Contribution ID: **249** Type: **Poster presentation (105min)**

Fiber Bragg grating sensors for a mass flow determination in a rotating liquid neon cooling channel

Tuesday, 8 July 2014 14:15 (1h 45m)

The use of High Temperature Superconducting (HTS) magnets has increased in recent years in many applications due to its chances of achieving high current carrying capacity and the possibility of avoiding the HTS cooling by costly, less available liquid helium. While most of the applications aimed at liquid nitrogen coolant, some special applications like HTS Generator, for example, use liquid neon for cooling its rotor. The operational characteristics of such a rotor could be greatly improved by optimized cooling channel, mass flow rate of the coolant and its interaction with the magnet under given thermodynamic conditions. To understand and to optimize the cooling efficiency, a model has been developed in which the thermodynamic parameters have been varied and analyzed. The calculated mass flow rate of the optimized cooling channel has to be validated by a real time measurement system. The commercially available sensing systems may not be suitable for this purpose, because of the various practical difficulties in sensor installation, wiring and signal tapping in a high speed rotating cooling channel. In order to overcome these issues, a Fiber Bragg grating based sensing system with multiplexing capability has been considered. The measured temperature distribution along a cooling channel could be used to determine the mass flow rate. In this work, an outline of the simulated model and the initial test studies of FBG sensors will be reported.

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Session Classification: Tue-Af-Posters Session 1.4

Track Classification: C-16: Instrumentation and process control