Preliminary tracking results with multipole fields

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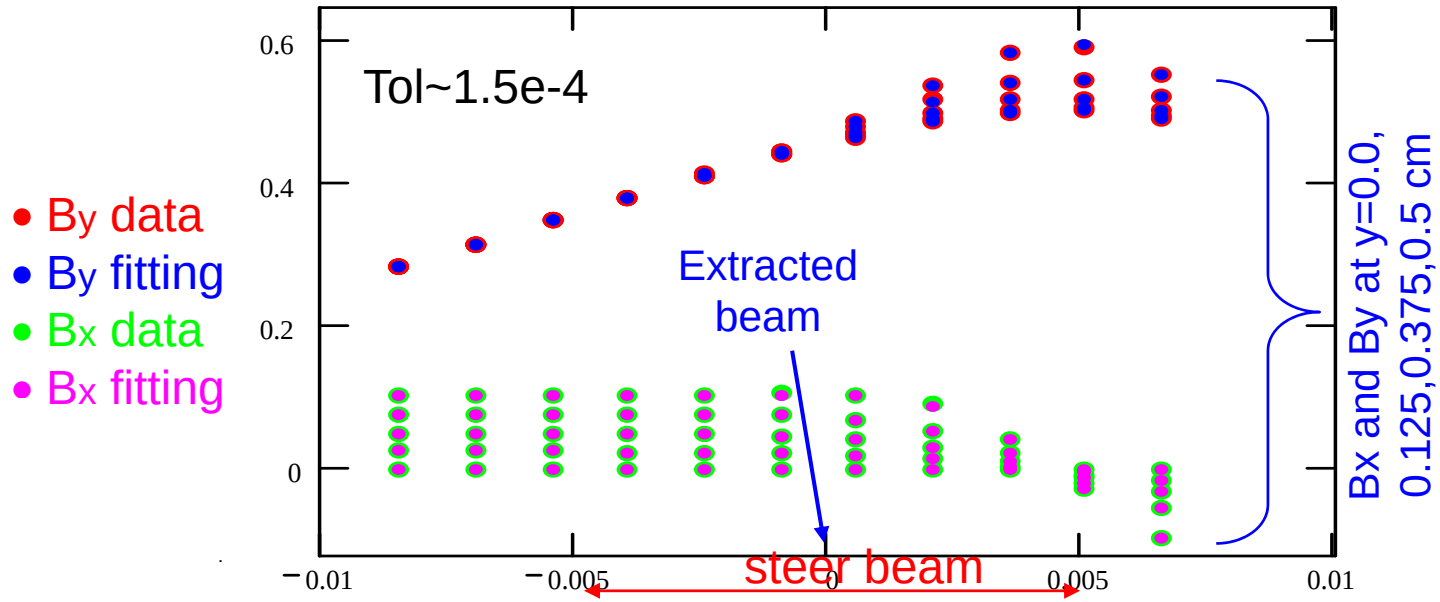
Thank Andrei, Cherrill, John, Mark, and Sergei for their great contributions.

ATF2 meeting, April 24, 2007 (PST)

QM7-like multipoles



$z = x + jy$

x→ (x - 0.022) (m)

$$B_y + jB_x = 0.461 + 17.557z - 959.345z^2 - 1.426\cdot10^5 z^3 - 9.898\cdot10^6 z^4$$
$$+ 4.93\cdot10^8 z^5 + 1.551\cdot10^{11} z^6 + 6.512\cdot10^{12} z^7 - 9.81\cdot10^{14} z^8$$
$$- 9.424\cdot10^{16} z^9 + 2.051\cdot10^{18} z^{10} + 4.082\cdot10^{20} z^{11} - 6.191\cdot10^{21} z^{12} - 1.281\cdot10^{24} z^{13}$$

(by Sergey + Zhou)

Tracking only with multipole fields (other magnets are perfect)

- To convert Woodley's MAD deck v3.6 into 'elegant' deck used for tracking
- To add QM7-like multipole fields:
  - W/o orbit correction: ~12% horiz. emittance growth
  - W/ orbit correction: negligible
  - Steer beam x=±5mm at QM7 by changing kicker angle, emittance changes are very slight.

