Superconducting Magnets of the Mu2e Experiment

Michael Lamm
Fermilab

The Fermilab Mu2e experiment seeks to measure the rare process of direct muon to electron conversion in the field of a nucleus. Key to the design of the experiment is a system of three superconducting solenoids; a muon production solenoid (PS) which is a 1.8 m aperture axially graded solenoid with a peak field of 5 T used to focus secondary pions and muons from a production target located in the solenoid aperture; an “S shaped” transport solenoid (TS) which selects and transports the subsequent muons towards a stopping target; a detector solenoid (DS) which is an axially graded solenoid at the upstream end to focus transported muons to a stopping target, and a spectrometer solenoid at the downstream end to accurately measure the momentum of the outgoing conversion elections. The magnetic field requirements, the significant magnetic coupling between the solenoids, the curved muon transport geometry and the large beam induced energy deposition into the superconducting coils pose significant challenges to the magnetic, mechanical, and thermal design of this system. A conceptual design for the magnetic system which meets the Mu2e experiment requirements is presented, with emphasis on design issues related to beam induced heating and radiation damage.