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Requirements On The Strength Of The Steering Dipoles For RHIC

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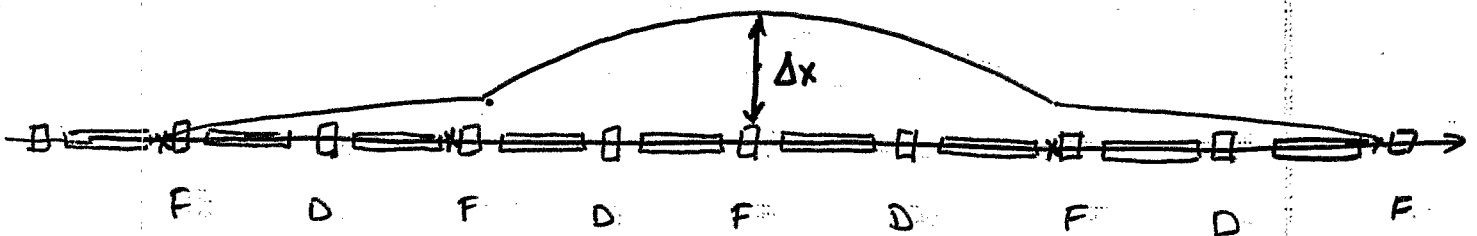
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REQUIREMENT ON THE STRENGTH
OF THE STEERING DIPOLES
FOR
RHIC

A.G. Ruggiero

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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

$$\beta_1 = \beta_2 = 50\text{m}$$

$$\theta = \frac{\Delta B \cdot l}{B \rho}, \text{ steering angle}$$

Δx , displacement at the centre of the bumps

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

We take $\sin \psi = 1$ then

$$\frac{\Delta B \cdot l}{B \rho} = \frac{\Delta x}{50\text{m}}$$

For $B \rho = 839.5 \text{ T}\cdot\text{m}$

$$\Delta B \cdot l = (0.17 \Delta x) \quad \begin{matrix} \text{where } \Delta x \text{ in mm} \\ \Delta B \cdot l \text{ in KG}\cdot\text{m} \end{matrix}$$

For $\Delta x = \pm 2\text{mm}$ one needs

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

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

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

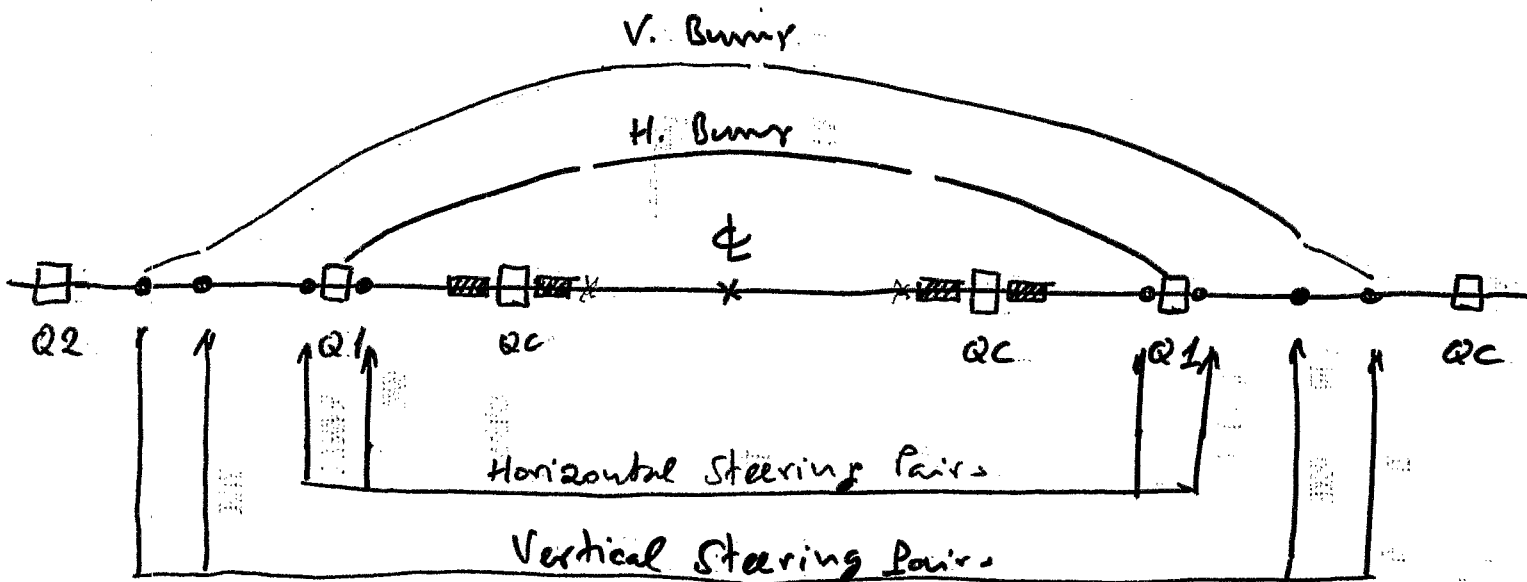
For instance

$$\begin{array}{l} \Delta B = 1 \text{ KG} \\ l = 0.5 \text{ m} \end{array} \quad \text{for} \quad \Delta x = \pm 2 \text{ mm}$$

~~Anything~~ Anything on top of this will certainly help - the above requirement is a minimum.

(9)

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

$$\sin \psi = 1$$

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

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

$\theta = \frac{\Delta B l}{B \rho}$ with $B \rho = 839.5 \text{ T}\cdot\text{m}$

$\sigma_0^* = \text{rms beam size for } \epsilon_N = 10 \pi \text{ mm}\cdot\text{mrad}$

Horizontal

Vertical

β_1	0.8855 m	6.3122 m
β_2	70.0 m	150. m
σ^*	0.12 mm	0.32 mm
$\theta/\Delta z$	0.127 m^{-1}	0.0325 m^{-1}
for	$\Delta z = \pm 5 \text{ mm}$	
$\Delta B \cdot l$	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

~~at both sides of Q_1~~
2, between Q_1 and Q_2