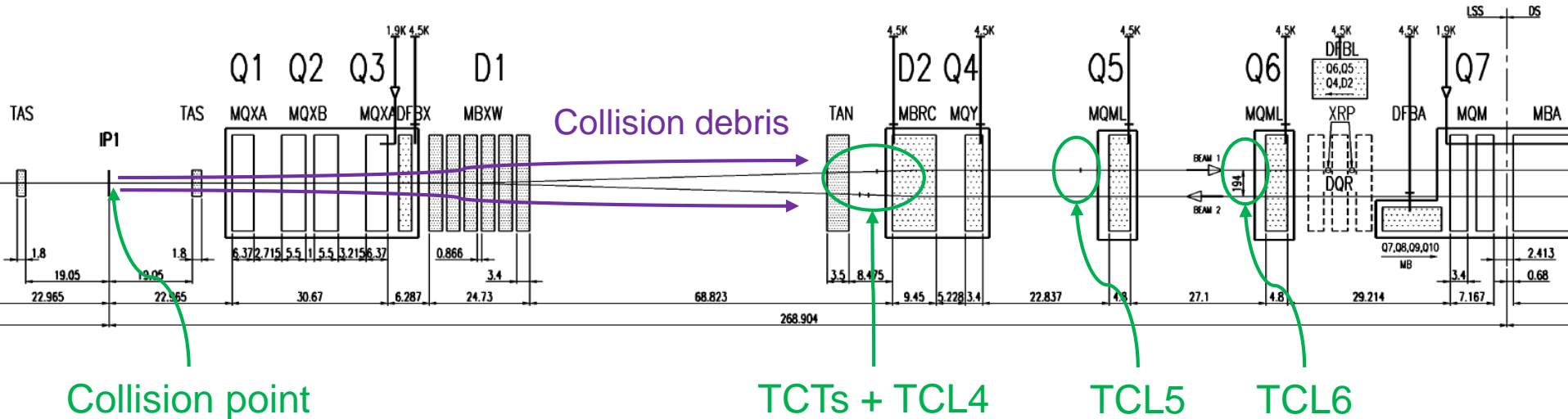


Required Flat Top Corrections to BLMs at TCTs/TCLs due to Collision Debris

A. Mereghetti, on behalf of the LHC Collimation Team

Introduction

ATLAS



Collision debris:

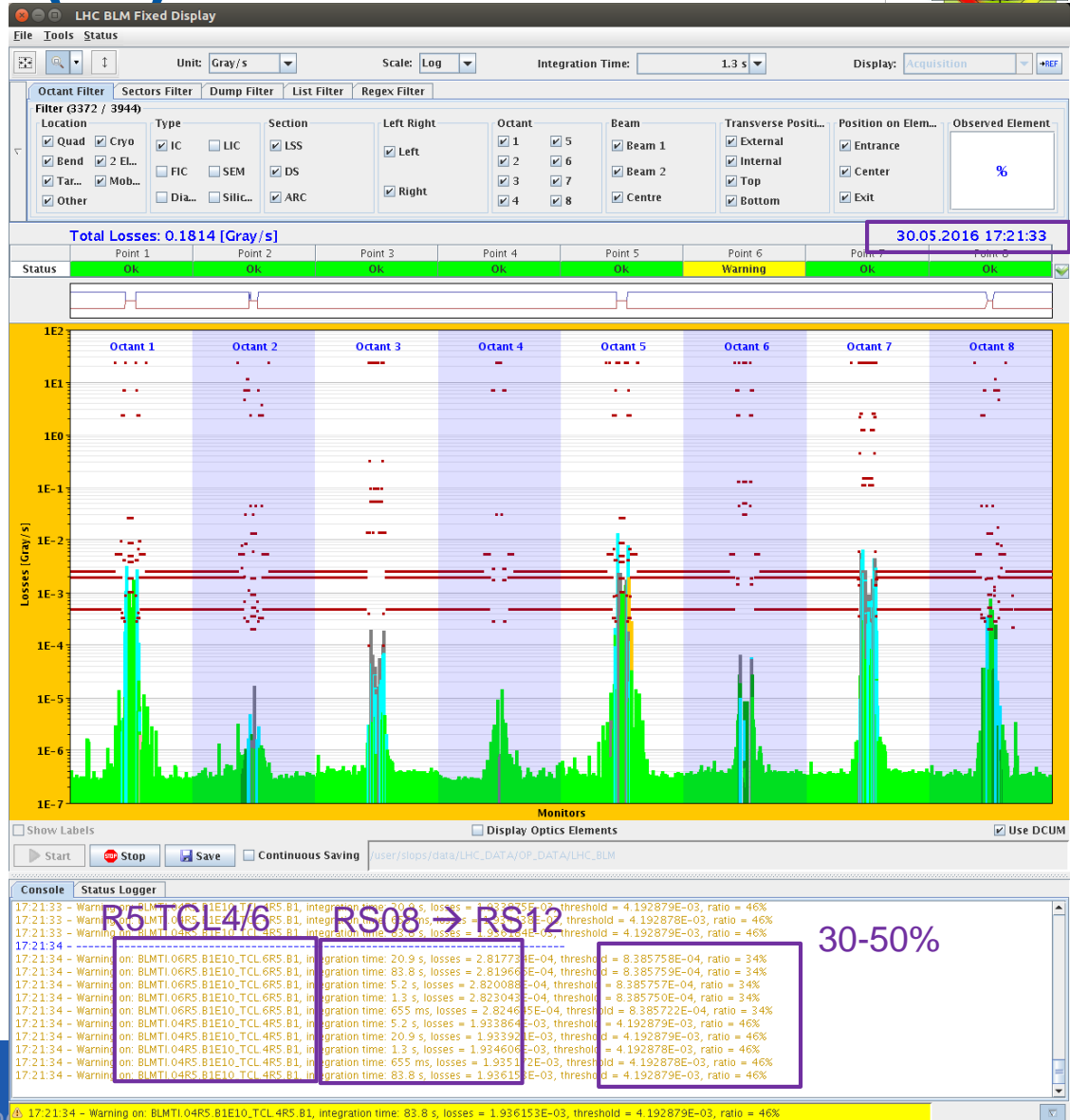
- (a fraction) goes back to machine;
- It reaches BLMs around TCTs/TCLs, inducing “spurious” signal;
- BLM signals (concerned RS: the longest ones) proportional to luminosity, and thus to number of bunches;

Introduction (II)

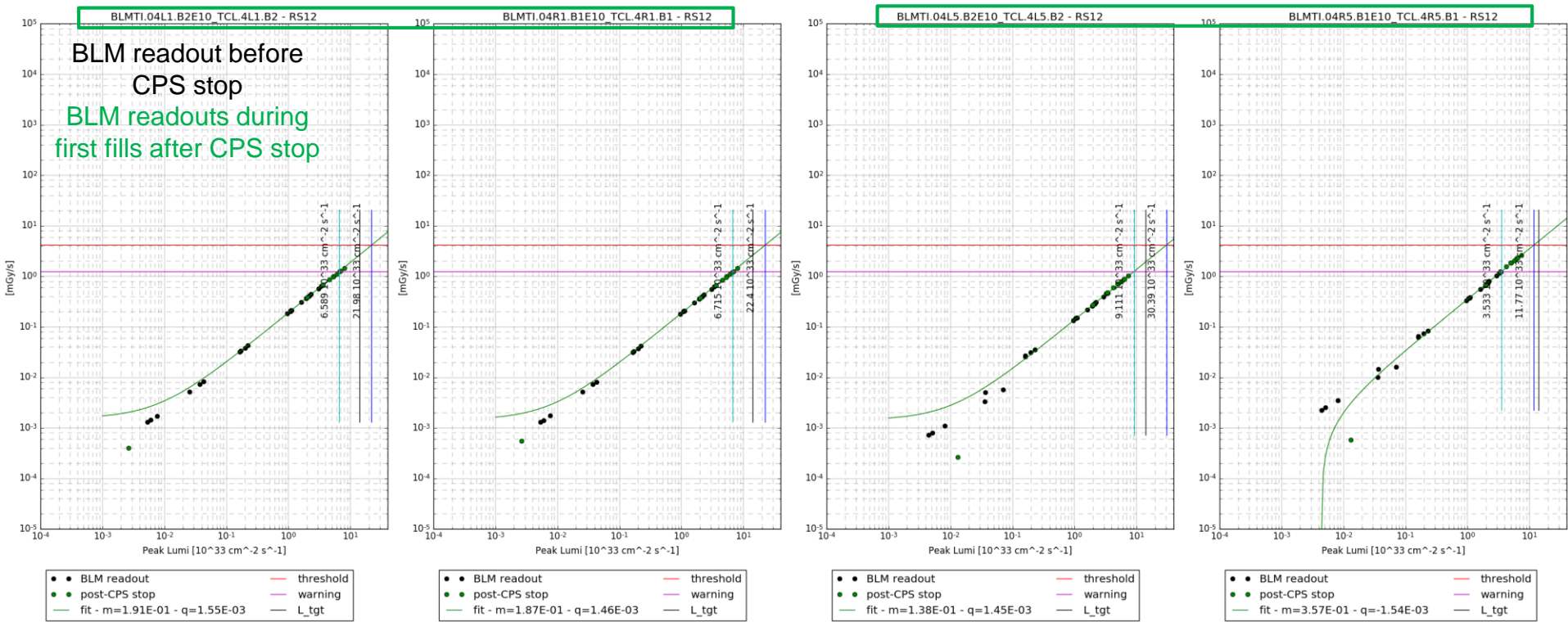
Fill 4964 (Monday 30th May, afternoon):

