Corrections of residual dispersions/xy couplings

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Acknowledgements: K. Oide

OUTLINE

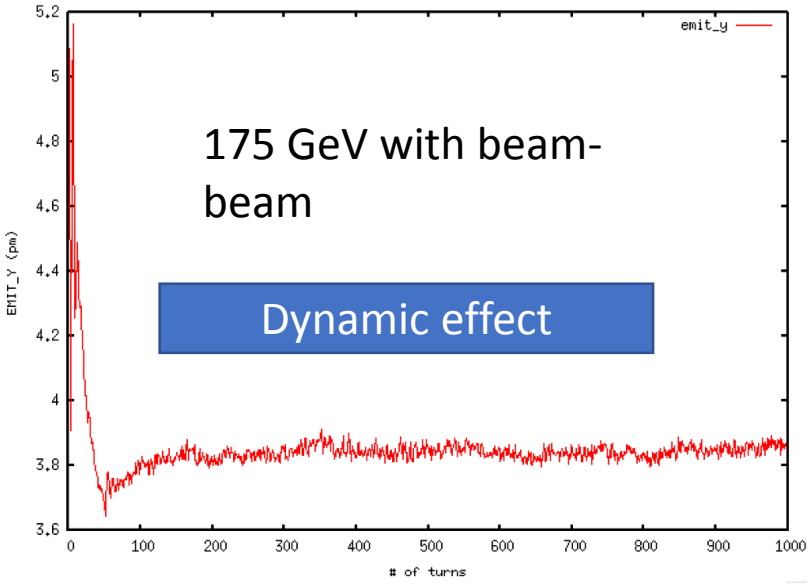
→ Effects of misalignments on the vertical emittance

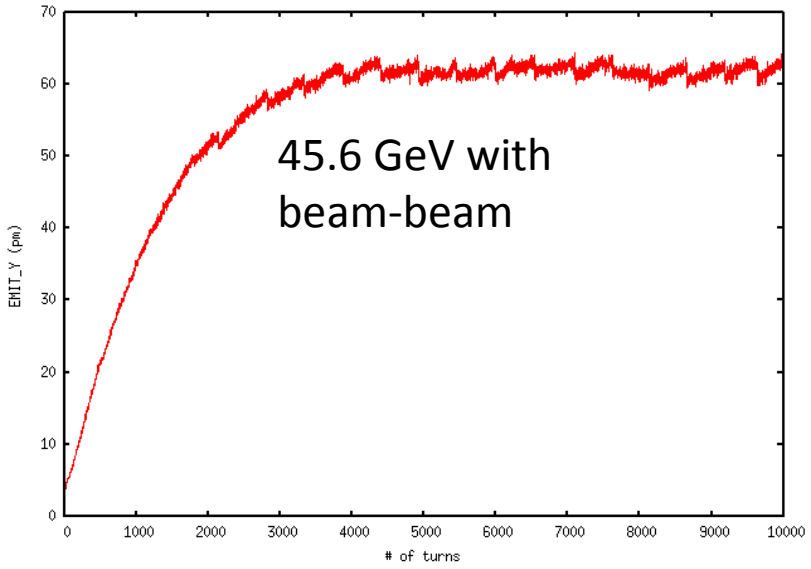
→ Correction of residual misalignments with sextupoles

→ Alternative method for creating the x-y coupling with corrected disperisons and

Misalignments and Emittance-I

- → Observation point is at the center of the RF system (FRF)
- → Simulations in the presence of vertical misalignments of sextupoles needed for the xy coupling
- → Simulations with beam-beam effects resulted in a slight increase of ϵ_y
- → Could be explained by a dynamic effect also given by a thin lens insertion of linear beam-beam element (@ 175 GeV) (design value : 2.7 pm)
- → At 45.6 GeV, the blow-up is extremely huge (design value: 1 pm) (xy coupling 2 times larger that 175 Gev)



