EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CERN - SPS DIVISION

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CEDAR TUNING

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1. INTRODUCTION

1.1 Short description

The Cerenkov Differential Counter with Achromatic Ring focus is a detector capable of identifying and flagging particles according to their masses.

Fig. 1 : Cross sectional view
Fig. 2 : CEDAR Hardware

The selection of the flagged particle is obtained by modifying the pressure of the filling gas (N_2 for the West type, He for the North type).

The Cerenkov light is collected through an achromatic optics and an adjustable ring diaphragm by 8 photomultipliers used in 6, 7 or 8-fold coincidence.

The counter is provided with an XY remote alignment mechanism.

1.2 Controls

The CEDAR is controlled through the BEAM TREE and has the following functions :

```
#TRUNK#/DETECTORS :
        ↓
        CEDAR/THRESHOLD...
        ↓
        STATUS/SETUP/TUNE/MEASURE :
              |     |     ↓
              |     |     EFFICIENCY, SCAN :
              |     ↓
              |     PRESS/MASS/DIAPHRAGM/ALIGNMENT :
              ↓
              TRIGGERS/PMS :
```

1.3 Beam parallelism

Before starting the tuning procedure it is important to check the beam parallelism in the CEDAR, especially at high momenta where the beam divergence starts to influence the optical resolution.

1.4 Guidelines to the users

a) The smallest dimension of the diaphragm aperture is a compromise between resolution and efficiency which has to be fixed by the experimental requirements.

An indication on the CEDAR limits may be obtained from Fig. 3, 4 (West type) and Fig. 5, 6 (North type) which give for each particle the nominal width of the light ring (curve a - full line), the contribution of multiple scattering (curve b - dotted line), and the separation from other particles, as a function of momentum.

b) Fig. 7 gives the efficiency as a function of the number of photoelectrons for different coincidence modes.

NPE must usually be $\geq$ 2.

c) When the triggers are removed from the beam, the ratio η_6/η_7 may be used to monitor the stability of the beam and CEDAR equipment.

2. TUNING PROCEDURE

2.1 Check the STATUS of the CEDAR. Faults are normally indicated.

2.2 Adjust the pressure to the value corresponding to the pion mass. The computed value is indicated in the status.

2.3 Using the branch ALIGNMENT, open the diaphragm to 18 mm and check the efficiency of the 8 photomultipliers which must be > 85 %.

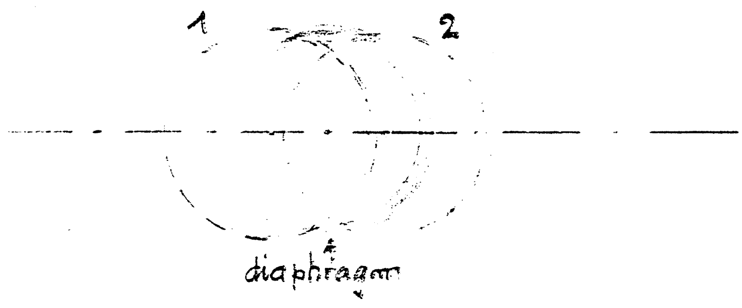
If not, use the branch SETUP → RESTORE to try to recover the nominal operational conditions.

Keep a copy of the final result giving R/L (right over left ratio) U/D (up over down ratio) and NPE (number of photoelectrons).

2.4 Align the CEDAR by closing progressively the diaphragm, starting from 2-4 mm, and by adjusting X and Y alternatively and by steps.

The CEDAR is correctly aligned, for a given value of the diaphragm, when the value of NPE is maximum for the values of R/L and U/D found in 2.3.

N.B. : Two positions of the light ring respective to the diaphragm give the same results for the ratios R/L and U/D



The way to move for optimization can only be found by trial.

