Methodology:
Measure trajectory.
Make a change upstream and measure new trajectory.
Calculate differential orbit.
Adjust quadrupoles to match differential orbit.

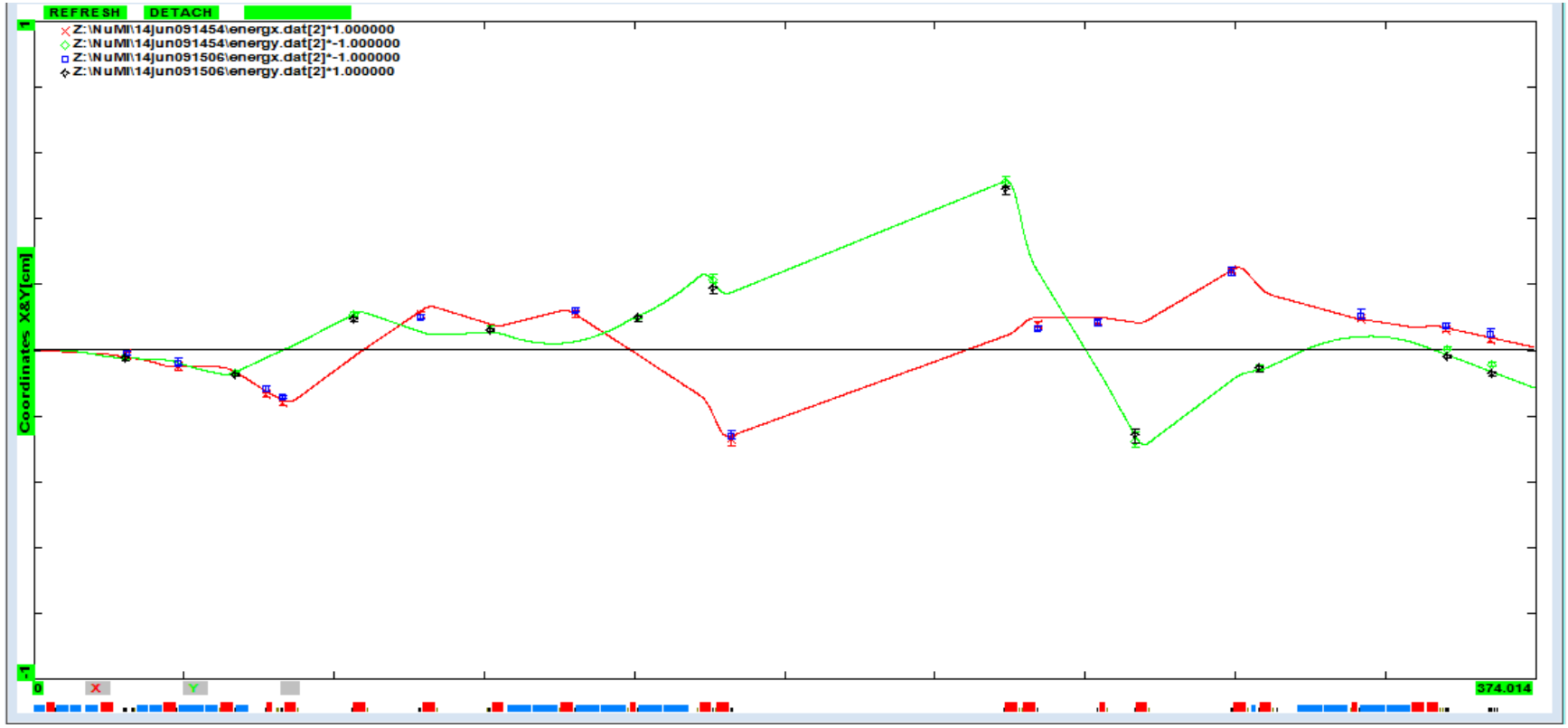
Changes made:

- Varied frequency at flat top (allow measurement of dispersion).
- Varied HT101, HT105, VT106, and VT108 by +2 and -2 amps.

