

Performance and meteorological effects with KM2A in Scaler mode

In the ground-based cosmic ray experiments, there are two common independent data acquisition systems, corresponding to the shower and scaler operation modes. In the scaler mode, it is not necessary for too many detectors to be hit within a fixed time window. The energy threshold of the experiment can be greatly lowered. In this work, the performance of the KM2A array operating in scaler mode was described. The KM2A-ED array is divided into 61 clusters. For one cluster (composed of 64 EDs), the event rates of showers having a number of fired EDs = 1, 2, 3 and ≥ 4 (in a time coincidence of 100 ns) are recorded every 0.1 s. The scaler mode began acquiring data on June 21, 2023. By analyzing the scaler data with KM2A in fair weather, the detector stability over short time periods (half an hour) was studied. To study the effects of environmental parameters (such as atmospheric pressure, temperature) on the scaler data, the event rate distributions with different multiplicities over long time periods (for 24 hour of data accumulation) were analyzed. These counting rates showed clear diurnal distributions and were also correlated to meteorological parameters. Finally, we analyzed the event rate variations in scaler mode during a thunderstorm that occurred on July 17, 2023, and found the counting rate increased significantly in electric fields.

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