Status Report:
MAX IV
3 GeV Storage Ring Lattice Design

simon.leemann@maxlab.lu.se
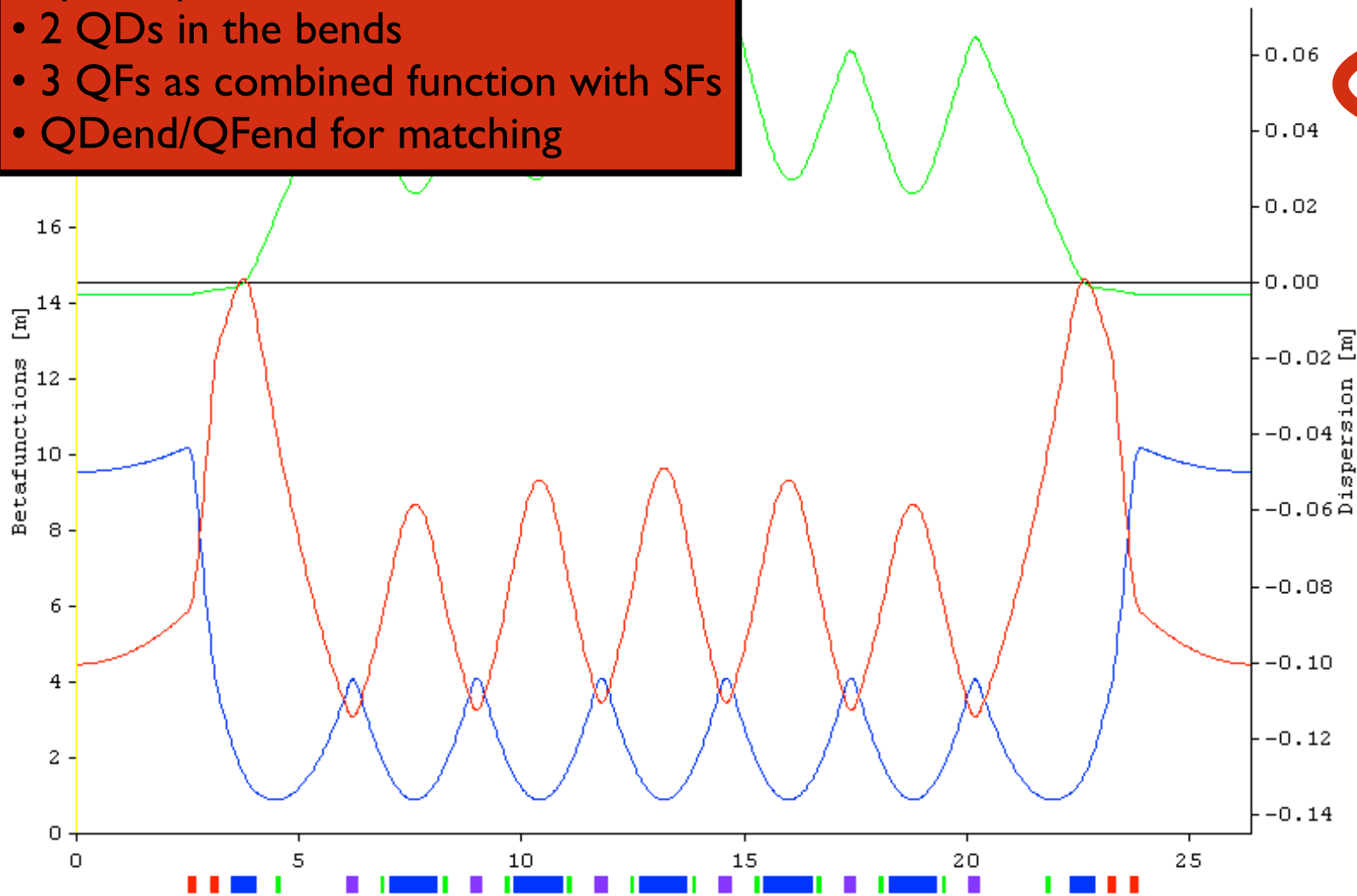
Simon C. Leemann • May 16, 2008

