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The AugerPrime Radio Detector: Enhancing the Sensitivity to UHE Cosmic Rays

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The ongoing AugerPrime upgrade at the Pierre Auger Observatory significantly enhances the sensitivity and precision for measuring ultra-high-energy (UHE) cosmic rays beyond the baseline design. A crucial element of this upgrade is the installation of the Radio Detector (RD), comprising loop antennas mounted on top of each of the 1660 water-Cherenkov detectors (WCD). These dual-polarized antennas are sensitive to inclined air showers and will enhance the Observatory's sky coverage and exposure. Particularly notable is the RD's high sensitivity to the electromagnetic component of air showers, providing new data for reconstructing the primary mass, energy, and arrival direction of cosmic rays. It will complement the WCD's sensitivity to muons, helping to yield a measurement of the muon number and its fluctuations with high precision. The symbiosis of both systems opens new possibilities for detecting rare primary particles, such as UHE photons and neutrinos, with a high identification probability.

In this presentation, we discuss the design, current deployment status and measurements of the RD. With increasing number of equipped stations, we showcase statistics and reconstructions of detected events. We provide insights into calibration measures as well as cross-validations with the other detector components at the Pierre Auger Observatory. Finally, we highlight the potential of the Observatory with the inclusion of radio measurements and RD triggering, particularly for detecting air showers with weak particle footprints.

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