Chromatic Correction in the long DB TL

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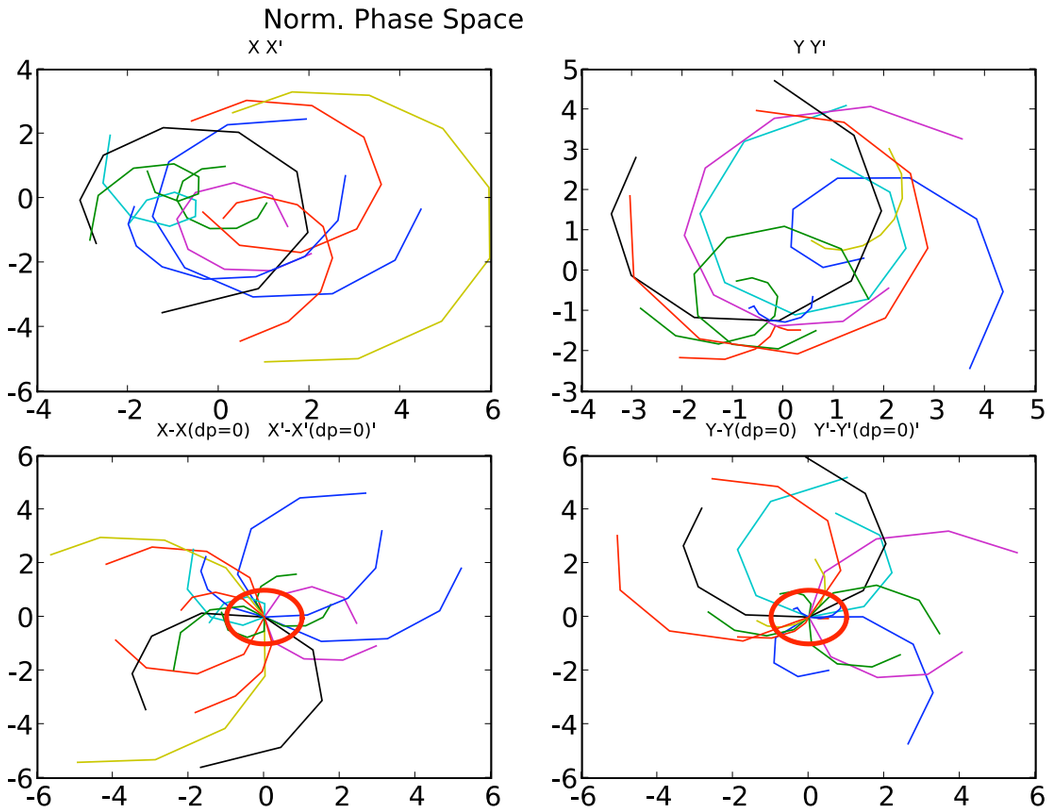
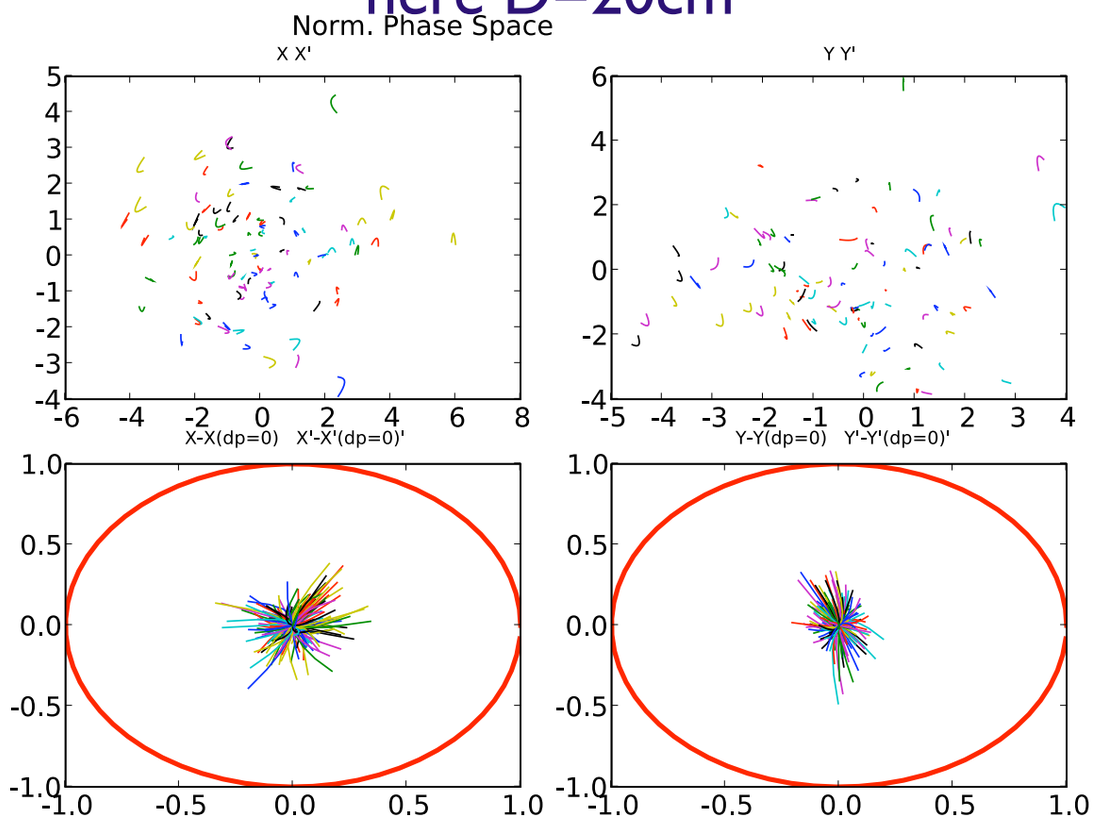
The need : correct Q' to avoid filamentation with ∂_p

