TDI impedance MD

V. Baglin, H. Bartosik, C. Bracco, J. Esteban Mueller, E. Métral,
N. Mounet, G. Papotti, S. Redaelli, B. Salvant, J. Uythoven

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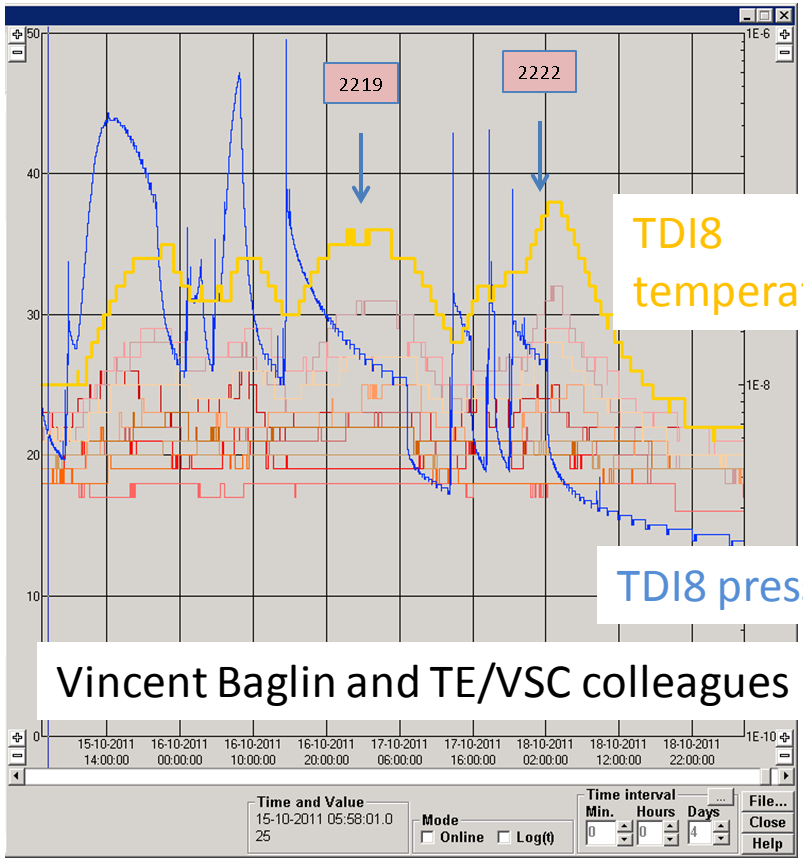
A. Grudiev, B. Goddard, G. Lanza, T. Mastoridis, E. Shaposhnikova,
R. Steinhagen, M. Timmins

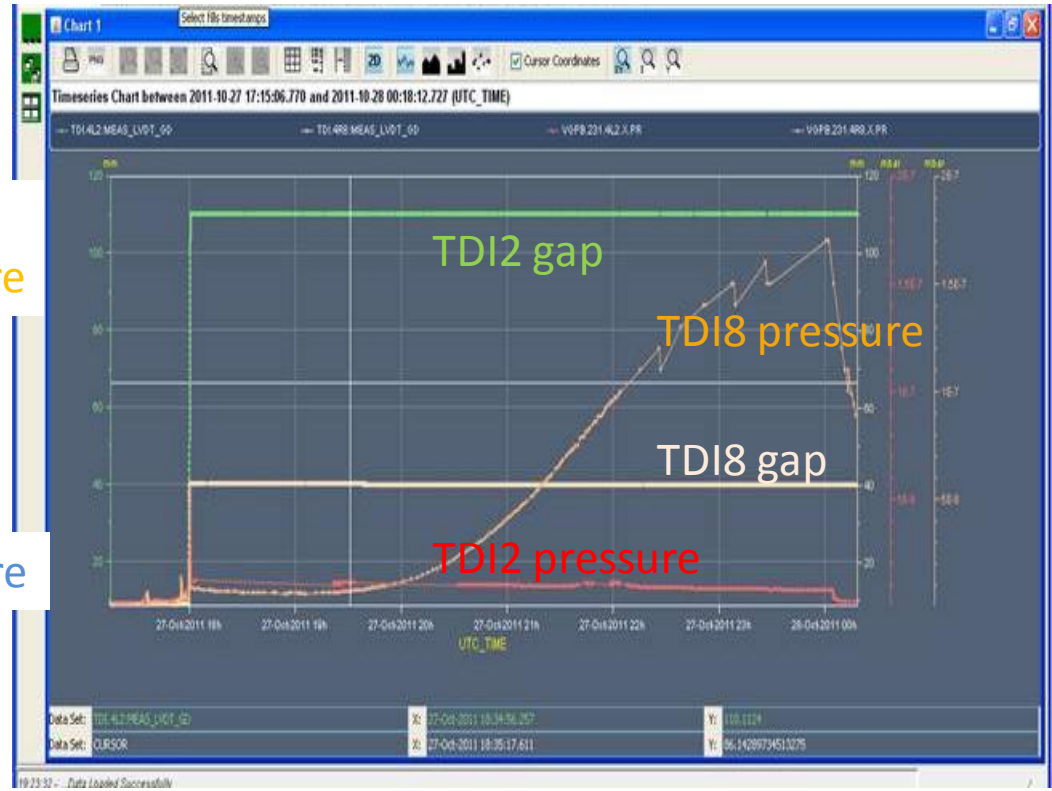
Preliminary conclusions

- Very good beam conditions. Thanks to everyone!
- Clean measurements of B1 and B2 tune shifts with changing TDI gap for single bunch
- Not much could be seen with physics beam
- Total effective vertical impedances of TDI.2 and TDI.8 are very similar and there could be signs of degradation since last year.
- It seems that it is confirmed that the corresponding total effective vertical impedance is larger than predictions
- Phase error shift with TDI jaw movement was recorded and longitudinal impedance could be inferred (J. E. Mueller)

Context

- Pressure and temperature increase in both TDIs during physics fills → beam induced





Increasing the gap of the TDI from +/-20mm to +/-55mm from fill 2219 damped the pressure increase, but not the temperature increase.

