

Beam Commissioning Plan with Crab Cavities

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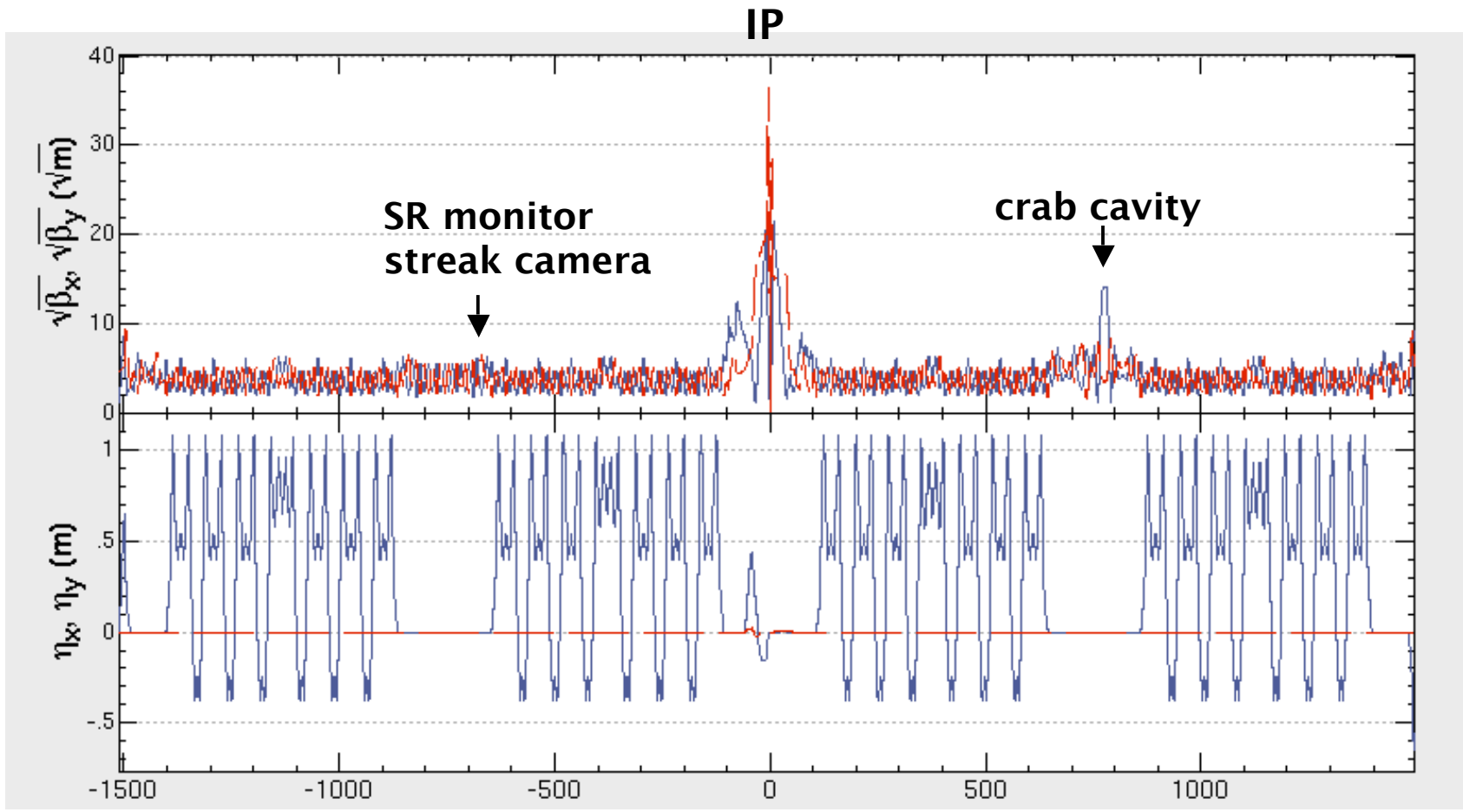
Our basic viewpoint

- Goal – To establish the crab crossing scheme.
 - Completely new collision scheme
 - Completely new hardware components
- Achieve higher vertical beam-beam parameter ($\xi_y > .1$) at medium beam currents.
 - Our goal in the first step
 - ξ_y (LER/HER) = 0.096/0.055 @ 16.27/nb/s
- Higher luminosity at high beam currents may be in the next step.
 - May need some improvements on crab cavities for high current operation.

