

***Beam Extraction Line of ATF2
(from Damping Ring to Final Focus)***

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@SLAC

We should decide in this meeting.

- 1) Sextupoles at new extraction line.

- 2) Skew quadrupoles at new extraction line.

We should discuss the alignment and reference line
at the entrance of extraction line

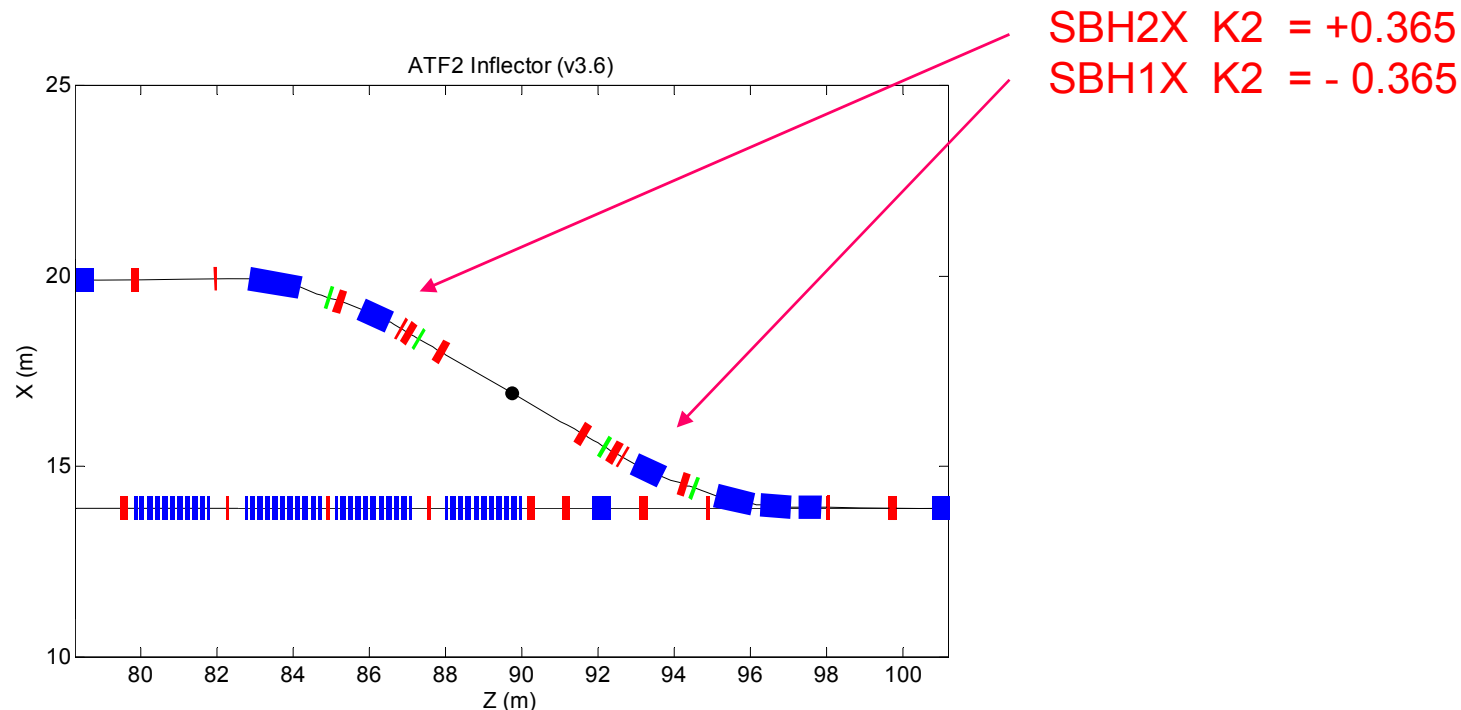
Sextupoles at new extraction line

Nonlinear Field 1 - Sextupole Component of Bending Magnet.

- The sextupole component of bending magnets for ATF was roughly evaluated by SLAC collaborators (ATF report 00-06).

$$K2 = 0.365$$

- In the ATF2, the same bending magnets are used.
- The same amount of sextupole fields are assumed to the bend in ATF2 transport line.



