E-6

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ISR PERFORMANCE REPORT

Run 564 26 GeV/c Low-β, Rings 1 and 2, 10.12.74

Vertical Closed Orbit Bumps for the Low-β Insertion

Aim

To measure the precision of the special vertical closed orbit bumps (LOB 2) used in Intersection 7 with the low-β insertion and to determine the radial dependence of the bumps.

Conclusion

The local closed orbit bumps in the low β insertion given by file LOB 2 are accurate to better than 2% in both Rings which should be considered as adequate. The radial dependence of the bumps is only slightly larger than that measured in a normal intersection with the FP line. It can be approximated by $\frac{\Delta Z}{Z} = - 0.065\ \Delta r$ where Δr in average mm gives $\frac{\Delta Z}{Z}$ in percent.

Measurements and Results

The low-β scheme was set up and the working lines adjusted for use with the SFM (K. Brand, P.J. Bryant, J.P. Gourber - Performance Report "Fifth test of steel low-β insertion" - 18.12.74).

The vertical profiles of single pulses in Ring 1 were measured with the I7 scrapers using the standard program (PROB). Profiles were taken of pulses at a number of radial positions (Ave. mms) at the nominal zero of the vertical displacement scale. The program LUMS with bump file LOB 2 was then used to displace the beam to +3 mm in I7 and

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profiles taken using the same radial positions as above. The real displacement of the beam at each radial position was calculated off-line. The scraper analysis program gives the centre of the profile to better than ± 0.01 mm. The results are displayed in figure 1 where the differences between the nominal position Z_{SET} and measured Z are plotted against radial position. In figure 2 the differences in percentages of the nominal displacement are plotted against radial position.

The residual distortion in I5 was measured for a 3 mm displacement in I7 the measured shift of the beam in I5 was 0.02 mm (i.e. 0.7% of the displacement in I7).

Similar measurements were also made in Ring 2 but because of shortage of time measurements were made at fewer radial positions. The results are shown in figures 3 and 4.

Discussion

On the central orbit the 3 mm displacement in Ring 1 was measured to be 0.8% too large and in Ring 2 1.3% too large. These values are a little larger than have been observed on the FP line even when no account is taken of hysteresis. But more measurements would be needed to verify this and there is probably little point in trying to make displacements more accurate than a few percent in the low β insertion.

The local tilt of the beam across the aperture between -15 mm and +30 mm is 1.7 mrad in ring 1 but the measurement at +43 mm (+70 mm locally) is not consistent with this. The radial dependence of a displacement is given approximately by $\frac{\Delta Z}{Z} = -0.065\ \Delta r$ where Z is the vertical displacement and $\frac{\Delta Z}{Z}$ is a percentage if the radial offset Δr is given in mm (average). At +43 mm the effect is much greater but there is insufficient data to establish whether a non-linear fit is justified or if there is an inconsistency at extreme radial positions. The approximation given above is a little steeper than that measured

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for the FP line[1].

In Ring 2 there is insufficient data to draw any real conclusions but the measurements are in approximate agreement with those of Ring 1.

Figure 5 shows the effective height obtained from the scraper profiles plotted as a function of radial position for beam 1. No explanation is offered!

K.M. Potter

1) $\frac{\Delta Z}{Z} = - 0.05 \times \Delta r$ (Perf. Report 27.11.74 - K. Potter)

