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Understanding Magnetic Field Error Correction in DIII-D,*
M.J. Schaffer, R.J. La Haye, E.J. Strait, *GA*, J-K Park, J.E. Menard, *PPPL*, A.H. Boozer, *Columbia U.* – A comparison was made between the measured DIII-D magnetic field error and an ideal MHD plasma response model. New measurements of TF coil errors reduced the bounds of unknown errors. Empirical error corrections for DIII–D standard left-handed-pitch plasmas were refined, and a new empirical correction was developed for right-handed-pitch plasmas. Empirical corrections were analyzed by the new Ideal Perturbed Equilibrium Code, which computes the linear free-boundary plasma response to prescribed external error and/or correction fields in real geometry. This analysis explained the paradox of why the DIII-D C-coil empirical correction is ~3 times the error field on a vacuum field basis: the plasma strongly modifies the error and correction fields differently, and the total fields actually come to partial cancellation. The theory provides guidance for error correction with imperfectly matched fields. Separately, a short proof of principle experiment showed that further improvement (locked mode avoidance) is possible if the remaining TF coil current feed error were reduced.

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