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Solenoid Spectrometers for Reaccelerated Beam Experiments[1]

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The coming availability of reaccelerated rare-isotope beam promises many new advances in the study of nuclear structure. Already, measurements of transfer reactions with unstable beams have provided new information about nuclei far from stability. The necessity of performing these experiments in inverse kinematics, however, introduces technical challenges that accompany the potential gains that can be achieved. These include the resolution of excited states in the nuclei of interest, the suppression of backgrounds from beam impurities, and the identification of the reaction products. One approach that has been developed recently to cope with these challenges uses the uniform magnetic field of a superconducting solenoid to transport light charged particles from the target to an array of position-sensitive silicon detectors, both of which are positioned on the magnetic axis of the solenoid. An implementation of this concept, called HELIOS (the HELIcal Orbit Spectrometer) has been in operation at the ATLAS facility at Argonne National Laboratory since 2008, and has been used to study a variety of nucleon transfer reactions with stable and unstable beams. The technical concept and examples of recent experimental results will be discussed, and opportunities for studies at future reaccelerated beam facilities will be presented.

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