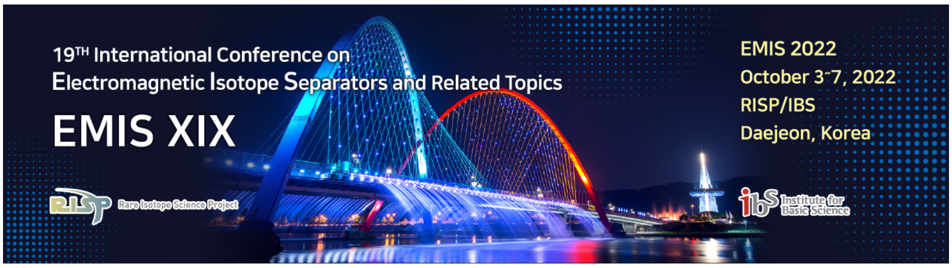

Contribution ID: **120**

Type: **Poster Session**

High-resolution mass measurements for the verification of particle identification at in-flight separators

Monday, 3 October 2022 21:42 (8 minutes)

Nowadays, many experiments in the field of nuclear structure, fundamental interactions and nuclear astrophysics require the use of exotic nuclei. These rare isotopes can be produced with modern powerful accelerator facilities at several laboratories worldwide. These laboratories solve the problem of the inherent small production cross sections via high primary beam intensities and high energies. However, the successful production of exotic nuclei is only the first necessary step, the separation from the primary beam and from the abundant contaminants and the particle identification, by measurements of their properties are of equal importance.

At the FRS facility at GSI, exotic ions are produced, separated and identified in-flight. The Particle IDentification (PID) by proton number (Z) and mass number (A) can be performed with the FRS and its particle detectors applying the Bρ-ΔE-TOF method. At relativistic velocities, the verification of the selected bare ions can be easily performed with particle detectors via velocity (TOF), energy-deposition (ΔE) and magnetic rigidity (Bρ) measurements in coincidence. Still the separation and identification requires an elaborated absolute calibration. At lower velocities (300~MeV/u), the heaviest fragments emerge from the target in different ionic charge states which makes an unambiguous PID very difficult.

Therefore, the fragment identification in-flight by the Bρ-ΔE-TOF method at these velocities can be verified by accurate high-resolution mass measurements. Note that each isotope has a unique signature in terms of the measured binding energy (mass excess). At the final focal plane of the FRS, the FRS Ion Catcher (FRS-IC) setup is installed where the ions-of-interest are stopped in a gas cell to perform accurate mass measurements. The mass measurements of the ions are performed with a multi-reflection time-of-flight mass spectrometer (MR-TOF-MS). In this way, the FRS-IC can provide an unambiguous isotope identification via high-resolution mass measurement. This method has been successfully applied with the combination of the FRS-IC and the in-flight separator FRS. The method is fast, sensitive and universal. A verification of the FRS PID by the MR-TOF-MS at the FRS-IC was proven in several experiment with ^{107}Ag, ^{124}Xe, ^{208}Pb and ^{238}U primary beams.

Primary authors: HORNUNG, Christine (GSI Helmholtzzentrum für Schwerionenforschung); DICKEL, Timo (GSI Helmholtzzentrum für Schwerionenforschung GmbH; JLU Gießen, Germany); AMANBAYEV, Daler (Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany); AYET SAN ANDRES, Samuel (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany); BECK, Sönke (Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany); BERGMANN, Julian (Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany); GEISSEL, Hans (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany; JLU Gießen, Germany); HAETTNER, Emma (GSI Helmholtzzentrum für Schwerionenforschung GmbH); HUCKA, Jan-Paul (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany); KRIPKO-KONCZ, Gabriella (Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany); MARDOR, Israel (Tel Aviv University, 6997801 Tel Aviv, Israel, Soreq Nuclear Research Center, 81800 Yavne, Israel); MOLLAEBRAHIMI, Ali (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, Nuclear Energy Group, ESRIG, University of Groningen, 9747 AA Groningen, The Netherlands); MUKHA, Ivan (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); PIETRI, Stephane (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); PLASS, Wolfgang (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany; JLU Gießen, Germany); PURUSHOTHAMAN, Sivaji (GSI Helmholtzzentrum für Schwerionenforschung GmbH); REITER, Moritz Pascal (Justus-Liebig-Universität Gießen, II. Physikalisches Institut, Gießen, Germany, University of Edinburgh, EH8 9AB Edinburgh, United Kingdom); RÖSCH, Heidi (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany); SCHEIDENBERGER, Christoph (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany; JLU Gießen, Germany); TANAKA, Yoshiki (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); WEICK, Helmut (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); ZHAO, Jianwei (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany)

Presenter: HORNUNG, Christine (GSI Helmholtzzentrum für Schwerionenforschung)

Session Classification: Poster Session