Decreasing the gap on B2 back to +/-20mm for fill 2261 generated pressure again. Clear correlation with the gap.

- For the last fills, TDI gap was put to +/-37.5mm for B2 but no significant difference with +/-55mm was observed

Objectives

- Since most of heating and pressure issues had been dealt with during physics fills, it was decided to concentrate on TDI impedance measurements.

- Previous TDI measurements had been performed last year (see here and here), but the noise levels were very high. TDI+TCLIs impedance was larger than expected (a factor 2 to 3)

- Degradation of the pressure during the year could also be explained by degradation of the 3 micron Ti coating on the hBN blocks.

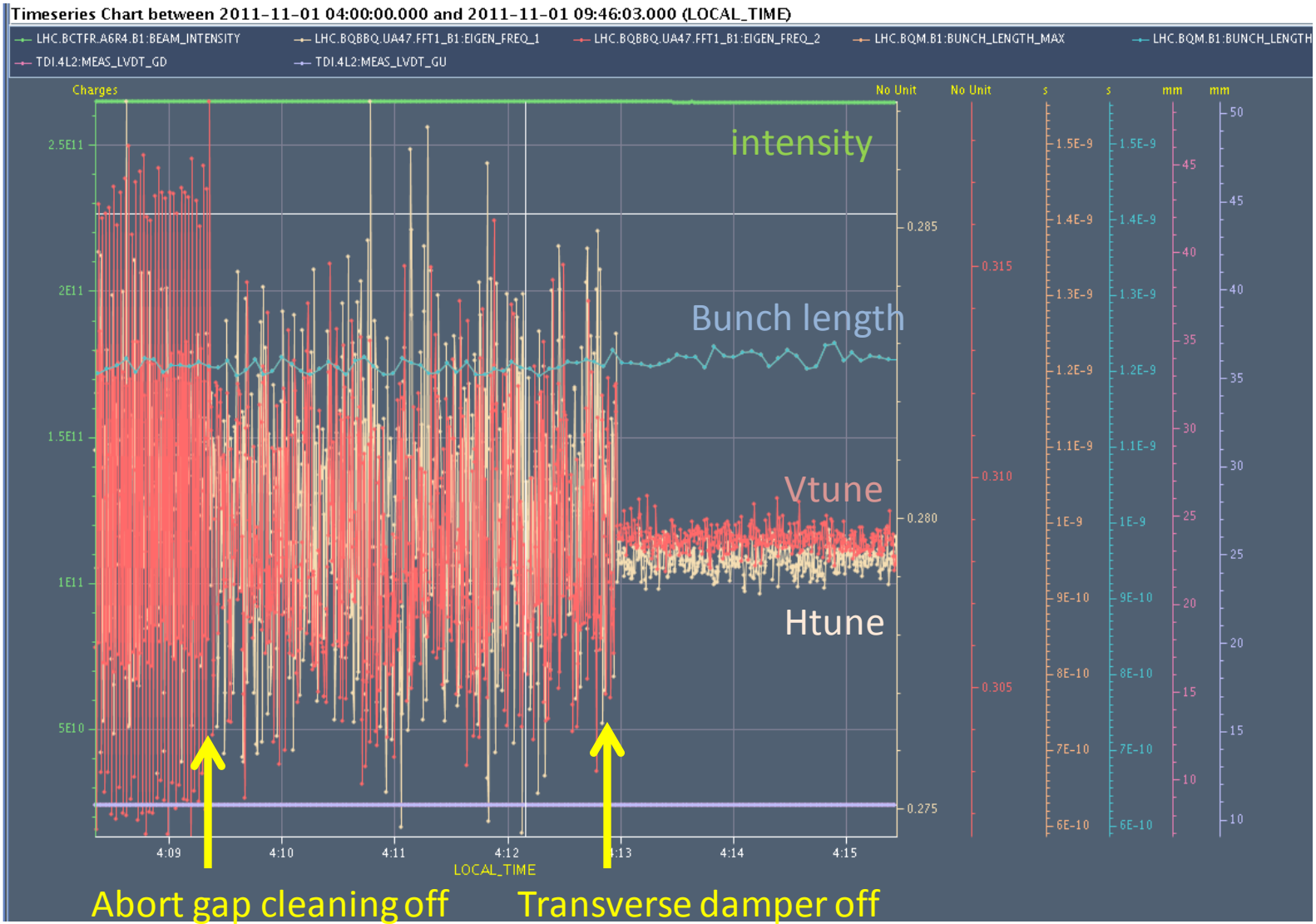
→ Measure the TDI impedance alone with more accuracy

