The FRS Ion Catcher at GSI/FAIR –

Mass measurements of the most short-lived nuclides and the search for new isomeric states

Timo Dickel

Justus-Liebig-University Giessen, Giessen, Germany / GSI Helmholtzcenter for heavy ion research

At the FRS Ion Catcher at GSI/FAIR, projectile and fission fragments are produced at relativistic energies at the FRS, separated in-flight, range-focused, slowed-down and thermalized in a cryogenic stopping cell and transmitted to a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS). The MR-TOF-MS can perform direct mass measurements of exotic nuclei, to provide an isobarically and isomerically clean beam for further experiments, and as a versatile diagnostics device to monitor the production, separation and manipulation of exotic nuclei.

The MR-TOF-MS is extremely versatile devices with mass resolving powers beyond 600,000 (FWHM), high transmission efficiency, ion capacities of more than a million ions per second and cycle frequencies has high as 1kHz have been developed.

More than 30 short-lived ground state masses have been measured with high mass accuracies (down to 6E-8). The excitation energies of isomers and isomeric ratios were determined using mass spectrometry, and, for the first time, an isomeric beam was prepared using an MR-TOF-MS. The unique combination of performance parameters make the MR-TOF-MS the system of choice for measuring the masses of very exotic nuclei and for the search for new long-lived isomeric states.