Contribution ID: **39** Type: **Oral contribution**

Numerical Investigation on Electron and Ion Transmission of GEM-based Detectors

Thursday, October 15, 2015 2:35 PM (20 minutes)

A Time Projection Chamber (TPC) is an ideal device for three-dimensional tracking, momentum measurement and identification of charged particles. They are used in many running experiments, including ALICE. Owing to the enormous particle multiplicity per event, very specific requirements are made on the performance of the detectors in harsh radiation environments. Different R&D activities are currently concentrated on the adoption of the Gas Electron Multiplier (GEM) as the gas amplification stage of the ALICE-TPC upgrade version. Despite the promise, several issues related to the operation of the GEM have to be resolved before it can be finally considered as an option. For example, to keep distortions due to space-charge at a manageable level a lower ion feedback in the drift volume is required. Again, for a substantial detector gain, it is important that a large fraction of primary electrons partcipate in the avalanche process and contribute to the signal generation. Thus, a proper optimization of the detector geometry, field configuration and gas mixtures are required to have a higher electron transparency and lower ion backflow.

In the present work, Garfield simulation framework has been adopted to numerically estimate the electron transparency and ion backflow fractions of GEM-based detectors. Extensive simulations have been carried out to enrich our understanding of the complex physical processes occurring within single, triple GEM detectors. A detailed study has been performed to observe the effects of detector geometry, field configuration, magnetic field and gas mixtures on the above mentioned characteristics.

The description of the single GEM and triple GEM detector have made it easier for us to understand the operation of a quadruple GEM detector which is one of the viable solutions for the ALICE TPC. Ion backflow and electron transparency of quadruple GEMs containing foils with different hole pitch and different field configuration in presence of magnetic field have been studied to get an optimum configuration. Some preliminary results on single and triple GEM detectors are given in the attached document. The simulation results shown in the document and the experimental and simulation results presented in available literature are found to be in close agreement. In this presentation, we plan to demonstrate and discuss our detailed numerical results and will try to make an attempt to relate the above studies in the context of the high luminosity experiments.

The number of parameters for a device such as the quadrupole GEM is large. In future we will try to optimize the other parameters keeping in mind the specific requirement for the ALICE TPC. In parallel, experimental efforts will be given to measure the aforesaid characteristics under different configuration. Besides that, space charge and charging up effects will be included in the future computations in order to achieve an even better understanding of these devices.

Primary author: Ms BHATTACHARYA, Purba (School of Physical Sciences, NISER, India)

Co-authors: Prof. MOHANTY, Bedangadas (School of Physical Sciences, NISER, India); Prof. MAJUMDAR, Nayana (Applied Nuclear Physics Division, SINP, India); Dr BISWAS, Saikat (School of Physical Sciences, NISER, India); Mr SAHOO, Sumanya (School of Physical Sciences, NISER, India); Prof. MUKHOPADHYAY, Supratik (Applied Nuclear Physics Division, SINP, India)

Presenter: Ms BHATTACHARYA, Purba (School of Physical Sciences, NISER, India)

Session Classification: Contributed talks

Track Classification: Simulation and Software