

MAGNET DIVISION NOTES

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Title: End Fields for the SSC-B61 Dipole  
Task Force: Coil Geometry Analysis

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(This paper consists of 4 sheets).

RCF:vm

# End Fields for the SSC-B61 Dipole

R. C. Farnow

A study of the proposed ends for the SSC-B61 dipole shows that the peak fields encountered in the ends should not limit the magnet's performance. A layout of the end is shown in Fig. 1 along with the locations of the peak fields in the curved parts of the inner and outer coils. A longitudinal scan of the peak field at the conduction center is shown in Fig. 2. The peak fields and critical currents are given in Table 1.  $r_{min}$  is the expected minimum radius of curvature in the ends and ndf is the non-degradation factor for the critical current which corresponds to  $r_{min}$ . The magnet performance should be limited by the outer coil in the straight section. One sees, however, that the margins for the end layers are not well matched, so this is not an optimized design.

The end harmonics are given in Table 2. The harmonic  $h_n$  is defined as

$$h_n = \frac{1}{(2/B_0 L)} \int_0^L H_n d\ell$$

where  $H_n$  is the multipole transfer function,  $B_0 = 65$  kG, and  $L = 17.5$ m.

The quadrupole and sextupole terms are substantial. The final end design will probably require adjustments in the conductor placement in the ends to minimize these.

The end forces are given in Table 3. The magnitudes are comparable with those found in earlier end studies.

$J_c = NbT_c$

$n_{df} = Nb_2S_m$

Table 1. Critical Current Matching

Layer	Straight		Ends				
	$B_p$ (T)	$I_c$ (A)	$B_p$ (T)	$I_c$ (A)	$r_{min}$ (in)	$n_{df}$	$I_c * n_{df}$ (A)
inner	6.61	5900	4.02	11700	1.6	.90	10530
outer	5.37	5500	5.16	5800	1.9	1	5800

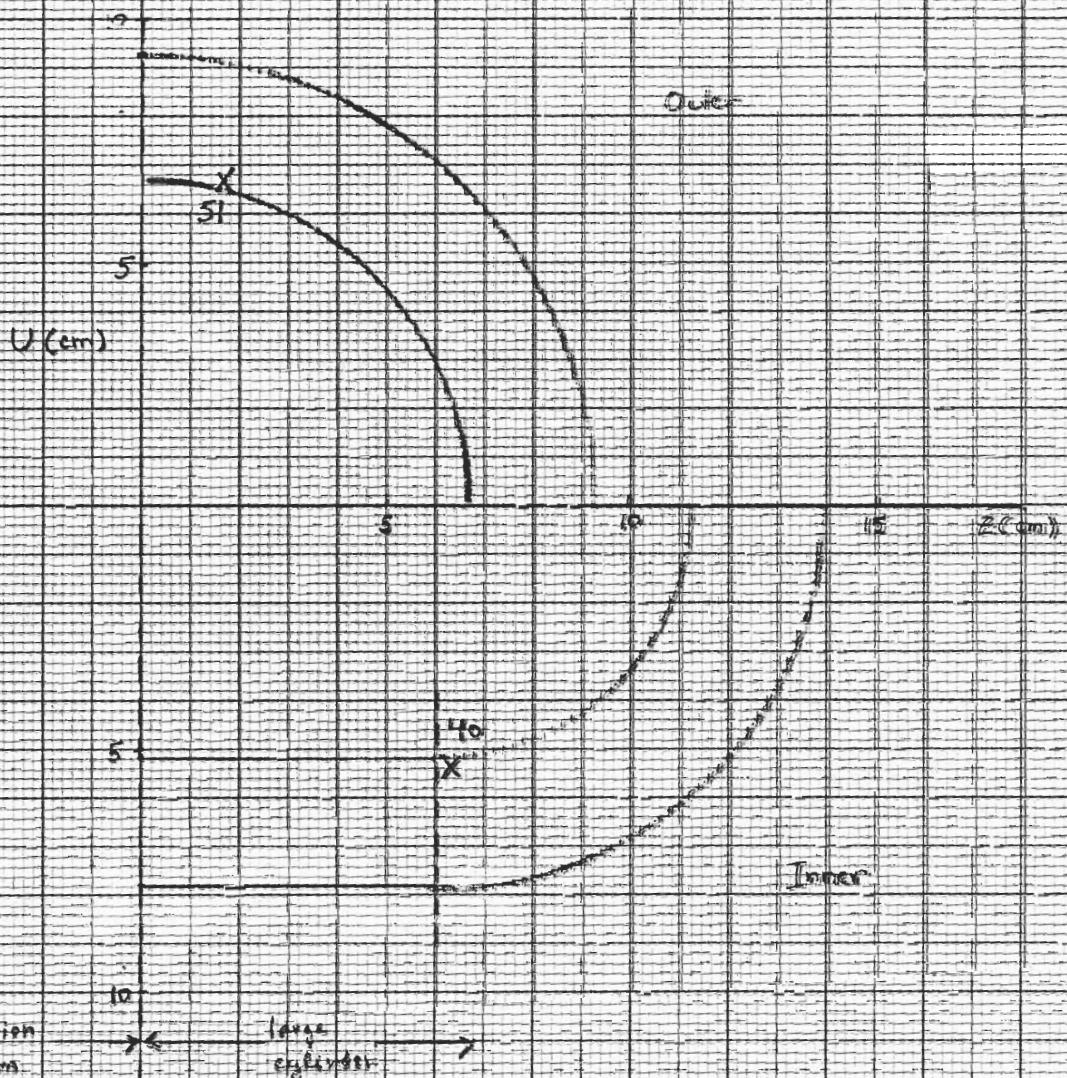
Table 2. End Harmonics  $h_n [ \times 10^{-4} ]$

