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Purification strategy of the JUNO liquid scintillator

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JUNO (Jiangmen Underground Neutrino Observatory) is a 20.000-ton multipurpose underground liquid scintillator detector, which is designed to study the fundamental neutrino parameters. The central detector of JUNO will be filled with a liquid scintillator (LS) mixture, composed of LAB as solvent, 2.5 g/l PPO as fluor and 3 mg/l bis-MSB as wavelength shifter. Given the huge mass, the high transparency and attenuation length (> 20 m @ 430 nm), high light yield (~1500 p.e./MeV) and low radioactive impurities (^{238}U,^{232}Th <10^{-15} g/g) are key parameters for the scintillator, and fundamental to achieve the experimental goals of JUNO. In order to reach the desired LS indexes, a dedicated sequence of 5 purification processes has been studied and implemented with large scale plants (nominal flow rate 7 m^3/h) at JUNO site.

Firstly, the raw LAB is filtered through Al_2O_3 powder to improve its optical properties. The second step is the distillation in partial vacuum, in order to remove heavy and high-boiling impurities and further enhance the transparency. The PPO and bis-MSB are washed and dissolved into the LAB by the Mixing Plant, according to the LS recipe, and sent to the underground laboratory for the last two steps. The water extraction aims to get rid of polar radioisotopes and ions, while the gas stripping process is effective in removing gaseous contaminants naturally dissolved into the LS.

The first joint commissioning campaign of all the plants has been recently concluded onsite, to prepare the 6-months filling phase of JUNO detector. Several measurements and tests are accomplished on purified LS samples, to check the performances and evaluate the purification efficiency of the plants. In this poster, all plants will be introduced and some preliminary results will be presented.

Poster prize

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