Neutronic analyses for EU DEMO upper limiter
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Introduction
• Limiters play a crucial role in the operation of DEMO
• Upper limiter integration was done in several steps
(Talk: M. L. Richiusa et al – P6A4, Thursday afternoon)

1. Tolls used
• SuperMC [1] for CAD to MCNP geometry conversion
• MCNP5 v1.60 [2] and JEFF 3.3 [3] nuclear data for analyses

2. Simple limiter model
• Initial simulations carried out using simple model
  • 3 plasma facing layers
  • Shield block (homogenized water-Eurofer mix)
• Shield block (SB) configurations – homogenized
  • Box design – Eurofer box with water filling
  • Plate design – Eurofer plates cooled by water channels
• Analysis of radial dependence of nuclear heating
• HCPB and WCLL tritium breeding blanket (TBB)

3. Analyses using simple limiter model
• Total nuclear heating of each layer
• Radial dependence of nuclear heating
• For different SB configurations and TBB concepts
  • Minor differences in deposited energy for HCPB
  • Significantly different heating radial profile in WCLL

4. Detailed model of upper limiter
• More realistic geometry
• 3 plasma facing layers + attachment layer
• Shielding block still homogenized – based on plate design

5. Analyses using a detailed model
• Nuclear loads of interest
  • Nuclear heating in limiter (total per component and mesh based)
  • DPA, He production in limiter
  • Peak nuclear heating in TFC: 6 W/m² (limit 50 W/m²) – good shielding properties
  • DPA in vacuum vessel (VV): 0.2 DPA / 6 FPY (limit 2.75 DPA) – VV is far from the limiter

6. Further work
• Upper limiter as a reference for other limiters
• Initial work already done on
  • Outboard midplane limiter (OML)
  • Outboard lower limiter (OLL)

References

This work has been carried out within the framework of the EUR fusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No. 100052200 — EUR fusion). Views and opinions expressed are however those of the author(s) and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.