Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Quantifying non-axisymmetric perturbations of the plasma edge[1]

JOE MILLIANO, Truman State, N. FERRARO, C. PAZ-SOLDAN, GA, B. LYONS, ORAU — Tokamak plasmas, while largely axisymmetric, exhibit non-axisymmetric displacements due to both internal instabilities and intentionally applied 3D magnetic fields. Measuring these displacements can identify non-axisymmetric sensitivities to various parameters and benchmark existing plasma response models. We measure the spatial shift of temperature, density, and rotation profiles as n=2 3D fields are applied by the DIII-D upper and lower in-vessel coils. The currents are quickly inverted, shifting the toroidal phase of the applied fields by 180 degrees. These quick polarity inversions allow us to extract information about the non-axisymmetric properties of the plasma, while keeping the overall axisymmetric properties unchanged. Using a variety of toroidally separated high-resolution kinetic profile diagnostics, we infer the magnitude of these displacements at various toroidal angles. The absolute magnitude of the displacements are compared against different applied n=2 field pitches and different underlying axisymmetric equilibrium conditions, such as plasma pressure and collisionality.

[1]Supported by US DOE under SC-G903402, DE-FC02-04ER54698.

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Date submitted: 21 Jul 2015 Electronic form version 1.4