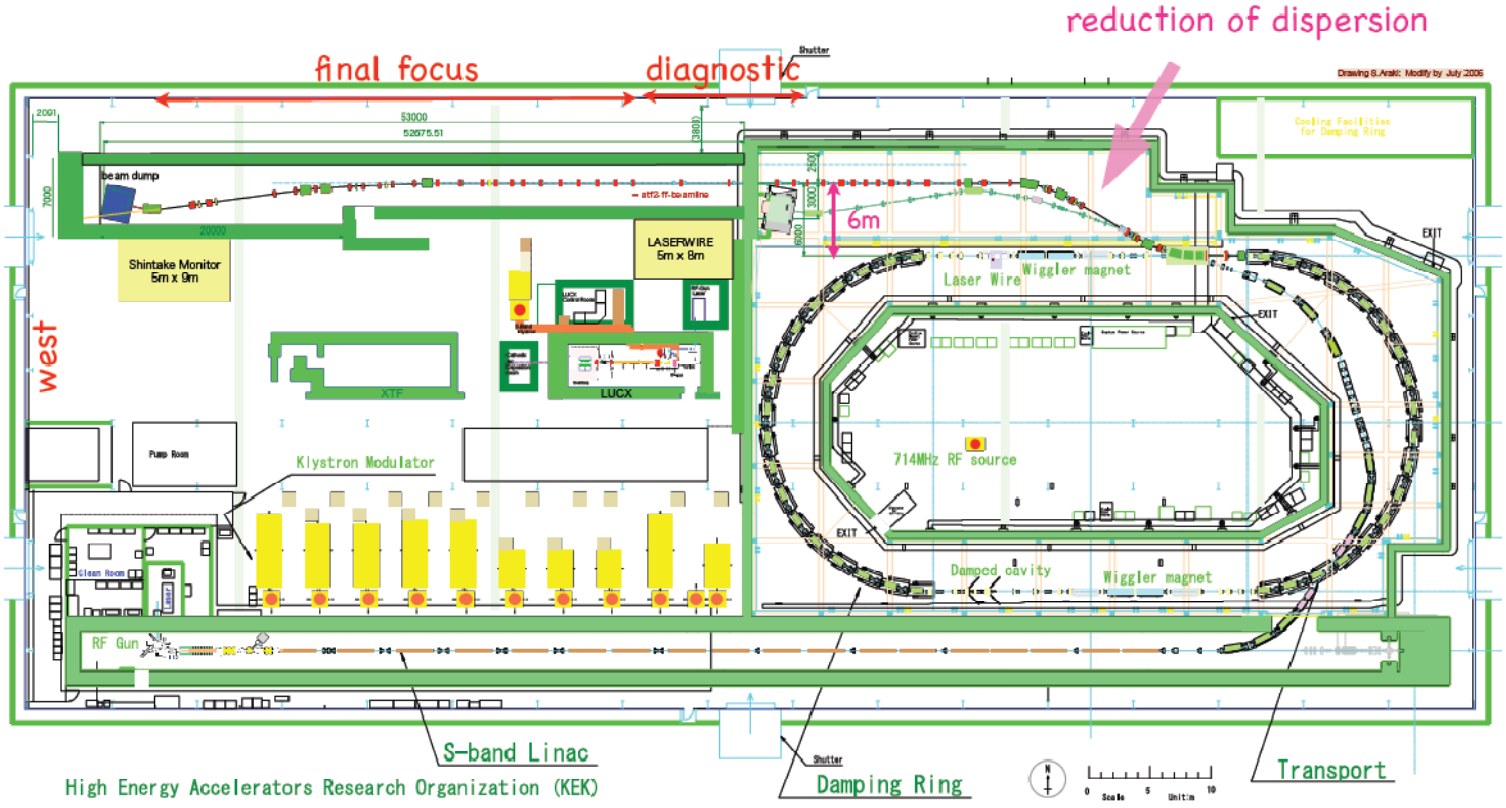
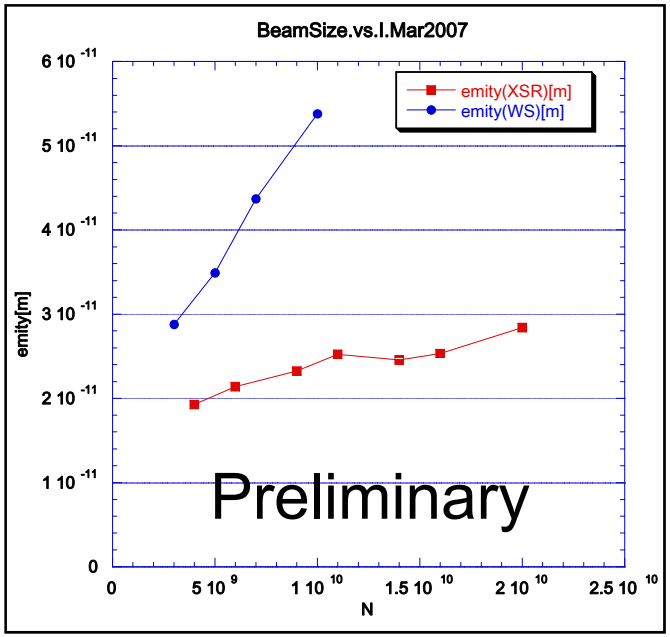
Summary of Tuning, Corrections, and Commissioning



