T 22: Detektorsysteme 1

Zeit: Montag 11:00–12:35 Raum: GFH 01-721

Gruppenbericht T 22.1 Mo 11:00 GFH 01-721

Towards an InGrid based low energy X-ray detector for the CAST experiment — •Christoph Krieger, Klaus Desch, Jochen Kaminski, and Michael Lupberger — Physikalisches Institut, Universität Bonn, Nußallee 12, 53115 Bonn

Micropattern gaseous detectors like Micromegas are used in many particle physics experiments. To make use of the high granularity of Micromegas one has to combine them with a readout structure of comparable granularity. One possibility for this is to produce a Micromegas structure directly on top of a highly granular and integrated pixel chip, e.g. the Timepix ASIC, by means of photolithographic postprocessing. Such an integrated Micromegas stage is called InGrid.

The CAST experiment (Cern Axion Solar Telescope) searches for solar axions and other new particles converting into X-ray photons inside a strong magnetic field. In order to enhance the sensitivity for physics beyond the standard model an efficient background discrimination as well as a detection threshold below 1 keV are required.

Featuring a high resolution combined with the capability to detect single electrons makes an InGrid based X-ray Detector an ideal candidate for a future CAST detector.

To provide proof of the low detection threshold an InGrid based detector has been tested in the CAST Detector Lab which provides an X-ray generator for energies down to a few hundred eV. In this talk results from these tests demonstrating the capability to detect the carbon K_α line at 277 eV will be presented as well as an overview over the developments towards an operation at CAST.

T 22.2 Mo 11:20 GFH 01-721

The ALPS-II Experiment in Hamburg; The current state — •Reza Hodajerdi for the ALPS-II-Collaboration — Deutsches Elektronen-Synchrotron, Hamburg, Germany

A few years ago the ALPS-I (Any Light Particle Search) experiment in Hamburg with its light-shining-through-the-wall (LSW) set up has given the best constraints of purely laboratory based experiments on the axion-like-particle to photon coupling $g_{a\gamma} \leq 7 \times 10^{-8}\,\mathrm{GeV}^{-1}$, $m_a \leq 10^{-4}\,\mathrm{eV}$ so far. To increase the sensitivity for axion-like particles and other weakly interacting slim particles (WISPs), a second experiment (ALPS-II, Hamburg) has been designed to reach a value of $g_{a\gamma} \approx 2 \times 10^{-11}\,\mathrm{GeV}^{-1}$. To probe the new parameter space, ALPS-II will be improved in all three essential experimental scopes for a LSW experiment. In the ALPS-II setup, a new type of detector has been applied; the transition-edge-sensor as a single photon detector. By straightening the magnets of the HERA it is possible to provide a magnetic field of about 5 Tesla for the whole 200 m long setup. Furthermore the laser power in ALPS-II will be increased compared to ALPS-I. The ALPS-II production cavity can increase the optical power of the light beam directed towards the wall by a factor of 5000 compared to the power of the injected laser (30 W). Behind the wall, the regeneration cavity increases the probability with which photons are created from the axion-like particle field by a factor of 40000. Altogether the improvements lead to a three orders of magnitude more sensitive setup than ALPS-I.

T 22.3 Mo 11:35 GFH 01-721

Detecting single infrared photons with a W-TES for ALPS-II — •Noëmie Bastidon for the ALPS-II-Collaboration — Institut für Experimentalphysik, Universität Hamburg

The ALPS-II experiment (Any Light Particle Search II at DESY in Hamburg) will look for light ($m < 10^{-4}$ eV) new fundamental bosons (e.g., axion-like particles, hidden photons and other WISPs) in the next years by the means of a light-shining-through the wall setup. A few years ago, its predecessor had constrained the coupling to photons of axion-like particles (ALPS) to $g_{a\gamma} \leq 7 \cdot 10^{-8}\mathrm{GeV}-1$, $m \leq 10^{-4}\mathrm{eV}$. Several improvements are foreseen to reach much better sensitivities ($g_{a\gamma} \leq 7 \cdot 10^{-11}\mathrm{GeV}^{-1}$). One of the main modifications which have been done is the substitution of the CCD camera by a W-TES (Transition Edge Sensor with a tungsten chip). This TES, operated at 80 mK, has already allowed single infrared photons detection as well as spectroscopy with very low background rates. In the near future, complete characterization, calibration and optimization (e.g., background suppression) need to be finalized. In this talk, the latest progress in this task will be presented as well as next steps planned for future developments.

