

## Power Supply Accuracy in RHIC

G. Parzen

December 1985

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-AP-24

POWER SUPPLY ACCURACY IN RHIC

G. Parzen

December 18, 1985

# Power Supply Accuracy in RHIC ①

G. Parzen, 12/18/85

## Criterion

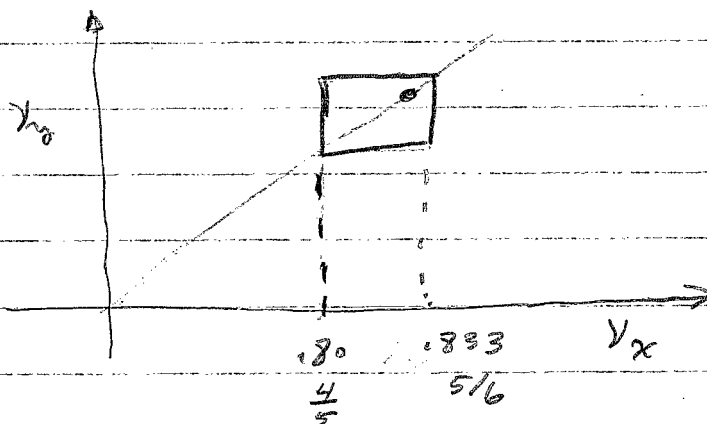
ISR, CBA - no  $\Delta V(t)$

$$\Delta V \leq 1 \times 10^{-3}$$

RHIC -  $\Delta V(t)$  present due

to Synchrotron oscillations

No crossing of  $10^{\pm 6}$  order allowed (SPS).



Box is  $33 \times 10^{-3}$  wide

$$A_{SL} = 19 \text{ mm} \rightarrow V = 28.827, 28.822$$

$6 \times 10^{-3}$  from  $6^{\pm 6}$  order resonance

Beam-Beam interaction gives  $\Delta V \approx 20 \times 10^{-3}$

$$V(A) \lesssim 19 \times 10^{-3}$$

$V(A)$  depends on  $\Delta V/p \rightarrow$  additional  $\Delta V = 6 \times 10^{-3}$

Box is fairly full

Criterion  $\Delta V \leq 1 \times 10^{-3}$  seems reasonable.

## Major Sources of $\Delta V$ errors

QF, QD	tuning
Q1, Q2, Q3	bypass
Q2, Q3	tuning
B2H, B2V	chromaticity Control
Q7, Q6	tuning

## Accuracy Definition

B-swing of 15  $\gamma = 7 \rightarrow \gamma = 100$

$$\text{Current accuracy} = \frac{\Delta I}{I}$$

$$\text{Power Supply Accuracy} = \frac{\Delta I}{I_{\max}}$$

$$\text{Current Accuracy} = 15 \times \text{Power Supply Accuracy}$$

# Quads in Series with Dipoles, QF Bypass, QD Bypass

Coll	Location	b k, max		cm <sup>-1</sup>	1.0		Power	
		%	amps		$\Delta V_x$	$\Delta V_y$	Supply Accuracy	Current Accuracy
						10 <sup>-3</sup>	10 <sup>-5</sup>	10 <sup>-5</sup>
B1H	QF	10	450	.013	.59	.10	1.2	18
B1V	QD	10	450	.013	.10	.59	1.2	18
Q123	Q1Q2Q3	60	1750	.100	.57	.57	1.0	15
Q7I		10	400	.020	.05	.26	10	150
Q6I		10	400	.020	.17	.11	10	150
Q3I		7	200	.012	.20	.07	5	75
Q2I		7	200	.012	.15	.35	5	75
Q1F		7	200	.012	.22	.23	5	75
Q10		7	200	.012	.23	.22	5	75
Q20		7	200	.012	.35	.15	5	75
Q30		7	200	.012	.07	.20	5	75
Q60		10	400	.020	.11	.17	10	150
Q70		10	400	.020	.26	.05	10	150
Q8I		5	200		.02	.003	10	
Q5I		5	200		.007	.06	10	
Q4I		5	200		.06	.007	10	
QXI		5	200		.02	.05	10	
QX0								
Q40								
Q50								
Q80								
bV total					1.06	1.06		

## QF, QD - separate power supply, QF QD Bypass

B1Q	QF, QD	100	4500	.50	.50	.12	1.8
BYQFQD		10	450	.2	.2	.4	6

B1Q,  $PSAC \approx \frac{1}{10} (PSAC(B1H))$

BYQFQD,  $PSAC \approx PSAC(B1H) \times \frac{1}{3}$

## Ripple Question

Quad Ripple  $\rightarrow \Delta V_Q$

Dipole Ripple  $\rightarrow \Delta V_D$

$\Delta V_Q + \Delta V_D = 0$  if Chromaticity = 0  
and ripples are equal.

If ripples uncorrelated, and  
natural chromaticity  $\sim 60$

$$\Delta V = 2 * 60 * \text{Ripple} \leq .2 \times 10^{-3}$$

$$\text{Ripple} \leq 2 \times 10^{-6}$$