ISR-MA/BA/SP/rh

16th September 1971

ISR RUNNING-IN

Run 109 - 8 September 1971 - 13.00 to 15.00 h

Ring 1 - p = 22.465 GeV/c - 20 bunches - 22 FA

Relation of beam position and pressure in SS 333

This run was devoted -

a) to confirm certain correlations seen in Run 80 between the vertical position of the beam and the pressure;

b) to check B. Montague's suggestion on the possibility of dissociating the dust effect from the ion bombardment of the wall.

The first attempt failed, the second seems promising. The idea is the following: if there is a dust effect, the pressure should rise when the beam approaches the centre of the vacuum chamber, then remains about constant whatever the displacements of the beam, since all the dust should have been attracted; conversely, if the effect of secondary ions is predominant, the variation of pressure is expected to have the same symmetry as that of the potential of the beam.

Stack No. 1

A first stack was made to see the behaviour of the pressure versus beam intensity. This is shown in Fig. 1. The injection was stopped at I = 4 A and the tail of the beam scraped. When the pressure was stabilized, the stacking process was resumed up to 5.3 A. The pressure kept rising very steeply and at $p = 3 \cdot 10^{-7}$ Torr, gauge 333.7 and the neighbouring clearing electrode switched off causing a 1.1 A loss.

Stack No. 2

A second stack was made under the same conditions and limited to 5 A to avoid a switching off of the clearing electrode, but unfortunately without success (Fig. 2). This stack was used up to the end of our time.

A ± 2.5 mm vertical displacement was carried out by energizing H 701. Though the stack was in the very outer part of the chamber, the relative displacement was too small to observe an effect on the pressure (Fig. 3) and could not be increased in such a mid-F region without losing beam. Another attempt was made with the beam closer to the centreline, without result however.

From the RF scan (Fig. 4) it can be deduced that the stack in SS 333 is included between 18.5 and 53 mm and that its centre of charge is at 35 mm. The typical shape of a bump controlled by the statement

H BUM (345, x)

is shown in Fig. 5. The maximum amplitude x was varied between +10 and - 60 mm which corresponds to the range 42.5, - 10 mm for the centre of the beam in 333.7. It would have been of interest to move the beam more inwards, but the auxiliary power supplies were at maximum current, and there was no time to make a new stack closer to the centreline. Furthermore, a magnetic scan of the horizontal aperture is not possible because of the resonance lines located in the inner half of the chamber. The outer half was swept twice and there is evidence that the pressure is related to the radial position (Figs. 6 and 7). The variation of p vs x is plotted in Fig. 8. The hysteresis of the phenomenon is due to the time constant of pressure rise or decay.

Conclusion

The present experiment tends to support the hypothesis of ion bombardment rather than the dust model which does not cope well with the position dependence of the pressure. This dependence seems so strong near the centre of the vacuum chamber that it explains the fact that no effect was perceived in Runs 73 and 80 where the beam was only moved outwards. In counterpart, Fig. 8 does not exhibit any maximum near x = 0; but it is clear that it is necessary to move the beam more inwards to have a full description of the phenomenon;

on the other hand, the presence of the wire in this straight section may perturb the potential distribution. At last, it remains that dust may have an effect at lower intensities and before the partial blow-up of the beam.