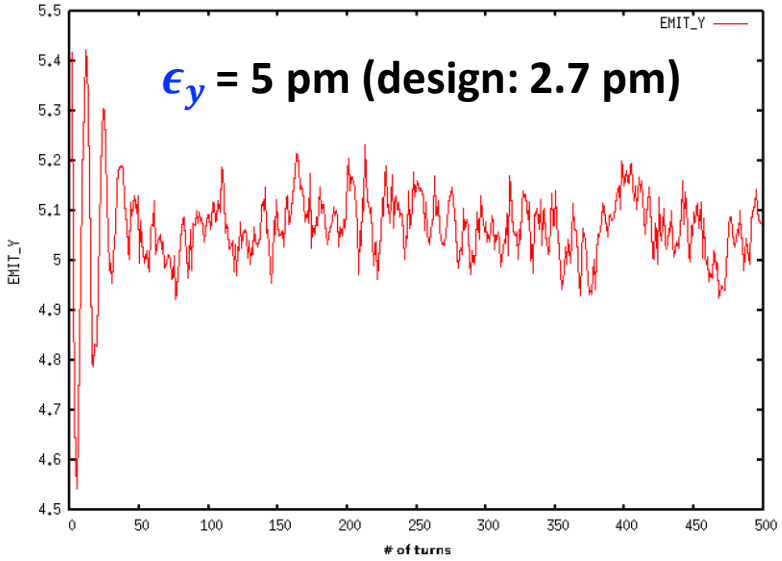


Misalignments and Emittance-II

→ Neglect beam-beam and track in a coupled lattice at 175 GeV

→ The vertical emittance is now almost twice the design value

→ Corrections need to be done



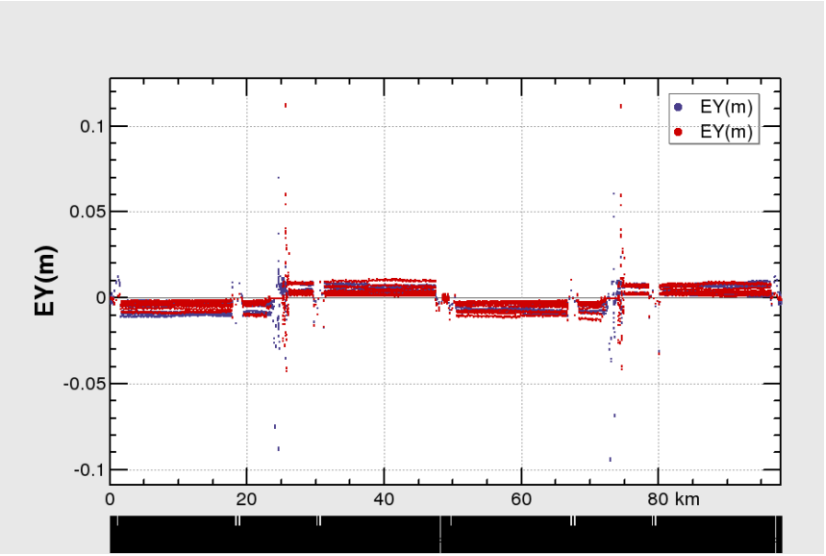
Corrections with sextupoles -I

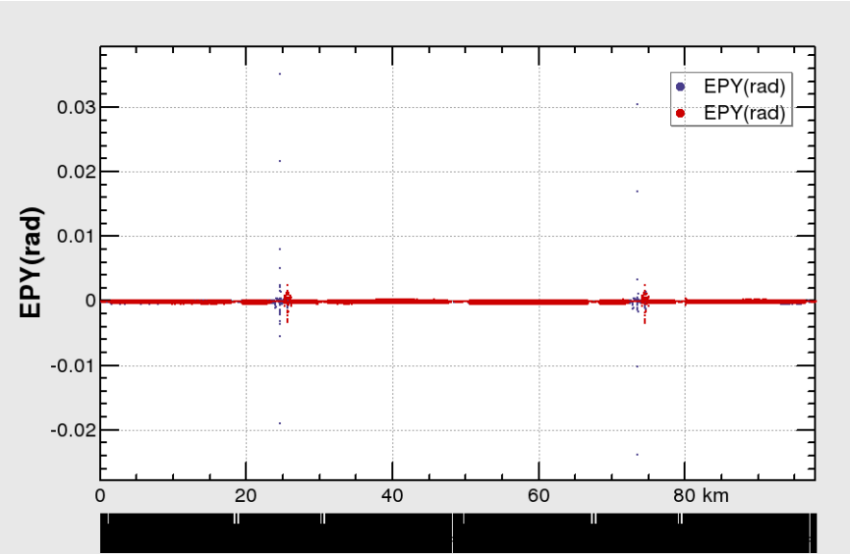
→ To correct dispersions:

