TECHNISCHE UNIVERSITÄT DARMSTADT

UFO type 2

Analysis of beam loss signature and explanation of related hypothesis

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CERN

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Brief overview of 16L2 issues

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Recap: Impact of 16L2 events in 2017

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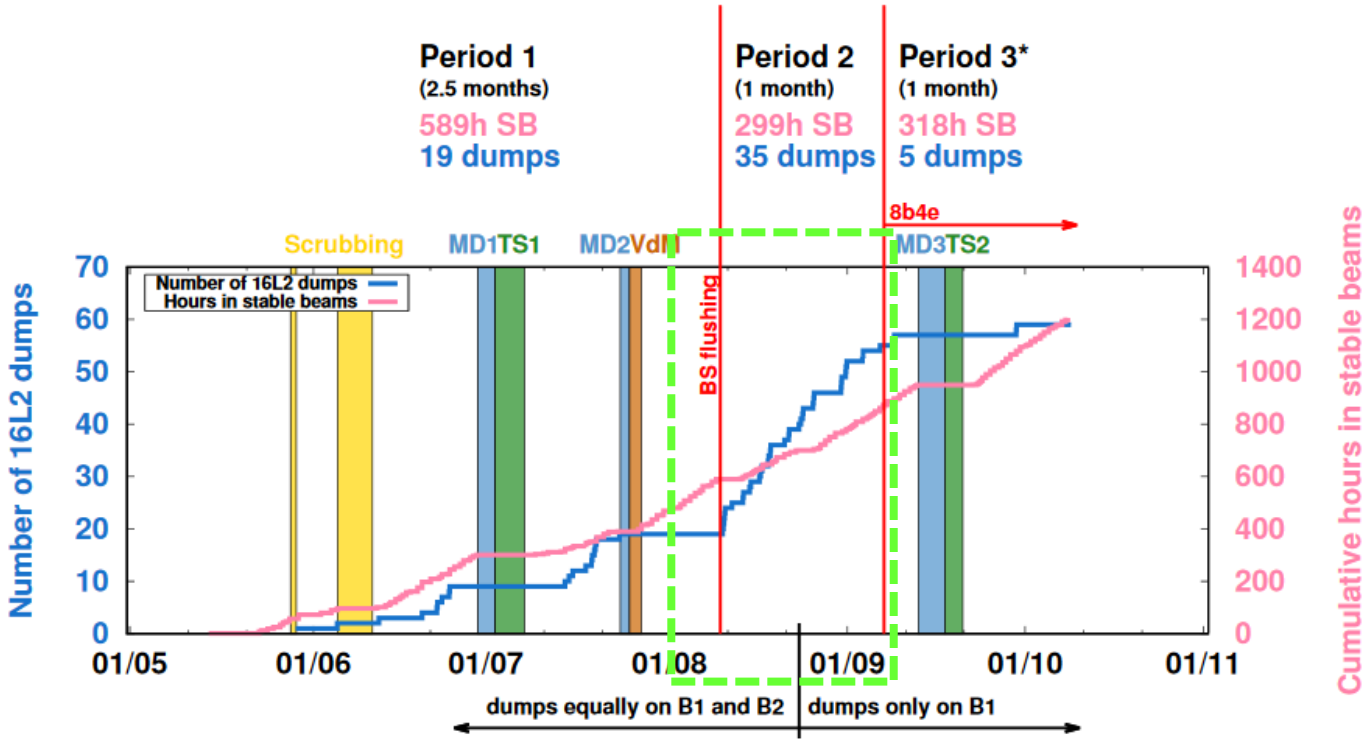
Dumps and quenches related to losses in 16L2

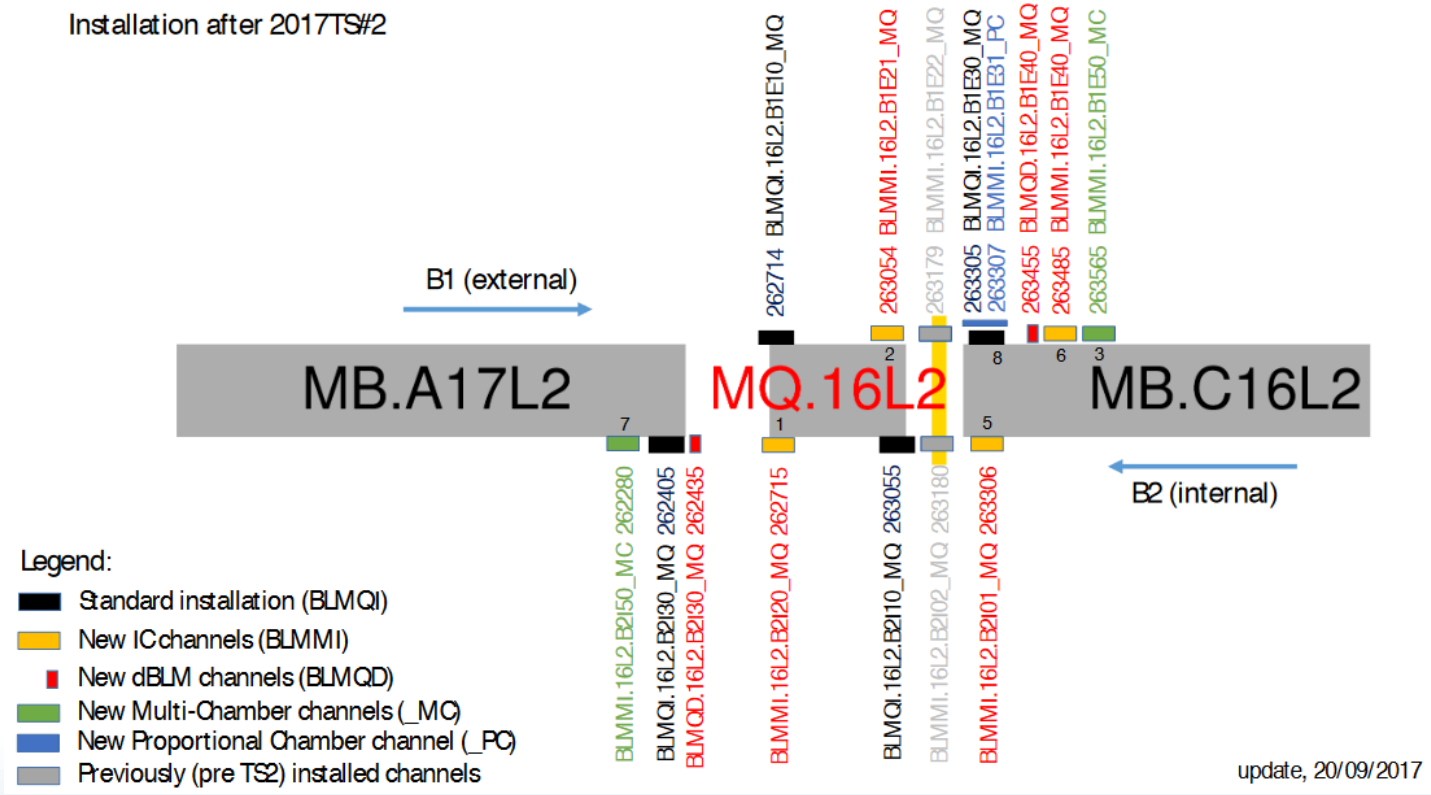
59 dumps (39×B1, 20×B2), including 1 quench on the 12/08:



*as of 09/10/2017

A. Lechner (BLMTWG58) Oct 10th, 2017 4 / 13

Recap: BLMs in 16L2 after TS2



From [morning meeting]

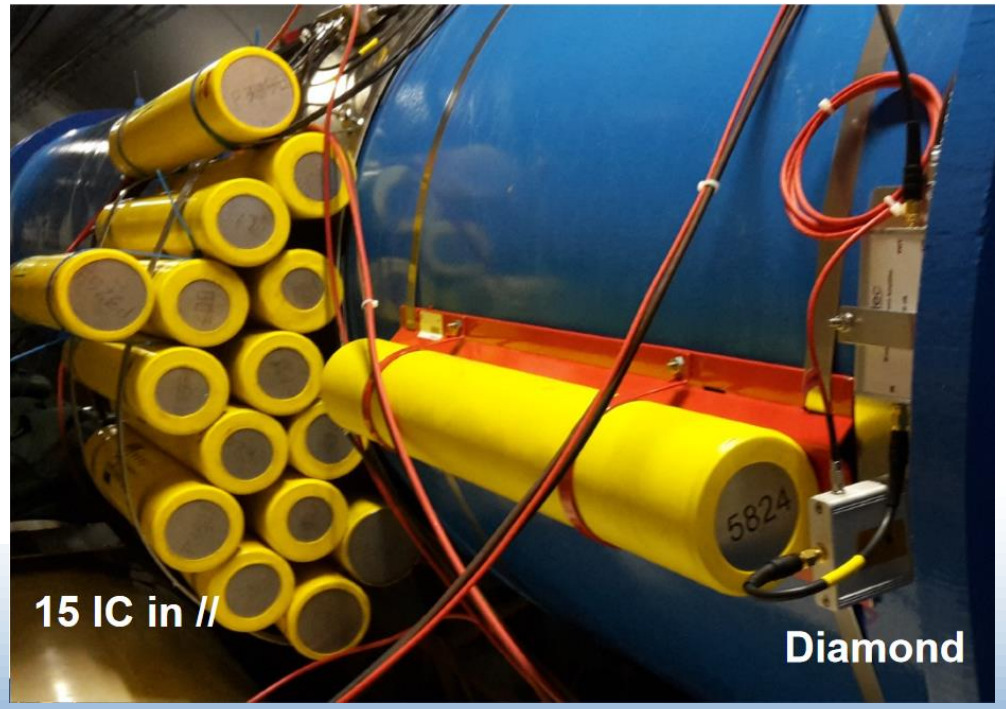
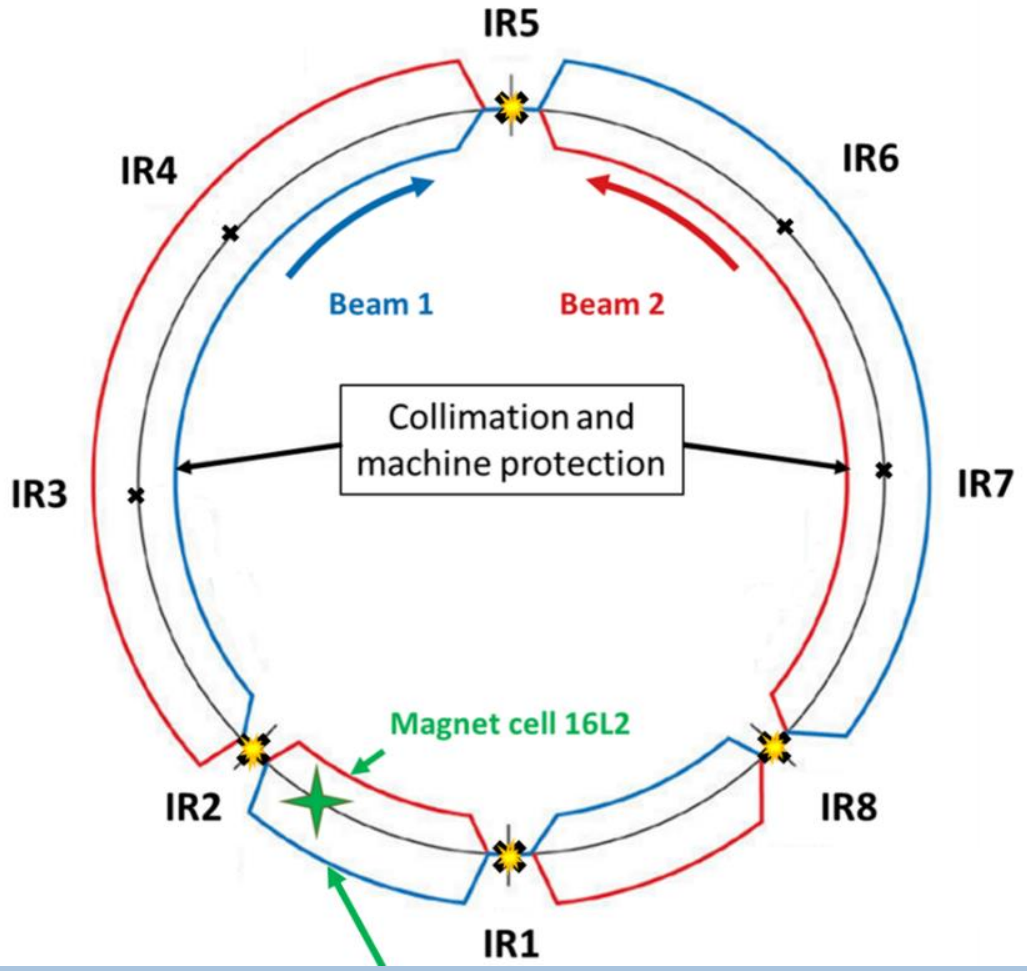
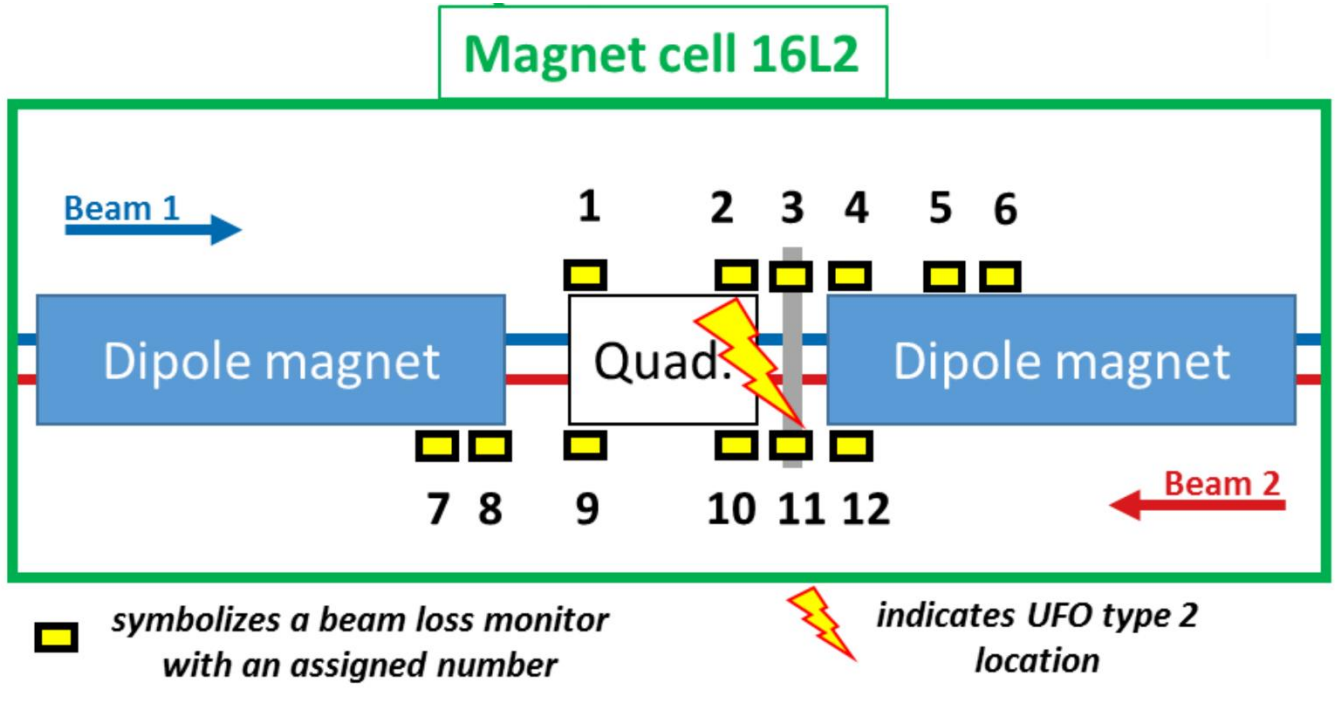


Illustration of loss location





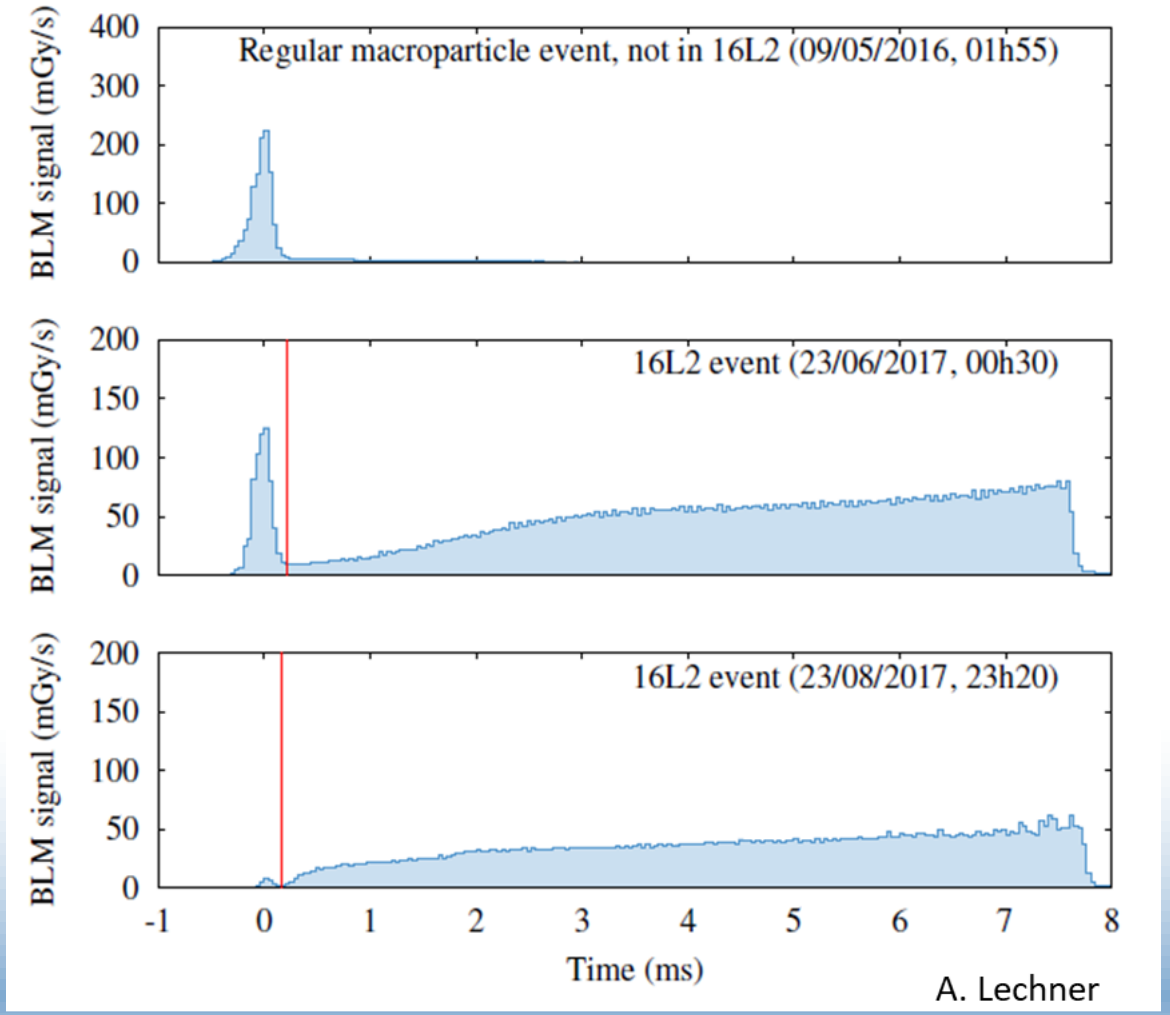
General observations

In 16L2:

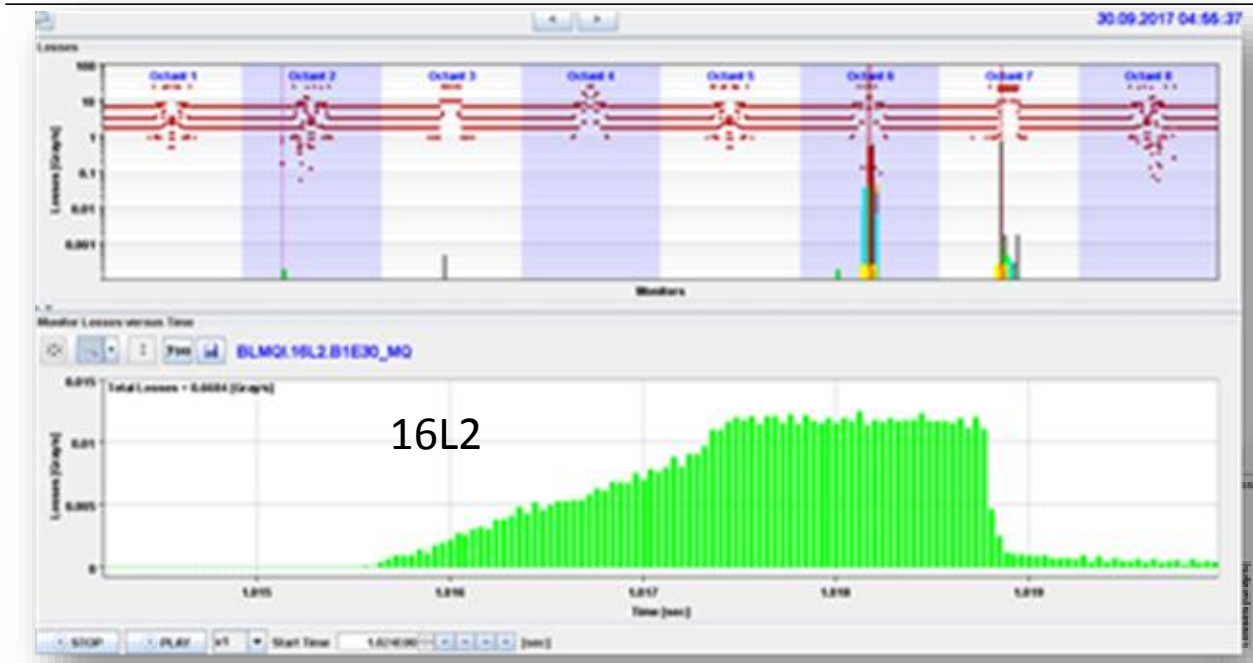
- Sometimes peak as seen in regular UFO type 1
- Sometimes no initial peak
- After ~ 1 ms losses increase coninuously

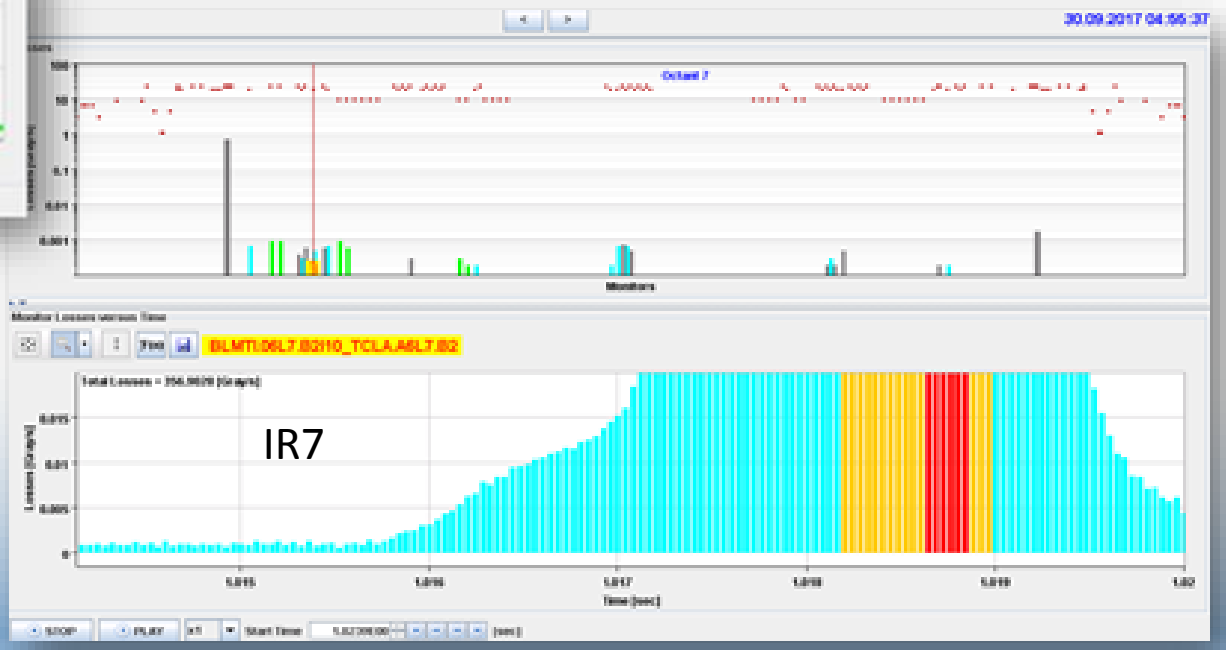
In IR7 – insertion cleaning:

- Negligible elastic losses
- Sometimes reduced losses (UFO acts as collimator!)
- Steap rising of losses due to beam instability
- Sometimes slow rinsing, oscillating losses
- IR7 triggers the dump



UFO Type 2 in post mortem interface





UFO Type 2 in cell 16L2: Hypothesis

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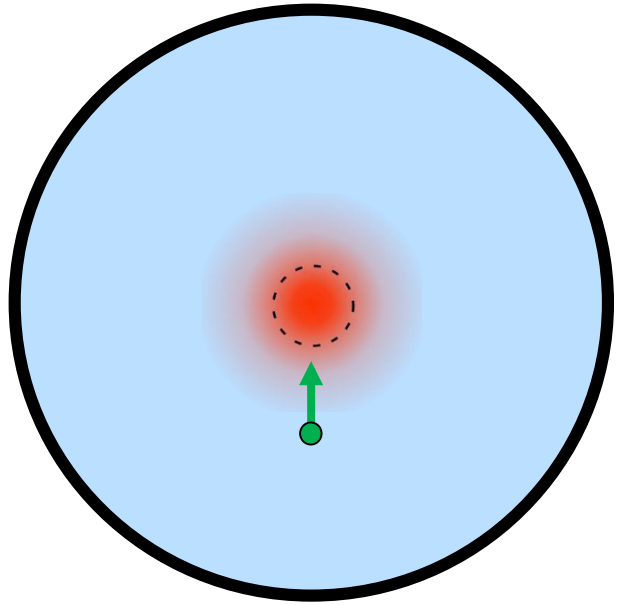
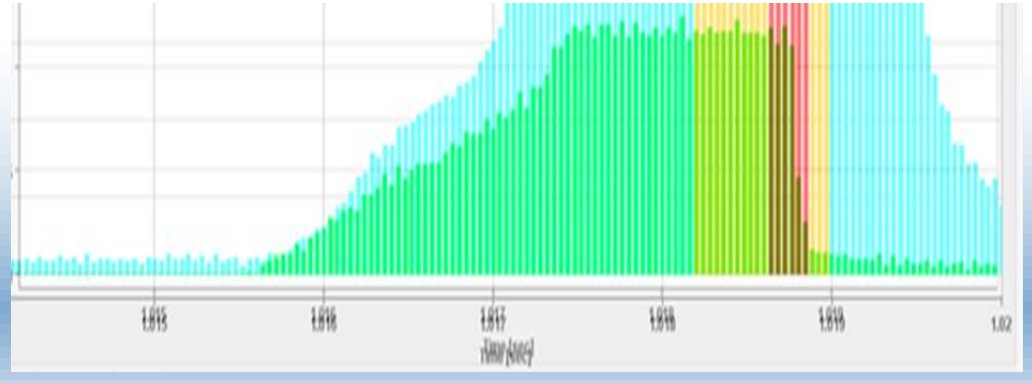
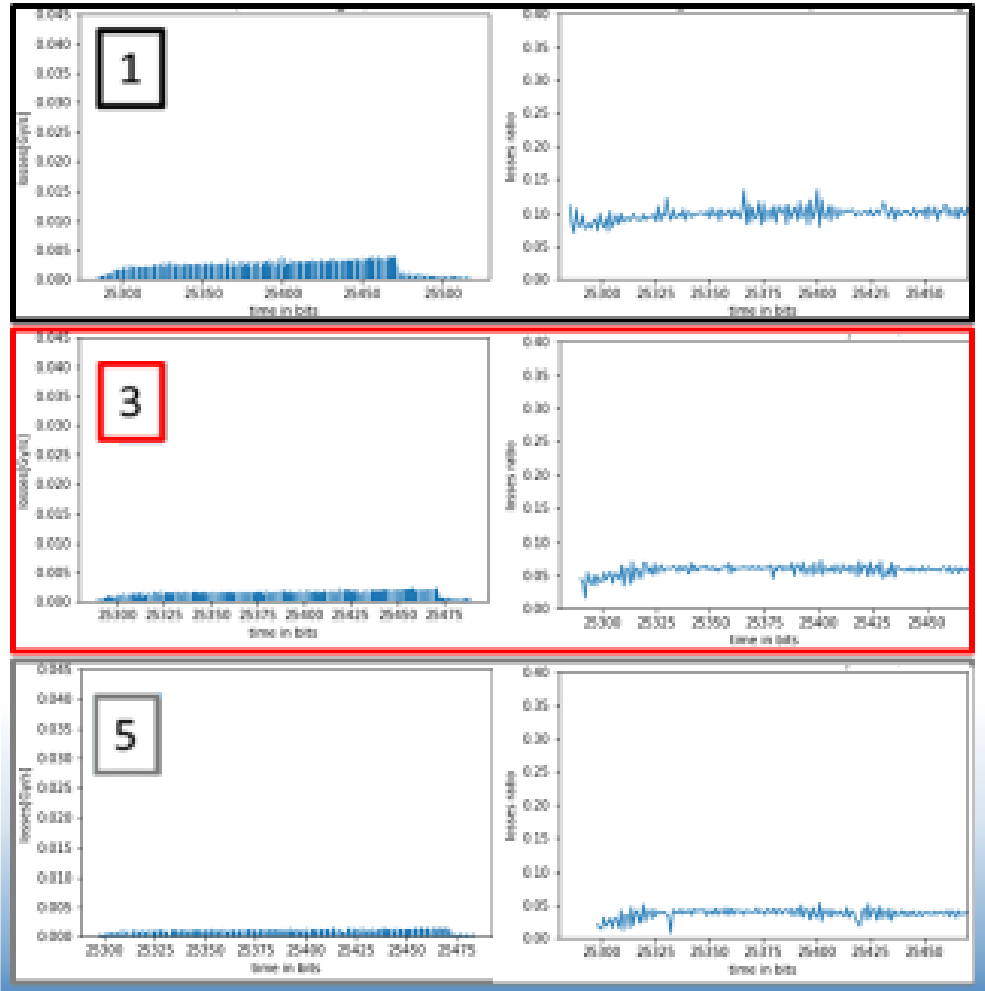
- Solid macroparticle of low melting point enters beam halo
- As in UFO type 1 it gets bombarded by protons
- It gets (at least partially) vaporized
- Part of the gas atoms remain in the beam
- Hadronic showers by inelastic scattering
- Ionization of the neutral gas atoms
- This creates a plasma → influences the beam dynamics





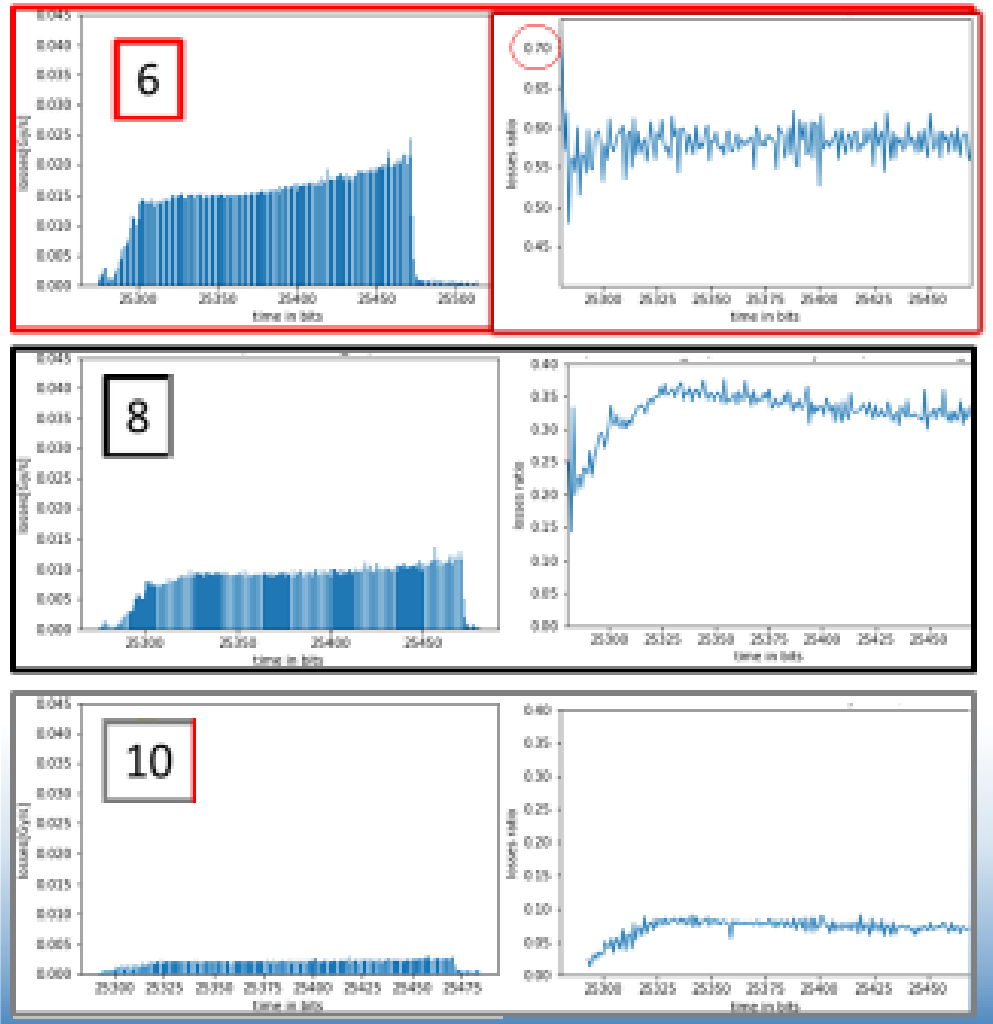
Recap: local losses of 2 events indicate expansion



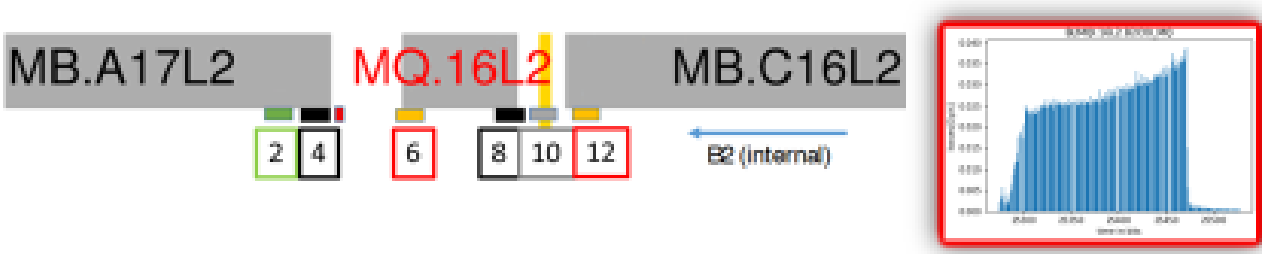
Normalized loss signatures in B1 monitors

02.11.2017 | TE-MPE-PE section meeting | Laura Grob

Recap: local losses of 2 events indicate expansion



Normalized loss signatures in B2 monitors



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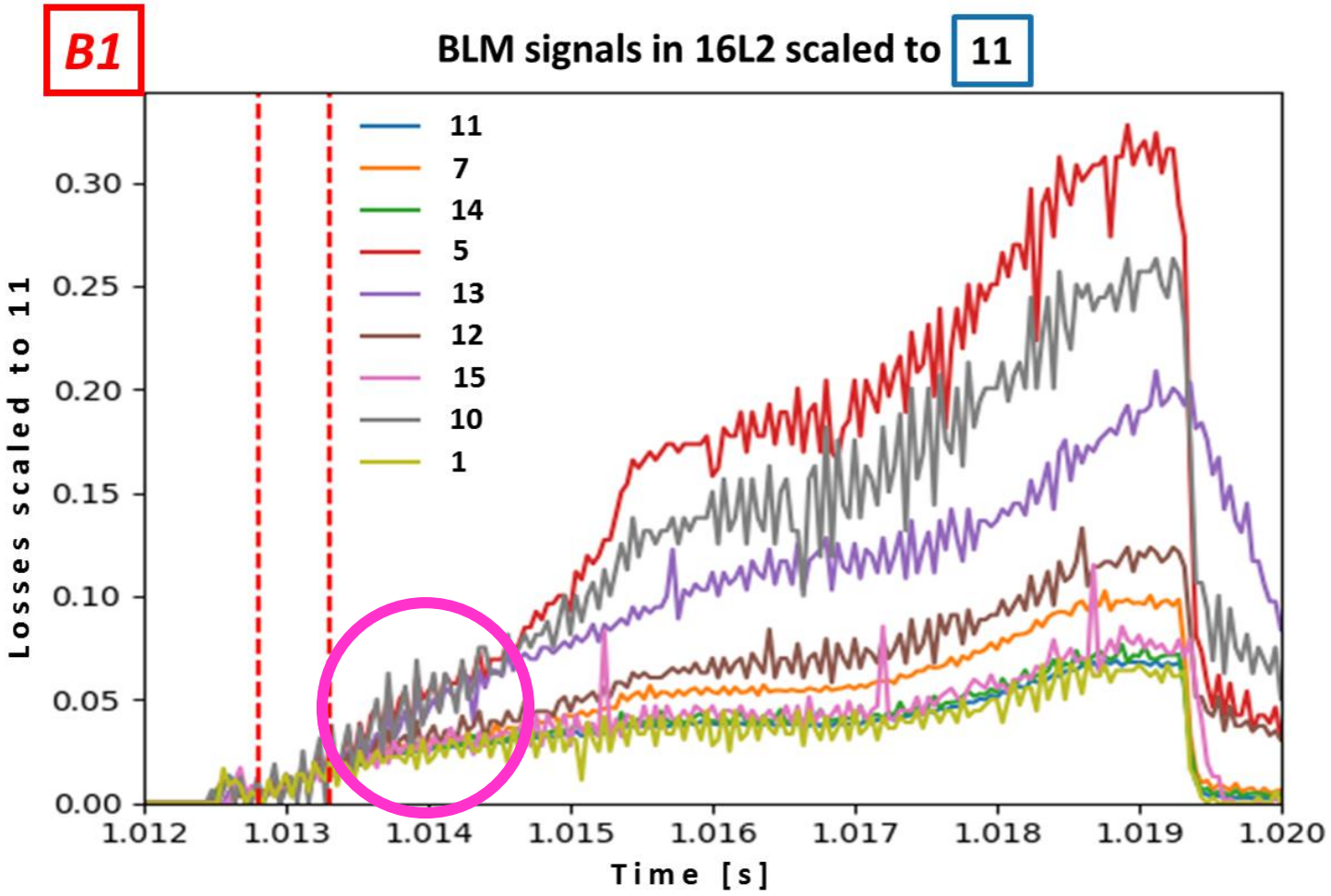
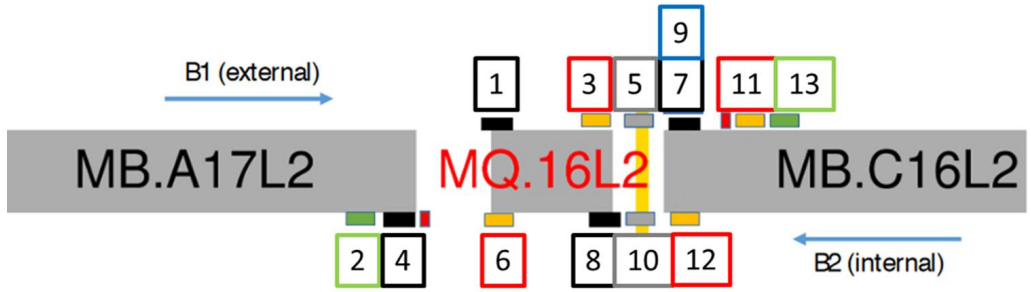
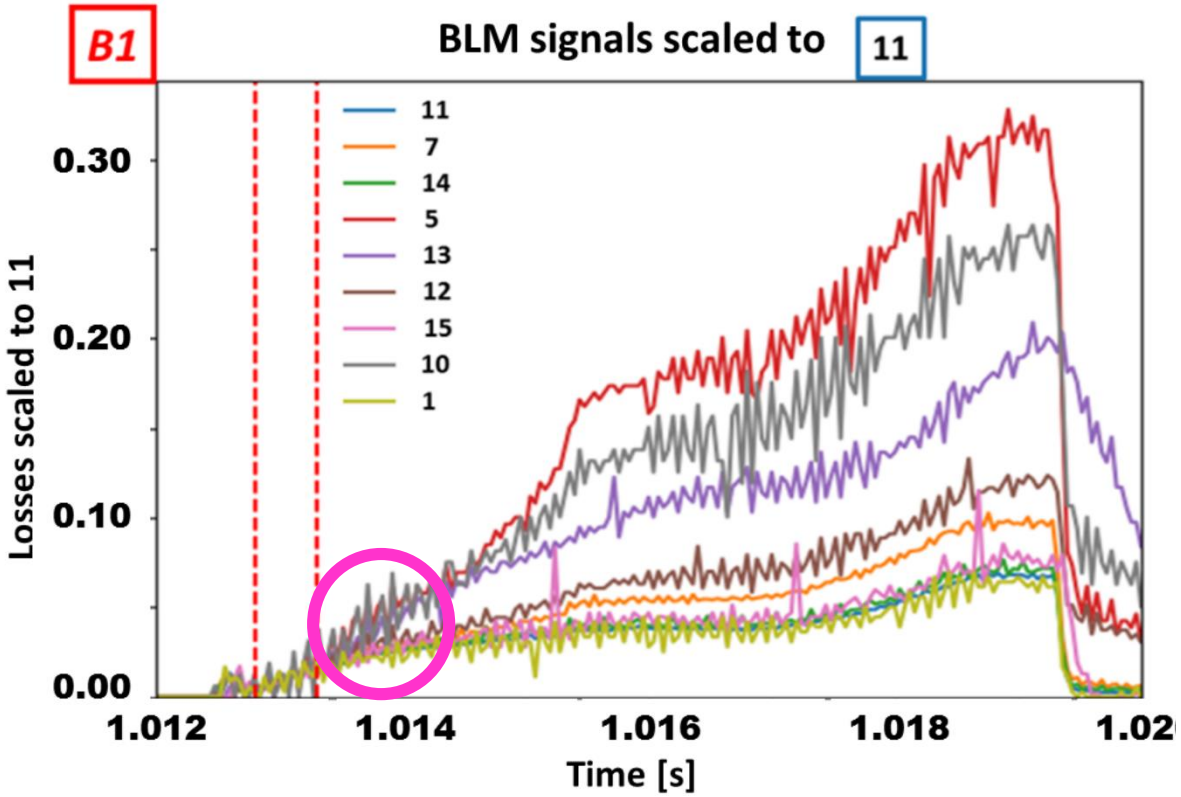
Closer analysis of 16L2 dumps in 2017