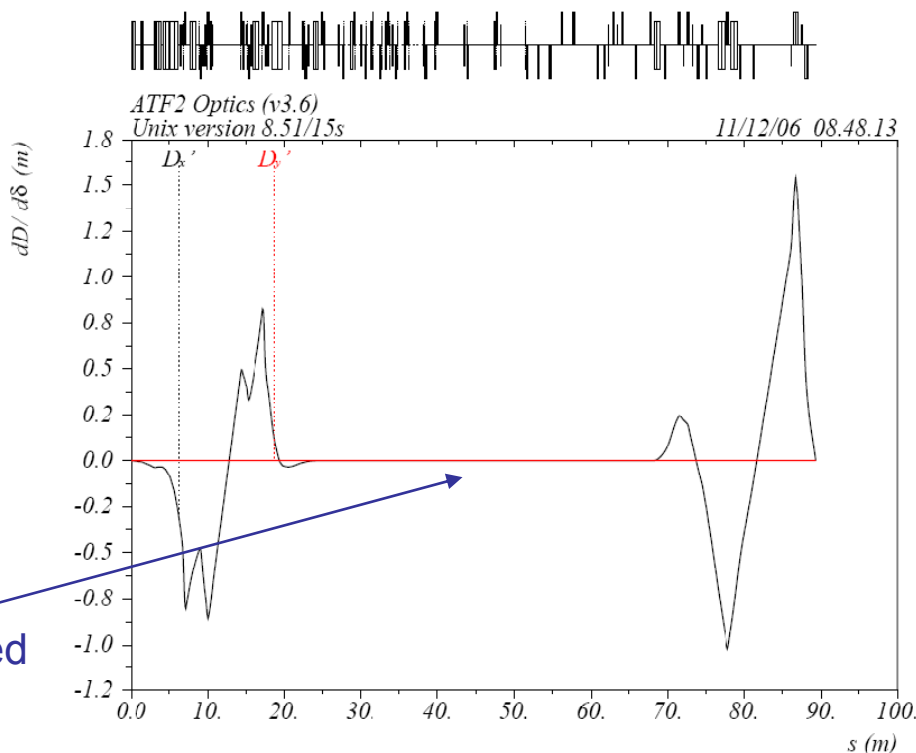
Presented by M.Woodley (SLAC) at 3rd ATF2 project meeting.

Nonlinear Field 2 - Sextupole Magnets for 2nd order Dispersion Correction.

- The 2nd order dispersion can be corrected by using 4 sextupoles.

SF1X K2 = +3.55
SD2X K2 = -3.15
SD3X K2 = +3.15
SF4X K2 = -3.72

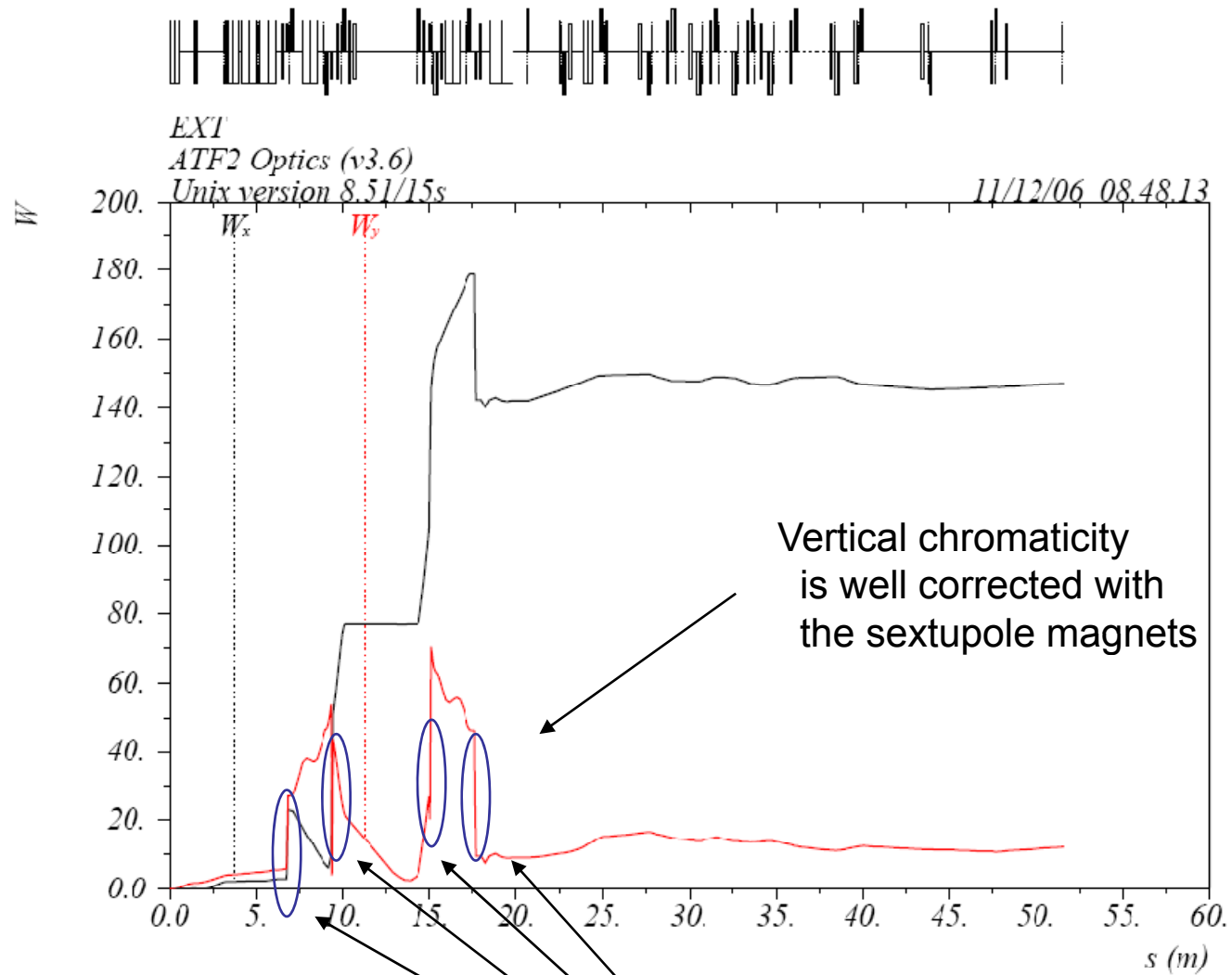
2nd order dispersion is corrected
at the entrance of FF line.



