HK 32 Instrumentation und Anwendungen

Zeit: Mittwoch 14:00–16:00 Raum: H

Gruppenbericht

HK 32.1 Mi 14:00 H

A recoil detector to measure hard exclusive reactions at HERMES — •Tibor Keri for the HERMES collaboration — II.Physikalisches Institut, Universitaet Giessen, Heinrich Buff Ring 16, 35392 Giessen

The study of a new class of reactions – hard exclusive processes– requires a recoil detector surrounding the internal gas target of the HERMES experiment at DESY to be installed. This recoil detector will improve the selection of exclusive events by a direct measurement of the momentum and track direction of the recoiling particle as well as by rejecting non-exclusive background. The HERMES recoil detector consists of three main components. The innermost layer of this recoil detector is a silicon strip detector (SSD) operated in vaccuum to ensure a low momentum threshold. The outer layers will consist of a newly developed scintillating fibre tracker. In addition to tracking particles with large momenta it will also provide the particle identification properties for particles inside the recoil detectors acceptance as the energy deposition in the scintillating fibres is measured as well. The outmost detector consists of a three layer tungsten-scintillator sandwich for photon detection. In this report, the design, assembly and calibration of the final setup in a cosmics test run and the implementation within the HERMES experiment will be presented. Results from detector tests using proton, pion and electron beams and cosmic radiation will be shown as well as the anticipated and very early performance of the final setup.

HK 32.2 Mi 14:30 H

Redesign of the ANKE Silicon Tracking Telescopes for Experiments with the Polarized Internal Target — •Dieter Oellers for the ANKE collaboration — IKP, Forschungszentrum Jülich

With the installation of the Polarised Internal Target(PIT) in summer 2005 the double polarised program at ANKE has started. A central part of this program will be the study of proton - neutron collisions by detecting low energy (2.5 MeV - 40 MeV) spectator protons from a deuterium target. For tracking and identification of these protons the three-layer silicon tracking telescopes have been built. In addition they determine the beam polarisation and the vertices.

Up to now one prototyp of the silicon tracking telescope had been used at ANKE. The redesigned telescope must be temperature stabilised to improve the energy resolution of the Si(Li) and to reduce the temperature drift of the frontend electronics. This will guarantee an absolute energy-loss determination with $\leq 1\,\%$ precision. The detector positions must be known with an accuracy better then 0.2 mm. Furthermore we would like to increase the energy range by installing a 10 mm thick Si(Li) detector.

For the eight telescopes for future experiments with the PIT/storage cell a redesign of the cooling and support structure is inevitably. It will be carried out in cooperation with the Central Technology Division(ZAT) of the Forschungszentrum Jülich.

Design and implementation into ANKE will be presented.

HK 32.3 Mi 14:45 H

Absolute Energy Calibration and Time Resolution Measurements of the ANKE Silicon Tracking Telescopes. — •Vladimir Leontyev for the ANKE collaboration — FZ-Jülich, Jülich, Germany

The ANKE Silicon Tracking Telescopes have to determine an absolute particle energy with about 1% accuracy. A calibration by α-sources allows to achieve that accuracy, if the dead layer thickness and structure of the detector have been measured. One method, using α-particles of two different energies will be presented. A combination of ^{239}Pu and ^{244}Cm as α-sources can be applied to realize the absolute calibration in the laboratory. It is planned to use an α-source as a permanent monitor for the telescope performance.

The time resolution of silicon detectors was investigated with two types of preamplifier, chips VA32TA2 (ideas, Norway) and MATE3 (Saclay, France). Laboratory measurements were carried out with α- and β-sources under vacuum and in air. It allowed to investigate the trigger time and resolution dependence on magnitude and spatial distribution of the charge. The results of α- and β-measurements were cross-checked in the overlapping energy region.

The Cologne Tandem-Accelerator provides a proton beam of precise energy, which allows to study the functioning of the detector with different particle ranges. In addition, it becomes possible to provide a direct Time-of-Flight measurement with two detectors of the telescope. Thus, the planned measurements at the accelerator will check the results of the energy and time investigations in an independent way.

