



Contribution ID: 29

Type: Oral

Quality control of PEN wavelength shifter for DarkSide-20k veto

Tuesday 27 August 2024 11:30 (20 minutes)

Efficient Wavelength Shifters (WLS) are crucial for liquid Argon (LAr) detectors. As the LAr detectors grow larger in volume, the scalability of WLS becomes an important concern. Tetraphenyl butadiene (TPB), which is the most common WLS in use, becomes impractical for LAr detectors with more than 100 m² of surface area due to its high cost and energy requirements.

DarkSide-20k veto detector will utilise nearly 200 m² of polyethylene naphthalate (PEN) wavelength shifter, available in form of large polymeric foil, a convenient alternative to TPB, albeit with approximately 50% reduced wavelength shifting efficiency. For quality assurance purposes, one needs to test multiple PEN samples from the DarkSide-20k production batch at cryogenic temperatures.

For this purpose, a new Argon Gas Setup (ArGSet) has been recently commissioned. In this setup, we exploit the Argon scintillation (128 nm) as excitation for measuring the wavelength shifting efficiency of the material under investigation.

In this work, we will present the results of the measurements of PEN for DarkSide-20k as well as comment on other alternative wavelength shifters for the future detectors.

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Session Classification: Light/Charge Readout

Track Classification: Light/charge readout (PMT, SiPM, WLS, electronics etc.): WLS