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Design, performance, and analysis of a measurement of optical properties of antarctic ice below 400 nm

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The IceCube Neutrino Observatory, located at the geographic South Pole, is the world's largest neutrino telescope, instrumenting 1 km^3 of Antarctic ice with 5160 photosensors to detect Cherenkov light. For the IceCube Upgrade, to be deployed during the 2022-23 polar field season, and the enlarged detector IceCube-Gen2 several new optical sensor designs are under development. One of these optical sensors, the Wavelength-shifting Optical Module (WOM), uses wavelength-shifting and light-guiding techniques to measure Cherenkov photons in the UV-range from 380 to 250 nm. In order to understand the potential gains from this new technology, a measurement of the scattering and absorption lengths of UV light was performed in the SPICEcore borehole at the South Pole during the winter seasons of 2018/2019 and 2019/2020. For this purpose, a calibration device with a UV light source and a detector using the wavelength shifting technology was developed. We present the design of the developed calibration device, its performance during the measurement campaigns, and the best fit comparing the data to a Monte Carlo simulation.

Keywords

IceCube, Calibration, SPICEcore

Collaboration

IceCube

other Collaboration

Subcategory

Experimental Methods & Instrumentation

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