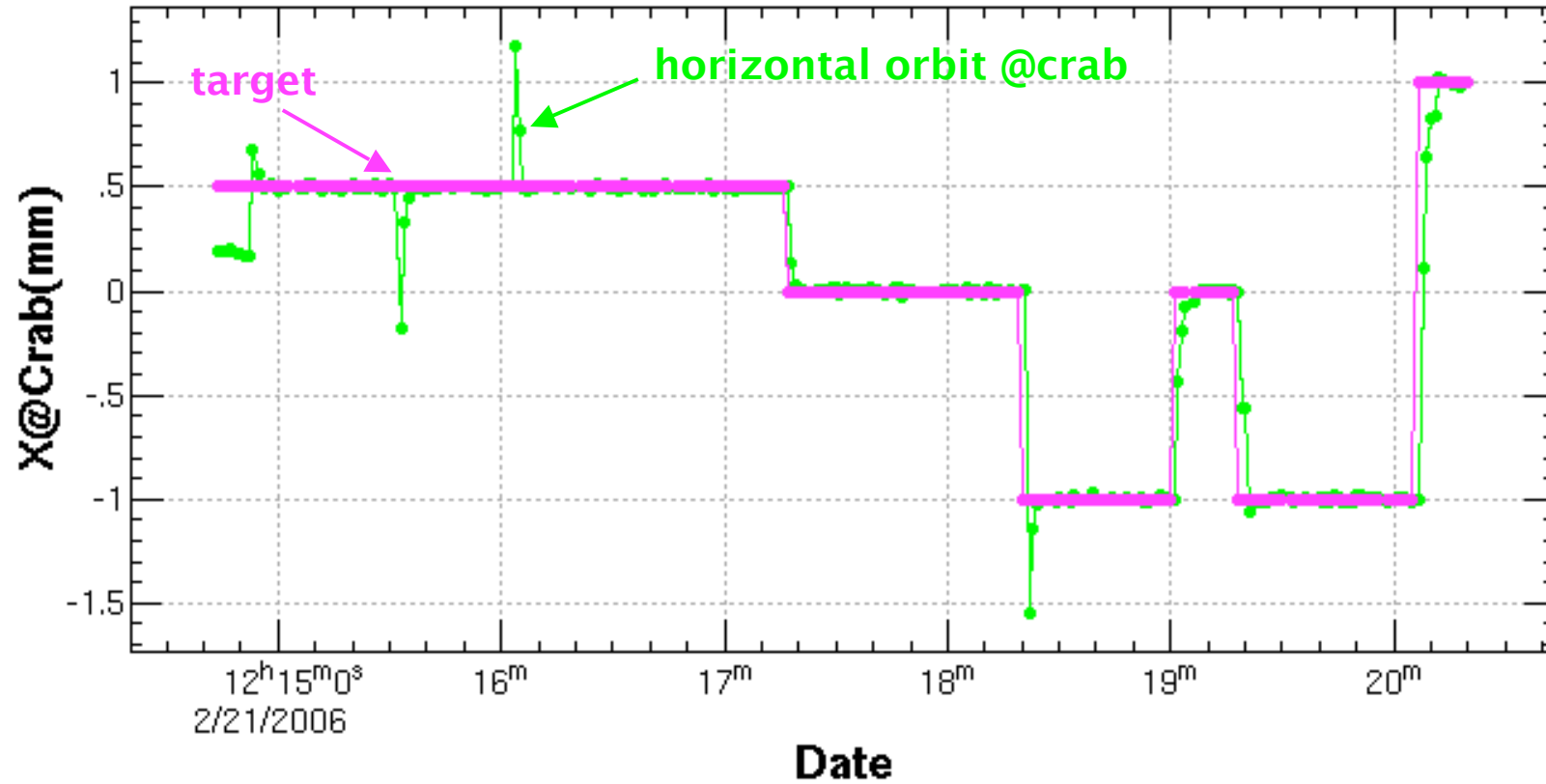
Commissioning plan (1)

- Vacuum scrubbing and developments of operation tools
 - Monitor of crabbing angle (x-z correlation) with streak cameras.
 - Orbit feedback system (<1 Hz) to maintain the horizontal position at crab cavities in the accuracy of 0.5 mm. (M. Masuzawa @KEK Review 2005)
 - RF phase feedback (0.05–0.1 Hz) of crab cavities with CCC (Continuous Closed–Orbit Correction) to compensate slow phase drift due to temperature, etc. (K. Akai)
 - Check single beam conditions with crab cavities.

