Chromatic Beta Beating Measurement

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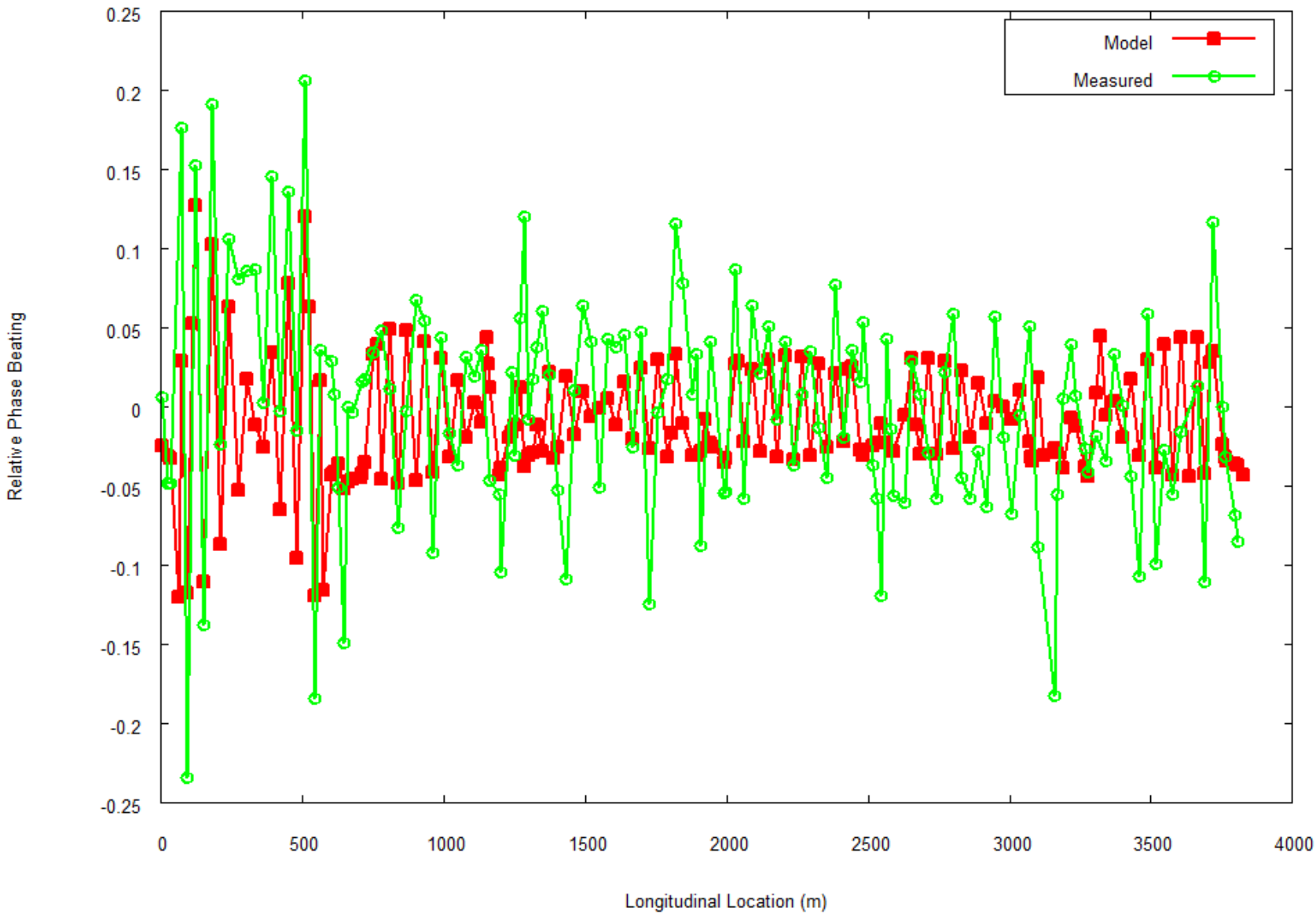
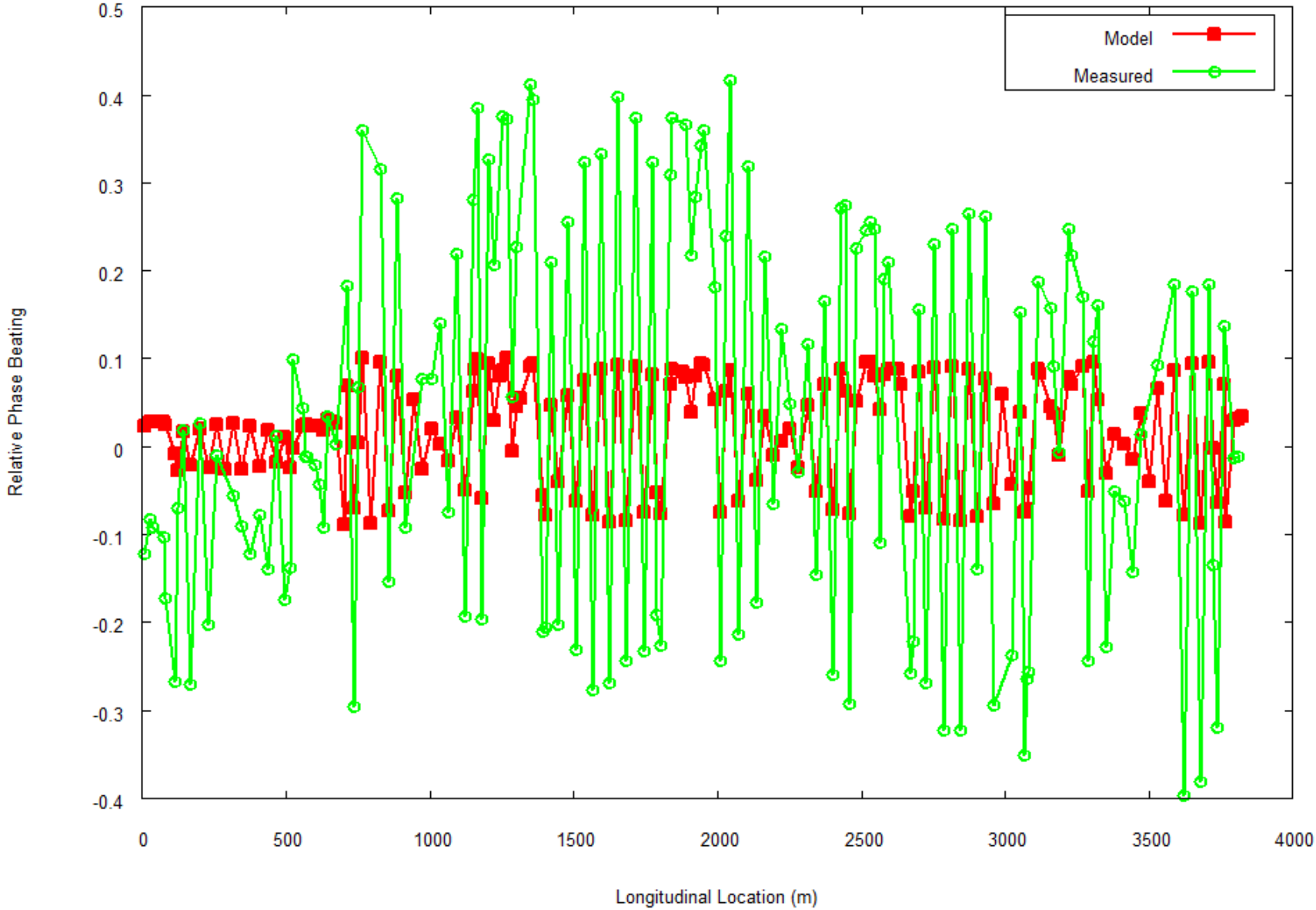
Feb. 5th ,2010