- BLM@TCL.4R5: longest RSs at <50% of threshold;
- Beam intensity: 1740 b;
- Peak lumi in IR5: $5.4 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$;
- Every intensity step (200-300b) buys us ~10-15% of signal;

	Target Lumi
IP1/5	$1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
IP2	$2 \times 9 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$
IP8	$2 \times 6 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$

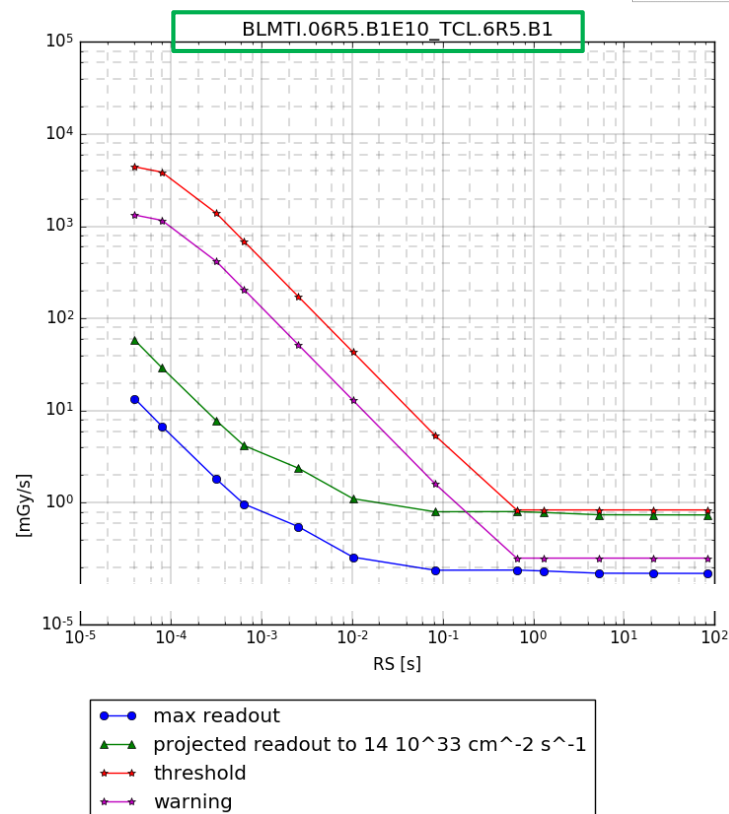
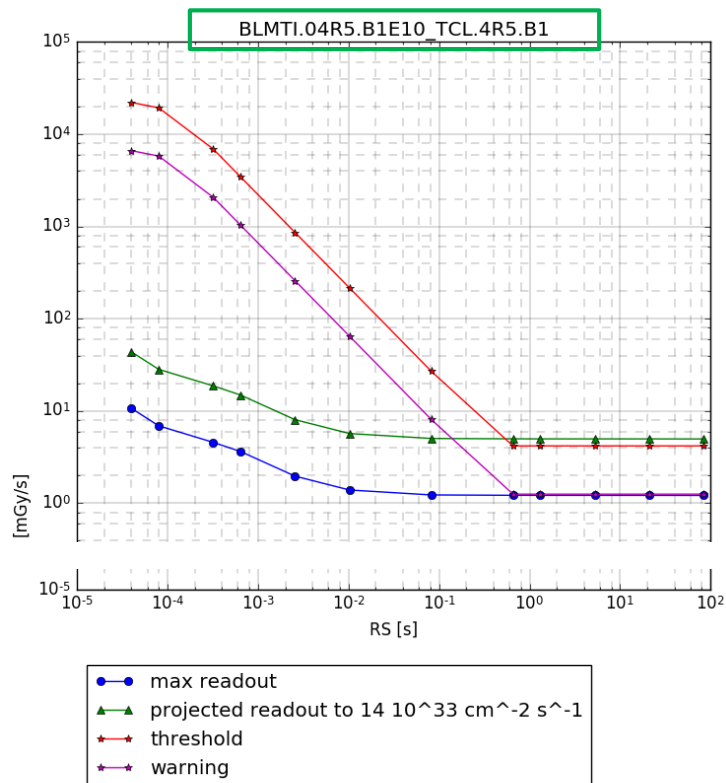


Extrapolation – TCL4



- Method: look into all fills in stable beams and relate max BLM signal (for each collimator/RS) to max lumi;
- All TCL4 would constantly be in warning when peak lumi at $0.9 \cdot 10^{34}$ cm^{-2} s^{-1} ;
- R5 TCL4: dump expected before reaching “target” lumi of $1.4 \cdot 10^{34}$ cm^{-2} s^{-1} ;

