Superconducting Magnets for the FRIB Fragment Separator

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Abstract –

The Facility for Rare Isotope Beams (FRIB) Project is funded by the DOE Office of Nuclear Physics with operating funds through a Cooperative Agreement with Michigan State University (MSU). FRIB is based on a superconducting heavy-ion linear accelerator with a minimum energy of 200 MeV/u for all ions at beam power of 400 kW. FRIB will have a rare-isotope production area, a three-stage fragment separator, ion stopping stations and a post accelerator. The production of rare isotope beams begins with a production target where a significant fraction of the beam power is deposited. The remaining beam power then goes into the beam dump. As the power in the rare isotope beams of most interest is expected to be less than 1 W, the areas around the production target and the beam dump will experience very high radiation levels. The purpose of the fragment separator is to filter out the nuclei of interest and, thus, represents the critical item in the production of rare isotopes. Because of the rarity of the isotopes of interest, the largest acceptance possible is required. This necessitates the use of high-field, large aperture quadrupoles and large-gap dipoles that can only be economically produced by superconducting magnets. To keep the neutron heating within acceptable limits, the cold mass must be limited. FRIB addresses this need by the use of warm-iron superferric magnets in the high radiation areas.

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