

Power Supply Accuracy in RHIC

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December 1985

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U.S. Department of Energy

USDOE Office of Science (SC)

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RHIC-AP-24

POWER SUPPLY ACCURACY IN RHIC

G. Parzen

December 18, 1985

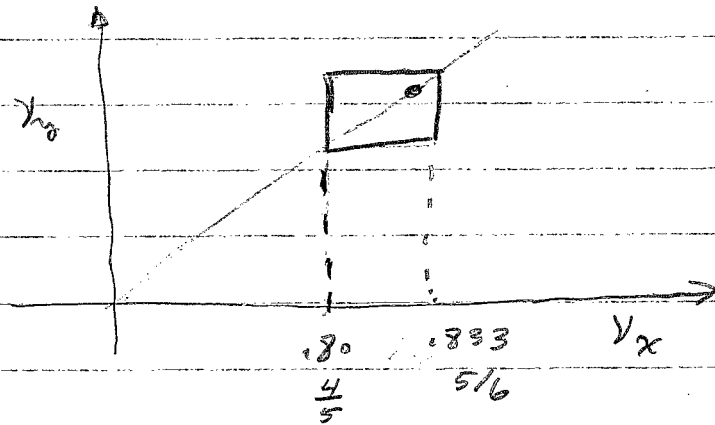
Power Supply Accuracy in RHIC ^①

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 33×10^{-3} wide

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

6×10^{-3} from 6^{th} order resonance

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

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

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

Box is fairly full

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

Major Sources of ΔV errors

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

Accuracy Definition

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

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

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

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

Quads in Series with Dipsles, QF Bypass, QD Bypass

Coil	Location	b k, max		cm ^{-1k}	ΔV _x	ΔV _y	Power	Current
		%	amps				Supply Accuracy	Accuracy
						10 ⁻³	10 ⁻⁵	10 ⁻⁵
B1H	QF	10	450	.013	.59	.10	1.2	1.18
B1V	QD	10	450	.013	.10	.59	1.2	1.18
Q123	Q1Q2Q3	60	1750	.100	.57	.57	1.0	1.15
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								
ΔV total					1.06	1.06		

QF, QD - separate power supply, QF QD Bypass

B1Q	QF, QD	100	4500		.50	.50	.12	1.18
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 ~ 60

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

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