BLM proposed system changes Primary Collimators, Triplet, TDI

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MPP

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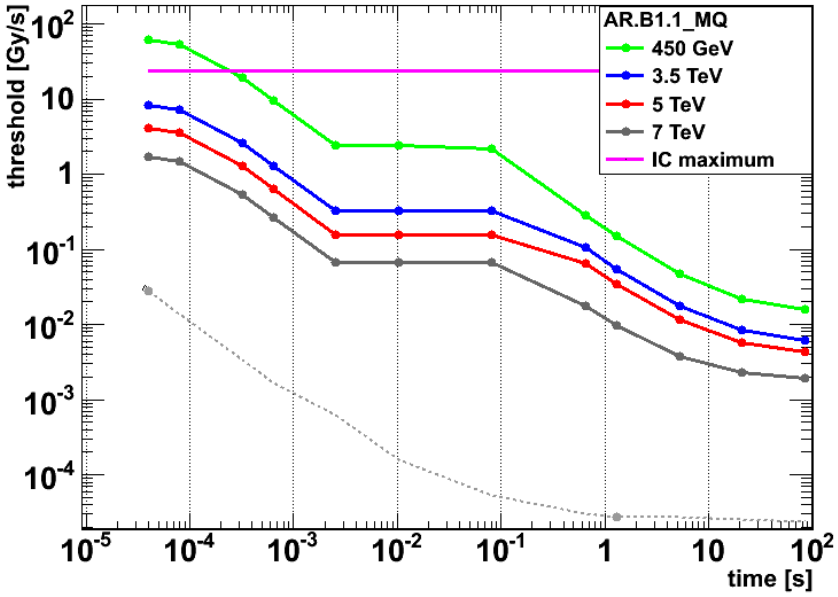
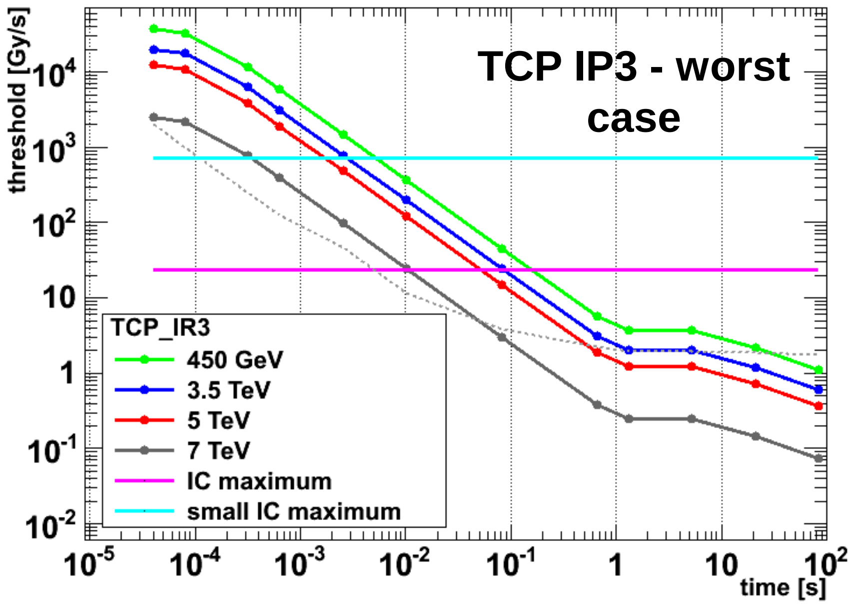
Threshold levels compared to dynamic range

Highest threshold cold magnets: OK (as defined in functional spec)

- Problem reduces with higher energies
- TCP IP3: worst case
  TCSG and TCLI: 10 times lower thresholds
  → capacitor (up to factor 100)
- Similar for warm magnets
  → most locations should need no changes
- possible limitation? → see next slides





TCP in IR7 – Andres Gomez Alonso

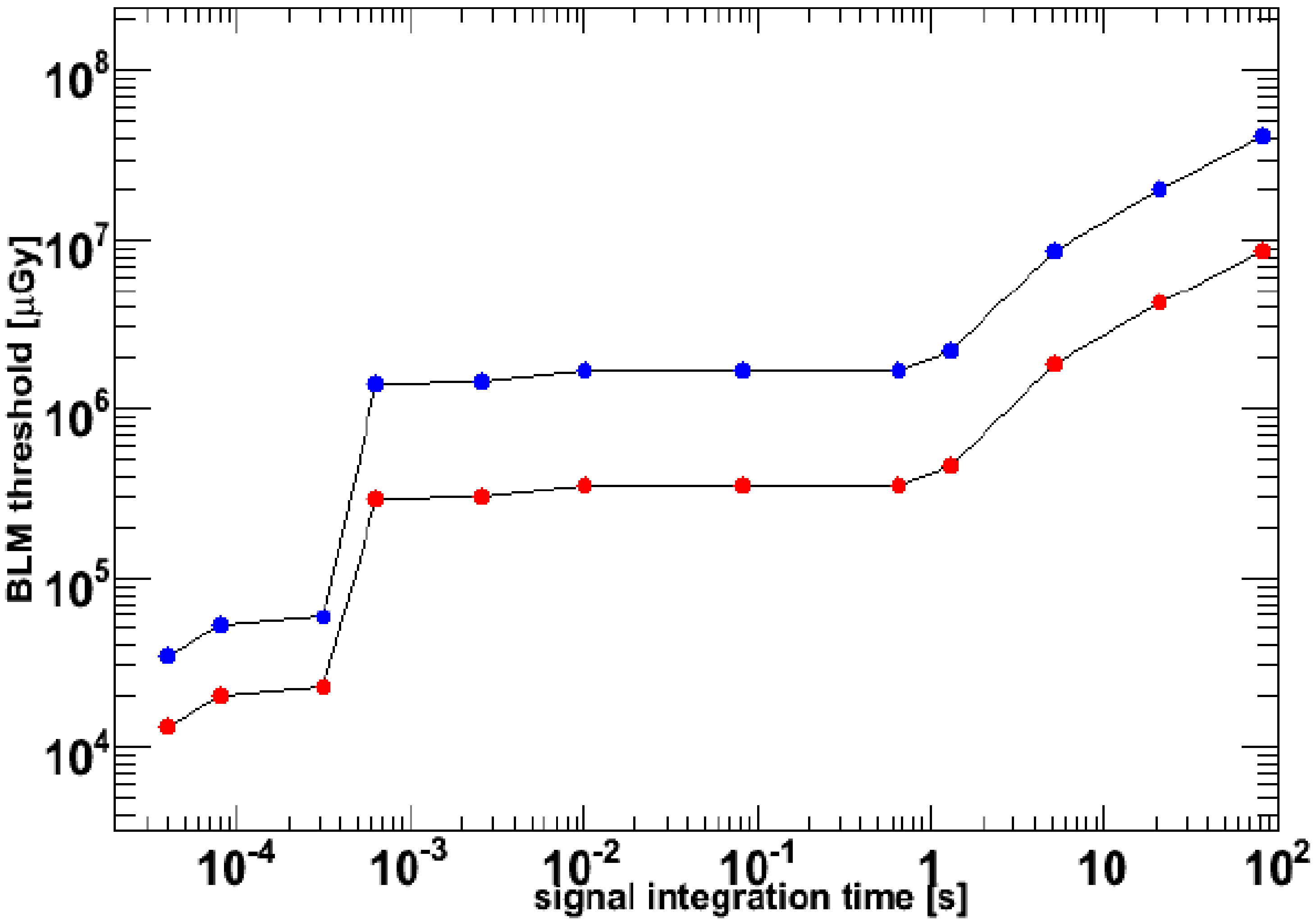


Illustration 4: BLM thresholds on TCP collimator in IR7 expressed in dose, as a function of signal integration time. A dose of 10^{-12} Gy per impinging proton is used.