Result:
Needed to change Q108, Q113, Q117, Q118 by 1% (V.L.)

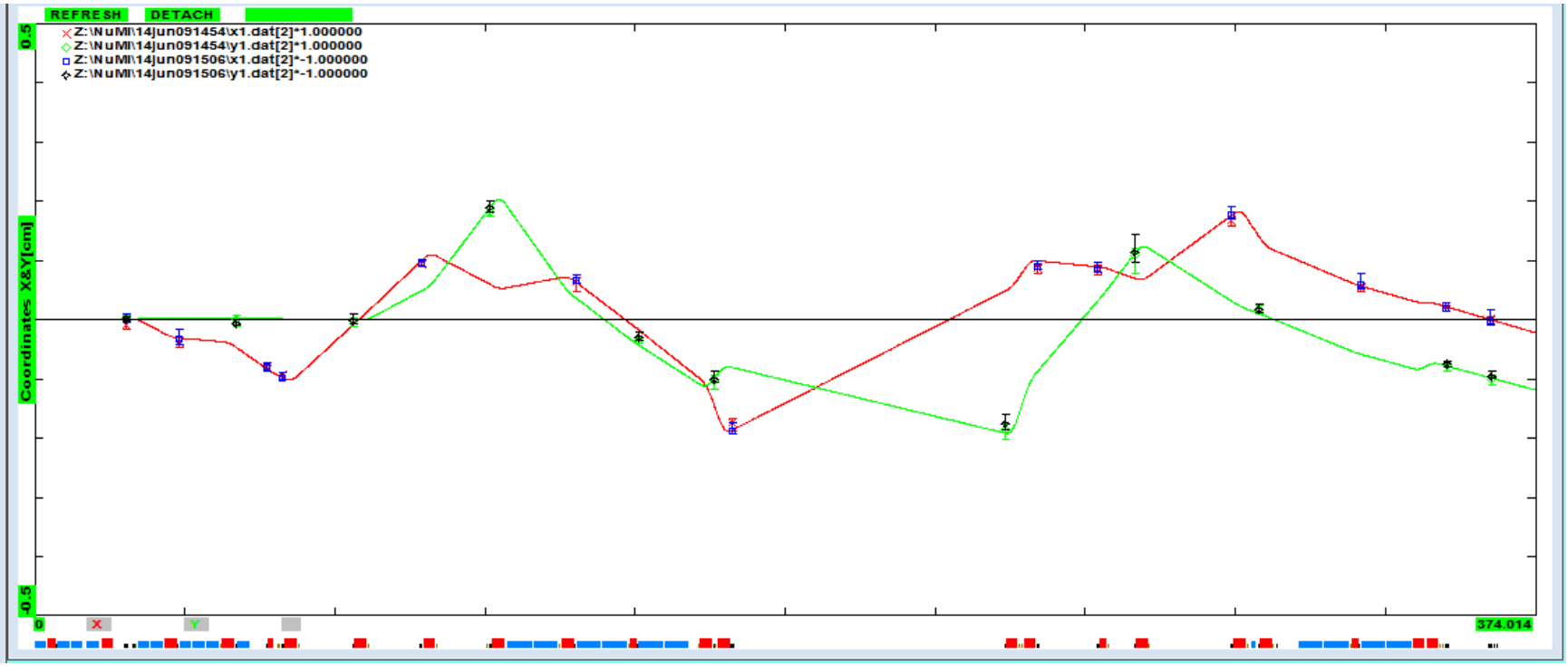
Slides follow.

