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Universal Correction Coil for Random Error Multipoles in RHIC

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U.S. Department of Energy

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Universal Correction Coil
for Random Error Multipoles in RHIC

G. Parzen

BNL, March 27, 1985

Universal Correction Coil

①

G. Parzen

3/26/85

Possibility to correct b_n, a_n in BC2,
in $Q1, Q2, Q3$.

Tracking Studies — to show which a_n, b_n ,
and which magnets to correct.

Assume — Correction of $b_i \rightarrow b_{10}, a_i \rightarrow a_{10}$
in BC2 as example.

Multilayer Universal Coil *

Layer No. 1

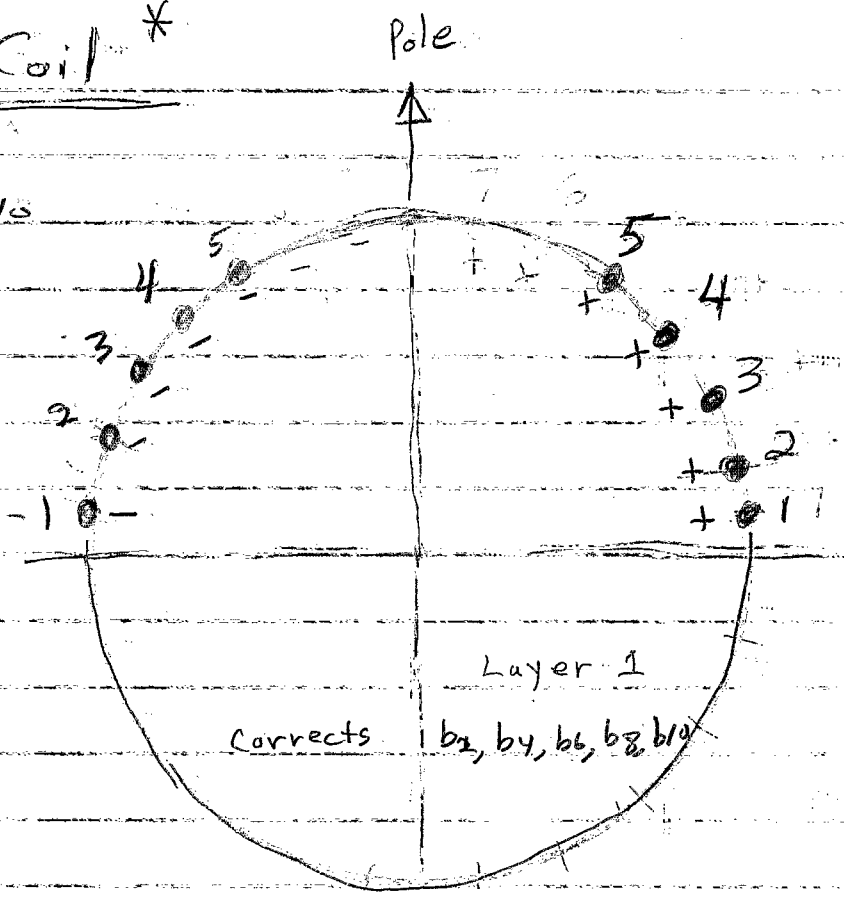
Corrects $b_2, b_4, b_6, b_8, b_{10}$

5 separately excited
coils

Pole at $\pi/2$

To correct $a_2, a_4, a_6, a_8, a_{10}$
rotate $\pi/2$.

Layer 1b



Layer No. 2

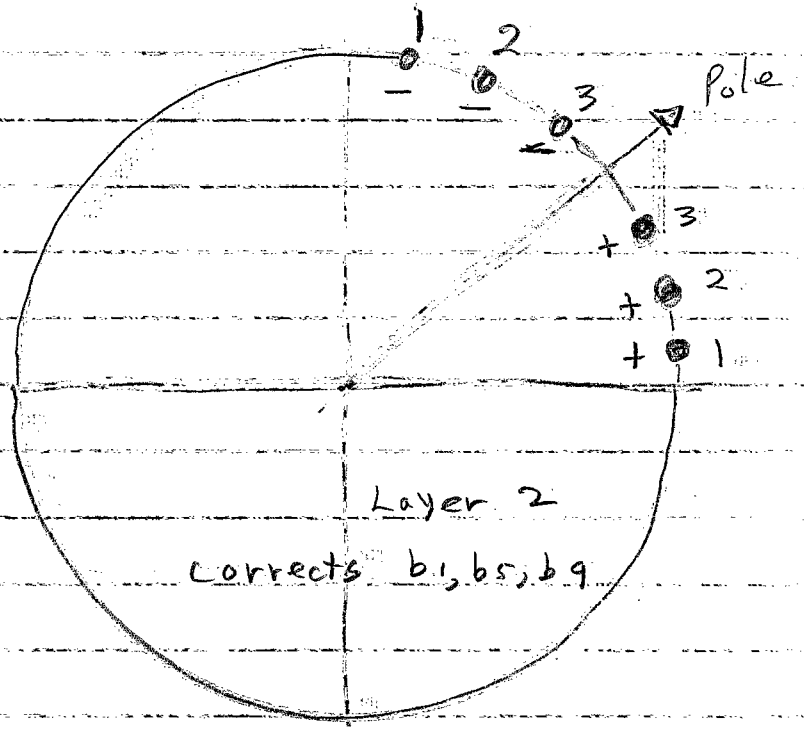
corrects b_1, b_5, b_9

3 separately excited coils

Pole at $\pi/4$

For a_1, a_5, a_9
rotate $\pi/4$.