Presented by M.Woodley (SLAC) at 3rd ATF2 project meeting.

However, the strength of sexts are extremely strong,
comparable for the sexts in FF.

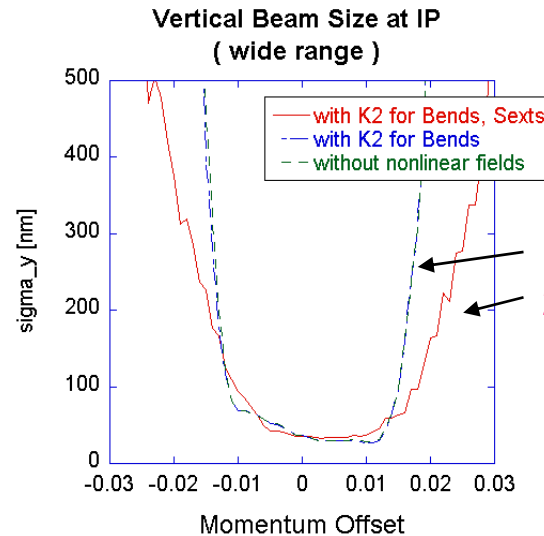
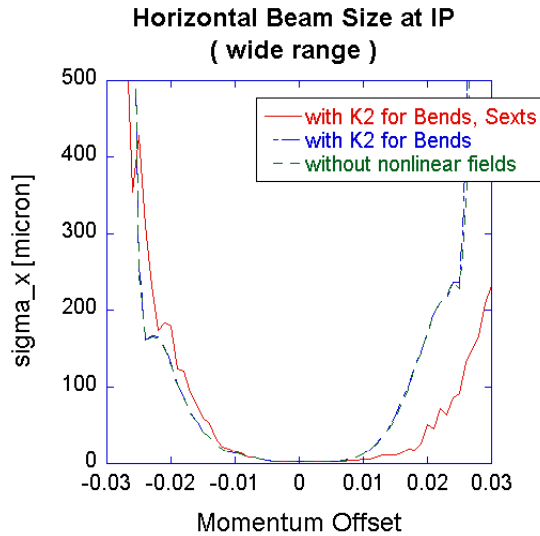
Chromaticity in ATF2 extraction line



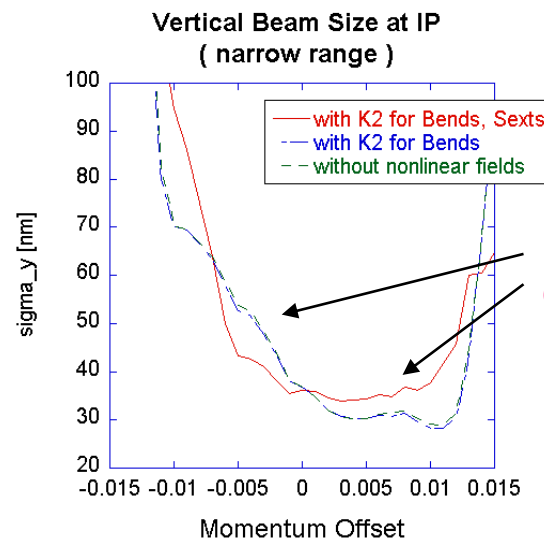
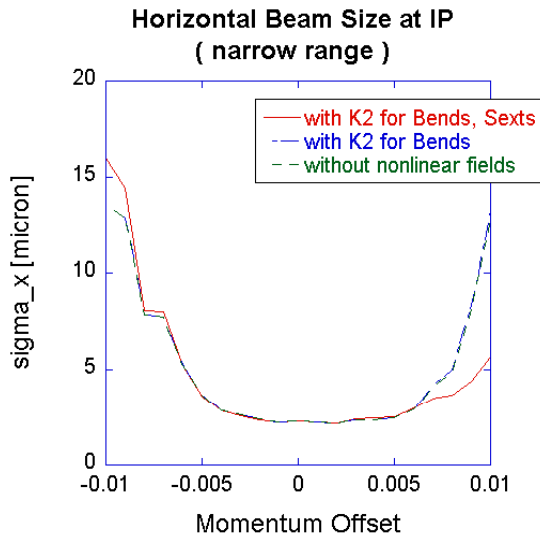
Presented by M.Woodley (SLAC) at 3rd ATF2 project meeting.