Dispersion Measurement



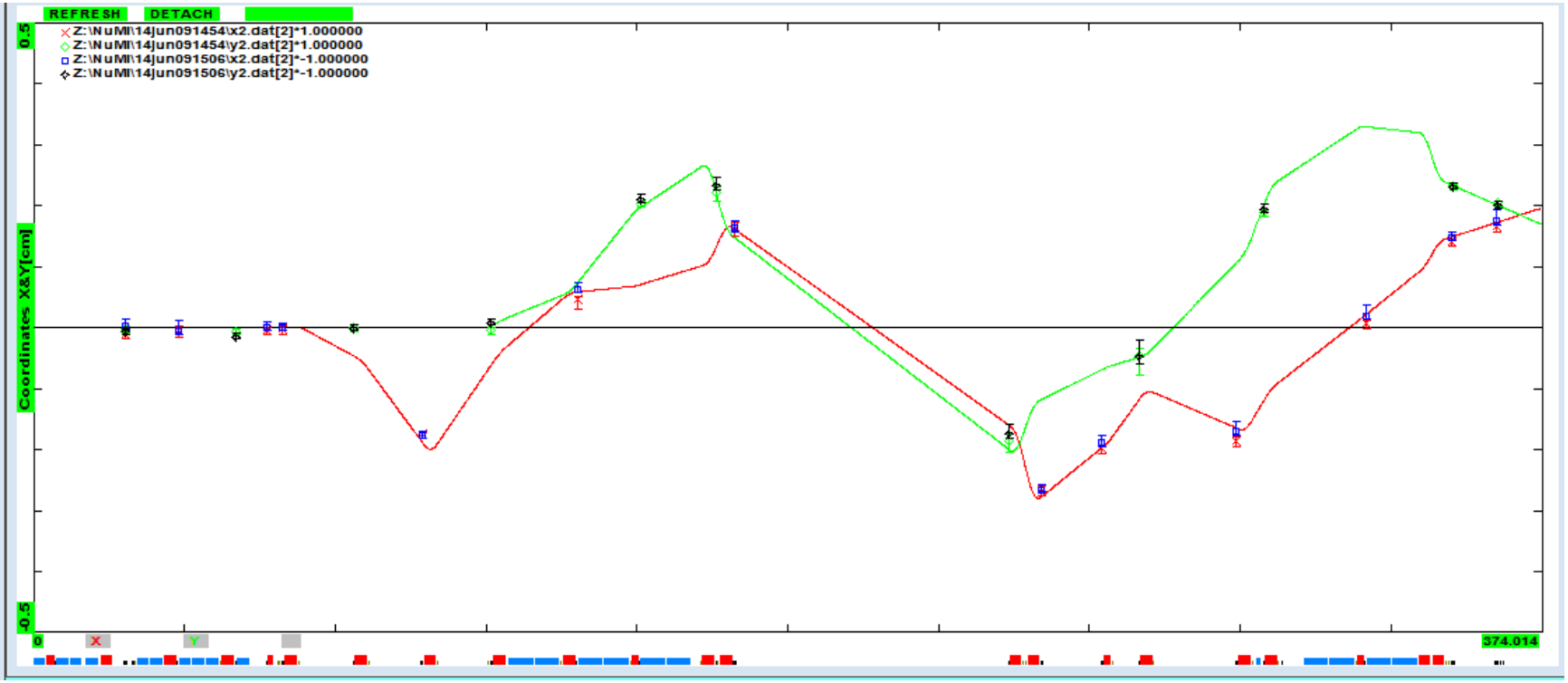
Lowered MI RF by 100 Hz

Horizontal and Vertical Correctors
Set 1



Changed HT101 and VT106. 2 amp change.

