On-line ^{26}Al and ^{62}Ga beams with the TRIUMF-ISAC resonant ionization laser ion source

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Experiments with short-lived isotopes rely on ultra efficient, sensitive, and selective techniques in isotope production, ionization, beam transport and detection. The TRIUMF resonant ionization laser ion source (TRI LIS) is a key link in the isotope production and delivery chain. Unique features of resonant laser ionization in this application are high efficiency and element selectivity. Element selective ionization allows for improved isobar suppression and throughput through the magnetic mass separator common to most ISOL facilities. The TRI LIS uses modern, Titanium-Sapphire lasers derived from the Mainz University design, with frequency doubling and tripling. The laser system of several, simultaneously pumped TiSa lasers, typically is operated at 10kHz pulse repetition rate, with a spectral laser linewidth of about 5GHz, and a temporal pulsewidth of 40ns. The YAG and frequency doubled YAG laser used for non-resonant ionization also exhibits a temporal pulsewidth of 40ns with 6W laser power at 10kHz repetition rate. These operating parameters are dictated by the properties of hot cavity ionization.

The year 2005 saw the first full year of on-line use of the resonant ionization laser ion source at TRIUMF. Nuclear astrophysics and nuclear structure experiments were done with the long lived ^{26}Al and the short lived ^{62}Ga. Laser excitation schemes for these elements involved a one-step resonant, one non-resonant (1+1') and a two-resonant step (2) excitation scheme into a Rydberg state, which is subsequently field ionized. Ionization efficiencies in excess of 10% were achieved and yielded a laser/surface ionization enhancement of 20x for Al and 100x for Ga.

TRI LIS as operated in these first radioactive beam production runs will be presented, particular aspects of the Al and Ga RIS be discussed and an outlook to the present development and beam delivery be given.