



BLM SYSTEM: INTERLOCK REQUEST OF 20/09/2016

Christos Zamantzas on behalf of the BLM team.

04/10/2016

Modifications done in the area during TS2

INSTALLATION & VERIFICATION

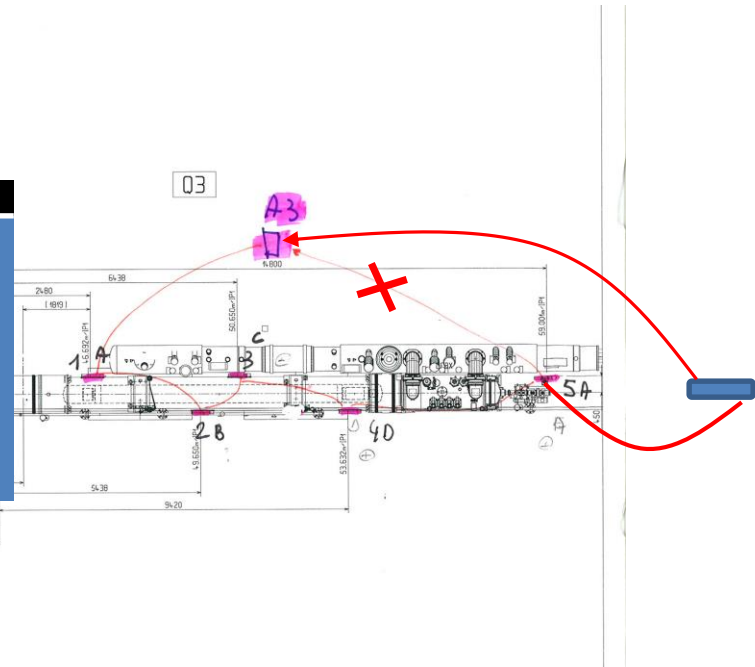
Addition of new channels

During TS2 two channels added to assist D1 studies

- Installation of channel **BLMAI.04R1.B2I10_MBXW.A4R1** & **BLMAI.04L1.B1I10_MBXW.A4L1**
- Standard addition on the high-voltage network
- Signal in the spare channel of the same acquisition card (BLECF)

1 Right

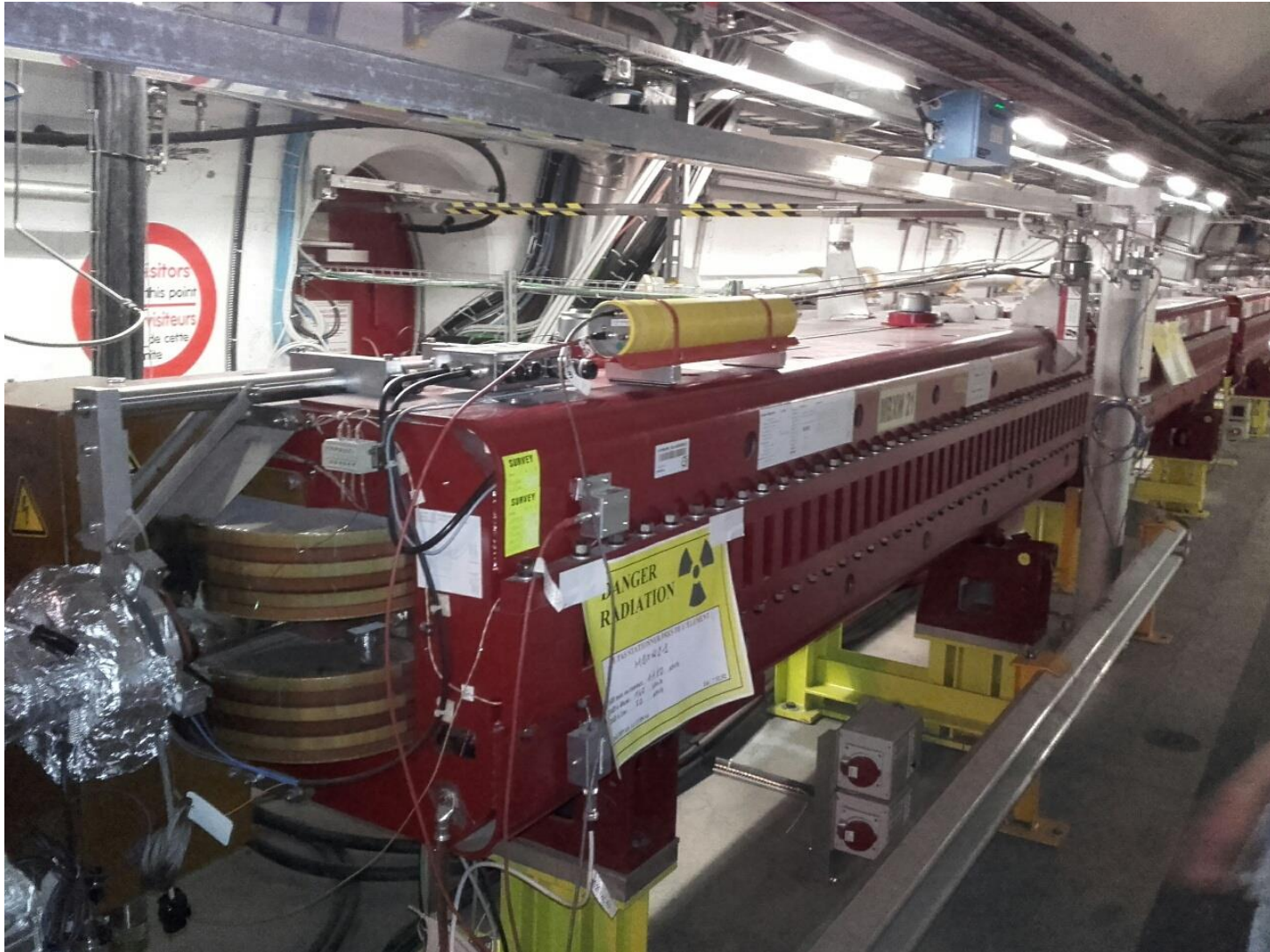
Expert Name	Official Name	CH	DCUM	Mask	BIS	Conn	MF
BLMQI.02R1.B1E30_MQXB	BLMQI.A3R1	9	4669	0	1	1	.166
BLMQI.03R1.B2I20_MQXA	BLMQI.B3R1	10	4965	0	1	1	.166
BLMQI.03R1.B1E20_MQXA	BLMQI.C3R1	11	5065	0	1	1	.166
BLMQI.03R1.B2I10_MQXA	BLMQI.D3R1	12	5363	0	1	1	.166
BLMQI.03R1.B1E30_MQXA	BLMQI.A4R1	13	5872	0	1	1	.166
BLMAI.04R1.B2I10_MBXW.A4R1	BLMAI.A4R1	14	6043	0	0	1	1
BLMM.HC.BLM.SR1.C.CD10.CH15	BLMM.HC.BLM.SR1.C.CD10.CH15	15		1	0	0	
BLMM.HC.BLM.SR1.C.CD10.CH16	BLMM.HC.BLM.SR1.C.CD10.CH16	16		1	0	0	



