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Developments in magnet modeling and beam optics for the ARIS separator at FRIB

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The Advanced Rare Isotope Separator (ARIS) at the future Facility for Rare Isotope Beams (FRIB) at Michigan State University will produce high-intensity rare isotope beam by in-flight separation of reaction products from fragmentation and fission of primary beams with energies of 200 MeV/u and higher and with up to 400 kW of beam power. ARIS will use a variety of bending and focusing magnets, as well as wedged-shaped energy degraders, in order to separate contaminants and efficiently transport the rare-isotope beam of interest. Due to the large emittances of many of the products, detailed and accurate knowledge of fields is required by the beam physics model to support efficient operation. The compact design and high acceptance requirements causes the contribution of fringe fields to be large, hence requiring detailed knowledge of the magnet field distributions. As magnet designs of different magnets are being completed, detailed simulated field distributions are becoming available. The fields are analyzed to extract a relatively small set of parameters used in the beam physics simulations that emulate the fields. The residuals between the field data and emulated fields are minimized by applying fitting and Fourier analysis algorithms.

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