

Ramp and Store Optics Corrections APEX (04/24/13)

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Outline:

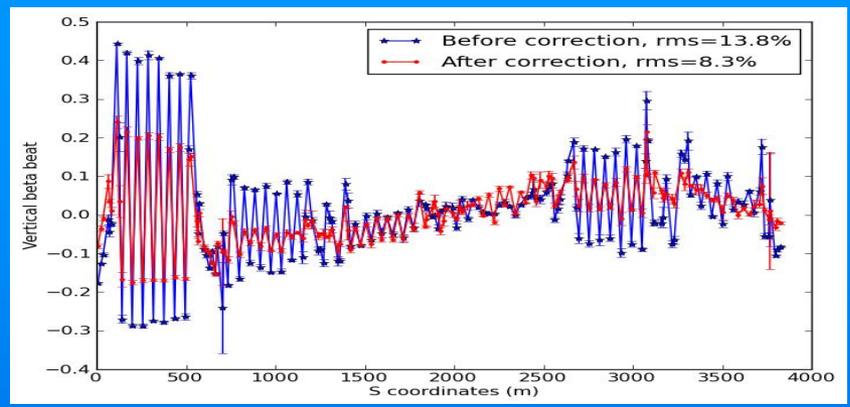
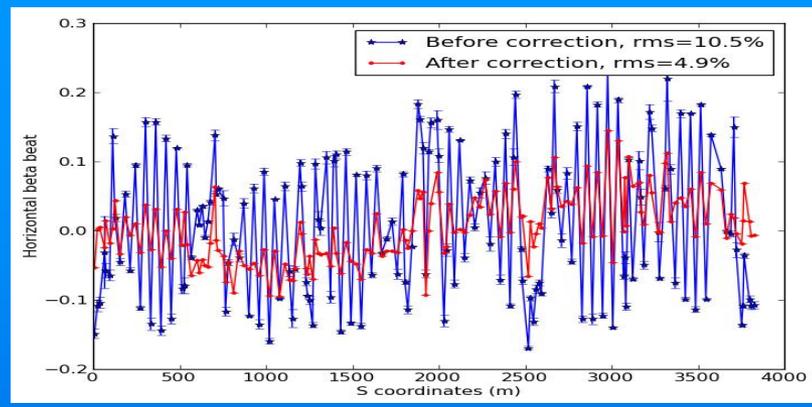
what was accomplished

