

Development of Threshold-Type Aerogel Cherenkov Counter with A Low Mis-PID Rate

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Abstract

Charged particles sometimes produce knock-on electrons. The speed of an electron with the kinetic energy of 2 MeV is approximately 98% of the speed of light. Therefore, Threshold-type Cherenkov counters sometimes fail to identify particles because of knock-on electrons. It is difficult to distinguish Cherenkov light produced by original charged particles from Cherenkov light produced by knock-on electrons, when using a standard threshold-type Cherenkov counter which use a small number of large-area photomultiplier tubes (PMTs). We are developing a threshold-type Cherenkov counter. In a standard counter, charged particles enter to the radiator perpendicularly. In our counter, charged particles have a small incident angle to the radiator. The area of the radiator of our counter is larger than that of a standard counter. However, the required volume of the radiator of our counter is nearly the same as that of a standard counter, because the thickness of the radiator of our counter can be reduced. In addition, the number of necessary PMTs of our counter is nearly the same as that of a standard counter, because PMTs of our counter are installed obliquely. In our counter, the PMT which most of the Cherenkov light produced by the original charged particles enter differs from the PMT which most of the Cherenkov light produced by the knock-on electrons enter. Therefore, the error rate of particle identification (PID) is greatly reduced. The mis-PID rate in standard threshold-type Cherenkov counters is 3 to 5%, and that in our counter is expected to be 0.5% or less.