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C3Po1B-02 [14]: Improved Utilization of Cryocooling Power in Superconducting Undulators at the Advanced Photon Source

Wednesday, July 24, 2019 9:00 AM (2 hours)

In 2018 a new cryostat designed to support operation of a helically-wound-coil superconducting undulator (HSCU) was installed at Argonne National Laboratory's Advanced Photon Source (APS) synchrotron. Magnet temperatures are maintained near 4.2K by natural circulation of liquid helium (LHe) through the magnet potting, and although the HSCU cryostat operates in "zero boil-off" mode by providing excess cooling power to the 4.2K cold-mass, the cooling margin does not meet expectations due to higher-than-anticipated thermal resistances between the 4.2K load and the cryocooler-based refrigeration system. The resulting loss in cooling power due to large temperature differentials between the cryocooler 2nd-stages and the load adversely affects quench response and tolerance to thermal transients. The current project seeks to characterize the thermal impedances in the 4.2K cold-mass cooling circuits through analysis and experiment, and propose mitigating measures to increase cooling capacity. Recent work has focused on measuring the 4K thermal conductances of the LHe reservoir wall and braided copper thermal links connecting the cryocooler 2nd stages to the 4.2K cold-mass, which together encompass the majority of the discrete thermal resistances in these cooling channels.

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