Achromat (as seen by OPA)
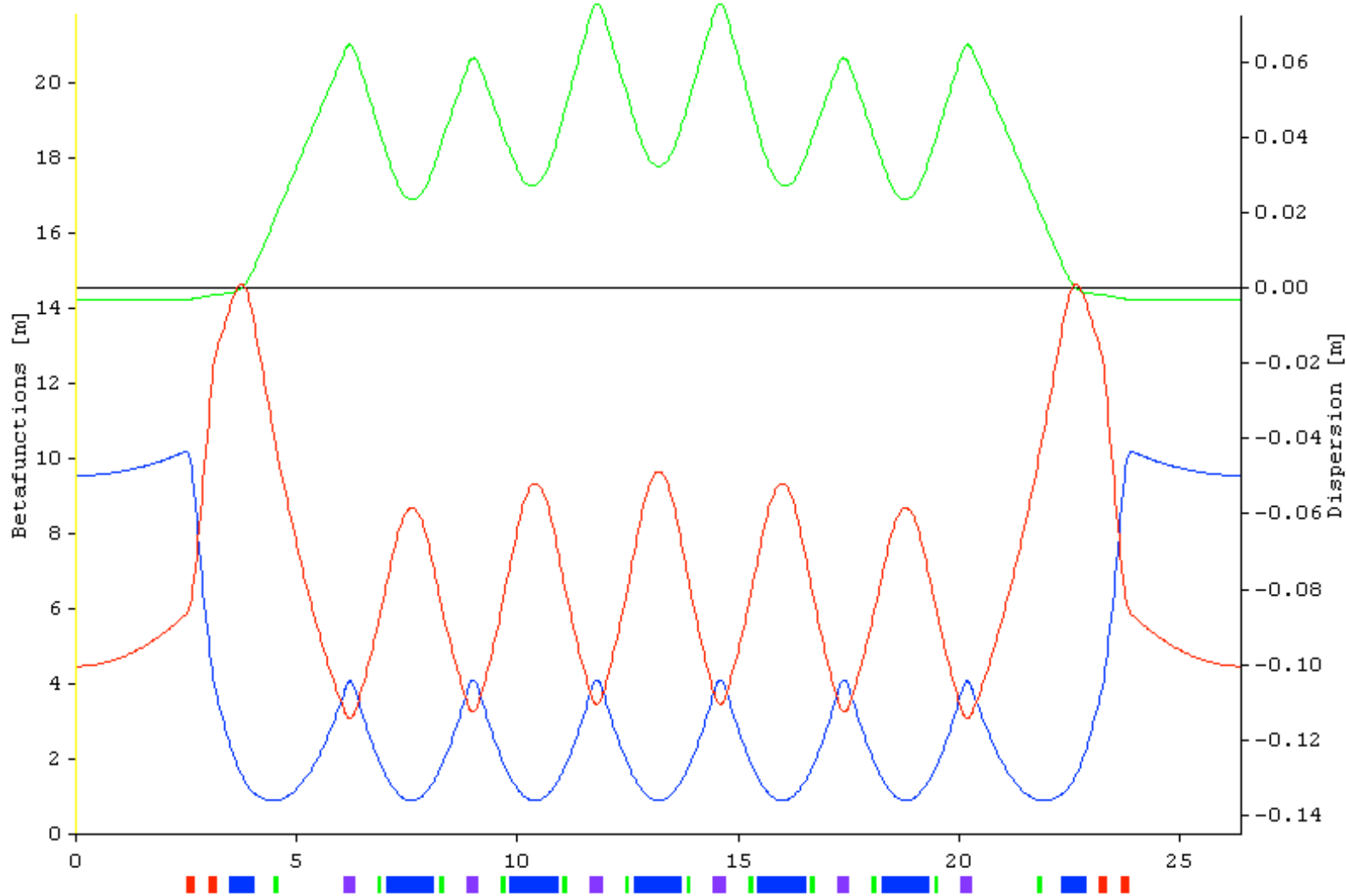
Line		1
Length	[m]	26.388
TuneX		2.11099
TuneY		0.71350
ChromX		-2.540
ChromY		-1.989
Alpha	[xE-3]	0.298
Jx		1.74275
Energy	[GeV]	3.000
EmitXo	[nm rd]	0.324
dE/turn	[keV]	18.1
Espread	[xE-3]	0.743
TauX	[ms]	16.709
TauY	[ms]	29.120
TauE	[ms]	23.161
Location		END
Position	m	26.388
BetaX	m	9.550
AlphaX		0.0000
BetaY	m	4.475
AlphaY		0.0000
Disp.	m	-0.0031
dD/ds	rad	0.0000
PhiX/2pi		2.1110
PhiY/2pi		0.7135
curly H	m	0.000001

Achromat (as seen by OPA)

7 quadrupole families:
- 2 QDs in the bends
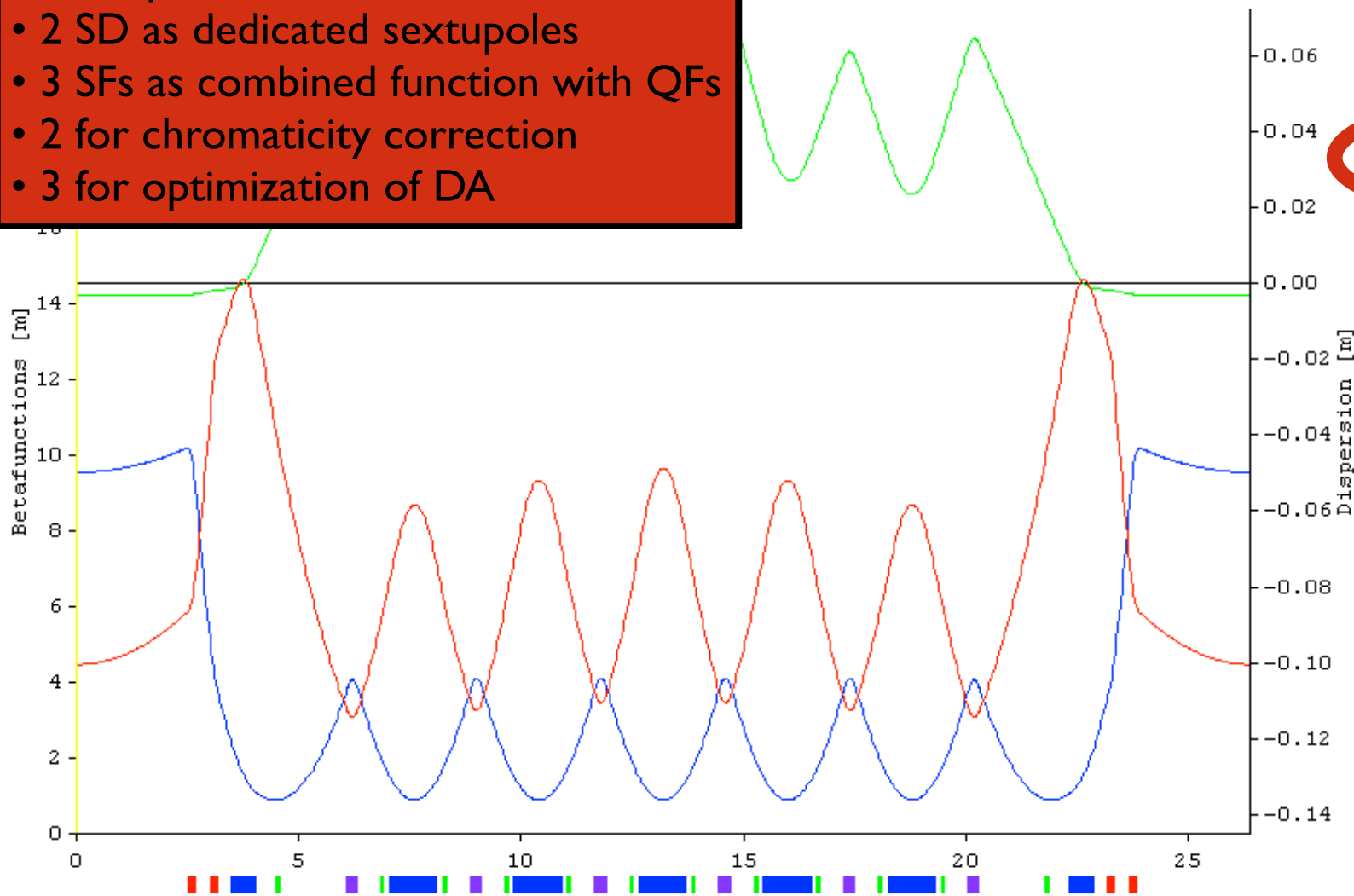- 3 QFs as combined function with SFs
- QDend/QFend for matching

