



Contribution ID: 729 Contribution code: THU-PO3-108-07

Type: Poster

Study on Conduction Cooling of Superconducting Magnets for the ILC Main Linac

Thursday, 18 November 2021 10:00 (20 minutes)

In the main linac of the International Linear Collider (ILC), superconducting magnets for beam focusing and steering will be located periodically in superconducting RF (SRF) cavity string for beam acceleration in common cryomodules. A concept of conduction cooling of the combined-functioned, split-able superconducting magnets has been proposed and investigated to adapt much different features and to meet different requirements for the superconducting magnet and SRF cavity in fabrication, assembly, and operation. It is required to integrate the superconducting magnet after the SRF cavity string assembly completed under ultra-clean environment, and to isolate and the magnet operation by using conduction cooling through thermal link to LHe cooling pipe. In addition, an important issue has been recently identified. High gradient SRF cavities naturally emit field emission electron flux from the inner surface, so called dark current. It may pass through the subsequent SRF cavity string and penetrate into the superconducting magnets placed downstream. It may heat up the superconducting coils may cause the quench. Therefore, further study on reliable conduction cooling and to secure the superconducting magnet operation with keeping sufficient safety margin. It is also important to integrate lessons learned from a model magnet development carried out in cooperation with Fermilab and KEK. In this report, we report the R&D progress in study on the conduction cooling of the superconducting magnet for the ILC main linac.

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Session Classification: THU-PO3-108 Accelerator Magnets VI: LTS