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TEST OF A MULTIPM HODOSCOPE

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ABSTRACT

In 1982, we performed a first test of a beam hodoscope using a position sensitive photomultiplier. This paper presents the results of a second test, after improvement of the light collecting system, and with different types of scintillators (normal and optical fibers).

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1. INTRODUCTION

In such a hodoscope, the position sensitive photomultiplier "Multipm" [1] sees the light produced by the particles in a scintillator plate (the experimental set-up is displayed in fig. 1). The coordinates of the incident particle are obtained from an amplitude analysis of the anodes signals of the Multipm.

2. MEASUREMENTS AND RESULTS

The spatial resolution expected with such a detector depends on several factors:

- (a) The amount of light incident on the photocathode.
- (b) The size of the light spot on the photocathode, which itself depends both on the optical performances of the light collecting system, and on the size of the source of light in the scintillator.

In this test, the light collecting system was composed of a plane mirror, and a large aperture plastic lenses system replacing the Fresnel lens of the first test [2]. On the other hand, we also tested the detector with either normal scintillator plates or plates made of a bunch of scintillating optical fibers, prepared by the STIP (Saclay), directed along the beam direction. In principle, the fibers, for an equal amount of light should give a better resolution, the light source, in this case, being more punctual. The results obtained are summarised in table 1, and some of the images obtained are presented in figs. 2 and 3.

CONCLUSIONS

These results show an important progress in the sense that the resolution of the order of 1 mm is attained with a 5 mm thick scintillator instead of 10 mm used in our previous test.

Comparing the two types of scintillators, the optical fibers should afford a more punctual spot, but it seems that this quality is unfortunately compensated by a loss of luminosity due to the limited angular acceptance for the scintillation light inside the fibers.

Another factor limiting the final resolution is the angular aberration of the optical system which was not optimised in the present device.

Following some preliminary results from our optical calculations, a simple aspheric correction lens, will improve considerably the quality of the image.

Finally, the present performances of our detector can be summarised as follows:

Comparing to conventional hodoscopes, in X-Y planes, the 1 mm resolution in both directions was achieved by using a simple bloc of 5 mm thick scintillator, which presents not only a great mechanical simplicity, but also an advantage in the problem of detector materials.

Note also that the actual resolution already provides about 100 pixels over a sensitive area of $9 \cdot 9 \text{ mm}^2$ at the cost of an amplitude read out of only 16 anodes cells.

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- [1] New type of position sensitive photomultiplier K. Kuroda, D. Sillou and F. Takeutchi; Review of Scientific Instruments 52 (1981) 337.
- [2] High resolution scintillation hodoscope using a position sensitive photomultiplier, J. Ditta, D. Sillou, A. Michalowicz, H. Azaiez, K. Kuroda; Nuclear Instruments and Methods 220 (1984) 343-348.

TABLE 1

Scintillator Thickness-type	Resolution (fwhm)	Figure number	Comment
3 mm normal	.90 mm	3	image of 2 bars
5 mm normal	.84 mm	XX	not shown
10 mm normal	.77 mm	xx	not shown
5 mm opt fiber	.95 mm	xx	not shown
10 mm opt fiber	.83 mm	2	image of 2 points

FIGURE CAPTIONS

Fig. 1 Scheme of the multipm beam hodoscope.

Fig. 2 Image of 2 points distant of 5.5 mm with a 10 mm thick
 scintillating optical fibers plate.

Fig. 3 Image of 2 bars distant of 3.3 mm with a 3 mm thick normal
 scintillator plate.

FIG.1

FIG.2a.

FIG.2b.

FIG.3a.

FIG.3b.