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Vacuum Silicon PhotoMultipliers

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Silicon PhotoMultipliers (SiPMs) are arrays of inverse polarized diodes operating in Geiger mode with a gain of 10^5-10^6, comparable with that of PMTs, thus showing single-photon sensitivity and excellent photon-counting capability. SiPMs show many advantages over PMTs, such as higher quantum efficiency, lower operation voltages and insensitivity to magnetic fields, however their main drawback is represented by their small sensitive surface. In order to overcome this limit our group has suggested a solution consisting in 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 such a device photoelectrons emitted by the photocathode are accelerated and focused by an electric field towards a small focal area covered by the SiPM which therefore acts as an amplifier, thus substituting the classical dynode chain of a PMT.
Before the realization of a first prototype of VSiPMT our group is carrying out a preliminary work consisting in the full characterization of the SiPM with a laser source, in the simulation of electron backscattering over SiPM surface and in the full characterization of the SiPM with an electron source.
The first two phases have already been completed and their results have been presented: in this work we will describe the third phase, in particular describing our experimental apparatus and our preliminary results.

Primary author: VIVOLO, Daniele (INFN - Napoli)

Presenter: VIVOLO, Daniele (INFN - Napoli)

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