Optics measurements and corrections at $\beta^* =$3.5m
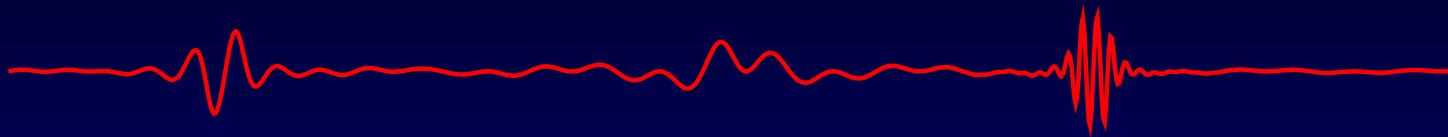
C. Alabau, R. Calaga, R. Miyamoto, F. Schmidt,
R. Tomás and G. Vanbavinckhove

Thanks to T. Baer, V. Kain, M. Lamont, R. Steinhagen
September 2010

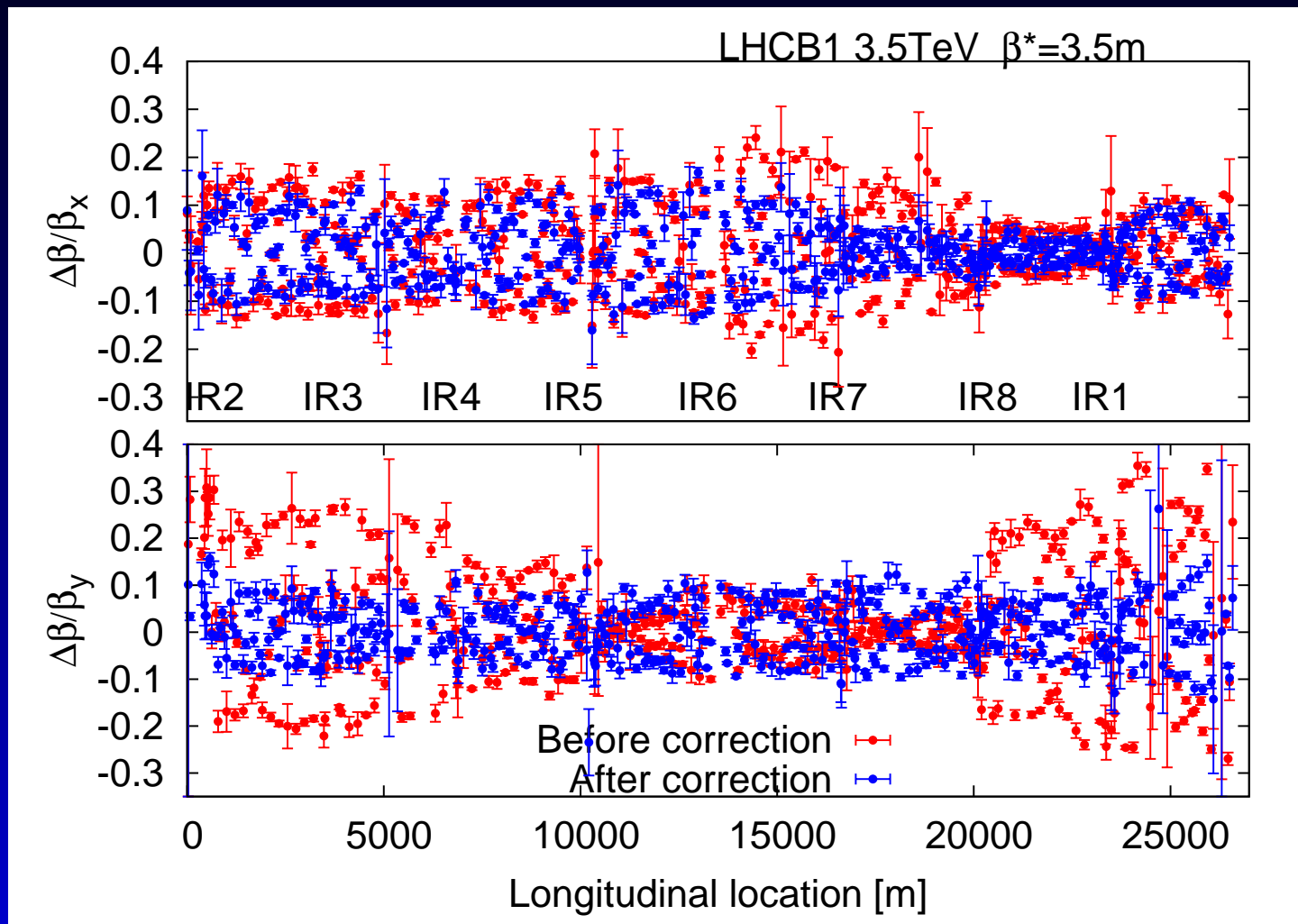# Local correction

IR1, IR2, IR5,
IR6 and IR8.
