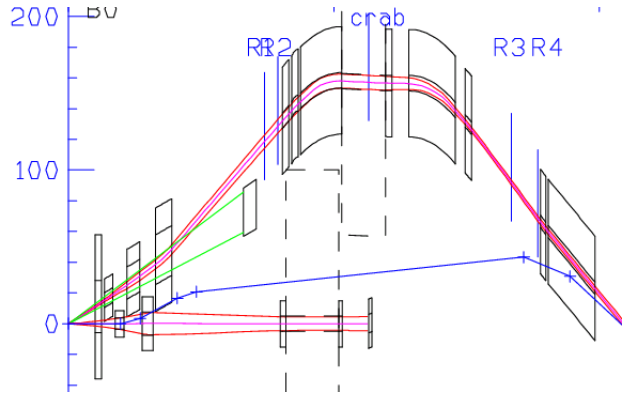
November IR update

11/17/17 Bob Palmer, Holger Witte

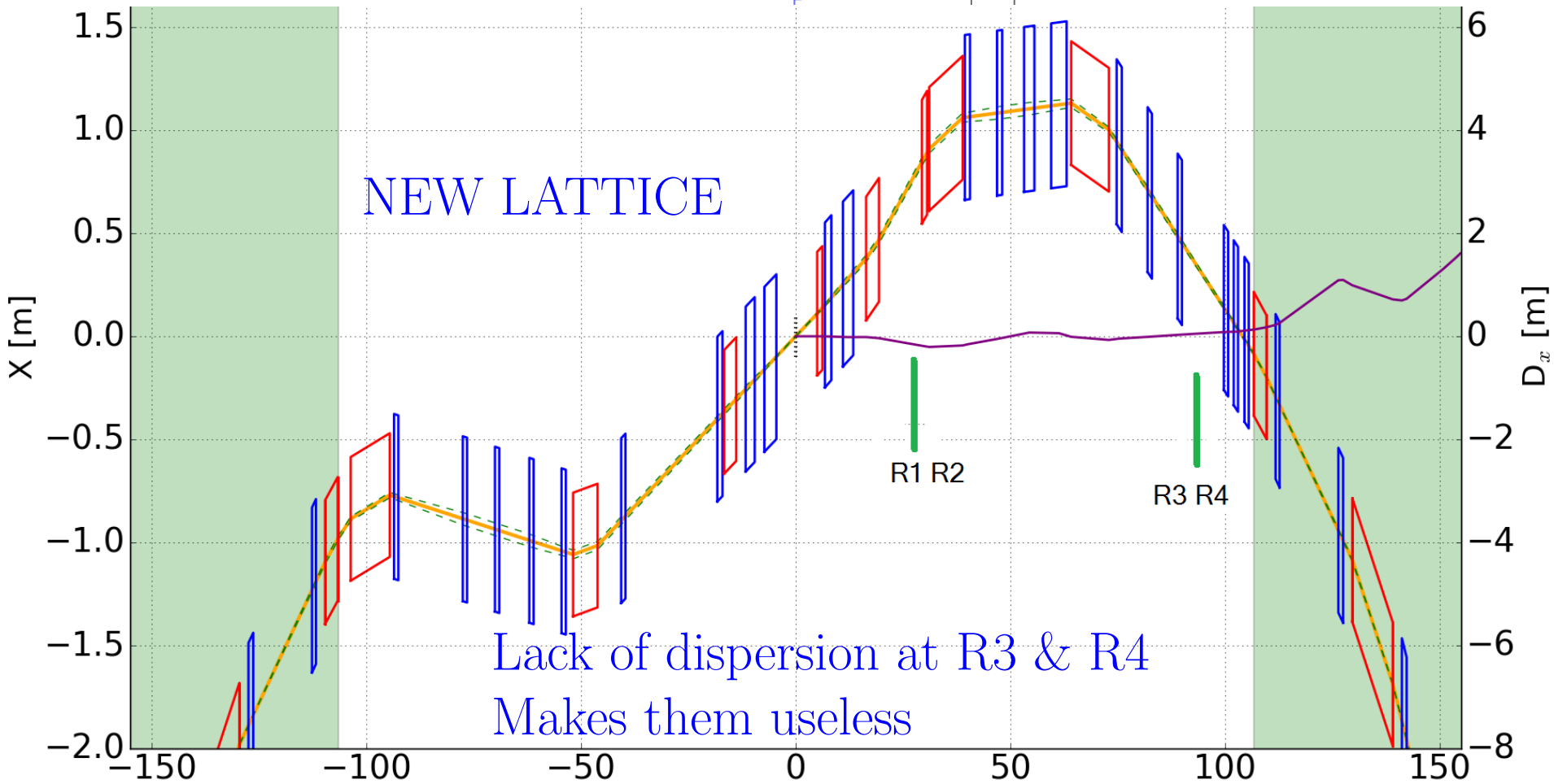
1. Now matched into ring (Guillaume)
   No more R3 and R4 at high dispersion
2. To reduce chromaticity for dynamic acceptance (Ferdinand)
   Spectrometer magnet has electron Quadrupole
3. Eliminate $Q2_{fe}$ and move $B1_{fp}$ back
   Less B1 aperture and electron chromaticity