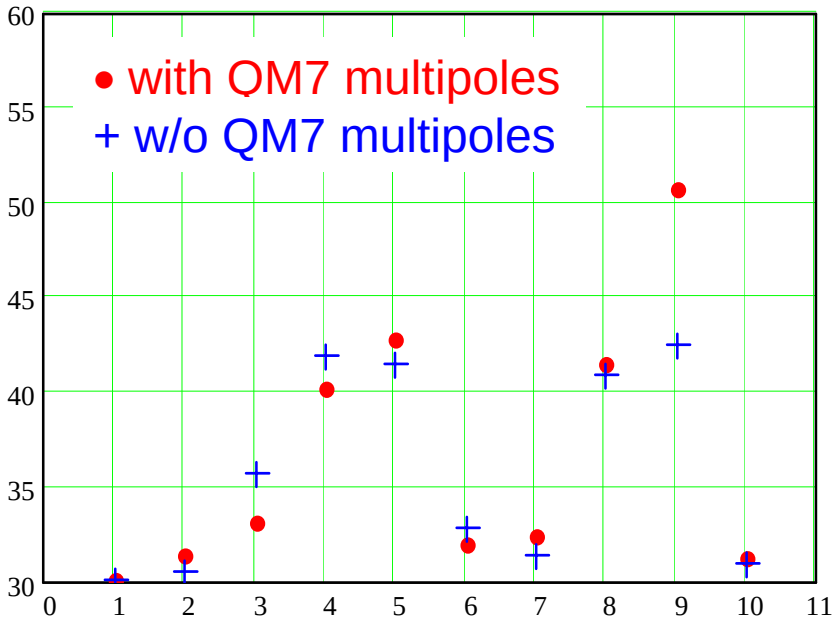
Tracking with multipoles and magnet errors

- To add QM7-like multipoles
- To add ATF2 beamline (only EXT + diagnostics station) magnet errors:
  - Dipole: Δy=0.1mm (rms)
  - Quad: tilt=0.3 mrad, Δx=50μm, Δy=30μm (rms)
- To take some correction steps:
  - Orbit correction (correctors)
  - Orbit, and dispersion correction (Qs1x and Qs2x)
  - Orbit, dispersion, and coupling corrections (Qk1x-4x)

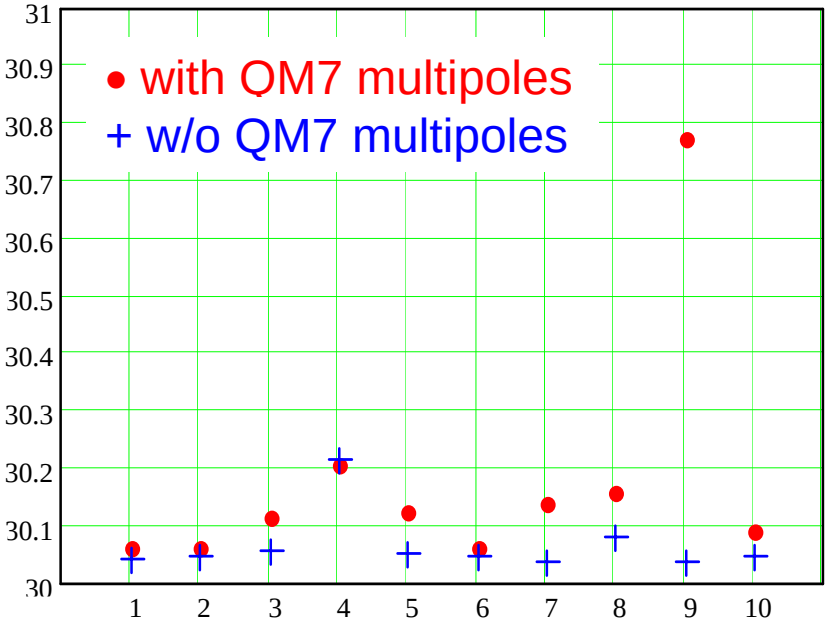
Parameters for tracking

- Initial parameters at the ATF2 entrance (copy from Mark Woodley):
  - $\gamma\varepsilon x/\ \gamma\varepsilon y$ = 5.09 μm/30 nm, δp = 0.08% and
  - σz = 8 mm
  - Dx/Dx' = -0.178E-2/3.76E-3, and other Twiss
- 10 seeds are applied for the magnet errors for the first step.
- Emittance is measured at the diagnostics station

