Abstract Submitted for the 52nd Annual Meeting
Division of Plasma Physics
November 8–12, 2010, Chicago, Illinois

Category Number and Subject:

[ ] Theory [X] Experiment

Improving Diamagnetic Flux Temporal Resolution to Measure ELM Energy Loss,* P.E. Sieck, *GA*; L.R. Baylor, *ORNL;* T.E. Evans, A.W. Leonard, T.H. Osborne, E.J. Strait, *GA*;— When an ELM occurs in a tokamak, a substantial loss of stored thermal energy can occur in a very short time, resulting in a change in the plasma diamagnetism. A diamagnetic loop is therefore an attractive diagnostic for characterizing the change in energy during ELMs. A loop external to the vessel can be used but it is bandwidth-limited by the vessel wall, therefore the signal is severely attenuated above 40 Hz in DIII-D. The temporal resolution can be improved by combining the (slow) diamagnetic signal with a properly-scaled internal (fast) toroidal B_T signal. The results agree with finely-spaced EFIT equilibrium reconstructions to within 10% before each ELM, but the diamagnetic calculation often shows up to twice the drop in energy at the ELM. The B_T signal reveals the magnetic change completes in 0.5 ms or less with occasional dynamics above 10 kHz. This improved temporal resolution allows comparison of phenomenology in natural vs. pellet-triggered ELMs, and also effects of partial ELM suppression under resonant magnetic perturbation.

*Supported by the US DOE under DE-FC02-04ER54698 and DE-AC05-00OR22725.