RHIC-AP-15

Universal Correction Coil for Random Error Multipoles in RHIC

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BNL, March 27, 1985

Universal Correction Coil

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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 $b_1 \rightarrow b_{10}$, $a_1 \rightarrow a_{10}$
in BC2 as example

Multilayer Universal Coil *

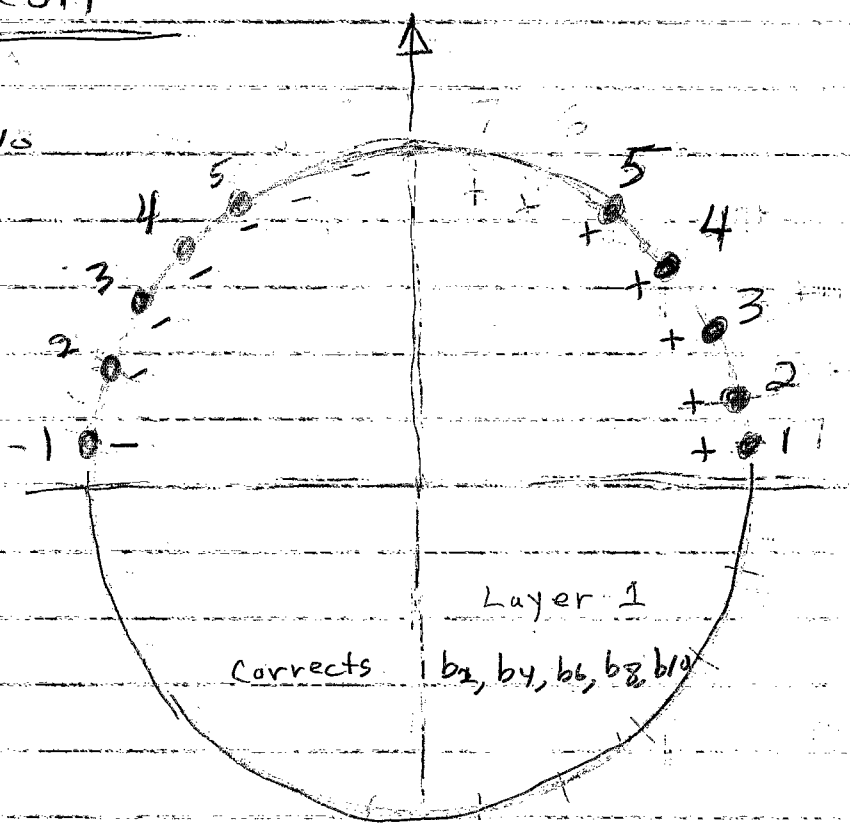
Layer No. 1

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

5 seperately excited Coils

Pole at $\pi/2$

To correct $a_2, a_4, a_6, a_8, a_{10}$ rotate $\pi/2$. Layer 1b



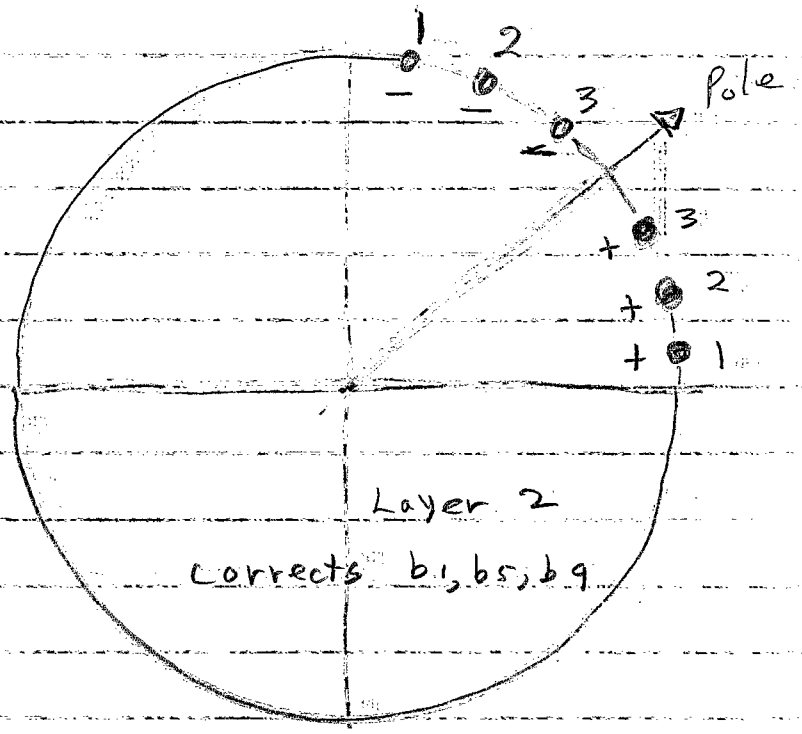
Layer No. 2

corrects b_1, b_5, b_9

3 seperately excited Coils

Pole at $\pi/4$

For a_1, a_5, a_9 rotate $\pi/4$. Layer 2b



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

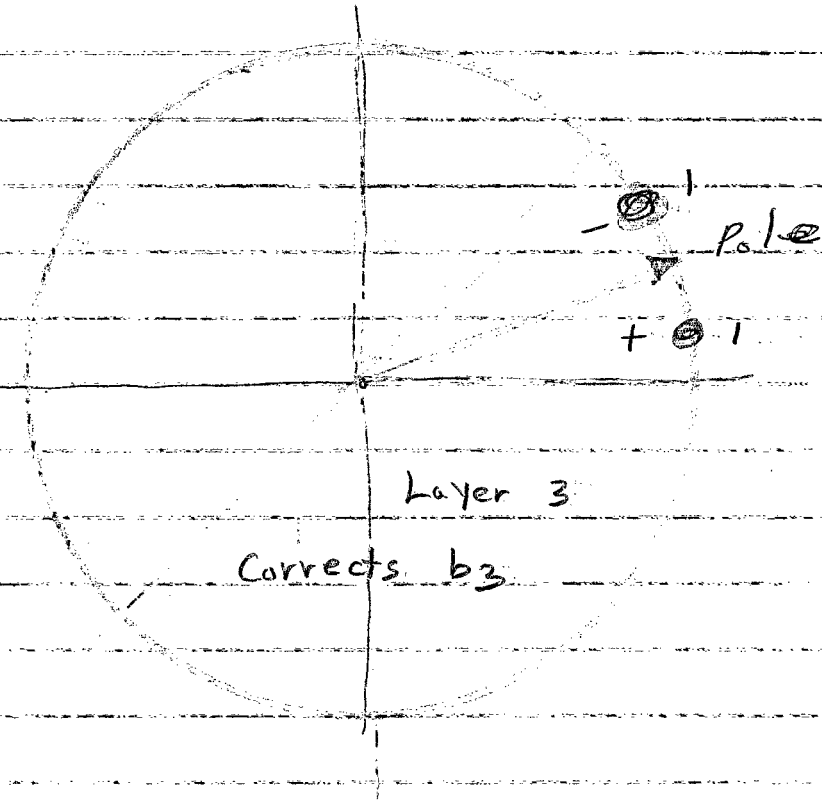
