

# Critical experiment - approaching critical state

Czech Technical University in Prague, Experiment CTU04

**Main topic:** Experimental reactor physics

**Keywords:** VR-1 reactor, approach to criticality, subcritical reactor, subcritical multiplying

**Purpose:** Approaching to the critical state is always connected with uncertainties which can't be avoided by the most perfect criticality calculations or reactor staff experience and which could affect the predicted critical parameter and could cause potential problems. In the worst case when the critical experiment is not performed in a proper and safe way prompt criticality can be reached. Therefore, the critical experiment must be performed very precisely with deep understanding all phenomena which can affect the experiment.

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

## What you will learn:

Learning objective of the experiment is to learn and to understand the method carried out for the safe approaching the critical state. 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:** Introduction to reactor physics, particularly with concept of multiplication factor and with neutron detection. Prior to this experiment, CTU02 - Neutron detection should be performed.

### Instruments required for exercise:

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

### Execution:

Critical experiment is carried out by withdrawing of a control rod from the core. Control rod withdrawing is followed by measurement of neutron multiplication in subcritical reactor with inserted external neutron source. Lecturer chooses suitable control rod according to the current core configuration and core composition. In order to ensure a safe approach to the critical state, a well-known inverse-counting method is used.

### 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.