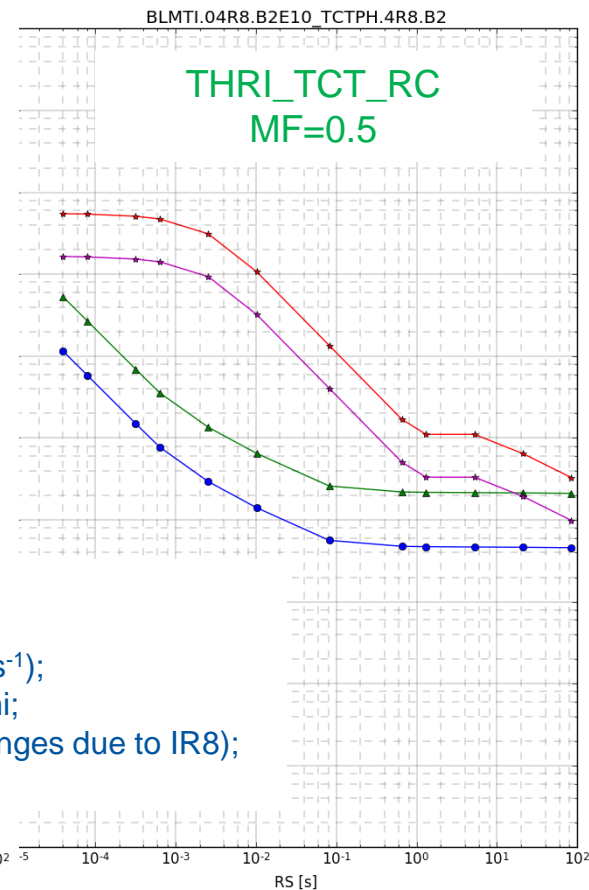
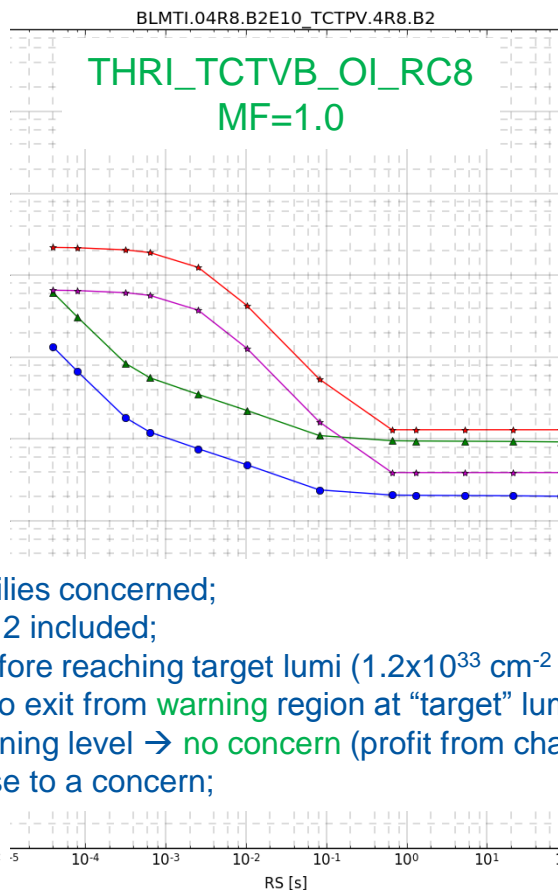
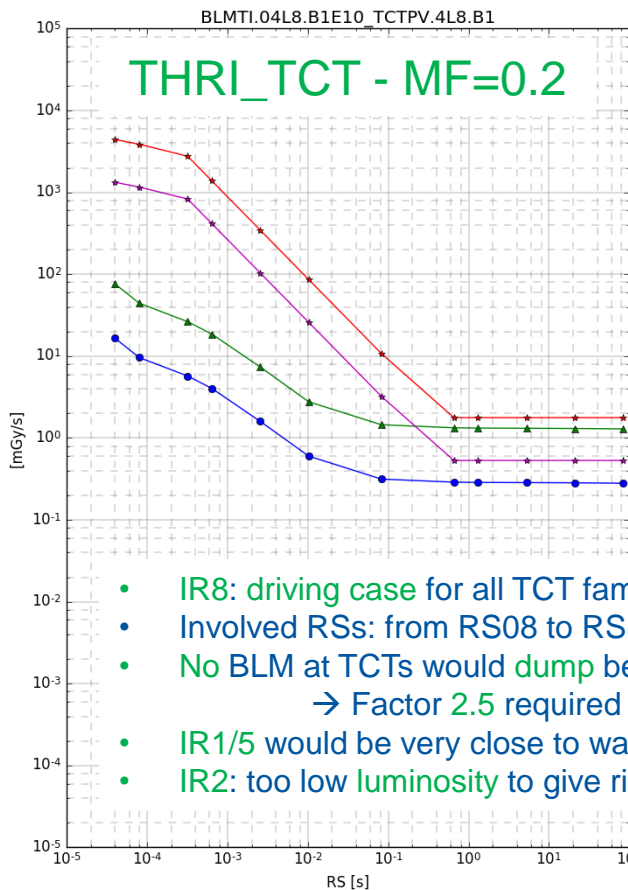
Extrapolation – TCL4, and TCL6 (XRP's IN)



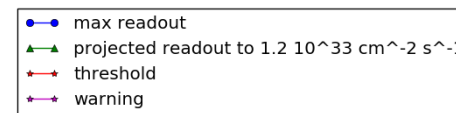
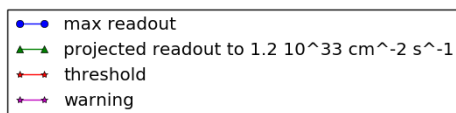
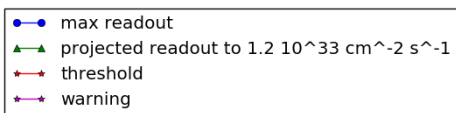
- Involved RSs: from RS08 to RS12 included;
- ~40% required to avoid dumping at “target” lumi ($1.4 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$);
- Factor 3-4 required to exit from warning region at “target” lumi;
- Family: THRI_TCL;
 - MF=1.0 for all BLMs;
 - Change required on MT!

- Involved RSs: from RS08 to RS12 included;
- 30% to avoid being at dumping level once at “target” lumi ($1.4 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$);
- Factor 3-4 required to exit from warning region at “target” lumi;
- Family: THRI_TCL_W;
 - MF=1.0 (0.5) in IR5 (IR1);
 - Change required on MT! (if MF=1 in IR1);

Extrapolation – IR8 TCTs



- IR8: driving case for all TCT families concerned;
- Involved RSs: from RS08 to RS12 included;
- No BLM at TCTs would dump before reaching target lumi ($1.2 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$);
→ Factor 2.5 required to exit from warning region at “target” lumi;
- IR1/5 would be very close to warning level → no concern (profit from changes due to IR8);
- IR2: too low luminosity to give rise to a concern;



Conclusions

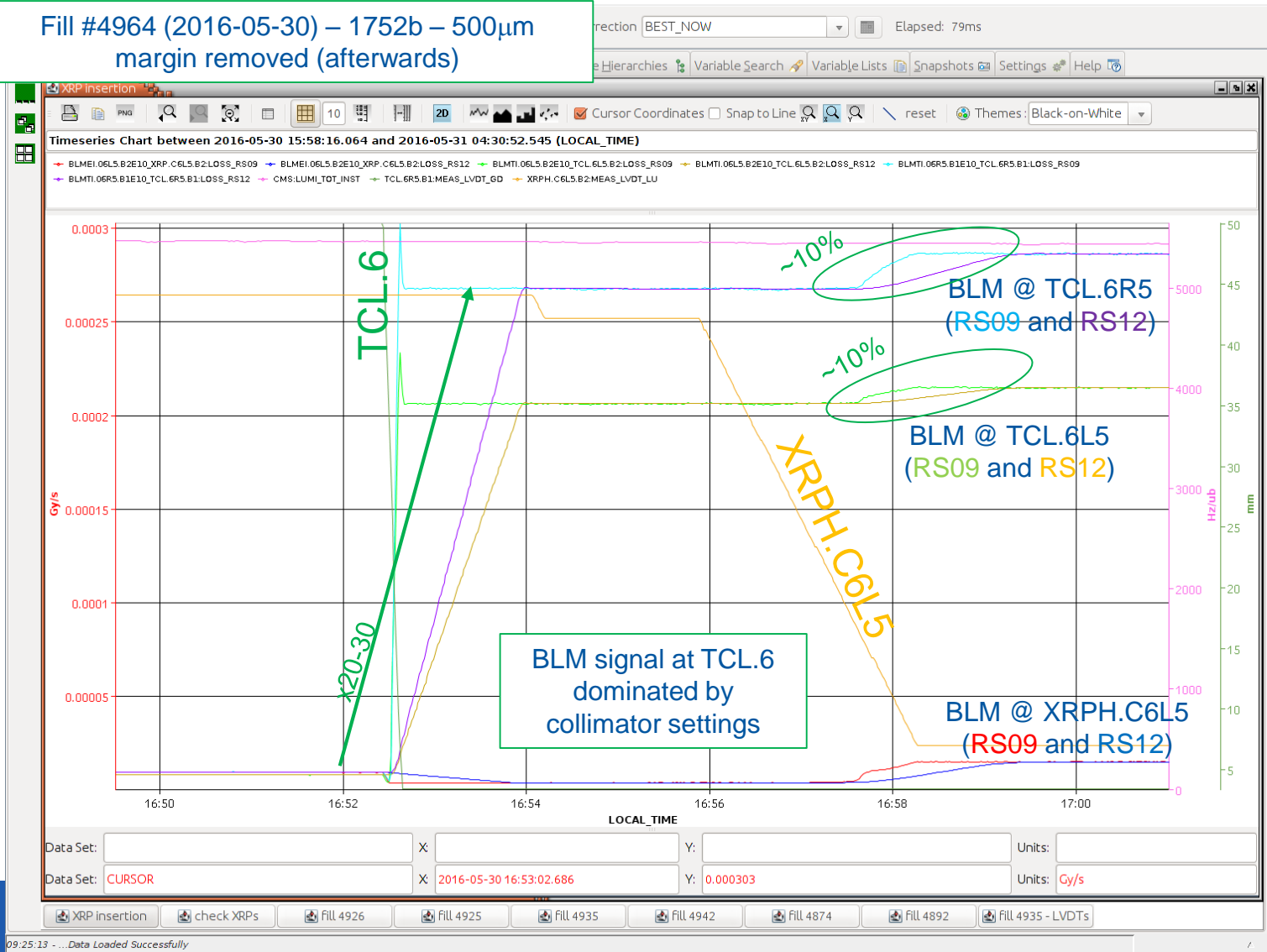
- **Collision debris** induces “spurious” signals in BLMs at TCTs/TCLs:
 - Long RSs affected: RS08 → RS12;
 - “Constant” signal (“constant” lumi);
 - BLMs at **TCL4** and **TCL6** (XRPs IN) mostly affected:
 - Dump foreseen before reaching target lumis (TCL6 would actually be extremely close to);
 - BLM readouts at TCL5 and TCL6 (XRPs OUT) are expected to stay far from thresholds also at target lumi;
 - BLMs at **TCTs** are affected but they are not expected to trigger a beam dump;
 - BLMs at IR1/IR5 TCTs expected to approach the warning region at the very last intensity steps;
 - IR8 TCTs will be in warning (i.e. @ $\sim 5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$);
 - IR2 TCTs far from threshold (very low lumi in IR2);
- **Requests based on IR5 TCLs:**
 - **THRI_TCL:**
 - FT correction on RS08-RS12 by 40% to avoid beam dumps at $1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;
 - FT correction on RS08-RS12 by factor 4 to enter warning region at $1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;
 - **THRI_TCL_W** (XRPs IN):
 - FT correction on RS08-RS12 by ~30% to avoid beam dumps at $1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;
 - FT correction on RS08-RS12 by factor 3.5 to enter warning region at $1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;
- **Requests based on IR8 TCTs:**
 - FT correction on RS08-RS12 by factor 2.5 to enter warning region at target lumis (IR1/5/8);