TCP in IR7 – Andres Gomez Alonso

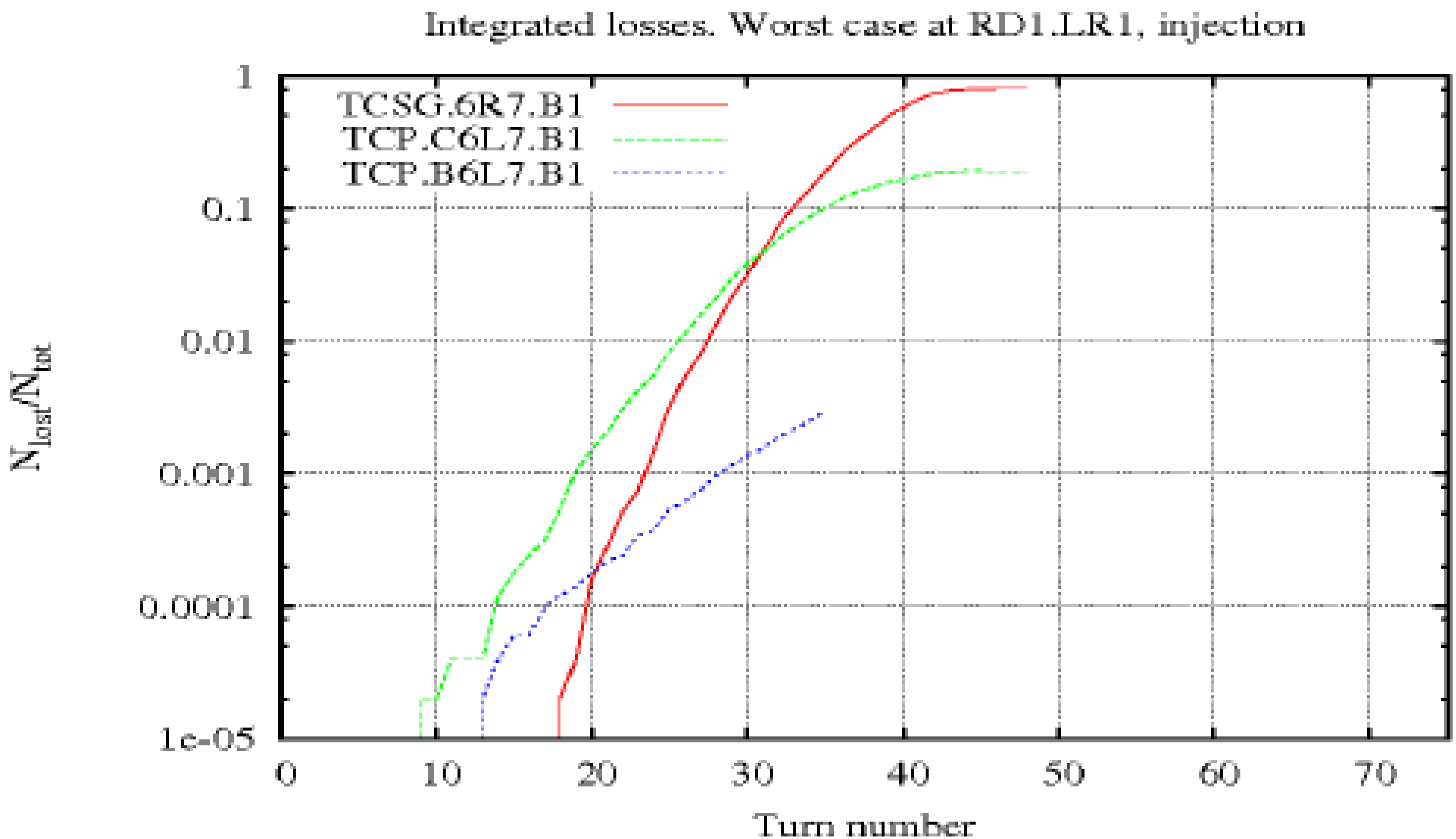
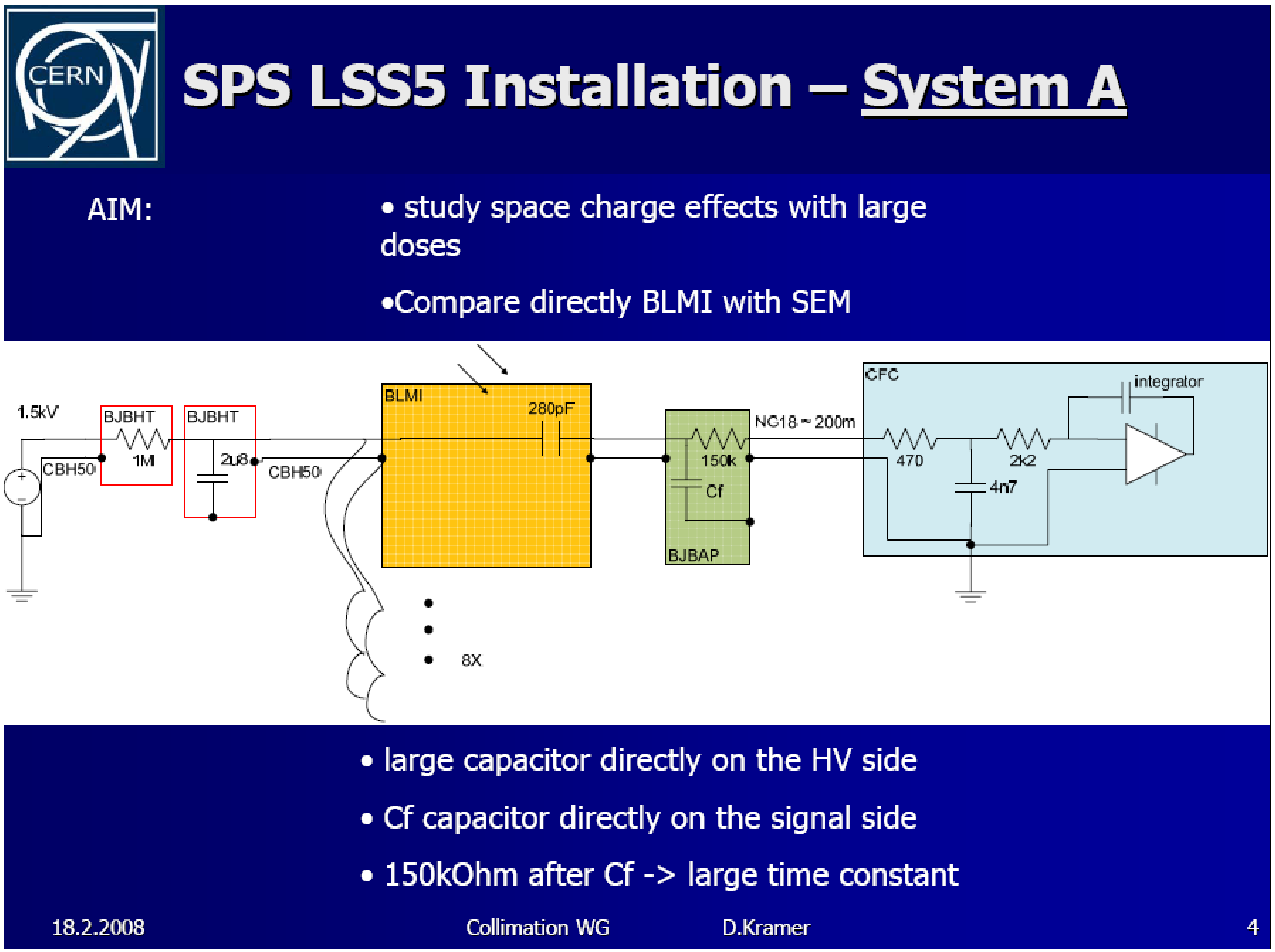


Illustration 1: Number of lost protons integrated from the beginning of the failure normalized to total number of circulating protons before the failure [4].