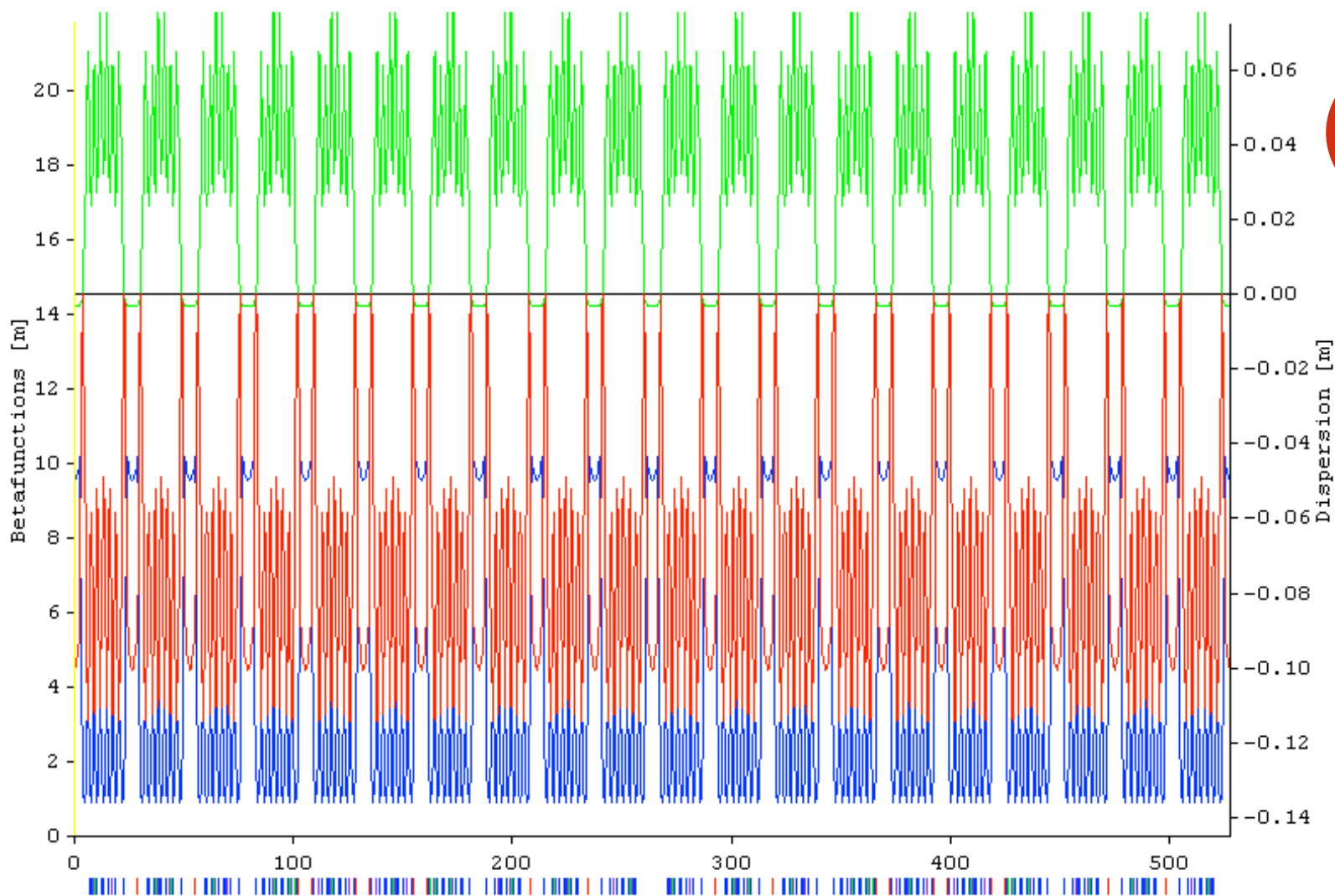| Line		1
TuneX		2.11099
TuneY		0.71350
ChromX		
ChromY		-1.989
Alpha	[xE-3]	0.298
Jx		1.74275
Energy	[GeV]	3.000
EmitXo	[nm rd]	0.324
dE/turn	[keV]	18.1
Espread	[xE-3]	0.743
TauX	[ms]	16.709
TauY	[ms]	29.120
TauE	[ms]	23.161
Location		END
Position	m	26.388
BetaX	m	9.550
AlphaX		0.0000
BetaY	m	4.475
AlphaY		0.0000
Disp.	m	-0.0031
dD/ds	rad	0.0000
PhiX/2pi		2.1110
PhiY/2pi		0.7135
curly H	m	0.000001

Achromat (as seen by OPA)

