HK 4: Instrumentation und Anwendungen I

Zeit: Montag 14:00–16:00 Raum: 2C

Gruppenbericht HK 4.1 Mo 14:00 2C

Position sensitive γ-ray detection with AGATA — •Bart Bruyneel[1], Benedikt Birkenbach[1], Jürgen Eberth[1], Herbert Hess[1], Gheorghe Pascovici[1], Peter Reiter[1], Andreas Wiens[1], Dino Bazzacco[2], Alberto Pullia[3], and Francesca Zocca[3] for the AGATA-Collaboration — [1]IKP, Universität zu Köln — [2]INFN, Padova — [3]INFN, Milano

The Advanced GAmma Tracking Array (AGATA) project is aiming to realize the first full 4π γ-ray spectrometer solely built out of Germanium. The 36-fold segmented encapsulated large volume HPGe detectors, equipped with fully digital electronics, will provide an optimal energy resolution and a very high efficiency combined with a position sensitivity of a few millimeters employing pulse shape analysis and the new method of γ-ray tracking. For the AGATA detector preamplifier circuitry a low cross talk level was determined which compares well with the expected calculated contributions. The results of a new correction method to eliminate the influence of cross talk will be presented. Several AGATA detector crystals have been characterized for pulse shape analysis by collecting a database of position dependent pulse shapes. The scanning results are reproduced by pulse shape simulations based on Ge crystal properties, electric field distributions and charge carrier mobilities. Recently the observable energy range of the AGATA preamps was extended up to 150 MeV by applying the time over threshold technique. Energy resolution for high energetic γ-rays is measured to be comparable with values obtained with the standard pulse height technique. *Supported by the German BMBF (06 K-167)

HK 4.2 Mo 14:30 2C

Java-Simulation von AGATA-Pulsformen mit JASS — •Michael Schlarb[1], Roman Gernhäuser[1], Reiner Krücken[1] und Pierre Désesquelles[2] für die AGATA-Kollaboration — [1]Physik-Department E12, TU München — [2]CSNSM Orsay

Das Advanced Gamma Tracking Array (AGATA) welches gerade aufgebaut wird, ist ein 4π- Detektor aus hochsegmentierten Germanium-Zählern. Für die genaue Rekonstruktion der Wechselwirkungspunkte im Detektor wird die Pulsformanalyse eingesetzt. Dabei wird die Methode eines direkten Vergleichs der gemessenen Pulsformen mit simulierten Daten verwendet. Um die geforderte Ortsauflösung zu erreichen wird eine präzise Simulation dieser Pulsformen benötigt. Grundlage ist eine genaue Kenntniss der Geometrie der unterschiedlichen AGATA-Detektoren, akurate Modelle der Beweglichkeiten der Ladungsträger[1] und eine Kenntnis der Dotierungsprofile im Kristall. Wir stellen die von uns entwickelte Simulation JASS und die verwendeten Lösungsansätze vor. Die Ergebnisse wurden anschließend durch einen Vergleich mit Daten eines Koinzidenz-Scans verifiziert.

* gef. d. BMBF(06MT238),EURONS(T-J02-3), DFG (Exz-Clust 153-Universe)

[1] B. Bruyneel,P. Reiter, G. Paskovici, Nucl. Instr. and Meth. A, 569, pp. 764-773, 2006

HK 4.3 Mo 14:45 2C

AGATA - Detektoren und Kryostaten — •Herbert Hess[1], Bart Bruyneel[1], Jürgen Eberth[1], Daniel Lersch[1], Gheorghe Pascovici[1], Peter Reiter[1], Heinz-Georg Thomas[2] und Andreas Wiens[1] — [1]IKP Köln — [2]CTT, Montabaur

Das Gamma-Spektrometer AGATA (Advanced GAmma Tracking Array) besteht aus 36-fach segmentierten, gekapselten hochreinen Ge-Detektoren. Jeweils drei dieser Detektoren mit leicht unterschiedlicher, hexagonaler Bauform bilden einen Clustermodul. 60 Clusterdetektoren können zu einer Kugelschale zusammengefügt werden, wobei 82% des Raumwinkels mit Germanium bedeckt werden. Die Ortsauflösung der AGATA-Detektoren von < 5 mm erlaubt erstmals ein Tracking der Wechselwirkungen des γ-Quants in dem Ge-Detektor. Herausragende Eigenschaften des AGATA-Spektrometers sind: Hohe Nachweiswahrscheinlichkeit, ausgezeichnete Linien-zu-Untergrund Verhältnis und optimale Korrektur der Verbreitung der γ-Linien durch Dopplereffekte. Für die ersten elf asymmetrischen HPGe-Detektoren der AGATA Kollaboration wurden die grundlegenden Eigenschaften in speziellen Testkryostaten in Köln bestimmt. Messergebnisse, die mit dem ersten asymmetrischen AGATA Tripel-Clusterdetektor gewonnen wurden, werden vorgestellt.