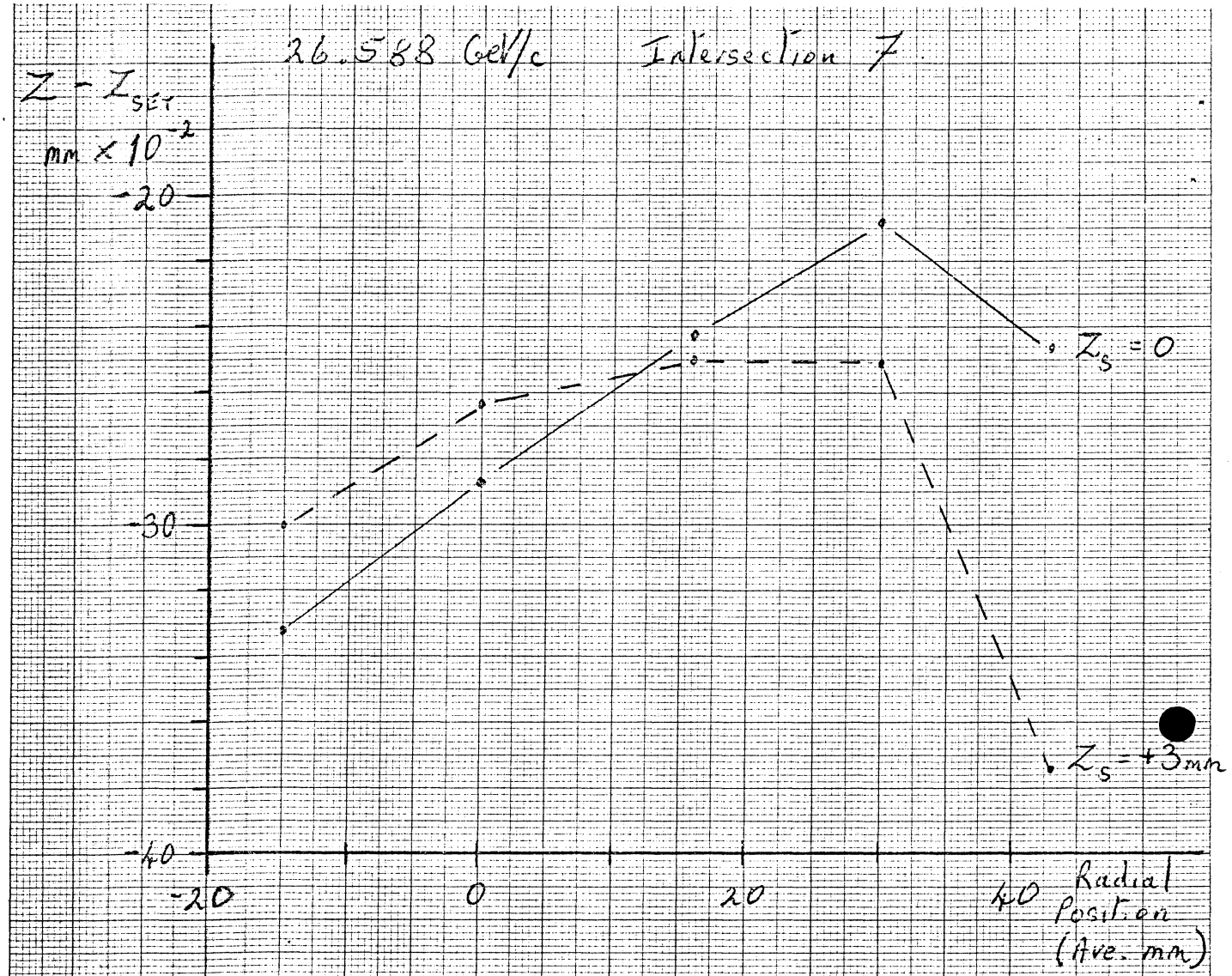

Figure 1: Radial Dependance of LOB 2 Bumps Ring 1

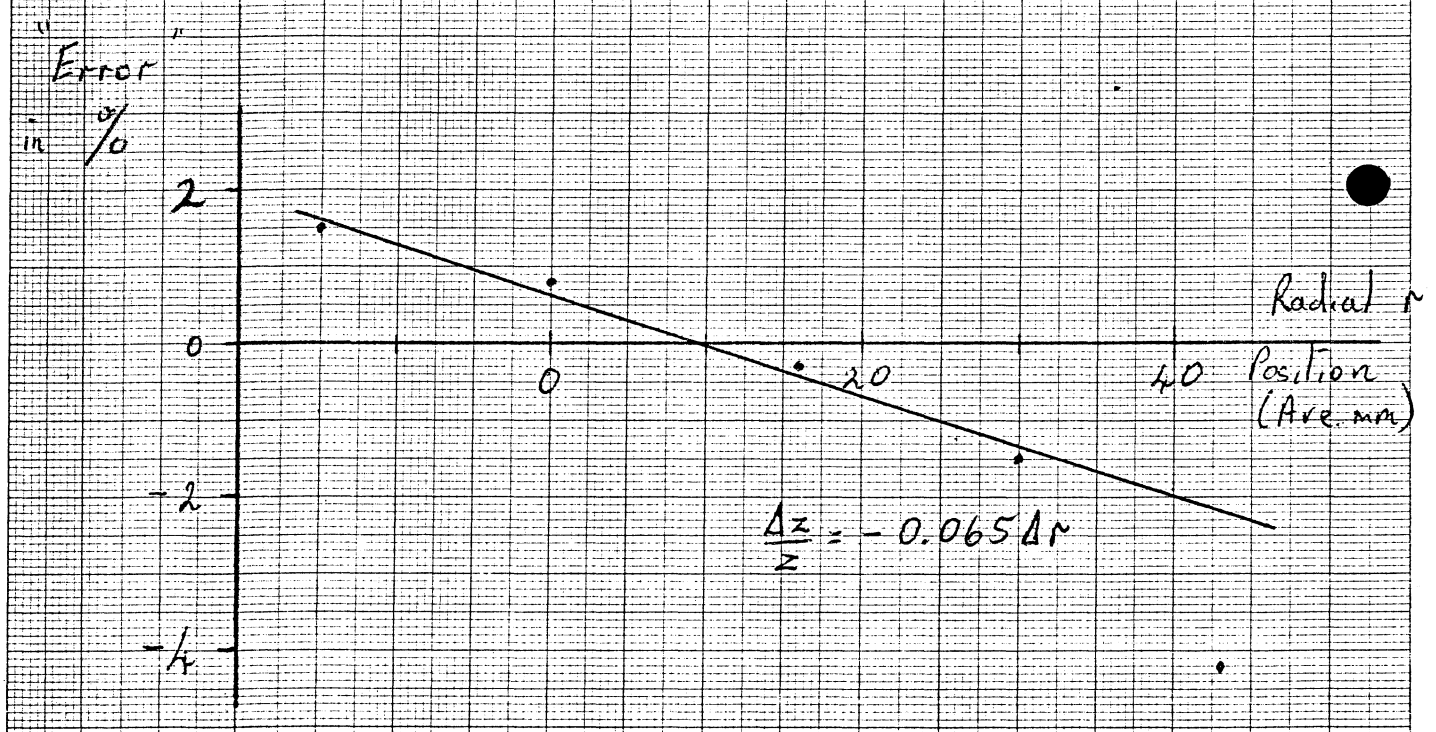

