Coupling Correction for ATF2 New Extraction Line

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3rd ATF2 Project Meeting, KEK

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Simulation Procedures

I put 0.3mrad rotation errors (rms.) for QD*X, QF*X only.
(No errors in FF line.
No position errors for all magnets.)

Dispersion correction in extraction line was done by local bump.
ZH1X ZH2X ZX1X ZX2X for horizontal
ZV1X ZV2X ZV3X ZV4X for vertical
(No effect of the skew quads for dispersion correction)

Coupling correction was done with QK*X
by monitoring wire scanner beam size at diagnostic section.

Betatron matching was done with QM*X.

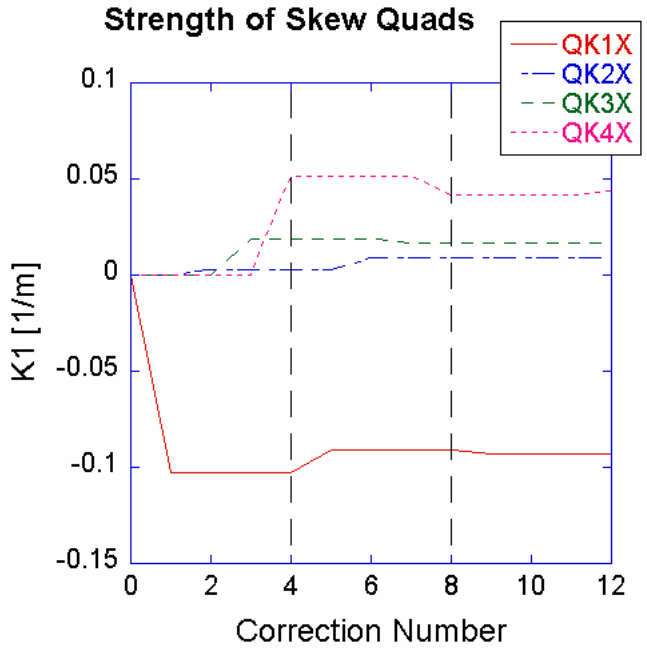
I applied for 50 random seeds for each.

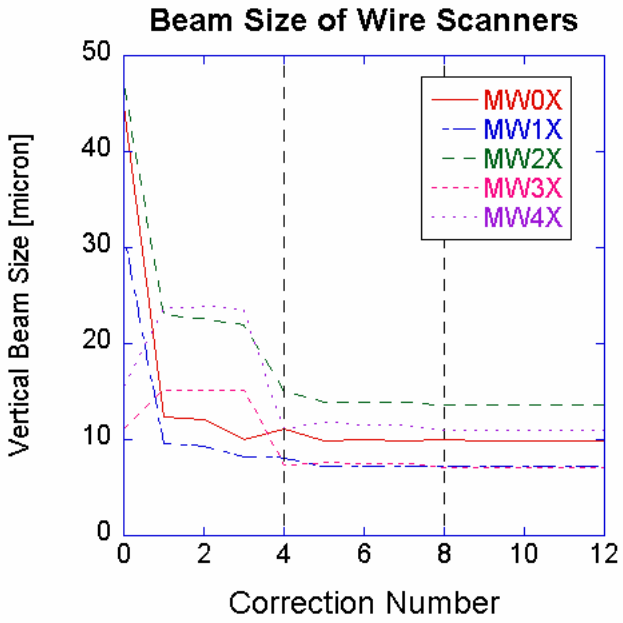
Example of the Coupling Correction with Skew Quads

QK1X strength was defined by minimizing MW0X
QK2X strength was defined by minimizing MW3X
QK3X strength was defined by minimizing MW1X
QK4X strength was defined by minimizing MW4X

