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BEHAVIOUR OF SMALL STREAMER TUBES AS A FUNCTION OF THE ANGLE BETWEEN THE WIRE AND THE INCIDENT PARTICLE

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During the last runs on the t_6 beam of the CERN-PS (October-December 1982) we put in front of the hadron calorimeter prototype under test for the L3 experiment some short samples of small cross section tubes operated in streamer regime mode.

We tested three tubes:

(A) A square tube, 6x6 mm^2 in cross section, constructed in plastic material and coated with graphite to provide a conductive inner surface.

(B) A tube with the same cross section as (A), but obtained by a U shaped brass profile covered with a graphited plastic sheet.

(C) A square tube with smaller cross section, 4x4 mm^2, constructed in plastic material coated with graphite, as (A).

Tubes (A) and (B) were equipped with 50 μm diameter wires; tube (C) with a 30 μm diameter wire.

We used for all the measurements the same gas mixture, Argon/Isobutane $\simeq$ 1/4.

For all tubes we found the H.T. value for entering in the streamer regime either looking to the pulse shape at the oscilloscope or looking to the counting rate plateau in the beam. We did that for different amplifications of the electronic chain to avoid biases introduced by discrimination (see Fig. 1 for tube (C)). We choose to work at about 100 V inside the plateau (i.e. 3.8 KV for tubes (A) and (B), and 3.3 KV for tube (C)), where the pulse-height spectra are compatible with the one streamer per particle situation (Fig. 2).

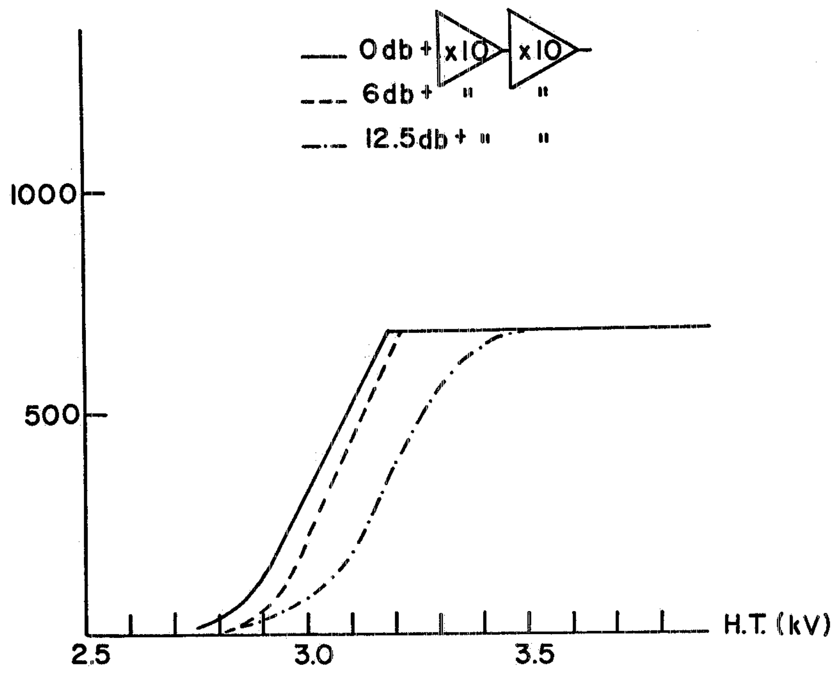

FIG. 1 - Tube (C) HV-Plateau for different attenuations.

