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Simulation of ion beam transport in the FRIB beam line for time-of-flight mass measurements

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The time-of-flight magnetic rigidity (TOF-Bρ) technique is an effective method for determining the mass of unstable nuclides that have lifetimes of the order of 10s of ms. This method uses the motion of an ion in a magnetic field to determine its mass. With sufficiently precise time-of-flight measurements, around 10 ps uncertainty, the resulting mass resolution is of the order of $m/\delta m = 10,000$. In order to increase measurement accuracy and optimize the setup for TOF-Bρ experiments at the Facility for Rare Isotope Beams (FRIB) we simulate the ARIS fragment separator and S800 mass spectrometer using LISE++. We used the Monte-Carlo simulation procedure in LISE++ to track the trajectory and properties of ions throughout the beam line. The objective of this work is to determine the effect of the beam line optics on the resulting time-of-flight measurements and the ability to correct for these effects, which would result in greater accuracy and precision for the resulting mass measurement.

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