Layout

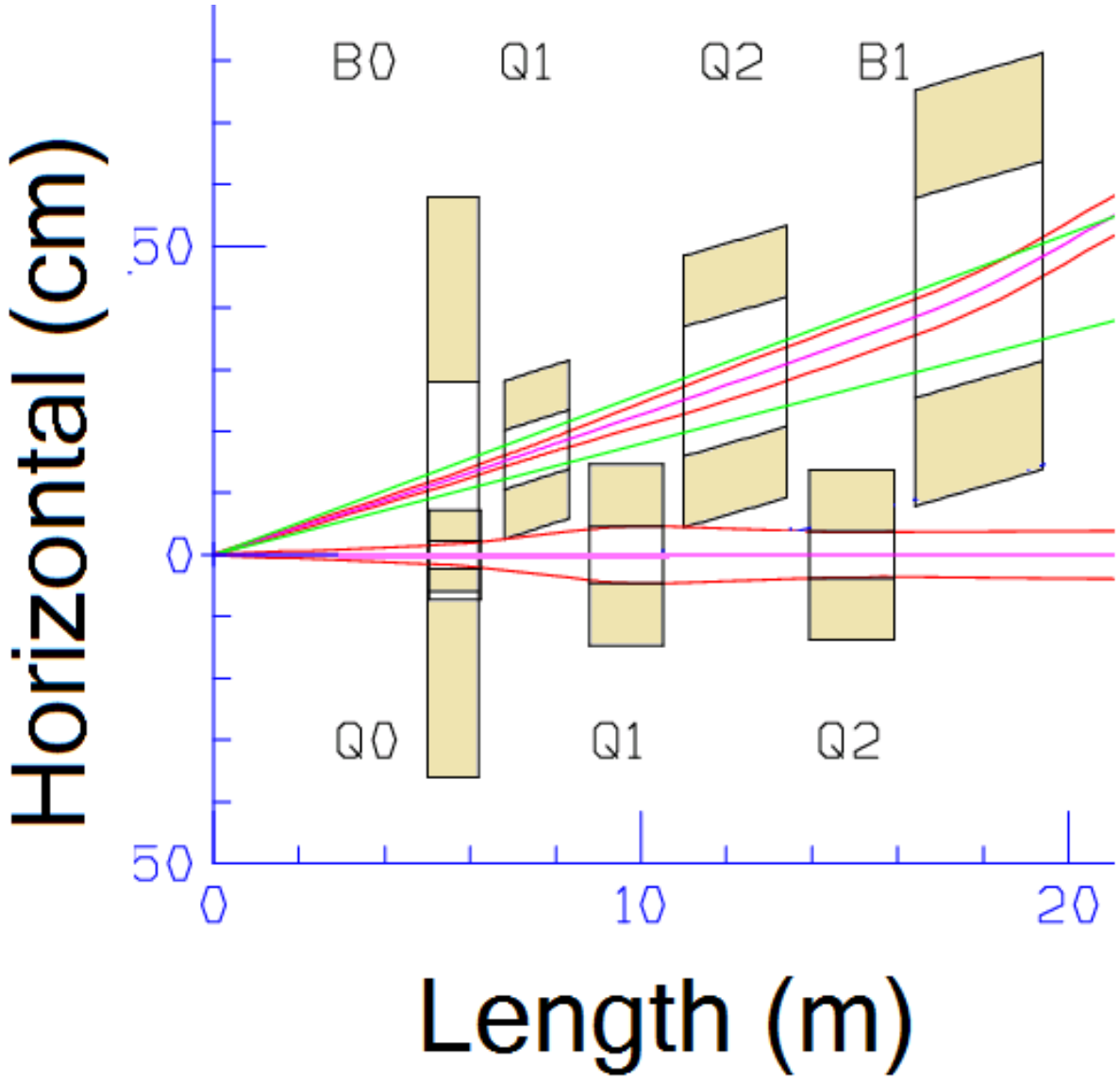
OLD LATTICE



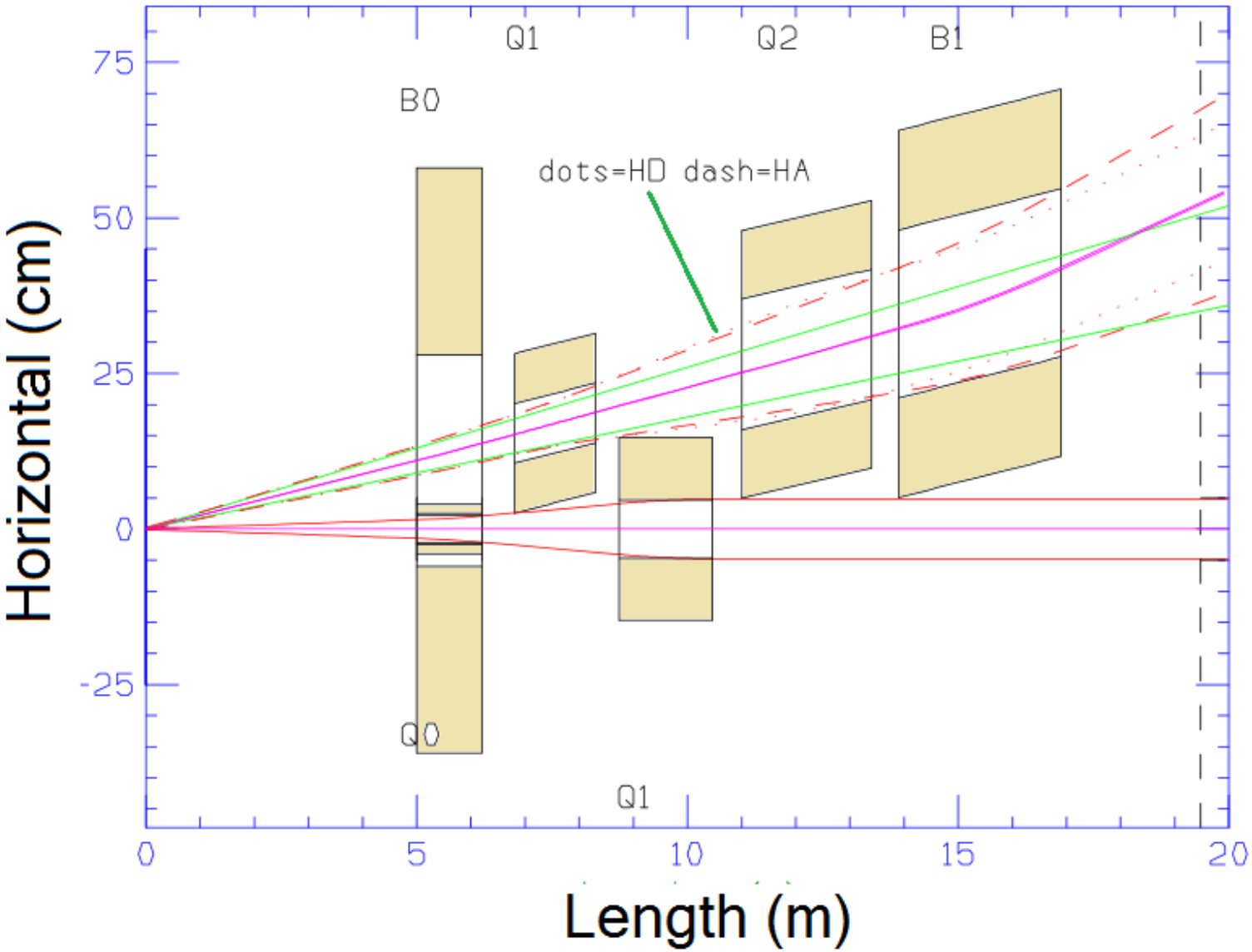
NEW LATTICE



cf Old Layout Detail



New Forward Detail

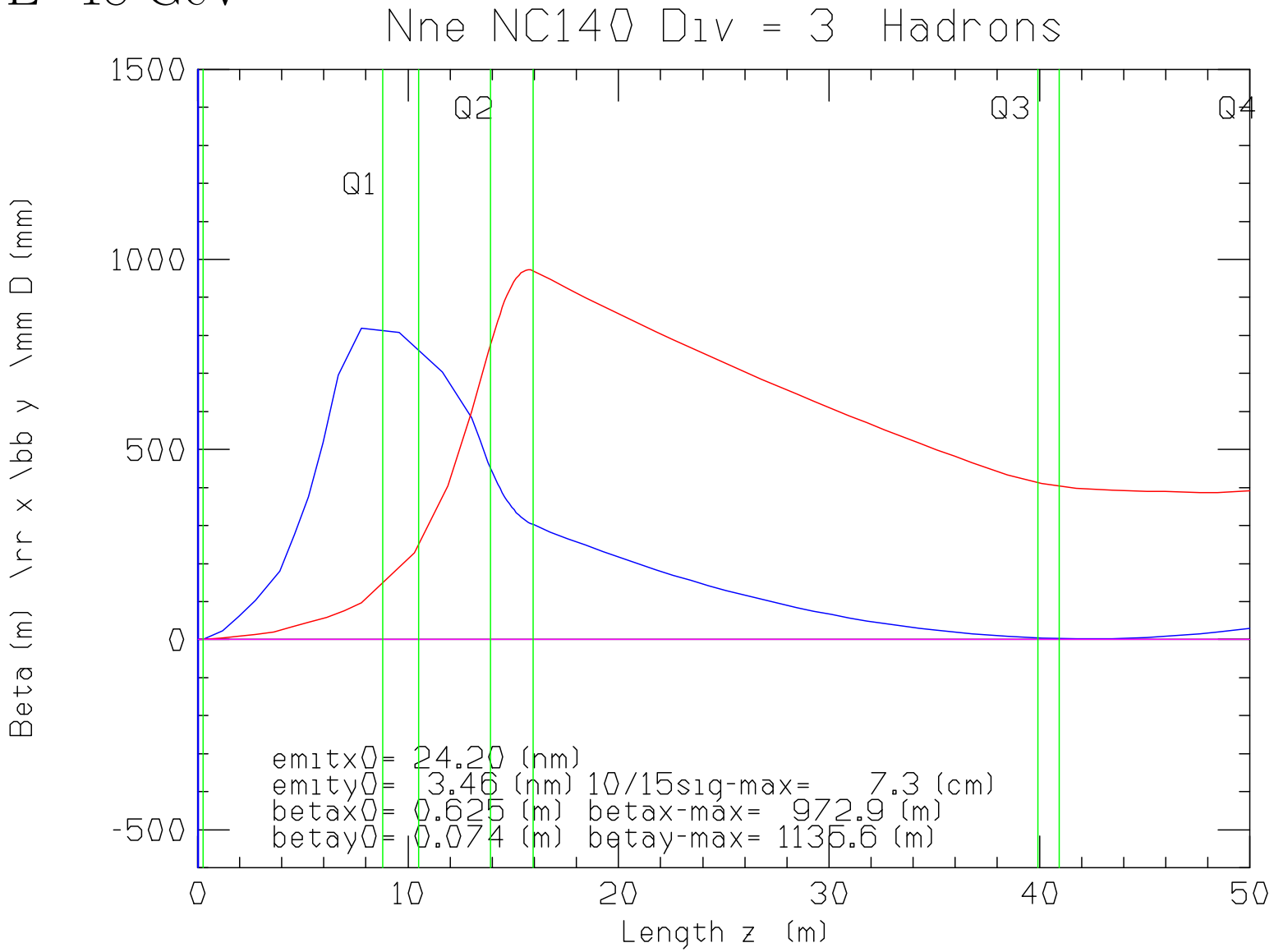


Electron doublet instead of triplet focus

Eliminates $Q2_e$ and allows $B1_p$ to move up

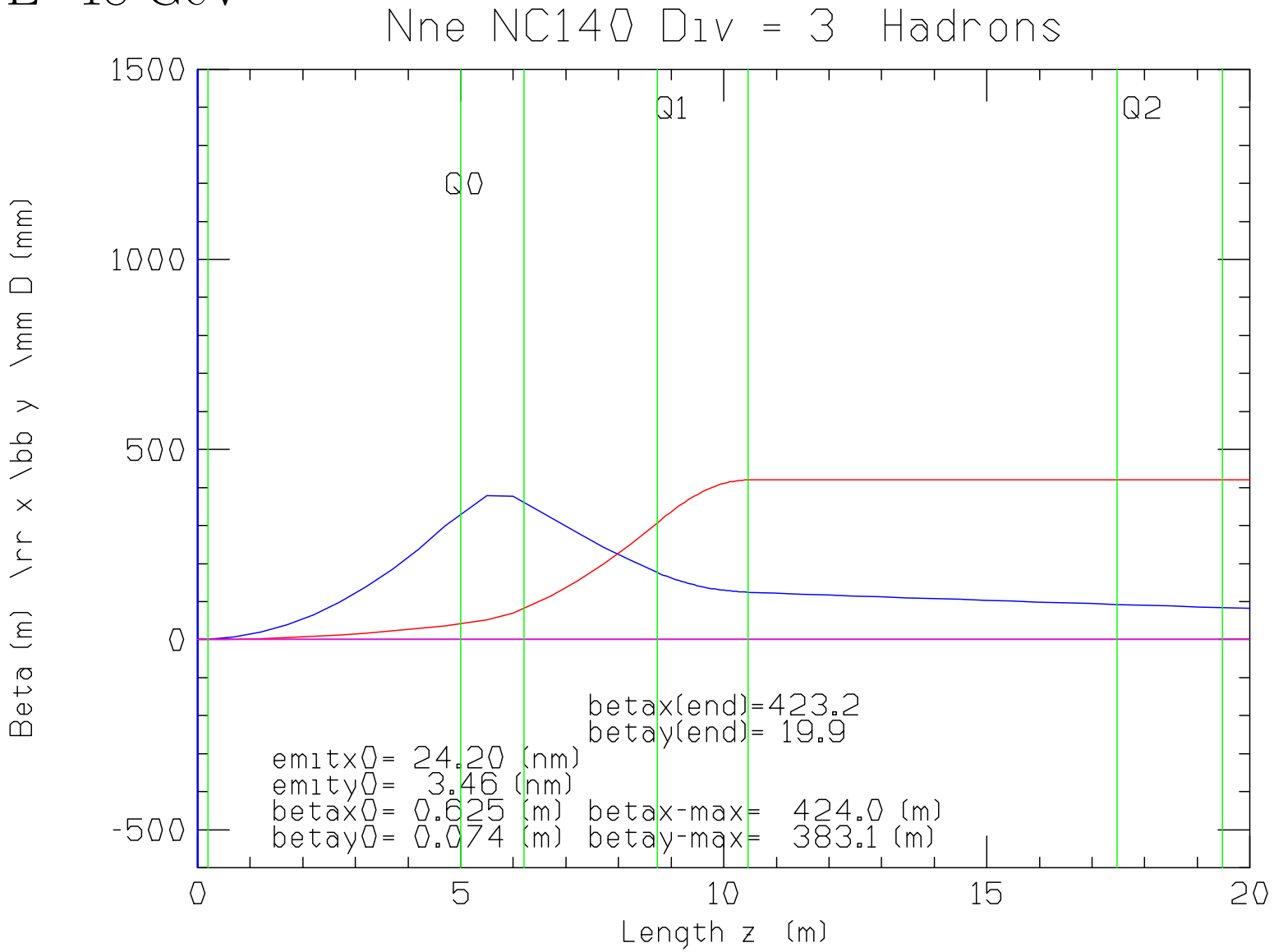
Old forward electron betas

E=18 GeV



