



Contribution ID: 176

Type: **Poster session**

Background measurements with ISMRAN set up in a nonreactor environment

We present the measurements of the nonreactor environmental background with **ISMRAN**(Indian Scintillator Matrix for Reactor Anti-Neutrinos) set up consisting of an array of 9×10 Plastic Scintillator Bars(PSBs) at BARC, Mumbai. These measurements are useful in context of the ISMRAN set up, which will be used to measure reactor antineutrinos, through inverse beta decay(IBD) signal. ISMRAN detector is planned to be an above ground set up, and will be situated in close proximity to the **Dhruva** reactor core(~ 13 m). In order to deal with fast neutrons and photons(γ), which are part of reactor related background inside the reactor hall, a 10 cm thick Lead(Pb) and 10 cm thick Borated Polyethylene(BP) shielding is also employed to enclose the PSBs of the ISMRAN set up.

Apart from reactor related background, cosmogenic neutrons and muons related background will also be encountered inside the reactor hall. Therefore a good understanding of cosmogenic background in plastic scintillator array is an essential prerequisite for understanding the nonreactor background to estimate their uncertainties. This has been accomplished through a constant measurement of cosmogenic background in plastic scintillator array at the Detector Integration Laboratory(**DIL**), in a nonreactor environment, about 1.5 km away from the reactor. The detector setup at DIL, consists of 90 PSBs, arranged in the form of a matrix in an array of 9×10 . Each PSB is wrapped with Gadolinium Oxide (Gd_2O_3 ; areal density: 4.8 mg/cm^2) coated on aluminized mylar foils. Each PSB is 100 cm long with a cross-section of $10 \times 10 \text{ cm}^2$. Three inch diameter, PMTs are coupled at the both ends of each PSB. The data acquisition system, based on waveform digitizers has been used for pulse processing and event triggering. The characterization of the different nonreactor, cosmogenic background is done on the basis of cell arrangement consisting of 9 PSBs in each cell. Different kind of background rates have been measured in each cell. Backgrounds have been simulated in ISMRAN geometry using the GEANT4 toolkit version 4.10.05. These experimentally measured results will be useful for discriminating correlated and uncorrelated background events from true IBD events in reactor ON and OFF condition inside the reactor hall.

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Session Classification: Neutrino Physics Session 2

Track Classification: Neutrino Physics