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Meteorological effects on the counting rates of LHAASO-KM2A in scaler mode

The Large High Altitude Air Shower Observatory (LHAASO) consists of three sub-arrays: KM2A, WCDA and WFCTA. The KM2A contains 5216 electromagnetic particle detectors (EDs) and 1188 muon detectors (MDs). There are two common independent data acquisition systems, corresponding to the shower and scaler operation modes. In scaler mode, the KM2A-ED array is divided into 61 clusters. One cluster consists of 64 EDs (8 EDs × 8 EDs). For each cluster, the event rates of showers having a number of fired EDs within a time coincidence of 100 ns (particle multiplicities m) = 1, 2, 3, 4⋯are recorded every 0.1 s. The scaler mode began acquiring data on June 21, 2023. In this study, we analyze the scaler mode data to study the meteorological effects on the counting rates with different multiplicities. Over short time periods, the effects of environmental parameters on the counting rates are negligible. While over long time periods, the distributions for all Ci (means the counting rate for m = i) are influenced by meteorological parameters, such as the atmospheric pressure (P) and temperature (T). The counting rates decrease with increasing P and T. The variation amplitude is about 10.78% for C1 and 4.26% for C3 over 24 h. The correlation coefficients between the counting rates and the meteorological parameters are studied in this work. After correcting for meteorological effects, the counting rates become stable over long time periods, with C1 following a Gaussian distribution and C≥2 following Poisson distributions.

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