



Status of Analysis of Beam Dumps Triggered by BLMs on Cold Elements

A. Nordt for the BLM team

MPP meeting 13th of August 2010



Overview over the 2 Beam Dumps in July

Event 1:

Time: 07-07-2010 @20:22:19

Logbook: 20:19: problem arming squeeze with sequenzer

20:22: started squeeze to 589

20:22: Beams gone, losses in pt 7 and 6. From PM orbit was stable before the dump. At the time of the dump we had just turned on the tune feedback for beam 1.

Beam Mode: Squeeze

Energy: 3.5 TeV

Intensity B1: 84 e10 p

Intensity B2: 85 e10 p

Bstar15/Bstar28: 11/11m

Event 2:

Time: 30-07-2010 @07:26:38

Logbook: Both beams dumped because of BLM in point 5

Beam Mode: Stable Beams

Energy: 3.5 TeV

Intensity B1: 178 e10 p

Intensity B2: 193 e10 p

Bstar15/Bstar28: 3.5/3.5m



Overview over the 2 Beam Dumps in August

Event 3:

Time: 07-08-2010 @02:14:38

Logbook: Beams dumped. Short fill. No alarm at the time of the dump or shortly before

Beam Mode: Stable Beams

Energy: 3.5 TeV

Intensity B1: 205 e10 p

Intensity B2: 215 e10 p

Bstar15/Bstar28: 3.5/3.5m

Event 4:

Time: 08-08-2010 @01:10:46

Logbook: Beams dumped (BLM left of P5 triggered)

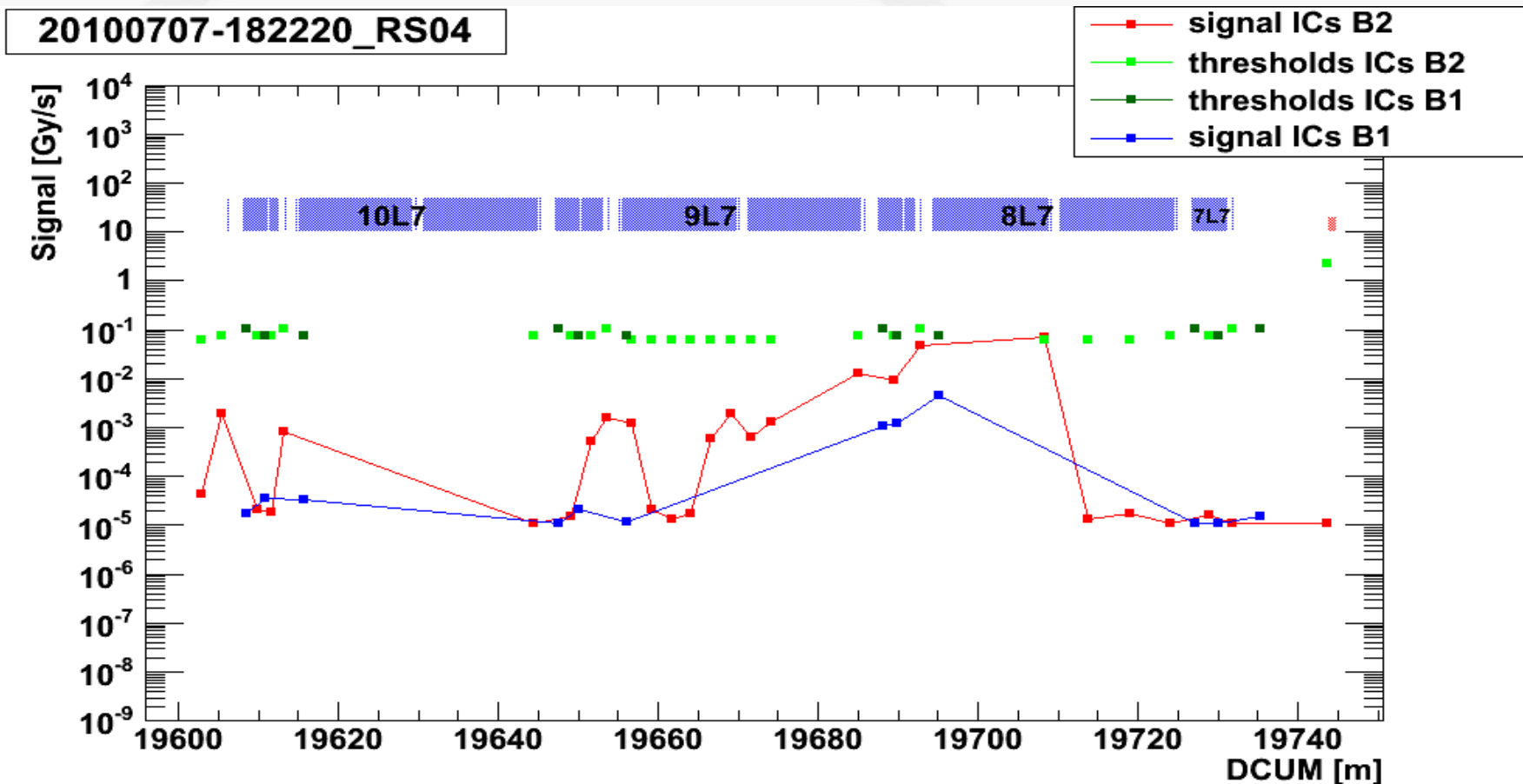
Beam Mode: Stable Beams

Energy: 3.5 TeV

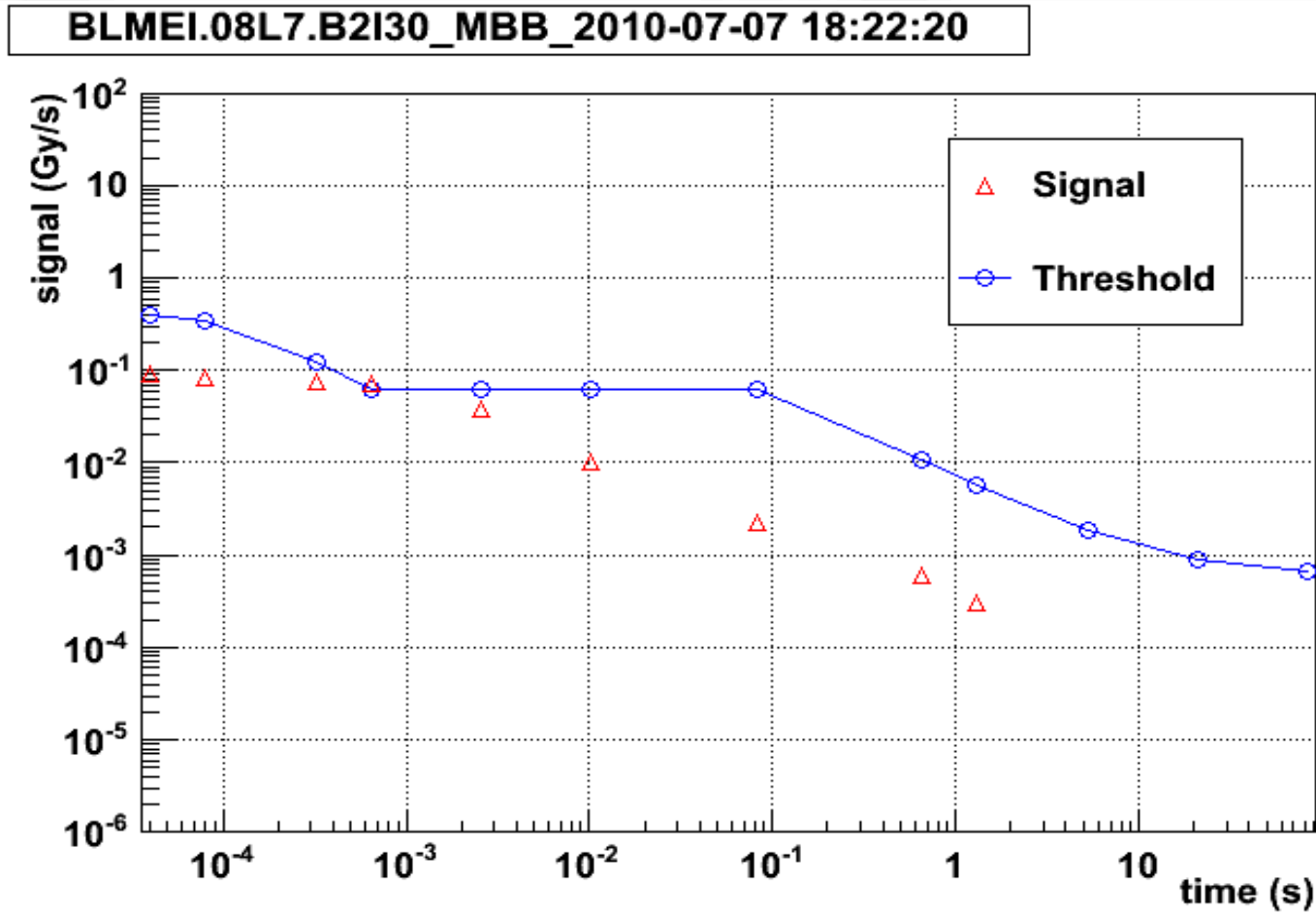
Intensity B1: 210 e10 p

Intensity B2: 214 e10 p

Bstar15/Bstar28: 3.5/3.5m



- Beam dump for RS04 = 640musec on BLMEI.08L7.B2I30_MBB
- B2 loss
- Losses seem to start either at the end of MBB or between the two MBBs
- The losses are also slower (> 1 sec)