All correctors
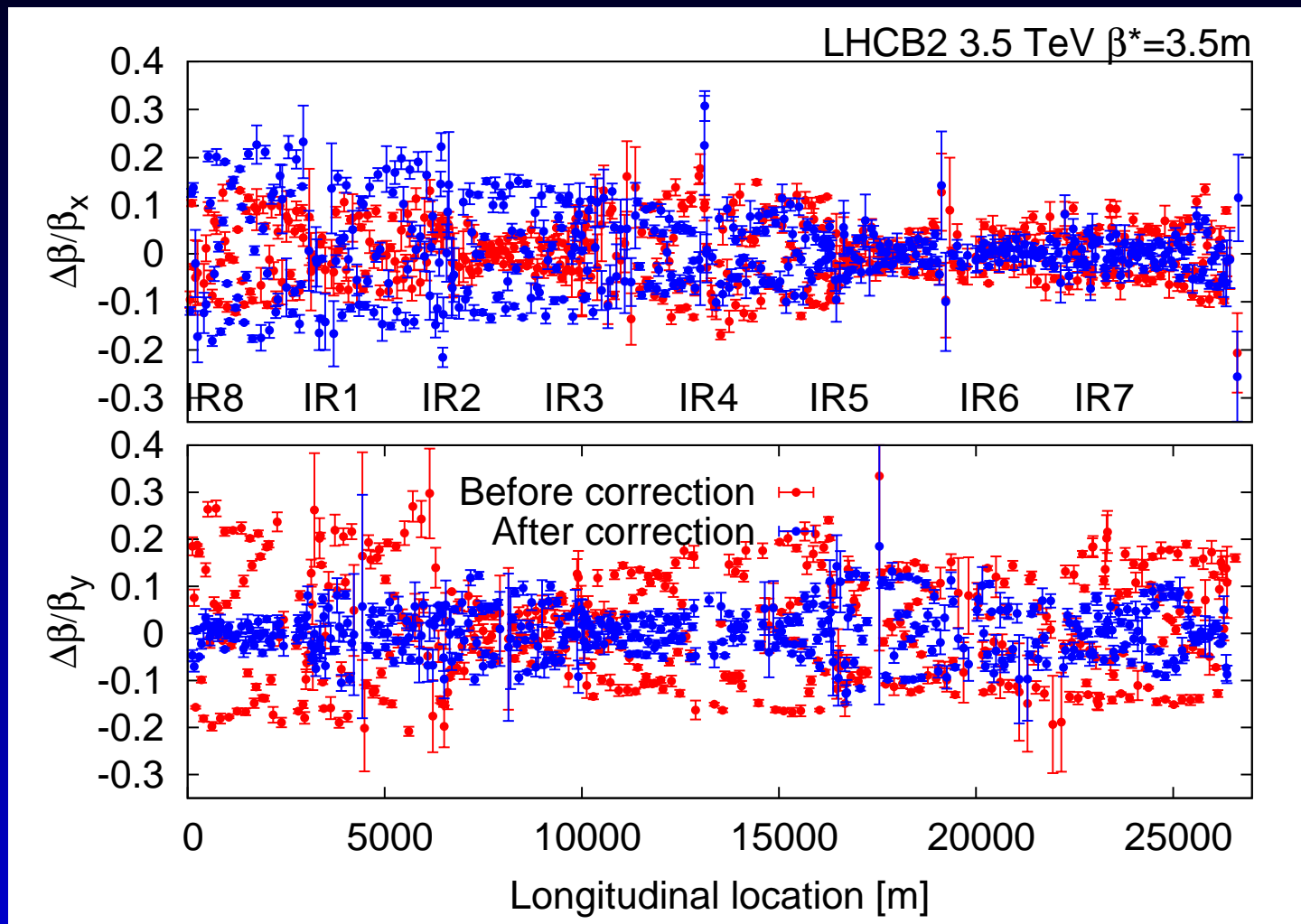$\leq 1\%$
Largest error in
IR8   T. Baer

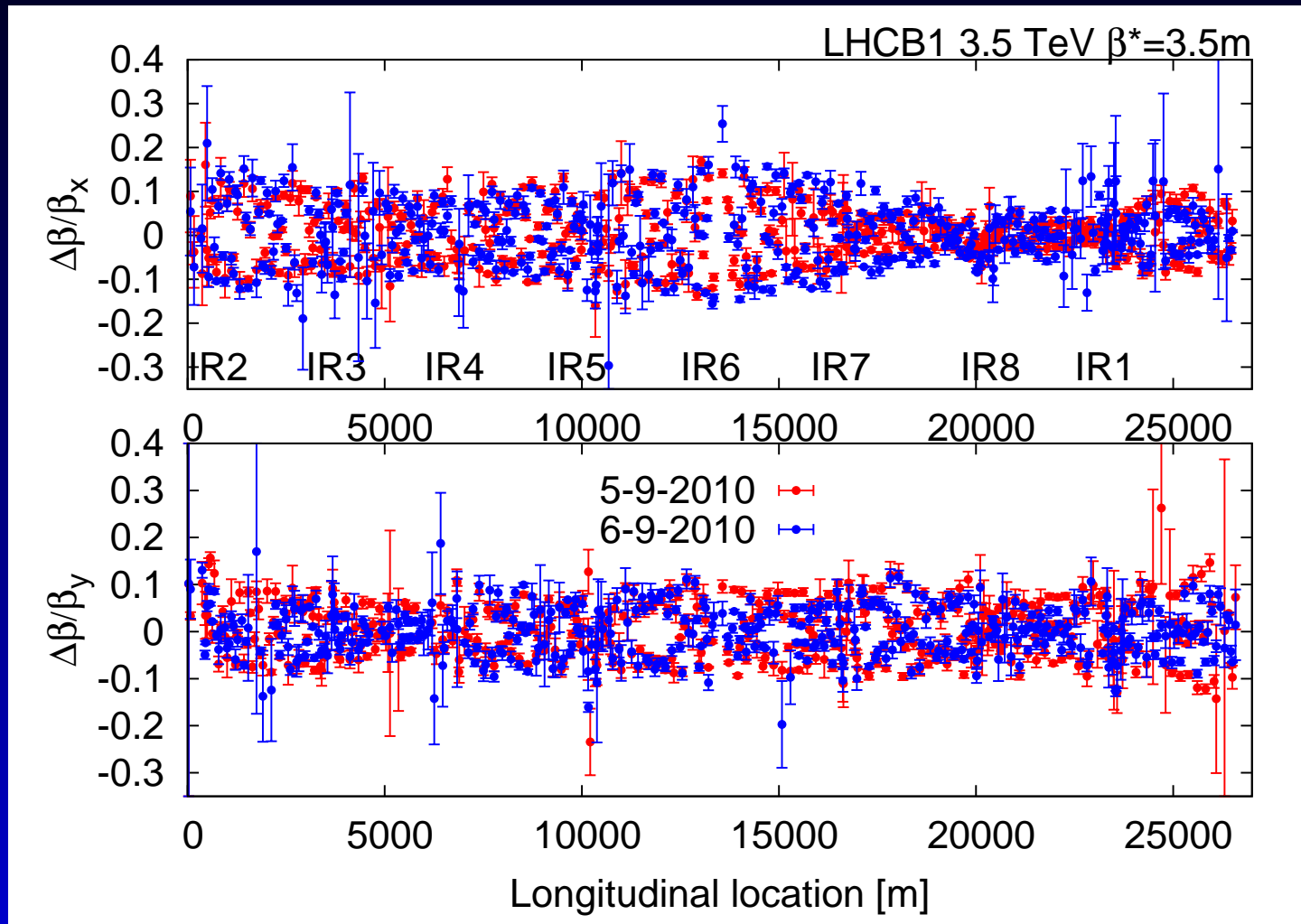|	
ktqx2.r1	0.8e-5
kq5.r2b2	1.7e-5
kq5.l2b2	-5.1e-5
kq9.r2b1	-6.9e-5
ktqx2.r5	-1.0e-5
ktqx2.l5	-1.0e-5
kq5.l6b2	-3.3e-5
kq5.l6b1	3.9e-5
kq6.l8b1	-2.7e-5
kq4.r8b1	1.7e-5
ktqx2.l8	2.3e-5
ktqx2.r8	0.5e-5

