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Design and Optimization of a Nested and Tilted Superconducting Solenoid with Multifunction Quadrupole/Dipole for the ISOLDE Superconducting Recoil Separator

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The CERN HIE-ISOLDE facility accelerates a unique worldwide variety of radioactive ions up to collision energies close to 10 MeV/A. The physics program encompasses a broad range of nuclear structure studies, from shell evolution to nuclear astrophysics. To fully profit from the new facility, our collaboration has proposed the construction of the "Superconducting Recoil Separator"ISRS will extend the HIE-ISOLDE physics program by in-beam and focal-plane particle-gamma correlation studies. The design of ISRS is based on an array of superconducting multifunction magnets (Canted Cosine Theta, CCT), integrated into a compact FFAG particle storage ring. A/Q analysis of reaction fragments is achieved by combining cyclotron frequency and RF extraction with ToF and PID at the focal plane

One of the key elements of the ISRS spectrometer is the prototype of the magnet "MAGDEM"(MAGnet DEMonstrator), the basic building block of the ISRS particle storage ring. MAGDEM
is an extremely compact, helium-free Nb-Ti CCT superconducting magnet cooled by a single GM cryocooler that incorporates the nested quadrupole and dipole functions. The cryostat features a 200 mm clear aperture for the circulation of the heavy ion fragments, and it is only ˜600 mm long. The innovative design incorporates a dipole coil (2.3 T) inside a quadrupole coil (10 T/m), providing the 36-degree bend needed for ion analysis/storage in the ISRS ring

In the talk, I'll review the design and characteristics of the ISRS ring, the ion optics, and the expected performance of the ring.

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