→ Compare with available predictions

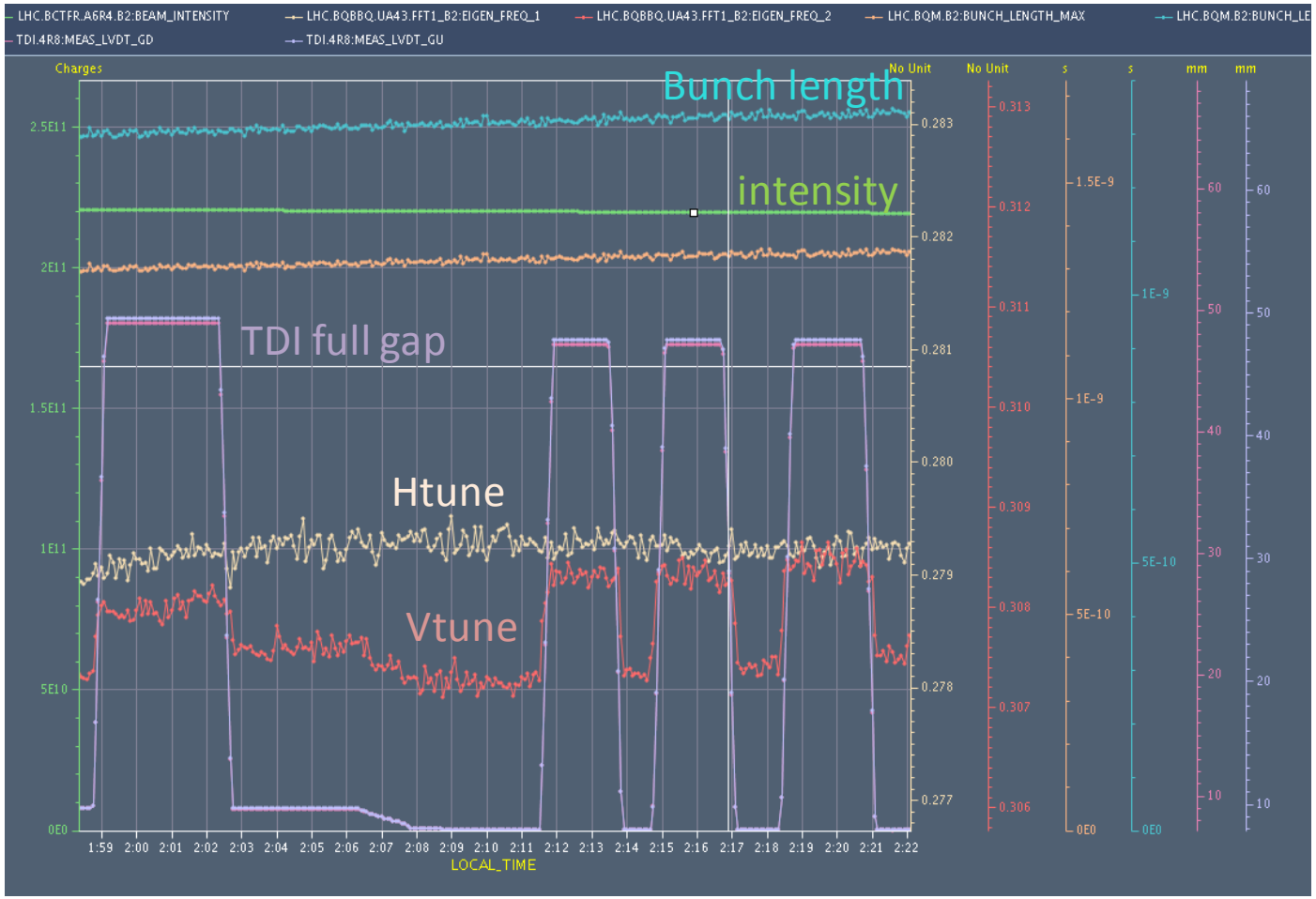
→ Has the impedance gone worse?

Methods to improve the signal:

- Reducing the noise by switching off dampers and abort gap cleaning
- Increasing intensity to 2.6e11 p/b (by the way bunch is stable with Q'y~4)

