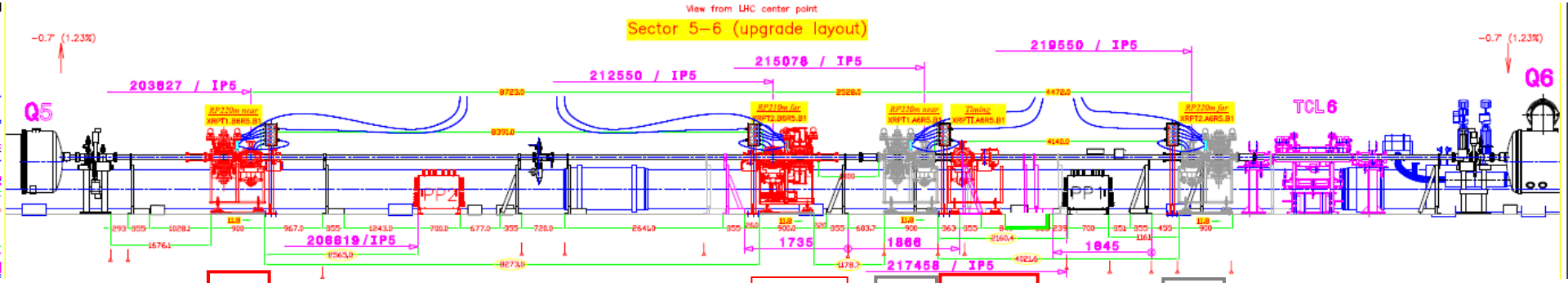
CT-PPS Roman Pot Insertions

M. Deile

MPP 04.09.2015



XRP.C6R5

XRP.D6R5 8°rotated unit

XRP.A6R5

XRP.E6R5 cylindrical pot

XRP.B6R5

Operation at low β* :
14 individual jaws (7 per sector)

Operation at high β*

Operations until End of August

3 July: Beam-based alignment of all 14 low-beta RPs in 1½ hours,
afterwards 45 minutes of diagnostic data taking in quiet beams with pots @ 6–8 σ

4 July: Loss maps with RPs in very conservative positions
~ 30 σ horizontally, ~ 20.5 σ vertically
still nominal TCL configuration: TCL5 in (i.e. intercepting all physics protons), TCL6 out

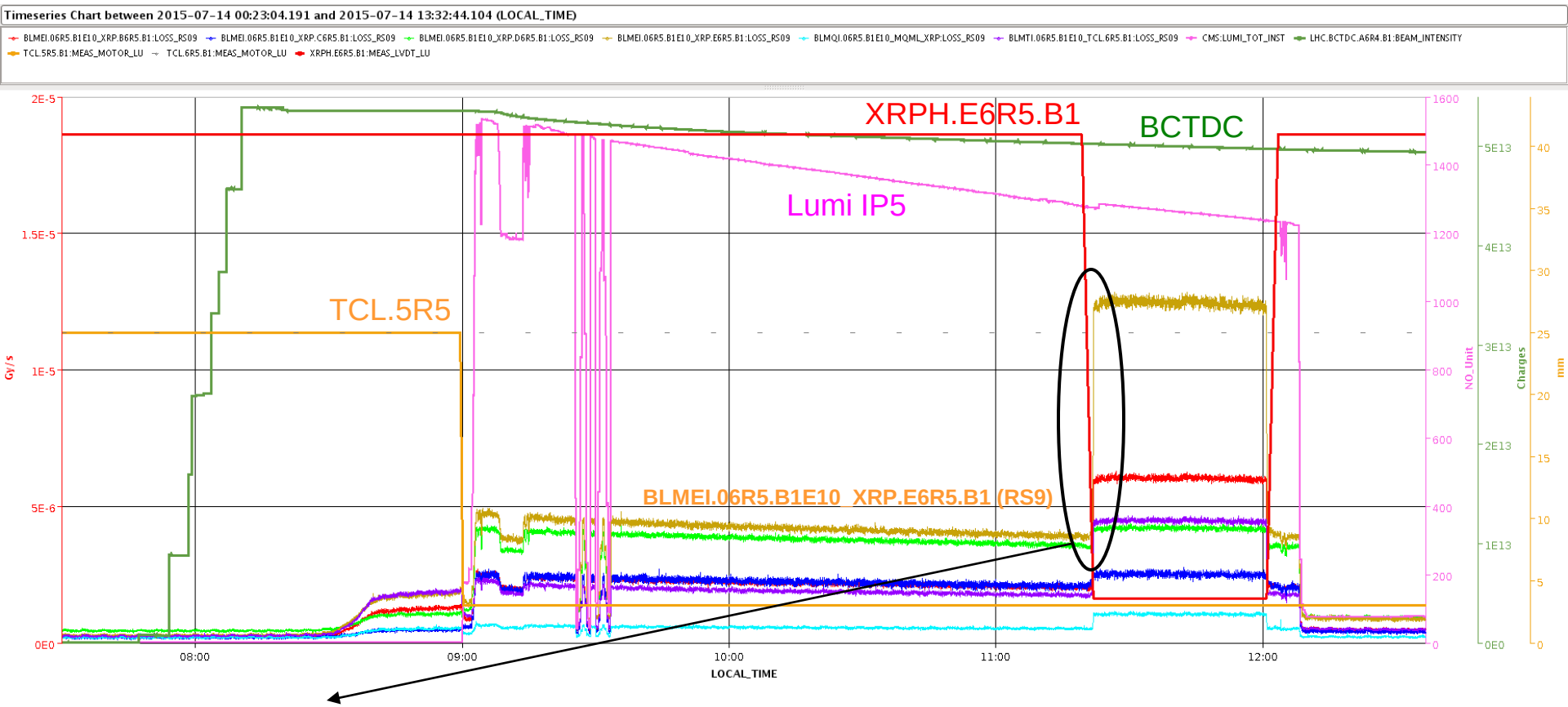
5 – 14 July: successful RP insertions in all intensity steps of 50 ns intensity ramp-up
3, 50, 152, 296, 476 bunches per beam → lumi up to 1.3 x 10^{33} cm^{-2} s^{-1}

12 August: New loss maps with RPs closer by 1 mm (without safety margin)
but agreed positions for 25ns ramp-up still with 0.5 mm safety margin:
~ 25 σ horizontally, ~ 19.5 σ vertically
final TCL configuration: TCL5 out (i.e. diffractive protons reach RPs), TCL6 @ 25 σ

13 – 21 August: successful RP insertions in first part of 25 ns intensity ramp-up
2, 86, 157, 219, 315 bunches per beam → lumi up to 0.7 x 10^{33} cm^{-2} s^{-1}
450 bunches: still missing (fills did not live long enough)

