34th International Cosmic Ray Conference (ICRC)

July 30 - August 6, 2015, The Hague, The Netherlands

Calibration of large water-Cherenkov Detectors at the Sierra Negra site of LAGO

A. Galindo[1,3], E. Moreno[2,3], E. Carrasco[1,3], I. Torres[1,3], A. Carramiñana[1,3]

[1] *Instituto Nacional de Astrofísica, Óptica y Electrónica.*

[2] *Benemérita Universidad Autónoma de Puebla.*

[3] *for the LAGO Collaboration*

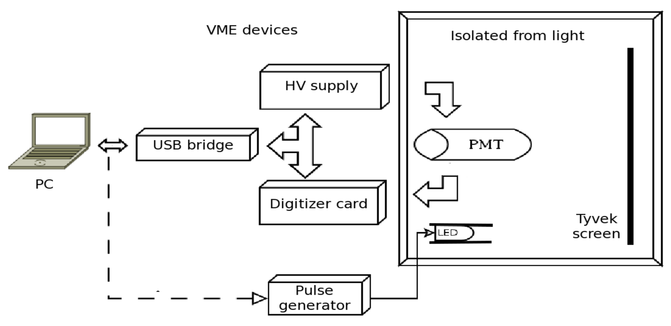
The Latin American Giant Observatory (LAGO) is an international collaboration with locations around south and central America, including a Mexico site. LAGO uses water Cherenkov detectors (WCD) in order to detect gamma ray bursts (GRBs) using the single particle technique, which looks for increases in the background rate on all detectors in a short period of time due to the arrival of many photons during a burst.

We describe the current status of LAGO in Sierra Negra, also the calibration of a detector including the PMTs characterization. We present preliminary data of the stability of the rate over time.

LAGO Site

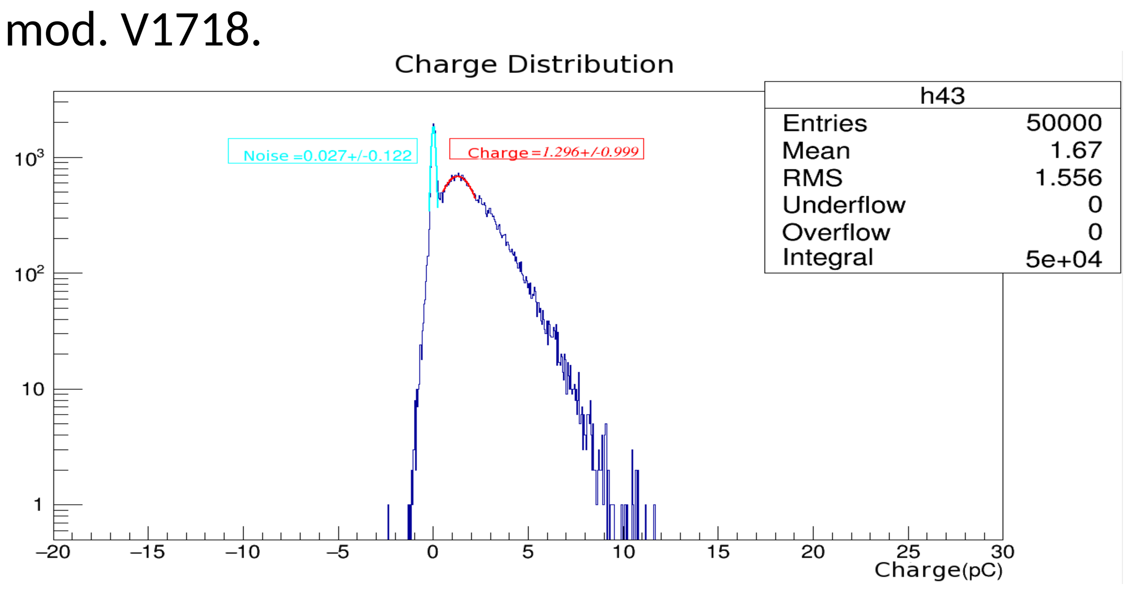
LAGO in México, located at 4530 m a. s. l.

