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The Simulation of MCP and 20 inch MCP-PMT

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Large-area MCP-PMT is an essential device for the neutrino detection experiment. The PMT requirements for this experiment are listed as follows: (1) Large size, high cathode coverage, and single PMT cathode as possible as covering its inner surface in 20 inches. (2) High detection efficiency. (3) Good single photoelectron detection capability and a large dynamic range. (4) Low radioactive background. (5) More than 20 years' lifetime. Taking into account of this,The simulation was done by two part, one is the simulation of the MCP the other is the simulation of the MCP-PMT.

For the high collection efficiency and high gain of the MCP, the model parameters are determined through the simulation are as follows: tha channel lengh is 410um, the diameter of the channel is 10um, the channel inclination angle is 10°, the input and out put electrode immersion depth are 5um. The simulation of two pieces of MCP is done . We adjust the distance and voltage between them, that makes the Cain of them can be 10e7, when the bise voltage is 800V. The collection efficiency can be 73,7% (the maxmum value is 80.2%). Yet for MCP-PMT, the effective work area of the photocathode of PMT should be large enough, the collection efficiency of MCP for the photoelectrons emitted from photocathode need be higher, and the MCP-PMT possesses smaller TTS. A 20 inches MCP-PMT which has ellipsoid structure was designed via computer simulation. The diameter of photocathode is 500mm. It includes transmission-type and reflection-type photocathode, which is able to improve its transformation efficiency. Meanwhile, we designed the best structure of the PMT whose collection efficiency is 98%, and the TTS is 17.7ns. Even considering the influence of the geomagnetic field, the collection efficiency can reach 86%

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