Spool Harmonics Data

Note: the spool data to be discussed are from warm AC measurements – they can be interpreted as representative of geometric values only. There is no information here on hysteretic behavior, magnetization effects, or saturation

Archival Data Files – D. Harding, R. Hanft proprietors

Q:\Tev-Magnets\Spools

refmenu.htm
spoolangles.dat
spoolresistances.dat
spools_1-100.html
spools_101-200.html
spools_201-300.html
spools_301-400.html
spools_1-100.txt
spools_101-200.txt
spools_201-300.txt
spools_301-400.txt
spool_harms.txt
spool_harms.xls
TD-02-048.doc

Harmonics Only Extractions

Q:\C0IR-Magnets\Spool Harmonics

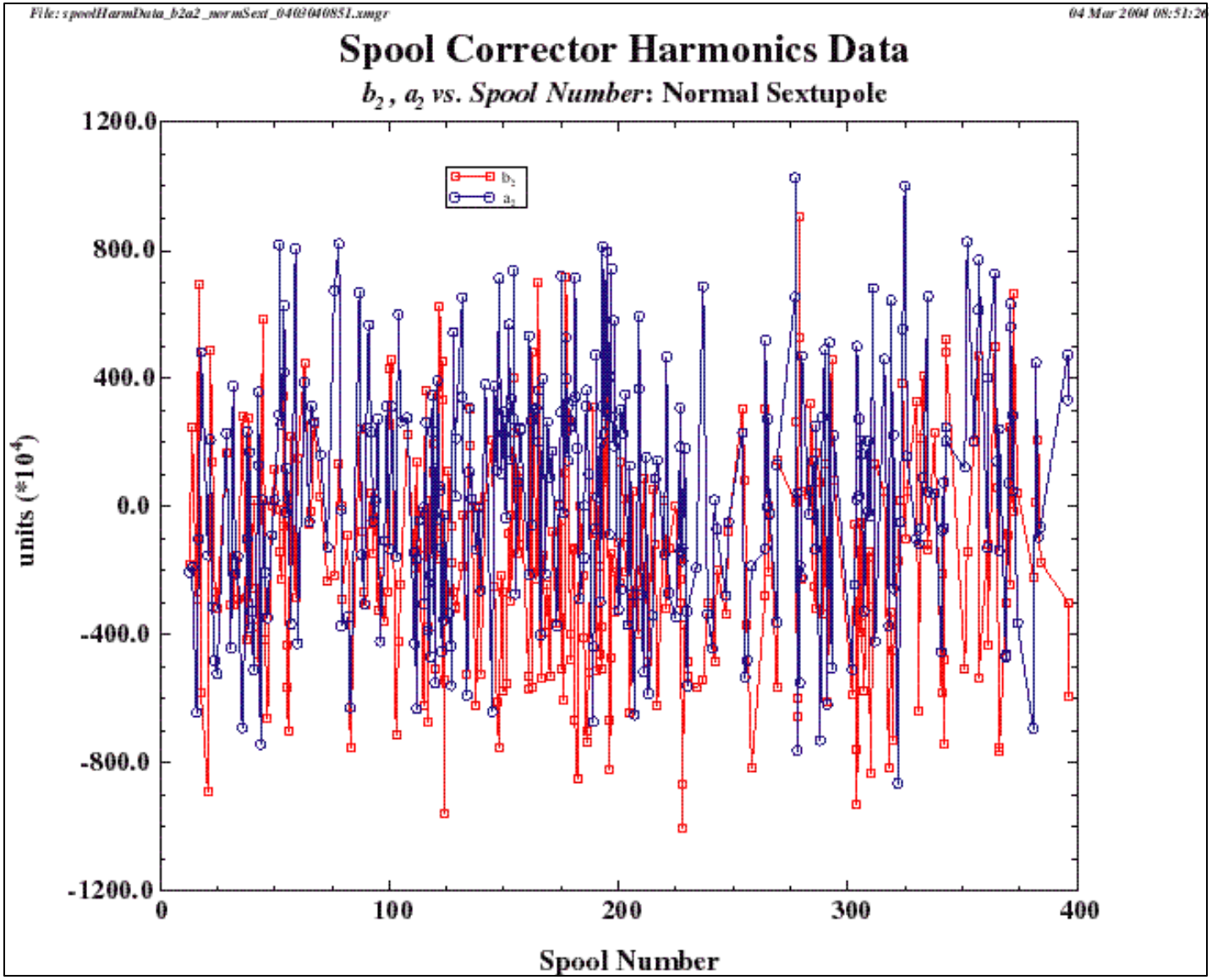
spools_1-100_harmSum_0402291552.lst
spools_101-200_harmSum_0402291552.lst
spools_201-300_harmSum_0402291552.lst
spools_301-400_harmSum_0402291553.lst
Spool_harmSummary_040229.xls

