T 76: Gas-Detectors

Time: Wednesday 15:50–16:50 Location: WIL/A120

T 76.1 Wed 15:50 WIL/A120

Material Optimization for Photon Detection by Structured Converter Layers using Micro-Pattern Gaseous GEM Detectors — •Nick Schneider, Otmar Biebel, Valerio D'Amico, Florian Egli, Stefanie Götz, Ralf Hertenberger, Christoph Jagfeld, Eshita Kumar, Katrin Penski, Maximilian Rinnagel, Chrysostomos Valderanis, and Fabian Vogel — LMU München

Micro-Pattern Gaseous Detectors are heavily used for the detection of charged particles with excellent temporal and spatial resolution. Electrically neutral particles are detected with poor efficiency due to the low density in the active gas volume. By inserting solid converter layers of high-Z material this disadvantage can be mitigated. In our design multiple converter layers are placed perpendicular to the first GEM foil. Proper electric fields guide the electrons to the amplification region. In order to further increase the photon detection efficiency the material and structure of the converter layers need to be optimized to find the perfect balance between creation and extraction rate. For photon conversion copper plated layers are used with relatively thin FR4 as carrier material. Different thick combinations of FR4 and copper are tested in order to achieve high photon detection efficiencies. These results are compared to simulations for better understanding of the physical processes. This method increases the photon detection efficiency by a factor of about 2 and provides interdisciplinary possibilities in material research, medical physics or astrophysics.

T 76.2 Wed 16:05 WIL/A120

Photon Position Reconstruction using Structured Converter Layers in Micro-Pattern Gaseous Detectors — •Katrin Penski, Otmar Biebel, Valerio D'Amico, Florian Egli, Stefanie Götz, Ralf Hertenberger, Christoph Jagfeld, Eshita Kumar, Maximilian Rinnagel, Nick Schneider, Chrysostomos Valderanis, and Fabian Vogel — LMU München

Micro-Pattern Gaseous Detectors are high-rate capable with excellent spatial and temporal resolution. Developed for the detection of charged particles, the low density in the active gas volume of these detectors exhibit only a poor detection efficiency for electrically neutral particles. For photons the detection via the photoelectric effect can be increased using a solid converter cathode, which is made of high-Z materials. With our novel approach, the detection efficiency can be optimized by incorporating multiple converter plates quasi perpendicularly on top of the first GEM foil. Moreover, this technique aims to provide a full two-dimensional position reconstruction of the particle with a resolution of less than 100 μm within a converter plate. Using the two coordinates of the readout anode of the GEM detector enables this by mounting the converter layers at a specific angle that allows geometric position reconstruction. An optimized electric field, where the electric field lines are parallel to the amplification field, guides the electrons from the converter layers to the GEM foils. Detailed simulations on the influence of different parameters, such as the tilting angle or the drift gas, were performed to optimize the design. Simulation and measurement results are presented.

T 76.3 Wed 16:20 WIL/A120

Setup of a 5 m long Straw Tube prototype for the SHiP experiment — •Rishabh Moolya, Caren Hagner, and Daniel Bick — Hamburg University

The Search for Hidden Particles (SHiP) experiment is a proposed, general purpose fixed target beam-dump experiment utilising the 400 GeV Super Proton Synchrotron (SPS) proton beam at CERN. It is specifically designed to search for hidden particles, at the intensity frontier and to also study tau neutrino physics extensively for the first time. The SHiP hidden sector (HS) detector is designed to detect the decay products of hidden particles decaying inside its ∼50 m long vacuum decay vessel. An essential role is to reconstruct the tracks and determine the momentum of the charged particles produced in these decays. This is the purpose of the Spectrometer Straw Tracker (SST), consisting of roughly 16000 straw tubes, each 4 m long and 2 cm in diameter.

A prototype consisting of four straw tubes has recently been set up at Hamburg University. The status of the commissioning and the first results will be presented.

T 76.4 Wed 16:35 WIL/A120

The Influence of Water defects and Mesh Geometry on Measurements with a MicroMegas Detector filled with an Ar-CO_2 Gas Mixture — •Burkhard Böhm, Anno Strobel, and Raimund Ströhmer — Universität Würzburg

In particle physics, Micro-Pattern Gaseous Detectors (MPGD) find high usage in different experiments like ATLAS, CMS or ALICE. In this study MicroMegas Detectors (MM) - a special type of MPGDs - are researched in terms of H_2O contamination. They are well known for their simple single-stage amplification, high and stable gain and excellent spatial and temporal resolutions. These detectors can be contaminated by H_2O from air which can have an effect on detector stability. H_2O can also act as a quenching gas similar to CO_2. The effect on the gas-gain and the amplification of the number of primary electrons are studied by precisely controlled inflowing of H_2O inside a resistive MM chamber. Even a small change in concentration of H_2O is expected to have an impact on the detector performance.

Also the influence of different mesh geometries like gap size and wire diameter in terms of contamination is researched. The geometry can have an influence on the electric field and therefore on the detector gain as well as on the transparency of the mesh. Studied mesh types are 70/30, 50/30 and 45/18 (pitch size/wire diameter in μm).