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Spallation Backgrounds in Super-Kamiokande

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Neutrinos have played a key role in astrophysics, from the characterization of nuclear fusion processes in the Sun to the observation of supernova SN1987A and multiple extragalactic events. The Super-Kamiokande experiment has played a major part in past in these astrophysical studies by investigating low energy $O(10)\text{-MeV}$ neutrinos. It has notably been instrumental in characterizing the 8B solar neutrino spectrum and currently exhibits the best sensitivity to the diffuse neutrino background from distant supernovae. Low energy searches however face significant challenges due to important backgrounds from cosmic muon spallation. Reducing these backgrounds will require implementing state-of-the-art neutron tagging algorithms to discriminate between different types of interactions, as well as a thorough characterization of spallation-inducing mechanisms. Here, we present an in-depth study of spallation backgrounds, in particular of the showers produced by muons passing through the detector. This study, and in particular the implementation of new FLUKA-based simulations, are expected to significantly impact analysis strategies for a wide variety of low energy searches in Super-Kamiokande.

Collaboration name

Super-Kamiokande

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