Recent results on optics flexibility at top energy

29/10/07, LCU meeting

Masamitsu Aiba

AB/BI, CERN-Japan Fellow

Contents

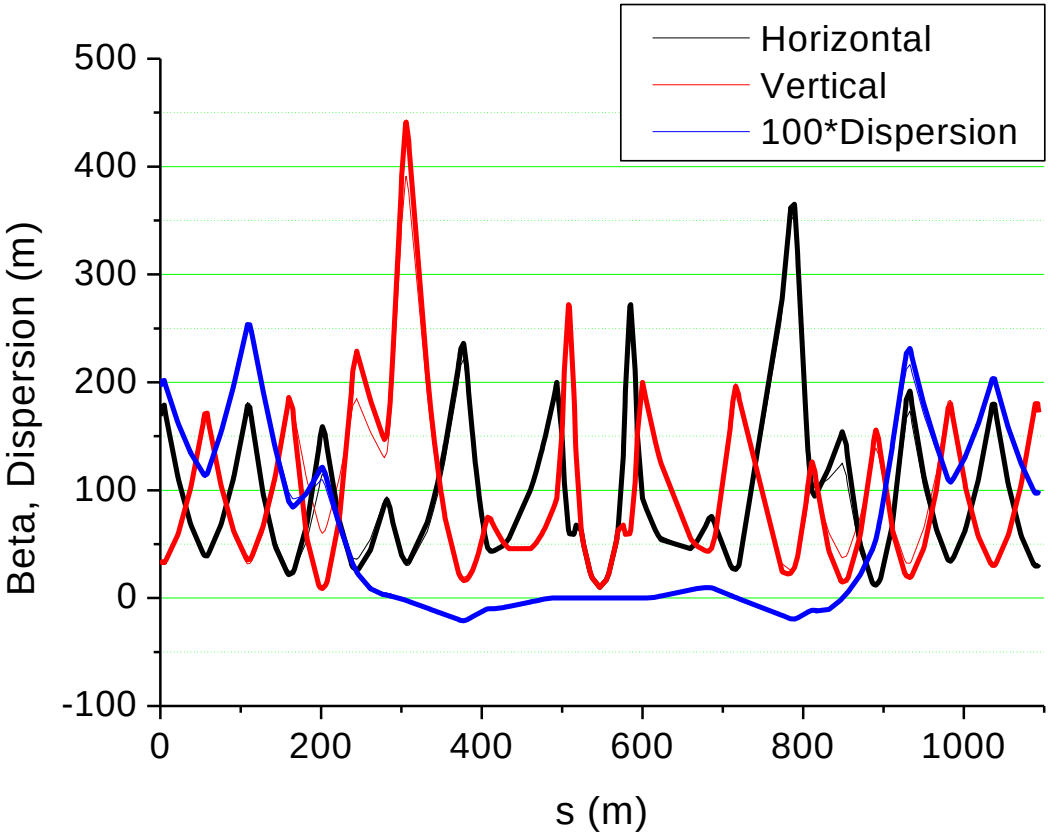
- Recent results on optics flexibility study
  - IR2
    - Tune compensation for high-beta with 205 T/m triplet strength
  - IR4
    - Tuning range at top energy
  - Arc
    - Tuning with main quadrupoles

IR2 (1)

