HK 76: Accelerators and Instrumentation II

Time: Thursday 16:30–19:00 Location: H-ZO 90

Group Report HK 76.1 Th 16:30 H-ZO 90

Status Report of the Darmstadt Polarized Electron Source at the S-DALINAC* — •Christian Eckardt[1], Roman Barday[1], Uwe Bonnes[1], Marco Brunken[1], Ralf Eichhorn[1], Joachim Enders[1], Alf Göök[1], Wolfgang F.O. Müller[2], Markus Platz[1], Yuliya Poltoratska[1], Markus Roth[1], Markus Wagner[1], and Thomas Weiland[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Institut für Theorie elektromagnetischer Felder, Technischer Universität Darmstadt, Germany

A source of polarized electrons has been designed and constructed for the superconducting Darmstadt electron linear accelerator S-DALINAC. The source has been set up in a separate test stand for commissioning.

A laser beam stimulates photoemission electrons from a negative electron affinity strained superlattice GaAs cathode. The electron beam is preaccelerated to 100 keV, focused and redirected to the horizontal plane. A Wien filter and Mott polarimeter in the beam line are used to manipulate and measure the polarization. For beam diagnostics wire scanners, fluorescent screens and a coaxial Faraday cup are installed.

Recent results on operation parameters and plans for future development are presented.

*Supported by Deutsche Forschungsgemeinschaft through SFB 634.

Group Report HK 76.2 Th 17:00 H-ZO 90

The PARIS project — •Adam Maj for the PARIS-Collaboration — IFJ PAN Krakow, Poland

The measurement of high energy gamma rays with good energy resolution has always been experimentally challenging, with the best resolution obtainable from a scintillator detector being around 10% from sodium iodide. The novel scintillator material LaBr3(Ce) promises a step-change in what is achievable using scintillator detectors with an unprecedentedly high resolution of <3%. The PARIS array [1] is intended to comprise a double shell of this novel material and more conventional scintillator material. The array could be used in a stand-alone mode or in conjunction with an inner particle detection system (GASPARD, FAZIA), or with high-purity germanium arrays such as EXOGAM or AGATA. Initial designs and simulations for PARIS will be discussed as well as the potential Physics opportunities. The latter will focus on aspects such as the study of giant resonances, or of low- and intermediate-energy fragmentation and Coulomb excitations. The host laboratory for PARIS will be GANIL, nevertheless dedicated campaigns elsewhere (for example FAIR, RIKEN, Poland) are envisaged.

[1] http://paris.ifj.edu.pl

HK 76.3 Th 17:30 H-ZO 90

Timing measurements at ELBE on multigap resistive plate chamber prototypes for NeuLAND — •Dmitry Yakorev[1], Tom Aumann[2], Daniel Bemmerer[1], Konstanze Boretzky[2], Tom Cowan[1], Michael Elvers[3], Jörg Hehner[2], Michael Heil[2], Jens Volker Kratz[4], Wawrczek Prokopowicz[2], René Reifarth[2], Dominic Rossi[4], Gerhard Schrieder[2], Daniel Stach[1], Andreas Wagner[1], and Andreas Zilges[3] for the R3B-Collaboration — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Universität zu Köln — [4]Johannes-Gutenberg-Universität, Mainz

The NeuLAND detector for fast neutrons (0.2-1 GeV) at the R3B experiment at FAIR aims for high time and spatial resolutions (σ_t<100 ps, $\sigma_{x,y,z}$<1 cm). The detector will consist of about 60 sequences of a stacked structure from iron converter material and multigap resistive plate chambers (MRPC's). The secondary charged particles stemming from hadronic interactions of the high energetic neutrons in the converter will be detected in the MRPC's, with excellent timing properties. As part of the ongoing development of the NeuLAND detector, MRPC prototypes designed for this application have been studied at the superconducting electron linac ELBE in Dresden with its picosecond time structure. The ELBE experiments show that the prototypes studied so far have efficiency ≥90% for minimum ionizing particles in a 2x2 gap structure and fulfill the called for time resolution.

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HK 76.4 Th 17:45 H-ZO 90

Studies on multigap resistive plate chamber prototypes for the new NeuLAND detector at the R3B experiment at FAIR — •Michael Elvers[1], Tom Aumann[2], Daniel Bemmerer[3], Konstanze Boretzky[2], Janis Endres[1], Jörg Hehner[2], Michael Heil[2], Jens Volker Kratz[4], Wawrczek Prokopowicz[2], René Reifarth[2], Dominic Rossi[4], Gerhard Schrieder[2], Daniel Stach[3], Andreas Wagner[3], Dmitry Yakorev[3], and Andreas Zilges[1] for the R3B-Collaboration — [1]IKP, Universität zu Köln — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [4]Johannes-Gutenberg-Universität, Mainz

The NeuLAND detector is part of the R3B experiment at FAIR and will detect neutrons between 0.2 and 1 GeV. The high energy neutrons are converted to charged particles, mainly protons, which are detected by Multigap Resistive Plate Chambers (MRPC).
For the detector, a time resolution of $\sigma_t < 100$ ps and a position resolution of $\sigma_{x,y,z} \approx 1$ cm is required for given flight paths in the range from 10 to 35 m. An active area of $2 \times 2\,m^2$ of the neutron detector at a distance of 12.5 m to the target will match the angular acceptance of ±80 mrad for the neutrons defined by the gap of the superconducting dipole magnet.
The salient features of the prototypes will be described, as well as electrical measurements and studies with cosmic rays.

