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Development and Characterisation of Large Size RPC detectors for the INO-ICAL Experiment (12' + 3')

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The India-based Neutrino Observatory (INO) is an approved underground laboratory for doing basic science experiments. It will house multiple on accelerator based experiments. One such experiment will be the massive 51 kton magnetised Iron Calorimeter (ICAL) detector to study atmospheric neutrinos and parameters related to their oscillations. Resistive Plate Chambers (RPCs) detectors will be used as an active detector element for ICAL. The ICAL detector will have three modules each of 17 ktons and 16m X 16m X 14.5m in dimensions. A total number of about 28,000 RPCs of 2m X 2m in size will be used to construct the active part of the ICAL. The RPC detectors were chosen for the ICAL experiment because of their excellent timing resolution of few nanoseconds, high detection efficiency for minimum ionising particles and low cost per unit area. But, to improve the efficiency, time resolution and overcome the ageing problem, the electrode materials are required to have high resistivity and homogeneous smooth surface. Because of the huge numbers of detectors required for ICAL experiment and keeping in mind the long life span of the experiment, it is pertinent to perform a vigorous $R\&D$ to carefully optimise the various detector design and operational parameters like the electrode material, gas composition, operational conditions, etc. to fully exploit all the advantages of the RPC detectors. We first fabricated RPC prototypes of 30 cm x 30 cm in size with different glass and bakelite electrodes and performed the characterisation studies. We then moved on to fabricate large area RPC of 2m X 2m size and constructed a stack of 12 layers of these RPC. We then performed variety of measurements related with effciency, count rate, cross talk, dark current, time resolution and charge spectra as a function of various gas mixtures and environmental conditions. The results from these studies along with the present status of ICAL RPC detectors will be presented in this talk.

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