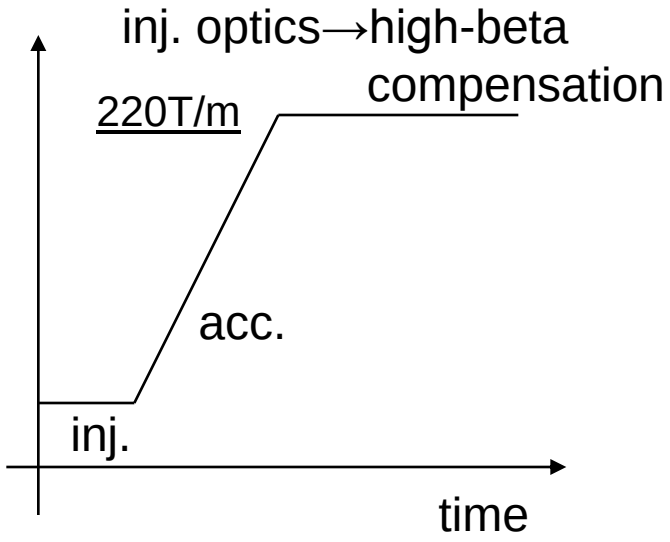
- Triplet strength
  - 9.42E-3 /m^2 for injection optics
    →220 T/m at 7 TeV top energy
  - 220 T/m in the last results of tune compensation
  - Compensation with 205 T/m is tried

IR2 (2)

