HK 47: Instrumentation und Anwendungen

Zeit: Donnerstag 14:15–16:00 Raum: F

HK 47.1 Do 14:15 F

Der Flugzeitdetektor im CBELSA-TAPS-Experiment an ELSA. * — •Alexander Ramseger für die CBELSA-TAPS-Kollaboration — Physikalisches Institut, Rheinische-Friedrich-Wilhelms-Universität Bonn, Deutschland

Der Flugzeitdetektor für das Crystal Barrel-Experiment an ELSA besteht aus vier Lagen mit jeweils 14 Szintillatorlatten von 5 cm Dicke und 20 cm Breite. Insgesamt deckt er eine Fläche von 3 × 3 m^3 ab. Jedes Detektormodul wird an beiden Enden durch Sekundärelektronenvervielfacher ausgelesen. Über TDC-Differenz- und Summen-Spektren ist es möglich, sowohl den Auftreffort von Teilchen als auch deren Flugzeit zu messen. Im Rahmen einer Diplomarbeit wurden die effektiven Abschwächlängen des Szintillatormaterials sowie die Zeit- und Ortsauflösung des Detektors bestimmt. Die Ergebnisse und der Einsatz am CBELSA-TAPS-Experiment werden vorgestellt.

* gefördert durch DFG (SFB/TR 16).

HK 47.2 Do 14:30 F

Upgrade of the FOPI ToF Barrel with MMRPCs — •Mladen Kiš for the FOPI-Collaboration — Gesellschaft für Schwerionenforschung, Darmstadt

Multi-strip Multi-gap Resistive Plate Counters [1] (MMRPCs) were developed for FOPI to improve the existing ToF system and in particular to obtain charged kaon identification with the FOPI setup. In order to achieve a full phase space coverage, a time resolution of better than 100 ps is required for the complete system. The system performance was evaluated [2] with a proton test beam at SIS using a pre-production series of the counters. The result of the performance evaluation will be reported demonstrating the capability of the counter concept.

The readout of the MMRPCs is done via a custom electronic design [3] developed at GSI, using a 3-stage broad-band preamplifier and an ASIC based TAC digitizer [4]. This electronic system is optimized for processing small RPC signals (85 fC on average) and has an excellent intrinsic time resolution of $\sigma_e \leq 15$ ps. We will discuss the status of the series production and the integration of the MMRPCs that aims at installing the full subsystem into the FOPI setup in spring 2007.

[1] E.C. Zeballos et al., Nucl. Inst. and Meth. A 374 (1996), 132.
[2] A. Schüttauf et al., Nucl. Phys. B (Proc. Supp.) 158 (2006) 52.
[3] M. Ciobanu et al., *submitted to* IEEE Trans. Nucl. Sci.
[4] K. Koch et al., IEEE Trans. Nucl. Sci. 52 (2005), 745.
Supported by EU/FP6 HadronPhysics and BMBF 06HD953.

HK 47.3 Do 14:45 F

Properties of Multigap RPC detectors tested with continuous electron beams at ELBE* — •Frank Dohrmann, Roland Kotte, Lothar Naumann, Daniel Stach, Arina Sytcheva, and Jörn Wüstenfeld for the CBM-Collaboration — Institut f. Strahlenphysik, FZ Dresden-Rossendorf, PF 510119, 01314 Dresden

Multigap Resistive Plate Chambers (MRPC) provide the possibility for assembling high-granularity, large-area TOF sytems designed for modern nuclear and particle physics experiments. Currently, experiments like ALICE, STAR, FOPI, HADES prepare MRCP based TOF systems with time resolutions of less than 100 ps. The planned CBM experiment at the future FAIR facility at GSI/Darmstadt considers using an MRPC system provided sufficient time resolution and rate stability can be achieved. These properties of MRCP have been successfully demonstrated in prototype tests performed at the FZD electron linac ELBE, using continuous e^- beams of 20-40 MeV [1]. Typical time resolutions of 70 ps were achieved. The rate capabilities of MRCP using special low-resistive silicate glas were tested and stable efficiencies up to rates of 20 kHz/cm^2 were observed.

[1] R. Kotte, F. Dohrmann, J. Hutsch, L. Naumann, D. Stach NIM A 564 (2006) 155

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HK 47.4 Do 15:00 F

Status of the RPC TOF System of the Compressed Baryonic Matter Experiment — •Everard Cordier for the CBM-Collaboration — Physikalisches Institut, Heidelberg, Germany

The Compressed Baryonic Matter Experiment (CBM) is dedicated to the study of the ultra-dense hadronic matter produced in heavy-ion collisions at energies ranging from 2 AGeV to 45 AGeV. A time of flight (TOF) detector system based on timing Resistive Plate Chambers (tRPC) will be used for hadron identification. The TOF wall will be placed at 10 m from the target, providing a polar angle acceptance of 30 degrees and full azimuthal coverage. The total area is in the order of 150 m^2 and the number of cells has to be about 60.000 in order to keep the occupancy below 5%. Despite the very different rates changing with the polar angle from 1kHz/cm^2 to 20kHz/cm^2 the response over the full area has to be homogeneous with a time resolution better than 80 ps and an efficiency close to 100%.

