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[**X**] Theory [ ] Experiment [ ] Combined/General

Exploration of steady-state scenarios for the Fusion Development Facility (FDF),* V.S. Chan, A.M. Garofalo, R.D. Stambaugh, M. Choi, J.E. Kinsey, L.L. Lao, P.B. Snyder, H.E. St. John, A.D. Turnbull (GA) – A Fusion Nuclear Science Facility (FNSF) has to operate at 10^5 times longer duration than that of present tokamak discharges. The scalability of plasma sustainment to such a long time is an issue that needs to be resolved by scientific understanding. We carry out steady-state (SS) scenario development of the FDF (a candidate for FNSF-AT) using an iterative process toward a self-consistent solution via alternating temperature profiles and current profile evolution. The temperature profile evolves according to a physics-based transport model GLF23. SS requires large off-axis current drive (CD). To achieve this with no NBI is highly challenging. It however simplifies tritium containment, increases area for tritium breeding, and avoids costly negative-ion NBI technology. We find that with ECH/ECCD only, too much power is required. A SS baseline equilibrium is found by adding LHCD: $Q_{fus} \sim 4$, $H_{98y2} \sim 1.2$, $f_{BS} \sim 70\%$, $P_{fus} \sim 260$ MW, $P_{EC} = 35$ MW, $P_{LH} = 21$ MW. The GATO ideal MHD code finds the equilibrium stable to $n = 1$ internal kink at $\kappa = 2.3$.

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