Last result

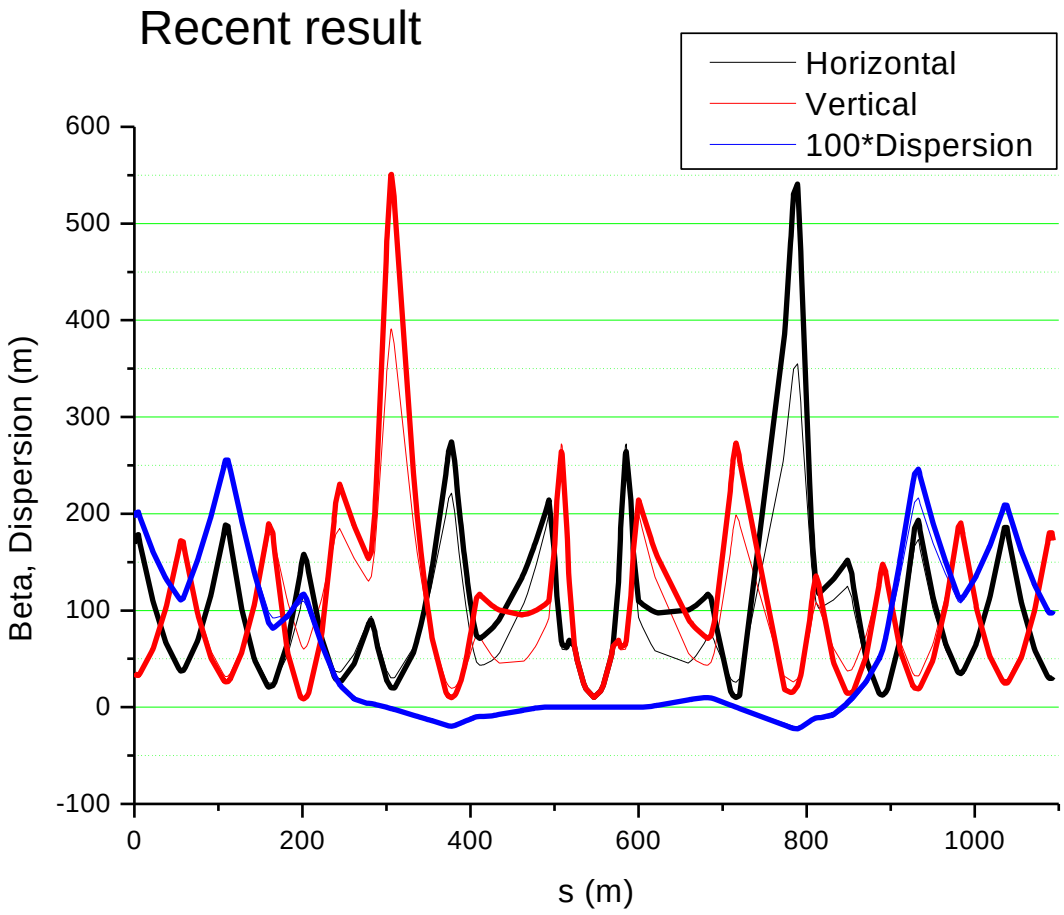


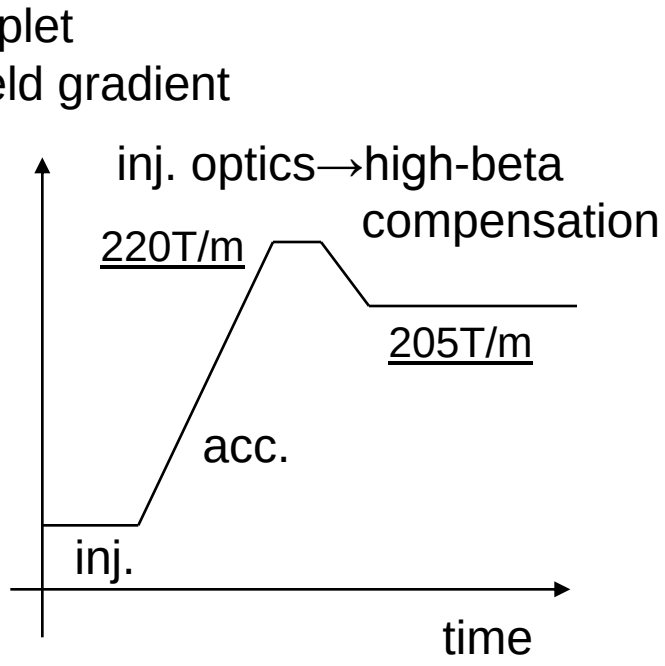
triplet
field gradient



dQx=0, dQy=+0.5 with ~220 T/m

IR2 (3)



