Contribution ID: **693** Type: **Poster**

Research of the 20-inch Microchannel Plate Photomultiplier with Transit Time Spread Improved

Friday, July 6, 2018 8:15 PM (15 minutes)

Abstract: The transit time spread (TTS) is an important parameter of photomultiplier tube in the high energy physics field. By the software of CST and Matlab, the theoretical model of the photomultiplier tube structure was established, and the particle sources theoretical model was established according to the M-C integral sampling method of cosine distribution. Based on the establishment of theoretical models, the trajectories of photoelectrons in the 20-inch microchannel plate photomultiplier were simulated. The influence of the focusing electrode structure and the divided voltage ratio between the photocathode and the surface of the first microchannel plate on the TTS was analyzed. The simulation results were that, the transit time spread was improved greatly by adjusting the focusing electrode structure and the divided voltage, and the focusing electrode structure looked like flower. According to the theoretical simulation results, the 20-inch microchannel plate photomultiplier with TTS improved was produced. The TTS of the new 20-inch microchannel plate photomultiplier with the flower-like focusing electrode was about 5 ns (FWHM), and the TTS of the initial 20-inch microchannel plate photomultiplier was about 20ns. The TTS of the new 20-inch microchannel plate photomultiplier was much better than the initial one. The research of improving the TTS was in favor of enlarging the application of 20-inch microchannel plate photomultiplier in the high energy physics field.
Keywords: transit time spread, microchannel plate, photomultiplier tube, focusing electrode.

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Session Classification: POSTER

Track Classification: Detector: R&D for Present and Future Facilities