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Antenna design studies for the Radio Neutrino Observatory in Greenland (RNO-G)

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The Radio Neutrino Observatory in Greenland (RNO-G) is a radio neutrino array under construction at Summit Station, Greenland. It is planned to consist of 35 stations, of which 8 have already been deployed and are providing data. RNO-G will study ultra-high-energy (>10s PeV) neutrinos, thereby extending the energy range of current neutrino observatories (e.g. IceCube, KM3Net and GVD) and shedding light on the long-standing question of the origin of astrophysical neutrinos. Even in its partial configuration, RNO-G has already delivered science results while substantially improving detector calibration.

Looking ahead, RNO-G will serve as a blueprint for the radio expansion of the IceCube Neutrino Observatory which, together with an enlarged and upgraded in-ice optical array and a surface array of cosmic-ray detectors, will comprise IceCube-Gen2. Angular reconstruction in radio detectors benefits greatly from having both vertically and horizontally polarized antennas, as the polarization information significantly constrains the uncertainty on the reconstructed direction. An optimized design, tailored to the station geometry, of both antenna types is therefore key to achieving the scientific goals of a neutrino telescope.

Additionally, in order to reach the planned number of stations for IceCube-Gen2, adjustments to the RNO-G antenna design are needed to ensure mass-production capability while maintaining, or even improving, neutrino source sensitivity. This contribution presents the current status of the antenna redesign process, focusing on simulations of the antenna response and its impact on the angular reconstruction and the observatory's effective area.

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