T 87: Gaseous detectors II

Time: Thursday 16:30–18:45 Location: L-3.016

T 87.1 Thu 16:30 L-3.016

Belle 2 Central Drift Chamber Wire Monitoring Software Developments — •Henrikas Svidras, Alexander Glazov, and Kerstin Tackmann for the Belle II-Collaboration — Deutsches Elektronen Synchrotron, 22607 Hamburg, Germany

Belle 2 is an experiment at the next-generation B factory SuperKEKB located at KEK in Tsukuba, Japan. It aims to probe heavy flavour physics at a higher precision than its predecessors, namely BaBar and Belle. The goal is to collect 50 ab^{-1} of data during its run: more than 50 times that of Belle. One of the main components used in triggering, tracking and charged particle identification is the Central Drift Chamber (CDC). Thorough understanding and monitoring of the conditions of this subdetector are crucial, as it is a key element in the whole detector performance. In this talk, a newly-developed CDC wire monitoring software tool will be presented. It is used to identify faulty wires and wire groups within the CDC for a given period of data takes. The information from reconstructed tracks is used to look for the closest wires that particles passed but had no hits recorded. Therefore, the wire monitoring tool is able to select the wires and wire sectors that continuously fail to produce hits that contribute to track reconstruction. This has been used to mark and monitor these wires for most recent data takes, with this information now available for tracking and to simulate the detector conditions.

T 87.2 Thu 16:45 L-3.016

Production and Characterisation of square-meter-sized Micromegas Quadruplets — •Maximilian Herrmann, Otmar Biebel, Bernhard Flierl, Ralf Hertenberger, Christoph Jagfeld, Felix Klitzner, Maximilian Rinnagel, Sebastian Trost, Chrysostomos Valderanis, and Fabian Vogel — Ludwig-Maximilians Universität München

The momentum reconstruction of muons in high energy physics experiments requires large, high-rate-capable precision tracking detectors. Resistive strip Micromegas are ideally suited for this application. The highly segmented anode enables hit position reconstruction within one plane of about 0.1 mm resolution. The resistive strips ensures a fast quenching of discharges in the 0.12 mm high amplification gap. Using multiple modules with four layers of Micromegas a large area can be covered.
In this talk the production progress of such modules will be presented. Focus will be placed on the steps to ensure high voltage stability in the amplification gap and on validation measurements. Imperfections and dust in the gap would lead to dark currents which could harm the active area. Therefore an elaborate production scheme was developed to keep these currents below 100 nA. Using the tracks of cosmic muons in a reference facility the quadruplets can be investigated in terms of efficiency homogeneity, reaching values of 97% over two square meter.

T 87.3 Thu 17:00 L-3.016

Noise related studies for large area Micromegas detectors — •Sebastian Trost, Otmar Biebel, Bernhad Flierl, Maximilian Herrmann, Ralf Hertenberger, Christoph Jagfeld, Felix Klitzner, Katrin Penski, Maximilian Rinnagel, Chrysostomos Valderanis, and Fabian Vogel — LMU München

As part of the New Small Wheel upgrade of the ATLAS detector at the LHC, high-rate-capable large-area Micromegas detectors are being constructed and investigated at LMU Munich. These four-layered Micromegas modules are designed for precision track reconstruction in the muon spectrometer. This talk presents the evaluation of cosmic muon tracking performance of the Micromegas detector under high fluxes of MeV neutron background at the MLL tandem accelerator at Garching. Moreover, the influence of small water vapor additions at the ppm level to the Ar:CO2 93:7 vol% detector gas are studied systematically for stability, pulse height and efficiency at the Cosmic Ray Facility in Garching.

T 87.4 Thu 17:15 L-3.016

Particle position reconstruction using a segmented GEM foil in combination with a Micromegas readout — •Christoph Jagfeld, Otmar Biebel, Bernhard Flierl, Maximilian Herrmann, Ralf Hertenberger, Felix Klitzner, Katrin Penski, Maximilian Rinnagel, Sebastian Trost, Chrysostomos Valderanis, and Fabian Vogel — LMU München

In Micromegas (Micro-MEsh GAseous Structures) detectors, a modern form of micro-pattern gaseous detectors, the signal is usually read out via readout strips on the anode. The signal created at the mesh is neglected for the particle position reconstruction. By replacing the mesh with a GEM (Gas Electron Multiplier) foil, which is segmented into 0.5 mm broad readout strips on its side facing the anode, the particle position can be determined on the "mesh" as well. If the strips on the GEM foil are orientated perpendicular to the anode strips, a particle position can be reconstructed in two spatial coordinates without adding a second layer of readout strips on the anode. This talk presents results from simulation studies to investigate the performance of this detector concept. First measurements with the new GEM foil will be presented.