Fig. 2: Percentage Error against Radial Position. Ring 1

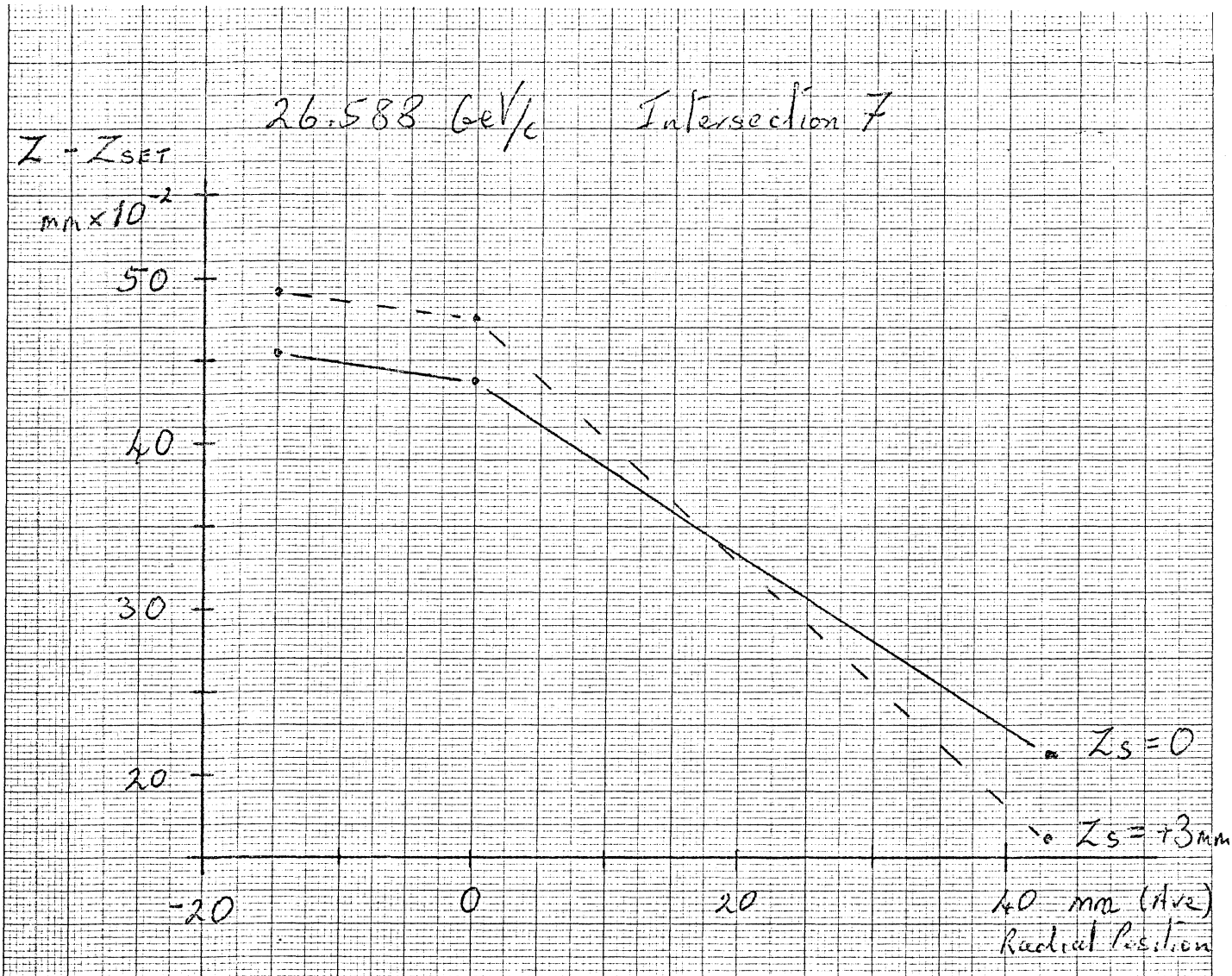

Figure 3: Radial