Crab optics HER



Test of orbit feedback



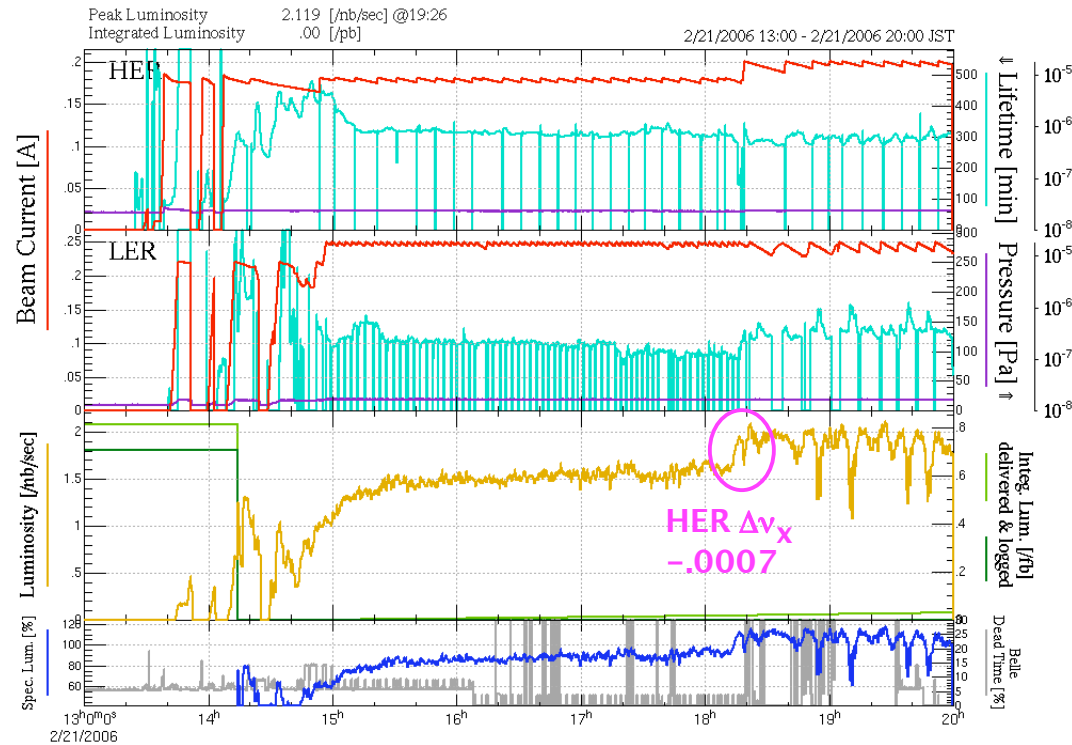
Works successfully

M. Masuzawa, et al.

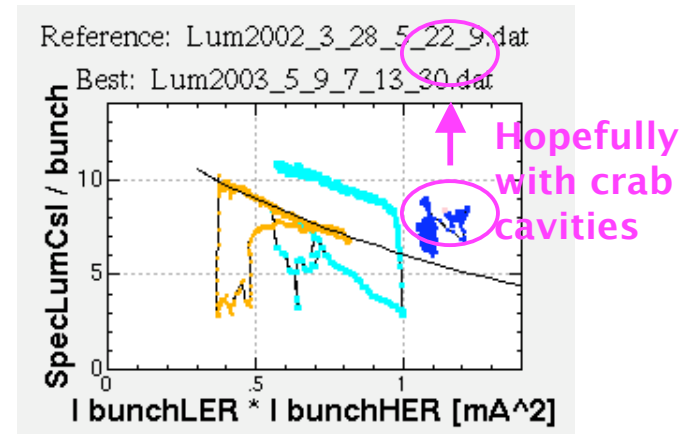
Commissioning plan (2)

- Collision tuning at medium currents.
 - Medium beam currents, but same bunch currents as in the usual physics run.
 - No. of bunches should be adjusted depending on beam currents which can be stored with crab cavities. For example, 300 mA (LER), 220 mA (HER), and 220 bunches ($\sim 1/6$ bunches as usual).
 - Usual tuning methods will be useful.
 - In addition, the voltage of crab cavities and the betatron phase difference between IP and the crab cavity may have to be adjusted.
 - Measure luminosity and beam-beam parameters at several crabbing angles.

Example of collision tuning at medium current



Specific luminosity



HER 200 mA, LER 250 mA, 202 bunches, 2/nb/s

Commissioning plan (3)

- Crab cavities will be installed in the summer shutdown, 2006.
- Initial tuning and vacuum scrubbing: **~10 days**
- Collision study at medium currents: **<30 days**
 - If possible, share machine time with physics runs without crabbing.
 - Increase beam currents gradually.
 - Need long time to optimize many tuning parameters.

After the study,

- If the luminosity is acceptable, continue tuning with crab cavities.
 - What is criterion?
- If not, remove crab cavities for improvements. **~7 days**