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CBA Project

Technical Note No. 403

NEW CBA DIPOLE CROSS SECTION

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This note describes the proposed CBA dipole cross section, sometimes referred to as the "A' solution". It represents a small adjustment of the present conductor cross section[1] so that the maximum requirements on the trim coils are reduced. In particular this design should reduce the values of b_2 to about 5×10^{-4} and b_4 to about 0 at 3800 A while leaving the value of b_6 around 0 at injection[2].

Table I and Figure 1 indicate the new coil cross section. The midplane angle of 0.07° corresponds to the amount of midplane insulation that we are currently using. The number of turns in the inner coil blocks is the same as in the TN 337 design[1]. The outer coil has 1 more turn in the block nearest the post. Both copper wedges have a chordal thickness ℓ at the mean conductor radius r of

$$\ell = 2r \sin \frac{\theta}{2} = 265 \text{ mils}$$

where θ is the wedge angle. Thus the construction is somewhat simplified since only one type of copper wedge is needed.

The infinite permeability values of the multipoles for the straight section are given in Table II. The transfer function is 0.8% higher than the TN 337 design. The b_8 and higher multipoles are comfortably below the tolerances. The column labelled "A66 Option" gives the calculated multipoles if 3 mils (0.056°) of extra insulation is added at the outer coil midplane and removed from the outer post shim. Thus this option uses the same coils and could be implemented at assembly time. It is presently thought that this configuration gives slightly more desirable multipoles.

I would like to thank Harald Hahn for useful discussions on this topic.

References

1. H. Hahn & R.C. Fernow, Interim Cable Dipole Coil Design, ISA Tech Note No. 337 (1981).

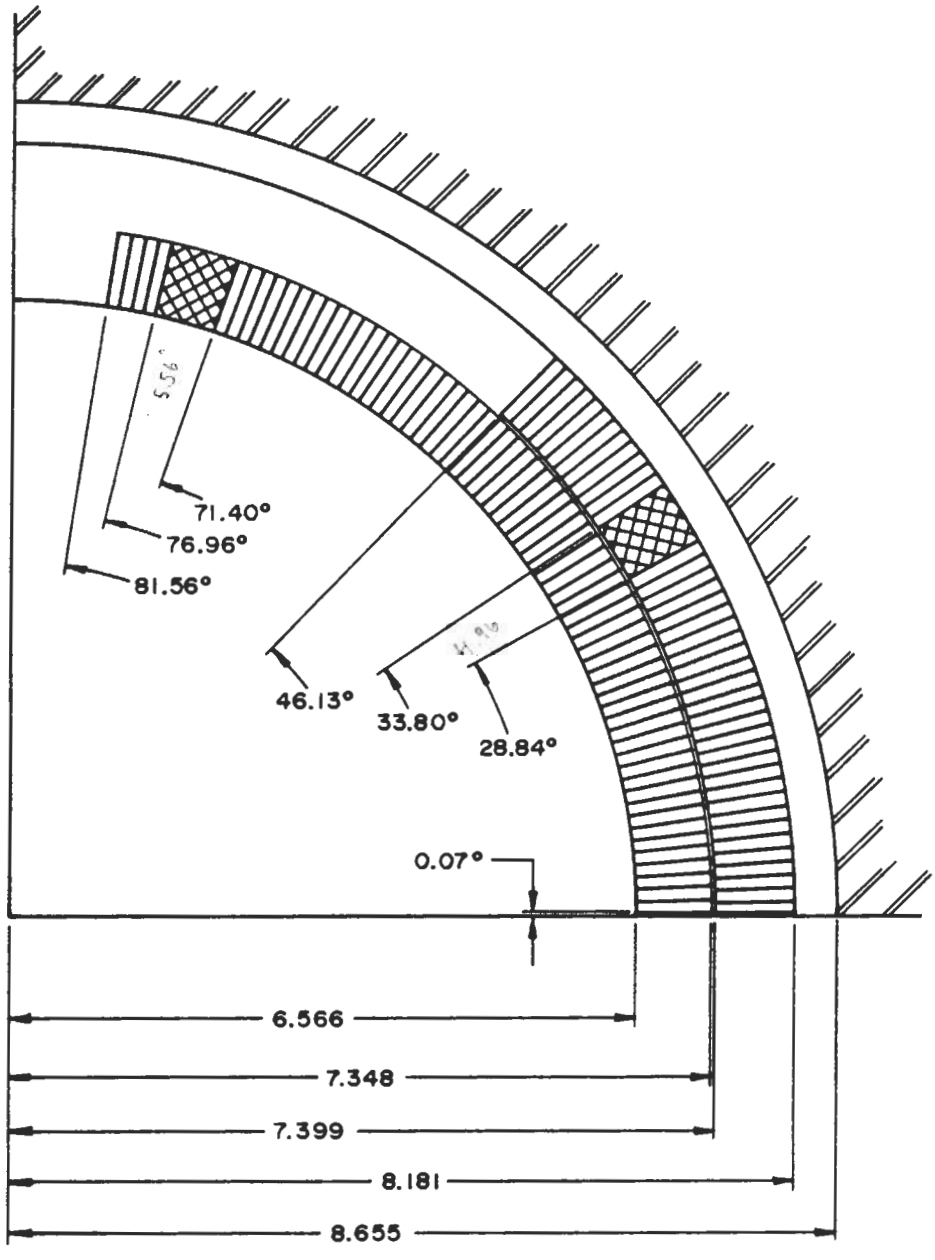
2. R.C. Fernow, New Dipole Cross Section: The A Option, Magnet Division Field Computation Note No. 12 (1982).

TABLE I
Cross Section

Layer	Turns	ϕ_{start}	ϕ_{end}	r_i (cm)	r_o (cm)	wedge
Inner	62	0.07°	71.40°	6.566 6.957	7.348	5.56
	4	76.96	81.56	6.566	7.348	
Outer	28	0.07	28.84	7.399 7.790	8.181	4.96°
	12	33.80	46.13	7.399	8.181	

TABLE II
Straight Section Multipoles ($\times 10^{-4}$)

	b_n	b_n (A66 Option)
2	-26.13	-28.74
4	-4.34	-5.07
6	0.44	0.36
8	0.12	0.06
10	0.07	0.04
12	-0.34	-0.35
TF	15.766	15.764 G/A


5.56°
71.40°
76.96°
81.56°
46.13°
33.80°
28.84°
0.07°
6.566
7.348
7.399
8.181
8.655

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