Contribution ID: **49** Type: **Poster**

Silicon Photomultipliers as Readout System for Shashlik and Crystal Based Calorimeters

Tuesday, 22 May 2012 13:16 (0 minutes)

Silicon PhotoMultipliers (SiPMs) consist of a matrix of small passively quenched silicon avalanche photodiodes operated in limited Geiger-mode (GM-APDs) and read out in parallel from a common output node. Each pixel (with a typical size in the 20-100 μm range) gives the same current response when hit by a photon; the SiPM output signal is the sum of the signals of all the pixels, which depends on the light intensity. The main advantages of SiPMs with respect to the photomultiplier tubes (PMTs) are essentially the small dimensions, the insensitivity to magnetic fields and a low bias voltage. This contribution presents the performance of a SiPM based readout system for shashlik and crystal calorimeters developed in the framework of the FACTOR/TWICE collaboration. A prototype of shashlik calorimeter has been tested with an array of 36 (6400 cells each) SiPMs using low and high energy electrons. The SiPMs have been readout using a frontend board based on the MAROC3 ASIC, while a LED system has been used to monitor and correct the gain variations due to the temperature drift. On the other hand, a new type of SiPM, consisting in a matrix of four sensors embedded in the same silicon substrate (called QUAD) has been tested coupled to a lead tungstate crystal, an early-prototype version of the crystals developed for the electromagnetic calorimeter of the CMS experiment. New tests are foreseen using a complete module consisting of nine crystals, each one readout by two QUADs.

for the collaboration

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Session Classification: Calorimetry - Poster Session

Track Classification: P8 - Calorimetry