Pictures



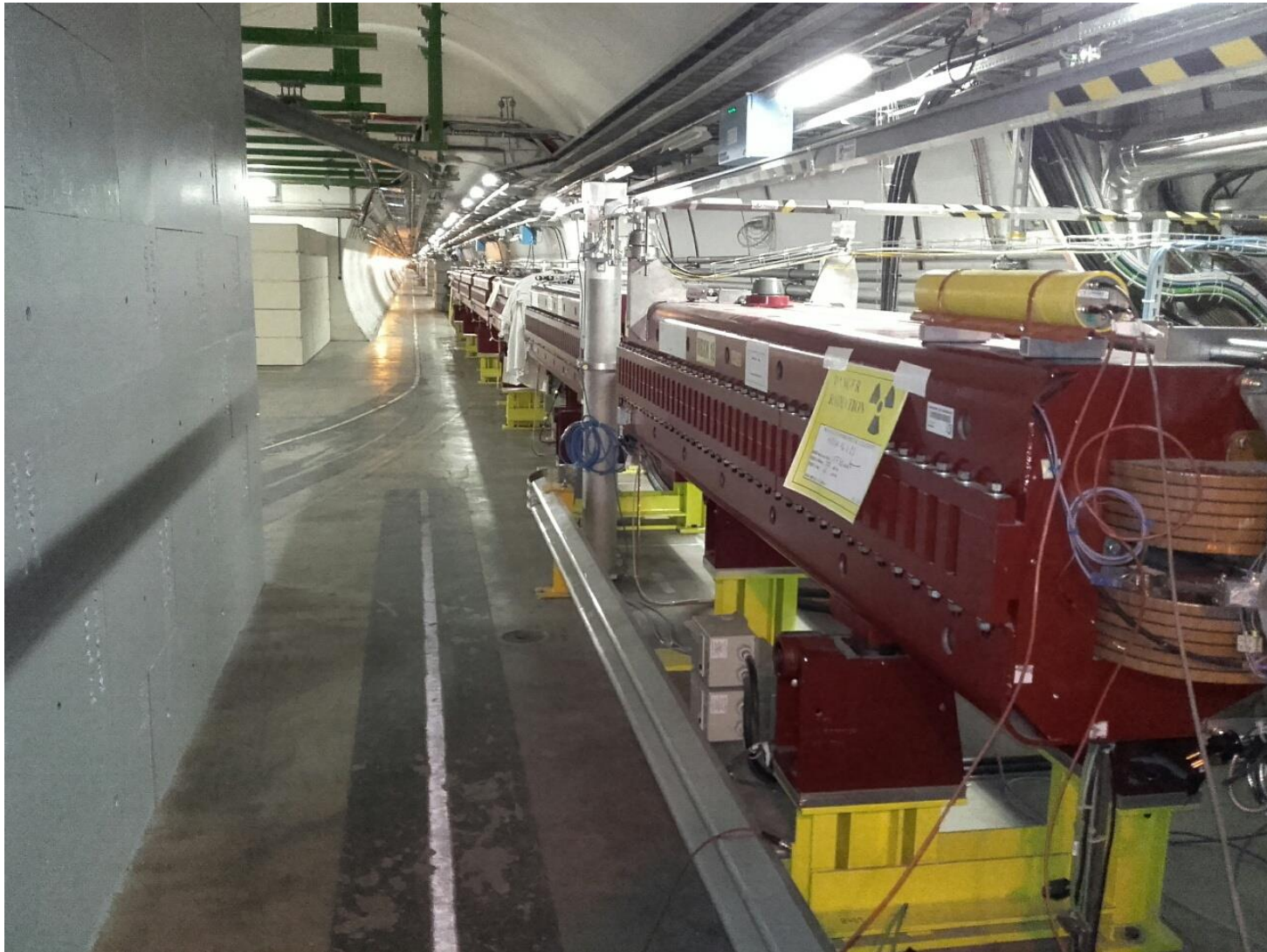
Pictures



Pictures



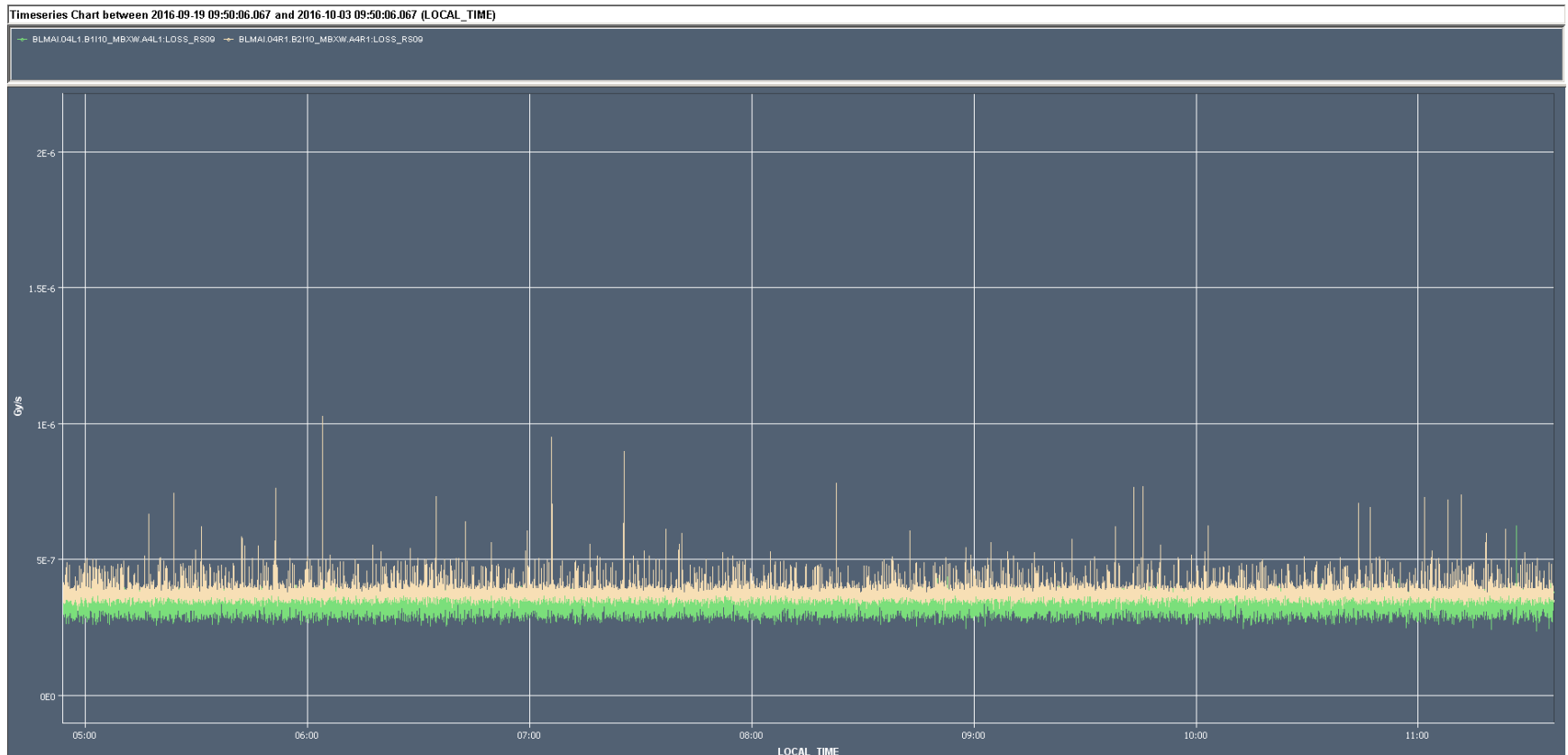
Pictures



Offset

Offset of both new channels