T491 and T503 report

Study of an extruded scintillator detector with wave-length shifting fiber readout for K2K

T. Nakaya, M. Hasegawa, I. Kato, H. Maesaka, K. Nishikawa, S. Yamamoto (Kyoto U.)
Y. Hayato, A. Ichikawa, T. Kobayashi, M. Yoshida (KEK)

A primary purpose of T491 and T503 experiments is to study a basic performance of an extruded scintillator detector with wave-length shifting (WLS) fiber readout. The key technology studied in these experiments will be applied for a new neutrino detector in K2K, which is Full Active Scintillator Tracker named SciBar (Scintillator Bar) detector. Features of the detector are:

- With an extruded scintillator, a large full-active detector can be built inexpensively. In addition, an uniform response of each segment in the detector is expected.
- By using WLS fiber readout, the light correction from a large volume of the detector can be lead to small area of photo-detectors with high efficiency.
- A recent development of a multi-anode PMT makes it possible to read out many channels inexpensively, and to provide the precise measurement of the light yield.
- The recent ASIC (Application Specified IC) technology will be used to record multi-anode PMT information. We use VA/TA chip made by Ideas company.

We have tested the light yield and the uniformity of an extruded scintillator produced by Fermilab, which is originally developed for MINOS experiment. We measure 20 photo-electrons for 1cm thick scintillator with 1.5mmϕ WLS fiber (Kuraray Y-11 MS(200)). The result is shown in Figure 1 for pions and protons. We measure the dE/dx response as a function of charged particle momentum. The dE/dx information will be used for particle identification (PID) between a proton and a pion, and also used to measure the proton momentum. Since the PID capability is almost same as the result of T476, we show the proton momentum reconstruction in Figure 2 at this time.

T491 and T503 experiments are very successful and the results were presented at the JPS meeting [1, 2]. The new detector technology of extruded scintillator is satisfactory as a new neutrino detector. Currently, based on measurements of T491 and T503 experiments, the K2K SciBar detector is intensively designed, developed, and carried out.

References

[1] M. Hasegawa, ,JPS meeting at Shiga, "The development of a full active scintillator tracker for K2K upgrade", March 2002.

[2] S. Yamamoto, JPS meeting at Shiga, "The study of multi-anode PMT readout and the electronics for K2K upgrade", March 2002.

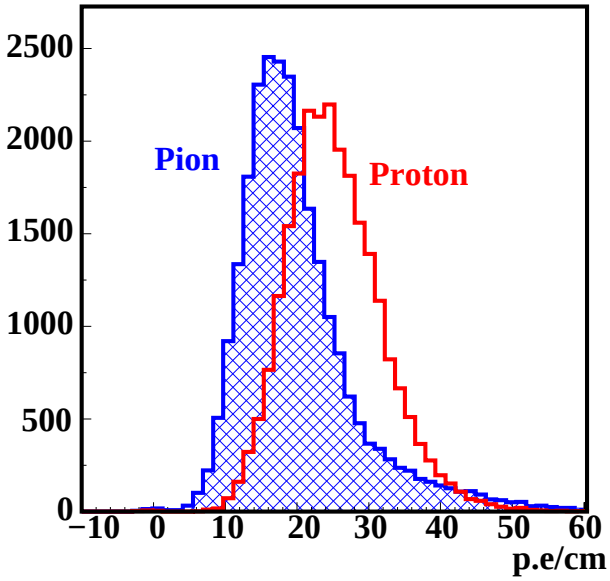

Figure 1: Light yield of extruded scintillator with 1.5 mmϕ WLS fiber readout.

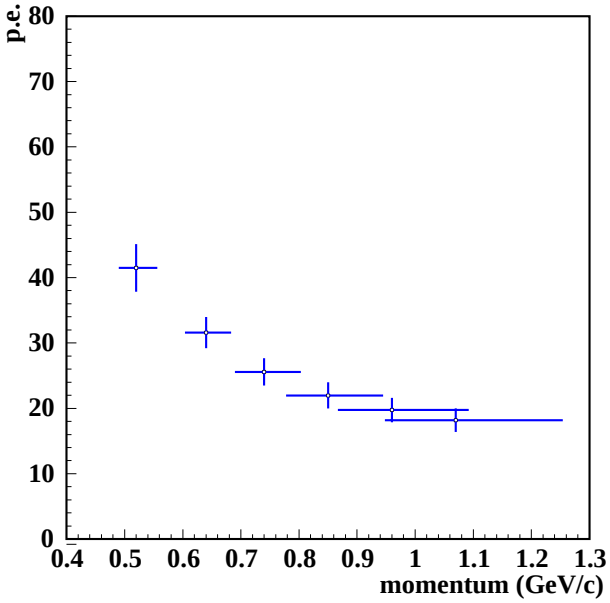

Figure 2: The relation between proton momentum and the light yield per centimeter. Based on this information, the proton momentum can be reconstructed by dE/dx.