INFN Sections and Universities of Firenze, Napoli, Perugia.
Fermilab, LAL, INGV-Osservatorio Vesuviano, University of Tokyo

A PCB hosting 32 SiPMs controlled in temperature and a dedicated DAQ system for low power consumption experiments.

ABSTRACT

Silicon photomultipliers (SiPM) are very low power consumption light detectors and their use fits very well in experiments where a low power budget is mandatory. This is the case for the MU-RAY project [1], where radiography of volcanoes might be performed in places where no standard electric power is available.
In this scenario, the SiPM's operating temperature can change of several degrees during data acquisition. It's possible to compensate the temperature dependences of SiPM response by appropriate bias voltage variations, but only in a limited range of temperature, that anyway must not exceed 25-30 Celsius degrees. To achieve the best data acquisition efficiency and uniformity, the SiPM temperature must be controlled. In order to achieve a good thermal insulation the 32 SiPM are bonded, die, on a single PCB, well insulated with respect to the environment and thermally connected to Peltier cells by conductive vias. A rubber O-ring around the sensitive area is issued to ensure light and air tightness.
The front-end electronic is based on the SPIROC ASIC developed by the OMEGA group in Orsay [2], specifically for SiPM read-out and for a very low power consumption. (~20 mW/ch). Dedicated boards with FPGA perform digitization and read-out from the SPIROC and the trigger logic.

TECHNOLOGY STAGE

- First SiPM PCB produced and under test.
- DAQ prototypes boards produced and under test.

POSSIBLE APPLICATIONS

- Satellite borne detectors.

EXISTING APPLICATIONS

- Muon radiography.

SPECIFICATIONS

- 32 SiPM board.
- SiPM positioning better than 50 microns.
- SiPM temperature controlled by Peltier cells.
- Slave boards hosting one SiPM board and SPIROC chip.
- Charge and time measurements.
- Master board with programmable trigger logic.
- Low power consumption.

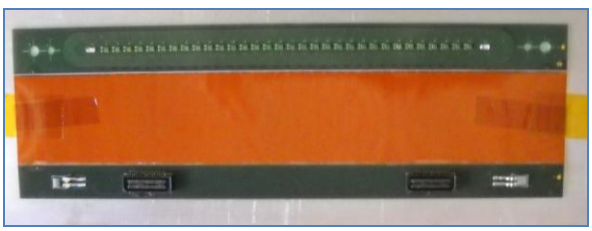

Figure 1: 32 SiPM board.

ADVANTAGES

- SiPM are controlled in temperature.
- Low power consumption.
- Many SiPM are hosted in a single board.

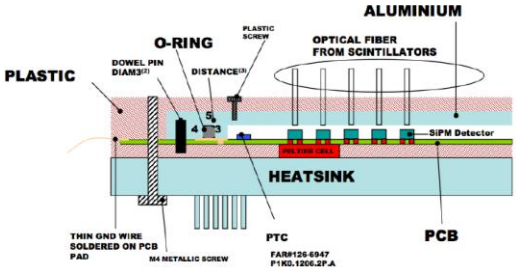

Figure 2: Schematic of the SiPM board and fibers coupling.

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CONTACTS:

Name: Saracino Giulio
Tel.: +39 081 676177
Email: saracino@na.infn.it

Name: D'Alessandro Raffaello
Tel.: +39 05 54572240
Email: candi@fi.infn.it