**Abstract**

A 51-kT magnetised Iron Calorimeter (ICAL), using Resistive Plate Chambers, is the flagship experiment at the India based Neutrino Observatory (INO). A prototype - 1500 kg of the weight of ICAL, called mini-ICAL was installed in the INO transit campus at Madurai. A cosmic muon veto around the mini-ICAL is now being planned. The veto walls will be built using three staggered layers of extruded scintillator strips. WLS fibres of 1.4 mm in dia are inserted into two extruded holes along the length of the strip to collect the light signal. Hamamatsu SiPM's of 2mm×2mm active area collect the light on both ends of the fibres. On veto trigger, the DAQ system will gather the charge, arrival time and position of muon tracks in the scintillator strips. But the data collected is transferred to the backend only if the trigger from mini-ICAL is also received in time. Details of the design and construction of the detector will be presented.

**Motivation for veto detector**

- The advantages of locating a large detector such as ICAL at a shallow depth of 100 m, are obvious.
-Muon background at such a depth at ICAL of about 3×10^10/day and the small atmospheric neutrino event rate of about 3 per day in the same detector.
-If one were to build a cosmic muon veto detector which could detect muons with >99.99% efficiency, the fraction that would escape detection would be of the same order or similar to that which survives after traversing a rock cover of about 1 km.

**What INO and ICAL detector can do?**

- Measure atmospheric muon neutrinos and anti-neutrinos, separately.
- Will target the open problem of ordering of the three tiny neutrino masses - Mass Hierarchy.
- Will help address CP violation in the neutrino sector, which could help in our understanding of why there is a preponderance of matter over anti-matter in the universe.

**Readout and data acquisition scheme**

- Trip-T: 32 channel charge amplifier. Charge and time of arrival per channel.
- VMM-3: 64 channel bi-polar inputs. Fast digital output signal per channel.
- The peak charge and peak to reference clock TAC values stored in analog memory.
- The digital data read out on two lines @200Mbps.

**Veto detector design and components**

**Structure of veto detector around mini-ICAL**

**Facts and Figures of ICAL detectors**

**Extruded plastic scintillators by Fermilab**

**Mini-ICAL detector**

**References**


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