Reserve Slides

Insertion of XRPs

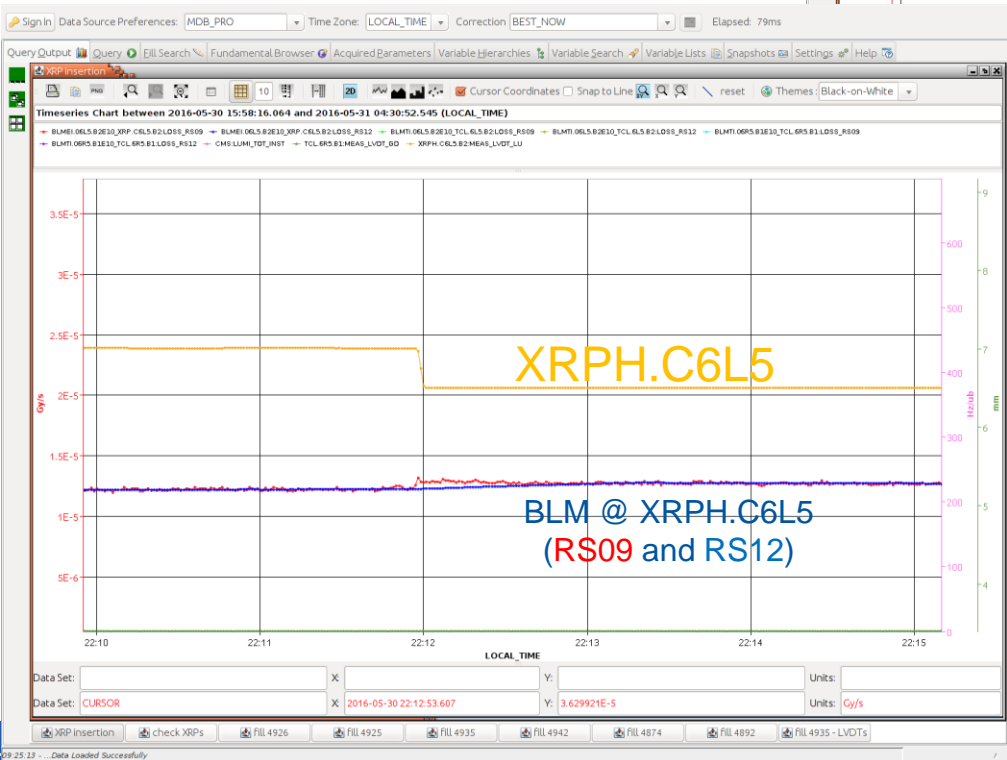
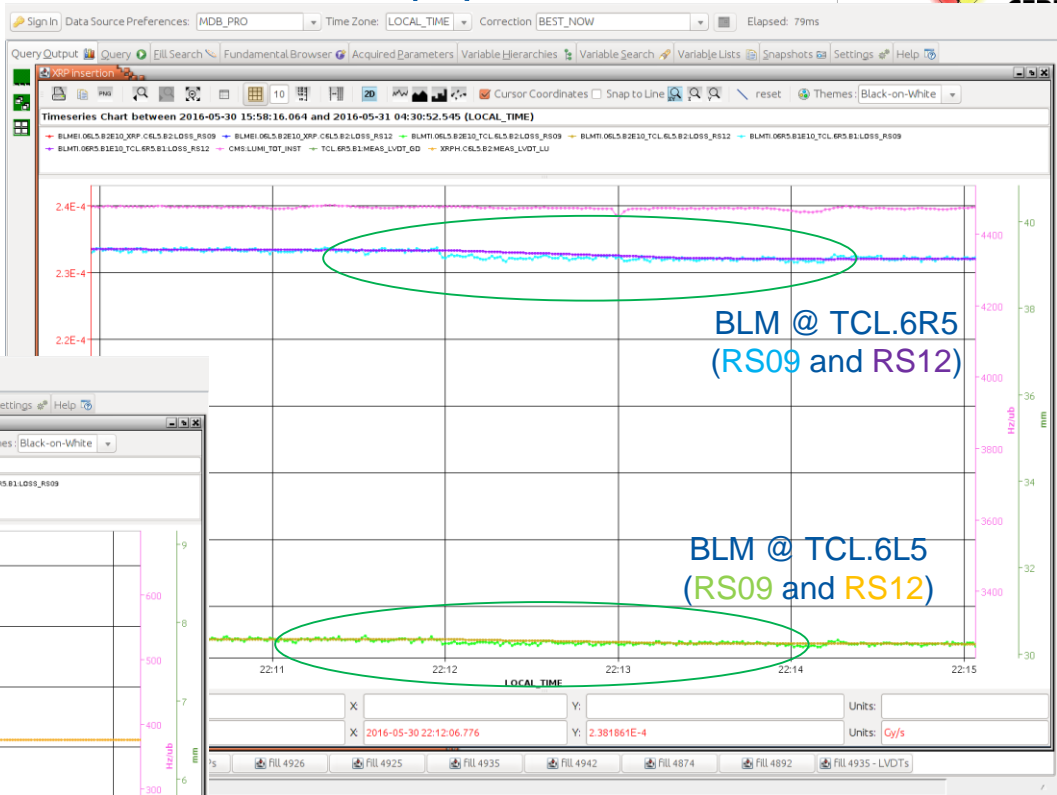
BLM@TCL6 vs Insertion of XRPs

Fill #4964 (2016-05-30) – 1752b – 500 μ m margin removed (afterwards)



BLM@TCL6 vs Insertion of XRPs (II)

Fill #4964 (2016-05-30) – 1752b – 500 μ m removing margin



BLM signal at TCL.6 seems to decrease when 500 μ m margin is removed;
 → Most prob: XRP's intercepting more debris, at the "expenses" of TCL6