n	$h_n$
1	1.9
2	3.4
3	0.0
4	0.0
5	0.0
6	0.0

Table 3. End Forces (Newtons)

Block	Layer	Turns	$F_\theta$	$F_r$	$F_\phi$
1	inner	5	-3425	20460	-3150
2	inner	8	-27610	28100	-8155
3	inner	4	-23940	9415	1450
4	outer	12	-18250	-8635	7210
5	outer	9	-38660	-6835	11790

SSC-Ba



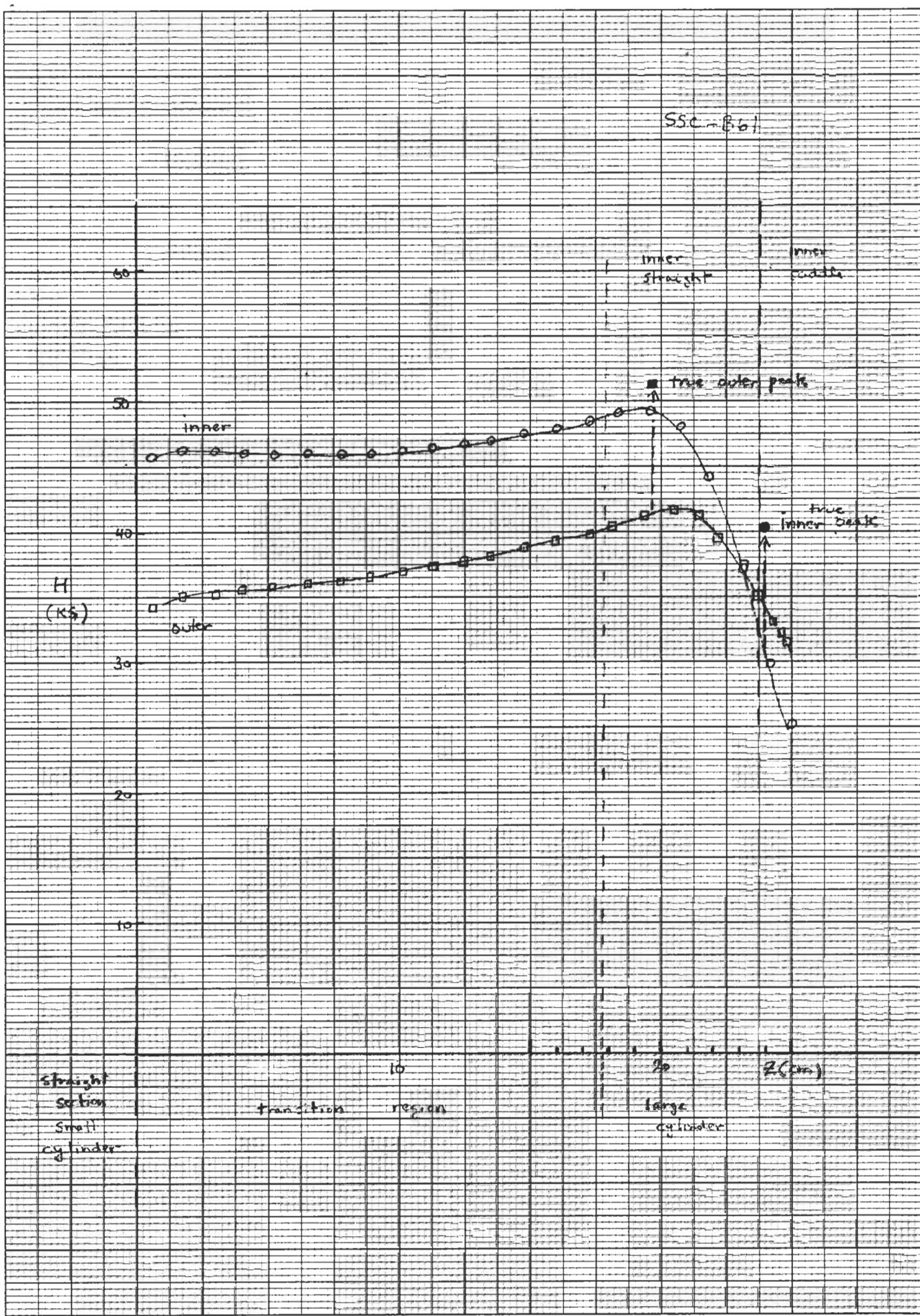


Fig. 2