The DIII D 110 GHz ECRF System Can Be An ITER EC Prototype Testbed*

R.W. Callis, J. Lohr, Y.A. Gorelov, D. Ponce, K. Kajiwara,[1] and J.F. Tooker

General Atomics, P.O. Box 85608, San Diego, California 92186-5608
[1]Oak Ridge Institute for Science Education, Oak Ridge, Tennessee

There is a synergistic relationship between the Electron Cyclotron Heating and Current Drive (EC H&CD) of ITER and the DIII-D EC program. As currently envisioned, the EC H&CD system on ITER is to consist of twenty-four 170 GHz, 1 MW CW gyrotrons. There are three more 1 MW CW gyrotrons operating at a frequency of 120 GHz to assist in starting up the plasma. These gyrotrons are to have depressed collectors to increase the rf generating efficiency above the efficiency of the gyrotrons in operation at most machines around the world today, such as at DIII-D. Each gyrotron unit has various support subsystems, such as normal and superconducting magnets with their respective power supplies, support systems, water cooling, and instrumentation and control systems. An EC local control station monitors and controls four gyrotrons, and each local control station communicates with the main EC control system. Twelve high voltage dc power supplies energize the gyrotrons, with two gyrotrons connected to each power supply. Low-loss rf transmission lines route the rf power to launchers in ports on the ITER tokamak. The equatorial launcher has steering in the toroidal direction and the upper launchers have steering in the poloidal direction.

The planned growth in the EC system on DIII-D over the next few years requires the installation of two depressed collector gyrotrons, a high voltage power supply, two low loss transmission lines, and the required support equipment. This new DIII-D EC equipment could be made as a prototype of the ITER EC System requirements. By building the DIII-D hardware to the ITER specifications it would allow ITER to gain beneficial prototyping experience on a working tokamak, prior to committing to building the hardware for delivery to ITER.

*Work was supported by the U.S. Department of Energy under DE-FC02-04ER54698 and DE-AC05-76OR00033.