Detailed measurements of the electron cyclotron current drive efficiency on DIII-D

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Abstract

Electron cyclotron current drive (ECCD) experiments on the DIII-D tokamak are solidifying the physics basis for localized, off-axis current drive, the goal being to validate a predictive model for ECCD. The ECCD profiles are determined from the magnetic field pitch angles measured by motional Stark effect (MSE) polarimetry. The measured ECCD switches from the co to the counter direction as the toroidal injection angle is varied with a profile width that is in accordance with ray tracing calculations. Tests of electron trapping in low beta plasmas show that the ECCD efficiency decreases rapidly as the deposition is moved off-axis and towards the outboard side of the plasma, but the detrimental effects of electron trapping on the current drive are greatly reduced in high beta plasmas. Overall, the measured ECCD is in good agreement with theoretical calculations using a quasilinear Fokker-Planck code over a wide range of injection angles and plasma parameters.