Calibration of PMTs

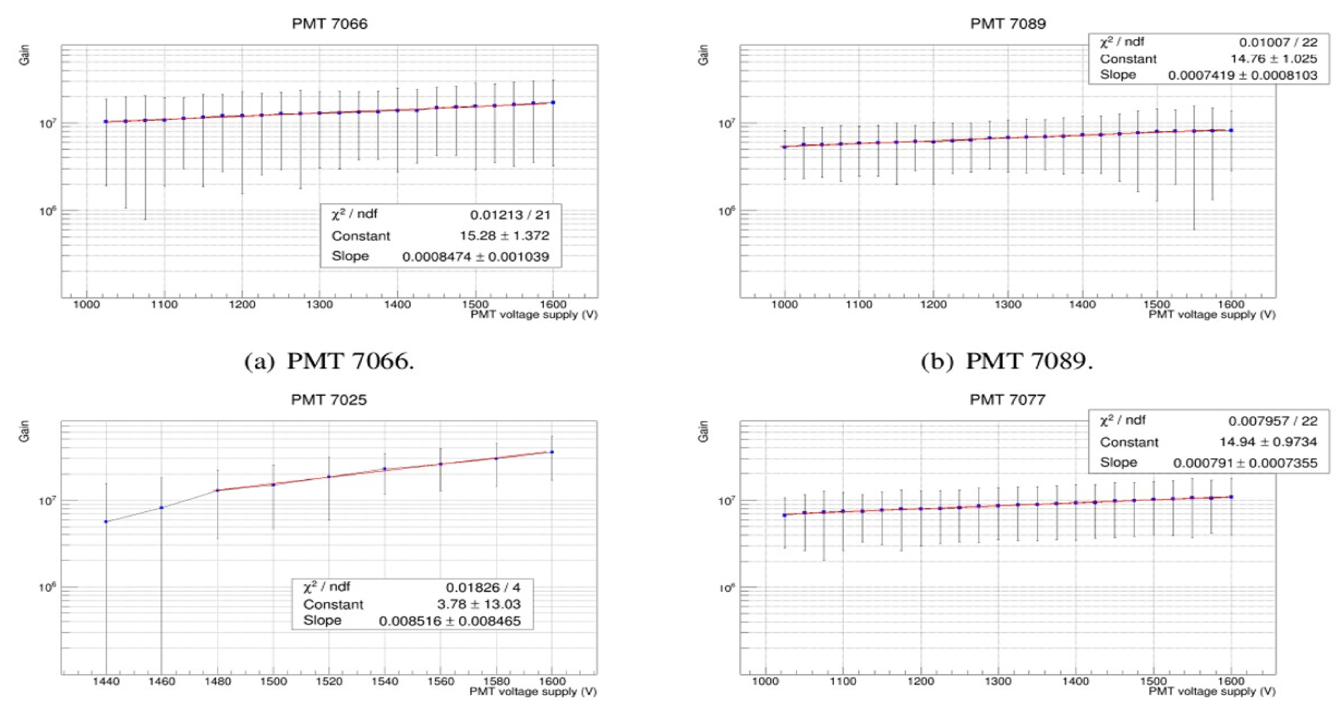


The acquisition system was conformed by CAEN devices based on VME bus, such as crate VME mod. 8011, a digitizer card mod. V1751, HV supply mod. V6533 and a USB bridge mod. V1718.

.