what we propose

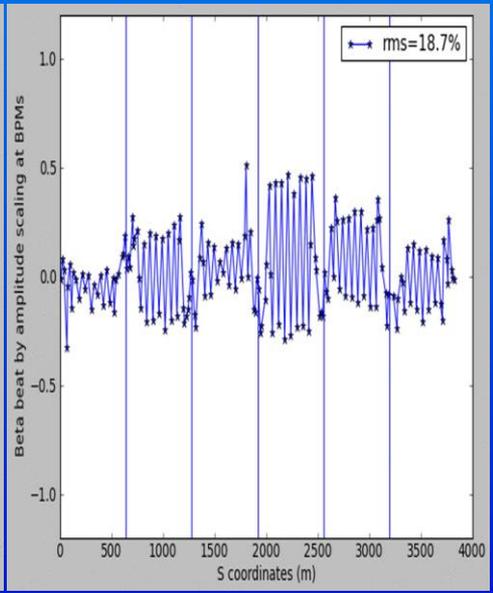
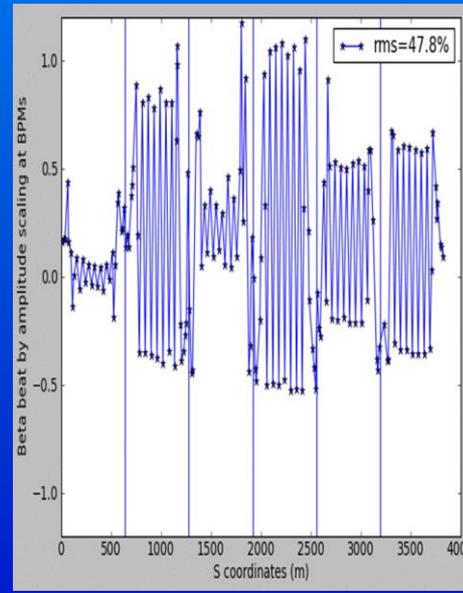
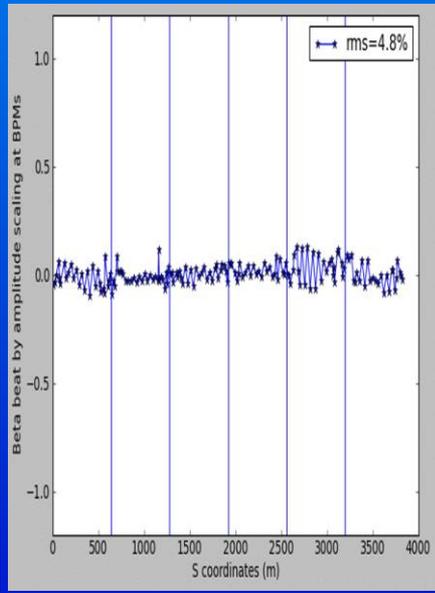
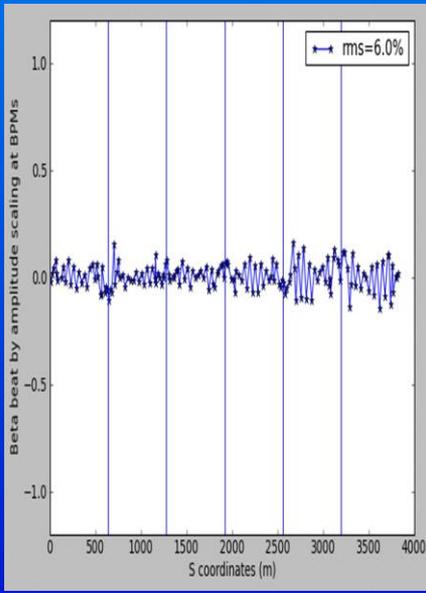
summary

We back-propagated the optics corrections measured at store in ...

... the blue ring on 04/10/13 (APEX)

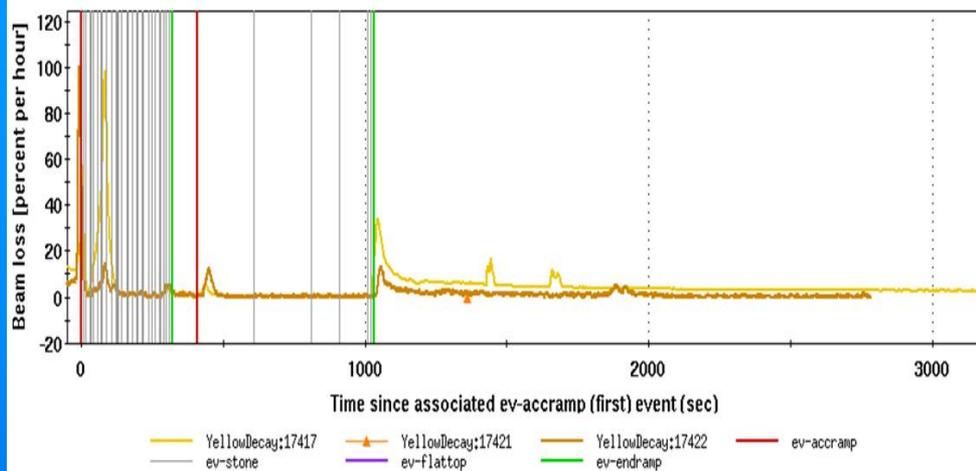
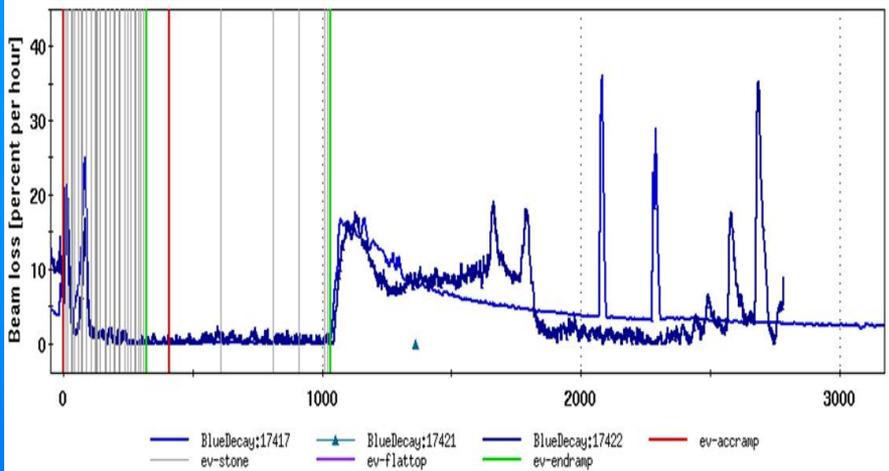


