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Improving count rate capability of timing RPCs by increasing the detector working temperature

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Timing Resistive Plate Chambers (tRPC) is a mature and widely used gaseous detector (ALICE@CERN, START@RHIC or HADES@GSI) for the precise timing tag of charged particles exhibiting an excellent timing precision, down to 50 ps, together with a high efficiency, larger than 98%, for minimum ionizing particles. Characteristics that can be implemented in large areas.

tRPC have traditionally been used with relatively low particle loads (a few kHz/cm2) due to the inherent limitation to the counting rate imposed by the resistive electrodes. Since tRPCs are one of the main large-area timing detectors, extension of its counting rate capability is of great interest for future HEP experiments, were the luminosity is expected to increase considerably.

Attempts have already been made to increase the count rate capability by using materials with lower electrical resistivity compared to the commonly used float glass, such as ceramics, special glasses or some technical plastics. As a result, the operation of small area detectors was successfully achieved, but the implementation of the medium/large area detectors failed due to the lack of homogeneity of the materials, which present low electrical resistivity paths, resulting in an unstable behavior of the detector. Another possibility, still very little explored, is to decrease the resistivity of standard float glass by increasing the operational temperature of the detectors, providing a ten-fold decrease in resistivity every 25ºC.

In this communication, test beam result of common float glass RPCs operated up to 40 ºC are presented. The results suggest an improvement of the count rate capability by a factor of four compared with room temperature, while keeping the timing precision and efficiency unchanged.

As a practical case, the use of RPCs operated in this regime in the forward region of the HADES spectrometer is discussed and preliminary results shown.

Collaboration

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