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Magnet R&D for the muon collider: proposed R&D plans

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The muon collider represents a transformative approach in particle physics, offering a pathway to achieve high energy and luminosity with reduced environmental impact compared to other collider technologies. Central to its feasibility is the development of advanced magnet systems capable of supporting the stringent requirements of muon production, acceleration, and collision. The key targets for magnet R&D include achieving field levels up to 40 T, magnets with stored energies up to 300 MJ, managing heat loads from muon decay at the level of several W/m, and ensuring radiation resistance well above 50 MGy. Given such extraordinary challenges, research presently focuses on integrating high-temperature superconductors (HTS), tailored for efficient cooling at cryogenic temperature, and striving for compact magnets to reduce the capital expenditure. In the past years we have progressed in the conceptual design, and in some cases initiated engineering design as well as materials and small-size coil testing. This has allowed to outline an R&D plan that we describe in this paper. The proposed plan involves staged milestones which include development of magnet prototypes.

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