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Radar echo signals in the RET-CR experiment

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The Radar Echo Telescope (RET) collaboration aims to utilise in-ice radar techniques to detect ultra-high-energy (UHE) cosmic neutrinos, allowing insight into extremely energetic astrophysical processes. The current goal of the RET collaboration is to demonstrate the radar echo method in-situ with the Radar Echo Telescope for Cosmic Rays (RET-CR) experiment, situated in Greenland in 2023 and 2024. RET-CR targeted in-ice cascades produced by high-energy cosmic ray air showers impacting a high-altitude ice surface. These cascades resemble those produced by UHE neutrinos interacting in ice, allowing RET-CR to serve as proof of concept for the radar detection method. In this work, radar signals have been simulated with the semi-analytic simulation package MARES, using a detector setup resembling the RET-CR experiment. These simulations are then used to explore properties of the radar signal, including geometry-dependent features which can be characterised and linked to the arrival direction and energy of the cascade progenitor particles.

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