New forward electrons betas

E=18 GeV



Electron Magnet Parameters

Mom=18 GeV

Old

		L1 m	DL m	gap m	x cm	θ mrad	IR cm	OR cm	B T	Grad) T/m
Q1	3	8.79	1.72	3.42	0.0	0.00	3.70	8.7	0.137	-3.701
Q2	5	13.93	2.00	24.00	0.0	0.00	7.50	17.5	0.171	2.284
Q3	7	39.93	1.00	10.00	0.0	0.00	5.00	15.0	0.036	-0.728
Q4	9	50.93	0.60	5.00	0.0	0.00	5.00	15.0	0.054	-1.070

New

		L1 m	DL m	gap m	x cm	θ mrad	IR cm	OR cm	B T	Grad) T/m
Q0	3	5.00	1.20	2.54	0.0	0.00	2.20	5.0	0.309	-14.061
Q1	5	8.74	1.72	7.02	0.0	0.00	4.70	14.7	0.282	5.996

New Quad is small (R=2.2 cm)

and has very low grad times radius =.3 T

Compare New and Old e Parameters

E=18 GeV

	Old	New	ratio
L* (m)	8.79	5.5	1.60
Max beta x (m)	900	410	1.50^2
Max beta y (m)	1050	380	1.66^2
Chromaticity x	7.3	4.18	1.75
Chromaticity y	11.8	6.89	1.71

