

Operation and recent On-line Results of the Laser Ion Source and Trap Unit LIST

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Today the Resonant Ionization Laser Ion Source (RILIS) has developed to become the preeminent technique for production of rare isotopes, being interfaced to different kind of ISOLDE targets. Striking advantages are its universality, high ionization efficiency and unsurpassed elemental selectivity. Unavoidable surface ionization processes on the hot cavity surfaces of the ion source produce some remaining isobaric contaminations in the radioactive ion beam, predominantly arising from alkaline and alkaline earth elements. The Laser Ion Source and Trap device (LIST) strongly suppresses these beam contaminations by a repeller electrode positioned at the ion source exit. In this way emerging of any ions from the hot area is prevented. Neutral atoms pass the electrode and are ionized by the laser radiation inside the volume of the LIST, which is defined by a guiding field radiofrequency quadrupole structure. In this way total elemental selectivity is achieved at the expense of a reduced efficiency due to geometrical constraints. This latter drawback is somewhat balanced by the possibility to rapidly switch the source from highest purity LIST-mode to high efficiency Ion-Guide-mode.

After off-line development at the Mainz University RISIKO separator, the LIST has successfully undergone its initial on-line tests installed at a titanium-target of the ISOLDE GPS in May 2011. Isobarically pure beams of $^{21, 22, 27}\text{Mg}$ isotopes were produced, suppressing contaminations by up to 1600 with an efficiency loss of around a factor of 50. Recently, LIST operation in connection with an uranium carbide target has been demonstrated and enabled determination of isotope shifts and hyperfine structures for the two missing short-lived isotopes $^{217, 219}\text{Po}$ in the long sequence of Po isotopes as studied by the collaboration of IS 456. In addition decay spectroscopy on ^{219}Po could be performed for the first time using the IKS windmill detector set-up. No negative side effects on the LIST operation were encountered during this run from the strong outgassing of this target material.

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