HK 53: Instrumentierung X

Zeit: Donnerstag 16:30–19:00 Raum: HG IV

Gruppenbericht HK 53.1 Do 16:30 HG IV

Towards 10 MeV/u with the HIE-ISOLDE project — •Alexander Herlert — CERN, Physics Department, 1211 Geneva 23, Switzerland

The HIE-ISOLDE project has been approved recently by the CERN Research Board and its implementation will start in January 2010 under the guidance of project leader Yacine Kadi. It aims at several important upgrades of the present ISOLDE facility. The main focus lies in the energy upgrade of the postaccelerated radionuclide beams from 3 MeV/u up to 10 MeV/u through the addition of superconducting cavities. This will open the possibility of many new types of experiments including transfer reactions throughout the nuclear chart. The prototype of the Nb-sputtered cavities will soon be tested following the construction of the first cryogenic module of the new superconducting linear accelerator. The project also includes a design study of improved production targets to accomodate to the future increase of proton intensity delivered by the new LINAC4 proton driver. This improvement combined with the recently installed solid state lasers of the RILIS laser ion source and the radiofrequency quadrupole cooler and buncher ISCOOL will lead to an increase of the radioactive beam intensities of up to an order of magnitude. An overview of the project and the timeline including first ideas for the layout of the new HIE-ISOLDE experimental hall will be presented.

HK 53.2 Do 17:00 HG IV

A new detector system for low energy neutrons for R^{3}B — •Christoph Langer for the R3B-Collaboration — Institut für Kernphysik, Universität Frankfurt, D-60438 Frankfurt am Main, Germany — GSI Darmstadt, Planckstrasse 1, 64291 Darmstadt, Germany

A new neutron detector, consisting of plastic scintillation material and based on the proton-recoil detection, for low energy neutrons in the region of several hundreds of keV up to a few MeV will be presented. The detector array will be placed close to the R^{3}B target at a distance of 1m in the upcoming FAIR facility in Darmstadt for detailed studies of (p,n)-reactions, which lead to a better understanding of astrophysically interesting β-decay lifetimes, GT-strengths and isovector giant resonances in exotic nuclei. The detector is used for time-of-flight measurements between the reaction point in the target and the detector array. The time resolution is required to be less than 1ns with a good angular resolution.
Tests with different γ-sources and a ^{252}Cf source were performed at ATOMKI in Debrecen, Hungary. Neutron detection efficiency studies were carried out with a neutron beam at the Los Alamos Neutron Scattering Center, LANSCE, in New Mexico, USA. We used a double time-of-flight technique to determine the efficiency for neutron-induced fission neutrons from ^{235}U. The ^{235}U was installed in a fission chamber at FP5 viewing a lower tier moderator at a distance of 9m. First results of these measurements will be presented and discussed. This project is supported by the HGF Young Investigators Project VH-NG-327.

HK 53.3 Do 17:15 HG IV

An MR-TOF-MS Isobar Separator and its Applications for TITAN at TRIUMF and the LEB at FAIR — •Christian Jesch[1], Timo Dickel[1], Wolfgang Plass[1,2], Arno Becker[1], Ulrich Czok[1], Hans Geissel[1,2], Emma Haettner[1,2], Wadim Kinsel[1], Martin Petrick[1], Christoph Scheidenberger[1,2], and Mikhail I. Yavor[3] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]Inst. for Analytical Instrum., Russian Academy of Sci., St. Petersburg

At low-energy radioactive ion beam facilities, isobaric contamination and short lifetimes constitute strong limitations for mass measurements and spectroscopy of exotic nuclei. A non-scanning, multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) with high transmission efficiency has been developed and built that will help to overcome these limitations.

A mass resolving power of > 300,000 FWHM, mass accuracies below 1 ppm and repetition rates of up to 100 Hz have been demonstrated. In order to use the MR-TOF-MS as an isobar separator, the ions have to be retrapped, accumulated and transferred to the connected experiments. The retrapping system is currently being designed and built.

First envisaged applications of the MR-TOF-MS are at TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN) and the low-energy branch of the Super-FRS at FAIR, facilitating measurements of beams with strong isobaric background as well as mass measurements on very short-lived nuclei ($T_{1/2} \geq 1$ ms). Systematic studies on the instrument performance and goals for physics experiments will be presented.

