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P4.224 Verification of SuperMC with HCLL mock-up experiment

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Within the frame of European Fusion Technology Program, two neutronics mock-up (HCLL and HCPB) experiments have been performed using 14-MeV neutron generator (NG) to validate neutronics computational tools and nuclear data library. SuperMC, which is a nuclear design and safety evaluation software system developed by the FDS Team, was verified with HCLL mock-up experiment based on the latest neutron source, comparing with MCNP simulation in this work.

According to the content of HCLL mock-up experiment, the calculation of tritium production rate (TPR) and neutron/photon flux spectra at two positions were performed with SuperMC3.2 and MCNP5.1.60 based on data libraries JEFF-3.2 and IRDFF1.05. In order to ensure that the results obtained by the two codes are comparable, the parameter settings were kept the same in simulations.

The maximum deviations of TPR from ^6Li and ^7Li between the two codes were found to be $-0.65\% \pm 0.0022$ (1σ) and $0.5\% \pm 0.0116$ (1σ) at LiF TLDs. The discrepancies of total TPR (i.e. from $^6\text{Li}+^7\text{Li}$) for natLi and ^6Li with enrichment of 95% pellets ranged from -0.77% to 0.54% , and -1.17% to 1.04% , respectively. The deviations of integral neutron and photon flux are -0.03% and 0.47% at position A, and -0.02% and -0.04% at position B, respectively. In addition, a very good agreement for both neutron and photon flux spectra were also found. The consistent results verified SuperMC's correctness in terms of fundamental physical processes, transport processes including biased simulation with cell/mesh-based weight window techniques, indicating that SuperMC can be applied in neutronics simulation of fusion reactors.

Presenter: LI, Bin (Institute of Nuclear Energy Safety Technology (INEST) Chinese Academy of Sciences (CAS))

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