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Multi-machine Scalings of n=1 and n=2 Error Field Correction[1]

N.C. LOGAN, J.-K. PARK, Q. HU, S. YANG, PPPL, C. PAZ-SOLDAN, E.J. STRAIT, S. MUNARETTO, GA, Y. IN, UNIST, H. WANG, IPP CAS PRC, T. MARKOVIC, IPP CAS CR, M. MARASCHEK, MP-IPP, L. PIRON, CCFE, P. PIOVESAN, RFX, Y. GRIBOV, IO — New power law scalings of the error field (EF) penetration thresholds across a wide range of tokamaks have been developed for toroidal mode numbers n=1 and 2. These scale the threshold in the EF aligned with the dominant mode of core resonant drive as calculated by GPEC and project values on the order of 1-10G for ITER (criteria the ITER tolerances and correction coils easily satisfy). Within the typical regimes of DIII-D, the nonlinear MHD code TM1 reproduces the primary scaling behaviors observed in experiments. However, not all experiments conform to the simple power scaling framework. Observations at high density in KSTAR and DIII-D show a regime transition that drastically alters the density scaling. Other anomalies are observable in the impact of nonresonant error fields, which can alter the threshold through rotation braking or impact on the L-H transition dynamics. These anomalies necessitate modification of the simple resonant scalings to better describe the EF correction challenge in ITER and existing tokamaks.

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