HK 53.4 Do 17:30 HG IV

Pulsformanalyse mit Silizium-Mikrostreifendetektoren — •Mirko von Schmid[1], Peter Egelhof[2], Roman Gernhäuser[3], Thorsten Kröll[1], Manfred Mutterer[2], Norbert Pietralla[1], Branislav Streicher[2] und Michael Weber[3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Physik-Department, Technische Universität München

Die Methode der Pulsformanalyse zur Teilchendiskrimination wurde auf einen doppelseitig segmentierten Silizium-Streifendetektor (DSSSD) angewendet. Der 300 μm dicke DSSSD ist je Seite in 16 Streifen (Breite: p-Seite 285 μm / n-Seite 235 μm, Interstrip-Abstand: p-Seite 15 μm / n-Seite 65 μm) segmentiert. Er ist mit 7,1 × 7,1 mm^2 der kleinste Detektor einer Serie von Prototypen für den inneren Si-Detektor des EXL-Experiments bei FAIR. Wir präsentieren die Ergebnisse eines Experimentes, das am Tandem-Beschleuniger des Maier-Leibnitz-Laboratorium (TUM/LUM) in Garching durchgeführt wurde. Ziel war es die leichten Produkte (p, d, α) aus den Reaktionen eines 70 MeV ^{12}C Strahls mit einem Mylartarget voneinander zu trennen. Durch Ausschluss von Interstrip-Ereignissen in der Offlineanalyse konnte eine gute Trennung von Alphateilchen und Protonen bis hinab zu einer Energie von 4 MeV demonstriert werden.

Diese Arbeit wurde gefördert durch BMBF (06DA9040I), GSI, MLL und HIC for FAIR.

HK 53.5 Do 17:45 HG IV

DSSD Prototyping for the EXL experiment at FAIR — •B. Streicher for the EXL-Collaboration — GSI, Darmstadt

Prototype double-sided silicon detectors (DSSD) produced in PTI St. Petersburg (Russia) were tested for the use as the tracking and telescopic detectors in EXL in the future facility FAIR. The spectroscopic properties and performance of 16x16 and 64x64(16) DSSDs were studied using 241Am alpha sources, with special emphasis on interstrip characteristics, using particle implantation from both, the junction and ohmic side. These detectors were used in telescope-like configurations for proton energy reconstruction in two experiments per*formed at KVI Groningen and GSI Darmstadt. Design of a unique readout board for the new generation of 128x64 DSSDs using semiconductor probes technology will be described. Details of testing a set-up suitable for ESR vacuum conditions using DSSDs as an UHV window will also be presented.

HK 53.6 Do 18:00 HG IV

MRPC prototypes for NeuLAND tested using the single electron mode of ELBE/Dresden — •Dmitry Yakorev[1], Tom Aumann[2], Daniel Bemmerer[1], Konstanze Boretzky[2], Christoph Caesar[2], Mircea Ciobanu[2], Zoltan Elekes[1], Michael Elvers[3], Jörg Hehner[2], Michael Heil[2], Mathias Kempe[1], Vassili Maroussov[3], Omar Nusair[2], René Reifarth[2], Haik Simon[2], Daniel Stach[1], Andreas Wagner[1], Andreas Zilges[3], and Kai Zuber[4] for the R3B-Collaboration — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [2]GSI, Darmstadt — [3]Universität zu Köln — [4]TU Dresden

The NeuLAND detector at the R^{3}B experiment at the future FAIR facility in Darmstadt aims to detect fast neutrons (0.2-1.0 GeV) with high time and spatial resolutions (σ_t<100 ps, $\sigma_{x,y,z}$<1 cm). Prototypes for the NeuLAND detector have been built at FZD and GSI and then studied using the 32 MeV pulsed electron beam at the superconducting electron accelerator ELBE in Dresden, Germany. Owing to the new, single-electron per bunch mode of operation, a rapid validation of the design criteria (≥90% efficiency for minimum ionizing particles, $\sigma \leq$ 100 ps time resolution) was possible.

Tested properties of the prototypes include glass thickness, spacing of the central anode, and a comparison of single-ended and differential readout. Tested frontend electronics schemes include FOPI (single-ended), PADI-based (both single-ended and differential mode tested), and ALICE (differential). — Supported by BMBF (06DR9058I) and

GSI FuE.