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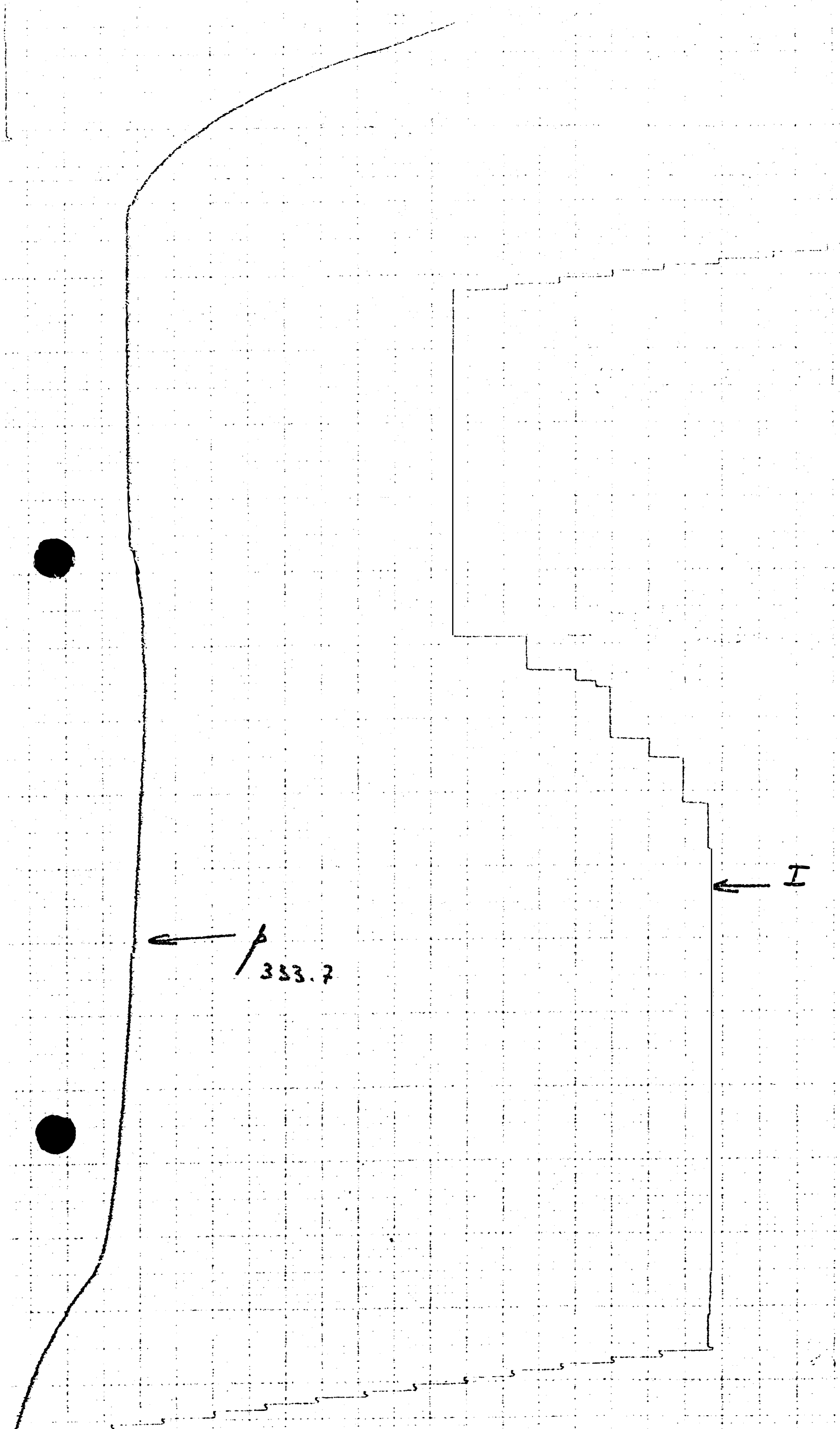


