Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

High Temperature Superconductor and 3D Additive Manufacturing for Non-Planar Stellarator Coils[1] ROBERT GRANETZ, MIT, RANDALL VOLBERG, Type One Energy, DAVID ANDERSON, LIANYI CHEN, THOMAS KRUGER, LUIS IZET ESCANO, University of Wisconsin — Optimized superconducting stellarators, such as W7-X, have used low-temperature superconductor technology and conventional machining of support structure to fabricate the required 3D non-planar coils. This technology limits the maximum B-field on-axis to ≤ 3 tesla, and construction is expensive and slow. ARPA-E has recently funded a 2-year project proposed by U. Wisconsin and MIT PSFC that will use high temperature superconducting (YBCO) tape and additive manufacturing (3D metal printing) to fabricate a prototypical 3D non-planar superconducting coil, with the eventual goals of producing higher magnetic field, while reducing the manufacturing cost and schedule. The non-planar coil will be based on HTS technology that has been developed for the SPARC tokamak, modified to accommodate the required non-planar geometry and tight-radius bends. The coil will consist of two multi-turn spiral pancakes, mechanically supported by 3D printed non-planar stainless steel radial plates, with inter-pancake electrical and coolant joints. The coil 'diameter' will be $\sim$70 cm, and it will be operated at 77 K, with 40 kA-turns generating a peak field of $\sim$1 tesla on the conductor. Well-diagnosed testing will characterize the critical current, 3D B-field structure, and quench robustness.

[1]ARPA-E (BETHE)

Robert Granetz
MIT

Date submitted: 19 Jun 2020 Electronic form version 1.4