T 64: Detectors 7 (gas detectors)

Time: Wednesday 16:00–17:45 Location: Geb. 30.23: 2/17

T 64.1 Wed 16:00 Geb. 30.23: 2/17

Test of ATLAS Micromegas detectors with a ternary gas mixture at the CERN GIF++ facility — •Fabian Vogel, Otmar Biebel, Valerio D'Amico, Stefanie Götz, Ralf Hertenberger, Roman Lorenz, Eshita Kumar, Katrin Penski, Nick Schneider, and Chrysostomos Valderanis — LMU München

The ATLAS collaboration at LHC has chosen the resistive Micromegas technology, along with the small-strip Thin Gap Chambers (sTGC), for the high luminosity upgrade of the first muon station in the high-rapidity region, the New Small Wheel (NSW) project. Achieving the requirements for these Micromegas detectors revealed to be even more challenging than expected. One of the main features being studied is the HV stability of the detectors. Several approaches have been tested in order to enhance the stability, among them the use of different gas mixtures. A ternary Argon-CO_2-iC_4H_{10} mixture has shown to be effective in dumping discharges and dark currents. It allows the operation of the Micromegas detectors at safe working points with high cosmic muon detection efficiency. The presence of Isobutane in the mixture required a set of aging studies, ongoing at the GIF++ radiation facility at CERN, where the expected HL-LHC background rate is created by a ^{137}Cs 14 TBq source of 662 keV photons. Preliminary aging results and muon reconstruction efficiencies under photon background of the ternary mixture will be shown.

T 64.2 Wed 16:15 Geb. 30.23: 2/17

Performance of new generation of Resistive Plate Chambers operating with alternative gas mixtures — •giorgia proto, hubert kroha, oliver kortner, Daniel soyk, nayana bangaru, and timur turkovic — Max-Planck-Institut fur Physik

The Resistive Plate Chambers (RPC) are gaseous detectors with excellent timing performance and are used for triggering on muons in the ATLAS experiment. They operate with the standard gas mixture, composed of $C_2H_2F_4$/i-C_4H_{10}/SF_6, because it allows the detector operation in avalanche mode, as required by the high-luminosity collider experiments. The $C_2H_2F_4$ and the SF_6 are now considered to be non-eco-friendly gases for their high Global Warming Potential (GWP). This gases are not recommended for industrial uses anymore, thus their availability will be increasingly difficult over time and the search for an alternative gas mixture is then of absolute priority within the RPC community. There are several studies on going which use different approach to find an alternative gas mixture suitable for experiment which work in high-radiation environment, as those operating at the Large Hadron Collider (LHC). One approach is to replace the standard gas with a mixture of HFO1234ze/CO_2/i-C_4H_{10}/SF_6. The second approach, currently under study by ATLAS and CMS collaborations, is to introduce a small fraction of CO_2 in the standard gas mixture and by reducing the amount of SF_6. In this presentation the results on the performance achieved using a 1 mm gas gap RPC with both types of gas mixtures are reported.

T 64.3 Wed 16:30 Geb. 30.23: 2/17

Performance Evaluation of the Newly Developed TPC Gas Monitoring Chambers for the T2K Near Detector Upgrade — Stefan Roth, •Keitlin Sejdarasi, David Smyczek, Jochen Steinmann, and Nick Thamm — RWTH Aachen University, Physics Institute III B, Aachen, Germany

In order to ensure the stable operation of time projection chambers (TPCs), the gas parameters are continuously monitored over time. For the upgrade of the T2K near detector ND280, this task will be accomplished by gas monitoring chambers (GMCs), which are essentially a miniature version of a TPC. In this talk, first results from the measurements of the gas gain and drift velocity for different gas mixtures for the newly developed GMCs are presented. These results are compared to simulations, as well as to measurements with the predecessor model of the GMC.

