Abstract for an Invited Paper
for the DPP05 Meeting of
The American Physical Society

Recent Progress on ECH Technology for ITER

JAGADISHWAR SIRIGIRI, MIT Plasma Science and Fusion Center

The Electron Cyclotron Heating and Current Drive (ECH&CD) system for ITER is a critical ITER system that must be available for use on Day 1 of the ITER experimental program. The applications of the system include plasma start-up, plasma heating and suppression of Neoclassical Tearing Modes (NTMs). These applications are accomplished using 27 one megawatt continuous wave gyrotrons: 24 at a frequency of 170 GHz and 3 at a frequency of 120 GHz. There are DC power supplies for the gyrotrons, a transmission line system, one launcher at the equatorial plane and three upper port launchers. The US will play a major role in delivering parts of the ECH&CD system to ITER. The present state-of-the-art includes major advances in all areas of ECH technology. In the US, a major effort is underway to supply gyrotrons of up to 1.5 MW power level at 110 GHz to General Atomics for use in heating the DIII-D tokamak. This presentation will include a brief review of the state-of-the-art, worldwide, in ECH technology. The requirements for the ITER ECH&CD system will then be reviewed. ITER calls for gyrotrons capable of operating from a 50 kV power supply, after potential depression, with a minimum of 50% overall efficiency. This is a very significant challenge and some approaches to meeting this goal will be presented. Recent experimental results at MIT showing improved efficiency of high frequency, 1.5 MW gyrotrons will be described. These results will be incorporated into the planned development of gyrotrons for ITER. The ITER ECH&CD system will also be a challenge to the transmission lines, which must operate at high average power at up to 1000 seconds and with high efficiency. The technology challenges and efforts in the US and other ITER parties to solve these problems will be reviewed.

*In collaboration with E. Choi, C. Marchewka, I. Mastovosky, M. A. Shapiro and R. J. Temkin. This work is supported by the Office of Fusion Energy Sciences of the U. S. Department of Energy.