Contribution submission to the conference Erlangen 2026

Directional Search for Ultra-High-Energy Photons Using the SD-1500 Array of the Pierre Auger Observatory — •Tim Fehler, Marcus Niechciol, and Markus Risse — Experimentelle Astroteilchenphysik, Center for Particle Physics Siegen, Universität Siegen

In addition to its capabilities for precise measurement of ultra-high-energy (UHE, $E > 10^{17}$ eV) cosmic rays through the observation of extensive air showers, the Pierre Auger Observatory offers the potential to effectively detect UHE photons. Their connection to UHE cosmic rays is manifold; constraints on their flux provide valuable hints on the elusive nature of the UHE cosmic rays. Contrary to charged cosmic rays, which are deflected by magnetic fields, UHE photons have the inherent advantage that their origin can be traced back directly, which promotes the search for directional excesses of photon-like events in the sky. This contribution details the full modular analysis pipeline for a new direction-dependent search for UHE photons, based on a novel photon-tagging approach using the paradigm of air-shower universality. With sole dependence on the SD-1500 array, given its 100% duty cycle, the full 19 years of Phase-I data will be available for analysis, providing unprecedented exposure to a potential UHE photon flux. Beyond the methodology, the contribution also covers the first preliminary application to data for final cross checks.

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