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THE NEUTRINO TEST BEAM

1. The ν - test beam

The ν - test beam (Fig. 1) utilizes the particles leaving the horn at 10° with respect to the ν - line. In principle one can use the non-energized ν - horn as normal target. For technical reasons, however, it is difficult to switch off the horn for a short period. Therefore, it is better to take only the particles defocused by the energized horn, that means those with the "wrong" sign. This has the additional advantage that one can change the intensity by varying the horn current (see sec. 2).

The beam is channelled through the main shielding wall into the P.S. South Hall. Entrance and exit of the channel can be closed by standard beam stoppers S_1 and S_2 which are controlled from the Neutrino Area (see sec. 3). In front of S_2 an adjustable collimator is located which can be used to vary the intensity.

A first bending magnet BM 1 bends particles of 2 GeV/c through a pipe in the neutrino shielding into the bubble chamber. The pipe can be closed by filling it with mercury. 4 GeV/c particles leaving BM 1 are accepted by further bending magnets BM 2 and BM 3 and sent through another pipe into the spark chamber. This pipe can be blocked by a beam stopper S_3.

2. The expected intensities

The expected intensities can be computed from S. van der Meer's curves for particles of the "unwanted" sign (Fig. 2) for the case of an energized horn, and from the formula of G. von Dardel for the case in which the horn is switched off. Fig. 2 shows the intensities for the fully energized horn. As in this case the intensity for 2 GeV/c particles at 10° is too low one has to move the peaks by varying the horn current. If one reduced this current by a factor of about two (extrapolated) the intensities of 4 GeV/c and 2 GeV/c at 10° are both about 0.1 $(\text{GeV/c ster.})^{-1}$. One obtains about the same intensity for the non-energized horn.

With the geometrical quantities from the following table

detector	distance horn-pipe exit [m]	pipe diameter [cm]	solid angle [ster]	momentum-band [o/o]	[MeV/c]
bubble chamber	48	5	10^{-6}	0.4	8
spark chamber	49	3	3×10^{-7}	0.4	16

one gets per burst at the

bubble chamber 320 particles of 2 GeV/c

spark chamber 200 particles of 4 GeV/c.

To reduce these intensities one closes the collimator and/or detunes the magnet currents.

3. Operation and control

The bubble chamber is expected to need the test beam once every half an hour for a few pulses. The spark chamber will need it presumably only about once a day, but then for about 30 to 60 minutes. (During the running-in period the spark chamber would need it for several days without interruption).

In order to guarantee minimum interference the following principle should be applied : A particular control should stay with the party most frequently using it, but the other party should have the indication of what is going on. Accordingly the bubble chamber team should control the current in the horn, the beam stoppers S_1 and S_2, the current in BM 1 and the filling of the mercury pipe. These operations should be made automatically after a predetermined number of neutrino beam pulses. The spark chamber crew instead controls the current in BM 2 - 3 (which are in series) and the stopper S_3. The non-controlling party should get the magnet currents and indicator lights for the stopper positions.

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Figures

Fig. 1 Layout of the ν - test beam.
(Note : Because of a reduction in size in the course of reproduction the actual scale is 1 : 165).

Fig. 2 Number of pions defocused by the ν - horn per GeV/c and ster and per circulating proton of 24.8 GeV/c. The horn current is 300 k Amp.

Appendix

Beam equations and magnet positions

horn - BM 1 : $Y = 0.5245\ X + 463.12$

BM 1 - bubble chamber: $Y = 983.43$

BM 1 - BM 2 : $Y = 0.2503\ X + 735.13$

BM 2 - BM 3 : $Y = 0.1202\ X + 863.02$

BM 3 - spark chamber : $Y = 980.97$

BM 1 : $X = 992.03$ $Y = 983.43$

BM 2 : $X = 983.08$ $Y = 981.19$

BM 3 : $X = 981.25$ $Y = 980.97$

Distribution : (open)
Scientific staff of N.P.A.

