HK 60: Instrumentation 18

Time: Thursday 17:00–18:45 Location: M/HS2

Group Report HK 60.1 Thu 17:00 M/HS2

The in-beam tracking detectors for R3B — •Stefanos Paschalis[1], Michael Heil[2], Jacob Johansen[1], Thomas Aumann[1,2], Heiko Scheit[1], and Anatoly Krivshich[3] for the R3B-Collaboration — [1]Institut für Kernphysik, Technische Universität, D 64289 Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany — [3]PNPI St. Petersburg, 188300 Gatchina, Russia

The R3B experiment is part of the NUSTAR pillar at FAIR. One of the great strengths of the R3B experiment is the kinematically complete measurement of reactions with exotic ions with energies of up to 1 AGeV. Key components of the R3B experiment are the neutron detector NeuLAND, the γ and charge-particle calorimeter CALIFA, the Si Tracker and the in-beam tracking detectors. A cornerstone instrument of the setup is the new dipole magnet (GLAD) which bends and momentum analyses the high-rigidity beams. A precise tracking of the charged particles through the magnetic field is crucial to resolve the masses of heavy ions and measure the momentum of the fragments with high resolution. In this contribution we present the technical design details of the in-beam tracking detectors that will be used in the R3B experiment together with recent results obtained from in-beam prototype testing. In particular, we discuss Si detectors, detectors based on plastic-scintillator fibers and paddles, straw-tube gas detectors and the overall performance of the system. This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, and the BMBF project 05P12RDFN8.

Group Report HK 60.2 Thu 17:30 M/HS2

Status of the FRS Ion Catcher and future prospectives at FAIR — •Moritz Pascal Reiter for the FRS Ion Catcher-Collaboration — Justus-Liebig-University Giessen

At the LEB of the Super-FRS at FAIR, projectile and fission fragments will be produced at relativistic energies, separated in-flight, range-bunched, slowed-down and than thermalized in a cryogenic stopping cell (CSC) filled with ultra pure helium gas to kinetic energies of a few eV. After thermalization the ions are delivered to the high precision experiments MATS and LaSpec. A prototype CSC for the LEB has been successfully commissioned at the FRS Ion Catcher, consisting of the FRS, CSC and a multiple-reflection time-of-flight mass-spectrometer (MR-ToF-MS). During these experiments high total efficiencies (15 %), average extraction times of 24 ms, mass resolving powers beyond 400.000 have been measured for several projectile and fission fragments.

To make full use of the beams delivered by the Super-FRS the areal density of the CSC has to be increased even further. The future CSC follows a new approach and will have an order of magnitude higher areal density, while at the same time allowing extraction times down to 5 ms. The future design will be presented and discussed in detail.

HK 60.3 Thu 18:00 M/HS2

Investigations of space charge effects in the cryogenic gas filled stopping cell for the FRS Ion Catcher — •Fabian Heisse[1,3], Timo Dickel[2,3], Wolfgang Plass[2,3], Moritz Pascal Reiter[2], Ann-Kathrin Rink[2], Hans Geissel[2,3], Christoph Scheidenberger[2,3], and Kai Zuber[1] for the FRS Ion Catcher-Collaboration — [1]IKTP TU Dresden — [2]II. Physikalisches Institut JLU Giessen — [3]GSI Helmholtzzentrum für Schwerionenforschung

At the FRS Ion Catcher experiment precision mass measurements of short lived projectile and fission fragments are performed. Therefore highly charged ions with relativistic energies need to be thermalized to kinetic energies of several eV. This process takes place in the cryogenic gas filled stopping cell (CSC). All stopping cells suffer at large ion rates under space charge effects, which lead to decreasing efficiencies and can also influence the extraction time.

Thus the understanding of space charge effects is of greatest importance to make full use of the higher yields at future rare ion beam facilities like FAIR. For this purpose simulation with the software SIMION® concerning space charge effects were done.

In this presentation the calculated transport efficiency of the CSC for different intensities, electric fields and spill structures are discussed and compared with measured results. Furthermore an outlook and first results of the simulation for the new CSC for the Low-Energy Branch at FAIR will be given.

HK 60.4 Thu 18:15 M/HS2

Development of a large area TEGIC-Detector for Heavy Ions — Steffen Maurus[1], Roman Gernhäuser[1], •Max Winkel[1], Ludwig Maier[1], Chiara Nociforo[2], and Stephane Pietri[2] — [1]Technische Universität München, E12 — [2]GSI Darmstadt

New accelerator facilities like the Facility for Antiproton and Ion Research (FAIR) at the GSI with higher beam intensities for secondary and primary beam experiments taking established detector system to their limit of operation. In order to separate fragments of interest a new Super FRagment Separator (Super-FRS) is under development. Regarding the identification of the proton number of the fragment beam cocktail produced by fragmentation or fission of heavy beams at the Super-FRS target a new promising concept is the tilted electrode gas ionisation chamber (TEGIC) consisting of a series of plane electrodes tilted with respect to the beam axis. The detector was also equipped with additional position sensitive sections.

A design concept of a TEGIC with a position sensitive extension was developed and realized with the construction of a full scale detector. In addition a test experiment was performed at the fragment separator of GSI with a secondary beam from uranium fragmentation at 700 MeV/u using a fully digital readout system for pile up handling.

We will report on a systematic study of the energy loss measurement and its particle rate dependency for ions in the range of Z $\sim$ 50.

This work is supported by MLL München and GSI Darmstadt.

HK 60.5 Thu 18:30 M/HS2

Investigation of the Pulse Shape Analysis for the position sensitive γ-ray spectrometer AGATA — •Lars Lewandowski, Benedikt Birkenbach, and Peter Reiter for the AGATA-Collaboration — Institut für Kernphysik Köln

The next generation of γ-ray spectrometers like AGATA will provide high quality γ-ray spectra by the new Gamma-Ray Tracking technique (GRT) [1]. Position sensitive HPGe detectors will allow for precise Doppler correction and small broadening of lines for spectroscopy at relativistic energies. GRT is based on the interaction position of the γ-rays within the volume of the highly segmented germanium detectors provided by Pulse Shape Analysis (PSA) methods. The proof of principle of GRT was already demonstrated with great success however systematic deviations from expected results occur. The parameterization of the following detector properties and their impact on PSA were thoroughly investigated and optimized: electron and hole mobility, crystal axis orientation, space charge distributions, crystal impurities, response functions of preamplifiers and digitizers, linear and differential crosstalk, time alignment of pulses and the distance metric. Results of an improved PSA performance will be presented.

[1] S. Akkoyun *et al.*, Nucl. Instr. Meth. A668 (2012) 26.