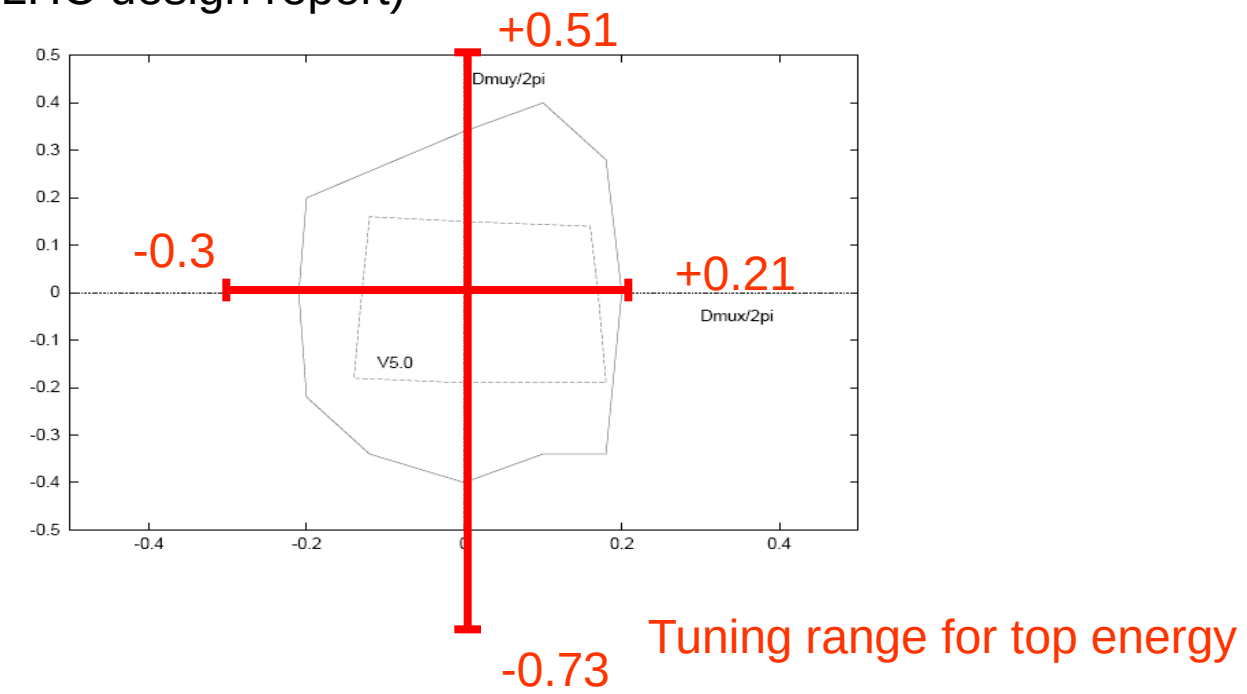


dQx=0, dQy=+0.5 with ~205 T/m

IR4 (1)

- Tuning range IR4
  - Has been studied at injection energy (LHC design report)
  - Preliminary result for top energy

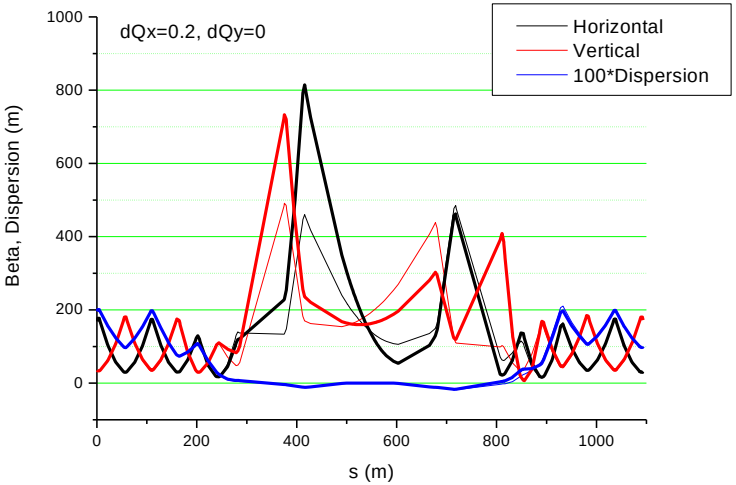
Tuning range for injection energy
(figure from LHC design report)

