

Intrabeam Scattering Results

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March 1984

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USDOE Office of Science (SC)

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INTRABEAM SCATTERING RESULTS

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March 11, 1984

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 δ . At each δ , 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 , σ_{z0} , ϵ_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 γ_{\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

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$X_p = 1.39$, $V = 1 \times 10^6$, $N = 1.2 \times 10^9$ / 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

γ	5	12	20	30	50	75	100	26.4 δ_z
$\delta_0 / 10^{-3}$, $t=0$	.638	.529	.543	1.205	.614	.432	.343	
σ_{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
σ_z (cm), $t=2$	191	125	80.	58	99	109	111	
$A_v \text{ Lum} / L_0$	.212	.413	.554	.680	.690	.672	.669	
RF								
$2.5 \delta / 10^{-3}$	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	
Aperture								
$X_p \epsilon$ (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	
Beam Half Width								
$2.5 (\sigma_H + X_p \epsilon)$	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
Physical Half-Aperture								
$2.5 X_p \epsilon + 6 \sigma_H$	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	

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

AS 0013-60
10 X TO THE HALF INCH
SQUARE

10 X TO THE HALF INCH
SQUARE

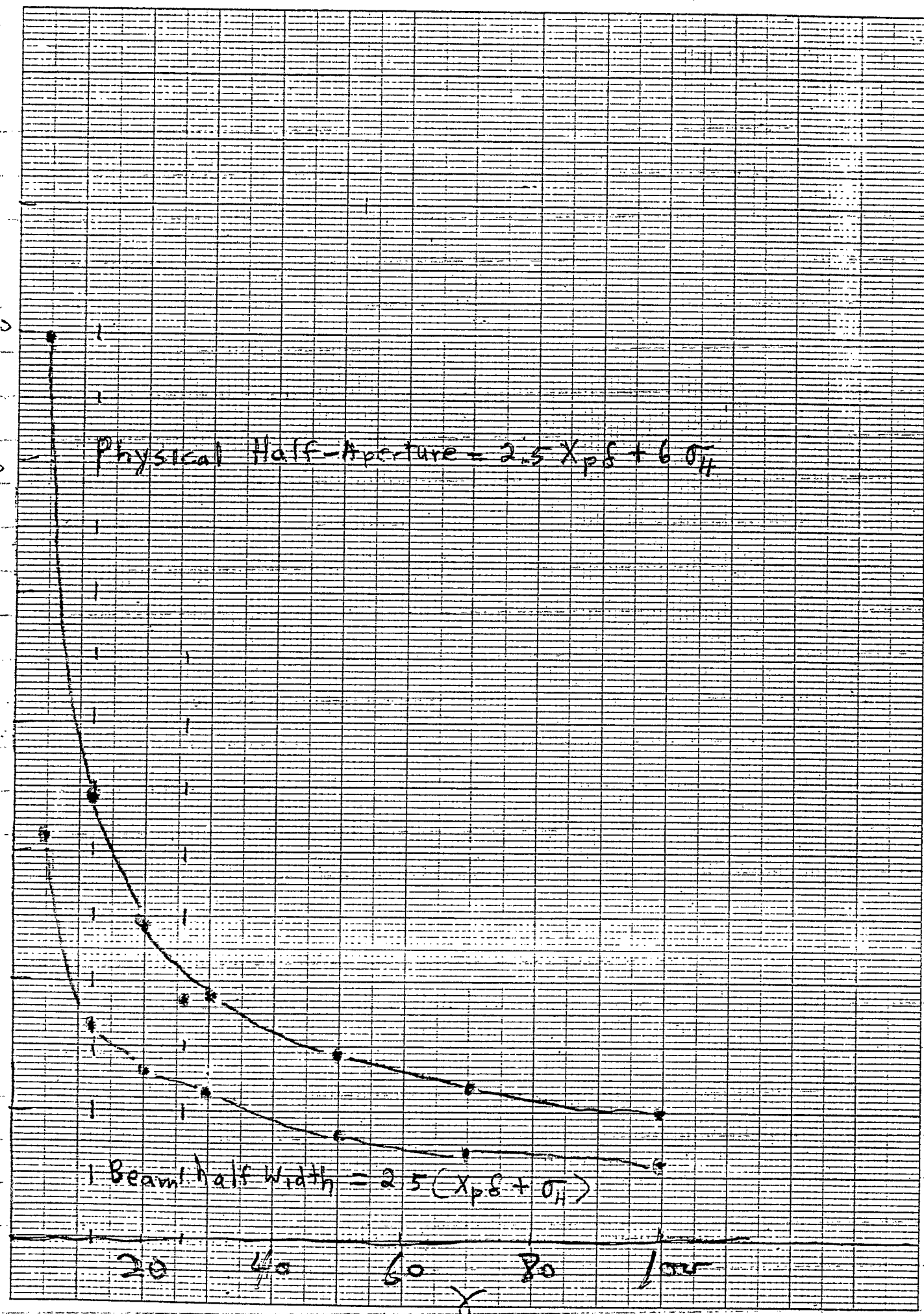
AS 0013-60
10 X TO THE HALF INCH
SQUARE

70
60
50
40
30
20
10
0

(mm)