Fig. 1 – Stack No.1

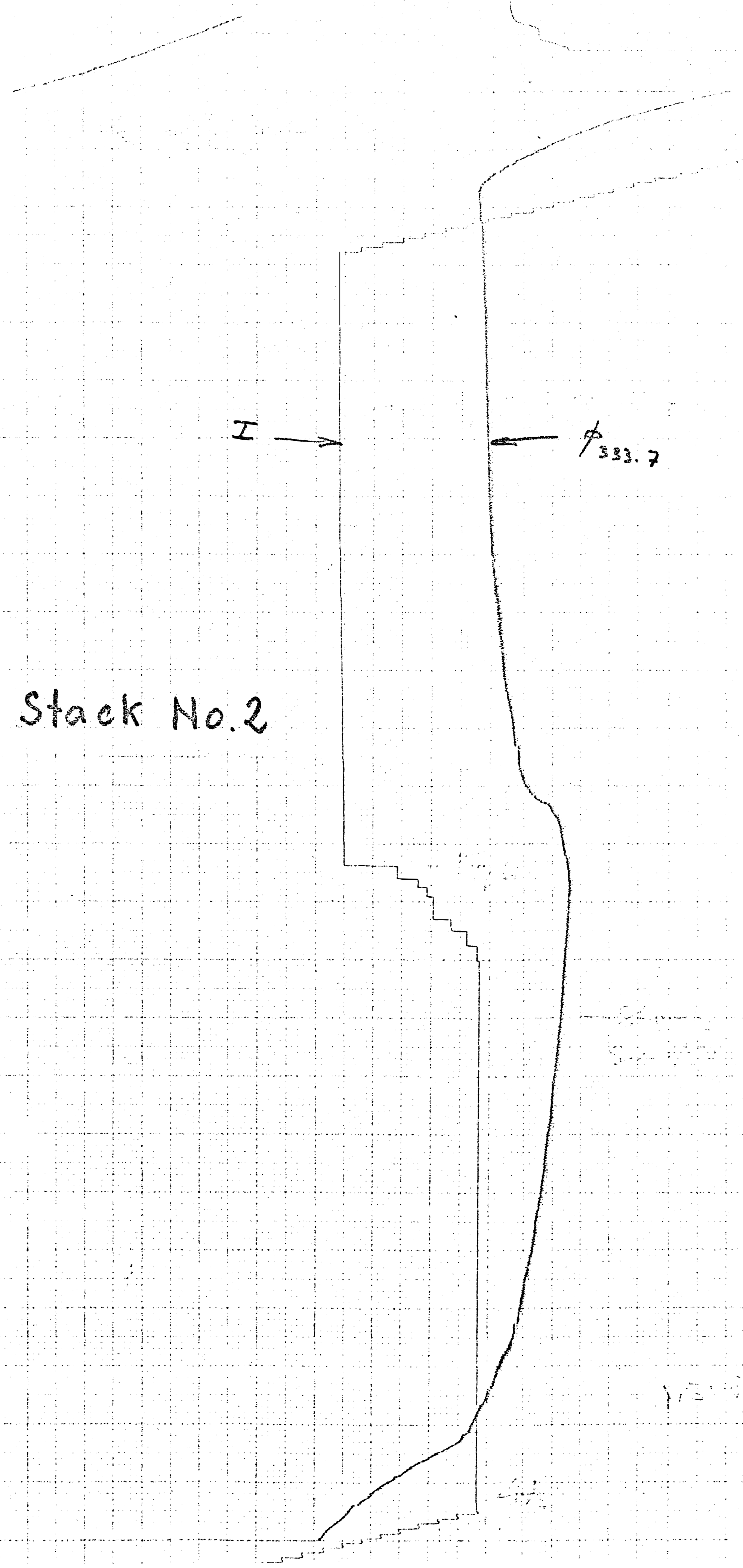


Fig. 2 - Stack No.2

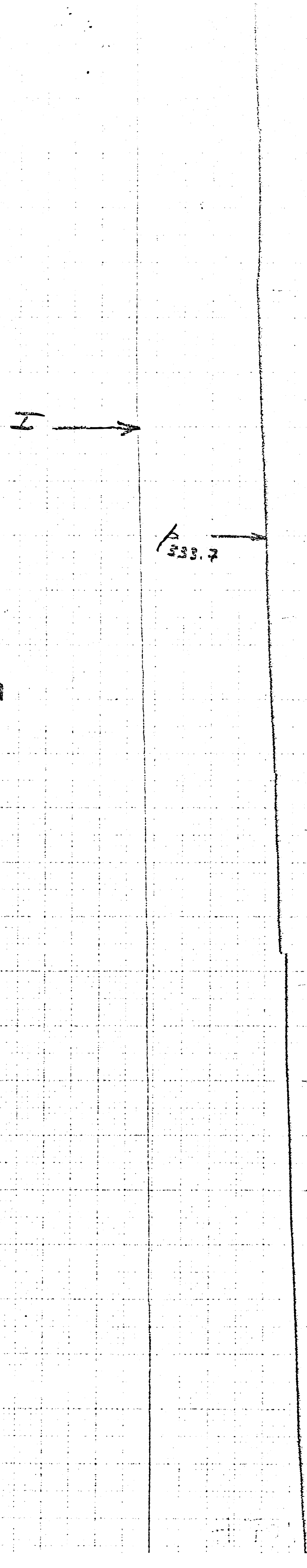


Fig. 3 - Vertical distortion