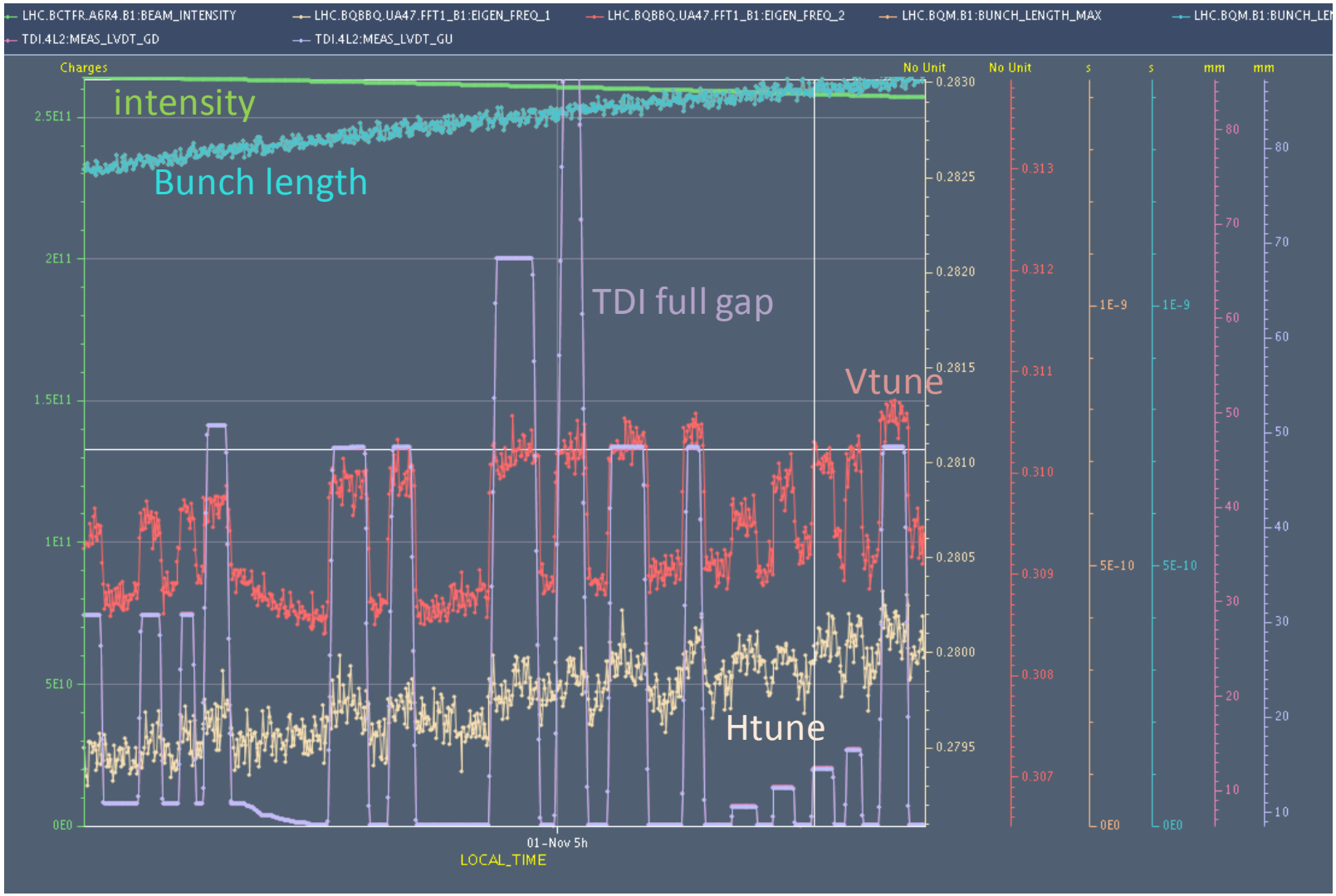


MD results with single bunch B2



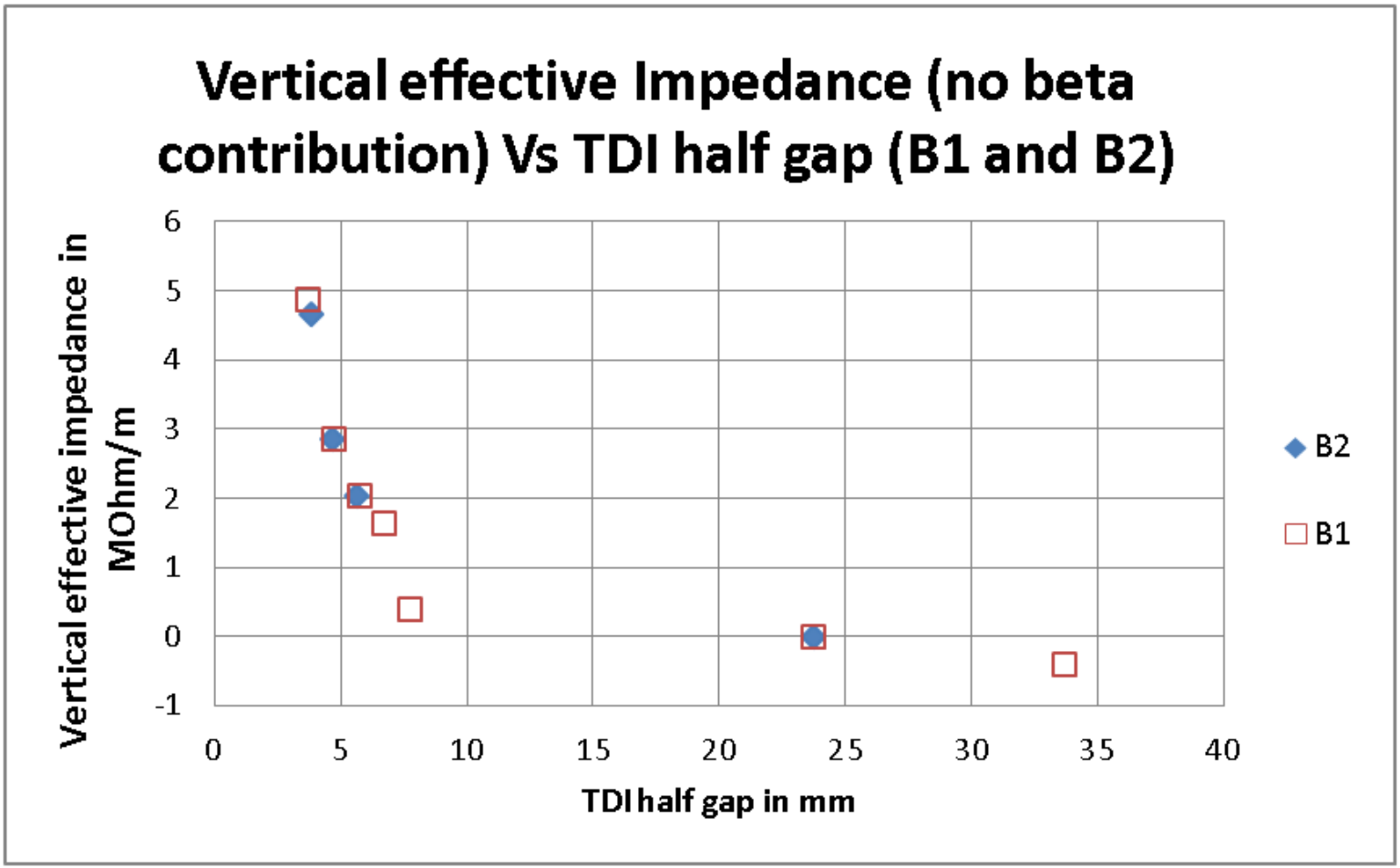
Clean vertical tune change. No horizontal tune change observed.