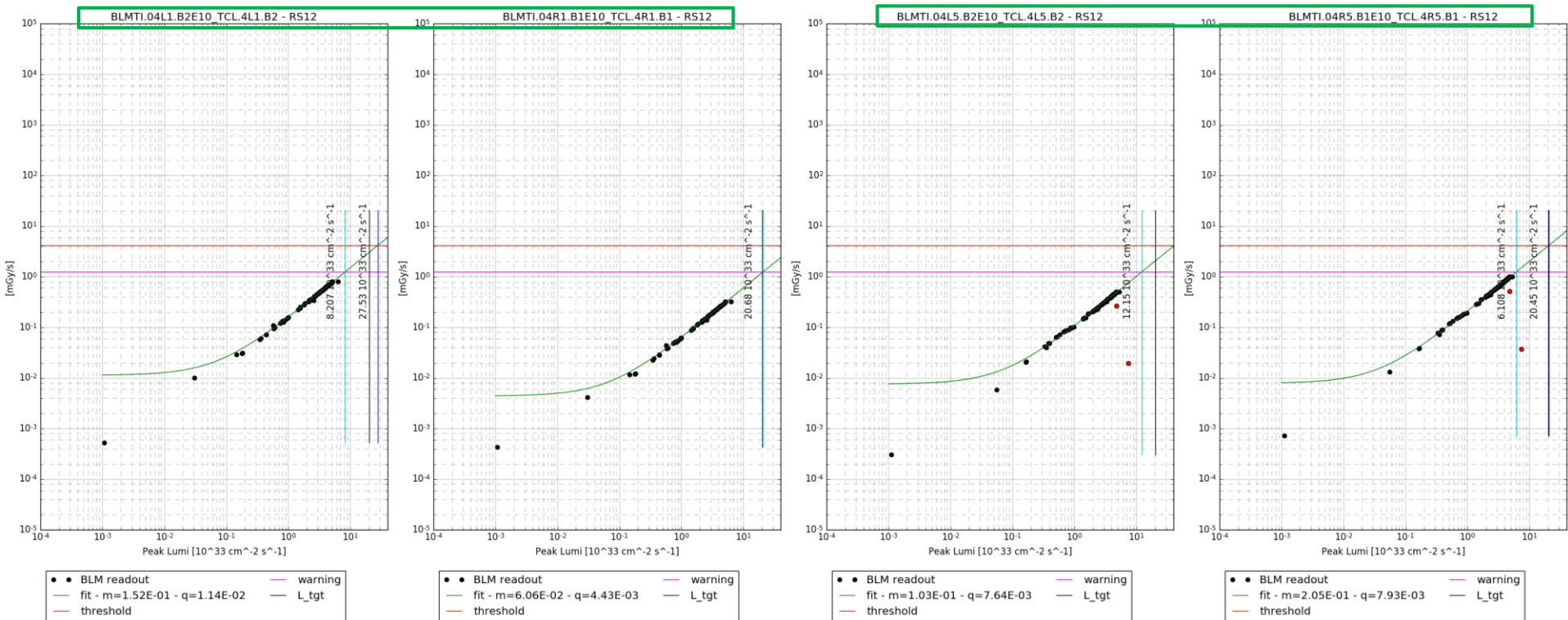
2015

Nota Bene

extrapolations are done based on one point only (per collimator/RS), from fill #3992 (2015-07-13 – 50ns intensity ramp up)

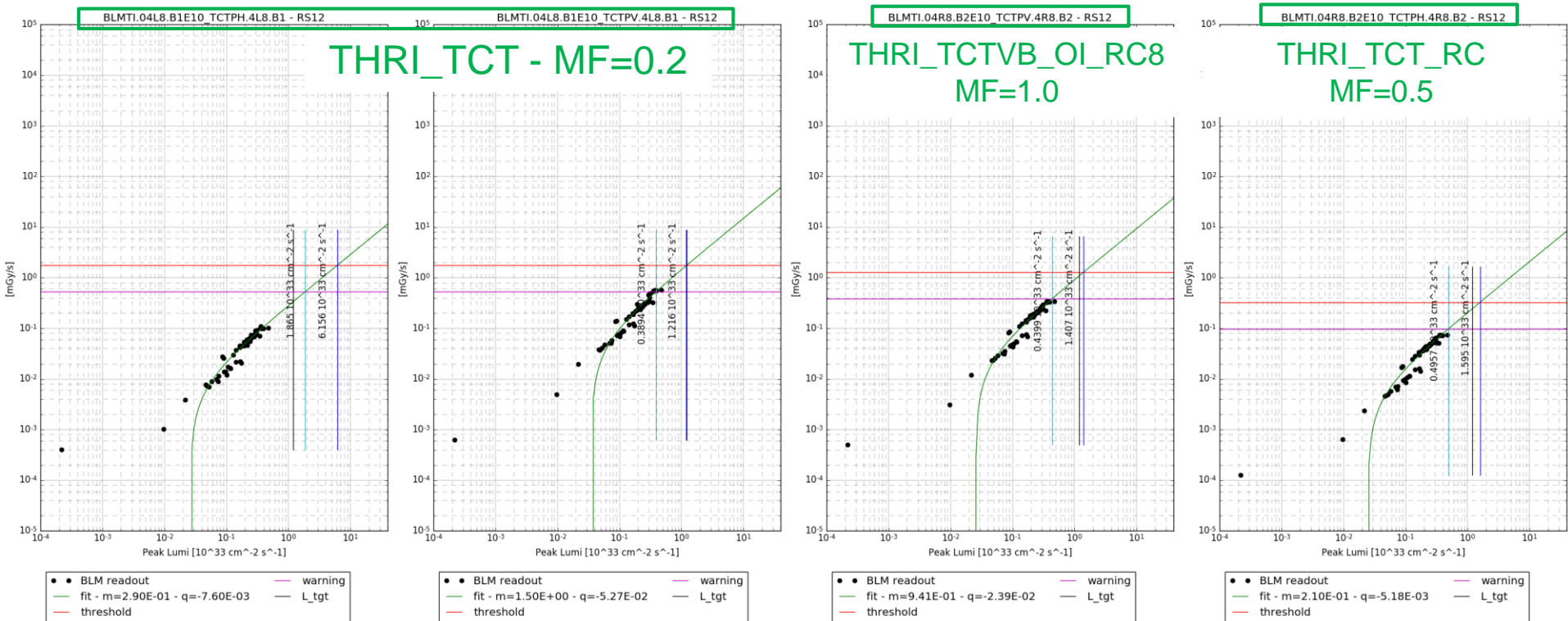
Analysis presented here is not the original one; results come from today's method of analysis

Extrapolation – TCL4



- R5 TCL4 was the one triggering the changes (target lumi of $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$);
→ matched target lumi and dump threshold;
- 2016: higher signals → change in crossing angle? (from $145 \mu\text{rad}$ to $185 \mu\text{rad}$);
- L/R asymmetry visible not only in IR5 (as in 2016), but also in IR1;

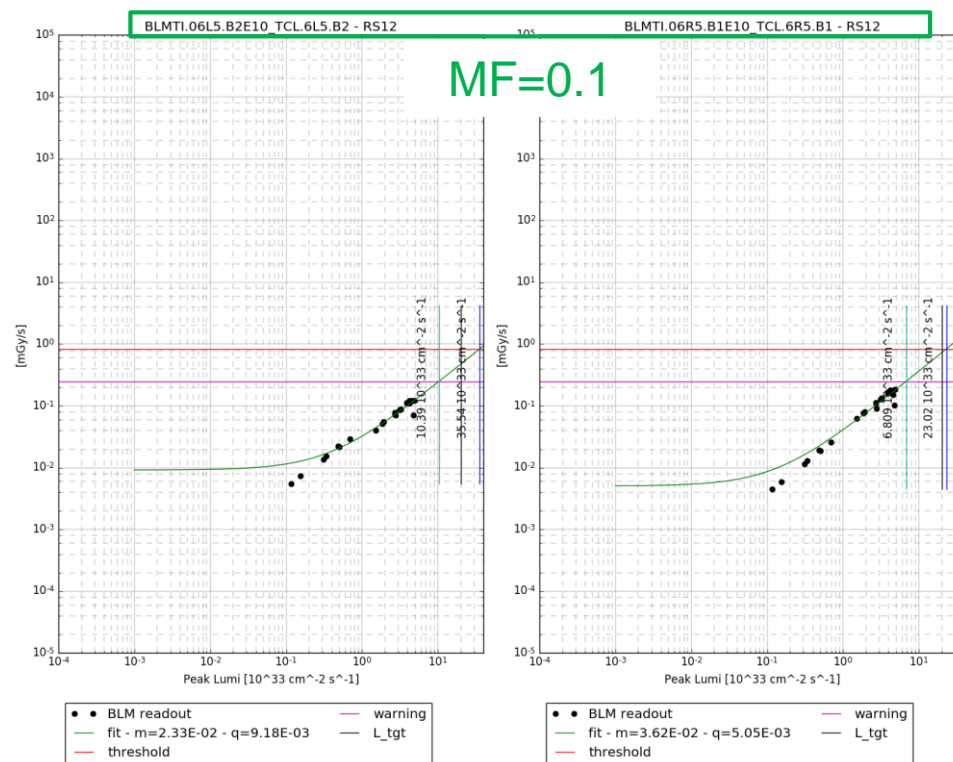
Extrapolation – IR8 TCT



- TCTPV.4L8.B1 triggered the change of threshold:
 → matched target lumi and dump threshold;
 → 2016 sees slightly lower signals;
- No specific request for BLMs at IR1/IR5 TCTs - signals are comparable to 2016 within 50%;
- IR2 has a very small luminosity → not at all a concern by construction;

