

The study of Rn in the JUNO prototype water system

The Jiangmen Underground Neutrino Observatory (JUNO) detector, under construction in a 700 meters underground lab, will explore the neutrino mass hierarchy by measuring the reactor anti-neutrino spectrum in a 20 kton liquid scintillator detector. For the sake of suppressing the radioactivity from the surrounding rocks and tagging the cosmic muons, the outer of the central detector is filled with water and equipped with ~2000 MCP-PMTs (20 inches) to form a water Cherenkov detector. Therefore, the strict requirements are put forward for radioactivity in water. One of the most important background of the experiment is the natural radioactive radon (Rn) which is soluble in water. Three cascade degassing membrane devices were installed in the JUNO prototype water circulation system to measure the removal Rn efficiency and to keep low Rn concentration in water. In order to monitor the Rn concentration in water, a high sensitivity detector for Rn in water and gas has been set up. The principle of radon detector is the electrostatic collection of the daughter nuclei of ^{222}Rn , and the energy measurement of the alpha decay with a PIN photodiode. Using ^{241}Am - ^{239}Pu hybrid source and ^{222}Rn gas source known concentration calibrates the radon detector. The background level of the radon detector was measured by using nitrogen. As a result, Rn concentration of the detector background is 0.3 Bq/m^3 . The better results can be obtained by optimizing the detector and can satisfy JUNO's requirements.

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