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The CANREB Project for Charge State Breeding at TRIUMF

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ISAC is the ISOL facility at TRIUMF where rare isotope beams for use in nuclear reaction investigations are created by bombarding solid targets with high energy particle beams. TRIUMF is enhancing its rare isotope production capabilities through a new scientific infrastructure known as the Advanced Rare IsotopE Laboratory (ARIEL). The low-energy transport section of the ARIEL expansion is known as CANREB (CANadian Rare-isotope facility with Electron-Beam ion source) which aims to increase the mass range of high purity beams available for further acceleration.

To accomplish this the cocktail of ions from the solid target will be first sent through a high resolution mass separator where most of the isobaric contaminations should be removed. The continuous beam of singly charged ions of interest will then be fed into an RFQ cooler buncher where pulses of typically 10^6 ions per bunch will be created before being transported to a pulse drift tube where the energy will be lowered to match that of the trap of the electron beam ion source (EBIS). Inside the trap of the EBIS the ions will be confined radially by a 6 T Helmholtz magnetic field and longitudinally electrostatically. They will then be charge bred through electron impact ionisation via interaction with an electron beam with a density of up to $20\,000\text{ A cm}^{-2}$. It is required that a mass to charge ratio of less than 7 amu/e be reached within a repetition time of 10 ms to allow for operation with short lived isotopes. The highly charged ions extracted from the EBIS will then be traversed through a NIER spectrometer for mass selection before reaching the goal of post-acceleration.

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