HK 38: Instrumentation VII

Time: Wednesday 16:30–19:00 Location: J-HS C

Group Report HK 38.1 Wed 16:30 J-HS C

Design optimizations and assembly status of the Electromagnetic Target Calorimeter of the $\overline{P}ANDA$ experiment — •Markus Moritz, Kai-Thomas Brinkmann, Valerii Dormenev, Anniko Falk, Christopher Hahn, Pavel Orsich, Marvin Peter, Matthias Sachs, and Hans-Georg Zaunick for the PANDA-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität, Gießen

The future $\overline{P}ANDA$ experiment with a next generation detector will focus on hadron spectroscopy. It will use cooled anti-proton beams with a momentum between 1.5 GeV/c and 15 GeV/c interacting with various targets. This allows to direct form all states of all quantum numbers and measure there widths with an accuracy of a few tens of keV. Its electromagnetic target calorimeter will be located inside a 2T solenoid and has the challenging aim to detect photons with excellent energy resolution over the full dynamic range. To reach this goal, improved $PbW0_4$ scintillator crystals, cooled down to $-25°C$ have been chosen. The target calorimeter itself is divided into into a barrel and two endcaps. The individual crystal will be read out with two precisely matched large area avalanche photo sensors (APD). In the very inner part of the forward endcap vacuum phototetrodes will be used instead. In this talk the construction and assembly status will be presented. This includes for example the assembly of detector subunits, mechanical support structure, the cooling system, optical monitoring system and front end electronics.
This project is supported by the BMBF, GSI and HIC for FAIR.

HK 38.2 Wed 17:00 J-HS C

APD-Gain optimization for the $\overline{P}$ANDA Barrel EMC — •Aniko Tim Falk, Markus Moritz, Hans-Georg Zaunick, Kai-Thomas Brinkmann, Valera Dormenev, Kim Tabea Giebenhain, Christopher Hahn, Marvin Peter, Matthias Sachs, and René Schubert for the PANDA-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität, Gießen

The future electromagnetic calorimeter of the PANDA Experiment will provide an excellent energy resolution over a wide dynamic range. In order to reveal the full potential of its readout, the gain of the APDs can still be further optimized. With the goal to detect high energy photons over a wide energy range from a few dozens of MeV up to 15 GeV, the gain must provide a most excellent energy resolution over the whole spectrum whilst maintaining the needed dynamic range of the individual readout-electronics. The progress made on this subject over the last year shall be briefly summarized in this contribution. Various measurements have been made on a complete setup, that is very close to the final read out of the $\overline{P}$ANDA EMC. To match environmental conditions during operation, the setup was cooled to -25 °C.
This project is supported by the BMBF, GSI and HIC for FAIR.

HK 38.3 Wed 17:15 J-HS C

Qualitätskontrolle der Bleiwolframat-Kristalle für das $\overline{P}$ANDA-Experiment — •Jan Seelbinder[1], Kai-Thomas Brinkmann[1], Valera Dormenev[1], Mikhail Korzhik[2,3], Markus Moritz[1], Pavel Orsich[1] und Hans-Georg Zaunick[1] für die PANDA-Kollaboration — [1]2. Physikalisches Institut Justus-Liebig-Universität, Gießen, Deutschland — [2]Institute for Nuclear Problems of Belarusian State University, Minsk, Belarus — [3]NRC Kurchatov Institute, Moscow, Russia

Bleiwolframat(PWO)-Kristalle finden Verwendung im Elektromagnetischen Kalorimeter (EMC) des $\overline{P}$ANDA Experiments. Das ausgesendete Szintillationslicht dient hier der Energiebestimmung elektromagnetisch wechselwirkender Teilchen. Da die Kristalle mit hohen Strahlendosen belastet werden, ist u.A. eine genaue Bestimmung der Strahlenschäden essenziell für den Erfolg des $\overline{P}$ANDA Experiments.
Dieser Vortrag präsentiert die verschiedenen Methoden der Überwachung der laufenden Massenproduktion sowie die erreichten Parameter.
Dieses Projekt wird unterstützt vom BMBF, der GSI und HIC for FAIR.