HK 76.5 Th 18:00 H-ZO 90

Test of prototype DSSDs for EXL — •le xuan chung[1], ruud borger[2], thomas davinson[3], peter egelhof[1], vladimir eremin[4], nasser kalantar[2], jens volker kratz[5], manfred mutterer[1,6], norbert pietralla[6], catherine rigollet[2], mirko von schmid[6], branislav streicher[1,5], and philip woods[3] — [1]GSI Darmstadt — [2]KVI Groningen, The Netherlands — [3]The University of Edinburgh, UK — [4]PTI St. Petersburg, Russia — [5]Universität Mainz — [6]TU Darmstadt

Prototype double-sided silicon strip detectors (DSSD) of 300 μm thickness produced at the PTI St. Petersburg (Russia) were tested for the use as position sensitive ΔE and E detectors for tracking and particle identification in the EXL (EXotic nuclei studied in Light-ion induced reactions) setup at the FAIR (Facility for Antiproton and Ion Research) project at GSI. We describe the characteristics of detectors with 16 x 16 strips of 300 μm pitch size and 7.0 x 7.0 mm2 chip dimension, and also with 64 x 64 and 64 x 16 strips of 300 μm and 1250 μm pitch size, respectively, and 21.2 x 21.2 mm2 chip dimension. The response of these detectors for 241Am α particles injected either from the p+ or n+ side was examined. The test measurements were performed partially at GSI and the University of Edinburgh. The results reveal good spectroscopic properties of these detectors. Our work will continue with 100 μm thick detectors and larger active area, up to 65 x 65 mm2.

HK 76.6 Th 18:15 H-ZO 90

The LYCCA detector module — •Andreas Wendt[1,2], Peter Reiter[1], Kerstin Geibel[1], Christoph Goergen[1], Gheorghe Pascovici[1], Dirk Rudolph[3], Pavel Golubev[3], Jürgen Gerl[4], and Robert Hoischen[4] — [1]Institut für Kernphysik, Universität zu Köln, Germany — [2]Frankfurt Institut for Advanced Studies (GP-HIR@FIAS), Germany — [3]Department of Physics, Lund University, Sweden — [4]GSI, Darmstadt, Germany

The Lund-York-Cologne Calorimeter Array LYCCA will be employed for future PRESPEC and HISPEC γ-ray spectroscopy experiments at the GSI/FAIR accelerator facility for reaction product identification after a secondary target at the focal plan of the FRS/SUPER-FRS.

The modular array will comprise plastic or diamond detectors for TOF measurement and ΔE-E telescopes of DSSSD and CsI detectors. The individual modular detector consists of 32x32 Si strip detectors and 9 CsI scintillators. A new developped preamplifier is used for energy measurement up to 5 GeV and fast timing in the subnanosecond time range. These new preamplifiers achieve an electronic energy-resolution of 10keV and obtain fast signal rise times below 20ns. Expected energy-resolution in combination with DSSSD is about 45-50 keV at 5-6 MeV alpha-energies.

First test results from two detector units were obtained using alpha-

sources and protons from the Cologne tandem accelerators.

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HK 76.7 Th 18:30 H-ZO 90

Characterization of lanthanum-chloride detectors for prompt fission γ-ray measurements — •Andreas Oberstedt[1], Stephan Oberstedt[2], and Wouter Geerts[2] — [1]Örebro University, S-70182 Örebro — [2]EC-JRC IRMM, B-2440 Geel

A particular challenge for the modelling of new generation reactor neutron kinetics is the calculation of the γ-heat deposition in e. g. steel and ceramics reflectors without UO_2 blankets, which is required to be known with an uncertainty as low as 7.5%. A major difficulty in measuring the competition between neutron and γ-ray emission during fission fragment deexcitation is the suppression of background γ-rays induced by prompt fission neutrons in the γ-detector. A common method is to distinguish between γ-rays and neutrons by their respective different time-of-flight, which however is limited by the timing resolution of the detector (not better than 5 ns for NaI). A promising approach seems to be the use of recently developed cerium-doped lanthanum halide crystal scintillation detectors. We will present results of the characterization of coaxial $1.5'' \times 1.5''$ $LaCl_3 : Ce$ detectors in terms of energy conversion and resolution, linearity, dynamical range, intrinsic efficiency, timing resolution and intrinsic radioactivity.

HK 76.8 Th 18:45 H-ZO 90

Ultra-Fast Timing with Plastic Scintillators — •Robert Hoischen[1,2], Stephane Pietri[2], Wawrzyniec Prokopowicz[2], Henning Schaffner[2], Jürgen Gerl[2], Dirk Rudolph[1], Hans Jürgen Wollersheim[2], and Nikolaus Kurz[2] — [1]Department of Physics, Lund University, S-22100 Lund, Sweden — [2]Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

Fast timing detectors for time-of-flight measurements are essential identification tools for isotopes studied at fragment seperators at major heavy-ion research facilities. While today's standard technique of utilizing a plastic scintillator read out by few photomultiplier tubes proofs to be efficient, it does not provide the required time resolution for future key experiments at, for example, the Super-FRS at FAIR. A common present-day approach is to use diamond detectors instead. While they do provide a better time resolution compared to scintillators, they are more difficult to use and far more expensive. Results from tests using a new design approach with standard materials will be presented. This leads to a much improved performance, but remains both cost-efficient, compact, and reliable. The design goals and how to accomplish them will be exemplified by the LYCCA (Lund-York-Cologne CAlorimeter) detector aiming for fast-beam experiments at HISPEC within NUSTAR.