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The DARKSIDE-20k neutron veto and its light detectors

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Darkside-20k is a global direct dark matter search experiment situated at Laboratori Nazionali del Gran Sasso, designed to reach a total exposure of 200 tonne-years free from instrumental backgrounds. The core of the detector is a dual phase time projection chamber (TPC) filled with 50 tonnes of low-radioactivity liquid argon. This is surrounded by an active neutron veto, employing Gadolinium-loaded polymethylmethacrylate (Gd-PMMA), and hosted inside a protoDUNE-like cryostat. The most dangerous background to the dark matter search comes from nuclear recoils induced by radiogenic neutrons, since this process can mimic a dark matter scattering-induced recoil. Neutron-induced nuclear recoils are rejected by identifying the presence of the neutron. The DarkSide-20k detector has a novel design in which the neutron veto and the TPC are integrated into a single mechanical unit that sits in a common bath of low-radioactivity argon. The entire TPC wall is surrounded by a Gd-PMMA shell which is equipped with large area Silicon Photomultiplier (SiPMs) array detectors. SiPMs are disposed in a compact design designed to minimise the number of Printed Circuit Boards (PCBs), cables and connectors, called vPDU+. The components of a vPDU+ are: a Tile+, which contains SiPMs and front end electronics, a MB+, which distributes voltage and control signals, sums Tile+ channels, and drives the electrical signal transmission. The neutron veto will be equipped with 120 vPDU+. The talk will focus on the preliminary results of vPDU+ prototype and the expected neutron veto performances.

Collaboration

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