

The purpose of this experiment is to research and develop a tracking detector consisting of plastic scintillator plates doped with light-scattering material (scatterer) and wavelength-shifting (WLS) fiber readouts. The WLS fibers (Kuraray Y11) are set in grooves carved orthogonally on the both sides of the scintillator plates (Figure 1). They are read out by 16-pixel multi-anode photomultipliers (MAPMT, Hamamatsu H6568). We can measure the passed position of a charged particle two-dimensionally.

One of the problems of this type of detector is that the scintillating light diffuses in the scintillator and it is difficult to specify passed position of a particle. To solve this problem, we dope the scintillator with scatterer. The scatterer prevents the scintillating lights from diffusing and localizes them. Then the lights are collected to the nearest fiber.

We confirmed the effect of the scatterer by preliminary test. This time, we measured the position resolution and hit finding efficiency as a function of scatterer concentration. We prepared two types of scintillators of which relative scatterer concentrations are 10 and 50, respectively. We measured the light distribution for the both scintillators using 1600 MeV/ c pion beam. The result is shown in Figure 2. We can easily find that the more concentrate one shows the better performance. In Table 1, position resolutions and hit finding efficiencies are summarized. The more concentrate one shows the better position resolution keeping good hit finding efficiency.

From this test experiment, T488, scatterer-doped plastic scintillator with WLS fiber readout is found to be a hopeful tracking detector.

Table 1: Position resolutions and hit finding efficiencies.

Concentration	Position resolution(cm)	Hit finding efficiency
10	0.31 ± 0.01	$0.990 \pm 0.003 \pm 0.007$
50	0.24 ± 0.01	$0.988 \pm 0.003 \pm 0.003$

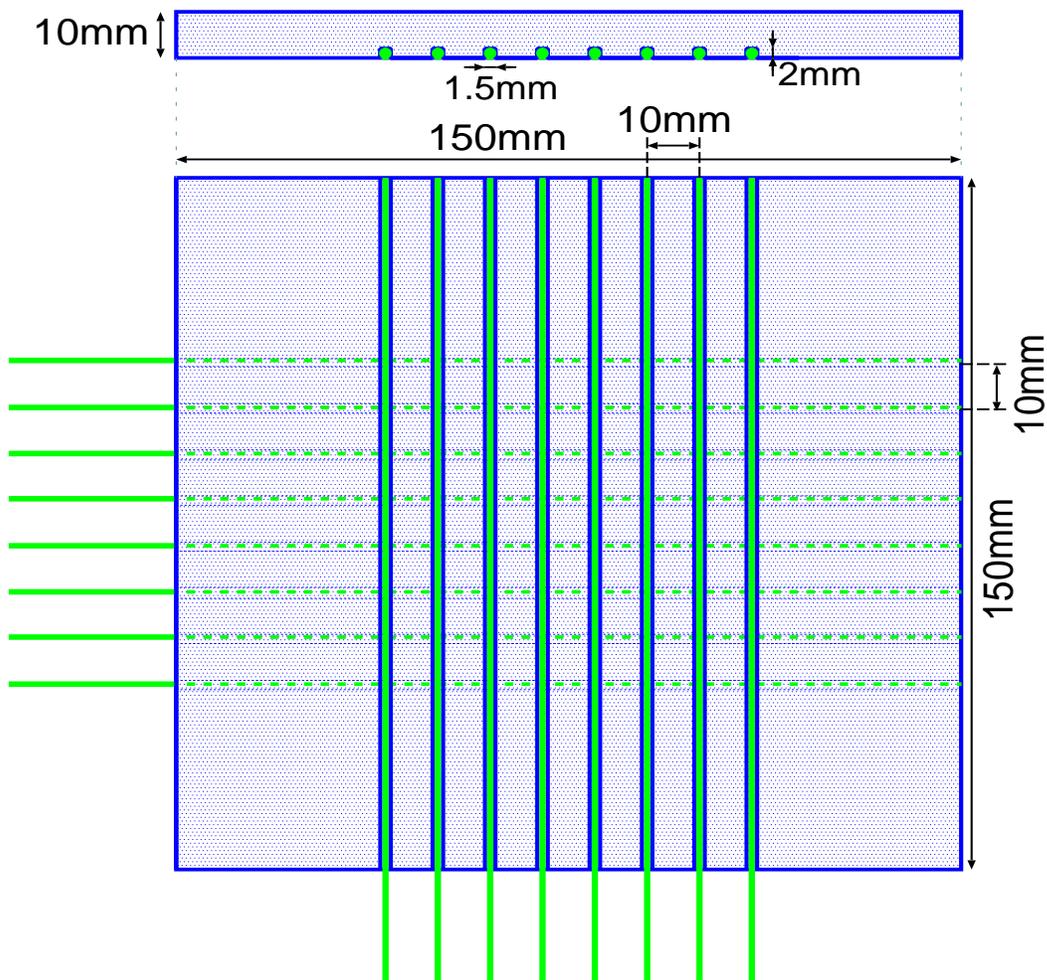


Figure 1: One layer of the detector. WLS fibers are set in the grooves carved orthogonally on the both sides of the plastic scintillator plate. Whole detector consists of the five layers in this test experiment.

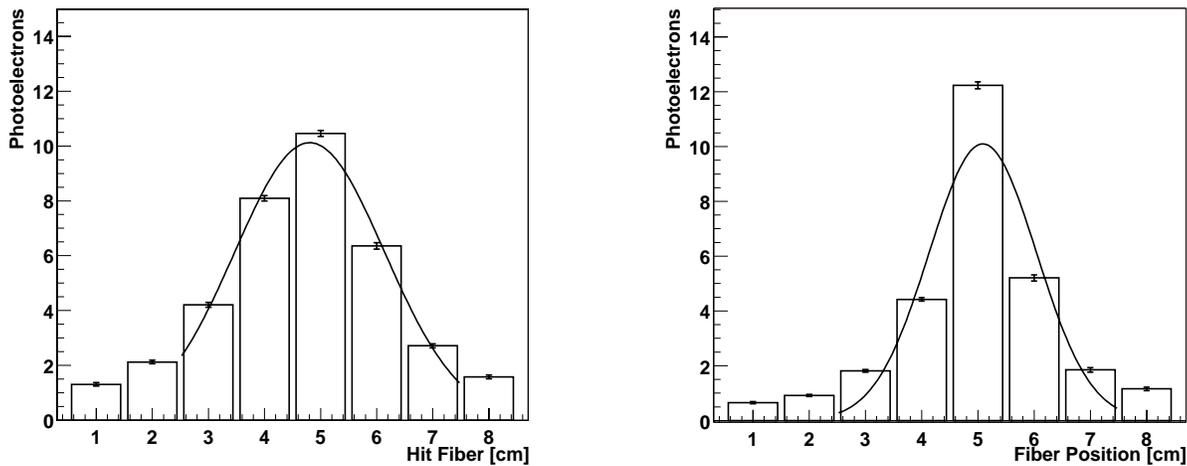


Figure 2: Light yield distribution in the scintillator. The vertical axis shows the light yield in photoelectrons and horizontal axis shows the readout fiber position. The left and right figures show the distributions for the relative scatterer concentrations 10 and 50, respectively.