Various investigations are being performed to improve the rate capability of tRPCs: low resistivity material (ceramic, semi-conductive glass), warm float glass and reduced thickness of the glass electrodes. Based on a realistic description of the RPC response we will present results on simulations of the TOF-layout, mainly discussing the capabilities for reconstruction of rare probes in the charm and strange sector.

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HK 47.5 Do 15:15 F

Isobaric separation by a multiple-reflection time-of-flight mass spectrometer — •Timo Dickel[1], Ulrich Czok[1], Hans Geissel[1,2], Christian Jesch[1], Martin Petrick[1], Wolfgang Plass[1], and Christoph Scheidenberger[1,2] — [1]II. Physikalisches Institut, Justus-Liebig-Universität Giessen — [2]GSI, Darmstadt

Time-of-flight mass spectrometers (TOF-MS) are novel tools for direct mass measurement and separation of exotic nuclei, because of their short cycle time, large mass window and high mass resolving power. The short analysis time will allow measurements of very short-lived nuclei (ca. 1 ms) and operation with up to 10 millions ions per second. Thus it can be used as an isobar separator for nuclear spectroscopy and as fast pre-separator for Penning trap experiments under conditions with strong isobaric contaminations.

As proof-of-principle a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) has been developed. It consists of an electron-impact ion source, two electrostatic reflectors and an MCP-detector. For the use of the MR-TOF-MS as an isobar separator the temporal separation of ions has to be converted into a spatial separation by in a pulsed ion gate, which has been realized as a Bradbury-Nielson-Gate.

For the MR-TOF-MS a mass resolving power of 60,000 has been achieved; a maximum transmission efficiency of 70 % has been estimated. If the MR-TOF-MS is used as separator, its resolving power is half as large as that for mass measurement.

HK 47.6 Do 15:30 F

Characterization and optimization of a time-of-flight detector for Isochronous Mass Spectrometry at FRS-ESR — •Benjamin Fabian[1], Fritz Bosch[2], Timo Dickel[1], Hans Geissel[2], Christophor Kozhuharov[2], Ronja Knoebel[2], Litvinov Sergey[2], Baohua Sun[2], Yuri Litvinov[2], Martin Petrick[1], Wolfgang Plass[1], Christoph Scheidenberger[2], Martin Winkler[2], and Helmut Weick[2] — [1]II. Physikalisches Institut, Gie{\ss}en, Germany — [2]GSI, Darmstadt, Germany

Isochronous Mass Spectrometry can be used to measure masses of exotic nuclei with lifetimes as short as a tens of microseconds at the FRS-ESR facility at GSI. For measurement of the ions* revolution frequencies, a time-of-flight detector is used. Secondary electrons released from a thin carbon foil at every passage of the ion through the detector are transported to micro-channel-plates (MCP) by electric and magnetic fields. The detector has been characterized and optimized. The transport of the secondary electrons onto the MCPs has been simulated and compared with offline measurements. Optimized settings have been found which increase the transmission efficiency by 100\%. The effect of different foil thicknesses and coatings on the detection efficiency have been investigated. Calculations of the secondary electron yield for different projectiles and energies have been performed.

HK 47.7 Do 15:45 F

Detection of Fast Neutrons for R^3B and EXL at FAIR

— •Dominic Rossi[1], Kripamay Mahata[2], Alberto Blanco[3], Konstanze Boretzky[2], Ushasi DattaPramanik[4], Paulo Fonte[3], Klaus Hildenbrand[2], Nasser Kalantar-Nayestanaki[5], Lucia-Ana Popescu[5], Catherine Rigollet[5], Andreas Schuettauf[2], Haik Simon[2], Matjaz Vencelj[5], and Heinrich Woertche[5] for the R3B-Collaboration — [1]Johannes Gutenberg Universität, D-55099 Mainz — [2]GSI, D-64291 Darmstadt — [3]LIP, P-3000 Coimbra — [4]SINP, I-700064 Kolkata — [5]KVI, NL-9747 AA Groningen

The R^3B and EXL projects at the FAIR facility aim for investigations of unstable nuclei by means of reactions with high-energy radioactive beams in inverse kinematics. A high resolution neutron time-of-flight spectrometer NeuLAND is currently being developed for the study of reactions involving emission of projectile-like neutrons. With the design goals of $\sigma_t \approx 100$ ps and $\sigma_{x,y,z} \approx 1$ cm, a resolution for the excitation energy of up to $\Delta E \approx 30$ keV at the neutron threshold can be reached. The neutrons are detected via their interaction in a converter, producing dominantly protons at various energies. While the existing neutron detector LAND is built from a converter-scintillator structure, for NeuLAND the use of resistive plate chambers (RPC) is planned. Since up to now RPCs were mainly developed for detection of minimum ionizing particles, the response of RPCs to protons (30 to 190 MeV) has been investigated in a test experiment performed at KVI with two RPC prototypes from the FOPI and HADES collaborations. - Supported by BMBF (06MZ222I) and EC (EURONS 506065).