Contribution ID: **50** Type: **Poster**

Parallelization of Garfield++ and neBEM to simulate space charge effects in RPCs

Monday 12 December 2022 14:00 (1 hour)

The detailed avalanche, saturated avalanche, and streamer simulation can help understand the detector physics behind the Resistive Plate Chamber (RPC). From a 3D Monte Carlo simulation of an avalanche inside an RPC, the transition from avalanche to saturated avalanche (when electron gain and loss are almost the same) followed by a streamer may be understood in more detail. Such simulation is preferable to search for the optimum voltage and alternate gas mixtures.

Garfield++ with appropriate interfaces to Heed (primary ionization), Magboltz (transport properties), and neBEM (electric field) is a freely available C++-based software using which one can make the numerical geometry of a gas detector and examine the physics inside them. All the methods available in Garfield++ to generate an avalanche follow the 3D particle model. One of the advantages of the particle model is that one can extract information (drift velocity, energy, etc.) from every step of the avalanche with detailed tracking of each primary and secondary. Since the methods of GARFIELD++ are sequential, they are resource-hungry and time-consuming. This is especially true when attempts are made to study the effect of space charge accumulation within the device. At the same time, the space charge field plays a crucial role while an avalanche is developing. The dynamic change of the electric field inside the RPC due to space charges limits the gain of an avalanche, which is called the space charge effect.

In this work, the primary goal is to build a numerical model to calculate the dynamic space-charge field inside an RPC and implement it in the GARFIELD++ framework. The multithreading technique OpenMP has been applied to calculate electric field, drift line, electron gain, and space charge field to address the issue of extensive time consumption. Here, the space charge region is modeled by using several charged lines. Therefore, the field has been estimated for those line charges. The field calculations have also been verified with the neBEM. All these modifications in GARFIELD++ have been applied by introducing a new class, pAvalancheMC. An example is provided to show the performance of pAvalancheMC. Moreover, the details of the transition of an avalanche into a saturated avalanche have been discussed.

Session

Future Experiments and Detector Development

Author: DEY, Tanay

Co-authors: MAJUMDAR, Nayana (Saha Institute of Nuclear Physics); Ms BHATTACHARYA, Purba (Department of Physics, School of Basic and Applied Sciences, Adamas University); Dr CHATTOPADHYAY, Subhasis (VECC); MUKHOPADHYAY, Supratik (Saha Institute of Nuclear Physics (IN))

Presenter: DEY, Tanay

Session Classification: Poster - 1