5 sextupole families:
- 2 SD as dedicated sextupoles
- 3 SFs as combined function with QFs
- 2 for chromaticity correction
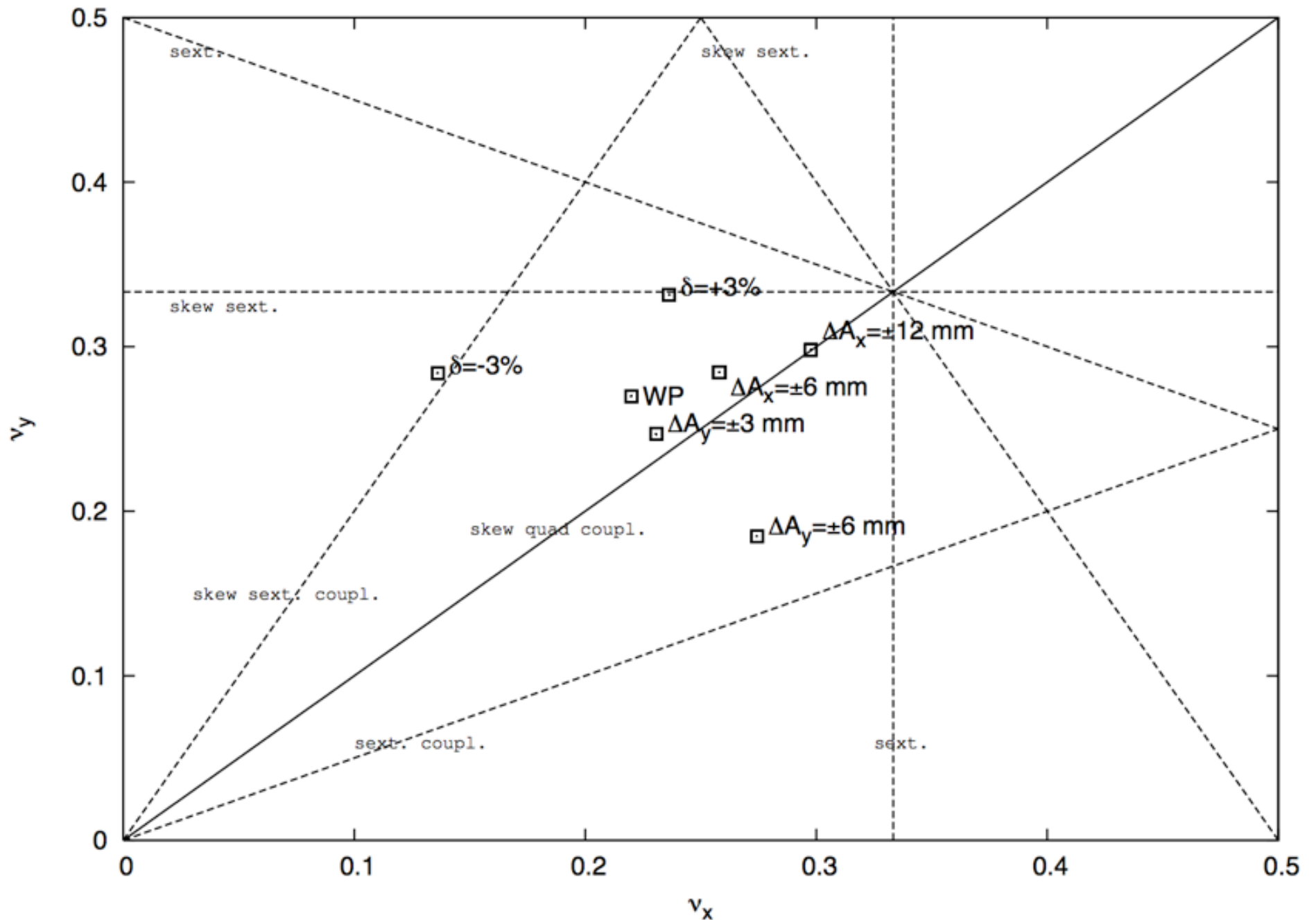- 3 for optimization of DA

Line		1
Length	[m]	26.388
TuneX		2.11099
ChromX		-2.540
ChromY		-1.989
Jx		1.74275
Energy	[GeV]	3.000
EmitXo	[nm rd]	0.324
dE/turn	[keV]	18.1
Espread	[xE-3]	0.743
TauX	[ms]	16.709
TauY	[ms]	29.120
TauE	[ms]	23.161
Location		END
Position	m	26.388
BetaX	m	9.550
AlphaX		0.0000
BetaY	m	4.475
AlphaY		0.0000
Disp.	m	-0.0031
dD/ds	rad	0.0000
PhiX/2pi		2.1110
PhiY/2pi		0.7135
curly H	m	0.000001

