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On the detection strategy of inclined air showers induced by ultra-high-energy particles

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The complex system composed of millions of electromagnetic particles in cosmic rays provides a free laboratory for studying fundamental particles. Research on this system has greatly promoted the development of physics over the past century and has also provided powerful research tools for high-energy physics and multi-messenger astronomy. Using simulated data, we have identified a new fundamental effect generated by electromagnetic particles—the geosynchrotron radiation in inclined air showers, resulting from strong magnetic fields. This discovery opens new research pathways for next-generation ultra-high-energy particle detection experiments and introduces new challenges for the reconstruction of cosmic rays incident at large zenith angles. Based on this work, we have optimized the correction factor for energy reconstruction in radio detection, achieving an initial primary energy reconstruction accuracy better than 10%. Meanwhile, by accounting for both atmospheric and magnetic effects, we have developed a new model that can accurately predict muon deflections in cosmic rays and facilitate mass resolution of cosmic rays.

Collaboration you are representing

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