

IR

4/28/17

R. B. Palmer

- SR Problem
- New Parameters for FHD case
- New IR design

SR Problems (Montag)

- SR fan depends on electron horizontal (x) divergence
- 200 μrad in HD (without cooling) case taken as max acceptable
- VHL (326) and FHD (387) much worse
 - But with lower e emittance, FHD (FHD1) now ok
- Electron focus also changed to reduce SR intensity
 - First quads separated to reduce required strengths
 - First quads made longer to reduce SR intensity and critical energy

Parameters

		E GeV	N 10^{10}	Nb	$\epsilon_x(\epsilon_{Nx})$ nm(μm)	$\epsilon_y(\epsilon_{Ny})$ nm(μm)	β_x cm	β_y cm	σ_x μm	σ_y μm	σ'_x μrad	σ'_y μrad	ξ_x	ξ_y	ΔQ	σ_s cm	I A	SR MW	HG %	lum 10^{33}
HA	com	105.4																		
	p	275	11.1	330	16.5(4.8)	6.1(1.8)	566.2	4.2	306	16.0	54	381	.015	.002	.002	8.0	0.46		82	1.17
	e	10.1	30.5	330	24.5(484)	3.94(78)	381.1	6.5	306	16.0	80	246	.098	.032	.000	1.0	1.26	5.0		
HD	com	105.4																		
	p	275	11.1	330	16.1(4.7)	6.1(1.8)	94.4	4.2	123	16.0	131	381	.014	.005	.002	7.0	0.46		82	2.90
	e	10.1	30.5	330	24.2(478)	3.47(69)	62.5	7.4	123	16.0	197	217	.092	.083	.000	1.0	1.26	5.0		
VHD	com	105.4																		
	p	275	15.0	660	16.1(4.7)	6.1(1.8)	48.9	4.2	89	16.0	181	381	.013	.006	.003	7.0	1.24		76	10.02
	e	10.1	30.5	660	28.9(571)	6.13(121)	27.2	4.2	89	16.0	326	382	.100	.085	.000	1.0	2.52	10.0		
FHA	com	104.9																		
	p	275	5.6	1320	9.3(2.7)	0.4(0.1)	283.0	2.1	162	2.9	57	138	.013	.006	.026	4.0	0.93		85	12.65
	e	10.0	15.2	1320	20.0(391)	0.23(4)	132.1	3.5	163	2.8	123	81	.063	.099	.000	0.8	2.51	9.6		
FHD	com	104.9																		
	p	275	5.6	1320	7.8(2.3)	3.1(0.9)	34.8	2.0	52	7.9	150	394	.014	.005	.003	4.0	0.93		83	14.07
	e	10.0	15.1	1320	20.0(391)	1.70(33)	13.3	3.7	52	7.9	387	214	.056	.099	.000	0.8	2.50	9.5		
FHD1	com	104.9																		
	p	275	5.3	1320	7.8(2.3)	3.1(0.9)	37.2	2.0	54	7.9	145	394	.014	.005	.003	4.0	0.88		84	12.95
	e	10.0	15.1	1320	10.6(207)	1.70(33)	26.9	3.7	53	7.9	198	214	.100	.091	.000	0.8	2.50	9.5		
AuL	com	63.2																		
	p	100	0.2	100	16.5(1.8)	6.1(0.7)	100.0	10.6	128	25.4	128	240	.015	.008	.000	10.0	0.00		76	.0072
	e	10.0	31.1	100	25.0(489)	4.80(94)	66.0	13.4	128	25.4	195	189	.097	.100	.000	1.0	0.39	1.5		

New Changes

- Spaced and longer electron focus quads (for SR)
- Use Nb₃Sn and/or 1.8 K
- Increase acceptance for 1.3 GeV/c pt protons
- Increase n cone to 5 mrad (came for free from above)
- Increase spaces between magnets

New Hadron Magnets

	L1	DL	x	θ	IR	OR	B	Grad)	
	m	m	cm	mrad	cm	cm	T	T/m	
B0	3	5.00	1.20	11.0	0.00	17.00	47.0	1.70	0.00
Q1	5	6.80	1.50	16.4	16.00	4.80	12.8	6.81	-141.89
Q2	7	10.77	2.40	26.4	17.00	10.50	22.5	4.79	45.64
B1	9	15.17	3.00	36.9	24.20	13.70	31.2	5.50	0.00
Q3	11	40.07	1.20	137.9	38.20	5.00	35.0	0.59	11.84
B2	13	41.77	9.00	145.1	20.20	5.10	35.1	-4.40	0.00
Q4	15	58.97	1.20	162.9	0.00	5.00	35.0	1.62	32.47
B3	17	63.37	8.80	162.5	-22.00	5.00	35.0	-4.40	0.00
NQ	19	73.97	1.20	135.3	-41.54	6.00	36.0	3.15	-52.52
Q5	21	89.47	1.00	68.3	-41.47	4.00	34.0	2.20	55.00