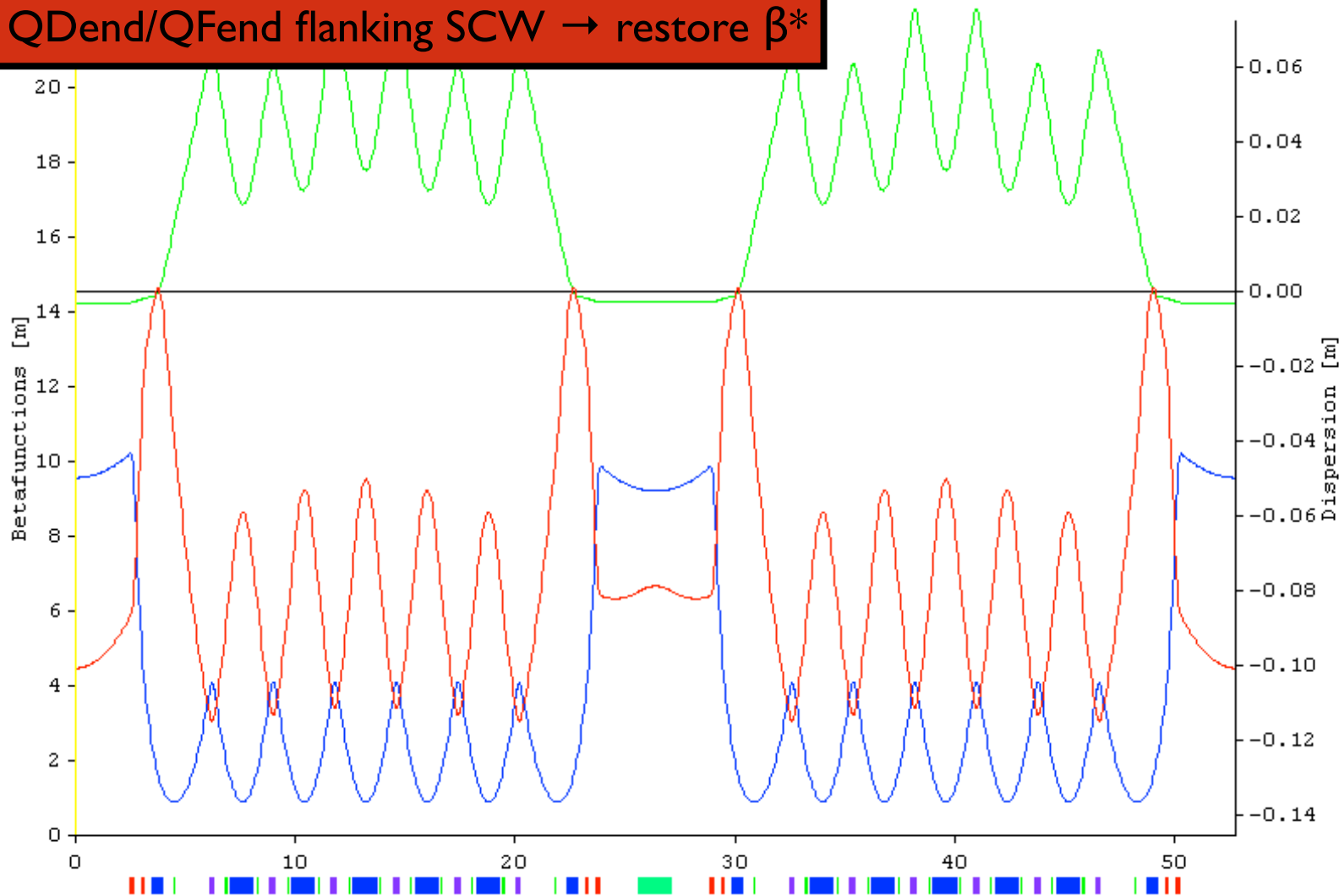# Bare Ring (as seen by OPA)

Tune Space / Tune Shifts (Tracy 3)

Dynamic Aperture (Tracy 3)
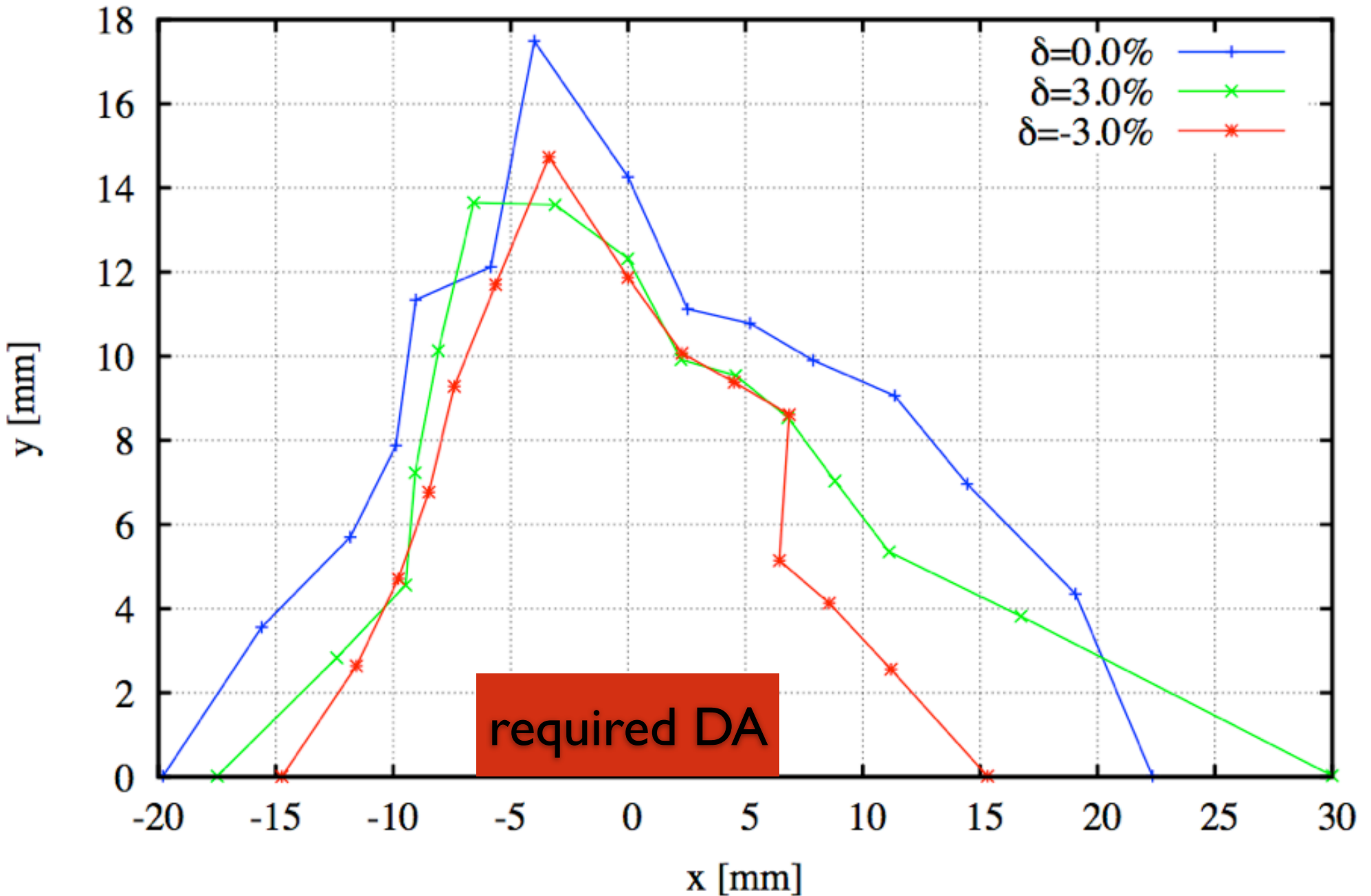
Introduce Super-Conducting Wiggler

