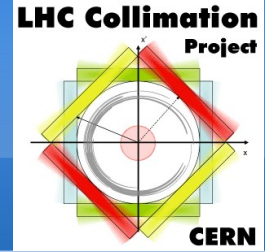


Status of multi-turn debris tracking at 7 TeV

F. Cerutti, L. Esposito, A. Marsili, S. Redaelli



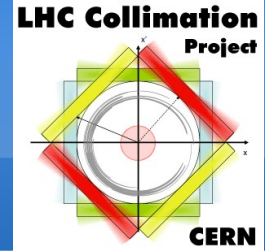
Outline



- Introduction
- 7 TeV – after LS1
 - Reminder: Frascati
 - Reproducing FLUKA simulations
 - Normalisation
- 4 TeV – reproducing measurements
 - TCL5 in/out



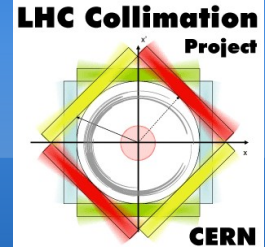
Introduction



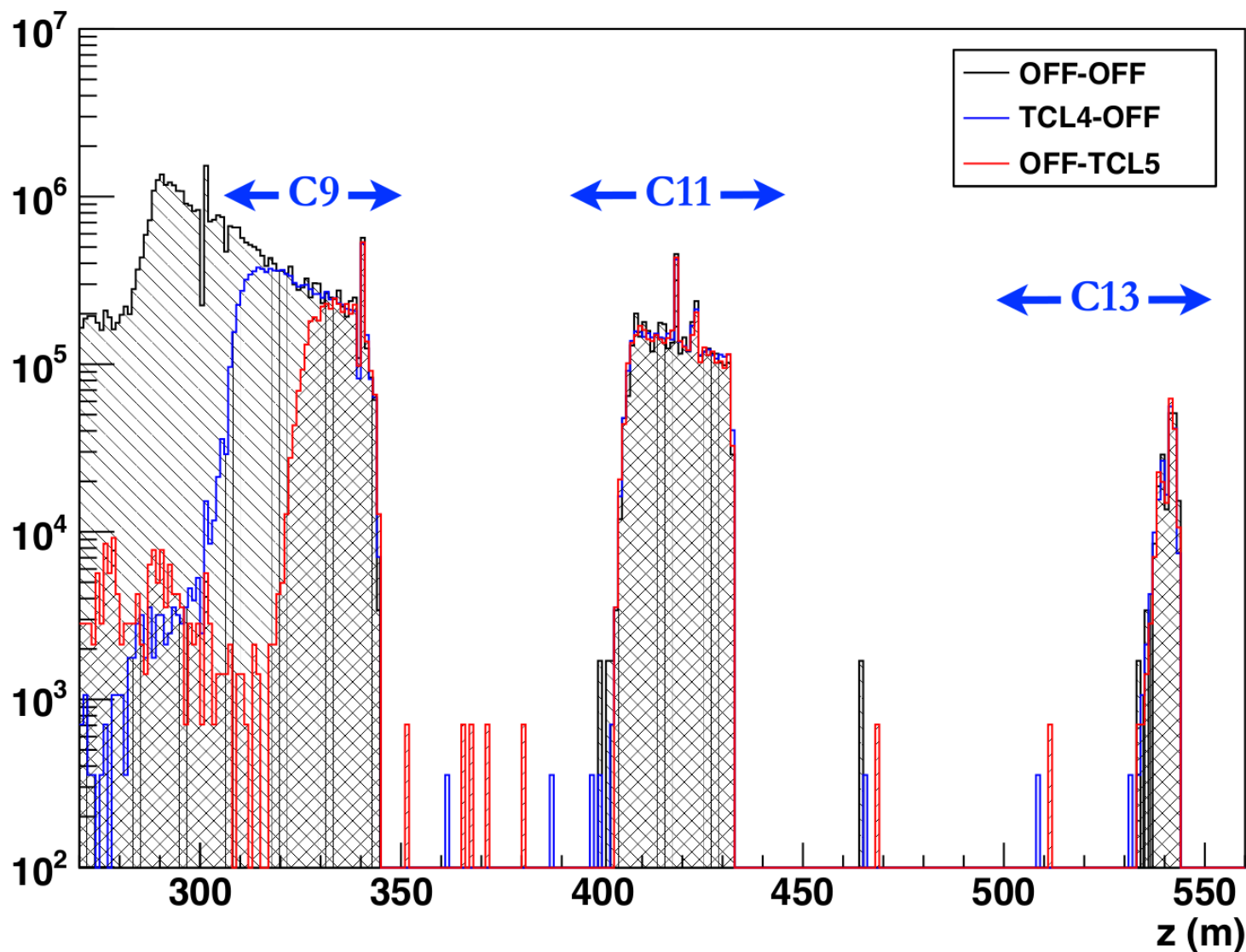
- Goal:
 - Study the losses due to debris from IPs instead of regular beam losses) by tracking them around the ring
 - Comparison with FLUKA simulations as presented in Frascati (Nov. 2012).
- 7 TeV
- Nominal optics + LS1 modifications
 - TCTVB are now beam-specific TCTVA
 - Extra TCLs around IP1 and IP5 for tests
- Initial particle distribution generated from simulations of collision products from the FLUKA team (F. Cerutti)



