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DIII-D Upgrade to Prepare the Basis for Steady-State Burning Plasmas,* R.J. Buttery, H.Y. Guo, T.S. Taylor, M.R. Wade, *GA*; D.N. Hill, *LLNL* – Future steady-state burning plasma facilities will access new physics regimes and modes of plasma behavior. It is vital to prepare for this both experimentally using existing facilities, and theoretically in order to develop the tools to project to and optimize these devices. An upgrade to DIII-D is proposed to address the three critical aspects where research must go beyond what we can do now: (i) torque free electron heating to address the energy, particle and momentum transport mechanisms of burning plasmas using electron cyclotron (EC) heating and full power balanced neutral beams; (ii) off-axis heating and current drive to develop the path to true fusion steady state by reorienting neutral beams and deploying EC and helicon current drive; (iii) a new divertor with hot walls and reactor relevant materials to develop the basis for benign detached divertor operation compatible with wall materials and a high performance fusion core. These elements with modest incremental cost and enacted as a user facility for the whole US program will enable the US to lead on ITER and take a decision to proceed with a Fusion Nuclear Science Facility.

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