Criticality Safety Validation of the SCALE System

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Abstract. Computational systems, including software, hardware and nuclear data, can be characterized by a computational bias that demonstrates how accurately the computational system is able to simulate reality. The criticality safety criteria require that the effective multiplication factor of the investigated system is less than the defined limits. Therefore, the computational bias of criticality safety calculations, as an additional margin, must be established through the validation of the applied methods to critical experiments. This paper is devoted to the criticality safety validation of the SCALE system. Complex set of benchmarks was defined based on DICE database and VALID procedure. Previous analysis identified special needs of the original set and therefore WWER and Subcritical type benchmarks were supplemented. The entire benchmark set was categorized based on simple criteria, like type and form of fuel, spectrum and criticality level. Validation process was carried out for four cross section libraries. Obtained results were processed to the definition of Upper Safety Limit for each group of benchmarks and cross section library. Finally, the significance of cross section induced uncertainties within criticality safety calculation was demonstrated and special requirement and its consequence to the subcritical experiments was highlighted.