



Contribution ID: 1606

Type: Poster

The 20-inch PMT system for the JUNO experiment

Monday, 8 August 2016 18:30 (2 hours)

The Jiangmen Underground Neutrino Observatory (JUNO) is a multi-purpose neutrino experiment currently under the stage of civil construction. The primary goal is to determine the neutrino mass hierarchy and precisely measure the oscillation parameters by detecting reactor anti-neutrinos. There will be around 20000 PMTs with a large photo-cathode of 20-inch equipped for the JUNO experiment, which include 15000 MCP PMTs from a Chinese vendor and 5000 Dynode PMTs from Hamamatsu. To achieve the designed 3% energy resolution, the PMTs are required to have very high detection efficiency as well as very compact layout in the central detector. The PMT system for JUNO includes PMT characterization, waterproof sealing, chain implosion protection, earth-magnetic field shielding, and finally their installation to the detector. Characterization of the PMTs will use a test stand developed in a container for mass testing and a scanning station for sampling test. Since the PMTs are required to work for 20 years in high purity water with a depth up to 45 m, and the front-end electronics including base, high voltage and the ADC chips will be put on PMT, it is very important to design a highly reliable waterproofed sealing. And in a situation that the PMTs will be closest possible arranged with the spacing only a few mm to achieve a coverage larger than 75% in the central detector, their protection from chain implosion and also their installation is very challenging. In this talk, all the aspects of building the large PMT system for the JUNO experiment will be addressed, with a focus on the most challenging parts mentioned above.

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Session Classification: Poster Session

Track Classification: Detector: R&D and Performance