... in the yellow ring on 04/22/13 (end-of-store MD)

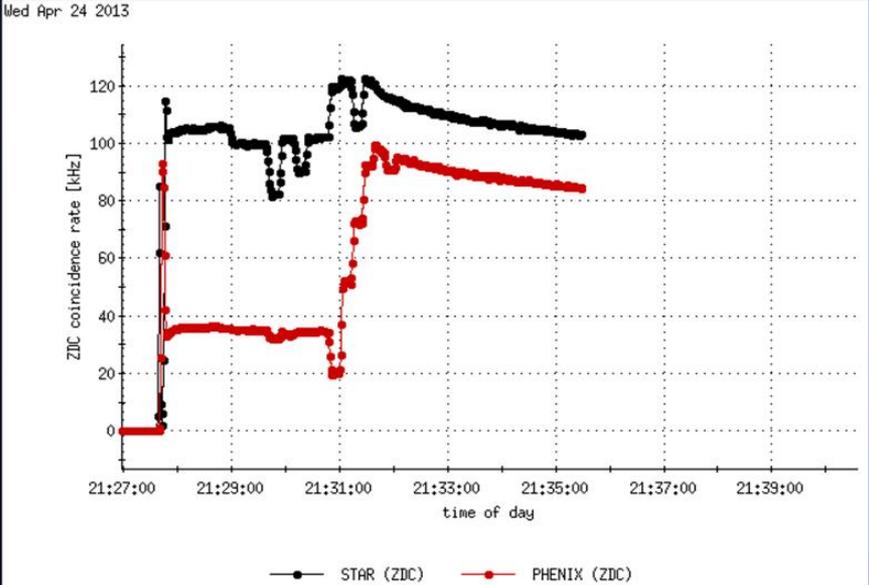


... into the rotator ramp.

We ramped with these changes into the corrected optic (pp13b-v2+optics corrections) using 12-by-12 bunches of nominal single-bunch intensities with no increase in beam losses.