is in the expected range

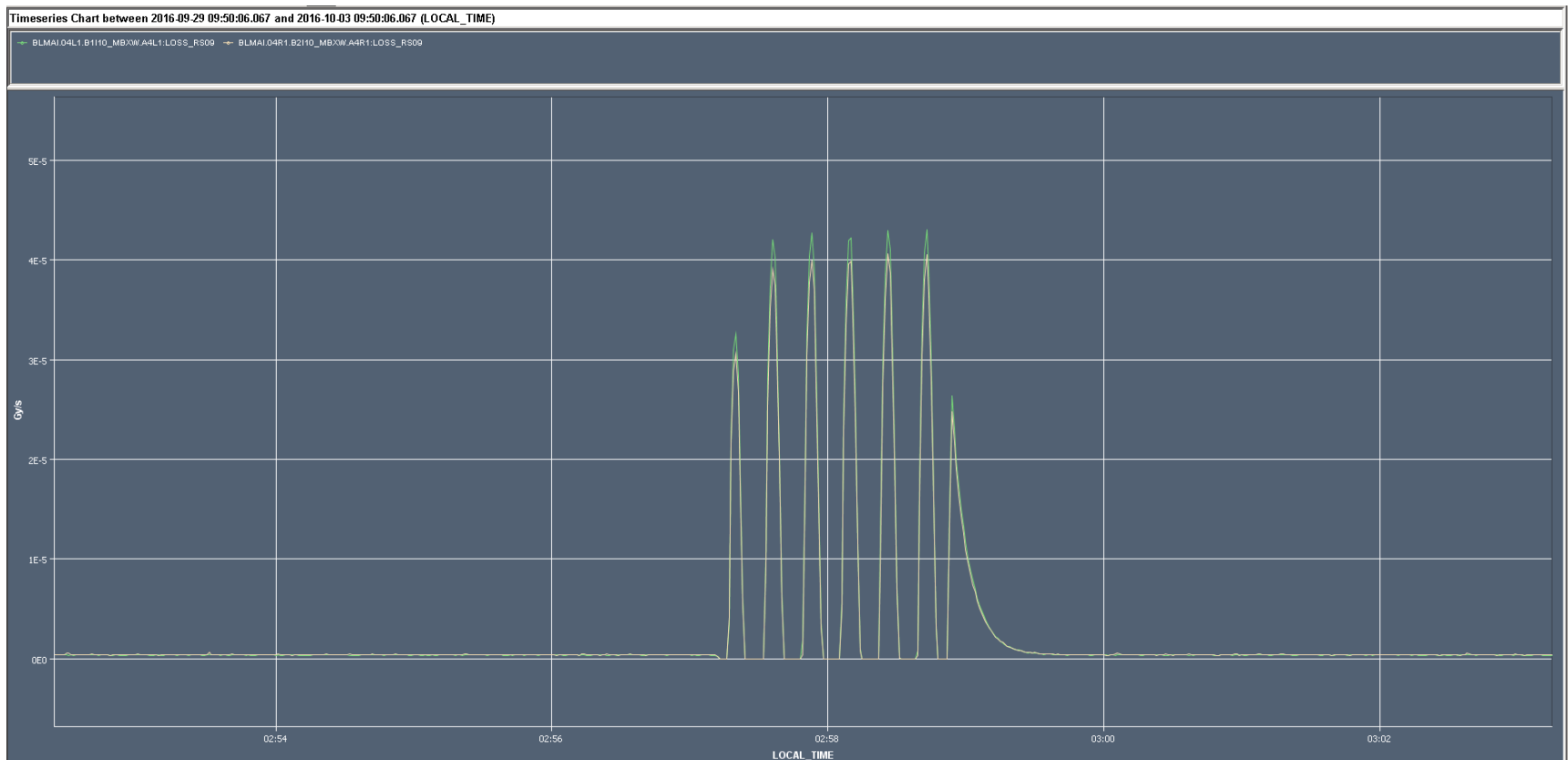
- Cables are not long (~additional 10 m)
- Nevertheless, not in cable trays, but on the floor.



