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First measurement of radioactive isotope production through cosmic-ray muon spallation in Super-Kamiokande IV

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Cosmic-ray-muon spallation-induced radioactive isotopes with β decays are one of the major backgrounds for solar, reactor, and supernova relic neutrino experiments. Unlike in scintillator, production yields for cosmogenic backgrounds in water have not been exclusively measured before, yet they are becoming more and more important in next generation neutrino experiments designed to search for rare signals, for example, the SuperK-Gd's SRN search. We have analyzed the low-energy trigger data collected at Super-Kamiokande IV and determined the yields of ^{12}B , ^{12}N , ^{16}N and ^9Li in the water for the first time. We also placed limits on the yields of ^{11}Be , $^8\text{He}/^9\text{C}$, and ^{15}C and gave the combined yield of ^8Li and ^8B . Agreement of the data with theoretical calculations is in general much better in water than in scintillator; only those isotopes produced as a result of ejecting many nucleons of ^{16}O significantly deviate by about a factor of four from predictions.

Primary author: CHEN, Shaomin (Tsinghua University)**Presenter:** CHEN, Shaomin (Tsinghua University)**Session Classification:** Poster Session**Track Classification:** Neutrino Physics