Effect of the chromaticity for ATF2 FF

Bandwidth of the IP beam size of ATF2

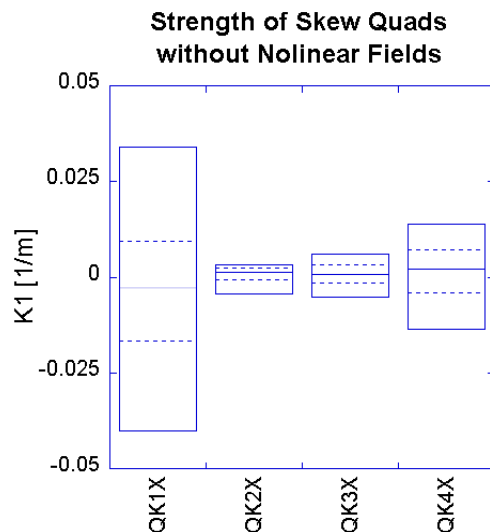


Difference come from that of
2nd order dispersion at extraction line.
but no change within $\pm 1\%$.

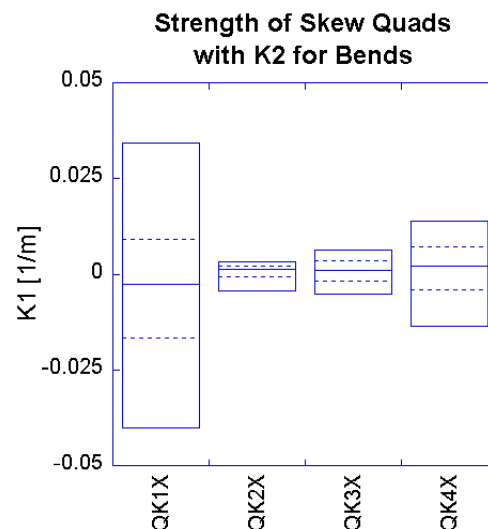


Difference come from that of
chromaticity at extraction line.
FF line is optimized with Sexts
in extraction line.

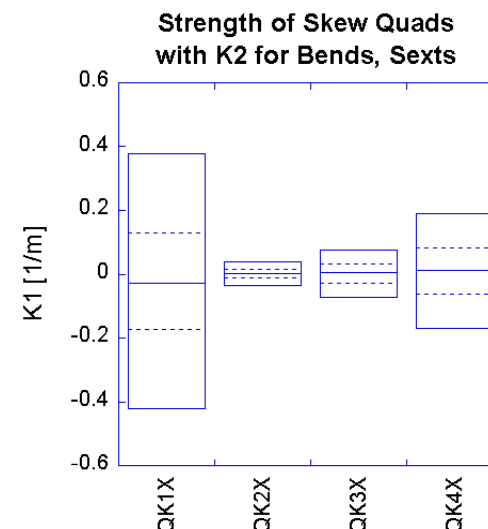
No Nonlinear Field



with Bends K2



with Bends, Sexts K2



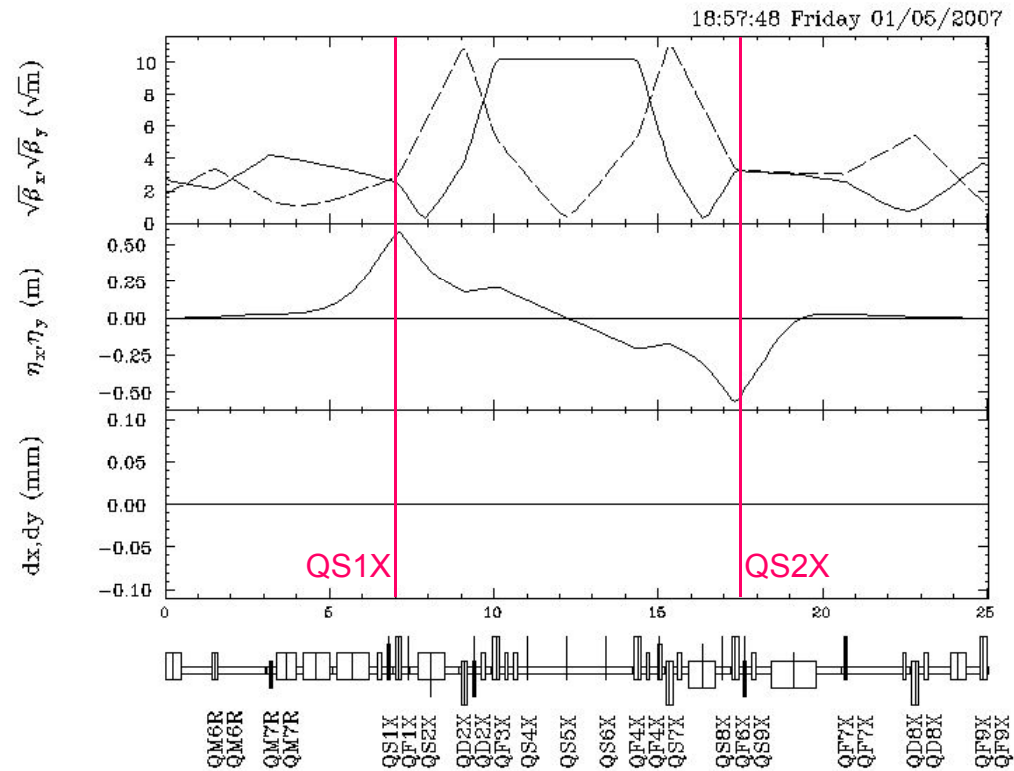
Sextupole components of bending magnets are no effects for betatron coupling at 1-2mm beam position offset.

