Contribution ID: **24** Type: **Oral Contribution**

Study of Streamer Development in Resistive Plate Chamber

Friday, February 14, 2020 9:50 AM (20 minutes)

India-based Neutrino Observatory (INO) is an underground facility for studying different neutrino properties. Iron Calorimeter (ICAL) is one of the experiments, which will be housed in the facility for identification of neutrino mass hierarchy and measurement of neutrino mixing parameters. It will consist of a horizontal stack of 151 layers of iron plates interleaved with Resistive Plate Chambers (RPC) for tracking the muons generated out of charged-current interaction of the passing neutrinos with the iron nuclei and the whole ICAL setup will be magnetized for distinguishing between the muon charges. The requirement of the experiment demands RPC operation in avalanche regime in order to achieve excellent position resolution and long term operation for which a gas mixture of R134a, iso-Butane and sulfur hexafluoride (95.5: 4.2: 0.3) has been chosen. These gases have high Global Warming Potential and hence better be replaced with eco-friendly ones, however, without compromising the performance of the RPC and the objectives of the experiment thereof. This study has been carried out to simulate the working modes (avalanche and streamer) in RPC and compare with the experimental data in order to build a numerical test bench for exploring proposed eco-friendly gas mixtures to fulfill the required working conditions of the RPC. The simulation of the RPC dynamics has been carried out using COMSOL Multiphysics [1]. It uses finite element method to calculate the time evolution of electric field, propagation of electrons and ions in the gas gap and their multiplication. The necessary electron propagation and Townsend coefficients have been calculated using MAGBOLTZ [2], while the number of primary electrons and their initial positions have been obtained with HEED [3]. The time evolution of the electron number has been simulated to study the working modes of the RPC for a given gas mixture. As a test case the streamer probability for different voltages for a mixture of R134a and iso-Butane 95:5 ratio by volume has been calculated and compared with the experimental result to examine the efficacy of the proposed simulation framework for studying the RPC dynamics.

References:
1. https://www.comsol.co.in
2. https://magboltz.web.cern.ch/magboltz
3. http://ismirnov.web.cern.ch/ismirnov/heed

Primary authors: DATTA, Jaydeep (Homi Bhabha National Institute); TRIPATHY, SRIDHAR (SAHA INSTITUTE OF NUCLEAR PHYSICS, KOLKATA); Mrs MAJUMDAR, Nayana (Saha Institute Of Nuclear Physics, HBNI, INDIA.); Mr MUKHOPADHYAY, Supratik (Saha Institute Of Nuclear Physics, HBNI, INDIA.)

Presenters: DATTA, Jaydeep (Homi Bhabha National Institute); TRIPATHY, SRIDHAR (SAHA INSTITUTE OF NUCLEAR PHYSICS, KOLKATA)

Session Classification: Simulations