mom = 275

Chrom y 17.19

Chrom x 8.29

Vcrab (MV) 11.53818

High Accept (HA) Magnets

		L1	DL	x	θ	IR	OR	B	Grad)
		m	m	cm	mrad	cm	cm	T	T/m
B0	3	5.00	1.20	11.0	0.00	17.00	47.0	1.70	0.00
Q1	5	6.80	1.50	16.4	16.00	4.80	12.8	4.40	-91.67
Q2	7	10.77	2.40	26.4	17.00	10.50	22.5	0.30	-2.88
B1	9	15.17	3.00	36.9	24.20	13.70	31.2	5.50	0.00
Q3	11	40.07	1.20	137.9	38.20	5.00	35.0	1.05	21.07
B2	13	41.77	9.00	145.1	20.20	5.10	35.1	-4.40	0.00
Q4	15	58.97	1.20	162.9	0.00	5.00	35.0	1.72	34.37
B3	17	63.37	8.80	162.5	-22.00	5.00	35.0	-4.40	0.00
NQ	19	73.97	1.20	135.3	-41.54	6.00	36.0	3.15	-52.52
Q5	21	89.47	1.00	68.3	-41.47	4.00	34.0	2.20	55.00

Chrom y 15.16

Chrom x 8.01

mom = 275

New Electron Magnets

	L1	DL	x	θ	IR	OR	$B_{15\sigma}$	grad	
	m	m	cm	mrad	cm	cm	T	T/m	
Q1	3	8.75	1.50	19.2	0.00	2.30	12.3	0.18	-7.89
Q2	5	13.66	1.10*	30.0	0.00	4.80	15.3	0.34	7.04
Q3	7	49.76	0.60	109.5	0.00	4.80	24.8	0.18	3.85
Q4	9	54.36	0.60	119.6	0.00	4.80	24.8	0.18	-3.85

* I can lengthen this if need be

$$E_{beam} = 18$$

$$C = 0.665$$

$$B = 0.12 \text{ at } 10\sigma$$

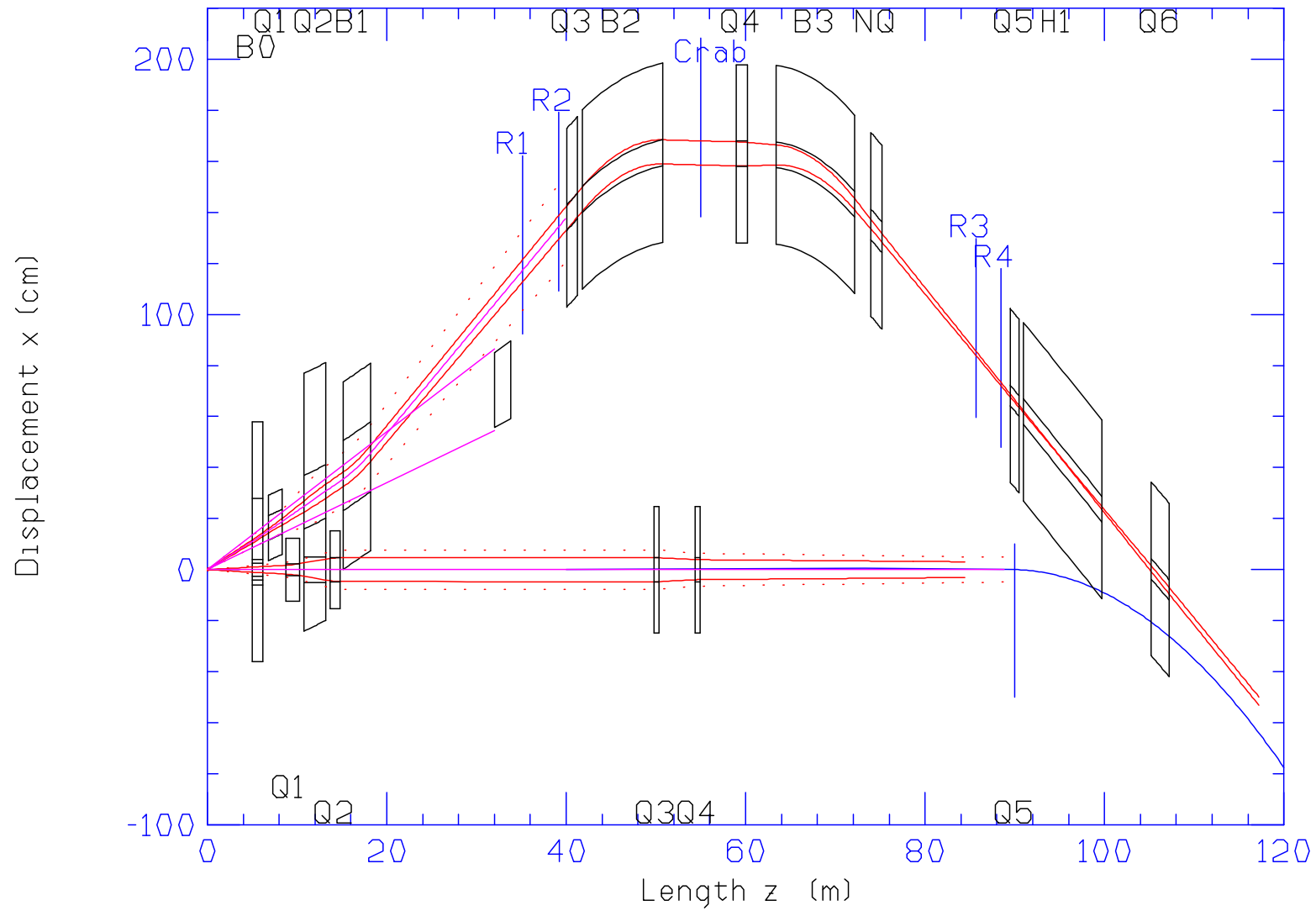
$$E_{crit} = C B E_{beam}^2 = 25.8 \text{ KeV}$$

