Contribution ID: **3403** Type: **not specified**

P4.1026 Comprehensive benchmark studies of ASCOT and TRANSP-NUBEAM fast particle simulations

Thursday, 11 July 2019 14:00 (2 hours)

See full abstract here
http://ocs.ciemat.es/EPS2019ABS/pdf/P4.1026.pdf

The ASCOT [1] and TRANSP-NUBEAM [2] Monte-Carlo codes are the most commonly used tools for analysing fast particle and fusion product distributions in JET plasmas. Differences have been observed in the physics included in the codes and the resulting predictions, including differences between experimental and modelled neutron production rates. A thorough benchmarking exercise between these two codes has been undertaken in view of the upcoming DT campaign at JET. The results from ASCOT (incorporated in JINTRAC [3]) are compared with TRANSP results with input settings chosen as to match the physics models as much as possible and using identical kinetic input profiles. Two discharge were chosen for detailed comparisons: a highperformance baseline discharge and a high-performance hybrid discharge, both with total input power exceeding 30MW. The main differences between the two discharges were a higher density and lower fast particle fraction in the baseline discharge. To match the boundary conditions and minimise non-model related causes for differences in the results, several settings were modified from their default values, mainly in ASCOT-JINTRAC. These include the beam divergence, ionisation cross section, plasma rotation, the magnetic equilibrium, the Coulomb logarithm and sources of neutrals. A large number of output quantities were compared for NBI heating, including fast particle density and energy, power depositions and neutron production. The most significant differences between ASCOT and TRANSP were observed in the electron heat deposition (15-20%) and the neutron production rate (around 10%) when the plasma rotation has been taken into account in the simulation. Important differences in profile shapes can also arise from differences in the equilibrium, unless the same equilibrium is enforced in both codes. [1] E. Hirvijoki et al. 2014 Comput. Phys. Commun. 185 1310-1321 [2] A. Pankin et al. 2004 Comput. Phys. Commun. 159 157-184 [3] M. Romanelli et al. 2014 Plasma Fusion Res. 9 3403023

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Presenter: SIRÉN, P. (EPS 2019)

Session Classification: Poster P4

Track Classification: MCF