Development of Data Acquisition System for the CANGAROO-III Telescope

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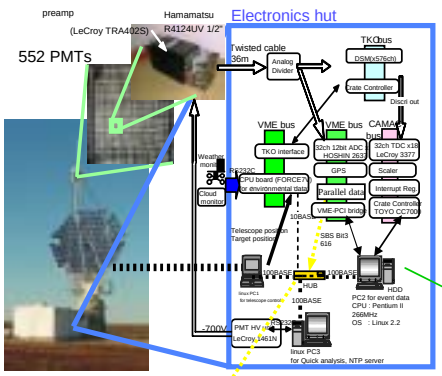
abstract

We report the development of the data acquisition system of the CANGAROO-III imaging Cherenkov telescope. Now the first telescope of four telescopes has been operated and the second telescope is being tuned. Multi-pixel cameras at the prime focus consist of 552 and 427 PMTs for the first and the second one, respectively. The charges of signal from each PMT are measured with ADCs and hit timings are measured with TDCs of which time resolution is 1nsec. Since these modules are connected to a fast VME-bus and read out by a CPU board on which Linux OS is running, the system can accept triggers at high rate up to 530Hz. Furthermore, using a 'hit pattern' module to judge in hardware whether PMTs with charge signal above a threshold are adjacent or not, we can reduce background noise effectively. In stereoscopic observation, two telescope observe shower events independently and the events are reconstructed in offline.

Introduction

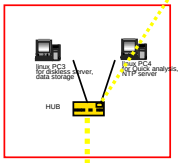
The CANGAROO-III project to construct an array of four 10m imaging atmospheric Cherenkov telescopes is underway in Woomera, South Australia. Observations with the first telescope started in March 2000. The second telescope was constructed in March 2002, and the observation will be started the end of 2002. In this poster we report the data acquisition system (DAQ) of CANGAROO-III in detail.



First Telescope

Optical fiber

Central electronics hut



Optical fiber

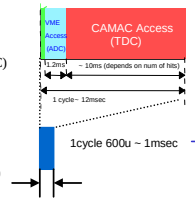
DAQ Timing

First telescope

ADC(VME) + TDC(CAMAC)

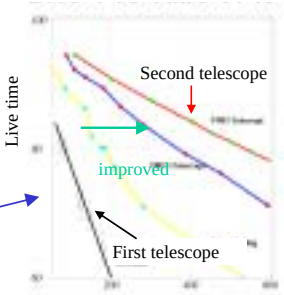
Second telescope

ADC(VME) + TDC(VME)

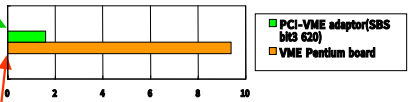


Live time of DAQ

Measured by random triggers



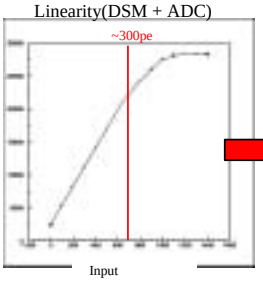
VME bus transfer PIO read(MB/s)



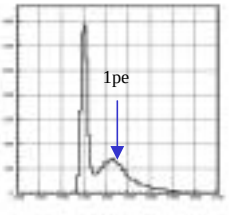
Charge ADC

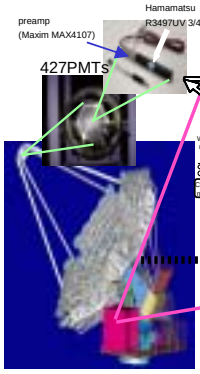
- HOSHIN V008HS
- VME 9U size, A24D16/D32 access
- 16ch*2/board * 14 boards
- Readout 1ch(T1), 2ch(T2)(readout time <20μ s/board)
- 0.1pC/ADC ch
- VME J1,J2,Jaux(CERN V430) required
- Linearity from 0pe to ~300pe
- Internal 150ns delay-line chip for each channel

Linearity(DSM + ADC)



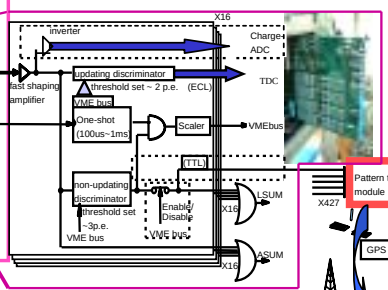
ADC distribution





Second Telescope

Discriminator and Summing Module(DSM)



- Signal from preamp in the camera is fed to a fast shaping amplifier, and splitted to ADC and TDC
- For each PMT a signal is counted by a scaler when the pulse height is over the threshold(~3 p.e.)
  Reject PMTs hit by starlight in the offline analysis
- TKO(1st telescope), VME 9U[J1,J2,Jaux](2nd telescope)

Pattern Trigger Module

- Installed to the 2nd telescope in order to reduce triggers by the night-sky background

Stereoscopic observation

T1 data: Event num 1234 | data

Transferred by optical fiber

T2 data: T1 event num 1234 | T1 trigger Flag & time

Observe same shower
And reconstruct in offline

See Nishijima's poster