Chrom y 12.80

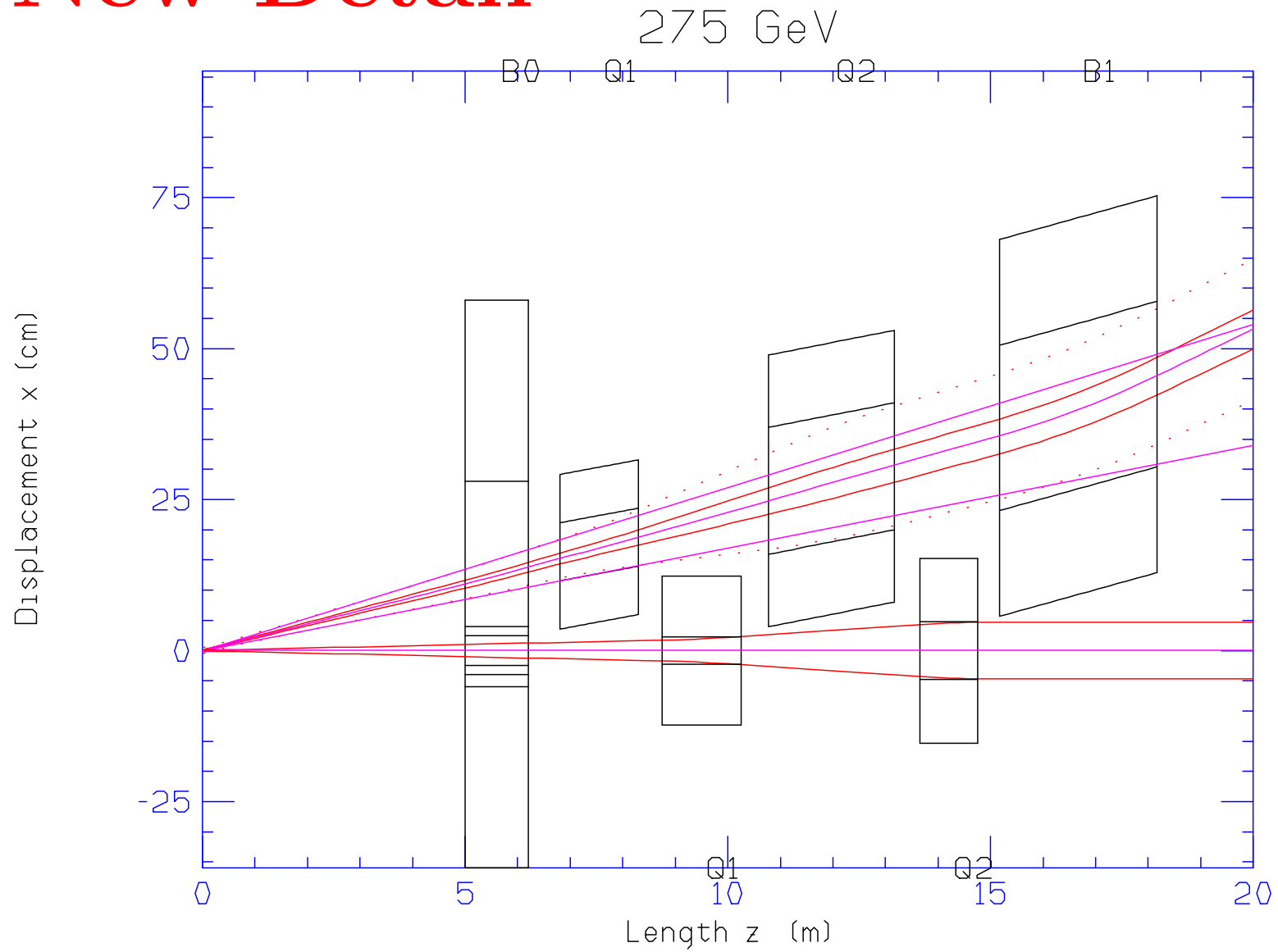
Chrom x 6.94

New Layout

275 GeV



New Detail



Conclusion

- SR fan sets bound on electron x divergence
- This excludes VHD without cooling, and FHD with cooling
- But use of lower e emittance recovered FHD case

- New IR with better acceptance of 1.3 GeV/c pt and more realistic spacing
- Requires Nb₃Sn or 1.8 K
- Checked for HA and HD without cooling
- needs checking for HHA and FHD with cooling