1) Create the vertical emittance by vertical misalignments of sextupoles

2) Correct the local dispersions at either the IP or FRF, or at both by varying the skew quadrupole components of 2N sextupoles upstream and downstream of the desired location

3) Dispersions are corrected locally at IP, but vertical emittance given by the lattice is now 5.86 pm (N=24)



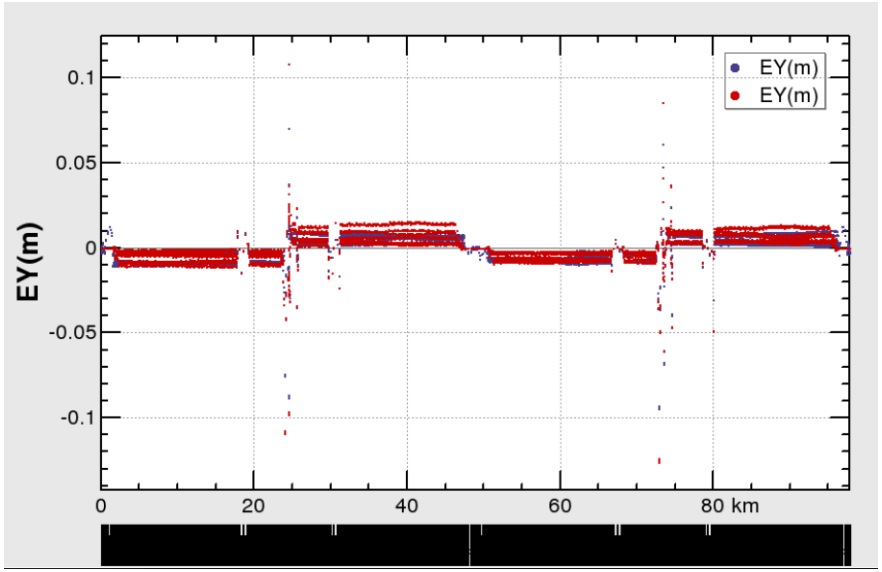


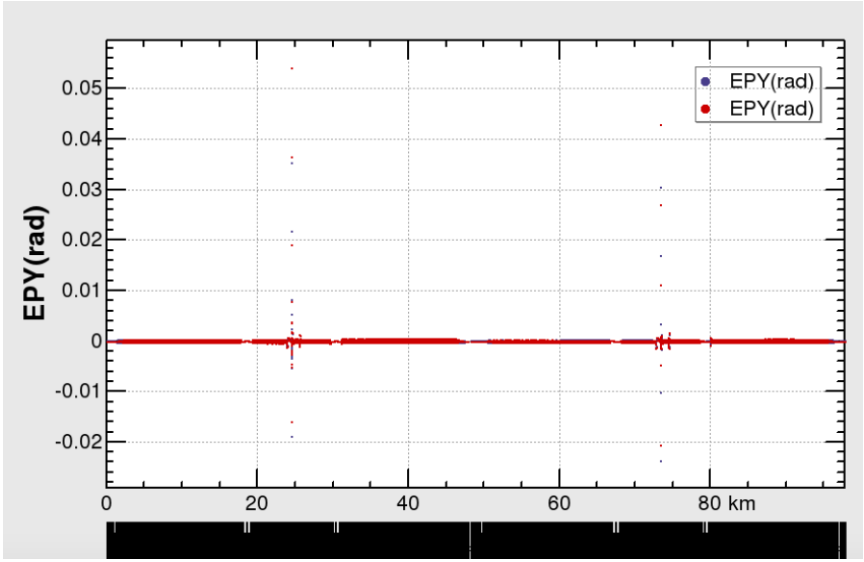
Corrections with sextupoles -II

→ Correction knob at IP is creating larger emittance

→ Correct at FRF only

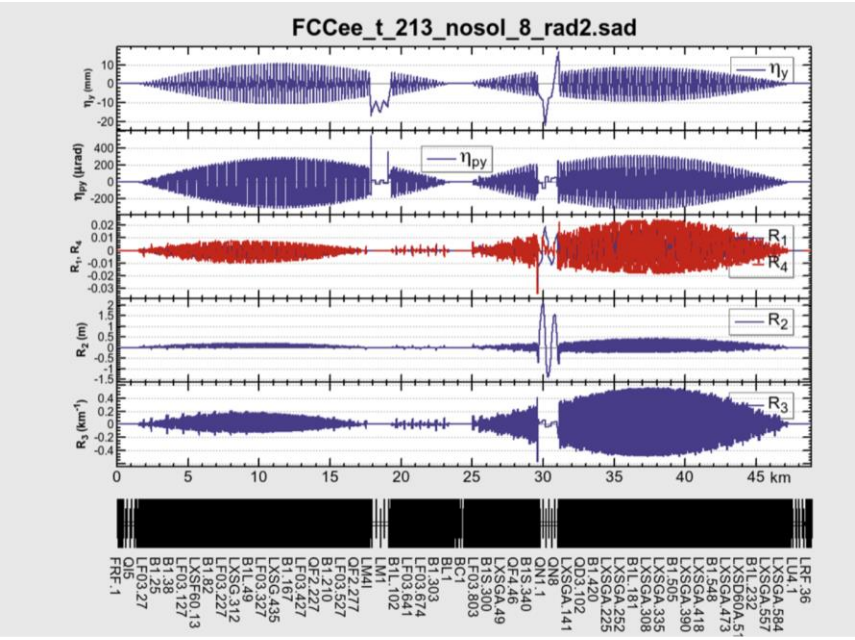
→ The vertical emittance given by the lattice is now 3.8 pm (less than before but still large)

