Predictions of fast ion parameters in ITER Advanced Plasmas

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Results from time-dependent, integrated modeling of Advanced Plasmas for ITER using pTRANSP will be discussed. This code is a synthesis of the TSC [1] and TRANSP [2] codes. TSC simulates the startup and control of the plasma boundary using the planned shaping and control coils. The GLF23 model is used to predict the evolution of the plasma temperatures. The output boundary and plasma profiles are input to TRANSP for detailed analysis. TRANSP has more comprehensive and self-consistent methods for computing the equilibrium, heating, and current drive. TRANSP uses Monte Carlo techniques (NUBEAM [3]) to model alpha heating and neutral beam heating and current drive. The impurity stopping is based on interpolation of Carbon and Oxygen cross sections [4]. Enhanced deposition from excited states ionization is modeled [5]. The SPRUCE [6] full-wave, reduced order code is used for ICRH, LSC [7] for LHCD, and TORRAY-GA [8-10] for ECH/ECCD. The heating and current drive profiles can be input back into TSC for iteration.

TRANSP can also calculate the distribution functions for the alpha particles and beam ions in two spacial variables (radial and poloidal) and two energy variables (magnitude and parallel velocity fraction or pitch angle). This capability has been upgraded recently to allow greatly increased statistics. The outputs from TRANSP can easily be used in other codes.

pTRANSP has been used to model the ITER baseline ELMy H-mode regime and two Advanced Plasma regimes: the Hybrid scenario with reduced inductive current fraction and with the q_{MHD} profile maintained above unity, and the Steady-state scenario with near zero inductive current. This talk will give predictions for fast ion parameters from several examples of Advanced Plasmas.

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