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Wed-Af-Po.12-03: HTS Power Supplies for DC Fusion Magnets

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OpenStar is building a levitating dipole reactor (LDR), following in the footsteps of LDX and RT-1. In our quest to achieve fusion we are building Junior; an assembly of non-insulated (NI) high temperature superconducting (HTS) pancake coils weighing 500 kg operating at 1.44 kA and a peak field of 5.6 T.
An enabling step for the LDR is developing an integrated power supply system which has the ability to maintain the current in the magnet while it is levitating and confining plasma. Recent developments in HTS superconducting power supplies have shown that they are a viable solution to keeping an HTS magnet charged with minimal heat leak to the magnet (operating at 30-50 K). We will detail the challenges of building and operating a power supply which needs to interface with two drastically different temperature regimes (50 K and 300 K) in addition to another intermediate regime (65 K).
While levitated, we need the power supply system to operate without supervision, maintaining the current and watching for crucial events; like over temperature, which can be communicated via simple IR communications. A traditional suite of semi-conducting power supplies and control electronics were developed and integrated which is housed in an internal cavity on-board Junior.
In this presentation we will present the performance specifications of the developed HTS power supply system, such as charge time, energy efficiency, and thermal performance of our dipole system during our first plasma experiment.

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