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Microscopic and fluid modelling of RPCs under LHC-like conditions

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We present a 2.5D Particle-in-Cell Monte Carlo collision (PIC/MCC) and a 2D fluid model of RPCs. The PIC/MCC model uses a Monte Carlo technique and a 2D numerical grid coupled with Poisson equation solver to track individual electrons and their collisions with the background gas in 3D. The fluid model is based on drift-diffusion-reaction equation and local field approximation. Both models rely on axis symmetry and are developed using the AMReX software framework. AMReX is an open-source C++ library for massively parallel block structured adaptive mesh refinement applications. The presented RPC models are employed to study the signal induction, space charge effects and avalanche to streamer transition in RPCs under LHC-like conditions. The conditions assume a 2 mm gas gap with a standard gas mixture based on C2H2F4, or eco-friendly alternatives based on C3H2F4 and CO2. In addition, we also employ a microscopic Monte Carlo model to calculate the efficiency and time response functions for these RPC configurations.

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