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U. Cazzola, F. Cervelli, V. Chiarella, P. Spillantini and
E. Zetti: A SIMPLIFIED MECHANICAL STRUCTURE
FOR DRIFT CHAMBERS.

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ABSTRACT. -

The mechanical structure of 21 modular drift chambers planned for an ISR experiment⁽¹⁾ is described. The new features of these chambers are a cheap and reliable power-supply distribution to the cathods and a very simple procedure for laying down sense and field wires.

A system of 21 drift chamber modules to be arranged in a telescope inside the aperture of a large toroidal magnet (Fig. 1) has been built for ISR experiment R 209⁽¹⁾. The chambers have a number of special features which can be of some interest in other cases. The telescope had to be placed as near as possible to the ISR pipe in order to cover small angles around the forward direction. To satisfy this requirement to the best the frame dimensions were minimized. Moreover the high rate of ionizing particles had advised to make the field shaping by means of stretched shaping wires.

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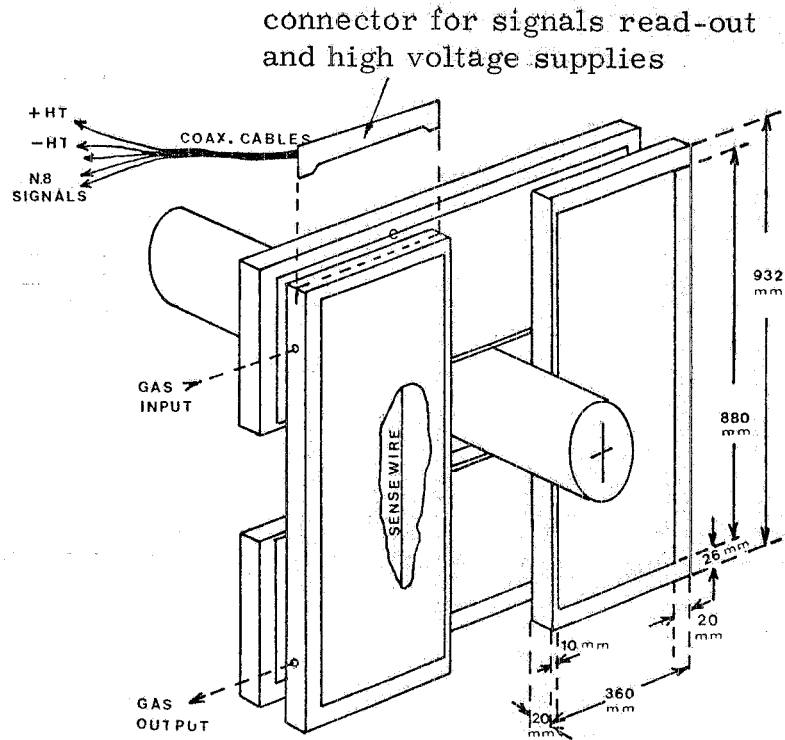


FIG. 1 - Sketch of four chamber arranged in a plane around the ISR vacuum pipe (lengths in mm).

Each module is 88 cm long, 32 cm wide and contains 8 cells, which are 4 cm wide. The distance between the cathodic planes is 1 cm. The frame consists of two fiber-glass rods kept 88 cm apart by means of two light aluminium supports (Fig. 2). The two planes of shaping wires are soldered on a simple flexible printed circuit (Fig. 3) glued around each of the fiber-glass rods (Fig. 4) and providing also the field distribution. The field and sense wires are laid inside the middle gap through hollow needles^(x) inserted in the rods and are soldered to the needles. The gas enclosure is obtained by gluing two mylar foils on each side of the frame. Holes for mechanical locking allow to arrange four chambers to form a plane (as in Fig. 1). As a result the total section of the frame supporting the wires is thus limited

(x) Commercial needles usually used for hypodermic injections.