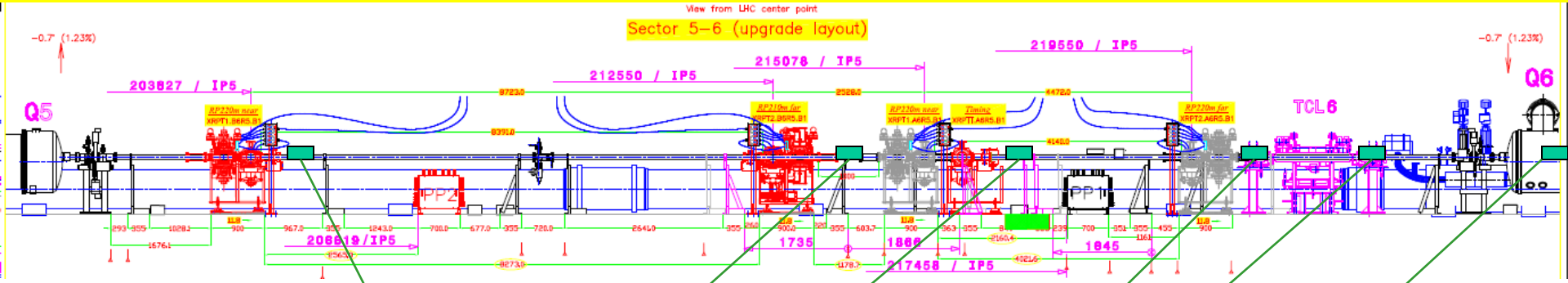
Example Insertion in 50ns Beam
(XRPH @ ~30 σ)

Fill 3996: 476 bunches, lumi @ insertion: 1.3 x 10^{33} cm^{-2} s^{-1}



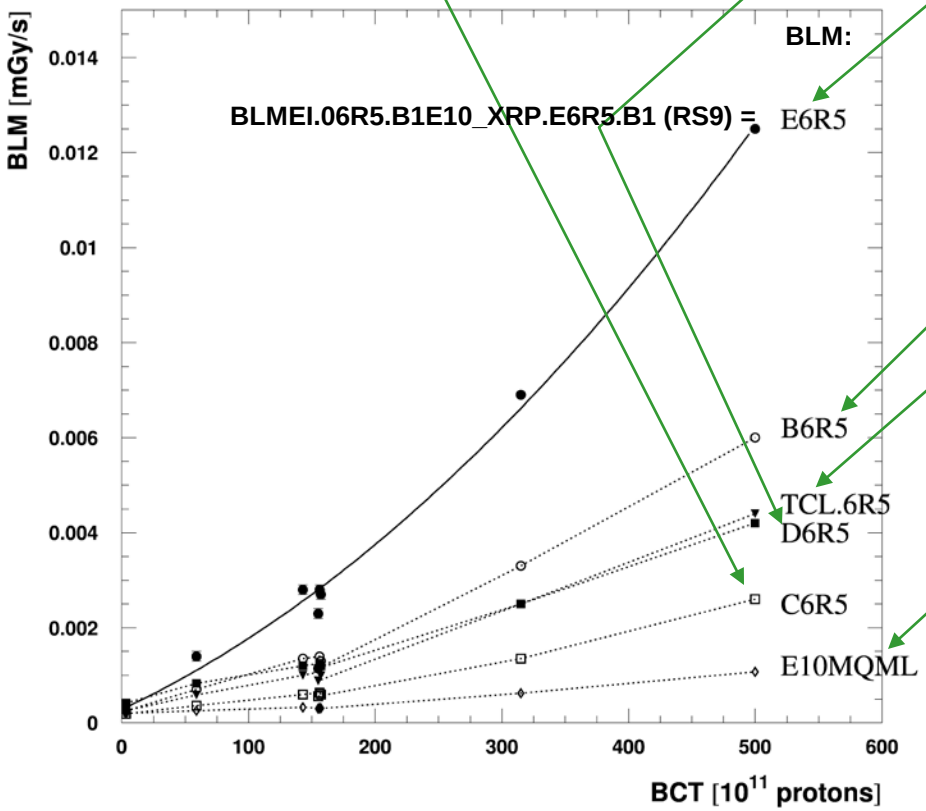
~ 1/3 of XRP BLM rate comes from TCL5 (or further upstream)