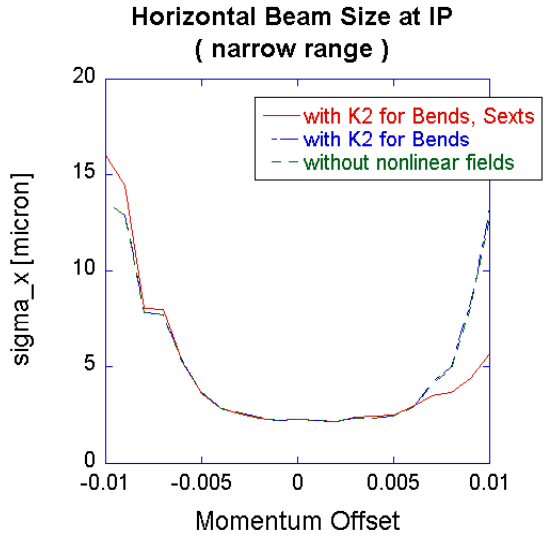
Tuning (0): recent results from ATF

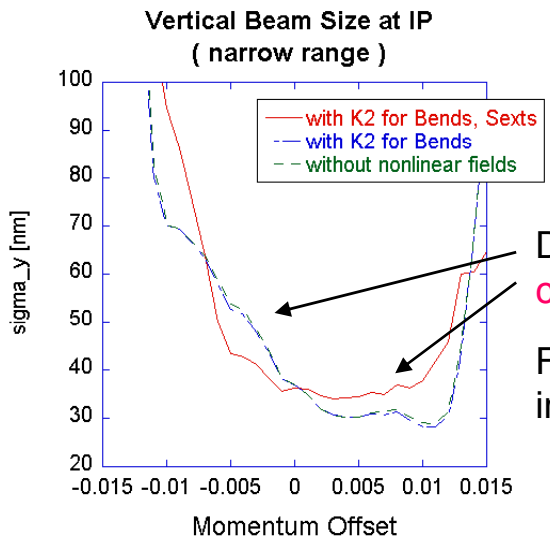
- single-bunch beam up to 2×10^{10} e-/bunch transported all the way through the DR and into the EXT line
- routine tuning in DR reproduces 25 nm normalized vertical emittance (zero current limit)
- current-dependent emittance growth observed in DR ... consistent with IBS
- much larger current-dependent emittance growth observed in EXT



Tuning (1): EXT sextupoles

- everyone agrees not to use (4) strong EXT chromatic correction sextupoles for commissioning
- Okugi-san showed that their improvement to energy bandwidth (±1%) is negligible
- Glen White showed that they aren't needed for achieving 35 nm spots
- Okugi-san suggests not installing them, Woodley suggests turning them off