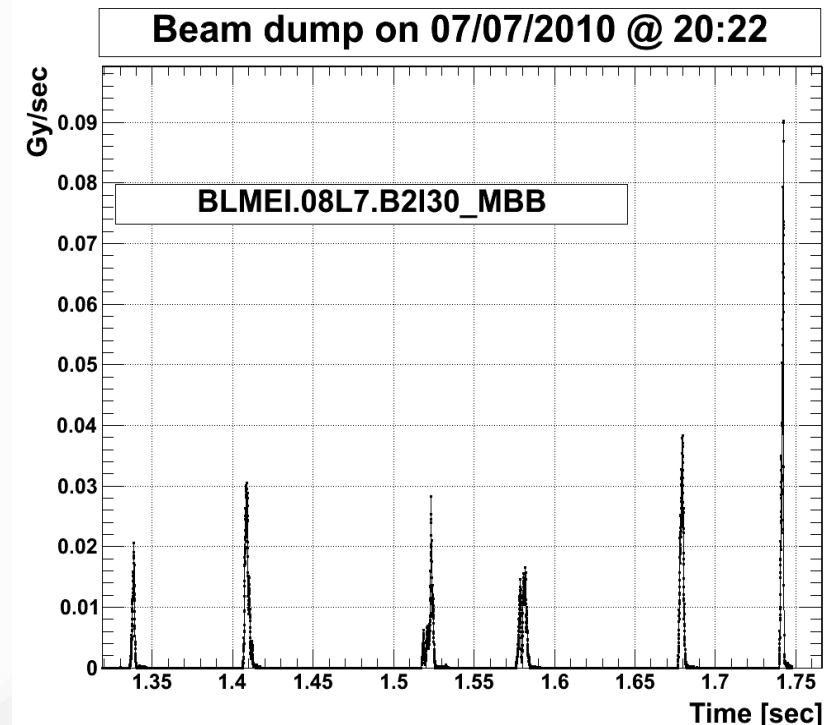


- Loss duration is approx. 640musec

Choose longer BLM PM buffer for analysis
 This allows to check for losses before the beam dump

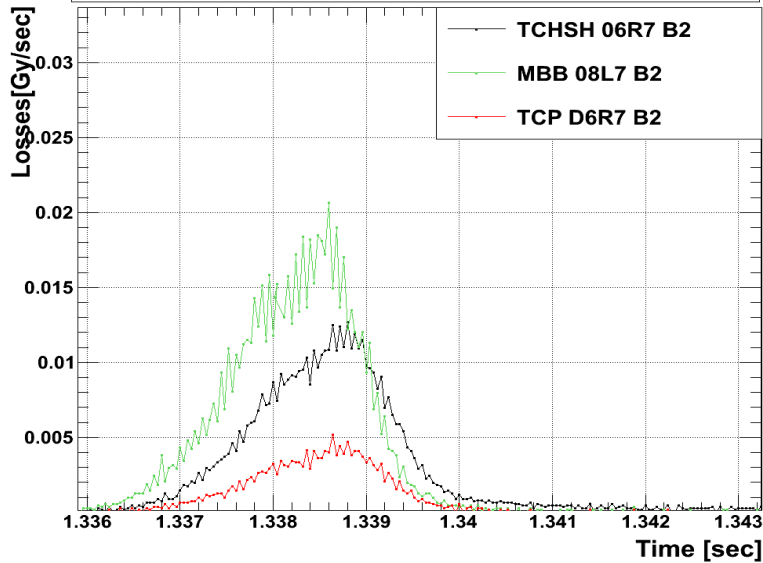
PM application:
 BLM data of 0.082 sec

Longer PM buffer:
 BLM data of 1.72 sec

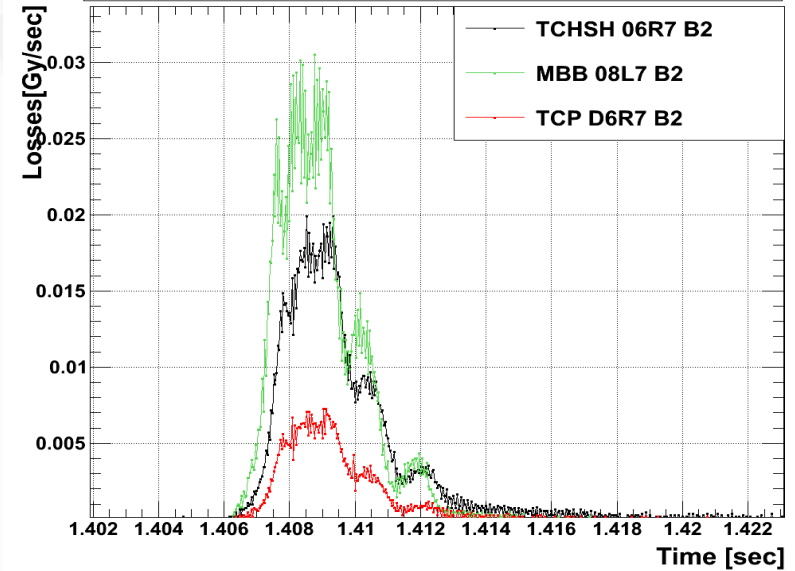


Example Event 1: One can see 5 times higher losses before the beam dump event in the long PM buffer data instead of only once from the application data.