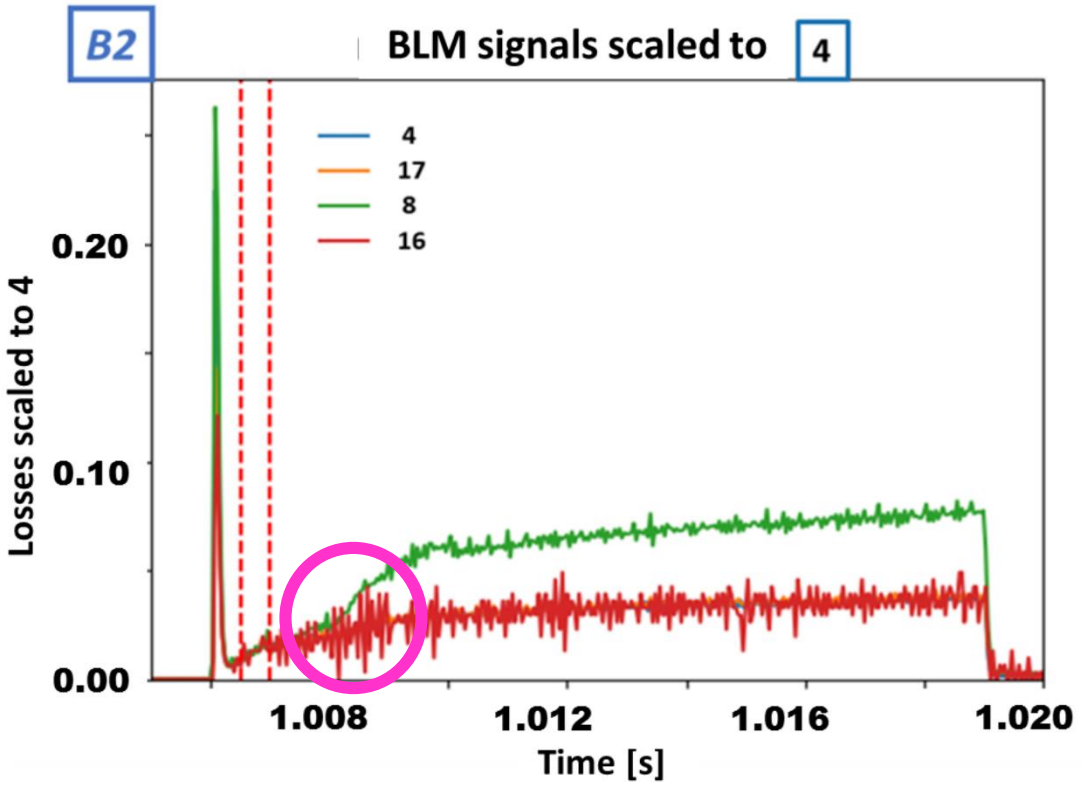


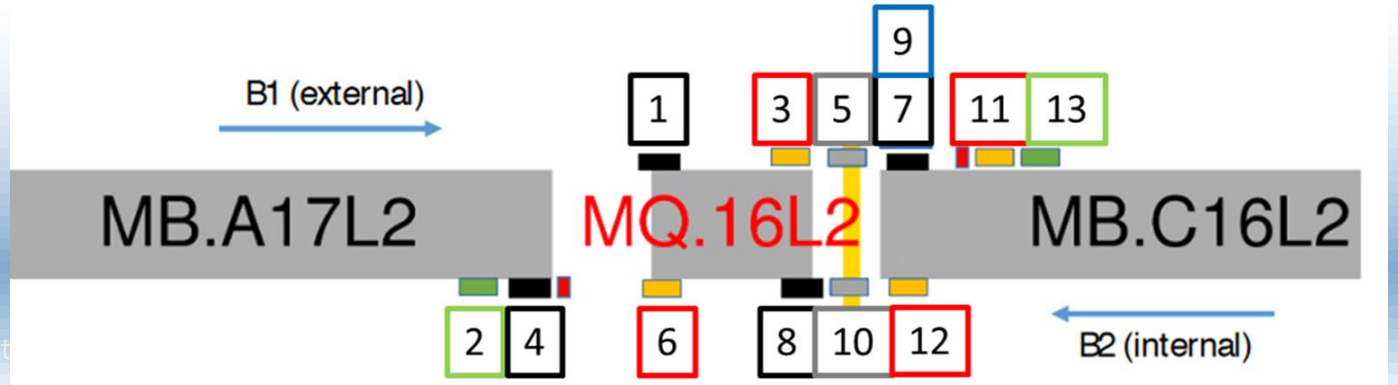


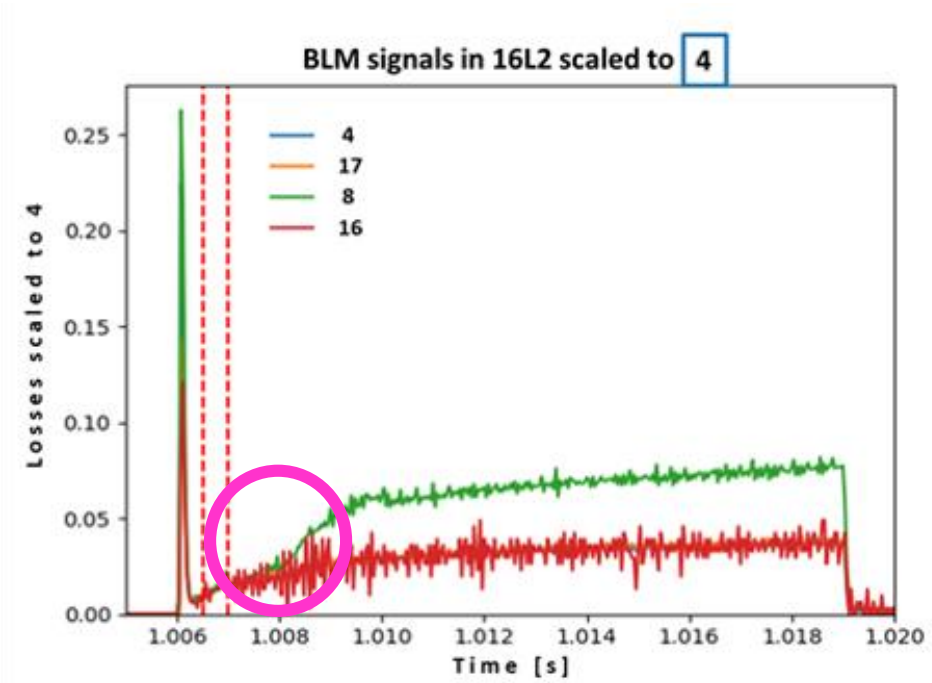
Divergence at ≈ 1.0135 s

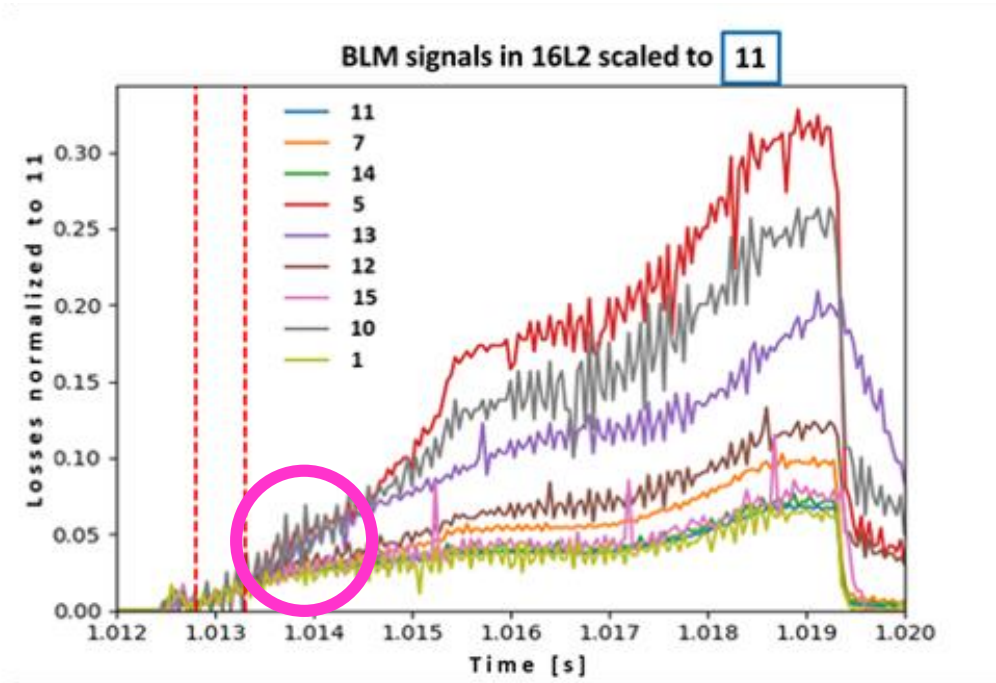
16 L2 signatures: B1 and B2 comparison

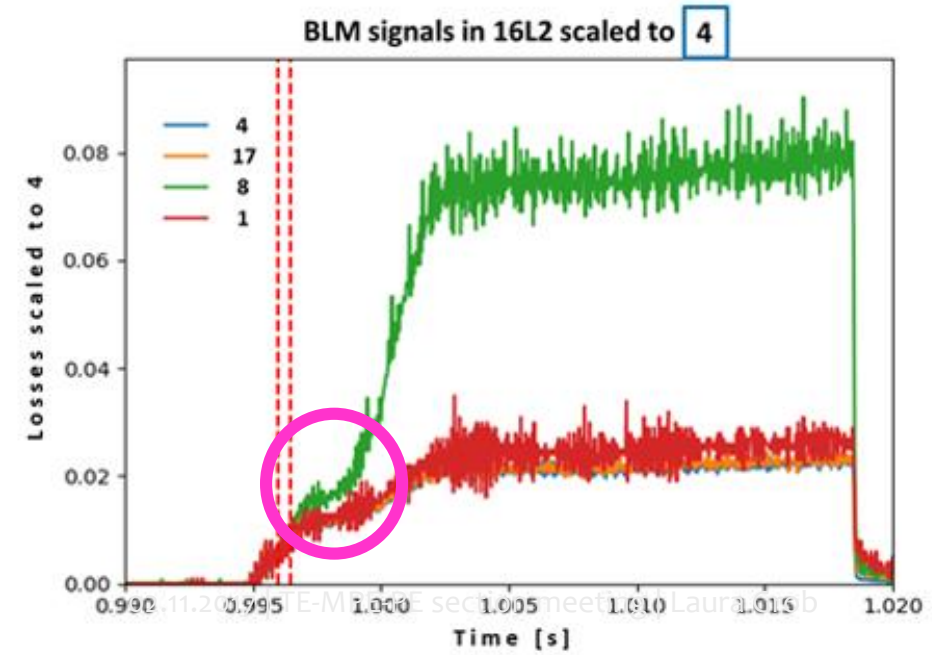


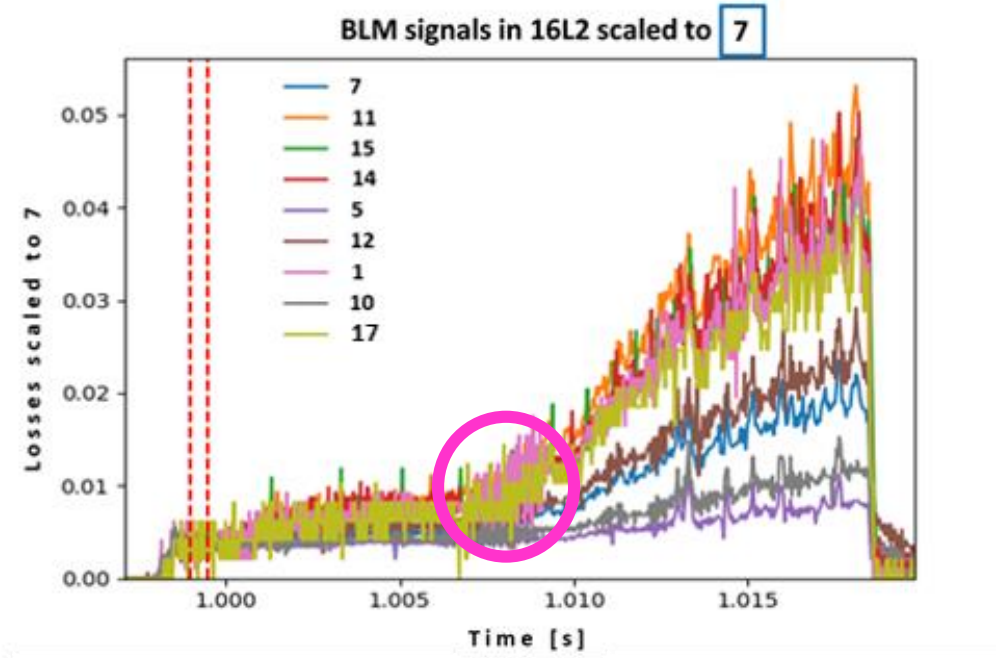




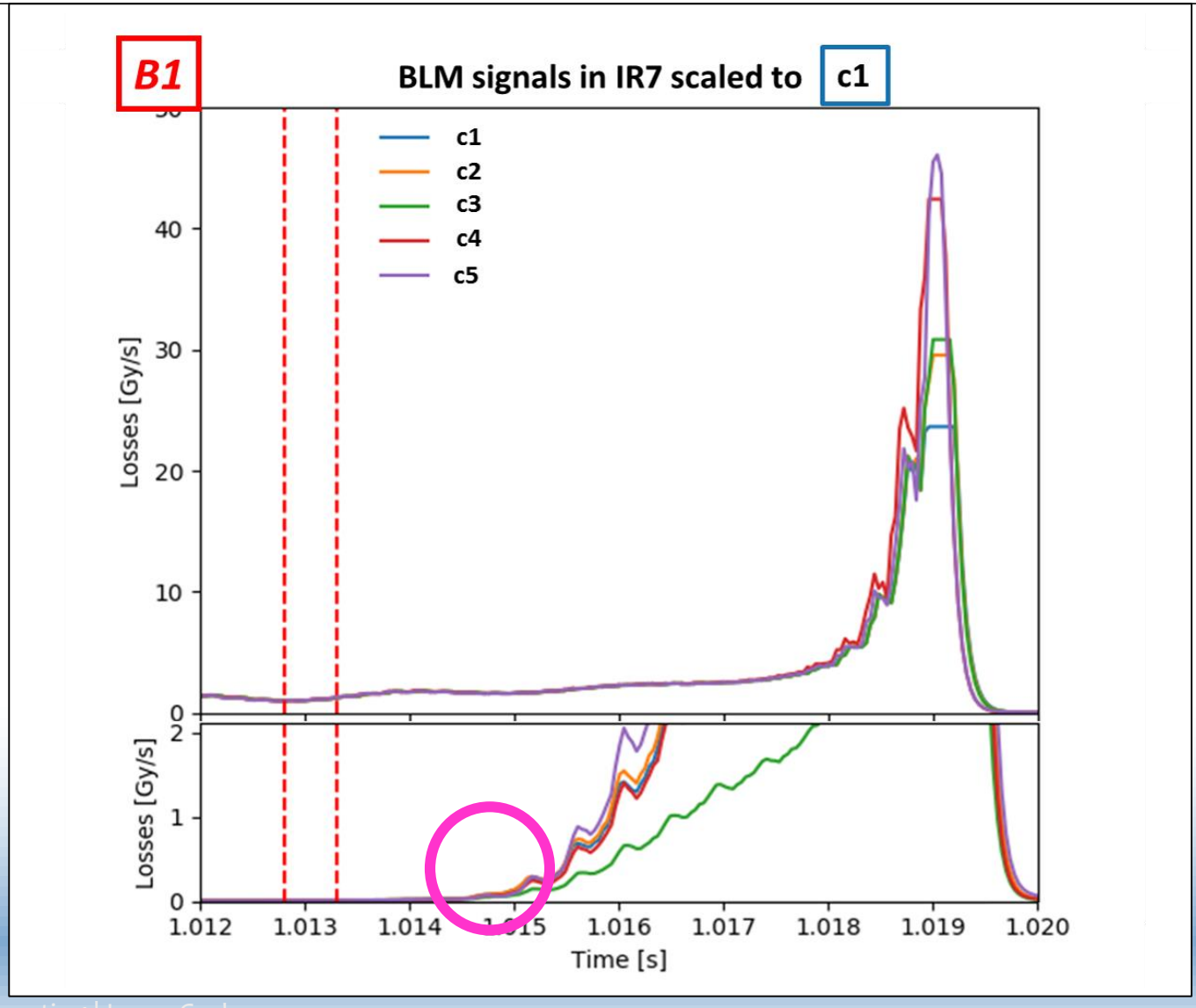

BLM signals in 16L2 scaled to 4
Losses scaled to 4
Time [s]
4
17
8
16

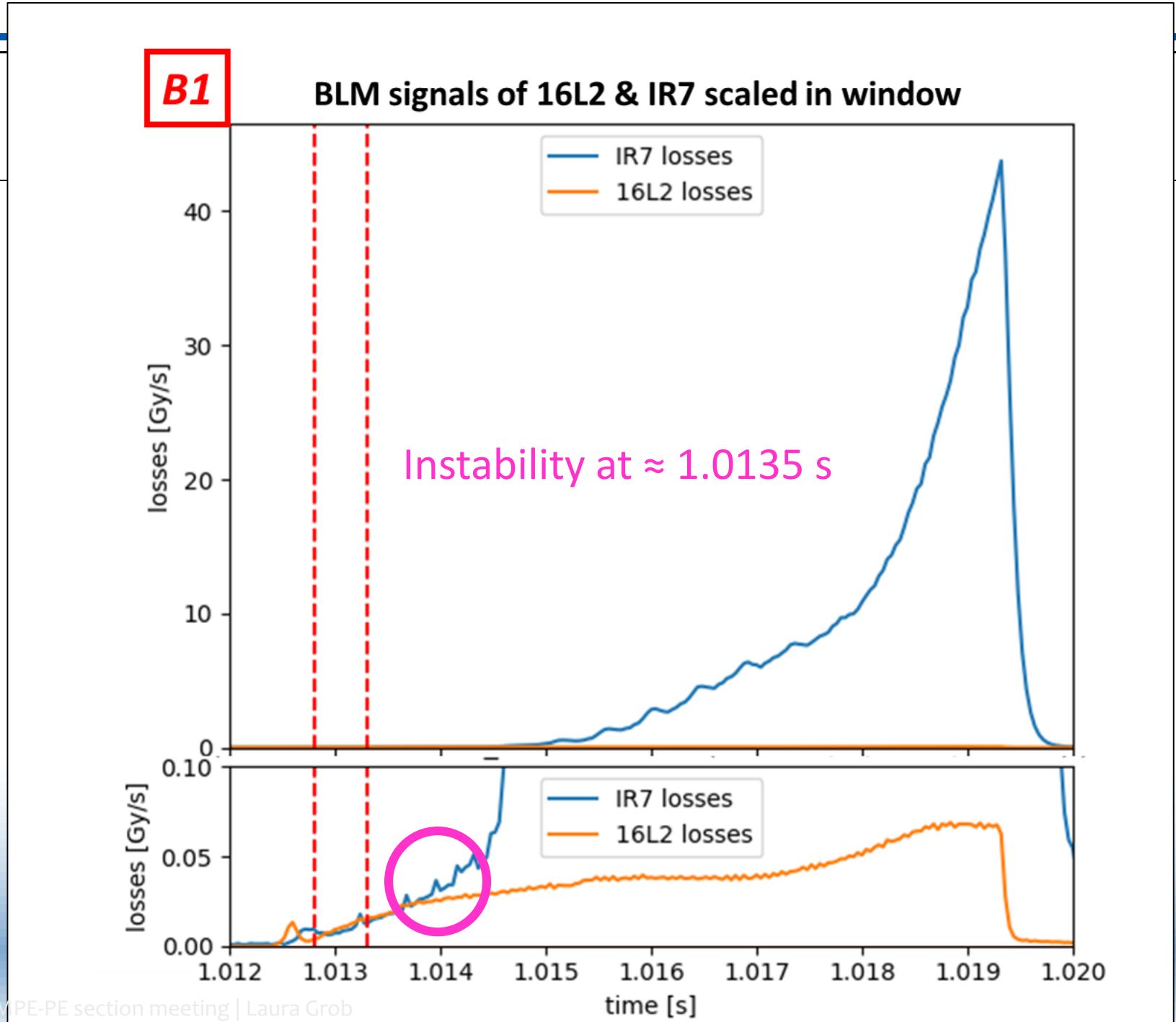

BLM signals in 16L2 scaled to 11
Losses normalized to 11
Time [s]
11
7
14
5
13
12
15
10
1


BLM signals in 16L2 scaled to 4
Losses scaled to 4
Time [s]
4
17
8
1


BLM signals in 16L2 scaled to 7
Losses scaled to 7
Time [s]
7
11
15
14
5
12
1
10
17

IR7 losses at collimators




B1
BLM signals of 16L2 & IR7 scaled in window
IR7 losses
16L2 losses
losses [Gy/s]
Instability at ≈ 1.0135 s
IR7 losses
16L2 losses
losses [Gy/s]
time [s]

Interpretation of observed behavior

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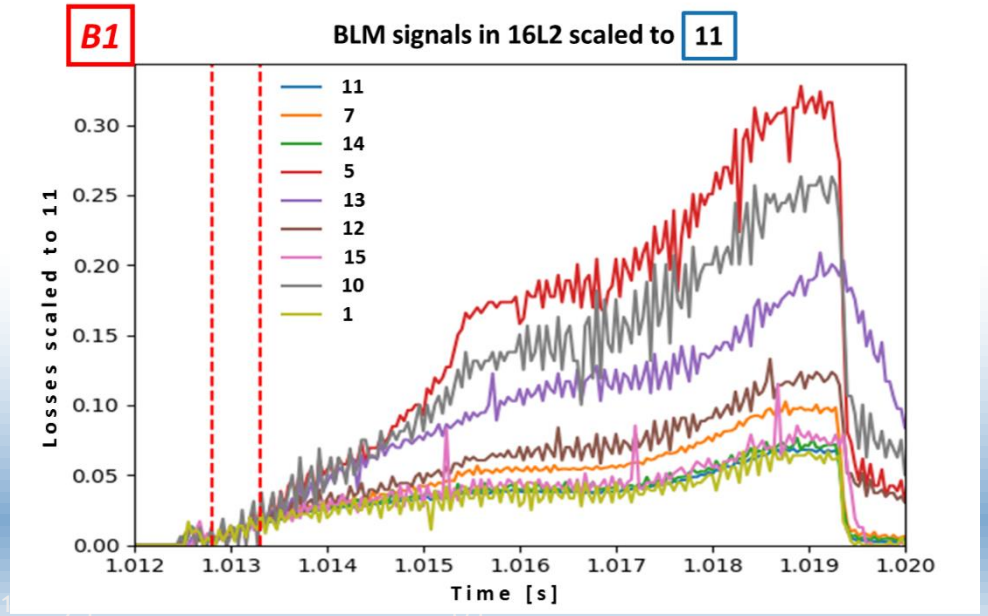
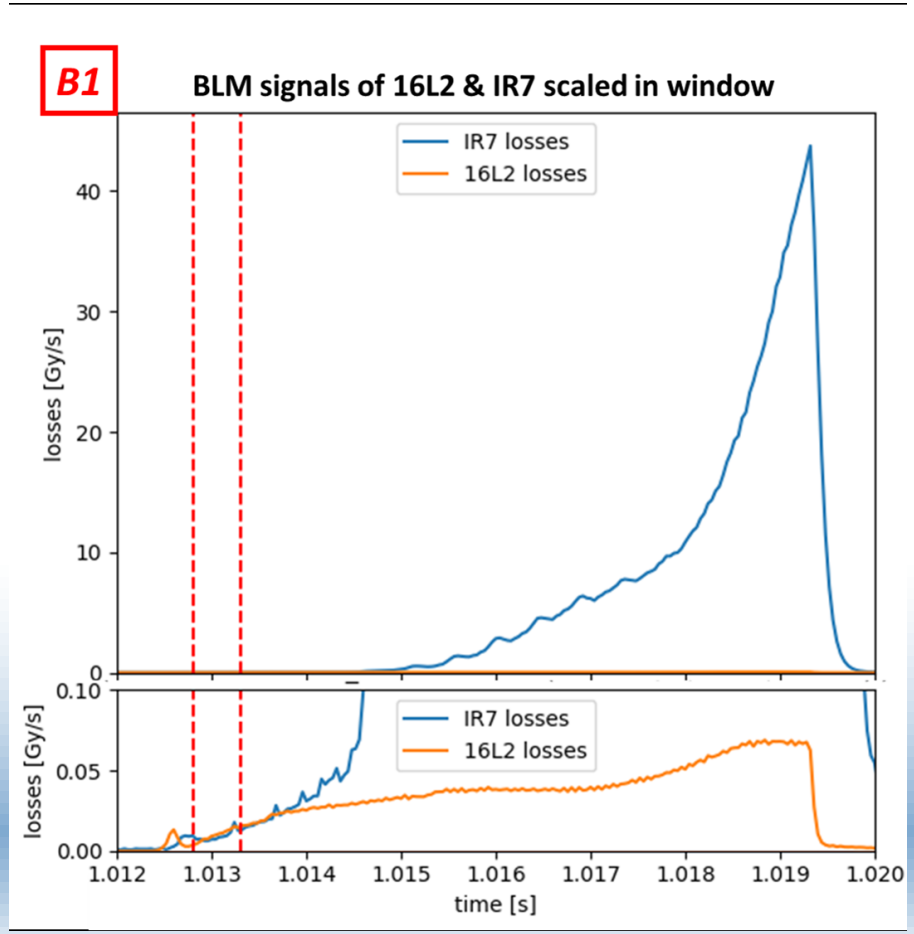
- Neighboring BLMs show losses
- Losses increase with time wrt BLM with highest signal
- This could indicate longitudinal expansion of source
- Can be explained by evaporation
- This supports theory of UFO type 2





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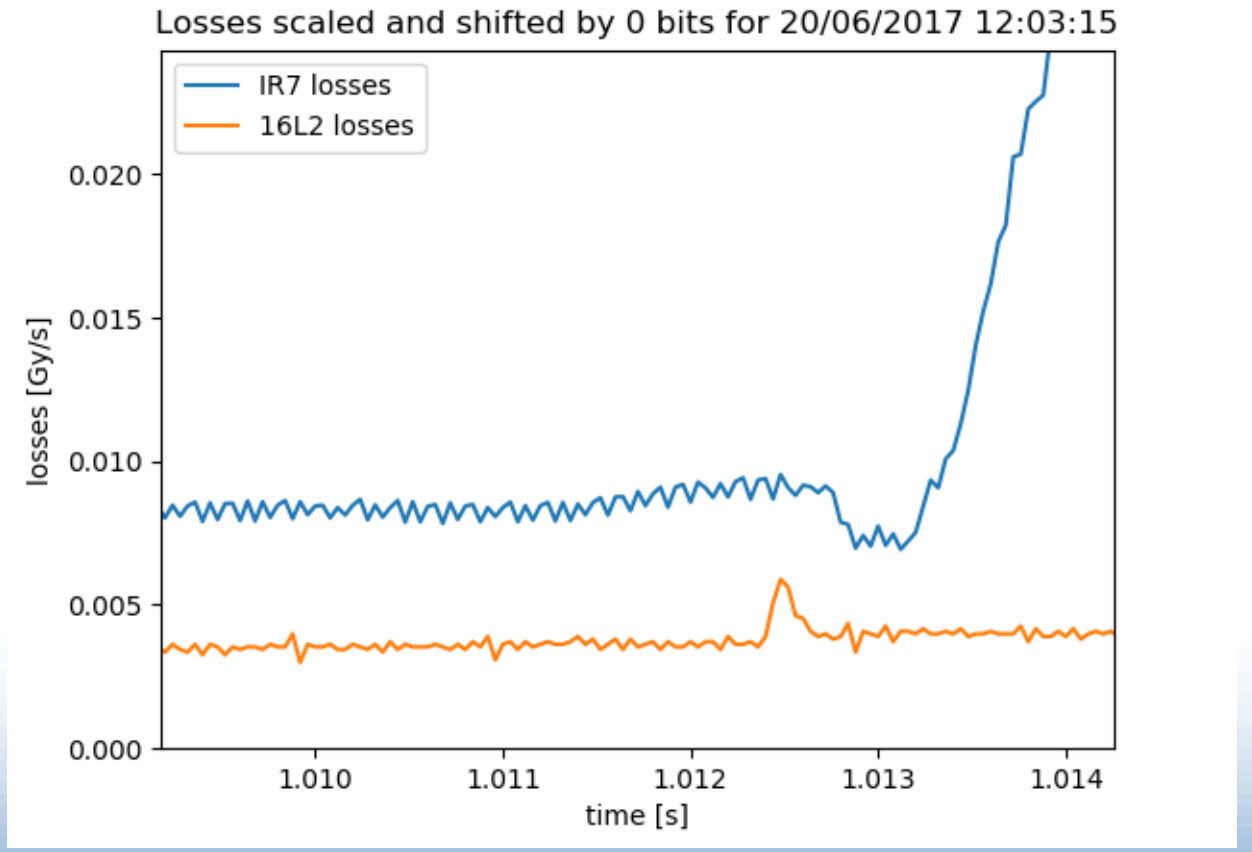
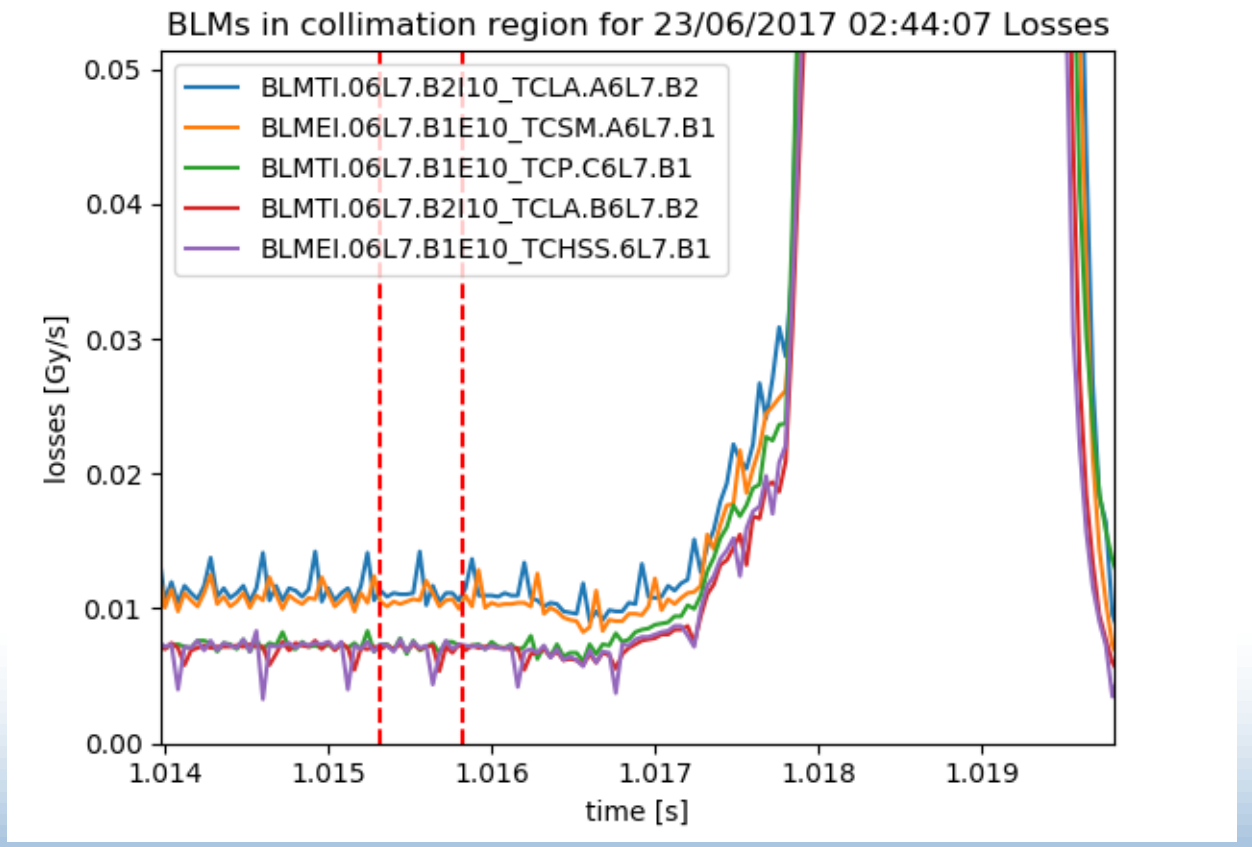
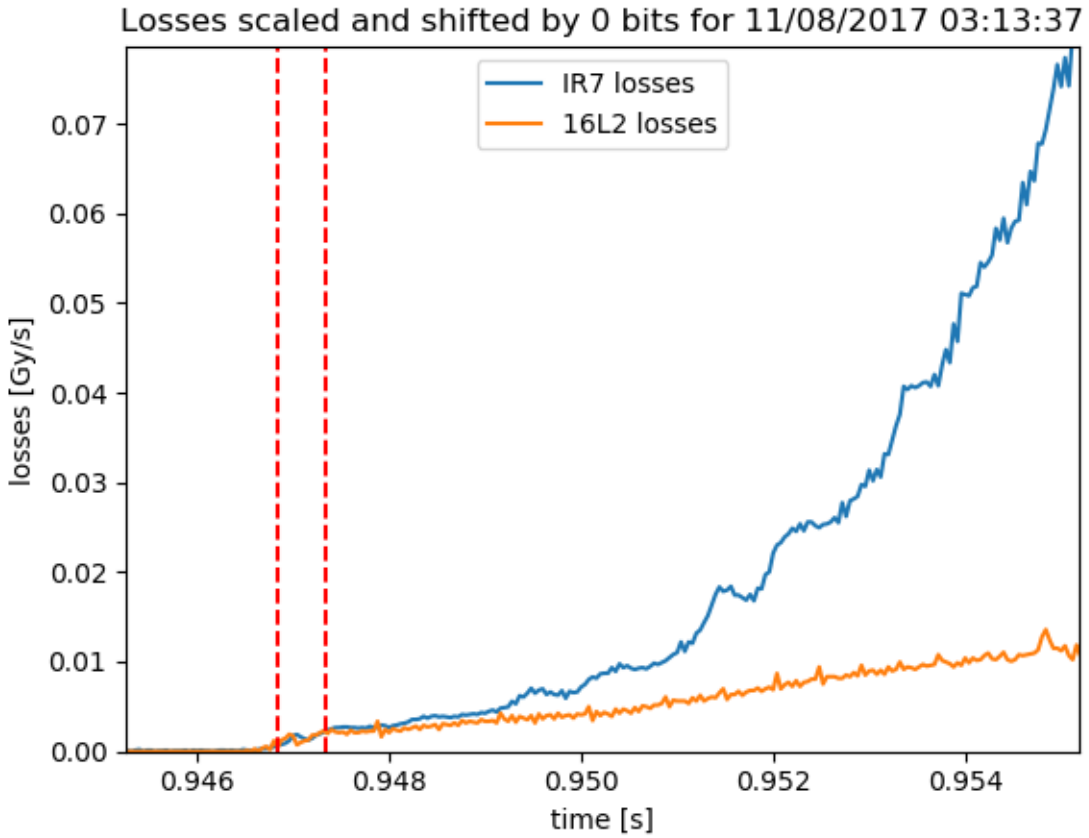
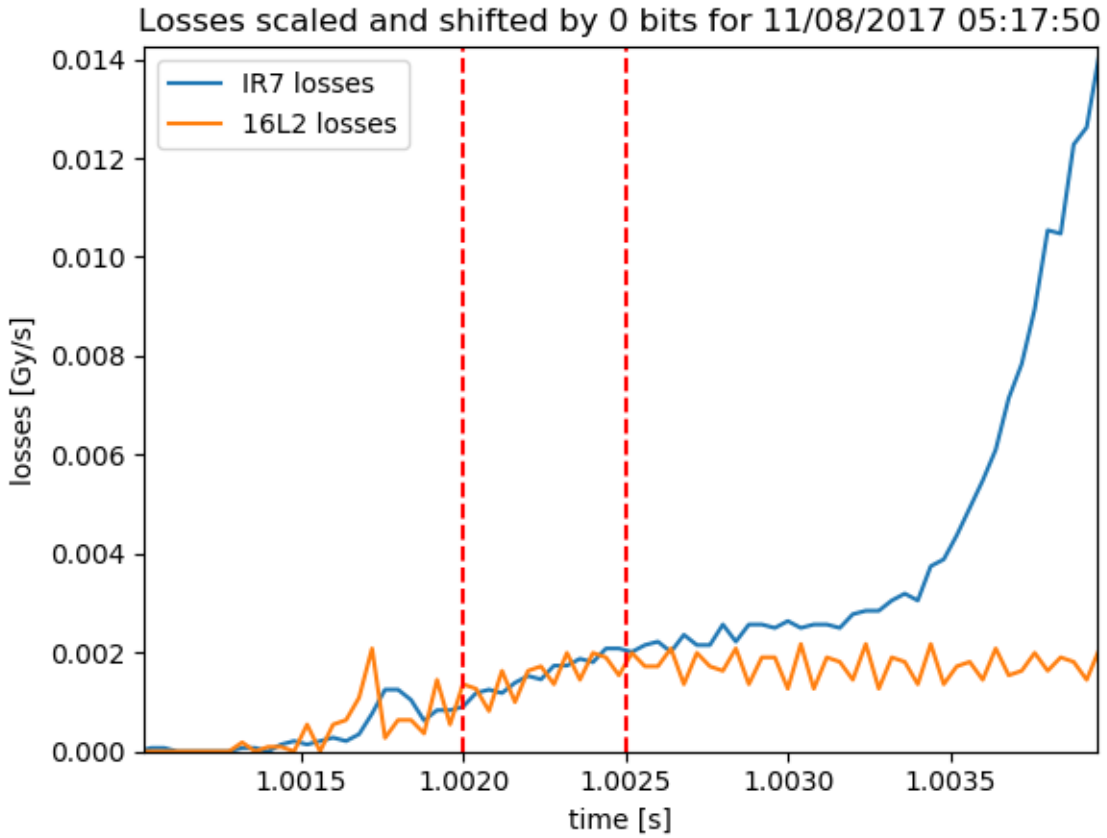
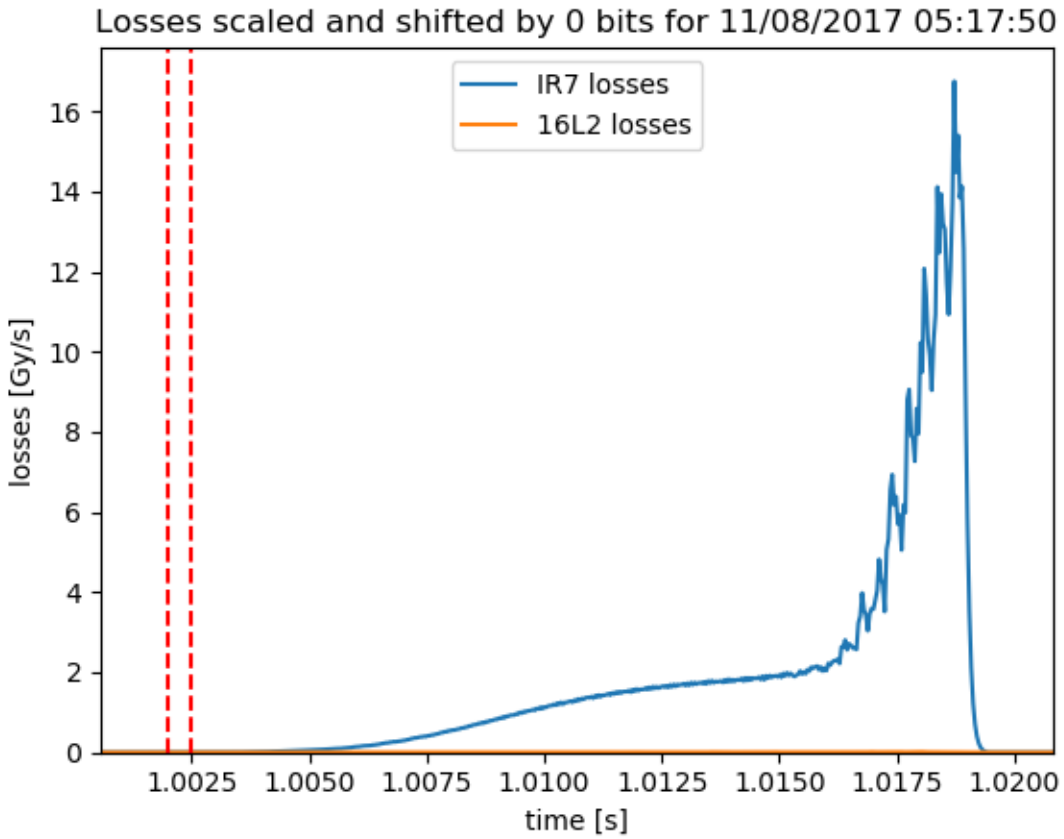
THANK YOU FOR YOUR ATTENTION!

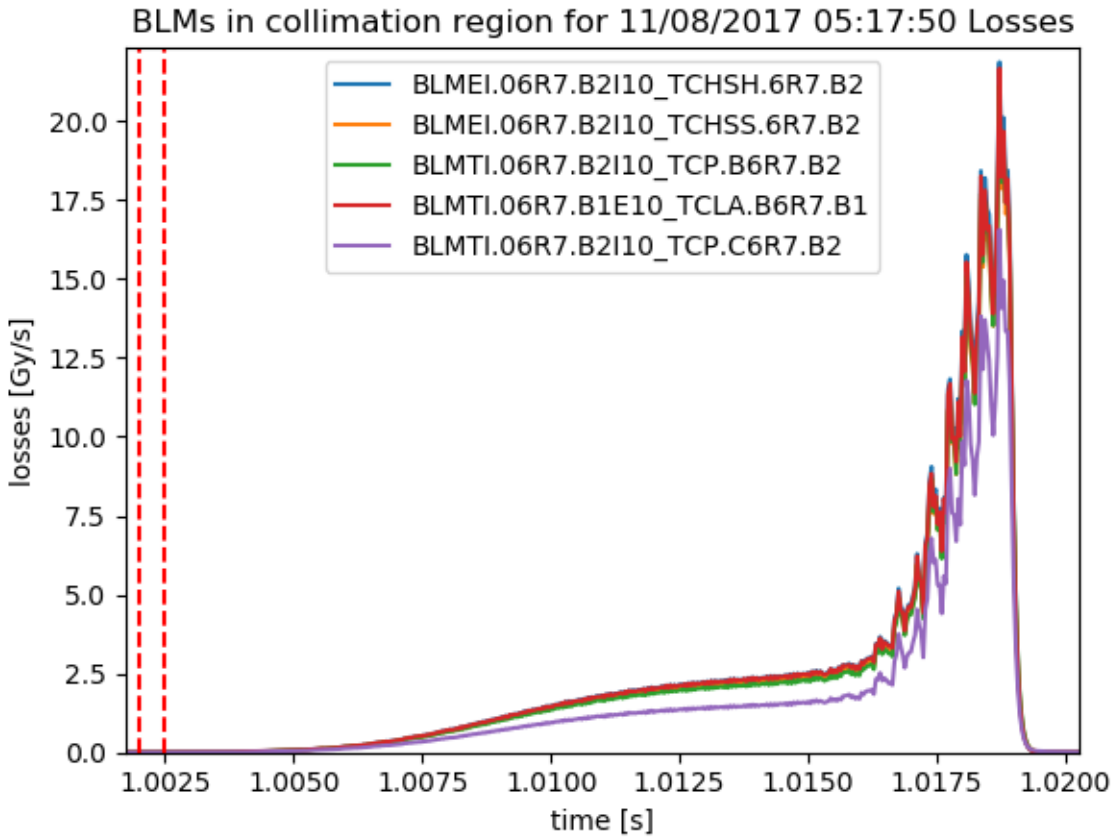

Losses scaled and shifted by 0 bits for 20/06/2017 12:03:15
IR7 losses
16L2 losses
losses [Gy/s]
0.020
0.015
0.010
0.005
0.000
1.010
1.011
1.012
1.013
1.014
time [s]


BLMs in collimation region for 23/06/2017 02:44:07 Losses
BLMTI.06L7.B2I10_TCLA.A6L7.B2
BLMEI.06L7.B1E10_TCSM.A6L7.B1
BLMTI.06L7.B1E10_TCP.C6L7.B1
BLMTI.06L7.B2I10_TCLA.B6L7.B2
BLMEI.06L7.B1E10_TCHSS.6L7.B1
losses [Gy/s]
0.05
0.04
0.03
0.02
0.01
0.00
1.014
1.015
1.016
1.017
1.018
1.019
time [s]


Losses scaled and shifted by 0 bits for 11/08/2017 03:13:37
IR7 losses
16L2 losses
losses [Gy/s]
time [s]
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.946
0.948
0.950
0.952
0.954


Losses scaled and shifted by 0 bits for 11/08/2017 05:17:50
IR7 losses
16L2 losses
losses [Gy/s]
time [s]
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
1.0015
1.0020
1.0025
1.0030
1.0035


Losses scaled and shifted by 0 bits for 11/08/2017 05:17:50
IR7 losses
16L2 losses
losses [Gy/s]
time [s]
0
2
4
6
8
10
12
14
16
1.0025
1.0050
1.0075
1.0100
1.0125
1.0150
1.0175
1.0200


BLMs in collimation region for 11/08/2017 05:17:50 Losses
BLMEI.06R7.B2I10_TCHSH.6R7.B2
BLMEI.06R7.B2I10_TCHSS.6R7.B2
BLMTI.06R7.B2I10_TCP.B6R7.B2
BLMTI.06R7.B1E10_TCLA.B6R7.B1
BLMTI.06R7.B2I10_TCP.C6R7.B2
losses [Gy/s]
time [s]
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
1.0025
1.0050
1.0075
1.0100
1.0125
1.0150
1.0175
1.0200

Longitudinal expansion I

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Analysis of 16L2 beam loss signatures showed unexpected behavior.

Considering a point source, the losses in the different BLMS should be proportional with a fixed scaling factor.
The 2 events previously shown in the section meeting (ref) showed a dis-proportional increase of losses seen by BLMs close to the UFO location, whereas BLMs further away don‘t see this.

This led to the believe that the scattering source expands longitudinally and creates losses closer to the respective BLMs.

Here I should show the previous slide

Longitudinal expansion I

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Since the topic received much attention a bigger post-mortem analysis of the 68 16L2-beam dumps was performed, employing an improved version of Martynas UFO-Buster Analysis Tool.

Comparative plots with scaled losses revealed the same observations but moreover showed the onset of the beam instability in the collimator BLMs as well as the local UFO signature.

One can see that the change of slope in 16L2 coincides with the fist oscillations leading to the instability. Although the oscillations seem to vary a lot in the different events. Some do not have this „pre-lude“ at all

Here I should show the plots from the IPAC paper.

Intelligent ordering to show above mentioned behavior

More cases!

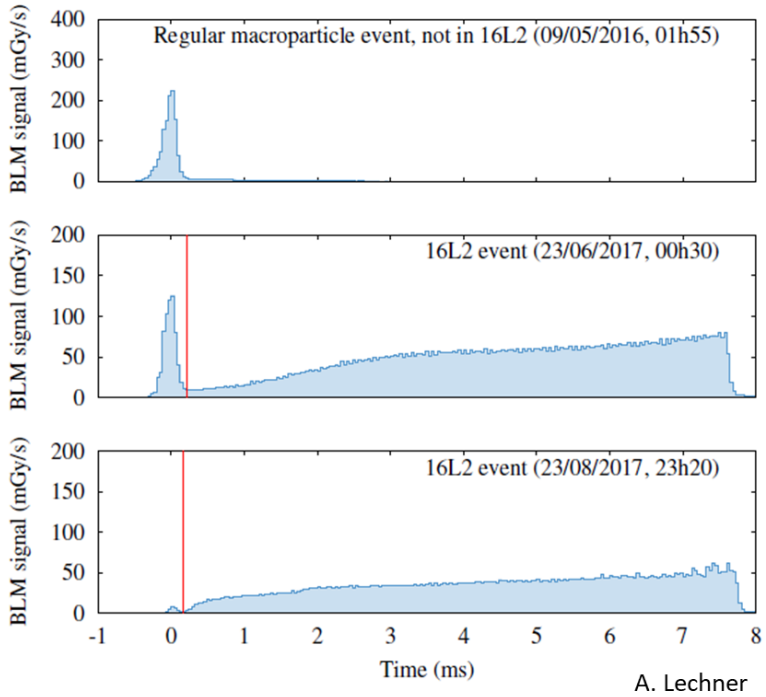
General observations

In 16L2:

- Sometimes peak as seen in regular UFO type 1
- Sometimes no initial peak
- After ~ 1 ms losses increase coninuously

In IR7 – insertion cleaning:

- Negligible elastic losses
- Sometimes reduced losses (UFO acts as collimator!)
- Steap rising of losses due to beam instability
- Sometimes slow rinsing, oscillating losses
- IR7 triggers the dump



A. Lechner

What is „16L2“

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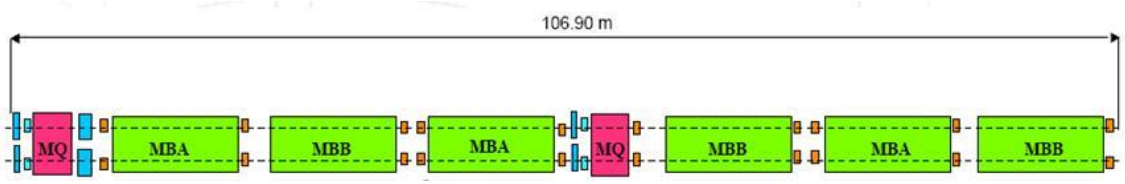
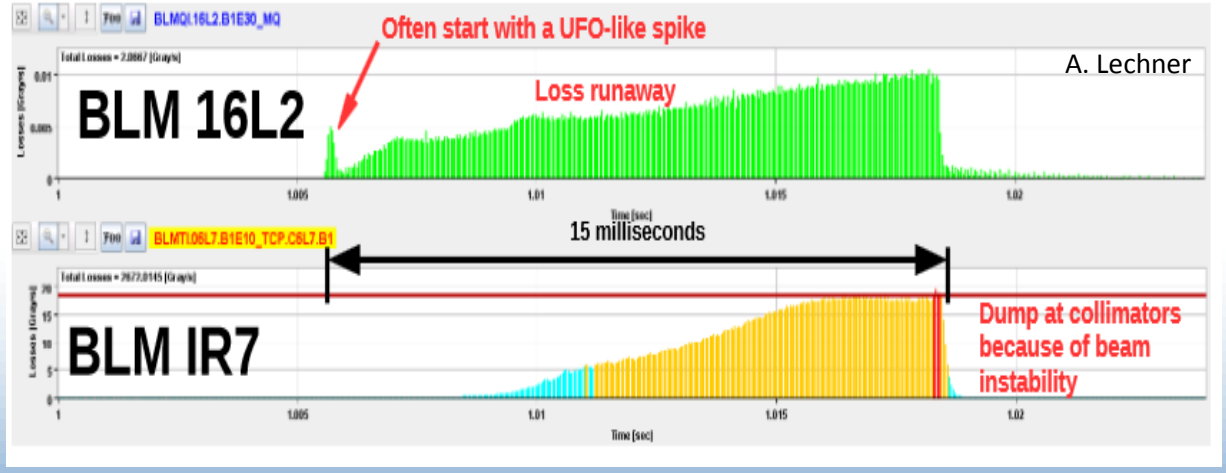
After sector 12 intervention in EYETS 16/17:

Multiple problems observed in one FoDo cell:



- Higher steady state losses in cell 16L2

- Repeated fast losses:
  - Local collisions in 16L2 causing inelastic/elastic losses
  - Fast rising instability causing losses in IR7 which dump



➢ More than 60 dumps only from 16L2 events!