Local correction, Beam 1

Local corrections yield 15%.
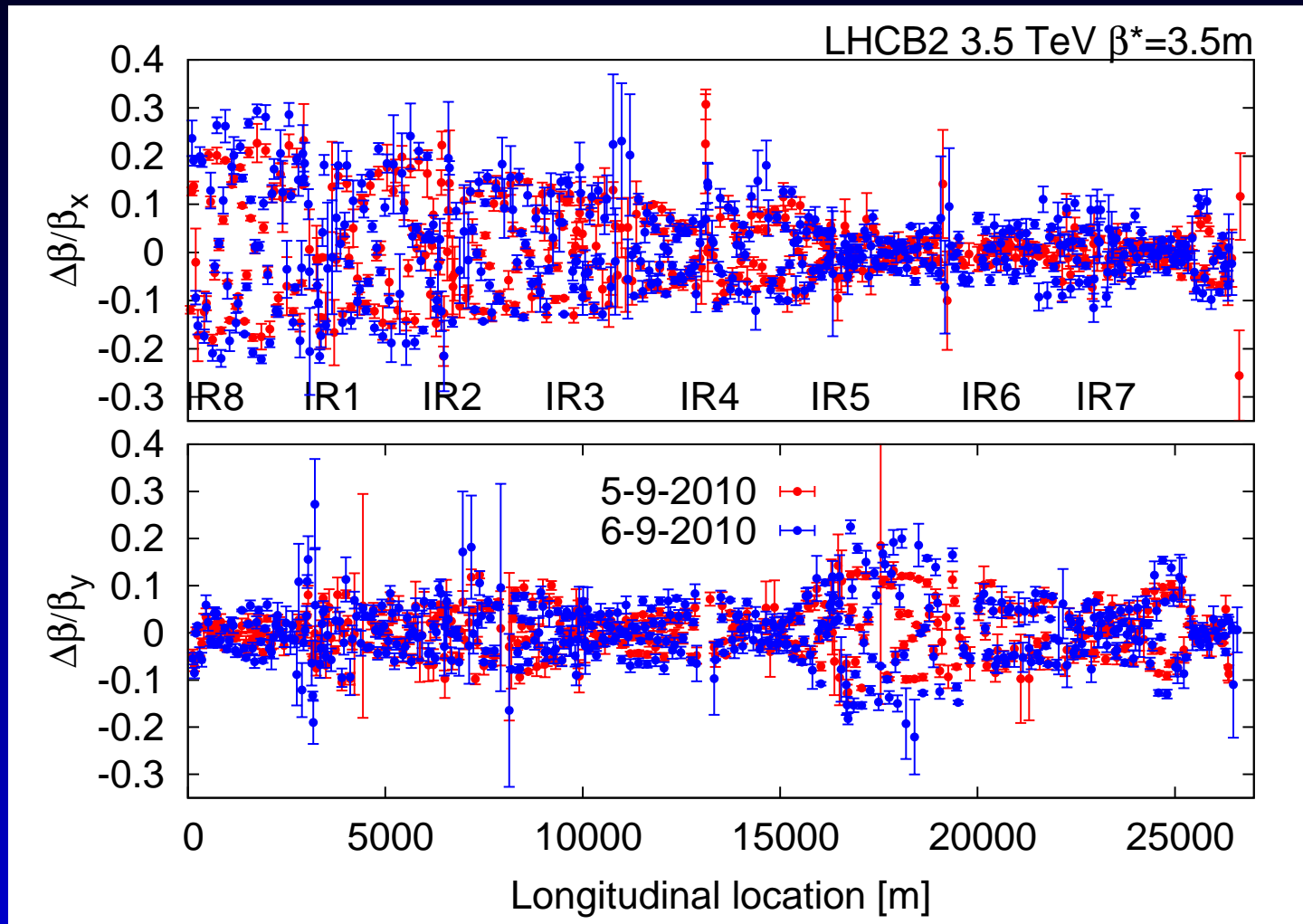
Local correction, Beam 2

Horizontal plane in Beam 2, slightly spoiled.

After incorporating correction, Beam 1

Some small differences...
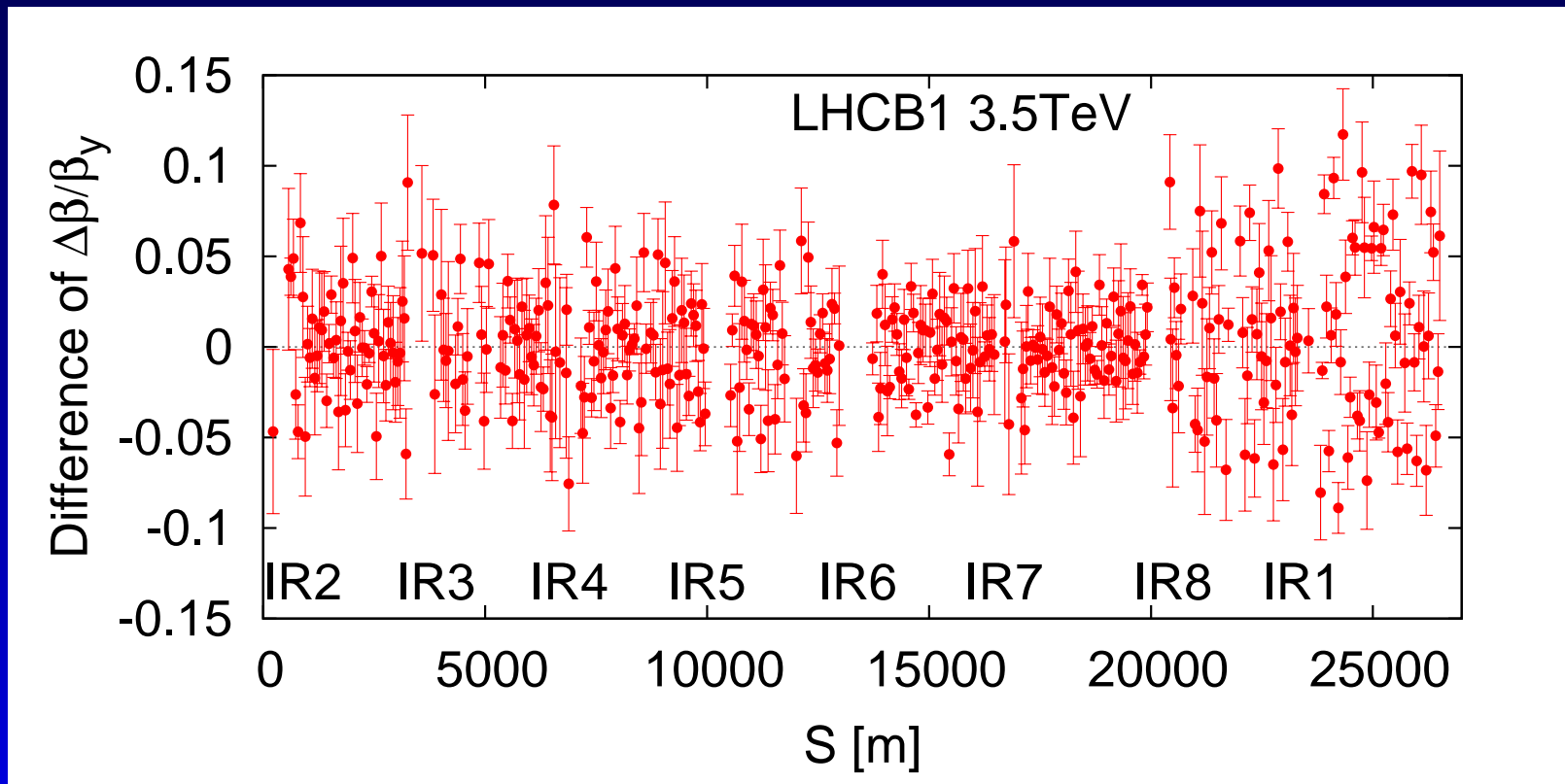
After incorporating correction, Beam 2

