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Simulating radio emissions from particle showers in complex media with CORSIKA 8

CORSIKA 8 is a modern Monte-Carlo simulation framework for particle showers in air and dense media. The calculation of shower-induced radio-emissions is a key element of the code, relevant for experiments targeting radio detection of cosmic rays and neutrinos.

In this contribution, we will report on the unique capabilities of CORSIKA 8 to simulate the radio emission from showers developing in inhomogeneous media and the propagation of this radiation through these complex environments that cannot be properly treated with other methods. We will review radio emission and propagation algorithms implemented in the code, including the "endpoint" and "ZHS" formalisms, numerical raytracing, and a new Green's function-based approach for a full-electrodynamics signal calculation provided by the "Eisvogel" package. A focus will be the comparison of these methods in situations relevant for radio neutrino observatories in the Arctic and Antarctic, which operate in a challenging environment. We will show how CORSIKA 8 can simulate the neutrino-induced radio signal in realistic glacial ice and help to characterize the background of near-vertical cosmic-ray air showers transitioning into ice, thereby helping to fully exploit the physics reach of these experiments.

Collaboration(s)

CORSIKA 8

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