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

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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 m^2 of surface area due to its high cost and energy requirements.

DarkSide-20k veto detector will utilise nearly 200 m^2 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.

Primary authors: CHOUDHARY, Sarthak (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences); CORTEZ, André (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences); KUZ-
NIAK, Marcin (AstroCeNT / NCAC Polish Academy of Sciences); KUŻWA, Maciej (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences); NIERADKA, Grzegorz (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences); SWOROBOWICZ, T. (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences); ŚWIDERSKI, Łukasz (National Center for Nuclear Research); SZCZĘŚNIAK, Tomasz (National Center for Nuclear Research)

Presenter: CHOUDHARY, Sarthak (Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences)

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