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Plasma Current Ramp-up and Sustainment with Bootstrap Current¹ P.A. POLITZER, H.E. ST. JOHN, R.L. MILLER, General Atomics, C.C. FOREST, U. Wisconsin, W.M. NEVINS, L.D. PEARLSTEIN, LLNL — Tokamak-based fusion power plant designs rely on ~100% bootstrap current for minimum auxiliary power steady-state operation. Further, noninductive current initiation and ramp-up is an essential feature of ST designs and would simplify the design of any tokamak. DIII-D has begun a study of the ramp-up and control of high-bootstrap-fraction plasmas. The optimum path for ramp-up is to initially raise the current at high β_p , maximizing bootstrap current near the equilibrium limit. The experiments are performed with $dI/dt=0$ in the transformer. Initially we use neutral beams for heating, and current drive to supplement the bootstrap. Almost constant current ($dI/dt \approx -30$ kA/s, at $I = 800$ kA) can be maintained for several seconds. Unfortunately, low level instabilities cause enhanced fast ion loss, reducing the heating and current drive by the beams. An experiment is planned using rf (ECH and fast wave), primarily for direct electron heating to maximize the bootstrap current. These results, with model calculations for DIII-D and low aspect ratio configurations will be presented.

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