FLUKA results, IR5 (L. S. Esposito, Frascati, 2012)

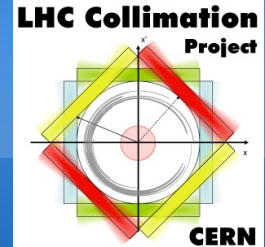


Proton loss (/m/s)





Simulation set-up



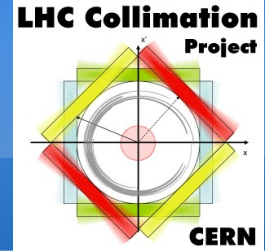
Coll. setting	σ
TCP IR7	6.
TCSG IR7	7.
TCLA IR7	10.
TCP IR3	12.
TCSG IR3	15.6
TCLA IR3	17.6

Coll. setting	σ
TCL	10.
TCLI	open
TCSTCDQ IR6	7.5
TCDQ IR6	8.
TDI	open
TCT IR1/5	8.3
TCT IR2/8	12.

- The setting of the new TCLs, under study, is still to be decided. When in use, they are set to 10σ .
- The TCTs around points 2 and 8 will be open more (unsqueezed optics)



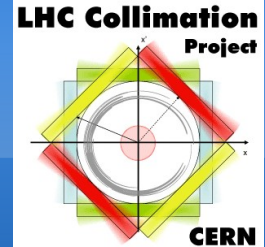
Normalisation: protons per meter per second



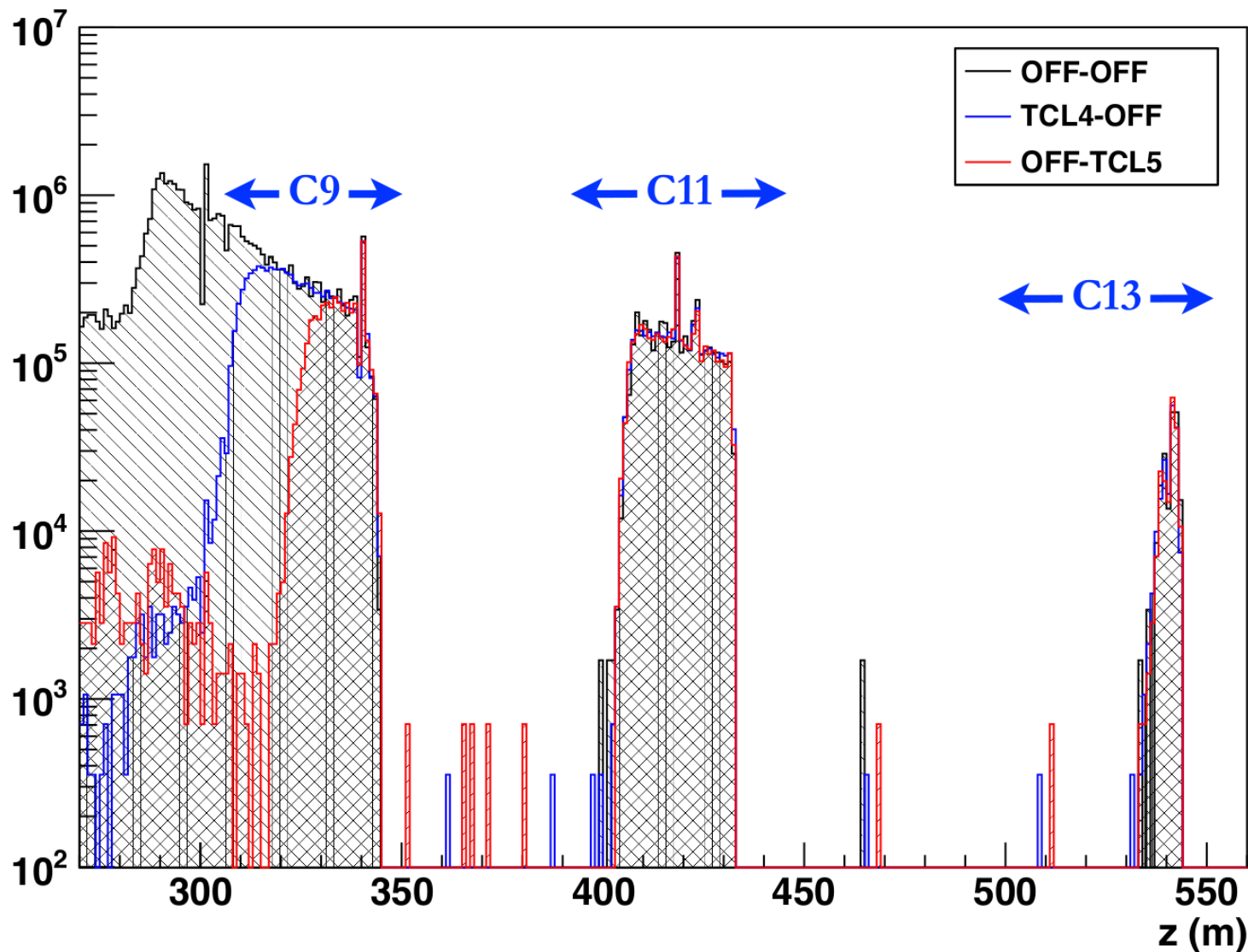
- Initial distributions generated for $1e7$ collisions
- (After cuts on type, angle and momentum, gives around $1.7e6$ protons)
- After LS1, expected luminosity is $1e34$ /cm²/s
- Inelastic cross-section at 7 TeV:
 $85 \text{ mbarn} = 85e-31 \text{ m}^2 = 85e-27 \text{ cm}^2$
- Which gives $8.5e8$ coll./s
- Results are given in p/10cm: extra factor 10
- Final factor: 850