HK 53.7 Do 18:15 HG IV

NeuLAND MRPC-based detector prototypes tested with fast neutrons — •Christoph Caesar for the R3B-Collaboration — GSI Darmstadt, Planckstrasse 1, 64291 Darmstadt, Germany

A detector for momentum measurements of high-energy neutrons in the energy range 0.2-1 GeV is being developed for the R^3B (Reactions with Relativistic Radioactive Beams) experiment at FAIR. Based on the running LAND detector at GSI, the currently pursued concept for NeuLAND is a layerd structure made of iron converters and charged particle detectors. As charged particle detectors Multigap Resistive Plate Chamber (MRPC) detectors will be used. The excellent time resolution of the MRPC units will allow for a very good time-of-flight resolution of NeuLAND. The design goal for the full detector is $\sigma_{time} < 100\ ps$. The full NeuLAND detector will consist of about 60 layers of the basic structure (converter + MRPC), leading to a detection efficiency of close to 100% for neutrons with energies higher than 200 MeV. Prototypes built at GSI and FZD were tested using MIPs at the ELBE electron beam facility at FZD. Here we present recent results from a first irradiation of the prototypes with fast neutrons. The TSL Uppsala monoenergetic neutron beam of $E_n = 175$ MeV is well-suited for such a study. These data will serve both for the validation of the basic detection scheme and as important input to refine GEANT4 and FLUKA simulations of the final detector.
This project is supported by BMBF and GSI. The access to TSL Uppsala was supported by the European Union through FP6-EFNUDAT (EURATOM contract no. 036434)

HK 53.8 Do 18:30 HG IV

Developments for a New Isochronous Mass Spectrometry Experiment with Uranium Fission Fragments at the FRS-ESR Facility at GSI — •Natalia Kuzminchuk[1,2], Samuel Ayet[1], Marcel Diwisch[1], Hans Geissel[1,2], Christophor Kozhuharov[2], Ronja Knöbel[1,2], Yuri Litvinov[2], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], Baohua Sun[1,2], and Helmut Weick[2] — [1]II. Physikalisches Institut, Gießen, Germany — [2]GSI, Darmstadt, Germany

Masses of nuclei around ^{130}Cd produced by ^{238}U projectile fission will be studied in a planned Isochronous Mass Spectrometry experiment at the FRS-ESR facility at GSI. These nuclei are of much relevance for the understanding of the neutron shell at N=82 as well as for the r-process nucleosynthesis. The masses of the nuclei are directly determined from the revolution frequencies measured by a microchannel plate (MCP) time-of-flight detector. In the detector, ions passing a thin carbon foil release secondary electrons, which are transported to microchannel plates by electric and magnetic fields.

In preparation for the experiment the detector has been further developed and improved. As a high rate of particles is expected for this experiment, the rate acceptance of the detector was determined and increased. The rate capability of MCP is influenced by their channel diameter. MCPs with the same active diameter but different pore sizes were tested. The timing characteristics of the detector were improved by modification of the electron transport from the foil to the MCPs. The design of an anode to improve the signal quality will be presented.

HK 53.9 Do 18:45 HG IV

Digitale Pile-Up Korrektur zur γ-Spektroskopie mit einem LaBr(Ce)-Detektor bei Zählraten bis 10 MHz* — •Bastian Löher[1], N. Pietralla[1], D. Savran[1,2,3], L. Schnorrenberger[1], K. Sonnabend[1] und M. Vencelj[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Jožef Stefan Institute, Ljubljana, Slowenien — [3]Innovation Centre for Advanced Sensors and Sensor Systems, INCAS[3], Assen, Niederlande

Die Spektroskopie von γ-Strahlung ist ein wichtiger Bestandteil vieler kernphysikalischer Experimente. Dabei ist die Zählrate im Detektor oft der limitierende Faktor, der die Dauer oder Realisierbarkeit eines Experiments bestimmt. Eine zu hohe Zählrate führt zu Pile-Up-Ereignissen, die die Energieauflösung und Effizienz verringern. Im Labor wurden γ-Quellen mit LaBr(Ce)-Detektoren und digitaler Aufnahmeelektronik vermessen. LaBr(Ce) ist als Szintillator mit einer guten Energieauflösung und bereits sehr kurzen Signalen für diese Anwendung gut geeignet. Die digitale Aufnahme der Daten lässt eine präzise Auswertung mit neuartigen Algorithmen im Anschluss an das Experiment zu. Es wird eine digitale Pile-Up Korrektur [1] der Daten durchgeführt, um die exakten Amplituden der Signale zu rekonstruieren. Dies ermöglicht mit Zählraten von bis zu 10 MHz, ohne wesentliche Verluste in Auflösung und Effizienz zu messen. Erste Ergebnisse werden gezeigt.

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[1] M. Vencelj *et al.* , Nucl. Inst. and Meth. A **607** (2009) 581