$$Chrom \approx\propto L*$$

$$Chrom \approx\propto \beta^2_{max}$$

Design of combined B0pf and Q0ef

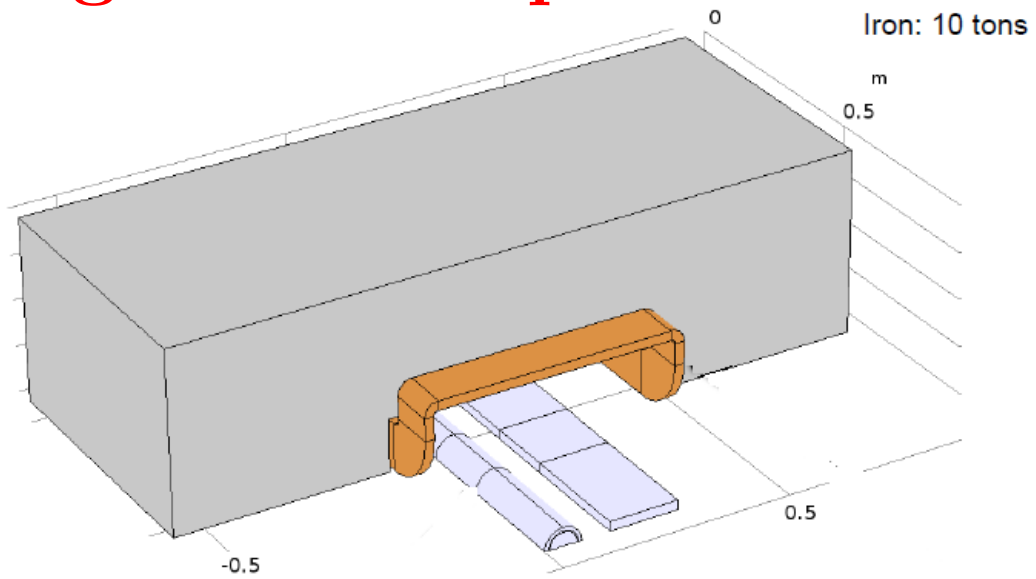
Assuming, as summerized by Elke, that

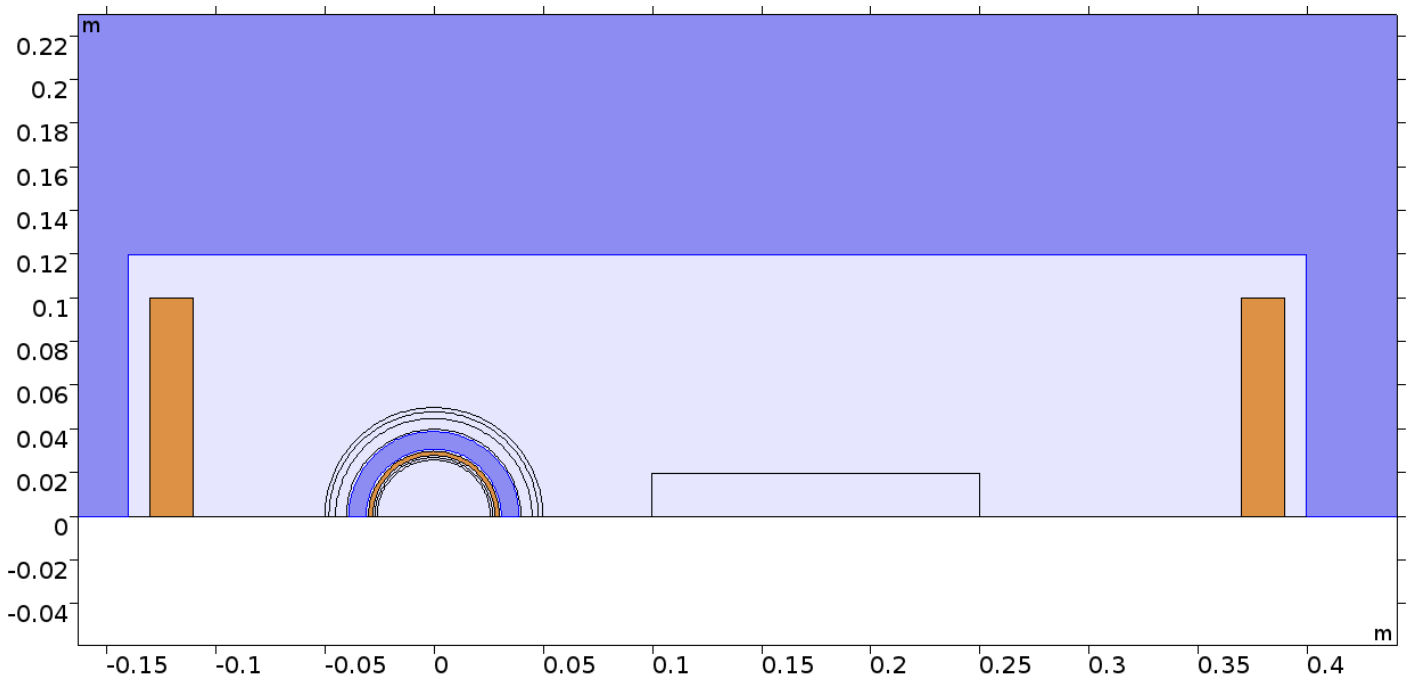
- Easy access to the detectors is not too high a priority