Dependance of LOB 2 Bumps Ring 2

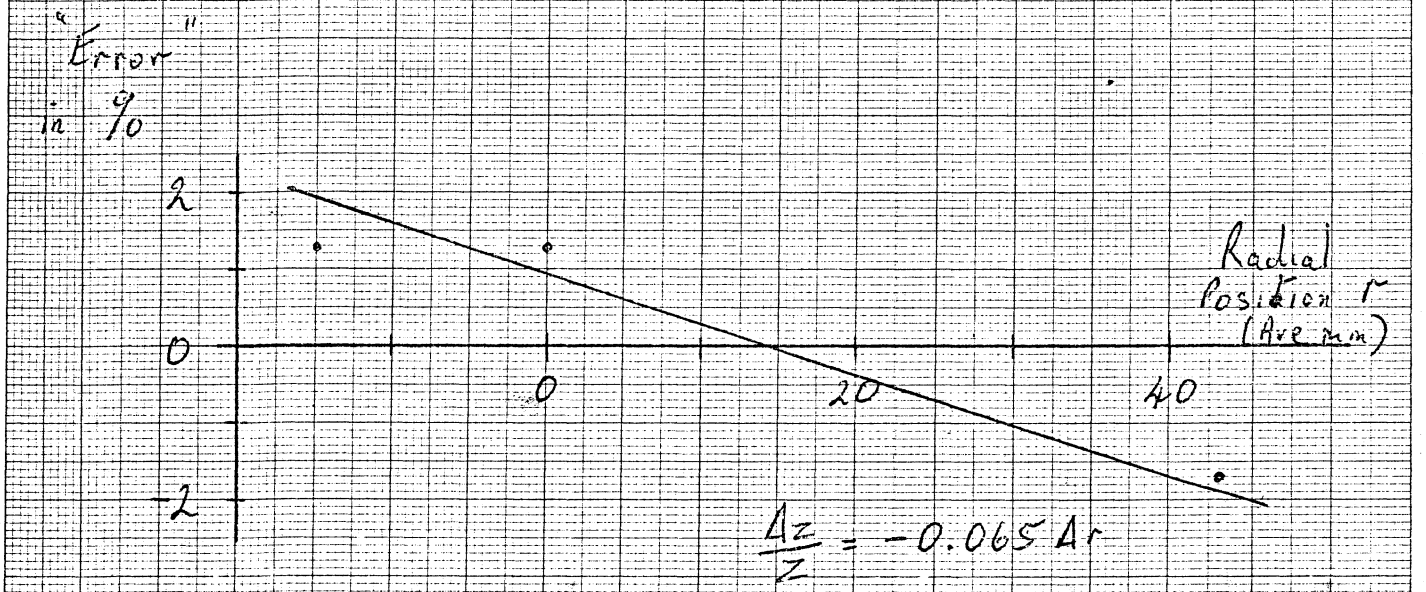

Figure 4: Percentage Error v Radial Position Ring 2

