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Expected performance of the AugerPrime Radio Detector

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The AugerPrime Radio Detector (RD) will increase the sky coverage and overall aperture for mass-sensitive measurements of ultra-high energy cosmic rays with the Pierre Auger Observatory. The installation of over 1600 dual-polarized short aperiodic loaded loop antennas on an area of about 3000 km^2 will enable the detection of the electromagnetic radiation in the 30-80 MHz band from highly inclined air showers in coincidence with the Auger water-Cherenkov detector (WCD). The combination of complementary information from the RD regarding the electromagnetic shower component and the WCD regarding the muonic shower component yields a strong sensitivity to the mass composition of cosmic rays.

We will present the expected performance of the RD to detect and reconstruct inclined air showers. This study features comprehensive sets of Monte-Carlo generated air showers, utilizes a complete description of the instrumental response of the radio antennas, and in-situ recorded background. The estimation of an energy- and direction-dependent aperture yields an expectation of about 3900 events with energies above 10^{19} eV being detected during 10 years of operation. From a full event reconstruction, we quantify the achievable energy resolution to be better than 10% at and beyond 10^{19} eV. With this at hand, the potential to measure the number of muons and discriminate between different cosmic-ray primaries in combination with the WCD using inclined air showers is presented. The discrimination between proton- and iron-induced air showers is described with a figure-of-merit of 1.6.

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