

Effects of Position Errors of the Magnetic Center in Dipoles

G. Parzen

January 1990

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No. DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

AD/RHIC/AP-88

RHIC PROJECT
Brookhaven National Laboratory

Effects of Position Errors of the Magnetic Center in Dipoles

G. Parzen

January 1990

Effects of Position Errors of the Magnetic Center in Dipoles

G. Parzen

Because of the systematic b_2 due to magnetization or iron saturation, random position errors in the magnetic center will generate a random b_1 .

The b_2 due to magnetization or saturation in the dipoles is

γ	7	12	100	
b'_2	-10	-3	-6.5	$\times 10^{-4}$

The expected random b_1 in the dipoles is $b_1 = 8.4 \times 10^{-5}/\text{cm rms}$. It is hoped to reduce this b_1 by about a factor of 4 by magnet shuffling. In order to preserve this factor of 4, the random magnetic center error should lead to a random b_1 which is smaller than $b_1 = \frac{1}{4}(8.4 \times 10^{-5})$ or $b_1 = 2.1 \times 10^{-5}/\text{cm rms}$.

A 0.5 mm rms error in the magnetic center will give a random b_1 of $b_1 = 1.46 \times 10^{-5}/\text{cm rms}$.

Assuming a closed orbit error in the dipoles of 0.5 mm rms, then the magnetic center is off the closed orbit by

$$\Delta x = \sqrt{(0.5)^2 + (0.5)^2} = 0.7 \text{ mm/rms},$$

and

$$b_1 = 2 \left(\frac{6.5}{6.25} \right) \times 10^{-4} \times 0.07 = 1.46 \times 10^{-5}/\text{cm rms},$$

using the $b'_2 = 6.5$ at $\gamma = 100$.

The average b_1 generated, as described above, can be corrected by horizontal positioning of the dipole during installation, as suggested by H. Hahn. A 0.5 mm rms error in the dipole installation may be considered as a possible tolerance.