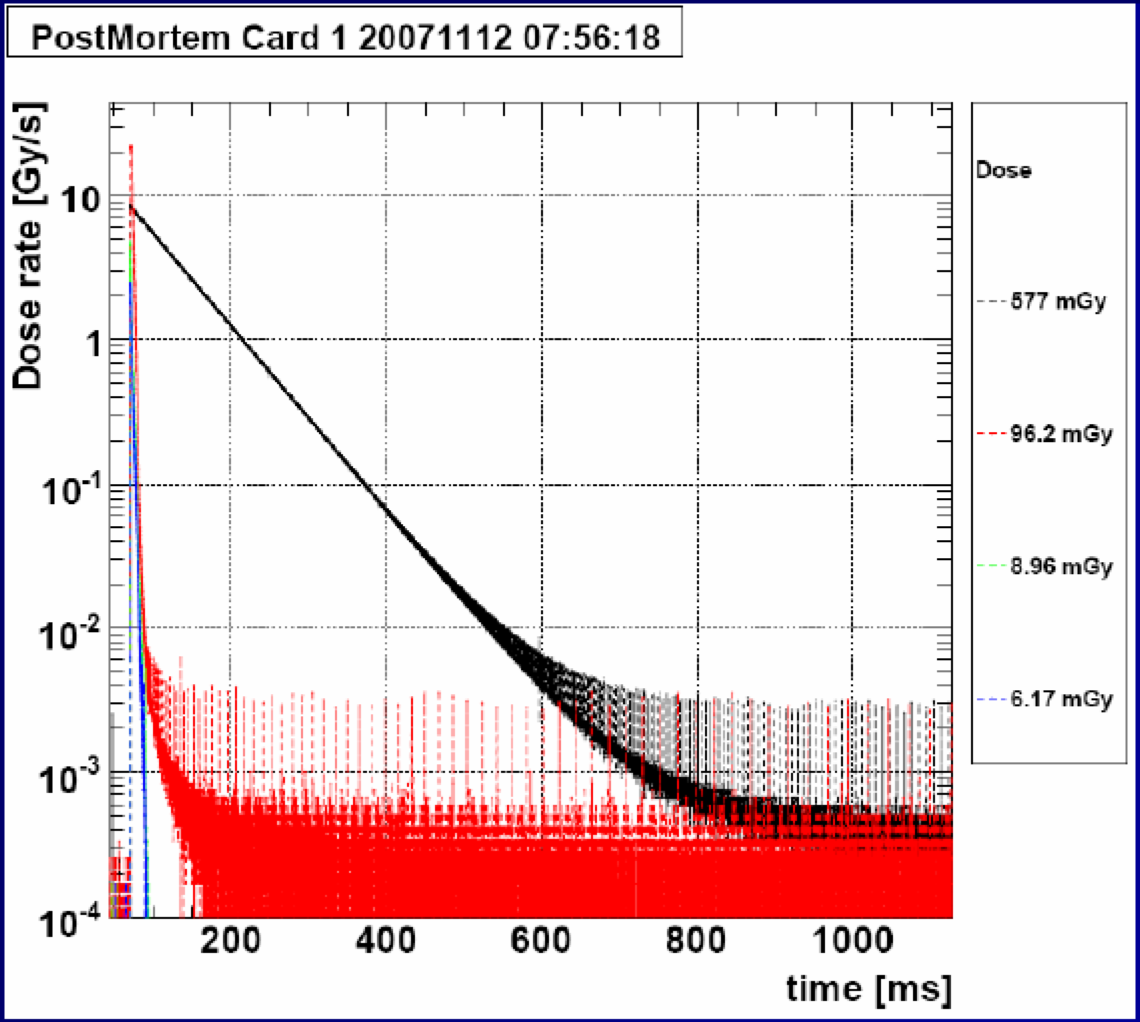
Resistor-Capacitor Delay



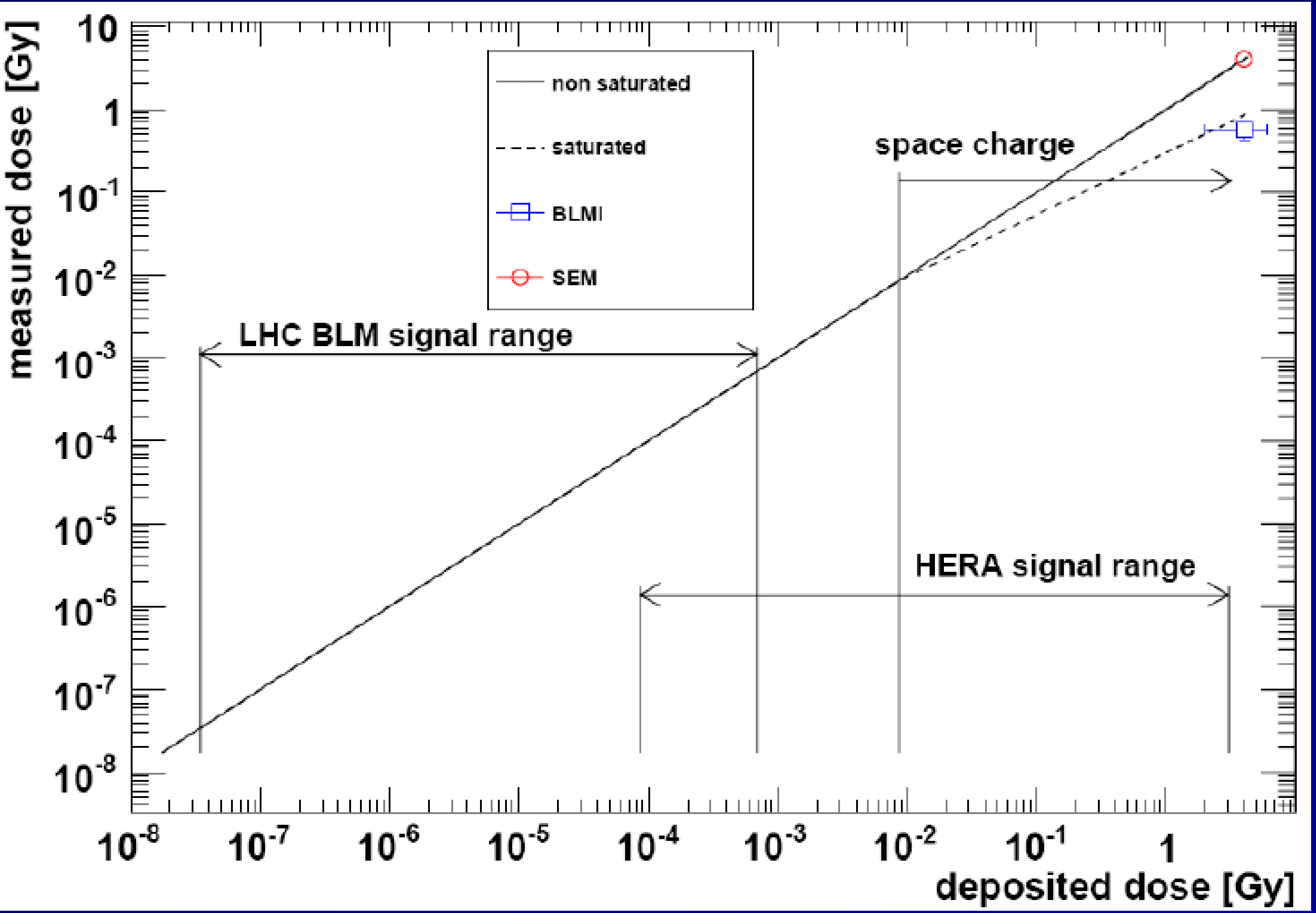
Experience:

- **LHC dump lines**
- **HERA and various IC response tests (thesis M. Stockner)**
- **Some of the SPS LHC collimator tests (thesis D. Kramer and T. Bohlen)**

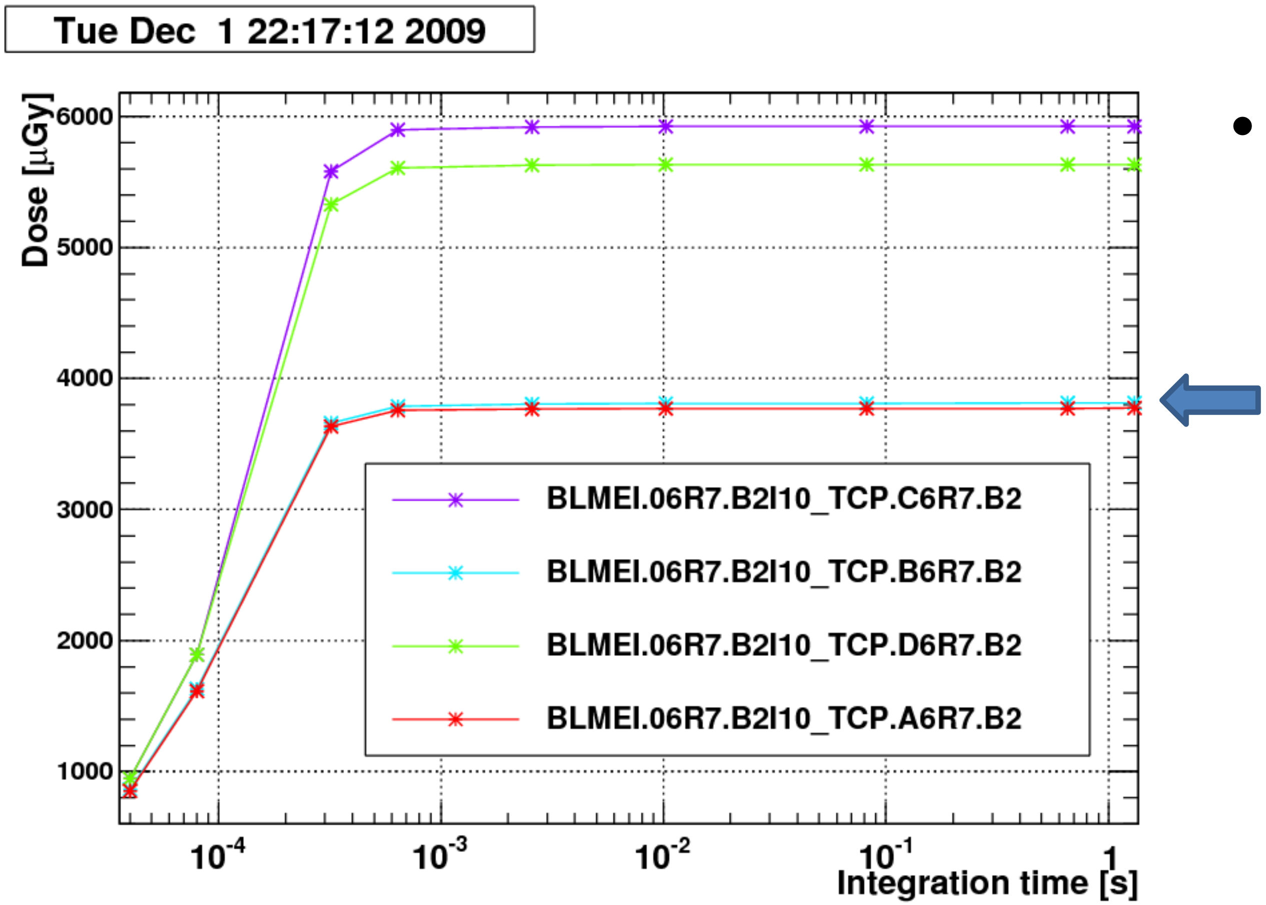
System A 1.3e13 p⁺ dumped on collimator, Left Jaw at -5 mm, Right Jaw out



BLMI Space charge effect estimation ("signal saturation")