We don't have to take care of the K2 component of bending magnets.

Sextupole magnets for 2nd order dispersion correction make the strength of the skew quads for betatron coupling correction **10 times more strong**, even if we have 1-2mm beam position offset at magnets.

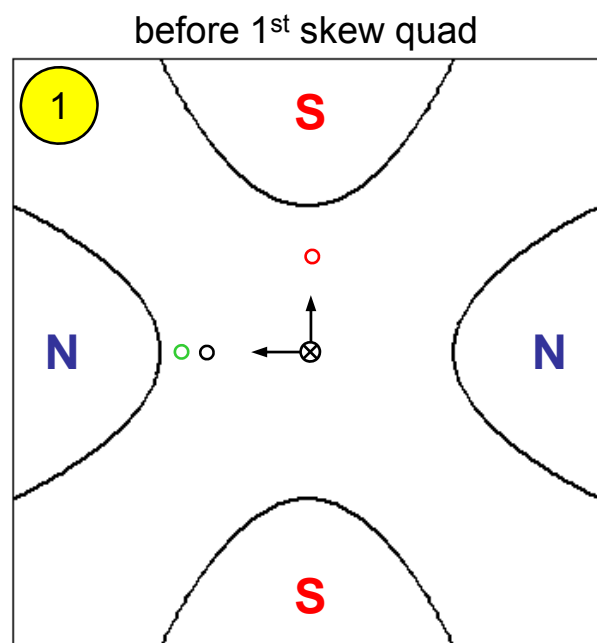
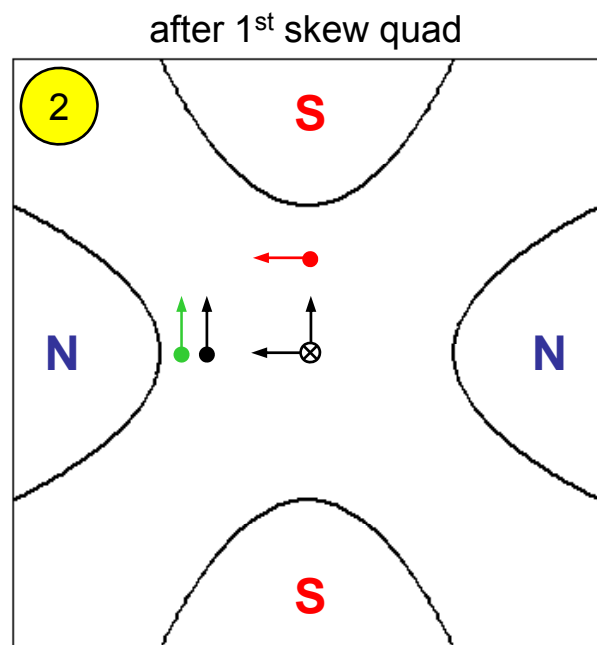
If we put the sextupole magnets in the transport line, The requirement of beam orbit tuning will be rapidly tight.

Vertical Dispersion Correction with Skew Quads



Candidate location of skew quads for vertical dispersion correction.

QS1X (SF1X), QS2X (SF4X) $NuX=2\pi$, $NuY=\pi$
- Betatron coupling was cancelled for "SUM KNOB".

