

20-inch Photomultiplier Tube Timing Study for JUNO

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Abstract

Jiangmen Underground Neutrino Observatory (JUNO) is now under construction at Jiangmen, Guangdong, China for determination of neutrino mass ordering with 3% energy resolution at 1 MeV, a precise measurement of neutrino oscillation parameters, and other neutrino physics. The central detector is made up from a 35.4 meters diameter acrylic sphere which contains 20 kton of liquid scintillator inside and is surrounded by thousands of 20-inch photomultiplier tubes (PMTs) on its surface. And PMTs performance is one of the JUNO's key success to reach the high resolution. In this study, the PMT characteristic and its timing related response were determined via the PMT generated signals, extracted from the PMT testing with scanning station system. About 2,400 of micro-channel plate PMTs (MCP-PMTs) and dynode PMTs were analyzed for their response with LED source such as rise time, fall time, transit time spread (TTS), gain, etc., which relate to photon hit on different positions of PMT's glass surface. Furthermore, we also observed the fluctuation of PMT performance under higher magnetic field which can decrease the PMT photon detection efficiency (PDE).