T 14: Gasgefüllte Detektoren I

Zeit: Montag 16:00–18:20 Raum: Z6 - SR 2.002

Gruppenbericht T 14.1 Mo 16:00 Z6 - SR 2.002

High Resolution Neutron Detection — •Markus Köhli, Markus Gruber, Fabian Schmidt, Jochen Kaminski, and Klaus Desch — Physikalisches Institut, University of Bonn, Bonn, Germany

Over decades the quasi-standard for thermal neutron detection has been set by helium-3, which acts as a converter as well as counting gas. Fueled by the helium crisis and the demand of large scale research infrastructures like the European Spallation Source the run for substitutional technologies using boron layers started - most of them adopted from particle physics. The MediPix platform - CMOS based chips with 55 μm sized pixels operated at clock speeds up to 80 MHz - has been successfully evaluated in various detectors. This contribution presents the technological capabilities of a highly granular CMOS readout for neutron detection and discusses the system developed in Bonn aiming to realize a neutron time projection chamber. In a detector with 8 TimePix chips equipped with InGrid meshes as a gas amplification stage, the track topology with this unrivaled high resolution has been studied. By reconstructing the origin of the conversion ions from a boron layer, arranged in parallel to the readout, a time resolution below 50 ns and a spatial resolution of 100 μm has been achieved.

T 14.2 Mo 16:20 Z6 - SR 2.002

Study of gas amplification and ionization processes in GridPix detectors — Klaus Desch, •Markus Gruber, and Jochen Kaminski — Physikalisches Institut, Universität Bonn, Nußallee 12, 53115 Bonn

GridPix detectors are gaseous detectors, which are based on a combination of a Timepix ASIC with a MicroMegas gas amplification stage. The MicroMegas is produced by photolithographic postprocessing techniques and can be aligned with the pixel structure so that one grid hole is directly above each pixel. This results in a low capacitance and thus low noise setup allowing for detection of low energetic events. Thus, the high resolution of the Timepix ASIC with its 55 μm · 55 μm pixel pitch allows for high resolution detection of single primary electrons and gives very detailed event pictures.

These features can be used to study primary processes of photons or charged particles in the detector gas. In this talk I will present measurements of the gas amplification and ionization processes in such a GridPix based detector using the X-ray fluorescence of aluminum as photon source.

T 14.3 Mo 16:35 Z6 - SR 2.002

Einsichten in die Spurfindung an der Belle II-Driftkammer mithilfe von kosmischen Strahlen — Florian Bernlochner, Nils Braun, •Michael Eliachevitch, Thomas Hauth und Martin Heck — Karlsruher Institut für Technologie, ETP

Das Belle II-Experiment strebt an, die Zerfälle der am SuperKEKB-Beschleuniger produzierten B-Mesonen mit hoher Präzision zu messen. Die dafür notwendige Spurfindung basiert neben einem Vertexdetektor auf einer Driftkammer, die im Vergleich zum Vorgängerexperiment vergrößert wurde und eine von Grund auf neu entwickelte Rekonstruktionssoftware verwendet.

Im Sommer 2017 wurde mit dem Belle II-Experiment in einer dedizierten Datennahme kosmische Strahlung aufgezeichnet. In diesem Vortrag werden erste Studien aus dieser Datennahme vorgestellt, welche es erlauben Erkenntnisse über die Effizienz der Spurfindung in der Driftkammer zu gewinnen und deren Einsatzfähigkeit demonstrieren.

T 14.4 Mo 16:50 Z6 - SR 2.002

Set up of a new X-ray detector for CAST — •Tobias Schiffer, Klaus Desch, Jochen Kaminski, Christoph Krieger, and Sebastian Schmidt — Physikalisches Institut, Universität Bonn

The search for solar axions and chameleons with helioscopes like the CERN Axion Solar Telescope (CAST) requires detectors with very low background rates and high detection efficiency, since the expected rates are in the order of one per week and cm^2 or less in the region of 2 to 7 keV. For this, multipattern gaseous detectors like MicroMegas are a convenient solution. Due to their high granularity they achieve a very high spatial resolution, thus allowing eventshape reconstruction. An appropriate way to maximise the useage of the granularity is a pixelised readout chip, like the Timepix ASIC, with a perfectly aligned gas amplification stage on top. This so called GridPix is also able to detect single primary electrons giving a good energy reconstruction for X-rays.

The measurement of particles like axions or chameleons is done via conversion X-rays, so also the transmission for low energy X-rays has to be kept in mind. Taking these two major aspects into account a low background X-ray detector based on the GridPix technology has been developed and built, including subcomponents like a 300 nm thick vacuum tight entrance window, closed loop water cooling, FADC trigger recording the analogue signal induced on the grid and veto scintillators.

The challenges of the developement and construction will be discussed, also some first results will be presented.

T 14.5 Mo 17:05 Z6 - SR 2.002

Konzeption eines Systems zur Messung von Gasverstärkungsprozessen in Micromegas-Detektoren bei variablem Druck — •Robin Boshuis, Raimund Ströhmer, Deb Sankar Bhattacharya und Thorben Swirski — Universität Würzburg

