B R O O K H A V E N N A T I O N A L L A B O R A T O R Y

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Title: Effect of the Azimuthal Variation in the Cable Thickness on the Field Harmonics in SSC 50 mm Dipole Cross Section

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Effect of the Azimuthal Variation in the Cable Thickness on the Field Harmonics in SSC 50 mm Dipole Cross section

Ramesh Gupta

When the coil is cured under compression, the thickness of the cable gets reduced – the cable was over-sized before the actual coil was made and cured. Generally, it is assumed that the cured cable thickness in any layer is same for all turns. However, there is a higher compression on the turns near the midplane then on those near the pole. This implies that the decrease in the cable thickness may not necessarily be the same in all turns and it may depend on the location of a particular turn. This would have an influence on the field harmonics. In this note we have made an attempt to estimate the magnitude of this effect in SSC 50 mm dipole cross section[1]. Unfortunately, it is not known experimentally that how does the cable thickness varies across the cross section. The computed deviation in the field harmonics from the design value would depend on what model is used for that. We have made computations in two cases to estimate the order of this effect. In both cases the pole angle is held constant. In the first case the cable thickness changes linearly from midplane to the pole turn with the midplane turn having the least thickness. The middle turn is displaced by 2 mil towards the midplane[2]. In the second cases all turns in the first block (midplane block) have a cable thickness 1 mil less then the nominal cable thickness. The thickness of the rest of the turns in that layer is increased by an amount so that the total cable thickness or the pole angle does not change.

The results of these computations are given in table 1 for the inner and outer layers separately and combined. The change in field harmonics is linear to first order. The change in harmonics higher then b_4 is about 0.01 unit or less.

Table 1: The change in field harmonics as a result of the variation in the cable thickness (see text).

Case No.	Layer	$\frac{\delta(TF)}{TF}$ 10^{-4}	δb_2 10^{-4}	δb_4 10^{-4}
1	Inner	2.6	1.1	0.05
1	Outer	2.0	0.5	0.02
1	Combined	4.6	1.6	0.07
2	Inner	8	3.4	0.24
2	Outer	10	2.5	0.14
2	Combined	18	5.9	0.38

References

1. R.C. Gupta, S.A. Kahn, G.H. Morgan, "SSC 50 mm Dipole Cross Section", Presented at the 3^{rd} International Industrial Symposium on Super Collider (IISSC), Atlanta, March 13-15, 1991.

2. P.A. Thompson, "Private communication on PAR2DOPT".