*Supported by the German BMBF (06 K-167)

HK 4.4 Mo 15:00 2C

Pulse shape discrimination between light charge particles and electrons using Si detectors* — •Sarla Rathi, Uwe Bonnes, Jurgen von Kalben, Manfred Mutterer, Peter von Neumann-Cosel, Inna Pysmenetska, Achim Richter, and Gerhard Schrieder — Institut für Kernphysik, Darmstadt, Germany

Pulse shape discrimination (PSD) is a very powerful tool for particle identification [1]. For good PSD using Si detectors, high homogeneity of the silicon material and fast low-noise front-end electronics are required. We have developed Si surface barrier detectors from homogeneously neutron-transmutation doped silicon for PSD. The detectors were run at twice the bias required for full depletion and light particles were injected from the rear side (reverse mount). For the first time, light ions like alphas from an ^{241}Am source and electrons from a ^{207}Bi source were separated, with an excellent time resolution. The difference between the collection times of the two pulses was maximized and used for a rise time based discrimination.

[1] A. Fazzi et al., IEEE Trans. Nucl. Sci. 51 (2004) 1049.

*Supported by the DFG through SFB 634.

HK 4.5 Mo 15:15 2C

Performance of the new Si microstrip detector prototypes for the R3B recoil system — •Kristian Larsson for the R3B-Collaboration — GSI Darmstadt

The performance of the new double-sided silicon microstrip detector (DSSD) prototypes developed for the R3B setup (Reaction studies with Relativistic Radioactive Beams) will be presented. They have been recently tested and used in several experiments at GSI, Darmstadt: measurements of nuclear and electromagnetic dissociation ^{17}Ne and ^{27}P, as well as for a feasibility experiment of quasi-free scattering in inverse kinematics using a ^{12}C beam. All experiments required to record simultaneously protons and the residual fragments with good position and energy resolution. This requires both low noise and high dynamic range of the front-end electronics. Our experimental results show that both protons and heavy ions ranging from Z=2 up to 12 can be identified with good signal-to-noise ratio and spatial resolution. This detection system serves as a prototype for the R3B target recoil detection system, which will be composed of two shells of DSSDs enabling the use of extended, thick liquid hydrogen and helium targets for scattering experiments with radioactive beams at FAIR.

HK 4.6 Mo 15:30 2C

Diamond detectors for ultra-fast fission-fragment timing — •Stephan Oberstedt[1], F.-J. Hambsch[1], Cezar Negoita[1], Andreas Oberstedt[2], Carlos Chaves de Jesus[1], Wouter Geerts[1], and Marzio Vidali[1] — [1]EC-JRC IRMM, B-2440 Geel — [2]Örebro University, S-70182 Örebro

The precise knowledge about delayed neutron (DN) yields in fission is highly relevant for the reliable control of nuclear reactors and the save operation of sub-critical assemblies, like e. g. ADS, where minor actinides are mixed into the nuclear fuel. One way to achieve a more fundamental understanding of the production of so-called DN pre-cursor isotopes in fission is to measure the emission yields with high mass resolution. For this purpose a two-arm time-of-flight spectrometer for high resolution fission-fragment spectromertry is being built at the Institute for Reference Materials and Measurements, a Joint Research Centre of the European Commission. The ultimate goal is to achieve a mass resolution $A/\Delta A \approx 120$ in conjunction with a reasonable counting efficiency. One pre-requisite for such a device is the use of ultra-fast timing detectors. For this purpose poly-crystalline chemical vapour deposited (pcCVD) diamond detectors have been tested for the first time as time pick-up for binary fission fragments. In particular, the charge-collection efficiency has been investigated as a function of the irradiation time, which corresponds to the integral dose applied to the detector material. The intrinsic timing resolution for fission fragments has been determined to be better than 40 ps.

HK 4.7 Mo 15:45 2C

Performance study of scintillating fiber detectors for the HypHI project — •Daisuke Nakajima for the HypHI-Collaboration — University of Tokyo, Japan

Hypernuclei spectroscopy has been investigated by means of meson- or electron-beam induced reaction with a target material of stable nuclei in most of experiments. Consequently all existing methods are restricted to the production of hypernuclei close to the valley of stability.

The HypHI project at GSI and FAIR aims to produce hypernuclei by stable and unstable heavy ion induced reactions, which is the only way to produce hypernuclei at extreme isospins and to measure directly hypernuclear magnetic moments for the first time. The first HypHI experiment defined as Phase 0 has been proposed to demonstrate the feasibility of the experimental principle by producing and identifying ${}^{3}_{\Lambda}$H, ${}^{4}_{\Lambda}$H and ${}^{5}_{\Lambda}$He by reconstructing their invariant masses with ^{6}Li projectile at 2 A GeV impinging on a ^{12}C target. The proposed experimental setup consists of the ALADIN dipole magnet, three layers of scintillating fiber detector, two Time-Of-Flight (TOF) walls, a diamond detector, a K^{+} detector and two sets of drift chambers.Three layers of scintillating fiber detectors will be placed just behind the target, and used for tracking charged particle and for the measurement of decay vertices. Prototypes of scintillating fiber detectors have been tested with cosmic-rays, ^{90}Sr beta sources and beams of the GSI SIS18 accelerator. In the presentation, the performance of the scintillating fiber detectors will be discussed.