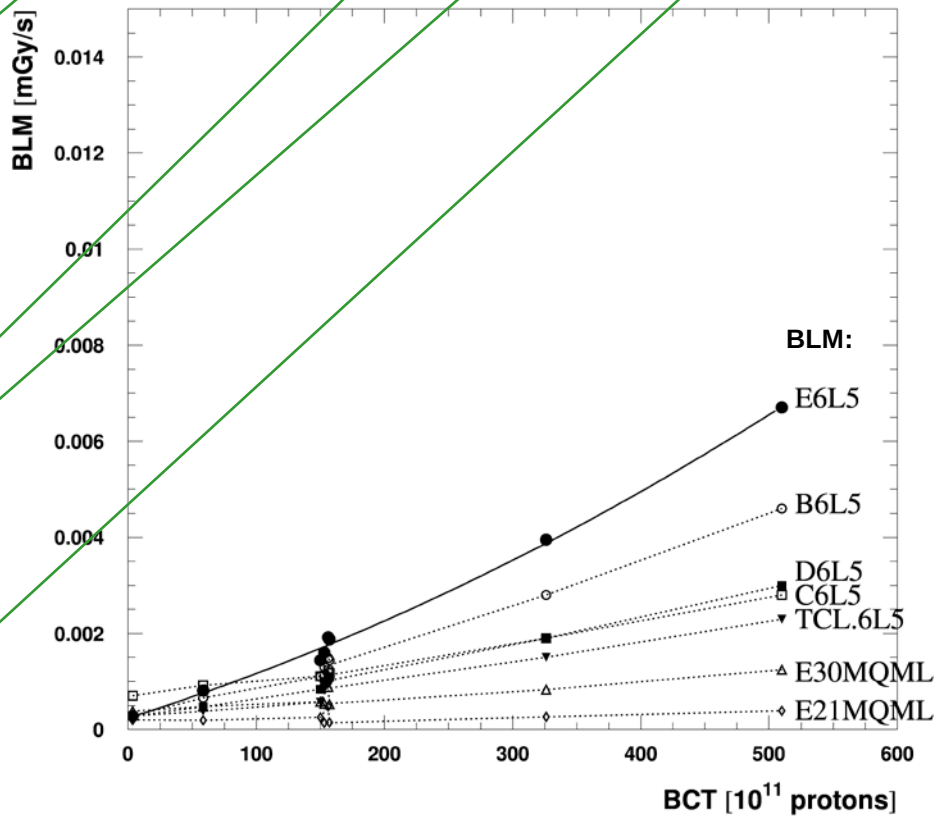
50 ns Intensity Ramp: XRPH @ ~30 σ



Beam 1, 50ns

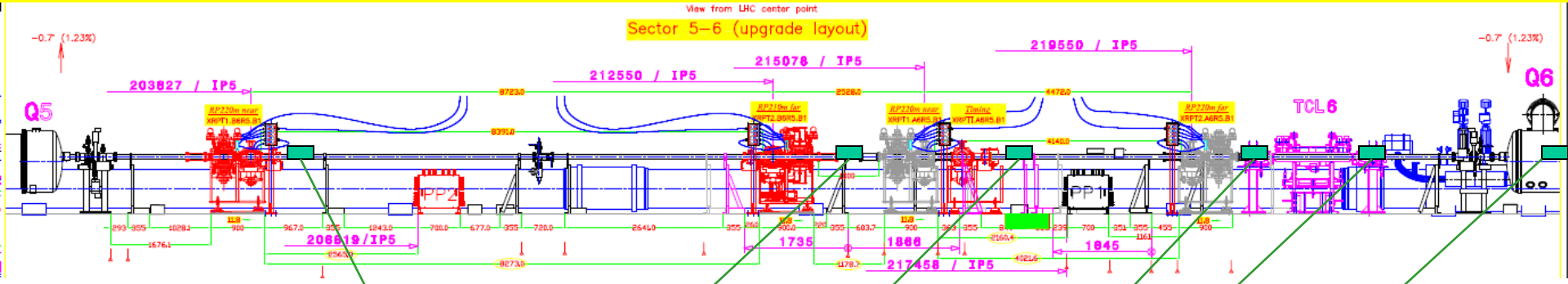
Beam 2, 50ns





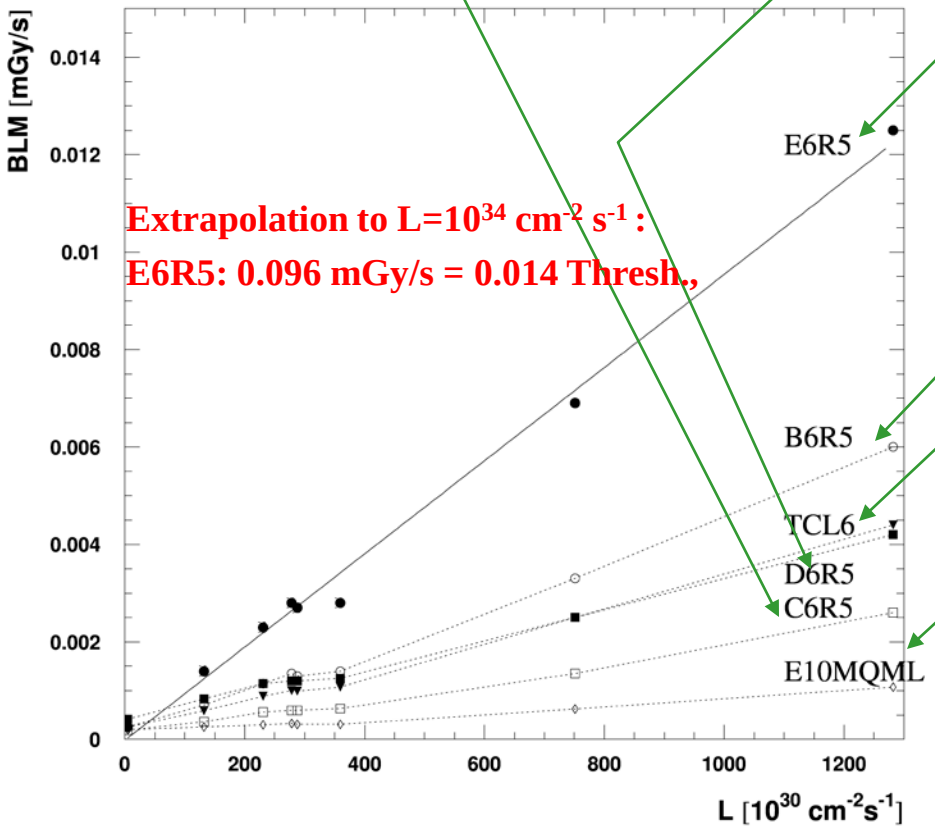
Quadratic dependence on current → try and plot vs. lumi

50 ns Intensity Ramp: XRPH @ ~30 σ



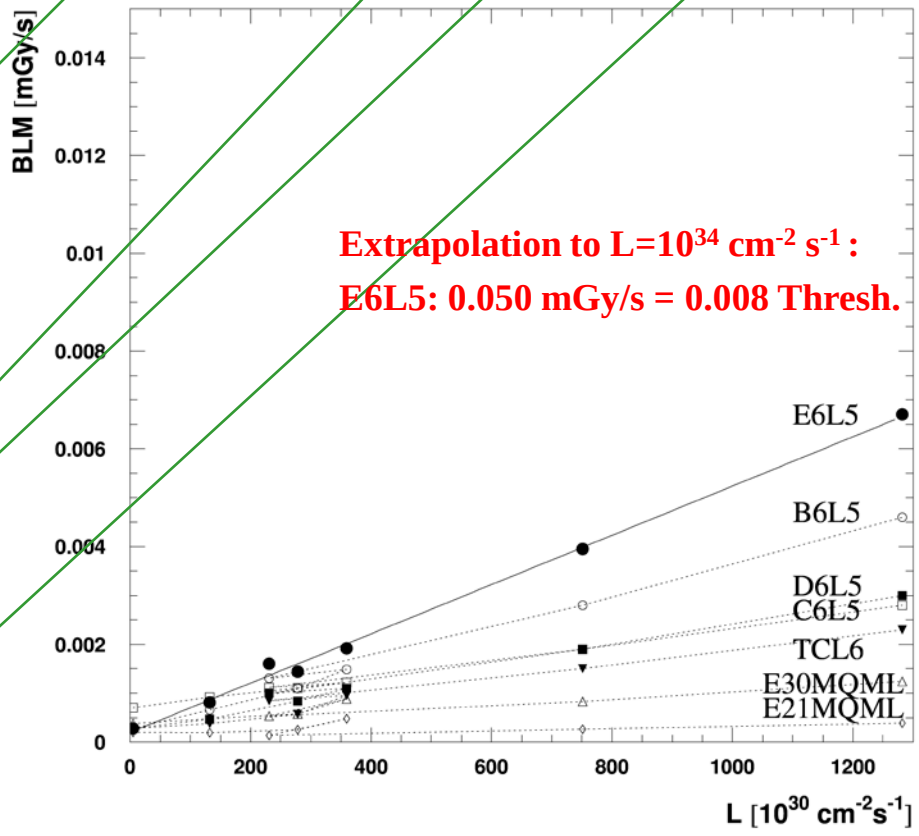
Beam 1, 50ns

Beam 2, 50ns



Extrapolation to $L=10^{34}$ cm^{-2} s^{-1} :

