HK 7 Instrumentation und Anwendungen

Zeit: Freitag 14:00–16:00 Raum: TU MA042

Gruppenbericht HK 7.1 Fr 14:00 TU MA042

FOPIs MRPC-ToF Upgrade — •Andreas Schüttauf for the FOPI collaboration — GSI Planck Str.1 64291 Darmstadt

We present the results of the detector R&D for the new FOPI-ToF system at GSI. This proposed ToF-upgrade, an array surrounding the Central-Drift-Chamber (CDC) of FOPI, will have a size of $6m^2$ with 600 individual cells. The time resolution needed is below $\sigma_t \leq 100$ ps with a ϕ granularity of $d\phi \leq 3^o$ and a multihit capability. The use of Multigap Resistive Plate Chambers (MRPC) with segmented anodes seemed to be the most adequate solution in terms of time resolution, granularity and cost.

We will discuss the final MRPC-hardware design like the segmented anode structure (strip/pitch) as well as the optimized counter parameters for mass production. We have also developed a new Front End-Electronic-(FEE) which consists out of preamplifier (bandwidth of $\delta f \sim 1.5$ GHz at a gain of $g \sim 200$) followed by a discriminator stage. For the digitization we developed a TAC-ASIC based readout system which has an intrinsic electronic resolution of $\sigma_E \leq 10$ ps. Altogeter 4800 electronic channels are needed. Finally we will present results on time resolution, efficiency and double hit capability of the setup.

Gruppenbericht HK 7.2 Fr 14:30 TU MA042

Test Resultate von dem AGATA γ-ray tracking Detektor Modul — •D. Weisshaar, J. Eberth und G. Pascovici für die AGATA-Kollaboration — Institut für Kernphysik, Universität zu Köln

Das **A**dvanced **GA**mma **T**racking **A**rray AGATA ist das erste komplette 4π γ-ray Spektrometer, das gänzlich nur aus Germaniumdetektoren aufgebaut sein wird. Neben der guten Energieauflösung können mit den AGATA Germaniumdetektoren auch die Positionen der γ-Wechselwirkungen mit einer Auflösung von wenigen Millimetern bestimmt werden. Dieses erlaubt den Streuweg eines γ-Quants zu rekonstruieren (Compton, Paarbildung und abschließender Photoeffekt), um zu entscheiden, ob es komplett absorbiert wurde.

Die Entwicklung des AGATA Detektors basiert auf der Technologie von MINIBALL [1,2]. Bei AGATA werden drei gekapselte, hexakonische Germaniumkristalle in einem gemeinsamen Kryostaten zusammengefasst. Jeder Kristall ist an seinem Außenkontakt 36-fach segmentiert [3].

Die ersten gekapselten AGATA Detektoren wurden in Köln mit radioaktiven Quellen und γ-Strahlung aus in-beam Reaktionen getestet. Es werden Daten vorgestellt, die die exzellente Energieauflösung, das gute Übersprechverhalten unterhalb von 0.1% und die Ortssensitivität zeigen. Über den aktuellen Fortschritt des AGATA-Projektes wird berichtet werden.

[1] D. Weißhaar, DPG-Verhandlungen 2001-2003
[2] J. Eberth *et al.*, Prog. Part. Nucl. Phys. 46, **389** (2001)
[3] D. Weißhaar, DPG-Verhandlungen 2004, HK4.2

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HK 7.3 Fr 15:00 TU MA042

Charge carrier mobility in segmented large volume HPGe detectors — •B. Bruyneel, P. Reiter, J. Eberth, and D. Weisshaar — IKP, Universität zu Köln

γ-ray tracking in future HPGe arrays like AGATA will rely on pulse shape analysis of multiple γ-interactions. Therefore, an accurate description of electron and hole mobility as a function of the electric field strength is needed. Preamplified signals from a 12-fold segmented MINIBALL detector [1] were processed using digital XIA electronics [2]. For the electrons the whole crystal surface was scanned yielding 336 detector responses with a collimated ^{241}Am source. Anisotropy and crystal geometry cause considerable rise time differences in pulse shapes ranging up to 30% at the front side of the detector. Pulses of direct and transient signals are very well reproduced by weighting field calculations. Exploiting the segmentation a precise measurement of the hole drift anisotropy - a 10% rise time effect - was performed for the first time with 356 keV γ-rays from a ^{133}Ba source. The measured angular dependence of the rise times is caused by the crystal orientation and geometry, changing field strength and space charge effects. For the hole mobility in Ge semiconductors an applicable theoretical description is missing. Hence, a model based on the drifted Maxwellian hole distribution was developed for the hole drift anisotropy using the experimental velocity along the crystal axis as parameters.

