Contribution ID: **90** Type: **Poster**

# Numerical simulation of neutron flux distribution for DEMO Divertor heterogeneous model concept

*Tuesday, 8 November 2022 17:30 (20 minutes)*

Results from calculations of the neutron flux in the divertor cassette body for the Helium Cooled Pebble Bed and Water-Cooled Lithium Lead concepts are presented in this paper. For both cases under investigation, the same divertor model setup and designated DEMO neutron source were utilized. Neutron transport calculations were performed using the MCNP6 and the FENDL-3.1 nuclear data library. The ADVANTG (AutomateD VAriaNce reducTion Generator) tool and MCNP code, which were utilized for the variance reduction and particle movement appropriately, are also included in this study's estimations of the neutron-induced dose rate. The development of the dose rate and neutron flux maps for the DEMO reactor's divertor was made possible by the use of such a coupled computing technique.

Results from the study of neutron flux calculations in the divertor cassette body were considered using in HCPB and WCLL concepts as a breeding blanket (BB). To obtain the presented results in this paper, the MCNP6 code was combined with the ADVANTG code and FW-CADIS variance reduction settings, which allowed for less computational time and statistical error. When employing the WCLL BB model, the statistical error fell by an average of 1.13 and 2.1 times for neutron and dose rate estimates, compared to 3.1 and 5.4 when using the HCPB BB concept design. Calculations of the neutron flux in various cells of the MCNP model revealed that the two examined BB models had similar neutron distributions in the energy range from 0.794 MeV to 15.6 MeV. Since no neutrons are created in the EU DEMO utilizing DD or DT fuel cycles above 15.6 MeV energy, there are no neutrons above this energy threshold. The average number of neutrons in the WCLL seemed to be 1.29 times higher than in the HCPB in the lower energy zone (i.e., 1.05e-11 MeV - 0.794 MeV).

As stated in the abstract of the paper, the effect of the variance reduction tool—such as the WW produced using ADVANTG—was evaluated. The ratio of the calculation results can reach up to 1.28 for WCLL and 1.80 for HCPB BB instances when utilizing WW and without WW, according to the neutron flux maps. Additionally, the effect of WW on dose rate estimates is comparable; the ratio rises by 3.46 and 3.90 times, respectively for HCPB and WCLL BB at investigated locations that are furthest from the source below the divertor.

## Speaker's Affiliation

Lithuanian Energy Institute

## Member State or IGO

Lithuania

**Primary authors:** STANKUNAS, Gediminas (Lithuanian Energy Institute); BREIDOKAITE, Simona (Lithuanian Energy Institute, Laboratory of Nuclear Installation Safety)

**Presenter:** STANKUNAS, Gediminas (Lithuanian Energy Institute)

**Session Classification:** Poster Session II (all tracks)

**Track Classification:** Poster