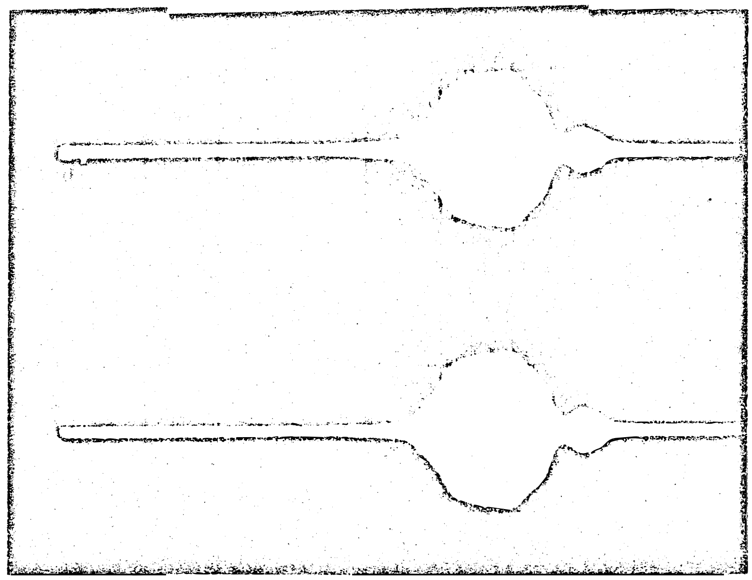


FIG. 4

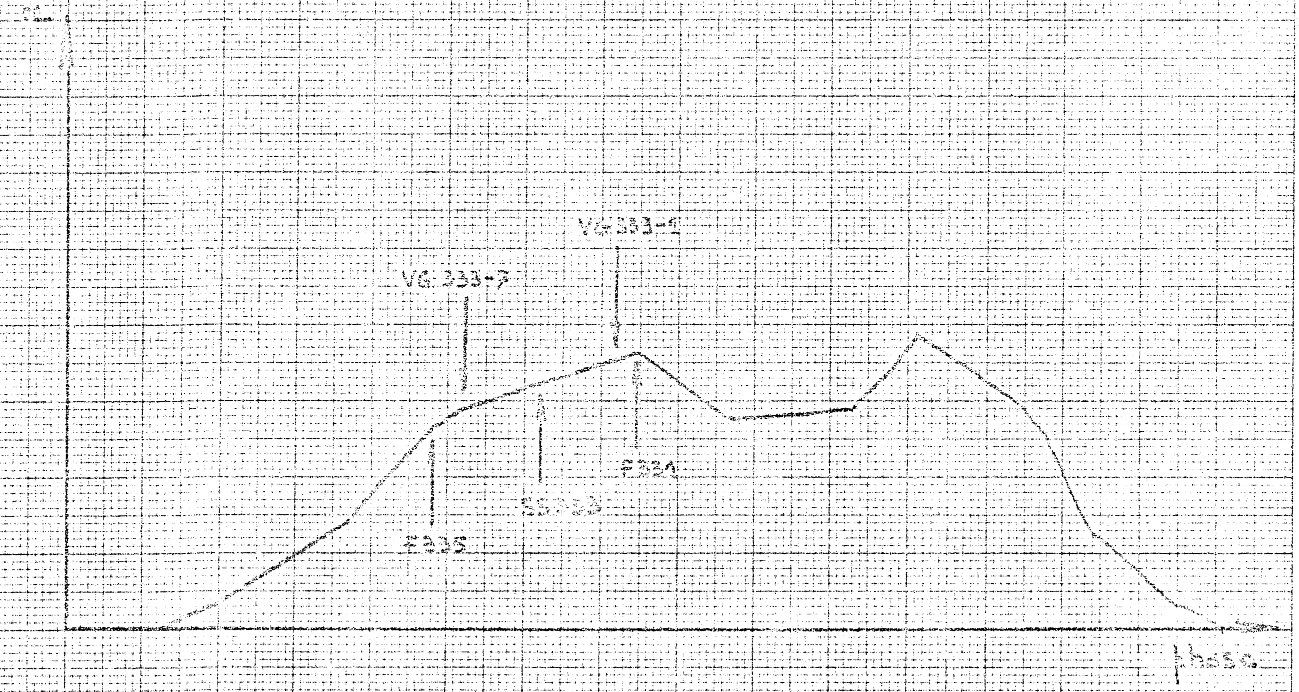


Fig. n°5

Shape of a radial bump in SS 333.

