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# Requirements On The Strength Of The Steering Dipoles For RHIC

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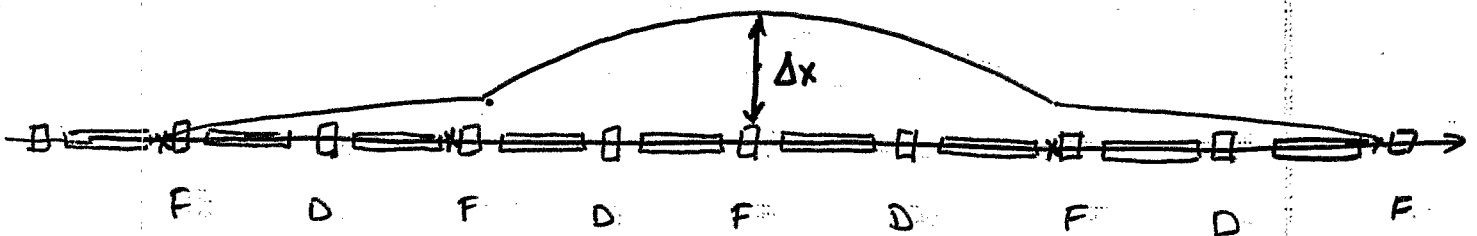
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REQUIREMENT ON THE STRENGTH  
OF THE STEERING DIPOLES  
FOR  
RHIC

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## Local Closed Orbit Correction in the Regular Arcs



Phase advance per cell  $98^\circ$

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

Since the phase advance is not quite  $90^\circ$ , 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  $90^\circ$  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

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

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

$\Delta x$ , 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  $B \rho = 839.5 \text{ T-m}$

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

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

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

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

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

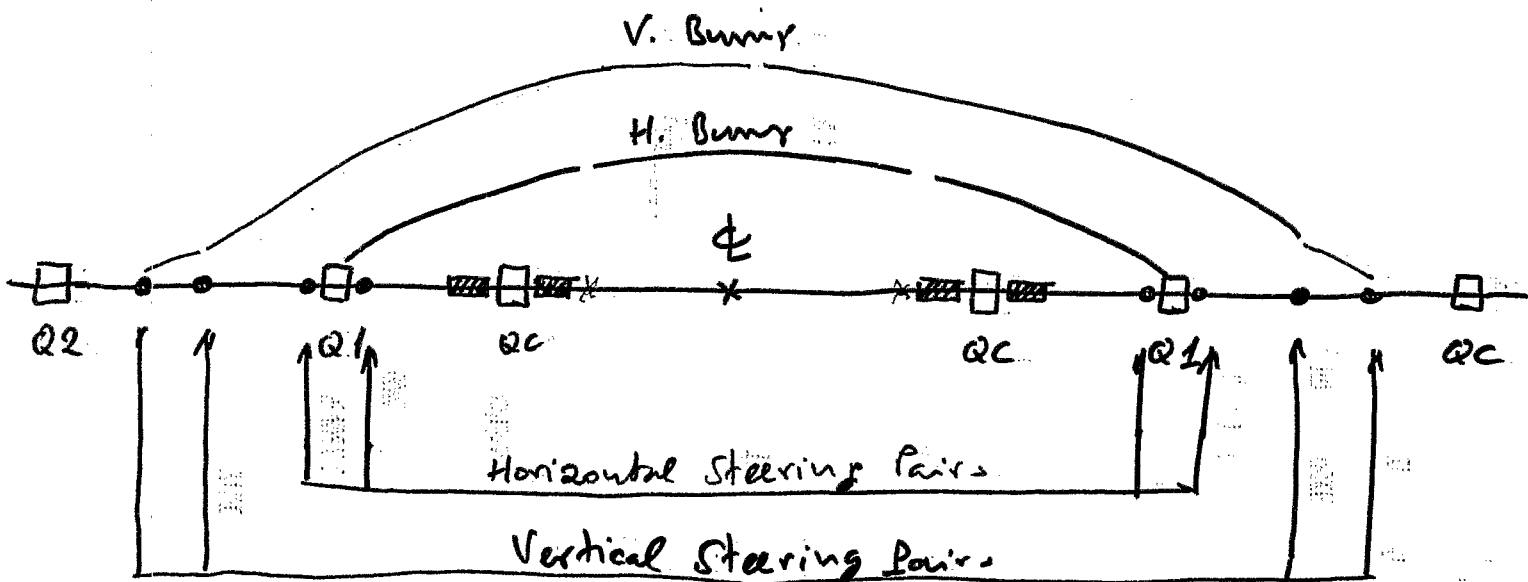
For instance

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

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

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

Horizontal

Vertical

$\beta_1$	0.8855 m	6.3122 m
$\beta_2$	70.0 m	150. m
$\sigma^*$	0.12 mm	0.32 mm
$\theta/\Delta z$	0.127 $\text{m}^{-1}$	0.0325 $\text{m}^{-1}$
for	$\Delta z = \pm 5 \text{ mm}$	
$\Delta B \cdot l$	5.35 KG·m	1.365 KG·m
$\Delta B$	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  $Q_2$