∗ Supported by the German BMBF(06 K-167).
[1] P.Reiter *et al.*, Nucl. Phys. **A701** 209 (2002)
[2] DGF-4C User's Manual, XIA, http://www.xia.com

HK 7.4 Fr 15:15 TU MA042

Kalibration der Siliziumzähler für den HERMES-Recoil-Detektor — •Christian Vogel — Universität Erlangen-Nürnberg

Das HERMES-Experiment am HERA-Speicherring (DESY/Hamburg) dient zur Untersuchung der polarisierten Lepton-Nukleon-Streuung bei tiefinelastischer Kinematik ($Q^2 > 1\text{GeV}^2$, $W^2 > 4\text{GeV}^2$). Das Spektrometer erlaubt neben der Bestimmung der spinabhängigen Strukturfunktionen und Quarkverteilungen auch die Beobachtungen harter, exklusiver Prozesse, bei denen nur ein einziges, relativ hochenergetisches Meson oder Photon unter geringem Impulsübertrag auf den Targetkern erzeugt wird.

Das HERMES-Spektrometer besitzt zur Zeit nur eine eingeschränkte Messgenauigkeit für diese Prozesse. Eine Detektor-Erweiterung, der sogenannte Recoil-Detektor, soll ab Sommer 2005 zusätzlich das Rückstoßteilchen nachweisen.

Die Kalibration der Siliziumzähler, welche in diesem Detektor zum Einsatz kommen, wurde am Erlanger Tandem-Beschleuniger durchgeführt, die Ergebnisse werden in diesem Vortrag dargestellt.

Gefördert durch BMBF (Projekt 06 ER 125I).

HK 7.5 Fr 15:30 TU MA042

Test and performance of the scintillating fibre tracker for the HERMES recoil detector — •Roberto Perez, Michael Düren, Matthias Hartig, Matthias Hoek, Tibor Keri, Shaojun Lu, Lukas Rubacek, Björn Seitz, and Hasko Stenzel — II. Physikalisches Institut, Uni Giessen, 35392 Giessen

The HERMES recoil detector will operate a scintillating fibre tracker to identify and track protons for momenta up to 1400 MeV/c.

Scintillating fibers are an ideal tool to combine energy and position measurements for charged particles in an intermediate momentum range. They offer a high granularity while keeping the mechanical construction and material density at a minimum. Modules build from Kuraray SCSF–78 fibres of 1 mm diameter were tested at a secondary beam consisting of pions and protons at various momenta from 300 MeV/c to 900 MeV/c. Their particle identification and spatial resolution properties were tested. Data from these tests will be presented together with data using a 5 GeV/c electron beam for precise position and resolution studies of the final detector.

HK 7.6 Fr 15:45 TU MA042

Results from a beam test of a scintillating fibre hodoscope with multianode photomultiplier read-out — •Carlos Ayerbe Gayoso and Patrick Achenbach for the A1 collaboration — Institut für Kernphysik, Universität Mainz, 55099 Mainz

A scintillating fibre hodoscope has been designed as an electron detector with the future kaon spectrometer at MAMI. A prototype detector has been tested near the focal plane in one of the three existing spectrometers. A timing resolution of less than 1 ns (FWHM) width with detection efficiencies of 99% has been measured with 4 layers of 0.83 mm diameter multiclad fibres. Spatial resolution and the effect of cross-talk between neighbouring channels were studied in detail.

Performance of a prototype with a Cockroft-Walton voltage multiplier as PMT base is also presented.

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