Here quadrupoles randomly mis-aligned by 0.1mm
Observe the beam centroid displacement at the end of line

No Chromatic corrections



With Chromatic corrections here D=20cm



Chromatic Correction

Sextupole kicks : $k_x = k_2(x^2-y^2)/2$

$k_y = - k_2xy$

Dispersion at the sextupole : $x \rightarrow x + D\delta_p$

$$\Rightarrow \quad k_x = k_2D\delta_p x + k_2(x^2-y^2+ D^2\delta_p^2)/2$$

$$k_y = -k_2D\delta_p y - k_2xy$$

$\updownarrow$ $\qquad$ $\updownarrow$

$k_1\delta_p$ $\qquad$ Quadratic terms to be compensated

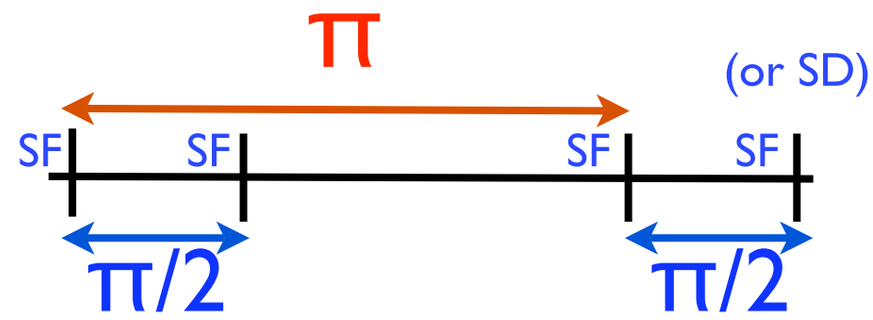
Position SX to compensate Quad terms and use MadX to match k_2's

