$\{\beta,\ D_x\}$ Beat Correction @LHC/RHIC

R. Calaga, R. Tomás

Oct 8, 2007

LHC Simulations

- Realistic magnetic errors from MADX error tables
- Observables

  $\Delta\vec{\phi}_x,\ \Delta\vec{\phi}_y$: Indep. of BPM Calibration (FFT, SVD)

  $\Delta\vec{D}_x$: Calibration Dependent - $\pm 4\%$ (Rad. Steering)

- Specifications:

$$\left\{\frac{\Delta\beta_x}{\beta_x},\ \frac{\Delta\beta_y}{\beta_y}\right\}_{peak} < 15\% \quad \text{[Rep.501]}$$

$$\left|\frac{\Delta D_x}{\sqrt{\beta_x}}\right|_{RMS} < 0.013\sqrt{m} \quad \text{[Rep. 501]}$$

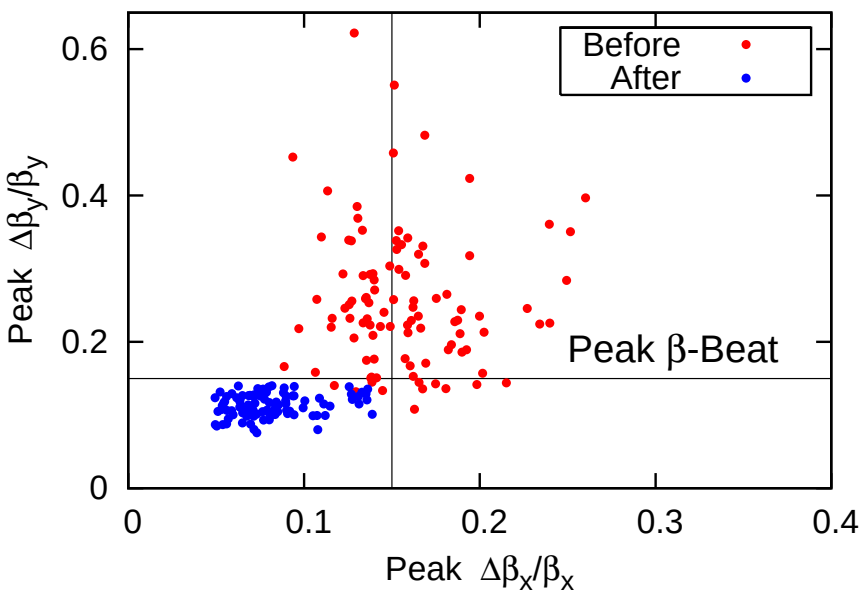
- BPM Resolution: 200μm
- 210 Variables:

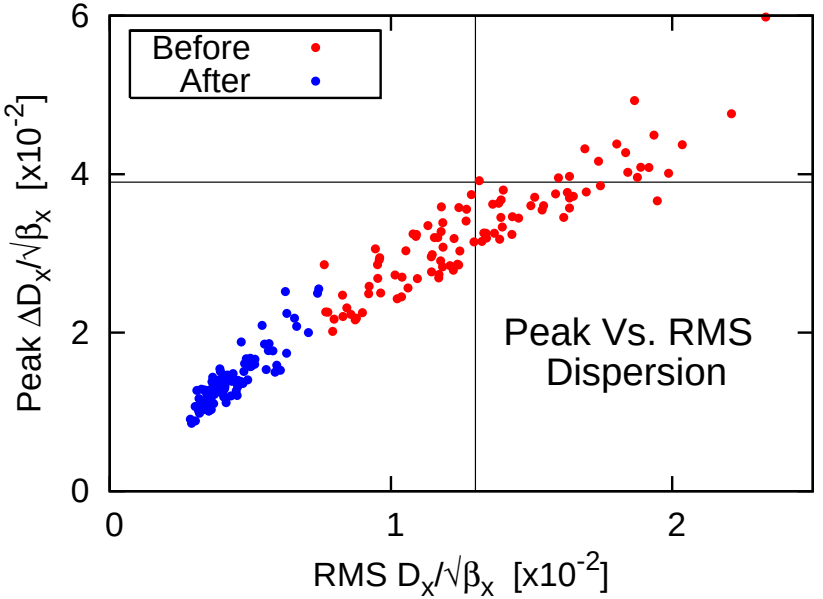
$$\vec{k}_1\text{: } \{\text{KQ[4-10], KQX, KQF, KQD, KQT, } \cdots\}$$