Modulation

Modulation output of both new channels is in the expected range

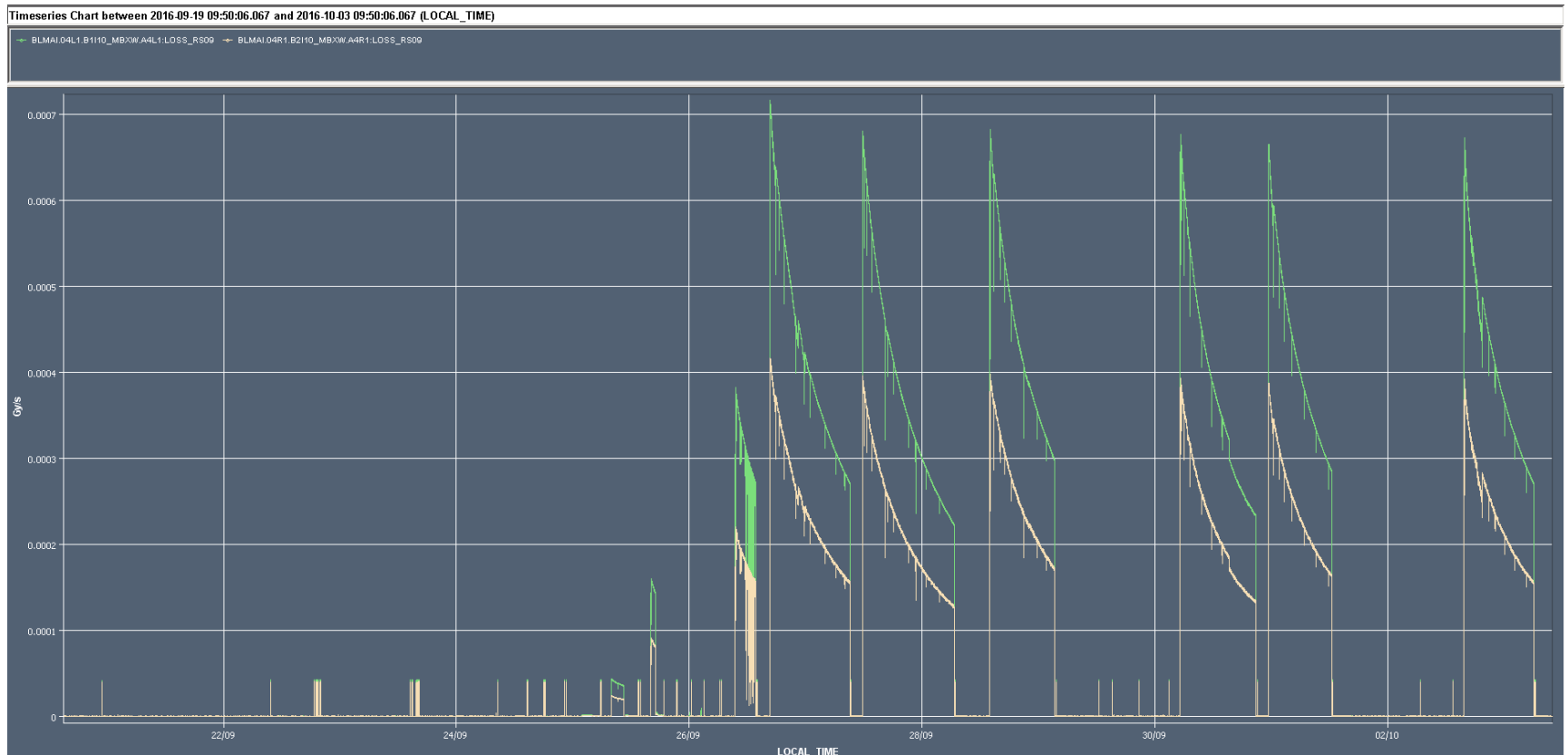
- Cables are not long (~additional 20 m)
- Nevertheless, not in cable trays, but on the floor.



Measurements

Checking RS09 over the logged period (up to 03/10/2016)

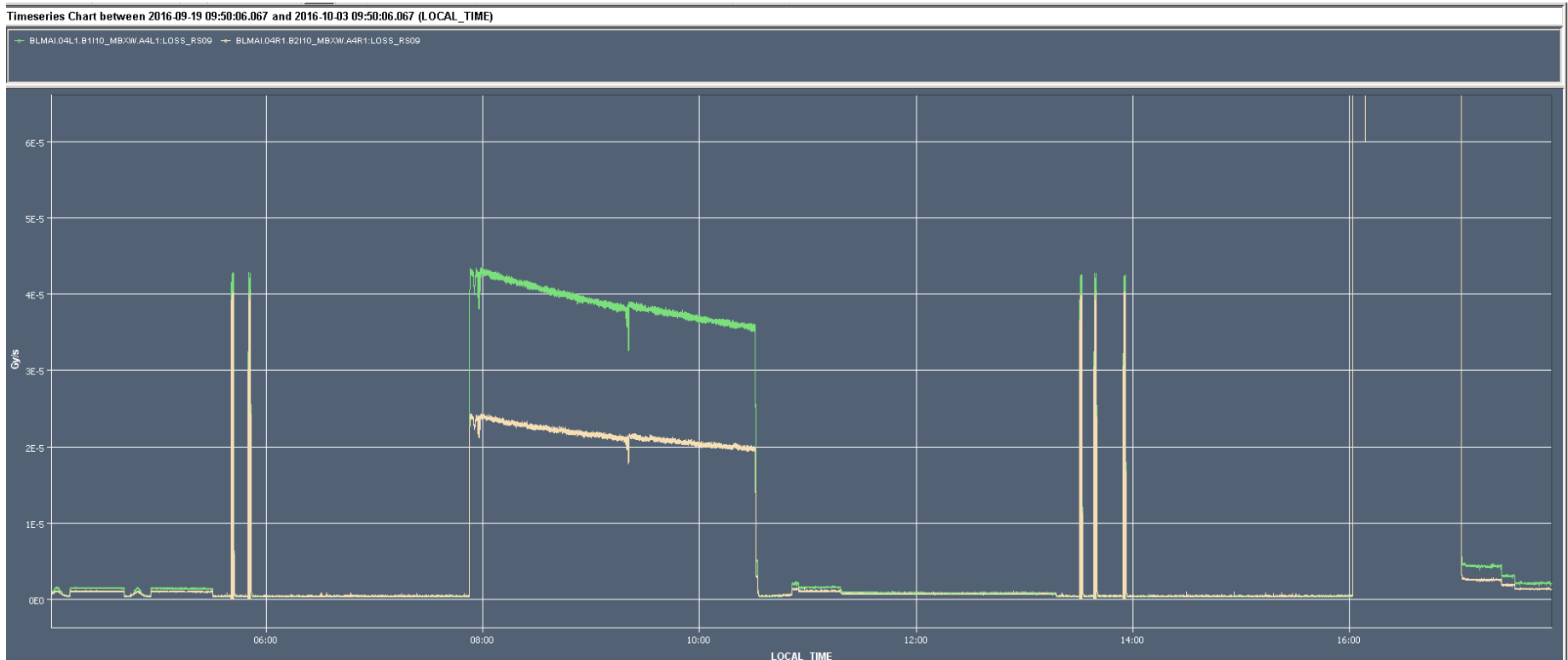
- Losses always x2 at L1
- Note: smaller spikes are modulation checks



