# CONTROL OF THE RESISTIVE WALL MODE IN ADVANCED TOKAMAK PLASMAS ON DIII–D*

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DIII–D experiments[1] have confirmed the MHD prediction that an n=1 resistive wall mode (RWM) becomes unstable when the plasma normalized beta exceeds the ideal limit calculated without including the effect of the wall, and the plasma rotation slows below a critical speed. Recently, RWMs were observed during experiments to devolp quasi steady-state advanced tokamak regimes with low internal inductance. In the absence of RWMs, these ELMing H–mode discharges have maintained normalized performance parameters of $\beta_N$*H~9 for up to 2 s. The destabilization of the RWM and its damping of the plasma toroidal rotation were correlated with beta saturation or collapse. We are investigating two possible approaches to the stabilization of the RWM: sustainment of a large plasma toroidal rotation and application of external magnetic fields in closed loop feedback.

In DIII–D the plasma rotation can be increased by varying the number and the energy of the neutral beam sources used for heating. Preliminary analysis suggests that increased angular momentum injection may be responsible for an increase in the duration of the high performance phase by at least a factor of two. Comparison with results from experiments performed with neutral beam injection opposite the plasma current direction should allow us to separate the contributions of diamagnetic drift and E×B drift to the plasma toroidal rotation, and thus determine which velocity is relevant for stabilization of the RWM.

The feedback experiments use the existing six-element error field correction coil (C-coil), located outside the vessel on the mid-plane and energized by three new switching-power amplifiers with a frequency range of 0–100 Hz. Six sensor loops monitor the flux leakage through the vessel wall and are poloidally and toroidally aligned with the active coils. A qualitative survey of several feedback schemes has been carried out, with emphasis on the "smart shell,"[2] the "fake rotating shell,"[3] and the "mode control"[4] concepts. The results show that the amplitude of the RWM can be reduced, and in some cases the onset of the mode can be delayed. The experimental results are consistent with the simulations of the 3D feedback modeling code VALEN, which predict only a small improvement in stability against the RWM with a feedback system using the existing sensor and active coil geometry. The VALEN code is being used to design extensions to the present feedback system that would further improve RWM stabilization.

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