T 22.4 Mo 11:50 GFH 01-721

The BEAST II Experiment at Belle II - A Commissioning and Background Detector for SuperKEKB — •Tobias Kleinohl, Carlos Marinas, and Norbert Wermes for the Belle II-Collaboration — Physikalisches Institut, Universität Bonn, Deutschland

An upgrade of the existing Japanese flavour factory (KEK, Tsukuba) is foreseen by 2015. The new machine (SuperKEKB) will deliver an instantaneous luminosity 40 times higher than the current machine. To exploit the larger number of events that are expected, the detector (Belle) has to be also updated (Belle II). Experience with the KEKB accelerator, has shown that during machine commissioning, it is critical to measure the backgrounds near the interaction point in detail. The SuperKEKB commissioning detector (BEAST II), which will characterize the beam-induced backgrounds near the interaction point, is needed to determine if the vertex detector system can be installed safely, to provide feedback to the accelerator during commissioning, and to cross check the simulations of the different background components. In this talk the expected backgrounds at SuperKEKB, simulations of the detector systems and the required detectors for the machine commissioning will be discussed.

T 22.5 Mo 12:05 GFH 01-721

Radiopurity of $CaWO_4$ Crystals — •Andrea Münster[1], Andreas Ertl[1], Achim Gütlein[1], Jean-Côme Lanfranchi[1], Felix Neumann[1], Walter Potzel[1], Sabine Roth[1], Stefan Schönert[1], Moritz von Sivers[1], Raimund Strauss[2], Stephan Wawoczny[1], Michael Willers[1], Marc Wüstrich[2], and Andreas Zöller[1] — [1]Physik Department E15, TU München, 85748 Garching — [2]Max-Planck-Institut für Physik, 80805 München

The direct Dark Matter search experiment CRESST uses scintillating $CaWO_4$ single crystals as targets for possible WIMP recoils. The observed background is mainly due to intrinsic radioactive impurities of the crystals the activity of which can be determined by investigating α decays. In the past $CaWO_4$ crystals were produced by external suppliers. Since 2011 the crystal laboratory of TU Munich is able to grow $CaWO_4$ crystals to better meet the requirements of CRESST and to prepare for the future ton-scale multi-material experiment EURECA. The radiopurity of the raw materials is measured by γ-spectroscopy with low-background germanium detectors. Furthermore, first TUM-grown crystals were investigated in low-temperature test measurements and are now taking data in the current CRESST run. In this talk we will discuss the investigated radiopurity of TUM-grown crystals in comparison to commercial crystals installed in CRESST. This research was supported by the DFG cluster of excellence: "Origin and Structure of the Universe", the "Helmholtz Alliance for Astroparticle Phyiscs", the "Maier-Leibnitz-Laboratorium" (Garching) and by the BMBF: Project 05A11WOC EURECA-XENON.

T 22.6 Mo 12:20 GFH 01-721

Untersuchungen des elektrischen Feldes von hoch bestrahlten Diamantsensoren — Tobias Barvich[1], Wim de Boer[1], Alexander Dierlamm[1], Moritz Guthoff[1,2], •Florian Kassel[1], Thomas Müller[1], Andreas Nürnberg[1] und Pia Steck[1] — [1]Institut für Experimentelle Kernphysik (IEKP), KIT — [2]CERN

Um ein unkontrolliertes Entweichen des Strahls am LHC zu verhindern, wird der Teilchenstrahl durch etwa 3700 Strahlmonitore überwacht. Im Bereich der Detektoren sind dies aus Platzgründen keine Ionisationskammern, sondern Diamantsensoren. Das im CMS Detektor auf Diamantsensoren basierende "Beam Condition Monitor (BCM)" System wurde von uns mitgebaut. Die Strahlungshärte der Diamantsensoren bezogen auf die Ladungssammlungseffizienz fiel deutlich geringer aus, als anhand von Labormessungen erwartet wurde. Die Erklärung liegt in der Ratenabhängigkeit der Effizienz: bei hohen Raten, wie sie während des Betriebs des LHC vorkommen, werden die durch Strahlung erzeugten Defekte geladen, wodurch das interne elektrische Feld abnimmt ("Polarisation"). Um diesen Effekt zu verifizieren, wurden TCT (Transient Current Technique) Messungen an bestrahlten Einkristall- und polykristallinen Diamantsensoren durchgeführt und das elektrische Feld als Funktion der Rate bestimmt. Simulationen mit der Software "Synopsys TCAD Sentaurus" wurden mit den experimentellen Ergebnissen verglichen.