Das Verhalten der Gasverstärkung eines Micromegas-Detektors hängt von der Stärke des elektrischen Feldes, der Höhe der Verstärkungsregion sowie des Gasdrucks ab. Die Elektronen werden im el. Feld beschleunigt und können bei ihren Stößen mit den Gasmolekülen weitere Elektronen auslösen. Während man durch die Variation des Feldes den Energiegewinn - und dadurch die Ionisationswahrscheinlichkeit - zwischen zwei Stößen verändern kann, hat die Variation des Abstandes von Anode zu Gitter eine Auswirkung auf die Gesamtanzahl der Stöße bis zum Ende der Kaskade. Da eine systematische Variation der Höhe des Verstärkungsbereichs komplex in der Umsetzung ist, wird ein alternativer Ansatz gewählt, in dem der Druck variiert wird, was ebenfalls die Gesamtanzahl der Stöße ändert. Die Spannung kann so gewählt werden, dass sich der mittlere Energiegewinn zwischen zwei Stößen nicht ändert. Dazu wurde der vorhandene Höhenstrahlungsteststand durch eine Druckkammer erweitert, in der der Absolutdruck zwischen 500mbar und 1500mbar verändert werden kann. In diesem Vortrag werden die Konzeption der Druckkammer und die damit einhergehenden notwendigen Änderungen am Messaufbau beschrieben. Außerdem werden erste Messungen der Gasverstärkung an Bulk-Micromegas-Detektoren bei variablem Druck vorgestellt und mit Simulationen, die mit Garfield++ angefertigt wurden, verglichen.

T 14.6 Mo 17:20 Z6 - SR 2.002

Results of a Testbeam Campaign with a Micromegas Quadruplet — •Philipp Lösel[1], Otmar Biebel[1], Robin Boshuis[3], Andreas Düdder[2], Bernhard Flierl[1], Maximilian Herrmann[1], Ralf Hertenberger[1], Felix Klitzner[1], Ralph Müller[1], Friedemann Neuhaus[2], and Andre Zibell[3] — [1]LMU München — [2]JGU Mainz — [3]Uni Würzburg

In a testbeam campaign at the H8 beamline at SPS/CERN the first SM2 Micromegas quadruplet for the NSW upgrade of the ATLAS Muon Spectrometer at CERN was investigated using pions and muons. The two square meter sized Micromegas quadruplet consist of two eta layers, which will give position information of the traversing muons in radial direction of the ATLAS experiment, and two stereo layers. The combination of the stereo layers, where the strips are rotated by $\pm 1.5°$ with respect to the eta strips, will give position information in both radial direction as well as along the strips.
We will present results on the spatial resolution in the precise radial direction as well as along the strips. The spatial resolution is determined for perpendicular traversing charged particles as well as for the tilted SM2 quadruplet. The track reconstruction of the quadruplet compared to the reference track reconstructed by a telescope consisting of two-dimensional GEM and Micromegas detectors will be discussed. Additionally on the homogeneity in gas gain and efficiency will be reported.

T 14.7 Mo 17:35 Z6 - SR 2.002

Two-Dimensional Floating Strip Micromegas Detectors — •Felix Klitzner[1], Otmar Biebel[1], Jonathan Bortfeldt[2], Bernhard Flierl[1], Phillipp Lösel[1], Ralph Müller[1], Maximilian Herrmann[1], Ralf Hertenberger[1], and Chrysostomos Valderanis[1] — [1]Ludwig-Maximilans-Universität München — [2]CERN

Floating strip Micromegas detectors are high-rate capable particle detectors with excellent spatial and temporal resolution, allowing single

particle tracking for particle fluxes up to 7 MHz/cm^2. A floating strip Micromegas detector collects the amplified ionization charge on copper anode strips with high ohmic contact to high voltage, so called floating strips. The charge signal is read out by readout strips, separated by a thin Kapton layer from the anode strips. This scheme makes the detector robust against discharges between the micro-mesh and the floating anode strips, induced by strongly ionizing particles. Different two-dimensional anode designs have been realized with two readout strip layers, parallel and perpendicular to the floating strips. Simulations have been set up to understand the signal formation and propagation to the front-end electronics, as different pulse shapes are observed on both strip layers. Measurements have been carried out with 20 MeV protons at beam intensities up to $\mathcal{O}$(MHz). Position sensitive triggers were derived from a thin triple GEM detector placed in front of the Micromegas. We present results with respect to cluster reconstruction, efficiency and μTPC angle reconstruction of both layers for three different designs, recorded with APV25 front-end boards.

T 14.8 Mo 17:50 Z6 - SR 2.002

Design and commissioning of a Gas Monitoring Chamber for High Pressure Applications — •Philip Hamacher-Baumann, Lukas Koch, William Ma, Thomas Radermacher, Stefan Roth, and Jochen Steinmann — III. Physikalisches Institut B, RWTH Aachen University

Currently, High Pressure Time Projection Chambers (HP-TPC) are intensely discussed in the neutrino detector community as active targets. Increased pressure results in likewise increased probability for gas interactions, but retains a low momentum detection threshold, compared to e.g. liquid gas detectors, for final state particles. The CERN Neutrino Platform has formed a working group to investigate new technologies needed for the operation of HP-TPCs. One of the adressed aspects for long term operation at high pressures is the monitoring of gas properties. This can be done by building a gas monitioring chamber capable of measuring drift and gain properties up to 10 bar.

T 14.9 Mo 18:05 Z6 - SR 2.002

Field Programmable Gate Array for drift velocity measurement — •William Ma, Thomas Radermacher, Stefan Roth, Jochen Steinmann, and Philip Hamacher-Baumann — III. Physikalisches Institut B, RWTH Aachen University

The usage of a field programmable gate array (FPGA), which was configured to perform a drift velocity measurement of electrons in a gas monitoring drift chamber, will be demonstrated. The fully customizable FPGA augmented with a discriminator mezzanine board allows an efficient registration of the start and stop trigger signals required for the drift velocity measurment. Fewer components are needed compared to the usual setup since the logic is completely implemented in the FPGA. Additional filtering or measurement of specific quantities, like the drift time, can be performed directly on the board, which reduces the data volume to be transfered for further data processing. A further advantage is the possibility to perform multiple measurements simultaneously inside one FPGA.