E6R5: 0.096 mGy/s = 0.014 Thresh.,



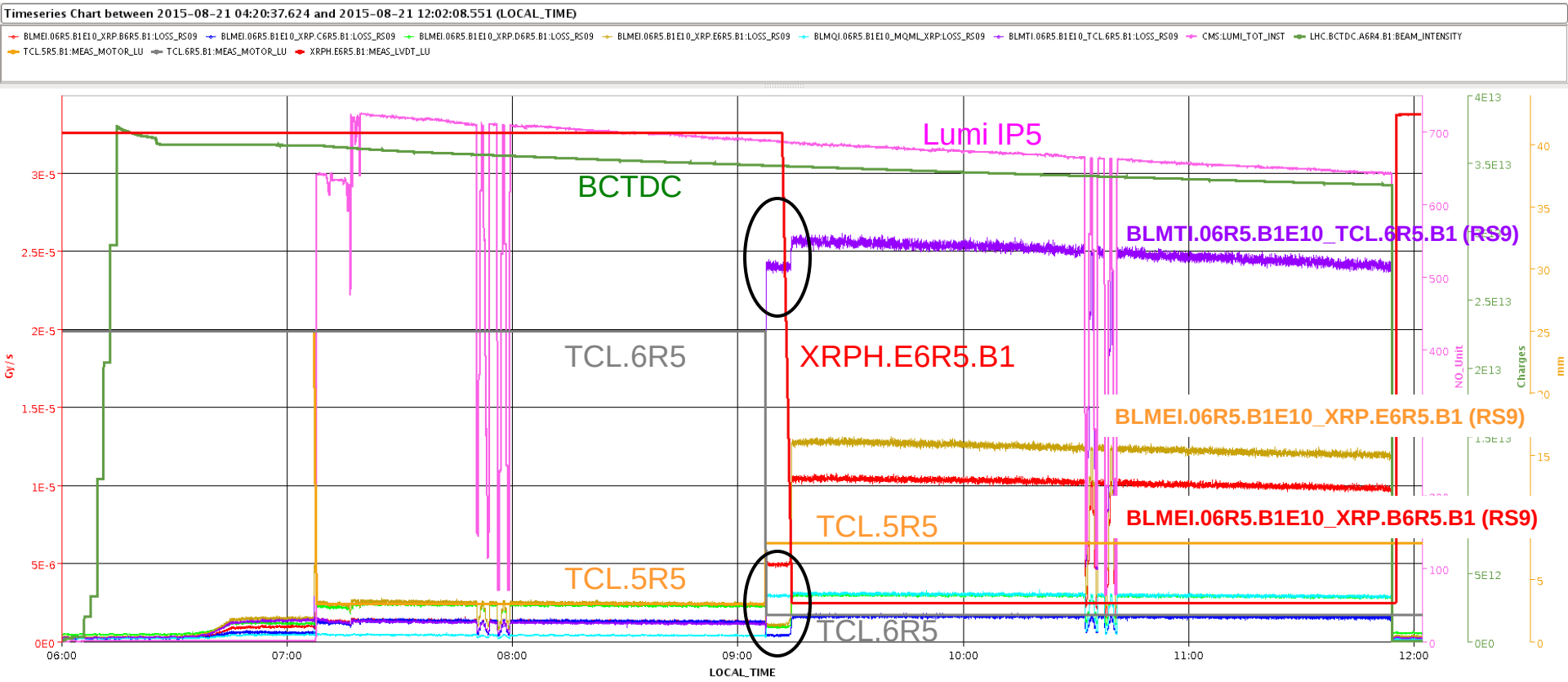
Extrapolation to $L=10^{34}$ cm^{-2} s^{-1} :

E6L5: 0.050 mGy/s = 0.008 Thresh.

BLM dose rate linear with lumi → collision debris, not single-beam background

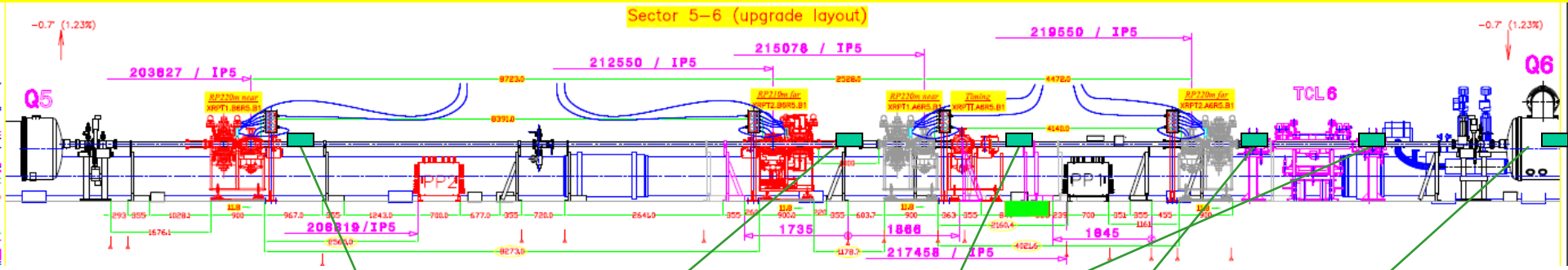
Example Insertion in 25ns Beam
(XRPH @ ~25 σ)

Fill 4243: 315 bunches, lumi @ insertion: 0.7 x 10^{33} cm^{-2} s^{-1}

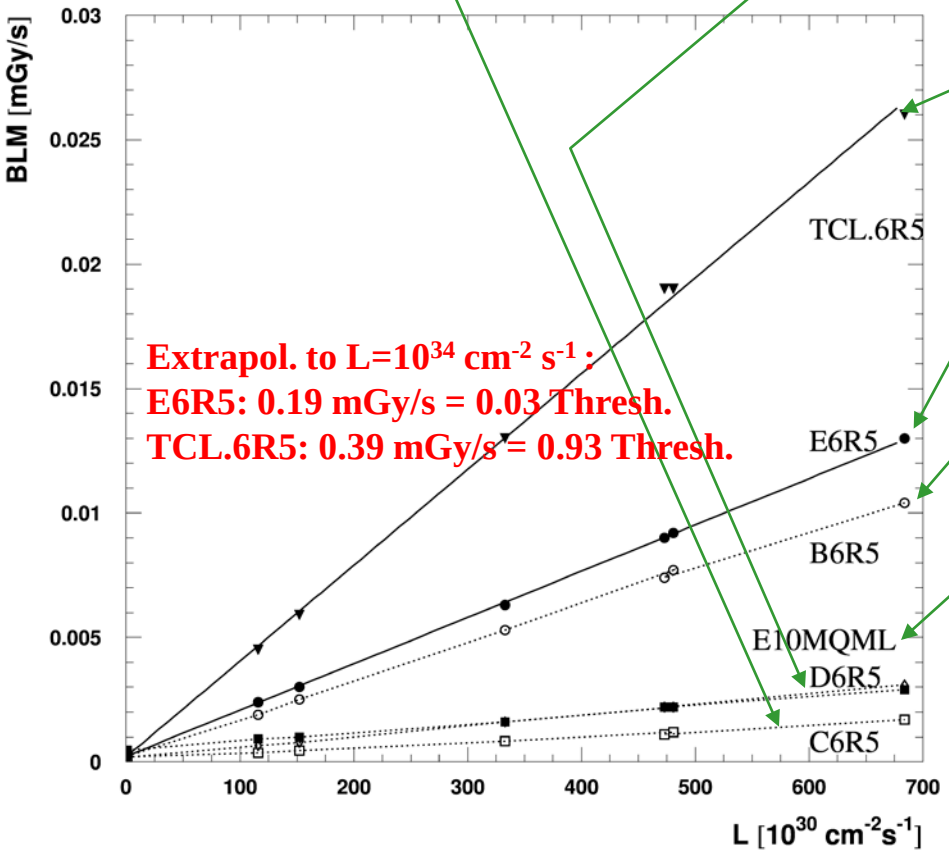


- Retraction of TCL5 → rate decrease in all XRP BLMs except in the B6R5 BLM → albedo from TCL6 ??
- BLM levels with: only TCL5 in, only TCL6 in, TCL6+XRP in → disentangle contributions
- TCL6 BLM sees mainly the showers from TCL6, very small contrib. from XRPs