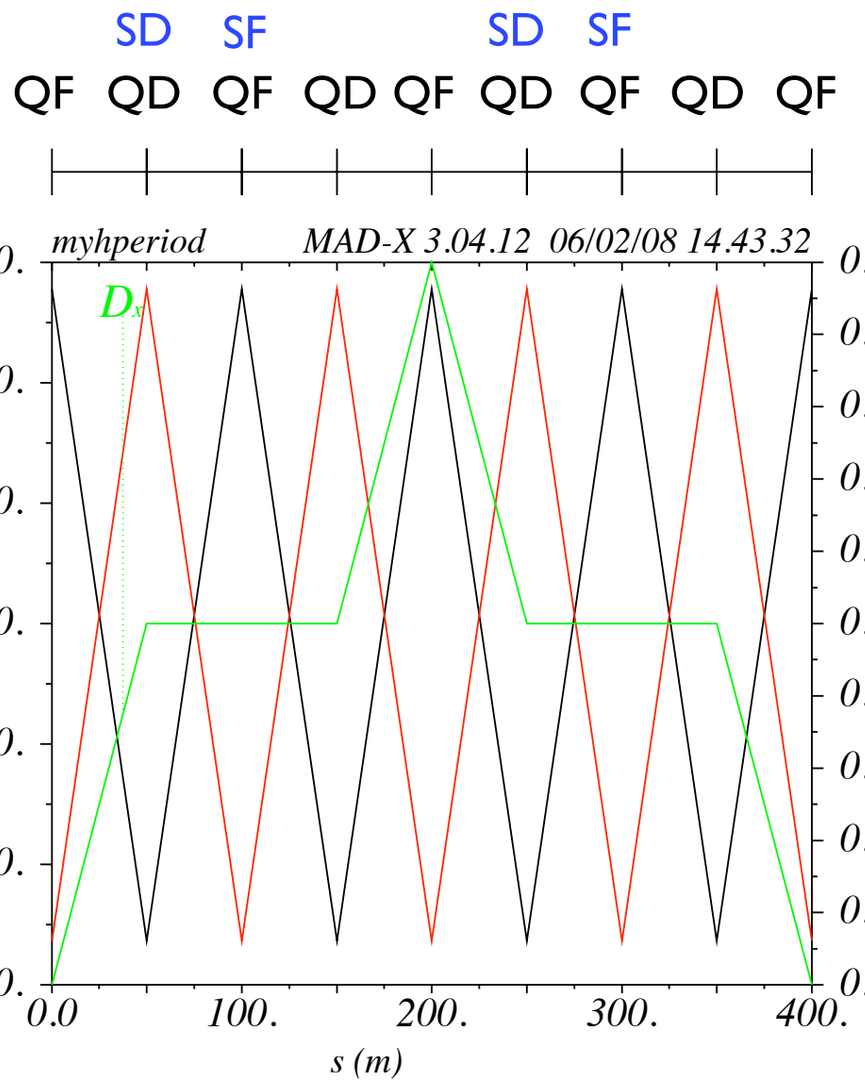
Half-cell optics

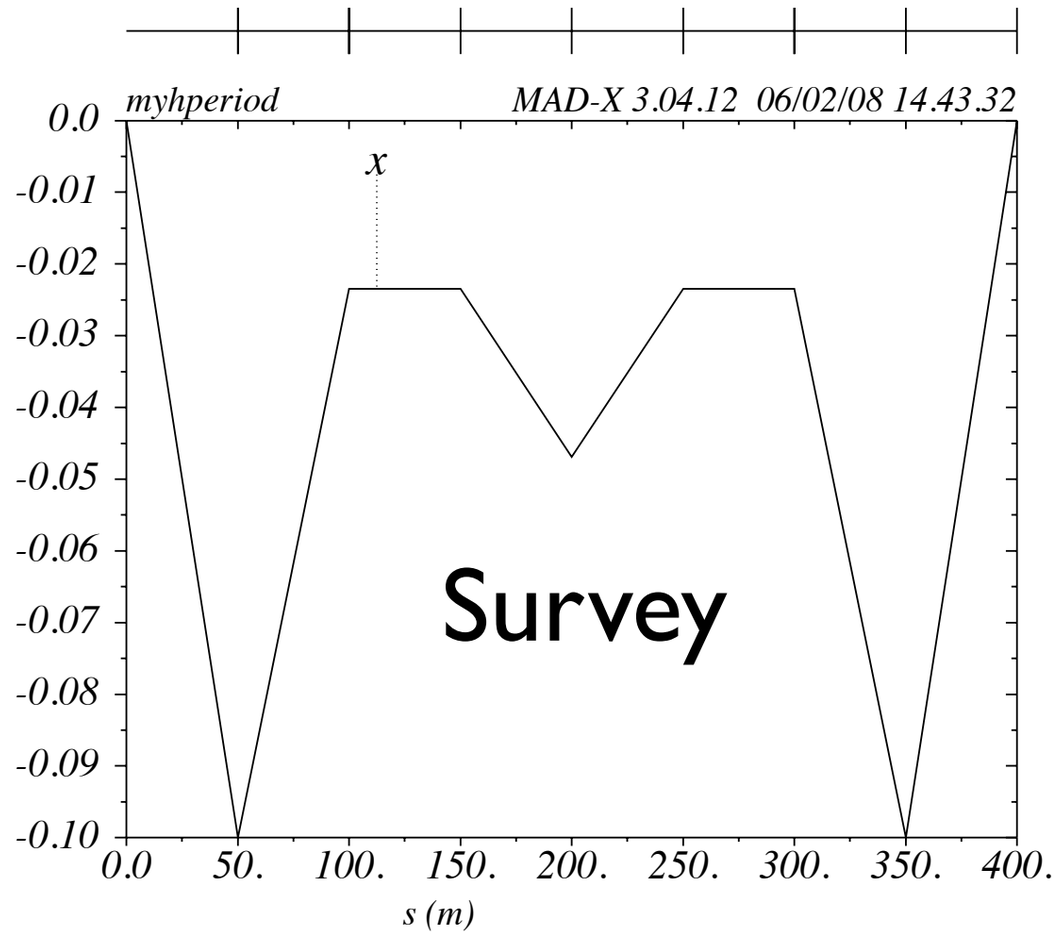
Sextupoles to get $Q'_{x,y} = 0$

Then : correct $\partial Q/\partial J$ →

correct $\partial\beta/\partial\delta_p$ →







