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Performance of conduction-cooled HTS Magnet in radio blackout mitigation experiment

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In the framework of the Helmholtz-Russia Joint Research Group "COMBIT"a conduction-cooled HTS magnet has been designed and built for a radio blackout mitigation experiment. Radio blackout phases often occur during hypersonic or reentry flight of space vehicles. A dense plasma layer created during hypersonic or reentry flight leads to attenuation or reflection of radio waves and therefore to interruption of communication with ground stations or satellites including GPS signals, data telemetry, and voice communication. To prevent attenuation or reflection of radio waves transmitters and antennas can be placed in regions with lower plasma number density. The aim of "COMBIT"is to demonstrate that the plasma density can locally be reduced with crossed electric and magnetic fields which deflect charged particles and reduce the plasma number density in the vicinity of transmitters or antennas.
Numerical simulation of the plasma flow in crossed electric and magnetic fields was preformed at Ioffe Institute. Ground experiments have been performed in an arc-heated wind tunnel (L2K facility) at the German Aerospace Center in Cologne. The magnetic field was produced by a conduction cooled HTS magnet consisting of 5 coated conductor double pancakes. The main challenge for design and construction of the magnet and cryostat was to realize a high stray field in the plasma beam outside the cryostat with a small coil diameter. In the 2014 measurement campaign magnetic fields up to 2 T in the plasma beam could be achieved, corresponding to a maximum field of 5.16 T at the winding. After a revision of magnet and cryostat a new measurement campaign will be started in 2015. Details about magnet and cryostat design and performance during the measurement campaigns at the German Aerospace Center will be presented together with first results related to the Radio blackout mitigation Experiment.

Primary author: SCHLACHTER, Sonja (Karlsruhe Institute of Technology)

Co-authors: GÜLHAN, Ali (German Aerospace Center); KLING, Andrea (Karlsruhe Institute of Technology); RINGSDORF, Bernd (Karlsruhe Institute of Technology); FILLINGER, Holger (Karlsruhe Institute of Technology); WU, Hong (Karlsruhe Institute of Technology); WILLMS, Johann (Karlsruhe Institute of Technology); BRAND, Jörg (Karlsruhe Institute of Technology); STEFFENS, Lars (German Aerospace Center); PONIAEV, Serguei (Ioffe); WALSCHBURGER, Uwe (Karlsruhe Institute of Technology); GOLDACKER, Wilfried (Karlsruhe Institute of Technology); KURAKIN, Yurii (Ioffe)

Presenter: SCHLACHTER, Sonja (Karlsruhe Institute of Technology)

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