Measurements

Checking RS09 over the logged period (up to 03/10/2016)

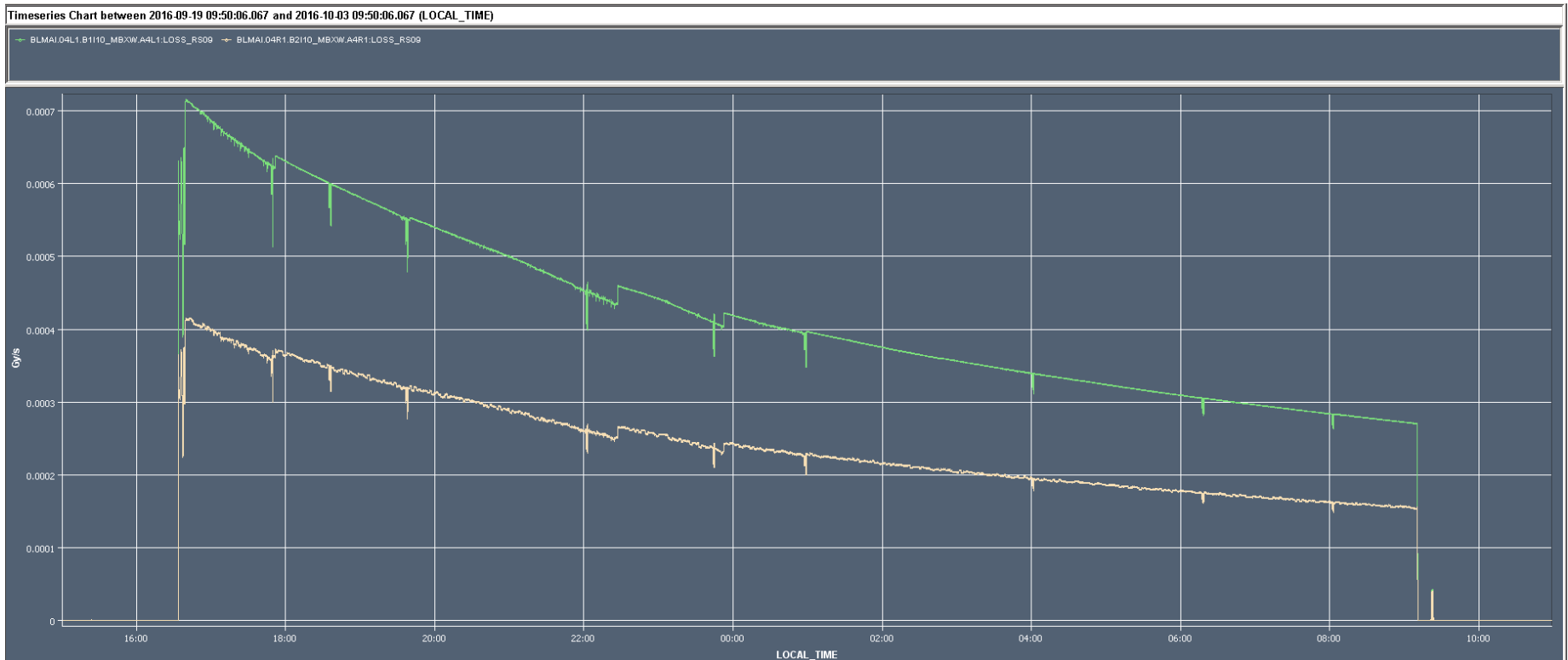
- Losses always almost x2 at L1
- Note: smaller spikes are modulation checks



Measurements

Checking RS09 over the logged period (up to 03/10/2016)

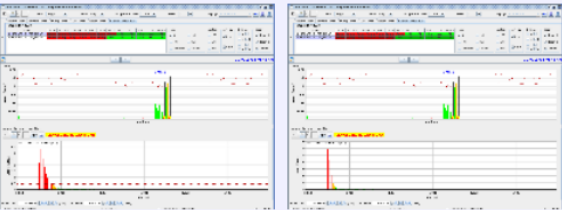
- Losses always almost x2 at L1
- Note: smaller spikes are modulation checks



20/09/2016 EVENT

GPM Event

Event Timestamp: 20/09/16 08:53:04.910

7	08:53	1	<p>Global Post Mortem Event</p> <p>Event Timestamp: 20/09/16 08:53:04.910 Fill Number: 5313 Accelerator / beam mode: PROTON PHYSICS / ADJUST Energy: 6499320 [MeV] Intensity B1/B2: 17 / 21 [e^10 charges] Event Category / Classification: PROTECTION_DUMP / MULTIPLE_SYSTEM_DUMP First BIC input Triggered: First USR_PERMIT change: Ch 4-BLM_UNM: B T -> F on CIB.US15.L1.B1</p>  <p>20160920091755.png 20160920091805.png</p> <p style="text-align: right;"><small>created by lhcop on CWO-CCC-D4LC</small></p>
8	08:53	1	<p>Global Post Mortem Event Confirmation</p> <p>Dump Classification: Beam Loss Operator / Comment: msolfaro / Fast losses at the IT.R1 during 2.5 km run (5 low nominal bunches)</p> <p style="text-align: right;"><small>created by lhcop on CWO-CCC-D4LC</small></p>

- All channels of the BLMAI type were missing from the BLM applications.
- Logging was not correctly configured for the new channels.