Adjustments:
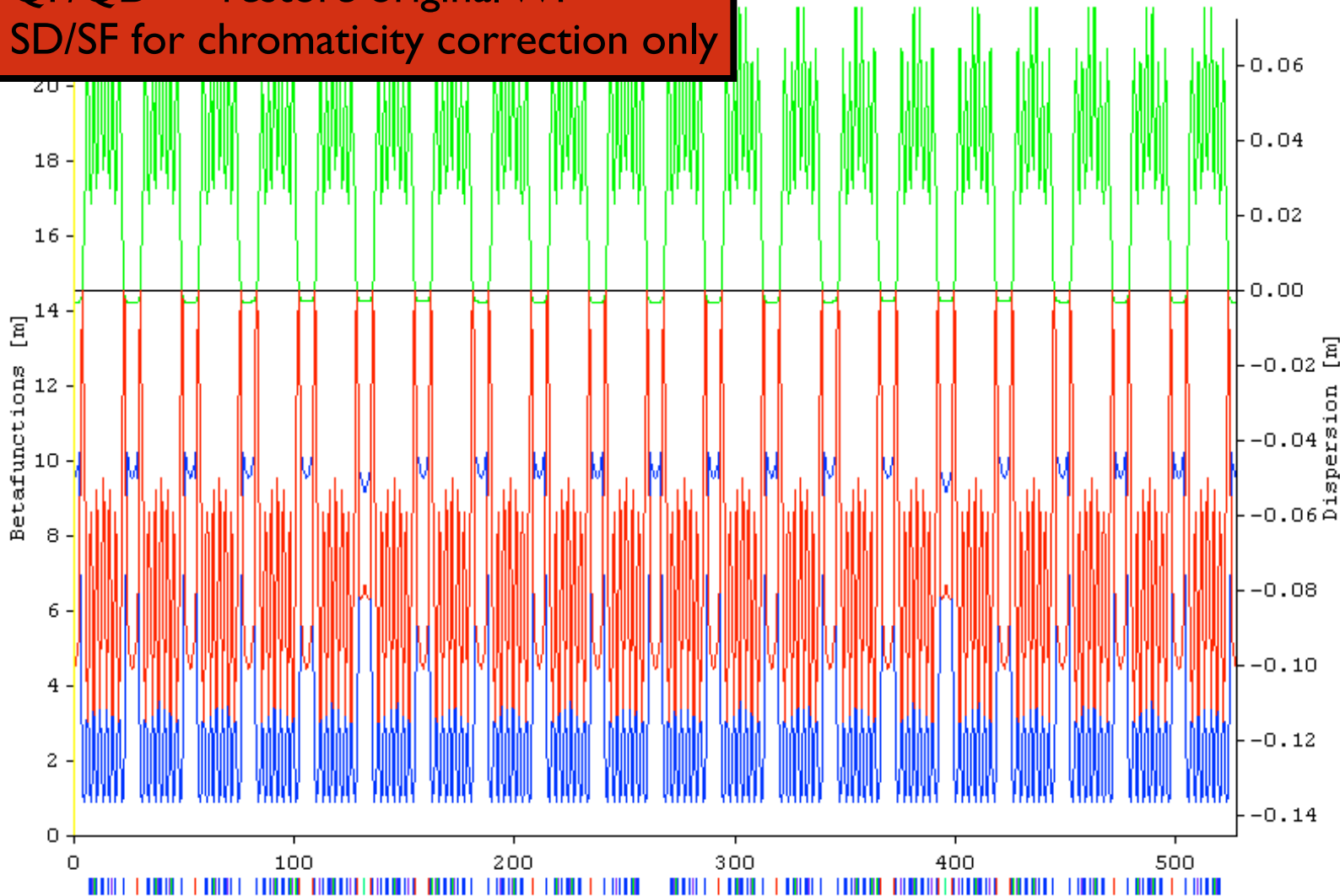- QDend/QFend flanking SCW → restore β*

Line		1
Length	[m]	52.776
TuneX		4.22447
TuneY		1.39454
ChromX		-5.051
ChromY		-3.883
Alpha	[xE-3]	0.298
Jx		1.20024
Energy	[GeV]	3.000
EmitXo	[nm rd]	0.215
dE/turn	[keV]	134.7
Espread	[xE-3]	1.304
TauX	[ms]	6.531
TauY	[ms]	7.839
TauE	[ms]	4.355
Location		END
Position	m	52.776
BetaX	m	9.570
AlphaX		0.0000
BetaY	m	4.474
AlphaY		0.0000
Disp.	m	-0.0030
dD/ds	rad	0.0000
PhiX/2pi		4.2245
PhiY/2pi		1.3945
curly H	m	0.000001

3.54 T, 61 mm, 24.5 periods

2 SCW Installed in Ring

| Line		1
Leng... [m]		
TuneX		42.21996
TuneY		14.26996
Chrom...		
ChromY		-39.510
Alpha	[xE-3]	0.298
Jx		1.48208
E...		3.000
EmitXo	[nm rd]	0.281
dE/...		553.7
Espread	[xE-3]	1.099
TauX	[ms]	12.734
TauY	[ms]	18.873
TauE	[ms]	12.433
Location		QFEND
Position	m	50.276
BetaX	m	10.225
AlphaX		0.2611
BetaY	m	5.872
AlphaY		0.5589
Disp.	m	-0.0030
dD/ds	rad	0.0000
PhiX/2pi		4.1807
PhiY/2pi		1.3540
curly H	m	0.000001