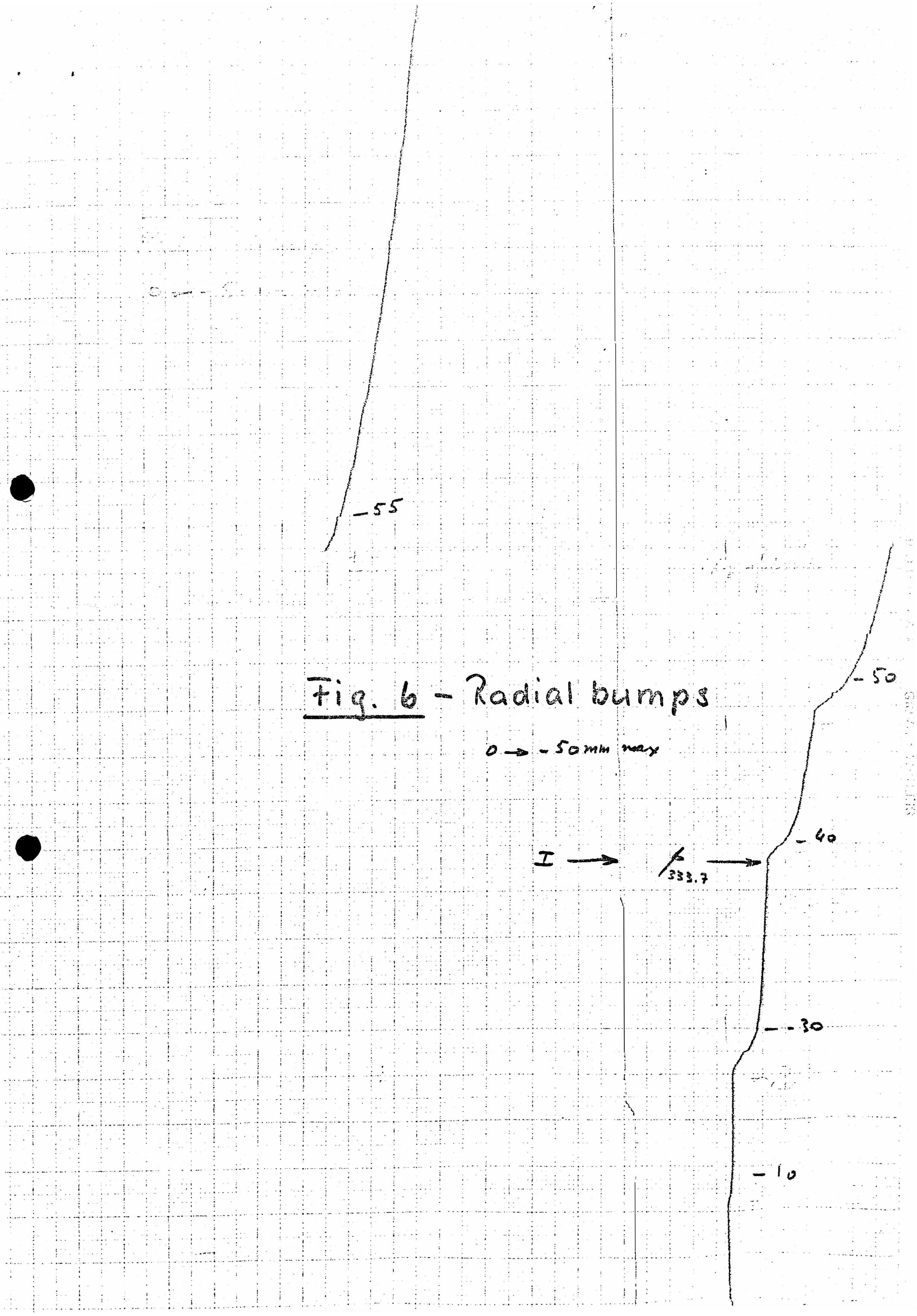