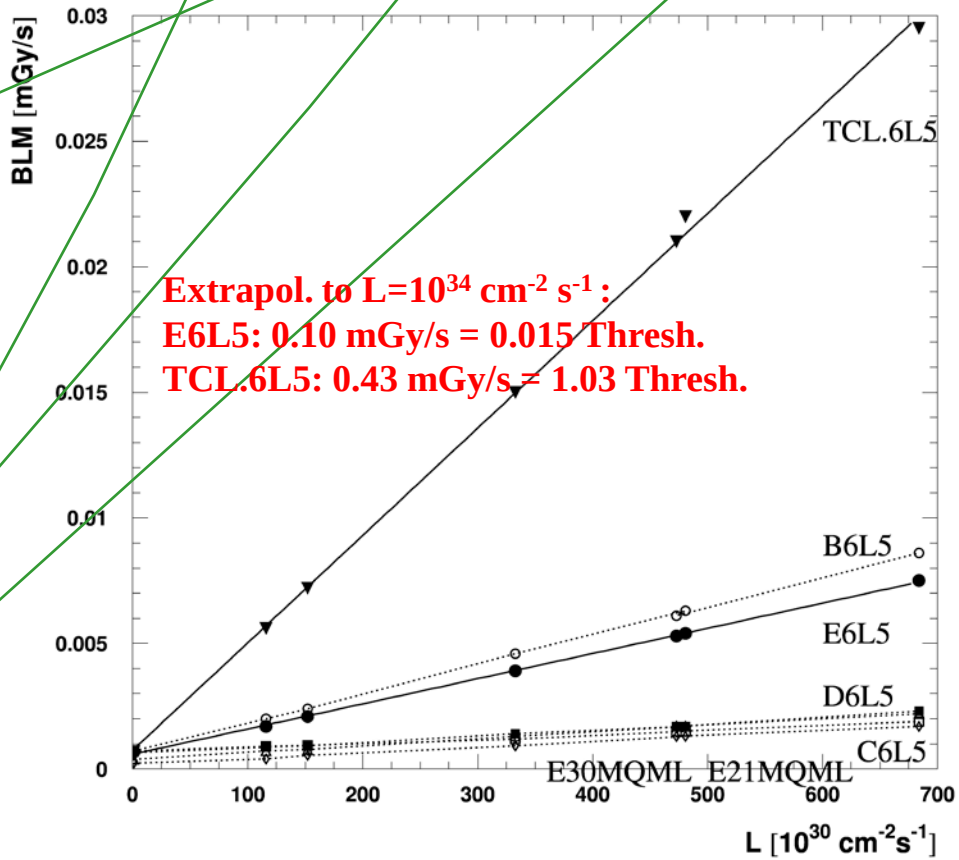
25 ns Intensity Ramp: XRPH @ ~25 σ



Beam 1, 25ns



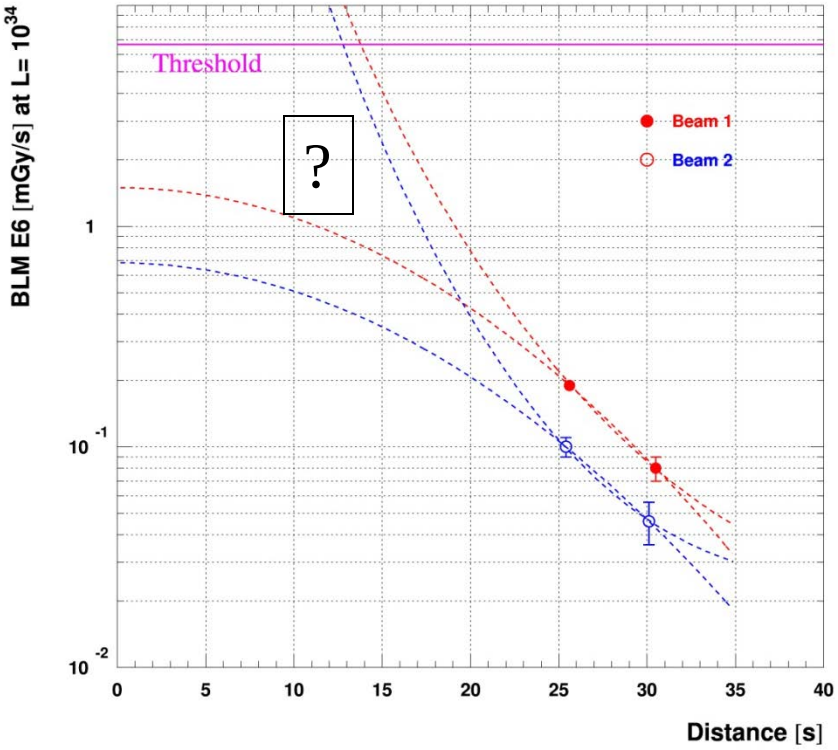
Beam 2, 25ns



No data from BLMQI.06R5.B2I30_MQML (on other beam, but very close to TCL6); still there ?

Can we reach 20 σ Distance ?
(or even closer from 2016 on)

1. Extrapolate the 25 σ and 30 σ BLM data to L=10^{34} cm^{-2} s^{-1} (see previous slides)
2. In 30 σ data: remove TCL5 contribution, add background (losses with RP and TCL5 out)



Problem: functional form? Only 2 points!

Hypothesis: dominance by diffraction

→dσ/dx ~ 1 / x + background

Incompatible with the 2 points

Empirical parameterisation with

$1 / x^n$ + background

gives n = 5.8 (B1), 6.5 (B2)

Or gaussian ? But why ?