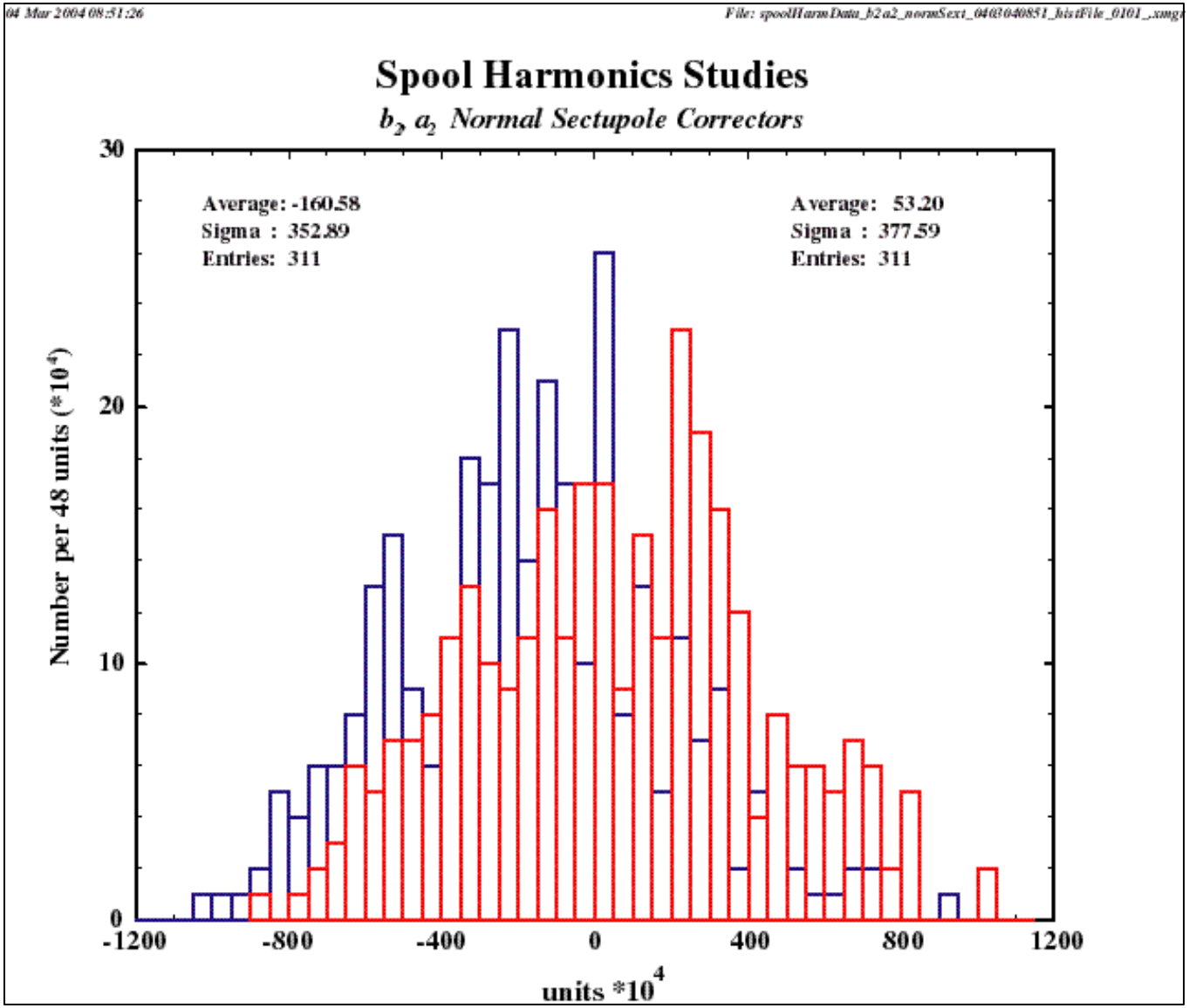
Note: the 'Q' drive is \\Tdserver1\project