- Spectrometer detectors can operate cold (either 4 K or 77 K)

Then:

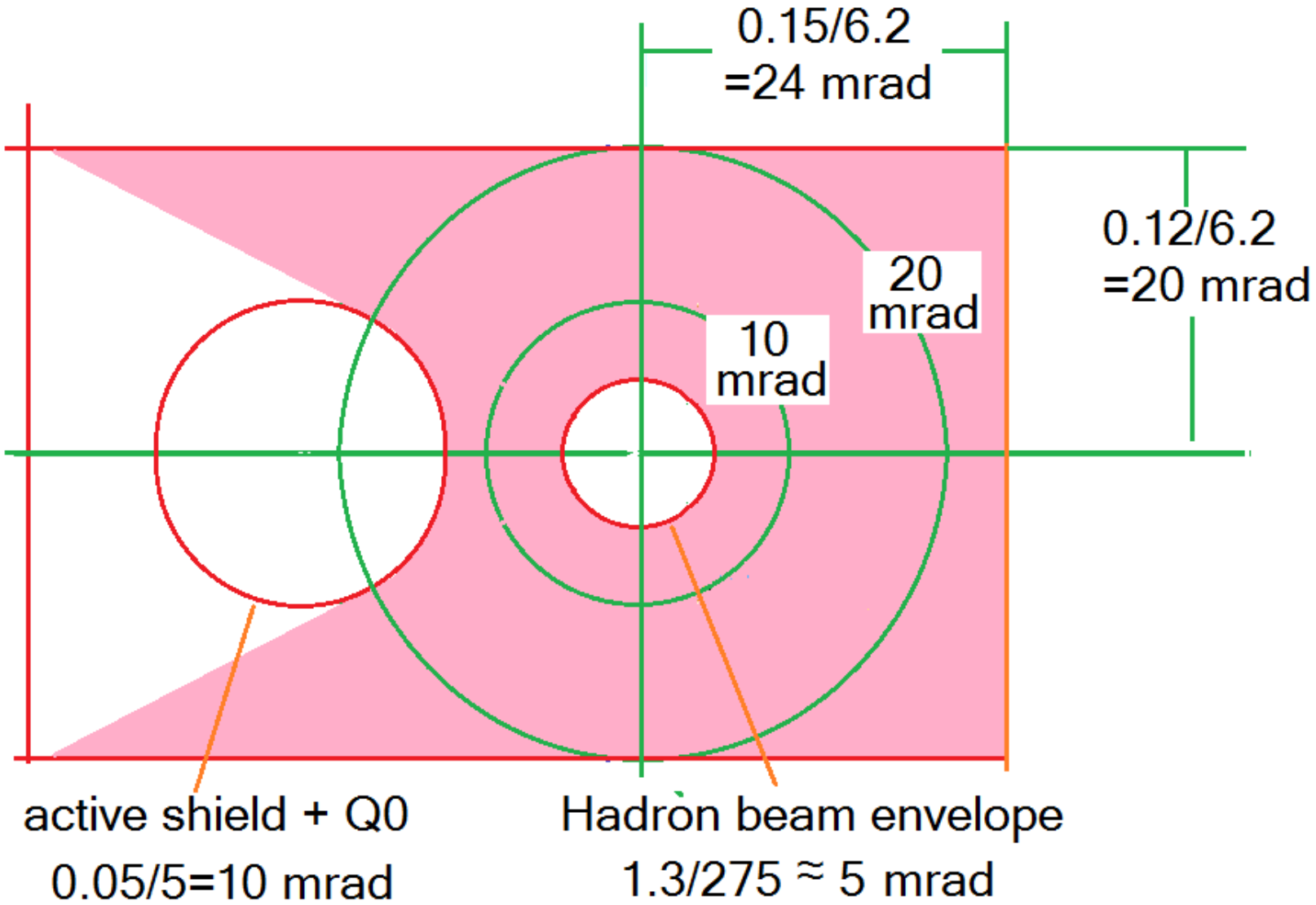
- Cold combined Active shield and SC quadrupole only 10 cm diameter (Holger)
- Can return to Holger's original B0 concept

