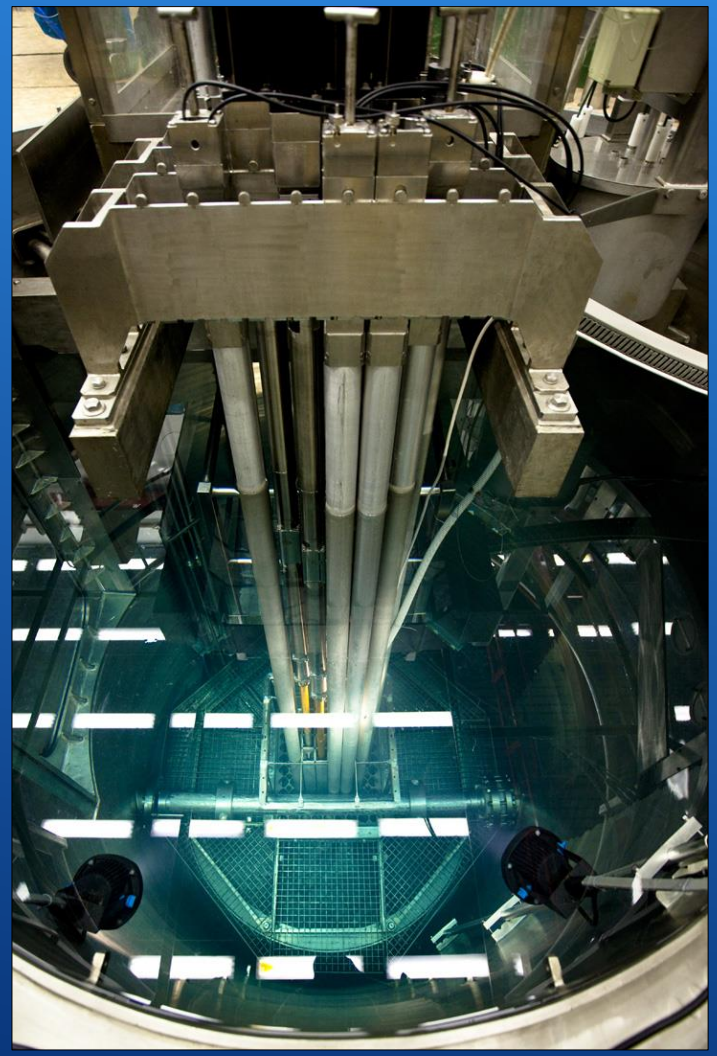
# Control rod calibration

## Czech Technical University in Prague, Experiment CTU09

**Main topic:** Experimental reactor physics

**Keywords:** VR-1 reactor, control rod, calibration curve, inverse rate method, rod insertion method, inter-calibration method

**Purpose:** The control rod in a research reactor is the primary reactor instrumentation which allows easy change and control of the reactor state and the reactor power as well as safe shutdown of the reactor. During control rod calibration the rod worth is measured and the relationship between the control rod position and the reactivity is determined (rod calibration curve).



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

**What you will learn:**

Learning objective of the experiment is to understand concept of control rod calibration and rod worth determination at a reactor. The experiment is highly suitable for students studying nuclear engineering as the major curriculum and it is suitable for students studying various major engineering curricula as such as power engineering, mechanical engineering, electrical engineering with future assignment in various nuclear curricula.

**Important information:**

- Minimal size of student group: 4
- Maximal size of student group: 10
- Overall duration of the experiment (in wall clock hours): 3

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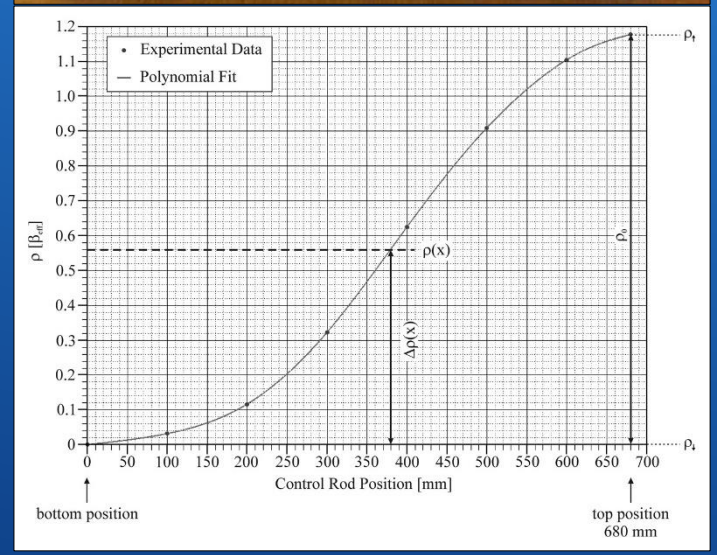
| Possibility to perform experiment on demand: | ☒ Yes ☐ No |
| Frequency of occurrence: | On demand, ca 30 times/year |
| Examination modalities: | Protocol, evaluation, discussion |
| Teaching languages: | English, Czech |

**Pre-knowledge required:** The students should be familiar with introduction to the reactor physics, particularly with concepts of reactivity, role of control rod in reactor operation, and with neutron detection. Prior to this experiment, CTU02 - Neutron detection and CTU08 - Reactivity measurement should be performed.


**Instruments required for exercise:**

- The VR-1 reactor
- The VR-1 neutron source
- Neutron detection system for education and training

**Execution:**

At the VR-1 reactor, the control rod calibration experiment is carried out by several methods: inverse rate method, inter-calibration (or rod swap) method and rod insertion (or dynamic calibration) method. Lecturer chooses one or two methods during this experiment and also the form of a control rod calibration curve (integral or differential) which will be measured.

**Limitations:**

No particular limitation for this experiment, only general requirements for entry to research nuclear installation according to the Czech nuclear legislation should be fulfilled.