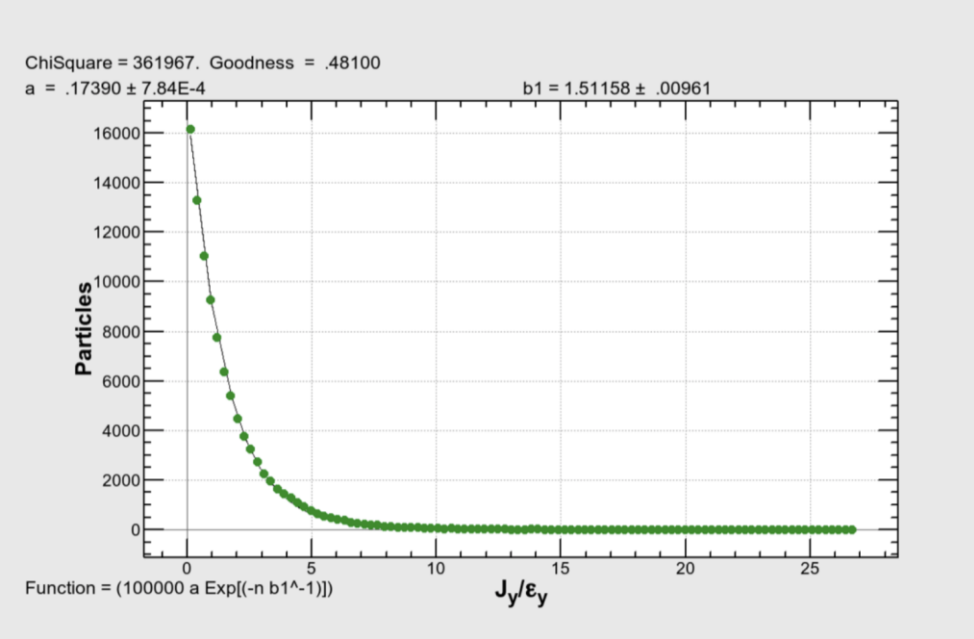




Alternative Method: K. Oide

→ The alternative method consists of creating the x-y coupling and setting a zero dispersion/xy coupling at IP and FRF at the same time





→ Obviously, multi-turn tracking result in a vertical emittance blowup of 50%

Reference:

"Anomalous equilibrium emittance due to chromaticity in electron storage rings", K. Oide, H. Koiso

Conclusions

→ Separate corrections by sextupoles still give some problems

→ The alternative method seems good but still simulations should be done.

→ To be done:

1) Improvements of the scripts for sextupole corrections

2) Use a 1.7 pm instead of 2.7 pm for the alternative method and compare