

Development of trigger system for the ICAL detector of India-based Neutrino Observatory

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The India-based Neutrino Observatory (INO) collaboration is planning to build a 50 kton magnetized Iron Calorimeter (ICAL) detector to study atmospheric neutrinos and to make precision measurements of the neutrino oscillation parameters. The detector will mostly look for muon neutrino induced charged current interactions using magnetized iron as the target mass and around 28,800 Resistive Plate Chambers (RPCs) as sensitive detector elements. The architecture of the trigger scheme for the ICAL detector has been developed and is validated by estimating the associated chance coincidence rates and determining the trigger efficiency of the scheme for the events of interest. The salient features of the ICAL trigger scheme are described. The hardware implementation of the scheme is initiated by designing an FPGA-based trigger module for the prototype of the ICAL detector. The design of the trigger module and its performance validation in the prototype detector are discussed. A bigger prototype of the ICAL detector, known as the ICAL Engineering Module, is being built to serve as a testbench for the development of various integral components, like RPCs, magnet, gas system, front-end electronics, data acquisition system, etc., which will be finally deployed in the ICAL detector. The trigger boards, proposed to constitute the ICAL trigger system, will be used to build the trigger system of the Engineering Module, in order to authenticate their performance. This paper also presents the design of the trigger boards and the layout for the implementation of the trigger system of the ICAL Engineering Module.

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