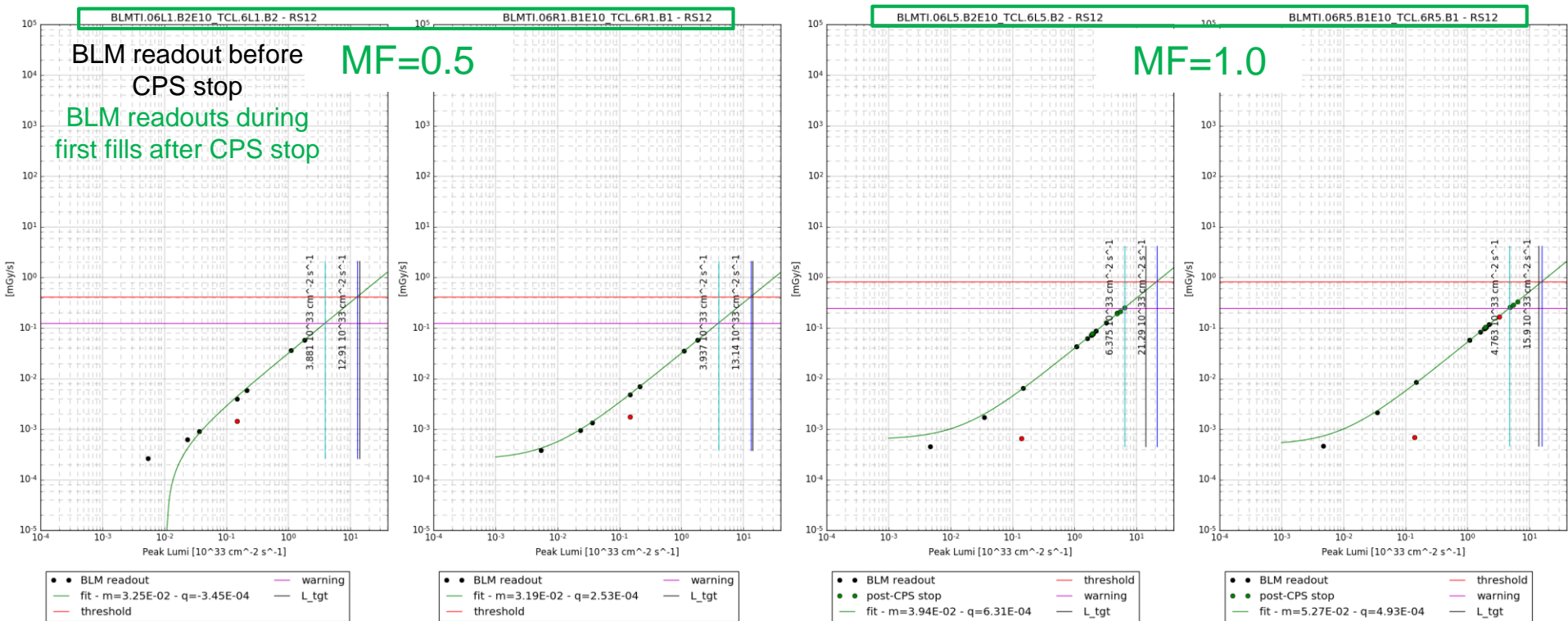
Extrapolation – TCL6 (XRP IN)

- Only TOTEM XRPs in 2015;
- No worry at all when XRPs are not in;
- R5 TCL6: just below dump level once at “target” lumi of $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;



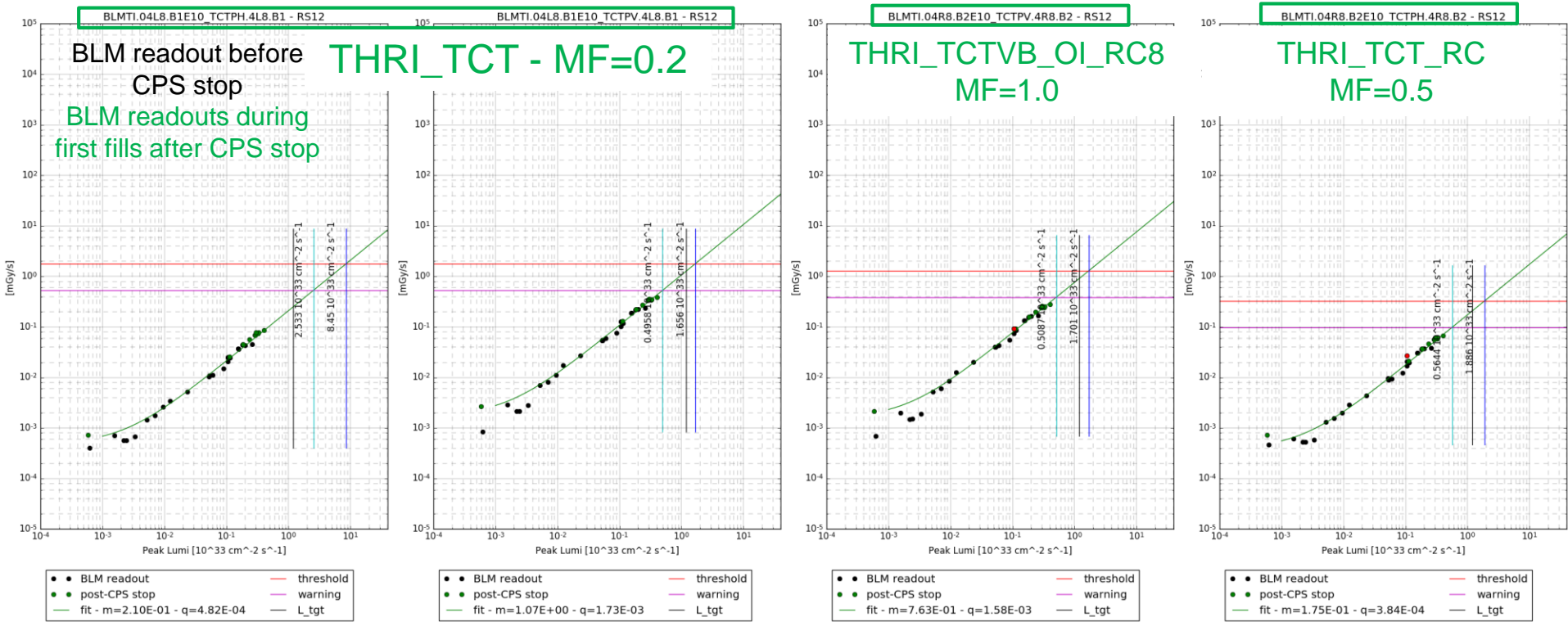
Other Extrapolations (2016)

Extrapolation – TCL6 (XRPs IN)



