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Increased ECCD Efficiency With Higher Beta on DIII-D[1] C.C. PETTY, L.L. LAO, Y.R. LIN-LIU, J. LOHR, T.C. LUCE, R. PRATER, General Atomics, R.W. HARVEY, CompX, Inc., M.A. MAKOWSKI, LLNL — The DIII-D program is making excellent progress towards experimentally validating a predictive model of electron cyclotron current drive (ECCD). Electron trapping is found to strongly affect the ECCD since the normalized current drive efficiency decreases rapidly with increasing radius in low beta plasmas. However, the measured ECCD efficiency at $r/a = 0.4$ increases by a factor-of-four as the local electron beta increases from 0.2% to 2%. This can be explained theoretically by the stronger damping of the electron cyclotron waves with higher density and temperature as well as relativistic effects, causing the electron cyclotron resonance to move away from the trapped/passing boundary in velocity space which reduces the deleterious effects of electron trapping. The practical result is that the ECCD efficiency decreases very little with increasing radius in high beta plasmas. The measured ECCD efficiency in high beta H-mode plasmas is already equal to the value needed for future advanced tokamak scenarios.

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