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Modeling of radio emission from a particle cascade in magnetic field and its experimental validation

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The SLAC T-510 experiment was designed to compare controlled laboratory measurements of radio emission of particle showers
to that predicted using particle-level simulations, which are relied upon in ultra-high-energy cosmic-ray air shower detection.
Established formalisms for the simulation of radio emission physics, the "end-point"formalism and the "ZHS" formalism, lead to results which can be explained by a superposition of magnetically induced transverse current radiation and a charge-excess radiation due to the Askaryan effect.
Here, we present the results of Geant4
simulations for the SLAC T-510 experiment, taking into account the details of the experimental setup
(beam energy, target geometry and material, magnetic field configuration, and refraction effects) and their comparison to measured data with respect to e.g. signal polarisation, linearity with magnetic
field, and angular distribution. It shows that the macroscopic models reproduce the measurements within uncertainties and give a very good description of the data.

Summary

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