HK 5: Instrumentation II

Time: Monday 14:00–15:30 Location: HK-H4

Group Report HK 5.1 Mon 14:00 HK-H4

The DarkMESA Experiment — •Mirco Christmann for the MAGIX-Collaboration — Institute for Nuclear Physics, Johannes Gutenberg University Mainz, Germany

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. The high-power beam dump of the P2 experiment (150 MeV, 150 μA) is ideally suited for a parasitic dark sector experiment – DarkMESA.

The experiment is designed for the detection of Light Dark Matter (LDM) which in the simplest model couples to a massive vector particle, the dark photon γ'. It can potentially be produced in the beam dump by a process analogous to photon Bremsstrahlung and may then decay into Dark Matter (DM) particle pairs $\chi\bar{\chi}$. A fraction of them scatter off electrons or nuclei in the DarkMESA calorimeter.

For the calorimeter, high-density PbF_2 and lead glass SF5 Cherenkov radiators readout with photomultipliers will be used. Within a `MadGraph` and `Geant4` simulation the accessible parameter space was evaluated. For the prototype stage, a hermetic veto system with two layers of plastic scintillators and 1 cm of lead shielding is currently under development.

DarkMESA DRIFT is currently considered as an addition to the project. A negative ion Time Projection Chamber (TPC) filled with CS_2 at low pressure will serve as DM detector. With the nuclear recoil threshold being in the keV range the accessible parameter space can be extended.

HK 5.2 Mon 14:30 HK-H4

Status of a HPGe-BGO Pair Spectrometer for ELI-NP — •Ilja Homm for the ELI-NP Pair Spectrometer-Collaboration — Technische Universität Darmstadt, Germany

The new European research facility called ELI-NP (The **E**xtreme **L**ight **I**nfrastructure - **N**uclear **P**hysics) is being built in Bucharest-Magurele, Romania. ELI-NP will offer unprecedented opportunities for photonuclear reactions with high intensity, brilliant and fully polarized photon beams at energies up to 19.5 MeV.

The 8 HPGe CLOVER detectors of ELIADE are important instruments for the γ-spectroscopic study of photonuclear reactions. We investigate the possibility to operate an advanced version of an anti-Compton shield (AC shield) as escape γ-rays pair spectrometer for one of the ELIADE CLOVERS. This should improve the performance at high energies where the pair production process dominates. The BGO shield operated as a stand-alone device can also be used as γ-beam intensity monitor and to investigate the cross section for pair production near the threshold. A prototype pair spectrometer, consisting of 64 BGO crystals with SiPM (silicon photomultiplier) readout, has been designed and built. Two test measurements with high energy photons have been performed at the University of Cologne and at the ILL in Grenoble. First results are going to be presented.

This work is supported by the German BMBF (05P15RDENA) and the LOEWE-Forschungsschwerpunkt “Nukleare Photonik”.

HK 5.3 Mon 14:45 HK-H4

Characterization system for CsI crystals coupled to APDs — •Han-Bum Rhee, Anna-Lena Hartig, Noel Merkel, Christian Sürder, and Thorsten Kröll for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt, Germany

CALIFA @ R3B/FAIR is a highly granular detection system based on CsI(Tl) scintillation crystals with readout via avalanche photodiodes (APD). It aims to detect gamma rays and light charged particles. CALIFA consists of 2464 detection units and each detection unit has to be characterized. In order to automatize the characterization two system have been built.

The gain and the noise of the APDs depend on both temperature and bias voltage, hence both have to be controlled. The temperature of the system is controlled via a Peltier unit.

In CALIFA CsI crystals with several distinct trapezoidal shapes are used. This causes inhomogeneities in the crystal light output. These inhomogeneities were investigated by measuring the response of the detector-APD unit to a collimated source, which is placed close to the crystal but at different positions relative to the APD readout. For the placement of the source, a x-y scanning table with stepping motors was employed.

This work is supported by BMBF (05P19RDFN1, 05P21RDFN1) and the GSI-TU Darmstadt cooperation contract.

HK 5.4 Mon 15:00 HK-H4

Recovery study of lead tungstate scintillation crystals for the $\overline{\text{P}}$ANDA-EMC. — •Pavel Orsich[1], Valery Dormenev[1], Markus W. H. Moritz[1], Hans-Georg Zaunick[1], Kai-Thomas Brinkmann[1], and Mikhail Korjik[2] — [1]II. Physikalisches Institut, Justus-Liebig-Universität, Gießen — [2]Institute for Nuclear Problems, Minsk, Belarus

Degradation of the optical transmittance of lead tungstate scintillation crystals in the scintillation spectral range under ionizing radiation leads to the loss of light output, which results in the deterioration of the energy resolution and limits the operation time of calorimeters made from the scintillator. This effect is especially prominent for calorimeters operating at low temperature, such as the Electromagnetic Calorimeter (EMC) of the $\overline{\text{P}}$ANDA experiment, where the calorimeter will be operated at -25 °C to gain an additional factor four in light yield.

We report new results on stimulated recovery of radiation damage in lead tungstate scintillation crystals induced by an external source of infrared photons. This method allows fast and efficient in-situ recovery of the crystals optical transmittance either during beam-off periods or even online in parallel to data acquisition. The application of light for recovery can substantially extend the running period the $\overline{\text{P}}$ANDA-EMC by keeping the radiation damage at a tolerable level.

This work is supported by BMBF, GSI and HFHF.

HK 5.5 Mon 15:15 HK-H4

Serial calibration 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

One of the main components of the upcoming PANDA experiment at the future FAIR complex in Darmstadt will be the Electromagnetic Calorimeter (EMC) inside a 2 T solenoid. The EMC's lead-tungstate crystals are read out by Large Area Avalanche Photodiodes (LAAPDs). Due to the required energy resolution, timing and spacial constraints, the individual bias voltage adjustments for the Photodiodes need to be accurate and stable on a level of 100 mV. At the same time, space constraints in the inner detector volume limit options for individual cable routing and connections for the LAAPD bias voltage. These constraints demanded new, innovative and specialized electronics to adjust the individual LAAPD voltage within the inner detector volume. The key elements of the high-voltage adjustment concept will be described. To enable a stable operation of the specialized electronics within a broad temperature window, tests of the slow-control electronics were conducted. First results of these preproduction tests and conclusions leading towards an automated calibration algorithm will be presented in this talk. *gefördert durch das BMBF, GSI und HFHF.