

A novel isobar separator for the TITAN facility at TRIUMF

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At TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN) mass measurements and in-trap decay spectroscopy of exotic nuclei are performed. The reach to even more exotic nuclei is often hampered or made impossible by strong isobaric contamination. Multiple-reflection time-of-flight mass spectrometers (MR-TOF-MS) have been shown to be ideal tools to overcome these limitations. Recently, several MR-TOF-MS have been installed at rare ion beam facilities around the world. It has been demonstrated that these systems can achieve outstanding performance, such as high transmission efficiency (up to 50%), mass resolving power as high as 600,000 FWHM, mass accuracies down to the 0.1 ppm level, repetition rates up to 400 Hz and high sensitivity.

An MR-TOF-MS has been developed to extend TITAN's capabilities and facilitate measurements of very short-lived nuclei (half-life longer than a few ms) that are produced in very low quantities (a few detected ions overall) in the presence of strong isobaric contamination. In order to enable the installation of an MR-TOF-MS in the restricted space at the TITAN facility, novel mass spectrometric methods have been developed. Ion transport into and out of the device is performed using an RFQ-based ion beam switchyard. Mass selection is performed using a dynamic re-trapping technique after time-of-flight analysis in an isochronous reflector system. Only due to the combination of these novel methods has the realization of an MR-TOF-MS based isobar separator at TITAN become possible. The system will be installed parallel to the existing TITAN beam line without requiring changes to the existing ion optics of TITAN. An isobarically clean beam can be provided to the TITAN EBIT and to the Penning trap. The exotic ions can be merged with ions from several offline ion sources for calibration and optimization of ion transport.

The system has been commissioned at the University of Gießen, Germany and installation at the TITAN facility is underway. First results of the commissioning will be presented.

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