

UPGRADES AND PERFORMANCE OF THE ELECTRON CYCLOTRON HEATING SYSTEM ON DIII-D*

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The Electron Cyclotron Heating (ECH) system on DIII-D consists of six 110 GHz gyrotrons that can generate up to a total of 4.8 MW of rf power for pulses up to 5 seconds in length. The HE_{11} mode content is over 85% for all the lines, and the transmission coefficient is less than 1.1 dB for four of the transmission lines, close to the theoretical value. A new depressed collector gyrotron was recently installed and is expected to inject up to 1 MW of power into the DIII-D during 2013 tokamak operations.

Three of the four dual waveguide launchers, which can steer the rf beams ± 20 degrees poloidally and toroidally were used for real-time neoclassical tearing mode control and suppression with increased poloidal scanning speed up to 60 deg/s and positioning accuracy of the beams of $\sim \pm 2$ mm at the plasma center.

The ECH capabilities on DIII-D are being steadily updated, leading to increased experimental flexibility and high reliability of the system. In the past year the ECH system reliability reached 87%, with a number of 2352 individual gyrotron successful shots into DIII-D.

Planning is under way for the addition of two new depressed collector gyrotrons, one additional one at 110 GHz, 1.2 MW and another at 117.5 GHz, 1.5 MW generated power, both of which are being manufactured at Communications and Power Industries, Palo Alto, CA.

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