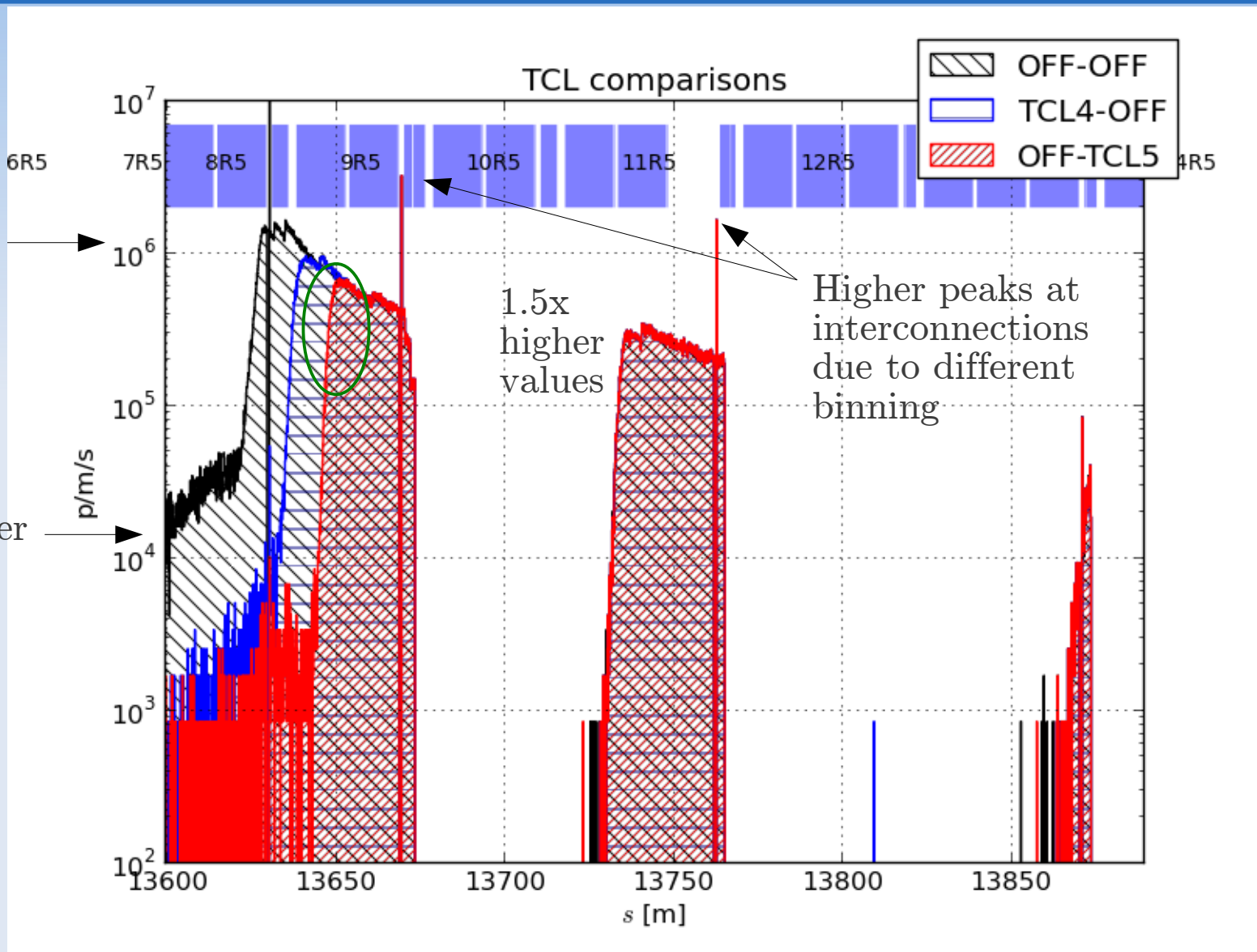


FLUKA results, IR5 (L. S. Esposito, Frascati, 2012)



Proton loss (/m/s)

