



**Brookhaven**  
National Laboratory

BNL-101592-2014-TECH

RHIC/PG/49;BNL-101592-2013-IR

## RHIC Performance With Intrabeam Scattering

G. Parzen

April 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.

RHIC-PG-49

RHIC PERFORMANCE  
WITH INTRABEAM SCATTERING

G. Parzan

BNL - April 16, 1984



# RHIC Performance

RHIC3

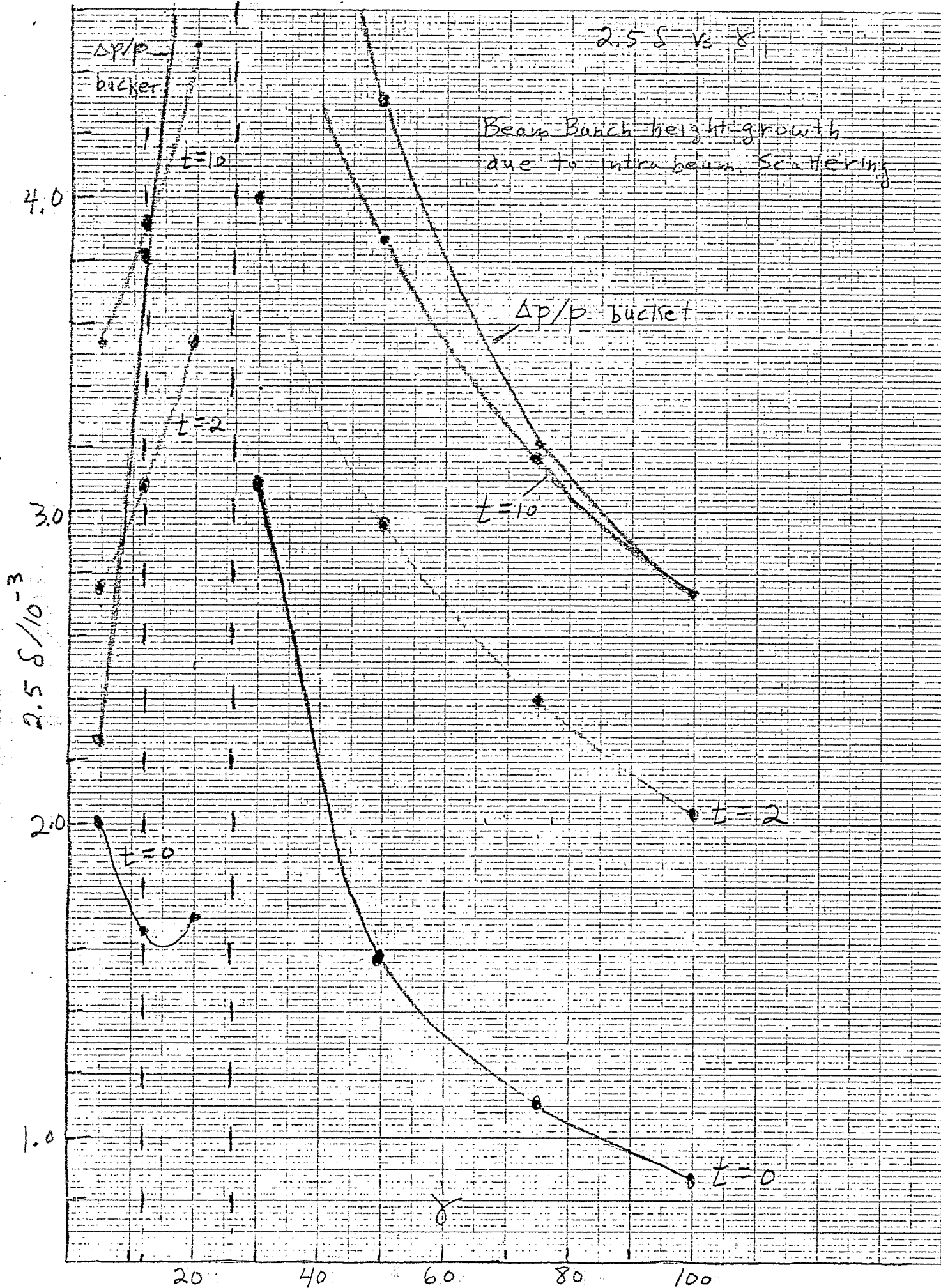
4/17/84

t=2 hrs

$X_p =$

$P_x =$

$\gamma$	5	12	20	30	50	75	100	$\delta t$
$\delta_0/10^{-3}, t=0$	.818	.678	.696	1.261	.643	.452	.359	
$\sigma_{x0}, t=0$	128.	63.3	36.9	45.2	53.2	50.5	47.7	
$\epsilon/10^{-6}, t=2$	54.2	27.4	22.4	20.4	18.3	18.5	18.7	
$\delta/10^{-3}, t=2$	1.104	1.230	1.414	1.604	1.180	.951	.817	
$\sigma_{x0}, t=2$	173.	115.	75.0	57.5	97.7	106.	109.	
Av. Lum./ $L_0$	.267	.506	.596	.645	.677	.665	.663	
RF								
$2.5 \delta/10^{-3}$	2.76	3.08	3.54	4.01	2.95	2.38	2.04	
$\Delta P/P \text{ buck}/10^{-3}$	2.28	3.82	6.72	9.95	4.31	3.19	2.68	
Aperture								
$X_p \delta$ (mm)	1.53	1.71	1.97	2.23	1.64	1.32	1.14	
$\sigma_H = \sigma_V$ (mm)	9.64	4.42	3.09	2.91	1.77	1.45	1.26	
$2.5 X_p \delta$	3.82	4.28	4.92	5.58	4.10	3.30	2.85	
$2.5 \sigma_H$	24.1	11.0	7.72	6.02	4.42	3.62	3.15	
Beam Half Width								
$2.5 (\sigma_H + X_p \delta)$	27.4	15.0	12.4	11.4	8.36	6.80	5.88	
$2.5 \sigma_V$	24.1	11.0	7.72	6.02	4.42	3.62	3.15	
Physical Half-Aperture								
$2.5 X_p \delta + 6 \sigma_H$	61.6	30.7	23.4	19.9	14.6	12.0	10.4	
$6 \sigma_V$	57.8	26.5	18.5	14.5	10.6	8.70	7.57	
Av. Lum/ $L_0, t=7.5$	.224	.442	.534	.588	.623	.611	.612	
Luminosity/ $10^2$	.165	.753	1.48	2.40	4.20	6.18	8.22	