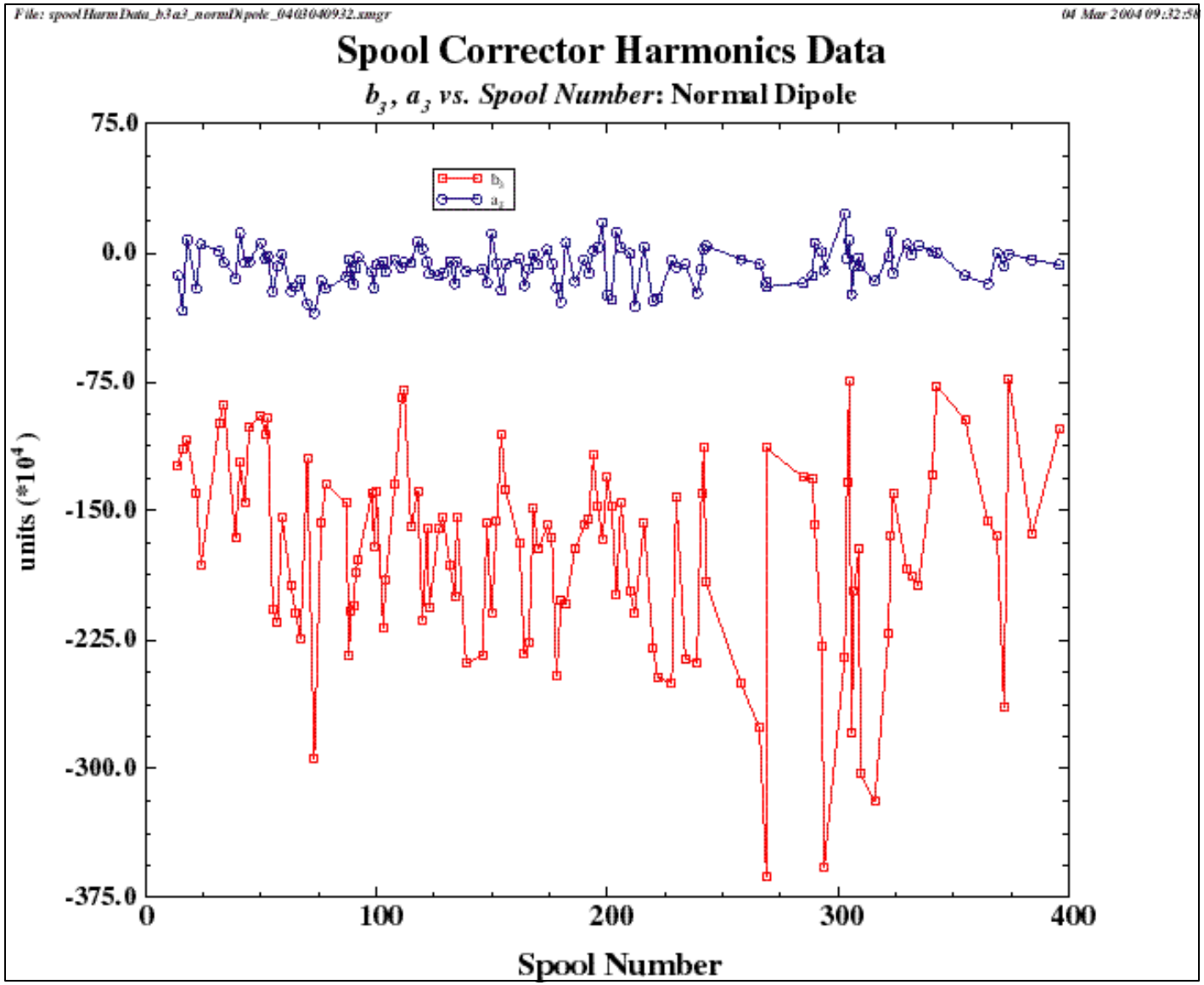
Harmonics for Correction Coils
all spools