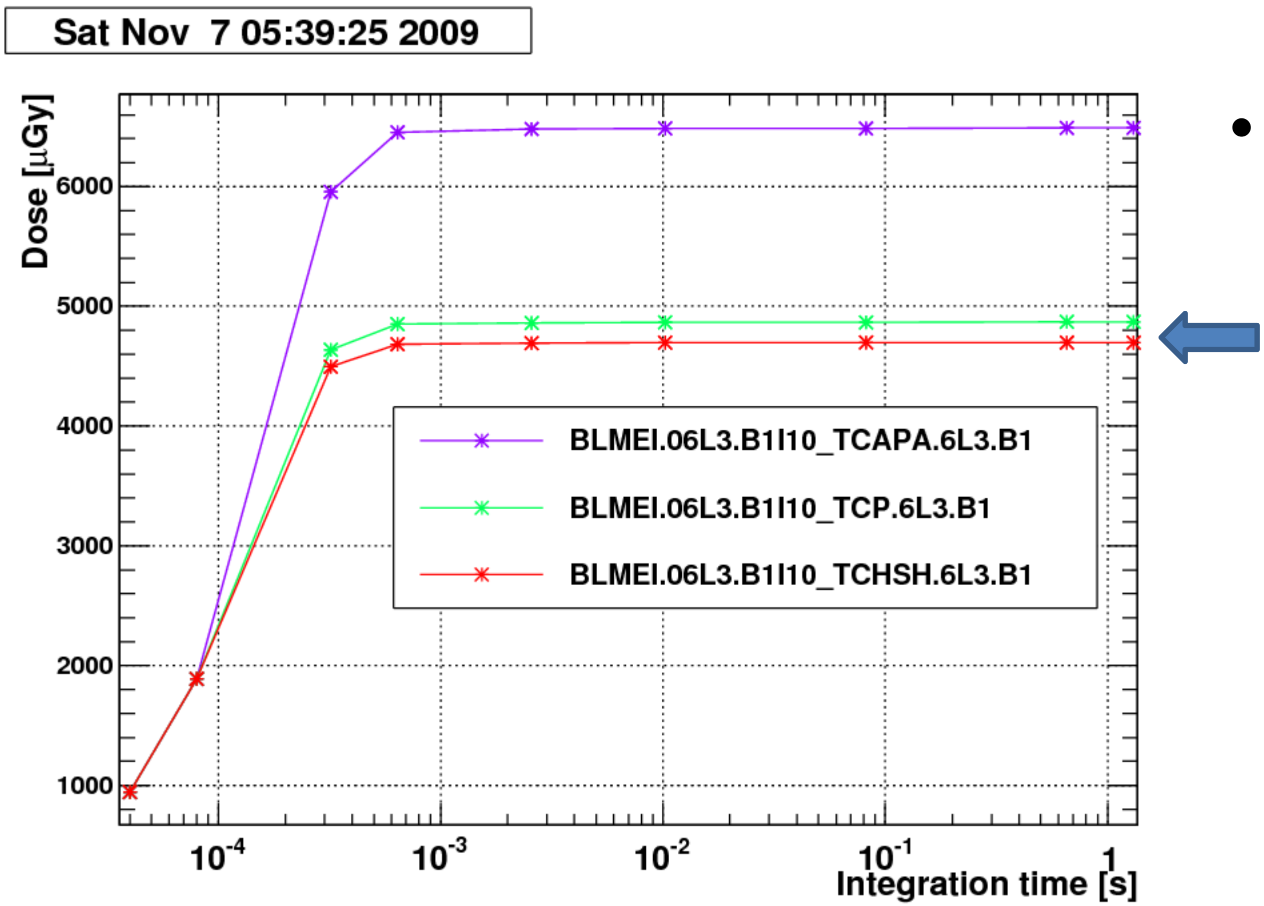


TCP in IP7



- Signal collected within 640μs
- IC on last collimator and IC 1.5-2m afterwards (no element in between) show same signal

TCP in IP3



- Signal collected within 640μs
- IC on last collimator and IC 1.5-2m afterwards (no element in between) show very similar signal

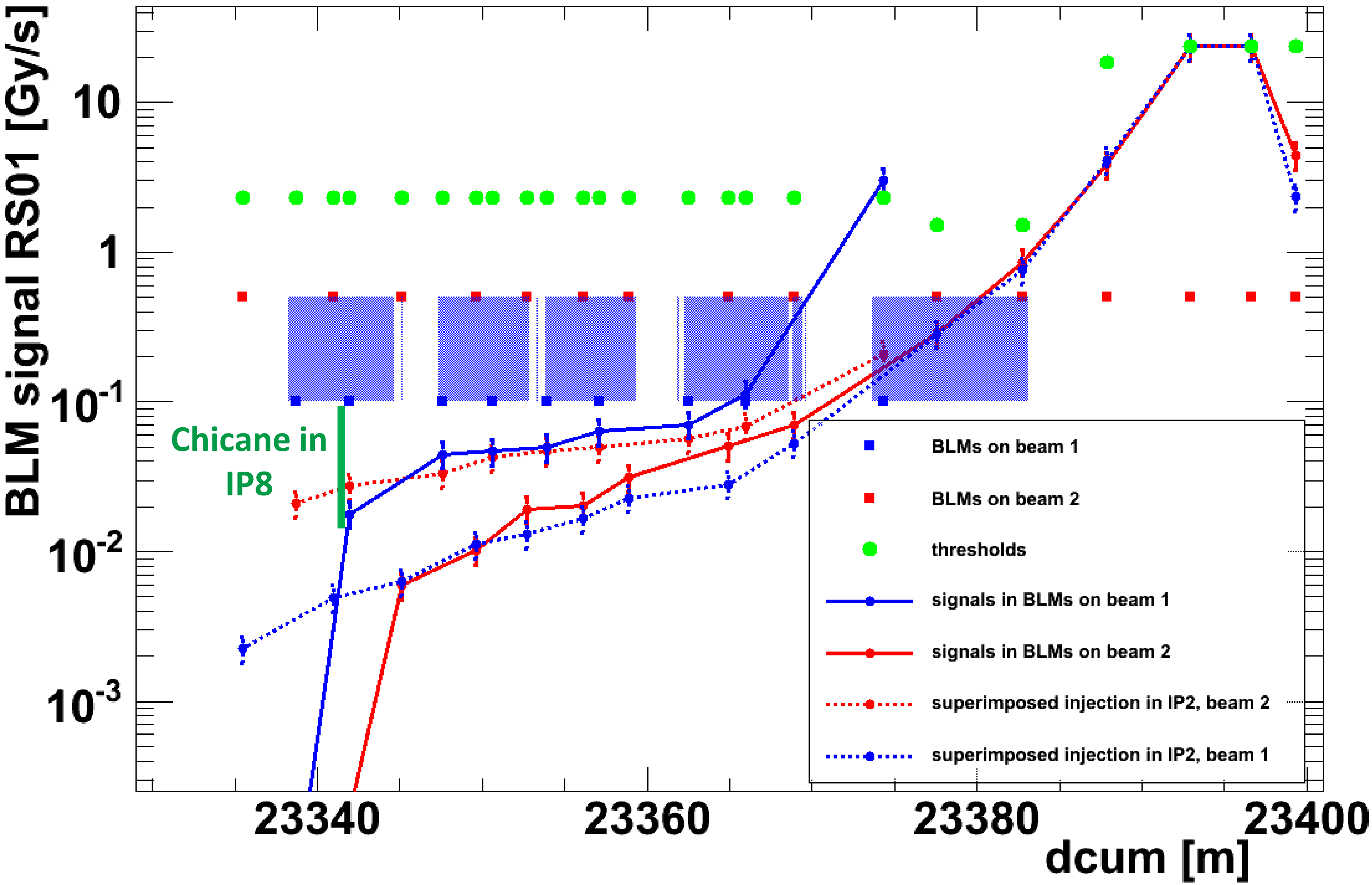
TCP Thresholds

- Add a capacitor and a resistor to the readout chain of all 8 TCP ICs
  - Reduce the peak signal by a factor of 175
  - Increase length of the signal by 175 → signal collected within 112ms
  - For 1.3s integration time (logged every 1s) → practically no difference
- Increase the upper end of the dynamic range by a factor of 175
- The thresholds will have to be recalculated and redeployed

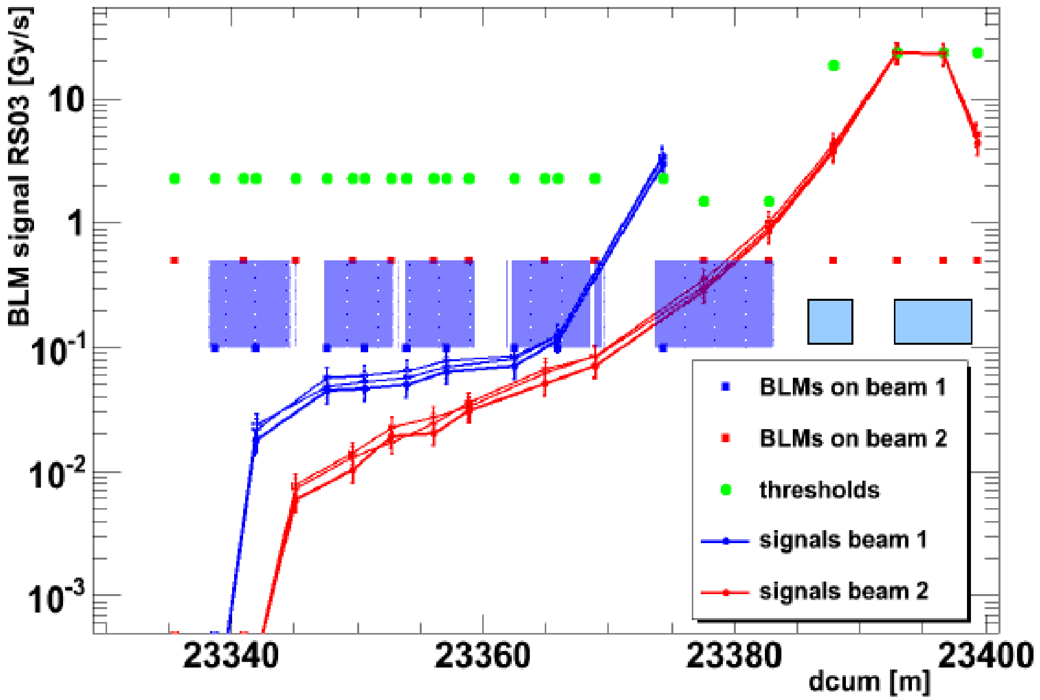
- 40µs 450 GeV threshold values:

TCP	Theoretical threshold [Gy/s]	Old thres. [Gy/s]	New thresh. [Gy/s]
IP3	~40’000	23	4’025
IP7	~2’000 (correction for ultrafast losses due to RD1.LR1 failure	23	4’025

Triplett at over-injection



Tests in December 2009 to investigate the overinjection



- overinjection, TDI open
- injection on closed TDI, kicker off
- in addition closed TCTV

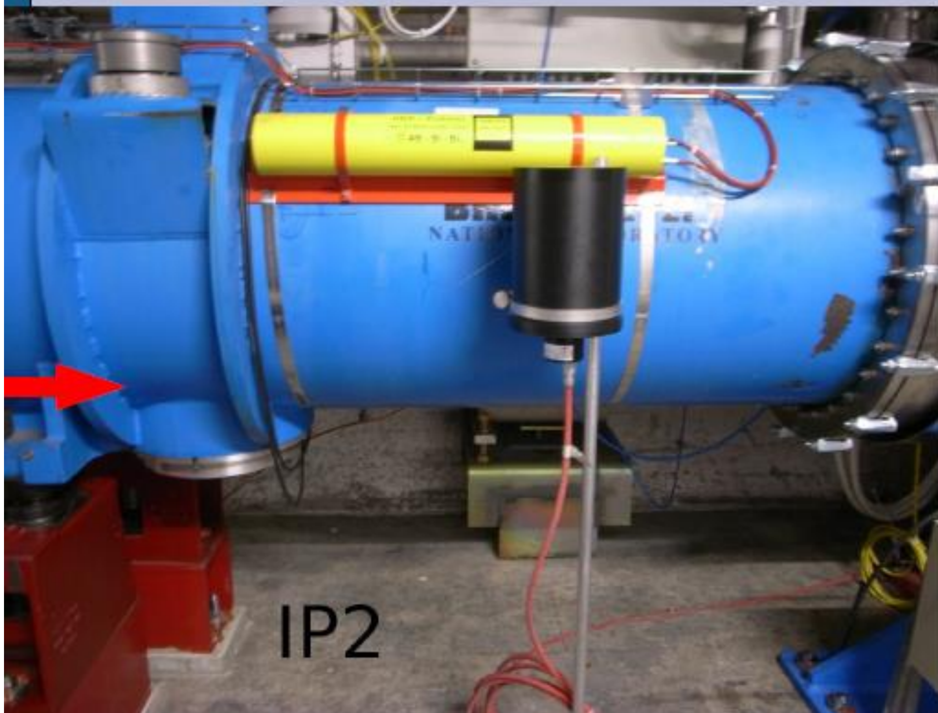
Observation: signals do not change

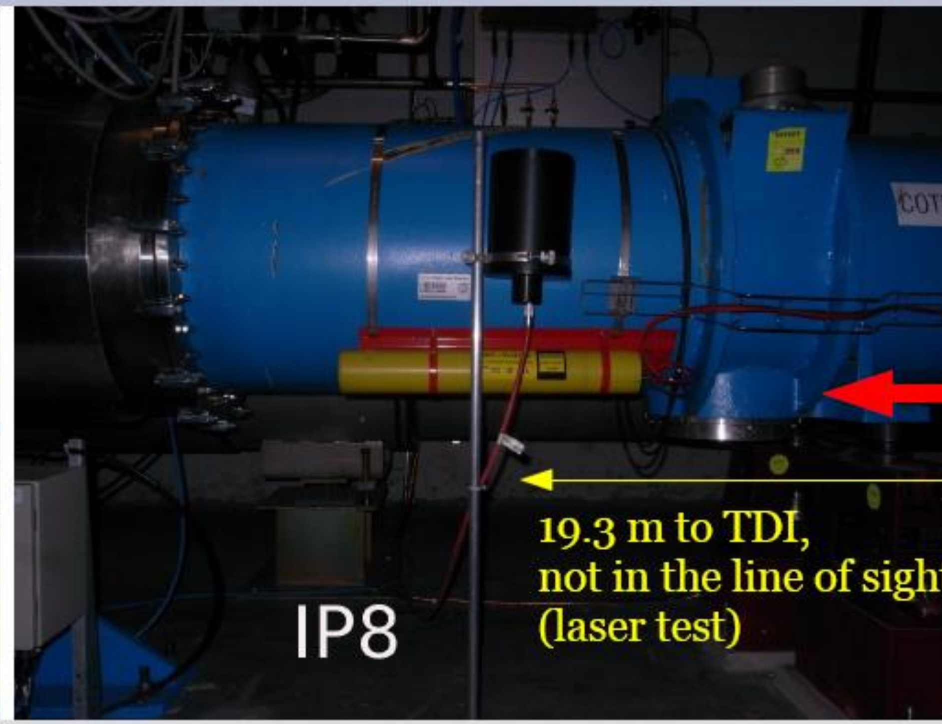
Observation: signals in BLMs on beam 1 systematically higher than on beam 2 while beam 2 injected – because of triplet symmetry they are expected to be the same

Conclusion:

- signal in the BLMs comes from shower outside the cryostat

Inspection of IP2 and IP8





- Inspection: January 26th, 2010, with Laurette Ponce
- Next day monitor in IP8 has been moved up
- There is no guarantee that this solves the problem
- Data from Ramses monitors will probably not help to analyze the problem

Overinjection: proposed solution

- Test overinjection and see if the monitor goes over threshold after change of its position
- If yes than load new thresholds to this monitors (this one is factor 3 below the expected quench level) – short term solution
- Long term solution:
  shield (simulation needed!)

