

MAGNET DIVISION NOTES

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Title: A Preliminary Look at Collared SSC Coil Designs
Task Force: Coil Geometry Analysis

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(This paper consists of 5 sheets).

RCF:vm

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We have taken a preliminary look at three collared coil designs. Each design assumed that a 30 mm thick collar was inserted between the outer coil and the iron. This makes the iron inner radius $R=7.393$ cm. Each design uses the radial dimensions of the LBL 40 mm SSC magnet (B61).

Table 1 lists the properties of the cables used in the three designs. Design C2 uses the present LBL cables with LBL (1.5 mils compressed azimuthal) insulation. Design C3 and C4 use new cable dimensions with CBA (5.5 mils compressed ^(both sides) azimuthal) insulation. t is the mean azimuthal thickness of a turn including insulation, and K is the bare cable keystone.

Table 2 shows the current grading (i.e. matching of critical currents in the inner and outer layers) and the expected central fields B_0 . Comparing design C2 with B61 shows that collaring with the same cable costs about 3 kG in central field. Using CBA insulation, we should get ~ 67 KG with Nb_3Sn and ~ 57 KG with $NbTi$.

The number of turns per layer in the designs are shown in Table 3 and Figures 1-2. ϕ_{max} is the maximum azimuthal angle for the conductor. Table 4 gives the multipoles at 1 cm. Design C2 is field quality, C3 might be, but C4 definitely is not. Table 5 shows MDP runs with the C2 design. The collar almost completely removes any saturation swings.

I want to thank G. Morgan for his assistance.

Table 1 Cable Properties

Design	Material	Insulation	N_w	Cu/Sc	t (mils)	k (mils)
SSC-C2	LBL NbTi	LBL	23	1.3/1	59.9	10.6
			30	1.8/1	49.0	11.3
SSC-C3	New Nb ₃ Sn	CBA	25	2.05/1	59.7	12.3
			29	3.08/1	54.4	11.1
SSC-C4	New NbTi	CBA	24	1.49/1	62.0	12.8
			28	2.11/1	56.1	11.5

Table 2 Current Grading

Design	Iop (A)	Ic(In) (A)	Ic(Out) (A)	TF (G/A)	Bo (kG)
C2	6032	6536	6035	9.94	59.9
C3	7189	7000	7256	9.42	~66.8
C4	6372	6232	6548	9.02	~56.8

Table 3 Coil Geometry

Design	Inner turns	Outer turns	$\phi_{max}(in)$	$\phi_{max}(out)$
C2	5, 8, 4	12, 9	74.9	47.9
C3	6, 6, 4	12, 8	71.4	52.5
C4	7, 5, 4	11, 7	69.8	49.0

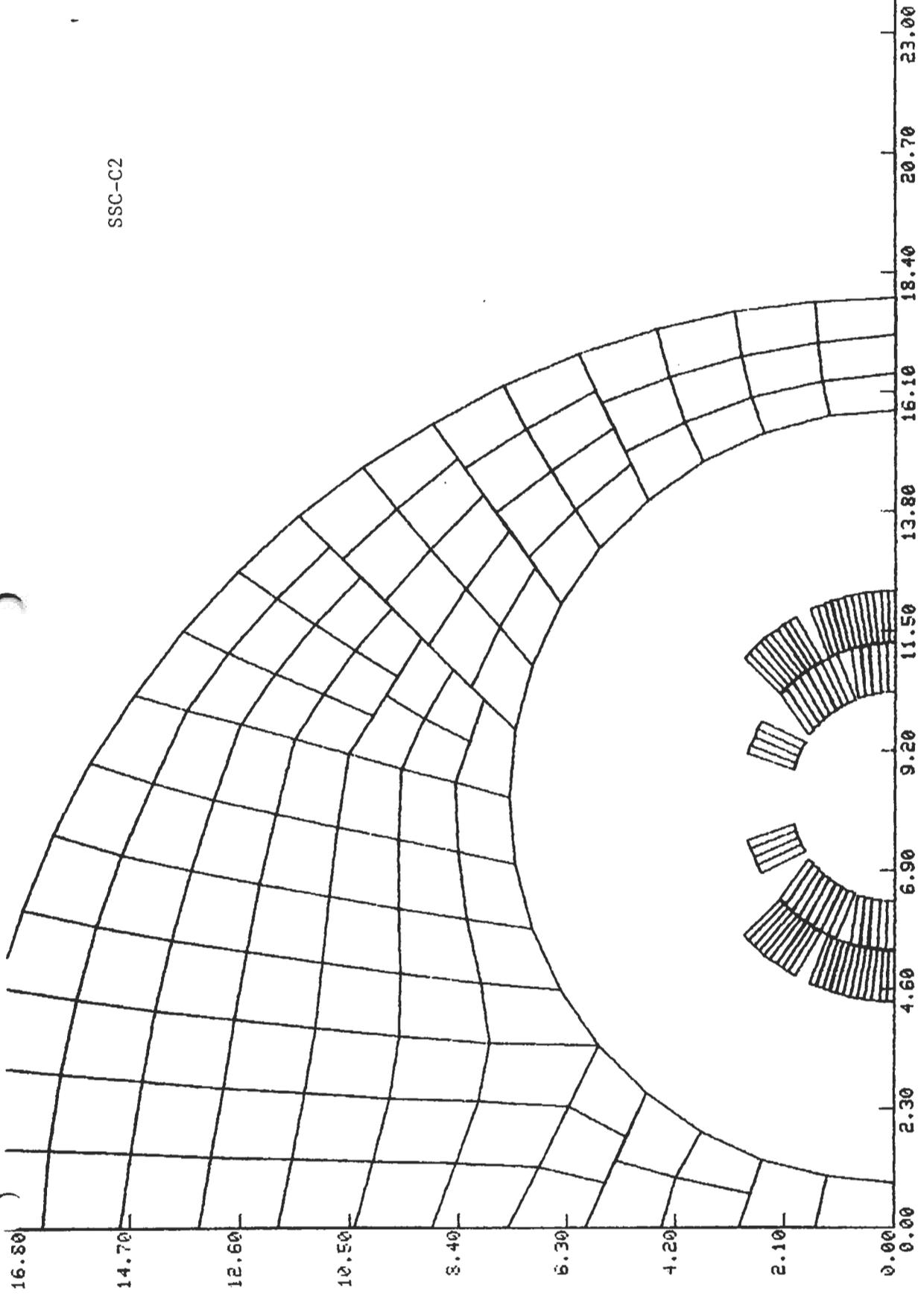
Table 4 Multipoles b_n @ 1 cm ($\times 10^4$)

Design	b_2	b_4	b_6	b_8	b_{10}
C2	-1.4	-0.4	-0.7	0.4	0.2
C3	4.0	1.2	1.5	-0.1	0.2
C4	2.5	0.4	4.4	-0.4	0.1

Table 5 Saturation Properties of SSC-C2

I (A)	TF	b_2	b_4	b_6
3500	9.935	-1.4	-0.4	-0.7
5000	9.933	-1.5	-0.4	-0.7
6000	9.931	-1.5	-0.4	-0.7

SSC-C2



SSC-C3