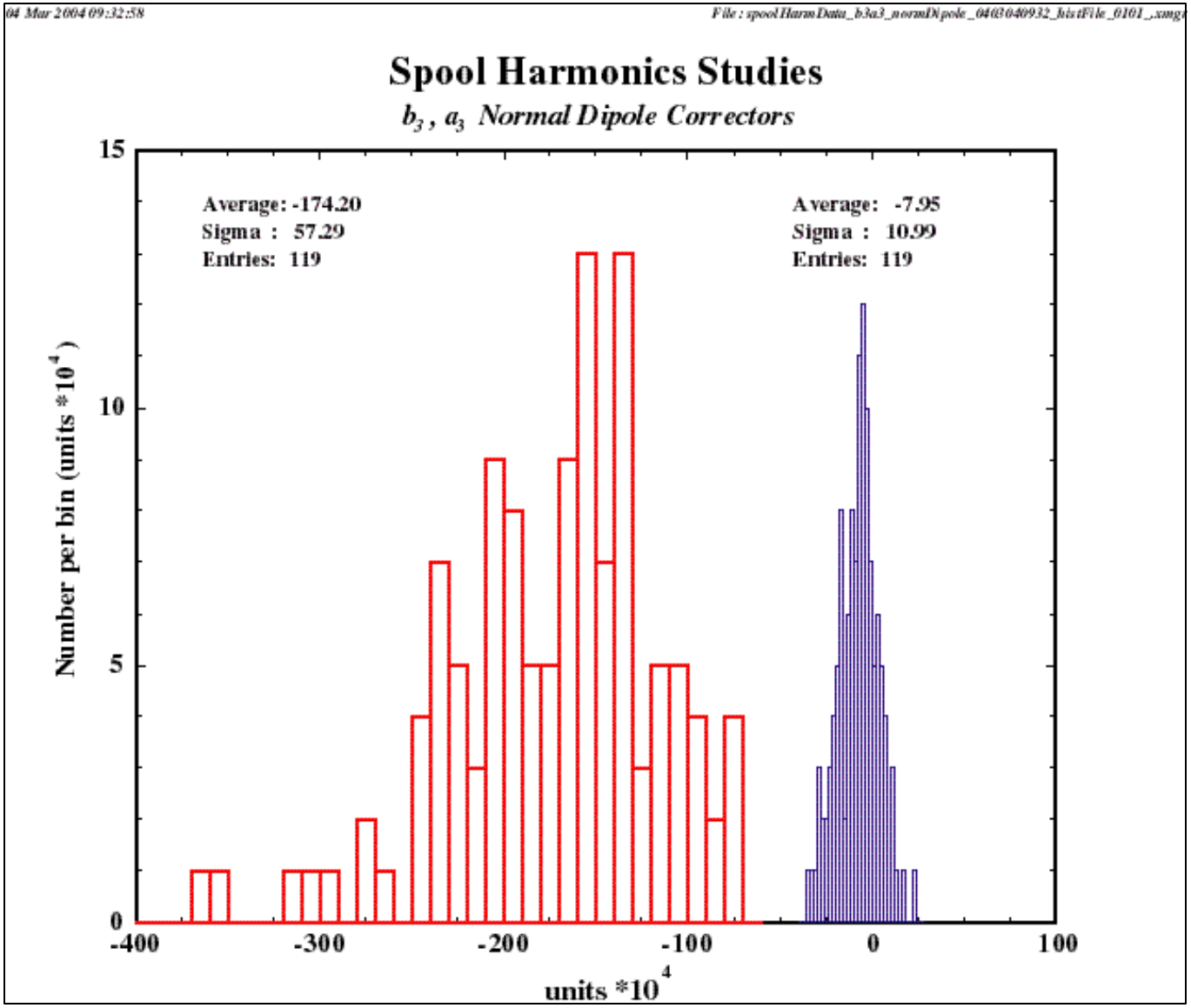
		Entries		b1	b2	b3	b4	a1	a2	a3	a4
Dipole	Normal	119	Mean		-2.5	-174.2	5.6	-30.0	-2.3	-7.9	-3.4
			?		38.2	57.3	18.4	148.6	34.0	11.0	18.0
	Skew	141	Mean	-34.4	-4.7	5.7	-2.0		3.8	-171.1	-4.7
			?	162.0	37.5	10.5	19.0		34.9	86.3	17.8
Quadrupole	Normal	298	Mean	-70.4		-7.7	0.9	43.1	-59.4	-8.3	-1.8
			?	181.3		33.9	8.0	195.1	246.0	36.8	14.0
	Skew	125	Mean	105.0	-60.1	-10.3	0.0	54.8		9.5	1.5
			?	208.5	291.1	40.2	7.2	215.7		51.1	19.1
Sextupole	Normal	311	Mean	-18.3	-160.6		-0.6	-50.4	53.2	-10.4	-13.6
			?	143.9	352.9		45.9	130.3	377.6	457.3	45.2
	Skew	95	Mean	38.6	168.1	-90.3	-22.1	-35.7	53.1		27.8
			?	179.6	413.3	449.6	52.2	186.2	365.9		57.4
Octupole	Normal	165	Mean	29.2	-56.6	-177.9		14.2	33.6	238.3	-126.3
			?	185.2	177.8	578.6		190.1	186.8	576.5	576.2

