

Possible Orbit Separator for the IP in RHIC

S. Y. Lee

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Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

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Possible Orbit Separator for the IP in RHIC

S. Y. Lee

BNL

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To avoid the beam-beam effect of unwanted collisions in the collider, Beam-Beam separators are usually used to separate two beams. For RHIC operation in the high luminosity mode, the practice is also important. There are many methods to separate the beams at the interaction points. In the following, we shall describe an efficient ~~method~~^{way} of using the phase advance of 90° from the IP to the high β quadrupole for beam separation. Since there are dipole correctors (θ_0) in each quadrupole, we shall use a_0 next to the defocusing quadrupoles Q4I, Q2I, Q30 and Q50.

The phase advance from IP to Q2I ^{and IP to Q30} are ~~are~~ ^{respectively} $\pi/2$ ~~and~~

with a kicker arm of $\sqrt{\beta_i \beta_f} \sin \Delta\mu \approx \sqrt{1250} \approx 35$ m.

Thus a kicker strength of 0.1 mrad can create about 35 mm of orbit distortion. The orbit however should be corrected

to nearly zero elsewhere. The ~~kickers~~ ^{a₀} correctors

at Q4I and Q50 ^{then} are excited to eliminate the

residual effect. Fig. 1 shows the ^{vertical} orbit bump for

the $\beta^* = 6$ m lattice at ~~this~~ superperiodicity 3. The

residual ^{closed} orbit excursion is ~~about~~ less than 0.13 mm, ~~if~~

Fig. 2 shows the γ_{co} in the lattice with

five $\beta^* = 6$ m insertions and one $\beta^* = 2$ m insertion.

The closed orbit a_0 dipoles are excited to ~~reach~~ ^{reach} ~~the~~

proper beam separation at those $\beta^* = 6$ m insertion

The effect of $\beta^* = 2m$ insertion gives the residual effect of $Y_{co} \leq 0.5 \text{ mm}$ at the $\beta^* = 2m$ insertion. Due to the antisymmetric structure of the insertion, the $Y_{co} \approx 0.02 \text{ mm}$ at the IP of $\beta^* = 2m$. We feel that the effect to the collision rate should be small. This effect can however be corrected by the ~~the~~ orbit correctors in the $\beta^* = 2m$ insertion,

Fig. 3 shows the Y_{co} as a function of the kicker strength at ~~Θ_{2I}~~ Θ_{2I} . The strength of other kickers ~~are shown for~~ is related to Θ_{2I} by

$$\Theta_{4I} = \frac{1.15}{2.15} \Theta_{2I}$$

$$\Theta_{30} = \frac{1.95}{2.15} \Theta_{2I}$$

$$\Theta_{50} = \frac{0.89}{2.15} \Theta_{2I}$$

P Because of these orbit bumps, the beam may move into the nonlinear region of the magnets. One should compromise between large beam-beam separation for minimizing beam-beam interaction and the nonlinear effect due to the magnets. Some types of tracking study/simulation may be useful