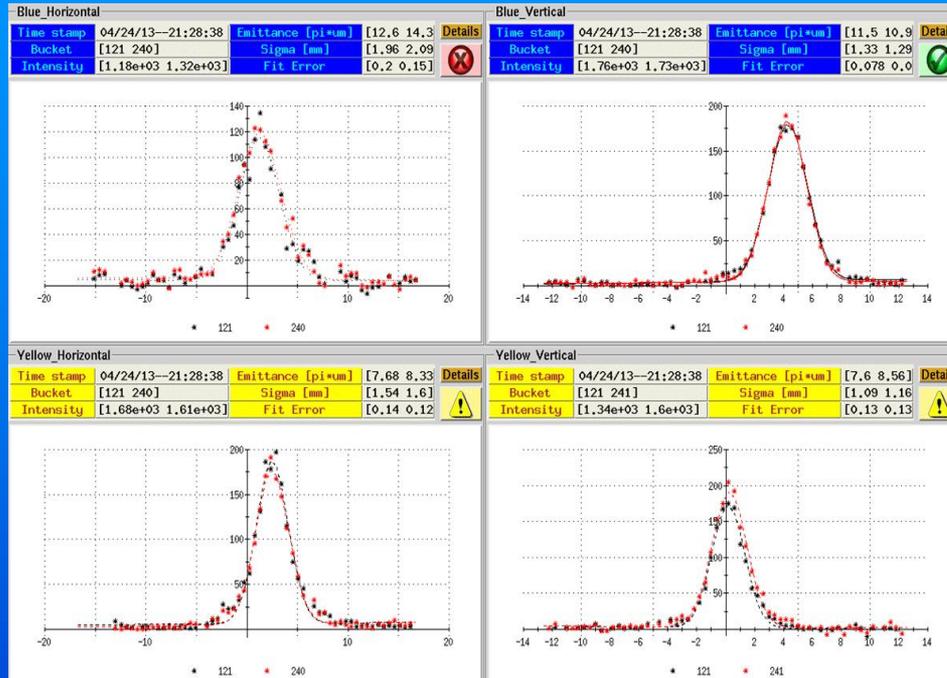


We ramped straight into collisions using the standard protocol for physics stores (rebucketing, collimation, LISA steering, etc.) and were pleasantly surprised by considerably increased specific luminosities (that is, collision rate per crossing) of ~ 15%.

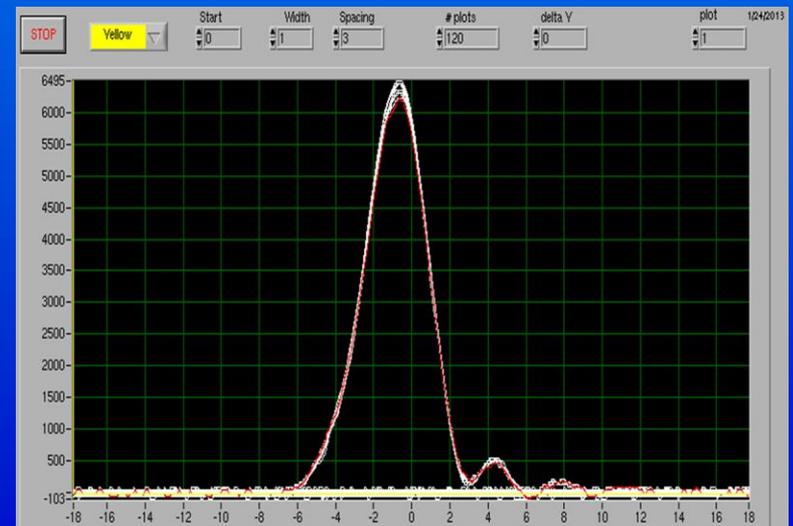
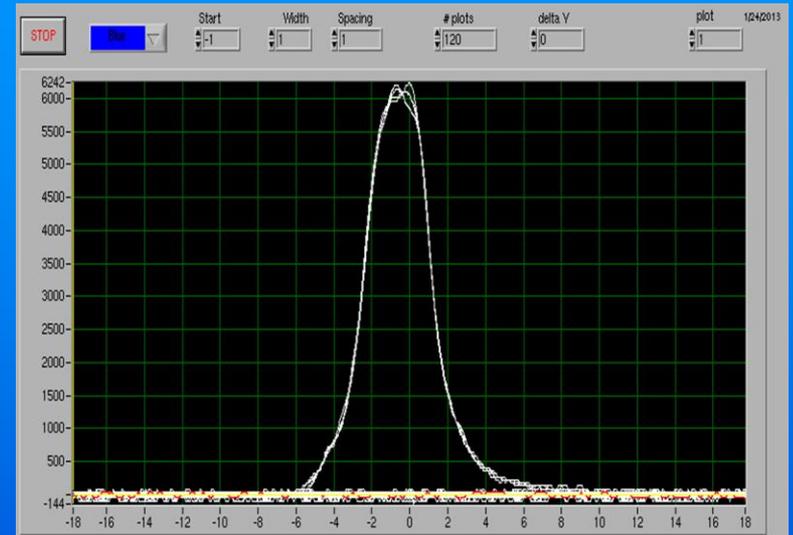


How much of this is due to the decreased beta* due to the corrections is not at this moment clear as there were other factors contributing to this achievement (maybe record low bunch lengths <-- not sure why, small beam emittances <-- due in part to the shorter time required to establish a 12-by-12 versus 110-by-110 bunch fill).

