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Methods for a consistent treatment of systematic uncertainties in a combined analysis of IceCube's high energy neutrino data

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The IceCube Neutrino Observatory has been observing a diffuse astrophysical neutrino flux, measuring the energy spectrum and flavor composition in different detection channels. With about 10 years of data, we combine the detection channels focused on the event topologies of tracks and cascades to measure the energy spectrum and flavor composition with improved precision compared to the individual channels. The high statistics data samples require rigorous treatment of systematic uncertainties, which we aim to achieve with the so-called SnowStorm method, recently developed within the IceCube collaboration. This technique involves a continuous variation of systematics parameters during the detector simulation and requires a dedicated analysis approach. We present the validation of this method for the purpose of measuring the energy spectrum and flavor composition. The treatment of uncertainties on the atmospheric backgrounds entering the measurement as well as the method of combining the data samples is discussed.

Collaboration name

IceCube

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