ITER SCENARIO MODELING

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The objective of this modeling study is to prepare for the commissioning of ITER and to plan for the burn stages of ITER operation. The combination of the TSC and PTRANSP codes is used to simulate ITER target steady state, baseline (15 MA) H-mode and hybrid (12.5 MA) discharges from ramp-up through flat-top. The target steady state discharges are discharges with limited Ohmically driven current. The TSC code computes free-boundary equilibrium, coil currents, temperature and magnetic *q*-profiles from start-up through the flat-top stage. The PTRANSP code is used to compute temperature, magnetic *q* and toroidal rotation profiles using either the new Multi-Mode model (MMM v7.1) or the GLF23 (renormalized) anomalous transport model. GLF23 is a quasilinear gyrofluid model that is used to compute the anomalous transport driven by ion and electron temperature gradient modes and trapped electron modes. The MMM7.1 is a multi-fluid theory based transport model which in addition to computing the anomalous transport associated with modes included in the GLF23 model also includes transport associated with the ideal MHD and drift resistive inertial ballooning modes. External heating and current drive involve injection of energetic neutral beams, ion cyclotron, lower hybrid (LH), and electron cyclotron (EC) waves. In the simulations of target steady state discharges using the MMM v7.1 model, an internal transport barrier in temperature and rotation frequency is predicted. In hybrid discharges, the MMM v7.1 model and the GLF23 model both predict that 500MW of fusion power is achieved with 50 MW input power (fusion Q=10) in 1000 second simulations. In target steady state discharges, it is found that there is an improvement in fusion production and a significant increase in fusion Q when LH heating and current drive is turned off after 500 seconds. The improvement occurs because the LH current, which is driven near the plasma edge, is replaced by core current when the total current is held constant. As a result, there is a flattening of the *q* profile and a reduction in magnetic shear. Simulations indicate that an improvement in fusion power production occurs when the LH current drive is replaced with EC current drive. This occurs because the replacement also results in more centrally located current. A study has been carried out to examine the sensitivity of fusion power production to the height of the H-mode pedestal and boundary rotation frequency. The ITER 15MA H-mode simulation results are compared with ITER hybrid 12.5MA results.