HK 38.4 Wed 17:30 J-HS C

Beam accelerator experiments with the new GAGG scintillator — •Pavel Orsich[1], Valerii Dormenev[1], Kai-Thomas Brinkmann[1], Markus Moritz[1], Hans-Georg Zaunick[1], Dmitry Kozlov[2], and Mihkail Korzhik[2] — [1]2nd Physics Institute, JLU, Giessen, Germany — [2]Institute for Nuclear Problems, Minsk, Belarus

Recently developed mono-crystalline materials with garnet type structure, $Gd_3Al_2Ga_3O_{12}$ (GAGG), expected to be one of the tolerant crystals to detect different types of ionizing radiation. Relatively high density, fast scintillation kinetics, high light yield and high radiation hardness make GAGG a promising scintillator for calorimetry applications in harsh radiation environments.

Due to the content of Gd, which absorbs neutrons with following emission of γ-quanta, GAGG can be considered as a candidate for different types of neutron detectors. Moreover, the GAGG scintillation detectors, possessing fast response to γ-quanta, allow precise time-of-flight discrimination of the fast neutrons.

Here we report results of beam tests for two different geometries: a matrix consisting of sixty-four 4x4x40 mm^3 GAGG pixels and a bulk geometry 20x20x25 mm^3 crystal. Tests were performed with a 220 MeV proton beam with different targets (Pb, Polyethylene). The presented results will give an understanding about the future potential of GAGG scintillator, especially for next generation promt γ-detectors and PET applications.
This work was supported by HIC for FAIR.

HK 38.5 Wed 17:45 J-HS C

DSB Glass and Glass Ceramic Scintillation Material for High Energy Physics Applications — •Valerii Dormenev[1], Andrey Borisevich[2], Kai-Thomas Brinkmann[1], Mikhail Korzhik[2,3], Dmitry Kozlov[2], Markus Moritz[1], Rainer Willi Novotny[1], Pavel Orsich[1], and Hans-Georg Zaunick[1] — [1]2nd Physics Institute, JLU, Giessen, Germany — [2]Institute for Nuclear Problems BSU, Minsk, Belarus — [3]NRC "Kurchatov Institute", Moscow, Russia

Glass and glass ceramics can be considered as alternatives to the crystal-based scintillators widely used in radiation detectors for the high-energy physics experiments as well as for applications in medical diagnostics. They can be prepared in a variety of geometrical shapes such as blocks, plates and fibers. Large quantities can be fabricated in a relatively short period of time. However, most of the glasses do not feature scintillation properties. Recently, it has been shown that novel glasses of binary composition enable fabrication of scintillating glasses heavily doped with Ce. Lead-free glasses with the composition BaO*2SiO2:Ce (DSB:Ce) have a density of 3.7 g/cm3 and were found to be radiation hard under irradiation with photons and high energy protons. Here we report the present status of the overall performance of small and large DSB:Ce samples. Moreover, the contribution will report on test results of 3x3 arrays of homogenous blocks and sampling modules assembled from DSB/Pb layers exposed to energy-marked photons up to 250 MeV.
The work was supported by the INTELUM, ATTRACT and Crystal Clear Collaboration Projects.

HK 38.6 Wed 18:00 J-HS C

Veto Prototype Studies for DarkMESA — •Mirco Christmann for the MAGIX-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. In the extracted beam operation (155 MeV, 150 μA) the P2 experiment will operate 10,000 hours. Therefore, the high-power beam dump of this experiment is ideally suited for a parasitic dark sector experiment.

Theoretically, dark photons γ' are generated in the beam dump by a process analog to electromagnetic bremsstrahlung and decay invisibly to pairs of dark matter particles. Behind the beam dump and outside of the accelerator hall, electrons scattered off by dark matter particles can be detected in a calorimeter.

Suggested calorimeter materials were tested at MAMI with electrons below 14 MeV, where the materials PbF_2 and the Pb glass Schott SF5 performed best. This contribution presents a veto system for testing prototype detector arrays of these two materials.

The veto concept consists of two layers of plastic scintillators with Pb as shielding in between. The readout electronics with silicon photomultipliers were developed and various concepts with or without wavelength shifting fibers were studied during a beam test at MAMI. As well

the sensitivity to neutrons was studied with an americium-beryllium source for the relevant materials.