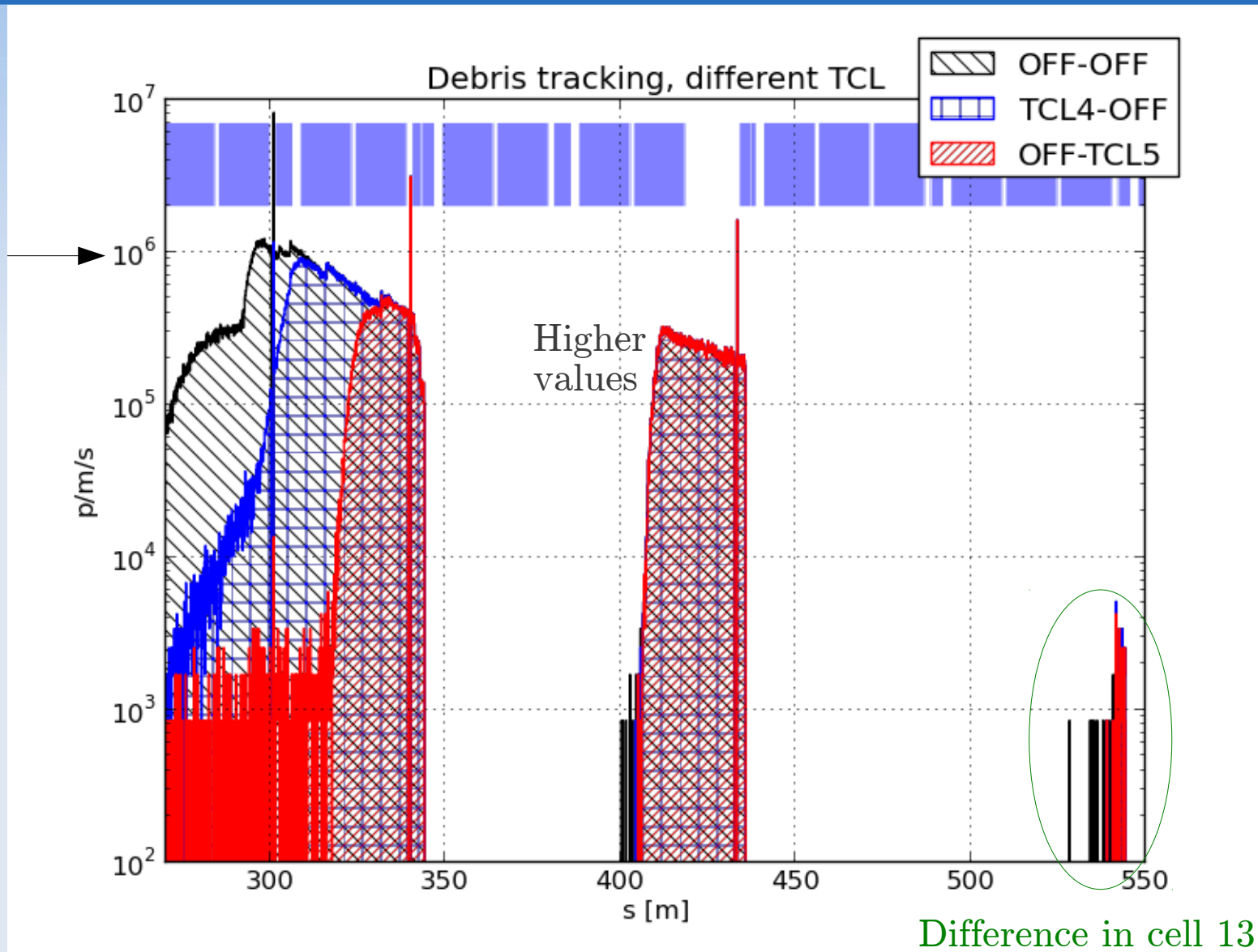




TCL5: losses start increasing at 313m from IP5 for SixTrack, instead of 320m for FLUKA

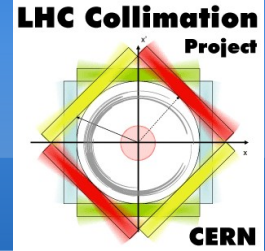
Sixtrack simulations, IP1

p/m/s





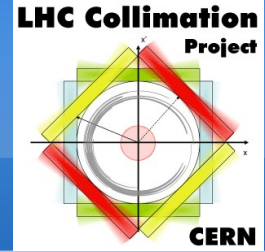
Conclusion



- Very promising results
- Good overall agreement after normalisation, especially in the most critical areas
- Still some differences to track down: differences in orbit, position of the collimators? (a few meters can matter a lot)
- Further work:
 - How to protect further downstream?
 - TCL6
 - TCL7
 - Scans (intermediate settings)