Layer 2b



* G. Parzen, BNL Report BNL 51455
4, Multilayer Universal Correction Magnet (1981)

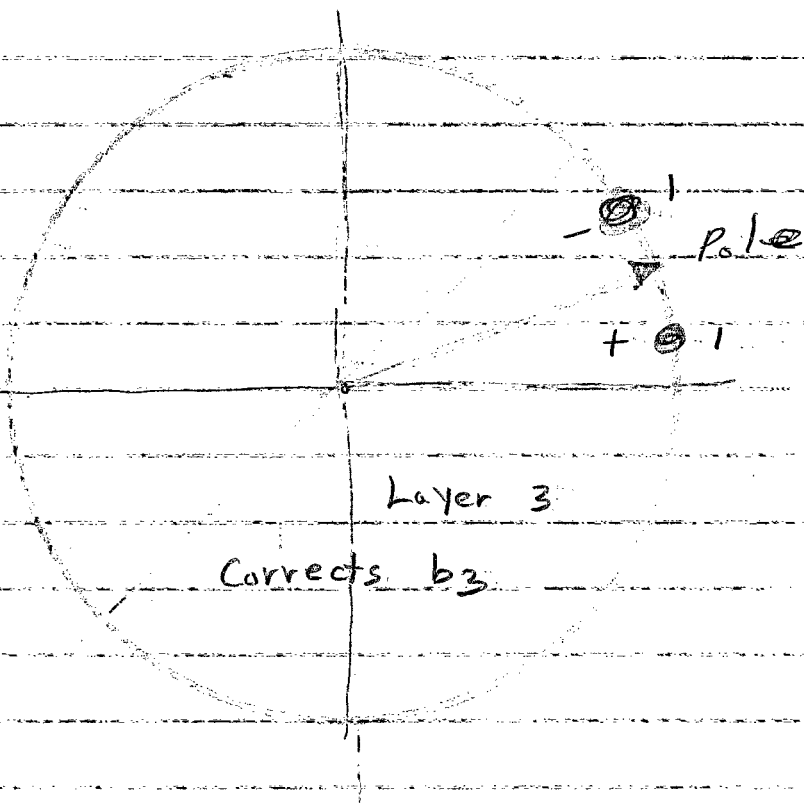
Multilayer Universal Coil (Continued)

Layer No. 3

Corrects b_3 (b_{11})

1 separately excited
coil

Pole at $\pi/3$



Layer No. 4

Corrects b_7 (b_{23})

1 separately excited
coil

Pole at $\pi/16$

(4)

Multilayer Universal Col. (Summary)

8 - layers

Layer 1a \rightarrow $b_2, b_4, b_6, b_8, b_{10}$

1b \rightarrow $a_3, a_4, a_6, a_8, a_{10}$

Layer 2a \rightarrow b_1, b_5, b_9

2b \rightarrow a_1, a_5, a_9

Layer 3a \rightarrow b_3

3b \rightarrow a_3

Layer 4a \rightarrow b_7

4b \rightarrow a_7

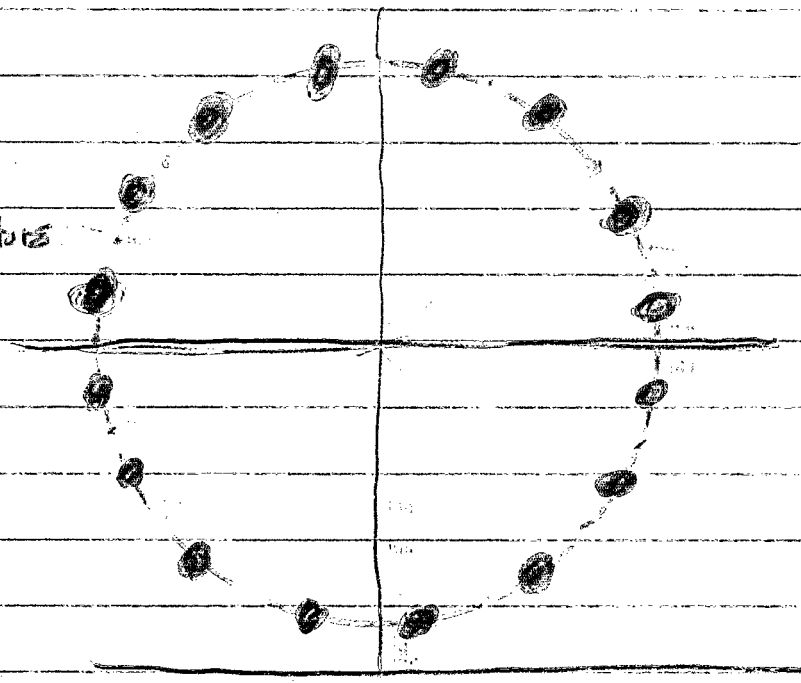
May be possible to reduce number of layers.

Single Layer Universal Coil

Single Layer - No Return Currents (ISR)

Correct $a_i \rightarrow a_{i0}$
 $b_i \rightarrow b_{i0}$

Seperately excited conductors



Return Currents?
around iron

$$\sum_n I_n = 0$$

(ISR \rightarrow C magnet)

May need extra conductor

2) Seperately excited conductors (22?)

$I_n \approx 10^{-3}$ of main total dipole current.

Inversion of Matrix

$$b_n = \sum_m B_{nm} I_m$$

$$a_n = \sum_m A_{nm} I_m$$

may have problem with higher multipoles
 b_{11}, b_{12} etc.

Pure Multipole Coils

20 layers

each layer, a pure multipole.

IF coils rotatable, b_n and a_n

can be combined \rightarrow 10 layers