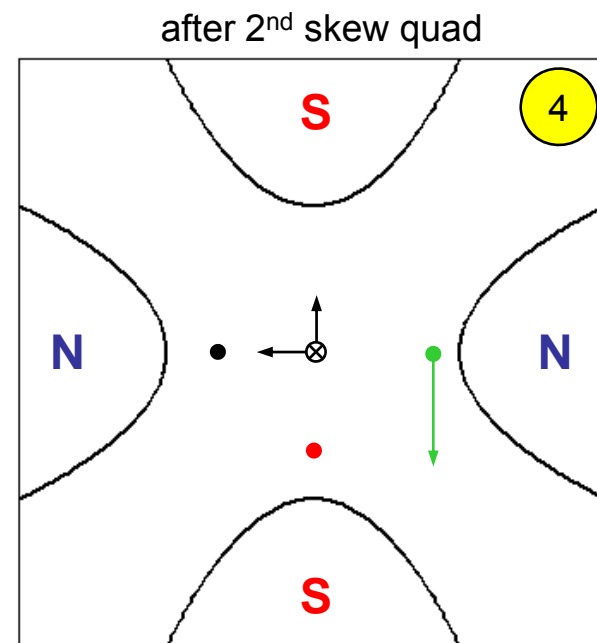
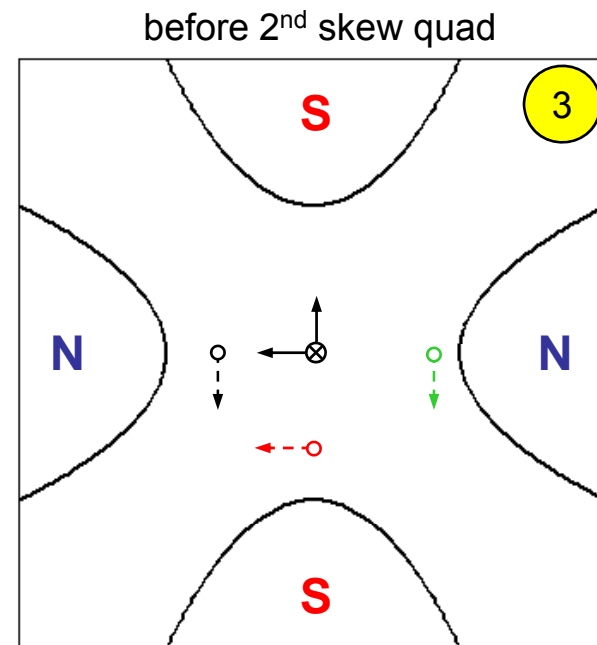


$$\begin{aligned}\Delta\mu_x &= 0,360^\circ \\ \Delta\mu_y &= 180^\circ \\ +\eta_x &\rightarrow -\eta_x\end{aligned}$$

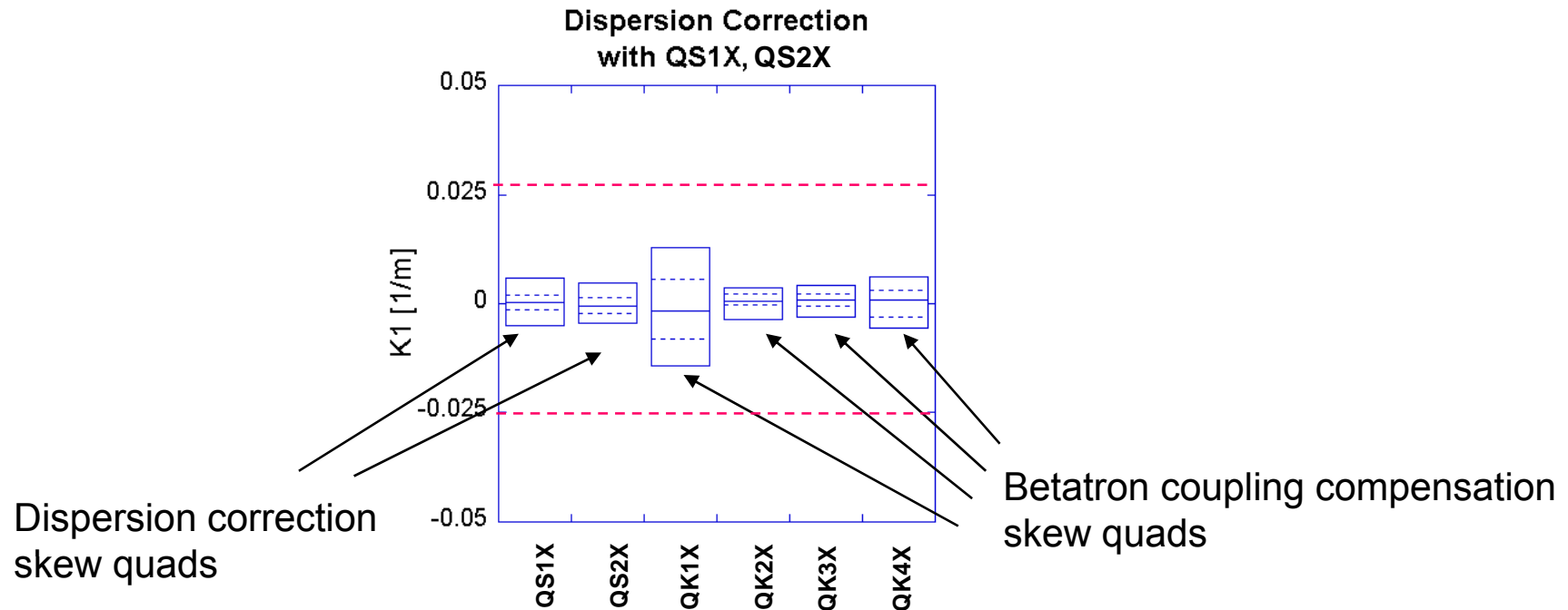
how to generate η_y
without introducing
coupling