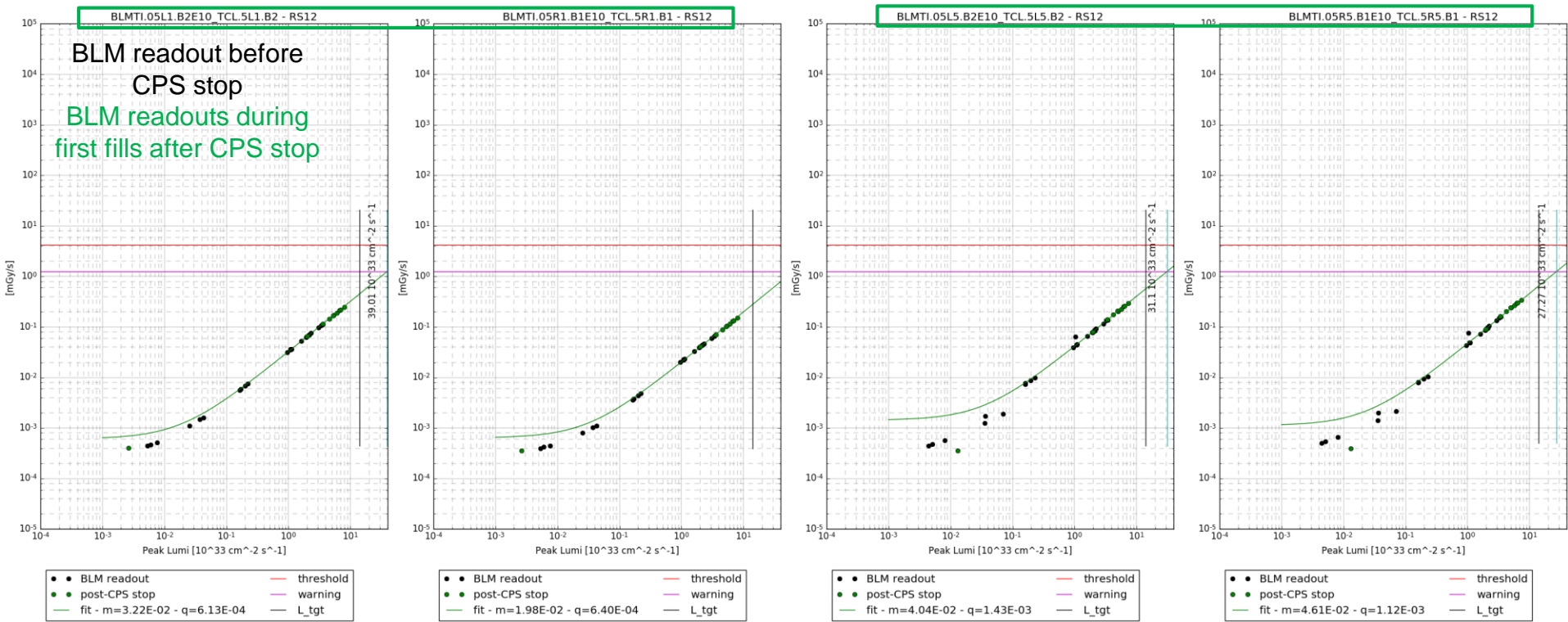
- No worry at all when XRPs are not in (AFP/TOTEM);
- IR1 TCL6: MF=1.0 would make the situation more relaxed than in IR5;
- R5 TCL6: just below dump level once at “target” lumi of $1.4 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$;

Extrapolation – IR8 TCT



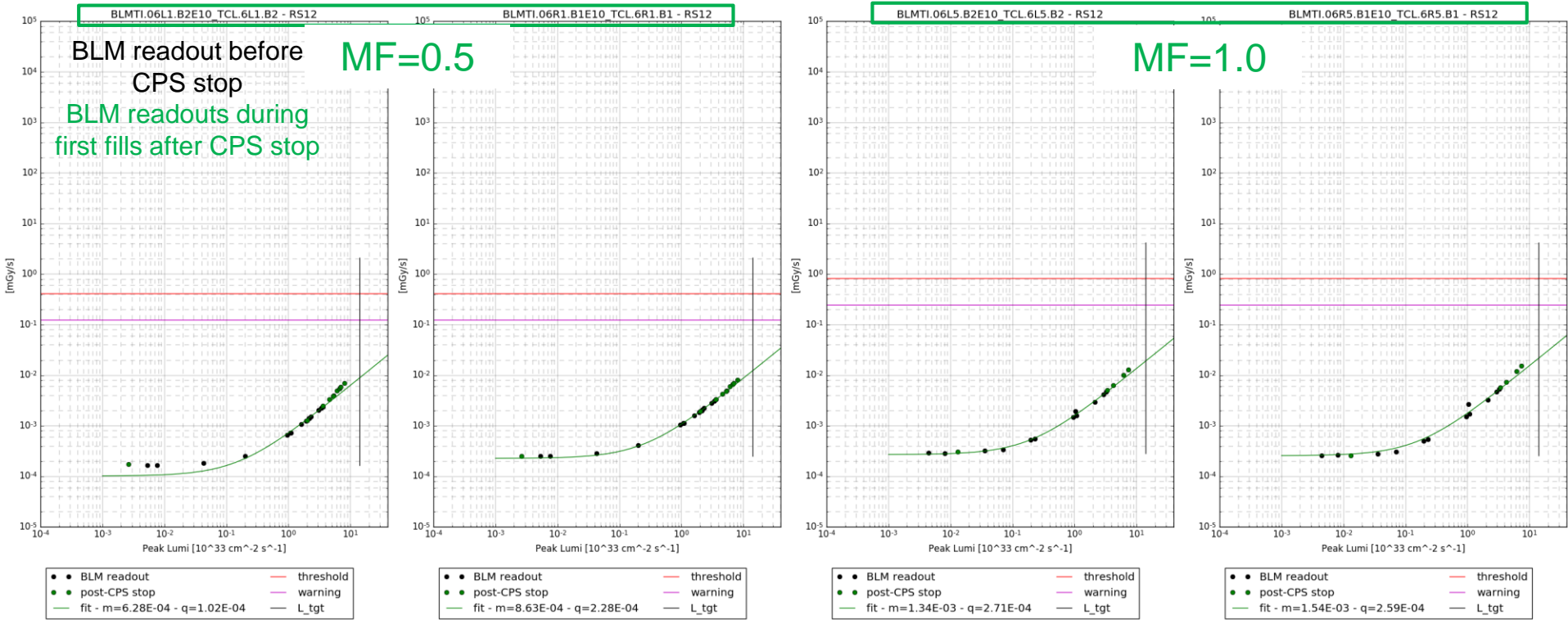
- TCTs would never trigger a beam dump;
- Factor 2.5 would move them out of the warning region;
- No specific request for BLMs at IR1/IR5 TCTs → expected to be close to the warning region for the very last intensity steps;
- IR2 has a very small luminosity → not at all a concern by construction;

Extrapolation – TCL5



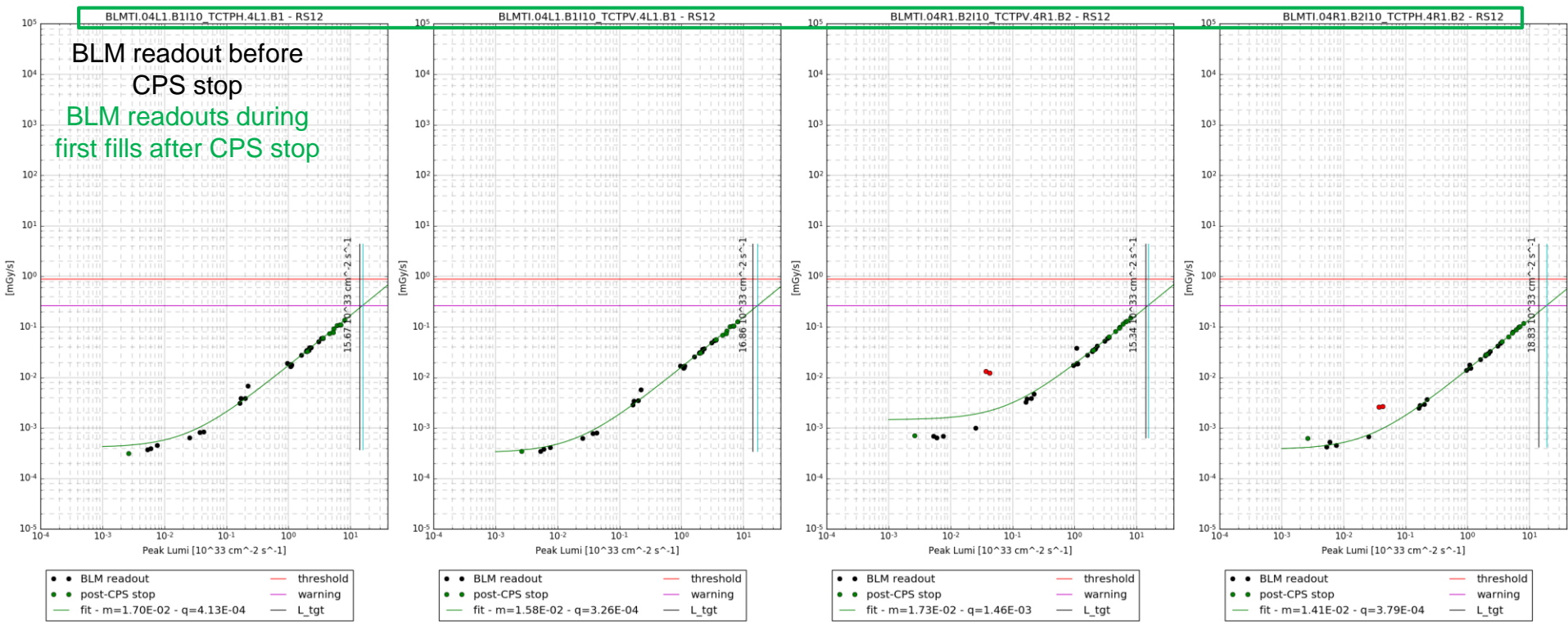
- No worry at all;