Interlock Sequence

- Only the UNMASKABLE output triggered
- Note: If error was from error or statuses would trigger both outputs

bic_eventseq >> Version: 2.0.3 Responsible: TE-MPE-MS Software Team (167226 - mpe-software-coord@cern.ch)

HEADER		SUMMARY	
System	BIC	pmAnalysisModuleVersion	2.0.3
Class	EVENT_SEQ	Analysis result description	FirstUSR_PERMIT change: Ch 4-BLM_UNM: B T-> F on CIB.US15.L1.B1
Source	ISA	Triggered BIC inputs	Ch 4-BLM_UNM(L1.B1), Ch 4-BLM_UNM(L1.B2), Ch 6-CIBDS Beam 2(R6.B2), Ch 6-CIBDS Beam 1(L6.B1)...
Event stamp	08:53:04.910 20/09/16	Beam 1 propagation delay to LBDS	62000 ns
Version	2.0.3	Beam 2 propagation delay to LBDS	64000 ns
Encoding	BIC/EVENT_SEQ	OVERALL	40 BICs triggered valid PM data
Qualifier			
Analysis flags	[NORMAL]		

EVENT OVERVIEW						SOURCE OVERVIEW		
Index	Loc. Permit A/B	Time	Delta(uSec)	Description	BIC name	Index	Source Name	Data Valid
49		08:53:04+910869	0	USER_PERMIT: Ch 4-BLM_UNM: B T-> F	CIB.US15.L1.B1	1	CIB.UA87.R8.B2	true
50		08:53:04+910869	0	USER_PERMIT: Ch 4-BLM_UNM: A T-> F	CIB.US15.L1.B1	2	CIB.UA87.R8.B1	true
51		08:53:04+910869	0	USER_PERMIT: Ch 4-BLM_UNM: B T-> F	CIB.US15.L1.B2	3	CIB.UA23.L2.B1	true
52		08:53:04+910869	0	USER_PERMIT: Ch 4-BLM_UNM: A T-> F	CIB.US15.L1.B2	4	CIB.UA23.L2.B2	true
130		08:53:04+910933	64	USER_PERMIT: Ch 6-CIBDS Beam 2: A T-> F	CIB.UA67.R6.B2	5	CIB.TZ76.U7.B2	true
145		08:53:04+910935	66	USER_PERMIT: Ch 6-CIBDS Beam 1: A T-> F	CIB.UA63.L6.B1	6	CIB.UA67.R6.B1	true
199		08:53:04+910968	99	USER_PERMIT: Ch 2-LBDS-b2 (TSU): B T-> F	CIB.UA67.R6.B2	7	CIB.TZ76.U7.B1	true
200		08:53:04+910968	99	USER_PERMIT: Ch 2-LBDS-b2 (TSU): A T-> F	CIB.UA67.R6.B2	8	CIB.UA67.R6.B2	true
228		08:53:04+910990	121	USER_PERMIT: Ch 2-LBDS-b1 (TSU): A T-> F	CIB.UA63.L6.B1	9	CIB.USC55.R5...	true
229		08:53:04+910990	121	USER_PERMIT: Ch 2-LBDS-b1 (TSU): B T-> F	CIB.UA63.L6.B1	10	CIB.USC55.L5...	true
250		08:53:04+910995	126	USER_PERMIT: Ch 6-CIBDS Beam 1: B T-> F	CIB.UA63.L6.B1	11	CIB.UJ33.U3.B1	true
328		08:53:04+911030	161	USER_PERMIT: Ch 6-CIBDS Beam 2: B T-> F	CIB.UA67.R6.B2	12	CIB.USC55.L5...	true
655		08:53:04+912001	1132	MASKED_PERMIT: Ch 14(BETS TCDQ beam-2): B T-> F	CIB.UA63.L6.B2	13	CIB.UJ33.U3.B2	true
656		08:53:04+912001	1132	MASKED_PERMIT: Ch 14(BETS TCDQ beam-2): A T-> F	CIB.UA63.L6.B2	14	CIB.SR8.INJ2.2	true
661		08:53:04+912002	1133	MASKED_PERMIT: Ch 14(BETS TCDQ beam-1): B T-> F	CIB.UA67.R6.B1	15	CIBDS.UA63.L6	true
662		08:53:04+912002	1133	MASKED_PERMIT: Ch 14(BETS TCDQ beam-1): A T-> F	CIB.UA67.R6.B1	16	CIB.UA63.L6.B1	true
814		08:53:04+978590	67721	USER_PERMIT: Ch 3-LBDS-b1 (PLC): B T-> F	CIB.UA63.L6.B1	17	CIB.UA43.L4.B2	true
815		08:53:04+978591	67722	USER_PERMIT: Ch 3-LBDS-b1 (PLC): A T-> F	CIB.UA63.L6.B1	18	CIB.UA43.L4.B1	true
816		08:53:04+996112	85243	USER_PERMIT: Ch 3-LBDS-b2 (PLC): B T-> F	CIB.UA67.R6.B2	19	CIB.UA63.L6.B2	true
817		08:53:04+996114	85245	USER_PERMIT: Ch 3-LBDS-b2 (PLC): A T-> F	CIB.UA67.R6.B2	20	CIB.US15.L1.B1	true
818		08:53:05+043736	132867	USER_PERMIT: Ch 4-BLM_UNM: B F-> T	CIB.US15.L1.B1	21	CIB.US15.L1.B2	true
819		08:53:05+043736	132867	USER_PERMIT: Ch 4-BLM_UNM: A F-> T	CIB.US15.L1.B1	22	CIB.SR2.INJ1.2	true
820		08:53:05+043736	132867	USER_PERMIT: Ch 4-BLM_UNM: B F-> T	CIB.US15.L1.B2	23	CIB.SR7.S7.B1	true
821		08:53:05+043736	132867	USER_PERMIT: Ch 4-BLM_UNM: A F-> T	CIB.US15.L1.B2	24	CIB.SR2.INJ1.1	true
822		08:53:05+069672	158803	USER_PERMIT: Ch 2-LBDS-b2 (TSU): B F-> T	CIB.UA67.R6.B2	25	CIB.SR7.S7.B2	true
823		08:53:05+069673	158804	USER_PERMIT: Ch 2-LBDS-b2 (TSU): A F-> T	CIB.UA67.R6.B2	26	CIB.SR8.INJ2.1	true
824		08:53:05+076791	165922	USER_PERMIT: Ch 2-LBDS-b1 (TSU): B F-> T	CIB.UA63.L6.B1	27	CIB.SR3.S3.B1	true
825		08:53:05+076791	165922	USER_PERMIT: Ch 2-LBDS-b1 (TSU): A F-> T	CIB.UA63.L6.B1	28	CIBDS.UA67.R6	true