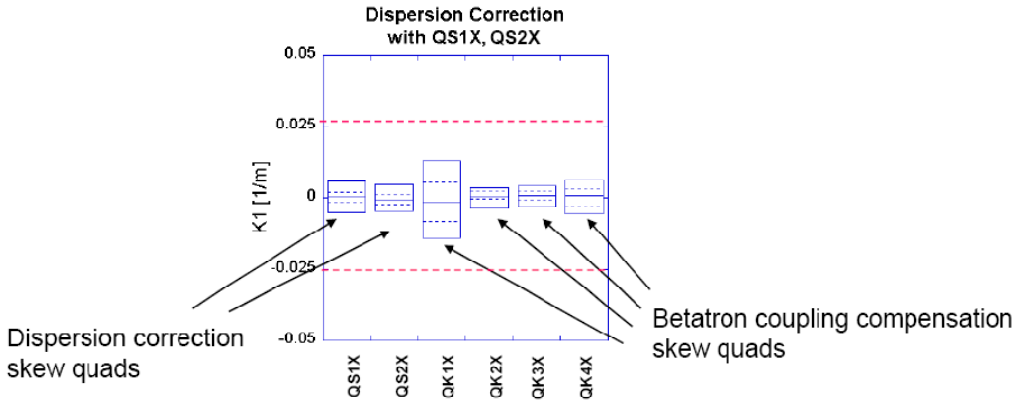


Difference come from that of chromaticity at extraction line.

FF line is optimized with Sexts in extraction line.

Tuning (2a): Okugi-san's simulation (1)

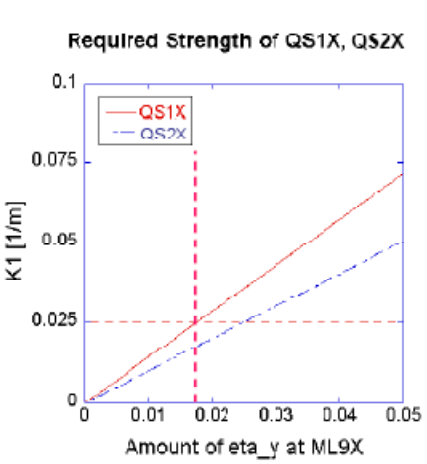
- includes quadrupole roll errors (300 urad rms); 100 seeds
- uses 2 IDX skew quadrupoles at SF1X and SF4X locations (QS1X, QS2X) for vertical dispersion correction
  - corrects both DY and DPY using 2 independent quad strengths
- uses 4 IDX skew quadrupoles (QK1X,QK2X,QK3X,QK4X) for coupling correction
- finds all skew quadrupole strengths OK for ±5 amps

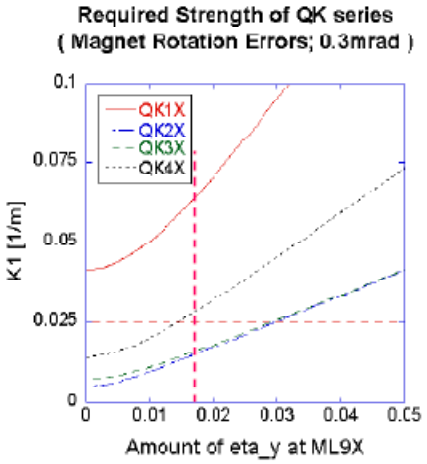


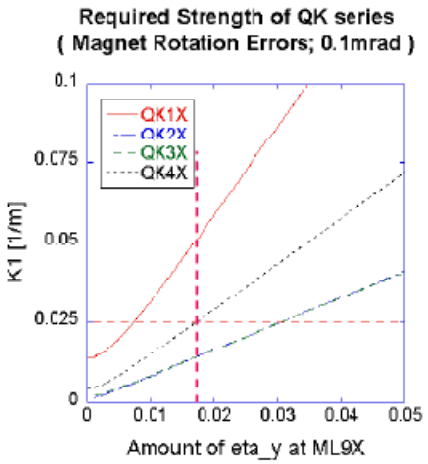
All of the skew strengths are within the strength of IDX skew quads.

