

## Intrabeam Scattering Results

G. Parzen

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Collider Accelerator Department  
**Brookhaven National Laboratory**

**U.S. Department of Energy**

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INTRABEAM SCATTERING RESULTS

G. Parzen

Brookhaven National Laboratory

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# RHIC Intra-beam Scattering Results

This note summarizes ~~the~~ some results of a study of the effects of Intra-Beam Scattering on the beam for the RHIC-2 lattice ( $\beta_x^* = 17$ ,  $\beta_y^* = 3$ ). An output file for this lattice was provided by Jan Clauss.

The effects of intra beam scattering were studied as a function of  $\delta$ . At each  $\delta$ , the beam was allowed to grow for 2 hours.

The RHIC2 lattice has the following parameters. In the cells,  $X_{p,max} = 1.39$  m,  $\beta_{x,max} = 51.4$  m,  $\gamma_{\pm} = 26.4$

The table on the following page lists the starting parameters  $S_0$ ,  $\sigma_{z0}$ ,  $\epsilon_0$  and the various beam parameters after  $t = 2$  hours. Below transition,  $\gamma_{\pm} = 26.4$ , the initial bunch area is  $A = .2$  ev-sec, and above  $\gamma_{\pm}$ , the initial bunch area is  $A = 1$  ev-sec. All results are for  $A_u$  with  $N = 1.2 \times 10^9$  ions/bunch. The RF parameters are  $V = 1 \times 10^6$  volts,  $h = 6 \times 5 - 7$ .

# RHIC Performance

G. Parzen

$X_p = 1.39$ ,  $V = 1 \times 10^6$ ,  $N = 1.2 \times 10^9$  / bunch  
 $\beta_x = 51.4$ ,  $H = 5 \times 67$ ,  $\epsilon_0 = 10 \times 10^{-6}$ ,  $\delta_z = 26.4$   
 $\beta_x^* = 17$ ,  $\beta_y^* = 3$        $A = 1.2$  ev-sec       $A = 1$  ev-sec