Horizontal plane in Beam 2 again spoiled now due to incorporation...

Lesson

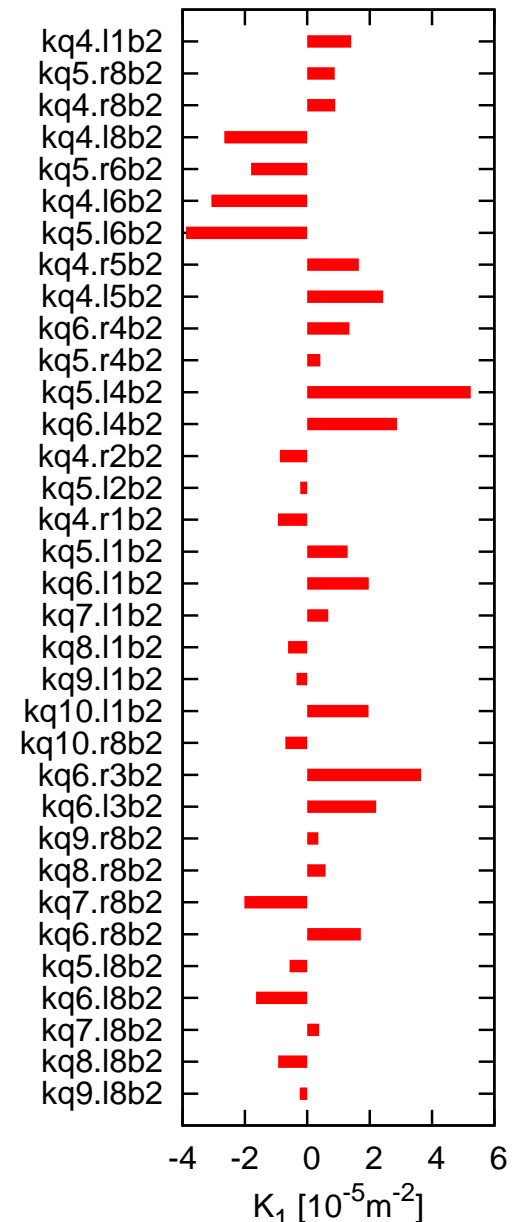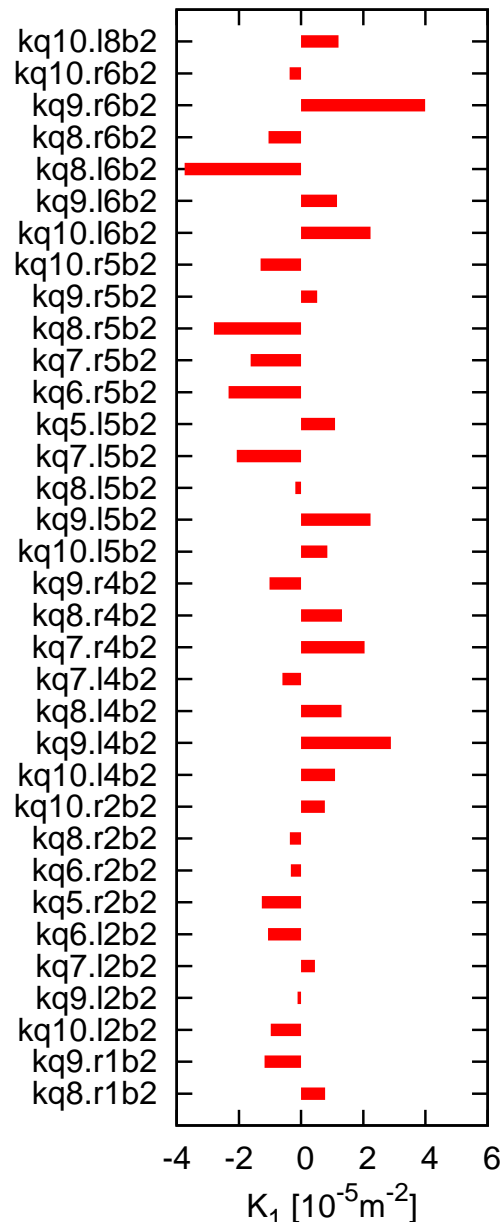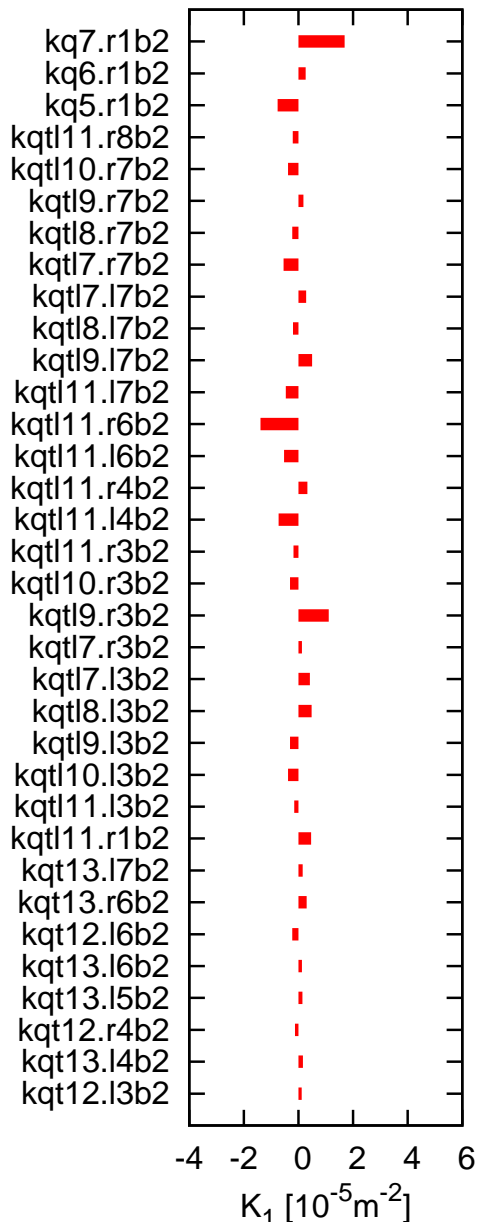- Always check the optics after incorporating the correction in a new ramp.

