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Parameter Sensitivities and Physics Optimization for SPARC<sup>1</sup> M. GREENWALD, MIT, D. BRUNNER, A. CREELY, CFS, N. HOWARD, J.W. HUGHES, A.Q. KUANG, YIJUN LIN, P. RODRIGUEZ-FERNANDEZ, MIT, S. SCOTT, PPPL, S. WUKITCH, MIT, AND THE SPARC TEAM — SPARC, the fourth in the series of compact high-field tokamaks at MIT, will be a D-T burning experiment based on emerging HTS magnet technology. Using conservative plasma physics assumptions – essentially the ITER baseline – an initial design point was predicted to achieve a mission defined as Q>2, with significant margin, and fusion power greater than 50 MW. Starting with that V0 design point, which had = 12T and R = 1.65m, recent activities have focused on joint optimization Вт of the physics and engineering of the device. These studies have looked at the dependence of fusion gain and power with machine parameters: magnetic field, safety factor, auxiliary power, aspect ratio, elongation and triangularity while assessing sensitivities to uncertainties in energy confinement L-H power threshold, density and temperature profile peaking and impurity content. Both 0D scaling and 1.5D simulations were used in these studies. Maintaining performance margin for the mission against these uncertainties is a key consideration. Physics performance is then balanced against the impact on device cost, mechanical stresses, thermal loads and neutron shielding. The outcome will be a new design point which will be the subject of detailed engineering design.

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