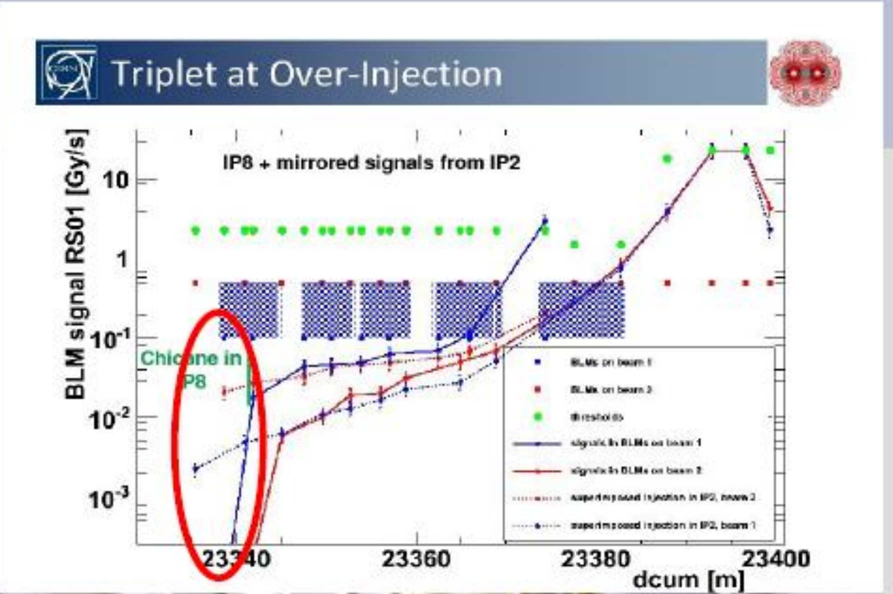
TDI (Saturation)

- Same as at TCP: install capacitor + resistor to slow down the signal and measure higher instantaneous losses. Factor: between 10 and 175?
- Integration over a longer time: averaging out fluctuations
- Daniel Kramer found that integration times of about 1ms gave the best signal to noise ratio with LHC set-up in SPS.

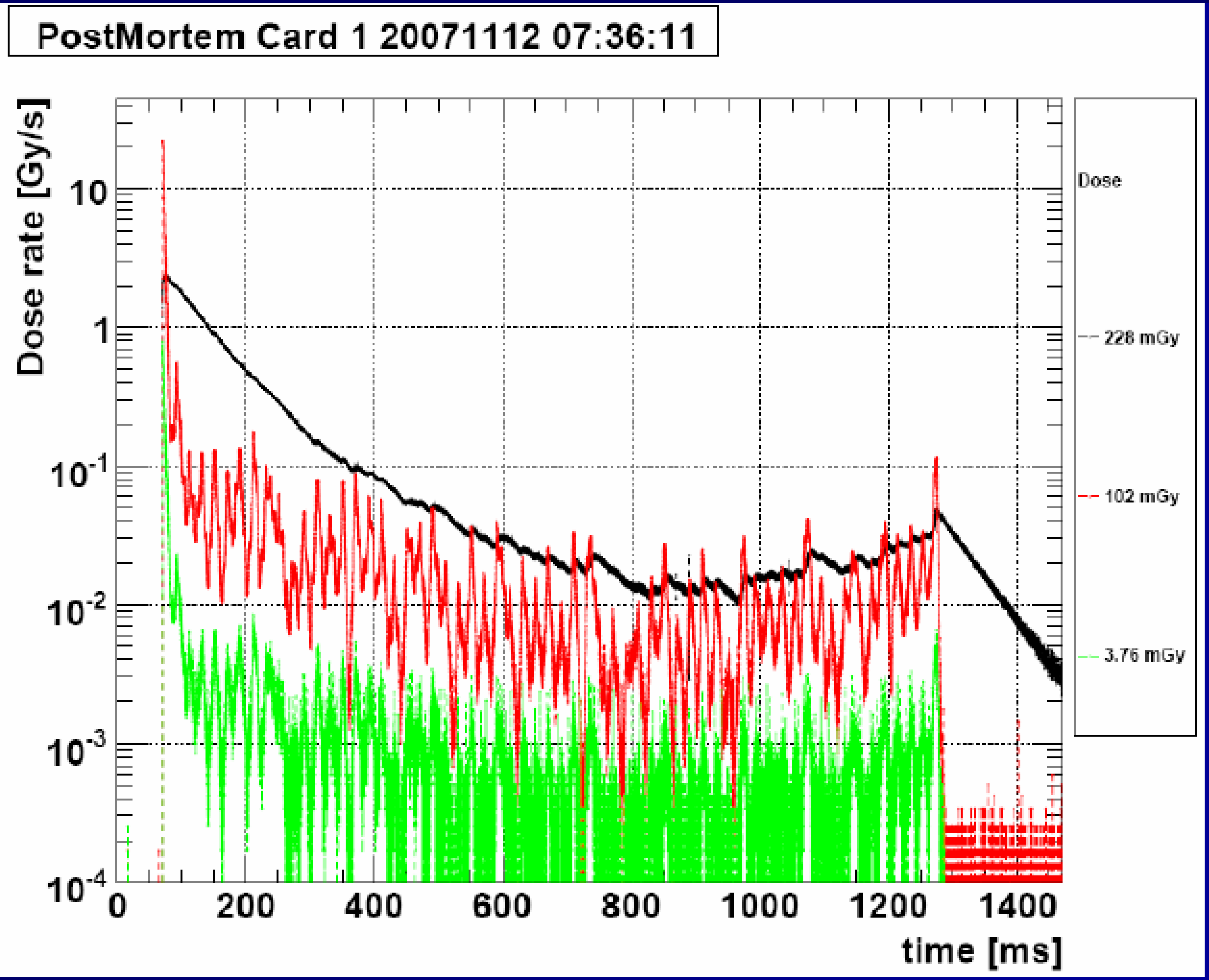
Additional Slides

Chicane in IP8

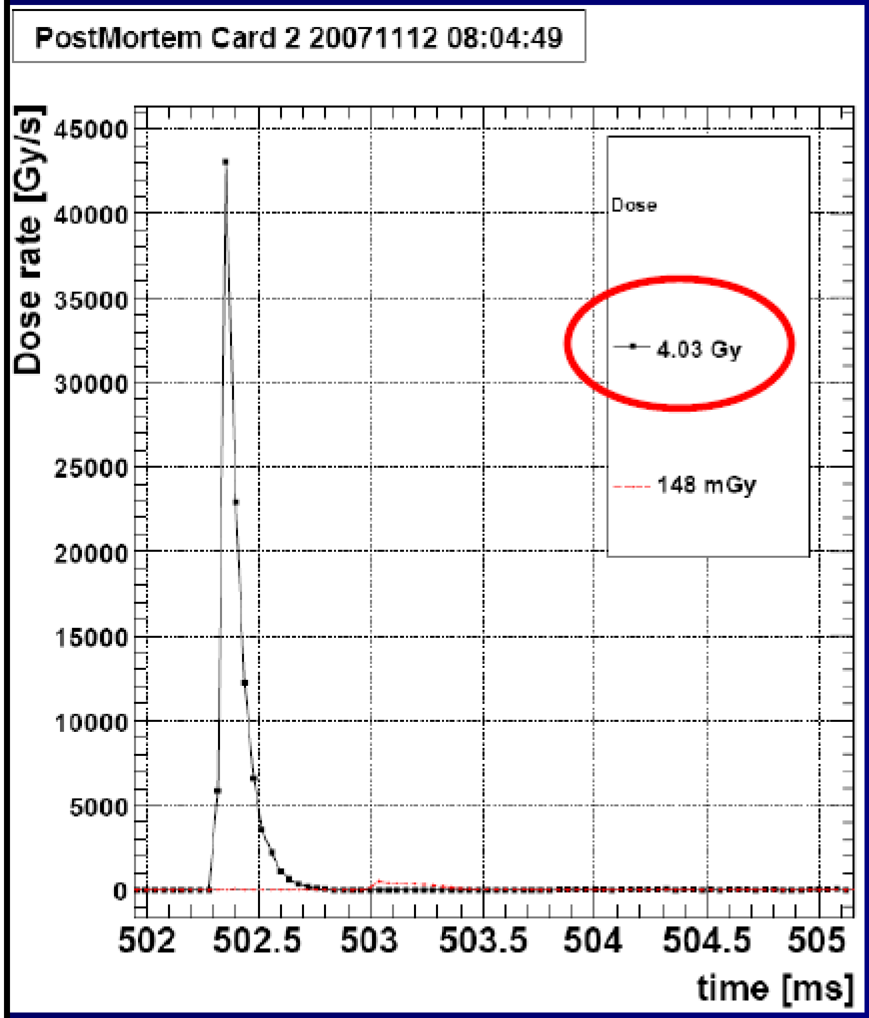
- Why signals in IP8 at the beginning of triplet are 2 orders of magnitude smaller than in IP2?
- There is a chicane in IP8 not present in IP2 (why?)
- This proves (again) that signals in the BLMs come from outside the cryostat