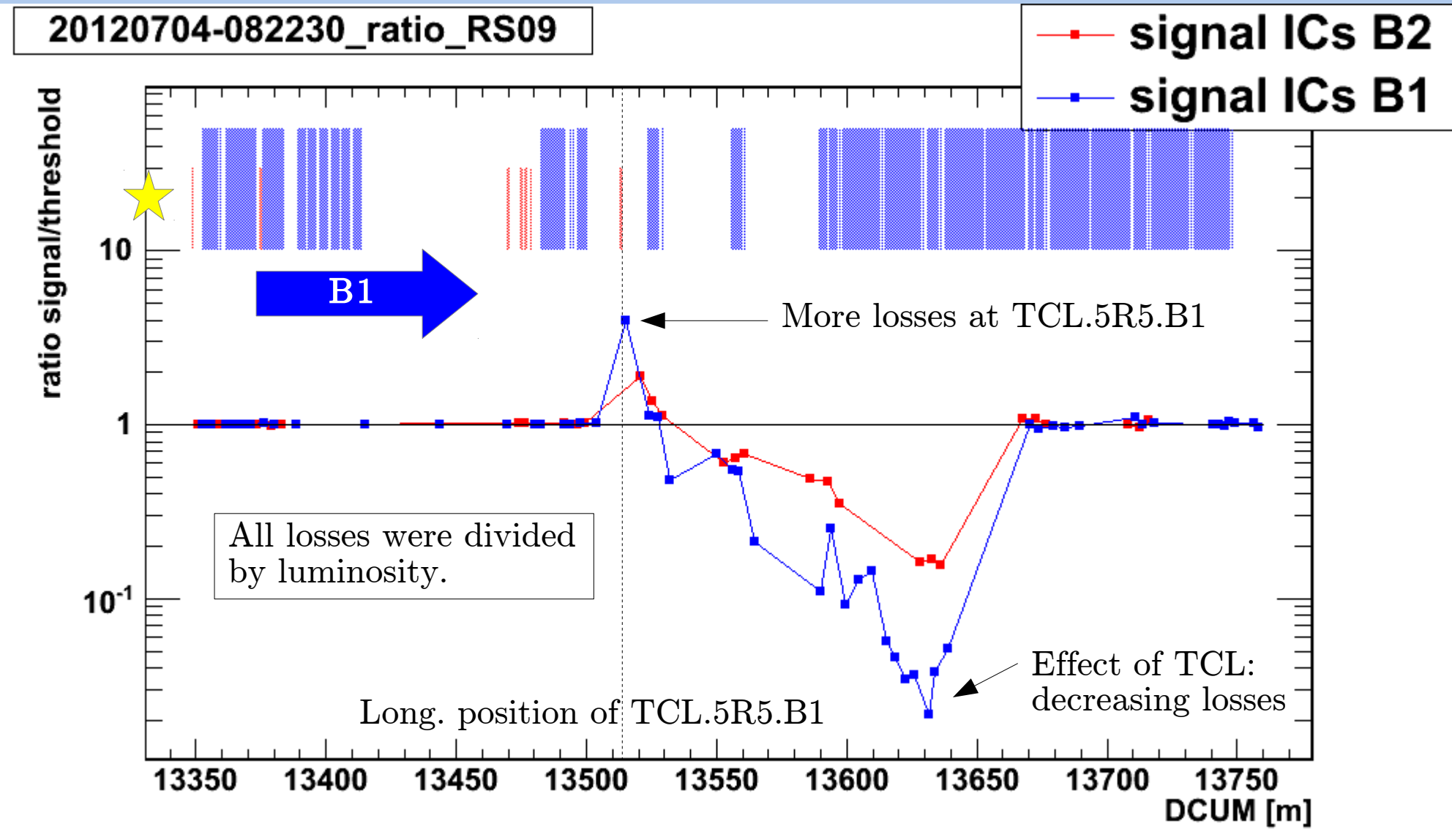
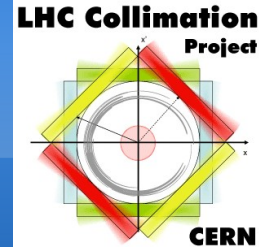
4 TeV Reproducing measurements



