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miniTRASGO: A Compact RPC Telescope for Global Cosmic Ray Monitoring

The miniTRASGO is a compact and cost-effective secondary charged cosmic ray detector designed for studies in solar activity, cosmic rays, and atmospheric physics. Utilizing Resistive Plate Chambers (RPCs), it ensures stable detection rates and high sensitivity, as demonstrated by the measurement of Forbush Decreases in March and May 2024 at the Madrid station (40.4° N, 7 GV), the only deployed miniTRASGO unit at that time. These observations underscore the detector's reliability, even with its small active area of 0.1 m². Furthermore, due to its design and location, miniTRASGO can also serve as a complement to existing neutron monitor stations from the NMDB, such as CaLMa, which is geographically close to the Madrid station. By detecting the secondary muon component of cosmic rays, it offers an additional perspective to cosmic ray studies.

With additional deployments in Warsaw, Puebla, and Monterrey by early 2025, each positioned at distinct latitudes (52°N, 19°N, 25°N) and characterized by varying magnetic cutoff rigidities (2.5 GV, 8.2 GV, and 8.5 GV), the miniTRASGO offers a scalable platform for establishing a global muon monitoring network, enabling comprehensive studies of cosmic ray modulation and space weather effects.

Beyond global flux measurements, the miniTRASGO also allows for angular-resolved studies of cosmic ray variations, applying atmospheric corrections and analyzing rate dependencies on the arrival direction. These capabilities open new opportunities for investigating geomagnetic effects, solar modulation, and atmospheric interactions with cosmic rays, further enhancing the detector's contribution to multi-site cosmic ray research.

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