HK 50: Instrumentation XII

Time: Thursday 14:00–15:45 Location: J-HS K

Group Report HK 50.1 Thu 14:00 J-HS K

The new APD Based Readout of the Crystal Barrel Calorimeter — •Christian Honisch, Peter Klassen, Johannes Müllers, and Martin Urban for the CBELSA/TAPS-Collaboration — HISKP, University of Bonn, Nussallee 14-16, 53115 Bonn

The Crystal Barrel is an electromagnetic calorimeter located at the electron accelerator ELSA. The detector consisting of 1320 CsI(Tl) scintillator modules is used to detect the decay products of baryon resonances, $\vec{\gamma}\vec{n} \to N^* \to n\pi^0 \to n\gamma\gamma$.
To comprehensively study reactions that have no charged particles in the final state, an exchange of the readout electronics was necessary to achieve a high and uniform trigger efficiency for such reactions.
The upgrade was finished in 2017 and this talk gives an overview over the key challenges:
- Fast signals from CsI(Tl) while maintaining a reasonable SNR,
- Clustering in the 26 matrix in 100 ns,
- APD gain measurement and stabilization.
The talk will introduce the new readout and present its achieved performance in prototype tests and the first production beamtimes.

HK 50.2 Thu 14:30 J-HS K

Test measurements of the cZDD prototype for the BESIII experiment — •Saskia Plura, Achim Denig, Yasemin Schelhaas, Werner Lauth, Peter Drexler, and Igor Beltschikow for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

The BESIII experiment is located at the BEPCII electron-positron collider in Beijing, China, which is operated in the τ-charm energy region. Physics events, such as Initial State Radiation (ISR) processes, require an instrumentation close to the beam axis.

The crystal Zero Degree Detector (cZDD) is a small calorimeter consisting of LYSO crystals, which was proposed for BESIII. A first prototype of the cZDD has been studied at the test beam facility at the MAMI accelerator in Mainz. We report on GEANT4 simulations, which have been carried out to provide similar beam conditions compared to BESIII at the test stand. We also present the results of the test beam time and implications for the final setup at the BESIII experiment.

This work is supported by DFG SFB1044.

HK 50.3 Thu 14:45 J-HS K

Simulation of the Crystal Zero Degree Detector at BESIII for Two Photon Physics Analyses — •Jan Muskalla, Achim Denig, Thomas Lenz, Christoph Florian Redmer, and Yasemin Schelhaas — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

The BESIII experiment at the electron positron collider in Beijing (BEPCII) is collecting data in the τ-charm energy region. To increase the detection efficiency at small polar angles, a crystal zero degree detector (cZDD) is developed. The cZDD is comprised of two arrays of scintillating LYSO crystals and will be placed in the very forward and backward regions. It was developed primarily for the detection of photons from initial state radiation. This contribution will present simulation studies aiming to investigate up to which extent scattered leptons from two photon processes, such as $e^+e^- \to e^+e^-\pi^0$, can be detected as well. — Supported by DFG (SFB1044)

HK 50.4 Thu 15:00 J-HS K

Test beam results for the SiPM readout electronics of the crystal Zero Degree Detector for BESIII — •Yasemin Schelhaas, Igor Beltschikow, Achim Denig, Peter Drexler, Werner Lauth, and Saskia Plura for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

The BESIII experiment is situated at the e^+e^- collider BEPCII at the Institute of High Energy Physics in Beijing, China. It is designed to study hadron and τ-charm physics to high accuracy. The investigation of processes in which particles are emitted under strongly forward and backward peaked angles, however, suffers from a limited detection efficiency. For this purpose, a small angle calorimeter is currently under construction, the crystal Zero Degree Detector (cZDD). It consists of two arrays of scintillating LYSO crystals that are separated by a gap to reduce the impact of the high flux of low energetic photons from Bhabha scattering processes. The scintillation light is collected by silicon photomultipliers (SiPMs).

In this contribution, results of a test beam time in July 2019 at the MAMI electron accelerator in Mainz are presented. During this beam time the SiPM readout electronics were tested with regard to saturation effects.

Supported by DFG SFB 1044.

HK 50.5 Thu 15:15 J-HS K

A Scaled-Down Version of the Crystal Barrel Calorimeter for Lectures — •Eugenia Fix, Christian Honisch, Johannes Müllers, and Reinhard Beck for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

At the Crystal Barrel Calorimeter at the electron accelerator ELSA in Bonn, an upgrade of the read-out electronics was performed. The new components are now being used at a small version of the Crystal Barrel calorimeter consisting of 18 calorimeter crystals dedicated to student measurements.
In the setting of an annual master's course lecture, participants have the opportunity to perform a self-contained measurement at ELSA, where the tasks include assembly and commissioning of the experimental set-up as well as the analysis of the measured data.
In this presentation read-out characteristics of the upgraded set-up are presented, such as energy and timing resolution, with special focus on performance of the newly developed SADC.

HK 50.6 Thu 15:30 J-HS K

Afterglow and delayed gain recovery effects of recently developed Microchannel-Plate Photomultipliers (MCP-PMTs) — •Steffen Krauss, Merlin Böhm, Albert Lehmann, and Daniel Miehling — Physikalisches Institut, Universität Erlangen-Nürnberg

The new FAIR accelerator facility for antiproton and ion research is currently being built at GSI Darmstadt. The PANDA experiment will investigate antiproton-proton annihilations to study new QCD phenomena. For this an excellent particle identification is mandatory, accomplished by Cherenkov detectors of the DIRC-type. Because their focal planes reside inside an up to 1 Tesla magnetic field, lifetime-enhanced MCP-PMTs were chosen as sensors. Recent measurements with MCP-PMTs revealed unexpected effects like increased dark currents and gain losses after a high photon intensity illumination. After further studies these dark currents, here called afterglow, were identified as photons emitted from the MCPs. The other effect revealed itself in a gain loss which needs several seconds to minutes to recover to the gain level existent before the illumination. We call this a delayed gain recovery. For the high photon rates expected in the PANDA DIRCs it has to be guaranteed that these afterglow and delayed gain recovery effects have no negative impact on the MCP-PMT performance. This talk will discuss our investigations of the afterglow and delayed gain recovery effects.

- Funded by BMBF and GSI -