TRIUMF Advanced Rare Isotope Laboratory (ARIEL)

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Troubleshooting the Next-Generation High-Power Electron Gun for Re-Accelerated Beam Production at TRIUMF

Nuclear reactions reveal critical information about nuclear structure and nuclear astrophysics. Some studies, like half-life determinations, are directly relevant to understanding the evolution of nuclear shells, while others have an indirect impact through the production of exotic species to advance the pathway of the rapid-neutron-capture process. The common requirement for these studies at TRIUMF is re-accelerated beam, which requires ion charge breeding. This can be best achieved by upgrading from an ECRIS-style to an EBIS-style breeder.

EBIS is the Electron Beam Ion Source in CANREB that charge breeds ions to highly charged ions (HCI) using a high power electron gun. Since the source faced several design challenges, an E-gun Test Stand was designed to perform a modular testing of the system. Its goal is to mimic the magnetic field of EBIS at the emission surface, ensuring a proper electron beam formation, and to capture the beam properties. We designed and simulated various configurations of the e-gun position using finite element analysis and multi-particle tracking code TRAK, benchmarking it with other codes like TRANSOPTR, IGUN and COMSOL. The Test Stand will also be used for further gun development, like testing the TITAN electron gun.

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