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Motivations and Techniques of a Surface Detector to Veto Air Showers for Neutrino Astronomy with IceCube at the Southern Sky

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IceCube is the world's largest high-energy neutrino observatory, built at the geographic South Pole. For neutrino astronomy, a large background-free sample of well-reconstructed astrophysical neutrinos is essential. The main backgrounds for this signal are muons and neutrinos, which are produced in cosmic-ray air showers in the Earth's atmosphere. The coincident detection of these air showers by the surface detector IceTop is already used in IceCube analyses to veto atmospheric neutrinos and muons in the field of view of the southern sky. The success and limitations of the IceTop array as a cosmic ray veto motivate properties of future surface veto detectors. Dependent on different scenarios for the astrophysical neutrino flux a surface air shower detector has the potential to significantly improve IceCube Gen2.

Here, we summarize different physics cases for a surface veto and the motivation for different detection technologies based on first simulations and measurements.

Collaboration

IceCube

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