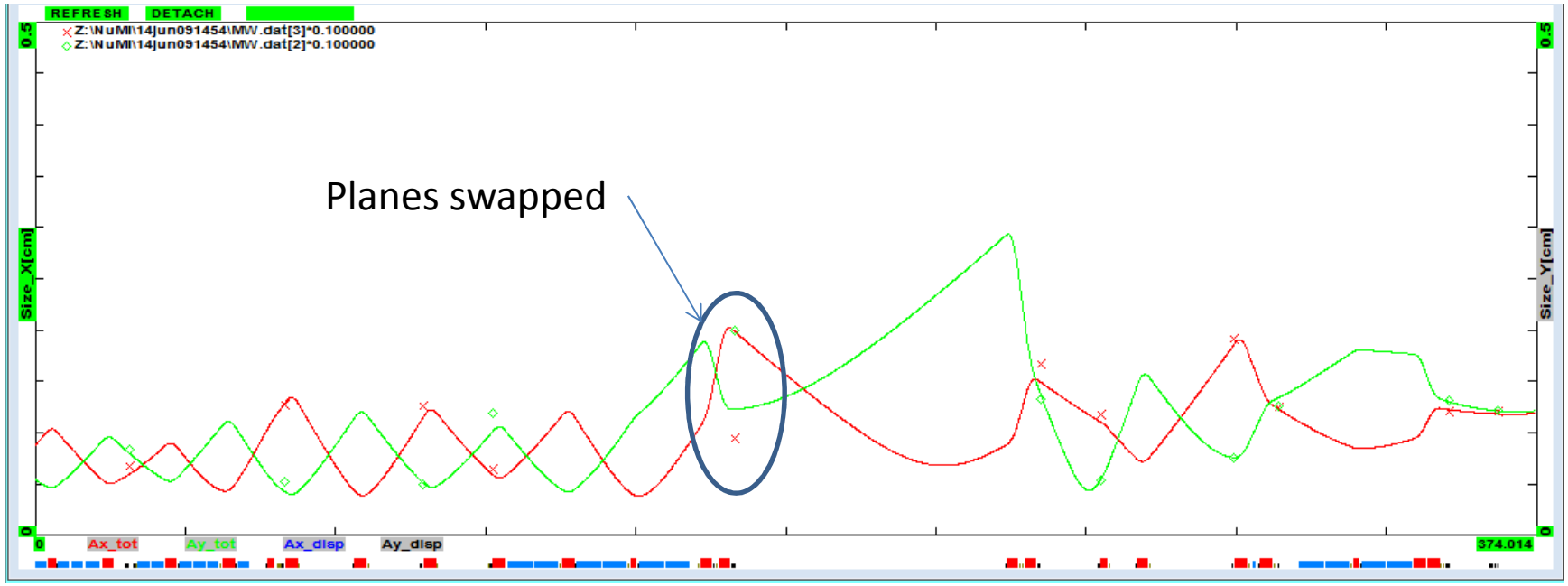
Horizontal and Vertical Correctors
Set 2



Changed HT105 and VT108. 2 amp change.

Adjust initial lattice functions to match multiwires.

