Contribution ID: **781** Type: **Contributed Oral**

Sat-Mo-Or2-03: Achieving full-field magnet performance: insights from Openstar junior experimental campaigns 1 and 2.

Saturday 5 July 2025 08:45 (15 minutes)

High-Temperature Superconducting (HTS) fusion magnets play a pivotal role in plasma confinement for tokamaks and stellarators. Building on insights from the LDX and RT-1 programs, Openstar Technologies has developed a novel approach utilizing ReBCO for a levitated dipole magnet, powered by HTS flux pumps. We aimed to demonstrate a 5.6 T DC magnet made of 14 solder impregnated HTS coils, mimicking the output performance of the equivalent LTS magnet used in LDX. This work highlights the outcomes of both experimental campaigns we had, highlighting the key achievements..
Achieving plasma confinement with a fully levitated magnet at full field is our ultimate goal. Given the complexity of constructing and powering the largest HTS magnet with flux pumps, we structured the development into three milestones.

Campaign 1: Demonstrated plasma confinement using a mechanically supported magnet operating at ˜40% of its rated current.
Campaign 2: Aimed at plasma confinement with a levitated magnet, operating at over 60% of its rated current.
In Campaign 1, we achieved plasma confinement for over 20 seconds using a supported magnet. However, this approach did not address the critical challenge of levitating a 500 kg magnet at ˜1 m above the chamber base. Campaign 2 is designed to tackle these risks, achieving magnet levitation while maintaining plasma confinement.

This presentation will cover experimental findings from both campaigns, including: 1. Magnet current, voltage, operating temperature, and field as functions of time. 2. The unique behaviour of non-insulated magnets with HTS flux pumps, focusing on the non-uniform time constants of the coils.
Experimental results are further compared with modelled predictions to deepen our understanding of magnet performance. These insights pave the way for delivering our pre-seed targets while achieving full-field magnet performance.

Authors: BOULOUKAKIS, Konstantinos (OpenStar Technologies); VENUTURUMILLI, Sriharsha (Openstar Technologies Ltd); WORDSWORTH, Theo (Openstar Technologies)

Co-authors: LEUW, Bradley; CHISHOLM, Craig (Open Star Technologies); GARNIER, Darren (Open Star Technologies); CHAMBERS, Eleanor (OpenStar Technologies); HUNTER, Emily (Open Star Technologies); STEIERS, Eric (Open Star); RICE, James (OpenStar Technologies); TODD, Joe (OpenStar Technologies); JONES, Joseph (OpenStar Technologies); ELLINGHAM, Josh (OpenStar Technologies); HAMILTON, Kent (OpenStar Technologies); CHAPPELL, Kris (OpenStar Technologies Ltd); LYNCH, Matthew (OpenStar Technologies); MCCROHON, Mick (OpenStar Technologies Ltd.); Mr BUCHANAN, Mike (Openstar Technologies Ltd); ZHOU, Nancy (OpenStar Technologies); MATAIRA, Ratu (OpenStar Technologies); HU, Raymond (Open Star Technologies); BERRY, Thomas (Open Star Technologies)

Presenter: VENUTURUMILLI, Sriharsha (Openstar Technologies Ltd)

Session Classification: Sat-Mo-Or2 - Fusion Devices: Stellarators and Levitated Dipoles