2.5 <u>Pressure scan</u>

i) A pressure scan is necessary to find the experimental value of the pressure corresponding to the particles : small differences may exists with respect to the computed values.

ii) To reduce turbulences and instabilities a scan should better go from the highest to the lowest pressure.

iii) The starting pressure should be set through the orders TUNE → PRESS the read value of the pressure should be used as starting point.

This way to proceed speeds up the operations.

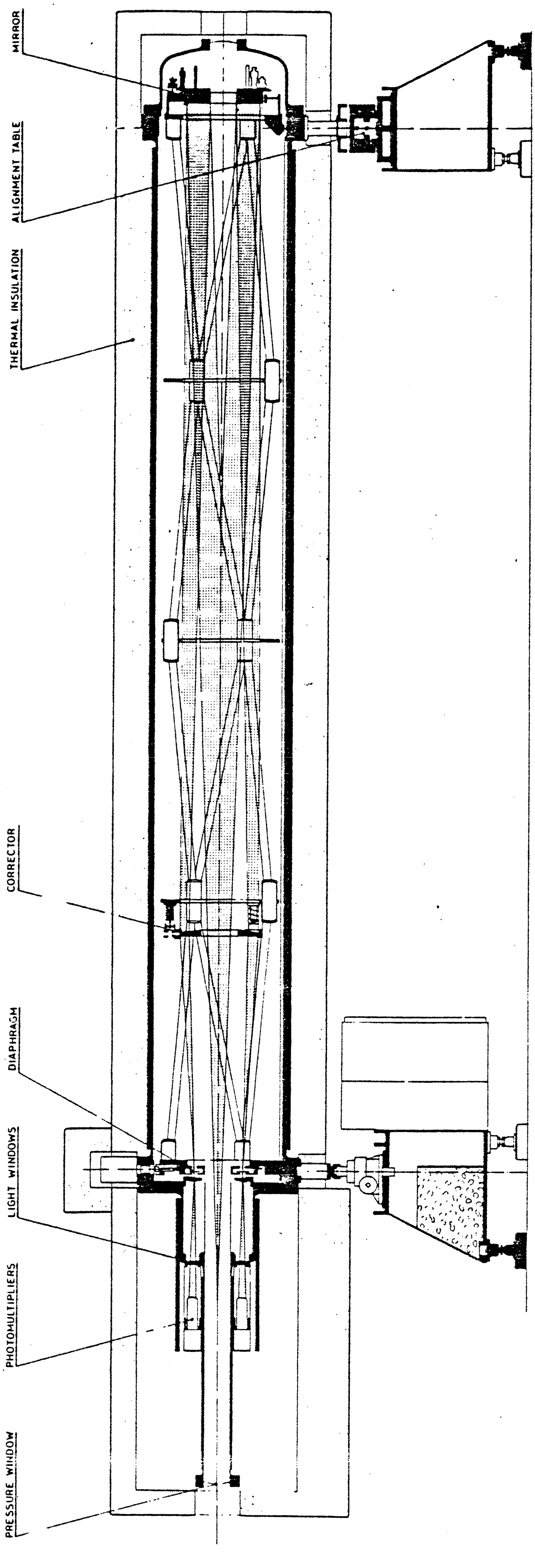


Fig. 1   Cross sectional view of a CEDAR counter

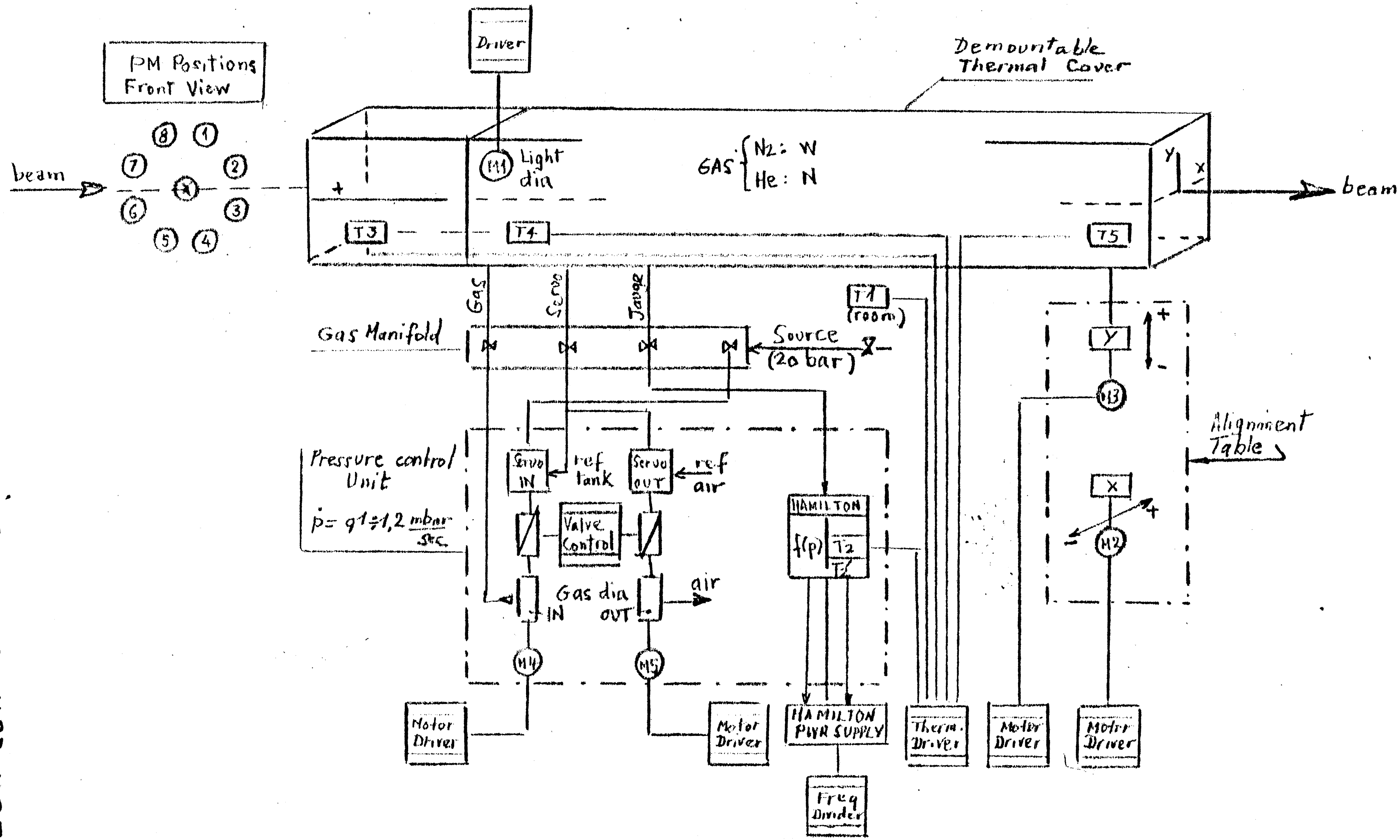
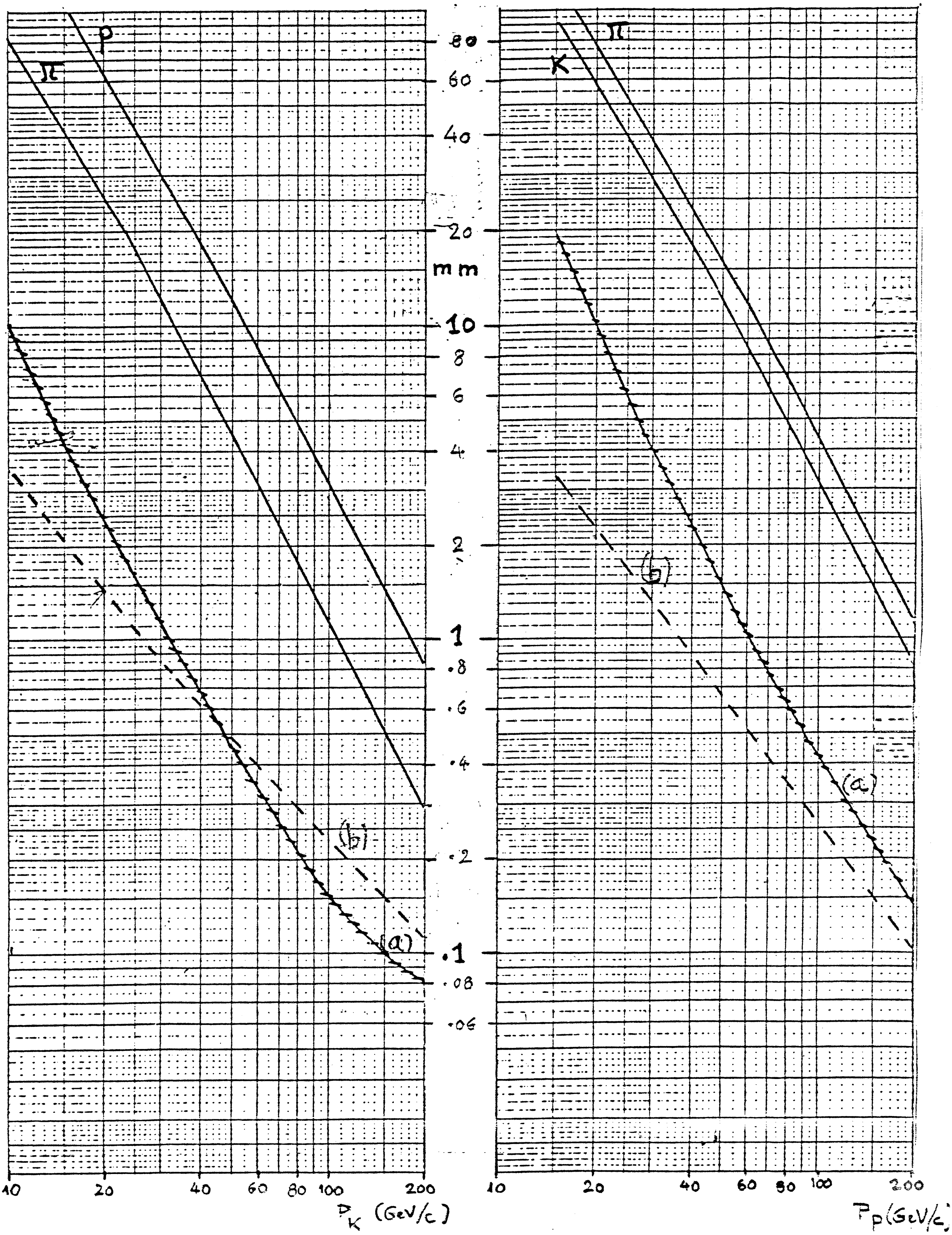