TCL5 scans, 4 TeV

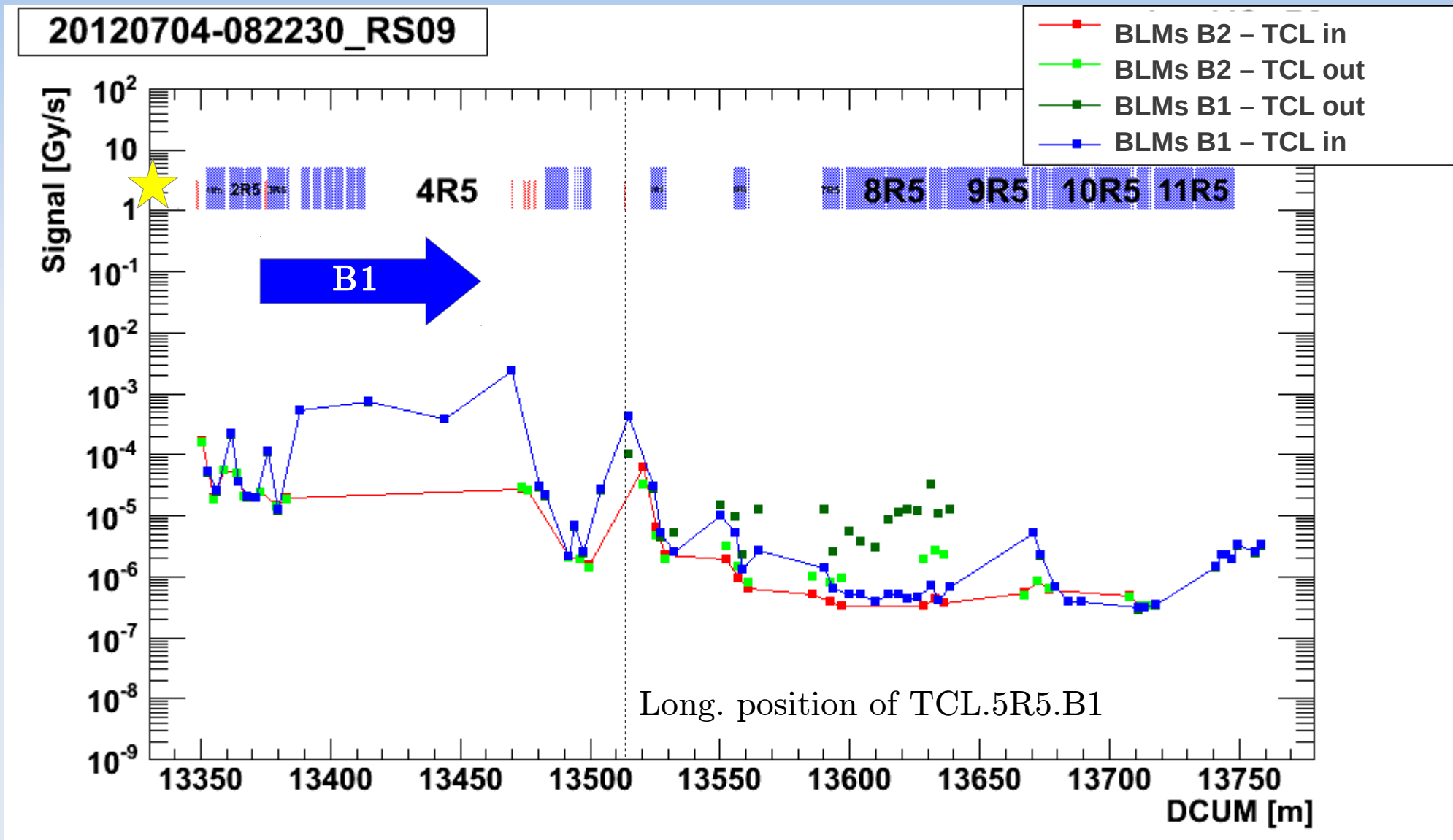
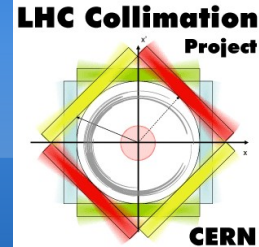


Ratio in/out losses normalised by luminosity



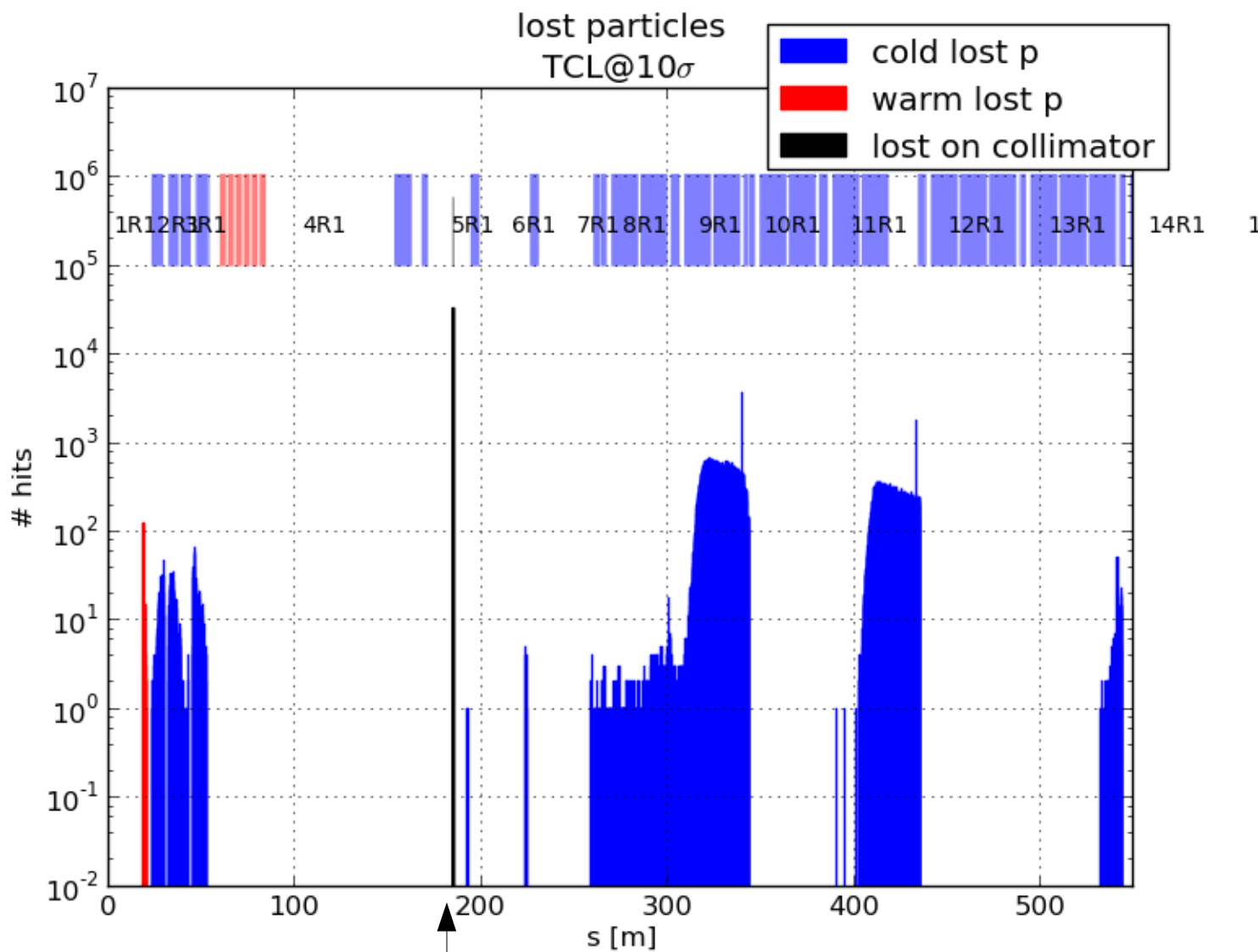
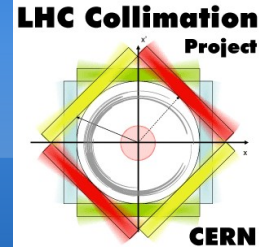


