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Characterization of the new FBK NUV SiPMs with low cross-talk probability

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The increasing interest for Silicon PhotoMultipliers (SiPMs) in Astroparticle Physics applications is due to several attractive features compared to the other detectors like Photo Multiplier Tubes (PMT). The great advancement in solid-state technology allowed SiPMs to have a higher Photo Detection Efficiency (PDE) in the near ultraviolet (NUV) region, a fast response, single photon sensitivity and low bias voltages. These properties make the SiPM technology a promising candidate for future astroparticle physics experiments.
In FBK several technologies have been developed for SiPMs. The ones sensitive in the blue and NUV region of the spectrum have been improved by increasing the photon detection efficiency and reducing the correlated noise. This have been obtained through an optimization of the high-field region within the Single Photon Avalanche Diodes (SPADs) and of the isolation among the different SPADs.
The FBK NUV-HD technology have deep trenches filled with silicon dioxide between one cell and the neighbouring ones, providing electrical and optical isolation, thus reducing the cross-talk probability. A recent improvement of such technology is based on the introduction of metal inside the trenches (called NUV-HD-MT technology) to further increase the optical isolation and therefore to improve the photon number resolution.
Here we report the results of the functional characterization of 6 × 6 mm^2 and 1 × 1 mm^2 FBK NUV-HD-MT SiPMs, developed to detect Cherenkov photons produced in atmospheric showers with the Imaging Atmospheric Cherenkov Technique (IACT). In this sense, a low cross-talk probability of the SiPM is useful both for improving the energy resolution of the primary cosmic ray and for reducing the rate of false triggers. However, the good NUV-HD-MT characteristics are also suitable for many other applications requiring high sensitivity in the NUV region, e.g., in space-based high energy cosmic radiation detection, scintillation light detection in medical imaging, etc.

Collaboration

Role of Submitter

I am the presenter

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