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TH/P2-08: Fusion Power Production in Baseline ITER H-Mode Discharges

Tuesday, 9 October 2012 14:00 (4h 45m)

Previous studies of ITER steady state and hybrid scenarios [1,2] are extended to studies of ITER ELMy H-mode 15 MA scenarios. Results are obtained using the PTRANSP predictive integrated modeling code with time evolved boundary conditions and the plasma shape provided by the Tokamak Simulation Code (TSC). Current is ramped to 15 MA during first 100 sec and the central density is ramped to values in the range of 0.85x10ˆ20 to 1.05x10ˆ20 m-3. Impurities are 2% Be, Argon in the range 0.12% to 0.3% and 2% He3. Variation in density and in level of Argon impurity provides insight to the sensitivity of fusion power production to variation in these parameters. The dependence of confinement and the associated fusion power production on the level and mixture of beam and RF heating as well as on the choice of RF heating mixes are examined. Components of the ITER H-mode plasma current density (ohmic, bootstrap, beam and radio frequency) are shown as functions of plasma radius along with the integrated current contained within a given plasma radius. Also shown, for various plasma conditions, are the neutron density production as a function of radius and the rate at which neutrons are produced within a given radius. Various discharge conditions are studied in which the input power is reduced once alpha power heating is underway. Pedestal pressure is varied in the range of EPED1 [3] predictions to examine the sensitivity of fusion power production to the pedestal pressure. The PTRANSP code is used to compute temperature, magnetic q and toroidal rotation profiles using either the MMM7.1 or the GLF23 anomalous transport model, combined with neoclassical transport. Verification studies are carried out repeating PTRANSP simulations using the ASTRA code. The effects of low, reverse and strong magnetic shear on internal transport barriers are explored. In the PTRANSP simulation scans the same rotation velocity boundary condition will be employed for each discharge. Simulations are carried out turning off flow shear in order to separate the flow shear and magnetic shear effects on internal transport barriers. This is an important issue for ITER since it is expected that the toroidal rotation will be small.

[1] A.H. Kritz, et al., Nucl. Fusion 51, 123009 (2011)
[2] T. Rafiq, et al., Phys. Plasmas, 18, 112508 (2011)
[3] P.B. Snyder, et al., Phys. Plasmas 16, 056118 (2009)

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