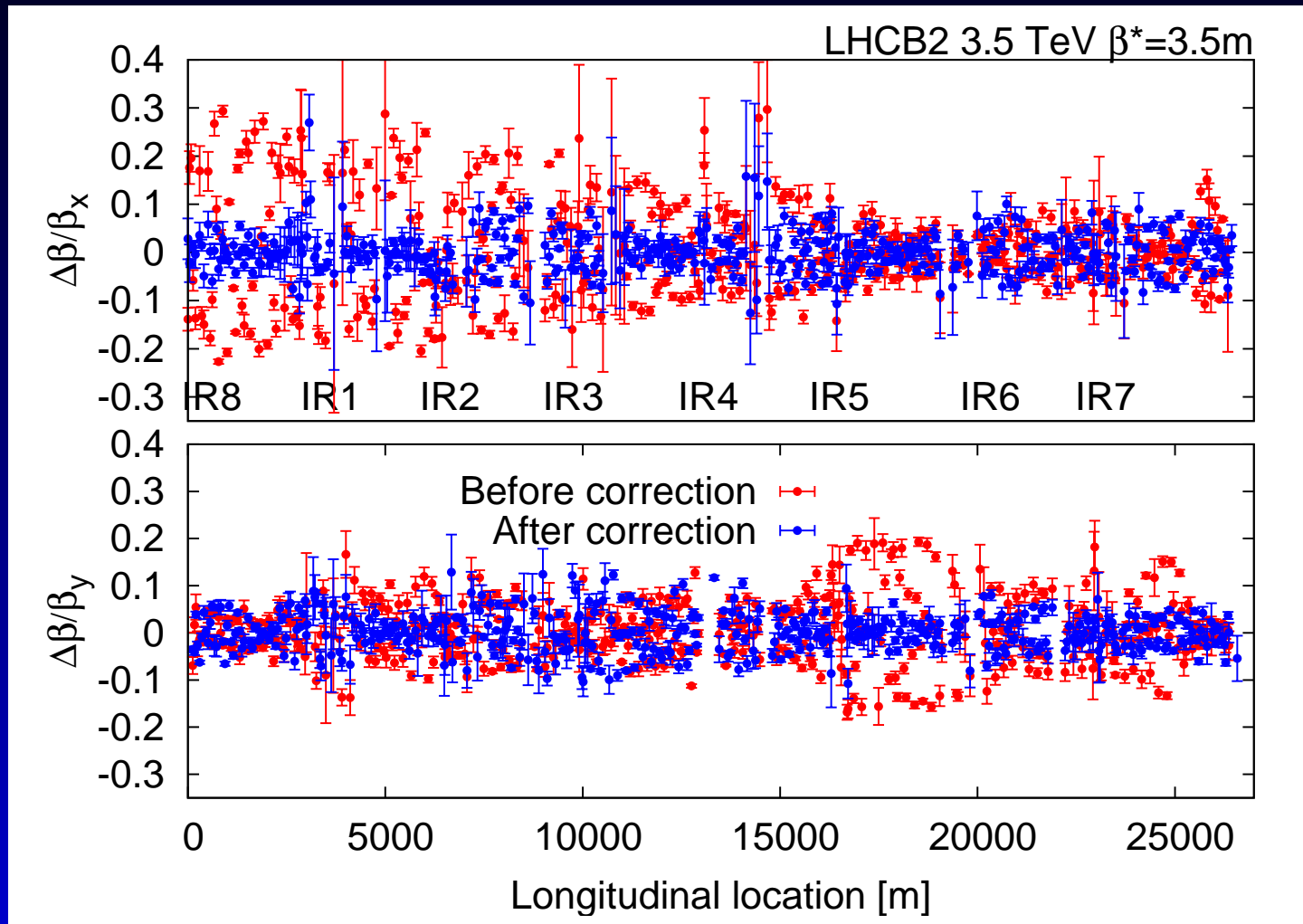 Now we understand irreproducibility @ β^*=2m!!

Then...

- IR errors are still locally corrected

- Remaining errors must be distributed. β-beating from dipole b_2 error and correction known to be $\approx 10\%$ in B2H.