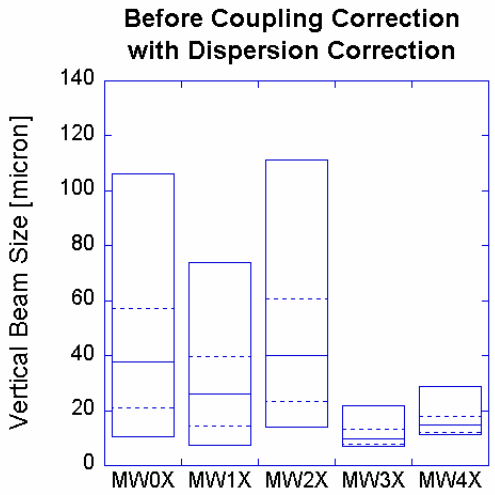
We don't have to solve the 4-by-4 beam matrix for coupling correction, but just minimize the vertical beam size at wire scanners.

We can estimate the skew quadrupole strength with error of the wire scanner measurements.

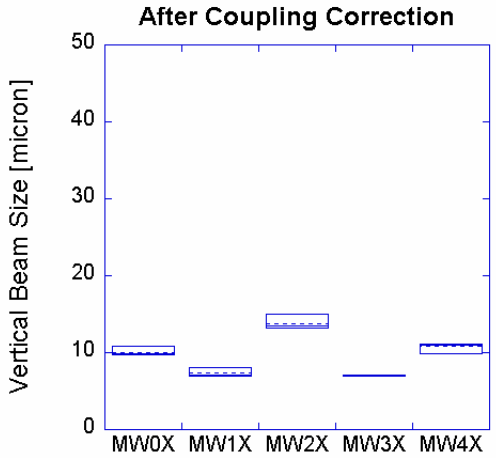




Simulation Result – Vertical Beam Size

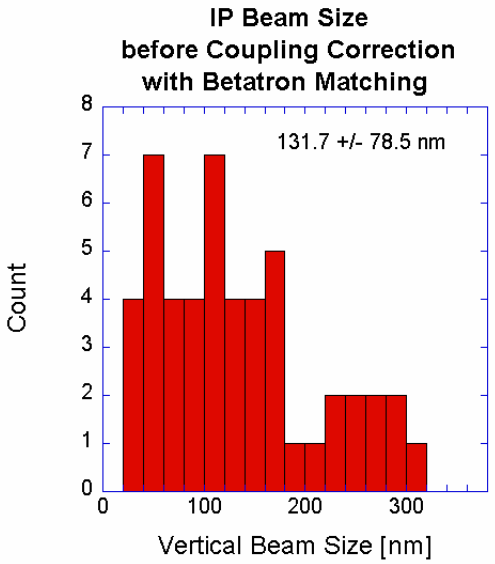


Dispersion correction by bump.

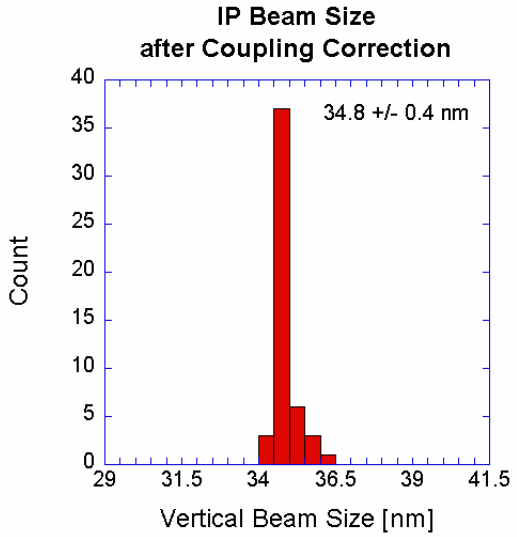


Dispersion correction by bump.