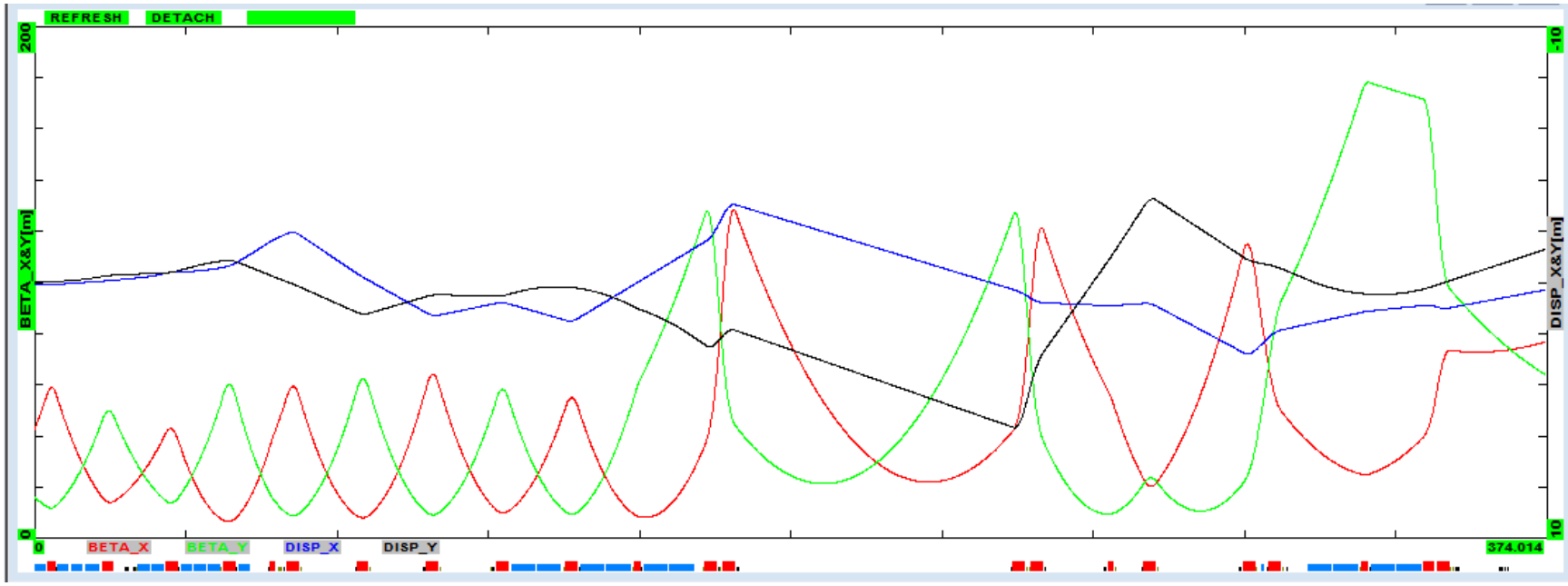
Spot Size



$e_x(95%)	13.7
$e_y(95%)	13.7
$Dp/p	0.0004

Needed to adjust Twiss parameters, see next slide (T.K.)