emittances at store

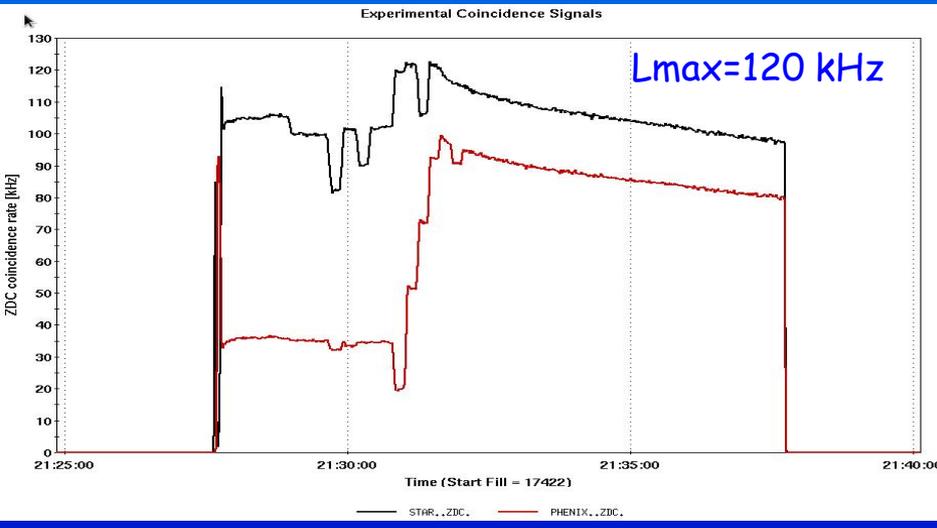
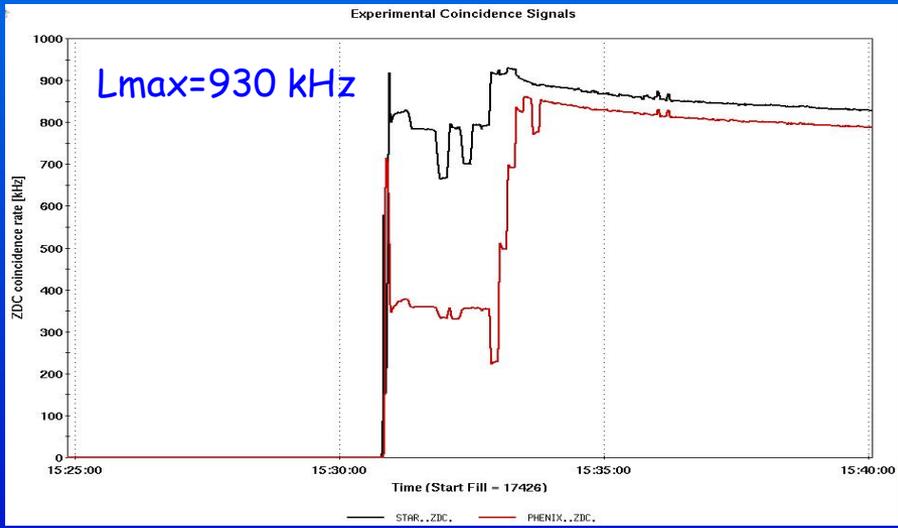
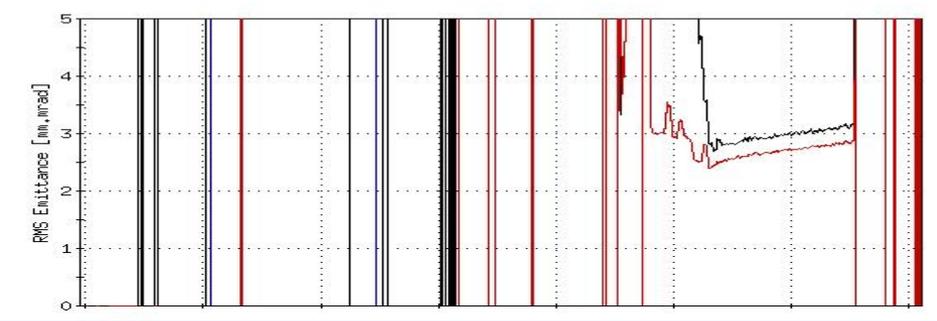