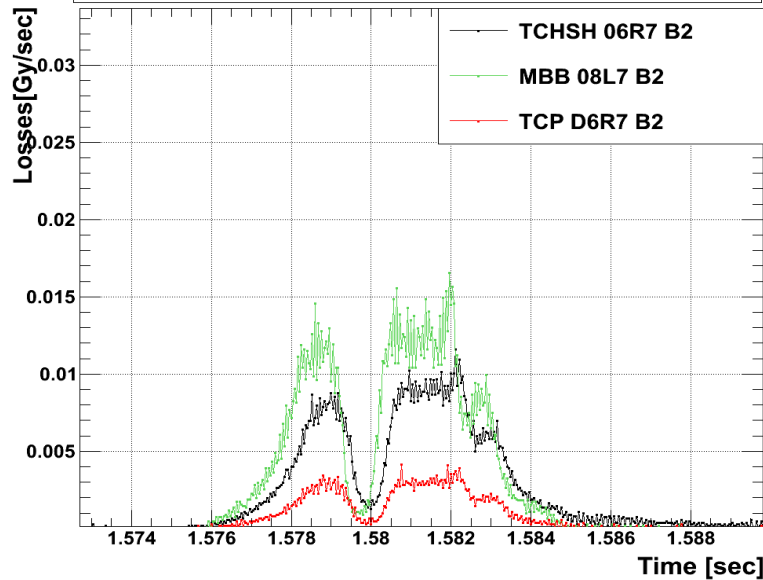
Beam Dump 07/07/2010 @ 20:22



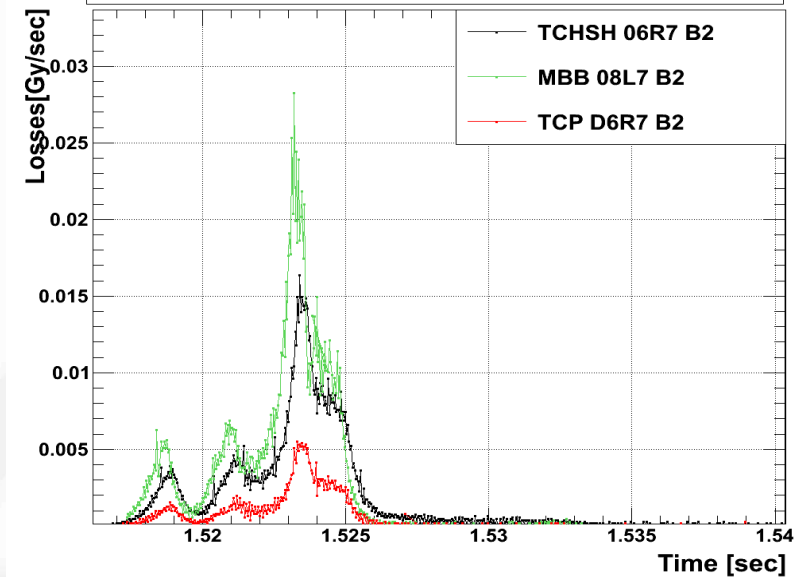
Beam Dump 07/07/2010 @ 20:22

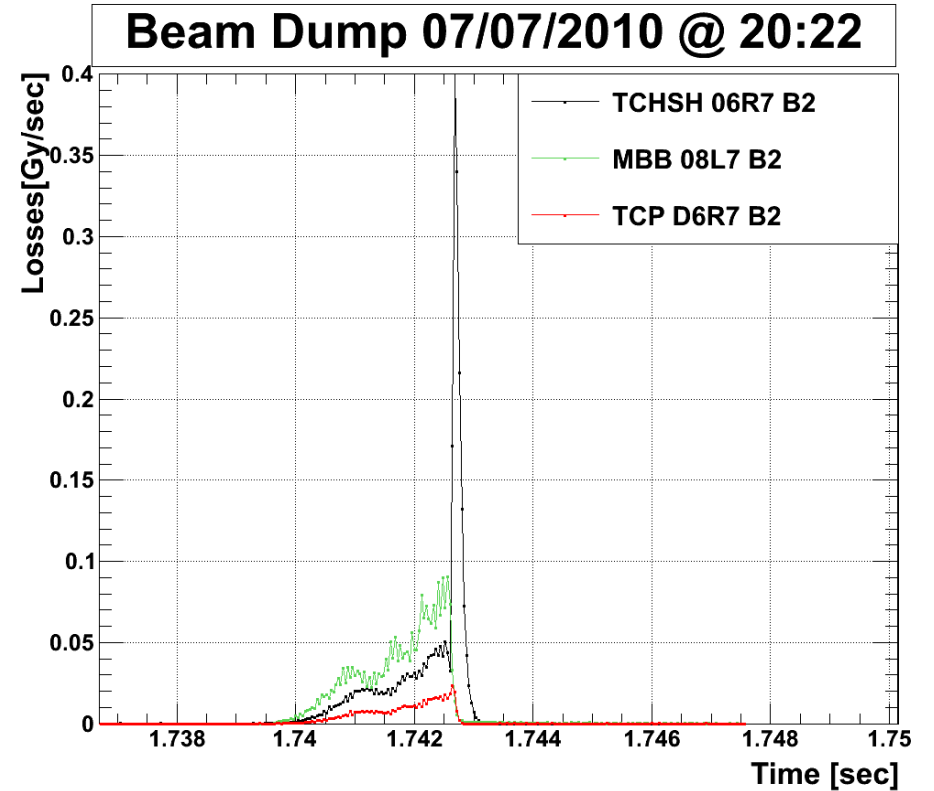
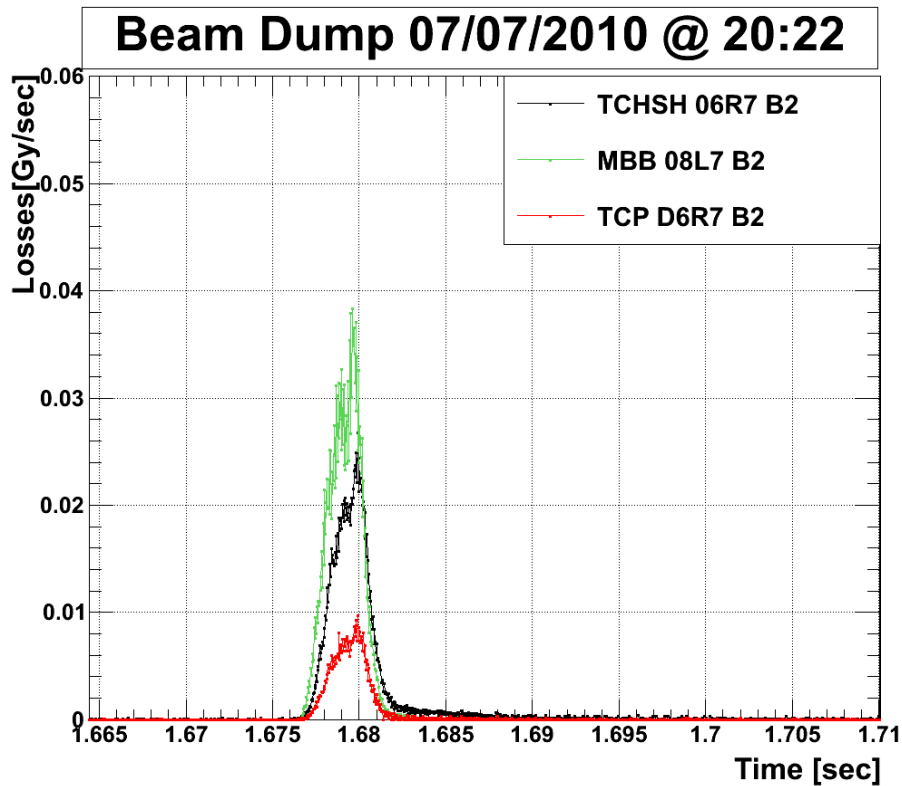


Beam Dump 07/07/2010 @ 20:22



Beam Dump 07/07/2010 @ 20:22





Loss Nr.	Time TCP [sec]	Time MBB [sec]	Diff. TCP	Diff. MBB
1	1.33864	1.33860	0.07040	0.07016
2	1.40904	1.40876	0.11428	0.11444
3	1.52332	1.52320	0.05744	0.05876
4	1.58076	1.58196	0.09916	0.09764
5	1.74264	1.74256	0.06272	0.06296

Summary:

- Losses happen at the almost same time (TCP delayed by 40 musec)
- Losses appear at the same frequency
- 1. pattern: time in between the loss is ~ 60-70ms (i.e. between 1. and 2. loss)
- 2. pattern: time in between the loss is: ~ 100 ms (i.e. between 2. and 3. loss)

Loss Nr.	FWHM TCP [sec]	FWHM MBB [sec]	Amplitude TCP [Gy/sec]	Amplitude MBB [Gy/sec]
1	0.00159	0.00158	0.00516	0.02063
2	0.00258	0.00255	0.00724	0.03050
3	0.00124	0.00104	0.00552	0.02824
4	(0.00159) 0.00277	(0.00154) 0.00269	(0.00344) 0.00416	(0.01457) 0.01656
5	0.00237	0.00234	0.00968	0.03828

Loss Nr.	Protons lost on TCP	Protons lost on MBB
1	8.459e4	7.859e4
2	11.86e4	11.619e4
3	9.049e4	10.758e4
4	5.639e4, 6.819e4	5.550e4 6.309e4
5	15.88e4	14.58e4

TCP:

- From simulations: $2e-12\text{Gy/p}$ (@ 3.5TeV)
- From measurement: $2.44e-12\text{Gy/p}$ (@ 3.5TeV)

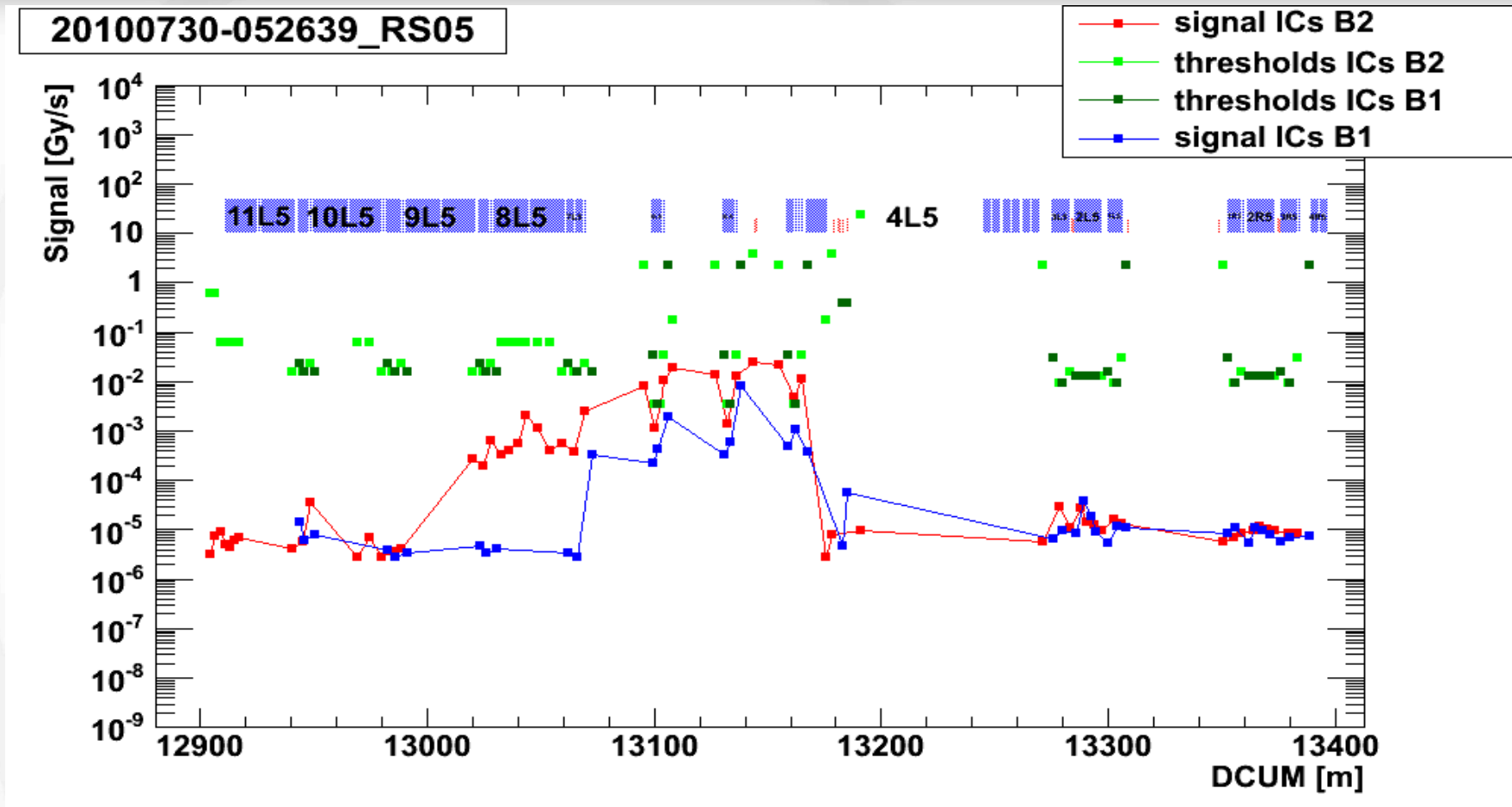
MBB:

- From simulations: $1.5e-12\text{Gy/p}$ (@ 3.5TeV)
- From measurement: $1.05e-11\text{Gy/p}$ (@ 3.5TeV)