Holger's Original Concept





Projected angular acceptance



Costs of main dipole

B=1.3

$V = 0.4\ 1.2\ .25\ = 0.125\ (m^3)$

Escalation since 2008 $\eta \approx 1.03^9 = 1.3$

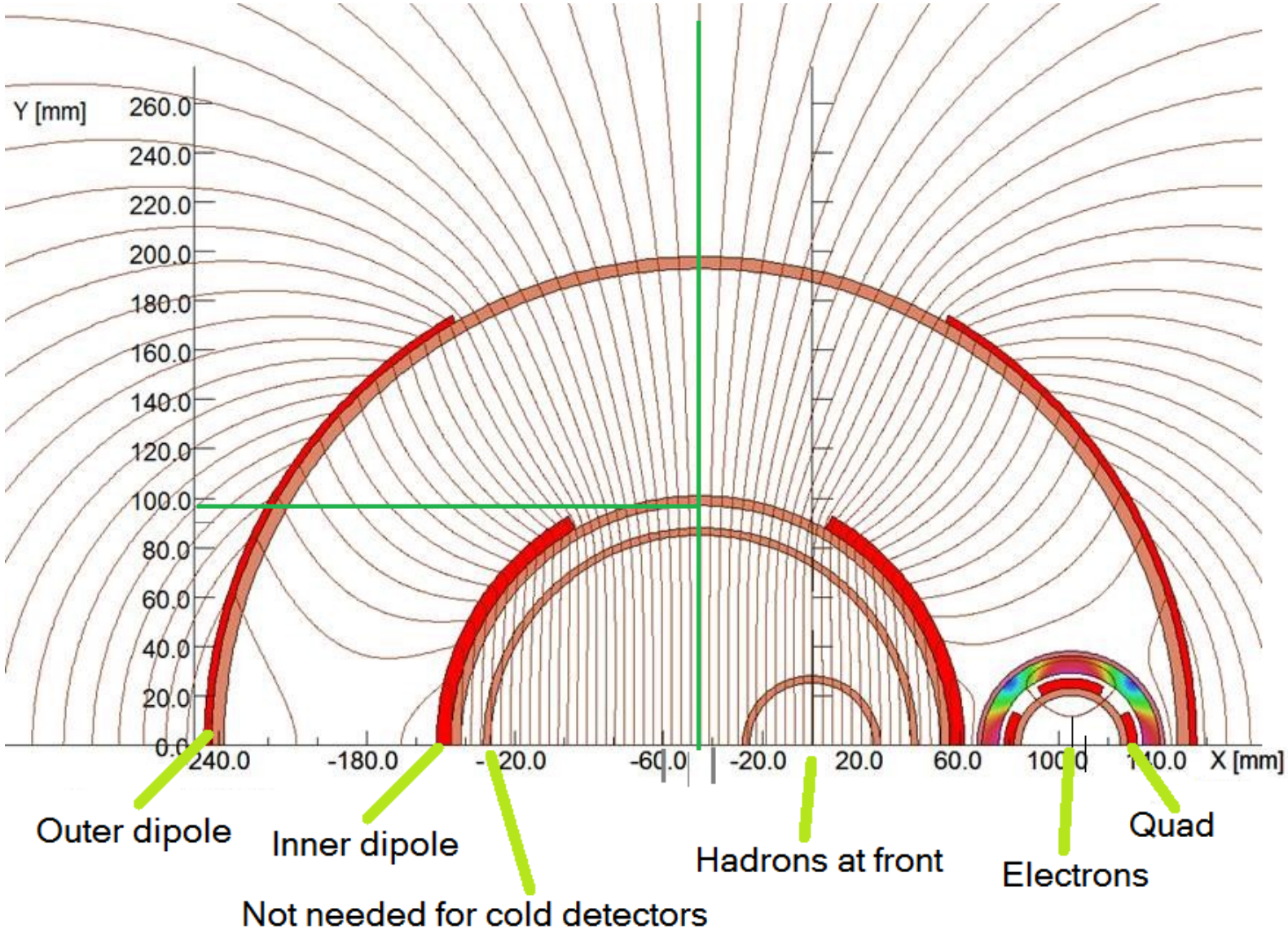
my fit of low field magnets in M A Green & B P Strauss in 2008

