35th International Cosmic Rays Conference

12 – 20 July 2017 | BEXCO, BUSAN, KOREA

The Water Cherenkov Detector Array of the LAGO project in Huancayo - Peru

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One importan goal of the High Energy program of the LAGO project is to detect the high energy component of cosmic rays due to Gama Ray Bursts. Therefore, high altitude sites (over 4500 m.a.s.l) are chosen for installation of some detectors. The altitude allows the improvement of the sensitivity of the detectors otherwise reduced due to the strong absorption of extensive air showers initiated by gamma rays in the atmosphere.

In Peru, near the city of Huancayo (12° 2,7 'S 75° 20.4 ' W), an array of three water Cherenkov detectors for the LAGO project is under construction. Here we describe the chosen location for this purpose and the detector development. Then, we show the development of a semi-analytical method for fast calibration and its comparison to CORSIKA/Geant4 simulations

Site

Prototype Water Cherenkov Detector (b) at Observatorio Magnetico del Huayao (a), 30 km from Huancato city (c).

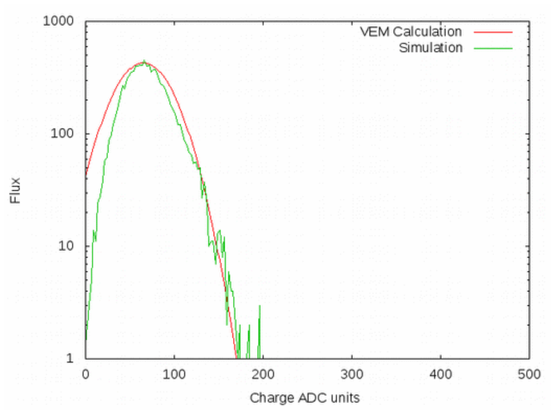
- 12"02.7' N 75" 20.4' W
- 3300 m.a.s.l.
- Cut off rigidity 13 GV

Huaytapallana mountain, 40 km from Huancato city (e) proposed installation high altitude sites at 4800 m.a.s.l. (d) and 4600 m.a.s.l. (f).

Calibration Method

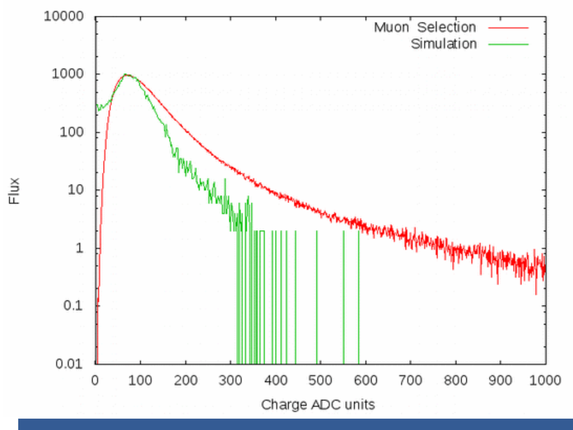
We estimate VEM charge histogram directly from total charge spectrum, first making a muon selection in the pulses measured. We relate muon charge histogram (F(q)) with total VEM charge distribution:

$$F(q) + q\,F'(q)/5 \approx V^{VEM}(q)$$



VEM charge histogram calculated from total charge and simulated (20000 particles).

VEM charge distribution is used to adjust GEANT4 simulation. Using the resuluts of CORSIKA background simulation, we calculate the charge histogram that would leave the total flow of muons of 1 hour when traversing the detector, and compare it with our muon selection.



Muon selection charge histogram calculated from total charge and simulated (40000 particles).

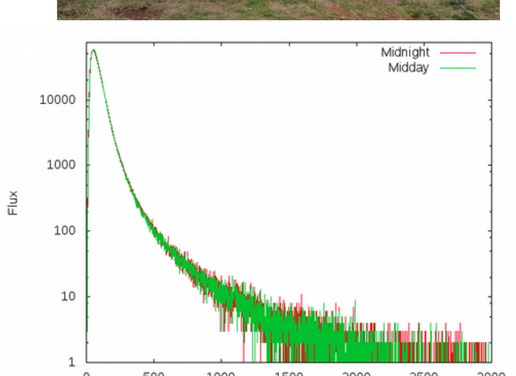
Detector Development

New design to overcome light leakage

Cylindrical metal pool, Tyvek bag and sensor.

Low density black polyethylene coating.

High density black polyethylene.



One Hour charge histogram measured on the detector at miday and midnight. No appreciable differences are notice

Conclusions

Our previous prototype detector had light leakage which was noticeable in appreciable variations (day/night) of the charge spectrum, we show these histograms at noon and midnight which do not show appreciable differences, this gives us confidence in our design).

The calibration process is under development, it is necessary to refine the simulation, we have not been able to reproduce the spread in the VEM or muon histogram, We believe that is caused by the water contamination. We manage to adjust the simulation to reproduce the VEM peak and the muon peak on charge histograms.

Acknowledgments

The autors gratefully acknowledges the financial support from Innovate Perú trough the project PIBA-2-P-020-14. The LAGO Collaboration is very thankful to the Pierre Auger Collaboration for its continuous support.

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