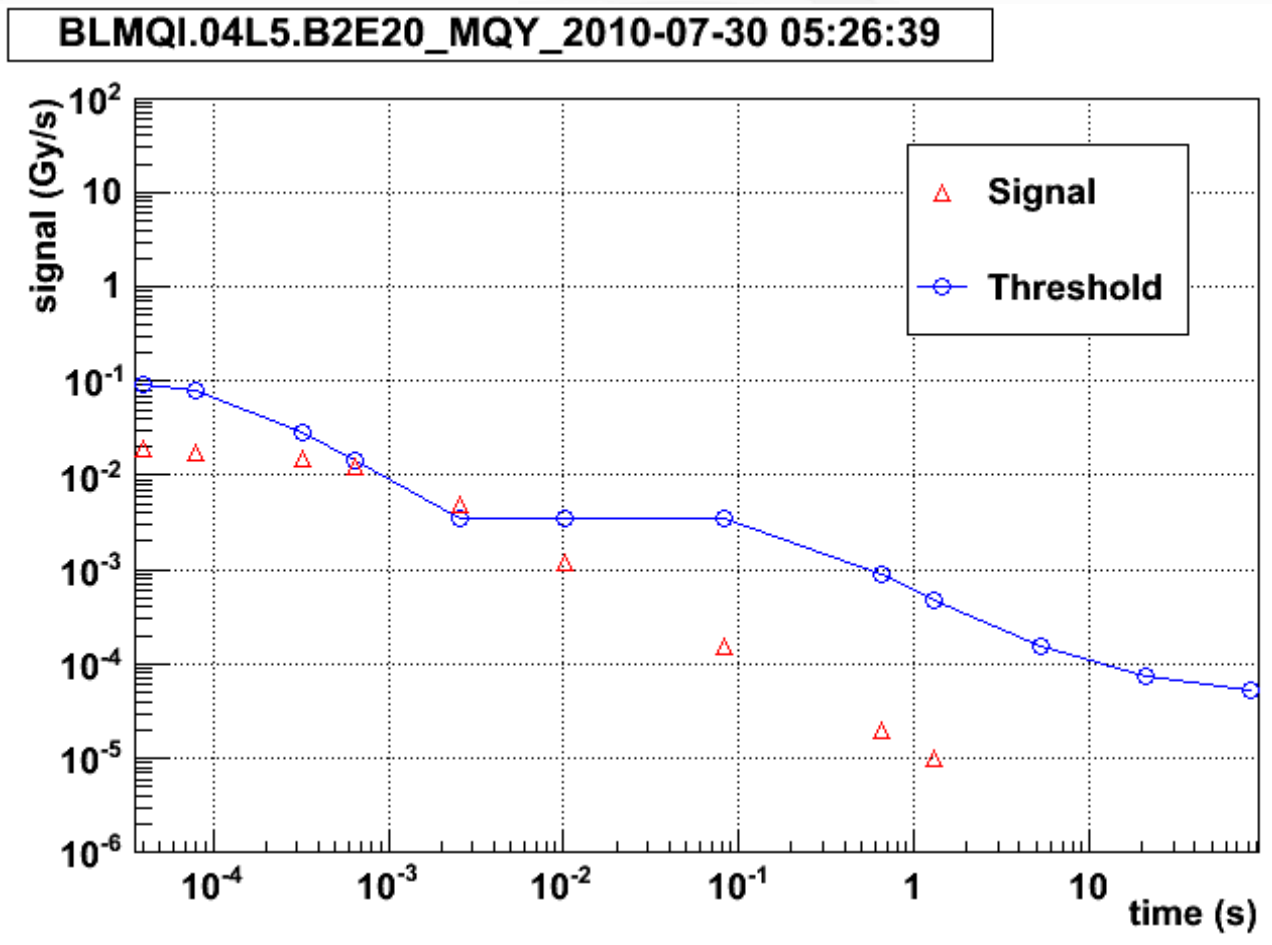
Losses show a pattern in time (pairs for bump 1 and 2, 3 and 4, 5 and dump)

Maximum losses appear with same ratio (pairs)

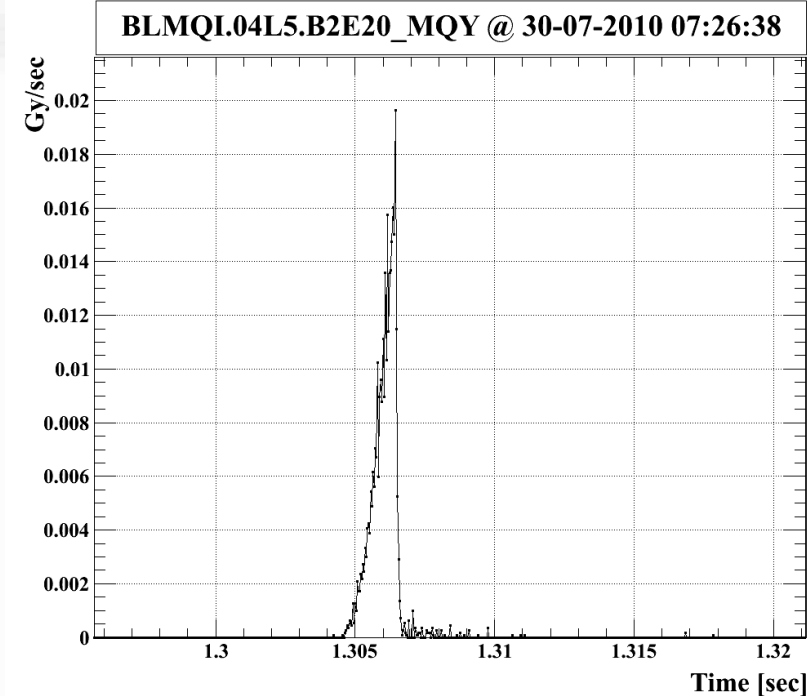
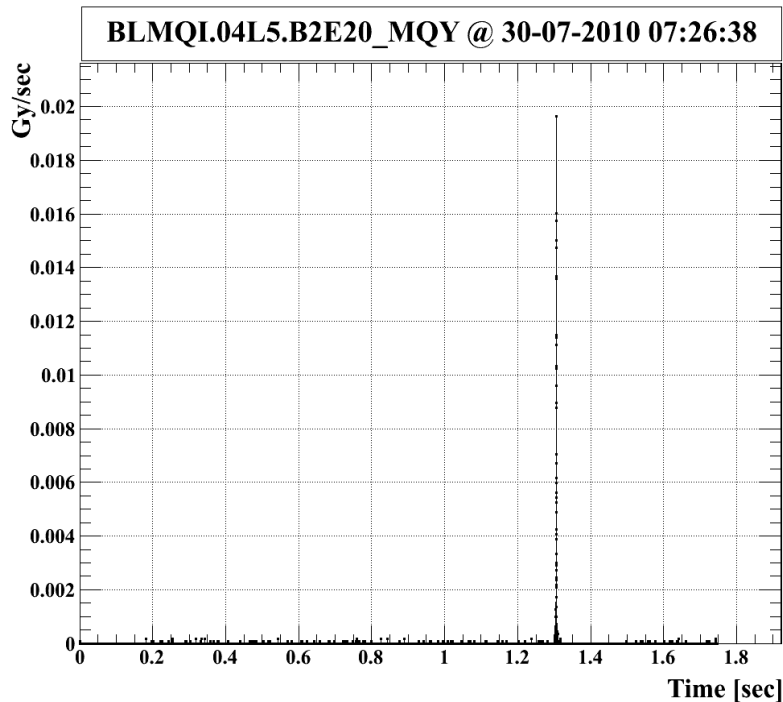
Number of lost protons seems to be almost equal for TCP and MBB



- B2 loss on BLMQI.04L5.B2E20_MQY in RS05 = 2560musec
- Losses seem to start before the quadrupole (either in the interconnect or at the end of the dipole) and continue over several cells (no dipoles in between the quads)
- The middle (monitor 2) is lower than the start and the end location (shielding effect from the magnet)



- Loss duration is approx. 640musec



Summary:

No Losses seen before the beam dump

Rise Time: 1.84ms

Duration: 1.95ms

Maximum Loss: 0.02Gy/sec

FWHM: 7.95e-4sec

Nr. of lost p:7.62e4 p

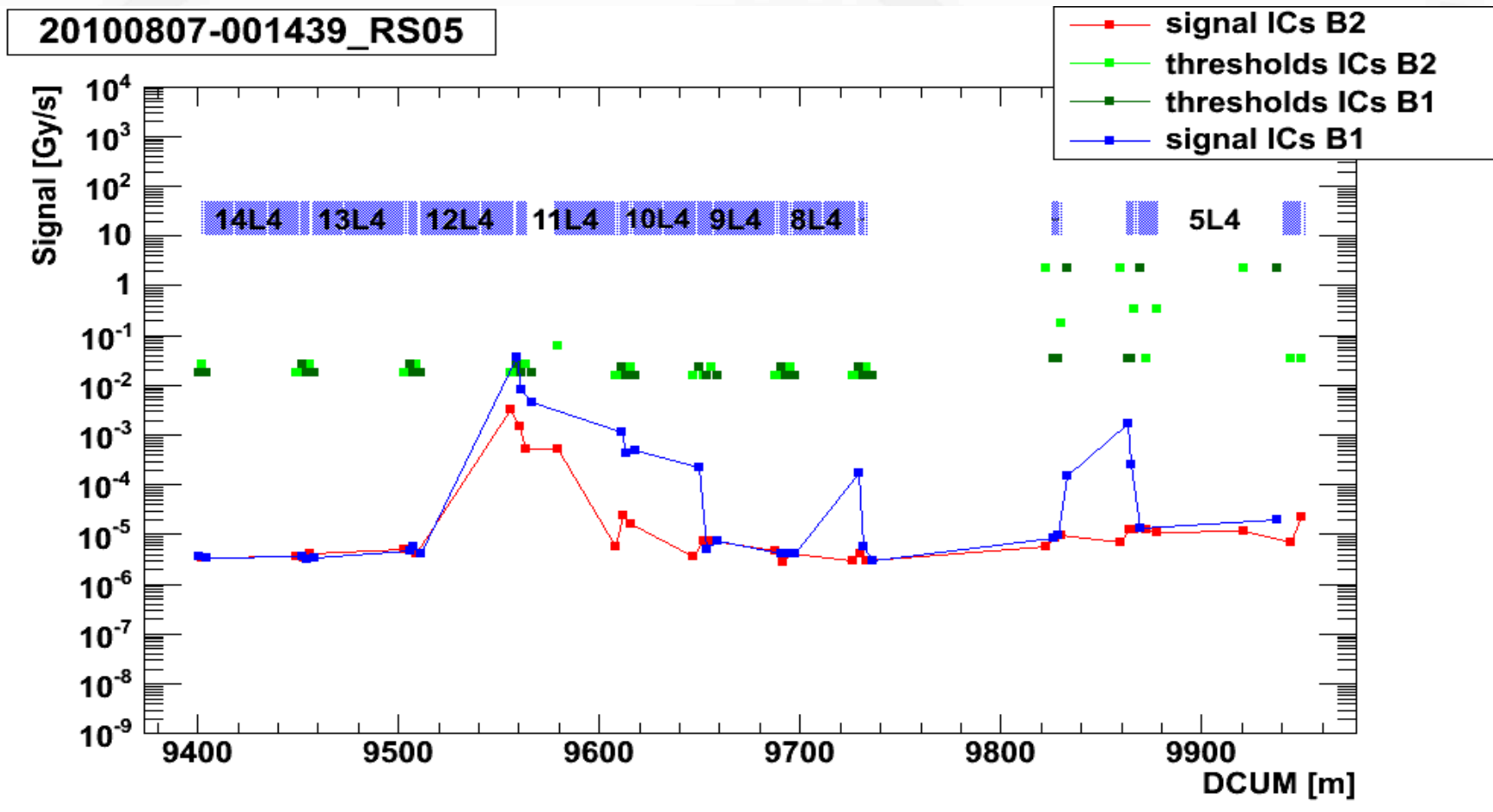
Summary:

Loss at TCP in R7: 0.29Gy/sec, 1450%, Np= 4.75e6 p

Loss at TCP in L7: 6.3e-3Gy/sec, 30%, Np= 0.10e6 p

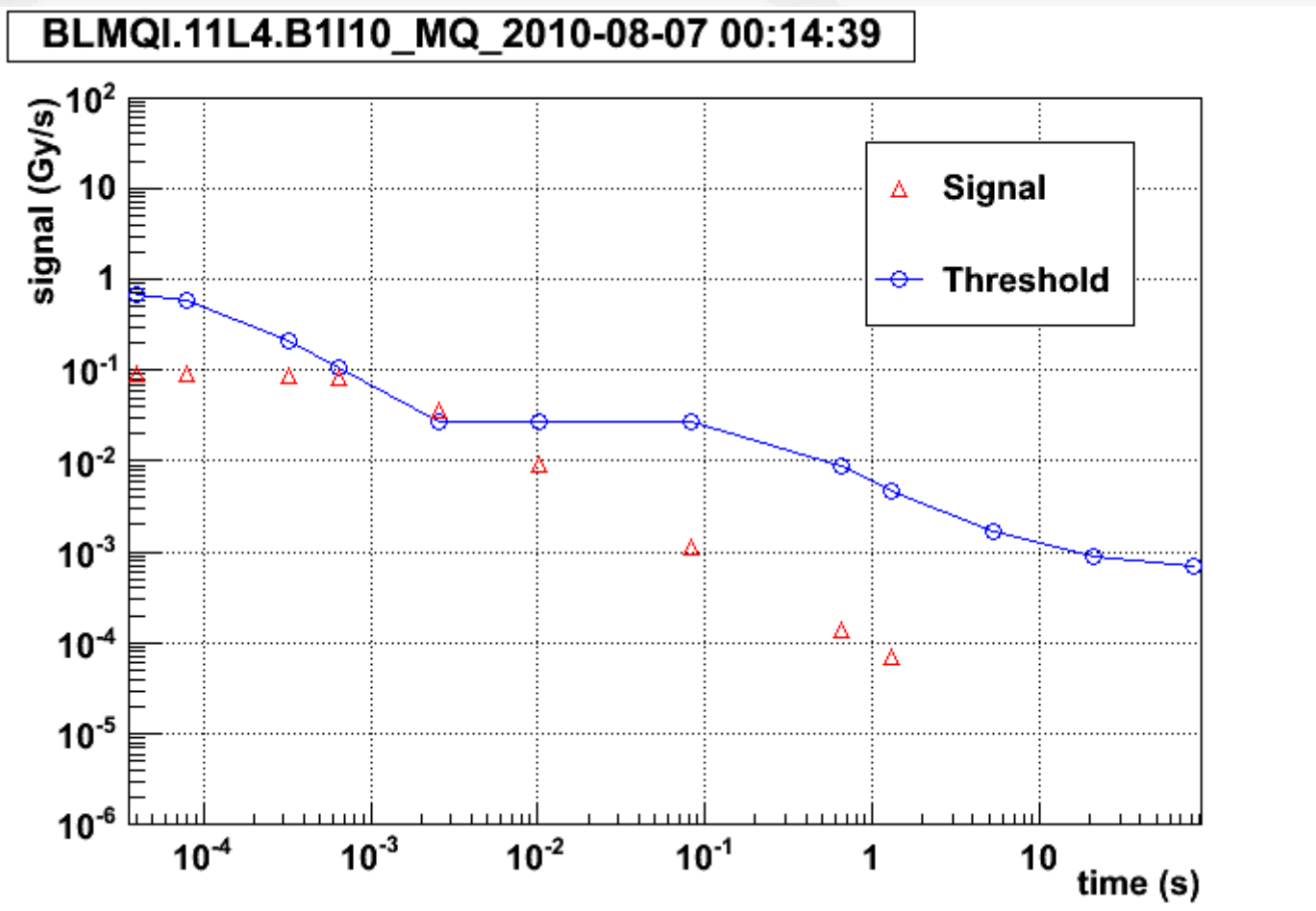
Loss at TCH in R7: 0.38Gy/sec, 1900%, Np= 6.23e6 p

Loss at TCH in L7: 6.1e-3Gy/sec, 31%, Np= 0.1e6 p

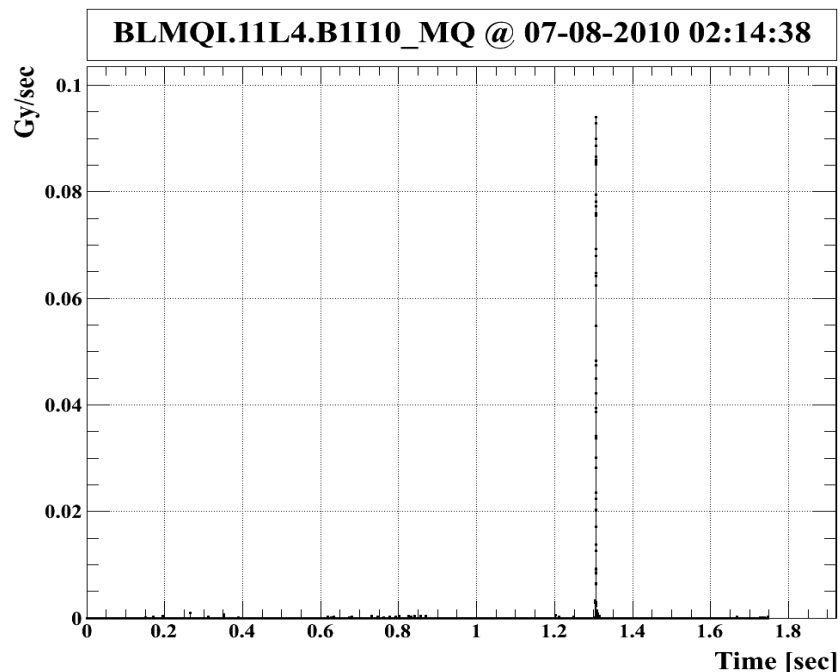


- B1 loss on BLMQI.11L4.B1I10_MQ in RS05 = 2560 musec
- The losses seem to start in the dipole before (monitor in position 3 for B2 is the highest of B2 monitors)

Loss over all RS for Event 3 for Dump Monitor



- Loss duration is approx. 640musec



Summary:

No Losses seen before the beam dump

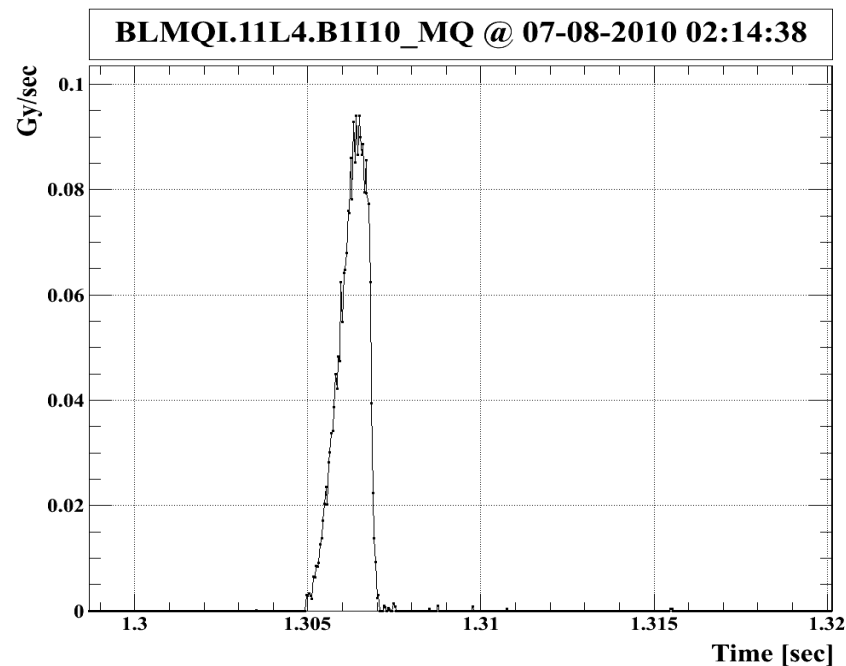
Rise Time: 1.45ms

Duration: 2.00ms

Maximum Loss: 0.07Gy/sec

FWHM: 9.48e-4sec

Nr. of lost p:2.67e5 p



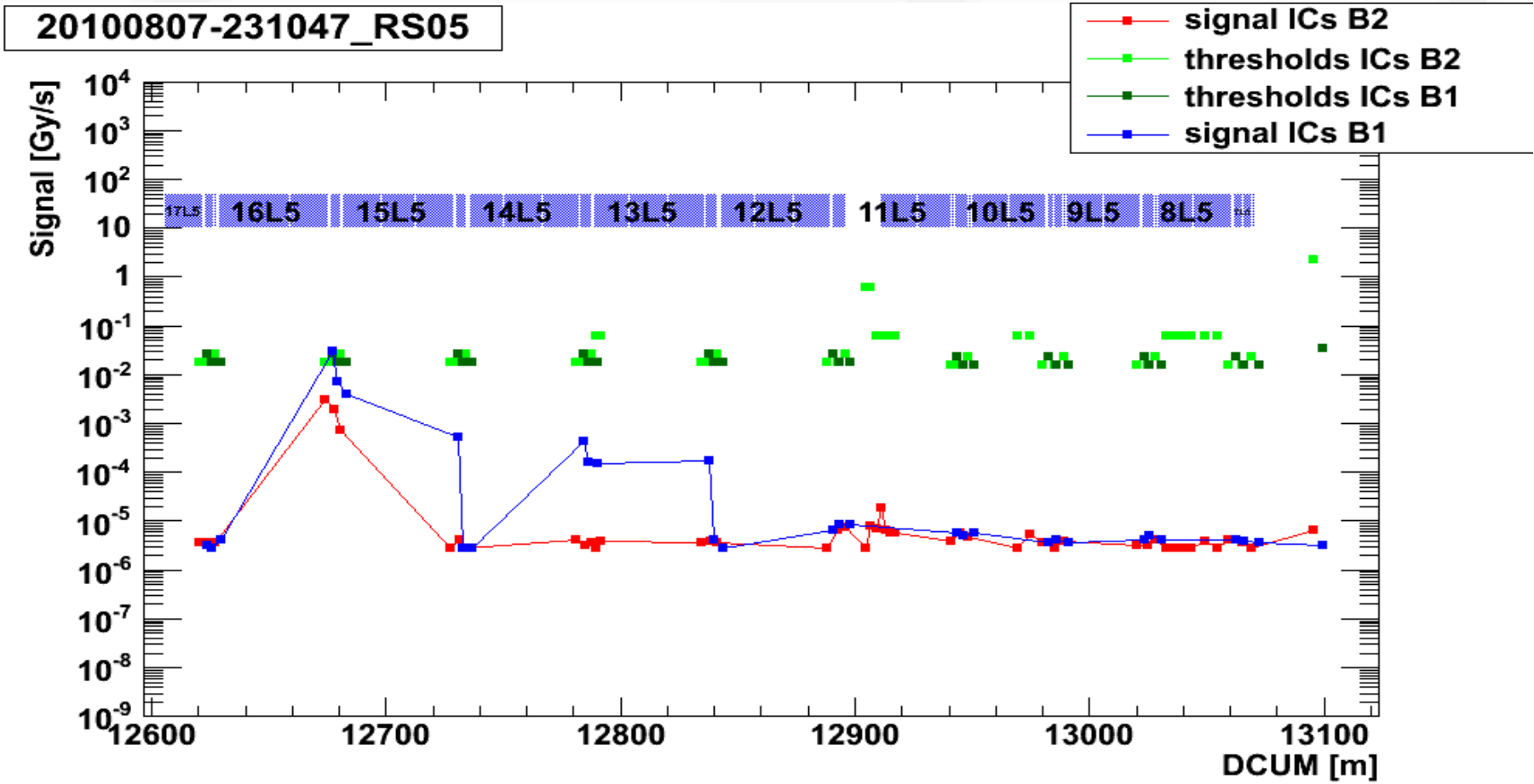
Summary:

Loss at TCP in R7: 0.17Gy/sec, 243%, $N_p = 2.79e6$ p

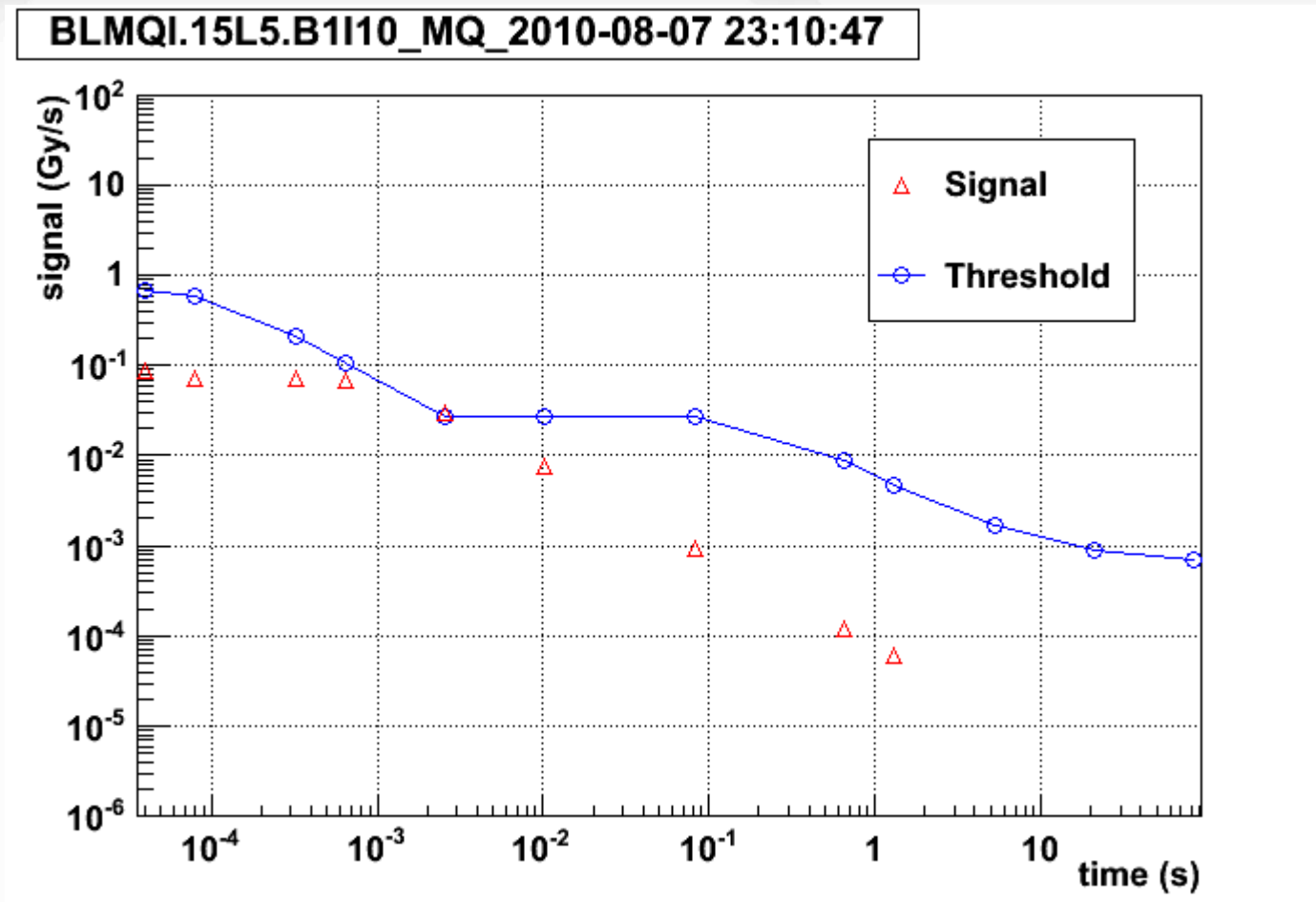
Loss at TCP in L7: 0.06Gy/sec, 86%, $N_p = 0.98e6$ p