180

160

140

120

100

80

60

40

20

Bunch length growth due to  
Intra-Beam scattering

$\sigma_e$  vs.  $\delta$

$t = 10$  hrs

$t = 2$

$t = 0$

20

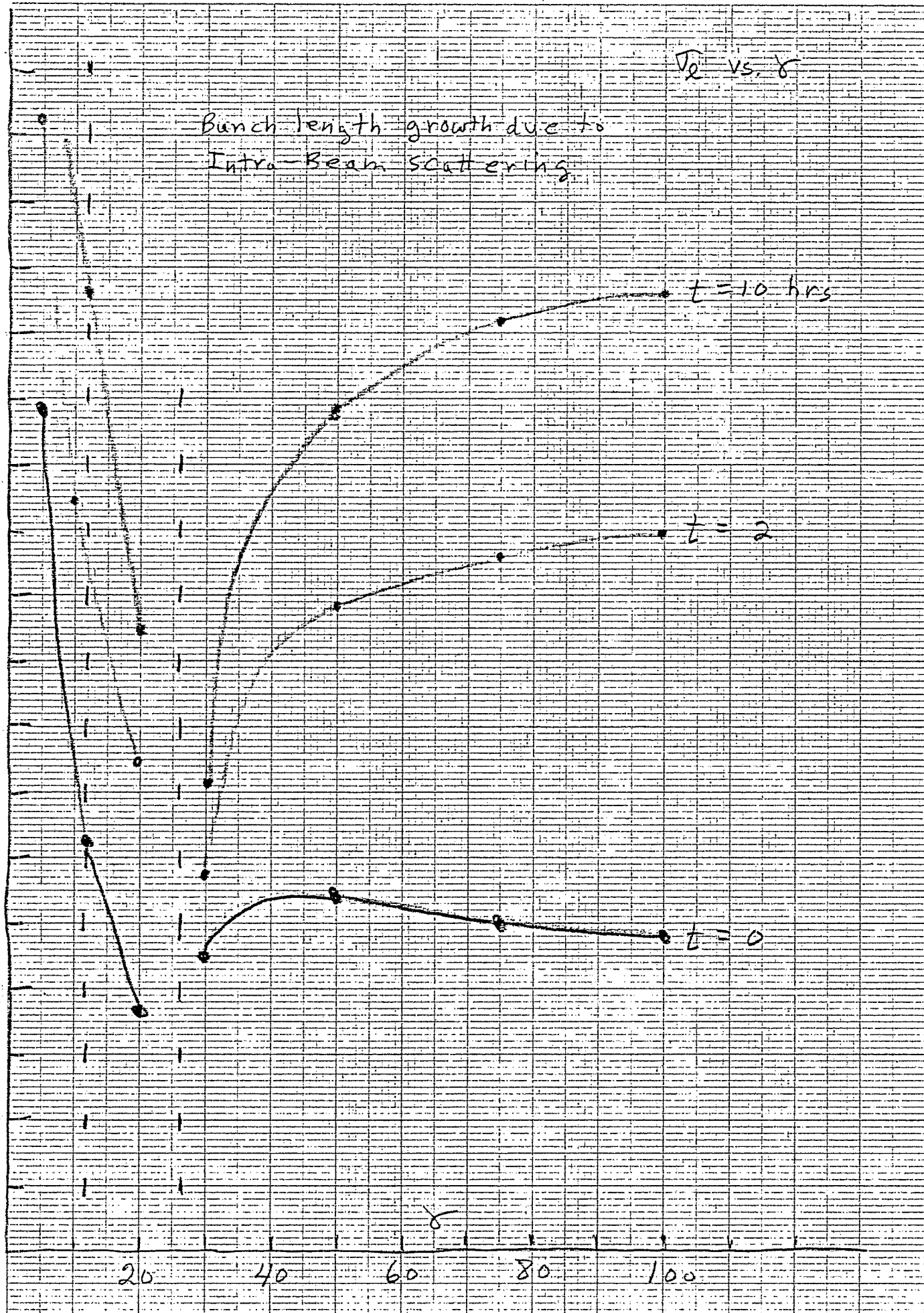
40

60

80

100

$\delta$

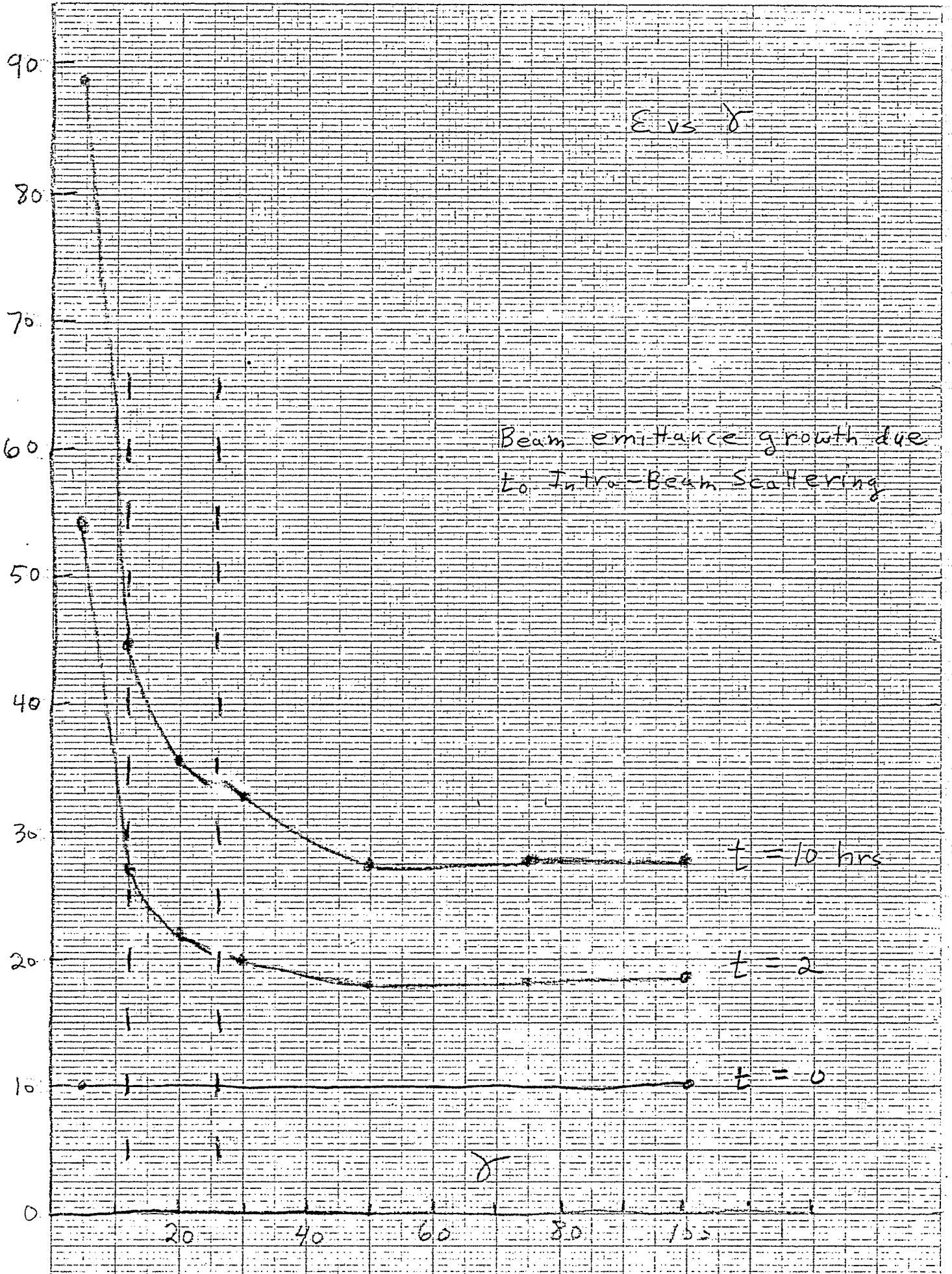


W 7 9 01/3

SQUARE

GRAPHIC CONTROLS CORPORATION  
Rd. 10, New York Printed in U.S.A.

GRAPH PAPER





$$2.5 (X_p \delta + \sigma_H) \sqrt{\delta}$$

30

20

10

(mm)

Beam half-width growth due to  
Intra-Beam Scattering

$t=10$  hrs

$t=2$

$t=0$

$\delta$

20

40

60

80

100

