

# Neutronic Comparative Study of SCALE, SERPENT, and MCNP

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**Abstract.** To tackle the safety, sustainability and non-proliferation requirements for Gen. IV reactor concepts, such as Sodium-cooled Fast Reactors (SFRs), precise modelling tools are required. The neutronic calculations are conducted using various codes such as MCNP (stochastic) or ERANOS (deterministic). However, new concepts require higher degree of safety, and thus new target accuracies for computer calculations of reactor parameters were set. Furthermore, majority of the widely used codes and data libraries were finetuned to perform the neutronic calculations of reactors with thermal spectrum of neutrons. The EBR-II benchmark included in the IRPhEP2018 handbook (Evaluation of Run 138B at Experimental Breeder Reactor II, a Prototypic Liquid Metal Fast Breeder Reactor) in combination with the 2021 sensitivity benchmark “Nuclear Data Sensitivity Study for the EBR-II Fast Reactor Benchmark Using SCALE with ENDF/B-VII.1 and ENDF/B-VIII.0” provide a good opportunity to assess the performance of the SERPENT Monte Carlo code for the SFR. In this paper, a short overview of the EBR-II model is provided and reactivity parameters are examined through the MCNP, SCALE and SERPENT Monte Carlo calculations using the ENDF/B-VIII.0 nuclear data library. The results are compared to the referential results of the experiment and the 2021 sensitivity benchmark.