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Thermal Analyses of the Intermediate Station of the Cryocooler-Cooled MICE Coupling Solenoid

Author Block

: A. Radovinsky, A. Zhukovsky;

PSFC, MIT, Cambridge, MA, USA.

Abstract:

MICE coupling coil is conduction cooled using 3 cryocoolers, which maintain an operating temperature of about 40 K and 4.5 K at the first and second stages respectively. The analyses account for the balance of heat loads at the intermediate cooling station integrating 3 cryocoolers on 3 copper plates connected by 2 pairs of copper joint straps, and 2 copper blocks with the terminals for the optimized RT and HTS current leads. Each cryocooler cooling power is a function of the temperature of its first and second stages. Temperatures at the first stage of individual cryocoolers are different. Temperature drop between the cryocooler first stage and Cu Lead cold end is calculated by FEA performed using TEMPO, a thermal package of the Vector Fields Opera program. Program Mathematica is used to find a balance between the heat loads, the power vs. temperature performance characteristic of the cryocoolers and the calculated temperature distribution in the copper plates. Usually analyses iterate between the cryocooler performance characteristics and the intermediate cooling station temperature distribution FEA. A method is developed to converge in one step.

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