Feedback Control of the Safety Factor Profile Evolution in DIII-D Advanced Tokamak Discharges\(^1\) J.R. FERRON, P. GOHIL, C.M. GREENFIELD, J. LOHR, T.C. LUCE, C.C. PETTY, M.R. WADE, General Atomics, T.A. CASPER, R.J. JAYAKUMAR, M.A. MAKOWSKI, LLNL, M. MURAKAMI, ORNL, D. MAZON, CEA — In an advanced tokamak discharge in DIII-D, the \(q\) profile is established during the plasma current ramp-up and early flattop phases and sustained during the subsequent high beta phase. Initial feedback control experiments have focused on ensuring that the desired \(q\) profile at the start of the high beta phase, \(1.5 < q_{\text{min}} < 2.5\) and \(q(0) - q_{\text{min}} \approx 0.5\), is reproducibly obtained. The rate of evolution of the current density profile, and thus the \(q\) profile, is modified through changes in the conductivity with electron heating. Closed loop control of the \(q\) evolution has been successfully tested in both L-mode and H-mode using either ECH at \(\rho \approx 0.4\) or neutral beam power as the actuator. The \(q\) evolution can also be modified with changes in the plasma current ramp rate or noninductive current drive. The \(q\) profile evolution data are being compared to models to facilitate development of improved controllers.

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