

The MCP-PMT for Neutrino Detector

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Microchannel plate (MCP) is always used in the small PMTs as the electron multiplier for the fast timing detection, which greatly improved the time resolution of PMT. The large scaler neutrino detectors, such as SuperK, DayaBay, JUNO and HyperK, need the large area PMTs for the large photocathode coverage and less electronic channels. Usually there was only one type of 20 inch PMT based on the Dynode part by the Hamamatsu company in Japan.

Researchers at IHEP have conceived a new concept of large area MCP-PMT several years ago. The small MCP units replace the bulky Dynode chain in the large PMTs. In addition the transmission and reflection photocathode in the same glass bulb to enhance the efficiency of photoelectron conversion.

After several years R&D, the 20 inch MCP-PMT was successfully produced. This type of PMT has large sensitive area, high QE, and large P/V for good single photoelectron detection. Compensating the PMT performances, cost, radioactivity, the JUNO ordered 15000 pic 20-inch MCP-PMT from the NNVT in Dec.2015. The MCP-PMT collaboration group finished to build the mass production line and batch test facility in Nanjing in 2016. From 2017 to 2019, all the 20-inch PMTs will be produced and tested one by one in NNVT for JUNO. This presentation will talk about the R&D, the mass production and batch test result of the 7K pieces of MCP-PMT prototypes for JUNO.

Further more, the QE of this type of MCP-PMT is improved from 28% to 34%@410nm in 2018, and this new technology has already used on the PMT mass production. And also in 2018, another Flower-liked MCP-PMT was designed with the TTS less than 5ns, and this new type of 20 inch MCP-PMT has already evaluated by the PMT group in LHAASO and HyperK.

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