LHC loss map: Effect of the TCL 5



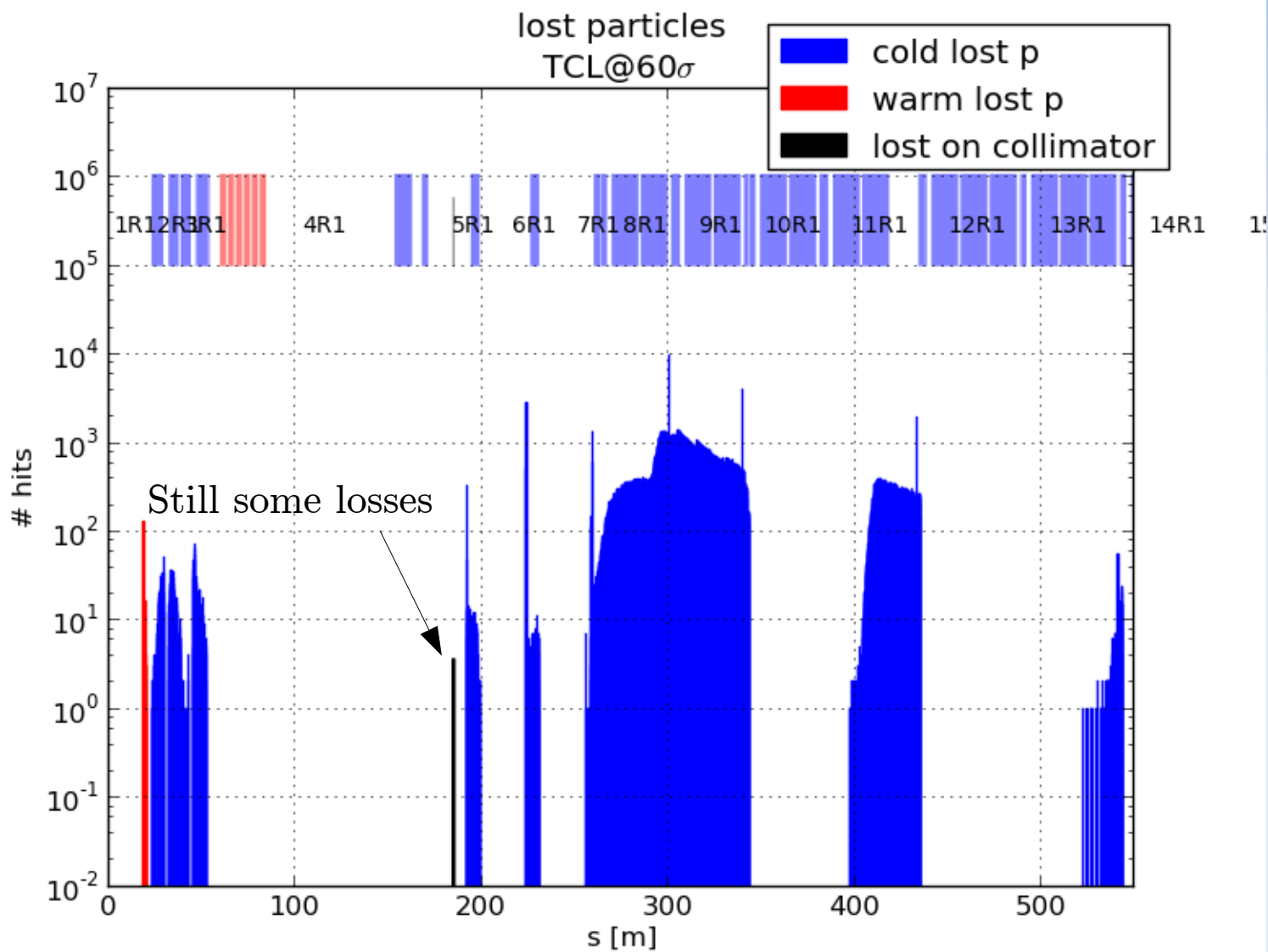


TCL in (10σ)



