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Study of SiPMs for calorimetry application

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SiPMs, Silicon Photo-Multipliers also referred to as Multi-Pixel Photon Counters (MPPCs), are solid state photo detectors, which consist of a high density matrix of avalanche photodiodes. Each photodiode operates in Geiger mode and works as photon-independent counter. They are characterized by an high internal gain which allows to detect from single photon to several thousand of photons. Furthermore their internal avalanche amplification is fast enough to obtain good timing properties. Due to their insensitivity to magnetic fields, low operating voltages, low cost and compactness, SiPMs have a wide range of applications in high energy physics instrumentation.
The present study aims to investigate the performance of a SiPM readout for application n calorimetry.
Hamamatsu MPPCs , with an effective photosensitive area of 3~\times~3~mm^2 and \lambda$_{MAX}$ $= 450\ nm$, have been tested in two different configuration of 16 and 64 channels, for reading out a sampling calorimeter.
A dedicated experimental set-up has been realised using an electromagnetic calorimeter made of lead thin (0.5 mm) layers and scintillating fibres. The calorimeter is segmented in modules with a diameter of 4.3~cm; internal modules are read by conventional photo-multipliers tubes (PMTs) connecting to photo-guides at one ends. Similar photo-guides are used to connect tested SiPMs to the other end, coupling different configuration of guides.
Also the possibility of a directly SiPM read out, without light guides, is evaluated.
The SiPMs efficiency, time and space resolutions have been studied using secondary cosmic rays, with an external trigger provided by a system of scintillators.
Some preliminary results, compared to PMTs performance, will be presented.

Collaboration

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