FILTER

Beam_Permit_Loop
 Beam_Permit
 Local_Permit
 User_Permit
 User_Permit_Glitch
 Software
 Mask
 Masked_Permit

Disabled_Permit
 Channel_Enable
 Test
 Power
 Self_Test
 Time
 Safe_Beam_Flag
 Marker
 Injection_BICs

Channel A
 Channel B
 Beam 1
 Beam 2
 Generator
 CIBDS

PM Buffer Verification

- No communication errors
- Markers in expert data show that data is correct

The screenshot displays the BLMLHC Debugging kit interface. At the top, there are tabs for 'DEBUG files' and 'PMExpertFiles'. Below this is a 'Selected file analysis' section containing a table of data points. The table has 16 rows and 32 columns, with the first column representing a marker index and the subsequent columns representing data values. The values are mostly hexadecimal, with some rows showing a sequence of '0000' followed by a sequence of '1111'.

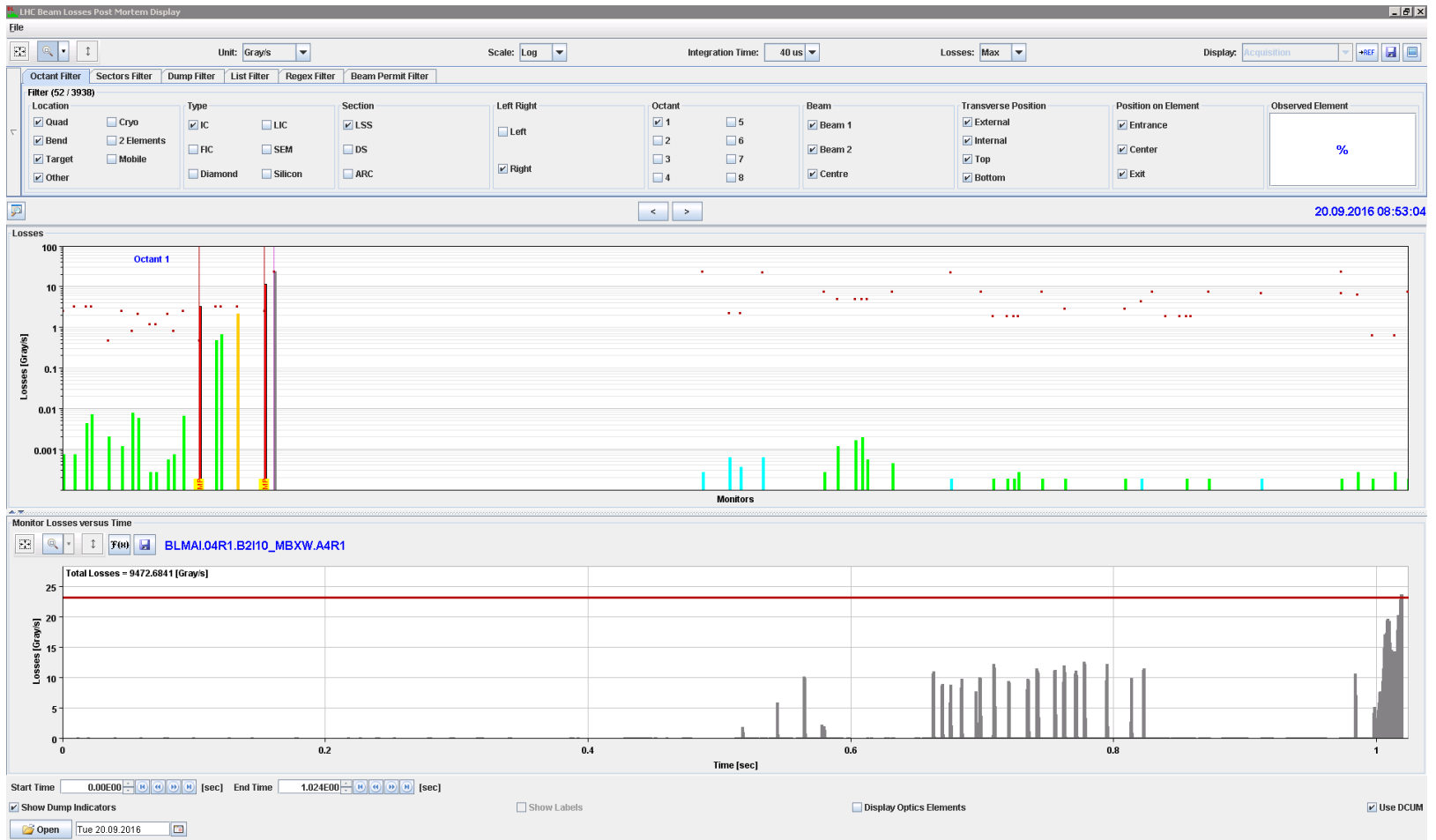
	43538	43539	43540	43541	43542	43543	43544	43545	43546	43547	43548	43549	43550	43551	43552	43553	43554	43555	43556	43557	43558	43559	43560	43561	43562						
1	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0	FFFF0						
2	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
3	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
4	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
5	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110	11110						
6	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
7	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
8	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000						
9	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220	22220						
10	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	14907	1E413	11C14	12811	0680C	0360A	0840D					
11	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	46903	00205	40514	80163	00A72	40A21	00DE1	807C0	40E20	00144		
12	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	80000	80000	80000	80000	80000	80000	80000	80000	80000	80000	80000	
13	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330	33330					
14	07074	0F498	0A4B8	0E8CF	0E8DF	0BCEB	014F0	0E8F7	0E8FB	0E5FB	0ECFB	0E8FB	E0DA0	60000	A0000	40000	20000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
15	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000	03000
16	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	90000	607A3	50705	80054	10373	80422	C0061	A0B30	C0CB0	E05B0	E0030	50000