Very preliminary results:
vertical normalized emittance



w/o coupling correction

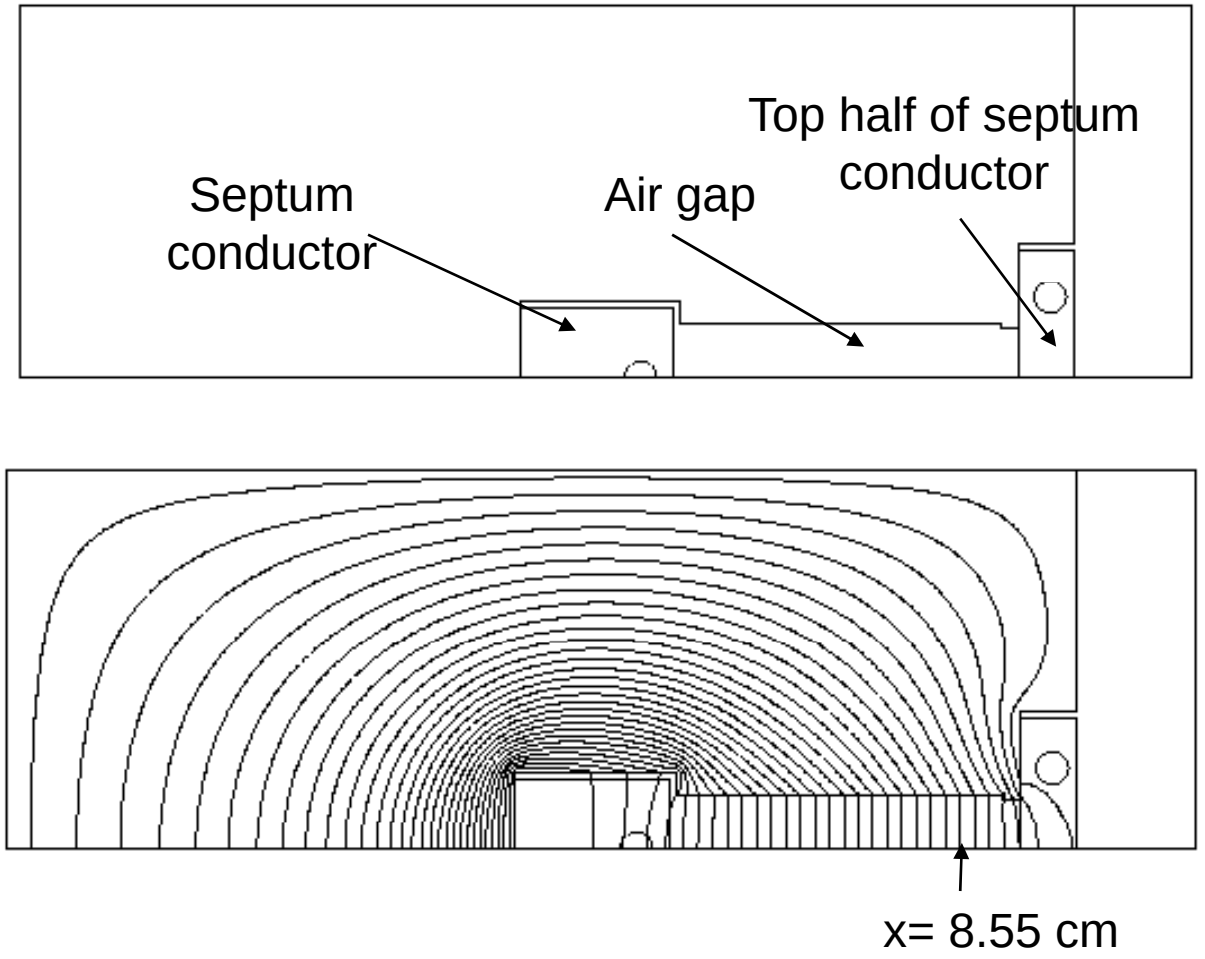


w/ coupling correction

Summary

- Tracking with multipoles is already setup
- The initial tracking shows that no obvious vertical emittance growth is observed by applying the QM7-like multipoles.
- Magnet tilts create coupling resulting in significant vertical emittance growth; *did we correct coupling properly in the real measurements?*
- Future work:
  - To analyze 2d and 3d septum fields
  - To track including septum multipole fields
  - To track including wakes, etc

Septum-A
(modeled by Cherrill)



Septum-A multipoles analysis

- Multipoles are initially analyzed based on 2D data provided by Cherrill:

$$B_y + jB_x = \sum_{n=0} A_n (x + jy)^n$$