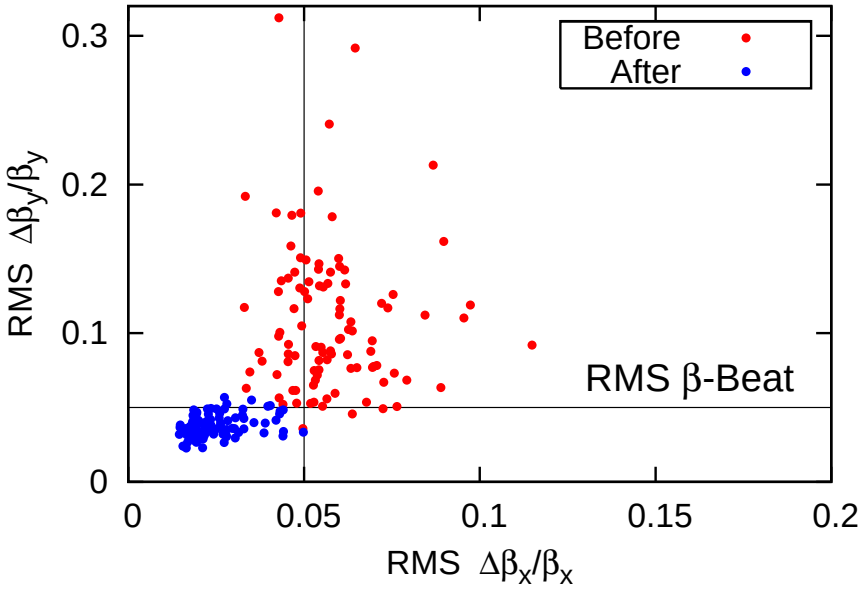
- Correction:

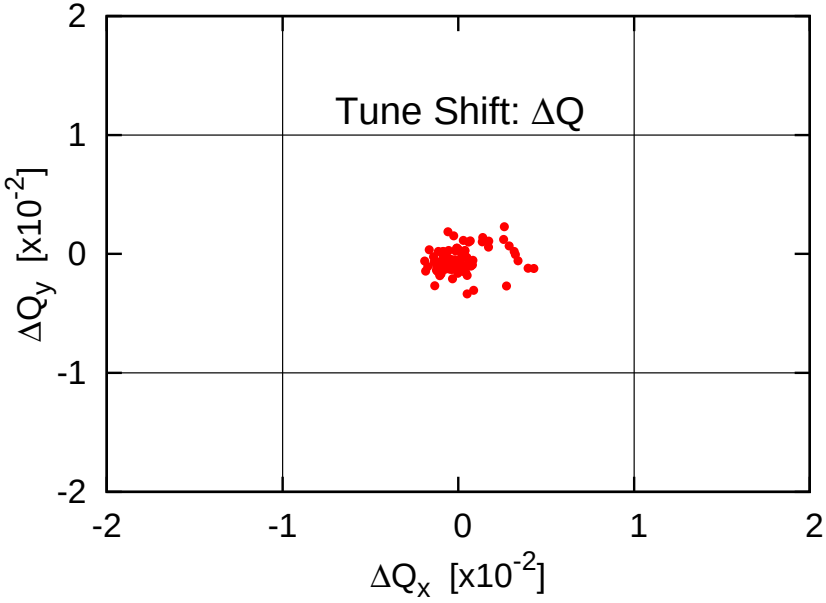
$$\begin{aligned}\Delta\vec{k}_1 &= -R^{-1}\left[\Delta\vec{\phi}_{(x,y)},\ \Delta\vec{D}_x,\ \Delta Q_x,\ \Delta Q_y\right]^T \\ \Delta\vec{k}_1 &= \left[(R^T W R)^{-1} R^T W\right]\vec{b}\end{aligned}$$

LHC $\{\beta,\ D_x\}$ Beat Corr. (5-10 Iters)

