



Contribution ID: 106

Type: Oral Presentation

SPACIROC: A Front-End Readout ASIC for JEM-EUSO cosmic ray observatory

Friday 10 June 2011 15:10 (20 minutes)

The SPACIROC ASIC is designed for the JEM-EUSO fluorescence imaging telescope onboard of the International Space Station. Its goal is the detection of Giant Air Shower above a few 10^{19} eV, developing at a distance of about 400 km, downward in the troposphere. From such distance, most of the time, the number of the photons expected in the pixels is very weak, ranging from a few units to a few tens. For such running conditions, we propose a low-power, rad-hard ASIC which is intended for reading out a 64-channel Multi-Anode Photomultiplier. The two main features of this ASIC are the photon counting mode for each input and the charge-to-time (Q-to-T) conversions for the multiplexed channels. In the photon counting mode, the 100% triggering efficiency is achieved for 50fC input charges. For the Q-to-T converter, the ASIC requires a minimum input of 2pC. The working conditions of JEM-EUSO require the ASIC to have a low power dissipation which is around 1mW/channel. The design of SPACIROC and the test results are presented in this paper. SPACIROC is a result of the collaboration between OMEGA/LAL-Orsay, France, RIKEN, ISAS/JAXA and Konan University, Japan on behalf of the JEM-EUSO consortium.

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Session Classification: Front-end Electronics

Track Classification: Front-end Electronics