FIG.2 CEDAR HARDWARE



P
π
K
π
80
60
40
20
mm
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
(a)
(b)
(b)
(a)
10
20
40
60
80
100
200
10
20
40
60
80
100
200
P_K (GeV/c)
P_p(GeV/c)

FIG 3 CEDAR - W

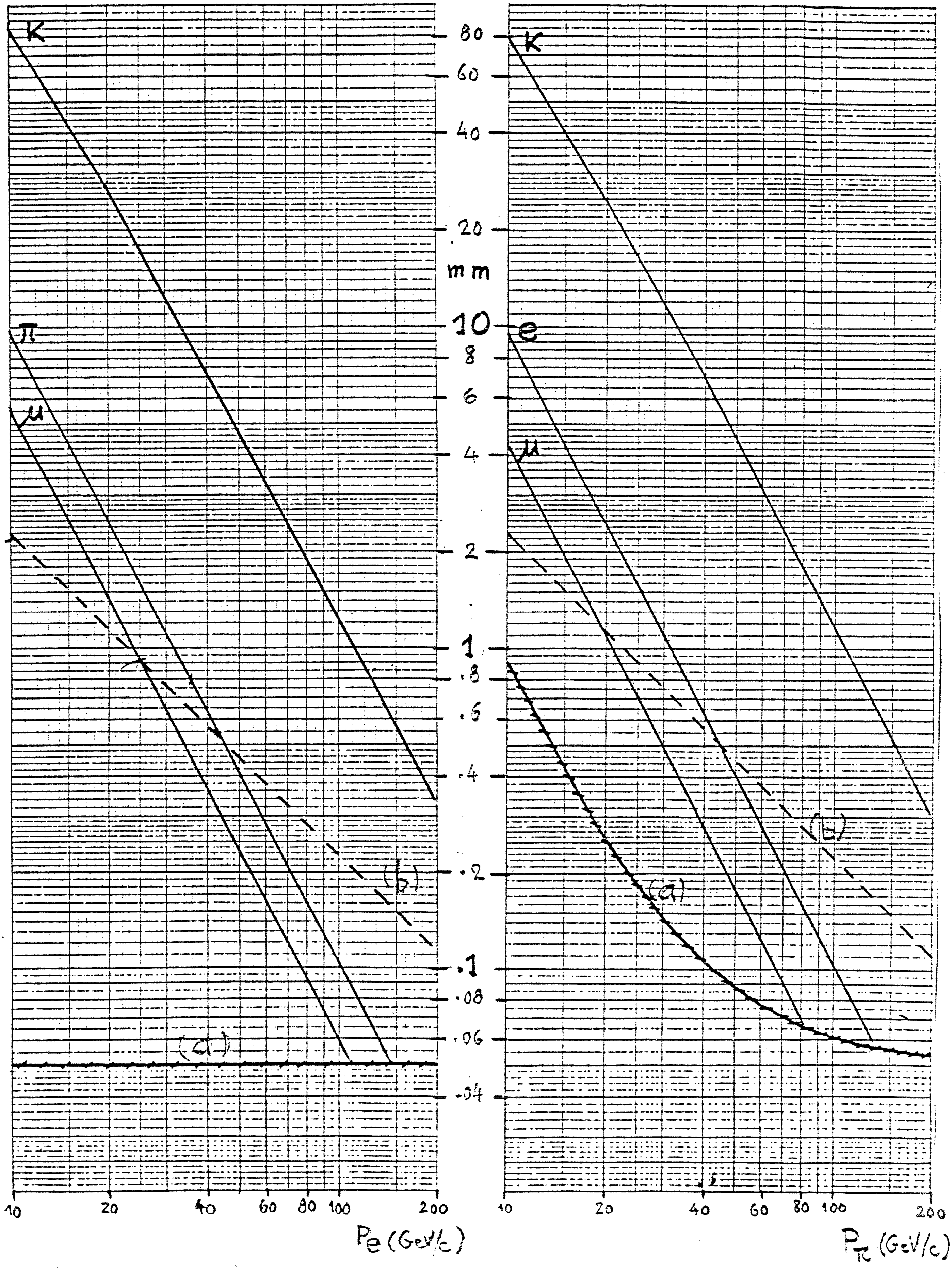
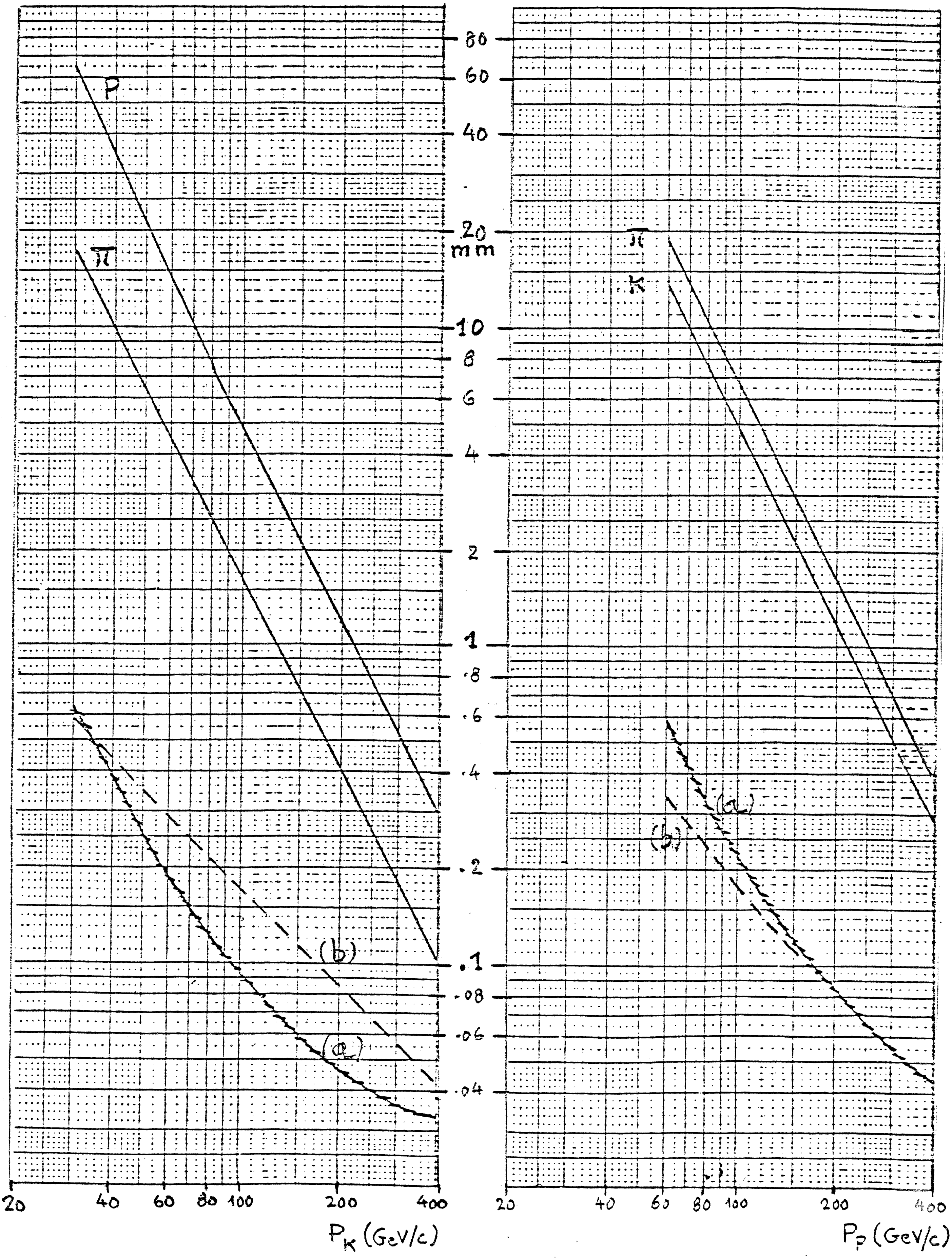
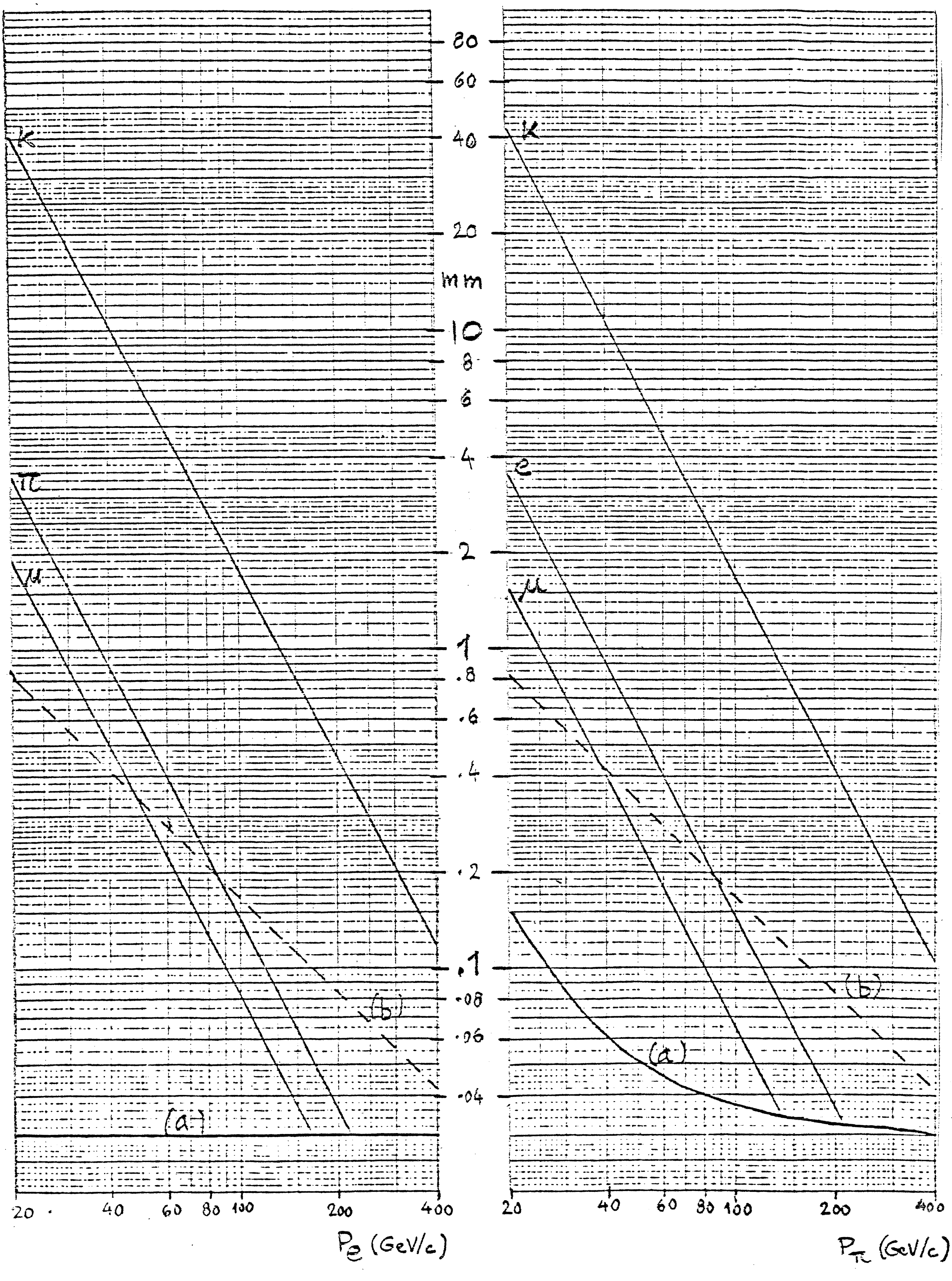

