Equilibrium and Stability Analysis of Pegasus Plasmas

G.D. Garstka, S.J. Diem, R.J. Fonck, A.C. Sontag, K.L. Tritz, E.A. Unterberg, University of Wisconsin-Madison

Magnetic equilibrium analyses of near-unity aspect-ratio discharges in the PEGASUS Toroidal Experiment have been performed using a locally developed code which incorporates a nonlinear least-squares fitting routine coupled to a Grad-Shafranov solver. Induced currents in the continuous, resistive vessel wall are estimated using a time-evolving current filament model and are constrained during the reconstruction by wall-mounted flux loops and B-dot coils. With I_{wall}/I_p up to 2, the wall contribution to the total poloidal field often dominates early in the discharge. An upgrade of the internal magnetics set to include 20 poloidal flux loops, a poloidal array of 20 B-dot coils, and a diamagnetic loop has increased the accuracy of equilibrium reconstructions. Plasmas with $A < 1.3$, $I_p <= 0.15MA$, $0.2 < l_i < 0.8$, and $beta_t < 25\%$ have been analyzed. The presence of a broad $q \sim 2$ region inside the plasma corresponds to the growth of a large m=2/n=1 internal mode; at higher values of plasma current an m=3/n=2 mode has been observed. Ideal stability analyses have been performed using DCON; these analyses predict instability to external kink modes in good agreement with observed plasma disruptions.

Supported by U.S. DoE Grant No. DE-FG02-96ER54375