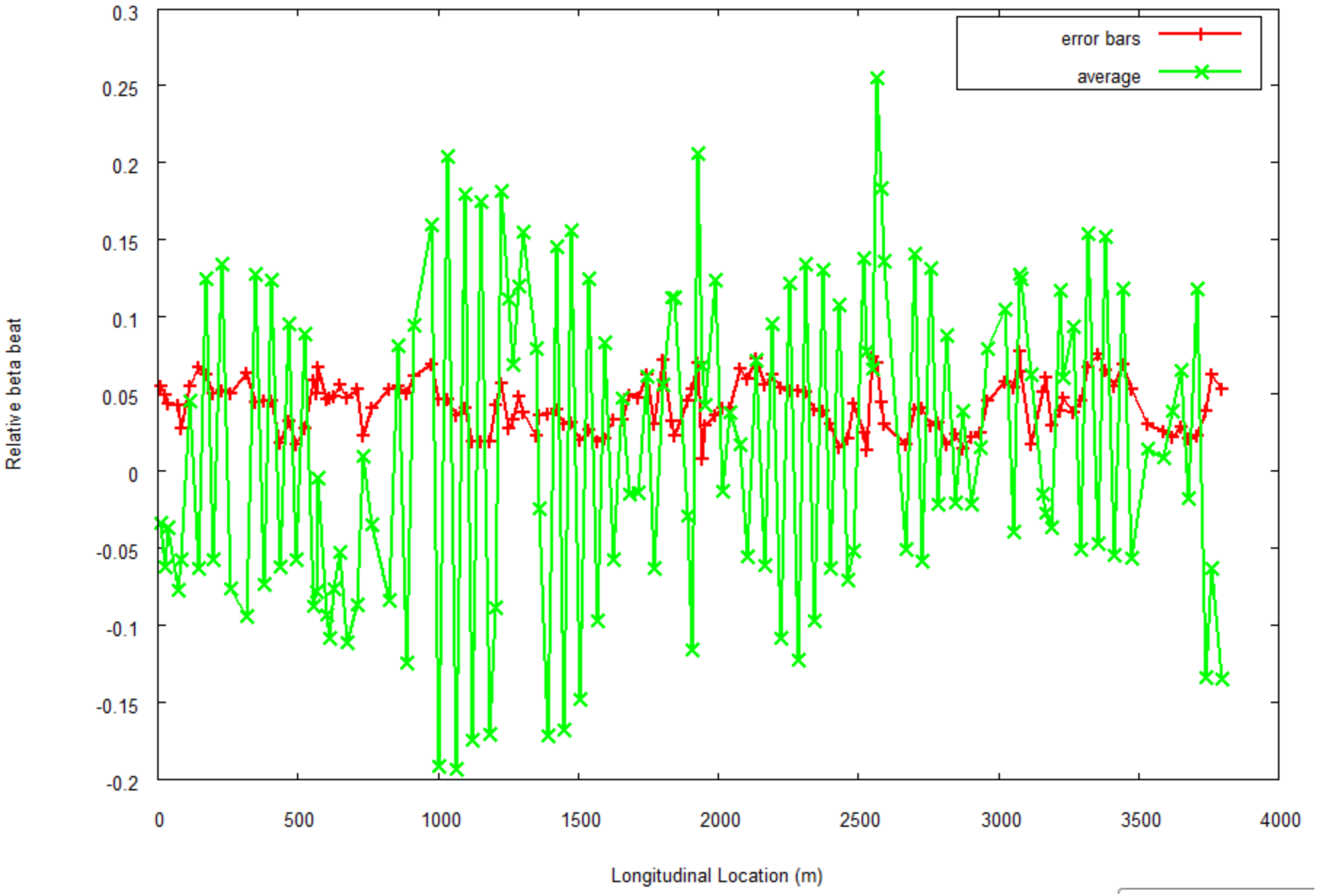
Blue fill 11500



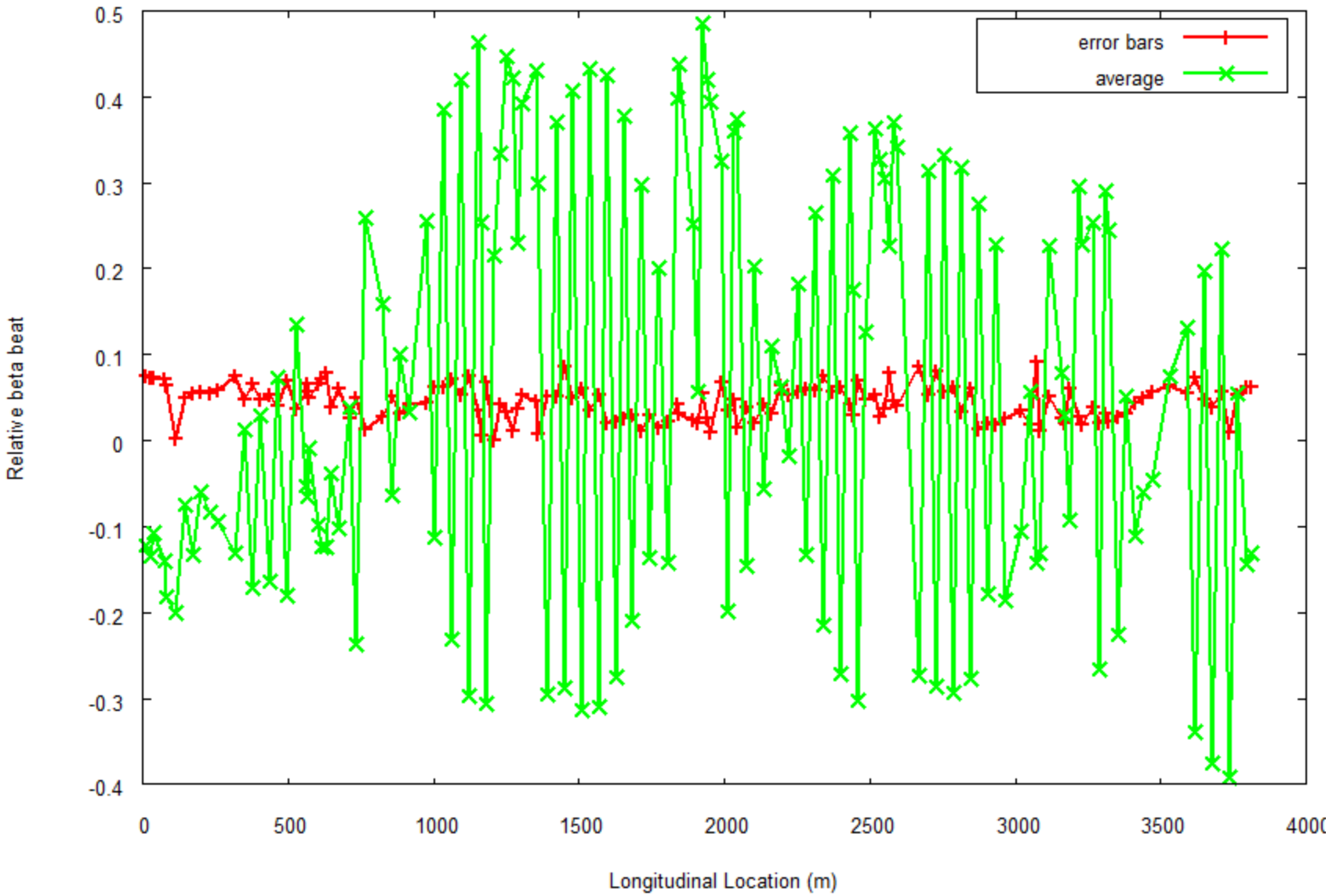
Yellow fill 11502



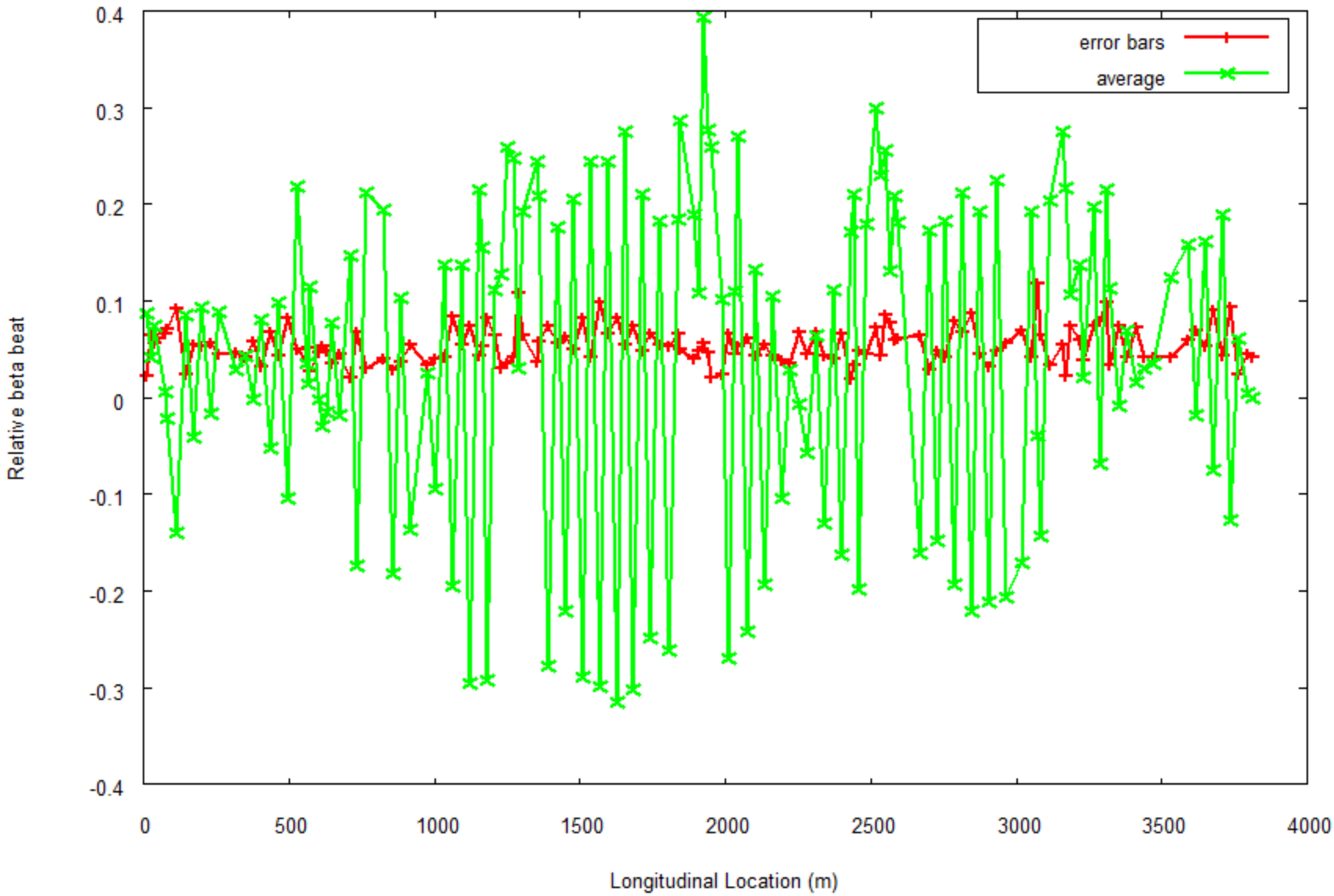
Beta beating for on momentum beam. (11502, Hacd06~09)



Beta beating for off momentum beam, excited below Qx. (11502, Hacd11~13)



Beta beating for off momentum beam, excited above Qx. (11502, Hacd14~16)



Formula and Discussion

Formula are grabbed from Rhic-ap-note-348 by Y. Luo

$$\frac{1}{\beta_{x,y}(s)}\frac{\partial\beta_{x,y}(s)}{\partial\delta} = \pm\frac{1}{2\sin(2\pi Q_{x,y})}\oint \beta_{x,y}(s')[\mp K_1(s') \pm K_2(s')D_x(s')]\cos(2|\phi_{x,y}(s)-\phi_{x,y}(s')| - 2\pi Q_{x,y})ds'.$$