HK 38.7 Wed 18:15 J-HS C

Commissioning Experiment for (e,e'γ) Measurements at the S-DALINAC * — •Gerhart Steinhilber[1], Antonio D'Alessio[1], Jonny Birkhan[1], Johann Isaak[1], Lars Jürgensen[1], Tobias Klaus[1], Ronan Lefol[2], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Philipp C. Ries[1], and Maxim Singer[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Laval University

High resolution electron scattering experiments at low momentum transfer are performed at the S-DALINAC using the QCLAM spectrometer at the Institut für Kernphysik at the TU Darmstadt. The QCLAM spectrometerfeatures a comparatively large solid-angle coverage of 35 msr and a momentum acceptance of 20%. This makes it suitable for (e,e'x) coincidence measurements.

**We combine the large acceptance QCLAM spectrometer with fast timing LaBr:Ce detectors to perform (e,e*γ) coincidence experiments. The excitation of the nuclei is studied by measuring inelastically scattered electrons, so that the energy of the excited state is known. It's γ-decays are measured in coincidence by an array of high efficiency LaBr:Ce detectors with excellent timing properties.

**The combined data acquisition (DAQ) of the QCLAM spectrometer and the LaBr detectors has been tested by observing off-beam cosmic radiation showers. A comissioning experiment with a 30.5-MeV electron beam impinging on a carbon target was performed. Experimental setup, DAQ and results from the commissioning experiment will be presented. **

* Supported by the DFG within the CRC 1245.

HK 38.8 Wed 18:30 J-HS C

Simulationsstudien zur Kalibration der Vorwärtsendkappe des $\overline{\text{P}}$ANDA Kaloriemeters — •Lukas Linzen für die PANDA-Kollaboration — Ruhr-Universität Bochum, Institut für Experimentalphysik I

Das $\overline{\text{P}}$ANDA-Experiment an der zukünftigen Beschleunigeranlage FAIR wird Antiproton-Proton-Kollisionen mit Schwerpunktsenergien von bis zu $5,5\,\text{GeV/c}^2$ untersuchen. Ein wichtiger Bestandteil des Detektors ist das elektromagnetische Kalorimeter (EMC) des Targetspektrometers, welches aus einem fassförmigen Mittelteil und zwei Endkappen aus $PbWO_4$-Szintillationskristallen besteht. Um aus den gemessenen Szintillationssignalen auf die deponierte Energie eines Teilchens zu schließen, muss das EMC kalibriert werden.
Die Kalibration der Vorwärtsendkappe soll am Cooler Synchrotron (COSY) in Jülich, mittels Zerfällen von π^0- und η-Mesonen erfolgen, welche in Proton-Proton-Reaktionen produziert werden. Um die Kalibration auf eine möglichst effiziente Weise durchzuführen, muss der Impuls des Protonenstrahls optimiert und geeignete Reaktionen ermittelt werden. Dies erfolgt durch Monte-Carlo basierte Simulationsstudien. Erste Ergebnisse dieser Studien werden vorgestellt.

Gefördert durch das BMBF.

HK 38.9 Wed 18:45 J-HS C

Recent developments of the slow-control of the barrel part of the PANDA EMC front-end bus system* — •Christopher Hahn for the PANDA-Collaboration — II. Physikalisches Institut, Gießen,Deutschland

The Electromagnetic Calorimeter (EMC) will be a main component of the upcoming PANDA experiment at the future FAIR complex in Darmstadt. Due to the aimed energy resolution, timing and spacial constraints the individual high-voltage adjustments for the Large Area Avalanche Photodiodes (LAAPDs) demands innovative and specialized electronics, such as, for example, the individual bias-voltage adjustments for the Photodiodes needs to be accurate down to 0.1V. In the same time, no space can be occupied in the inner detector volume for individual cable routing and connections for the LAAPD bias voltage. The key elements of the high voltage adjustment concept will be described, with a special focus on the first and the second iteration of the dedicated control ASICs for the front-end bus system, the so-called SerialAdapter ASICs (SAA). The SAAs are also utilized for the communication and control of the APFEL preamplifier ASICs, which read out the APD photodetectors. The different versions of the SerialAdapter ASICs have been compared and their impact on the resulting high voltage adjustment will be presented in this talk.

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