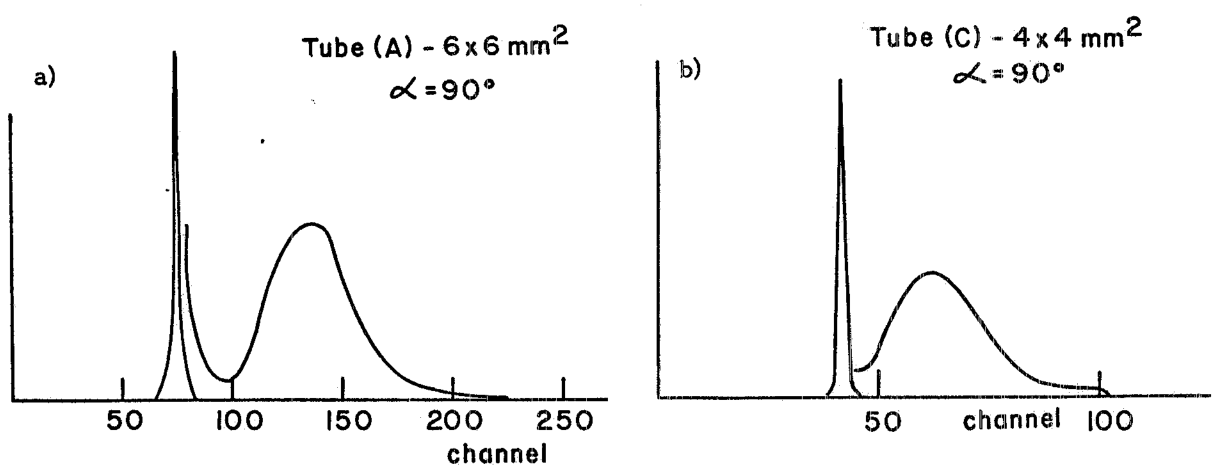

FIG. 2 - Pulse-height spectrum for minimum ionizing particle.

Our measurements can be classified in two groups :

1) Comparison of the p.h. spectra of tubes (A) and (B) for some values of the angle (α) between the wire and the beam, to check possible performance differences between graphited tube and brass tube.

2) Comparison of p.h. spectra for tubes (A) and (C) to study the influence of scaling down the geometry of the tube for 1.5 a factor.

The results for 1) are reported in Table I; the behaviour of the brass tube is only negligeably worse

TABLE I - 6x6 mm^2 cell - 50 μm wire - Argon/Isobutane $\simeq$ 1/4.

α (wire-beam angle)		Tube (A) (graphited plastic)	Tube (B) (brass)
90°	peak position =	59	59
	σ =	31%	33%
30°	peak position =	196	194
	σ =	22%	23%

than that of the graphited plastic tube. In particular the peak position of the p.h. spectra remains fixed, differently from what was previously obtained for Al tubes (see Fig. 3 of Ref. (1)).

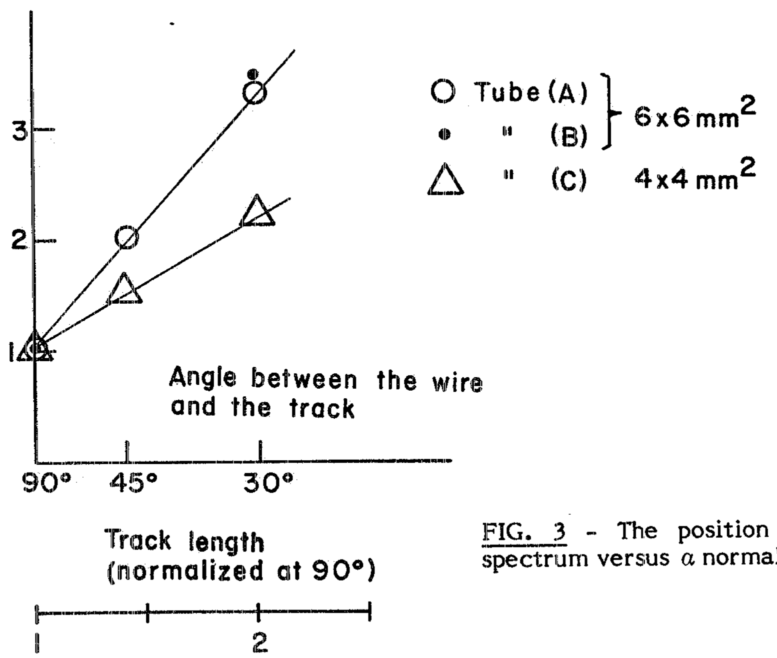

FIG. 3 - The position of the peak in the p.h. spectrum versus α normalized to α=90°.

The p.h. spectra obtained for tube (C) are compared with tube (A) in Table II for the two extreme values of the explored α. They show that tubes 4x4 mm^2 in cross section work well enough in streamer regime mode with the Argon/Isobutane mixture $\sim 1/4$. This is confirmed also by the fact that the length of the dead region along the wire due to a single particle crossing the tube perpendicularly to the wire is identical for all tubes ($\simeq$ 3.1 mm) as can be inferred from Fig. 3, where the trends with α for all tubes (normalized to α=90°) are reported.

TABLE II

α (wire-beam angle)		Tube (A) ($6x6 mm^2$)	Tube (C) ($4x4 mm^2$)
90°	peak position	59	18
	σ	31%	46%
30°	peak position	196	40
	σ	22%	38%

We thank all the members of the L3 Collaboration working on the hadron calorimeter test, and in particular we are grateful to V. Pojidaev and Y. Kamishkov from ITEP for their help during the runs.

REFERENCE

(1) G. Battistoni et al., "Influence of gas mixture and cathode material on limited streamer operation", LNF Report 83/1 (1983).