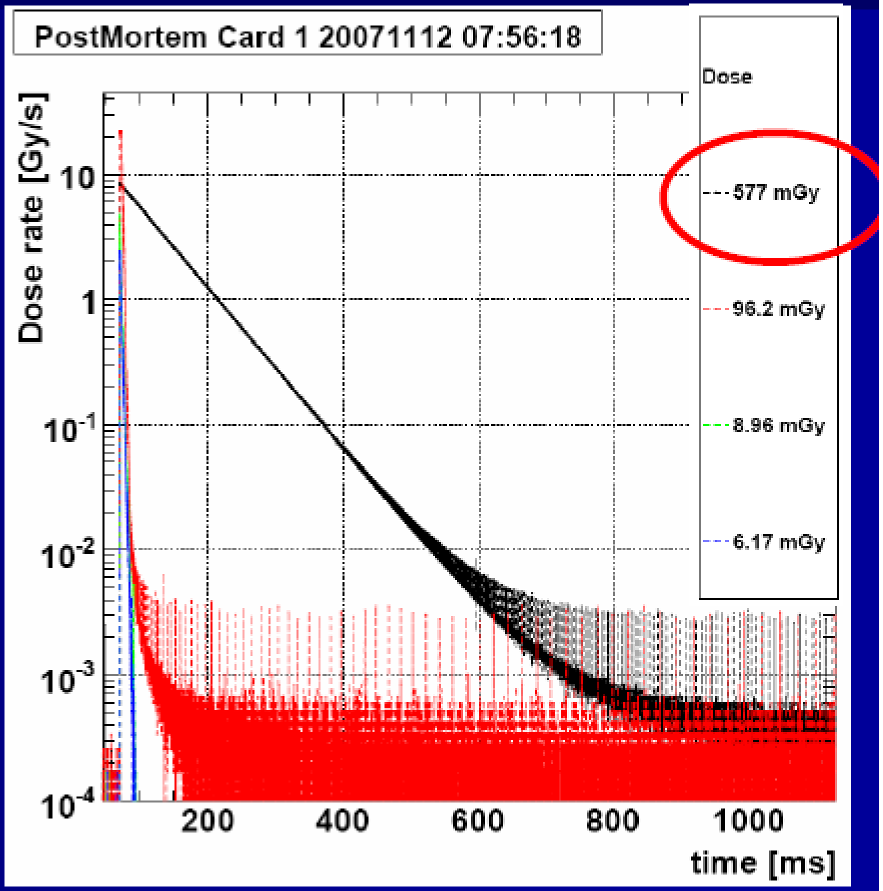


System A 1.3e13 p⁺ injection plateau, Left Jaw at 10mm, Right Jaw out, Dump @ 1.2s



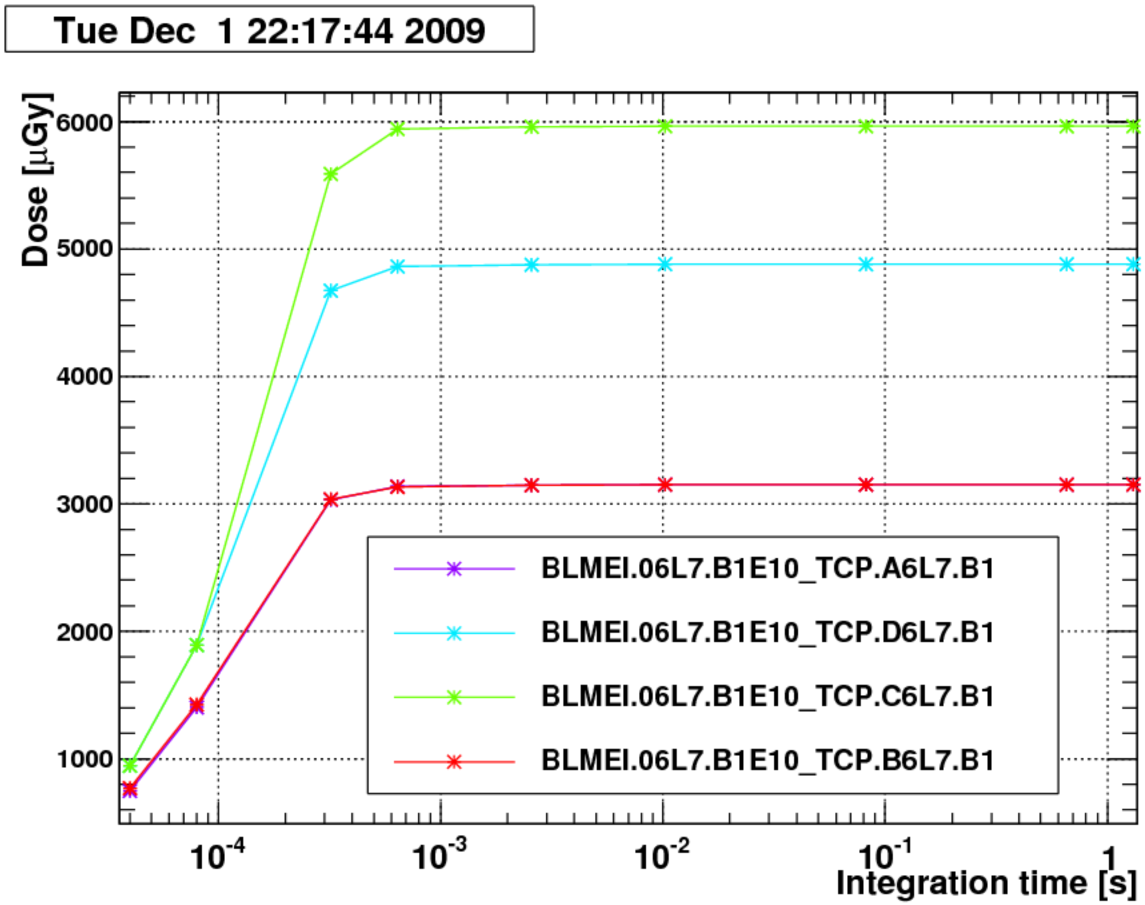
Beam dump on Closed Jaws
SEM to BLMI comparison 1.3 $10^{13}p^+$





Black line – signal not clipped

5*τ_filter = 350ms



Tue Dec 1 22:17:44 2009
Dose [µGy]
6000
5000
4000
3000
2000
1000
10^-4
10^-3
10^-2
10^-1
1
Integration time [s]
BLMEI.06L7.B1E10_TCP.A6L7.B1
BLMEI.06L7.B1E10_TCP.D6L7.B1
BLMEI.06L7.B1E10_TCP.C6L7.B1
BLMEI.06L7.B1E10_TCP.B6L7.B1