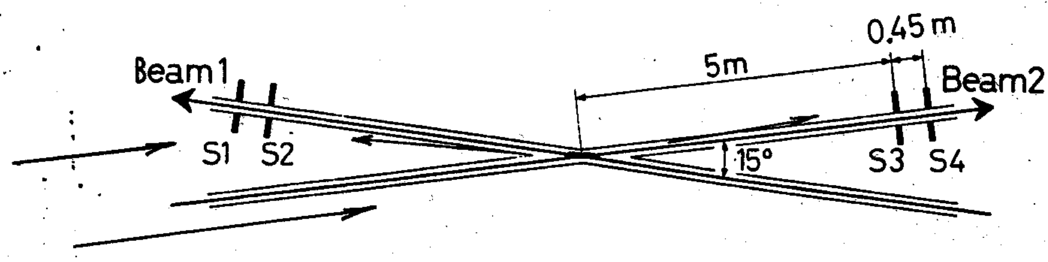
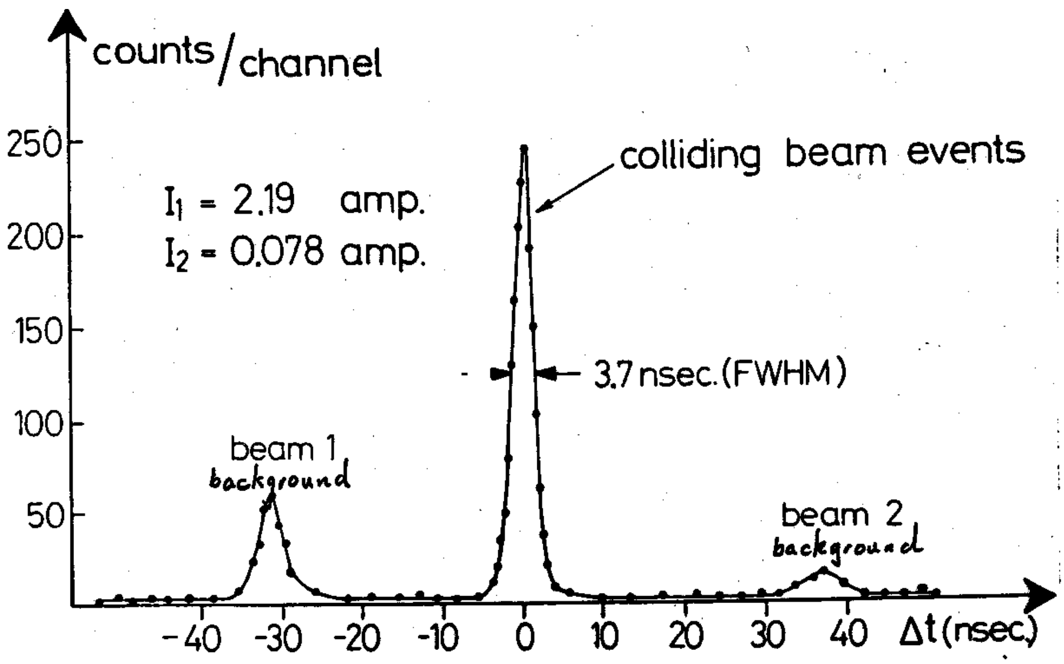
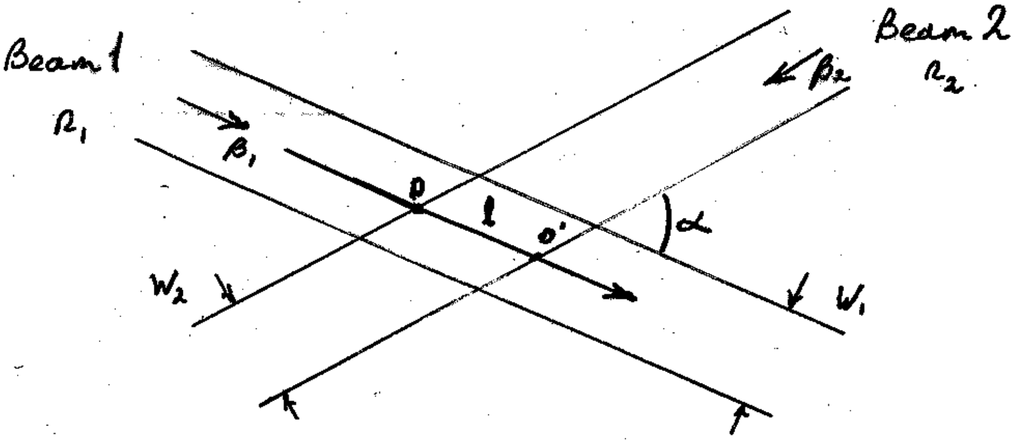
Luminosity Optimisation at the

ISR

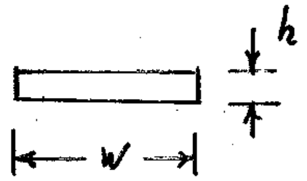




Coasting beams with crossing angle



$$\beta_{1,2} = \frac{V_{1,2}}{c}$$



Consider traversal of beam 2 by a single particle of beam 1

ISR luminosity depends only on circulating currents and h_{eff}.

