



Contribution ID: 259

Type: Poster

New electronics for the surface detectors of the Pierre Auger Observatory

Thursday, 28 May 2015 17:47 (0 minutes)

The Pierre Auger Observatory is currently the worldwide largest installation for the investigation of ultra-high energy cosmic rays. Air showers are detected in a hybrid technique by 27 fluorescence telescopes and 1660 water Cherenkov detectors (WCD) distributed over about 3000 km².

The Auger Collaboration has decided to upgrade the electronics of the WCD and complement the surface detector with scintillators (SSD). The objective is to improve the separation between the muonic and the e/m shower component for better mass composition determination during an extended operation period of 8-10 years. The surface detector electronics records data locally and forms coincidence trigger based on the GPS timing. The performance of the detectors is significantly improved with a higher sampling rate, an increased dynamic range, new generation of GPS receivers, and FPGA integrated CPU power. The number of analog channels will be increased to integrate the new SSD, but the power consumption needs to stay below 10 W to be able to use the existing photovoltaic system. In this paper, the concept of the additional SSD is presented with a focus on the design and performance of the new surface detector electronics.

Collaboration

The Pierre Auger Collaboration

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Session Classification: Front end, Trigger, DAQ and Data Management - Poster Session

Track Classification: S5 - Front End, Trigger, DAQ and Data Management