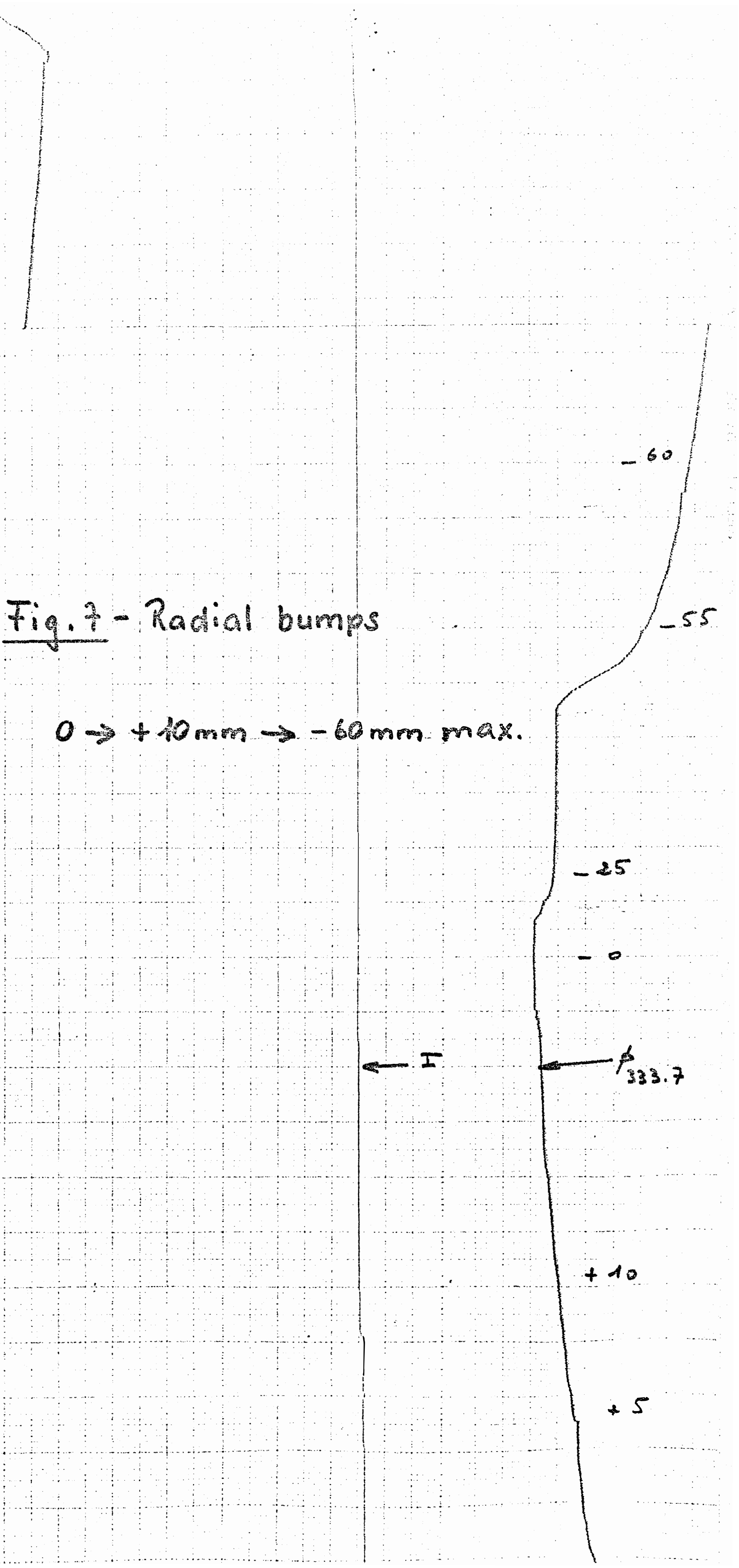


