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Calibration of TAROGE-3 for High-Accuracy Angular Reconstruction

Ultra-high energy (UHE) neutrinos and cosmic rays not only provide critical insights into high-energy astrophysical phenomena but also serve as probes for physics beyond the energy scales accessible by human-made accelerators. The Taiwan Astro-Particle Radiowave Observatory for Geo-synchrotron Emissions (TAROGE) is an experimental project designed to detect radio emissions from extensive air showers induced by UHE neutrinos and cosmic rays. As one of the observatories in the project, TAROGE-3 consists of six antennas deployed on a mountain along Taiwan's east coast, facing the Pacific Ocean.
To distinguish signals originating from downward-propagating cosmic rays and upward-traveling neutrinos, interferometry plays a crucial role in determining the incident direction of primary particles, necessitating precise synchronization between channels and accurate antenna positioning. In this study, we present the calibration techniques implemented for the TAROGE-3 system, including photogrammetry, drone-based pulser calibration, and back-end data processing, to meet these requirements. Through these methods, we have achieved an angular resolution of approximately 0.5 degrees and established a solid foundation for further data analysis.

Section

High Energy

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