

Analysis and correction of intrinsic non-axisymmetric magnetic fields in high beta DIII-D plasmas

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Abstract. Rapid plasma toroidal rotation, sufficient for stabilization of the $n = 1$ resistive wall mode, can be sustained by improving the axisymmetry of the toroidal magnetic field geometry of DIII-D. The required symmetrization is determined experimentally both by optimizing currents in external $n = 1$ correction coils with respect to the plasma rotation, and by use of $n = 1$ magnetic feedback to detect and minimize the plasma response to non-axisymmetric fields as beta increases. Both methods point to an intrinsic ~ 7 Gauss (0.03% of the toroidal field), $m/n = 2/1$ resonant helical field at the $q = 2$ surface as the cause of the plasma rotation slowdown above the no-wall beta limit. The drag exerted by this field on the plasma rotation is consistent with the behavior of “slipping” in a simple induction motor model.