Contribution ID: **563**   Type: **not specified**

P4.228 Assessment of Serpent 2 application for fusion radiation transport analysis

Thursday, 20 September 2018 11:00 (2 hours)

Radiation transport models for fusion neutronics analysis are becoming increasingly complex, further exacerbating problems in the creation and integration of neutronics models found in traditional analysis methods using MCNP. Serpent 2, an alternative radiation transport code developed at VTT Technical Research Centre of Finland, is considered as a potential method for neutronics analysis in fusion relevant problems. Advantages of Serpent 2 include a more robust universe implementation with capability for the use of a mixed geometry definition with of a combination of constructive solid geometry and mesh-based geometry, making it an excellent candidate as an alternative transport code for fusion neutronics, particularly in the case of complex models. Therefore, investigation into the use of Serpent 2 for fusion relevant neutronics analysis is ongoing with important computational and experimental benchmarking.

In this paper computational Serpent 2 results are compared with those from MCNP6. A spherical model is employed for a basic benchmark of the fusion application of Serpent 2 and its corresponding nuclear data library. Comparison of neutron/photon flux and heating for a fusion DEMO [demonstration reactor] model using Serpent 2 and MCNP6 will also be presented.

Preliminary results have shown good agreement with results within statistical uncertainties compared to MCNP for neutron flux in simple spherical models, and comparisons on ITER-like geometry within 1% for neutron heating in blankets. Initial comparisons and investigation show significant advantages in the use of Serpent 2 in fusion neutronics analysis methods with further work required to benchmark against experimental data.

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Session Classification: P4