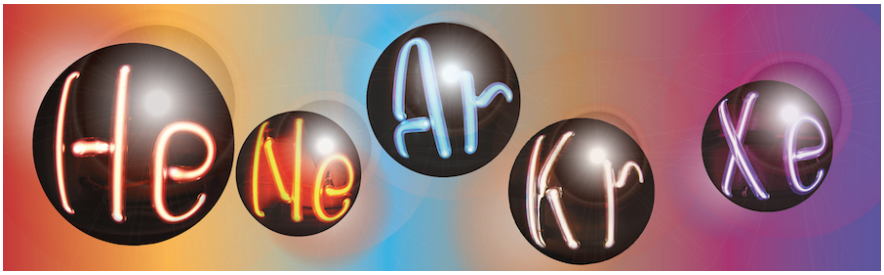

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Characterization, mass tests and first results of the FBK SiPMs for the Photon detection system of DUNE Far Detector

Wednesday, 22 October 2025 09:50 (20 minutes)

The Deep Underground Neutrino Experiment (DUNE) is a next-generation neutrino physics experiment that will answer some of the most compelling questions in particle physics and cosmology. The DUNE Far Detector (FD) exploits silicon photomultipliers (SiPMs) to detect scintillation photons produced by the interaction of charged particles in the liquid argon time projection chamber (LArTPC). Light signals are indeed extremely important to determine one of the spatial coordinates of the interaction and also allow triggering non-beam events.
The SiPMs are photosensors consisting of matrices of single-photon avalanche diodes operating in the Geiger-Mueller region. Their high sensitivity and dynamic range, as well as the possibility to fill large surfaces with high-granularity sensors, make them an ideal choice for the DUNE FD photo detection system. This system will use a combination of 6x6mm^2 area sensors produced by Hamamatsu Photonics K.K. (HPK) and Fondazione Bruno Kessler (FBK).
An international consortium of research groups is currently engaged in systematic characterization and quality assurance tests of all the sensors that will be installed in the FD to ensure their specifications. A custom set-up, CACTUS (Cryogenic Apparatus for Continuous Tests Upon SiPMs), has been developed at Ferrara and Bologna Universities and INFN sites to automatically perform the tests for a large number of sensors in parallel. This system can characterize up to 120 SiPMs simultaneously both by testing their mechanical and thermal resistance, and measuring the complete current-voltage curve for each sensor at room and cryogenic temperatures. These data allow to extrapolate the quenching resistor and the breakdown voltage, the key operating parameters of the SiPMs.
Furthermore, the CACTUS test facility allows for dark noise characterization through a custom-made fixed threshold amplifier-discriminator system.
Until now, more than 2400 arrays of 6 sensors each, produced by FBK., have been fully tested by the laboratories involved in the measurements, showing a failure rate of less than 0.8%. In this presentation we will show the main features of these sensors and the first results obtained during characterization and tests.

Primary author: GUARISE, marco (Università e INFN, Ferrara (IT))

Presenter: GUARISE, marco (Università e INFN, Ferrara (IT))

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