➢ Mechanism still unclear

Evolution of 16L2 events

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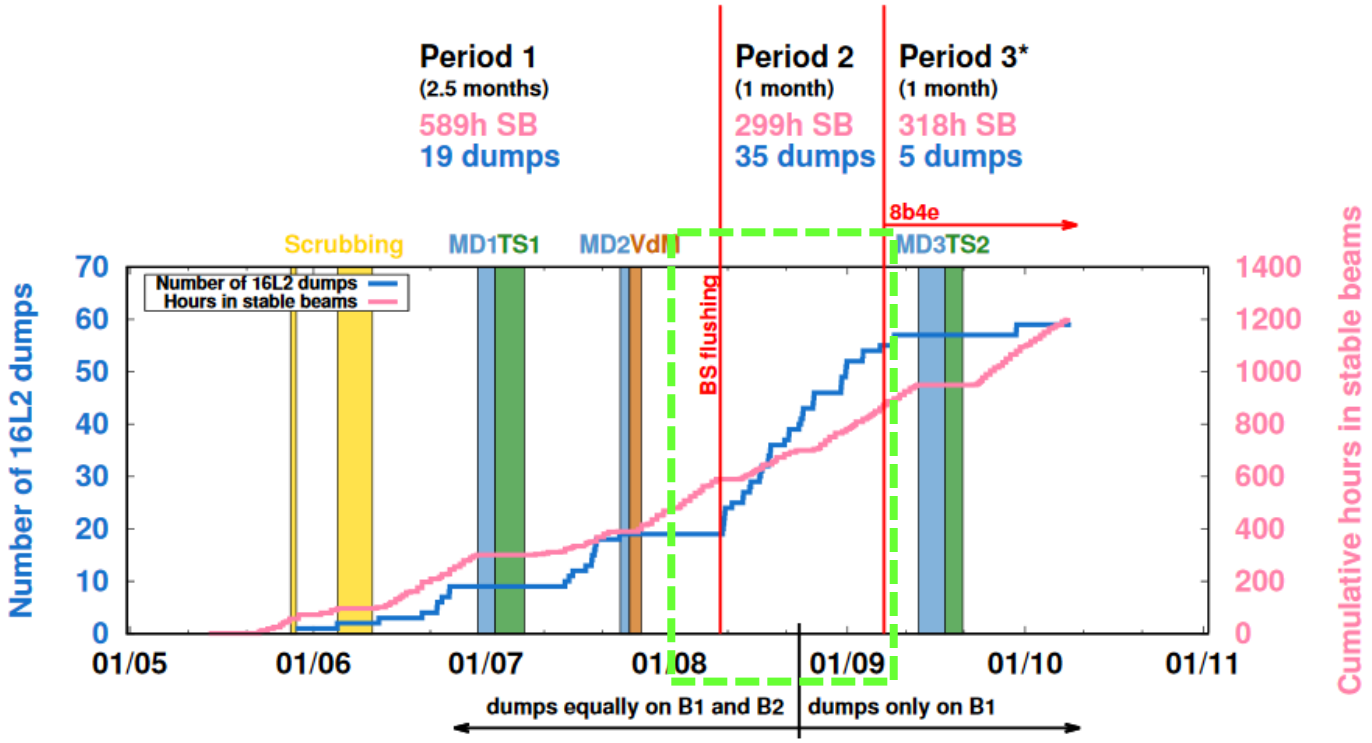
Dumps and quenches related to losses in 16L2

59 dumps (39×B1, 20×B2), including 1 quench on the 12/08:



*as of 09/10/2017

A. Lechner (BLMTWG58) Oct 10th, 2017 4 / 13

Different steps to reduce 16L2 impact

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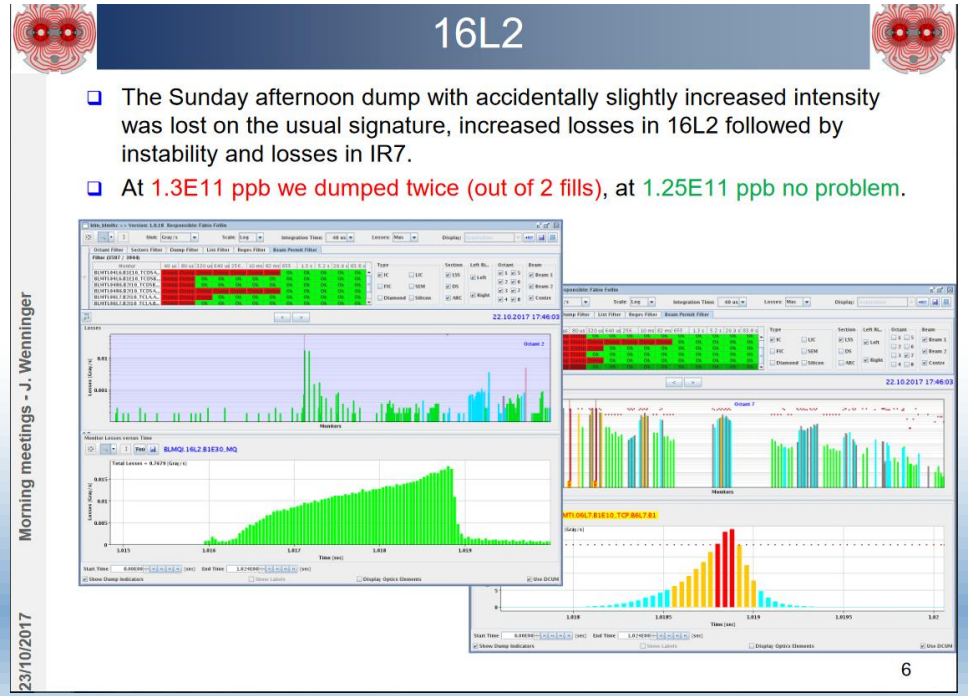
- Warm up of beam screen supposed to remove condensed gas:
  - Steady state losses reduced, but significant increase of 16L2 dumps
- Optimization of magnetic field
  - Small change of field in corrector magnet
- Installation of solenoid and additional BLMs
- Change of bunch pattern
- Bunch intensity is critical parameter!



Bunch-by-bunch losses

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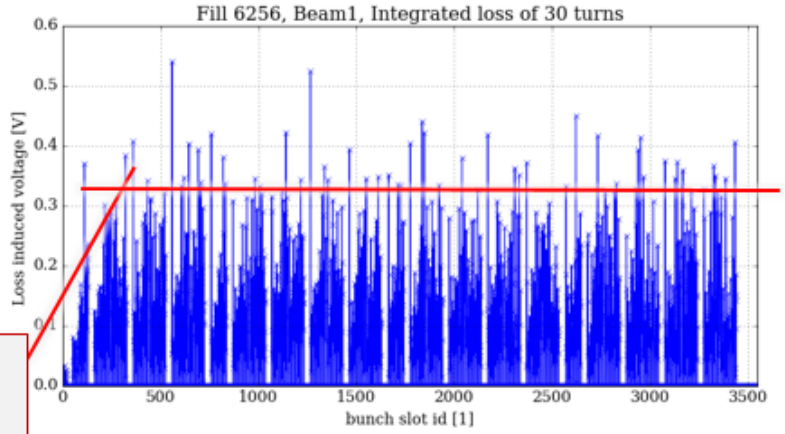
Integrated losses

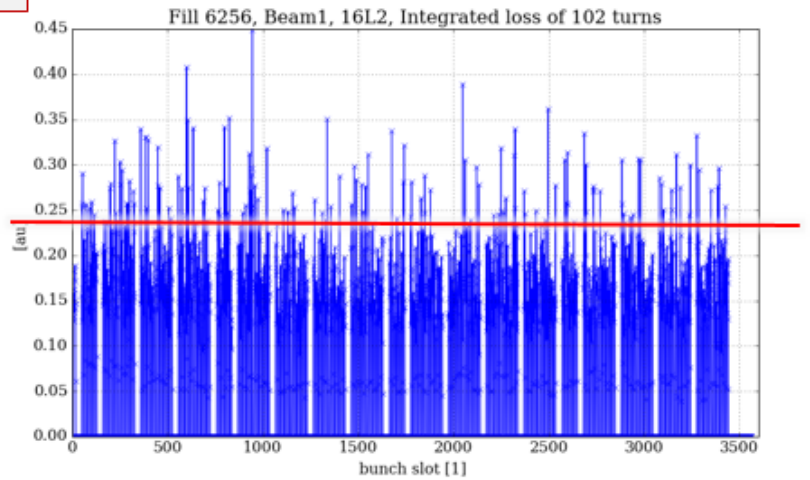
Fill 6256, 30/90
6.5 TeV,
8b4e scheme

dBLMs @ TCP

Rising slope after AG + some 30b LHC INJ gaps



dBLMs @ 16L2



A. Gorzawski

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Analysing the losses in 16L2

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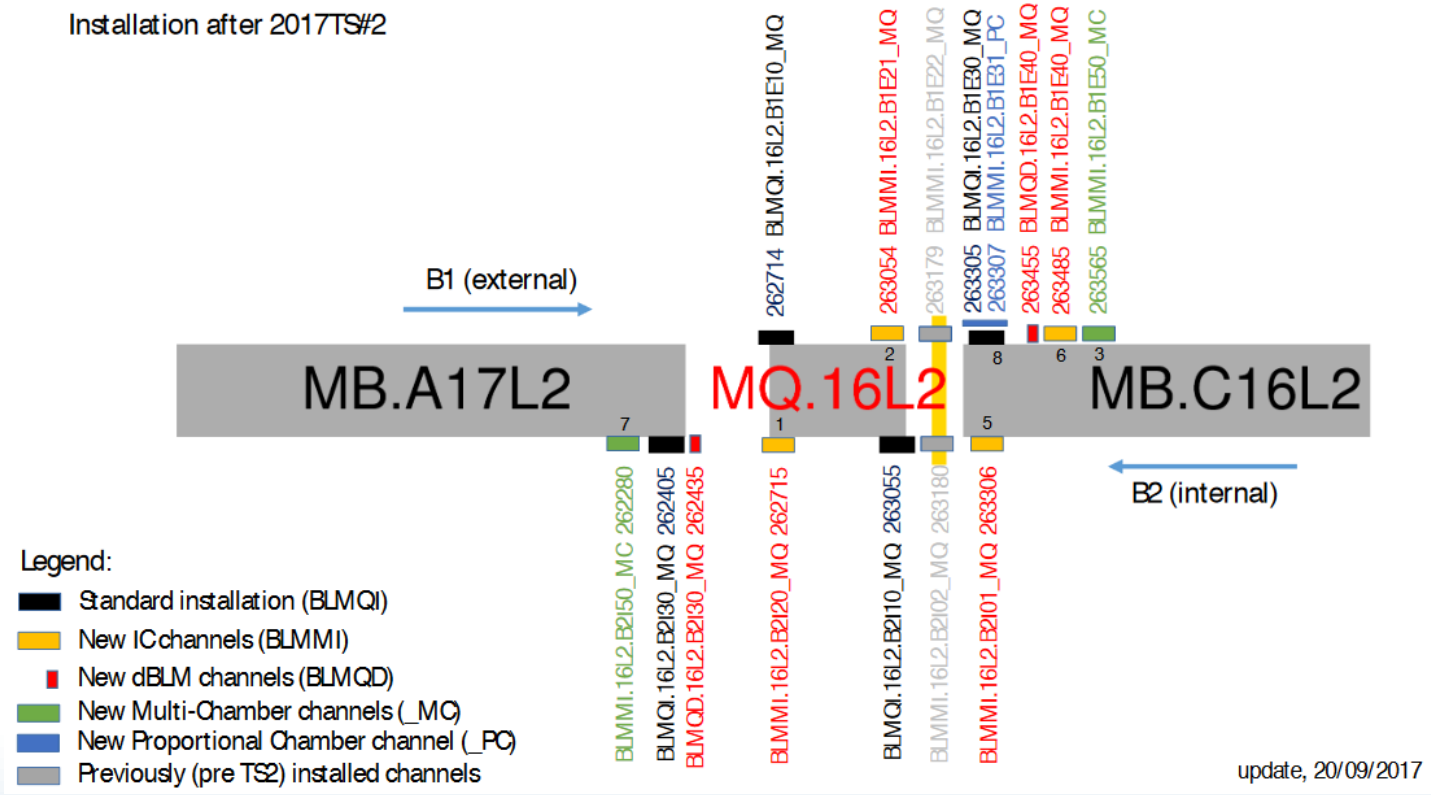
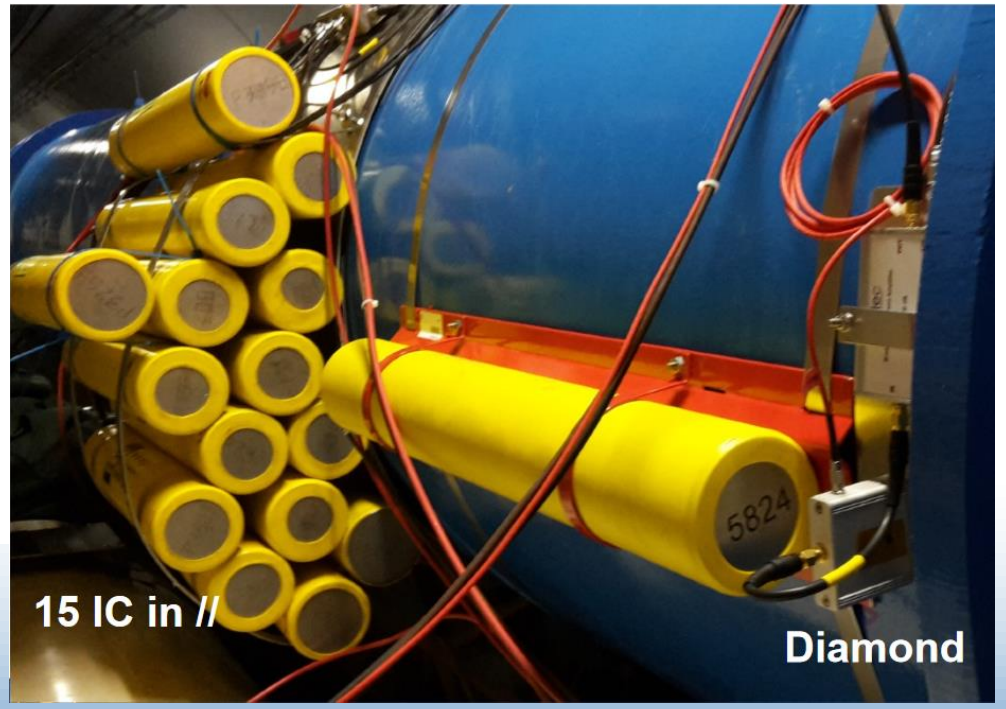
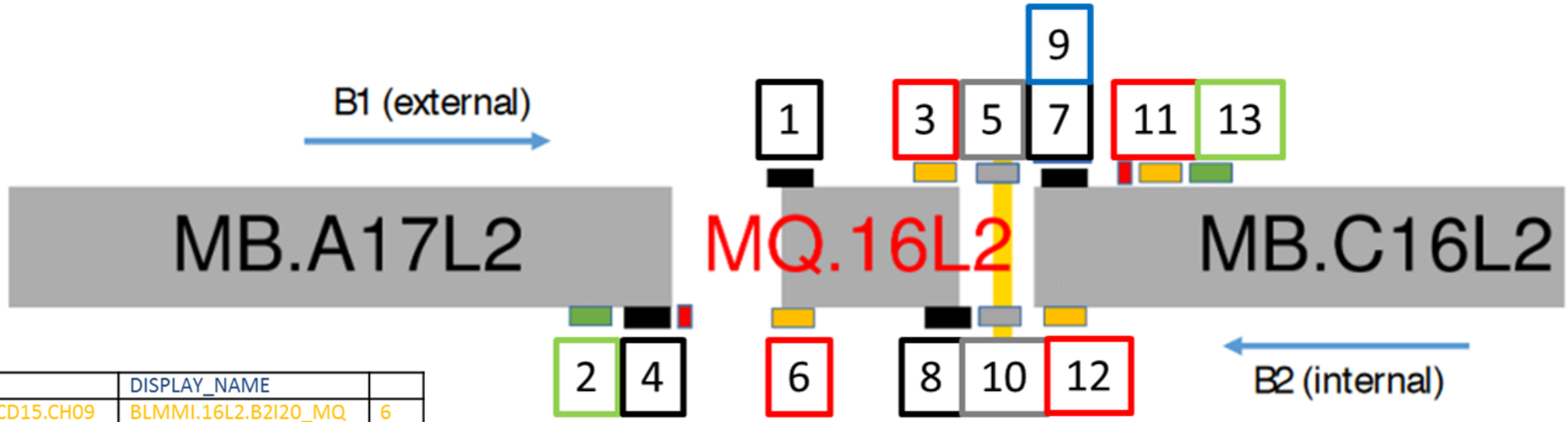
BLMs in 16L2 after TS2



From [morning meeting]



Simplified BLM layout



BLM_MOBILE_NAME	DISPLAY_NAME	
BLMM.HC.BLM.SR2.C.CD15.CH09	BLMMI.16L2.B2I20_MQ	6
BLMM.HC.BLM.SR2.C.CD15.CH10	BLMMI.16L2.B1E21_MQ	3
BLMM.HC.BLM.SR2.C.CD15.CH11	BLMMI.16L2.B1E22_MQ	5
BLMM.HC.BLM.SR2.C.CD15.CH12	BLMMI.16L2.B2I02_MQ	10
BLMM.HC.BLM.SR2.C.CD15.CH13	BLMMI.16L2.B2I01_MQ	12
BLMM.HC.BLM.SR2.C.CD15.CH14	BLMMI.16L2.B1E40_MQ	11
BLMM.HC.BLM.SR2.C.CD15.CH15	BLMMI.16L2.B2I50_MC	2
BLMM.HC.BLM.SR2.C.CD15.CH16	BLMMI.16L2.B1E50_PC	13
	BLMQI.16L2.B2I30_MQ	4
	BLMQI.16L2.B2I10_MQ	8
	BLMQI.16L2.B1E10_MQ	1
	BLMQI.16L2.B1E30_MQ	7

Idea for loss analysis

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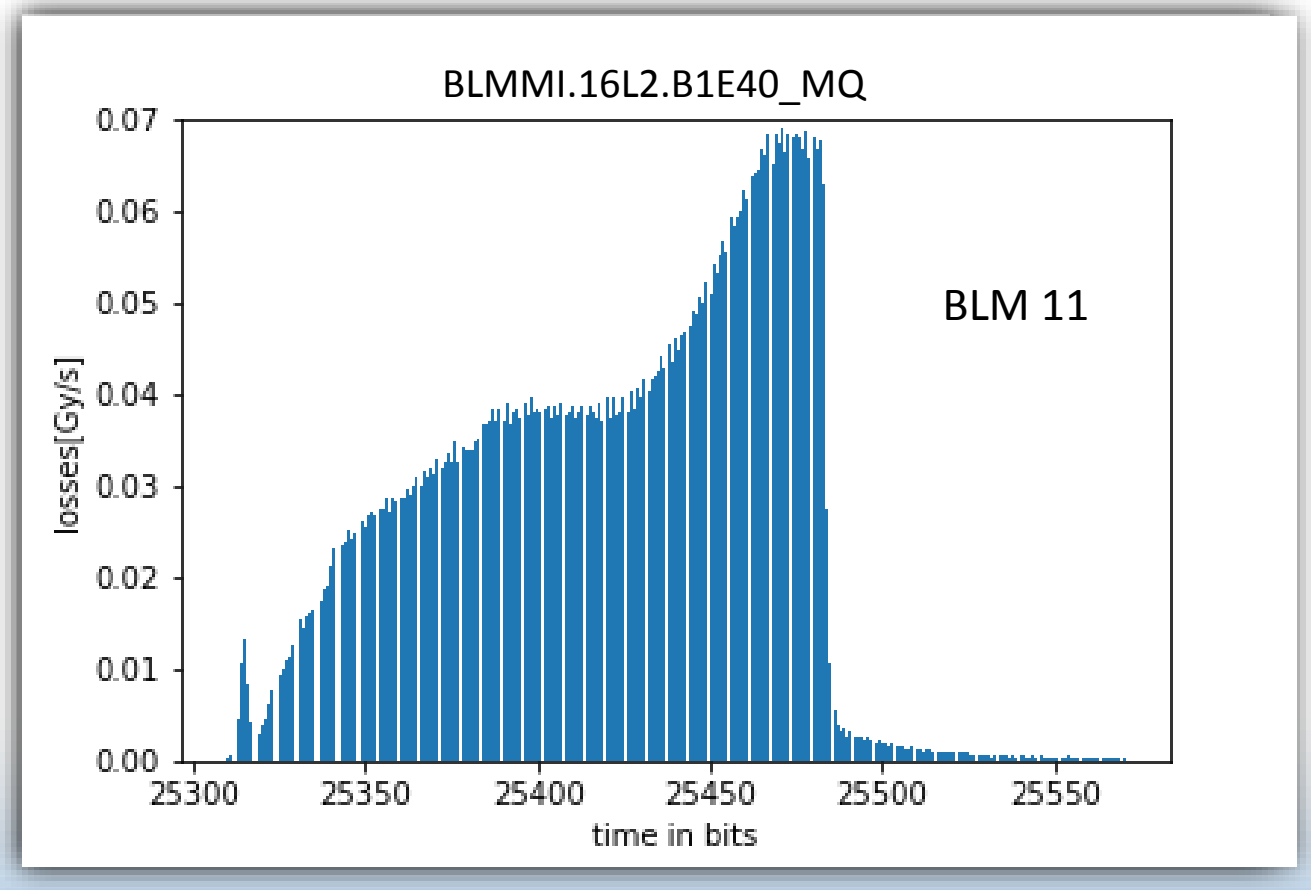
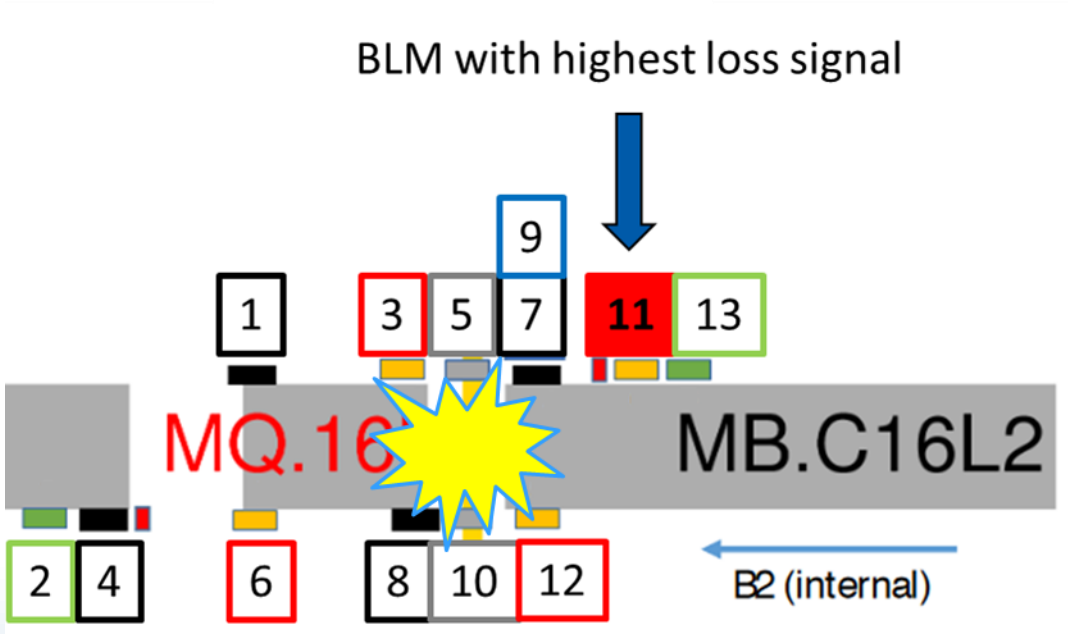
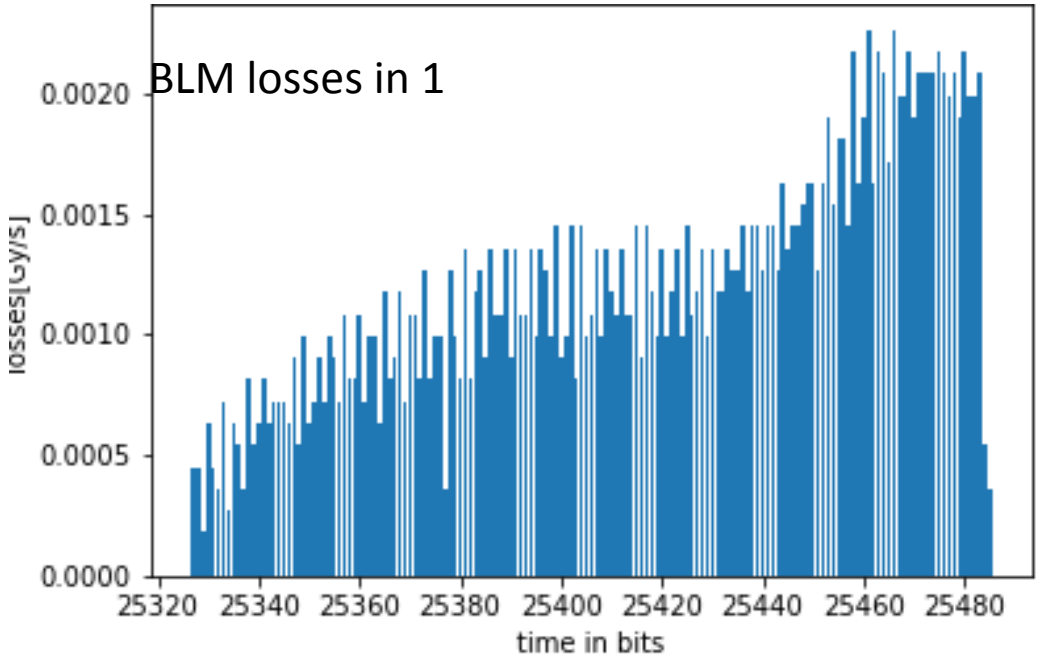
- Get Post Mortem BLM data
- Find BLM with highest losses
- Correlate the losses of other BLMs to this BLM
- See relative time structure of losses