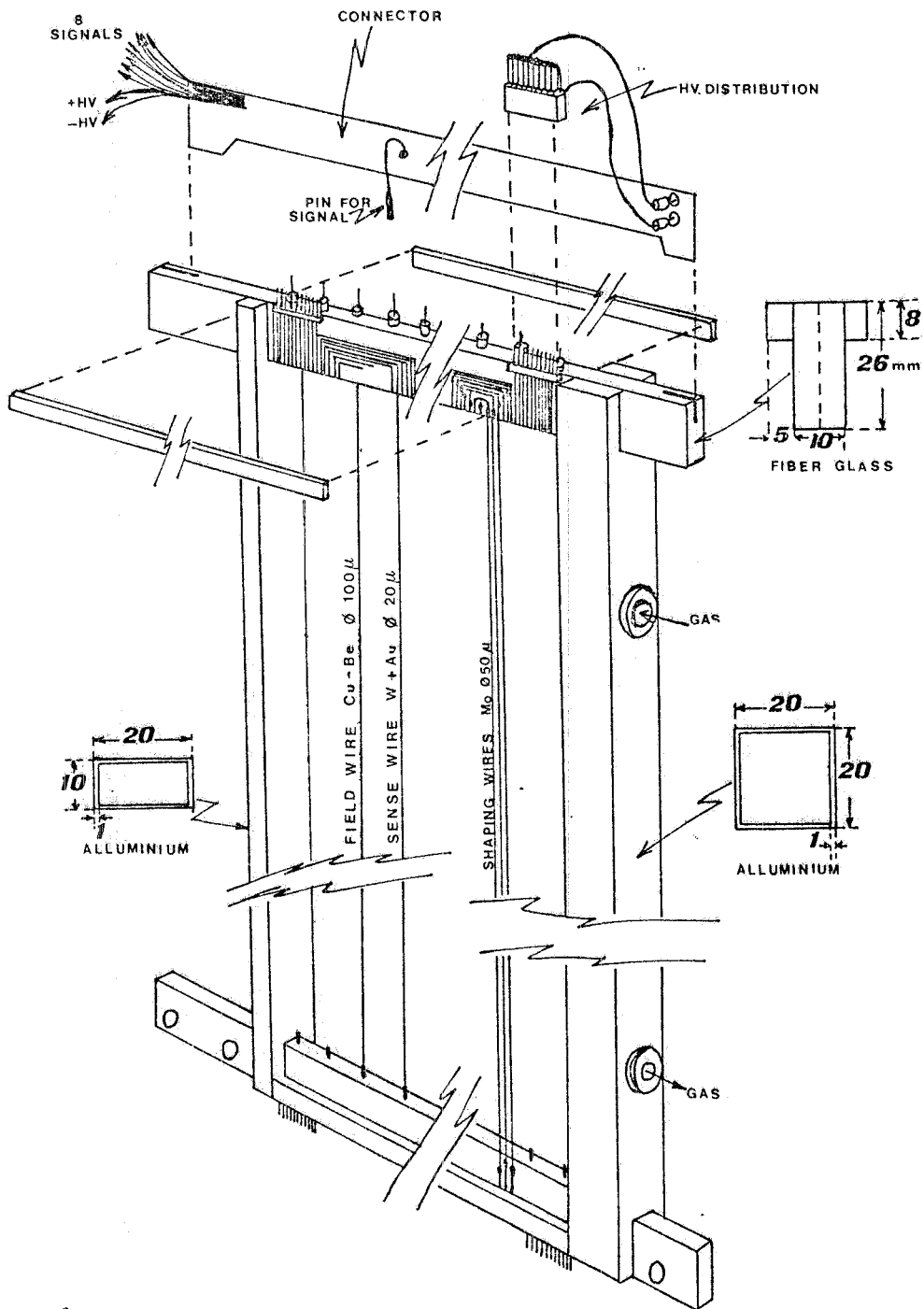


FIG. 2 - Assembly of the chamber frame with its electrical and gas connections.

