NUMERICAL BENCHMARKS TRIPOLI - MCNP WITH USE OF MCAM ON FNG ITER BULK SHIELD & PRELIMINARY FNG HCLL TBM MOCK-UP

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3D Monte-Carlo neutronics codes are of first importance for fusion neutronics. TRIPOLI-4 (R)[1] [1] is the fourth generation of the TRIPOLI family of Monte Carlo codes developed since the 60's by CEA. The automatic variance reduction feature and the user friendly parallel calculation capability of TRIPOLI-4 code are interesting for fusion neutronics simulation.

This paper is produced in the framework of EUROBREED program supported by the EFDA. It presents an evaluation of the FNG (Frascati Neutron Generator) ITER Bulk Shield benchmark from NEA/SINBAD database and the TRIPOLI-4 & MCNP5 [2] results obtained by dedicated calculations on the preliminary design of the FNG HCLL (Helium-Cooled Lithium–Lead) TBM (Test Blanket Module) mock-up. For FNG ITER Bulk Shield, the only detailed geometry available is a MCNP file so it has been decided to use the MCAM [3] software, developed by FDS team, to convert automatically the MCNP input into TRIPOLI one. MCAM is particularly efficient for converting and viewing, that is why it has been then applied to the preliminary design of the FNG HCLL TBM mock-up

To improve the FNG specific DT neutron source description in TRIPOLI-4 calculation, the discrete FNG source developed in KIT laboratory is used.

Results of the FNG ITER Bulk Shield benchmark show that the absolute difference between TRIPOLI (JEFF-3.1.1) and MCNP (EFF-3) reaction rates is 4.4 times lower than the absolute difference between measures and MCNP. This result is the average from 107 reactions rates of various nuclear reactions, materials and activation foils positions.

Results of the calculations performed using the preliminary design of the FNG HCLL TBM mock-up with FENDL-2.1 show that the horizontal layers neutron flux ratio of TRIPOLI / MCNP is in average 1.001 +/- 0.005 (2σ included). The same ratio applied to Tritium Breeding Rate is in average 1.001 +/- 0.010 (2σ included).

Thus the results of this study confirm:
- That TRIPOLI-4 and MCNP5 estimation of reaction rates, neutron flux and Tritium Breeding Rate are coherent ;
- The validity of MCAM for fast, automatic and appropriate TRIPOLI - MCNP conversion for FNG benchmarks ;
- The validity of discrete FNG source.

[1] TRIPOLI-4 Project Team, CEA report CEA-R-6169, 2008
[2] X-5 Monte Carlo Team, MCNP, LANL report LA-UR-03-1987, 2003
[3] Y. Wu, FDS Team, Fusion Engineering and Design, Vol. 84, 2009, p.1987 – 1992