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Thu-Af-Po.06-02: Design and integration of Top Magnet in the Levitated Dipole experiment

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Open Star Technologies is advancing the Levitated Dipole reactor concept, utilizing high-temperature superconducting technology to maintain a toroidal magnetic field for effective plasma confinement. Inspired by Earth's magnetic field, this innovative approach offers distinct advantages over other fusion concepts. It enables rapid iteration cycles, ensures inherently stable plasma physics, and leverages groundbreaking applications with HTS technologies. Coupled with cost-effective infrastructure scaling, it guarantees swift and affordable risk retirement.

Levitated dipole concept is realized by combining two magnets, one Top Magnet which provides lifting and containment of the Core Magnet within the vacuum chamber where plasma is generated. Levitating a half a tonne magnet, in the environment specific to the dipole fusion generation technology, poses special challenges to the magnet designer. The Top Magnet provides a lifting/containing force ensuring the toroidal magnet within the experimental chamber is levitated and kept within strict positional tolerances.

The Top Magnet at Open Star is created utilizing 2G (YBCO) HTS tape, wound in a double pancake configuration (˜300 turns each, using a total of ˜2km of YBCO tape). It is designed within its own cryostat to handle significant loads induced by magnetic couplings.

The Top Magnet operates at up to 700A with an AC control component. During levitation procedure, its power supply is controlled using PID modulation ensuring stable position of the Core Magnet. This modulation produces up to ±100V across the HTS coil.

This presentation covers the Open Star Top Magnet design, construction and integration into the control network.

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