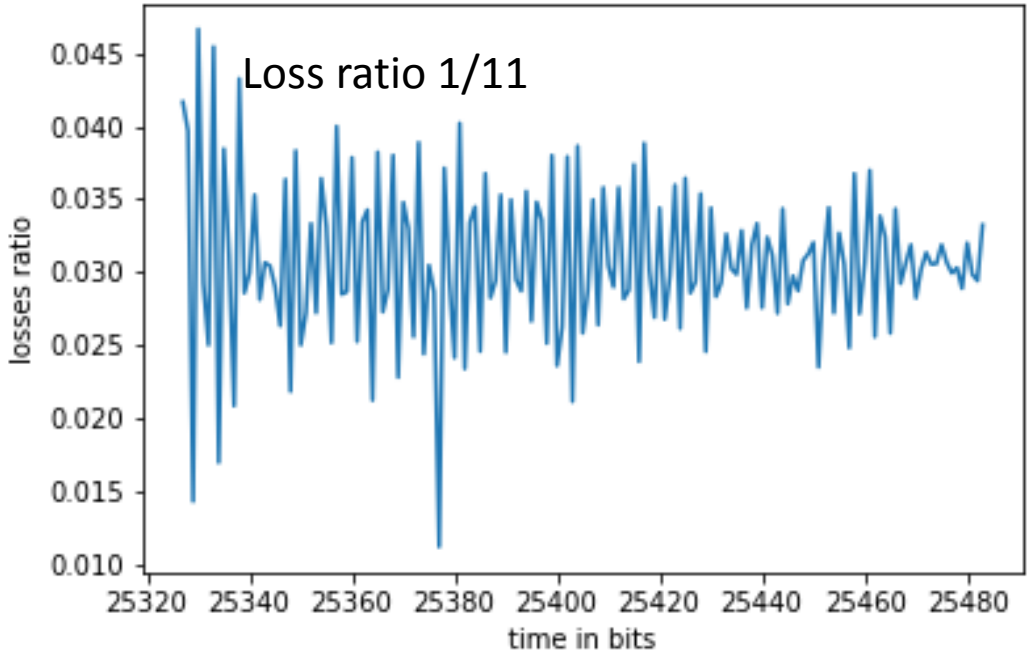
16L2 dump 1: 06-09-2017, 20:19, B1 UFO

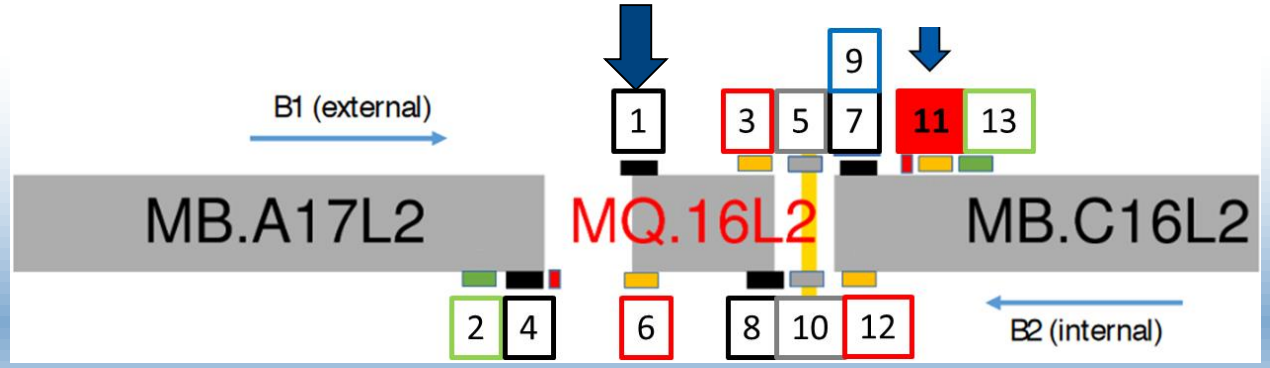




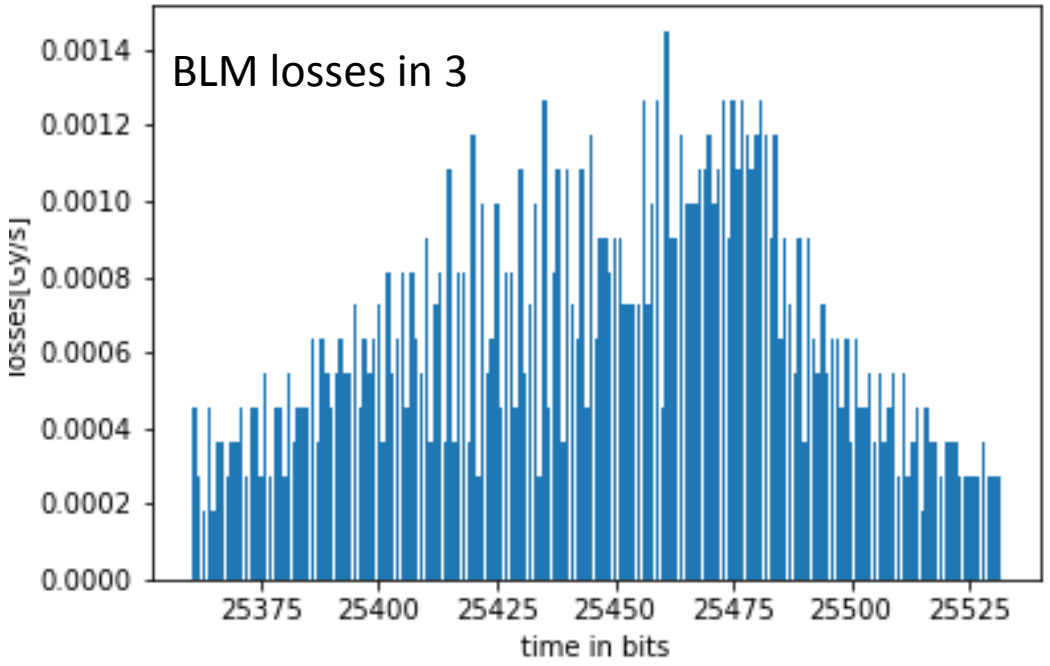
Ratio of BLM 1/11

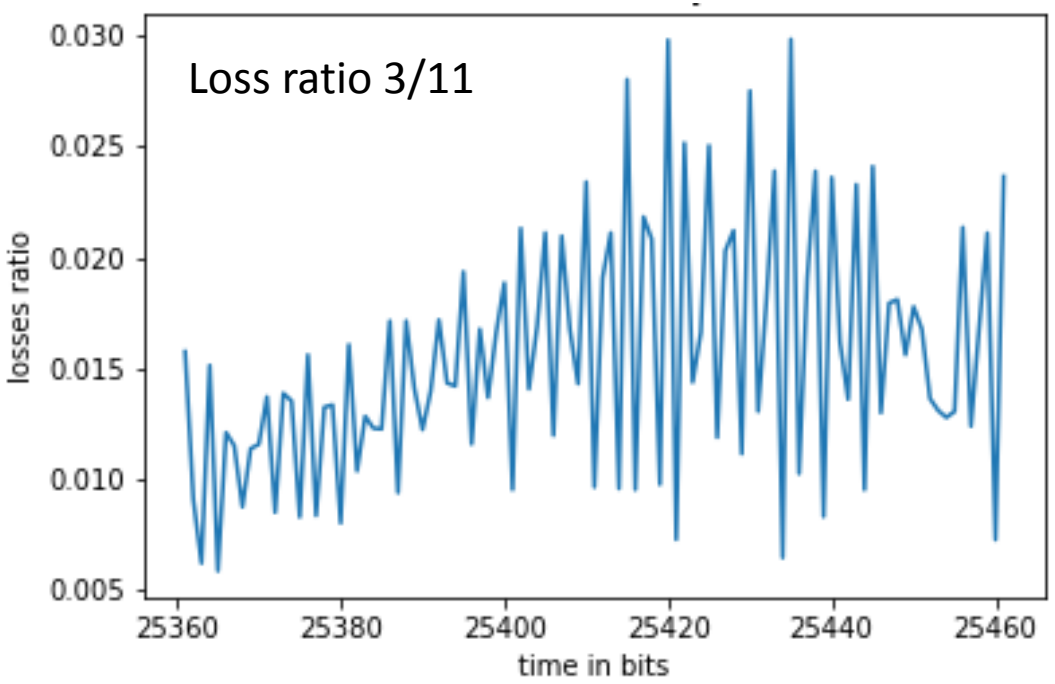


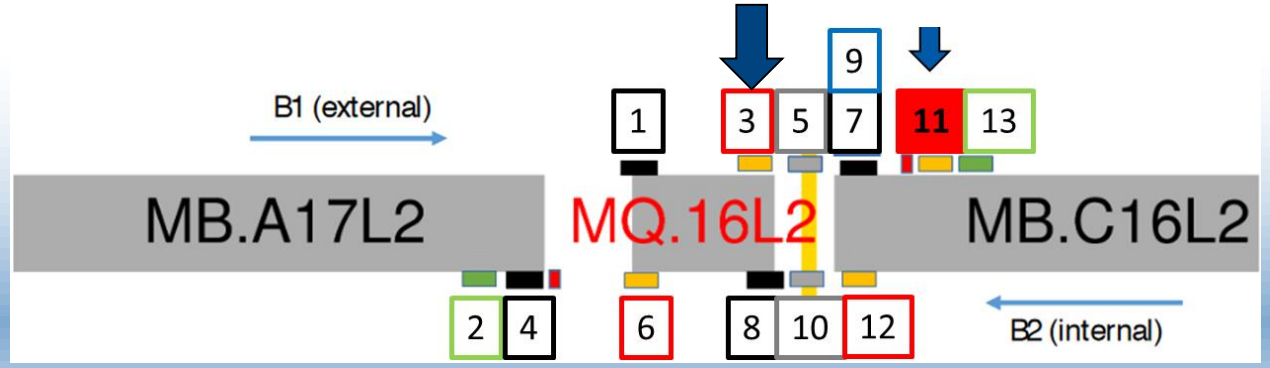




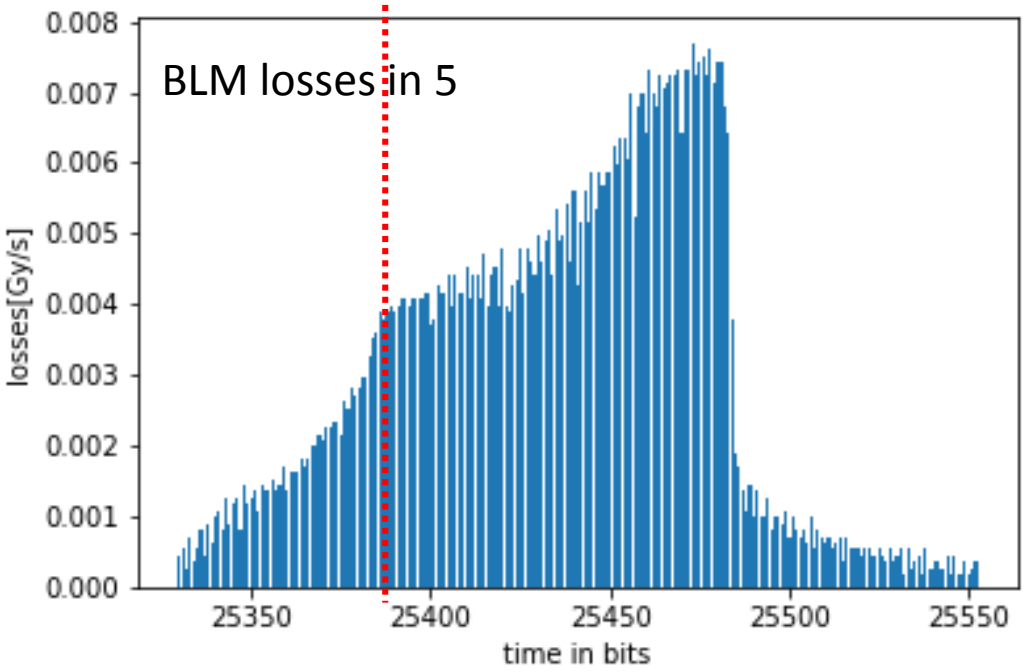
Ratio of BLM 3/11

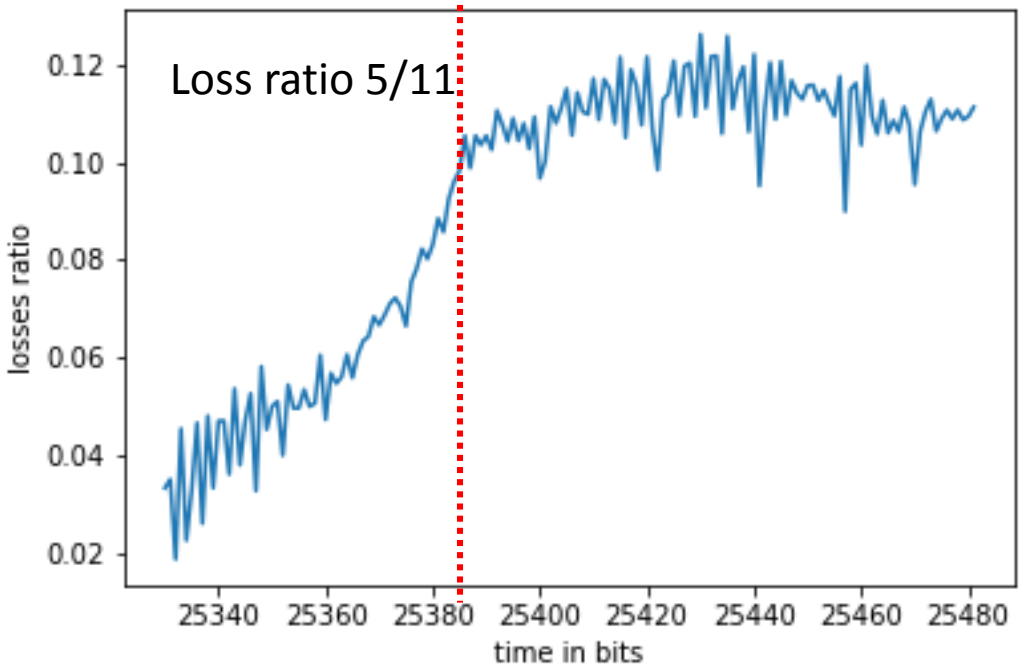


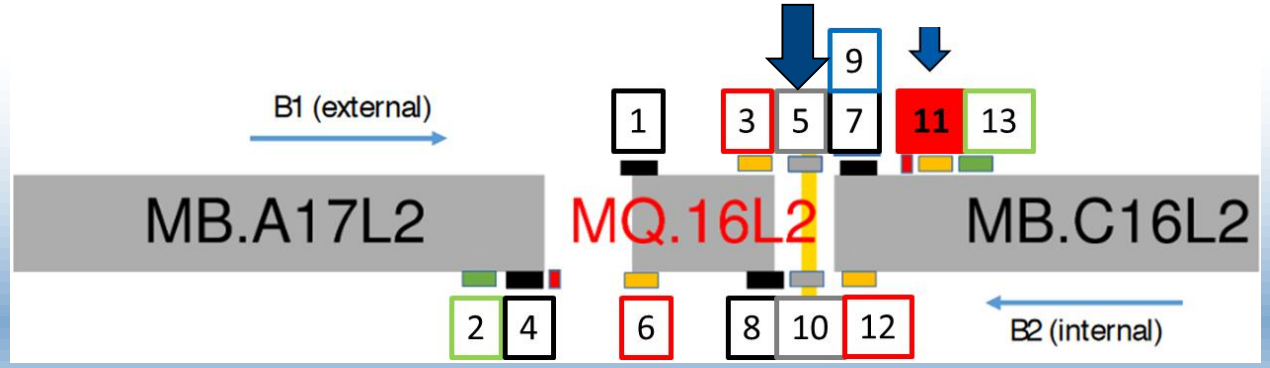




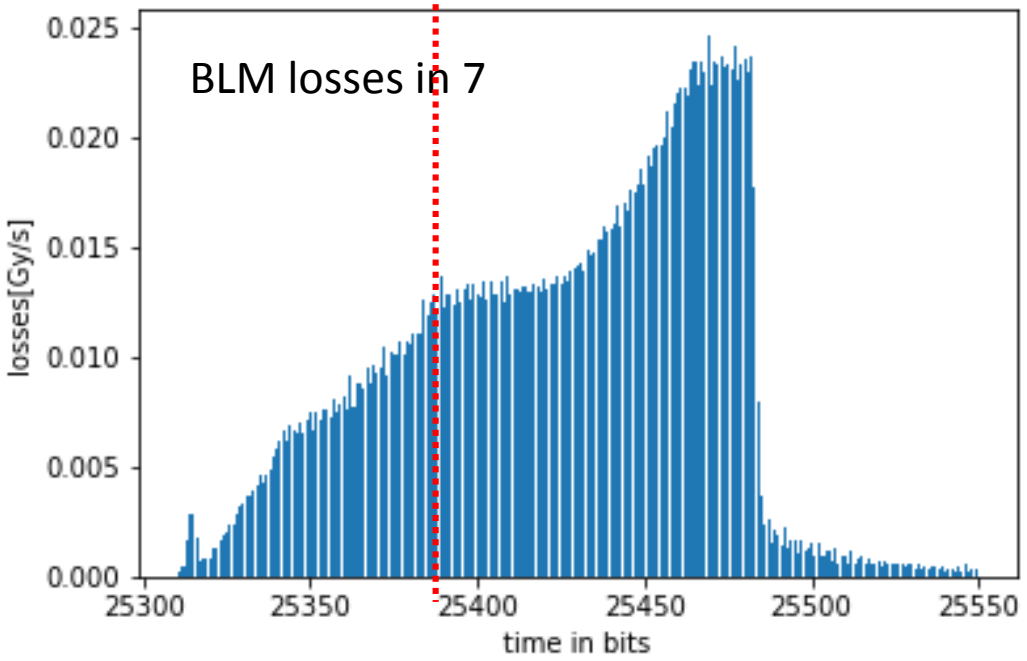
Ratio of BLM 5/11

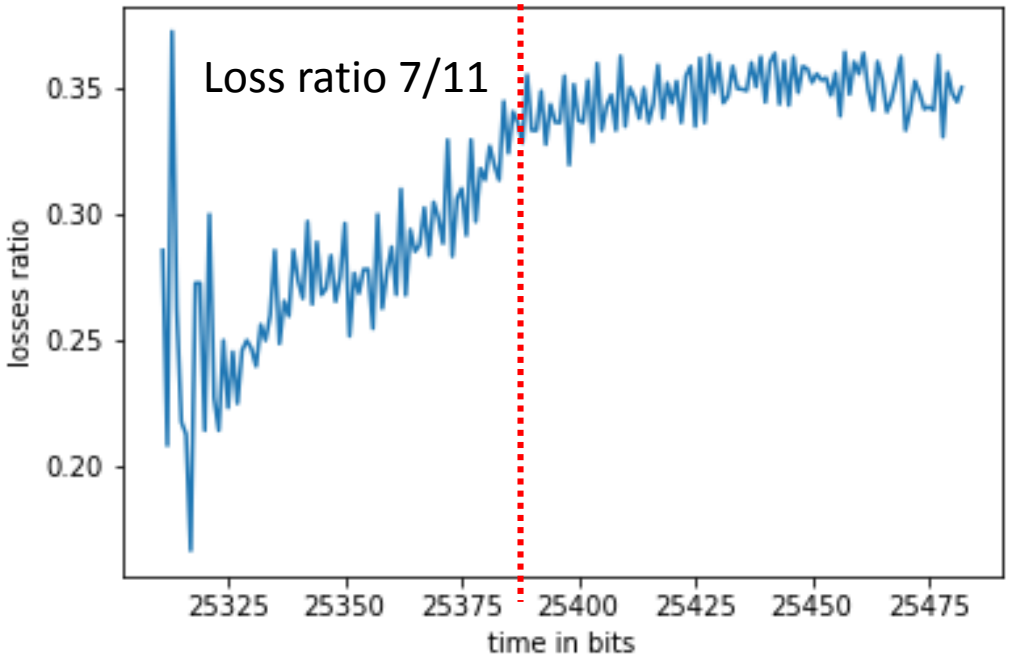


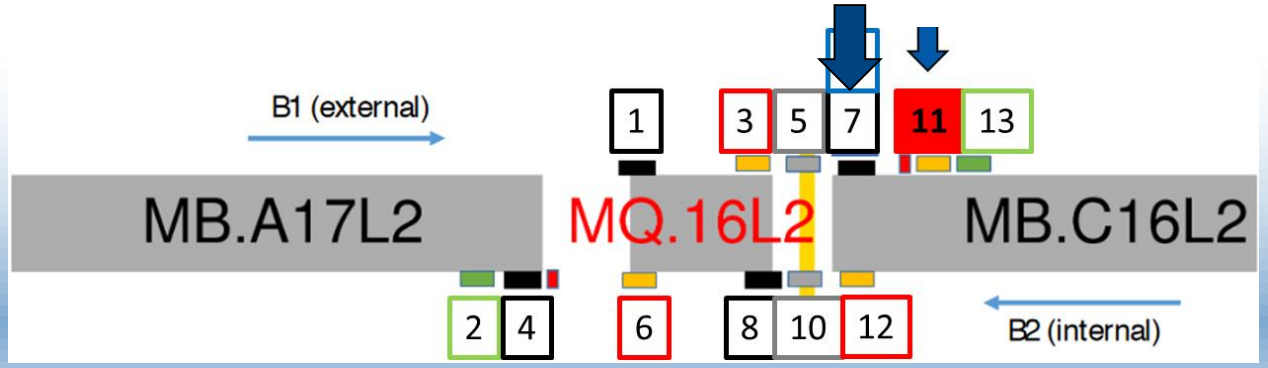




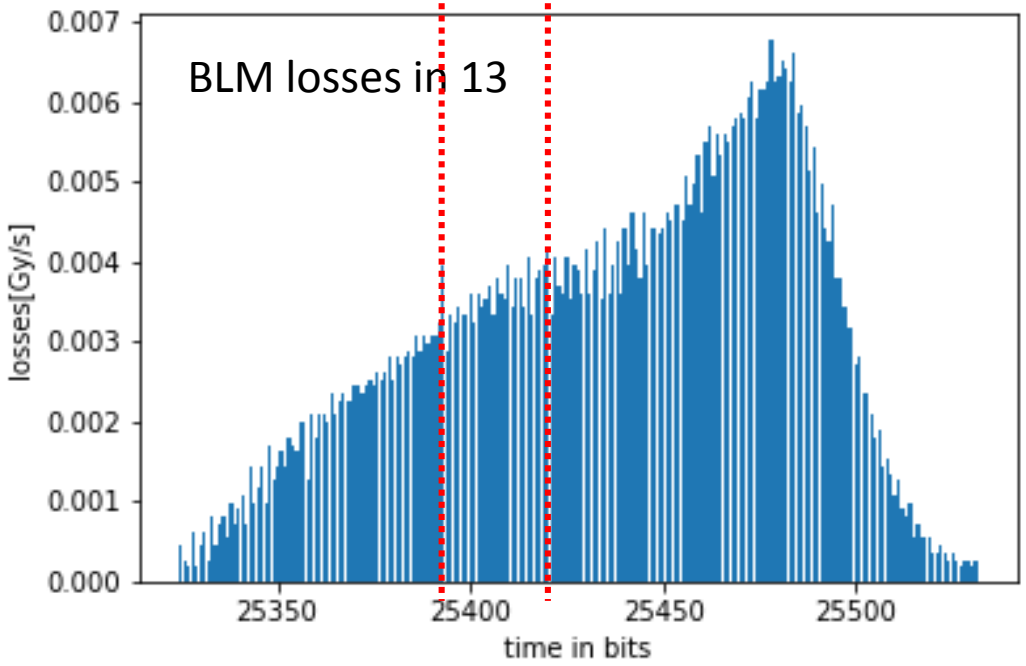
Ratio of BLM 7/11

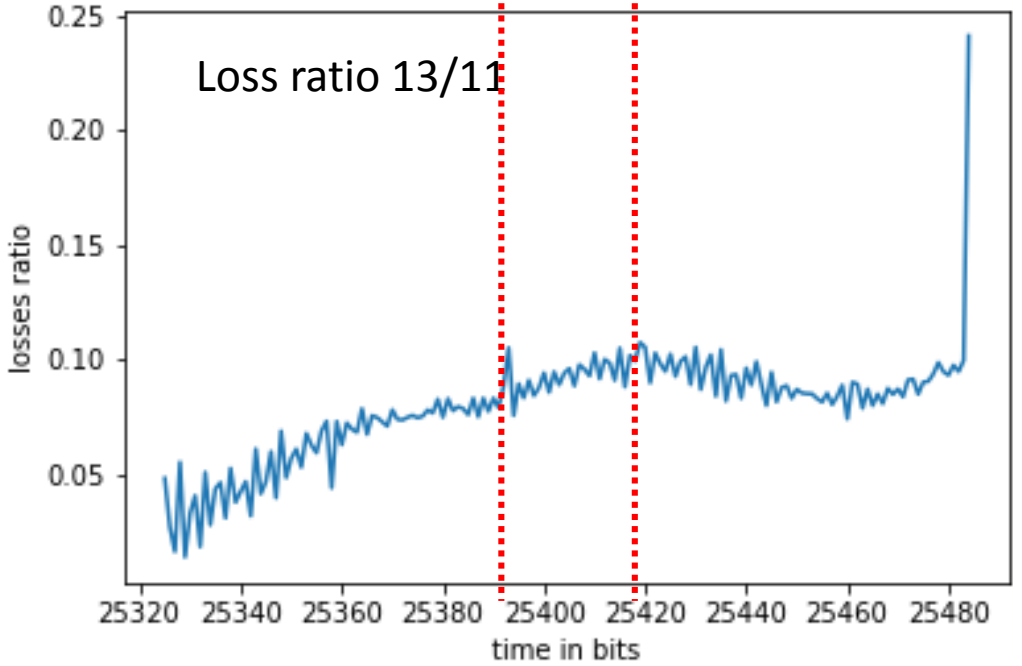


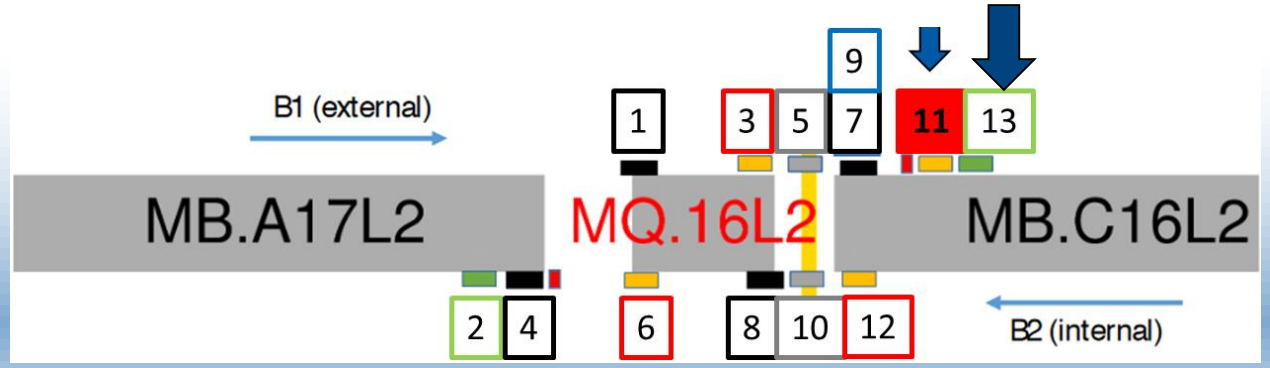




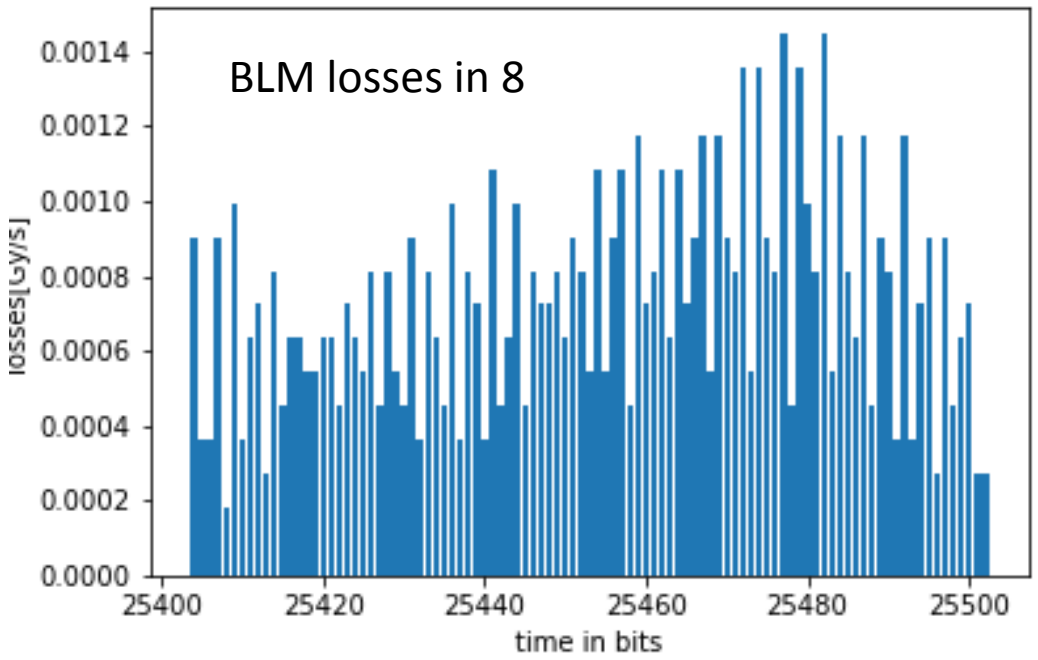
Ratio of BLM 13/11

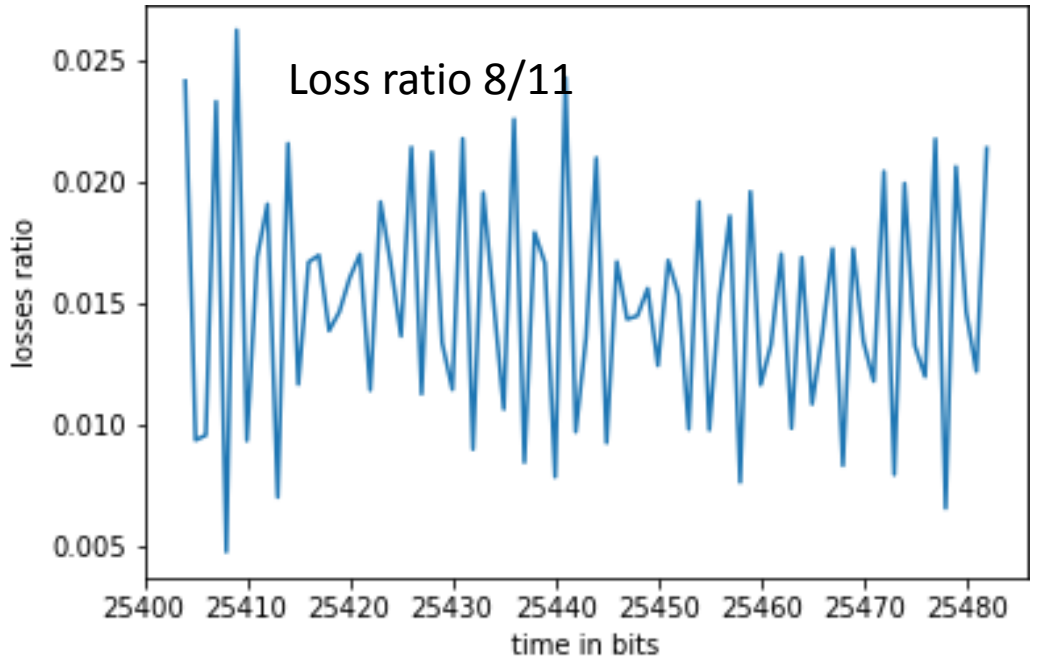


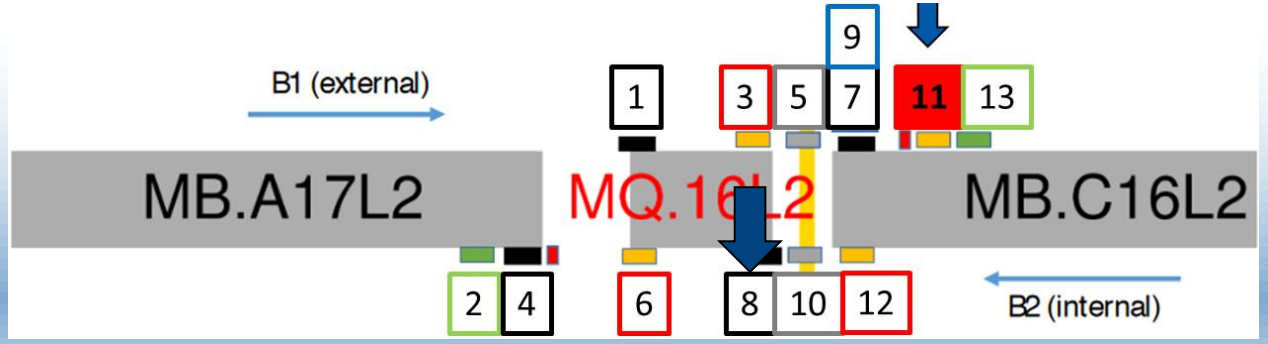




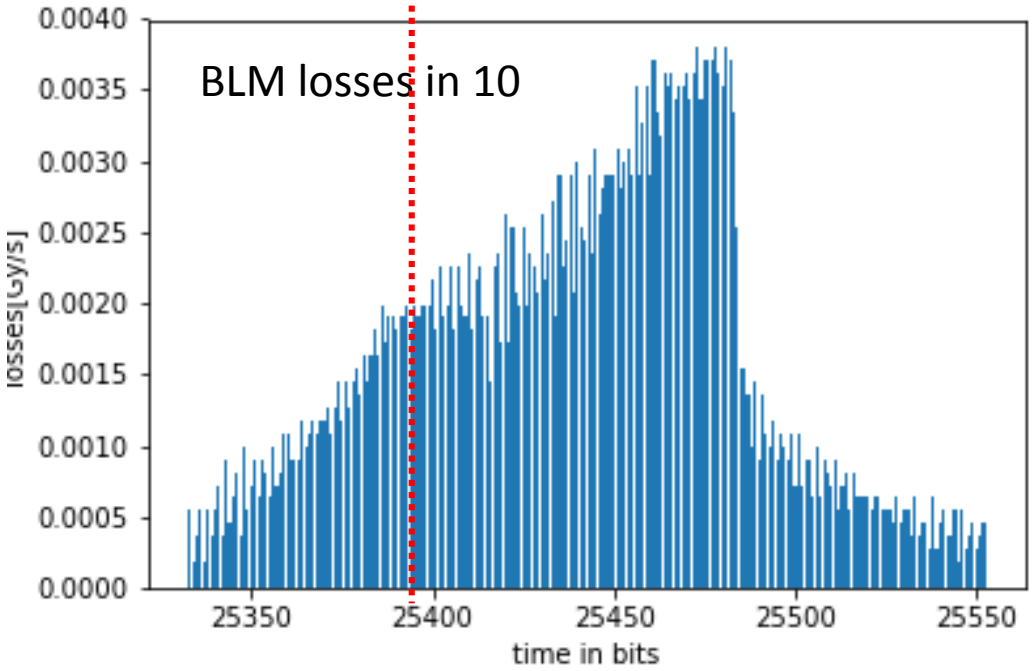
Ratio of BLM 8/11

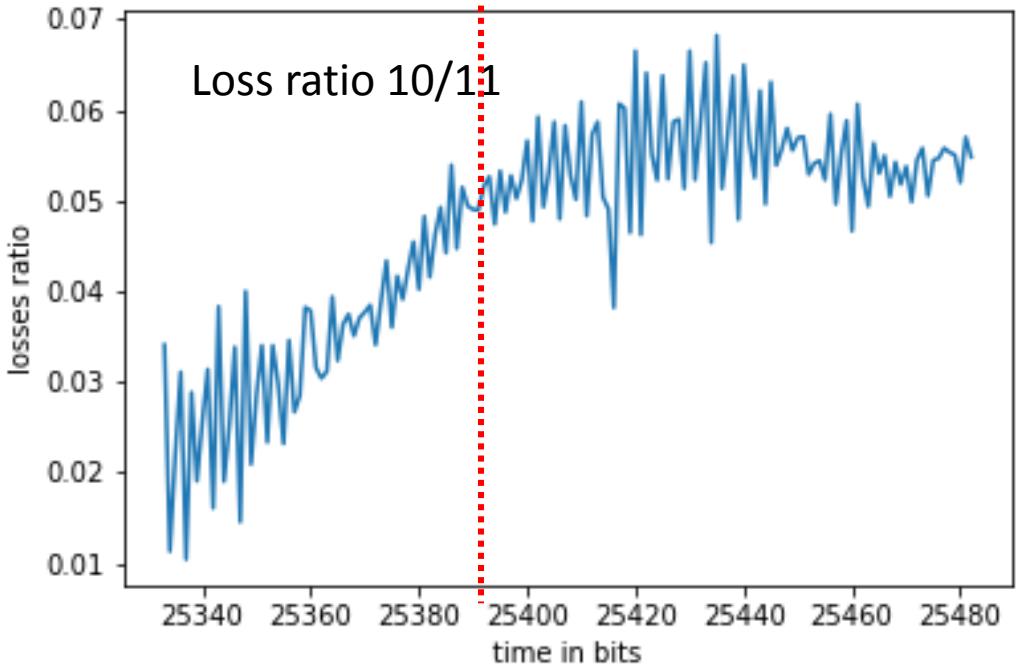


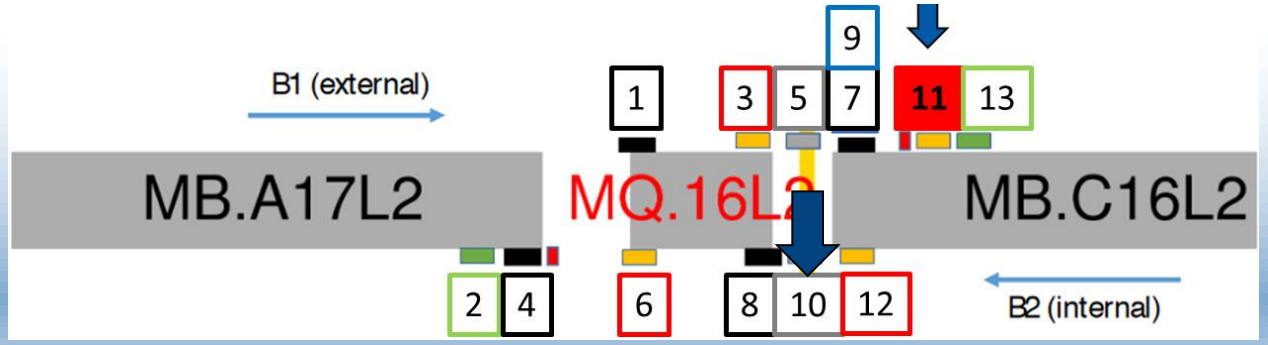




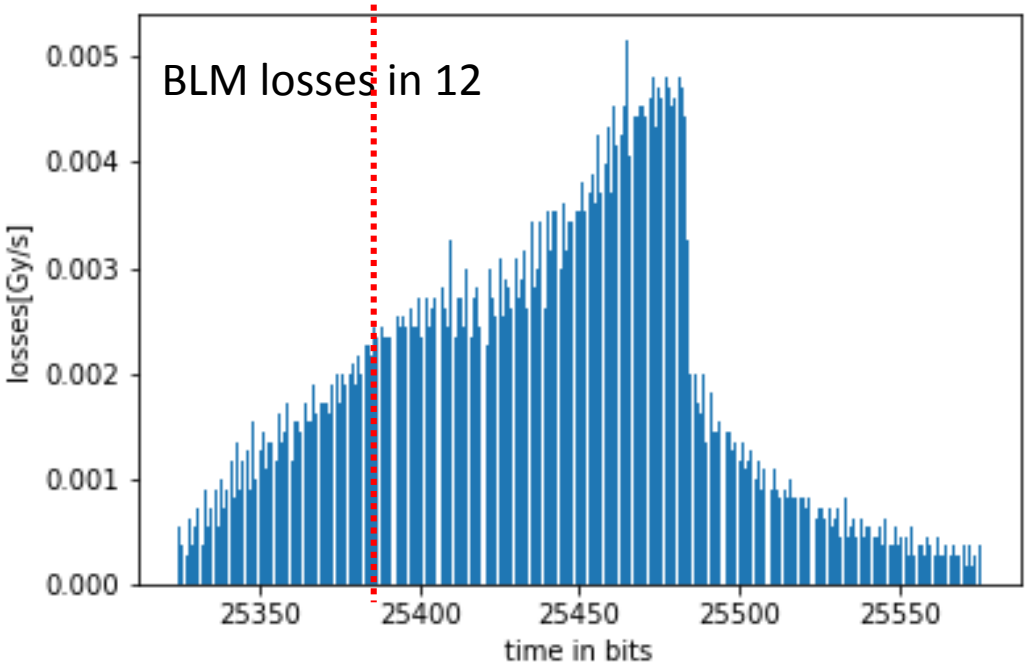
Ratio of BLM 10/11

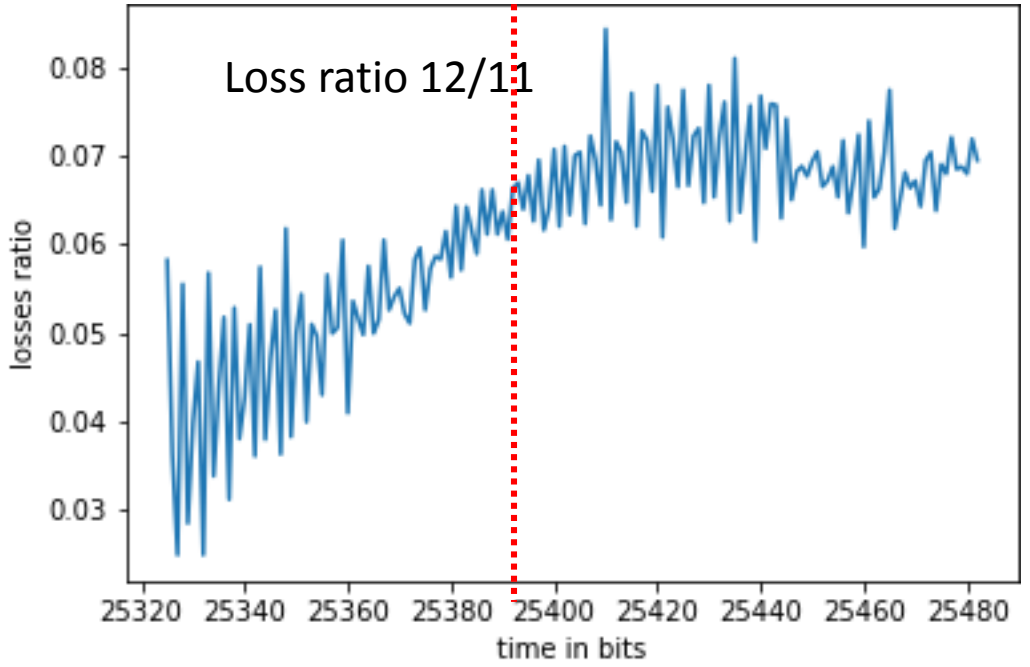


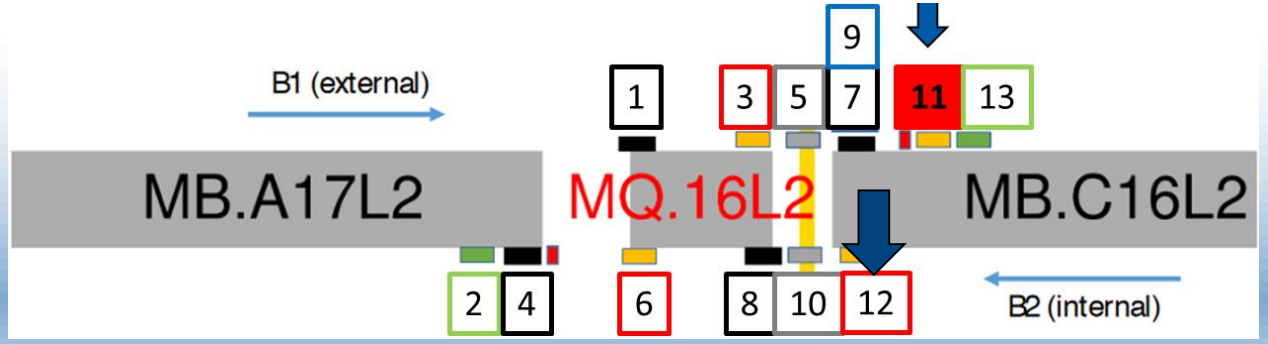




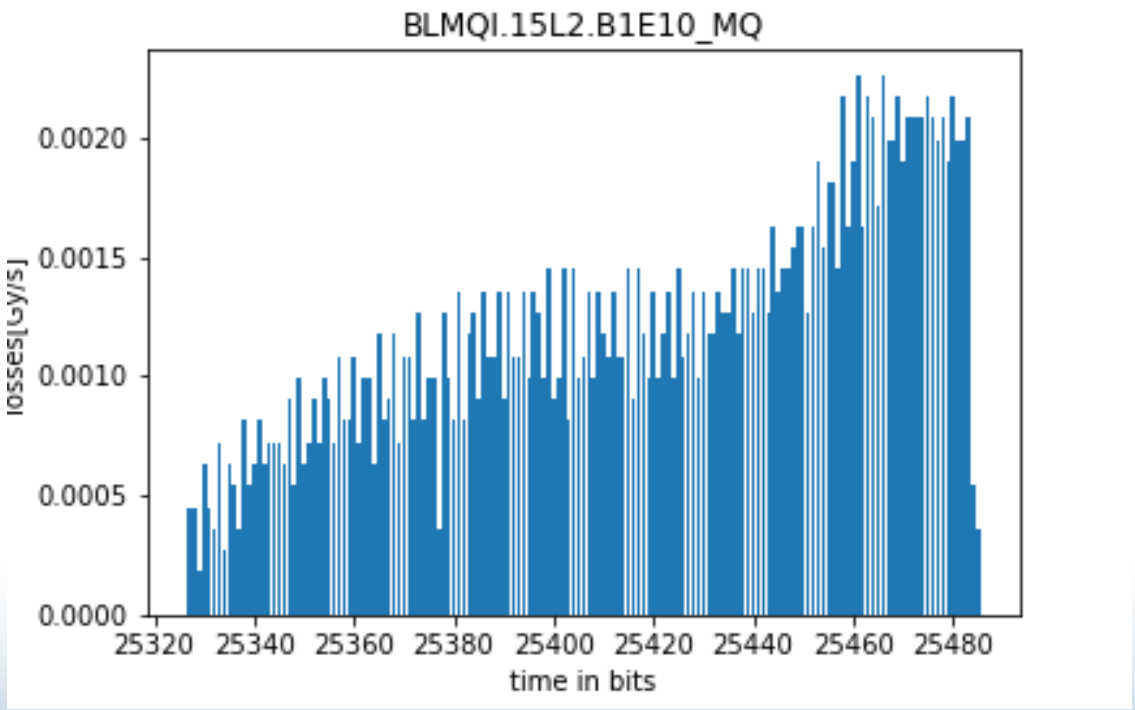
Ratio of BLM 12/11

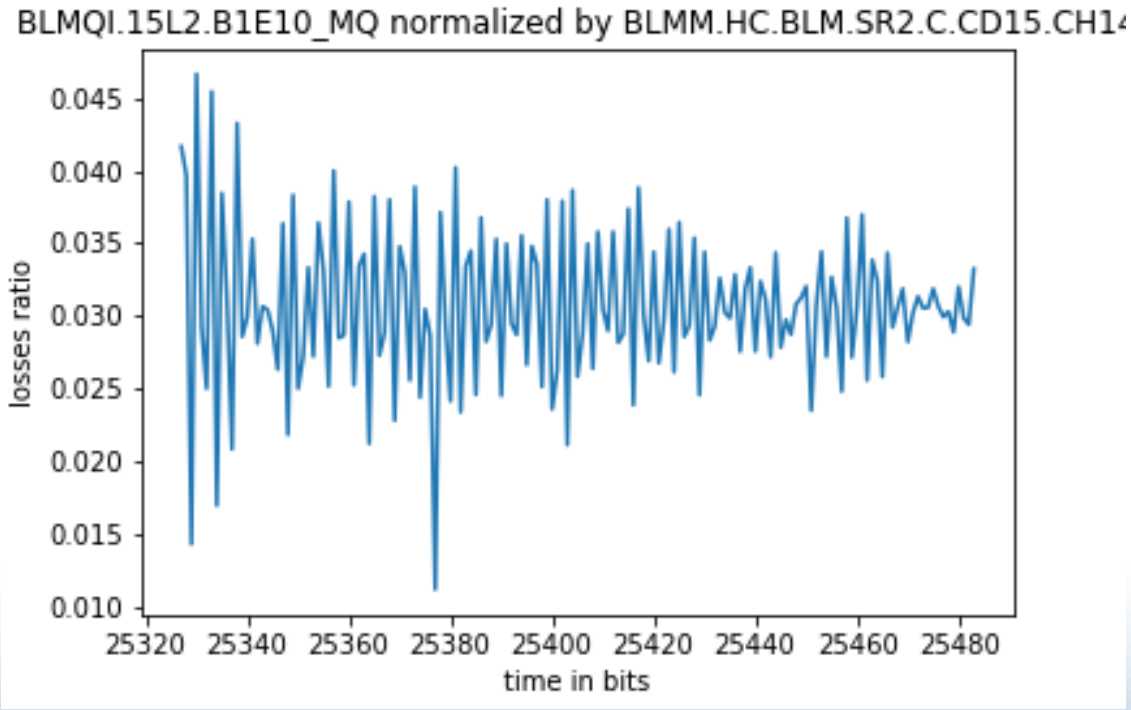




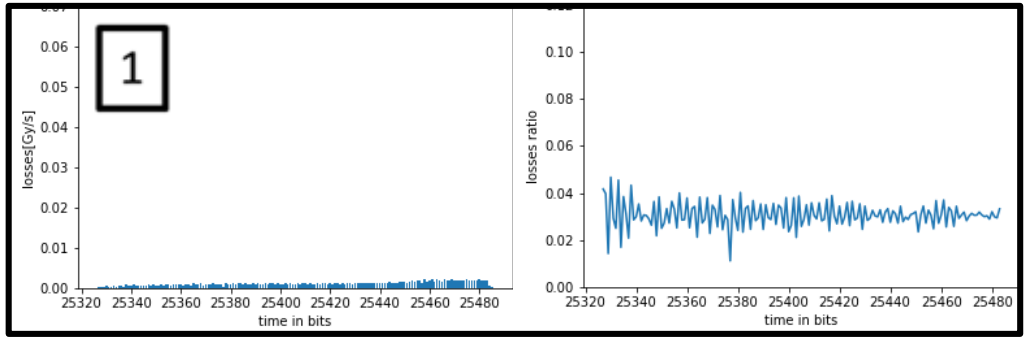


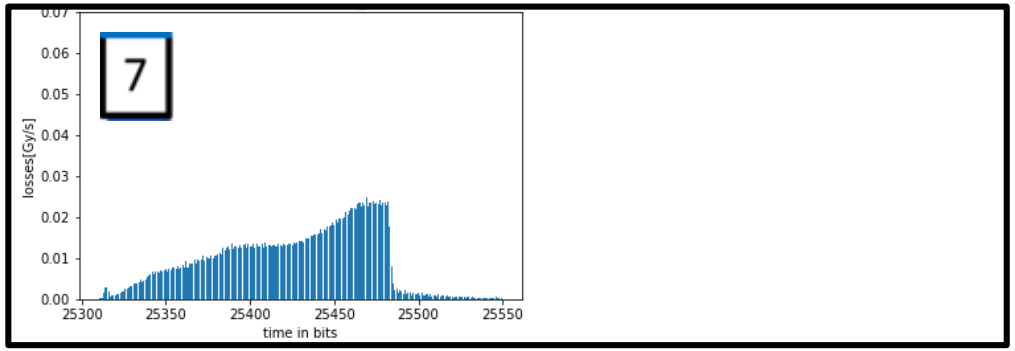
In addition: signal in BLMQI.15L2.B1E10_MQ

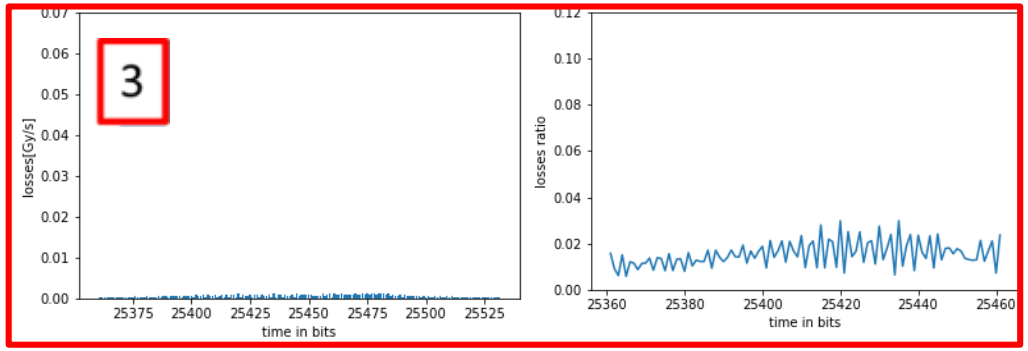


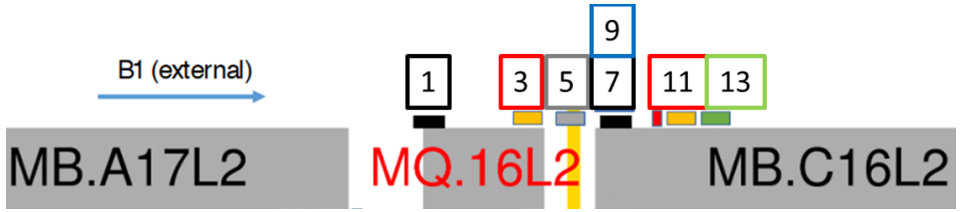


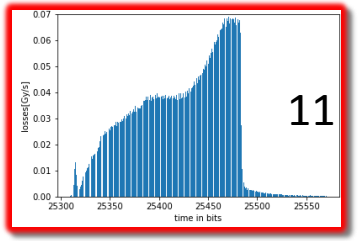
Comparison on same axes for B1

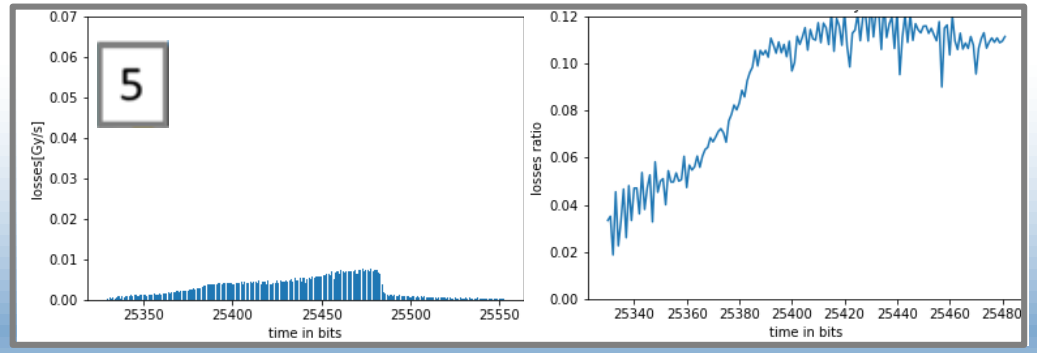


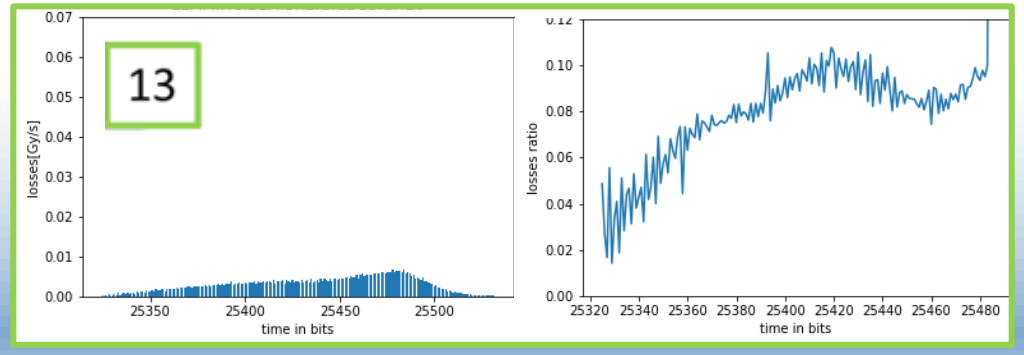




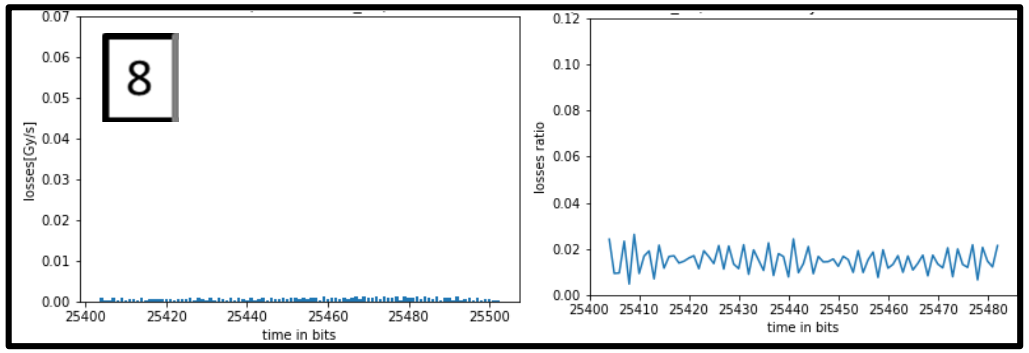


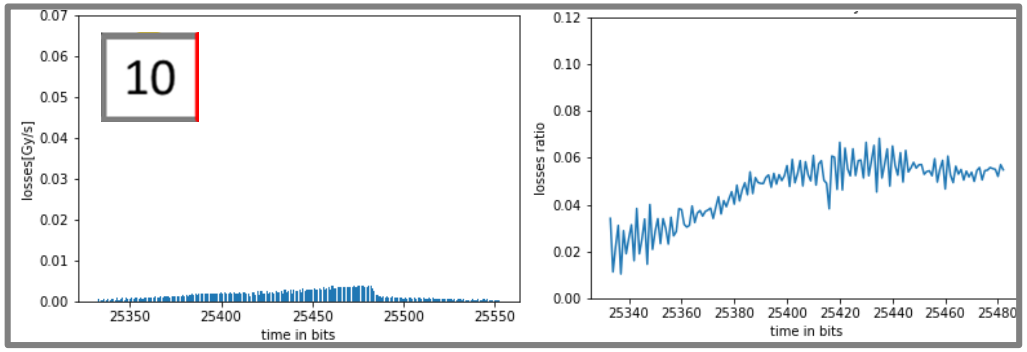


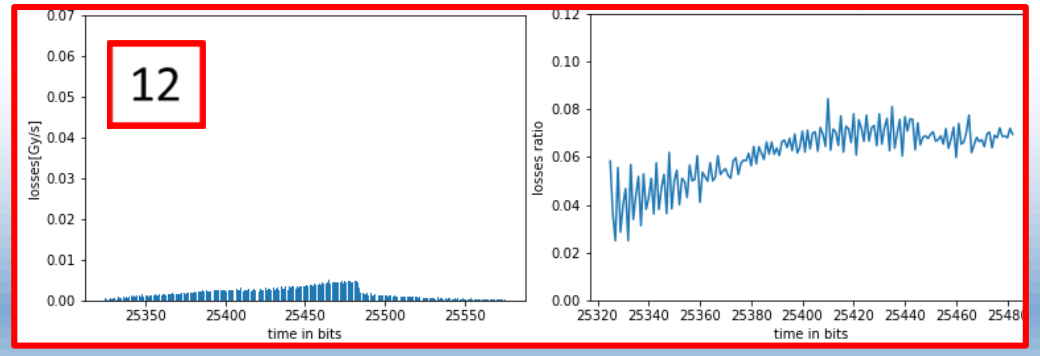


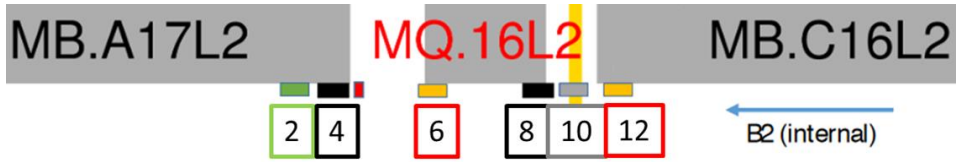


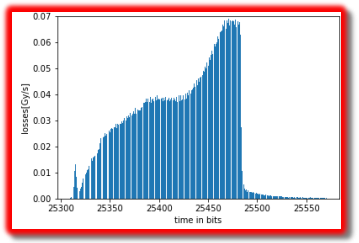
Comparison on same axes for B2











Observation from first dump:

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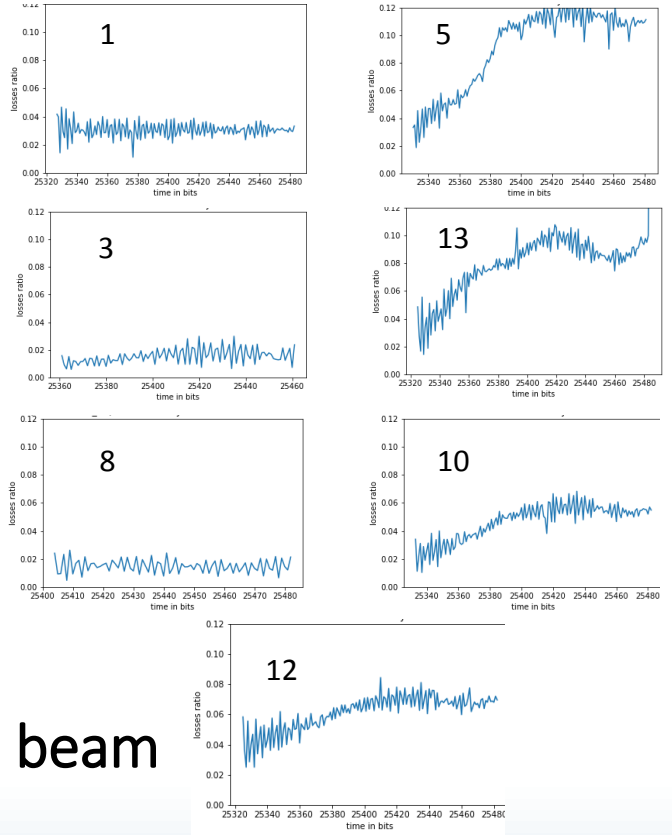
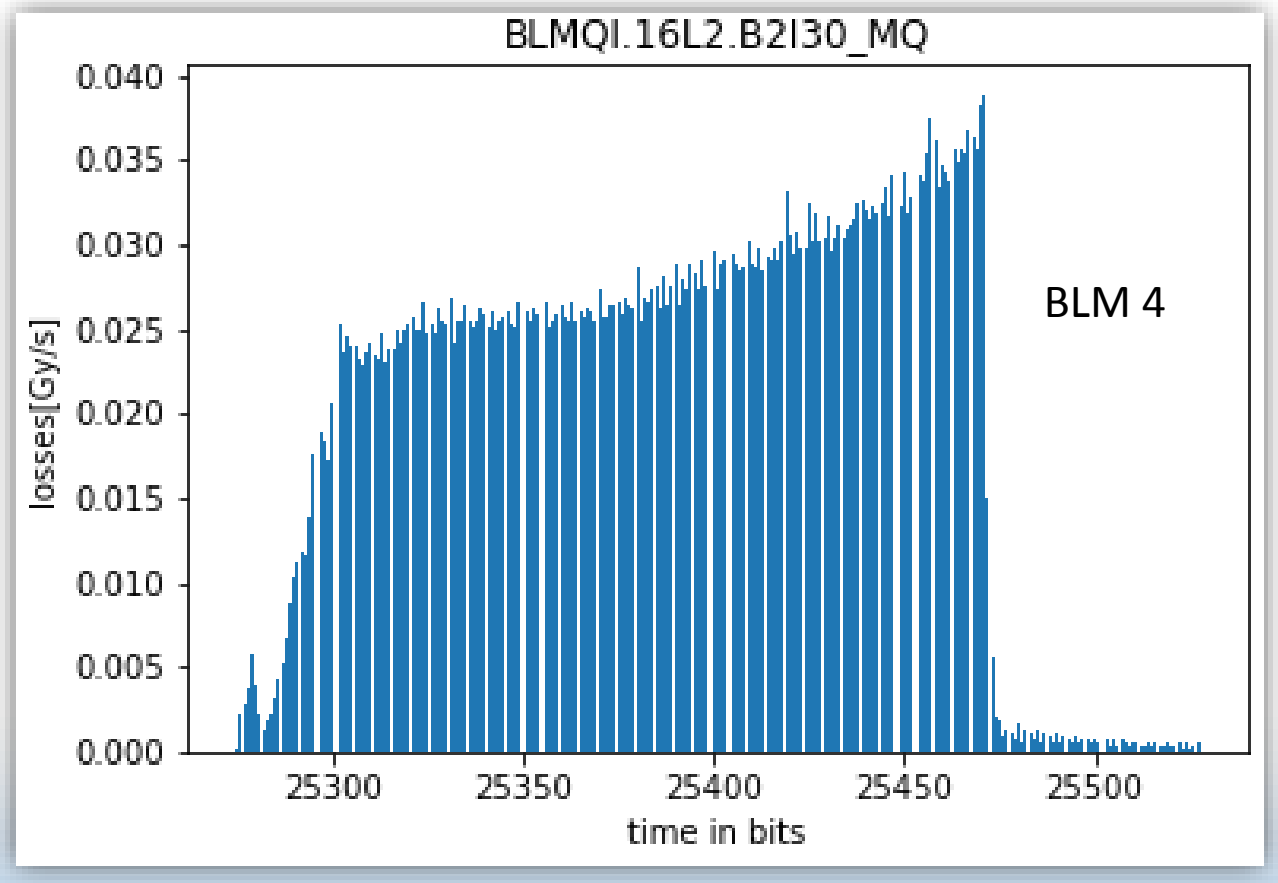
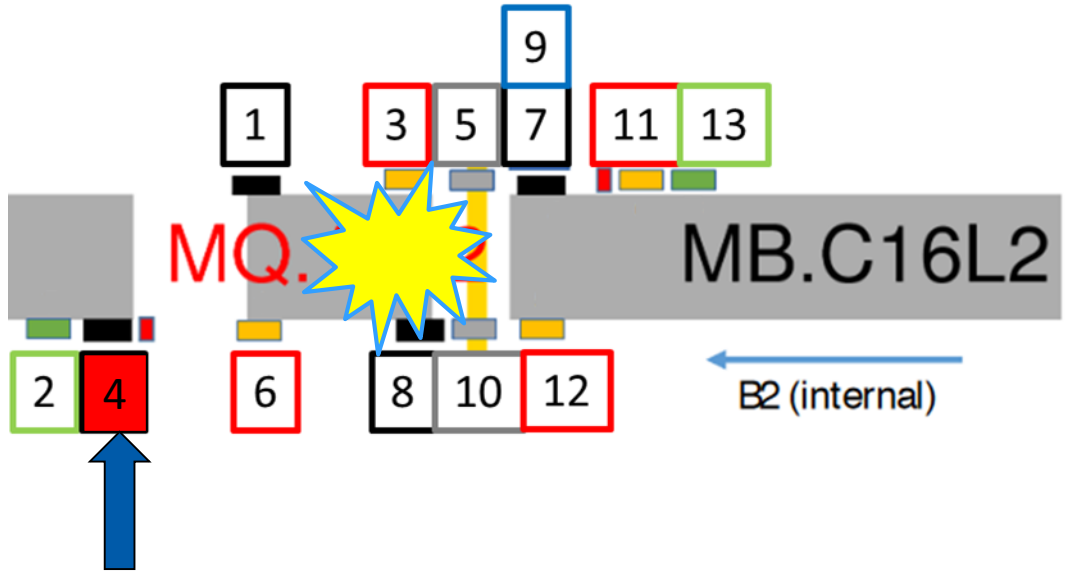
- Neighboring BLMs show losses
- The ratio is rising for many of the neighboring BLMs
- This means that the losses increase with time wrt BLM 11
- This could indicate longitudinal expansion of matter into the beam
- This supports theory of UFO type 2 (maybe caused by evaporation/explosion/atom cloud)