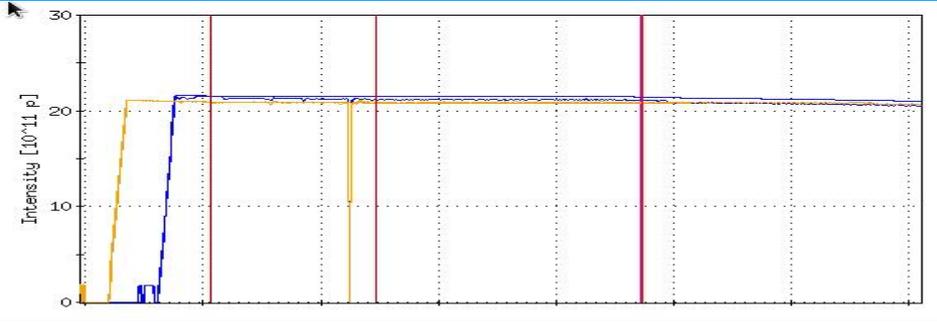
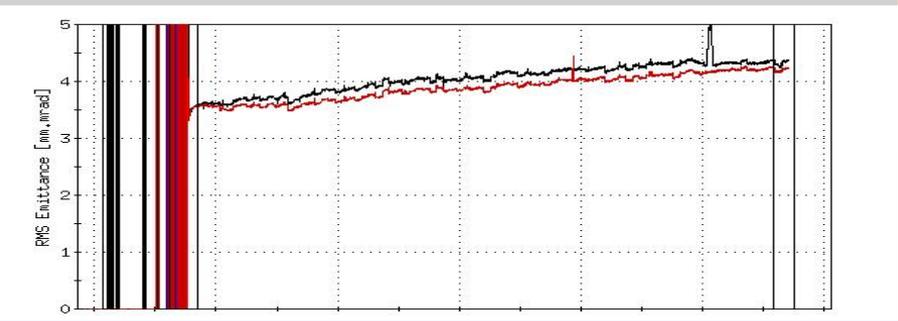
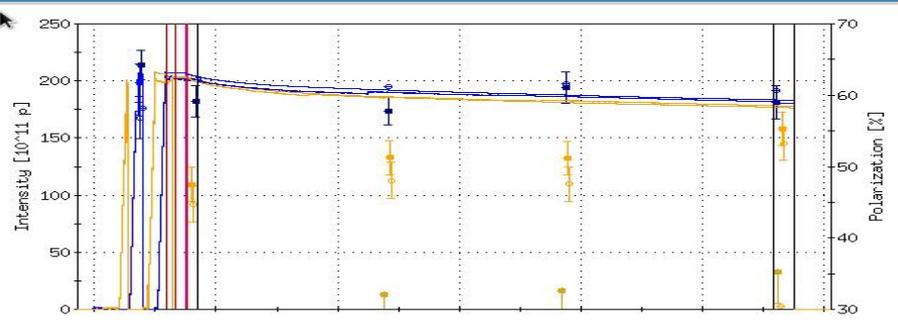