Very speculative → more measurements needed

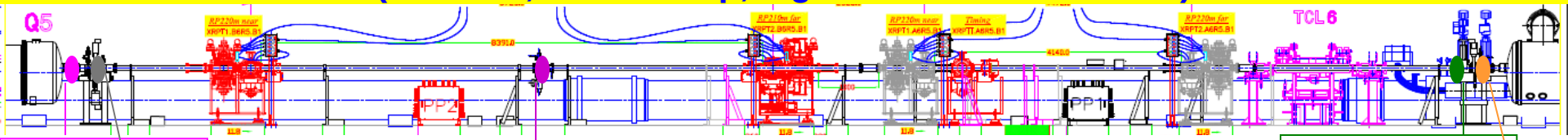
Strategy:

A. Complete the 25ns intensity ramp-up to highest lumi,
Measure BLM response at different distances: after automatic insertion retract in steps from 25 σ to 50 σ → more constraints for empirical extrapolation

B. Direct measurement: If orbit reliability allows, remove (or reduce further) the 0.5 mm margin

Vacuum during a Fill with XRP Insertion

(Fill 4243, 25 ns Ramp, highest lumi of the series)



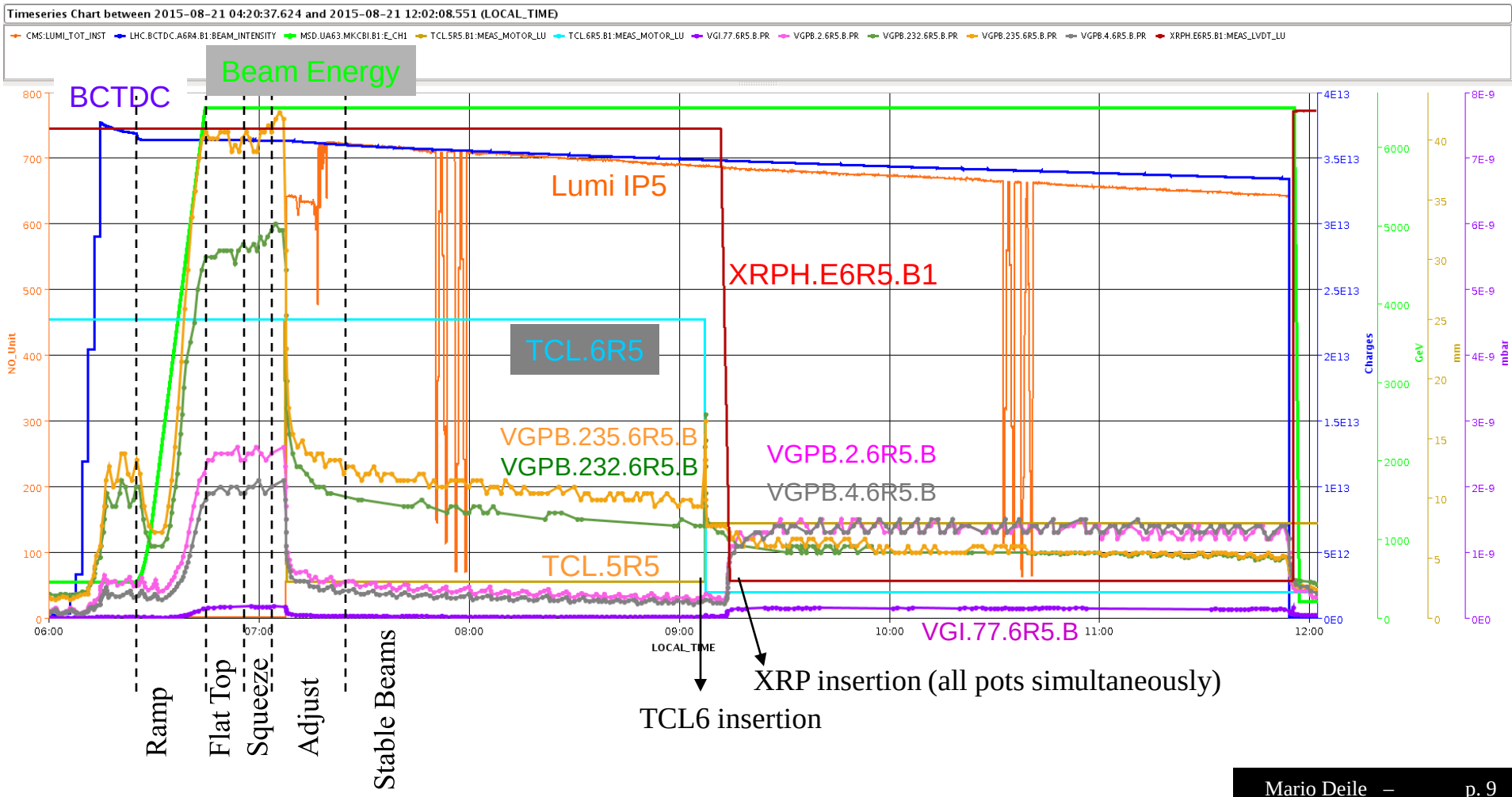
VGPB.2.6R5.B

VGPB.4.6R5.B

VGI.77.6R5.B

VGPB.232.6R5.B

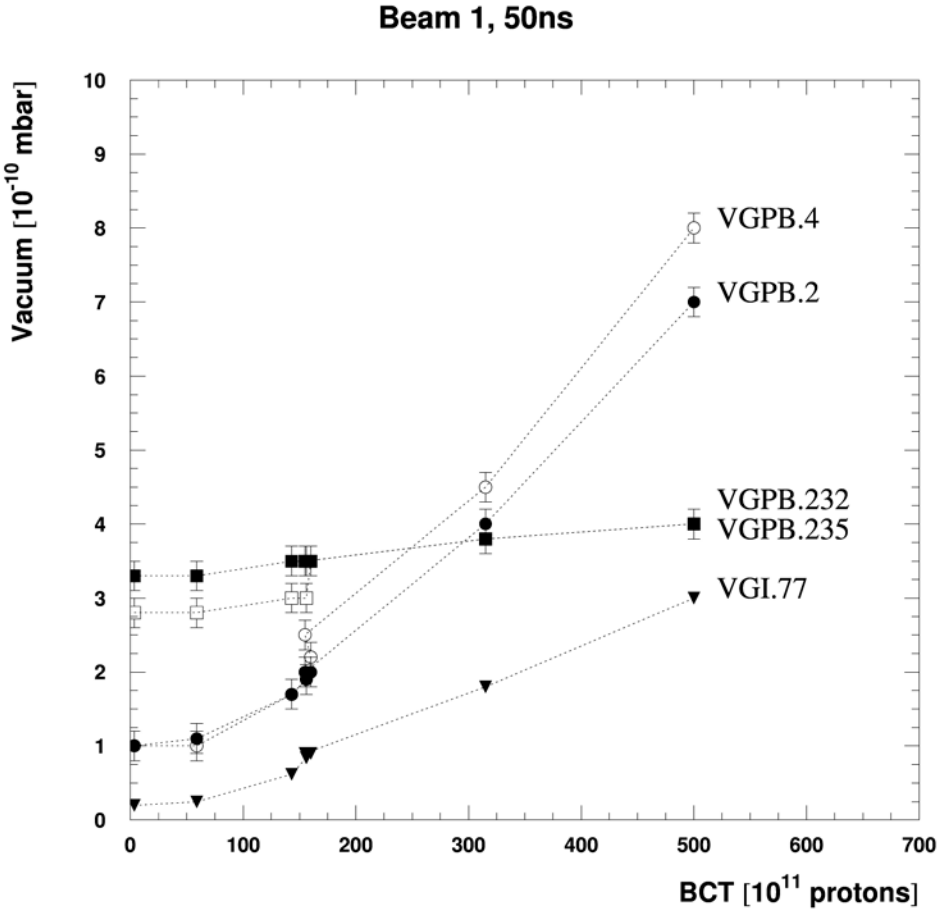
VGPB.235.6R5.B

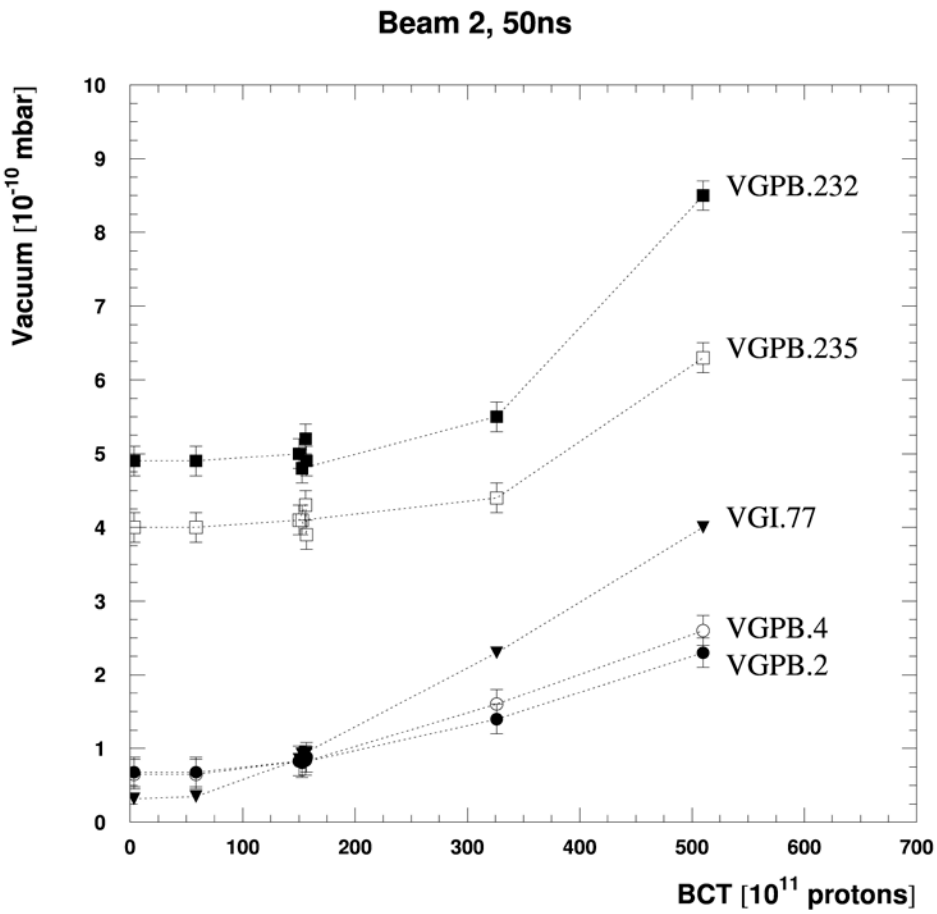


Vacuum in 50ns Intensity Ramp

XRPH @ ~30 σ

Equilibrium pressure after RP insertion:



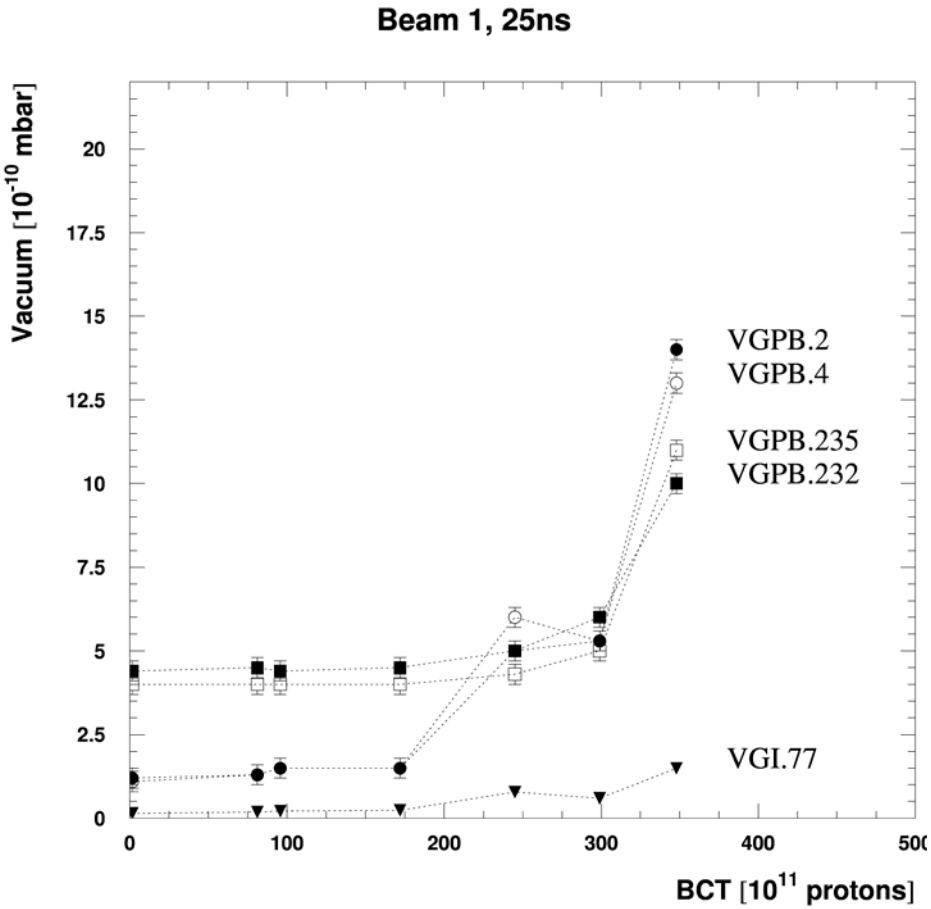


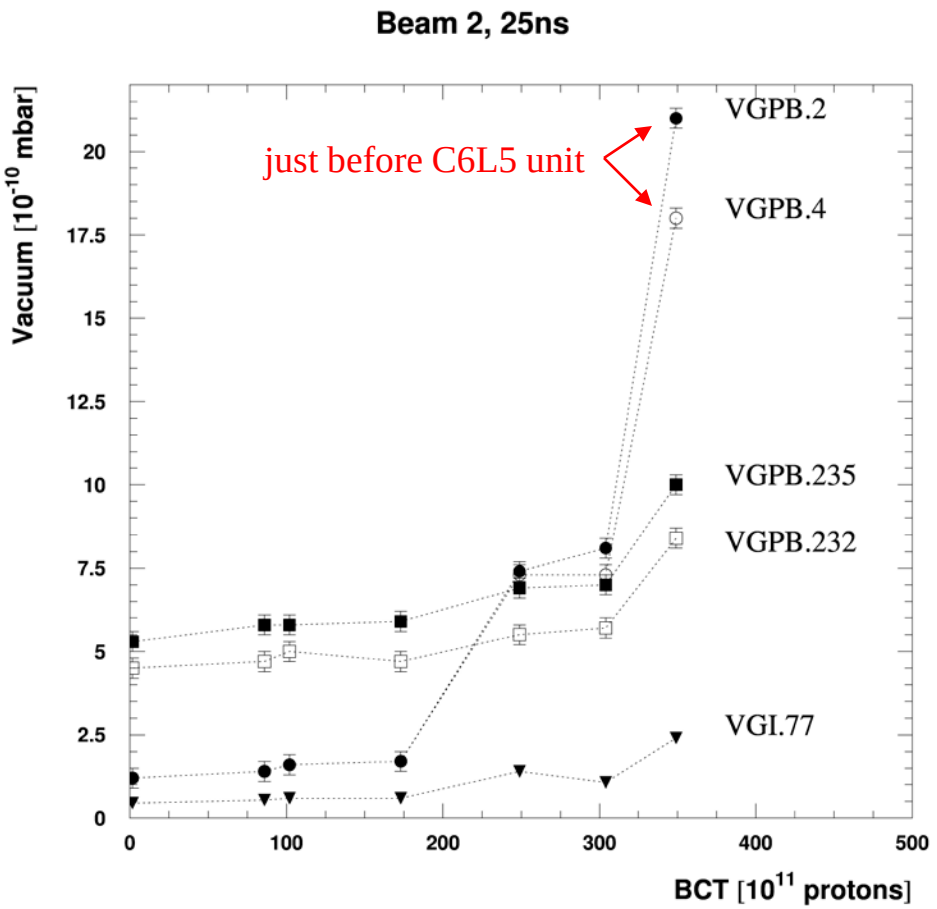
VGPB.232, VGPB.235: almost no effect from XRP insertion, but general pressure rise with beam current and lumi

Vacuum in 25ns Intensity Ramp

XRPH @ ~25 σ

Equilibrium pressure after RP insertion:





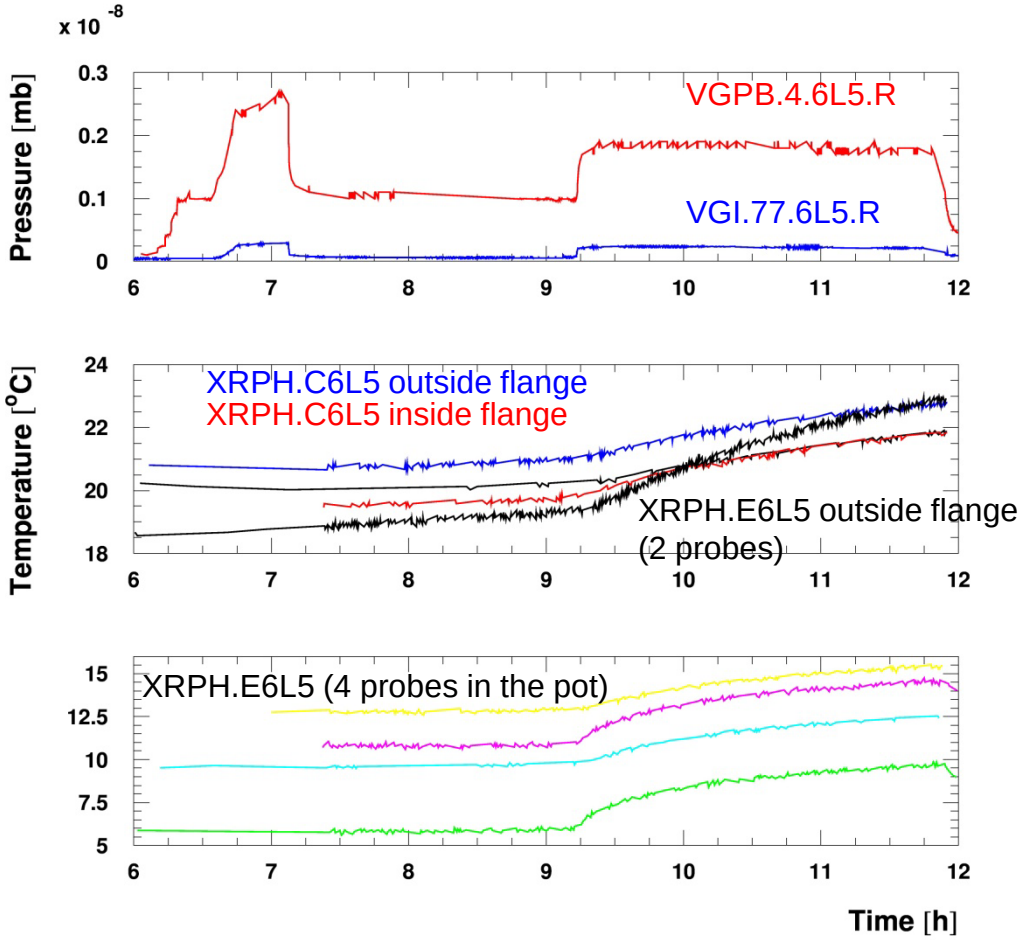
VGPB.232, VGPB.235: pressure rise with beam current, but not at XRP insertion

Functional dependence on current or lumi still unclear (non-linear in both) → no extrapolation possible

VGPB.2 and VGPB.4: very steep in last point → do we have to worry ?

Temperatures during a Fill with XRP Insertion

(Fill 4243, 25 ns Ramp, highest lumi of the series)



Temperature rise [°C] from 9:15 to 11:15 :

	C6L5 (45-210-N)	E6L5 (cyl.)	C6R5 (56-210-N)	E6R6 (cyl.)
flange out	1.5	2.9 1.2	2.5	1.5
flange in	1.7			
in the pot	0 (cooled)	3.2 3.1 2.3 2.2	0 (cooled)	

no dramatic temperature rise in C6L5 at time of pressure rise

Conclusions

- XRP BLMs do not indicate any show stopper for the 25ns intensity ramp with XRPH @ 25σ

- MQML BLMs see almost nothing

- TCL6 BLMs will probably reach their thresholds at L = 10^{34} cm^{-2} s^{-1}

- Distances < 25 σ : study of BLM dose rate dependence on distance needed for extrapolation, then direct test

- Possible upcoming vacuum problem at higher intensities near C6 units, but no indications from temperatures
  → in next intensity step consider sequential insertion:
  XRPH.E6 → XRPH.D6 → XRPH.C6 → XRPV.D6 → XRPV.C6