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Construction and development of RPC gas detectors

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Abstract

A Resistive Plate Chamber (RPC) is a type of ionizing particle detector that uses a gas mixture as the active detection medium and is characterized by its fast time response. One of the key parameters defining its operating characteristics is the separation distance between the resistive plates that make up the detector, known as the GAP.
Based on a methodological study, two resistive plate detectors were constructed, each featuring two 0.3 mm gaps, using low-cost materials.
The constructed detectors were characterized to determine their main performance parameters: efficiency, time resolution, and charge. An experimental setup based on the coincidence of detected events was employed, using two photomultiplier tubes coupled to plastic scintillator bars as reference detectors. An ASIC readout electronics system was adapted for data acquisition.
Finally, a statistical analysis of the collected data was performed, providing general estimates of the performance characteristics of the RPC detectors. Efficiencies from 70% to 90% were obtained using tetrafluoroethane ($C_2H_2F_4$) as the operating gas.

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