

# An Advanced Triggerless Data Acquisition System for GRAPES-3 Muon Detector

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The GRAPES-3 experiment operated in Ooty, India is designed to record the electron and muon components of extensive air showers (EAS). The signal processing and DAQ system have been going through systematic upgrades. Currently, GRAPES-3 is operating 400 plastic scintillators of size  $1 \text{ m}^2$  spread over an area of  $25000 \text{ m}^2$  and 3712 proportional counters (PRCs) divided into 16 modules with a total area of  $560 \text{ m}^2$  providing for an angular resolution of  $\sim 4^\circ$ . The muon detector is being doubled in area through the addition of another 16 modules. An advanced triggerless muon DAQ with a design based on compact embedded system has been developed to enhance physics capabilities. This will open a new window on several physics fronts such as, a) precise measurement of the muon flux for thunderstorm studies, b) study of large angle EAS using the muon component, c) search for exotic particles characterised by early or delayed arrivals. Some of the key salient features of the new triggerless DAQ system are –continuous recording of signals from all PRCs, precise time stamp with a resolution of 10 ns with GPS synchronization, enabling the generation of any physics motivated triggers offline. The system has negligible dead time ( $\sim 0.001\%$  compared to  $\sim 11\%$  for the legacy DAQ system) and it has been already deployed for 4 muon modules consisting of 928 channels. The design and features of this system will be presented.

## Keywords

GRAPES-3, FPGA, Embedded systems, DAQ

## Collaboration

## other Collaboration

GRAPES-3

## Subcategory

Experimental Methods & Instrumentation

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