MD results with single bunch B1

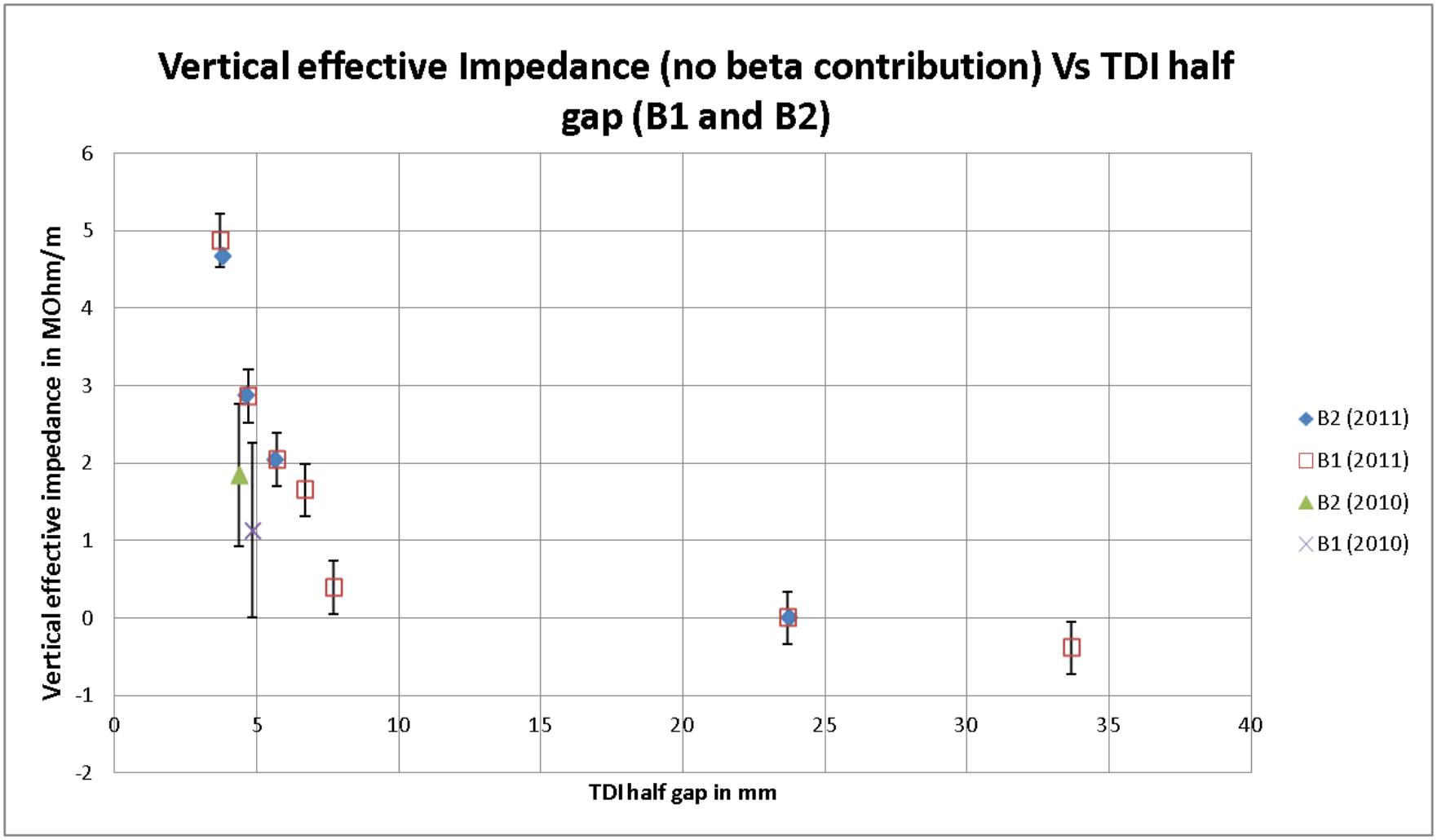


Clean vertical tune change. Small horizontal tune change also observed.

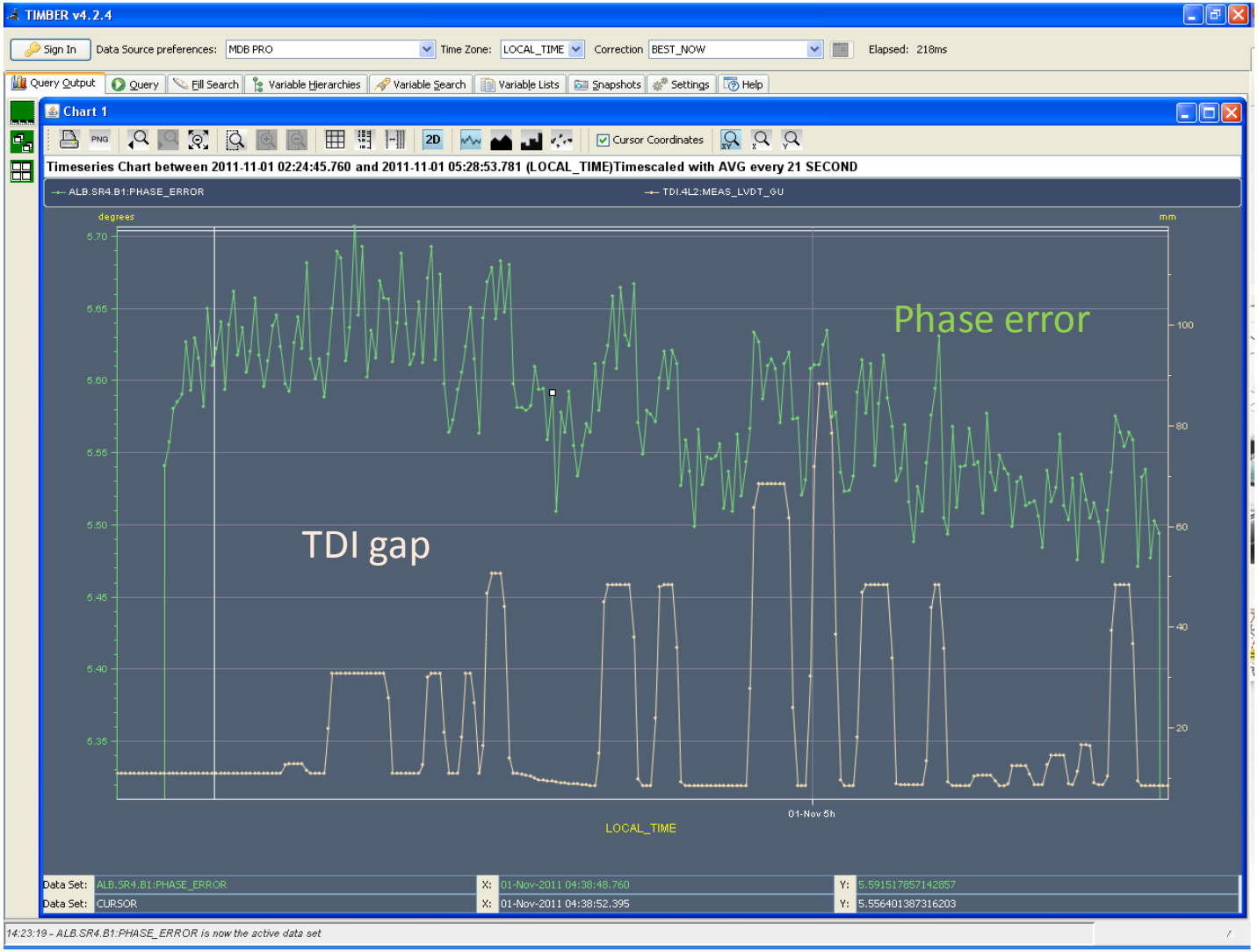
Total effective impedance for B1 and B2



Comparison with 2010 measurements



To be compared with phase error measurements (J. Esteban Mueller and E. Shaposhnikova)



Possibility to also compute energy loss and longitudinal impedance due to the TDI gap change

Measurement Vs predictions for transverse impedance?