Which dispersion at the SX ?

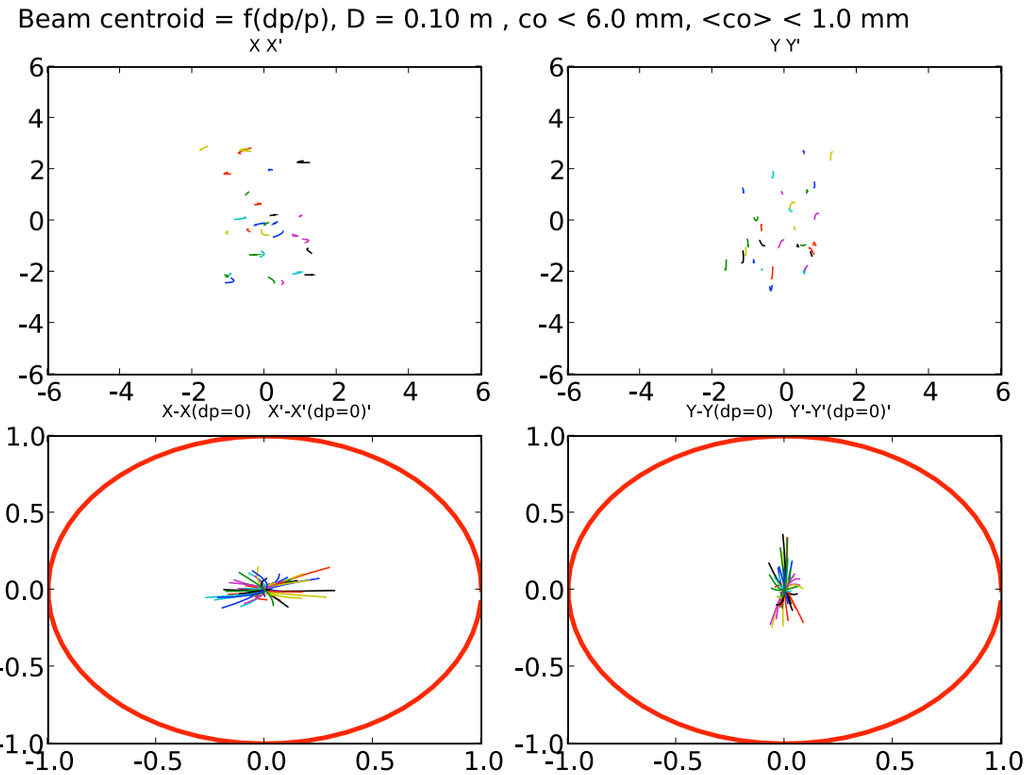
- D large enough for not being too sensitive to parasitic one
- D small enough to keep R56 small
- ⇒ Choose D = 0.1m
- See below if robust enough