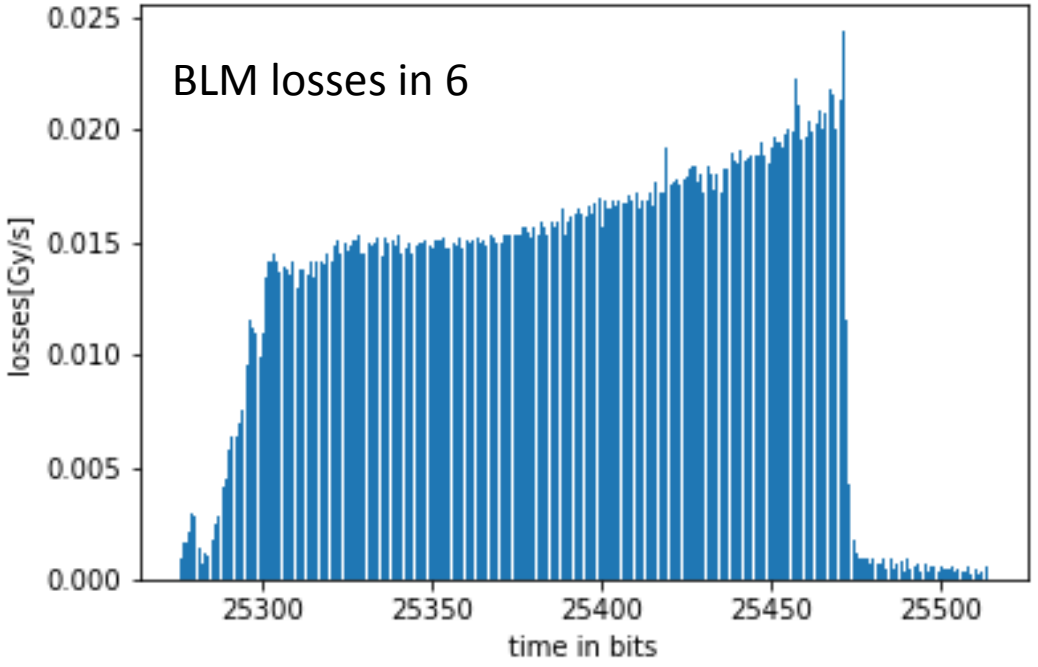
16L2 dump 2: 17-08-2017, 05:03, B2 UFO

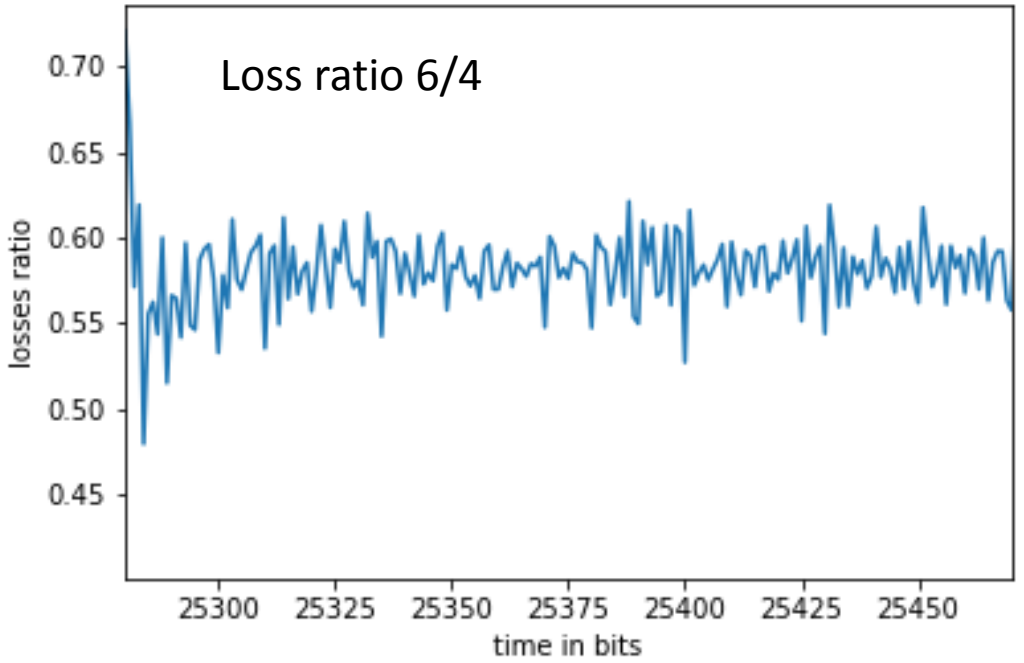


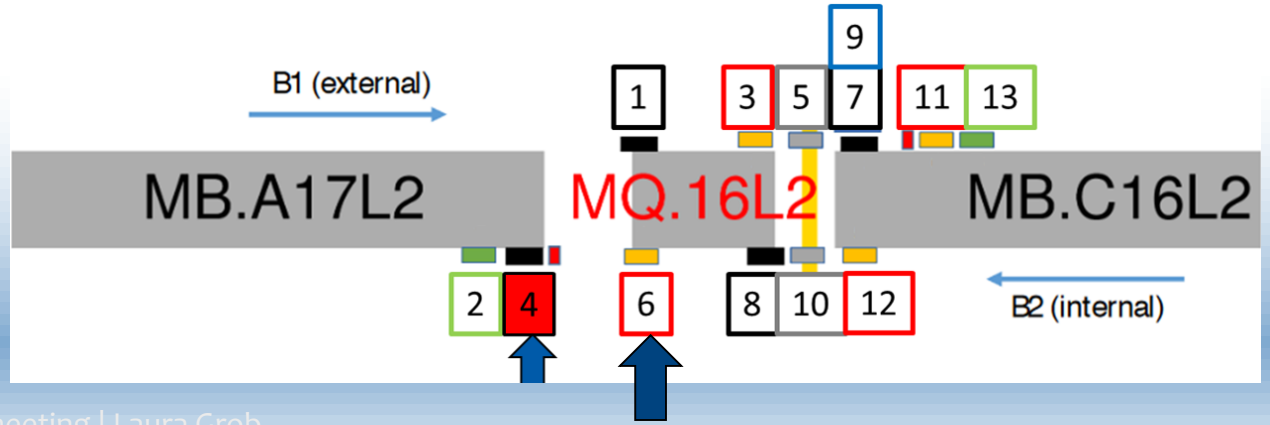


BLM with highest loss signal

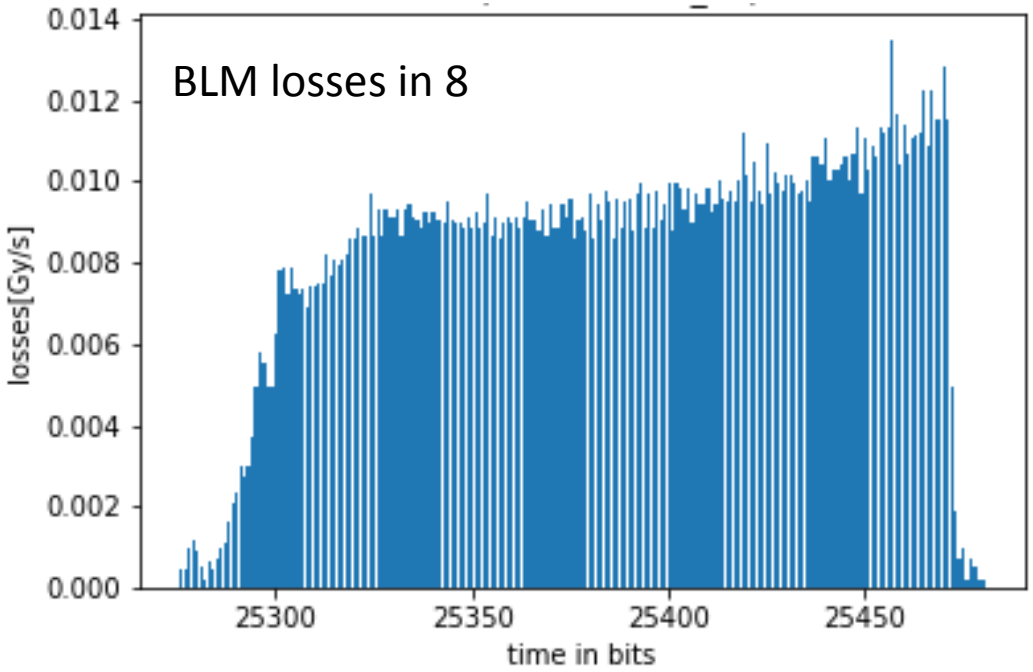
Ratio of BLM 6/4

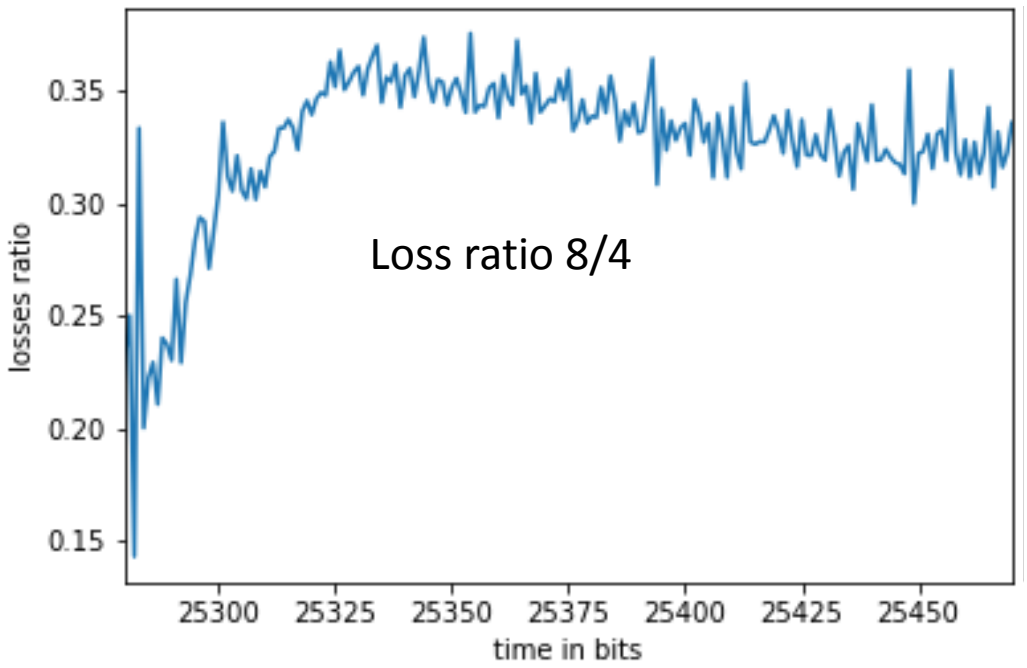


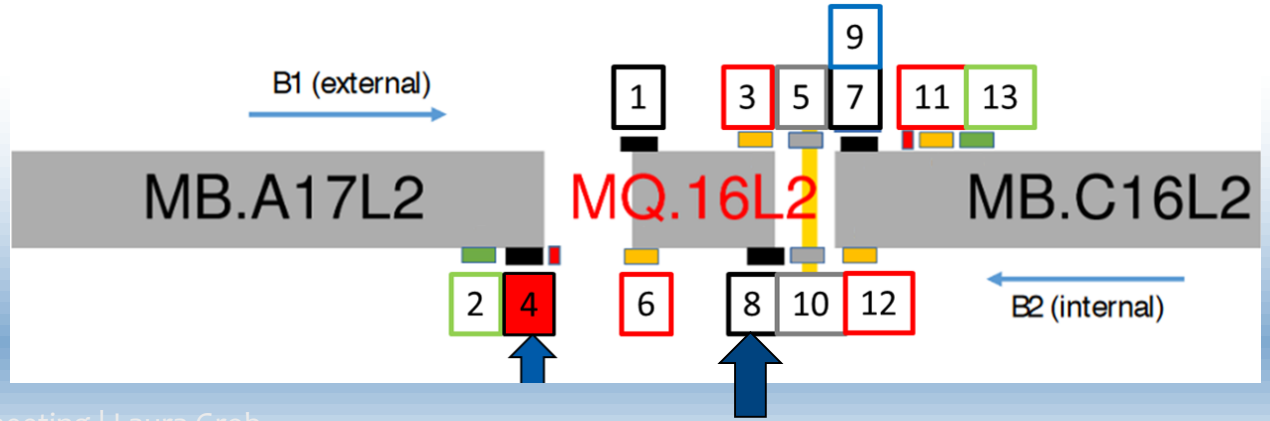




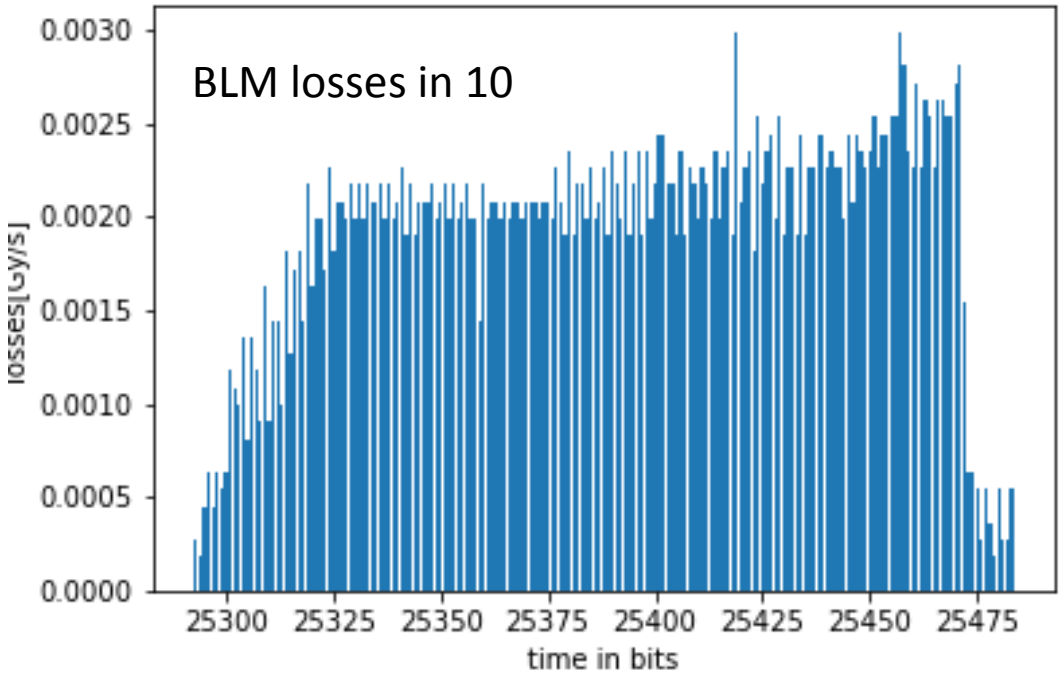
Ratio of BLM 8/4

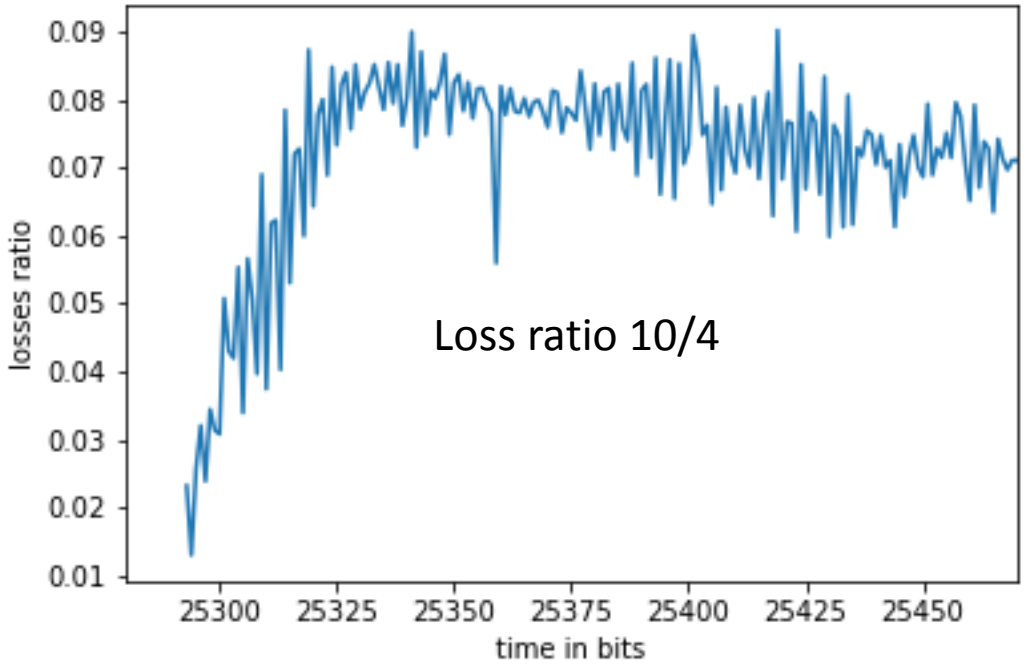


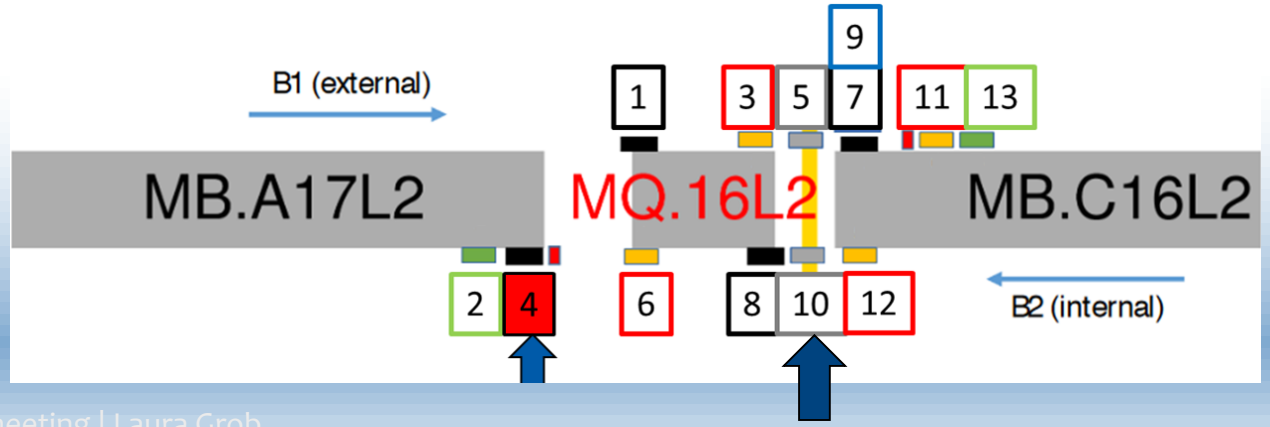




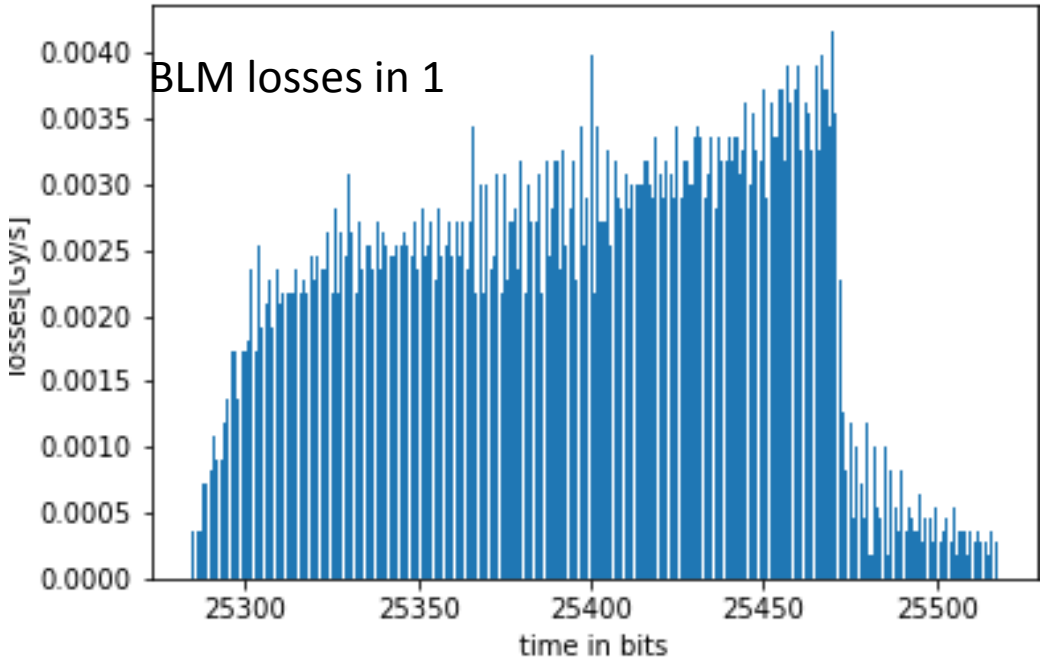
Ratio of BLM 10/4

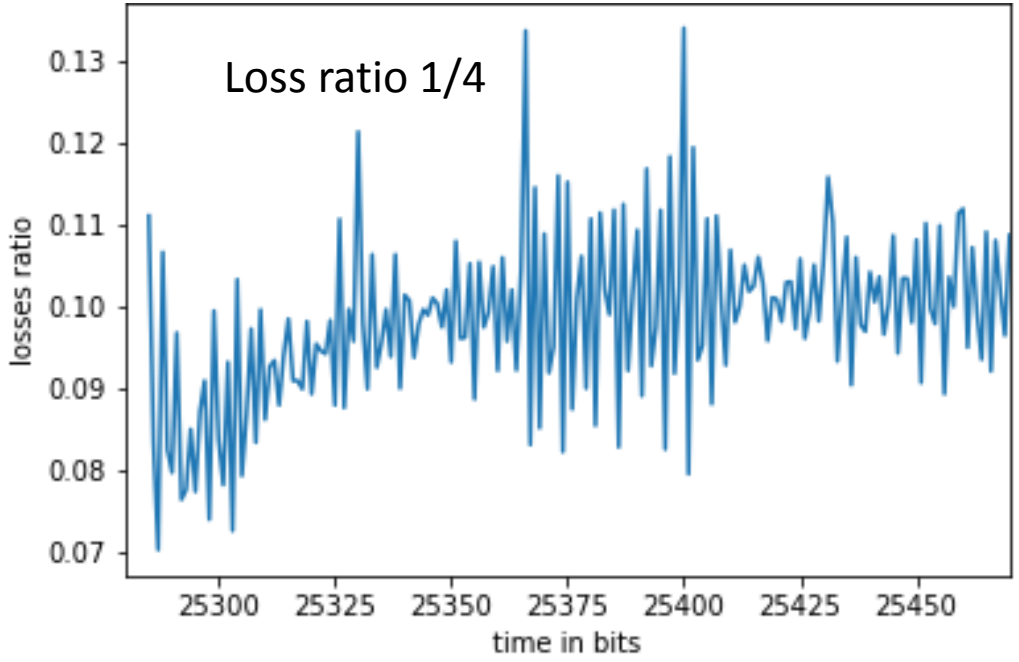


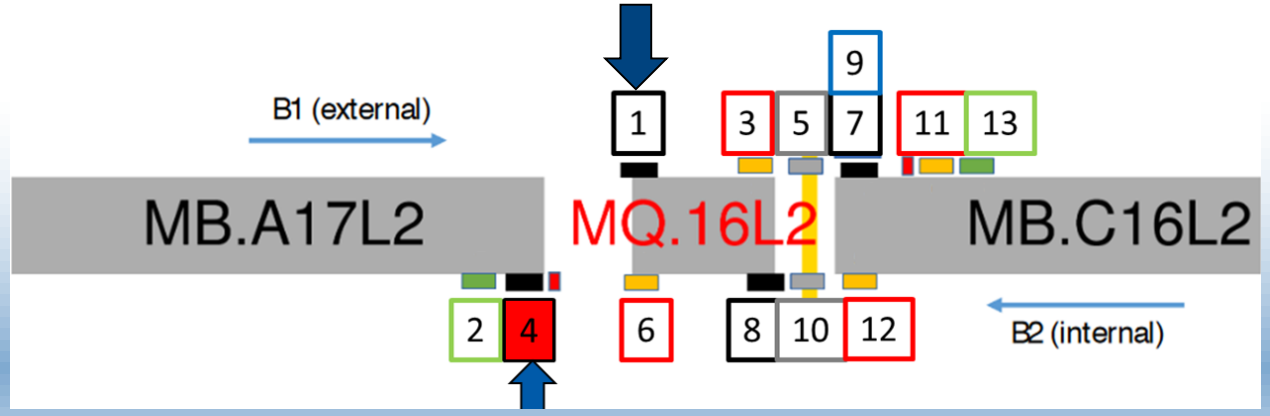




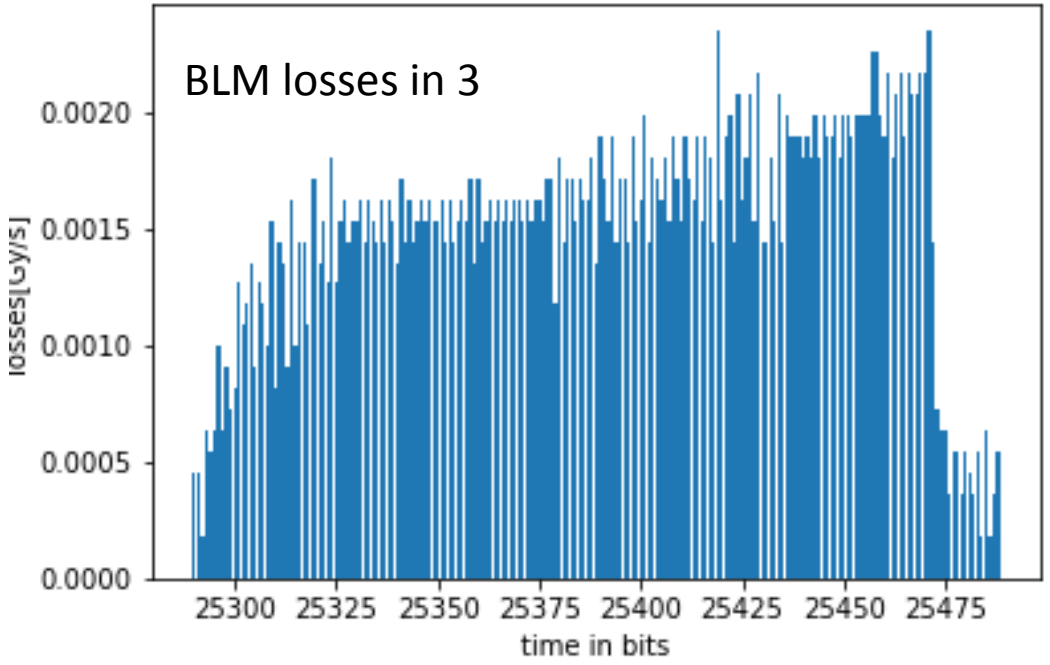
Ratio of BLM 1/4

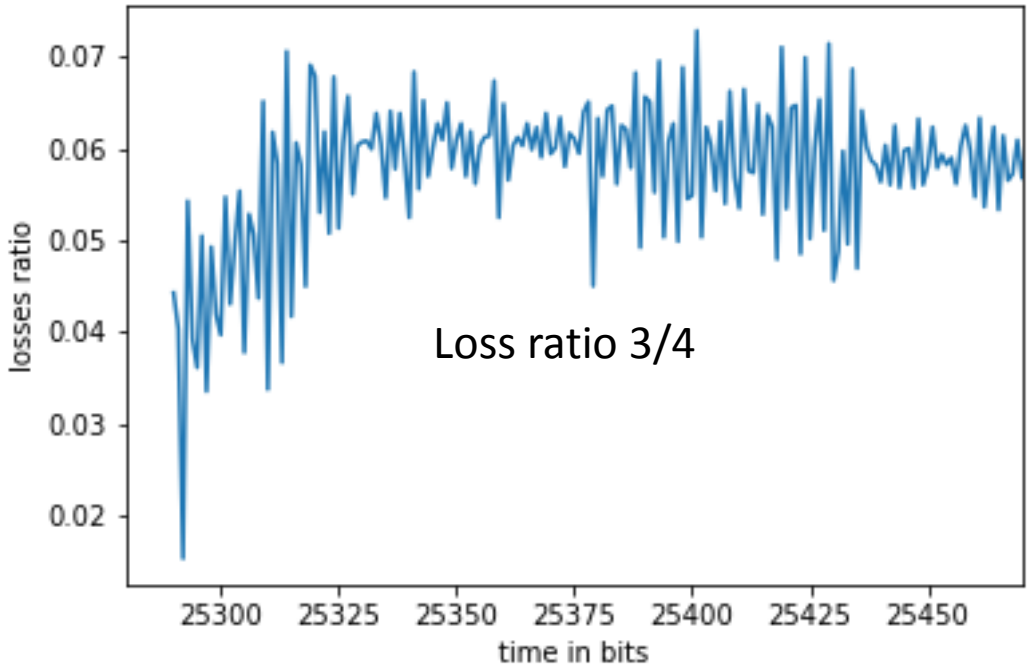


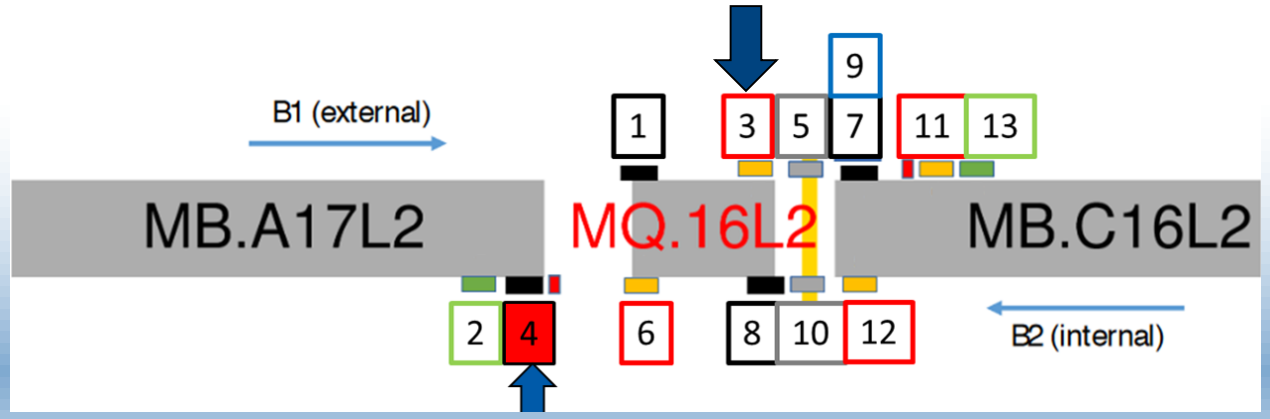




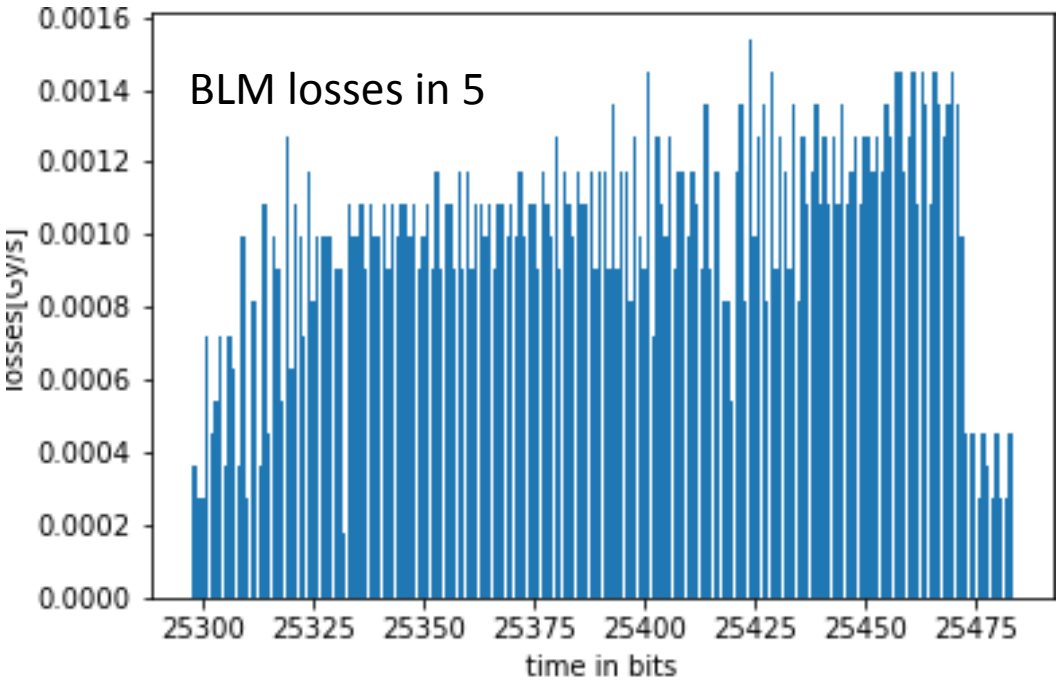
Ratio of BLM 3/4

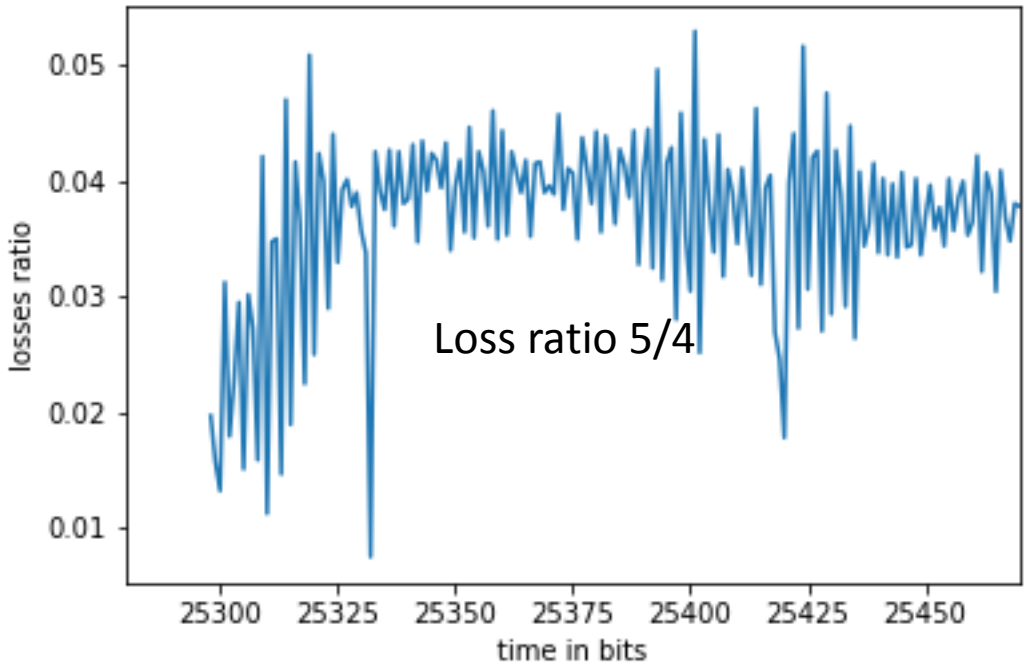


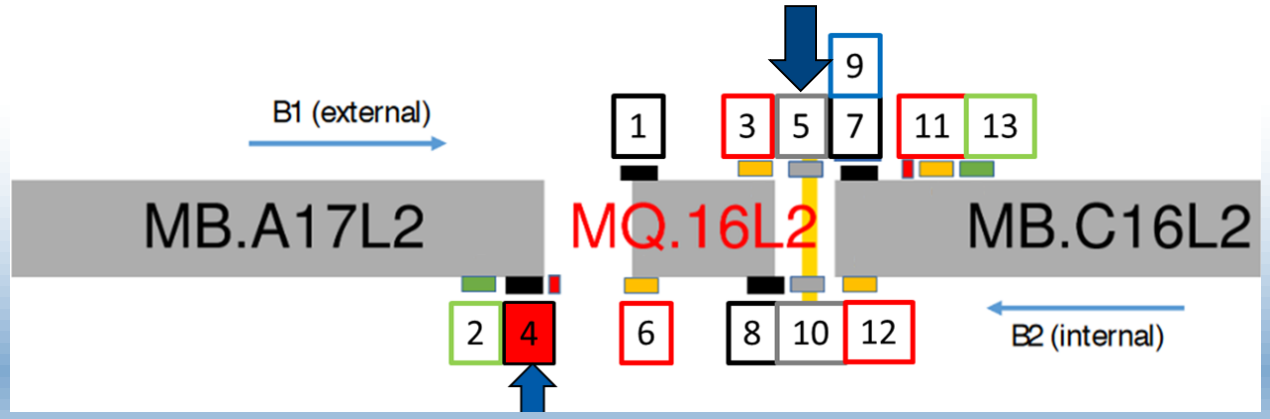




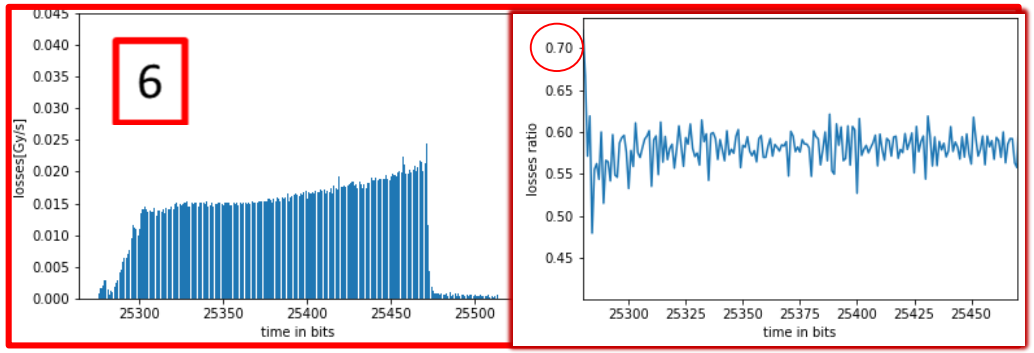
Ratio of BLM 5/4

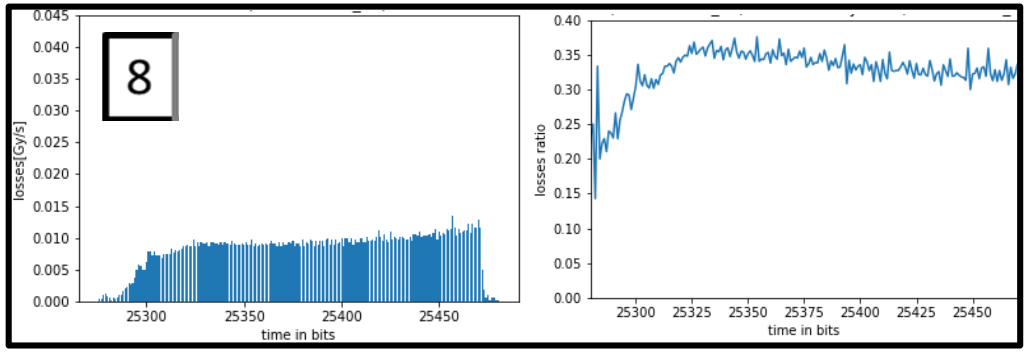


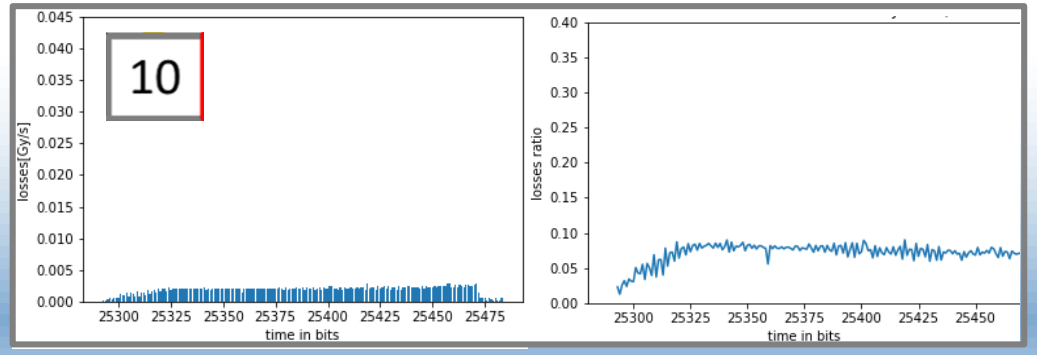


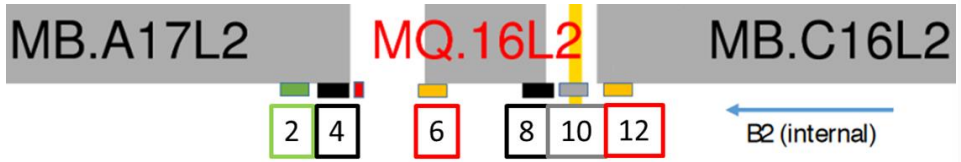


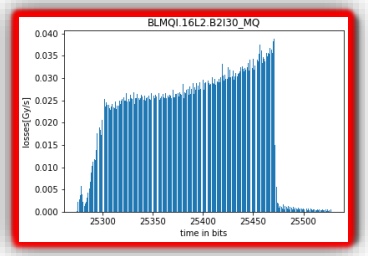
Comparison on same axes for B2



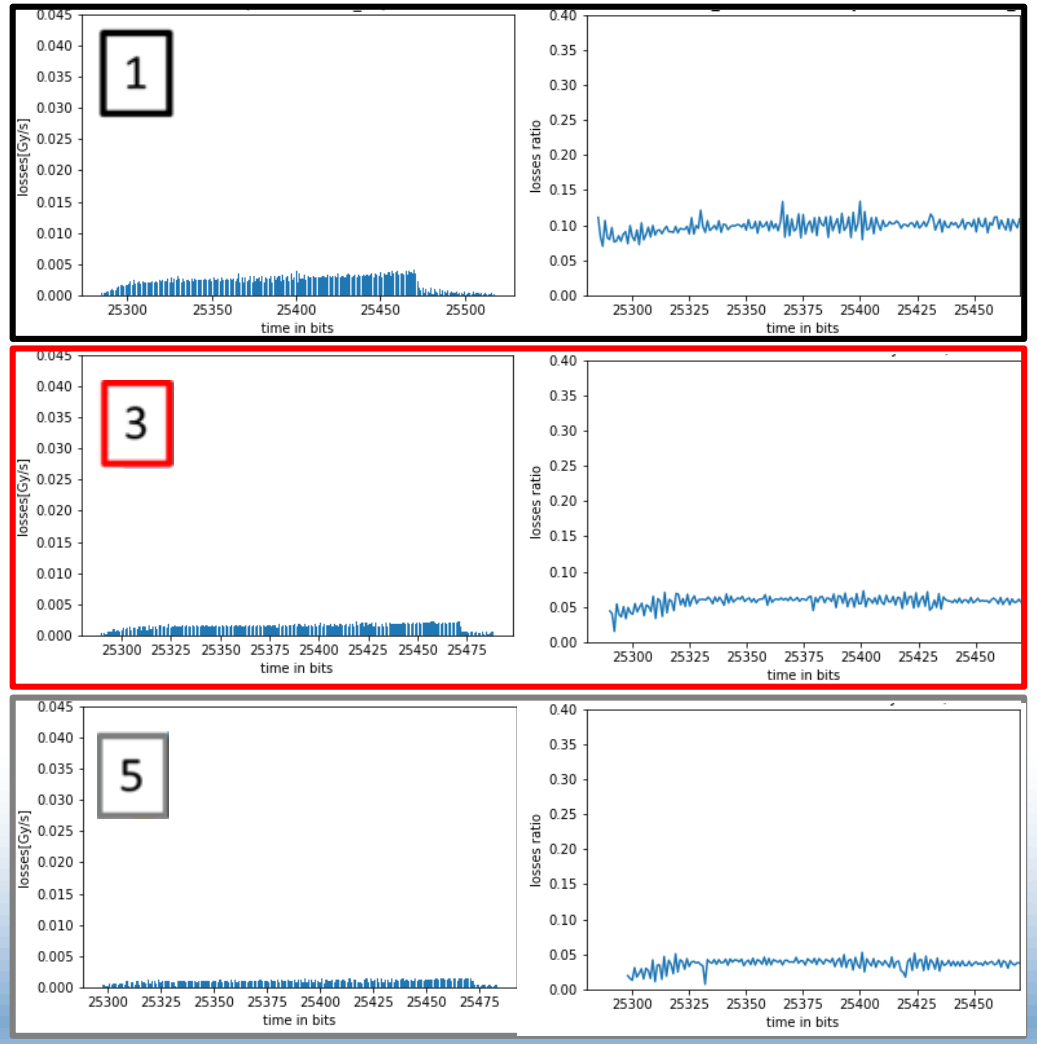


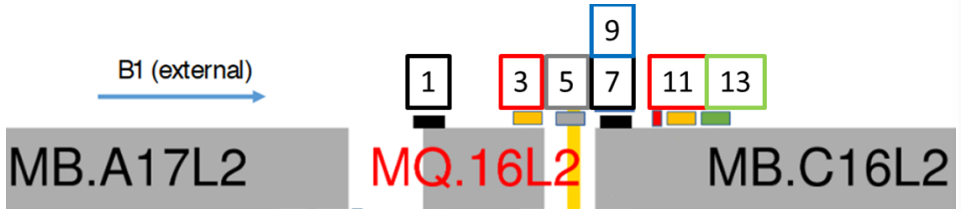


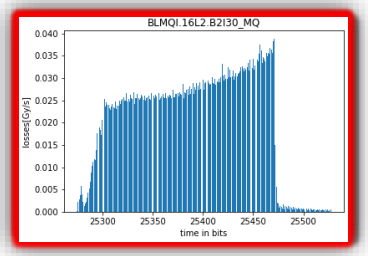




Comparison on same axes for B1







Observation

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Observation of loss patterns from first dump confirmed by second dump:

- Neighboring BLMs show losses
- The ratio is rising for many of the neighboring BLMs
- This means that the losses increase with time wrt BLM with highest signal
- This could indicate longitudinal expansion of matter into the beam
- This supports theory of UFO type 2 (maybe caused by evaporation/explosion/atom cloud)

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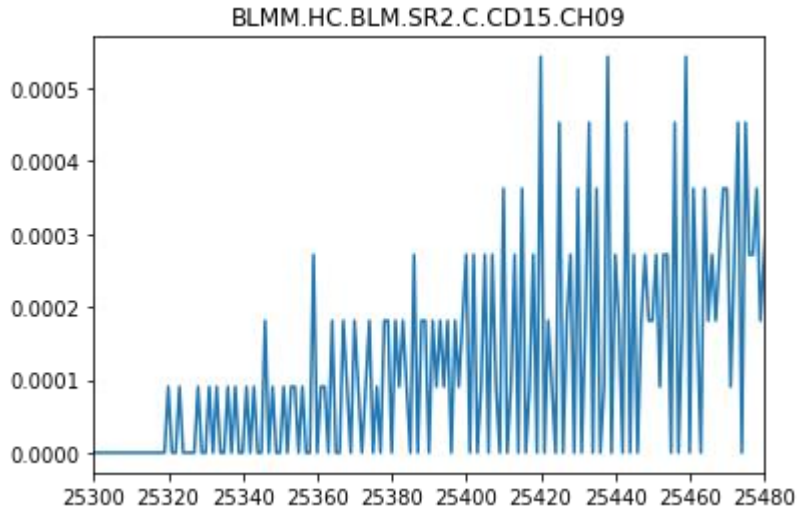
THANK YOU FOR YOUR ATTENTION!