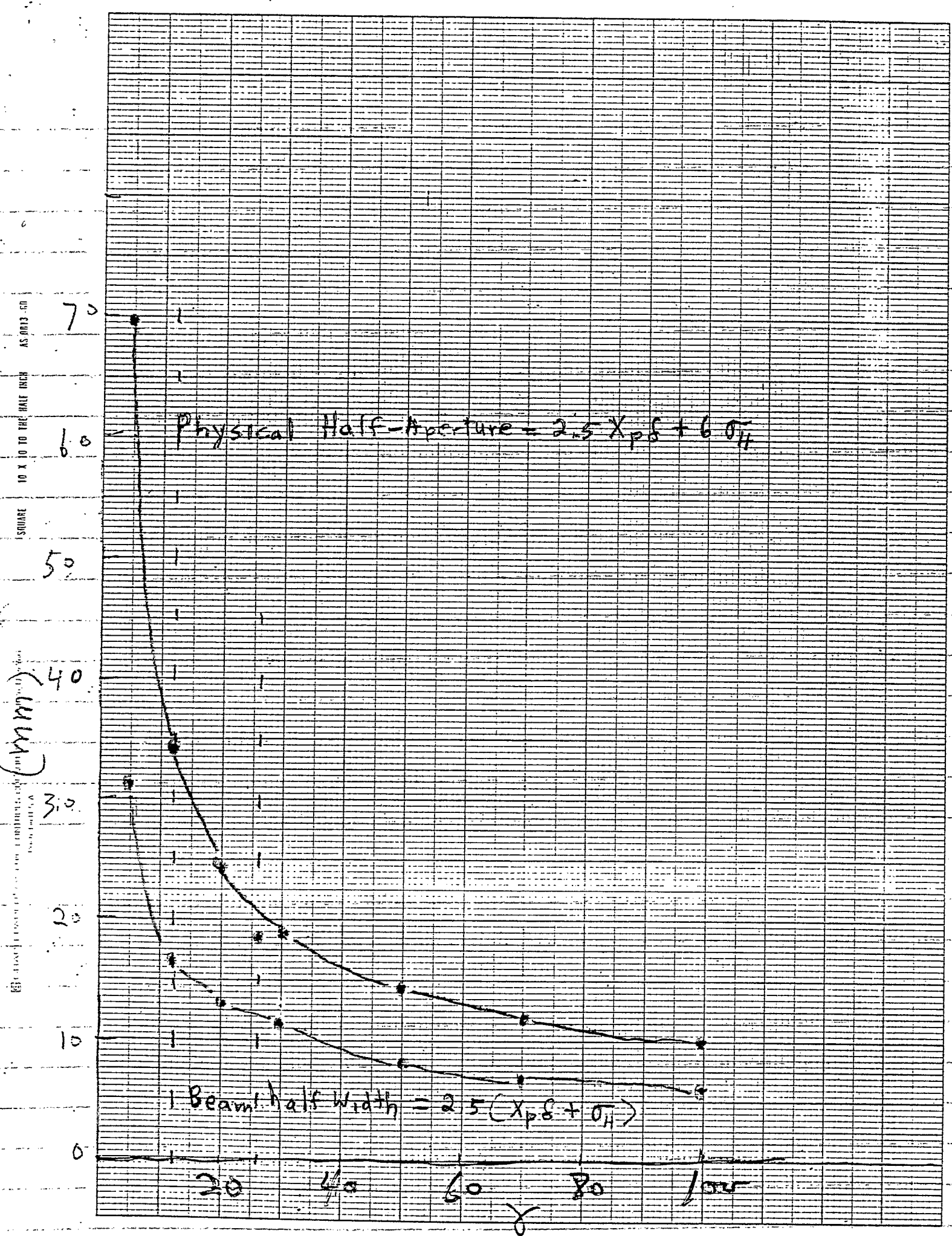
| $\gamma$                          | 5    | 12    | 20    | 30    | 50    | 75   | 100  | 26.4<br>$\delta_z$ |
|-----------------------------------|------|-------|-------|-------|-------|------|------|--------------------|
| $\delta_0 / 10^{-3}$ , $t=0$      | .638 | .529  | .543  | 1.205 | .614  | .432 | .343 |                    |
| $\sigma_{z0}$ (cm) $t=0$          | 110. | 54.1  | 31.6  | 47.3  | 55.7  | 52.9 | 49.9 |                    |
| $\epsilon / 10^{-6}$ , $t=2$      | 70.1 | 34.5  | 24.8  | 18.9  | 17.7  | 18.3 | 18.4 | 10                 |
| $\delta / 10^{-3}$ , $t=2$        | 1.11 | 1.22  | 1.37  | 1.57  | 1.14  | .921 | .789 | 4.12               |
| $\sigma_z$ (cm), $t=2$            | 191  | 125   | 80.   | 58    | 99    | 109  | 111  |                    |
| $A_v \text{ Lum} / L_0$           | .212 | .413  | .554  | .680  | .690  | .672 | .669 |                    |
| <b>RF</b>                         |      |       |       |       |       |      |      |                    |
| $2.5 \delta / 10^{-3}$            | 2.78 | 3.05  | 3.42  | 3.92  | 2.85  | 2.30 | 1.97 |                    |
| $\Delta p / p$ bucket $/ 10^{-3}$ | 2.08 | 3.49  | 6.13  | 9.08  | 3.93  | 2.91 | 2.45 |                    |
| <b>Aperture</b>                   |      |       |       |       |       |      |      |                    |
| $X_p \epsilon$ (mm)               | 1.55 | 1.70  | 1.91  | 2.19  | 1.59  | 1.28 | 1.10 | 5.7                |
| $\sigma_H = \sigma_V$ (mm)        | 11.0 | 4.96  | 3.26  | 2.32  | 1.74  | 1.44 | 1.26 | 1.8                |
| $2.5 X_p \epsilon$                | 3.88 | 4.25  | 4.78  | 5.48  | 3.98  | 3.20 | 2.75 |                    |
| $2.5 \sigma_H$                    | 27.5 | 12.4  | 8.15  | 5.80  | 4.35  | 3.60 | 3.15 |                    |
| <b>Beam Half Width</b>            |      |       |       |       |       |      |      |                    |
| $2.5 (\sigma_H + X_p \epsilon)$   | 31.4 | 16.6  | 12.9  | 11.3  | 8.33  | 6.80 | 5.90 | 18.7               |
| $2.5 \sigma_V$                    | 27.5 | 12.4  | 8.15  | 5.80  | 4.35  | 3.60 | 3.15 | 4.5                |
| <b>Physical Half-Aperture</b>     |      |       |       |       |       |      |      |                    |
| $2.5 X_p \epsilon + 6 \sigma_H$   | 69.9 | 34.01 | 24.34 | 19.4  | 14.4  | 11.8 | 10.3 | —                  |
| $6 \sigma_V$                      | 66.0 | 29.76 | 19.56 | 13.92 | 10.44 | 8.64 | 7.56 | —                  |
| Luminosity $/ 10^{26}$            | .011 | .106  | .331  | .802  | 1.45  | 2.06 | 2.67 |                    |

$$\text{Luminosity} / 10^{26} = 4 * A_v \text{ Lum} / L_0 * \left( \frac{\sigma_{H,100}}{\sigma_H} \right)^2$$