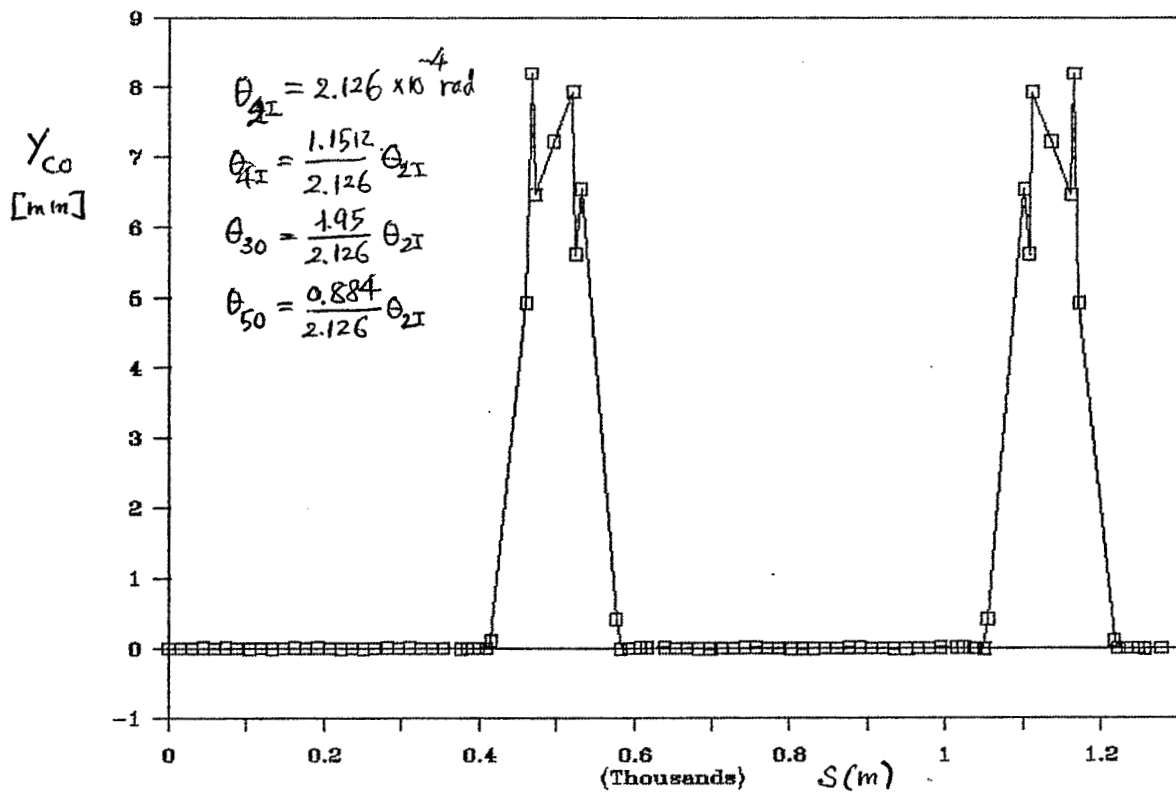
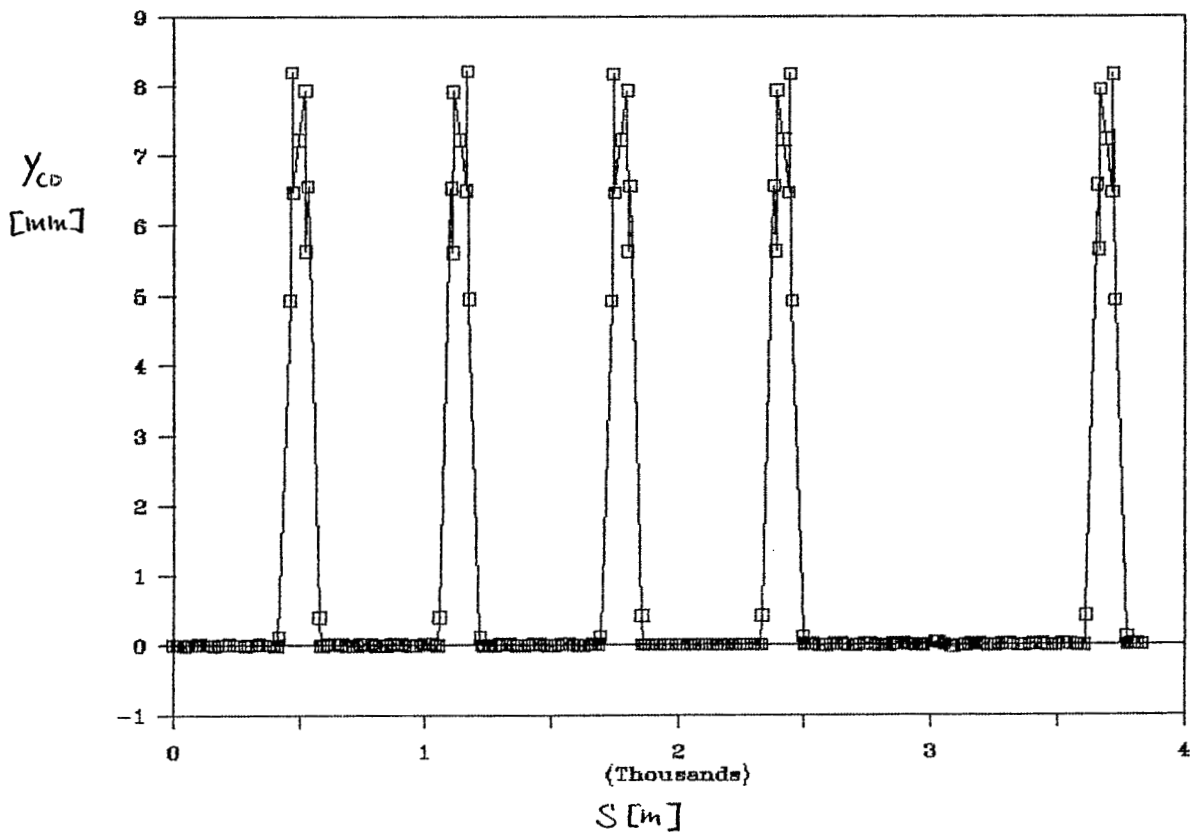