HK 32.4 Mi 15:00 H

Determination of the Analyzing Power A_y in quasi-free pp and np scattering with a Silicon Tracking Telescope at ANKE — •Andreas Mussgiller for the ANKE collaboration — Institut für Kernphysik, Forschungszentrum Jülich — now at Physikalisches Institut II, Universität Erlangen-Nürnberg

A beam-time in November of 2003 has been exploited to take data with a Silicon Tracking Telescope that has been developed for the ANKE spectrometer. In the experiment a deuteron beam of 2.4 GeV/c with eight different combinations of vector and tensor polarizations impinged on an unpolarized hydrogen cluster jet target.

From the obtained data it was possible to determine the analyzing powers A_y and A_{yy} for dp-elastic, and A_y for pp- and np-quasi elastic scattering. The performance of the Silicon Tracking Telescope and the analysis will be outlined, and first results will be presented.

HK 32.5 Mi 15:15 H

Challenges for solid state tracking detectors in nuclear physics experiments at FAIR — •Oleg Kiselev for the R3B collaboration — Institut für Kernchemie, Universität Mainz

A versatile reaction setup with excellent efficiency, acceptance, and resolution for kinematically complete measurements of reactions with high-energy radioactive beams will be installed at the focal plane of the new fragment separator at the new accelerator facility FAIR planned at GSI. The combination of a superconducting large-acceptance dipole with high-resolution tracking and time-of-flight detectors will provide significant improvements in momentum resolutions for heavy fragments, light-charge particles, and neutrons. The set of thin double-sided Si microstrip detectors will be developed for the detection of the light recoiling particles in a wide range of energies. The system should be able to work with the different target, including the liquid hydrogen and helium targets placed inside a ball of the crystal calorimeter. The unique feature of the target recoil system is a high angular, energy resolution and an identification of the particles for a wide variety of scattering experiments, such as heavy-ion induced electromagnetic excitation, knockout and fragmentation, or light-ion (in)elastic and quasi-free scattering in inverse kinematics. The results of the design studies, simulations and the first beam test of the prototypes will be presented.

HK 32.6 Mi 15:30 H

Ein Silizium-Detektorsystem zur Spur- und Vertexmessung im CBM-Experiment bei FAIR — •Johann M. Heuser für die CBM-Kollaboration — Gesellschaft für Schwerionenforschung mbH, Darmstadt

Mit dem **C**ompressed **B**aryonic **M**atter-Experiment soll an der zukünftigen internationalen Beschleunigeranlage FAIR der GSI stark wechselwirkende Materie bei hohen Baryonendichten untersucht werden. Das CBM-Experiment wird als Fixed Target-Experiment am SIS-300 Synchrotron geplant, das Schwerionenstrahlen mit Energien bis zu 45 GeV/Nukleon liefern wird. Zu den besonders interessanten aber herausfordernden Messungen, die Auskunft über Eigenschaften dichter Kernmaterie liefern können, gehören hadronische Zerfälle von D-Mesonen und leptonische Zerfälle leichter Vektormesonen.
Die zentrale Komponente des Experiments ist ein Silizium-Spur- und Vertexdetektor höchster Leistungsfähigkeit zur exklusiven Bahn-, Impuls- und Vertexmessung geladener Teilchen. Zu den technologischen Herausforderungen bei der Detektorentwicklung zählen besonders dünne Siliziumsensoren, extreme Strahlungstoleranz, hohe Ortsauflösung und schnelle Auslese ohne zentralen Trigger.
Der Beitrag diskutiert das Konzept des CBM-Spur- und Vertexdetektors anhand von Anforderungen an die Messung wichtiger Prozesse und gibt einen Ausblick auf die begonnene Entwicklung der Sensoren.

HK 32.7 Mi 15:45 H

Tracking in the Silicon Tracker System of the CBM Experiment using Hough Transform — •Christian Steinle, Joachim Gläss, and Reinhard Männer — Lehrstuhl für Informatik V, Universität Mannheim

The planned CBM fixed-target experiment produces up to 10 million nucleus-nucleus collisions per second, with multiplicities of up to 1000 particles.

In this paper we describe an adaptation of the Hough transform for the tracking of particles in the CBM STS detector, together with a possible implementation of the algorithm in hardware using FPGA (field programmable gate array) as a level-1 trigger.

Simulations of the Hough transform with central Au+Au data show an efficiency over 90 %. The processing time using FPGA processors is in the order of 10 to 100 microseconds.