Multilayer Universal Coil (Continued)

Layer No. 3

Corrects b_3, (b_{11})

1 seperately excited Coil

Pole at $\pi/8$



Layer No. 4

Corrects b_7, (b_{23})

1 seperately excited Coil

Pole at $\pi/16$

Multilayer Universal Coil (Summary)

8 - layers

Layer 1a → $b_2, b_4, b_6, b_8, b_{10}$
1b → $a_2, a_4, a_6, a_8, a_{10}$

Layer 2a → b_1, b_5, b_9
2b → a_1, a_5, a_9

Layer 3a → b_3
3b → a_3

Layer 4a → b_7
4b → a_7

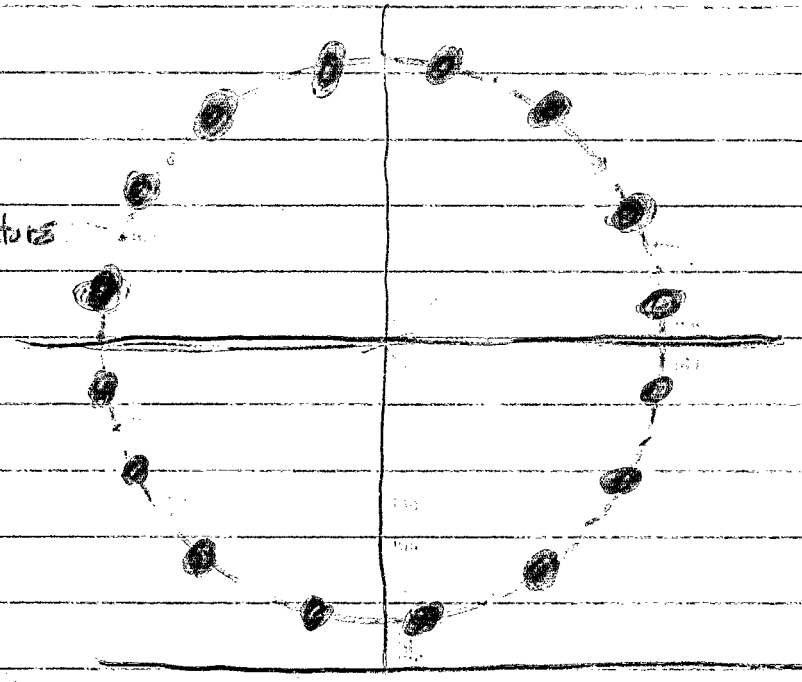
May be possible to reduce number of layers.

Single Layer Universal Coil

Single Layer — No Return Currents (ISR)

Correct $a_1 \to a_{10}$
$b_1 \to b_{10}$

Seperately excited conductors



Return Currents?

around iron

$$\sum_n I_n = 0$$

(ISR → C magnet)

May need extra conductor

2) Seperately excited Conductors (22?)

$I_n \simeq 10^{-3}$ 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 $\longrightarrow$ 10 layers