Fig.1 γ_{co} for $\beta^* = 6m$ with 3 superperiod

Fig.2 γ_{co} for 5 $\beta^* = 6m$ insertions and one $\beta^* = 2m$ insertion



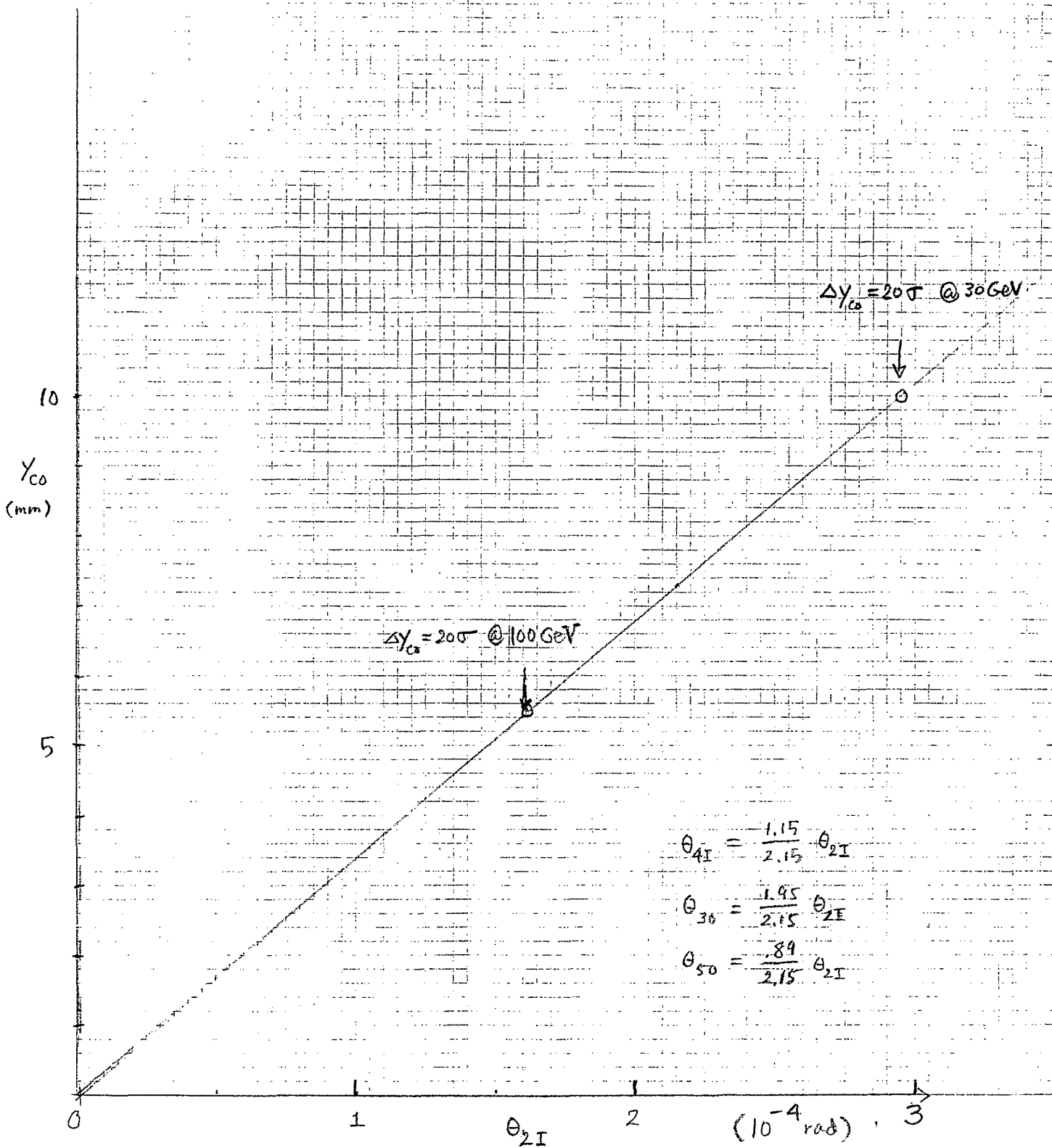


Fig. 3 y_{co} (mm) vs θ_{2I}