Contribution ID: **66** Type: **Oral**

Simulation of the background from $^{13}C(\alpha, n)^{16}O$ reaction in the JUNO scintillator

Tuesday 26 August 2025 15:00 (20 minutes)

The Jiangmen Underground Neutrino Observatory (JUNO) is a next generation neutrino detector. The experiment will begin data collection this year. Its main and ultimate goal is to determine the neutrino mass ordering. To achieve this fundamental milestone, the precise reactor antineutrino energy spectrum must be extracted. Therefore, detailed knowledge of all relevant backgrounds in the liquid scintillator target is mandatory. Antineutrinos are detected through the inverse beta decay reaction in liquid scintillator. One possibly significant background for the measurements can arise from (α, n) reactions. These occur on ^{13}C nuclei due to the presence of residual radioactive impurities, primarily, ^{238}U, ^{232}Th, ^{210}Pb/^{210}Po and their daughters. This work describes the simulation of this background, performed using the open source Geant4-based software SaG4n, a new event generator and JUNO's detector response simulation package. Each stage of the (α, n) reaction is considered, including the α particle propagation in the medium until the (α, n) interaction and emission of a neutron and de-excitation particles from the excited states of the final nucleus. Expected (α, n) background event rates and respective energy spectra have been obtained for all α particle sources (^{238}U and ^{232}Th chains and ^{210}Pb/^{210}Po), considering JUNO's predicted radioactivity concentration. Corresponding uncertainties are also evaluated. It is important to note that the background from $^{13}C(\alpha, n)^{16}O$ reaction may influence geoneutrino sensitivity in JUNO. The framework and results presented here are relevant for other organic liquid scintillator neutrino detectors and may be useful in direct detection dark matter experiments.

Collaboration you are representing

JUNO

Author: GROMOV, Maxim (SINP MSU, JINR)

Presenter: GROMOV, Maxim (SINP MSU, JINR)

Session Classification: Underground Laboratories

Track Classification: Underground Laboratories – Technology