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Effect of electric field and gas mixture on RPC time resolution

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The proposed ICAL detector at the India-based Neutrino Observatory [1] will deploy a large number of RPCs in 150 horizontal layers interleaved with iron plates to find the muon tracks, produced in the charged-current interaction of atmospheric neutrinos with the iron. Accurate timing information from each RPC layer will help to distinguish up-going muon tracks from the down-going ones and tag the events. The precision of the timing measurements depends on the time resolution of the RPC. It is important to study various parameters which may affect the timing response of RPC, such as, electric field, gas mixture, device geometry etc., to optimize them for better performance of RPC and analyse the experimental observations.

In the present work, the timing response of a Bakelite RPC of 2 mm gas-gap has been studied using numerical simulation as well as experimental measurements. The Garfield [2] framework has been used to calculate the current signals induced on RPC readout strips due to passage of 5000 muons through the detector. ROOT [3] data analysis framework has been used to analyse the simulated data. A distribution of times corresponding to crossing a signal threshold has been found out for 5000 events which is considered as the timing response of RPC. The variation of the distribution with the said parameters has been studied. Experiments have been performed to measure the timing response of RPC using a three-fold coincidence set-up in identical conditions to compare the numerical calculations.

REFERENCES:

[1] ICAL collaboration, S. Ahmed et al., Physics Potential of the ICAL detector at the India-based Neutrino Observatory (INO), arXiv:1505.07380.

[2] GARFIELD, recent developments, NIM A 419 (1998) p.726-730.

[3] ROOT –Data Analysis Framework, https://root.cern.ch.

Presentation type

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