*Coupling correction with QK*X*

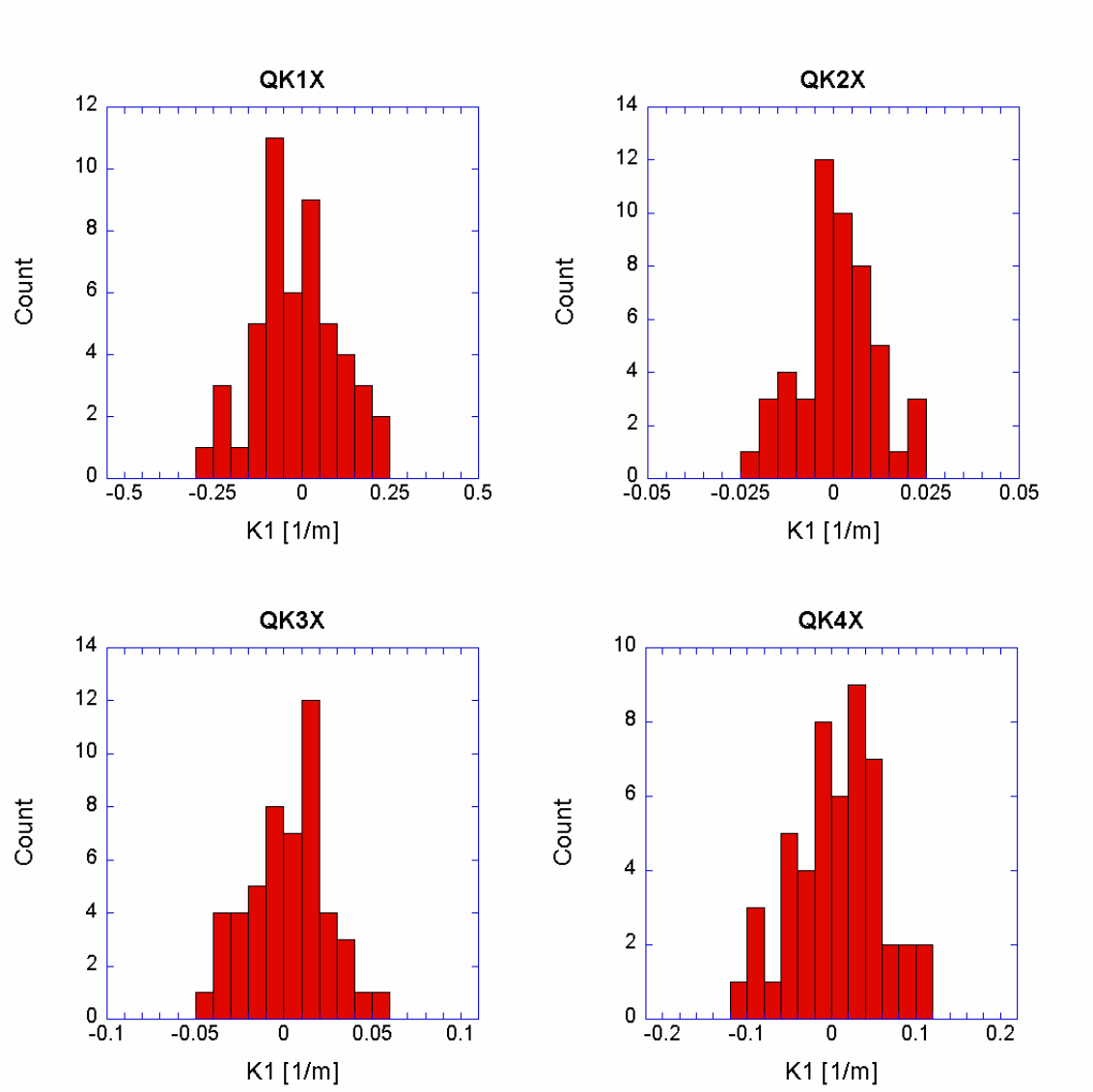


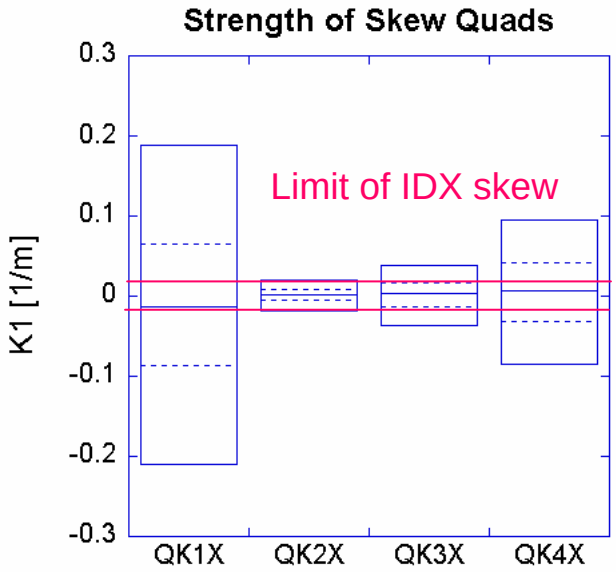
*Betatron matching with QM*X.*



*Betatron matching with QM*X.*

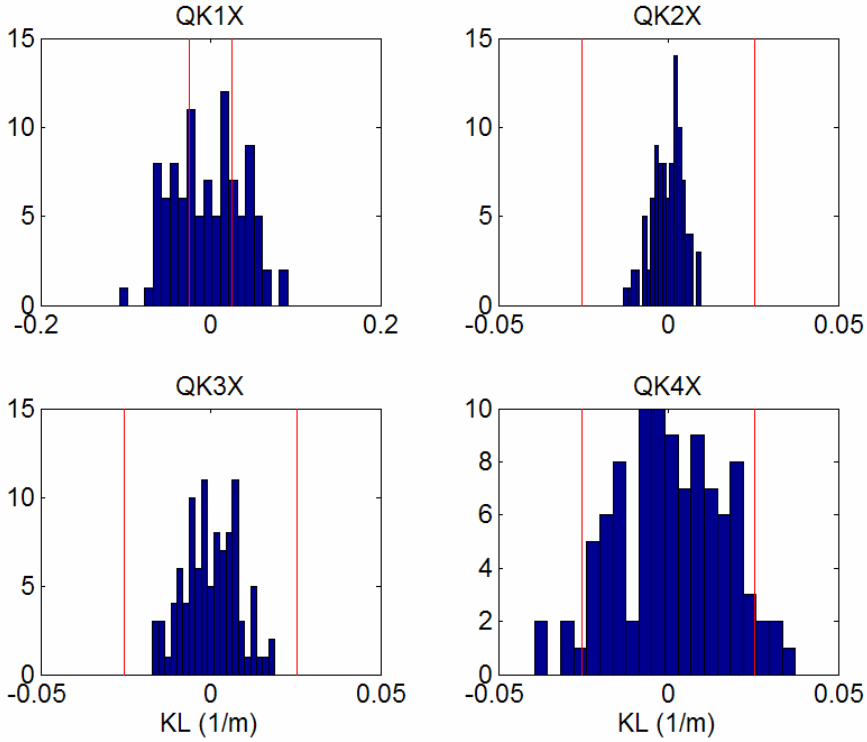
Simulation Result – Strength of Skew Quads





Compare to Simulated Results, presented by M.Woodley at 2nd ATF2 project meeting

Errors; perfect Final Focus (QM16 to IP)
vertical dipole misalignments1: 100 μm (rms)
horizontal quadrupole misalignments: 50 μm (rms)
vertical quadrupole misalignments: 30 μm (rms)
quadrupole rolls: 0.3 mrad (rms)



by M.Woodley at 2nd ATF2 project meeting

My results were almost twice stronger than these results.

Optics was a little bit different, but this difference seems too large.

Skew quads for dispersion correction was reduced the betatron coupling (?).

Anyway, it seems to be difficult to use the IDX skew quads for the coupling correction.

Question from M.Woodley at 2nd ATF2 project meeting

- *coupling correction quads (QK1-4X) seem strong,*
  given the assumed errors …
  due to vertical dispersion correction?

Answer is "No".

- *The required strength of skew quads were strong enough*
  only for betatron coupling correction.

- *My results were almost twice stronger than*
  the simulation with the skew quads for coupling correction (??)
  by M.Woodley, presented at 2nd ATF2 project meeting.

- *We need strong skew quads in diagnostic section.*
  Must we remake the skew magnets ?