HK 62: Instrumentation XIII

Zeit: Freitag 14:00–15:45 Raum: HS 11

Gruppenbericht HK 62.1 Fr 14:00 HS 11

Readiness of R3B setup for FAIR Phase-0 — •Dominic Rossi for the R3B-Collaboration — Technische Universität Darmstadt, Darmstadt, Germany

The R^3B experimental setup is designed to enable kinematically complete measurements of various types of nuclear reactions involving exotic secondary beams at relativistic energies up to the GeV/nucleon range. Currently located at GSI, the setup will be in use for several approved physics runs within the FAIR Phase-0 program.

The experimental setup and scope will be presented briefly, followed by the current status of the various detector subsystems, including for instance the superconducting dipole magnet GLAD, the neutron time-of-flight detector NeuLAND and the photon detector CALIFA. Preliminary results from on-line detector tests will be presented, illustrating the readiness of the experiment for the upcoming physics program.

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HK 62.2 Fr 14:30 HS 11

200μm Scintillating Fiber Detector with SiPM Readout — •Ashton Falduto[1], Junki Tanaka[1], and Thomas Aumann[1,2] for the R3B-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum

Being able to track charged particles using scintillation light detection near magnetic fields is currently challenging due to magnetic field influences on the often used photomultiplier tubes. However, with the development of a new Silicon Photomultiplier (SiPM) Fiber detector, it is now possible to detect these particles using a unique combination of SiPM, Preamplifing Discriminators (PADI) and an FPGA-based Time-to-Digital Converters (TDC). The detector is built from over two thousand 200μm round plastic scintillator fibers arranged in a unique pattern. The position is determined when light is detected by one of these scintillating fibers and a "hit" or "no hit" signal is produced. In this presentation, I will explain how the detector was constructed and how the electronics work together. I will show where the detector is located during experimental runs. And finally, I will discuss the performance of the detector during an on-line experiment.

This work is supported by the BMBF project 05P15RDFN1 and the GSI-TU Darmstadt cooperation.

HK 62.3 Fr 14:45 HS 11

Comparison of Different Coatings for Scintillating-Plastic Fibers — •Verena Eiblmeier, Laura Fabbietti, Martin J. Losekamm, Stephan Paul, and Thomas Pöschl — Technical University, Garching, Germany

Plastic scintillators have a long tradition as radiation detectors in high-energy and medical physics. Due to their low weights and cost, large segmented volumes can be built up from them. To suppress optical crosstalk between the different segments, the surface of the scintillator must be made impermeable to light. We tested different surface coatings on short scintillating-plastic fibers and compare their mechanical and optical properties. To compare the light output of the different fibers, we coupled them to silicon photomultipliers and irradiated them with a pion and proton beam at Paul Scherrer Insitute. We performed different measurements to compare the magnitude and the uniformity of the light yield along the scintillating fiber.

HK 62.4 Fr 15:00 HS 11

Zeitauflösung eines elektromagnetischen Blei-Wolframat-Kalorimeters mit Siliziumphotomultiplier-Auslese — •Lukas Nies, Kai-Thomas Brinkmann, Markus Moritz, René Schubert und Hans-Georg Zaunick — II. Physikalisches Institut, Gießen, Deutschland

Da moderne Messaufgaben immer leistungsfähigere Detektoren erfordern, wurde mit der Entwicklung des Siliziumphotomultipliers (SiPM) in den letzten Jahren eine Alternative zur traditionellen Photomultiplier-Röhre (PMT) geschaffen. Aufgrund der kleineren Größe, der geringen Betriebsspannung und der Insensitivität gegen Magnetfelder ist die SiPM der PMT in vielen Anwendungen überlegen. In dieser Arbeit wird die Entwicklung eines Detektors vorgestellt, welcher aus Blei-Wolframat (PWO) Kristallen und SiPM-basierten Auslesemodulen besteht. Das einzelne Auslesemodul besteht aus einer SiPM-Trägerplatine, welche neun SiPMs parallel betreibt und eine gesamte photosensitive Fläche von 81 mm^2 besitzt. Auf der Rückseite der Trägerplatine ist ein modularer Hochfrequenz-Verstärker aufgesteckt, der die Rohsignale der SiPMs wahlweise mit einer einfachen oder einer doppelten Verstärkerstufe verstärkt. Um die Leistung dieses Detektorkonzeptes zu testen, wurden neben Tests der einzelnen Komponenten auch kosmische Myonen gemessen und die Signale mit einem 100 MHz SADC digitalisiert. Über eine optimierte offline Merkmalextraktion wurden die Zeitauflösung zwischen zwei Detektoren bestimmt und das Spektrum der Energiedeposition der Myonen im Szintillatormaterial aufgenommen.

HK 62.5 Fr 15:15 HS 11

Collection efficiency performance of recently developed Microchannel-Plate Photomultipliers — •Daniel Miehling, Merlin Böhm, Albert Lehmann, Markus Pfaffinger, and Samuel Stelter for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Two Cherenkov detectors for hadron identification will be used for the PANDA experiment at the new FAIR facility. For both of these DIRC detectors the focal plane will be located inside a magnetic field of >1 T. Microchannel-Plate Photomultipliers (MCP-PMTs) are the chosen sensors for the detection of the Cherenkov photons. Typically the probability that an electron from the photo cathode is actually detected at the anodes is in the order of 60% for MCP-PMTs. This is called the collection efficiency (CE). PHOTONIS has built a new HiCE sensor which should reach 90% CE or even more. This is achieved with a special treatment of the microchannel-plates. In the Erlangen setup a measurement of the CE of different MCP-PMTs, older PHOTONIS and Hamamatsu and the new HiCE PHOTONIS tube, was performed. There are some challenging requirements for the measurement, namely a light source whose intensity is tunable over several orders of magnitude and a suitable setup for measuring very low currents in the range of picoampere. This talk will present the current setup and the latest obtained results. The focus will be on the comparison of various tubes with different lifetime enhancement methods applied like a protection film in the tube or ALD-coated (atomic layer deposition) MCPs.

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HK 62.6 Fr 15:30 HS 11

The eyes of XENONnT: Qualification tests of 494 photomultiplier tubes — •Oliver Wack and Luisa Hoetzsch for the XENON Collaboration — MPIK, Heidelberg, Germany

The next phase of the XENON dark matter direct detection experiments will be the XENONnT detector. Utilizing in total 8.4 tonnes of xenon in a dual-phase liquid xenon time projection chamber, its aim is to increase the sensitivity for direct dark matter detection by one order of magnitude to probe new regions of the parameter space.

The scintillation light induced within the detector volume by particle interactions will be detected with 494 photomultiplier tubes (PMTs). The Hamamatsu R11410 tube has been chosen for its high quantum efficiency and low intrinsic radioactivity to maximize the detector's sensitivity. Applying the knowledge gained during testing and operation of the previous detector, XENON1T, the characteristics and performance of the PMTs for XENONnT have been studied and tested extensively. The general testing procedures and the results of the testing campaign will be presented in this talk.