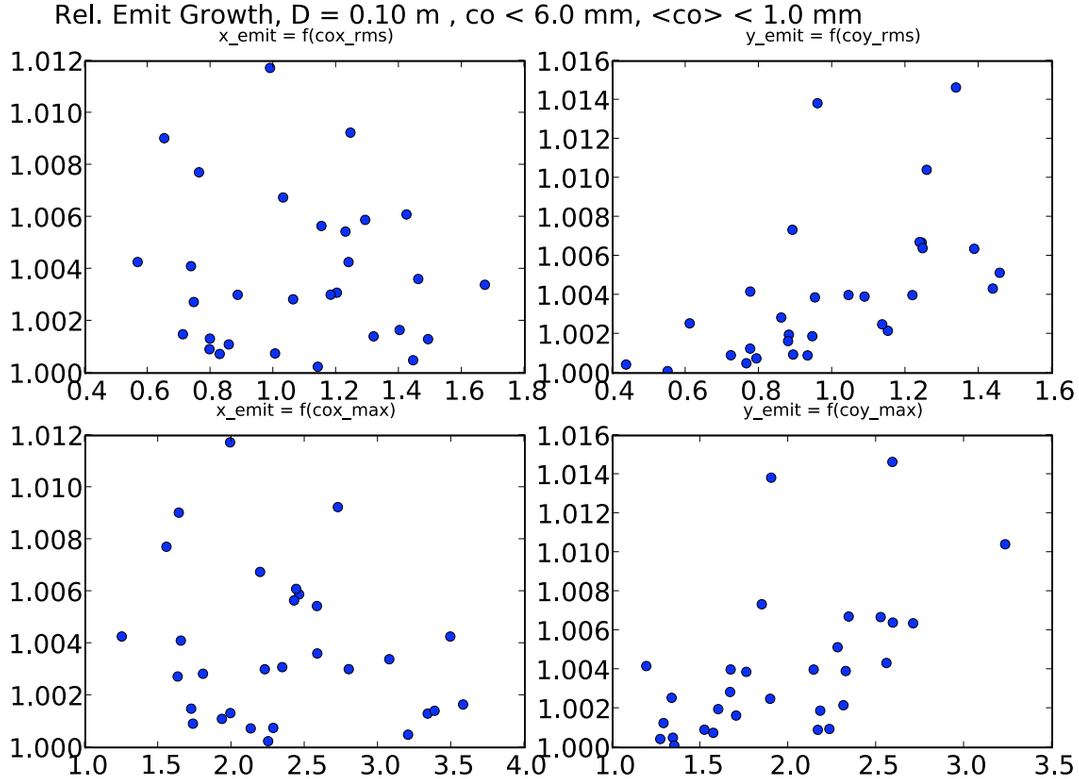
D =	0.1 m	0.2 m
R56	2.45E-02 m	9.8E-02 m
R56 x dp_max/2	0.245 mm	0.98 mm
σ_s	2 mm	2 mm
Quad sum	2.015 mm	2.23 mm

Residual centroid displacement

Parameter	Value	Unit	Cut
rms K0/K0	5.00E-04	-	2σ
rms K1/K1	5.00E-04	-	2σ
rms K2/K2	5.00E-03	-	2σ
rms dx/dy Q	0.1	mm	3σ
rms dx/dy SX	0.1	mm	3σ

Generate many seeds
Select reasonably good ones
Emittance growth with:
- dp gaussian weights , 2% ≡ 2 σ
- (With flat weights : ≈ 2× emit gr.)





Conclusions

- Static correction of chromatic detuning with sextupoles promising with D = 0.1m
- Small drawback : TL elements waving by 0.1m alongthe tunnel
- Further work :
  - Insert orbit correctors
  - Check that phase-space deform marginally with dp