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MR-ToF-MS At IGISOL

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A Multi-Reflection Time-of-Flight Mass-Spectrometer (MR-ToF-MS) [1], a device that rapidly separates ions based on their mass-over-charge ratios, has been incorporated to the Ion-Guide Isotope-Separator On-Line (IGISOL) facility [2]. At IGISOL, a variety of radioactive beams can be produced via fusion-evaporation, fission or multinucleon-transfer reactions. The continuous ion beam is accelerated to 30 kV, and mass-separated with a dipole magnet before it is injected to a radio-frequency quadrupole cooler and buncher (RFQ-CB). To facilitate narrow ion bunches for the MR-ToF-MS measurements, a miniaturized radiofrequency quadrupole cooler-buncher was recently commissioned at IGISOL [3]. It delivers ion bunches with small longitudinal emittance to the MR-ToF-MS, which consists of a stack of mirror and lens electrodes on both sides of the trap. The MR-ToF-MS is operated utilizing a pulsed drift tube to trap ions on closed paths between the mirror electrodes, where ion masses disperse over time-of-flight. In this overview, the IGISOL MR-ToF-MS, and the recent on-line measurement results, such as the mass measurements of the isomeric states of the N= Z nucleus 94Ag, are presented.

References

[1] W. R. Plaß, et al., “Multiple-reflection time-of-flight mass spectrometry”, International Journal of Mass Spectrometry, vol. 349-350, pp. 134–144, 2013. doi: 10.1016/j.ijms.2013.06.005.

[2] I. Moore et al., “Towards commissioning the new IGISOL-4 facility”, Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, vol. 317, pp. 208–213, 2013. doi: 10.1016/j.nimb.2013.06.036.

[3] V.A. Virtanen, et al., “Miniaturised cooler-buncher for reduction of longitudinal emittance at IGISOL”, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment vol. 1072, 170186, 2025. doi: 10.1016/j.nima.2024.170186.

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