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Implementation of a MR-ToF isobar separator at ISOLTRAP and first online results

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The Penning-trap mass spectrometer ISOLTRAP performs precision mass measurements at the isotope separator ISOLDE/CERN with a relative mass uncertainty routinely reaching δm/m≈1x10-8 [1]. The time-of-flight ion-cyclotron-resonance (ToF-ICR) detection technique is employed to determine the frequency of ions stored in a Penning trap, from which their mass can be extracted [2]. Nuclides with half-lives below 100ms and production yields of less than 1000 ions per second have been investigated. Masses of light systems - such as 17Ne - up to heavy ones - such as 229Rn, give insight into numerous physics topics.

As other setups are now also experiencing, ISOLTRAP is reaching a limitation with respect to the ion beam which is delivered from the on-line facility producing the short-lived nuclides of interest. In particular, due to space-charge effects only limited amounts of unwanted isobaric components can be handled by Penning traps . Thus, an isobar separator based on multi-reflection time-of-flight mass spectrometry (MR-ToF MS) has been implemented to support the isobaric contamination removal. The MR-ToF MS system consists of two ion optical mirrors between which ions are oscillating and are separated according to their different mass-over-charge ratios m/q [3]. First tests resulted in a mass resolving power of up to m/Δm ≈ 10ˆ5. The separation was demonstrated offline for the isobaric ions CO+ and N2+ and online for example at m/q=163. In combination with a Bradbury-Nielsen beamgate [4,5], a selection of the separated species can be achieved. The technical setup and recent results are presented.

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Author: Mr WOLF, Robert (Ernst-Moritz-Arndt University Greifswald, Germany)

Co-authors: Dr HERLERT, Alexander (CERN); Ms BÖHM, Christine (Max Planck Institute for Nuclear Physics, Heidelberg, Germany); Mr BORGMANN, Christopher (Max Planck Institute for Nuclear Physics, Heidelberg, Germany); Dr LUNNEY, Dave (CSNCM-IN2P3-CNRS, France); Dr NEIDHERR, Dennis (GSI Helmholtz Centre for Heavy Ion Research, Germany); Dr BECK, Dietrich (GSI Helmholtz Centre for Heavy Ion Research, Germany); Dr HERFURTH, Frank (GSI Helmholtz Centre for Heavy Ion Research, Germany); Dr AUDI, Georges (CSNCM-IN2P3-CNRS, France); Ms STANJA, Juliane (TU Dresden, Germany); Prof. ZUBER, Kai (TU Dresden, Germany); Prof. BLAUM, Klaus (Max Planck Institute for Nuclear Physics, Heidelberg, Germany); Prof. SCHWEIKHARD, Lutz (Ernst-Moritz-Arndt University Greifswald, Germany); Dr KOWALSKA, Magdalena (CERN); Mr ROSENBUSCH, Marco (Ernst-Moritz-Arndt University Greifswald, Germany); Dr BREITENFELDT, Martin (KU Leuven, Belgium); Mr WANG, Meng (CSNCM-IN2P3-CNRS, France); Dr CAKIRLI, R. Burcu (Max Planck Institute for Nuclear Physics, Heidelberg, Germany); Ms NAIMI, Sarah (CSNCM-IN2P3-CNRS, France); Dr GEORGE, Sebastian (NSCL Michigan State University, USA); Dr ELISEEV, Sergey (Max Planck Institute for Nuclear Physics, Heidelberg, Germany); Dr SCHWARZ, Stefan (NSCL Michigan State University, USA); Dr KREIM, Susanne (Max Planck Institute for Nuclear Physics, Heidelberg, Germany)

Presenter: Mr WOLF, Robert (Ernst-Moritz-Arndt University Greifswald, Germany)

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