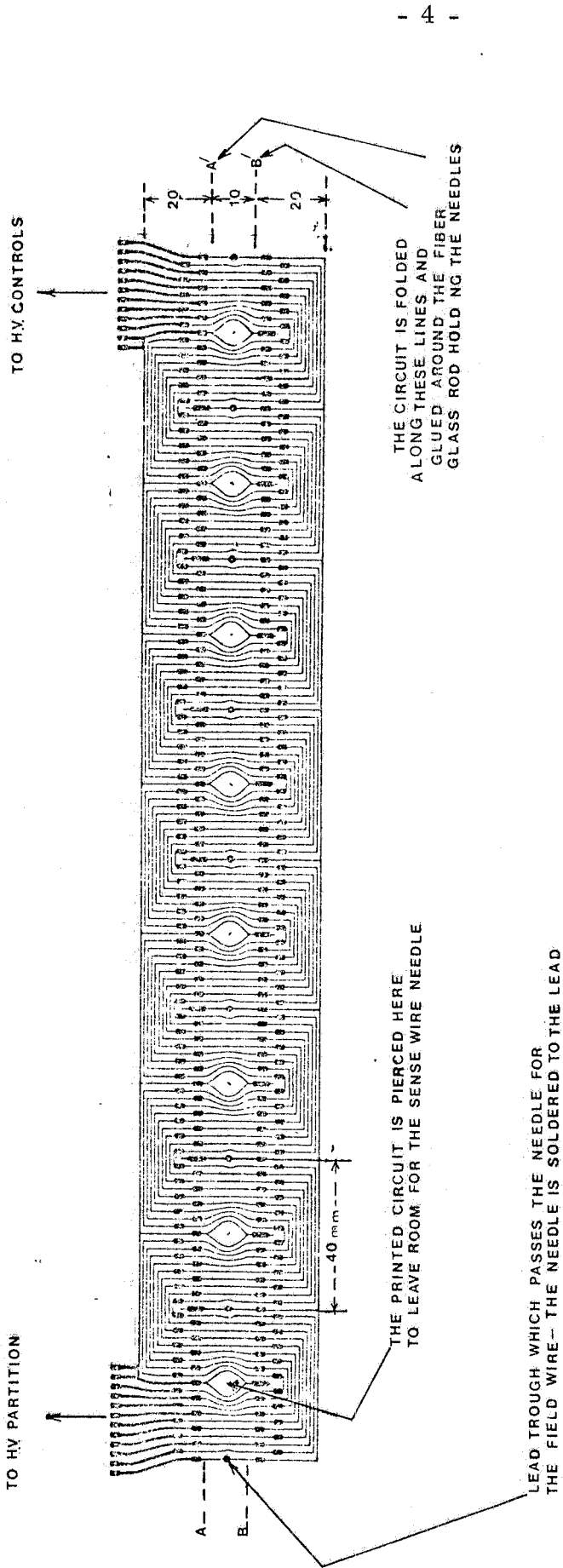


FIG. 3 - Printed circuit for voltage distribution to shaping wires. The support is made out of flexible material (Kapton) and is folded around the fiber-glass rod.

