



Contribution ID: 602

Type: **Contributed Oral**

Wed-Mo-Or2-01: Magnet R&D Plans for the Muon Collider

Wednesday 2 July 2025 11:15 (15 minutes)

The Muon Collider (MC) embodies a groundbreaking concept in circular colliders for high-energy physics, offering a unique pathway to achieve unprecedented energy and luminosity of the colliding partons while significantly reducing environmental impact compared to conventional collider technologies. A critical aspect of its feasibility lies in the development of cutting-edge superconducting magnet systems capable of meeting the demanding requirements of muon production, acceleration, and collision.

Key research and development (R&D) objectives include achieving magnetic field strengths of up to 40 T (in solenoids), managing stored energies exceeding 300 MJ in a single magnet (solenoid), mitigating heat loads from muon decay at levels of several W/m, and ensuring radiation resistance exceeding 50 MGy. Overcoming these extraordinary challenges requires the innovative integration of high-temperature superconductor (HTS) technology, optimized for efficient operation at cryogenic temperatures up to 20 K, as well as the pursuit of compact designs to reduce capital expenditure.

In recent years, the International Muon Collider Collaboration (IMCC), hosted at CERN, has made significant progress in both the conceptual and, in some cases, the engineering design of these systems. This includes advancements in materials development, small-scale coil testing, and the establishment of a comprehensive R&D roadmap. This paper outlines a detailed plan with staged milestones, focusing on the development and testing of small- and full-scale magnet prototypes, ultimately culminating in their validation under collider-relevant conditions. This systematic approach aims to advance the technological readiness of magnet systems, bringing the realization of the Muon Collider closer to reality.

Authors: BORDINI, Bernardo (CERN); BOTTURA, Luca (CERN)

Co-authors: CAIFFI, Barbara; AUCHMANN, Bernhard (PSI); BOATTINI, Fulvio (CERN); Prof. COOLEY, Lance; Dr STATERA, Marco (INFN Milano - LASA); MARIOTTO, Samuele; FABBRI, Siara Sandra (CERN); PRESTEMON, Soren; Dr GOURLAY, Stephen (FNAL); NAKAMOTO, Tatsushi (KEK)

Presenter: BORDINI, Bernardo (CERN)

Session Classification: Wed-Mo-Or2 - Muon Collider Magnets