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Performance of the MR-TOF-MS at the FRS

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Recently multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) have been established as important tools for direct mass measurements and for isobar separation at several facilities for research on exotic nuclei. They combine short measurement cycles with high mass resolving power.
The MR-TOF-MS is part of the FRS Ion Catcher, which is a test facility for the future Low-Energy Branch (LEB) of the Super-FRS at FAIR. At the FRS Ion Catcher, projectile and fission fragments are produced at relativistic energies, separated in-flight and energy-focused with the FRS. Further they are slowed-down and thermalized in a cryogenic stopping cell (CSC) and transported to the MR-TOF-MS. In the MR-TOF-MS the ions are accumulated, cooled and injected in bunches by a linear RF-trap. In the analyzer they are reflected multiple times to enlarge their flight path by orders of magnitude to achieve a high time-of-flight resolution. The MR-TOF-MS can perform high precision mass measurement and in addition it can spatially separate the ions of interest from isobaric contaminations for further experiments. It is a well suitable diagnostic device for operation of the CSC and in combination with the latter for particle identification of the FRS.
Recently, the performance of the MR-TOF-MS was improved: The kinetic energy of the ions in the time-of-flight section of the MR-TOF-MS has been increased to 1300 eV. Mass resolving powers (FWHM) for 133Cs of 120,000, 220,000 and 420,000 have been obtained in 2.3 ms, 4.6 ms and 18.3 ms, respectively. The repetition rate of the system has been increased up to 500 Hz. This opens up new possibilities for spectroscopy of short lived nuclei.
The performance of the MR-TOF-MS as a high- resolution mass separator has been investigated and characterized with alpha-emitting ions from a 223Ra source detected behind the Bradbury-Nielsen gate by a Si-detector. The time resolution as well as the suppression ratio have been measured.

Primary authors: HORNUNG, Christine (II. Physikalisches Institut, Justus-Liebig-Universität Gießen); EBERT, Jens (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany); AYET SAN ANDRES, Samuel (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany; GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany)

Co-authors: PIKHTELEV, Alexander (Institute for Energy Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Russia); RINK, Ann-Kathrin (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany); Prof. SCHEIDENBERGER, Christoph (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany; GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); Dr HAETTNER, Emma (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); Prof. GEISSEL, Hans (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany; GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); BERGMANN, Julian (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany); REITER, Moritz Pascal (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany); Dr PURUSHOTHAMAN, Sivaji (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); Dr DICKEL, Timo (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany; GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany); Dr PLAß, Wolfgang (II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany; GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany)

Presenter: HORNUNG, Christine (II. Physikalisches Institut, Justus-Liebig-Universität Gießen)

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