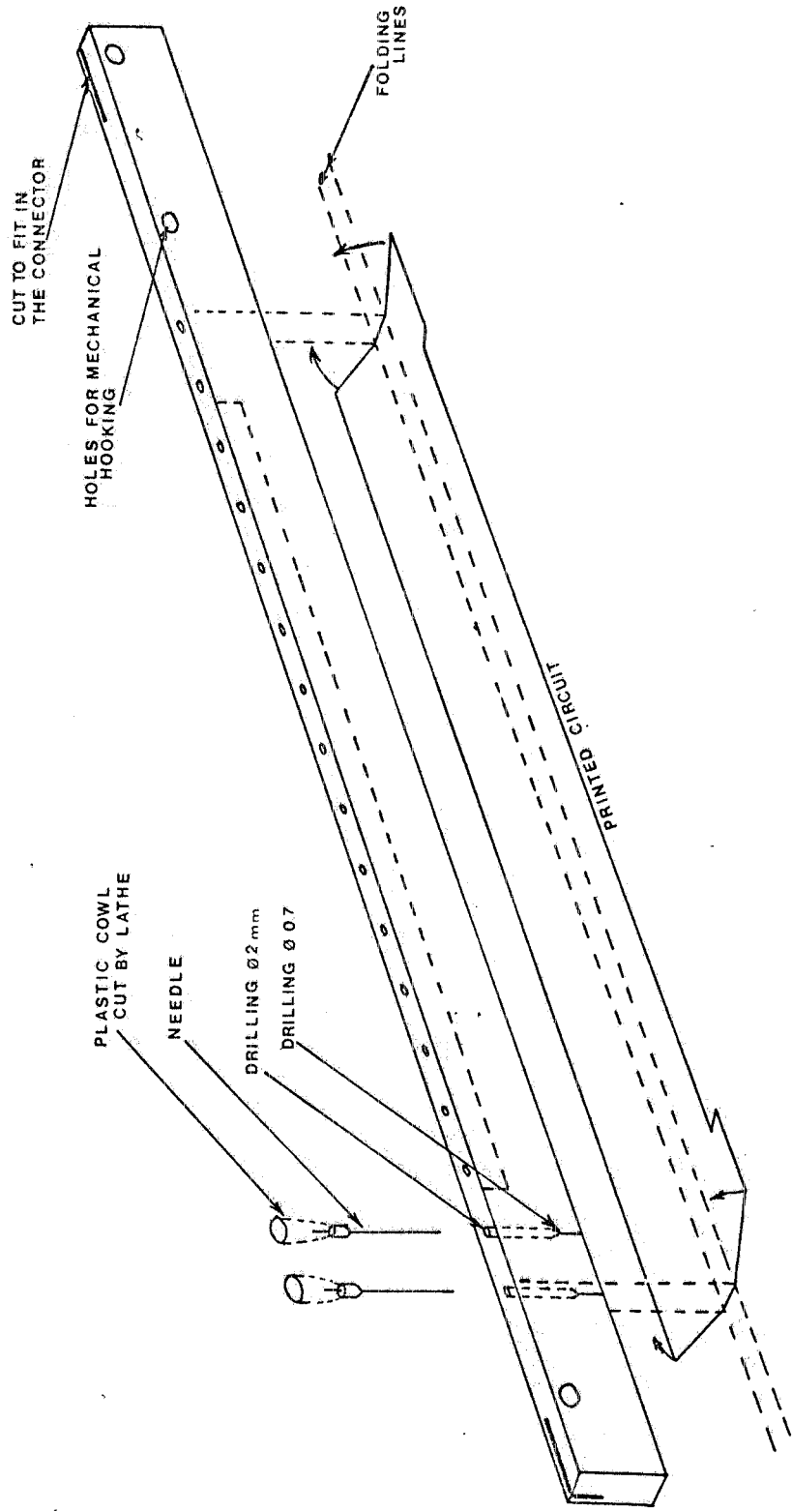


FIG. 4 - Assembly of printed circuit and hollow needles on the fiber-glass rod.

to only $20 \times 26 \text{ mm}^2$ (see Fig. 5).

The electrical connections (input of the H.V. and output of signals) are made on a printed board ("connector" in Fig. 2), mechanically separated from the frame: the contact with the sense wire is ensured by a short wire soldered on one side to the board and ending on the other side with a small pin; the field wires are supplied directly by the needles suitably soldered to the flexible printed circuit, thus avoiding an independent connection. Both ends of sense and field wires are accessible from the outside, which allows to detect easily any wire breakdown (and also to connect more than one wire to the same analysis chain). In our telescope the measurement of the longitudinal coordinate along the wire was not necessary. However, flat delay lines were mounted without difficulty on a previous prototype by fixing them on the flexible printed circuit in the same position as the three shaping wires facing the sense wires.

Typical H.V. plateau are shown in Fig. 6, from measurements taken during a high intensity ISR run (pp interaction rate = 0.3 MHz). The trigger was given by a scintillation counter hodoscope covering a solid angle larger than the telescope acceptance which opened a 400 nsec gate (i. e. particle hitting any point in the chamber cells were accepted).

As a conclusion the advantages of such a scheme can be summarized as follows :

- a) the shape of the field at the edges of the frame is optimized;
- b) the useful surface starts at distances as small as 15 mm from the frame;
- c) only one very simple printed circuit (one face, no metalized holes) is needed for each chamber;
- d) no auxiliary equipment is required for assembling the chambers;
- e) each module is very light (only 850 gr).