TDI half gap (mm)	**Measured** total Zeff (MOhm/m)	**Theoretical** Resistive Wall total Zeff 3 layers flat chamber (MOhm/m) Coating=3mic	**Theoretical** Resistive Wall total Zeff 3 layers flat chamber (MOhm/m) Coating=1mic	**Theoretical** Resistive wall total Zeff 2 layer round chamber (MOhm/m) No coating	**Simulated** geometrical Zeff (dipolar) with ferrite (MOhm/m)
3.7	4.9	0.53	1.5	7.4	0.84
4.7	2.9	0.26		4.6	
5.7	2.0	0.15		3.1	
6.7	1.6	0.09			
50	reference	0.0001			~0

- The measurements are probably larger than expectations by a factor 3 to 4 at 3.7 mm half gap
- Coating degraded?

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To do next

- Use overinjection as the pilot is generating noise
- Use different bunch lengths (as suggested by Elena S.)
- Temperature sensors will be taken out. Do we need some sensors closer to the jaw?
- Opening the TDI to check the Ti coating?

TIMBER v4.2.4

Sign In | Data Source preferences: LDB PRO | Time Zone: LOCAL_TIME | Correction BEST_NOW | Elapsed: 656ms

Query Output | Query | Fill Search | Variable Hierarchies | Variable Search | Variable Lists | Snapshots | Settings | Help

Chart 1

PNG | 2D | Cursor Coordinates

Timeseries Chart between 2011-09-14 00:48:00.000 and 2011-10-30 00:48:00.000 (LOCAL_TIME)Timescaled with MAX every 1 HOUR

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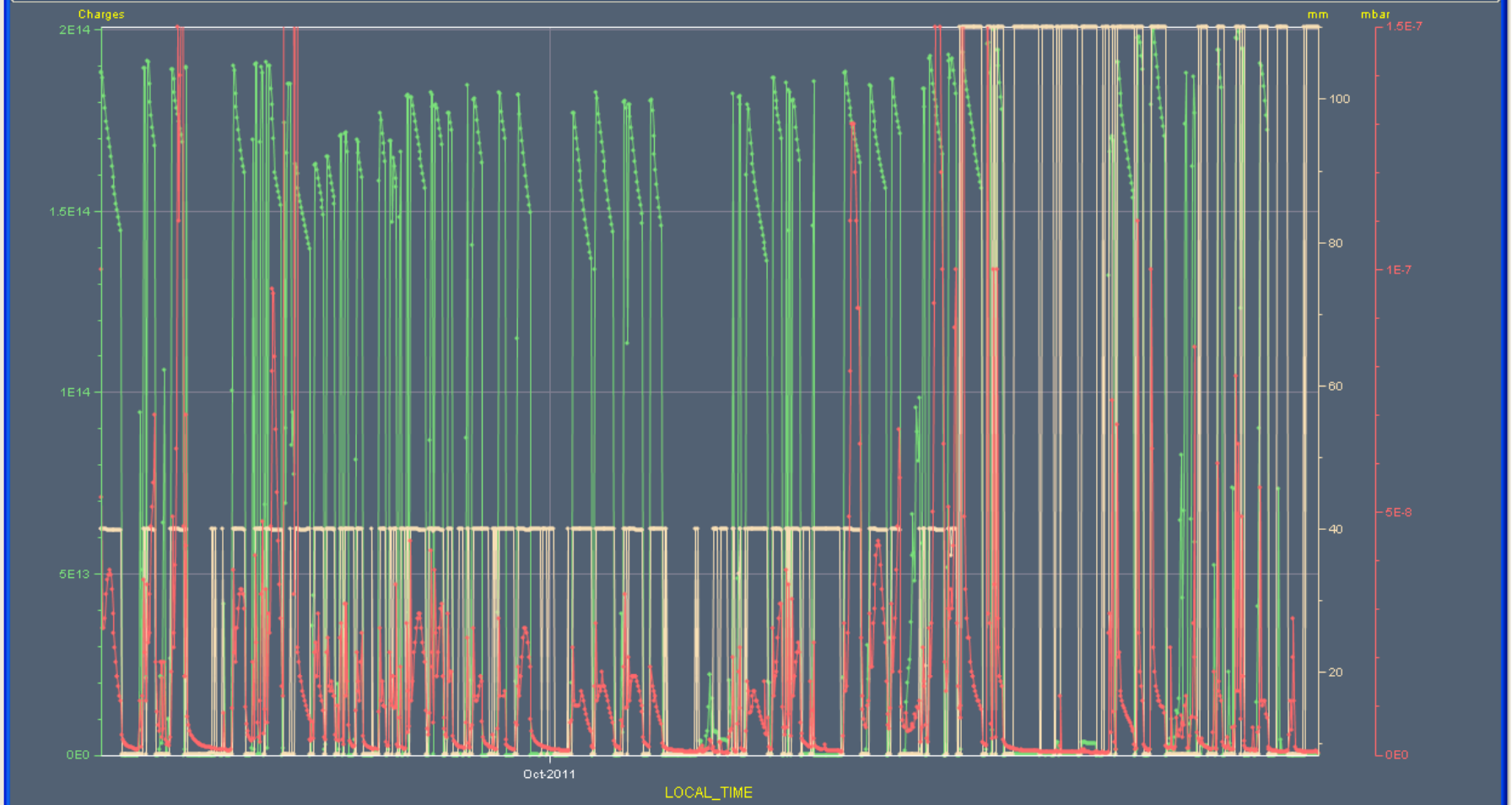
VGPB.231.4L2.X.PR