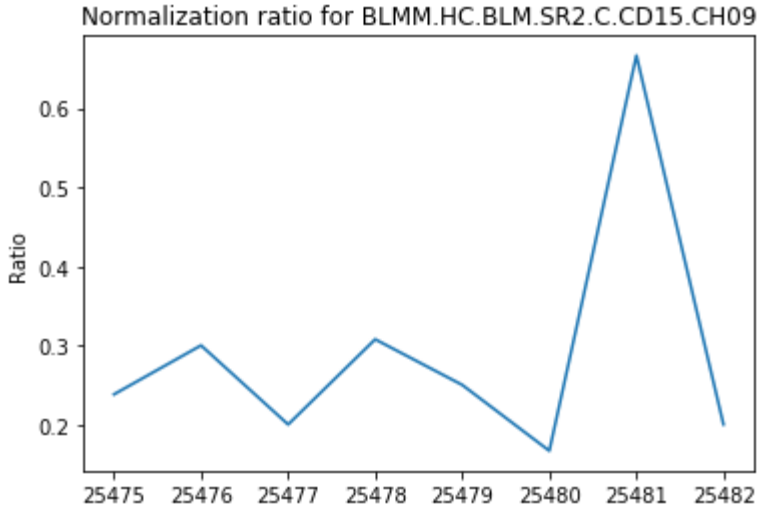
16L2 PM data ratio plots

By Martyna Dziadosz

06-SEP-2017
20.19.55.45
B1 losses

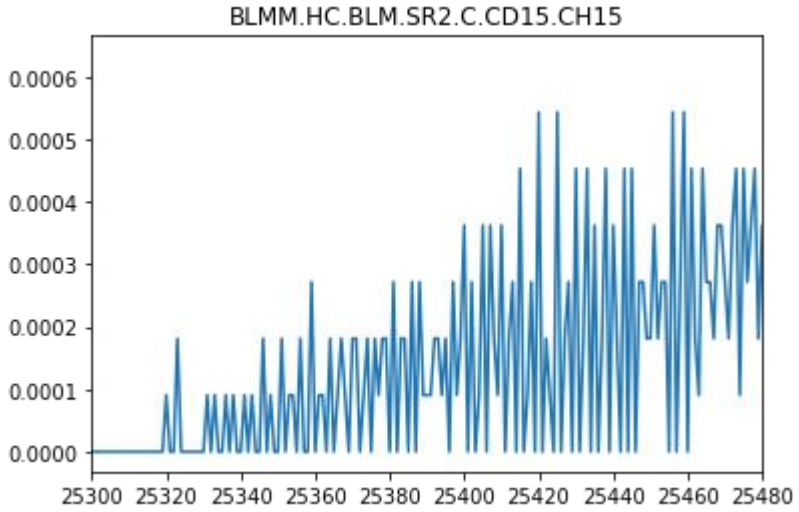
BLMM.HC.BLM.SR2.C.CD15.CH09

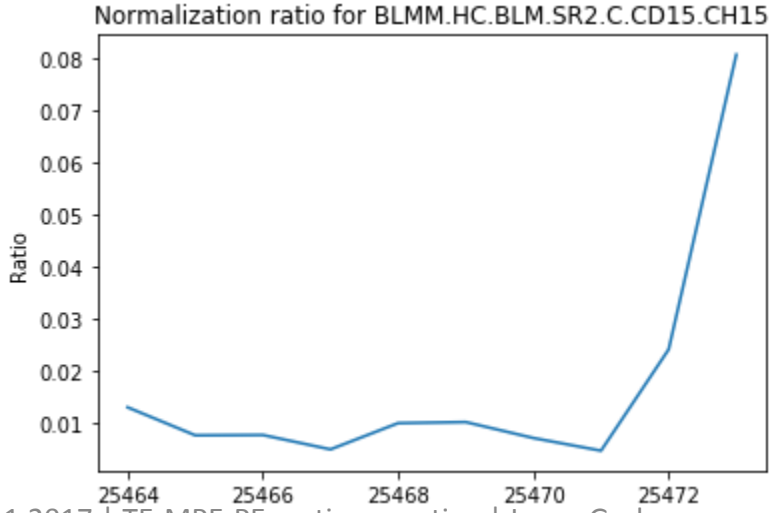


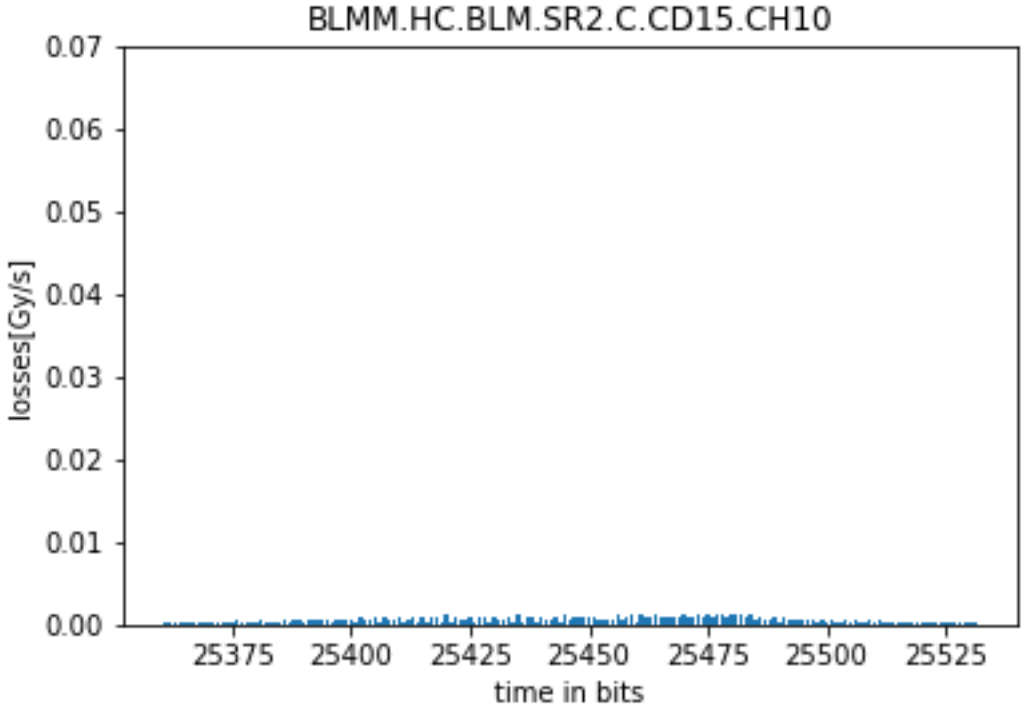


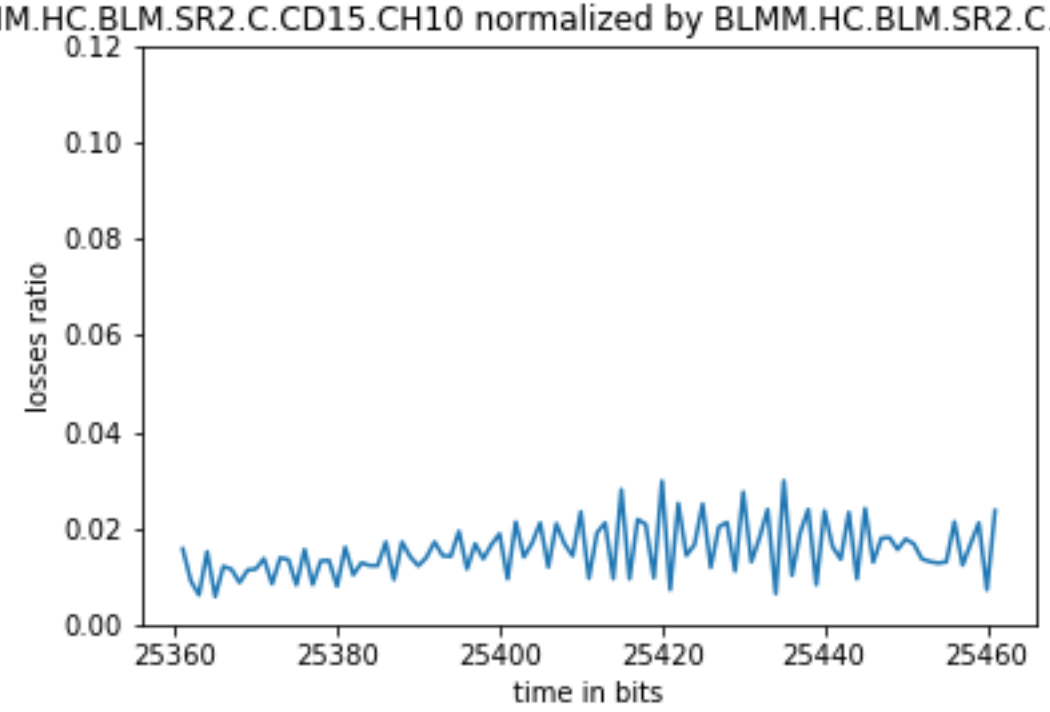
MISSING PLOTS

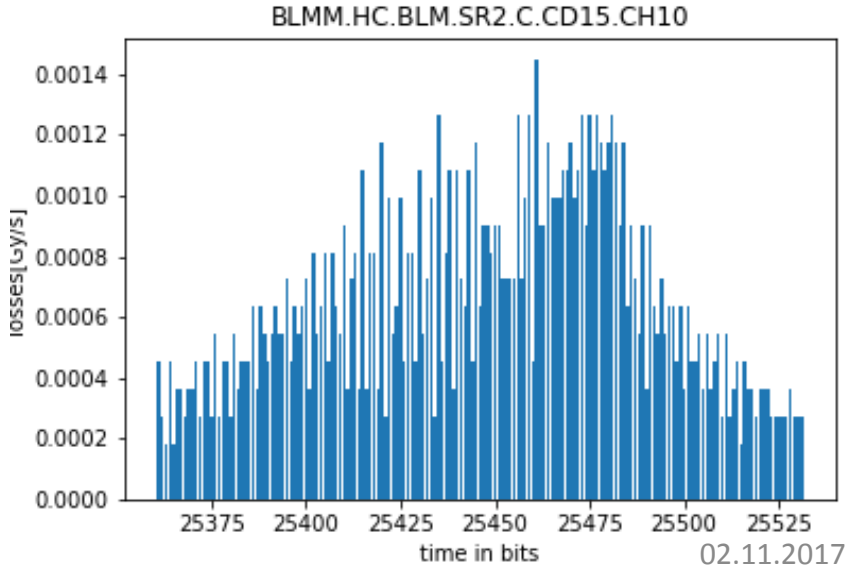
BLMM.HC.BLM.SR2.C.CD15.CH15CH15

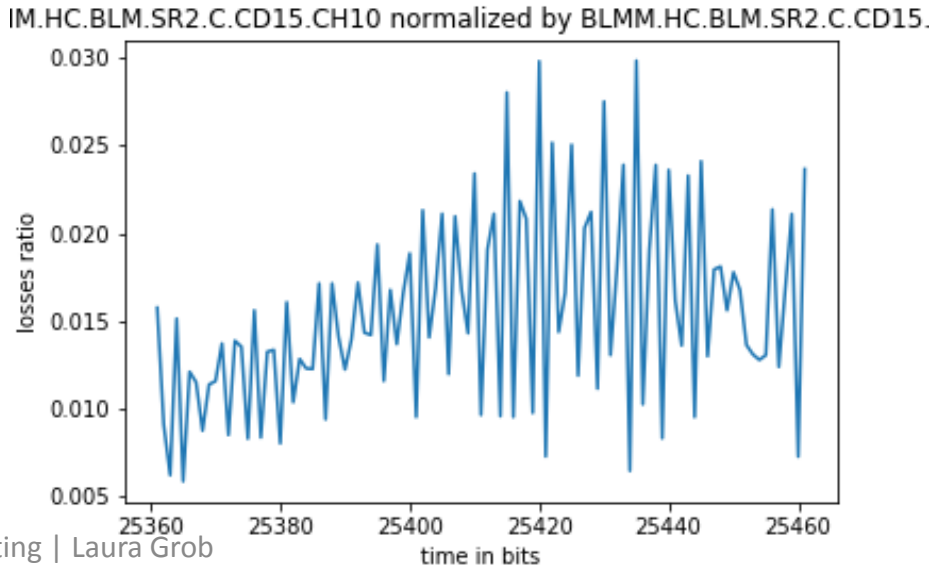


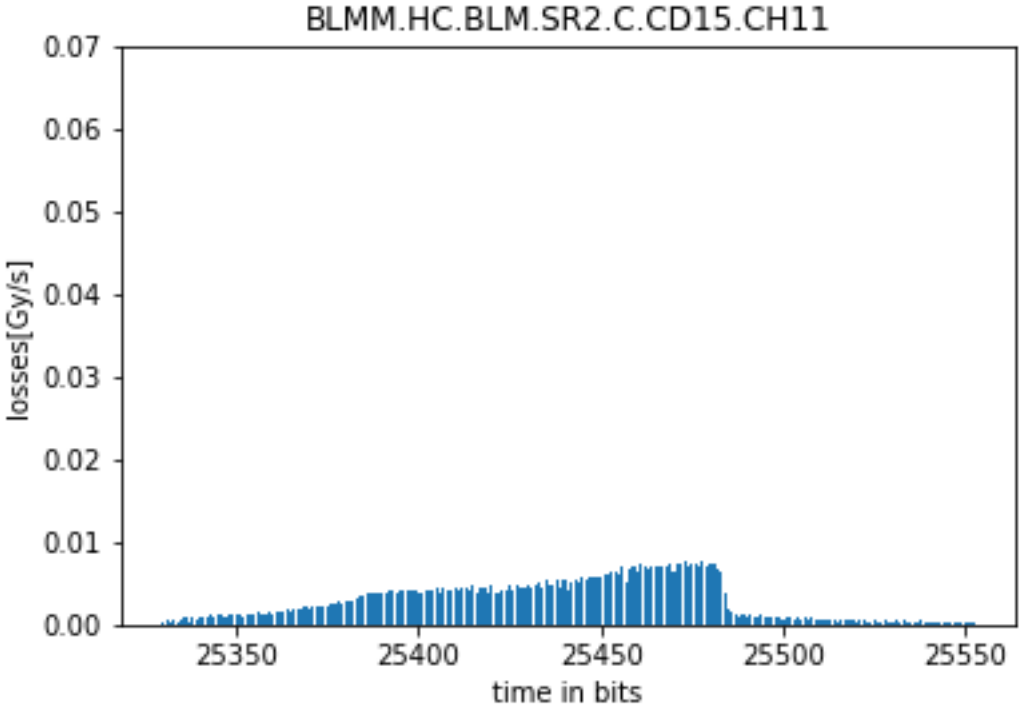


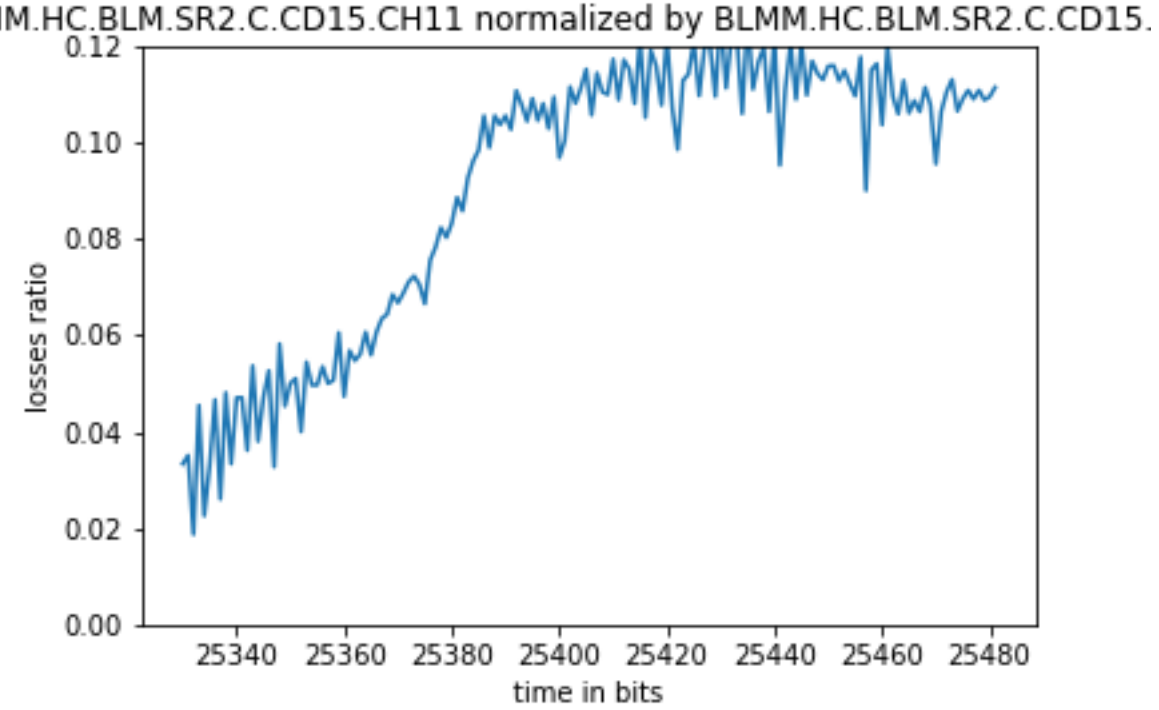

BLMM.HC.BLM.SR2.C.CD15.CH10
losses[Gy/s]
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
25375
25400
25425
25450
25475
25500
25525
time in bits

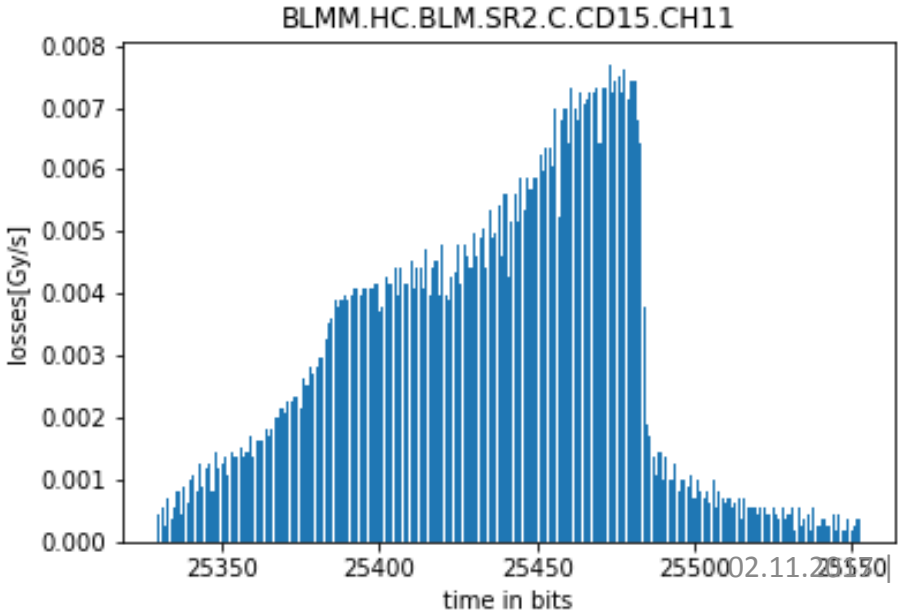

IM.HC.BLM.SR2.C.CD15.CH10 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.12
0.10
0.08
0.06
0.04
0.02
0.00
25360
25380
25400
25420
25440
25460
time in bits

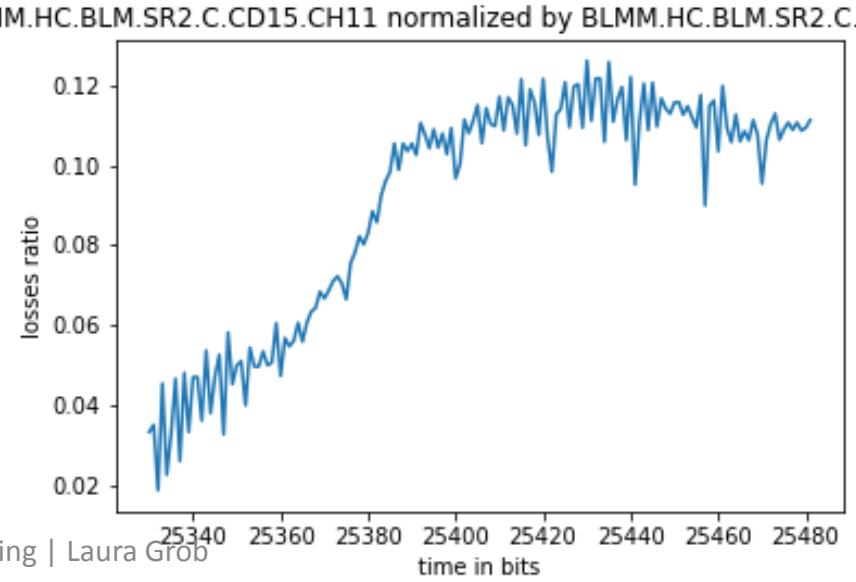

BLMM.HC.BLM.SR2.C.CD15.CH10
losses[Gy/s]
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
25375
25400
25425
25450
25475
25500
25525
time in bits

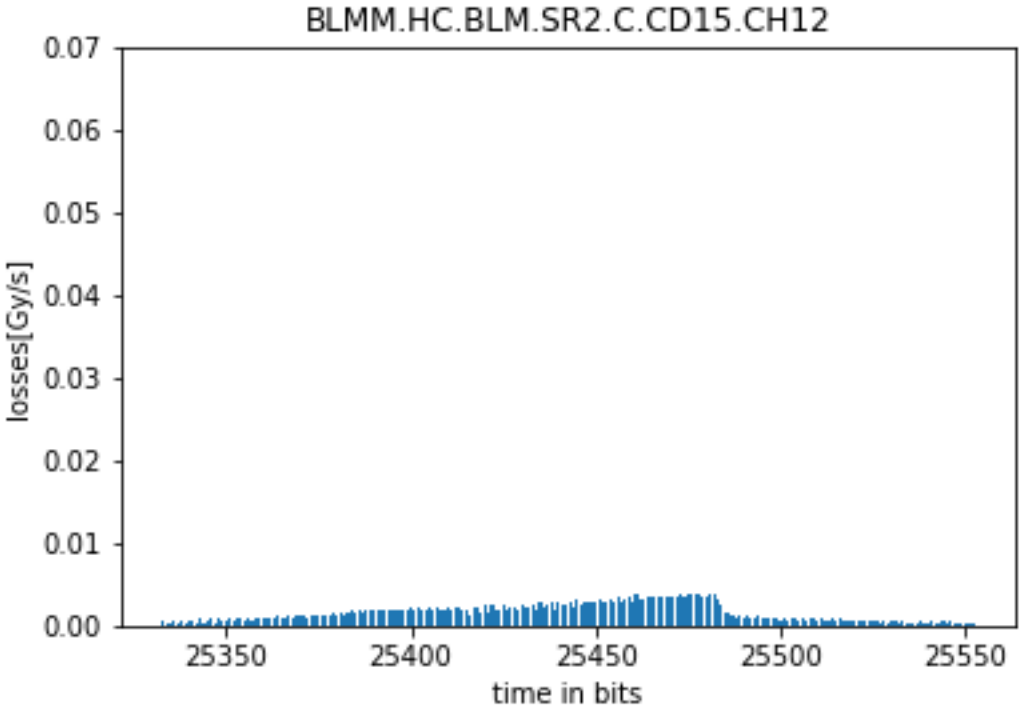

IM.HC.BLM.SR2.C.CD15.CH10 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.030
0.025
0.020
0.015
0.010
0.005
25360
25380
25400
25420
25440
25460
time in bits

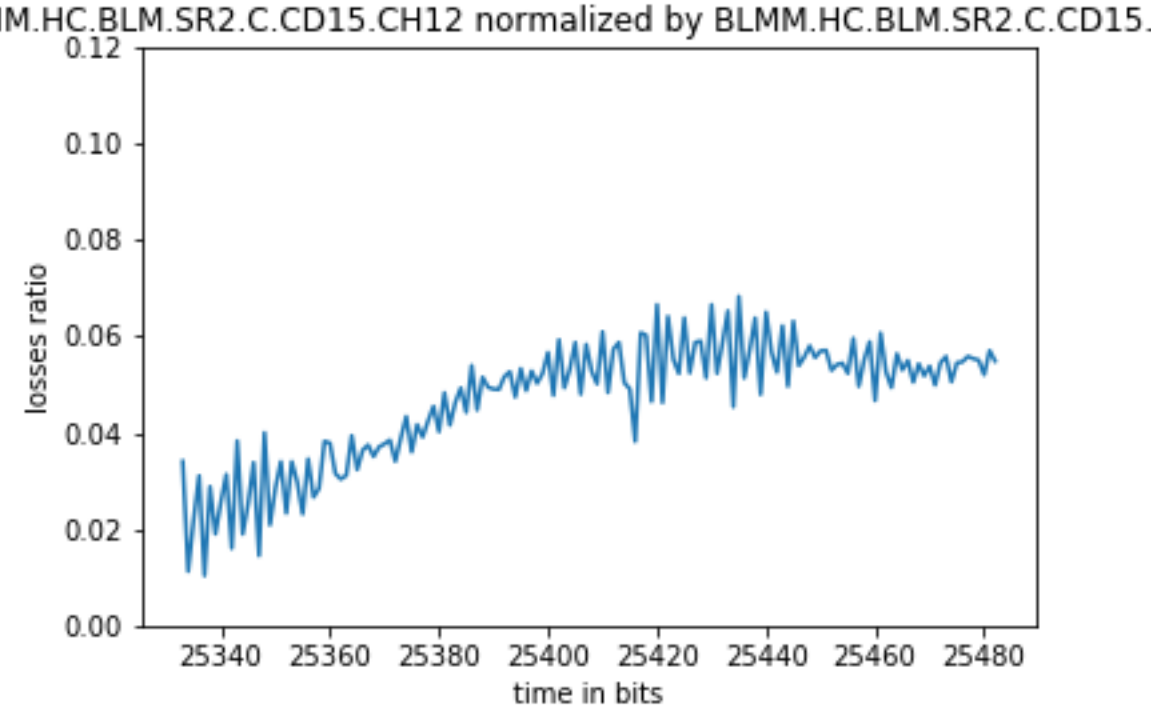

BLMM.HC.BLM.SR2.C.CD15.CH11
losses[Gy/s]
time in bits

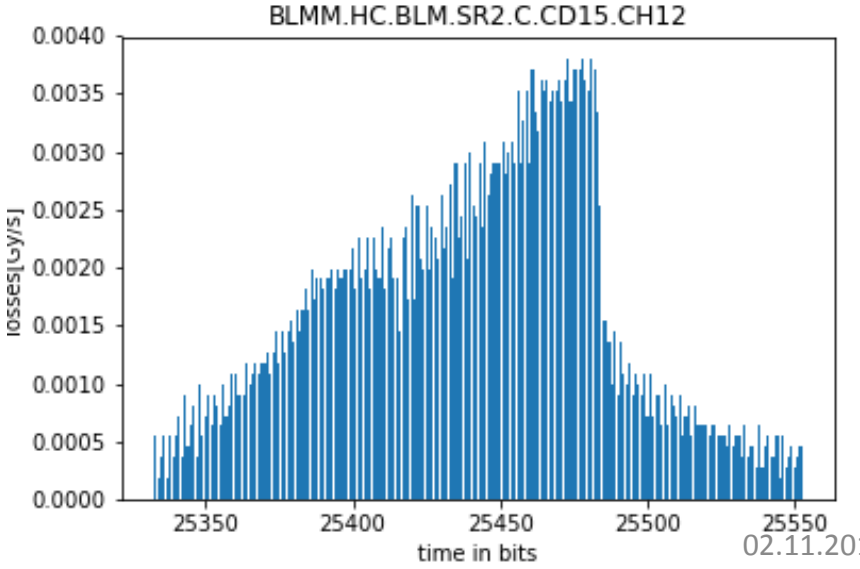

IM.HC.BLM.SR2.C.CD15.CH11 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
time in bits

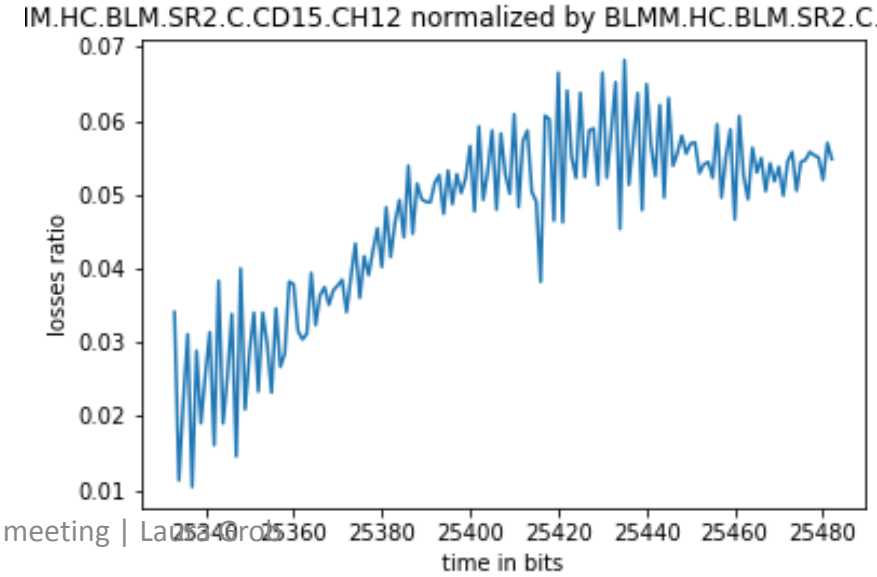

BLMM.HC.BLM.SR2.C.CD15.CH11
losses[Gy/s]
time in bits

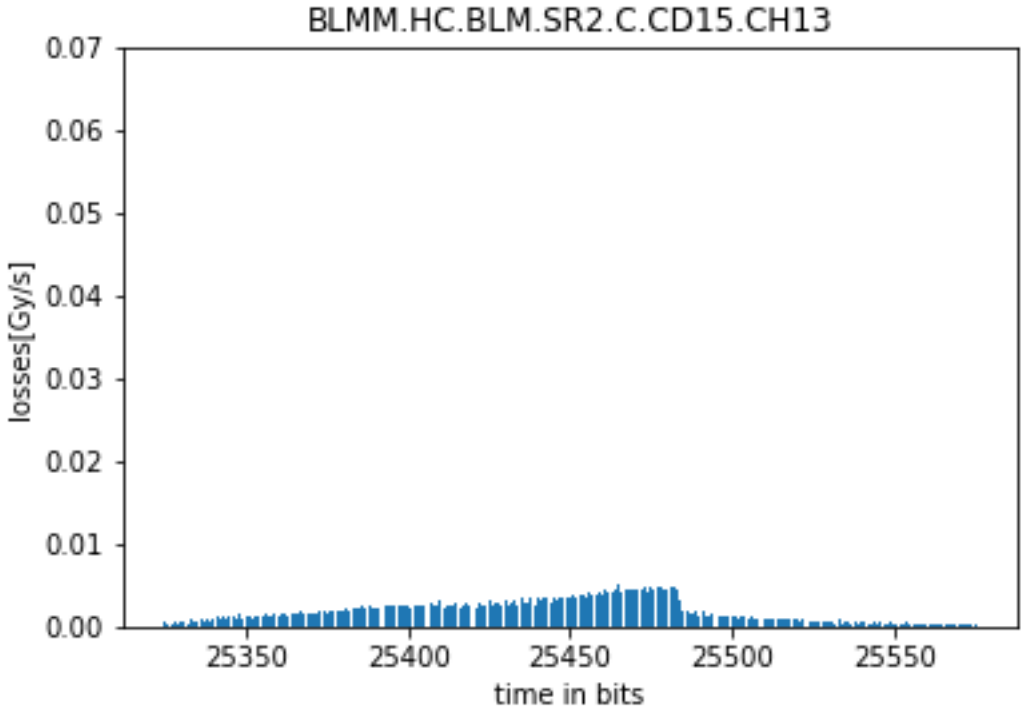

IM.HC.BLM.SR2.C.CD15.CH11 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
time in bits

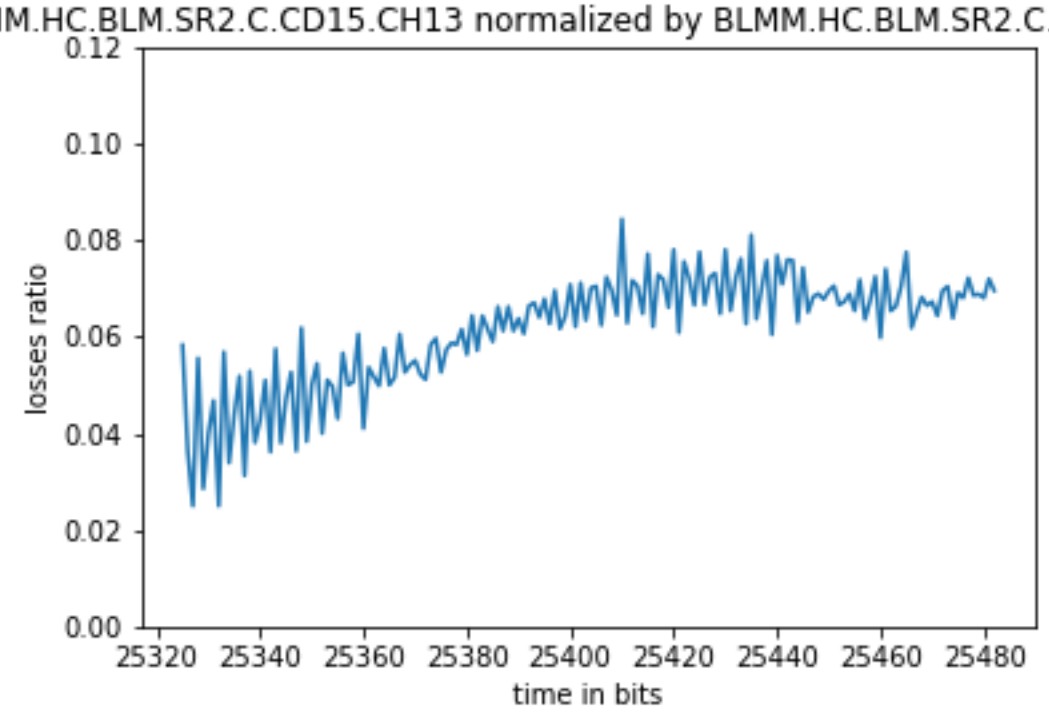

BLMM.HC.BLM.SR2.C.CD15.CH12
losses[Gy/s]
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
25350
25400
25450
25500
25550
time in bits

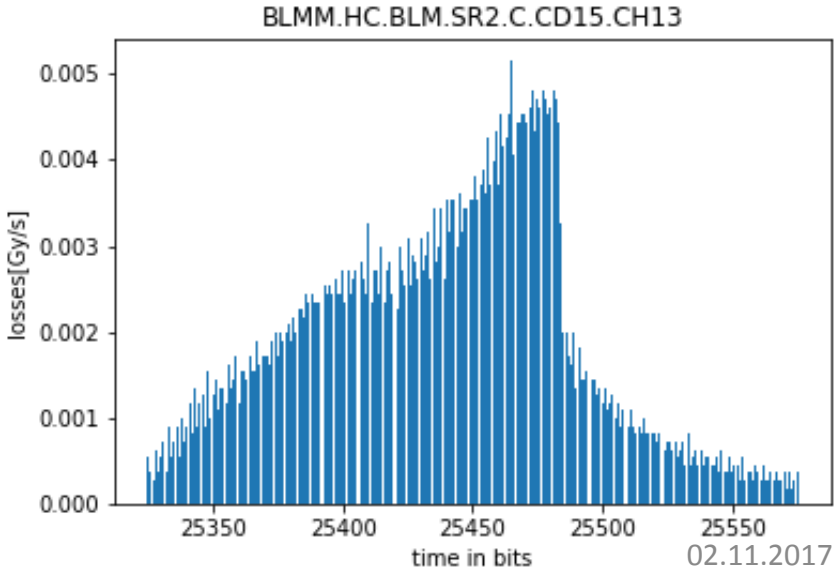

IM.HC.BLM.SR2.C.CD15.CH12 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.12
0.10
0.08
0.06
0.04
0.02
0.00
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

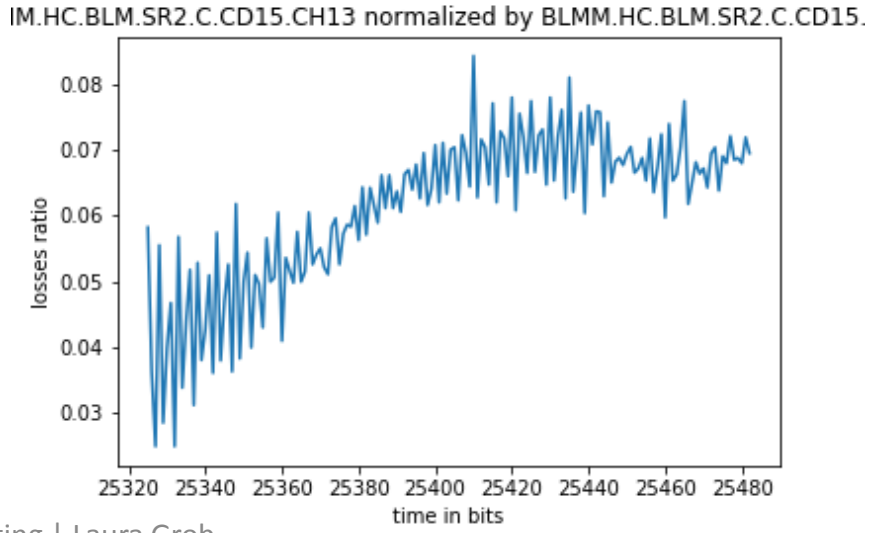

BLMM.HC.BLM.SR2.C.CD15.CH12
losses[Gy/s]
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
25350
25400
25450
25500
25550
time in bits

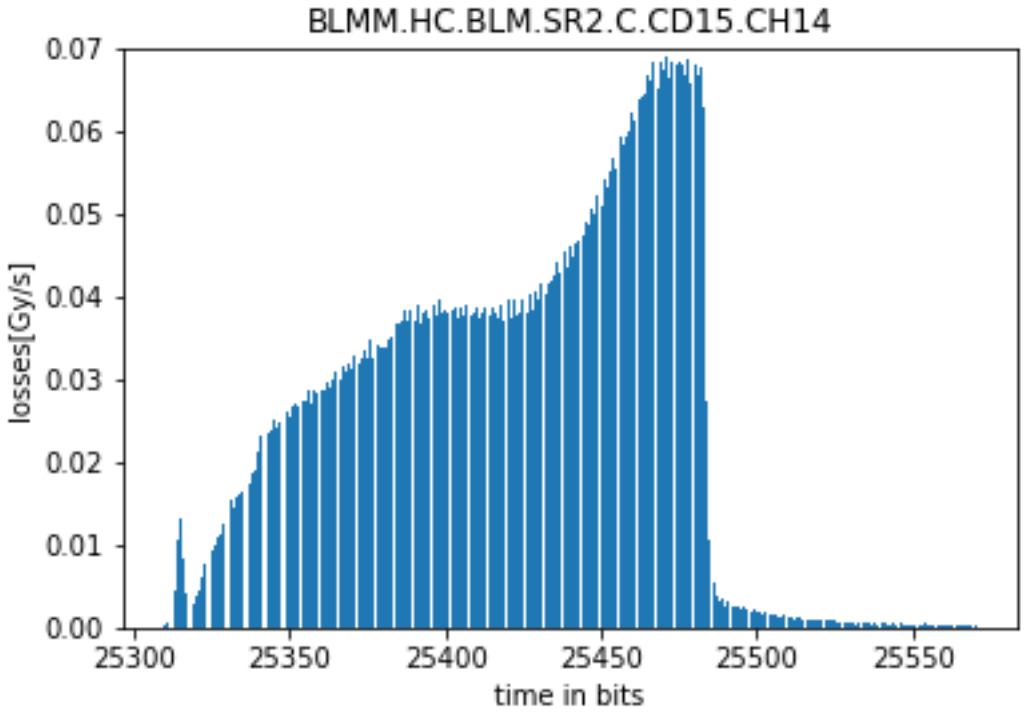

IM.HC.BLM.SR2.C.CD15.CH12 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.07
0.06
0.05
0.04
0.03
0.02
0.01
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

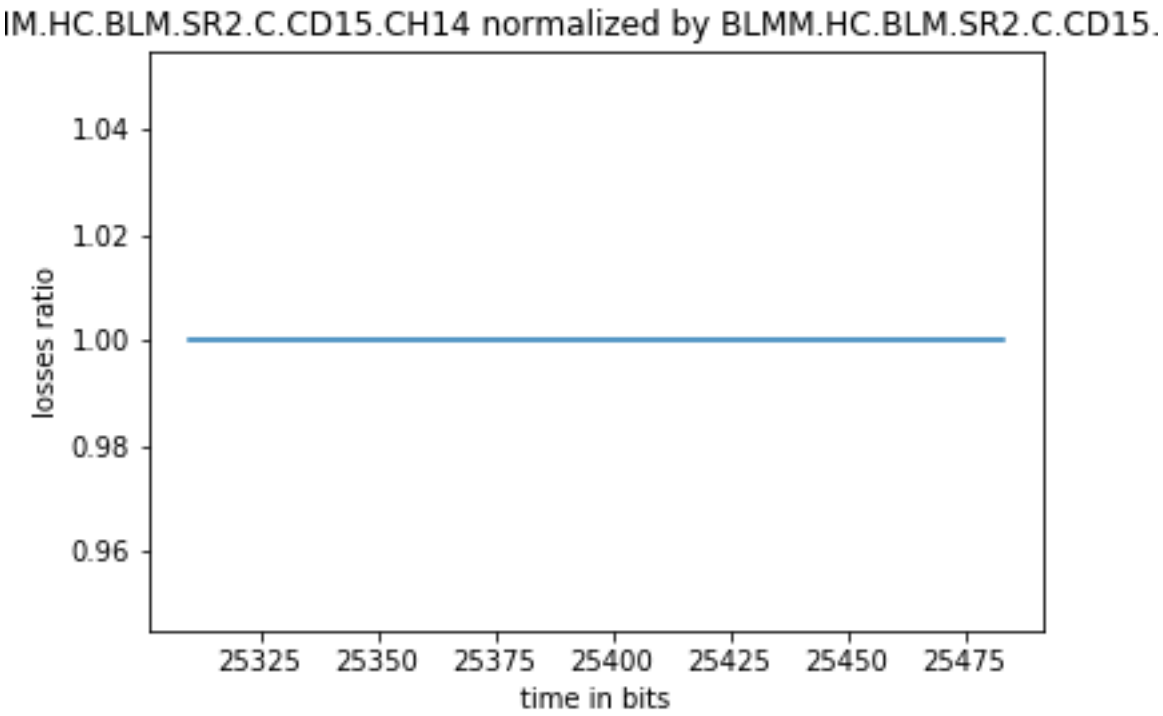

BLMM.HC.BLM.SR2.C.CD15.CH13
losses[Gy/s]
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
25350
25400
25450
25500
25550
time in bits