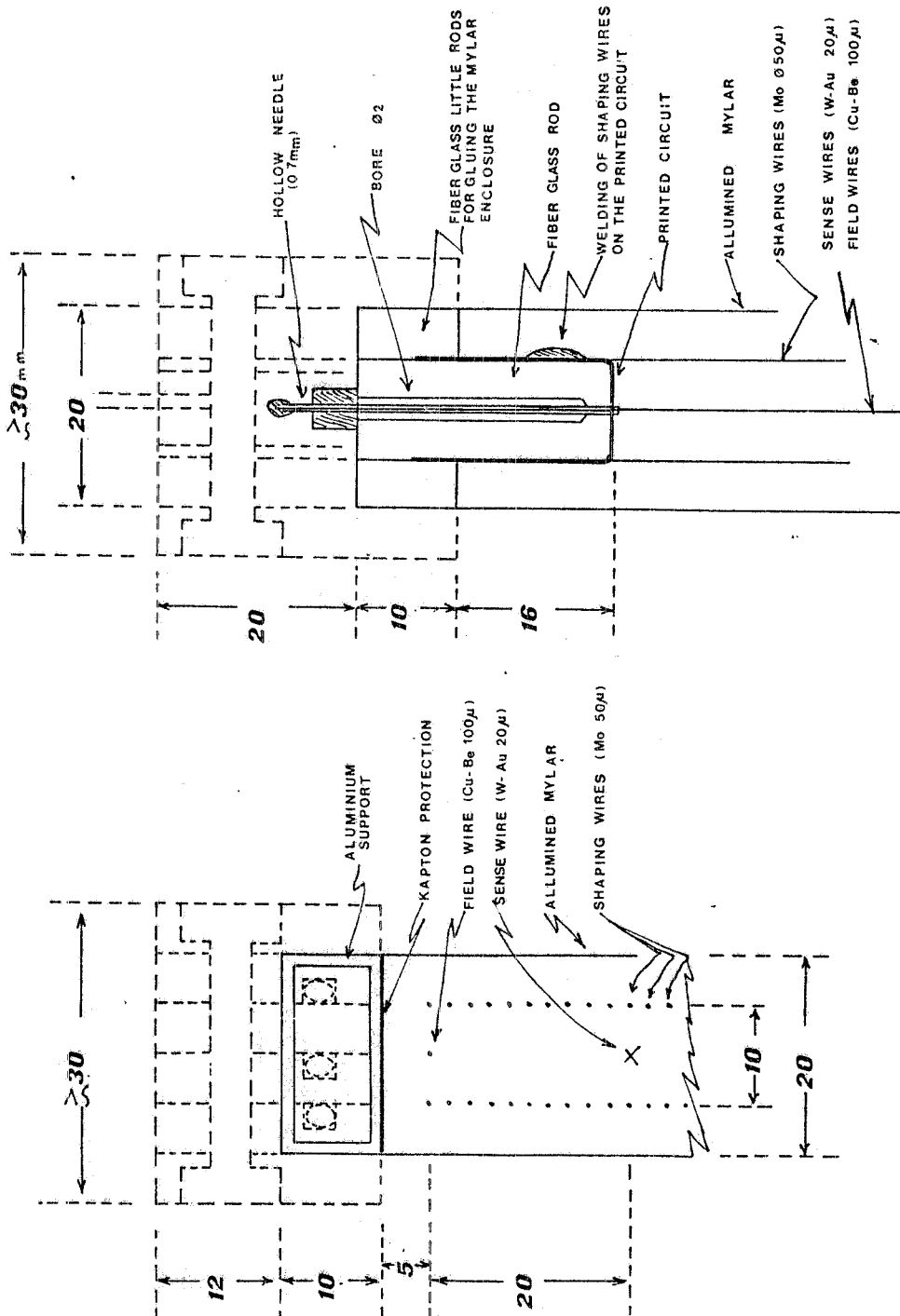


FIG. 5 - Sections of the frame on the side supporting the wires (a) and on the side near to the beam (b). For comparison a scheme is also shown (with broken lines) of a mechanical scheme consisting of separated fiber-glass parts assembled with rings and connecting screws between two aluminium frames.