equ (26)

$$L = \frac{I_1 I_2}{c e^2 h_{eff} \tan\frac{\alpha}{2}}$$

is calculable

I_1 & I_2 measured

and $\frac{dR}{dt} = \sigma_M \cdot L$ allows σ_M to be found

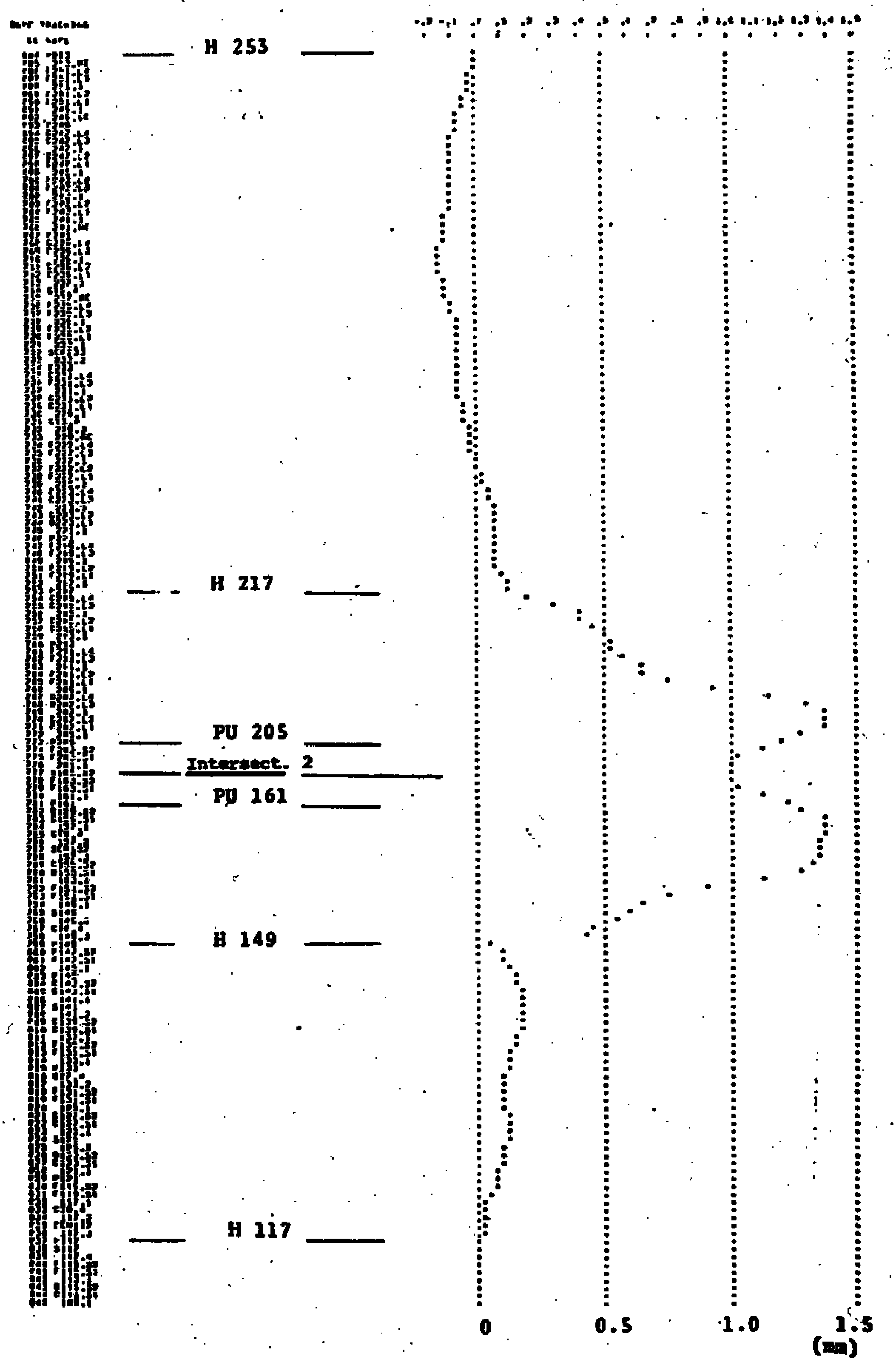
hence, now have a calibrated monitor.

Vertical Beam Displacements

Need accurate h scale

Horizontal field magnets $\frac{1}{4}\lambda$ before and after the crossing point for optimisation.

For completely local bumps with variable Q_V need correcting magnets in addition.



AGS tracking of 1 mm closed orbit bump

The Van der Meer method

$$h_{eff} = \frac{\int_{-\infty}^{\infty} \rho_1 \, dz \int_{-\infty}^{\infty} \rho_2 \, dz}{\int_{-\infty}^{\infty} \rho_1 \rho_2 \, dz} \qquad \text{equ (25)}$$

To maximise L need to minimise h_{eff} which requires zero separation between vertical beam centres.

Let the distance between vertical centres be h

The counting rate in a (background free) monitor will be

$$A \int \rho_1(z) \, \rho_2(z-h) \, dz \qquad (29)$$

where A is an unknown constant depending on the acceptance of the monitor and σ_i.

If this counting rate is plotted as a function of h a distribution of the following kind will be obtained.

Area under curve $= 3000$ counts.mm/s

At $h = 0$ rate $= 750$ counts/sec

$$h_{eff} = \frac{3000}{750} = 4\,\text{mm}$$