Contribution ID: **43** Type: **not specified**

VSiPMT for underwater neutrino telescopes

Wednesday 12 October 2011 18:50 (20 minutes)

Underwater neutrino telescopes are nowadays considered as one of the most important aims in the astroparticle physics field. Their structure consists of a cubic-kilometer three dimensional array of photosensitive devices aimed at the detection of the Cherenkov light emitted by charged particles produced by high energy neutrino interactions with Earth. To date, a crucial role in this kind of experiments has been played by PhotoMultiplier Tubes (PMTs), however they suffer of many drawbacks such as linearity-to-gain relationship and difficulty in single photon counting. The next generation of experiments will require further improvements in photon detectors performances, therefore alternatives to PMTs are under study. In particular the most promising development in this field is represented by the rapidly emerging CMOS p-n Geiger-mode avalanche photodiode technology (G-APD or SiPM), that will allow the detection of high speed single photons response with high gain and linearity. In order to overcome to the limits of its small sensitive surface we propose an innovative design for a modern hybrid, high gain, silicon based Vacuum Silicon Photomultiplier Tube (VSiPMT) based on the combination of a SiPM with a hemispherical vacuum glass PMT standard envelope.
In this work we describe the full SiPM characterization realized by our group and present the results of our Geant4-based simulations of backscattering of electrons over SiPM surface.

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Session Classification: Parallel Session 4

Track Classification: Photodetection and readout