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Simulation of In-ice Askaryan Radiation from Air Shower Cores for Cosmic Rays Search with RNO-G.

The Radio Neutrino Observatory in Greenland (RNO-G) was designed to detect ultra-high energy neutrinos through Askaryan radiation. The detector utilizes radio antennas that are deployed both just below the ice surface and inside the ice boreholes to observe radio signals that come from above and below the ice surface. However, high energy cosmic rays'in-ice cores also produce radio emission and are expected to be observed with in-ice antennas. The recently developed Framework for the simulation of Air shower Emission of Radio for In-ice Experiments, FAERIE, allows us to simulate radio pulses present at in-ice antennas with high precision but at great computational cost. Given the large variations in energy and development of air shower cascades, the ability to quickly and efficiently simulate radio emission from air showers as seen by the in-ice antennas becomes imperative. In this study, we present an efficient simulation method that reduces computing time but maintains significant features of the Askaryan radio signals such as timing, polarization, and overall amplitude footprint. This enables various studies that require a large volume of simulations like classification of cosmic ray candidates, training neural networks, and events reconstruction.

Collaboration(s)

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