Contribution ID: **439** Type: **Regular Oral (15m)**

Cooling system for the MEESST MHD heat flux and radio blackout mitigation HTS Magnet probe

Wednesday 24 July 2024 12:45 (15 minutes)

Radio Blackout and extreme heat fluxes are critical problems occurring during spacecraft (re-)entry into planetary atmospheres. Both occur at the front surface of the spacecraft due to the compressed and partially ionized plasma. Both can be catastrophic for the mission with damages to the protection material due to heat or the complete loss of GPS data telemetry or communication with ground stations for extended periods of time. The MEESST (Magneto-Hydro-Dynamic Enhanced Entry System for Space Transportation) European project investigates a mitigation solution for both effects by developing simulation tools and ground-based plasma experiments based on the use of magneto-hydro-dynamic (MHD) principles. An experimental probe was designed and manufactured to study radio blackout and heat flux mitigation in plasma wind tunnels at the Von Karman Institute for Fluid Dynamics (VKI, Belgium) and at the Institute of Space Systems (IRS, Germany), respectively. The probe encompasses a non-insulated and conduction-cooled HTS magnet, operating near 20 K and producing the magnetic field required for the MHD plasma experiments. The magnet is housed in a cryostat surrounded by a water-cooled shell, designed to protect the probe from the plasma jet heat. While the operation of the probe in the plasma environment was rather challenging, the magnet and the cooling system behaviors were quite stable during the first campaign of experiment at VKI.
We report, here, on the design of the probe, detailing the main design points with regards to the cooling system, including the cryogenic loop required to maintain the 5-pancakes REBCO (Rare Earth-Barium-Copper-Oxide) magnet near 20K, and the external water-cooled shell designed to sustain the extreme heat fluxes imposed by the plasma. We will finish with a brief overview of the tests performed to demonstrate the expected operation of the system in its test environment.

Submitters Country

France

Author: DALBAN-CANASSY, Matthieu (Absolut System)

Co-authors: Mr S. PAGAN, Adam (University of Stuttgart); Mr VILADEGUT, Alan (Von Karman Institute for Fluid Dynamics); Mr BEHNKE, Alexander (University of Stuttgart); Mr GODET, Alexandre (Absolut System); Mr LANI, Andrea (Katholieke Universiteit Leuven); Mr SMARA, Anis (THEVA); Mrs DRECHSLER, Antje (Karlsruhe Institute of Technology); Mr HELBER, Bernd (Von Karman Institute for Fluid Dynamics); Mrs LUIS, Diana (Von Karman Institute for Fluid Dynamics); Mr HERDRICH, Georg (University of Stuttgart); Mr REY, Jean-Christophe (Absolut System); Mr OSWALD, Johannes (University of Stuttgart); Mr BERINDEI, Jérémy (Absolut System); Mr LEFÈVRE, Nicolas (Absolut System); Mr CAMUS, Philippe (Absolut System); Mr RENAUD, Pierre (Absolut System); Mr GEHRING, Rainer (Karlsruhe Institute of Technology); Mrs I. SCHLACHTER, Sonja (Karlsruhe Institute of Technology); Mr SHARMA, Vatsalya (Katholieke Universiteit Leuven); Mr GIANGASPERO, Vincent (Katholieke Universiteit Leuven)

Presenter: DALBAN-CANASSY, Matthieu (Absolut System)

Session Classification: Wed-Or8

Track Classification: Tracks ICEC 29 Geneva 2024: ICEC 05: Cryogenic applications: aerospace