T 87.5 Thu 17:30 L-3.016

Alignment reconstruction of Micromegas quadruplets — •Fabian Vogel, Otmar Biebel, Bernhard Flierl, Maximilian Herrmann, Ralf Hertenberger, Christoph Jagfeld, Felix Klitzner, Katrin Penski, Maximilian Rinnagel, Sebastian Trost, and Chrysostomos Valderanis — LMU Muenchen

For the upcoming New Small Wheel upgrade of the ATLAS detector Micromegas quadruplets will be implemented as muon tracking detectors. These gaseous detectors are optimized for the detection of minimum ionizing particles. They contain a metallic micromesh to divide the gas volume into a drift and an amplification region. The anode on the bottom of the detector contains parallel readout strips on a printed circuit board (PCB) for one dimensional readout. Each of the four detector layers is built from three individual PCBs glued side-by-side on either side of the readout panel. The alignment of a quadruplet made from two readout panels with four layers of PCBs for each individual layer, as well as the alignment of these layers with respect to each other is investigated. Studies of those quadruplets in the cosmic ray facility of the LMU are compared to optical precision inspections using dedicated markers on the PCBs. New measuring techniques have been developed and integrated in the series production of the modules. First results of the comparison will be presented.

T 87.6 Thu 17:45 L-3.016

The Effect of Gas Contaminations on Micromegas Detectors — •Thorben Swirski, Deb Sankar Bhattacharya, and Raimund Ströhmer — Universität Würzburg

The Würzburg cosmic ray facility is used to conduct research on the behavior of Micromegas detectors. A homogeneous mixture of Argon and CO2 can be prepared in desired ratios.

The behavior of the detector changes with any impurities in the gas. Of these impurities, water has been shown to be often present. In addition, oxygen can have a large effect due to its high electronegativity, while making up about 20.95% of the air, making entry in case of a leak possible. A systematic study on such changes of the detector behavior with a controlled infusion of impurities can give us an idea about the detector responses in large experiments like ATLAS, ALICE or ILC.

To be able to produce a gas containing only trace amounts of up to 1% each of oxygen and water, the cosmic ray facility had to be augmented with a new gas system. The system was built at the end of 2018.

Since then, the system has been used to perform measurements on the typical amount of contaminants in the detector gas and their sources, such as plastic tubing. In these measurements, the influence of different materials, and pipe geometries has been evaluated at several different tube lengths. The effect on the detector performance is also being investigated, including changes in gain, the number of primary electrons lost due to attachment, transparency and high voltage stability.

T 87.7 Thu 18:00 L-3.016

Prototype of a Boron-based neutron Time Projection Chamber — •Divya Pal[1], Klaus Desch[1], Jochen Kaminski[1], Markus Köhli[1,2], and Michael Lupberger[1] — [1]Physikalisches Institut, Universität Bonn — [2]Physikalisches Institut, Universität Heidelberg

Thermal neutrons have widespread applications ranging from tests of fundamental physics to neutron tomography, solid-state physics and medical physics. Therefore, the development of improved detectors for thermal neutrons is an important challenge.

Thermal neutrons are traditionally detected with Helium-3 filled proportional counters. Due to the supply shortage of He-3 leading to a rapid rise in its price, alternative detectors are sought. In Bonn, a prototype neutron detector BODELAIRE (Boron detector with light and ionization reconstruction) is being developed with the aim of providing high spatial and time resolution.

BODELAIRE works on the principle of a Time Projection Chamber (TPC) with a GridPix readout which will have Timepix3 as ASIC. The idea is to use Boron-10 as neutron converter, which is coated on the walls. One of the reaction products will yield a track in the gas volume, while the other reaction product will provide a trigger signal in a scintillator.

The current development status of the BODELAIRE detector will be presented.

T 87.8 Thu 18:15 L-3.016

Time Projection Chambers for the T2K Near Detector Upgrade — Philip Hamacher-Baumann, Thomas Radermacher, Stefan Roth, and •Nick Thamm — III. Physikalisches Institut B, RWTH Aachen University

The Tokai to Kamioka (T2K) long baseline neutrino oscillation experiment is entering the next phase (T2K-II) with increased beam power of up to 1.3 MW. To match the reduced statistical uncertainty an upgrade of the near detector (ND280) is planned to increase the detector acceptance and therefore reduce the systematic uncertainties. In the upstream part a 3D fine-grained scintillator target, a time-of-flight system and two time projection chambers (TPCs) will be installed. The new high angle TPCs (HAT) will cover the phase space of neutrino scattering with the final state lepton scattered at a large angle. Improved momentum resolution and particle identification will be achieved by using resistive bulk Micromegas technology. Installation is scheduled for the year 2021 with first data taking starting in 2022. In this talk first tests of a prototype HAT including gas monitoring chambers will be presented.

T 87.9 Thu 18:30 L-3.016

Building and testing a TPC for IAXO and developing reconstruction algorithms — Ivor Fleck, •Jan Joachim Hahn, and Ulrich Werthenbach — Universität Siegen

We present the detection and reconstruction of X-rays in a time projection chamber. A test chamber has been especially designed and build for this purpose for the upcoming Baby IAXO and IAXO experiment. The chamber operates with an Ar:CO_2 mixture at a ratio of 80:20. The readout is done using an InGrid chip. A first reconstruction algorithm has been developed to reconstruct the events and distinguish between photons and background. The used algorithm is a based on the Cambridge-Aachen algorithm with additional discriminators to further supress the background events. The tests are done using ^{55}Fe X-rays as a test signal.