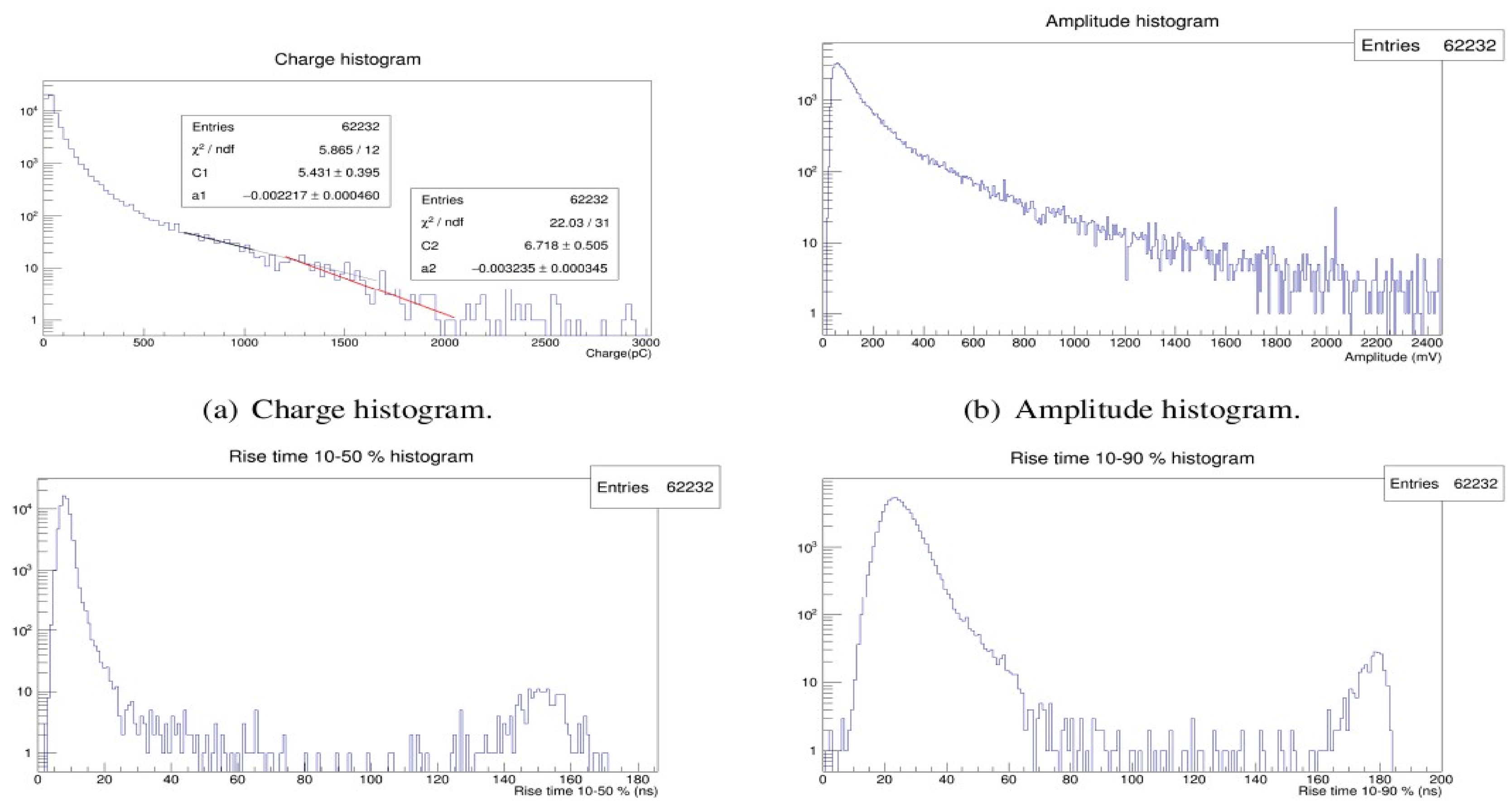
The blue LED intensity was varied by changing the width of a pulsed signal with 800 mVpp, 1.2 V offset and frequency of 1 KHz. When it was observed one pulsed signal from the PMT per 10 noise signals, the intensity of the light source was fixed. The traces taken were processed to obtain charges distributions in order to locate a single photoelectron distribution. The charge fit was divided by the known value of 1 pe charge. This process was done for different PMT voltage supply in order to have curves of gain.



(a) PMT 7066. (b) PMT 7089. (c) PMT 7025. (d) PMT 7077.

