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Simulation of the background from (α, n) reactions in the JUNO scintillator

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The Jiangmen Underground Neutrino Observatory (JUNO) experiment aims to precisely measure reactor anti-neutrinos via the Inverse Beta Decay (IBD): $\bar{\nu}_e + p \rightarrow e^+ + n$. With a baseline of about 53 km from the closest nuclear power plants in southern China, the experiment is optimised to determine the neutrino mass ordering. The IBD occurs inside the 20 kton Liquid Scintillator (LS) detector, with events characterized by two energy deposition signals separated by a time interval of about 200 μs. One significant background is the ^{13}C$(\alpha,\ n)^{16}$O reaction, where the α particle, originating from the radio-impurities, interacts with the ^{13}C nuclei in the LS. To precisely measure reactor anti-neutrinos, it's crucial to evaluate the energy spectrum and rate of this background. In this presentation, we will introduce the first dedicated Monte Carlo simulation of the ^{13}C$(\alpha,\ n)^{16}$O background in the JUNO LS. The Monte Carlo simulation encompasses an event generator that uses the open-source Geant4-based simulation package, SaG4n. This is incorporated within the JUNO simulation framework, which also comprises detector simulation, electronics and the data structure. We will present for the first time the energy spectra of the estimated $(\alpha,\ n)$ background from the ^{238}U and ^{232}Th chains and from ^{210}Po in the JUNO LS.

Poster prize

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