β_x (on-energy)
 β_y (on-energy)
 η_x (off-energy)

skew quads have
equal strengths
("sum knob")



Strength of skew quads for vertical dispersion correction by assuming 0.3% rotation errors for extraction quads



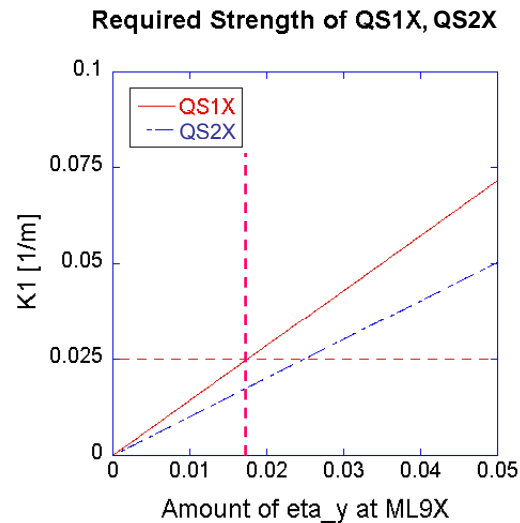
All of the skew strengths are within the strength of IDX skew quads.

No additional vertical dispersion sources

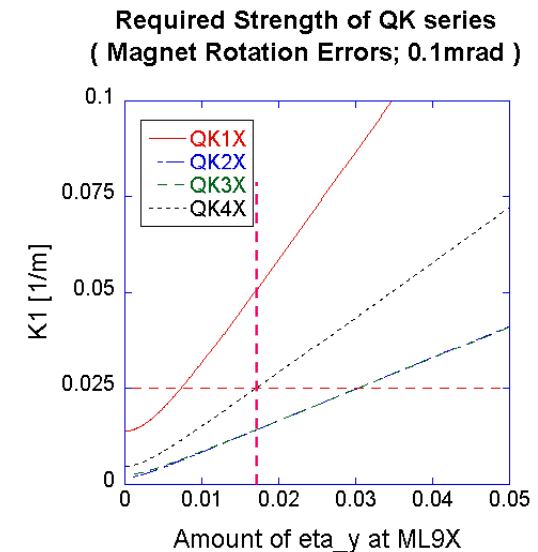
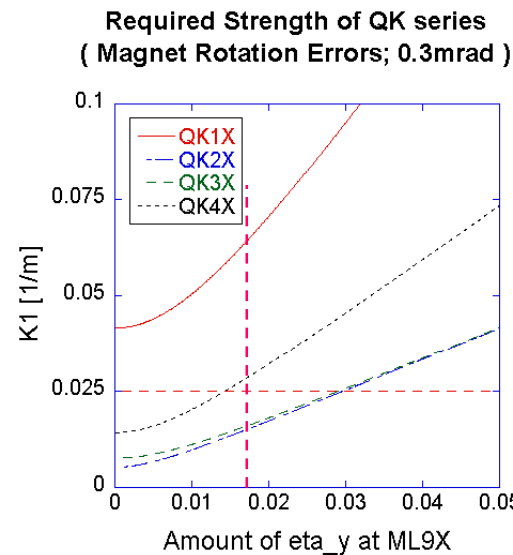
Strength of skew quads for ATF2

with additional vertical dispersion sources

Skew quads for
dispersion correction



Skew quads for
betatron coupling



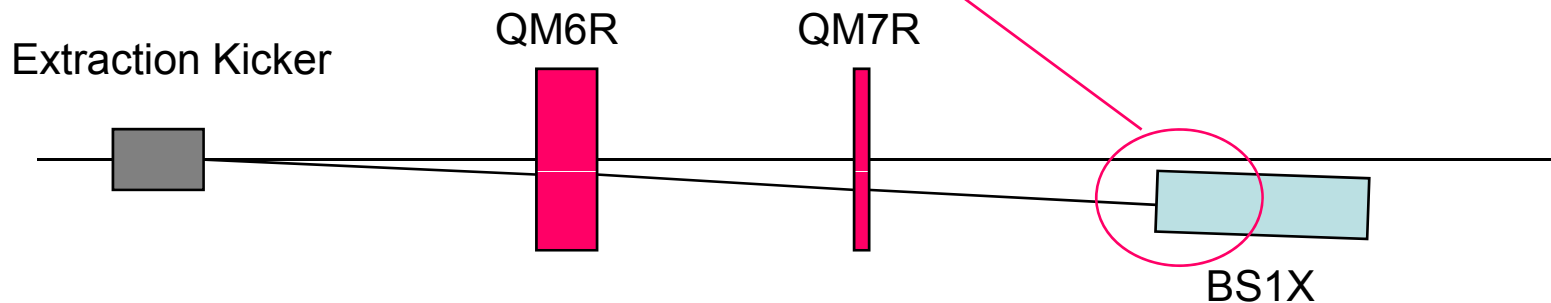
Amount of the correctable residual dispersion
with IDX skew quads to QS1X and QS2X is **17mm**.