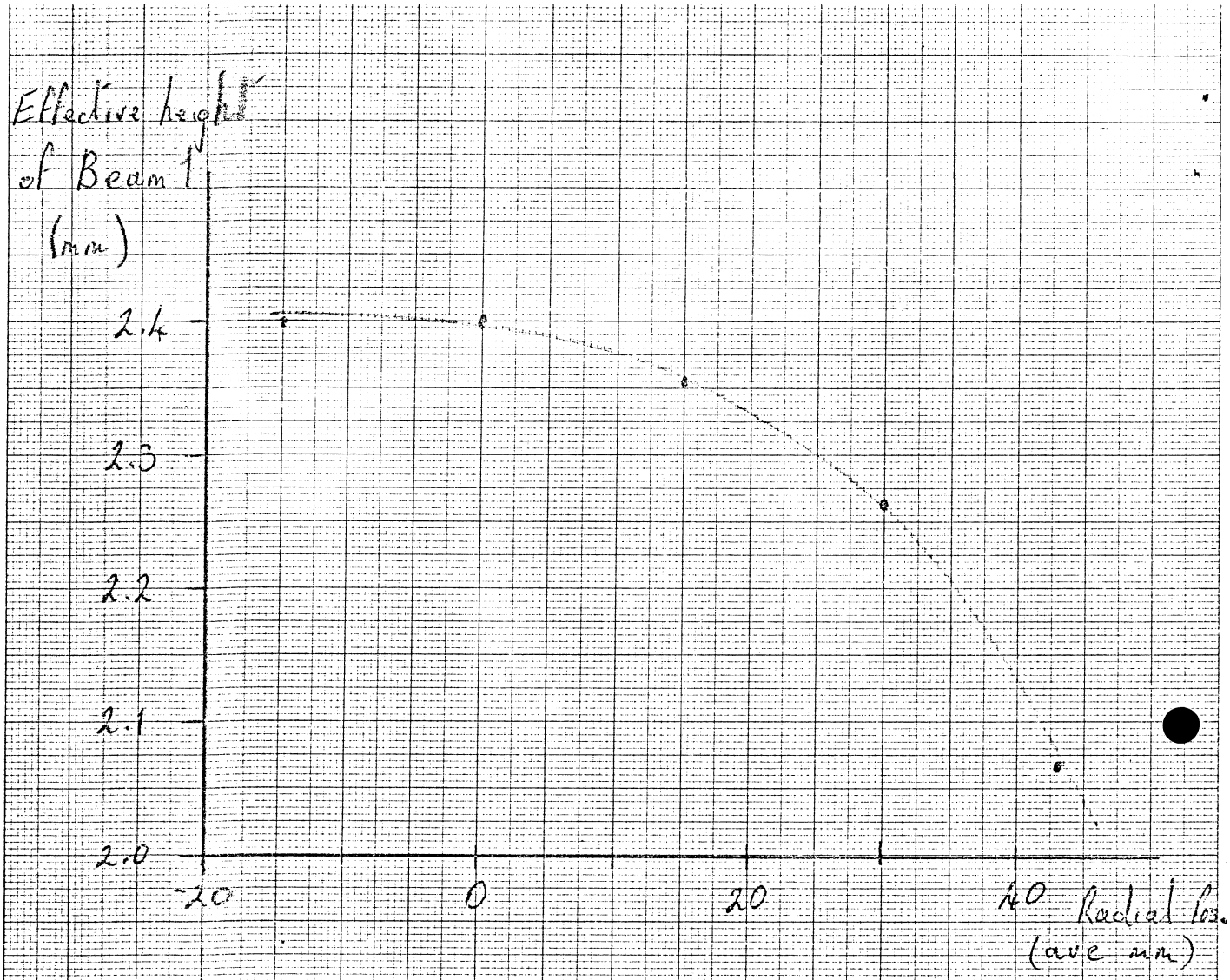

Figure 5 : Effective height of Beam 1 in the Low β insertion as measured by the scrapers