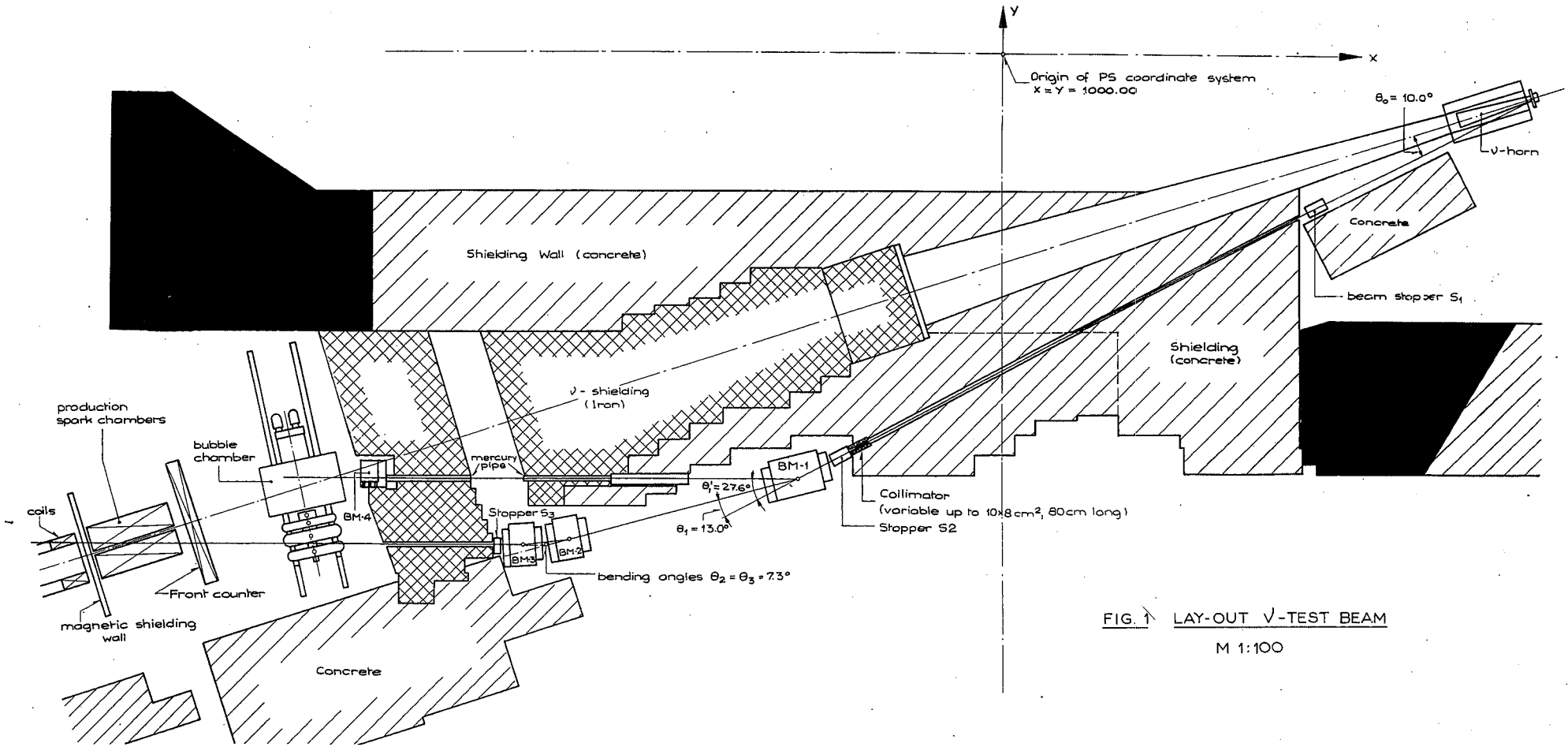

FIG. 1 LAY-OUT ν-TEST BEAM

M 1:100