Loss at TCH in R7: 0.22Gy/sec, 315%, $N_p = 3.61e6$ p

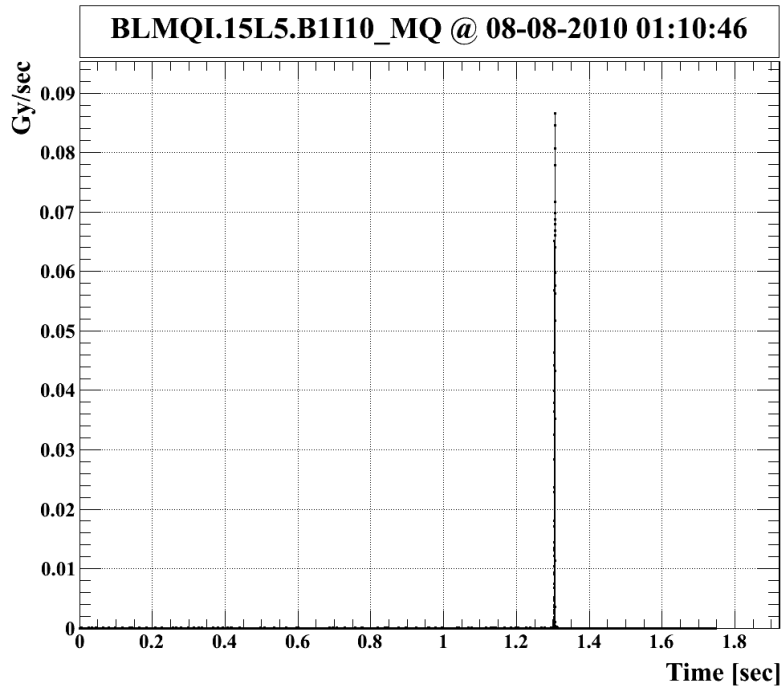
Loss at TCH in L7: 0.07Gy/sec, 100%, $N_p = 1.15e6$ p



- B1 loss on BLMQI.15L5.B1110_MQ in RS05 = 2560 musec
- The losses seem start in the dipole before (monitor in position 3 for B2 is the highest of B2 monitors)



- Loss duration is approx. 640musec



Summary:

No Losses seen before the beam dump

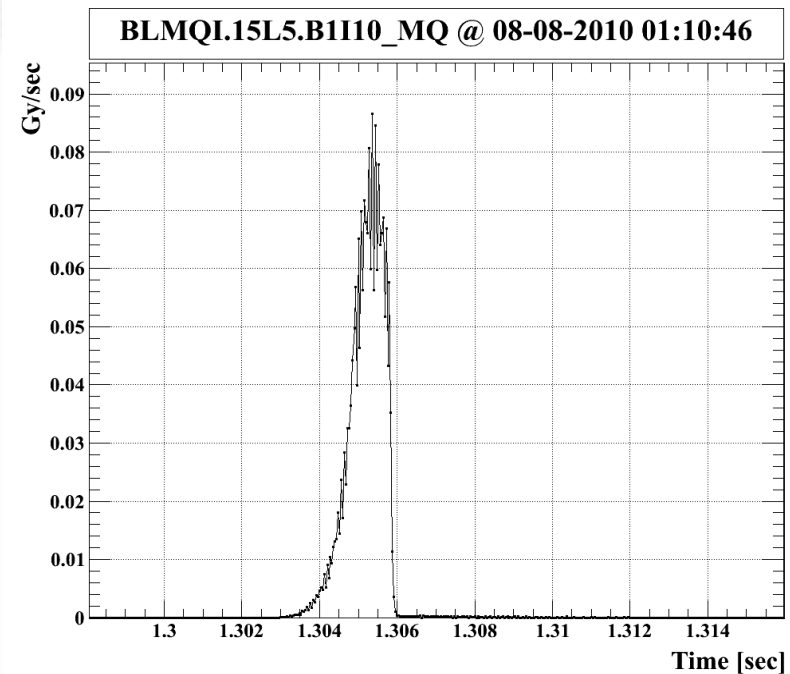
Rise Time: 1.76ms

Duration: 2.40ms

Maximum Loss: 0.086Gy/sec

FWHM: 1.15e-3sec

Nr. of lost p:3.30e5 p



Summary:

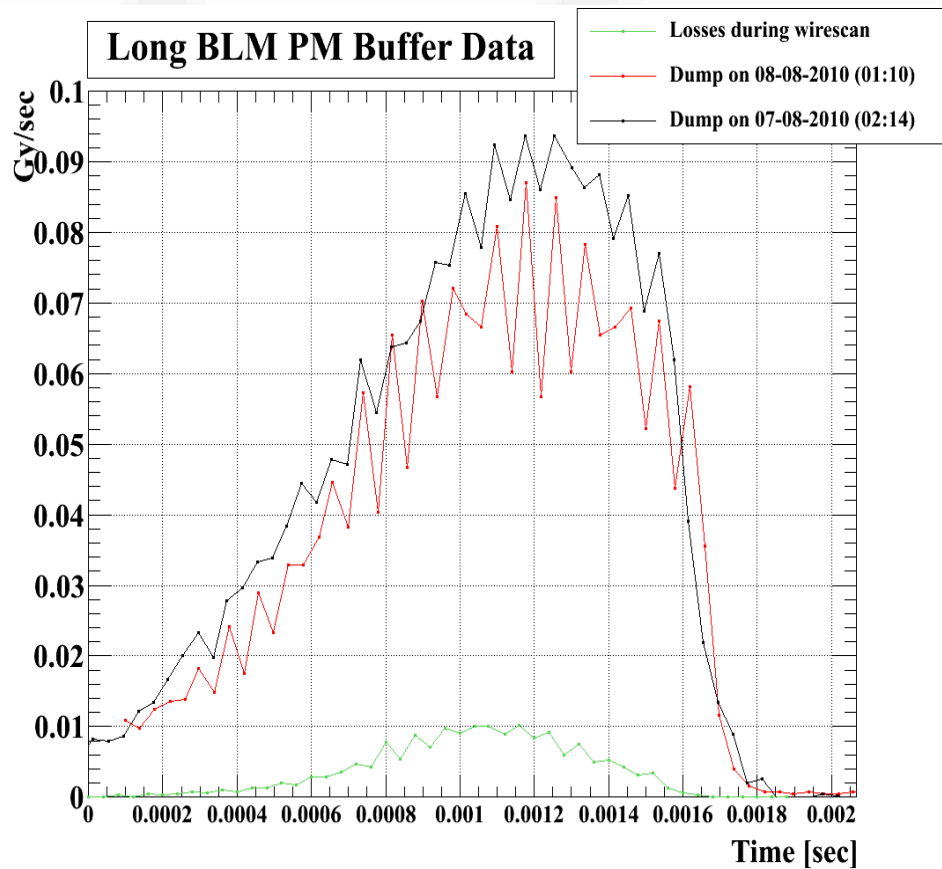
Loss at TCP in R7: 0.27Gy/sec, 314%, $N_p = 4.43e6$ p

Loss at TCP in L7: 0.06Gy/sec, 70%, $N_p = 0.98e6$ p

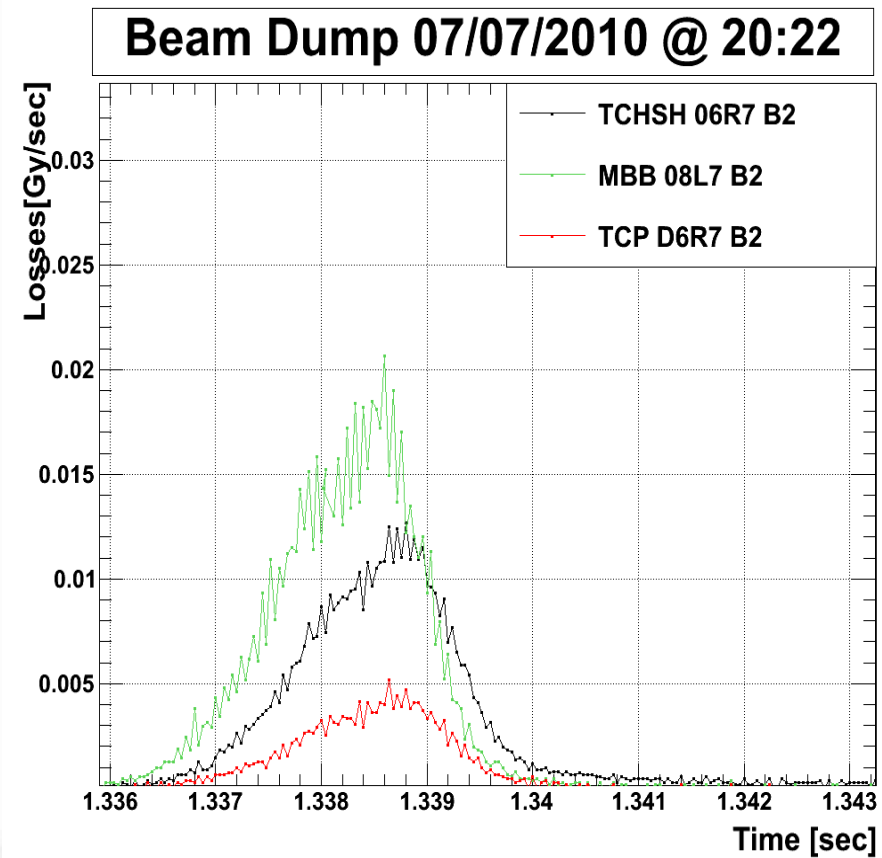
Loss at TCH in R7: 0.35Gy/sec, 461%, $N_p = 5.74e6$ p

