A Silicon Photomultiplier (SiPM)-based photodetector will be built to be possibly used in the Large Size Telescope (LST) camera of the Cherenkov Telescope Array (CTA). It has been designed to match the size of the standard Photomultiplier Tube (PMT) cluster unit and to be compatible with mechanics, electronics and focal plane optics of the first LST camera. Here, we describe the overall SiPM cluster design along with the main differences with respect to the currently used PMT cluster unit. The fast electronics of the SiPM pixel and its layout are also presented. In order to derive the best working condition for the final unit, we measured the SiPM performances in terms of gain, photodetection efficiency and cross-talk. A pixel, a unit of 14 SiPMs, has been built. We will discuss also some preliminary results regarding this device and we will highlight the future steps of this project.

The future of very high energy gamma-ray astronomy

The Cherenkov Telescope Array (CTA) represents the future for Imaging Air Cherenkov Telescopes (IACTs) [1].

Current generation of IACTs: H.E.S.S., MAGIC, VERITAS.

Design of a SiPM cluster for the LST camera

LST is designed to cover the lower energy range of CTA. The reflective surface area and the telescope size itself have to be maximized: the efficiency of the photo-sensor should be as large as possible to capitalize on the large cost of the telescope mechanics.

The baseline design of LST includes a focal-plane camera based on photo-multiplier tubes (PMTs), with a field of view of about 4.5 degrees.

LST camera design comprises 265 PMT modules. Each module, called “cluster”, has 7 channels, providing the camera with a total of 1855 channels. Hamamatsu PMTs with a peak quantum efficiency of 42% (R11520-100) are used [3].

The SiPM cluster:
- solid-state equivalent of a PMT
- matrix of 14 single PMTs, for a total of a few square centimeters of active area
- high photon detection efficiency, good single-photon sensitivity, and time response around 2-3 ns.

One of the next steps for this project is to design an optical system. We will also test how to drive the heat from the power control board to the cooling plate, which is 15 cm below. For this purpose a set of heat pipes will be applied and tested.

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