Extrapolation – TCL6 (XRPCs OUT)



- No worry at all;

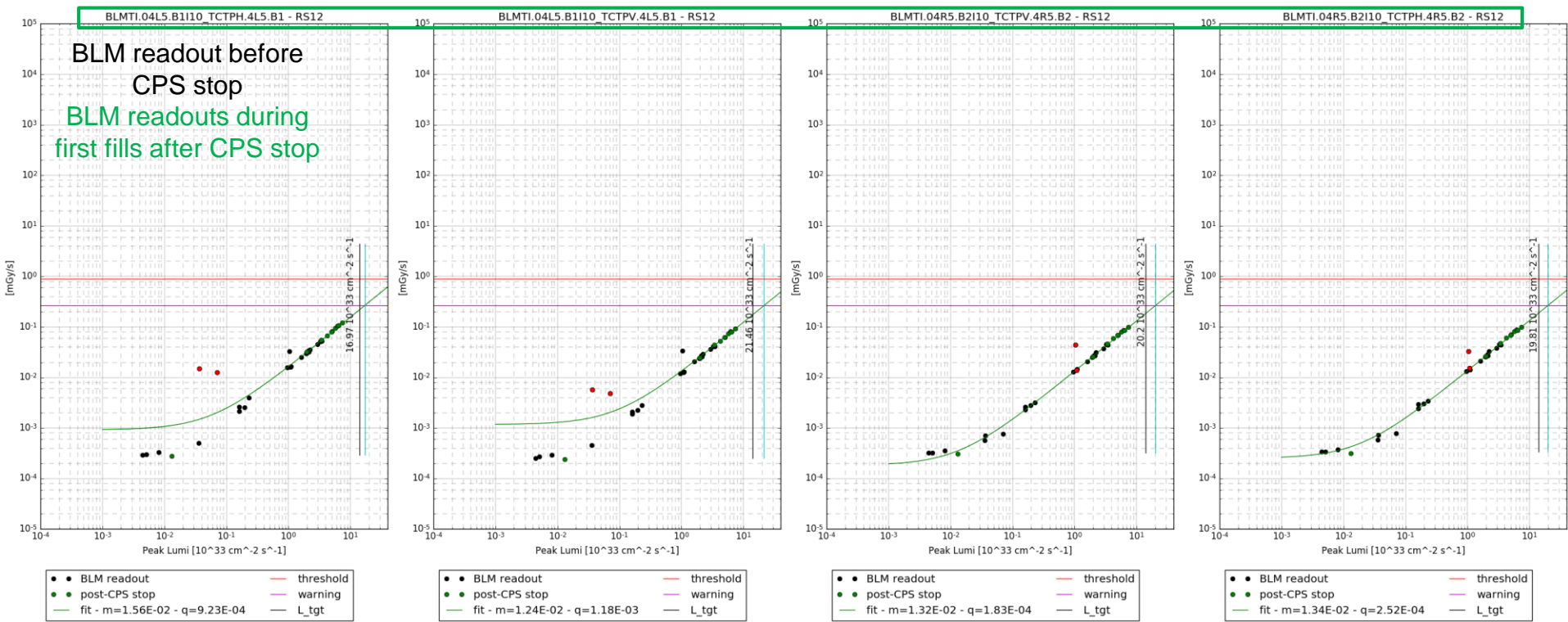
Extrapolation – IR1 TCT



- IR1 TCTs would never trigger a beam dump;

THRI_TCT - MF=0.1

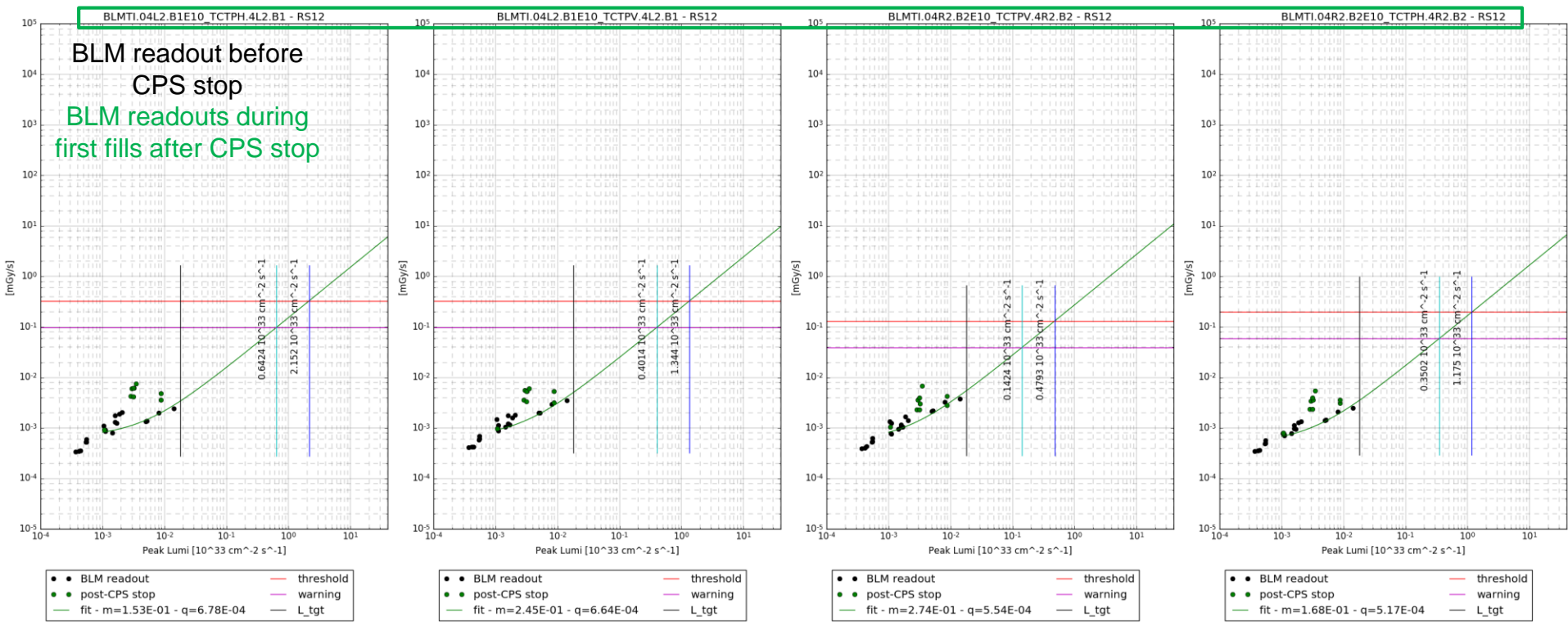
Extrapolation – IR5 TCT



- IR5 TCTs would never trigger a beam dump;

THRI_TCT - MF=0.1

Extrapolation – IR2 TCT



- No way for BLMs at IR2 TCTs to trigger a beam dump;

THRI_TCTVA - MF=0.2-0.5