Below the table, there is a 'Debug plot' section with a legend for 'Pos 1' through 'Pos 16'. The plot shows a series of vertical bars representing data points for each position over a range of approximately -40000 to 0. The bars are color-coded according to the legend.

At the bottom of the interface, there are sections for 'Files available for display' and 'What's up'. The 'Files available for display' section lists several files related to the debugging kit. The 'What's up' section provides a summary of the current analysis, including the file being analyzed and the status of the analysis.

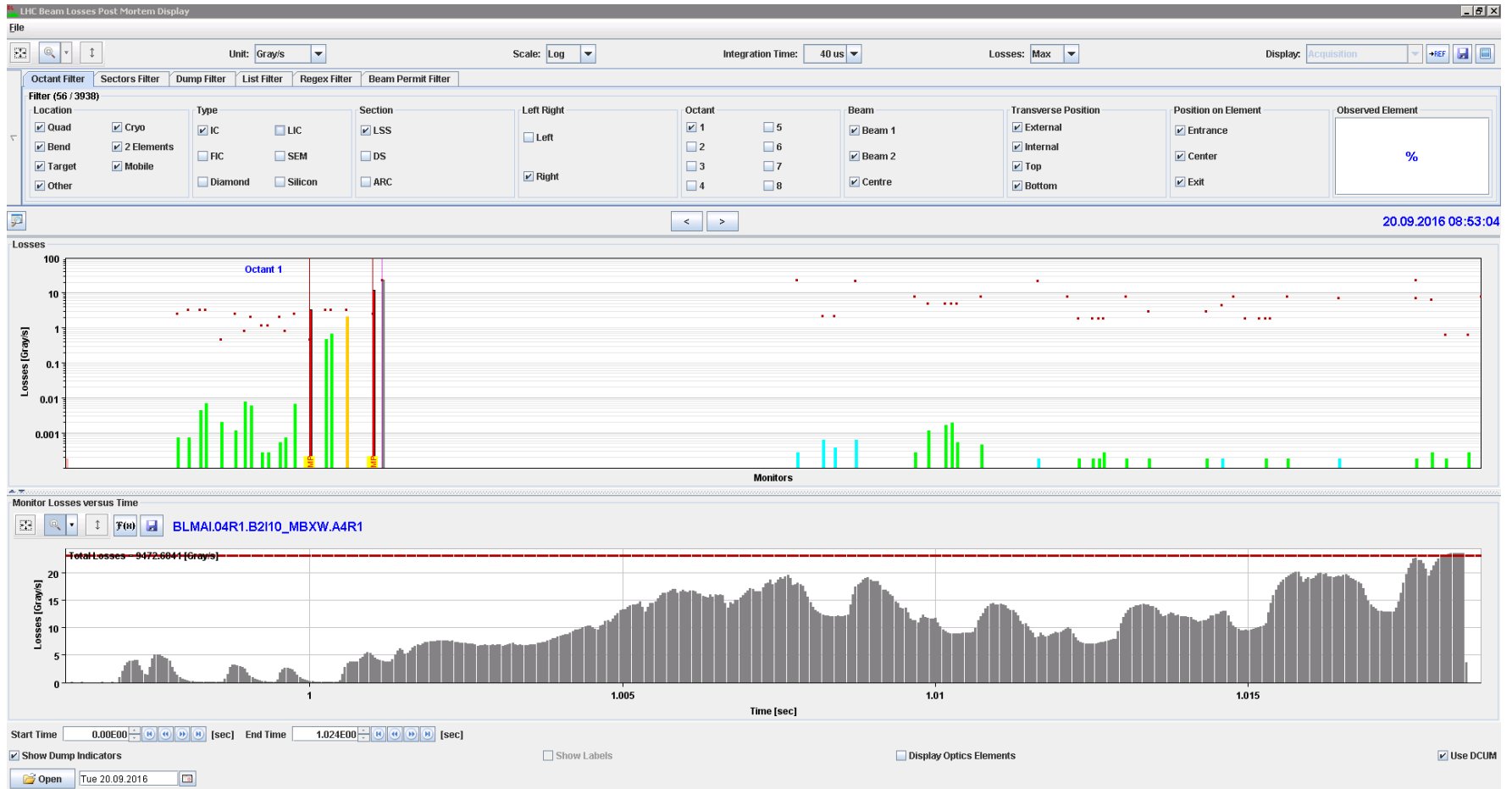
BLMAI.04R1.B2I10_MBXW.A4R1

Complete PM buffer:



BLMAI.04R1.B2I10_MBXW.A4R1

Zoom in the PM buffer just before the interlock request:



SR1.C, Card 10, Channels 09-14

Zoom in the PM buffer
1 ms around the
interlock request;

All channels on the
same acq. card and
HV Box:



14

13

12

11

10

09

Channel index

CONCLUSIONS

Summary

- None of the channels involved has shown any abnormal behaviour since the event.
- Issue cannot be attributed to SEU, broken card or wrong decoding of data
 - each channel is independent and
 - excessive check in the data correctness is done.
- Issue is localised
 - Some channels in other locations have minor losses at the same time, but most probably coincidence (noise) or crosstalk.
- Loss mechanisms cannot explain it (at least this is what experts claim)
- One probability (very low) is external coupling, but
 - cable adaptors for the extensions and detector are isolated
 - difficult to think how this would work to create such signals

THANK YOU