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Requirements On The Strength Of The Steering Dipoles For RHIC

A. G. Ruggiero

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Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

DISCLAIMER

RHIC-PG-50

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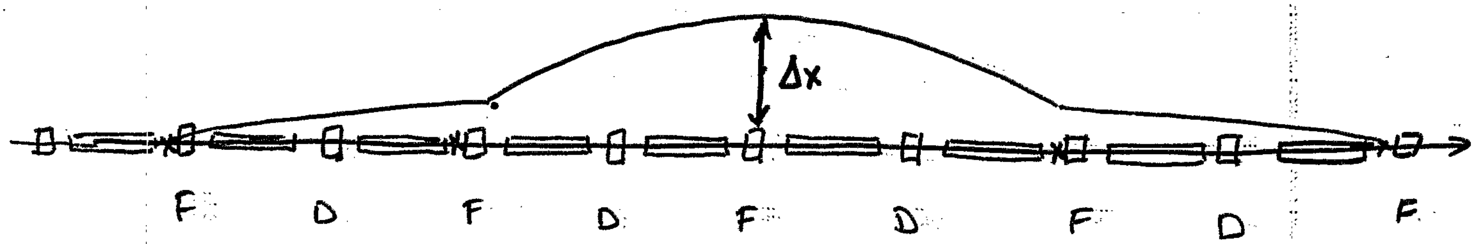
Local Closed Orbit Correction in the Regular Arcs



Phase advance per cell 98°

$$\sin 98^\circ = 0.99$$

Since the phase advance is not quite 90°, one requires a 4-magnet local bump. But since $\sin 98^\circ = 0.99$ to estimate the requirement of the steering dipole strength we can assume the phase advance to be exactly 90° and take a 2-magnet bump. The other 2 magnets at both ends are minor corrections.

At the location of the steering dipoles and at the centre of the bumps

$$\beta_1 = \beta_2 = 50\,m$$

$\theta = \dfrac{\Delta B \ell}{B\rho}$, steering angle

Δx , displacement at the centre of the bumps

$$\Delta x = \theta \sqrt{\beta_1 \beta_2}\, \sin\psi$$

We take $\sin\psi = 1$ then

$$\frac{\Delta B\, \ell}{B\rho} = \frac{\Delta x}{50\,m}$$

For $B\rho = 839.5$ T-m

$\Delta B \cdot \ell = (0.17\ \Delta x)$ where Δx in mm, $\Delta B \cdot \ell$ in KG-m

For $\Delta x = \pm 2$ mm one needs

$$\Delta B \cdot \ell = \pm 0.34 \ \text{KG-m}$$

In reality for the closed orbit correction all around one ring there will be a chain of overlapping local bumps. Therefore for safety the previous number should be multiplied by some factor. We propose

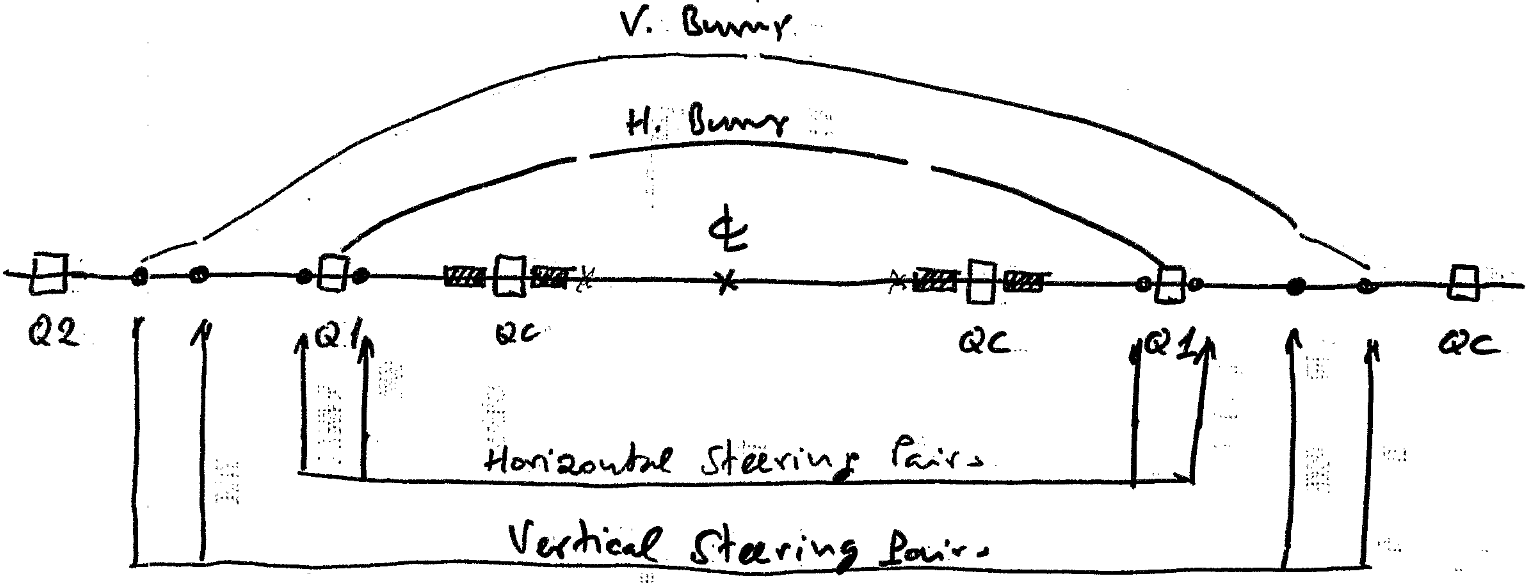
$$\Delta B \cdot l = \pm\, 0.5 \text{ KG} \cdot \text{m}$$

For instance

$$\Delta B = 1 \text{ KG} \qquad \text{for} \qquad \Delta x = \pm\, 2 \text{mm}$$
$$l = 0.5 \text{ m}$$

~~[illegible]~~ Anything on top of this will certainly help. The above requirement is a minimum.

Orbit Adjustment in the Crossing Region



We are dealing basically with 2-magnet local bumps, though for convenience in practice the system is made of 4-magnets -

$$\Delta z = \theta \sqrt{\beta_1 \beta_2} \sin \psi$$

The location of the steering dipoles in both planes is chosen so that

$$\sin \psi = 1$$

$2\psi = 180°$, phase advance across the full bump

The location of the steering magnets is as shown in the Figure.

$$\theta = \frac{\Delta B \ell}{B\rho} \quad \text{with} \quad B\rho = 839.5 \text{ T-m}$$

$\sigma_0^* =$ rms beam size for $\varepsilon_N = 10\pi$ mm·mrad

	Horizontal	Vertical
β_1	0.8855 m	6.3122 m
β_2	70.0 m	150. m
σ^*	0.12 mm	0.32 m
$\theta/\Delta z$	0.127 m^{-1}	0.0325 m^{-1}
for	$\Delta z = \pm 5$ mm	
$\Delta B \cdot \ell$	5.35 KG·m	1.365 KG·m
ΔB	3.0 KG	2 KG
ℓ	1.0 m	0.5 m
	at both sides of Q_1	~~at both sides of Q_1~~ 2, between Q_1 and Q_2