Tuning (2b): Okugi-san's simulation (2)

- includes incoming DY/DPY and quadrupole roll errors (300 urad rms); 100 seeds
- uses same correction scheme as simulation (1)
- finds maximum correctable residual DY is 17 mm @ ML9X (IDX ±5 amps)
- for maximum vertical dispersion correction, QK1X needs > 12 amps, QK4X needs > 5 amps, other skew quadrupoles OK for ±5 amps
- if quadrupole roll error rms is reduced to 100 urad, QK1X needs > 10 amps, other skew quadrupoles OK (QK4X marginal) for ±5 amps







Tuning (3a): Woodley's simulation (1)

- includes quadrupole roll errors only (100-300 urad rms); 100 seeds
- uses 2 IDX skew quadrupoles near QD2X and QD5X (QS1X,QS2X) for vertical dispersion correction
  - corrects DY with skew quadrupole "sum knob" (DPY is correlated)
  - with no errors, vertical emittance growth from residual coupling < 2.5% for |DY| < 10 mm
  - QS1X and QS2X currents < 0.5 amps
- uses 4 IDX skew quadrupoles (QK1X,QK2X,QK3X,QK4X) for coupling correction
- QK1X needs > 12 amps for 300 urad roll rms, maybe OK for 100 urad roll rms; other skew quadrupoles OK for ±5 amps (QK4X marginal at 300 urad roll rms)
- concludes maximum skew quad strengths are completely determined by assumed rms of quadrupole roll errors (Sugahara-san suggested at 3rd ATF2 Project Meeting that 100-150 urad might be achievable)

Tuning (3b): Woodley's simulation (2)

- includes quadrupole offsets (50/30 um X/Y rms) and quadrupole roll errors (300 urad rms); 100 seeds
- uses same correction scheme as simulation (1)
- finds QS1X,QS2X,QK2X,QK3X all OK; QK1X needs > 10 amps; QK4X needs > 5 amps

Tuning (3c): Woodley's simulation (3)

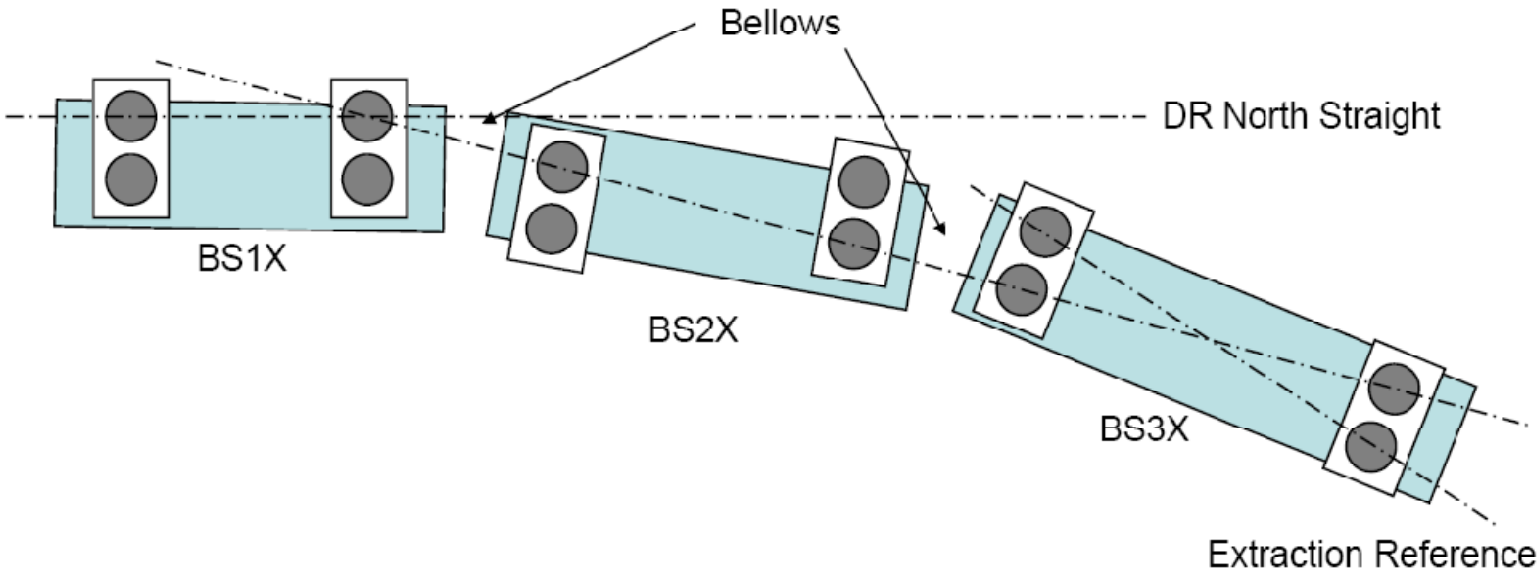
- includes quadrupole offsets (50/30 um X/Y rms) and quadrupole roll errors (300 urad rms); 100 seeds
- includes skew quadrupole errors in DR extraction channel that, on average, blow up vertical emittance by 100%
  - 6 thin skew quadrupoles (extraction kicker #1, QM6R.1, QM7R.1, 3 septa)
  - maximum uniformly-distributed random strength ≈ IDX @ 15 amps
- uses same correction scheme as simulation (1)
- finds QS1X,QS2X,QK3X all OK; QK1X needs > 15 amps; QK2X needs > 5 amps; QK4X needs > 12 amps