- Global correction is the only way to further reduce β-beating.
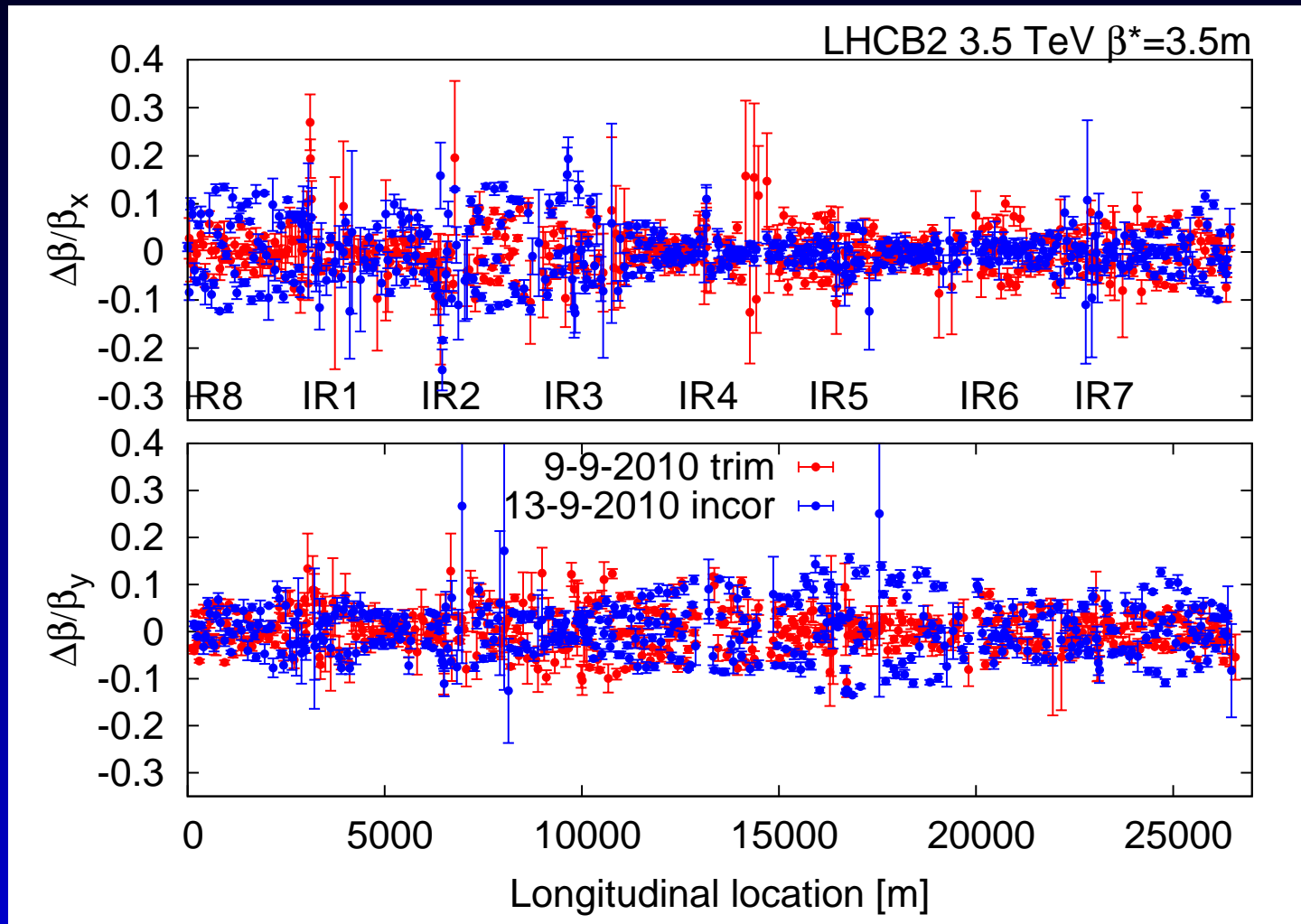
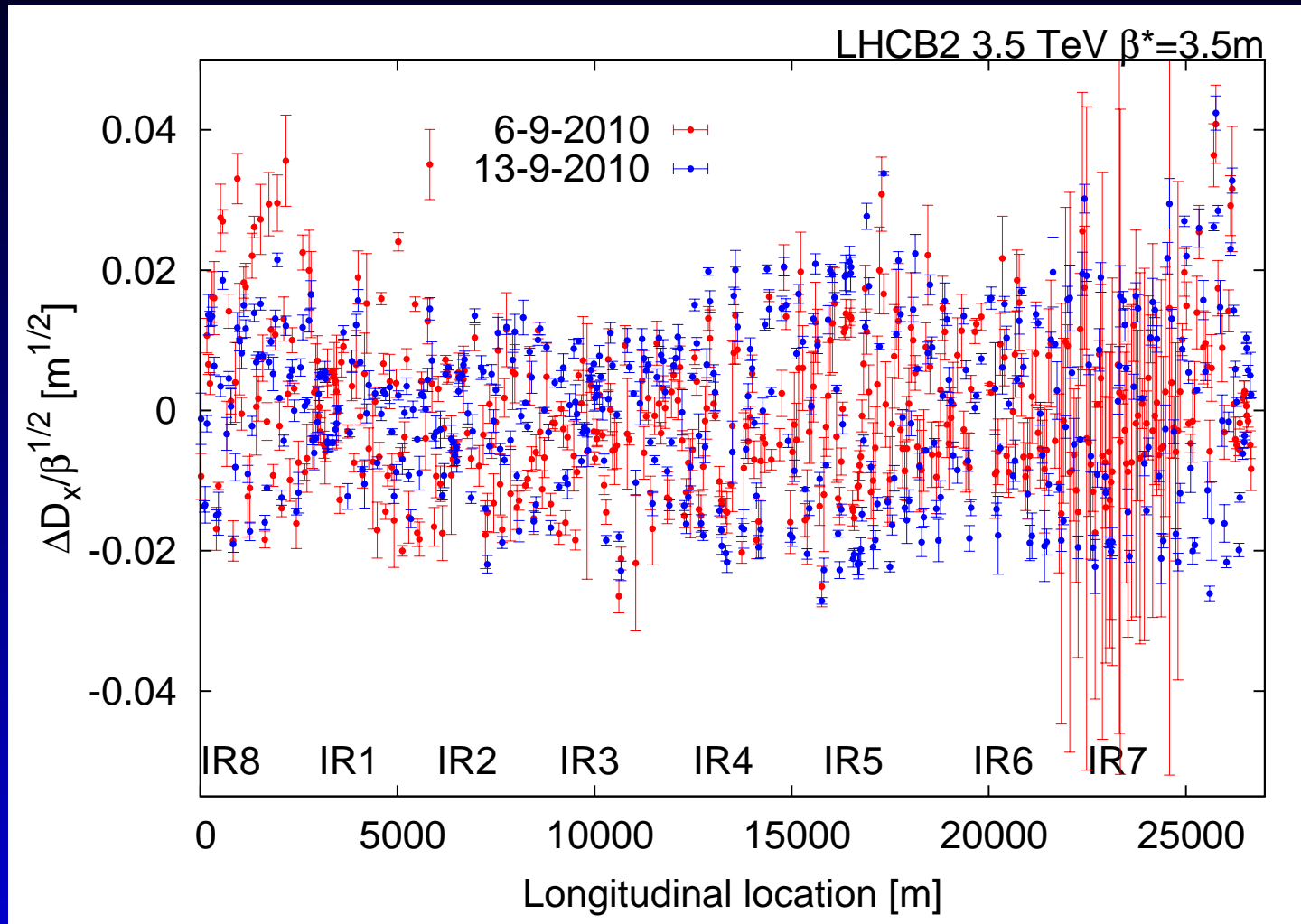# Global correction, Beam 2

