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P2.1001 SPARC: Extending the high-field path to a net-energy tokamak

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SPARC is designed to be a high-field (B0 = 12 T), compact (R0 = 1.65 m), D-T burning plasma tokamak with the goal of producing net energy gain (Q > 1) from magnetic fusion for the first time. Currently in the pre-conceptual design phase, SPARC will utilize new magnets based on rare-earth barium copper oxide (REBCO) high temperature superconductors (HTS), continuing the high-field path of the Alcator series of tokamaks. While previous high-field, net-energy tokamak designs (Ignitor, CIT, BPX, and FIRE) were considered technological dead-ends for power generation due to the power consumption in their copper magnets, HTS opens a new pathway to a high-field fusion power plant, as embodied in the conceptual ARC design [1, 2]. Using conservative plasma physics (H98 = 1), SPARC is projected to generate more than 50 MW of fusion power and achieve Q > 2.0, while being closer than ITER in dimensionless plasma parameters to current experiments. Additionally, SPARC is projected to achieve Q = 1.0 in L-mode with H89 = 1. Other aspects of the machine, such as the divertor and ICRF heating, will also be discussed in this presentation.

[1] B. Sorbom et al., Fus. Eng. Design 100, 378 (2015). [2] A.Q. Kuang et al., Fus. Eng. Design 137, 221 (2018).

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