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Searching for RF-Only Triggered Cosmic Ray Events with the High-Elevation BEACON Prototype

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The Beamforming Elevated Array for COsmic Neutrinos (BEACON) is a concept for a neutrino telescope designed to measure tau lepton air showers generated from tau neutrino interactions near the horizon. This detection mechanism provides a pure measurement of the tau flavor of cosmogenic neutrinos, which could be used to set limits on the observed flavor ratios for cosmogenic neutrinos in a manner complimentary to the all-flavor neutrino flux measurements made by other experiments. BEACON is expected to also be capable of detecting cosmic rays through RF-only triggers. BEACON aims to achieve this sensitivity by using mountaintop radio arrays of dual-polarized antennas operating in the 30-80 MHz which utilize directional interferometric triggering. BEACON stations are designed to efficiently use a small amount of instrumentation, allowing for deployment in a variety of high-elevation sites. The interferometric trigger provides a natural tool for directional-based anthropogenic RFI rejection at the trigger level, broadening the list for potential station sites. The BEACON prototype has seen continuous design advancements towards improving the mechanical durability and scientific capabilities since its initial deployment at White Mountain Research Station in 2018. Here we present the current prototype's sensitivity to RF-triggered cosmic-ray background signals. We also present the next generation prototype, which includes scintillating cosmic ray detectors, improved antennas, and refined calibration techniques.

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BEACON

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Experimental Methods & Instrumentation

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