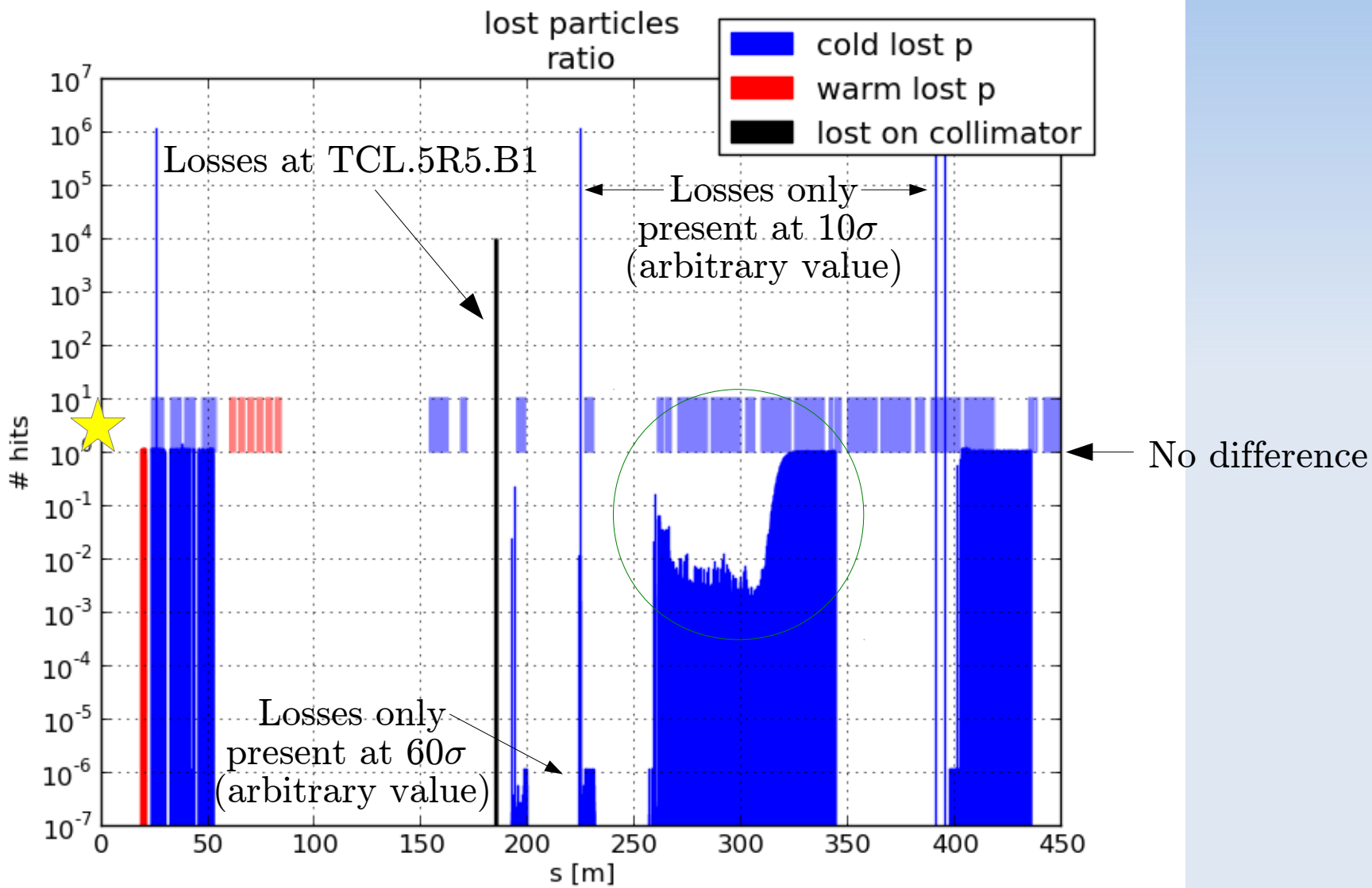
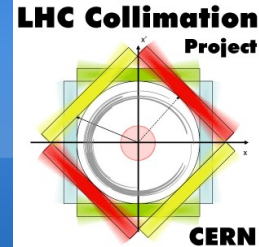
Long. position of TCL.5R5.B1

TCL out (60σ)



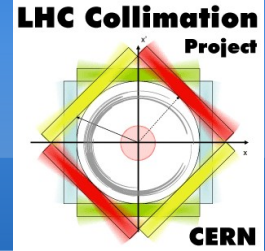


Reproducing measures with simulations: ratio in/out





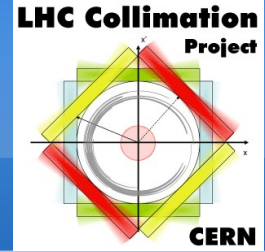
Observations



- Similar shape
- Ratios are more extreme in simulations
- At TCL:
 - Measured: factor 4 (secondary shower)
 - Simulated: factor $1e4$ (absorbed particles)
- Downstream:
 - Max. measured decrease: $2e-2$
 - Max. simulated decrease: $5e-3$
- Difference :
 - Number of impacts / losses measured by BLMs...



Conclusion



- Results similar to measurements
- Effect of TCL is much higher in simulations
- Issue of the reproduction of the BLM signal
- Further work: more measurements of TCL scans to process...