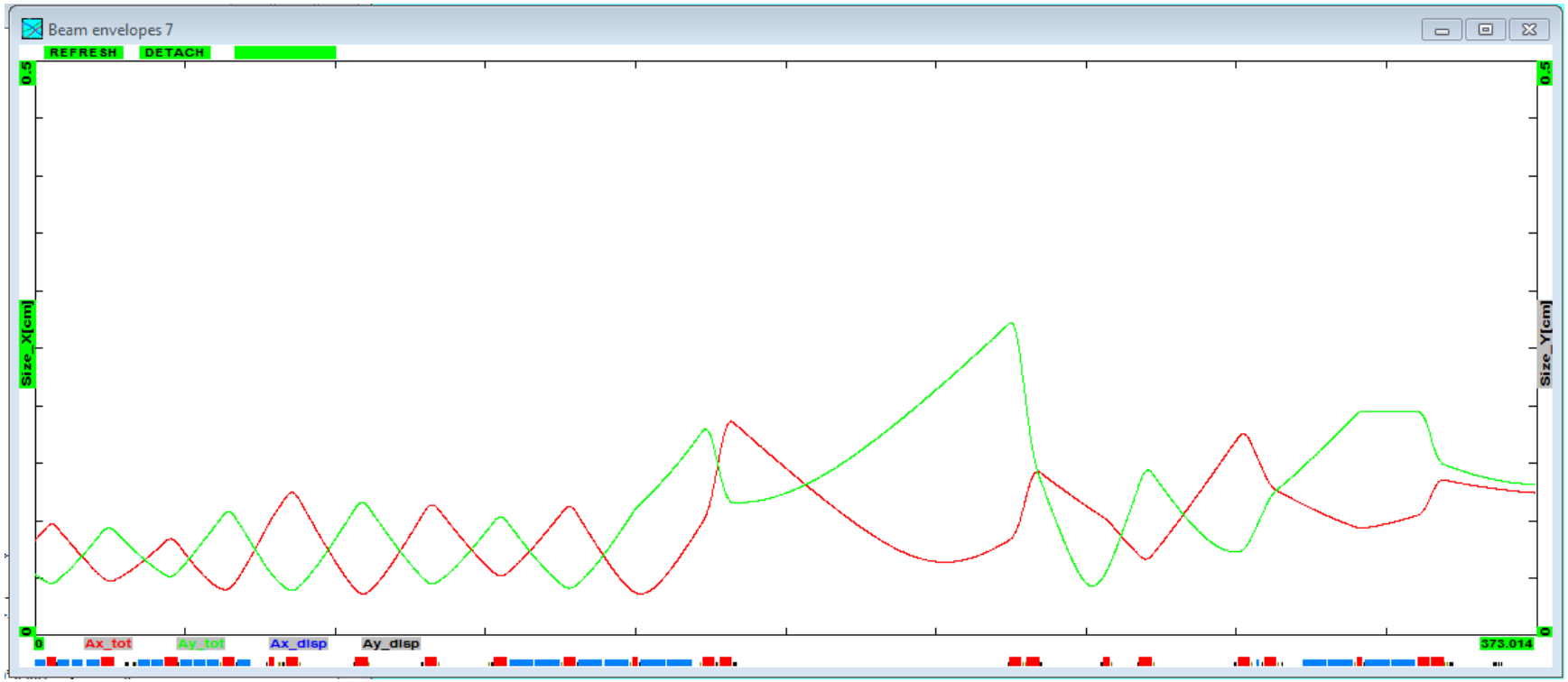
Lattice Functions



Function	value	Ming-Jen	units
$Beta_X	42.27	42.398+/-0.2	m
$Alpha_X	-1.994	-2.043	mR
$Beta_Y	15.86	15.881+/-0.7	m
$Alpha_Y	0.798	0.871	mR
$Dx	12.7	6.513	m/Dp/p
$Dxp	-2.03	-0.496	mR/Dp/p

