

December 5, 2012

RAMP

OMC team

Propagated  
Betas for  
BWS.5L4.B2

Beta-beat of  
propagated  
betas.

IP4 errors.

## Optics in the Ramp (Beam2).

E.H. Maclean

*Note: this talk complements the presentation by A.Langner on the Beam 1 measurements.*

**1** Propagated Betas for BWS.5L4.B2

**2** Beta-beat of propagated betas.

**3** IP4 errors.

# Propagated $\beta_{x,y}$ at BWS.5L4.B2

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- Results of Segment-by-segment (SbS) propagation to BWS of 2012 MD#3 measured betas during ramp.
- Several cuts on the error of measured betas (@ BPMs) were tried. Selected cuts are in green.

- Nominal model betas (inj') at BWS are: **123.78, 404.72** [m] in x and y planes respectively.

Energy [TeV]	Propagated $\beta_x$ [m] for cuts on BPM error				
	5%	10%	12%	15%	20%
1.29	112.84 ± 0.51	107.93 ± 0.51	107.93 ± 0.51	107.93 ± 0.51	107.05 ± 98.42
2.01	132.08 ± 0.19	129.03 ± 0.19	129.03 ± 0.19	129.03 ± 0.19	157.77 ± 0.19
2.62	121.12 ± 4.94	116.71 ± 11.83	111.96 ± 16.81	111.96 ± 16.81	111.96 ± 16.81
3.66	125.33 ± 4.61	125.33 ± 4.61	125.33 ± 4.61	125.33 ± 4.61	125.33 ± 4.61

Energy [TeV]	Propagated $\beta_y$ [m] for cuts on BPM error				
	5%	10%	12%	15%	20%
1.29	441.61 ± 49.29	448.77 ± 49.29	448.77 ± 49.29	448.77 ± 49.29	543.39 ± 35.69
2.01	440.11 ± 86.6	440.61 ± 86.6	440.61 ± 86.6	440.61 ± 86.6	441.21 ± 86.6
2.62	450.18 ± 5.75	425.38 ± 5.06	426.77 ± 4.72	426.77 ± 4.72	426.77 ± 4.72
3.66	457.75 ± 20.52	457.75 ± 20.52	457.75 ± 20.52	457.75 ± 20.52	457.75 ± 20.52

# Beta-beat of propagated elements: 1.29 TeV

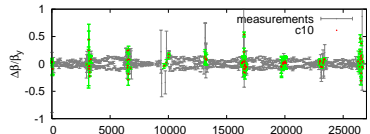
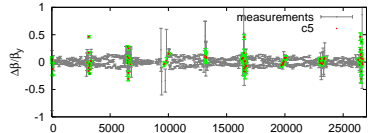
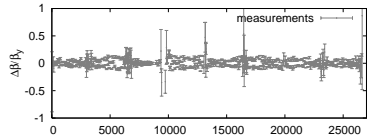
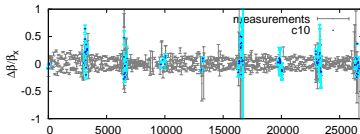
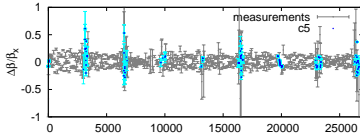
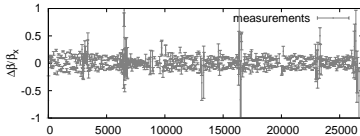
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# Beta-beat of propagated elements: 1.29 TeV

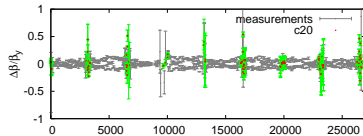
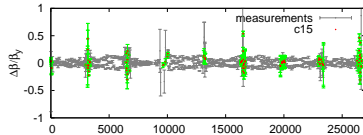
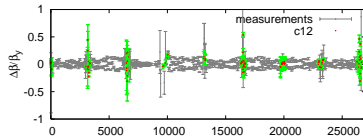
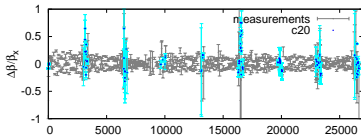
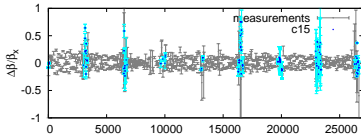
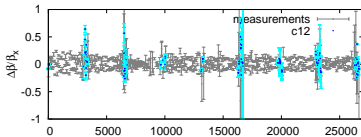
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# Beta-beat of propagated elements: 1.29 TeV