K
π
μ
(a)
(b)
e
mm
80
60
40
20
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
.04
10
20
40
60
80
100
200
Pe (GeV/c)
Pπ (GeV/c)

FIG 4 - CEDAR - W



P
π
π
K
(a)
(b)
(a)
(b)
80
60
40
20
mm
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
.04
20
40
60
80
100
200
400
P_K (GeV/c)
P_p (GeV/c)

FIG 5 _ CEDAR N



80
60
40
20
mm
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
.04
K
π
μ
(a)
(b)
e
20
40
60
80
100
200
400
P_e (GeV/c)
P_π (GeV/c)

FIG 6. CEDAR - N

VARIOUS COINCIDENCES VERSUS NUMBER OF PHOTOELECTRON n

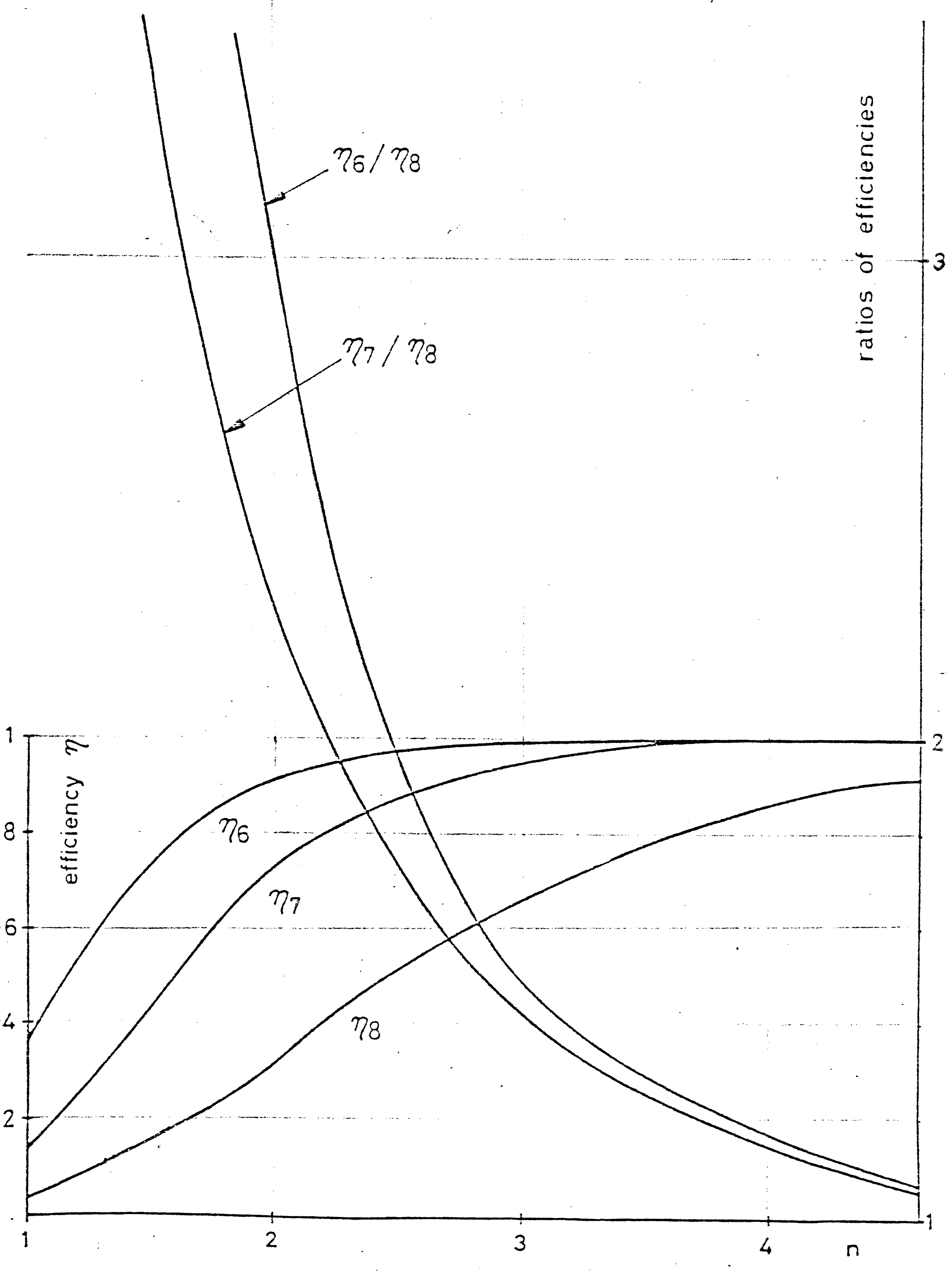


FIG. 7