T 64.4 Wed 16:45 Geb. 30.23: 2/17

Studying Effects of Temperature and Pressure on Measurements of the TPC Gas Monitoring Chambers for the T2K Near Detector Upgrade — Stefan Roth, Keitlin Sejdarasi, •David Smyczek, Jochen Steinmann, and Nick Thamm — RWTH Aachen University - Physics Institute III B, Aachen, Germany

A new pair of Time Projection Chambers for high angle measurements (HATs) are part of the T2K near detector upgrade. For their calibration, the gas parameters will be continuously monitored using newly developed Gas Monitoring Chambers (GMCs). Besides the gas mixture itself, temperature and pressure have a large effect on the monitored gas parameters. Only by measuring these environmental variables, and including them inside the analysis of the gas, significant statements about the gas parameters and quality can be made. Furthermore, the surrounding temperature influences the GMC setup, affecting the measurement process. The status of these investigations is presented.

T 64.5 Wed 17:00 Geb. 30.23: 2/17

Study of different operating gases for Micromegas detectors at the International Axion Observatory — •Christian Stoss, Elisa Ruiz Chóliz, and Matthias Schott — Johannes Gutenberg Universität Mainz

The purpose of this work is to determine the optimal operating gas for micromegas detectors that fulfils the requirement of the IAXO collaboration for the search for axions. In order to measure the few photons created by the Primakoff effect in the magnetic field of (Baby)IAXO, high-precision measurements with extremely low background rates are required. However, argon, which is the main component of the operating gas used, has an escape peak at around 2.9 keV. This can strongly overlap the expected signal in the range of 3-4 keV. To avoid this problem, a different gas mixture is required, so the performance of a micromegas detector with a Iron-55 source using several gas mixtures was analysed. However, as xenon in particular is a cost-intensive gas and the pressure, which has a major influence on the performance of the gas, could not yet be controlled in this setup, a gas-tight chamber was developed. In this chamber, a micromegas prototype within the same technical specifications as the BabyIAXO ones, can be characterized with different gases and different pressures with a comparatively small amount of gas. The development of the entire chamber and the development of a bash script for an automated measurement are the main components of this work. The first test measurements were also taken.

T 64.6 Wed 17:15 Geb. 30.23: 2/17

The Influence of Combined Oxygen and Water Impurities on Measurements with a MicroMegas Detector filled with an Ar-CO_2 Gas Mixture — •Burkhard Böhm and Raimund Ströhmer — Universität Würzburg, Germany

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 combined contamination from H_2O and O_2. These detectors are well known for their simple single-stage amplification, high and stable gain and excellent spatial and temporal resolutions. Gas systems are rarely perfectly tight and can be contaminated by H_2O or O_2 from ambient air. The effect of H_2O impurities on measurement results was researched to be very small while O_2 concentration can significantly effect the results. As processes in 3 or more component gases are complex, studying the behaviour of the combination O_2 and H_2O in an Argon atmosphere experimentally is very useful. By precisely controlled inflowing of O_2 and humid Ar-CO_2 inside a resistive MM chamber, the effect on the gas-gain, mainly due to attachment in the drift region, and the amplification of the number of primary electrons are studied. In parallel to the experimental study numerical investigations were done to explore the parameter space of the amplification gap of the MM detector.

T 64.7 Wed 17:30 Geb. 30.23: 2/17

Development of a flexible gas supply system for gaseous detectors — •Jan Glowacz, Jochen Kaminski, and Klaus Desch — Physikalisches Institut, University of Bonn

For testing and operation of gaseous detectors a well controlled supply of gas mixtures is of high importance. We have developed a compact and mobile gas system for operation both in the laboratory as well as in test beam environments. Its small dimensions and light weight facilitate transportation and setup at different locations. It is laid out to control the gas flow and gas pressure in the detector for premixed

gases or gas mixtures with two components. The system can be controlled via web browser interface and includes recording of important environmental parameters such as temperatures, gas pressure inside and outside the detector and flow rates. First tests with a detector have shown that the gas system can operate at a wide range of gas pressures of 0.3-1.5 bar.