IM.HC.BLM.SR2.C.CD15.CH13 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.12
0.10
0.08
0.06
0.04
0.02
0.00
25320
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

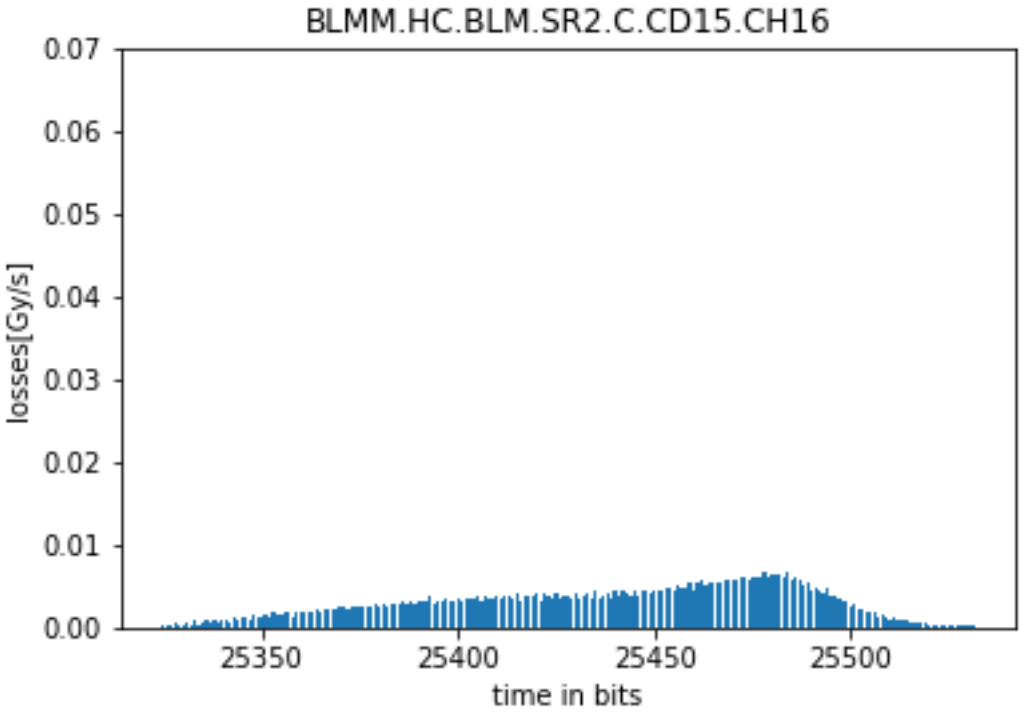

BLMM.HC.BLM.SR2.C.CD15.CH13
losses[Gy/s]
0.005
0.004
0.003
0.002
0.001
0.000
25350
25400
25450
25500
25550
time in bits

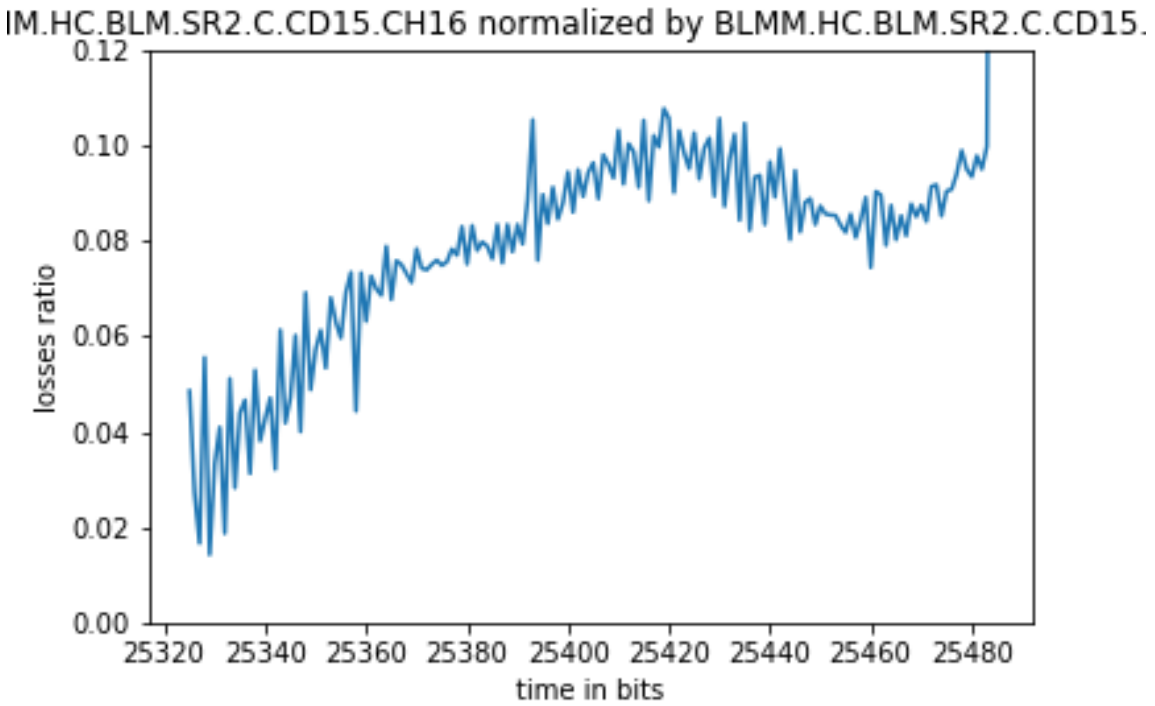

IM.HC.BLM.SR2.C.CD15.CH13 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.08
0.07
0.06
0.05
0.04
0.03
25320
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

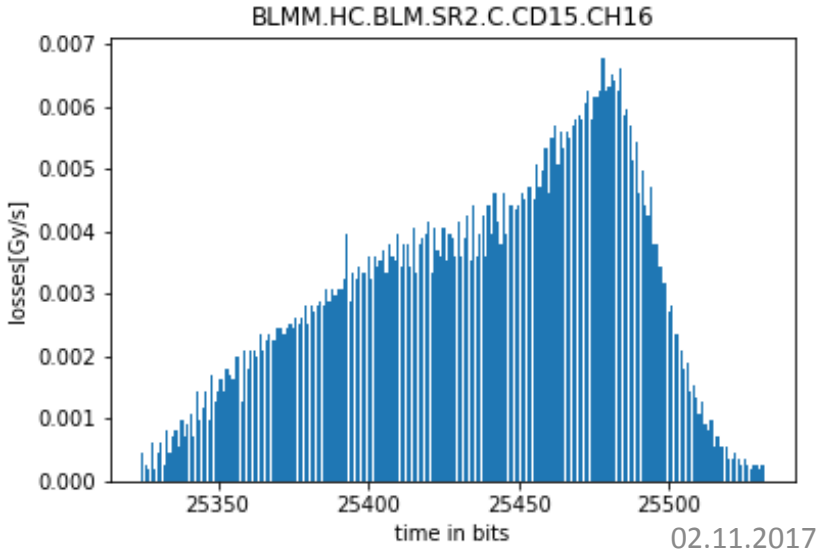


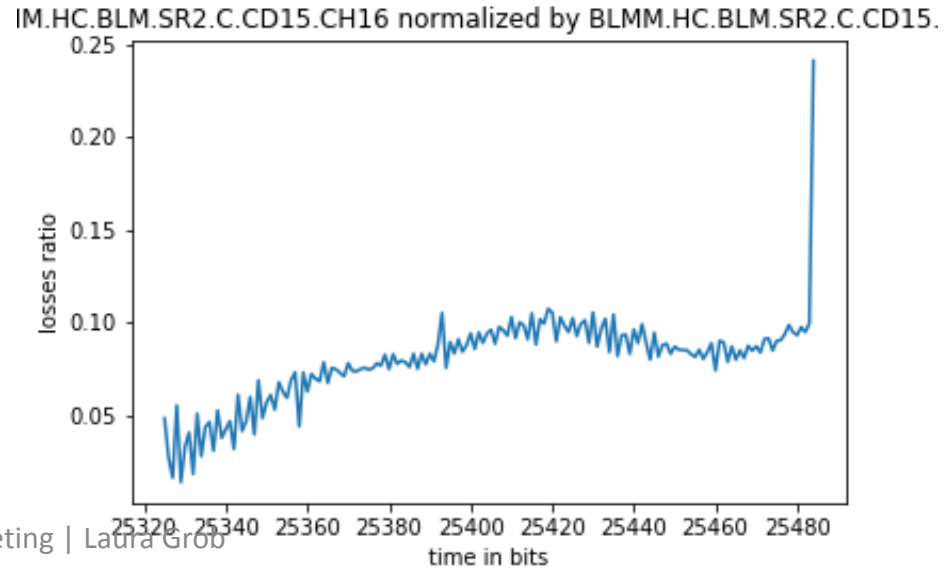


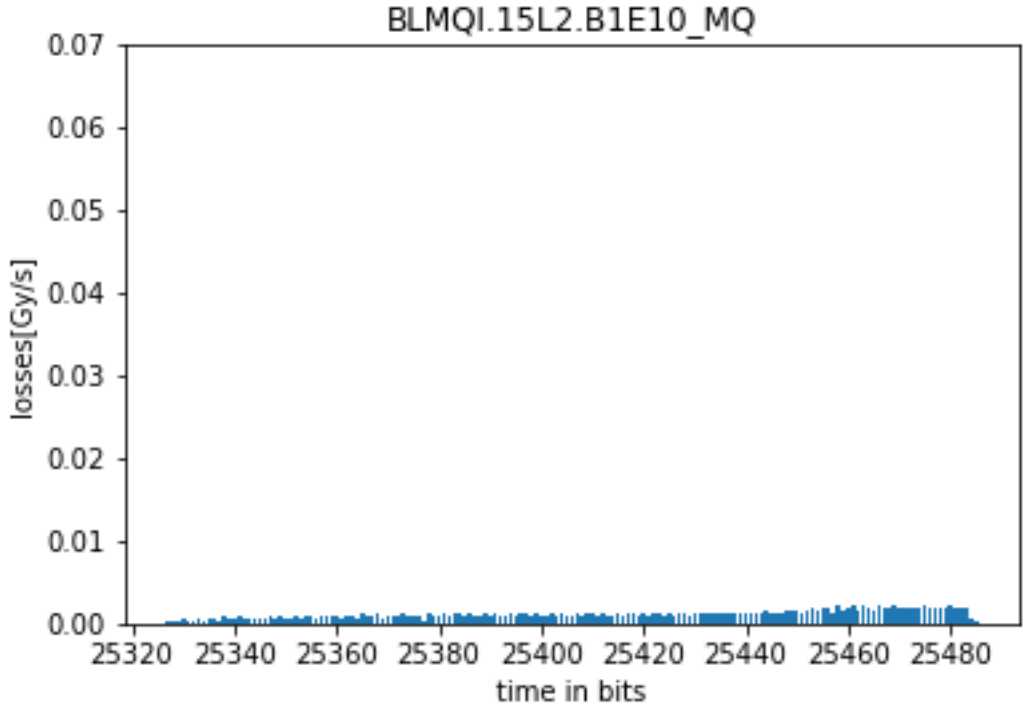
NORMALIZATION BLM !!!

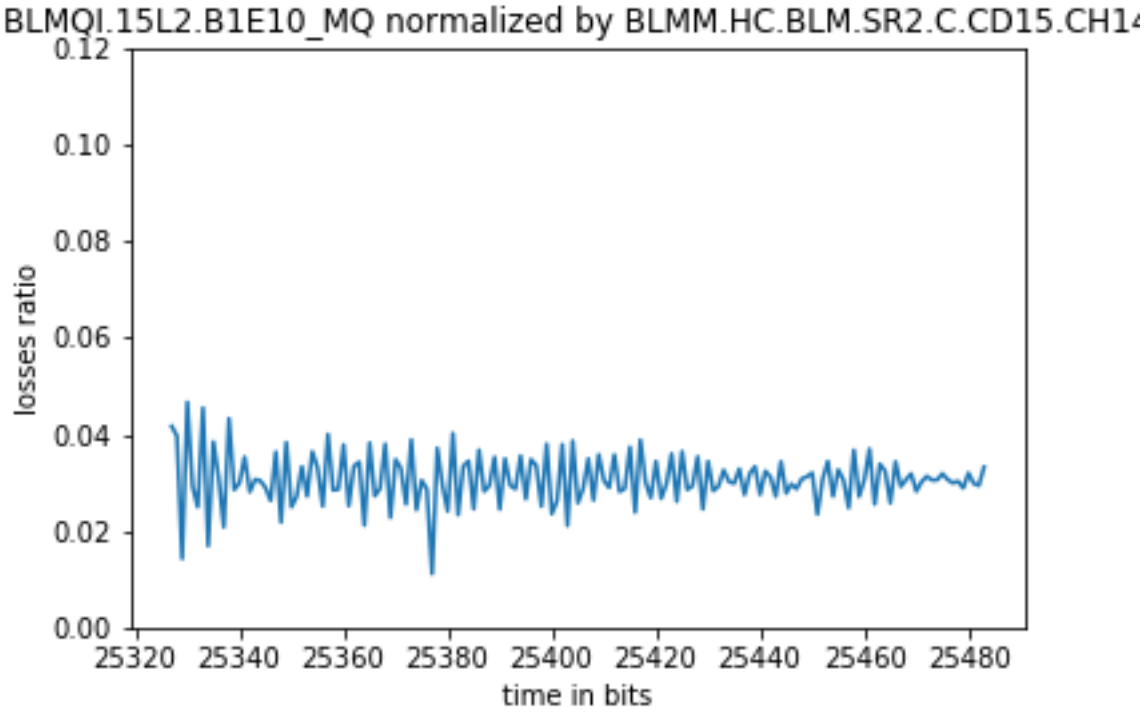

BLMM.HC.BLM.SR2.C.CD15.CH16
losses[Gy/s]
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
25350
25400
25450
25500
time in bits

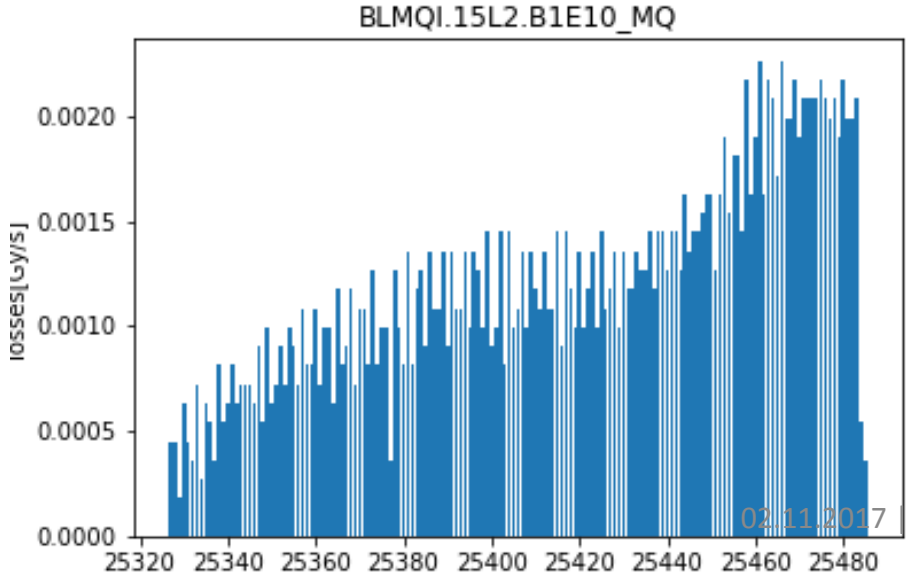

IM.HC.BLM.SR2.C.CD15.CH16 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.12
0.10
0.08
0.06
0.04
0.02
0.00
25320
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

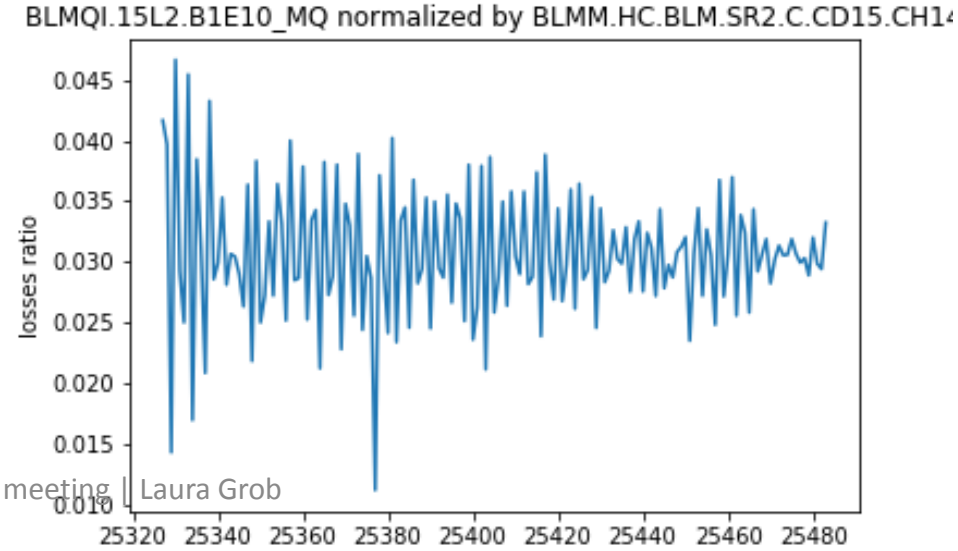

BLMM.HC.BLM.SR2.C.CD15.CH16
losses[Gy/s]
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
25350
25400
25450
25500
time in bits

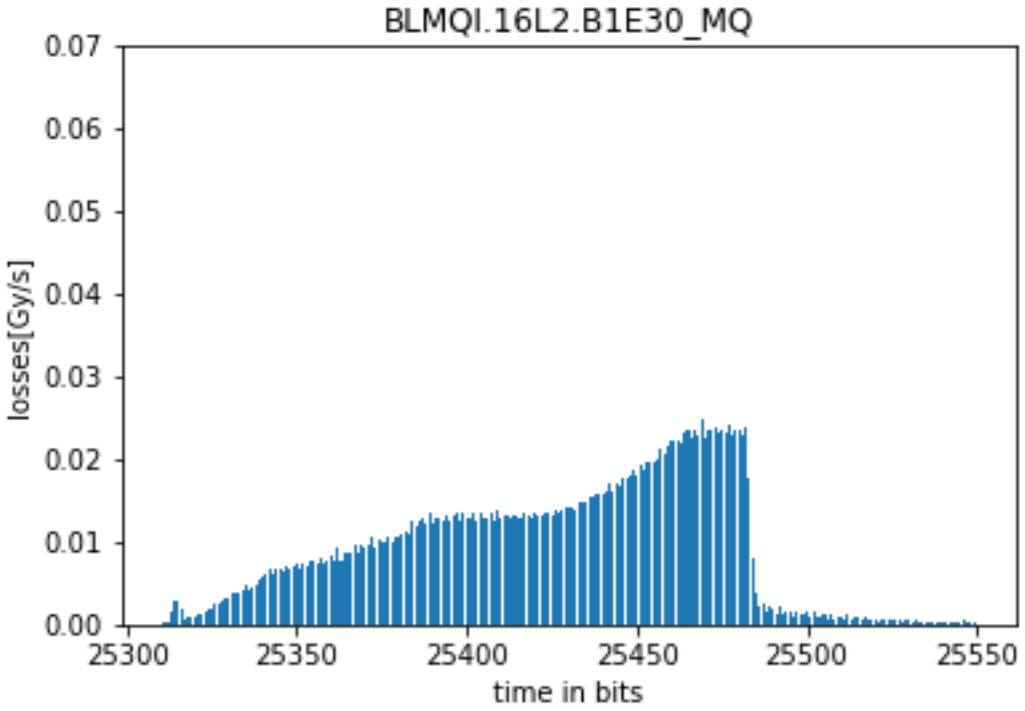

IM.HC.BLM.SR2.C.CD15.CH16 normalized by BLMM.HC.BLM.SR2.C.CD15.
losses ratio
0.25
0.20
0.15
0.10
0.05
25320
25340
25360
25380
25400
25420
25440
25460
25480
time in bits

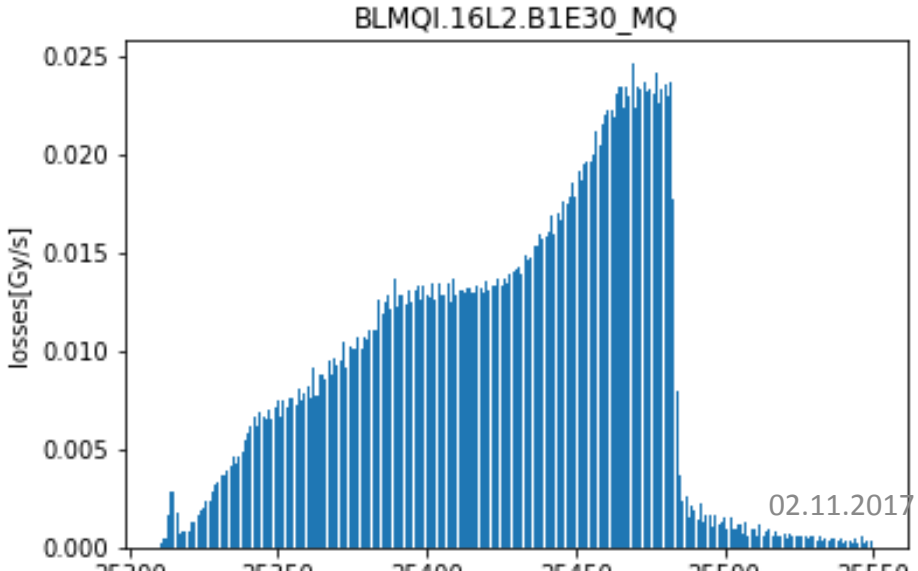

BLMQI.15L2.B1E10_MQ
losses[Gy/s]
time in bits

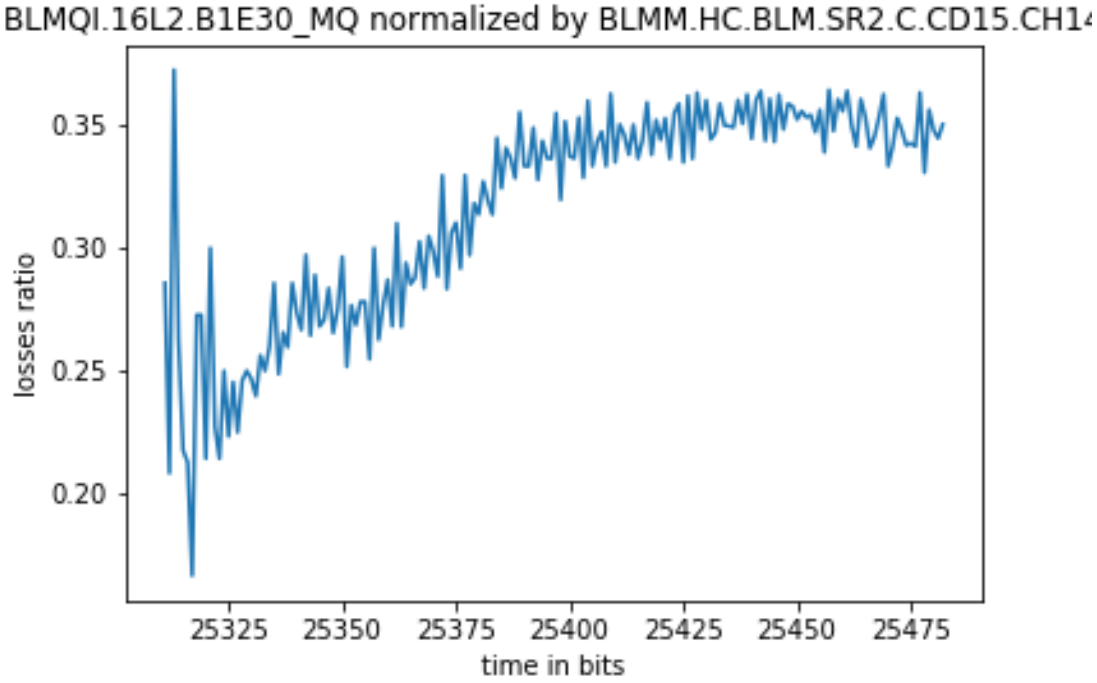

BLMQI.15L2.B1E10_MQ normalized by BLMM.HC.BLM.SR2.C.CD15.CH14
losses ratio
time in bits

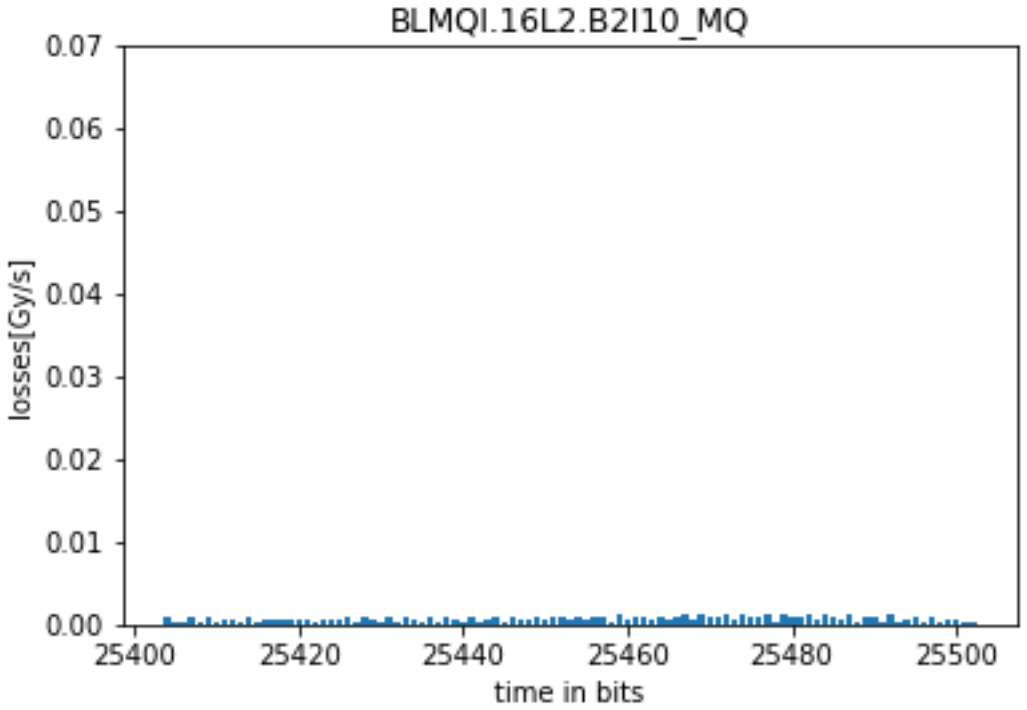

BLMQI.15L2.B1E10_MQ
losses[Gy/s]

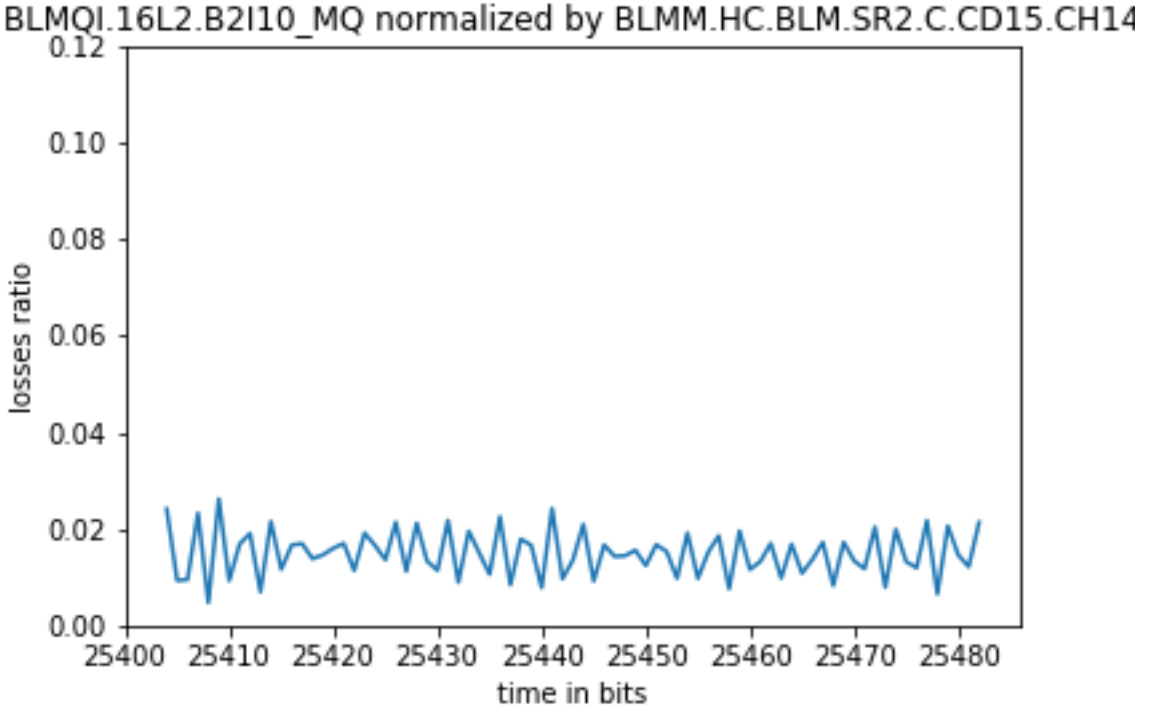

BLMQI.15L2.B1E10_MQ normalized by BLMM.HC.BLM.SR2.C.CD15.CH14
losses ratio

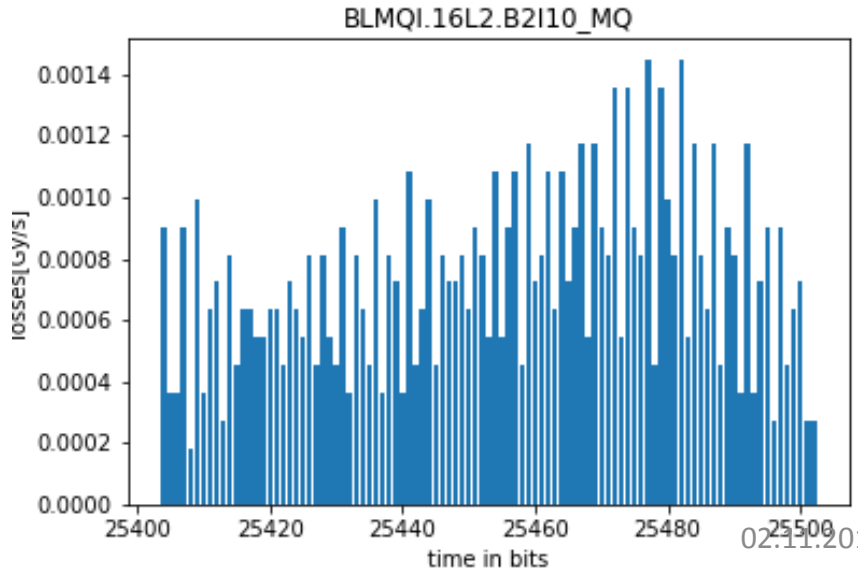

BLMQI.16L2.B1E30_MQ
losses[Gy/s]
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
25300
25350
25400
25450
25500
25550
time in bits

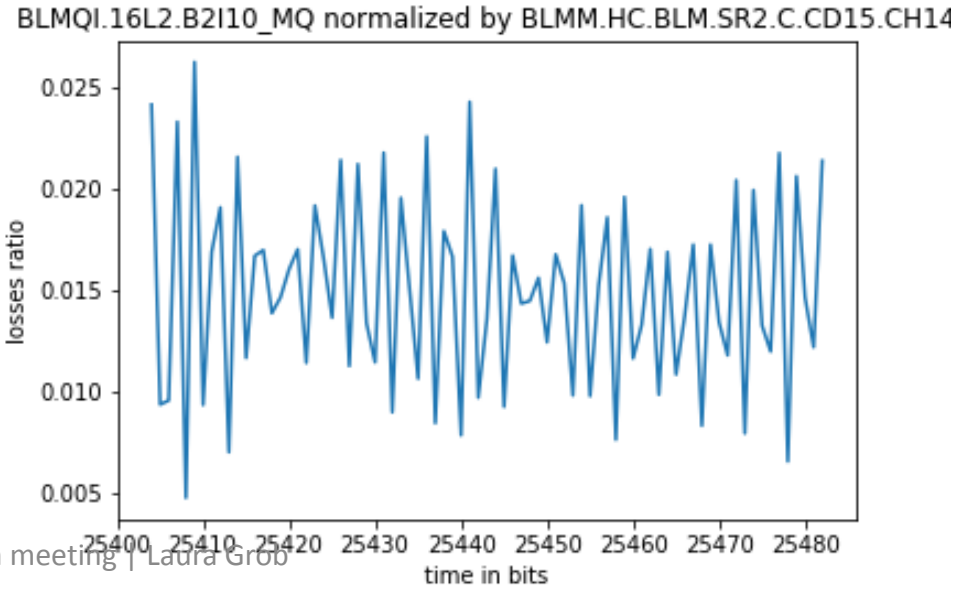

BLMQI.16L2.B1E30_MQ
losses[Gy/s]
0.025
0.020
0.015
0.010
0.005
0.000


BLMQI.16L2.B1E30_MQ normalized by BLMM.HC.BLM.SR2.C.CD15.CH1
losses ratio
0.35
0.30
0.25
0.20
25325
25350
25375
25400
25425
25450
25475
time in bits

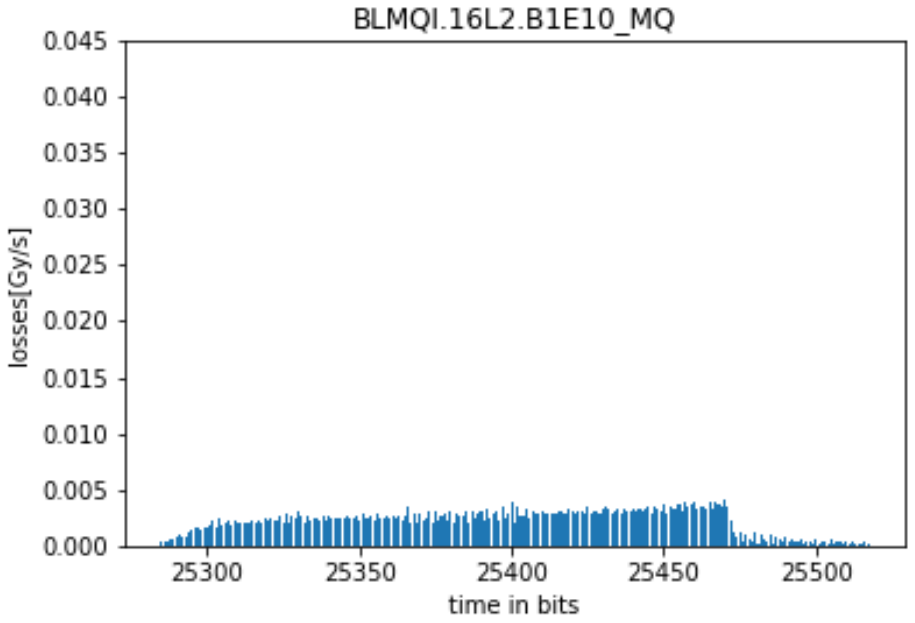

BLMQI.16L2.B2I10_MQ
losses[Gy/s]
time in bits

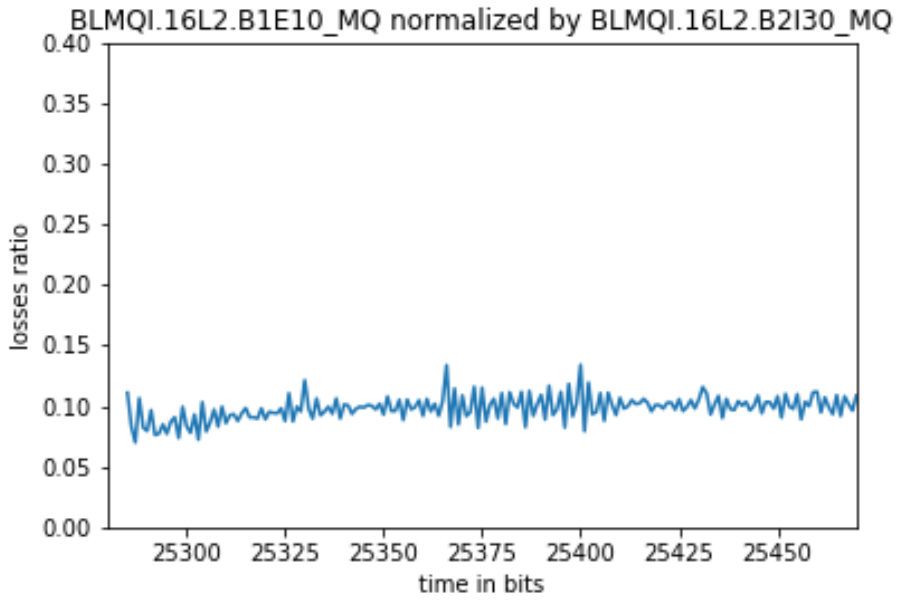

BLMQI.16L2.B2I10_MQ normalized by BLMM.HC.BLM.SR2.C.CD15.CH14
losses ratio
time in bits

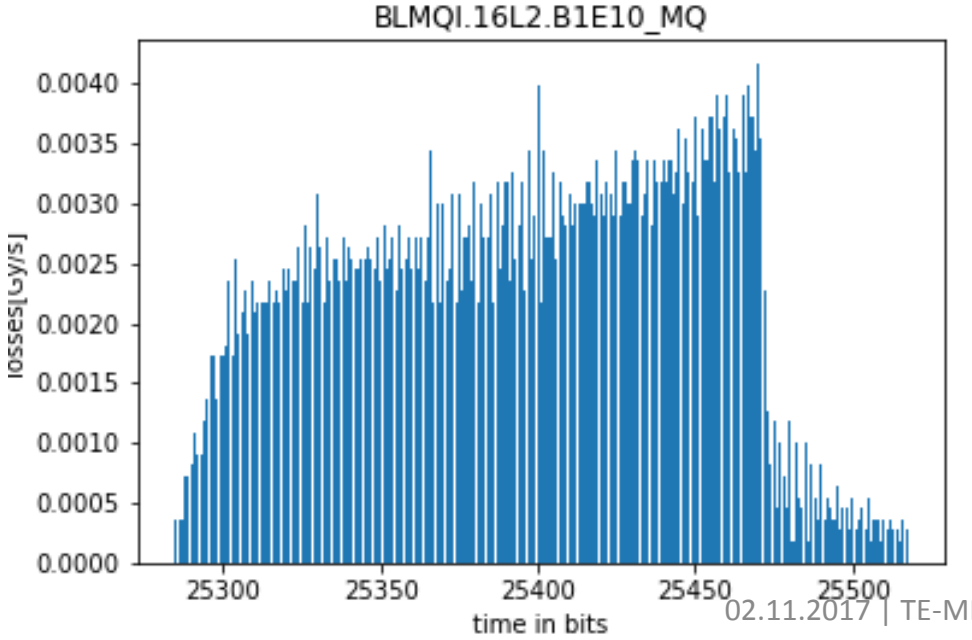

BLMQI.16L2.B2I10_MQ
losses[Gy/s]
time in bits

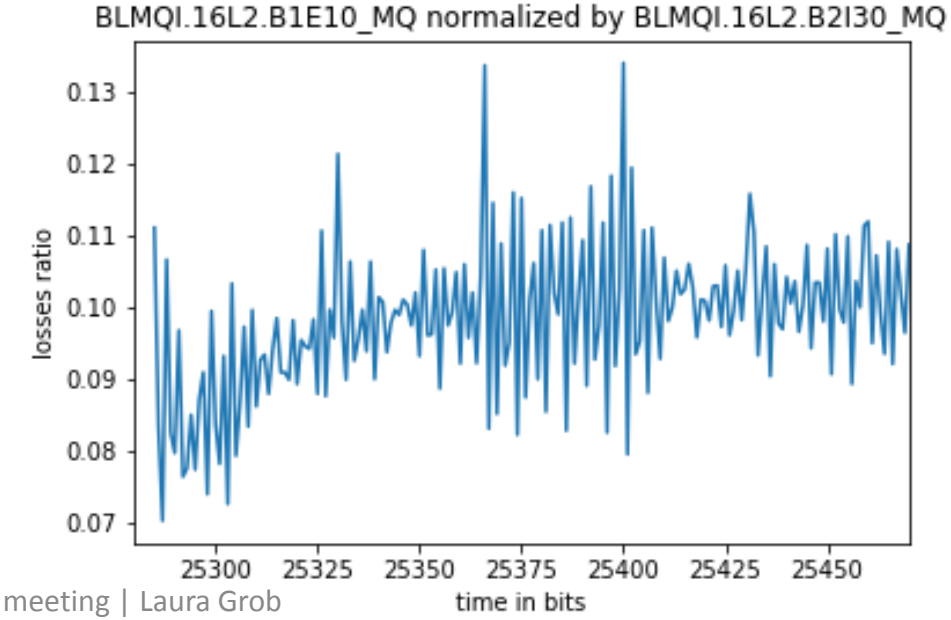

BLMQI.16L2.B2I10_MQ normalized by BLMM.HC.BLM.SR2.C.CD15.CH14
losses ratio
time in bits

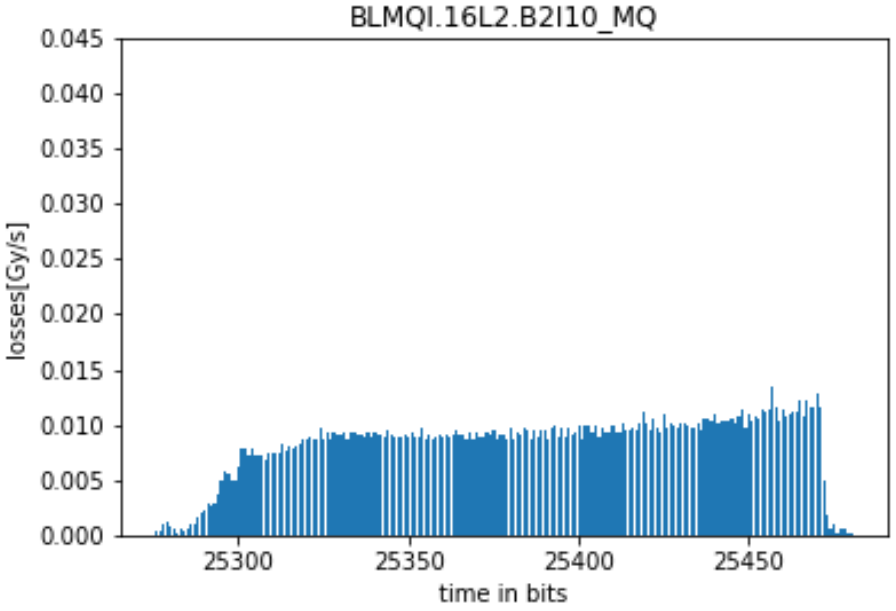
17-AUG-2017
5.03.55.45

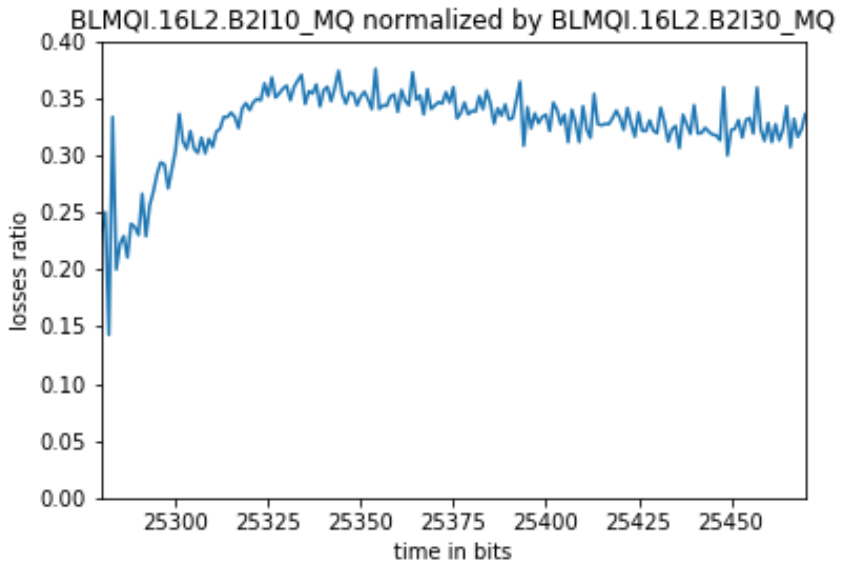

BLMQI.16L2.B1E10_MQ
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300
25350
25400
25450
25500
time in bits

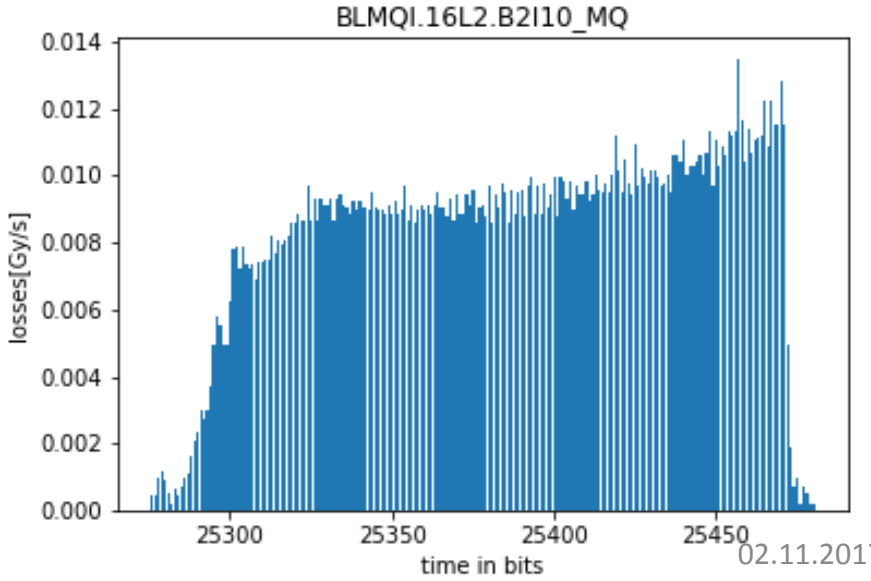

BLMQI.16L2.B1E10_MQ normalized by BLMQI.16L2.B2I30_MQ
losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300
25325
25350
25375
25400
25425
25450
time in bits