Global correction (trimmed), Beam 2

10% excellent! but we need to check with new ramp.
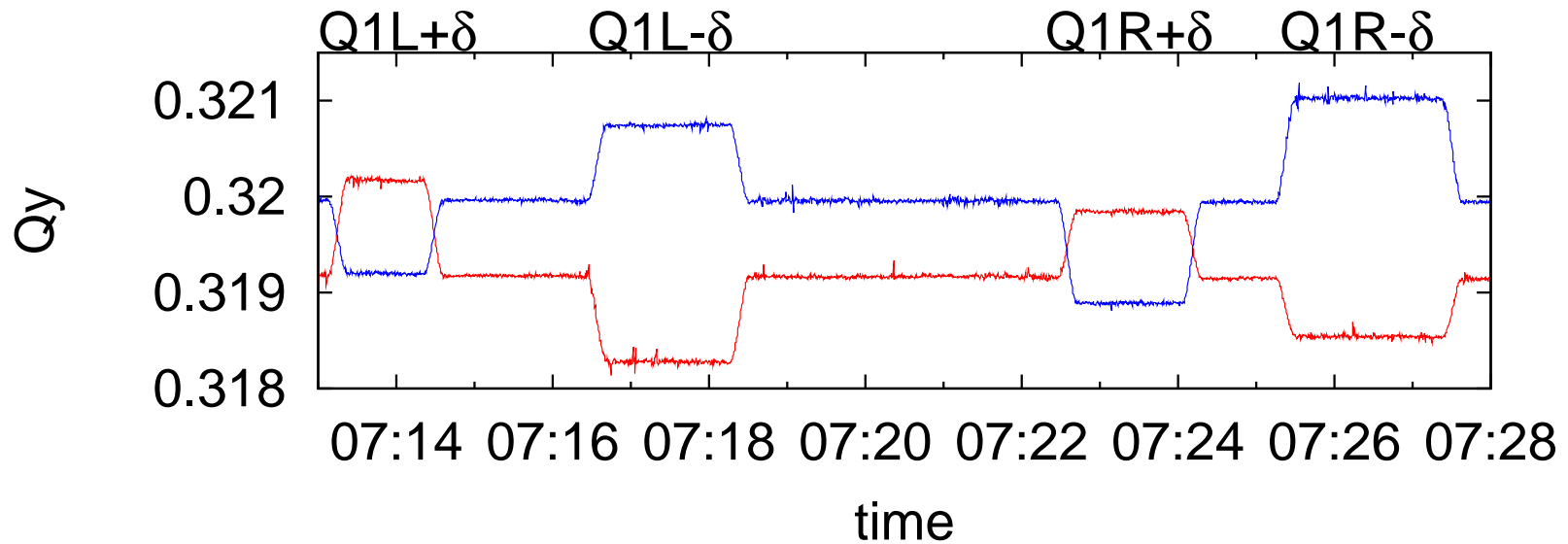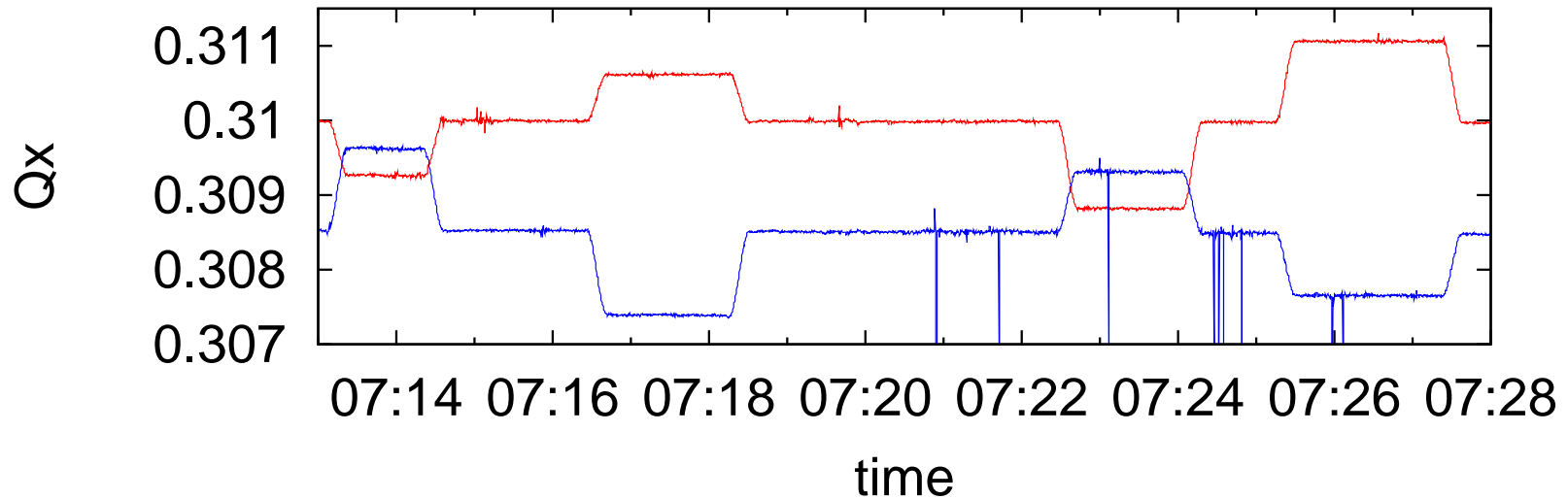
Global correction (incorporated), Beam 2
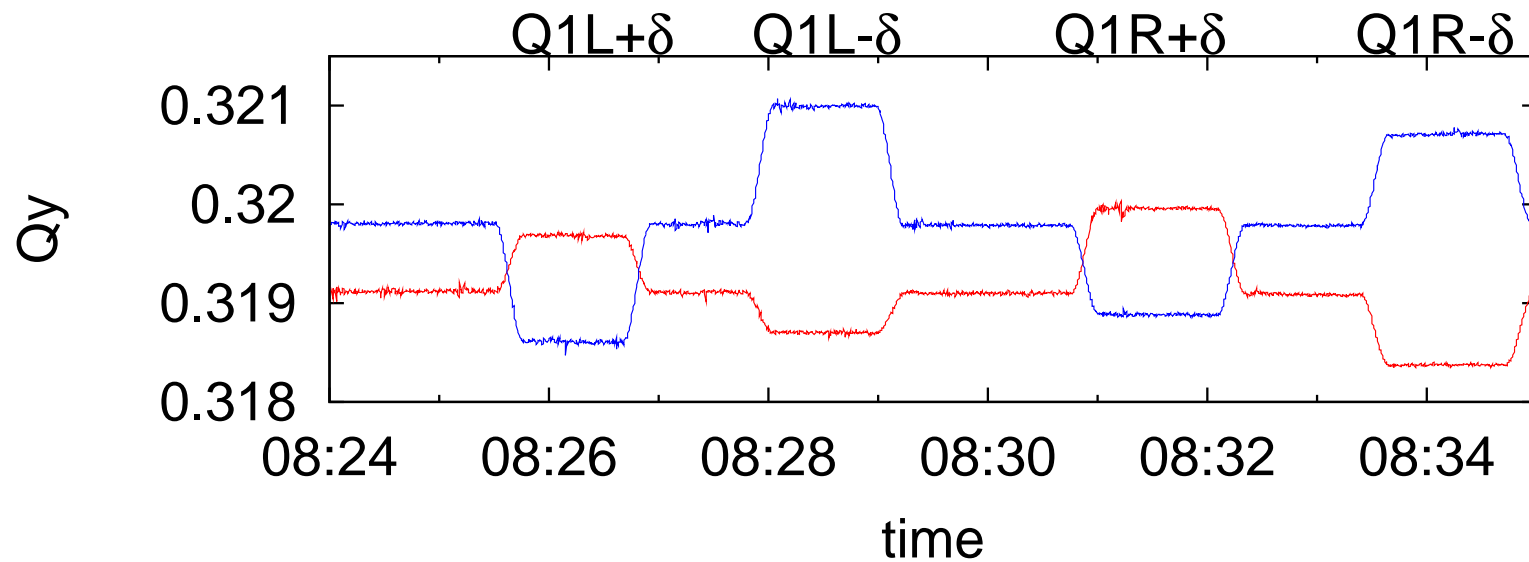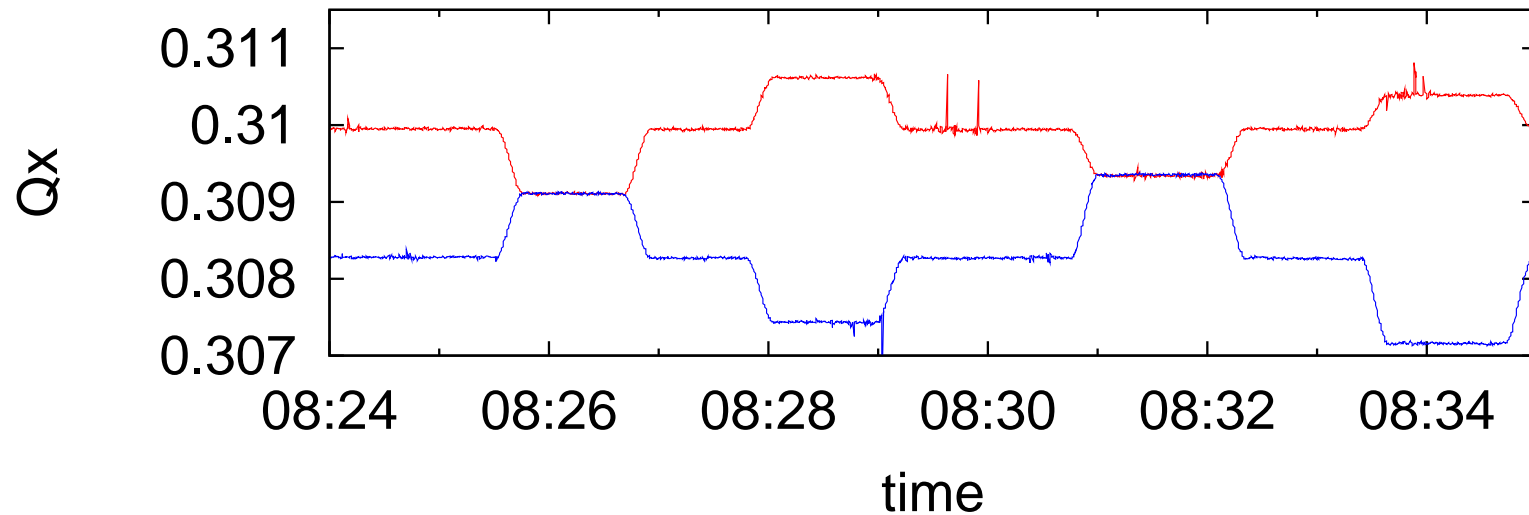