bunch lengths at store



Last night's super-store with pp13b-rot1 107-on -100 (fill 17426)

APEX with pp13b-rot1 + corrections 12-on -12 (fill 17422)



Next steps:

implement present solutions for physics operations (the latter entails coping with increased beam-beam effects due to beta* in reality matching beta* in model) - operations (?)

propagate solutions into energy ramp

refine corrections (iterations have not yet converged)

**APEX beam time request
(3 hours both beams)**

12-by-12 ramp with energy ramp - corrected optics and transition into slightly modified rotator ramp optics (2 hours)

one proof-of-principle ramp

on ramp with RampOptics measurements

iteration of corrections at store (1 hour)

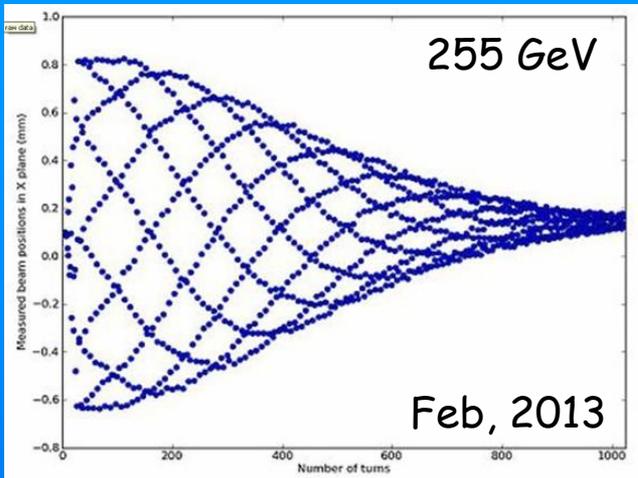
Summary:

Store-corrected optics successfully applied using back-propagation into rotator ramp

Solutions found are ready for physics-store-implementation: demonstrated already correction with nominal fill at store only (end-of-store) on 04/22/13, demonstrated with 12-by-12 ramp successful application with no increase in losses (and higher specific luminosity)

Experiences have shown that further iterations could take place incrementally

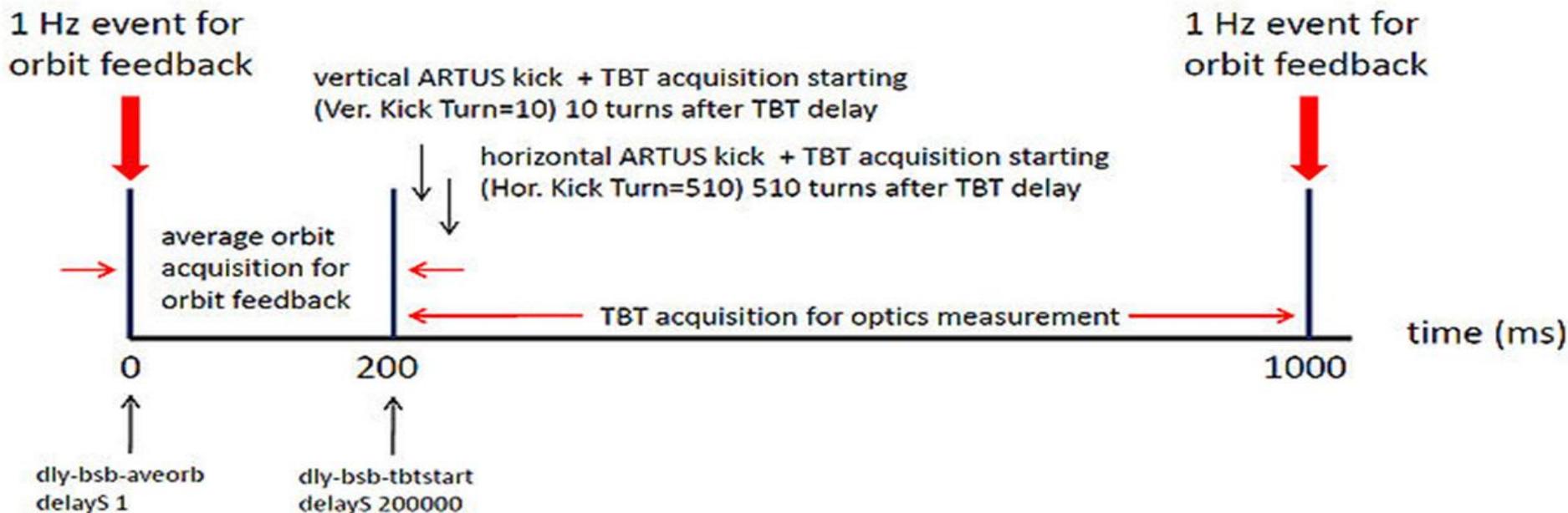
2013: optics measurements



In 2012 we demonstrated high precision turn-by-turn BPM measurements (~15 microns, rms) with pinged-beams allowing for phase determination with 0.1 deg rms phase precision (P. Thieberger, C. Liu)

In 2013 we've combined this analysis to measure the beam optics along the energy ramp (A. Marusic, R. Michnoff, R. Hulsart et al)

2013: ramp optics measurements



April, 2013: beta functions at the IPMs during the energy ramp