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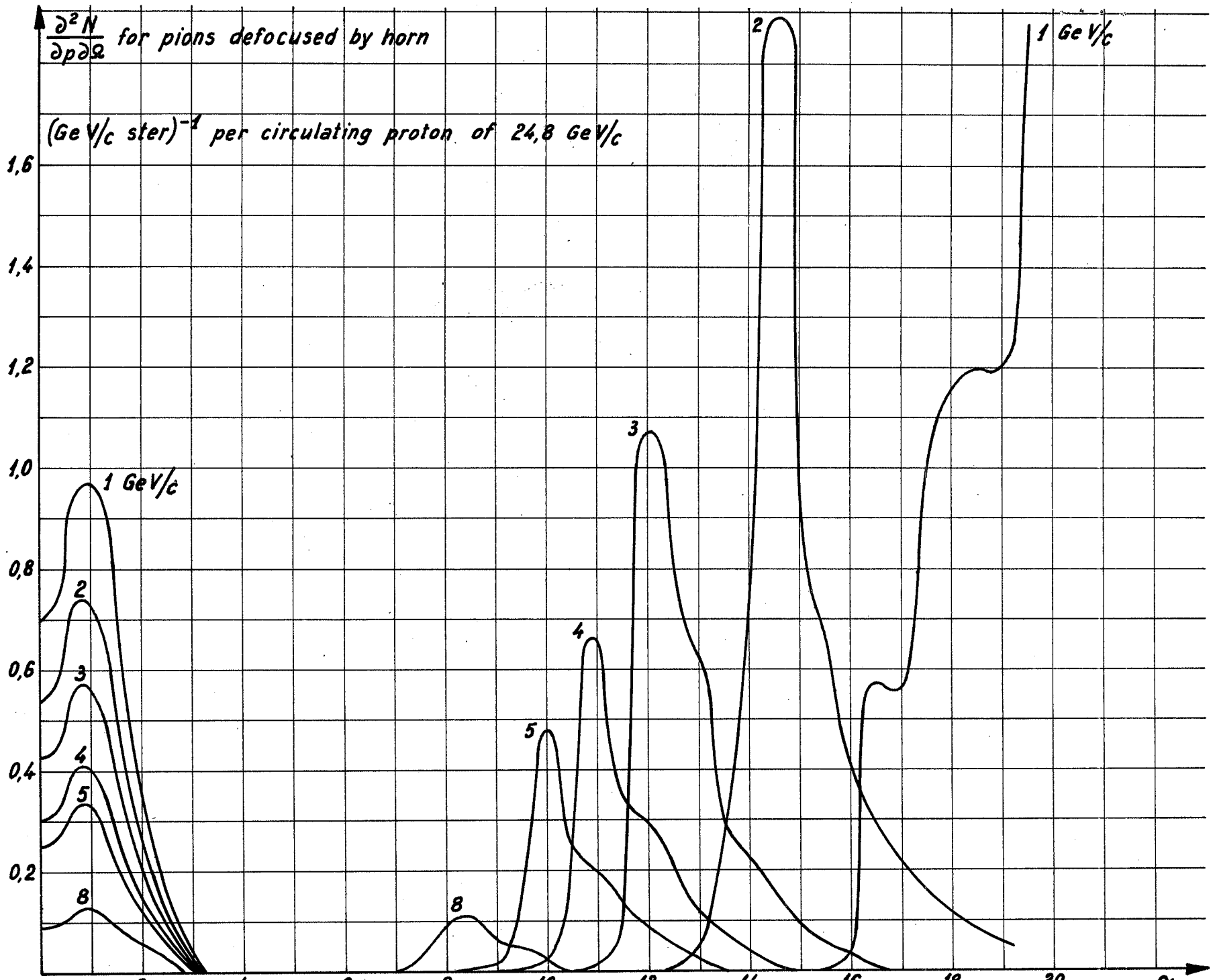

Fig. 2