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First application of mass selective re-trapping enables mass measurements of neutron-deficient Yb and Tm isotopes despite strong isobaric background

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TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN) [1] located at the Isotope Separator and Accelerator (ISAC) facility, TRIUMF, Vancouver, Canada is a multiple ion trap system specialized in performing high-precision mass measurements and in-trap decay spectroscopy of short-lived radioactive ions. Although ISAC can deliver high yields for some of the most exotic species, many measurements suffer from strong isobaric background. In order to overcome this limitation an isobar separator based on the Multiple-Reflection Time-Of-Flight Mass Spectrometry (MR-TOF-MS) technique has been developed and installed at TITAN [2]. Mass selection is achieved using dynamic re-trapping of the ions of interest after a time-of-flight analysis in an electrostatic isochronous reflector system [3]. Re-using the injection trap of the device for the mass-selective re-trapping, the TITAN MR-TOF-MS can operate as its very own high resolution isobar separator prior to mass measurements within the same device. This combination of operation modes boosts the dynamic range and background handling capabilities of the device, enabling high precision mass measurements with ion of interests to contaminant ratios of $1:10^6$.

We will discuss the technical aspects of re-trapping and recent results of mass measurements of neutron-deficient Yb and Tm isotopes investigating the persistence of the $N=82$ neutron shell closure far from stability made possible by employing for the first time online mass selective re-trapping to suppress strong isobaric background.

References:

- [1] J. Dilling et al., NIM B 204, 2003, 492–496
- [2] C. Jesch et al., Hyperfine Interact. 235 (1-3), 2015, 97–106
- [3] T. Dickel et al. J. Am. Soc. Mass Spectrom. (2017) 28: 1079

Primary author(s) : Dr REITER, Moritz Pascal (JLU Giessen, TRIUMF)

Co-author(s) : Mr BECK, Soenke (JLU Giessen, GSI); Mr BERGMANN, Julian (JLU Giessen); Dr DICKEL, Timo (JLU Giessen, GSI); Prof. DILLING, Jens (Triumf, UBC); Mrs DUNLING, Eleanor (TRIUMF, Surrey); Mr FLOWERDEW, Jake (U of Calgary); Dr GRAHAM, Leigh (Triumf); Mr JACOBS, Andrew (UBC, TRIUMF); Mr KLAWITTER, Renee (TRIUMF, U of Heidelberg); Mr KOOTTE, Brian (TRIUMF, U of Manitoba); Mr LAN, Yang (TRIUMF, UBC); Mr LEISTENSCHNEIDER, Erich (TRIUMF, UBC); Mrs LYKIARDOPOULOU, Marilena (TRIUMF, UBC); Dr MUKUL, Ish (TRIUMF); Mr PAUL, Stefan (TRIUMF, U of Heidelberg); Dr PLASS, Wolfgang (JLU Giessen, GSI); Prof. SCHEIDENBERGER, Christoph (JLU Giessen, GSI); Dr TRACY, James (TRIUMF); Mr VANSTEENKISTE, Mike (TRIUMF); Mr WILL, Christian (JLU Giessen); Prof. KWIATKOWSKI, Ania (TRIUMF, U of Victoria)

Presenter(s) : Dr REITER, Moritz Pascal (JLU Giessen, TRIUMF)