Tune Space / Tune Shifts (Tracy 3 with kick map)
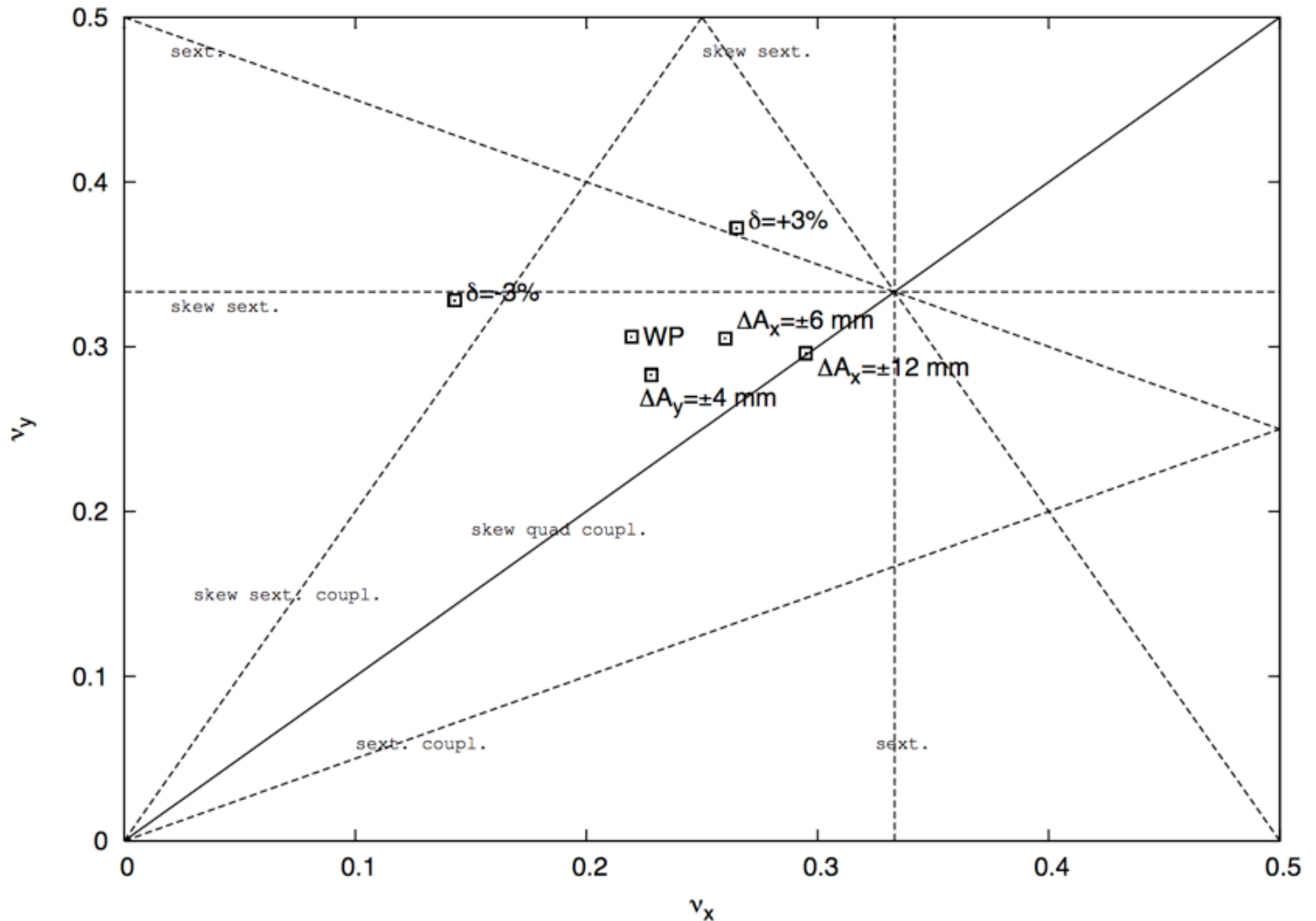
Dynamic Aperture (Tracy 3, δ=0%)
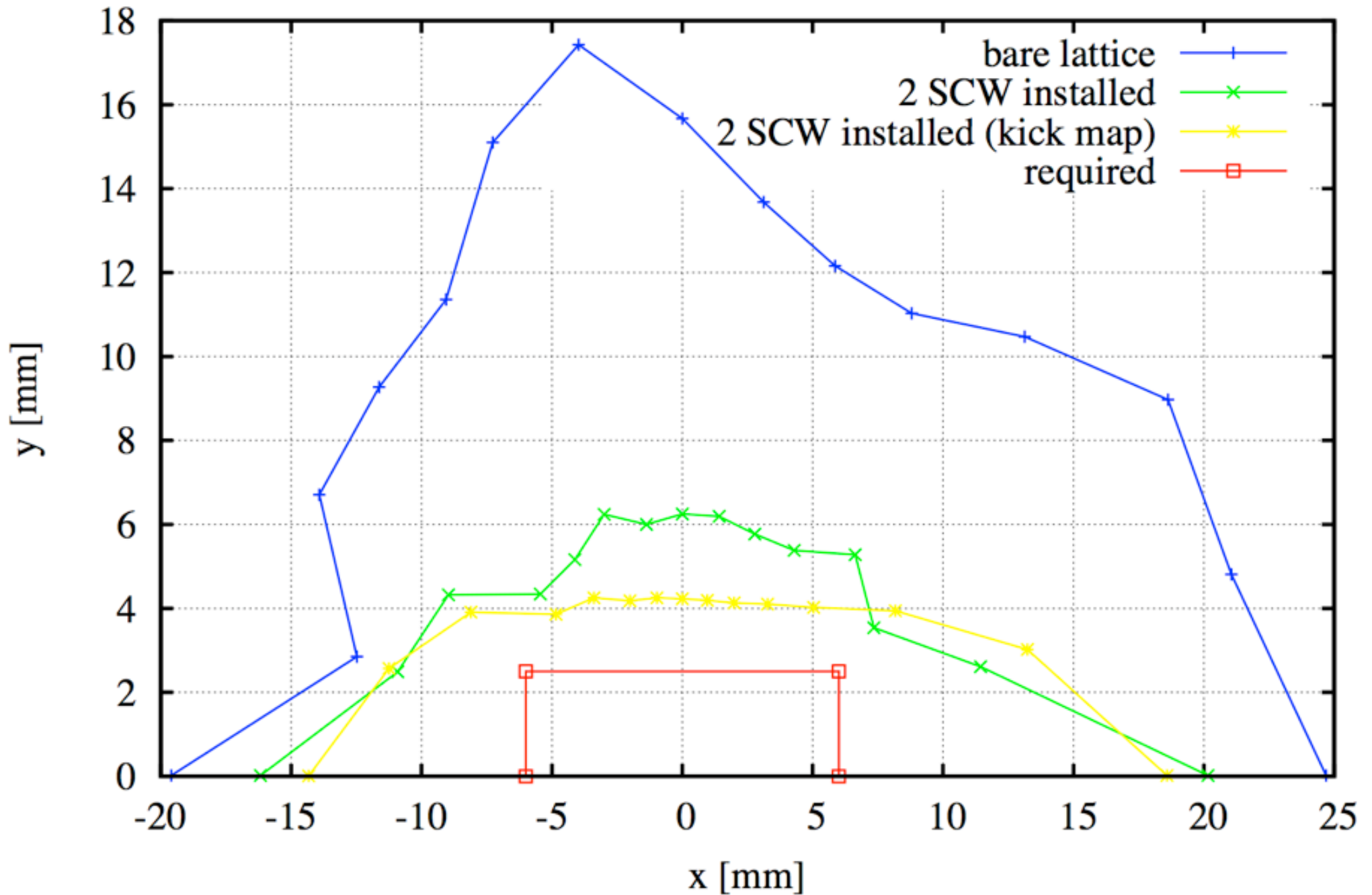
Dynamic Aperture (Tracy 3 with kick map)
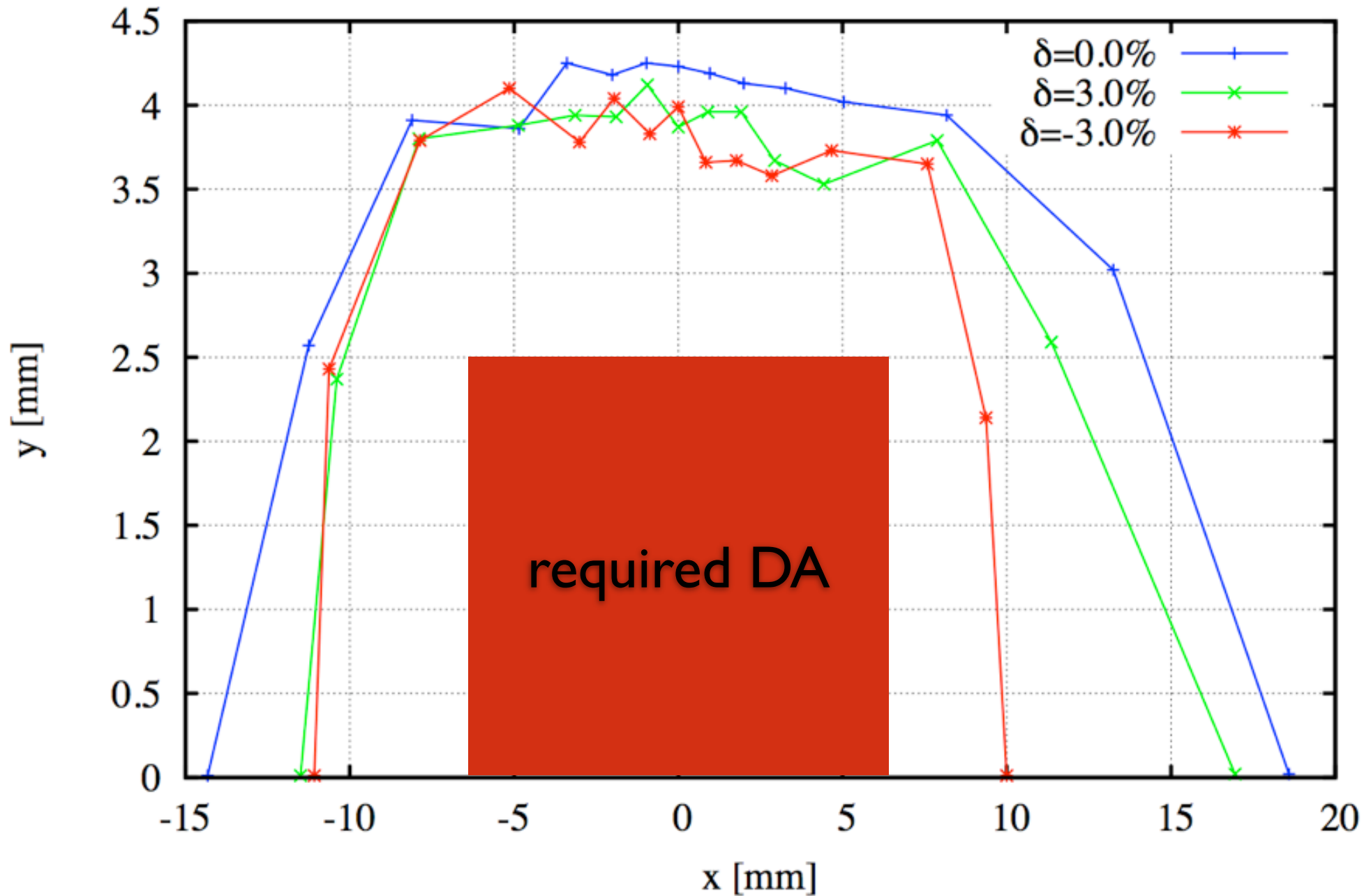
Conclusions / Outlook

- Damage caused by two 3.5 T SCWs seems to be manageable

- It appears we have found a stable lattice configuration and a good WP

- Starting to introduce misalignments to verify sufficient DA, but...

- Tracy 3 still broken (segmentation fault, possibly array overflow, compiler bug?)

- Further tweaks: octupoles to linearize chromaticity?

- Skew sextupole influence?