Proposed Trigger Scheme for the ICAL Detector of India-based Neutrino Observatory

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The India-based Neutrino Observatory (INO) collaboration has proposed to build a 50kton magnetized Iron Calorimeter (ICAL) detector with the primary goal to study neutrino oscillations, employing around 28,800 Resistive Plate Chambers (RPCs) as active detector elements. The ICAL detector will comprise of three modules, each of dimension 16m x 16m x 14.5m, housed inside a cavern with a rock cover of 1.3km, in order to reduce the cosmic muon background. The expected overall event rate is around 10Hz. The trigger scheme for such a low event-rate experiment should achieve an optimization of the detection efficiency of desired events and the chance trigger rates. It should also ensure feasibility of hardware implementation considering the vast volume of the detector module. In this paper, a trigger scheme with a distributed and hierarchical architecture is proposed for one module of the ICAL detector, which would satisfy these criteria. Chance coincidence rates have been calculated for different combinations of the trigger parameters which help to fix the criteria for an admissible chance trigger rate. Results from a simulation framework, developed in order to evaluate trigger efficiency of the scheme for different events of interest for the ICAL detector, are also discussed.