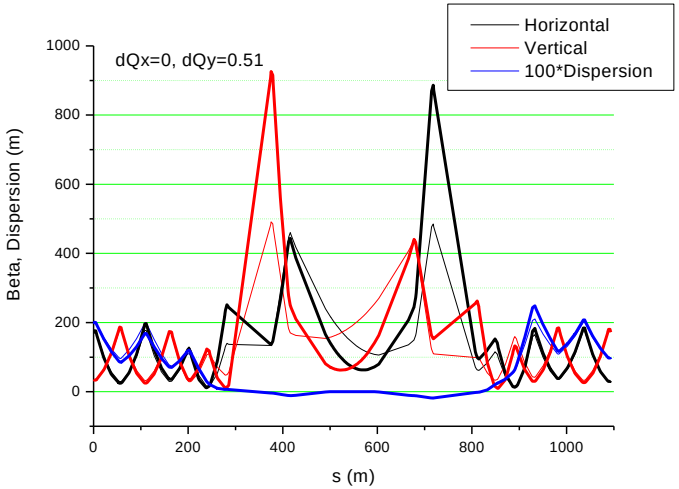


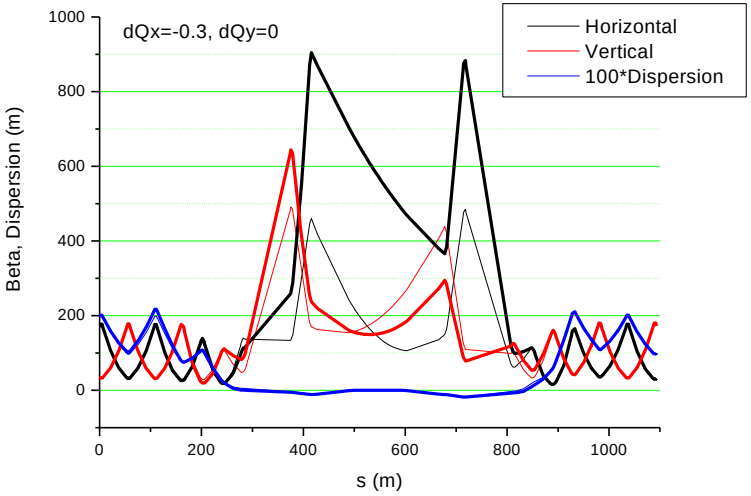
Tuning range for top energy

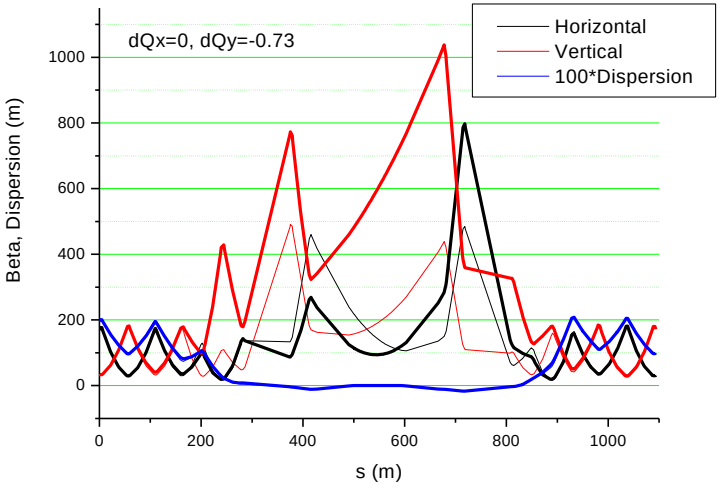
IR4 (2)

Optics for Beam1







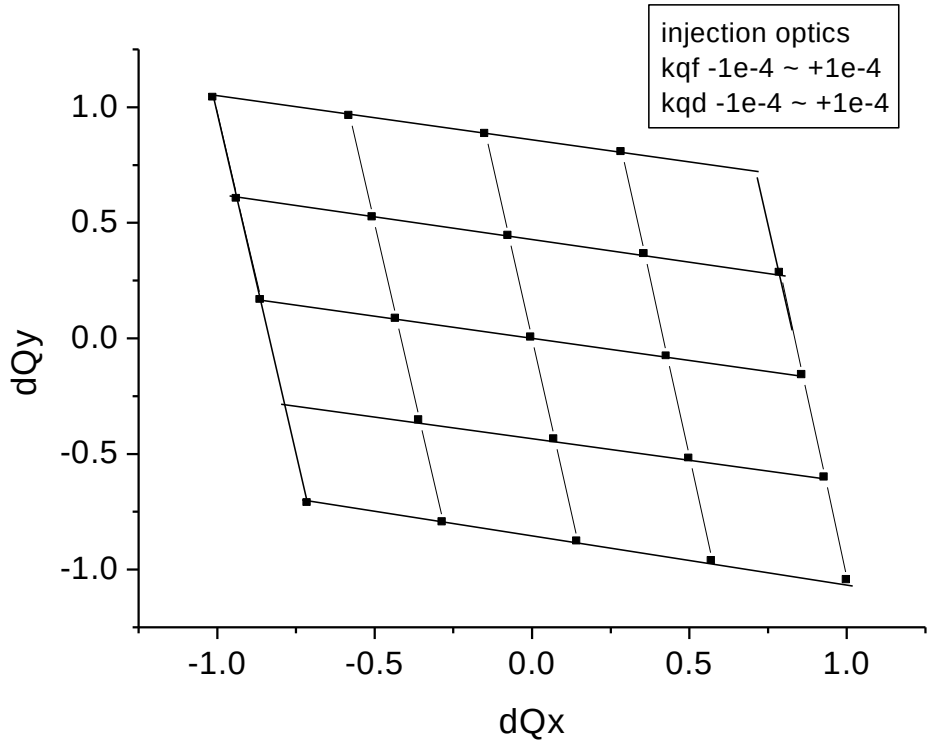


Arc (1)

