MT29 Abstracts and Technical Program



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Thu-Af-Po.05-01: High-rate production and validation of Canis magnets

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"Eos", Thea Energy, Inc.'s first integrated fusion system, will utilize arrays of small, optimized planar coils that help to mitigate manufacturing complexity found in prior generations of the stellarator. To properly shape the magnetic fields necessary for plasma confinement, Eos will require hundreds of these planar coils; Thea Energy's ability to reliably and quickly produce them will be critical for future development.

Through the manufacturing, testing, and integration of the "Canis"3x3 array of high-temperature superconducting (HTS) planar coils, Thea Energy successfully demonstrated the ability to rapidly scale magnet production while maintaining performance. With development focused equally on the critical and complex winding and stacking processes, in-house tools, fixtures, and software, we produced resilient and consistent magnets across differing input materials and piece part quality levels. Several design iterations and manufacturing process automations for tape preparation further enabled Thea Energy's magnet manufacturing to grow from one magnet per week to two magnets per day across a six-month period.

In parallel, Thea Energy developed and deployed all the instrumentation and testing infrastructure necessary to reliably perform acceptance testing of each of the Canis 3x3 magnet array's planar coils. Acceptance tests were conducted in a bath of liquid nitrogen at 77K, where each test consisted of current ramps, and voltages across various parts of the magnet coil were measured. Field measurements were obtained using Hall sensors, and magnet parameters such as equivalent series resistance (ESR), radial resistance, field scaling, etc. were extracted from the data acquired from each test. While an acceptance criterion based on Joule heating was used to qualify a magnet coil, other factors such as relative variance of field scaling and radial resistances were also considered. Winding, stacking, and testing operations together ensured that build and performance variance was within acceptable limits and that Thea Energy could reproduce this effort.

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