW-09

Main topic: Reactor Physics

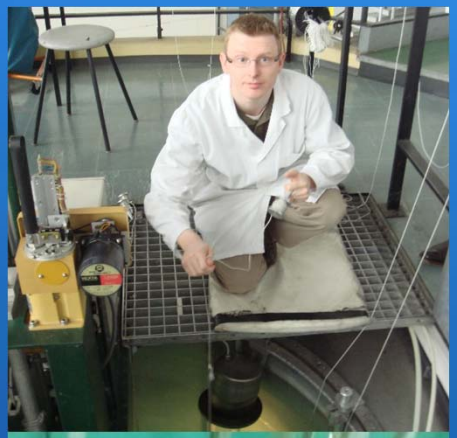
Keywords: Power calibration, reactivity coefficient, fuel temperature

Purpose: The purpose of this experiment is to calibrate the reactor power by measuring the increase of the pool water temperature during a given time period. The participants will observe the temperature rise during reactor operation and its, effect on the reactor power. Obtained measurement will be compared with those from the power calibration. The students will afterwards determine the temperature coefficient of reactivity.

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

What you will learn:
During this experiment the participants will gain the principal knowledge of reactor power calibration.

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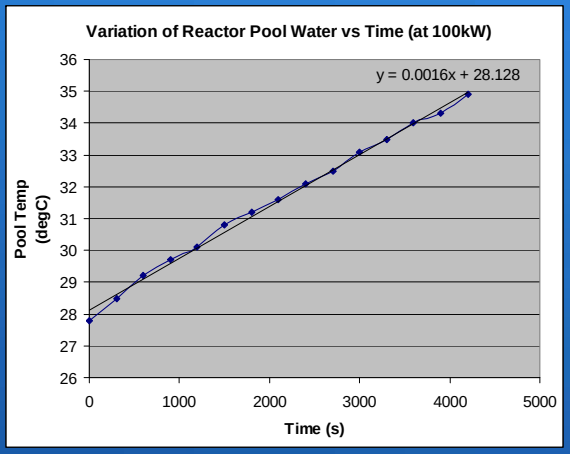
Possibility to perform experiment on demand: ☒Yes ☐ No
Frequency of occurrence: Once a year
Examination modalities: Participation in the experiment, protocol and final written test
Teaching languages: English/German



Pre-knowledge required:
understanding in nuclear and reactor physics; radiation physics and protection.

Instruments required for exercise:
- Reactor I&C system.;
- Pool water heaters;
- A pool temperature detector;
- A contamination monitor.

Execution:
- Five immersion heaters with a power of 20 kW heated the pool water electrically for 5 h (=100kWh) , the water temperature increase in this time interval was 5,19 degrees , this provides a thermal power calibration factor, which can be used to determine an unknown reactor power level
- To determine the temperature coefficient of the reactivity, the reactor is first operated at a low power, (i.e. 10 W). and the position of all control rods and the temperature of the fuel element are noted, the same values are then recorded for 100 kW
- As the control rods had to be withdrawn from 10 W to 100 kW the difference of reactivity $\Delta\rho$ is compensated by the increased fuel temperature ΔT. The $\Delta\rho$ can be found from the control rod calibration curve, and the ΔT can be read from the instrumentation.

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