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Wed-Mo-Or2-03: A “20 T at 20 K” Model Coil for the Muon Collider Target Decay and Capture Solenoid

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The Muon Collider (MC) is one of the options under study as the next step for high-energy physics beyond the Large Hadron Collider. The magnets for a MC, largely based on high-temperature superconductors (HTS), bear some of the most pressing technology challenges and will require intense development and demonstration in the next years. The “target decay and capture solenoid”, a high field solenoid hosting the muon beam production target, is one of these challenges. In the present baseline, the solenoid is 18 m long, produces a peak field of 20 T in a large bore of 1.4 m, it is designed to operate at 20 K, and has a stored energy in excess of 1 GJ. We have designed it based on a HTS, force-flow cooled, high-current conductor. Such performance is well beyond present state-of-the-art. This is why we are proposing to build and test a model coil that aims at increasing the technology readiness level, giving enough confidence that the whole system can be built and operated. Beyond its direct application to the Muon Collider, this development aligns with demands from other scientific fields, such as high-field physics, and societal applications, including fusion energy. In this paper we set the requirements on the model coil geometry and performance. We then describe the conceptual design of a 20 T model coil operated at 20 K, its initial engineering and analysis, and propose a construction and test plan.

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