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Understanding the temperature dependence of SiPM characteristics

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The prototype detector of the ICAL experiment at the India-based Neutrino Observatory, the mini-ICAL is in operation at the IICHEP, Madurai. A Cosmic Muon Veto detector (CMVD) around the mini-ICAL is being commissioned using extruded plastic scintillators with embedded WLS fibers. The SiPM is used as a photo-transducer and that will be calibrated using an ultrafast LED driver. Other than the basic efficiency and gain study for the CMVD as a function of overvoltage (V_{ov}), an experimental setup was designed to characterise the SiPMs in a temperature controlled environment. The readout electronics involves trans-impedance amplifiers of combined gain $1.24 \text{ mV}/\mu\text{A}$ and a digital storage oscilloscope for the data collection without much distortion of SiPM signal. Various characteristics of the Hamamatsu SiPM (S13360-2050VE), e.g. signal shape, optically correlated and uncorrelated noise, recovery time etc were studied as a function of V_{ov} , number of photoelectrons and the ambient temperature. This paper will cover the details of those results.

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