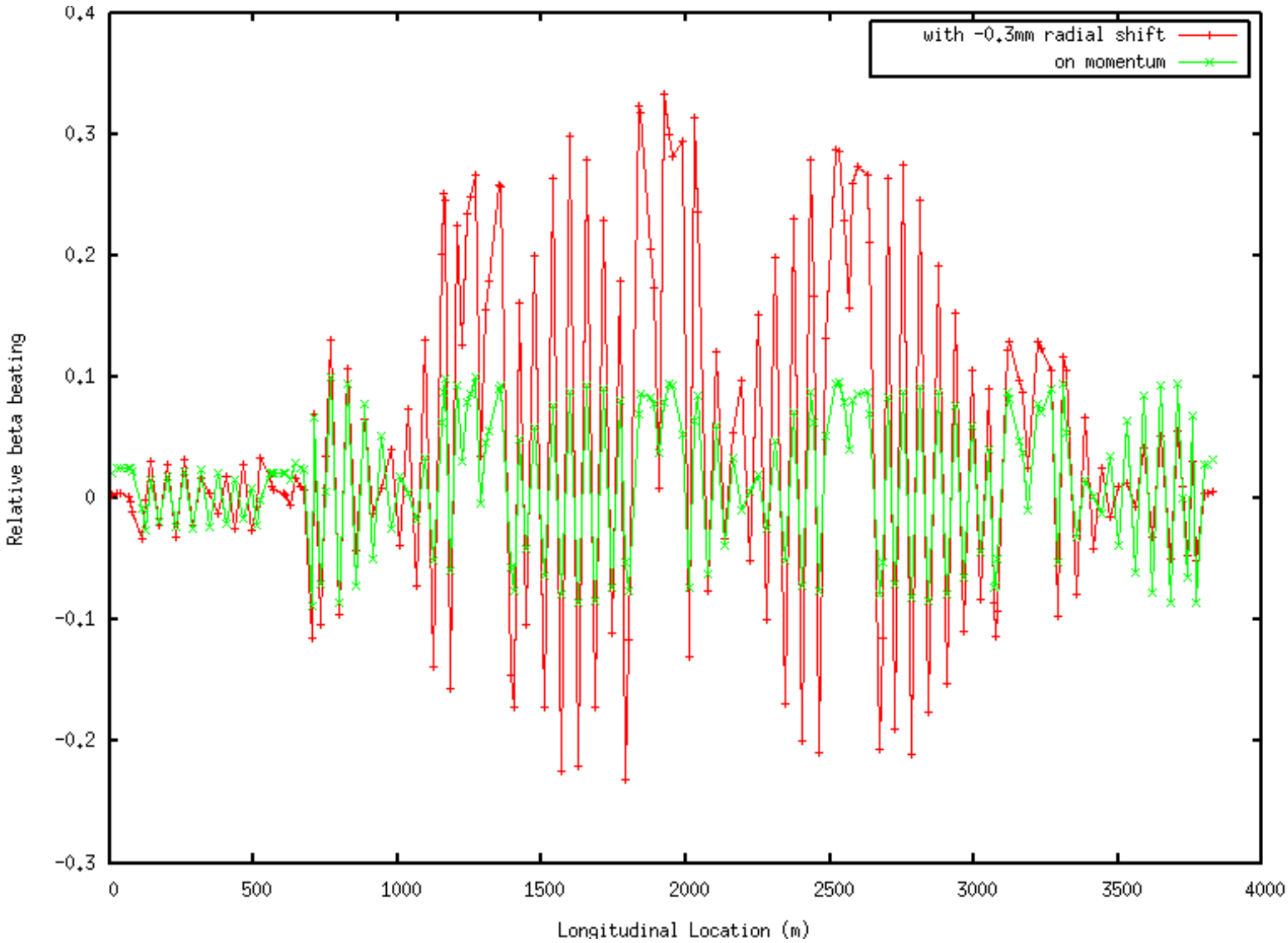
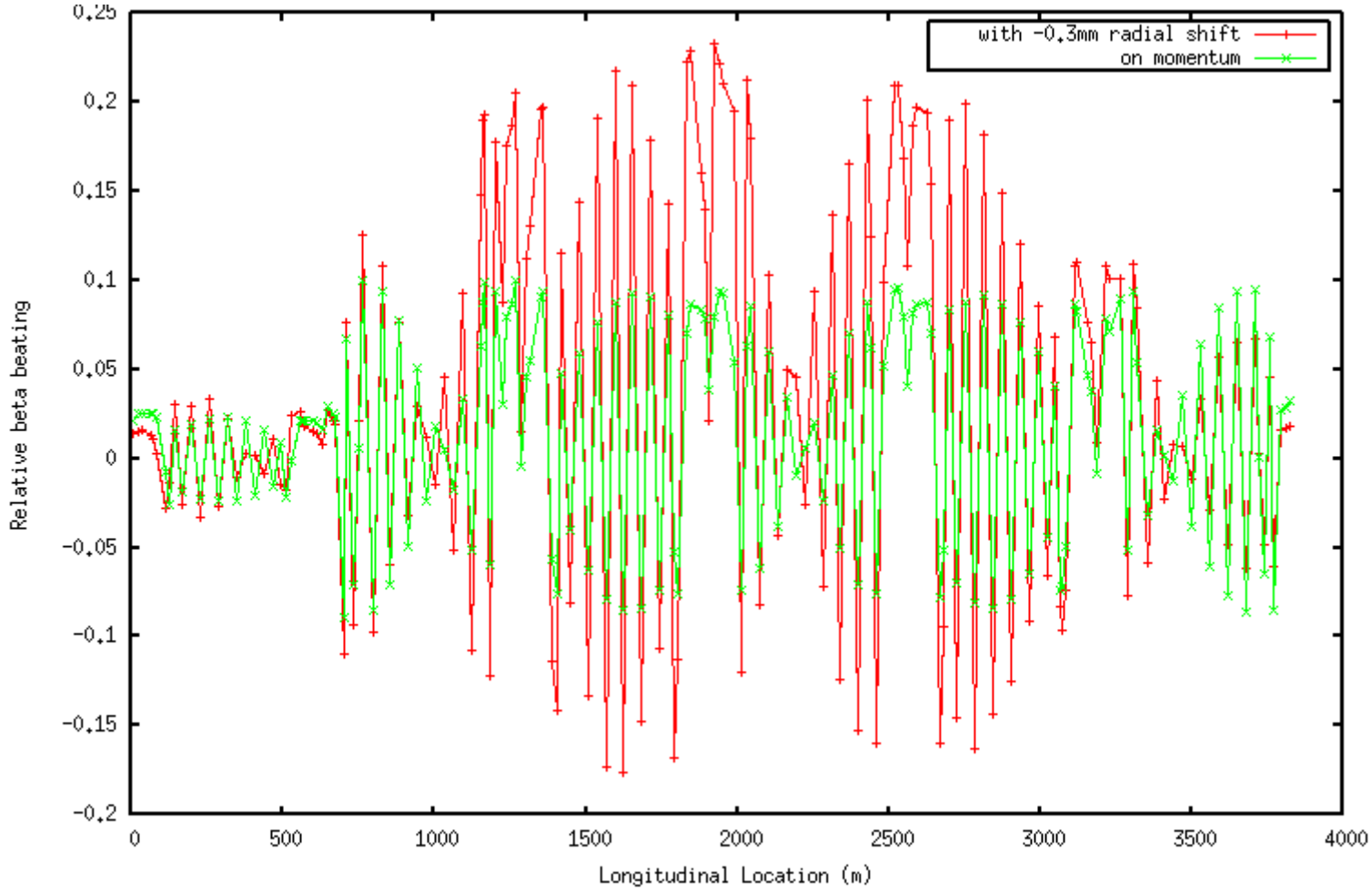
- Possible sources of the factor of ~3 differences of yellow off-momentum beta beating between model and measurement.
  - ➢Bad measurement?
    - ✓The agreements among various data sets are reasonable.
    - ✓Blue did not have this factor of 3 difference
    - ✓Need another measurement to confirm.
  - ➢Gradient errors?
    - ✓In order to generate factor of 3 difference for off-momentum beta beating, the on-momentum beta beating will be huge, which was not observed.
  - ➢Sextupole errors?
    - ✓From madx calculation, it seems that fairly large errors (factor of 8). has to present in order to explain the difference.
- How does the off momentum beta beating relate to beam loss?
- Does correcting second order chromaticity also correct off momentum beta beating? (Average vs. rms)

$$\xi^{(2)}_{x,y} = -\frac{1}{2}\xi^{(1)}_{x,y} + \frac{1}{4\pi}\oint[\mp K_1 \pm K_2 D_x]\frac{\partial\beta_{x,y}}{\partial\delta}ds \pm \frac{1}{4\pi}\oint K_2\beta_{x,y}D^{(2)}_x ds.$$

$$\xi^{(2)}_{x,y} = \frac{1}{2}\frac{\partial^2 Q_{x,y}}{\partial\delta^2}|_{\delta=0}$$

Thanks!

Sextupole errors: 8*(ranf()-0.5)



Sextupole errors: 5*(ranf()-0.5)