

Intrabeam Scattering Results

G. Parzen

March 1984

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No. DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

INTRABEAM SCATTERING RESULTS

G. Parzen

Brookhaven National Laboratory

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

G. Parzen

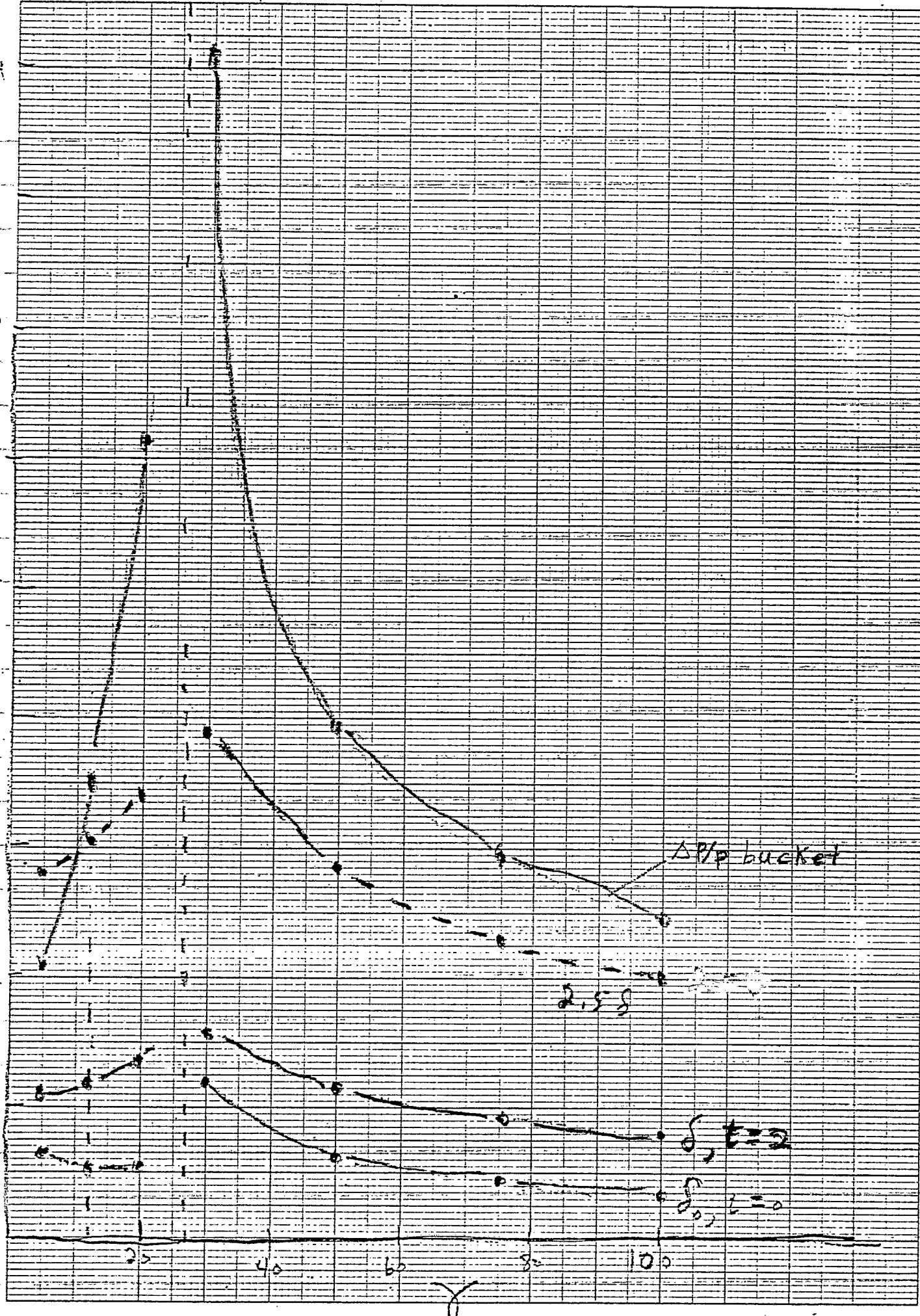
$X_p = 1.39$, $V = 1 \times 10^6$, $N = 1.2 \times 10^9$ / bunch
 $\beta_x = 51.4$, $H = 5 \times 67$, $\epsilon_0 = 10 \times 10^{-6}$, $\delta_z = 26.4$
 $\beta_x^* = 17$, $\beta_y^* = 3$ $A = 1.2$ ev-sec $A = 1$ ev-sec

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	

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

SQUARE 10 X 10 TO THE HALF INCH AS-0813 100

UNIT ON THIS SCALE IS 1000 FEET PER INCH (APPROXIMATELY)



Beam After 2 hours

SQUARE 10 X 10 TO THE HAY HIGH AS ORBIT GP

ESTABLISHED BY THE NATIONAL BUREAU OF STANDARDS

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

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

$$H = 6 \times 57$$

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

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

