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Quality Assurance and Quality Control of the 25 m² SiPM production for the Darkside-20k dark matter experiment

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Liquid Argon Time Projection Chambers (TPC) are promising detectors for dark matter search due to their response uniformity, scalability to large target masses, and suitability for extremely low background operations. The DarkSide-20k experiment is a new dark matter detector under construction at Istituto Nazionale di Fisica Nucleare (INFN) Laboratori Nazionali del Gran Sasso (LNGS) that aims to push the sensitivity for Weakly Interacting Massive Particles (WIMP) detection into the neutrino fog. The core of the apparatus is a dual-phase TPC, serving both as WIMP target and detector, filled and surrounded by low-radioactivity Underground Argon (UAr). Fondazione Bruno Kessler (FBK) NUV-HD Cryo Silicon Photomultipliers (SiPM)s have been selected as the photon sensors of choice to instrument the two 25 m² Optical Planes and the two veto detectors of the experiment. This talk focuses on the Quality Assurance and Quality Control (QA/QC) of the production wafers made with FBK-NUV-HD-Cryo SiPMs manufactured by LFoundry s.r.l. (Avezzano, AQ, Italy). Several SiPMs characteristics such as breakdown voltage, leakage current in the pre-breakdown region, quenching resistor and correlated noise are measured at the wafer level, at 77-K, with a custom design probe station. Overall up to September 2023 we tested 207 of the 1400 production wafers. The wafer yield is measured to be $94.3 \pm 2.3\%$ being not only in-spec but actually exceeding the 80% expected by the original DarkSide-20k production plan.

Early Career

Yes

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