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Similar plots for all energies are found:

[/afs/cern.ch/eng/sl/lintrack/LHC\\_commissioning2012/EXP\\_12-10-12\\_RampOptics+IRnonlinearity+ChromCoupl/Beam2/sbs\\_RAMP/](/afs/cern.ch/eng/sl/lintrack/LHC_commissioning2012/EXP_12-10-12_RampOptics+IRnonlinearity+ChromCoupl/Beam2/sbs_RAMP/)

# Beta-beat from MQY calibration

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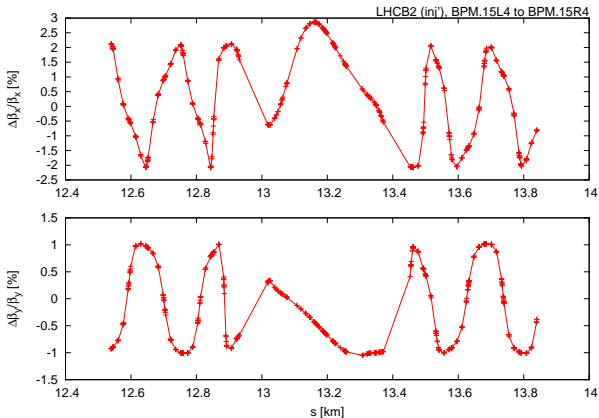
Beta-beat of  
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IP4 errors.

Beta-beating generated in nominal model by MQY errors in IP4:

$$kq5.r4b2 = kq5.r4b2 - 4.731297333e-06 ;$$

$$kq6.l4b2 = kq6.l4b2 - 3.345196126e-05 ;$$



- MQY calibration represents  $\sim 3\%$  effect for beam 2.
- Can be considered as an additional error on values quoted on first slide.
- These errors can be included in the propagation, but we've not had time yet!

# Summary

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- Propagated betas (and error) can be sensitive to measurements used for the propagation.
- Try to select an appropriate cut on measured beta  
→ look globally at beta-beat, propagated error, and stability of result between cuts.
- For BWS 2.01[TeV] betas look a bit dubious, error of 0.19m seems an underestimate in this case.
- MQY callibration also represents additional  $\sim 3\%$  uncertainty on propagated beta in IP4.  
→ shall include these errors in the propagation to see how result changes.



# Beta-beat of propagated elements: 1.29 TeV

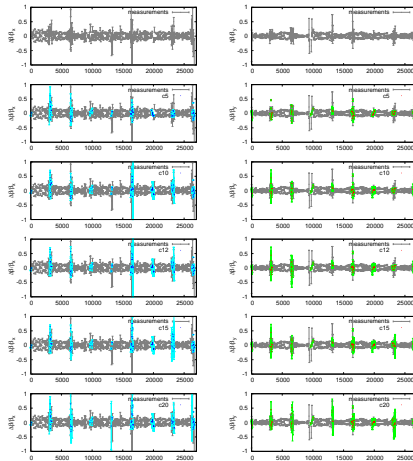
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# Beta-beat of propagated elements: 2.01 TeV

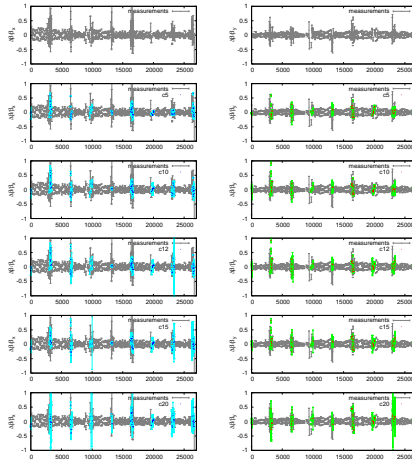
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IP4 errors.



# Beta-beat of propagated elements: 2.62 TeV

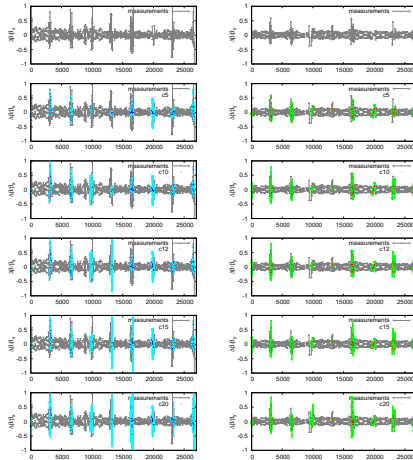
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# Beta-beat of propagated elements: 3.66 TeV

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