Fermilab

TS-SSC-91-189 [1]
September 27, 1991
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A Method To Measure Quadrpole Component Of Pre-Yoked Magnet

Since SSC magnet has no constraint in mid plane, it is very difficult to control the skew quadrupole caused by the mid plane shift even if we carefully control the matching of the upper and lower coil sizes. Some method for the correction of quadrupole moment are being proposed, [2] but to do such correction, the quadrupole component has to be measured before the yoking. The problem in this measurement is the off-centering of the probe. If the probe is off-centered by $\Delta z = \Delta x + i\Delta y$, The true quadrupole component $C_1 = B_1 + iA_1$ is expressed by apparent components $C_1', C_2', \ldots$ as:

$$C_1 = C_1' + 2C_2'\Delta z + 3C_3'\Delta z^2 + \ldots \tag{1}$$

$1mm$ off set of the probe could induce 1 unit of faked quadrupole component when there is 5 unit of sextupole moment. Actually -4 to -5 units of sextupole are usually observed in SSC dipoles before the yoking.

One solution for this problem is to make cancellation of sextupole during the room temperature measurement. Fig.1 is an example of the sextupole correction coil. It is just a set of 6 cables around the collared coil. If these cable are at radius R, curent I can make sextupole field B_2 as:

$$B_2[Oe/cm^2] = \frac{4}{5}\frac{I[A]}{R[cm]^2} \tag{2}$$

Suppose room temperature measurement of the field is made at 50 Oe, -5 unit is 0.025 Oe/cm^2. If $R = 8.0cm$, current I can be 2 A. This is very easy current to handle. Current should be adjusted to have no sextupole while using "mole". Since these cables can be stretched on the frame directly attatched on the collar, there should not be large problem in positioning.

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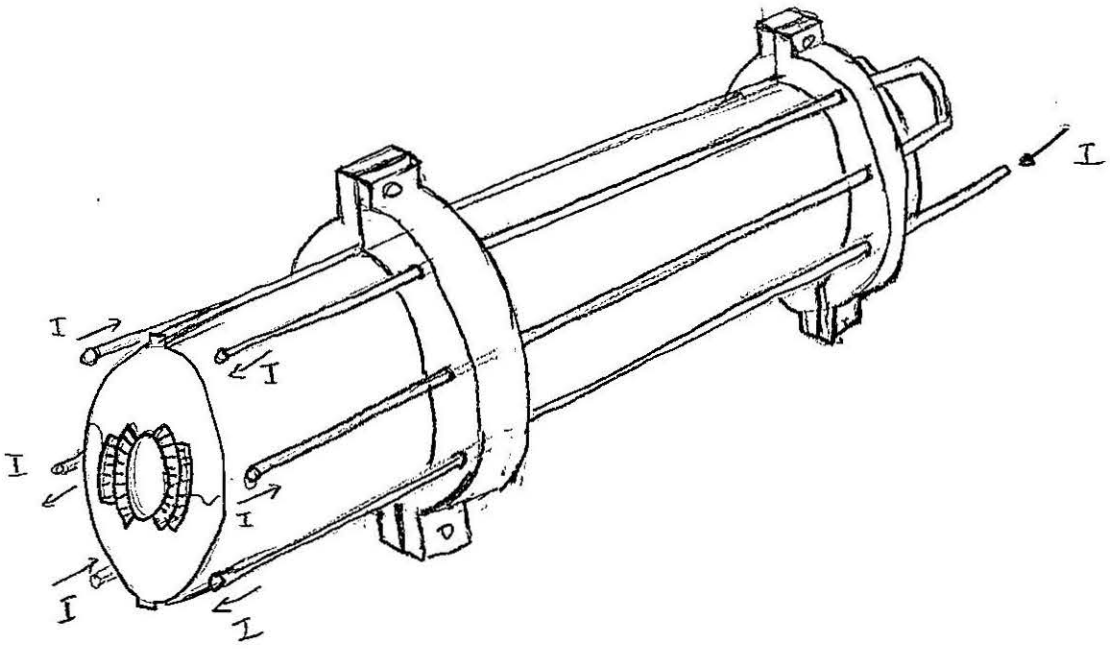
[1]Distribution: J.Carson, S.Delchamps, P.Mazur, R.Hanft, S.Gourlay, W.Koska, M.Kuchnir, M.Lamm, G.Pewitt, R.Sims, J.Strait

[2]R.Guputa, BNL Magnet Division Notes 388-1(SSC-MD-268)

Fig.1 : Sextupole Cancelling Coil



(Looks like a large Morgan coil.)

(This is also a good device for the calibration of harmonic measurement)