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Performance of radiopure large-area SiPM arrays for DarkSide-20k

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Low-background experiments are obtaining very important results about the most anticipated open problems of our universe, such as direct dark matter searches, neutrinoless double-beta decay, nucleon decay searches, neutrino astrophysics.
All these experiments have been made possible by the selection of radiopure materials to build such experimental facilities, often resulting in a challenging R\&D of the detector itself to accomplish strict radioactivity requirements.

DarkSide-20k (DS-20k) is one of the most ambitious direct dark matter search experiments of the near future. It is under construction in the Hall C of Laboratori Nazionali del Gran Sasso (LNGS), Assergi, Italy and its aim is to probe the WIMP-nucleus cross-section down to $10^{-48}\ cm^2$.
DS-20k will use a double-phase Time Projection Chamber (TPC) filled by 50 tons of underground liquid argon whose contamination of ^{39}Ar is significantly reduced to 0.5 mBq/kg, and a radiopurity level of the same order of magnitude was established as requirement for all TPC's components.
The light emitted by the expected WIMP-nucleus scattering or background particles interacting with the TPC will be read out by two 10.5 m^2 optical surfaces located in the top and bottom planes of the TPC. The optical planes will be populated by low-noise cryogenic arrays of silicon photomultipliers (SiPM) with excellent single-photon sensitivity.
The TPC will be surrounded by an equally radiopure active veto equipped with about 5 m^2 of SiPM-based detectors.

This talk presents the radioactive assay of the photodetectors to be installed in the TPC of DS-20k and their performance in liquid nitrogen. This assay, due to the big amount of material to measure, was carried out by the underground laboratories of Boulby (UK), Gran Sasso, Canfranc (Spain) and by the Jagiellonian University (Poland).
The final SiPM arrays are assembled and characterized in Nuova Officina Assergi (NOA) at LNGS, an ISO 6 clean room built for mass production of particle physics silicon detectors and arranged to host a radon abatement system. The bagging procedures for storing and shipping of DS-20k photodetectors will be also shown.

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