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Magnetic Field Errors: Reconciling Measurement, Modeling and Empirical Correction on DIII-D[1] M.J. SCHAFFER, J.L. LUXON, G.L. JACKSON, J.A. LEUER, J.T. SCOVILLE, General Atomics — The interaction between magnetic field errors and plasmas must be understood in order to rationally design efficient error correction systems for toroidal magnetically confined fusion experiments. Poloidal magnetic field system errors were first measured inside the DIII-D tokamak without plasma in 1990, after which a correction coil system was installed, routinely operated and upgraded several times. Subsequent empirical optimizations (for locked mode avoidance and minimum braking of toroidal plasma rotation) during plasma operations yielded much larger correction fields with different spatial phases than were predicted from the measured vacuum field errors. Vacuum magnetic errors were remeasured with improved techniques late in 2001 and were found to be somewhat smaller than those deduced in 1990. Numerical analysis shows that the empirically optimized correction fields add to, rather than reduce, the measured vacuum errors (new and old). We attempt to understand this puzzling error-plasma interaction through numerical and analytic models.

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