HK 43: Instrumentation XI

Zeit: Mittwoch 16:30–18:30 Raum: S1/01 A3

Gruppenbericht HK 43.1 Mi 16:30 S1/01 A3

Reactions with Relativistic Radioactive Beams — •Heiko Scheit for the R3B-Collaboration — TU Darmstadt

The experiment Reactions with Relativistic Radioactive Beams (R^3B) is currently being constructed at GSI. It will be commissioned and operated at GSI in the next years before being installed at the high-energy cave after the Super Fragment Separator (SuperFRS) of the future FAIR facility.

The R3B experiment allows for kinematically complete nuclear reaction studies of short-lived radioactive ion beams in inverse kinematics up to beam energies of 1 GeV/u. Various detection systems are employed to detect beam-velocity charge particles and neutrons. Furthermore light charged particles are detected around the target region as well as γ rays.

I will shortly introduce the setup and give an overview of the status of the different subsystems.

Support by BMBF project 05P15RDFN1 is acknowledged.

HK 43.2 Mi 17:00 S1/01 A3

The Dortmund Low Background Facility — Current Status and Recent Developments — Claus Gössling, Kevin Kröninger, and •Christian Nitsch — Experimentelle Physik IV, TU Dortmund, 44221 Dortmund

The Dortmund Low Background Facility (DLB) is a low-background gamma ray spectrometry system with an artificial overburden. The overburden of ten meters of water equivalent, in combination with a multi-layer lead castle and an active muon veto are shielding a high-purity germanium detector of 60 % relative efficiency. The background level is remarkably low compared to a conventional spectrometer system without special shielding and enables sensitivities well below 1 Bq/kg. Thus, material screening measurements as well as environmental monitoring measurements are possible on an easy-accessible location above ground at the campus of the Technische Universität Dortmund. The integral background count rate between 40 keV and 2700 keV is 2.528 ± 0.004 counts/kg/min, which is comparable to systems that are situated below ground.

In the talk, an overview of the current status of the DLB is given and recent developments are presented.

HK 43.3 Mi 17:15 S1/01 A3

The Muon Veto of the Dortmund Low-Background Facility — •Marcel Gerhardt, Claus Gössling, Kevin Kröninger, and Christian Nitsch — TU Dortmund, Physik EIV, D-44221 Dortmund

The Dortmund Low Background Facility (DLB) is a low-background gamma-ray spectrometry system with an artificial overburden built at ground level. It uses a high-purity germanium detector with a relative efficiency of 60 %, which is set up inside a massive shielding. The outer shielding consists of barite concrete and cast iron, corresponding to ten meters of water equivalent (mw.e.), and houses a multi-layer lead castle as an inner shielding, that features borated polyethylene as a neutron absorber. Additionally an active muon veto is installed to reduce cosmic-induced contributions to the spectrum.

The remarkably lowered background of the DLB compared to an unshielded spectrometer, allows radio-purity screening measurements for material preselection with sensitivities better than 1 Bq/kg.

This talk focusses on the muon veto of the DLB. Its basic concept and its benefits for low-background operation will be described. Also its current status of development and future upgrade plans will be presented.

HK 43.4 Mi 17:30 S1/01 A3

Half-life and Mass Measurement of the short-lived ^{215}Po Isotope (1.78ms) at the FRS Ion Catcher — •Ann-Kathrin Rink[1], Samuel Ayet San Andres[1,2], Julian Bergmann[1], Timo Dickel[1,2], Jens Ebert[1], Hans Geissel[2], Christine Hornung[1], Ivan Miskun[1], Wolfgang R. Plass[1,2], Sivaji Purushothaman[2], Moritz P. Reiter[1], and Christoph Scheidenberger[1,2] — [1]Justus-Liebig Universität Gießen — [2]GSI, Darmstadt

At the Low-Energy Branch (LEB) of the Super-FRS at FAIR, precision experiments with exotic nuclei will be performed using ion traps and lasers. The nuclei will be produced at relativistic energies, slowed down, thermalised in a cryogenic stopping cell (CSC) and made available to various experiments. The thermalisation is a challenging task because of the large energy straggling of the nuclei after production, which requires a stopping cell with large areal densities. Also, the process needs to be performed on a millisecond time scale in order to give access to short-lived nuclides. This method has already been successfully applied at the FRS Ion Catcher at GSI using a prototype CSC. Recently the potential of the method has been demonstrated by the mass and half-life measurement of the ^{215}Po nuclide with a half-life of 1.78 ms only. The multiple-reflection time-of-flight mass spectrometer at the FRS Ion Catcher has been used to determine the mass to a sub-ppm accuracy and to provide a mass-selected beam for alpha spectroscopy. Furthermore, experiments have been performed with the prototype CSC in order to test novel concepts to be used with the final version of the CSC for the LEB.

