A New Gaseous Detector of Ionizing Particles - the Dielectric Resistive Plate Chamber. Time-of-Flight Applications.

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Abstract

The Dielectric Resistive Plate Chamber (DRPC) was for the first time studied as a detecting cell for high-precision TOF applications.

Two- and four-gap detectors with the total gap width of 1.2 mm and the working area of 4×4 cm^2 were filled with freon-based gas mixtures. A stable energy resolution in the avalanche mode has been obtained for all fast signals with the average charge of 1–3 pC. The registration efficiency for MIP was found to be not less than 97%, with up to 100 mV discriminating threshold, and with 400–800 V counting plateau width. Specially designed fast-response amplifiers, connected to all the gas gaps, provided 70–80 ps of the detector time-of-flight resolution. The counting rate capability of the initial non-adopted detectors allowed to keep the characteristics unchanged under the beam intensitites of more than $5{\cdot}10^3$ Hz/cm^2. A 1% admixture of streamer signals at the end of the counting plateau did not influence the detector operation and characteristics. A special study of pion/kaon separation under real beam conditions was undertaken, which showed a very good quality of kaon separation by means of TOF performed with DRPC, at up to 1.5 GeV/c beam momentum, 3.5 m flight distance, and a 10% admixture of kaons in the pion beam.

The results prove that, in case of TOF, the DRPC technique shows the same performance as the standard (Scintillator-Phototube) one.

It was estimated that a channel price of a DRPC-based TOF detector is about an order of magnitude less than that of a detector based on the standard technique. This means that the relevant applications of DRPC may be large-scale high-granular cheap mosaic TOF detectors for studying high energy nucleus-nucleus collisions.

1. V. Golovine, A. Smirnitski. Patent of Russia #2148283,13.11.1998.
2. A. Akindinov *et al.* Preprint ITEP 45–98, 1998.
3. A. Akindinov *et al.* Preprint ITEP 20–99, 1999.