$$\text{Physical Half-Aperture} = 2.5 X_{p\beta} + 6 \sigma_H$$

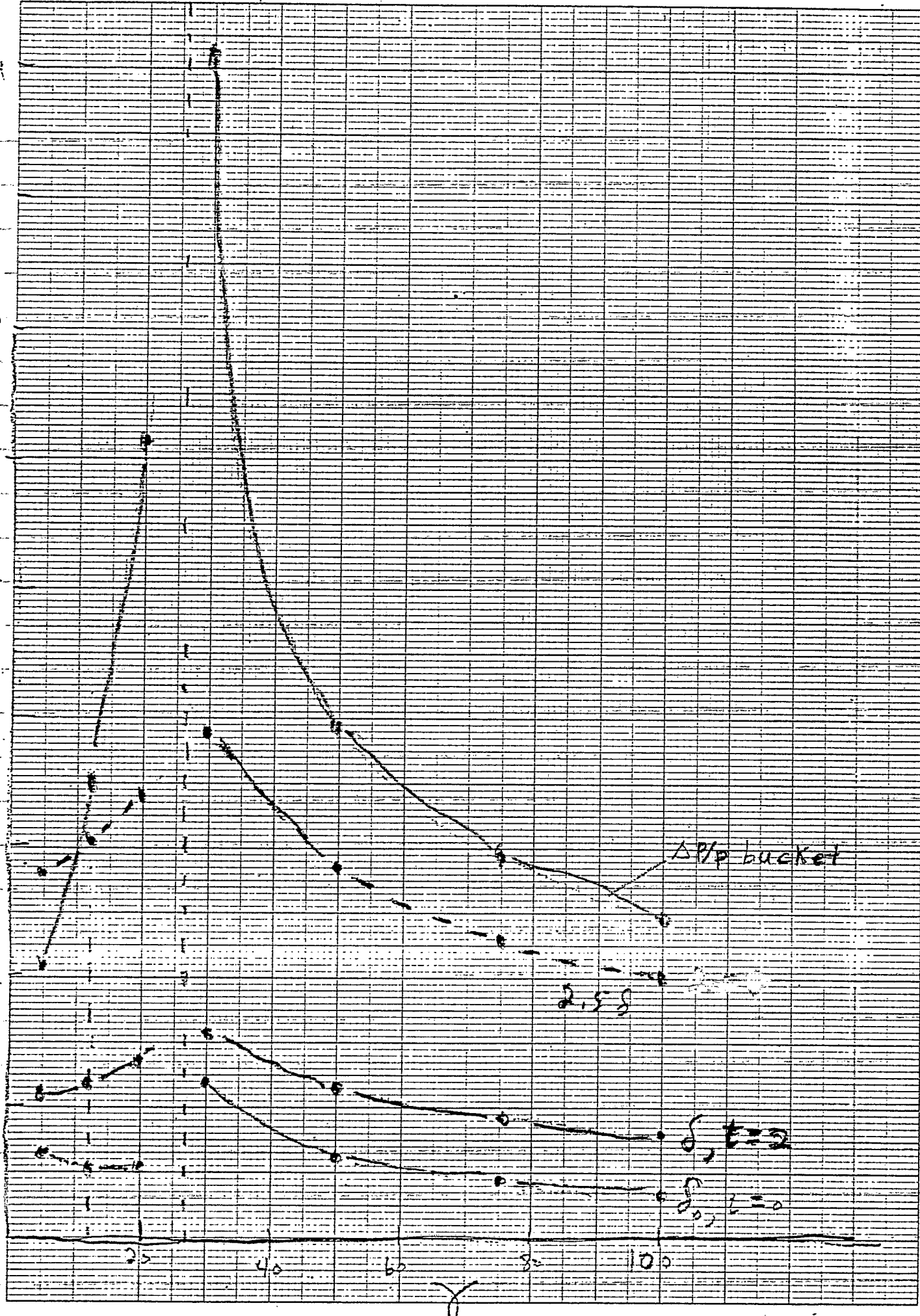
$$\text{Beam Half Width} = 2.5 (X_{p\beta} + \sigma_H)$$



20 40 60 80 100
X

SQUARE 10 X 10 TO THE HALF INCH AS-0813 60

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$\Delta P/P$ bucket

2.58

$\delta, E=2$

$\delta, E=0$

γ

Beam After 2 hours

$A_{\text{bunch}} / L_0 * 10$

$A_{\text{bunch}} = .2 \text{ ev-sec}$

$H = 6 \times 57$

$E \text{ (units } 10^{-5})$

$S \text{ (units } 10^{-3})$

SQUARE 10 X 10 TO THE HAYT (HIGH AS ORBIT OP

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