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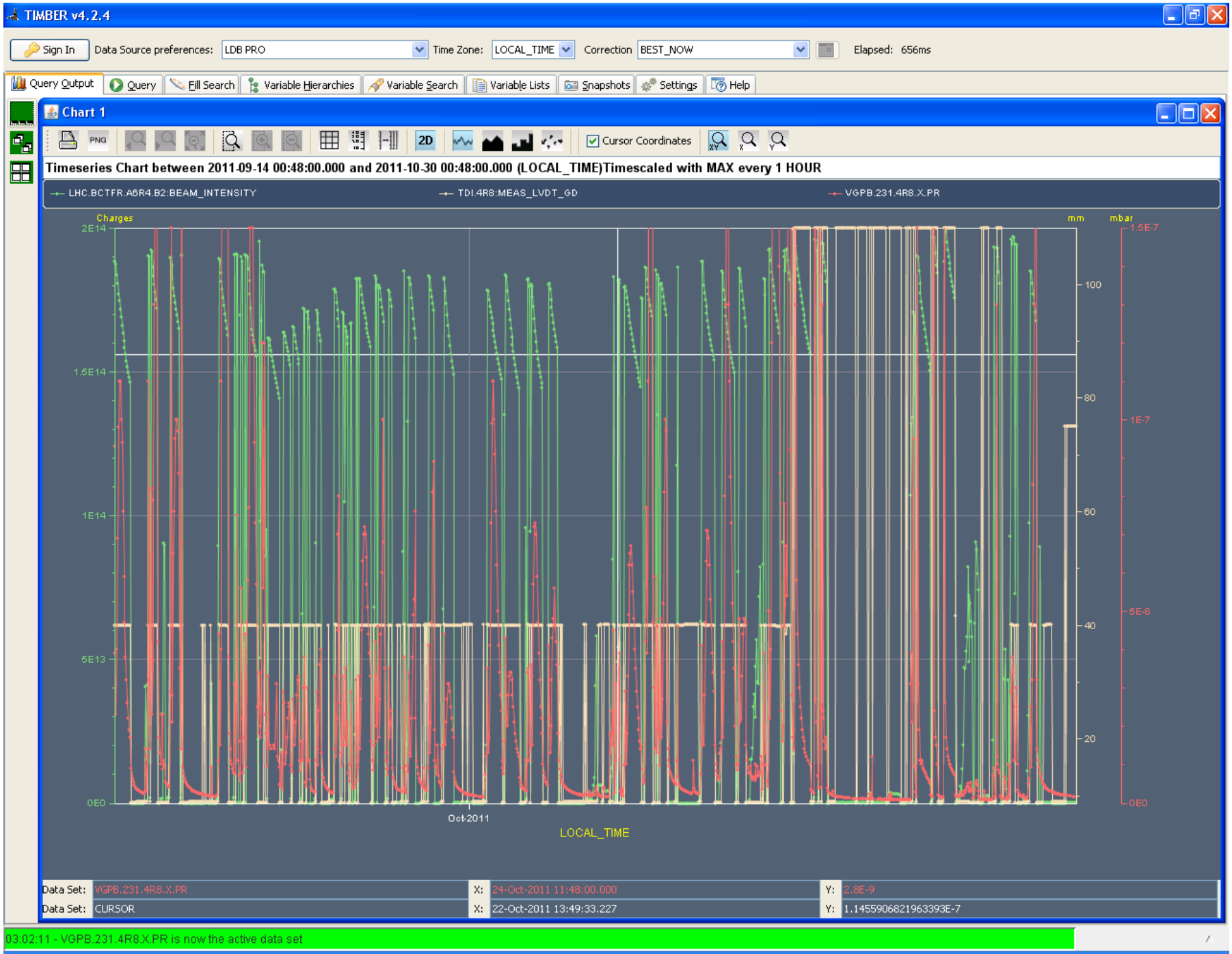
TIMBER v4.2.4
Sign In
Data Source preferences:
LDB PRO
Time Zone:
LOCAL_TIME
Correction
BEST_NOW
Elapsed: 656ms
Query Output
Query
Fill Search
Variable Hierarchies
Variable Search
Variable Lists
Snapshots
Settings
Help
Chart 1
PNG
2D
Cursor Coordinates
Timeseries Chart between 2011-09-14 00:48:00.000 and 2011-10-30 00:48:00.000 (LOCAL_TIME)Timescaled with MAX every 1 HOUR
LHC.BCTFR.A6R4.B2:BEAM_INTENSITY
TDI.4R8:MEAS_LVDT_GD
VGPB.231.4R8.X.PR
Charges
2E14
1.5E14
1E14
5E13
0E0
mm
100
80
60
40
20
mbar
1.5E-7
1E-7
5E-8
0E0
Oct-2011
LOCAL_TIME
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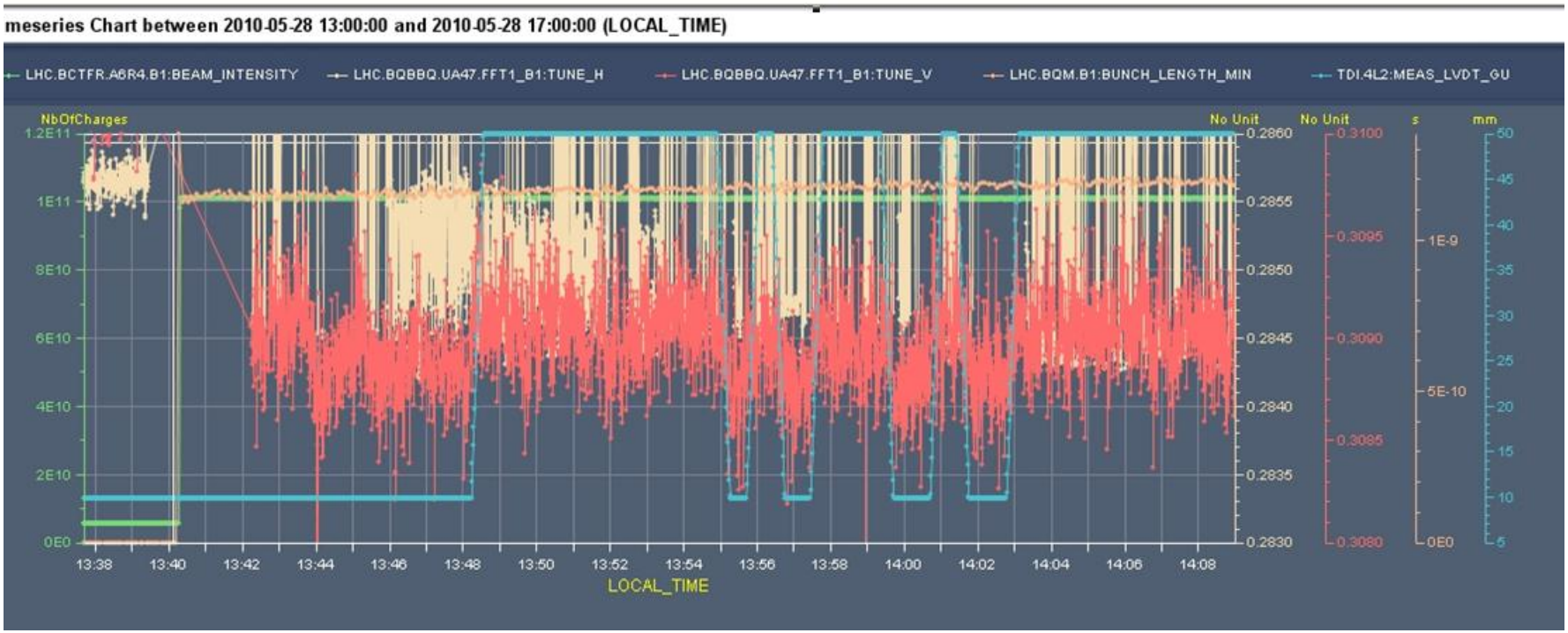
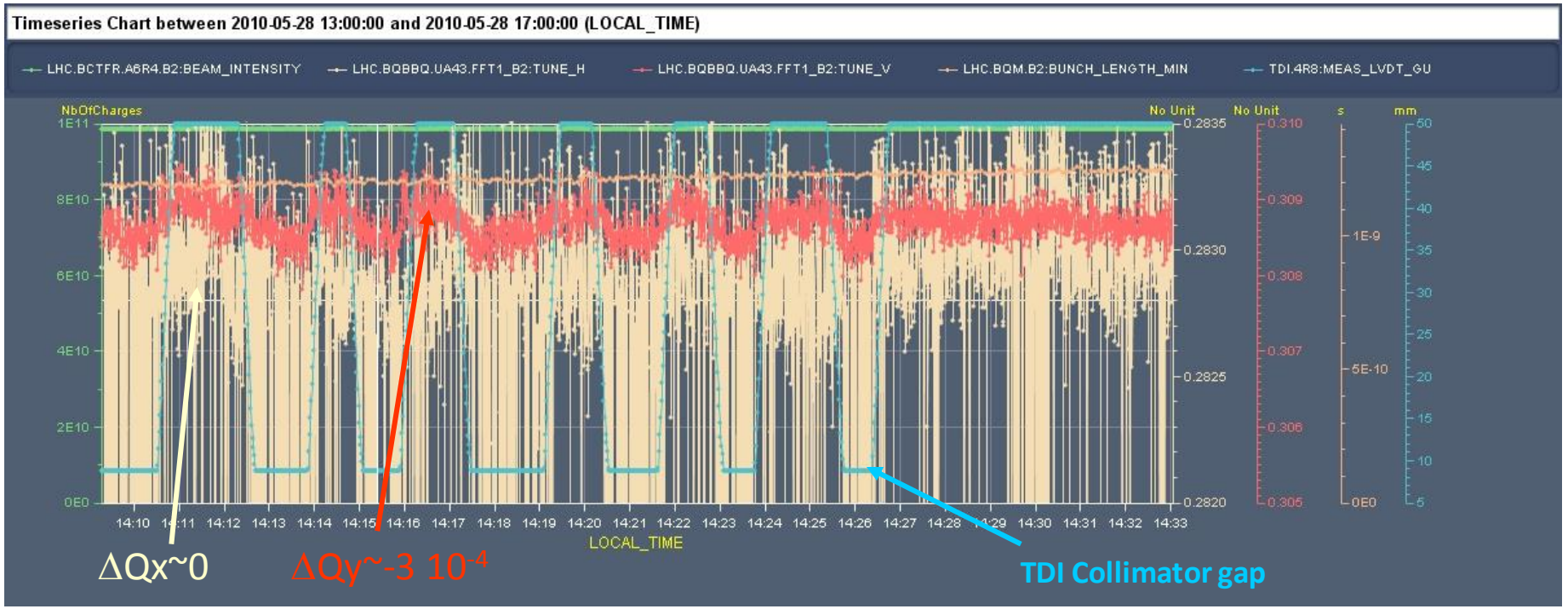
B1: Moving injection protection collimators



Moving TDI collimators from 5 sigma to 15 sigma leads to a tune increase of:

2e-4 in vertical plane (first guess)
? in horizontal plane (the tune jump to +1 sideband shadows the graph... to be filtered)

B2: effect on horizontal tune shift of moving injection protection collimators (TDI+TCLIs)



→ Correlation between the collimator gap and the vertical tune shift
→ The horizontal tune switches to another peak when collimators are in. To be investigated in more detail.

Tune shift due to injection protection collimators from B2 measurements: $\Delta Qy \sim -3\ 10^{-4}$ and $\Delta Qx \sim 0$

Coarse extrapolation from nominal model (only TDI): $\Delta Qy \sim -1.2\ 10^{-4}$ and $\Delta Qx \sim 0$