WCD calibration

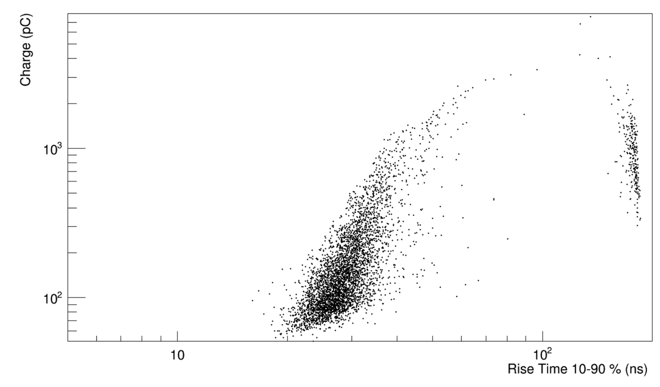
We implemented a data acquisition system with modules NIM and VME with the purpose of have a trigger capable to activate the acquisition only when the 4 PMTs have passed the threshold inside a window time. The resulting charge, amplitude, rise time 10% - 50% and rise time 10% - 90% distributions of about 7 hours of data, are important to have a correct characterization of the entire detector.



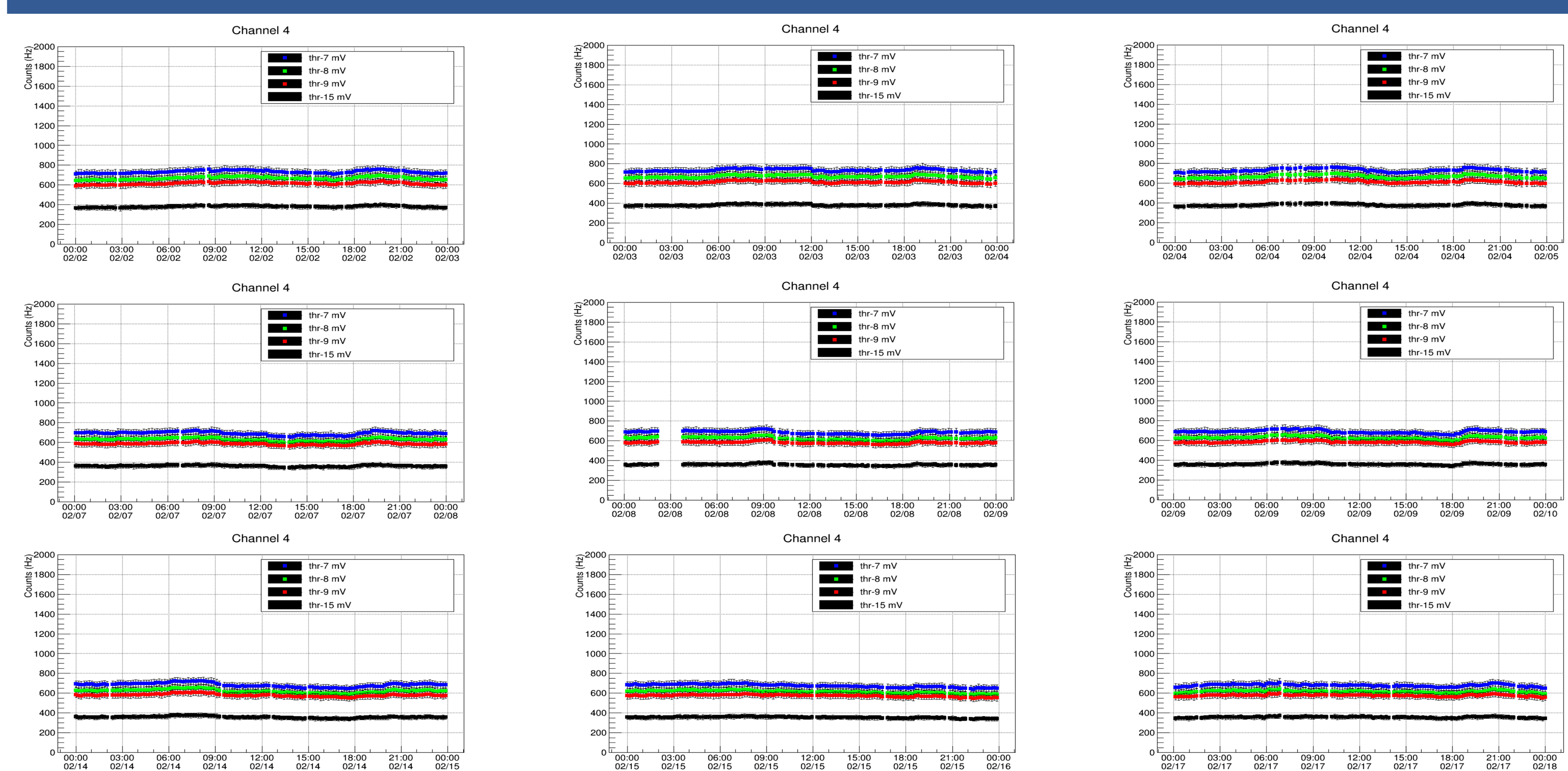
(a) Charge histogram. (b) Amplitude histogram.

