

# Requirements On The Strength Of The Steering Dipoles For RHIC

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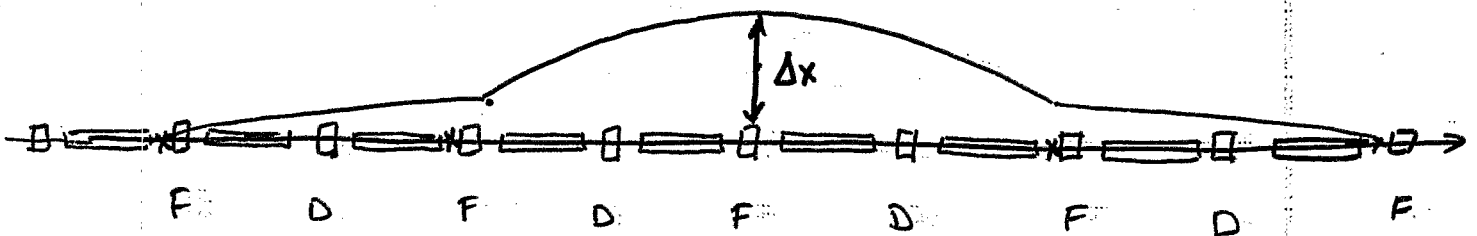
RHIC-PG-50

REQUIREMENT ON THE STRENGTH  
OF THE STEERING DIPOLES  
FOR  
RHIC

A.G. Ruggiero

BNL - April 17, 1984

## 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

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

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

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

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

$$\Delta B = 1 \text{ KG}$$

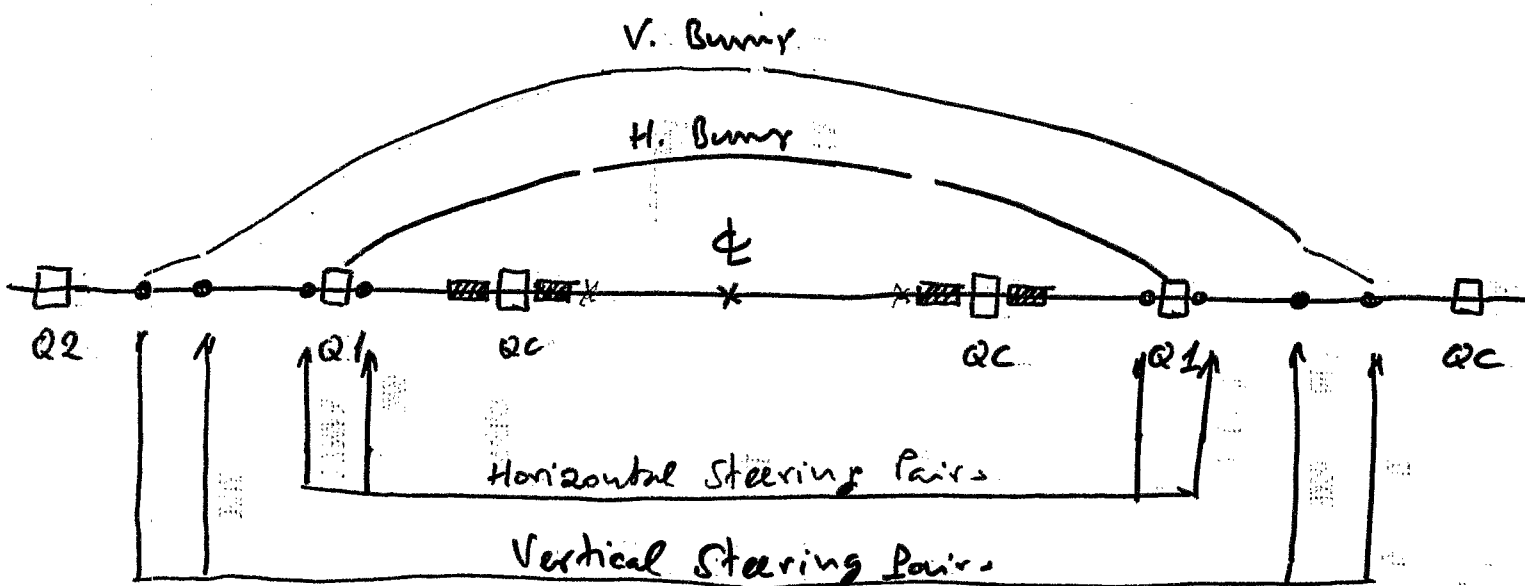
$$l = 0.5 \text{ m}$$

$$\text{for } \Delta x = \pm 2 \text{ mm}$$

~~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.

$$\Delta z = 0 \sqrt{\beta_1 \beta_2} \sin \psi$$

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

(5)

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

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

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

Horizontal

Vertical

 $\beta_1$   
 $\beta_2$   
 $\sigma^*$ 

0.8855 m

6.3122 m

70.0 m

150. m

0.12 mm

0.32 m

 $\theta/\Delta z$ 0.127 m<sup>-1</sup>0.0325 m<sup>-1</sup>

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

~~Between Q<sub>1</sub> and Q<sub>2</sub>~~  
 at both sides of Q<sub>1</sub>

~~at both sides of Q<sub>1</sub>~~  
 2, between Q<sub>1</sub> and Q<sub>2</sub>