Ming-Jen does not include the kicker

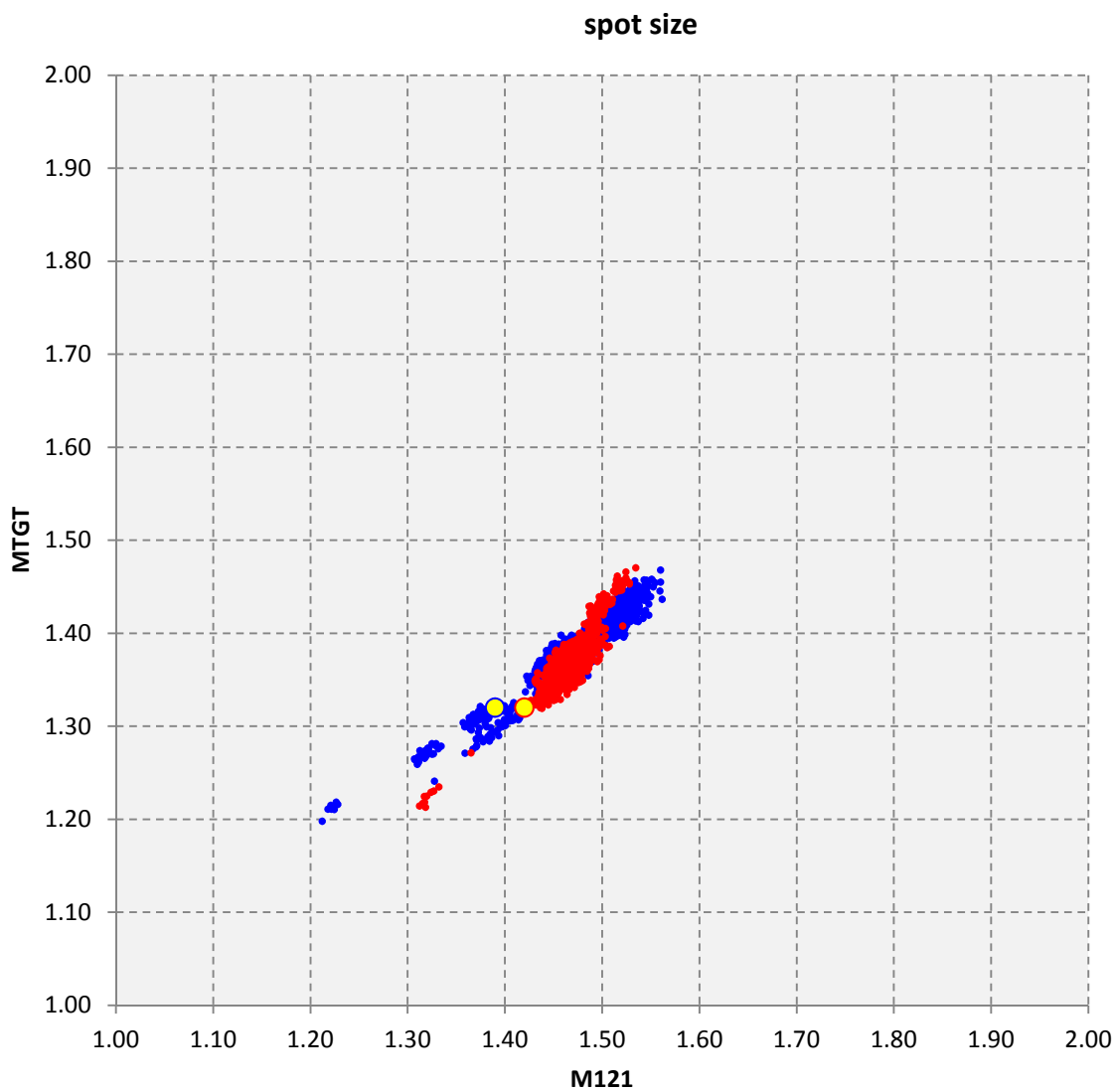
Projected 1.3 mm (almost) Round Spot



Position	horiz [mm]	verti [mm]
PM121	1.39	1.43
PMTGT	1.32	1.32
TGTus	1.28	1.30

Magnet	Current	Gradient [kG/cm]
QF117	51.2	1.030
QD118	-32.5	-0.657
QF119	-23.2	-0.476
QD120	-170.7	-0.818
QF121	44.3	0.896

Spot size should be close. Vary quads to “bracket” the desired spot size.



QF117 = 49.1
QD118 = 29.4
QF119 = 22.6
QD120 = 182.2
QF121 = 46.3

Errors

$$\sigma^2 = \varepsilon\beta + \left(n\frac{\Delta p}{p}\right)^2$$

spot size (squared)

emittance

beta function

eta function

momentum spread

$$2\sigma d\sigma = \partial\varepsilon\,\beta + \varepsilon\,\partial\beta + 2\left(n\frac{\Delta p}{p}\right)\left(\partial n\frac{\Delta p}{p} + n\partial\frac{\Delta p}{p}\right)$$

intuitively obvious to the most casual observer…

$$\delta\sigma = \frac{1}{2\sigma}\left[(\delta_\epsilon\beta)^2 + \left(\varepsilon\delta_\beta\right)^2 + \left(2n\frac{\Delta p}{p}\right)^2\left(\left(\delta_n\frac{\Delta p}{p}\right)^2 + \left(n\delta_{\Delta p/p}\right)^2\right)\right]^{1/2}$$

Assume a 10% error on all values

quantity	PM121		PMTGT		target		units
	x	y	x	y	x	y	
e_1s	1.56E-08	1.72E-08	1.56E-08	1.72E-08	1.56E-08	1.72E-08	[m*R]
de	1.56E-09	1.72E-09	1.56E-09	1.72E-09	1.56E-09	1.72E-09	[m*R]
beta	90.4356	118.506	86.8508	95.5484	86.3534	82.3129	[m]
dbeta	9.04	11.85	8.69	9.55	8.64	8.23	[m]
dp/p	4.00E-04	4.00E-04	4.00E-04	4.00E-04	4.00E-04	4.00E-04	[]
ddp/p	4.00E-05	4.00E-05	4.00E-05	4.00E-05	4.00E-05	4.00E-05	[]
eta	1.825	-0.172	1.529	-0.827	1.316	-1.296	[m]
deta	0.18	-0.02	0.15	-0.08	0.13	-0.13	[m]
spot	0.001394	0.001429	0.001315	0.001324	0.001275	0.001298	[m]
dspot	0.000090	0.000101	0.000083	0.000089	0.000081	0.000083	[m]
%	6.4%	7.1%	6.3%	6.7%	6.3%	6.4%	[]

1.28 mm × 1.30 mm
±6%