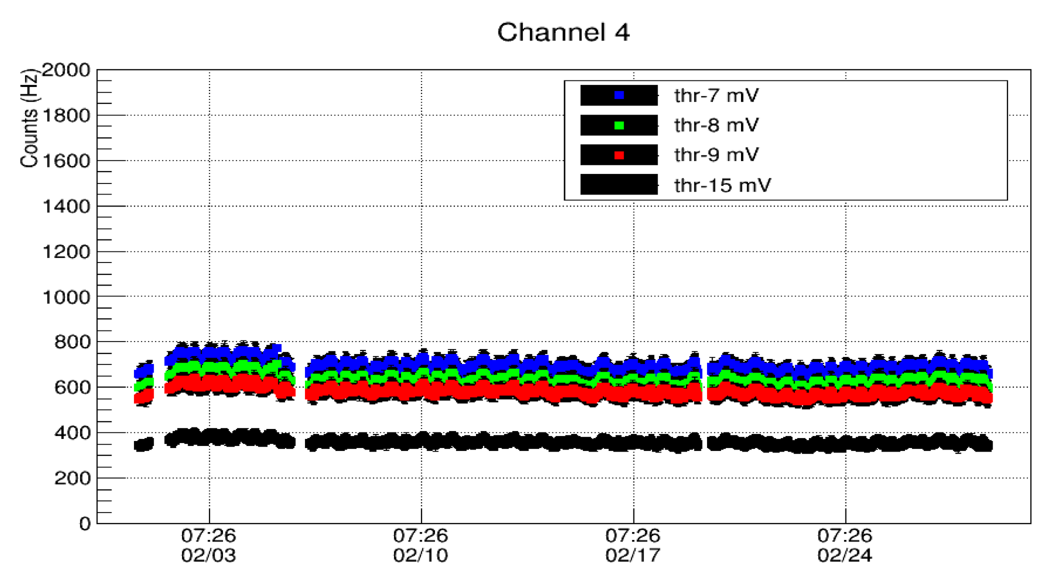
(c) Rise time 10-50 % histogram. (d) Rise time 10-90 % histogram.

Bidimensional correlation plots, i.e. charge vs. rise time, can be used to separate physical processes inside the WCD.



Rate data





The rate acquisition of the first PMT started in June 2014. Instrumentation of the entire WCD finished January 2015. We show 9 days of February data and the same entire month. The dispersion rms/mean was lower than 5 %, for the 4 PMTs.

Conclusion

We obtained gain curves as a function of the voltage supply using the SPE, to have calibration curves for each PMT. The characteristic curves of the WCD set in a coincidences mode were obtained and a breakpoint value of 1245 pC to fix the value for the other two WCDs. The stability from the rate counts of the detector with less than 5% in rms/mean value were discussed from preliminary data.

INSTITUTO NACIONAL DE ASTROFÍSICA, ÓPTICA Y ELECTRÓNICA

Luis Enrique Erro # 1, Tonantzintla, Puebla, México

E-mail: alinegalindo@inaoep.mx

Phone: +52 (222) 266.31.00