$$Cost \approx 1.6\ \eta\ (B\ V)^{0.6} = 0.52\ (M\$)$$

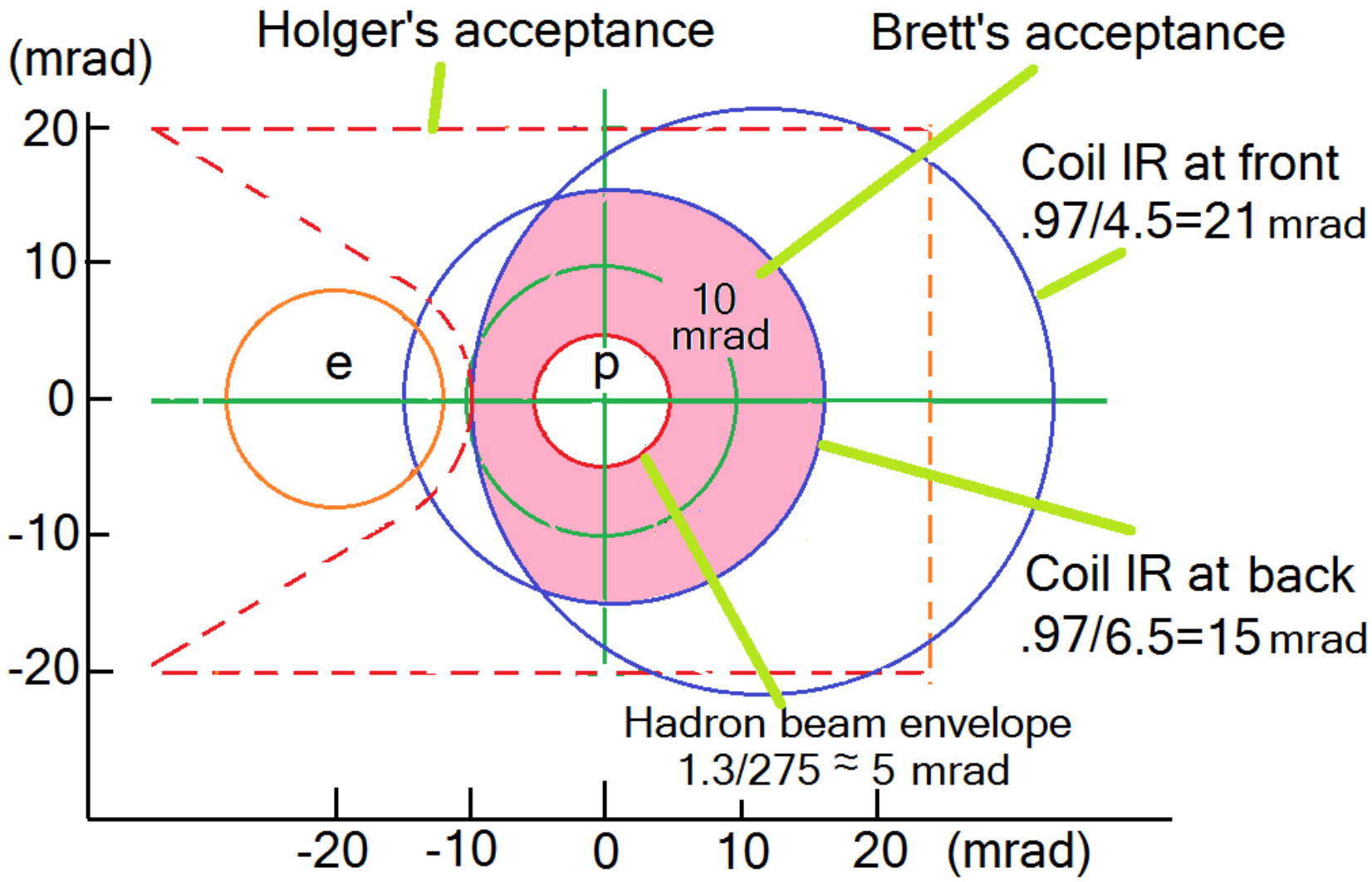
probably good to +/- $\approx$ factor 2

i.e. Not outrageously expensive

Brett's Version



Brett's Acceptance



Significantly less acceptance for a similar sized magnet