AS 0013-60  
10 X TO THE HALF INCH  
SQUARE

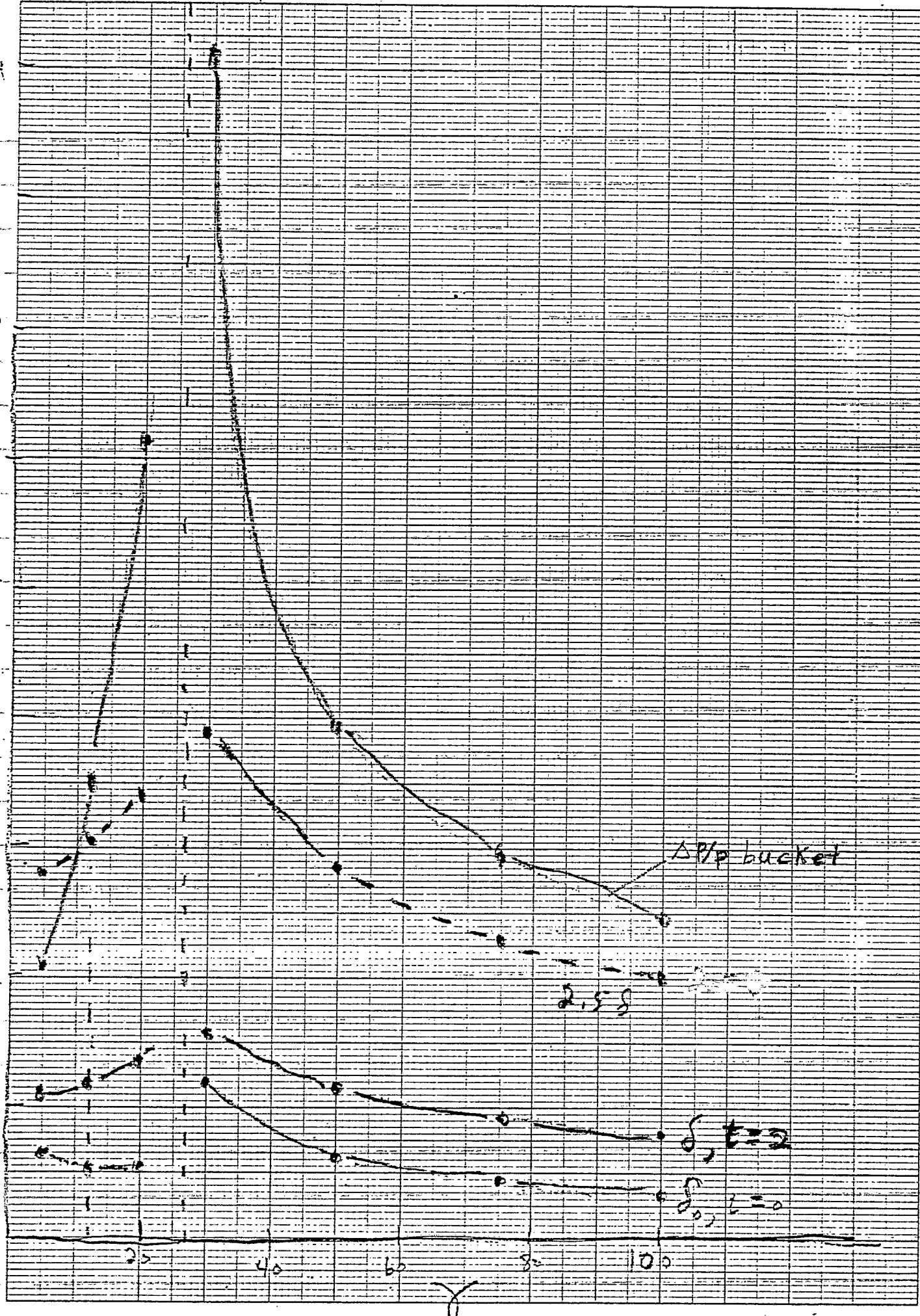
10 X TO THE HALF INCH  
SQUARE

AS 0013-60  
10 X TO THE HALF INCH  
SQUARE



SQUARE 10 X 10 TO THE HALF INCH AS-0813 10

UNIT ON THIS SCALE IS 1000 FEET PER INCH



# Beam After 2 hours

