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The TRIUMF Fast Ion Counter for Reaction Studies with Radioactive Ion Beams

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Advances in radioactive beam facilities have significantly increased capabilities for studying exotic nuclei. However, reaccelerated radioactive beams are rarely isotopically pure and necessitate equipment to monitor beam composition and to detect and identify recoiling reaction products. TRIFIC, the TRIUMF Fast Ion Counter (A. Chester, *et al.*, Nucl. Instrum. Meth. Phys. Res., Sect. A, 930, 2019), is an ionization chamber with titled, alternating anode and cathode grids along the beam axis. TRIFIC is used in conjunction with the TIGRESS γ-ray spectrometer for in-beam reaction studies at the TRIUMF-ISAC radioactive beam facility. The TRIFIC ion chamber may be operated in either an active recoil-tagging mode or passive beam composition monitoring mode.

Recently, several upgrades to the TRIFIC detector have been completed to enhance its capabilities. Characterization of beam-induced damage on thin metal and aluminized polymer foils was investigated in order to increase the acceptable beam rate through the gas window and into the detector system. Processing parameters of a custom digital data acquisition system were optimized for the TRIFIC detector and now allow for beam rates up to 10^5 ions per second in recoil-tagging mode. Upgraded window foils allow TRIFIC to safely withstand beam rates of up to 10^9 ions per second and enable snapshot beam composition measurements to be taken at high rates. Position-sensitive electrode grids have been commissioned that allow for improved energy loss reconstruction of ions transiting the gas volume. These improvements increase the scientific potential of reaction studies at TRIUMF-ISAC using TRIFIC and TIGRESS. A description of the TRIFIC detector, its recent upgrades, and recent measurement results using the detector will be discussed.

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Instrumentation for radioactive ion beam experiments

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