indeed ≈15%.

Normalized dispersion, Beam 2

Normalized dispersion changed and remains closely below specification 0.045 $\sqrt{\mathrm{m}}$.

K-modulation, IP1 Q1s

K-modulation, IP8 Q1s

β^* from K-modulation & ac dipole (4 Sep)

	β_x^1	err	β_y^1	err	β_x^2	err	β_y^2	err
IP1	3.6	0.1	3.7	0.1	3.8	0.1	4.2	0.1
IP2	3.4	0.1	3.3	0.1	3.7	0.1	3.5	0.1
IP5	3.8	0.1	3.7	0.1	3.8	0.1	3.7	0.1
IP8	3.6	0.1	3.4	0.1	5.5	0.1	5.5	0.1

from ac dipole

IP1	3.9	0.1	3.8	0.6	3.4	0.7	3.8	0.2
IP2	3.5	0.2	3.5	0.1	3.8	0.4	3.6	0.1
IP5	3.7	0.1	3.4	0.1	3.7	0.1	3.8	0.1
IP8	3.3	0.1	3.6	0.1	3.7	0.1	3.4	0.1

Most cases relative agreements within 10%. Big discrepancy in Beam2 IP8! real??

Summary

- $\Delta\beta/\beta \approx 15\%$!

- We are learning a lot about LHC:
    - trim Vs incorporation differences
    - else LHC is very reproducible
    - global corrections with 100 quads work

- K-modulation confirms most of the β^* measurements with ac dipole but

- there is a huge discrepancy in beam 2 IR8 β^*

- could we re-measure?