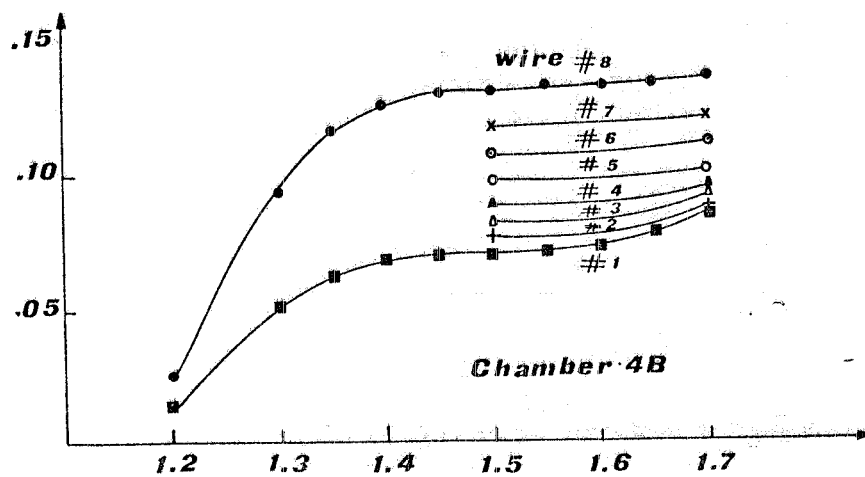
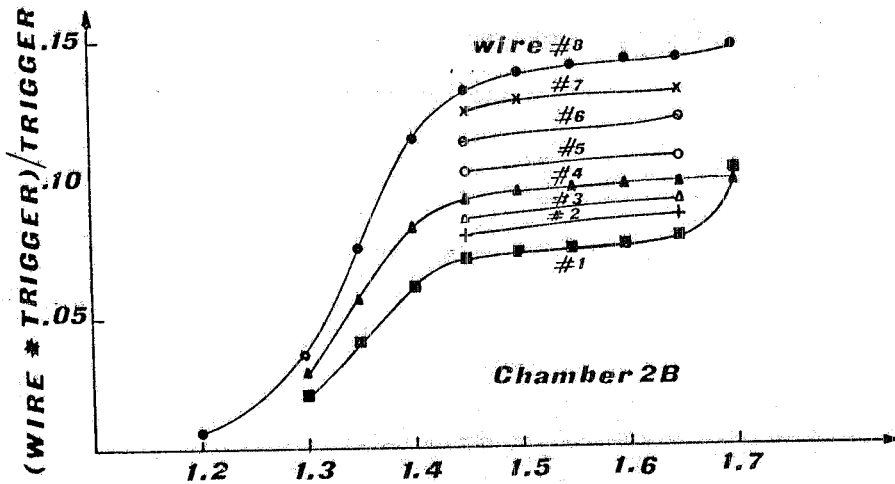
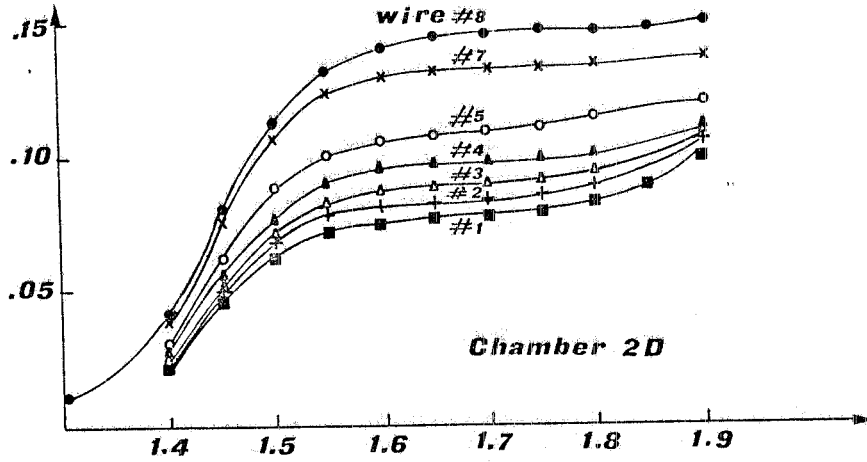


FIG. 6 - H.V. plateau for some chambers assembled near the pipe (see text). The trigger opened a 400 nsec gate at 300 KHz frequency. Negative H.V. was set at 2.0 KV.

Acknowledgments

We are very grateful the Detector Workshop of the Frascati National Laboratories for the skilful contribution in the construction of the chambers.

Reference

- (1) - G. Diambri-Palazzi et al., Proposal for an extension of the μ -pair experiment to include correlations with the associated hadrons, CERN/ISRC 73-28, Add. 1 (1973).