- indicates ABS(mean) > 100 units
- indicates ? > 100 units


File: spoolHarmData_b2a2_normSext_0403040851.xmgr
04 Mar 2004 08:51:26
Spool Corrector Harmonics Data
b2 , a2 vs. Spool Number: Normal Sextupole
b2
a2
1200.0
800.0
400.0
0.0
-400.0
-800.0
-1200.0
units (*10^4)
0
100
200
300
400
Spool Number


04 Mar 2004 08:51:26
File: spoolHarmData_b2a2_normSext_0403040851_listFile_0101_.xmgr
Spool Harmonics Studies
b_2, a_2 Normal Sectupole Correctors
Average: -160.58
Sigma : 352.89
Entries: 311
Average: 53.20
Sigma : 377.59
Entries: 311
Number per 48 units (*10^4)
30
20
10
0
-1200
-800
-400
0
400
800
1200
units *10^4


File: spoolHarmData_b3a3_normDipole_04030409 32.xmgr
04 Mar 2004 09:32:58
Spool Corrector Harmonics Data
b3, a3 vs. Spool Number: Normal Dipole
b3
a3
75.0
0.0
-75.0
-150.0
-225.0
-300.0
-375.0
units (*10^4)
0
100
200
300
400
Spool Number


04 Mar 2004 09:32:58
File : spoolHarmData_b3a3_normDipole_0403040932_histFile_0101_.xmg
Spool Harmonics Studies
b_3 , a_3 Normal Dipole Correctors
Average: -174.20
Sigma : 57.29
Entries: 119
Average: -7.95
Sigma : 10.99
Entries: 119
Number per bin (units *10^4)
units *10^4
15
10
5
0
-400
-300
-200
-100
0
100

Summary

?? First the disclaimer: this is a work in progress

?? A first look at spool corrector data confirms folklore - the harmonics are fairly frightening:

the means are significantly non-zero
the sigmas are enormous

?? While it's true that the Tevatron is working better than ever, it is certainly not obvious that we would want to reproduce the existing corrector design

specifications for new correctors must be developed from AP simulations – not based on the old data

?? We need to make studies of corrector cost as a function of requirements

do we need to estimate the cost difference between random wound and modern 'wire tape' construction ?

avoid wedges, (complicated) end designs, and R&D if cost significant