HK 43.5 Mi 17:45 S1/01 A3

Vakuumeigenschaften des AGATA-Cluster-Detektors — •Marcel Hahn, Peter Reiter, Jürgen Eberth, Herbert Hess, Benedikt Birkenbach, David Schneiders und Lars Lewandowski für die AGATA-Kollaboration — Institut für Kernphysik, Universität zu Köln, Deutschland

Drei großvolumige, hochsegmentierte HPGe-Detektoren werden gemeinsam als AGATA-Tripel-Cluster-Detektor in einem gemeinsamen Kryostaten unter Vakuum bei Temperaturen von flüssigem Stickstoff betrieben. Der Langzeiteinsatz der Detektoren im AGATA-Spektrometer erfordert hohe Anforderungen an die Qualität des Vakuums, die ohne aktive Pumpen durch den Einsatz von Gettermaterial gewährleistet sein muss. Der Einsatz verschiedener Kombinationen dieser Gettermaterialien und ihre Positionierung innerhalb des Kryostaten wurde in einer Reihe von Messungen mit einem Quadrupolmassenspektrometer für verschiedene Operationsbedingungen der Detektoren über einen großen Temperaturbereich von 77 K bis 300 K untersucht und optimiert. Detaillierte Restgasanalysen wurden mit verschiedenen Systemkonfigurationen durchgeführt. Die Ergebnisse tragen zur Langzeitstabilität der AGATA-Detekoren bei.

HK 43.6 Mi 18:00 S1/01 A3

Efficiency measurement of the NeuLAND detector — •Hans Toernqvist[1], Leyla Atar[1], Thomas Aumann[1], Konstanze Boretzky[2], Christoph Caesar[2], Igor Gasparic[3], Matthias Holl[1], Andrea Horvat[1], Julian Kahlbow[1], Kenjiro Miki[1], Dominic Rossi[1], Heiko Scheit[1], Fabia Schindler[1], and Haik Simon[2] for the R3B-Collaboration — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]GSI Gesellschaft für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Ruđer Bošković Institute, Zagreb, Croatia

NeuLAND is the next-generation high-energy and high-efficiency neutron detector currently under construction at GSI/FAIR by the R^3B collaboration. This detector will be used in a wide variety of experiments, ranging from nuclear-structure measurements of neutron-rich species to the investigation of the equation-of-state of asymmetric nuclear matter. The design goals of the full NeuLAND detector are a >95% detection efficiency for single neutrons, a time resolution of $\sigma_t \leq 150$ ps and a position resolution of $\sigma_{x,y,z} \leq 1.5$ cm, with a detection volume of $250 \times 250 \times 300$ cm^3. While still under construction, a set of 4 of the 30 planned NeuLAND double-planes were used for a series of experiments at the SAMURAI setup at RIKEN. In particular, the time resolution and one-neutron efficiency were measured using neutrons from the ^{7}Li(p,n)^{7}Be reaction. The test setup at RIKEN will be described and the resolution and efficiency results will be discussed.

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HK 43.7 Mi 18:15 S1/01 A3

Hochauflösende Spektroskopie von Betastrahlung mit PIPS Detektoren — •Alexander Robert Domula, Jan Thurn und Kai Zuber — Institut für Kern- und Teilchenphysik / TU-Dresden

In der modernen Physik treten oft Fragestellungen auf, die einer zunehmend genauen Kenntniss der Emissionspektren von Betastrahlung bedürfen. Insbesondere bei verbotenen Betazerfällen ist die Datenlage nicht ausreichend, so dass neue Experimente erforderlich sind. Das IKTP der TU-Dresden betreibt einen Detektoraufbau mit PIPS (Passivated Implanted Planar Silicon) Detektoren zur präziesen Vermessung von Betaspektren. Zur Charakterisierung der Detektoren im Energiebereich 10 keV..1 MeV mit Konversionselektronen wurde ein Satz verschiedener Nuklid-Standards etabliert. Erste Ergebnisse zur Bestimmung von Betaspektren werden vorgestellt.