At the 17mm of the residual dispersion case,
we can apply the IDX quads to QK2X, QK3X and QK4X(?),
but we need **twice or more** stronger magnet to QK1X.

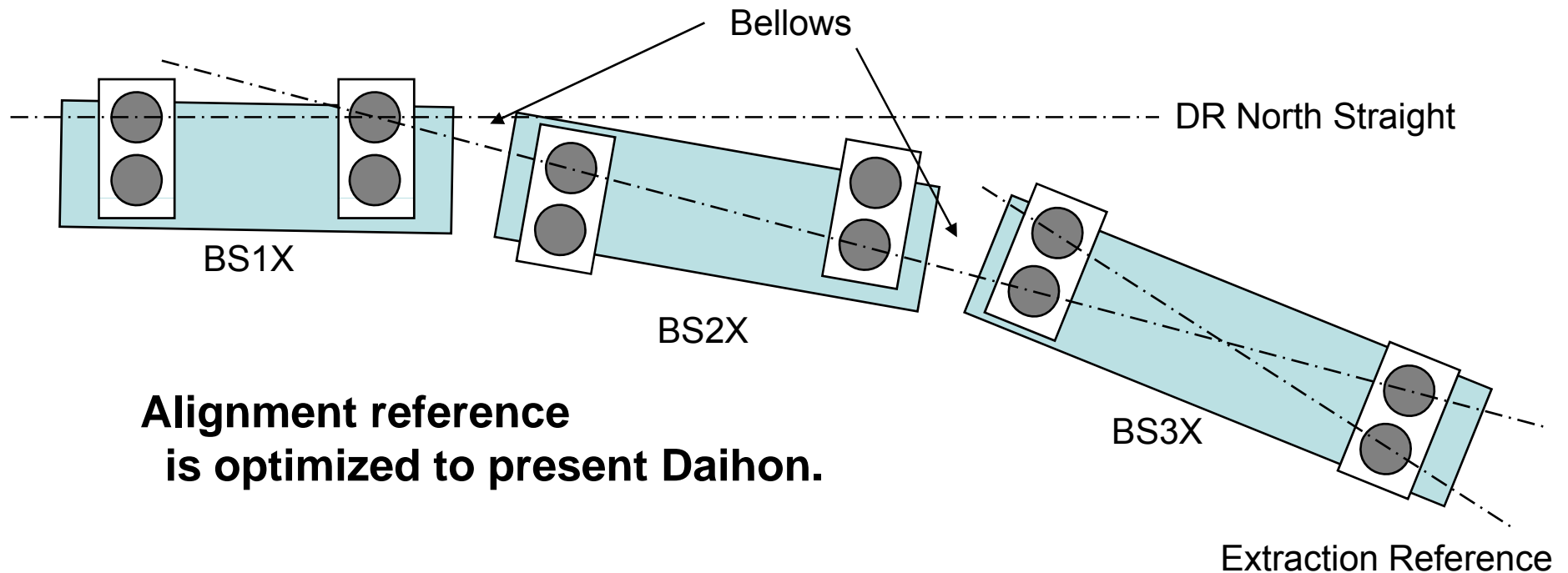
Geometrical location of Septum magnets

Present Status of the position and angle at the entrance of BS1X.

	position [mm]	angle [mrad]	
Alignment Reference	22.543	-1.030	
SAD EXT Daihon	22.706	-1.140	** disp g with COORD
Daihon Magnet Setting	22.733	-0.675	
3/15 QM magnet setting	22.685	-0.472	



- 1) Adjust by septum strength ?
 - No improvement from present situation.
- 2) QM settings ?
 - DR itself will be “new ring”.
- 3) Alignment ?
 - Difficult change for no bellows between QM7R and BS1X.
 - Alignment procedure should be remade.



Summary

1) Sextupole Issues

I recommend ...

SF1X, SD2X, SD3X and SF4X will not be installed.

2) Skew quads Issues

I (and M.Woodley at last project meeting) recommend ...

QS1X and QS2X will be put the location of SF1X and QF4X.

We will use the IDX skew quads to QS1X, QS2X, QK2X and QK3X.

QK1X and QK4X should be made new strong magnets
with twice or more strong magnet to IDX skew quads.

3) Geometrical location of Septum magnets.

We must decide which modification should we do...

- 1) septum strength change ?
- 2) QM setting modification ?
- 3) realignment ?

End of presentation