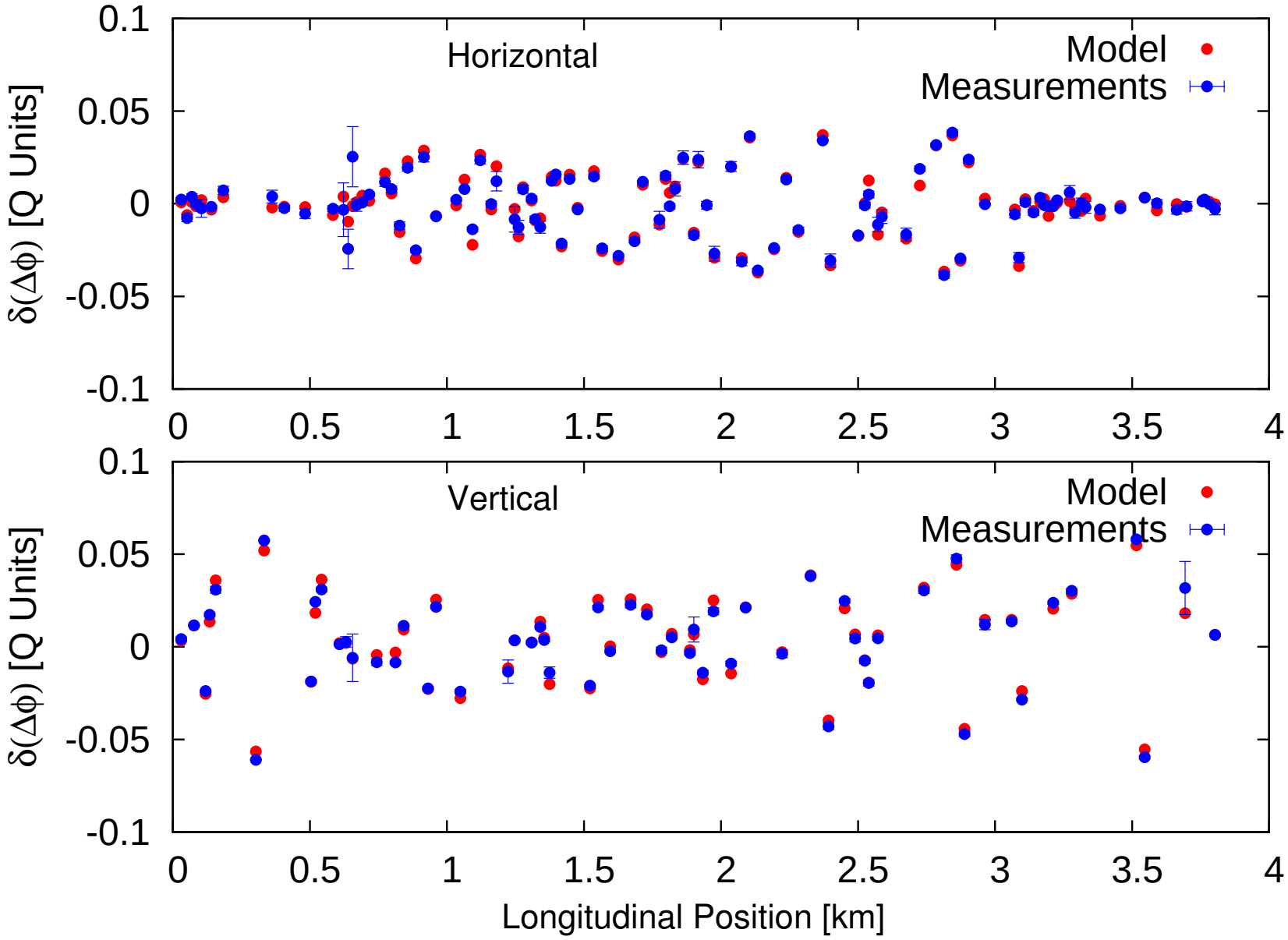




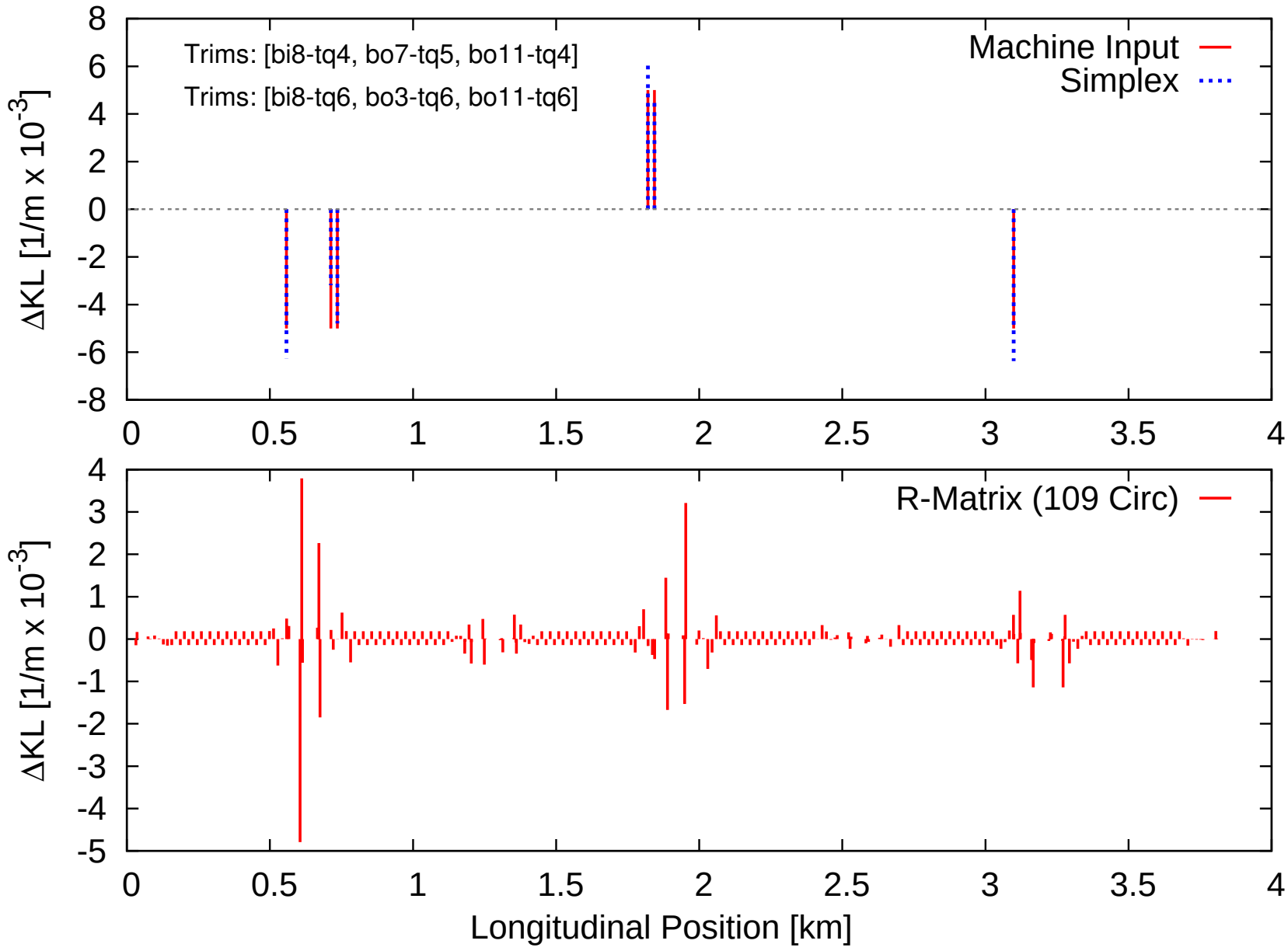




RHIC β-beat (6 Trim Quads)



RHIC β-beat



Application & Commissioning

- Requirements for Effective Corr:
  - Well Functioning and Synchronized BPM System (Turn-By-Turn)
  - Coherent Oscillations ($\sim$ 400 turns, perhaps AC Dipole)
  - Reproducibility
- Application:
  - High level JAVA application (Glenn)
  - Run python scripts underneath
  - Apply corrections with trim application