Loss at TCH in L7: 0.05Gy/sec, 58%, $N_p = 0.82e6$ p

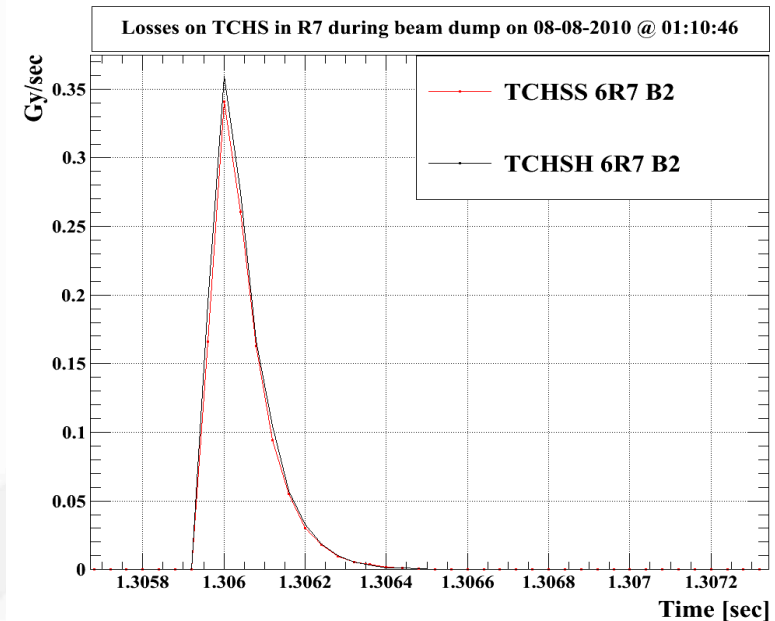
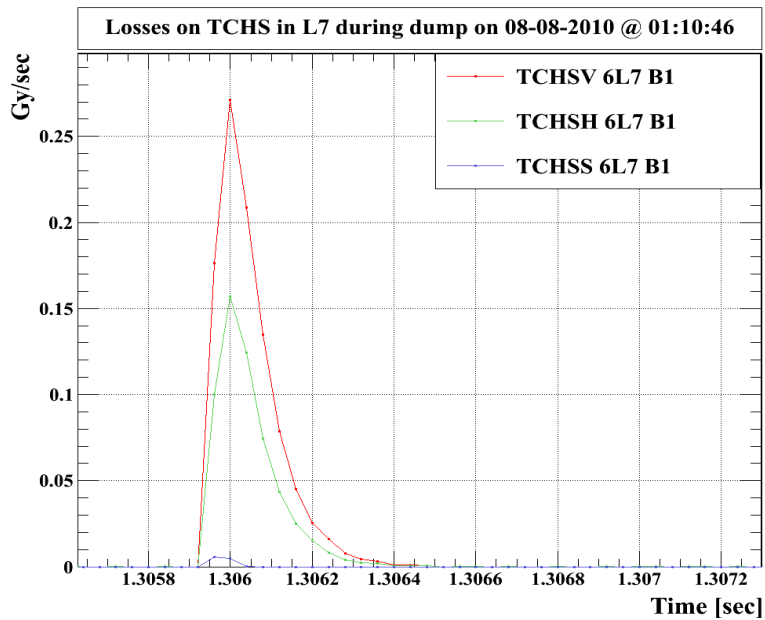
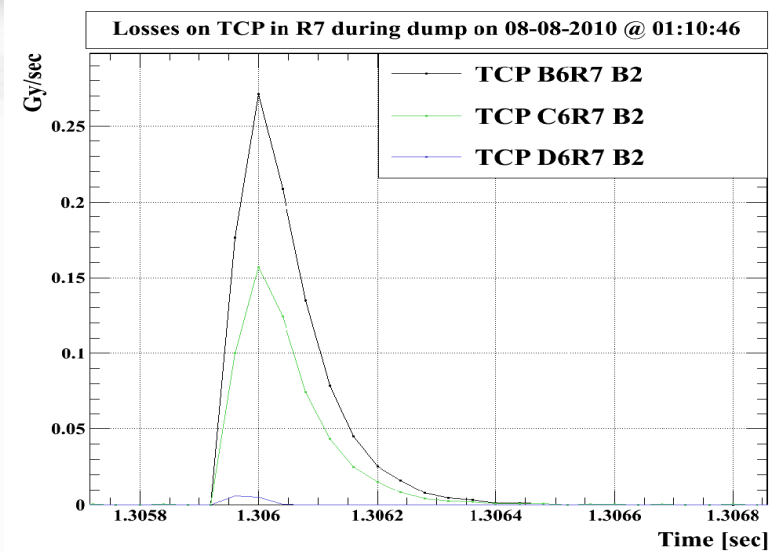
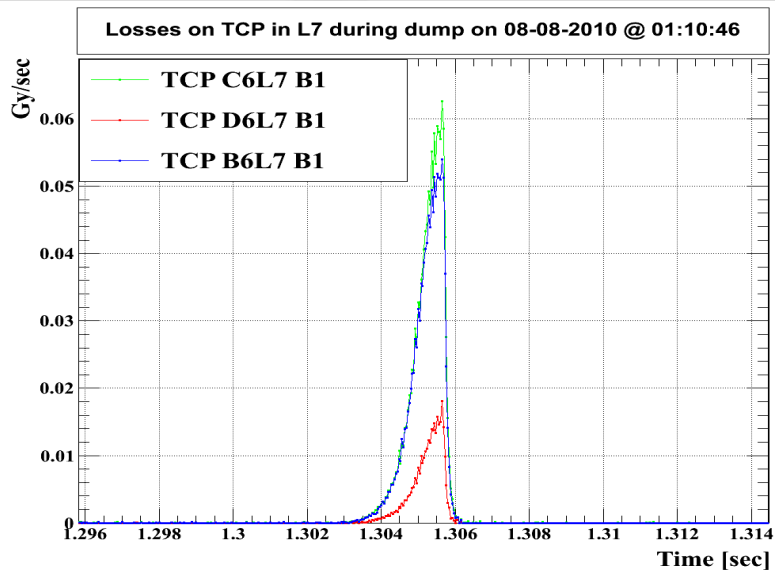
Comparison between losses from 07-08 and 08-08 with wirescan losses
03-07-2010 (10am)



Comparison between losses from 07-07 for different monitors



Losses have similar structure



Procedure:

Search for similar loss patterns

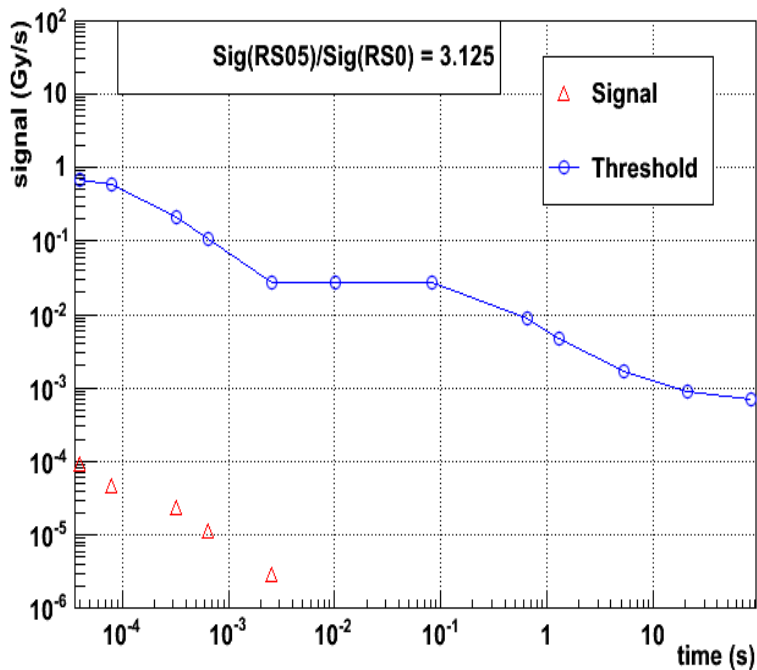
Results:

A similar event never occurred on the 4 dump monitors (according to 4 events) between 01-01-2010 and 12-08-2010

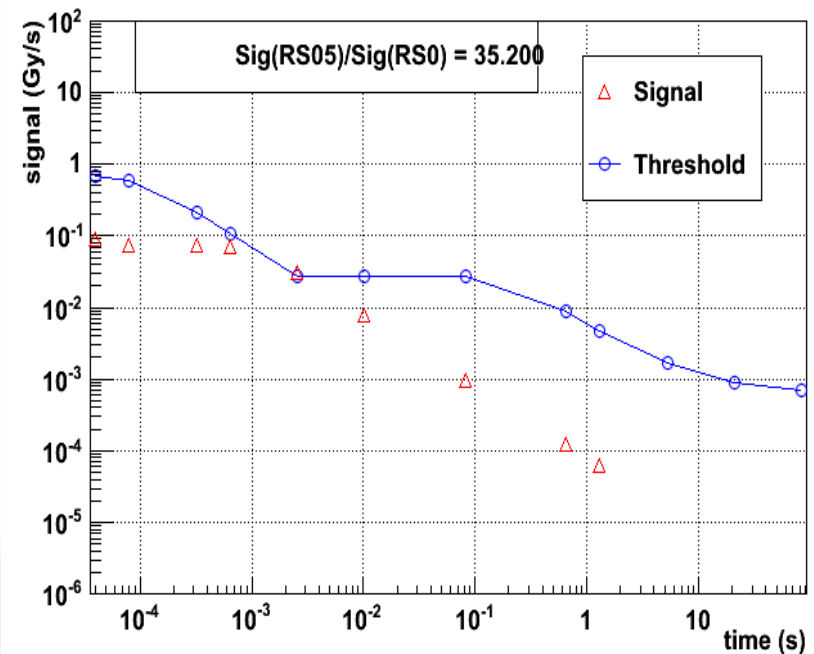
Todo:

Search full ring for similar events

BLMQI.15L5.B1110_MQ_2010-08-07 22:10:47



BLMQI.15L5.B1110_MQ_2010-08-07 23:10:47



Several things were checked so far (BCT,BPM,loss maps, PM data etc)

More detailed analysis is needed and on-going (losses on TCPs, losses around the beam dump monitor, search for similar events etc.)

In case you have some more suggestions what can be investigated, please let us know