Tuning Conclusions

- Okugi-san suggests using (4) existing IDX skew quadrupoles for QS1X, QS2X, QK2X, and QK3X; make 2 new skew quadrupoles for QK1X and QK4X
  - strength equivalent to IDX @ 10 amps (0.22 T)
- Woodley found magnetic measurements data for IDX skew quadrupoles up to 20 amps ... question to Terunuma-san: can IDX skew quadrupoles operate up to 20 amps? (magnets are not water cooled)
  - if so, provide 20 amp power supplies for QK1X and QK4X; still would need 2 new IDX skew quadrupoles (can we get them?)
  - if not, agree with Okugi-san to build 2 new stronger magnets, but would prefer strength equivalent to IDX @ 20 amps (0.44 T)
- Woodley/Okugi-san must compare notes and decide on optimal locations for QS1X and QS2X

Corrections (1): DR extraction layout

- present design model of extraction trajectory not consistent with installed locations of (3) septa
- actual extraction trajectory depends on settings of QM6R.1 and QM7R.1 (beam passes through these quadrupoles off-axis)
- should we realign the septa? (flexibility of vacuum chamber bellows)
- how do we cope with changes to settings of QM6R.1 and QM7R.1?



Commissioning (1): hardware

- beam "presence" (current/charge/losses)
  - KEK will provide ICTs and screen monitors
  - need reference cavity amplitude values from EPICS
  - SLAC to provide thin-fiber PLIC system to help localize losses (?)
- BPMs
  - would like to create a temporary QBPM control panel for ATF control system for commissioning ... need "raw" I & Q values from EPICS
  - other values from "first pulse" calibration scheme (high/low/left/right) (?)
  - "production" QBPM control/readout software to be provided by SLAC/UK
- FFTB magnet movers
  - movers should be pre-calibrated (X/Y/roll)
  - "production" mover control/readout software to be provided by SLAC/UK
  - hardware limit switch requested (movers self-limited due to use of cams?)

Commissioning (2): activities

- rebuilt EXT line
  - optics verification, BBA, …
  - dispersion correction
  - emittance measurement and coupling correction
- Final Focus
  - diagnostic hardware to be commissioned in parallel to EXT commissioning activities (QBPMs, IPBPMs, Honda IP BSM, carbon filament IP wire scanner)
  - BPM offset / BBA studies will be done simultaneously with cavity BPM hardware commissioning
  - IP beam size tuning begins when Honda BSM and/or carbon filament IP wire scanner hardware is commissioned; fine tuning when Shintake monitor comes online