- Tuning with arc
  - Main quadrupoles are strong knob
  - Nominal tune Qx=64.28, Qy=59.31

    → Change 1~2% in main quadrupole will result in unit of dQx, dQy

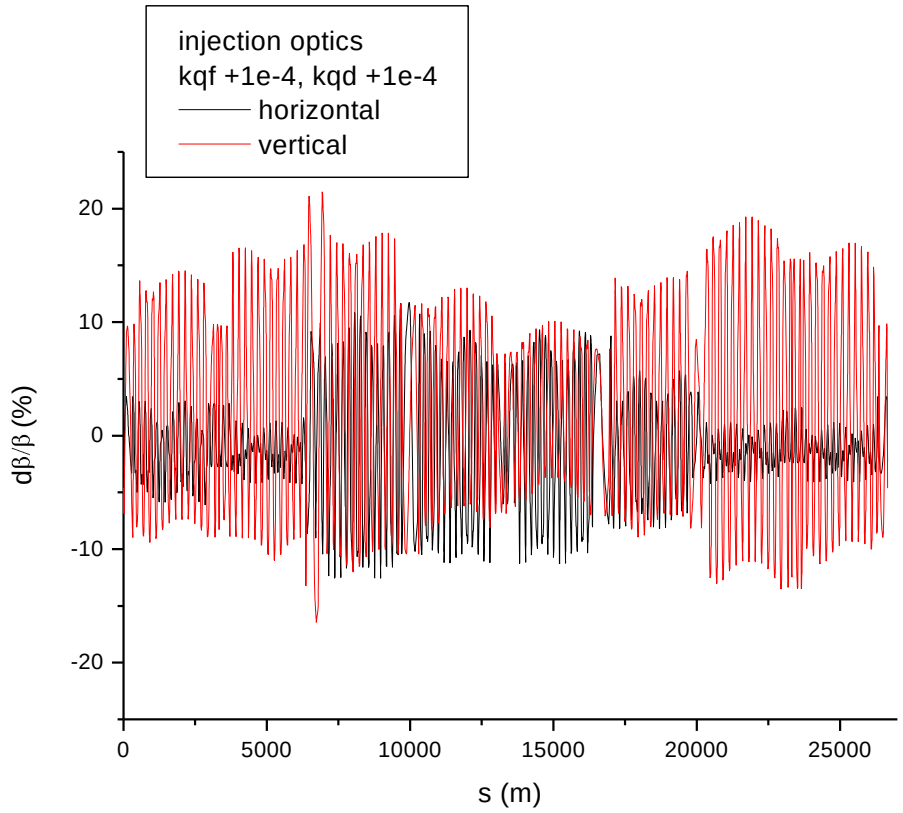
Arc (2)



dkqf, dkqd ~±1.0E-4 → dQx,y~ ±1.0

Arc (3)

Typical $\Delta\beta/\beta$ for injection optics



~20% $\Delta\beta/\beta$ will be acceptable for top energy **with high beta optics,**
would not acceptable for the nominal operation. (comment after meeting)
Remathing in insertions would be applicable

Summary

- Optics flexibility study
  - Mainly for high beta optics
  - For other applications, such as alignment optics and crab cavity (?)
- Recent results
  - IR2 with 205 T/m seems possible
  - For IR4, dQx -0.30~+0.20, dQy -0.73~+0.51

    still trying
  - Tuning with arcs seems also possible
  - Apertures, Beam1-Beam2 constraint, to be checked

My question:
220 T/m is really needed?

- Is 220 T/m avoidable with, for example, pre-acceleration optics??