Fig. 6 – Radial bumps

0 → -50mm max

Fig. 7 - Radial bumps

0 → +10mm → -60mm max.



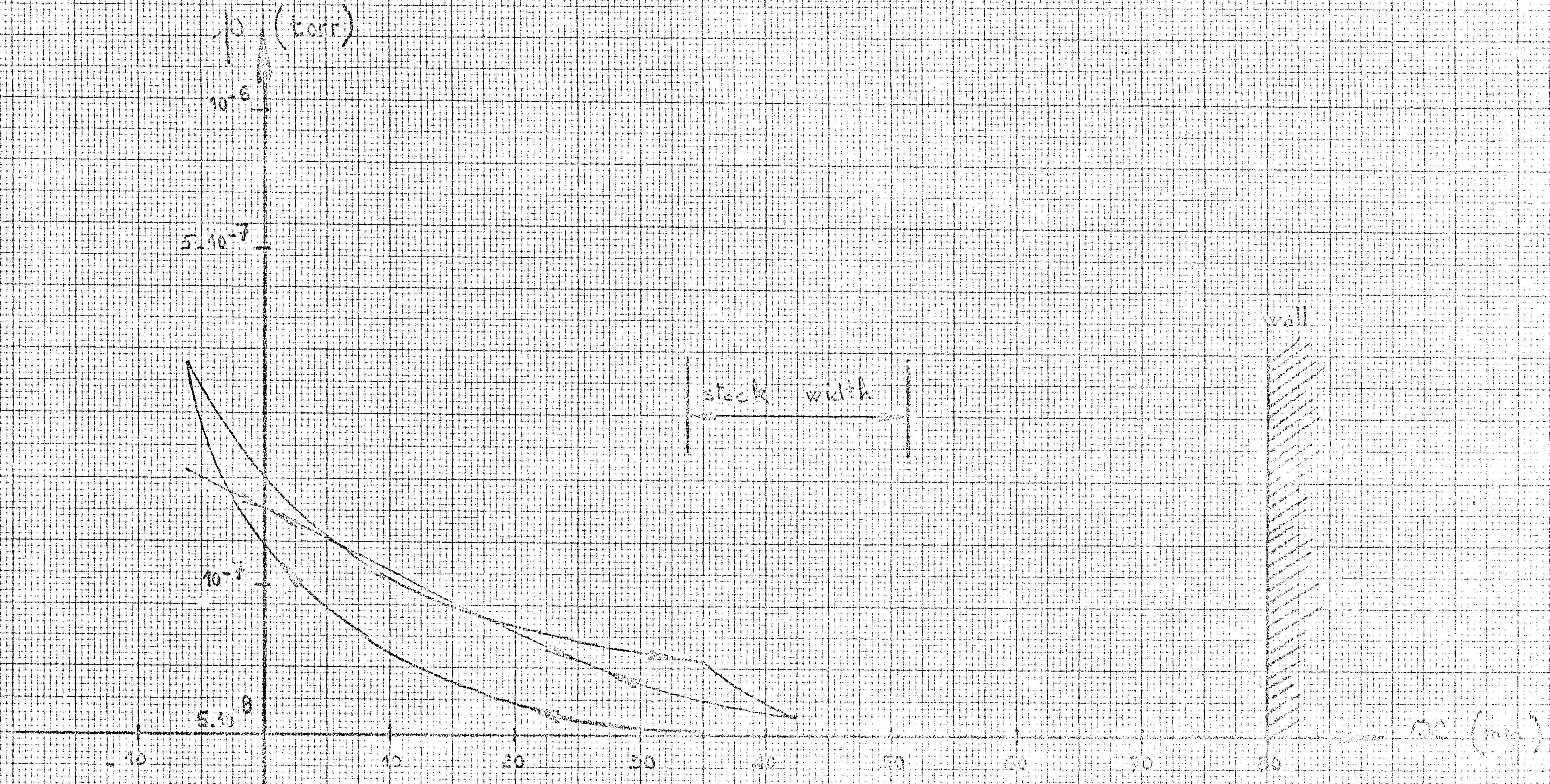

p (torr)
10-6
5.10-7
10-7
5.10-8
-10
10
20
30
40
50
60
70
80
x (mm)
stack width
wall

Fig. 8 $p = f(x)$