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Progress of NSTX Program in Physics Basis for 10-MA Devices[1]

Y.-K. M. PENG, ORNL, UT-Battelle @ PPPL, THE NSTX TEAM TEAM — Recent progress in Spherical Torus (ST) plasma science has indicated relatively robust and attractive physics conditions in a number of topical areas including shaping, stability limits, energy confinement, self-driven current, sustainment, and divertor heat flux. This progress has enabled an updated projection of the plasma conditions of a 10-MA ST such as the Component Test Facility (CTF), which is a necessary step in the development of practical fusion energy. The results indicated designs with R_0 = 1.2 m, A = 1.5, elongation $\sim$ 3, B_T $\sim$ 2 T, producing a fusion burn power of 140 MW, and a fusion neutron flux of 2 MW/m2, driven by 50 MW of combined neutral beam and RF heating and current drive power. The design uses a single-turn toroidal field coil center leg without a central solenoid, and will require physics data on solenoid-free plasma current initiation, ramp-up to, and sustainment at multiple MAs. An assessment of the ST physics basis to establish the design of such a 10-MA device and comparison with the present and planned achievements of the NSTX Program will be presented.

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