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Energization and Magnetic Field Mapping Results of Cold Iron Quadrupole Triplet for Vertical Pre-Separator of the Facility for Rare Isotope Beams

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The Facility for Rare Isotopes Beams (FRIB) employs an advanced fragment separator for the efficient production and purification of the in-flight rare isotope beams. At the first stage, the incoming primary beam from a production target experiences an initial separation from the products of interest. A large phase secondary beam needs to be purified and focused with magnetic multipole elements having up to third-order image aberration correctors. Therefore, cold iron quadrupole triplet (CIQT), in which sextupoles and octupoles are nested and independently operated, have been designed and built for use in a vertical pre-separator that is followed by post-separator stages and beam distribution system for experiments. In this paper, we present the results of cooldown, energization, and field mapping of CIQT for the pre-separator. Based on the test results, the magnetic field gradient and effective length were calculated and compared with the simulation results. Harmonic analysis was also carried out to evaluate the magnetic field quality and compare to the requirements. Discussion includes the premature quench behavior and training process comparison between as-individual and as-assembled CIQT.

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