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Validating NCQE interaction observables with T2K beam data for DSNB search in Super-Kamiokande

Wednesday 27 August 2025 18:00 (2 hours)

Neutral-Current Quasi-Elastic (NCQE) interactions on oxygen represent a dominant background in the Diffuse Supernova Neutrino Background (DSNB) search at Super-Kamiokande. We validate NCQE background rejection observables by analyzing T2K neutrino beam data, corresponding to 1.76×10^{20} protons on target. Three observables, multiple scattering goodness, Cherenkov angle, and reconstructed energy, are evaluated together with neutron capture detection. Neutrons are identified using a neural-network algorithm, for which an alternative configuration demonstrates the trade-off between detection efficiency and systematic uncertainty. We also assessed how hadron-nucleus interaction models affect both the event observables and the neutron multiplicity. The validated observables and neutron capture results offer key inputs for improving the DSNB search in Super-Kamiokande.

Collaboration you are representing

The T2K Collaboration

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