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Toward a high granularity, high counting rate, differential readout-timing RPC

Next generation experiments like CBM at FAIR will be confronted with the selection of rare probes in high multiplicity environment at collision rates up to 10⁷events/sec. Hadron identification in such a limiting environment is a real challenge and requires intensive R&D activity for developing high resolution and high granularity timing detectors at affordable cost. A new differential architecture of a resistive plate counter based on a high granularity strip structure readout electrodes, symmetric relative to the central anode, is proposed. Results of the ⁶⁰Co source tests and of the in-beam investigations using minimum ionizing particles are discussed.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

Toward a high granularity, high counting rate, differential readout - timing RPC

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Next generation experiments like CBM at FAIR will be confronted with the selection of rare probes in high multiplicity environment at collision rates up to 10⁷events/sec. Hadron identification in such a limiting environment is a real challenge and requires intensive R&D activity for developing high resolution and high granularity timing detectors at affordable cost. Low polar angles region of CBM-TOF detector will be exposed at high counting rate (up to about 20 kHz/cm²) and high multiplicity (up to 1000 tracks/event at 25 AGeV Au+Au collisions). Therefore a high counting rate
and high granularity detector is required. For this particular region of the TOF wall a new differential architecture of a resistive plate counter (RPC) based on a high granularity strip structure readout electrodes is proposed. The counter has two identical halves, symmetrically disposed relative to the central anode, with 2 x 5 gaps of 0.140 mm size each. The readout electrodes (the cathodes and central double-sided anode) have a strip structure of 2.54 mm pitch and 1.1 mm strip width. The high voltage electrodes have the same strip structure as the readout ones.
A time resolution better than 100 ps was obtained in the ⁶⁰Co source tests, using for signal processing the amplifier/discriminator based on NINO ASIC chip developed within ALICE Collaboration.
The in-beam tests were performed at the SIS accelerator of GSI - Darmstadt, using the same electronics.
During these tests the RPC was operated at different high voltages and a gas flow of 85\% C₂F₄H₂, 10\% SF₆and
5\% C₄H₁₀at normal pressure. The detection efficiency was studied as a function of high voltage. A very good time resolution and a cluster size of ˜1.2 strips are obtained. The results recommend such an architecture for high multiplicity environment.

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