Fayoum University
Faculty of Science
Department of Physics

Simulation and Modelling of Resistive Plate Chamber (RPC) by using deep learning

By

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Abstract :

The Resistive Plate Chamber (RPC) is a fast gaseous detector utilized at the Large Hadron Collider (LHC) to identify charged particles resulting from p-p collisions. Employed within the Compact Muon Solenoid (CMS) Experiment at the LHC, RPCs serve as a dedicated trigger system in both the barrel and endcap regions. RPCs made up of two parallel plates with a negative cathode and a positive anode. Both electrodes consist of plastic material with extremely high resistivity and are spaced apart by gas volume. Due to its simple design and construction, high efficiency, good time resolution and low-cost production, it is widely used in different high energy physics experiments. The operational gas within these detectors significantly influences their performance. This study aims to optimize the transport parameters of the operational gas using Garfield++ simulations and decision tree regression model. By rigorously evaluating key parameters such as drift velocity and diffusion coefficients, this research focuses on comparing the results obtained from Garfield++ simulations and decision tree regression model. Garfield++, a powerful simulation tool, offers detailed insights into the gas's behavior under various conditions, thereby aiding in the identification of optimal transport parameters and enhancing RPC detector performance. Simultaneously, the decision tree regression model are employed to model the transport parameters based on datasets generated through Garfield++ simulations. This approach provides a unique perspective on gas transport parameters, complementing the insights gained from simulation analyses.