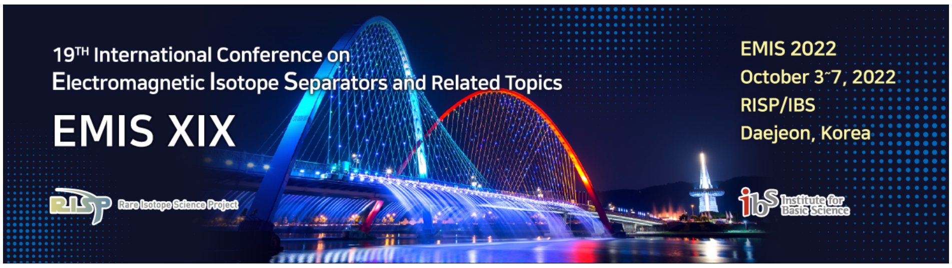

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The Cyclotron Gas Stopper at FRIB getting ready for operations

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Gas stopping of energetic projectile fragments has been an important pathway to science with unique stopped and reaccelerated beams at the National Superconducting Cyclotron Laboratory (NSCL) for more than a decade. The NSCL has transitioned into the recently opened Facility for Rare Isotope Beams (FRIB) in order to provide significantly more exotic and more intense exotic beams, prompting novel upgrades to the gas-stopping facility.

FRIB will continue to operate two linear gas-stopping cells to provide projectile fragments at low energy. In order to extract the lightest ions rapidly, which are difficult to stop efficiently in linear gas cells that are < 1m long, a gas-filled reverse cyclotron has been constructed. The device uses a ~2.6T field superconducting cyclotron-type magnet [1] and helium gas to confine and bring the injected beam to a halt. The beam is transported to the center of the magnet by a traveling-wave RF-carpet system, extracted through the central bore with an ion conveyor and will be accelerated to <60 keV energy for delivery to the users.

Following construction and successful low-energy ion transport tests with an internal ion source [2], the cyclotron gas stopper was moved to an experimental vault and connected to the A1900 fragment separator at the NSCL (and now to the ARIS separator) with a dedicated momentum compression beamline.

After a series of runs with primary beams to commission the new high-energy beam line and test the injection into the cyclotron stopper, a beam of ^{46}K fragments was stopped and extracted. The magnetic rigidity of the beam was reduced to match the acceptance of the Cyclotron stopper at ~1.1 Tesla-meter inside the beam chamber, where ions came to rest in helium gas at up to 40 Torr pressure. Beta activity with a half-life of ^{46}K, detected at the end of the ion conveyor, proved successful extraction of this beam from the cyclotron stopper.

A summary of the commissioning tests with high-energy beam and plans for integrating the device into FRIB's low-energy beam distribution network will be presented.

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[1]: S. Chouhan et al., J. of Physics CS 507 (2014) 032010
[2]: S. Schwarz et al., Nucl. Instr. Meth. B463 (2020) 293

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