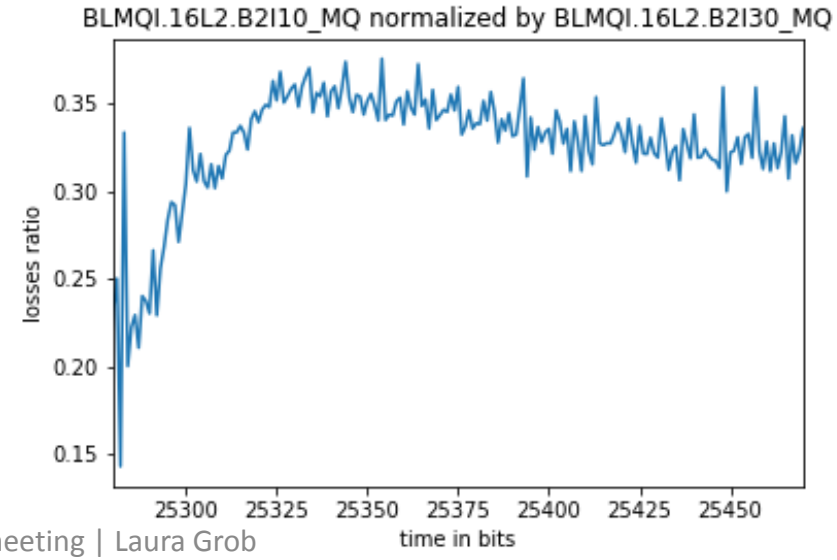

BLMQI.16L2.B1E10_MQ
losses[Gy/s]
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
25300
25350
25400
25450
25500
time in bits

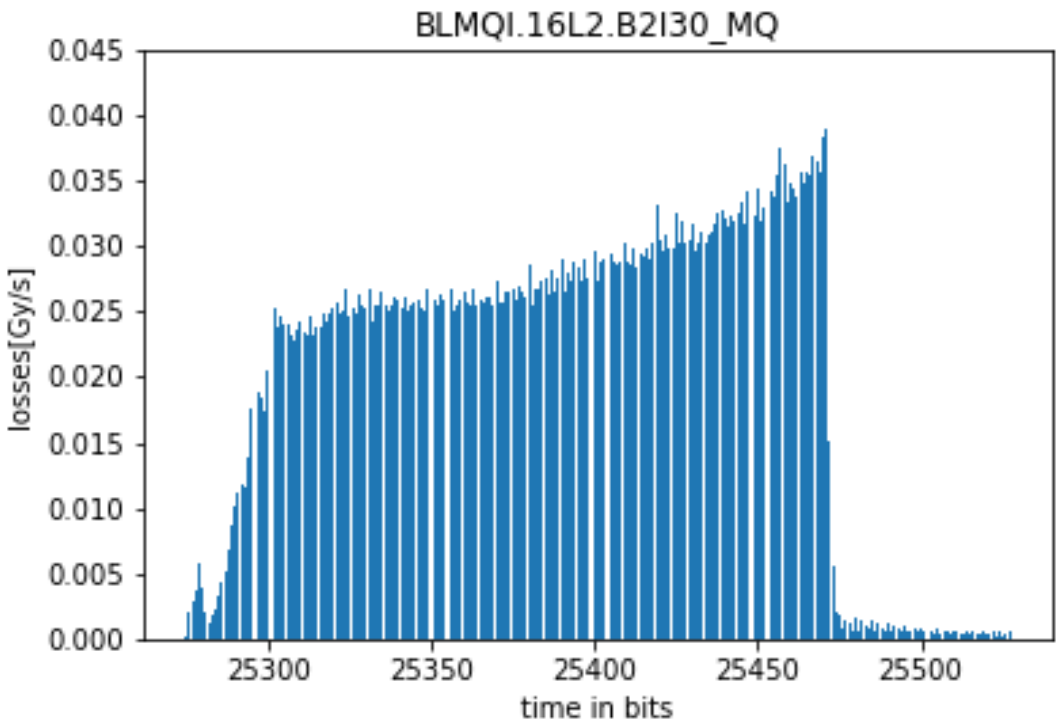

BLMQI.16L2.B1E10_MQ normalized by BLMQI.16L2.B2I30_MQ
losses ratio
0.13
0.12
0.11
0.10
0.09
0.08
0.07
25300
25325
25350
25375
25400
25425
25450
time in bits

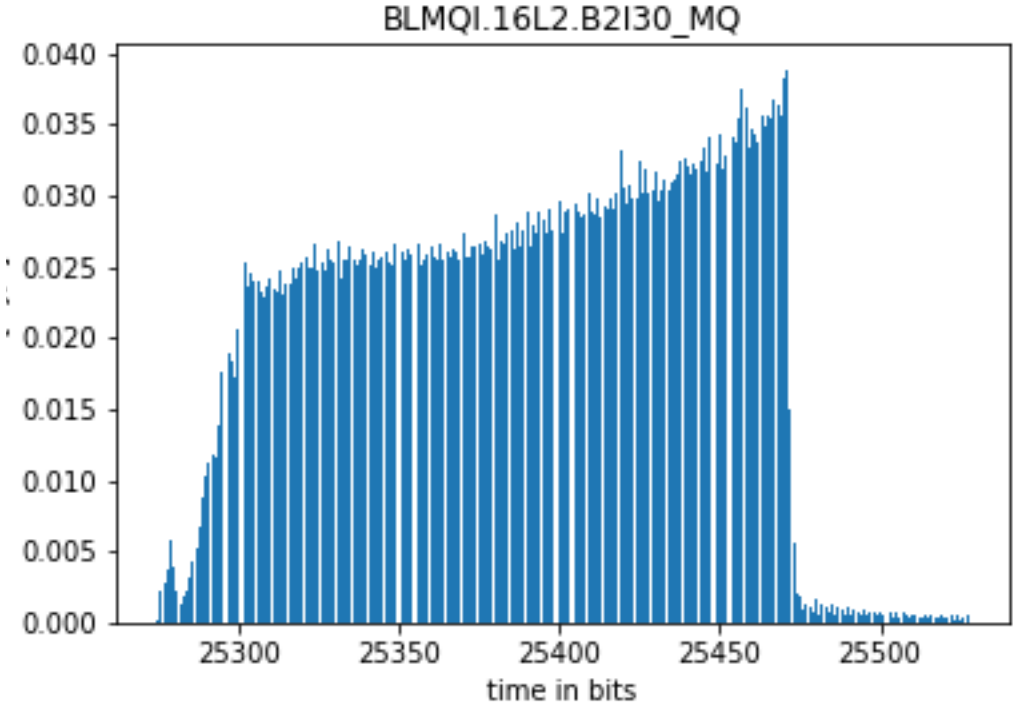

BLMQI.16L2.B2I10_MQ
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300
25350
25400
25450
time in bits


BLMQI.16L2.B2I10_MQ normalized by BLMQI.16L2.B2I30_MQ
losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300
25325
25350
25375
25400
25425
25450
time in bits

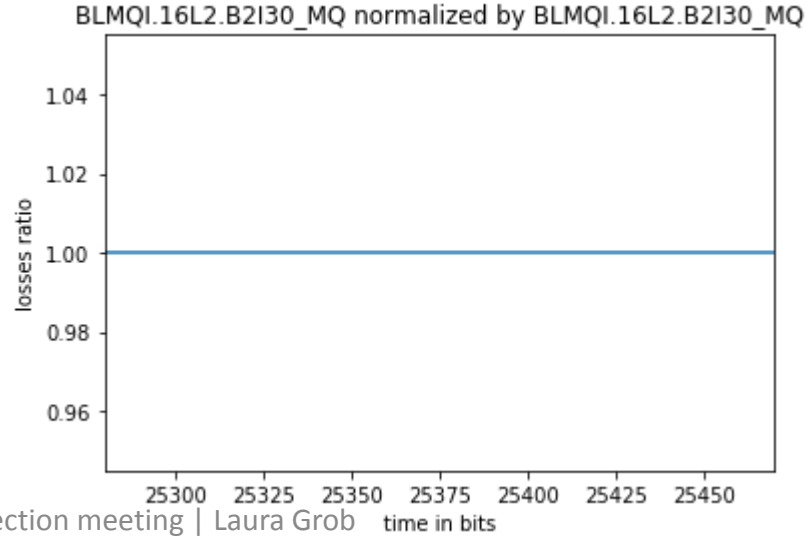

BLMQI.16L2.B2I10_MQ
losses[Gy/s]
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
25300
25350
25400
25450
time in bits

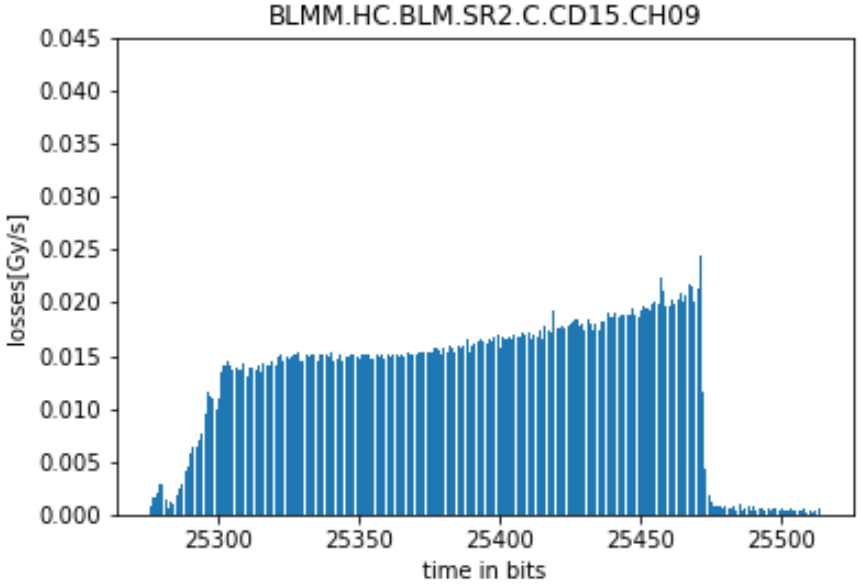

BLMQI.16L2.B2I10_MQ normalized by BLMQI.16L2.B2I30_MQ
losses ratio
0.35
0.30
0.25
0.20
0.15
25300
25325
25350
25375
25400
25425
25450
time in bits

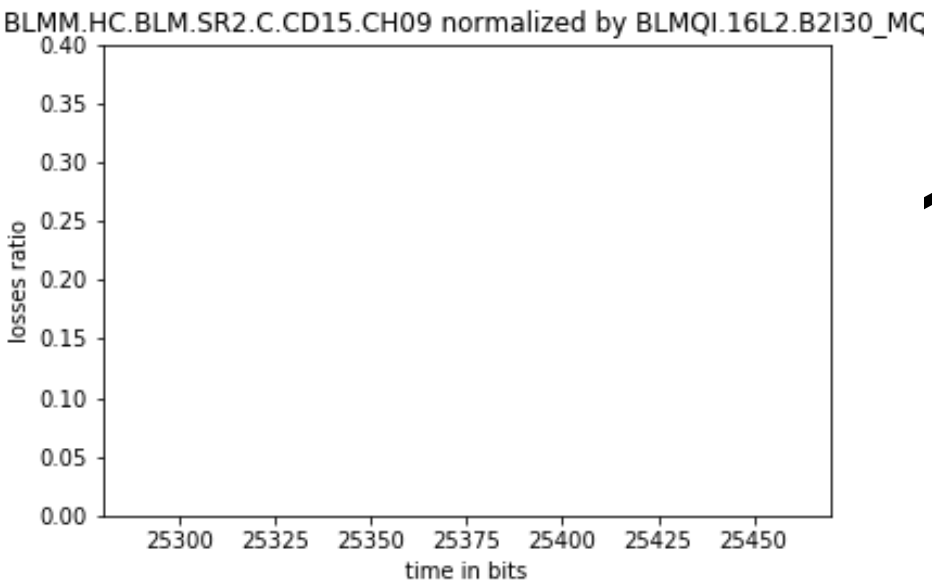


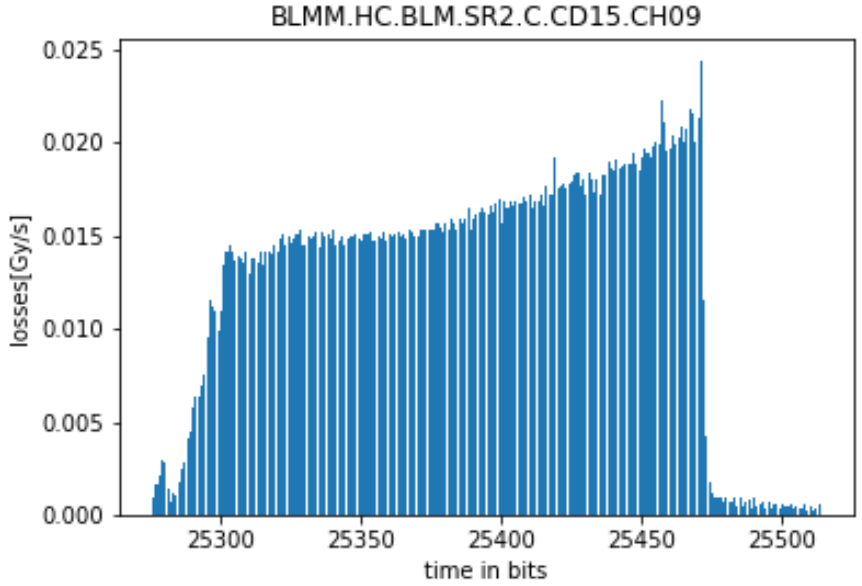


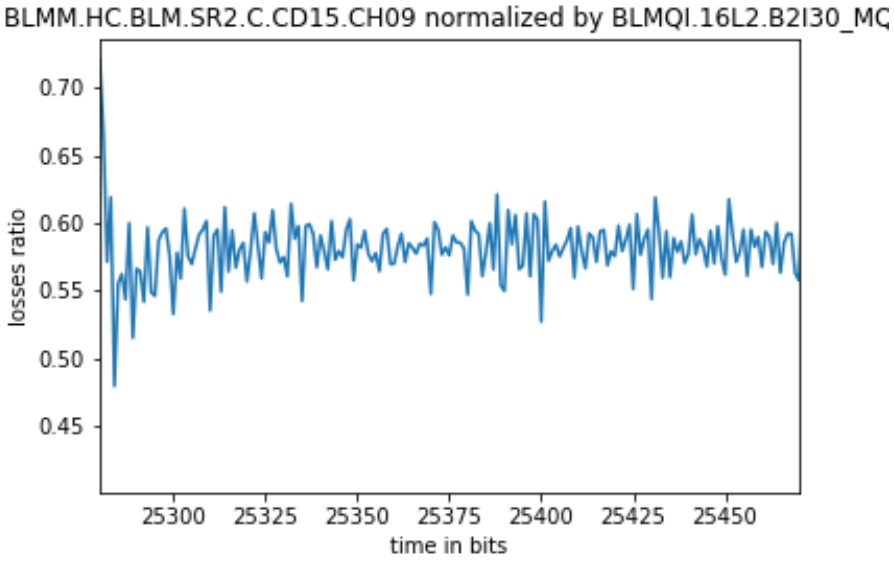
NORMALIZATION BLM !!!

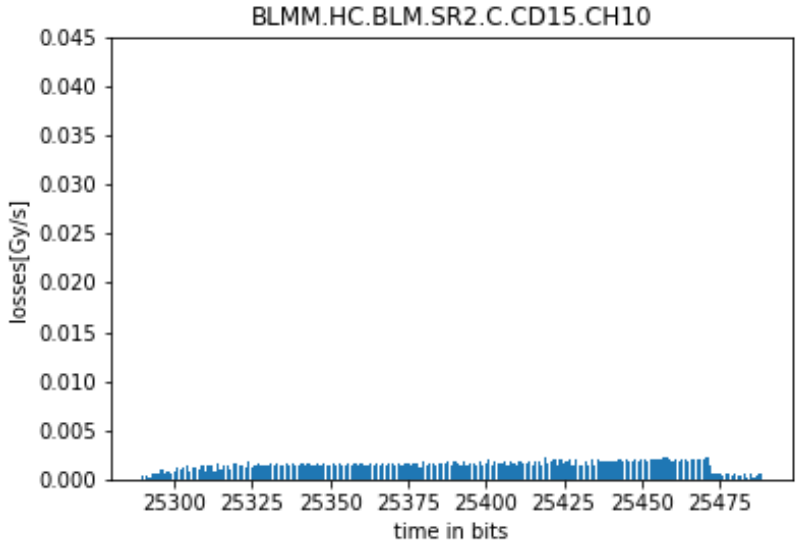


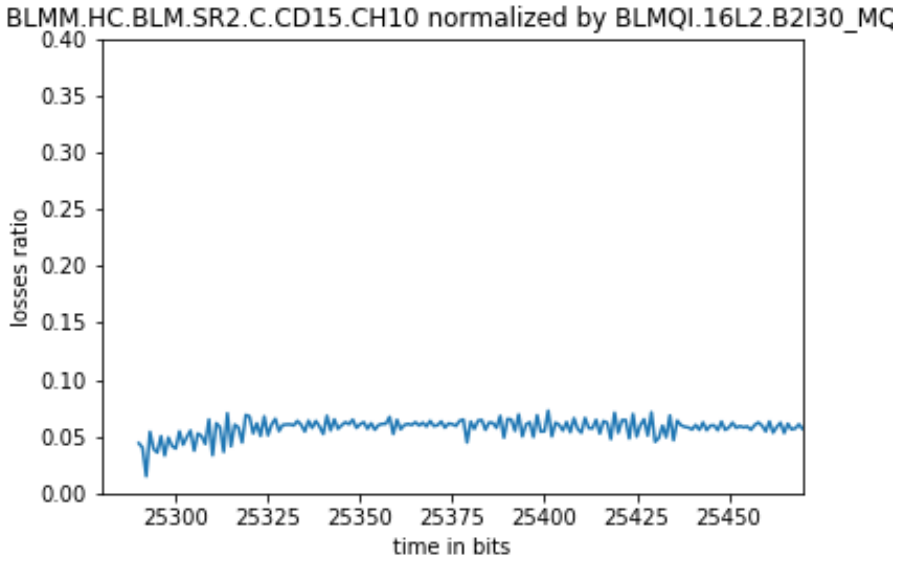

BLMM.HC.BLM.SR2.C.CD15.CH09
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300
25350
25400
25450
25500
time in bits

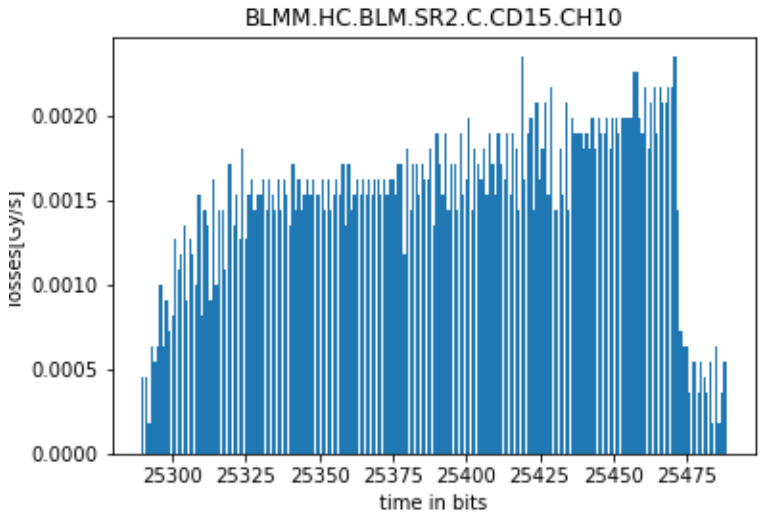

BLMM.HC.BLM.SR2.C.CD15.CH09 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300
25325
25350
25375
25400
25425
25450
time in bits

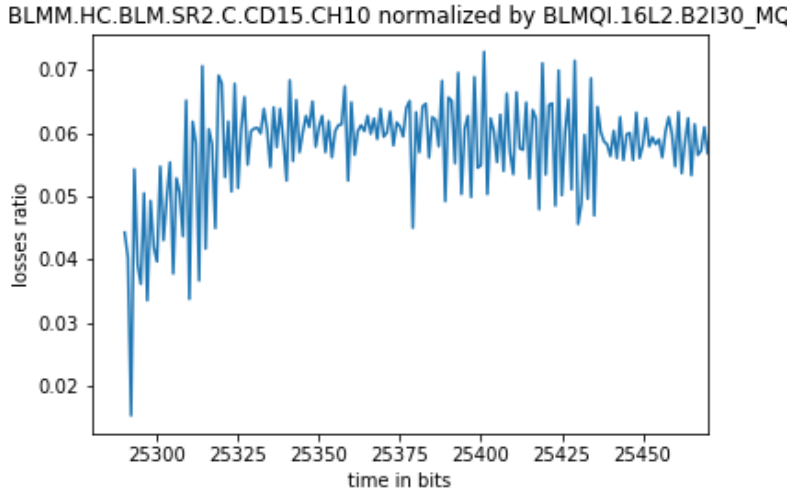

BLMM.HC.BLM.SR2.C.CD15.CH09
losses[Gy/s]
0.025
0.020
0.015
0.010
0.005
0.000
25300
25350
25400
25450
25500
time in bits

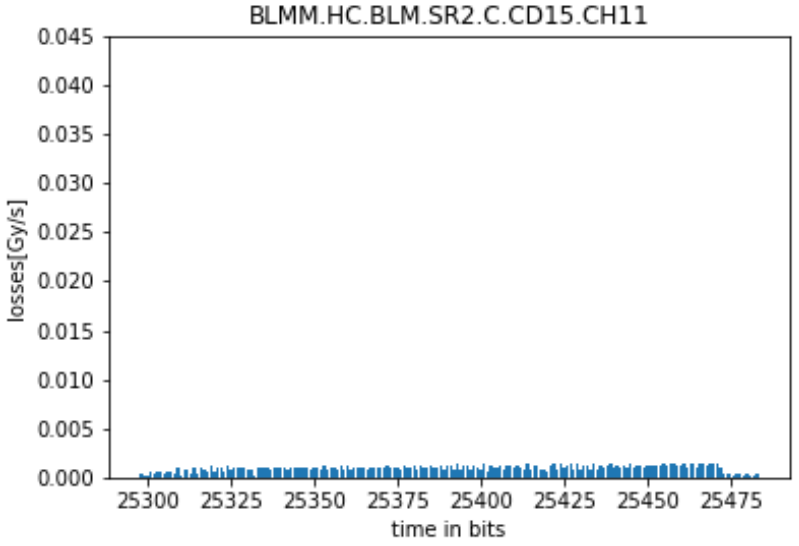

BLMM.HC.BLM.SR2.C.CD15.CH09 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.70
0.65
0.60
0.55
0.50
0.45
25300
25325
25350
25375
25400
25425
25450
time in bits

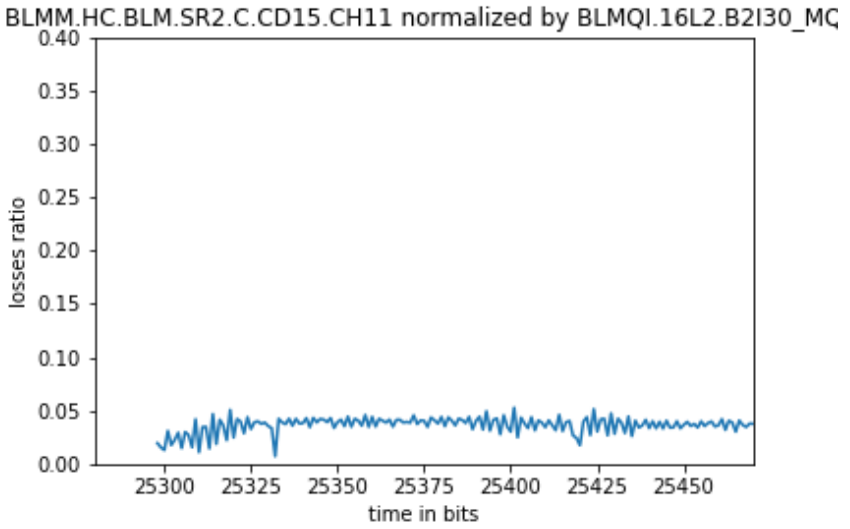

BLMM.HC.BLM.SR2.C.CD15.CH10
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

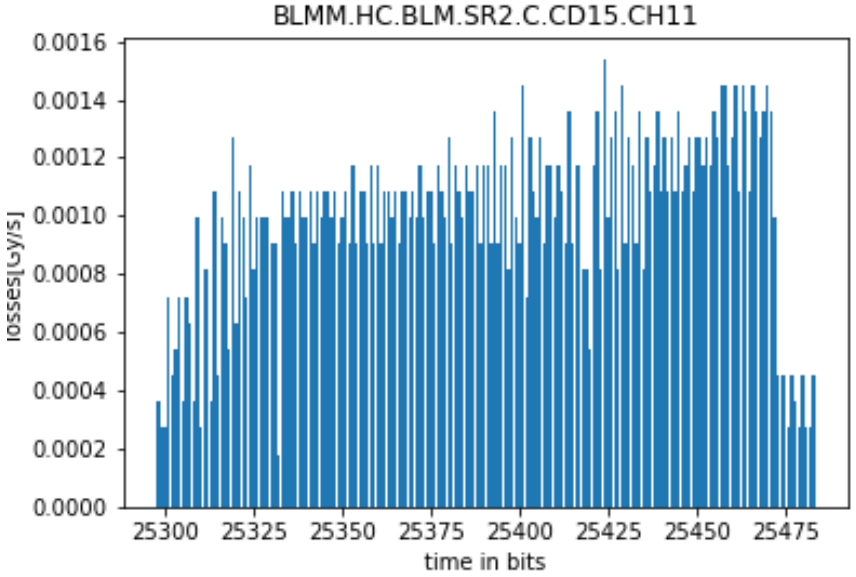

BLMM.HC.BLM.SR2.C.CD15.CH10 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300 25325 25350 25375 25400 25425 25450
time in bits

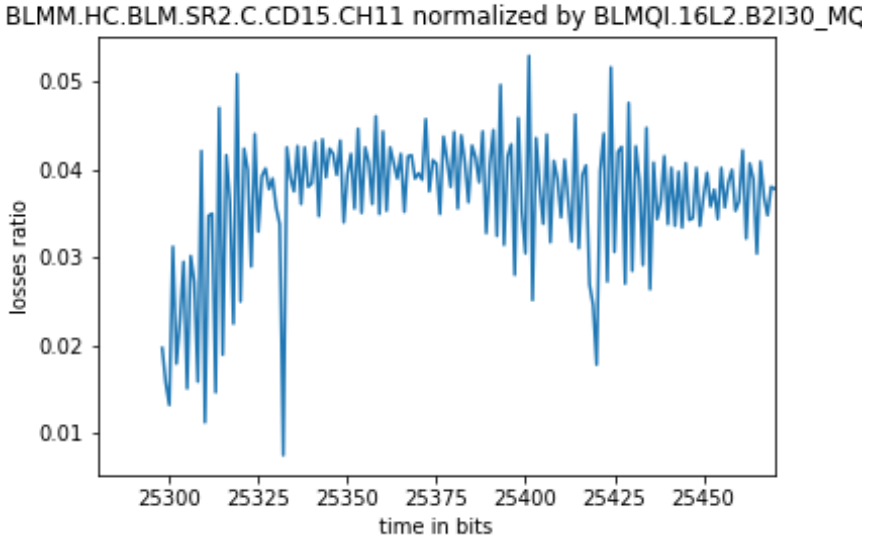

BLMM.HC.BLM.SR2.C.CD15.CH10
losses[Gy/s]
0.0020
0.0015
0.0010
0.0005
0.0000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

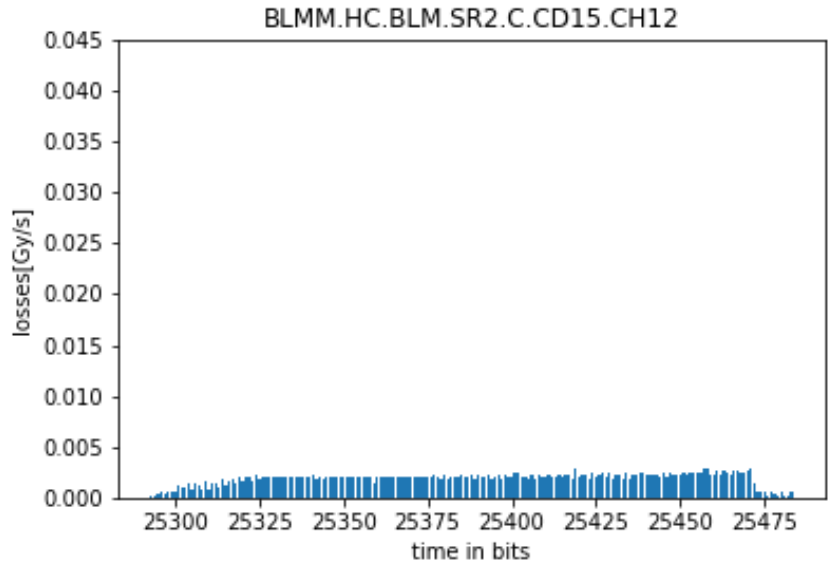

BLMM.HC.BLM.SR2.C.CD15.CH10 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.07
0.06
0.05
0.04
0.03
0.02
25300 25325 25350 25375 25400 25425 25450
time in bits

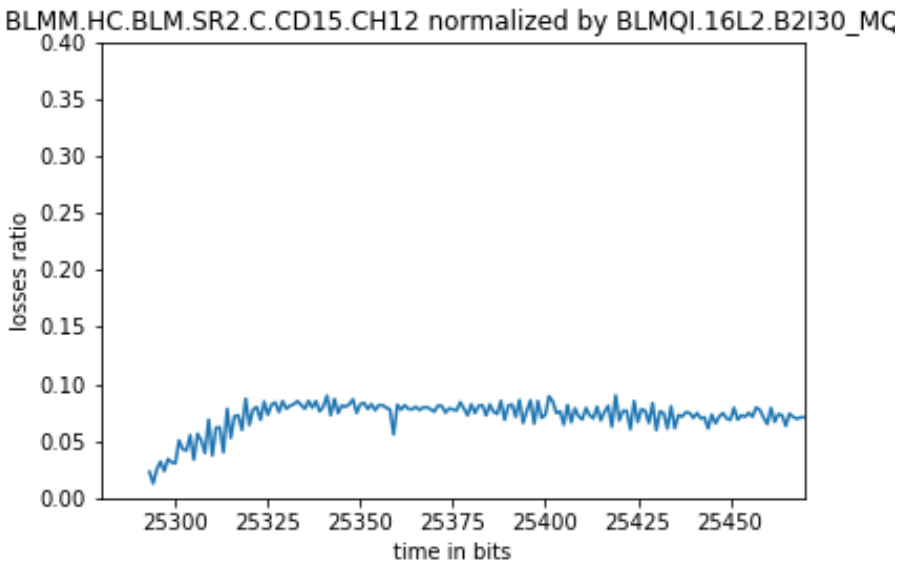

BLMM.HC.BLM.SR2.C.CD15.CH11
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

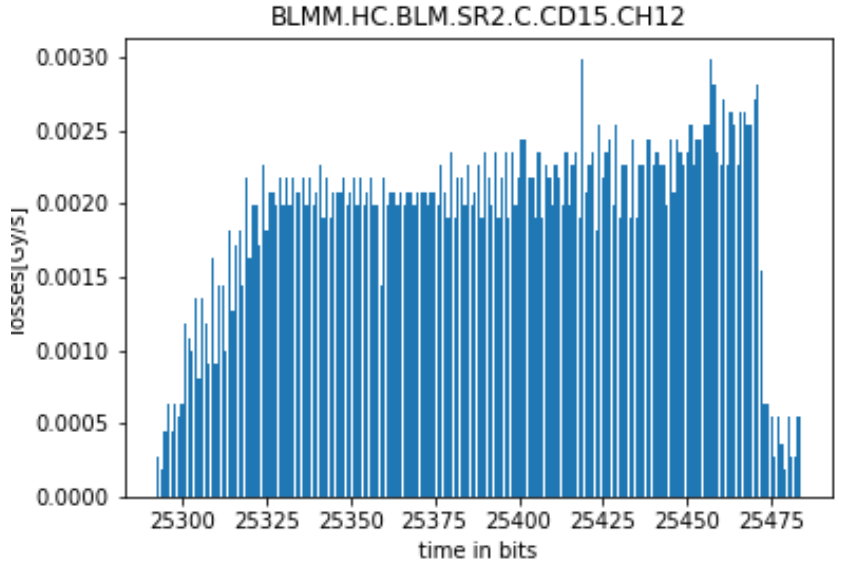

losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300 25325 25350 25375 25400 25425 25450
time in bits

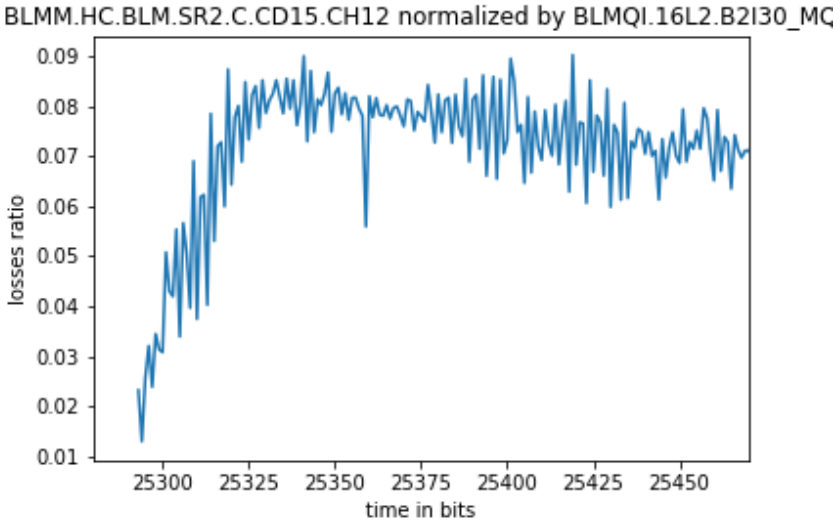

BLMM.HC.BLM.SR2.C.CD15.CH11
losses[Gy/s]
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

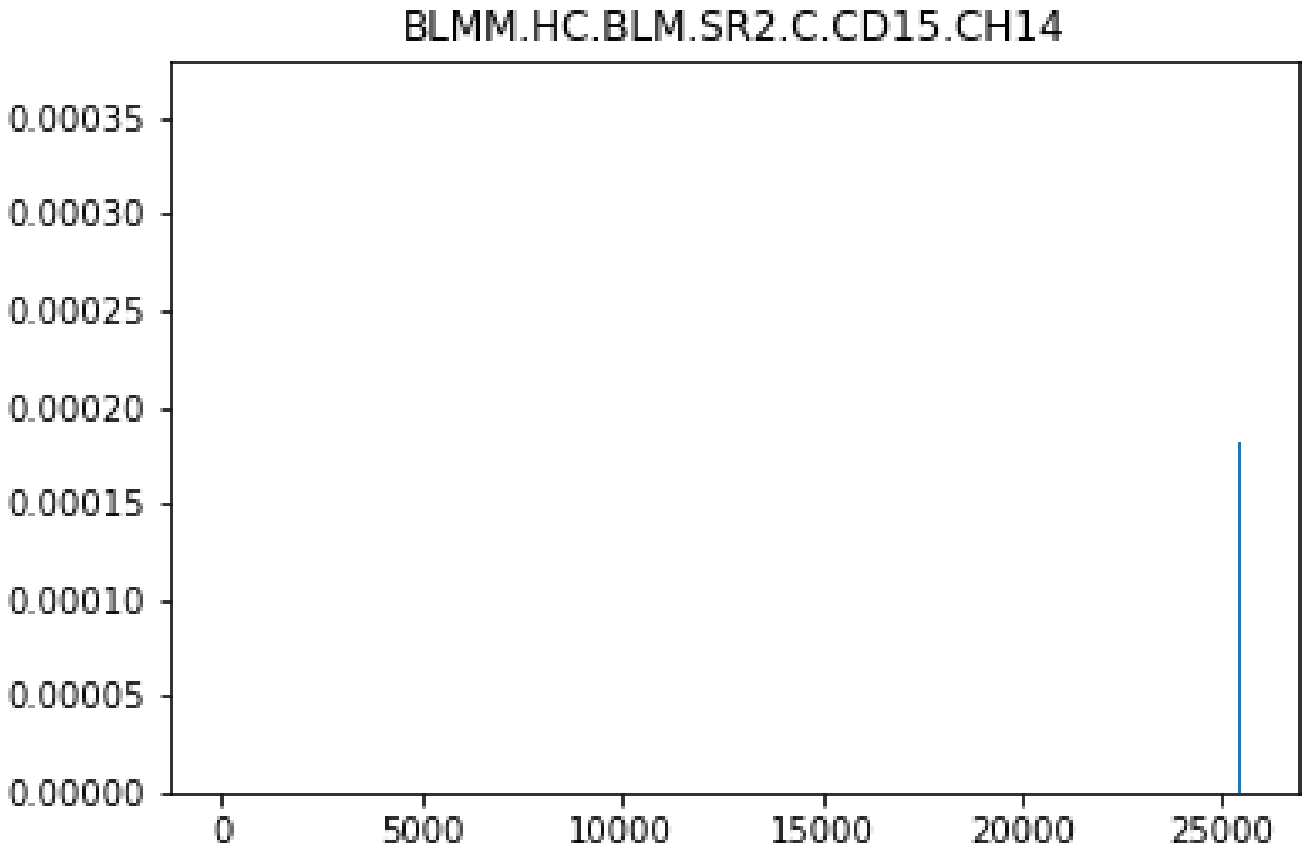

losses ratio
0.05
0.04
0.03
0.02
0.01
25300 25325 25350 25375 25400 25425 25450
time in bits

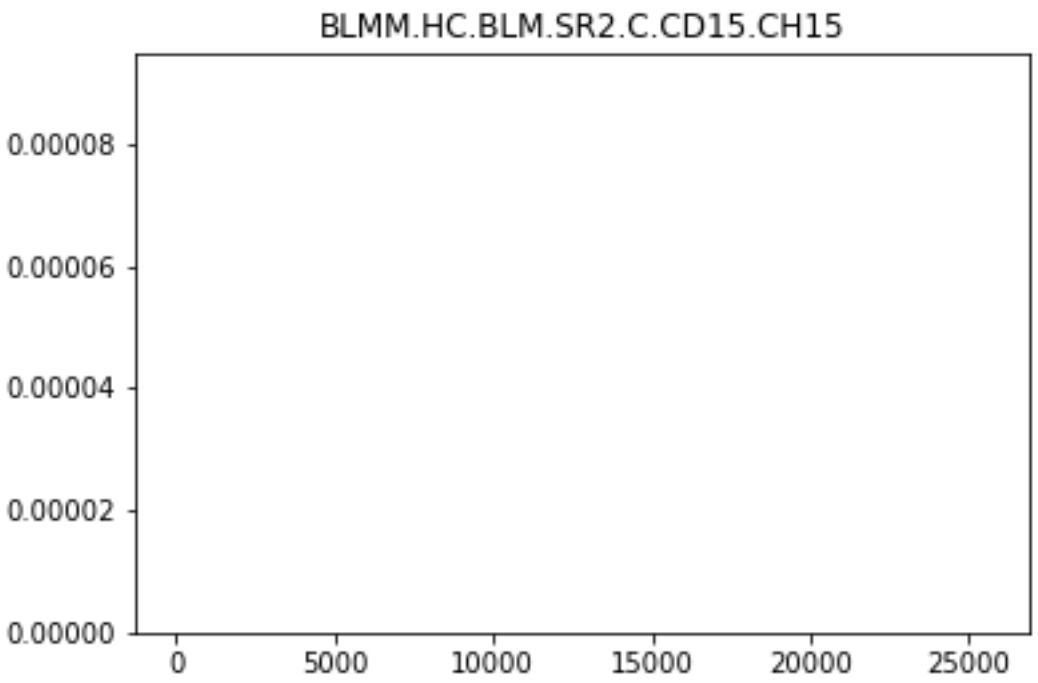

BLMM.HC.BLM.SR2.C.CD15.CH12
losses[Gy/s]
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

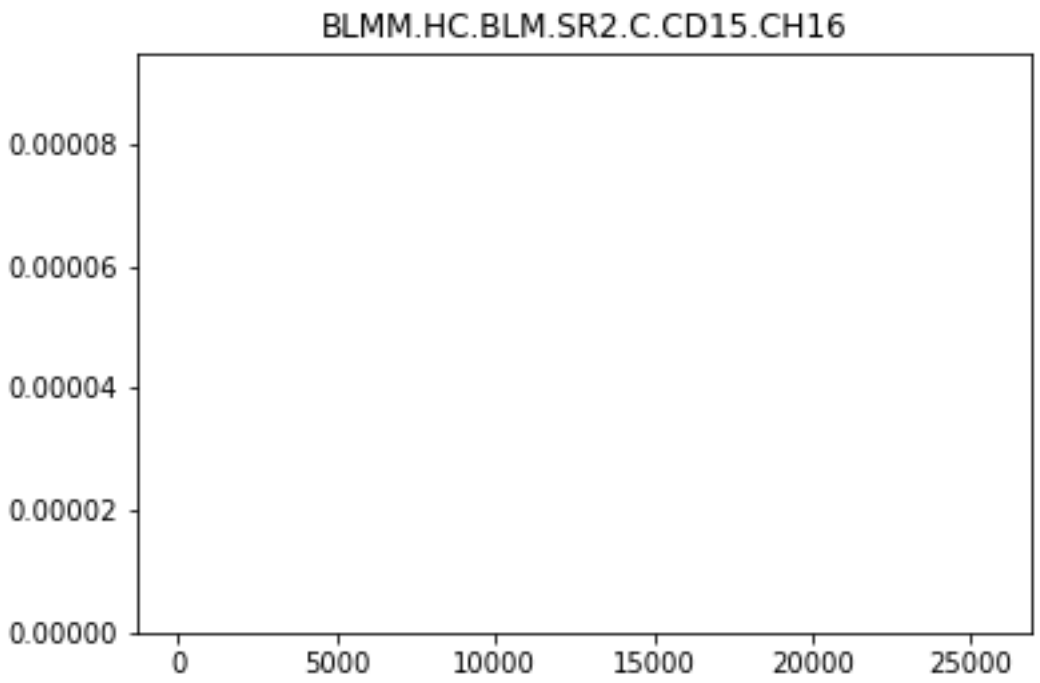

BLMM.HC.BLM.SR2.C.CD15.CH12 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
25300 25325 25350 25375 25400 25425 25450
time in bits

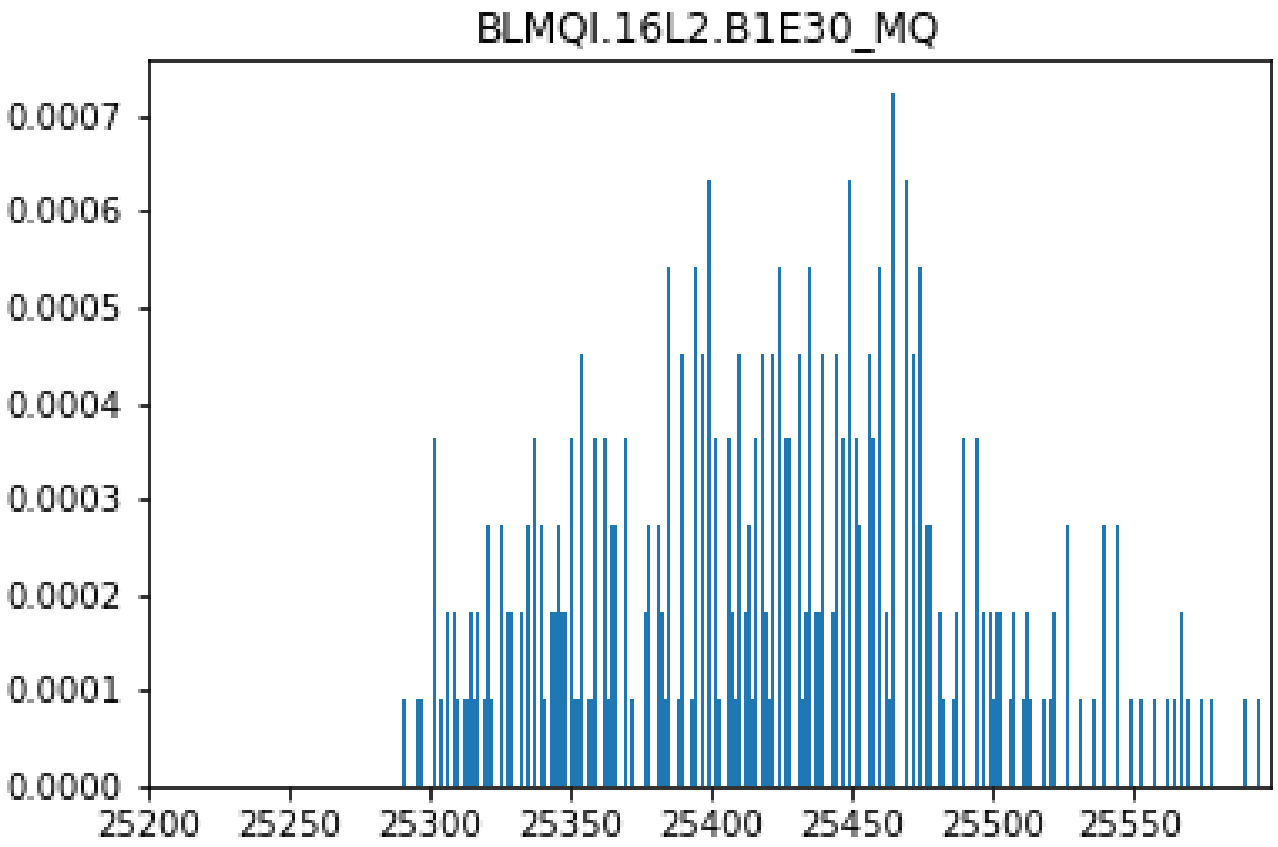

BLMM.HC.BLM.SR2.C.CD15.CH12
losses[Gy/s]
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
25300 25325 25350 25375 25400 25425 25450 25475
time in bits

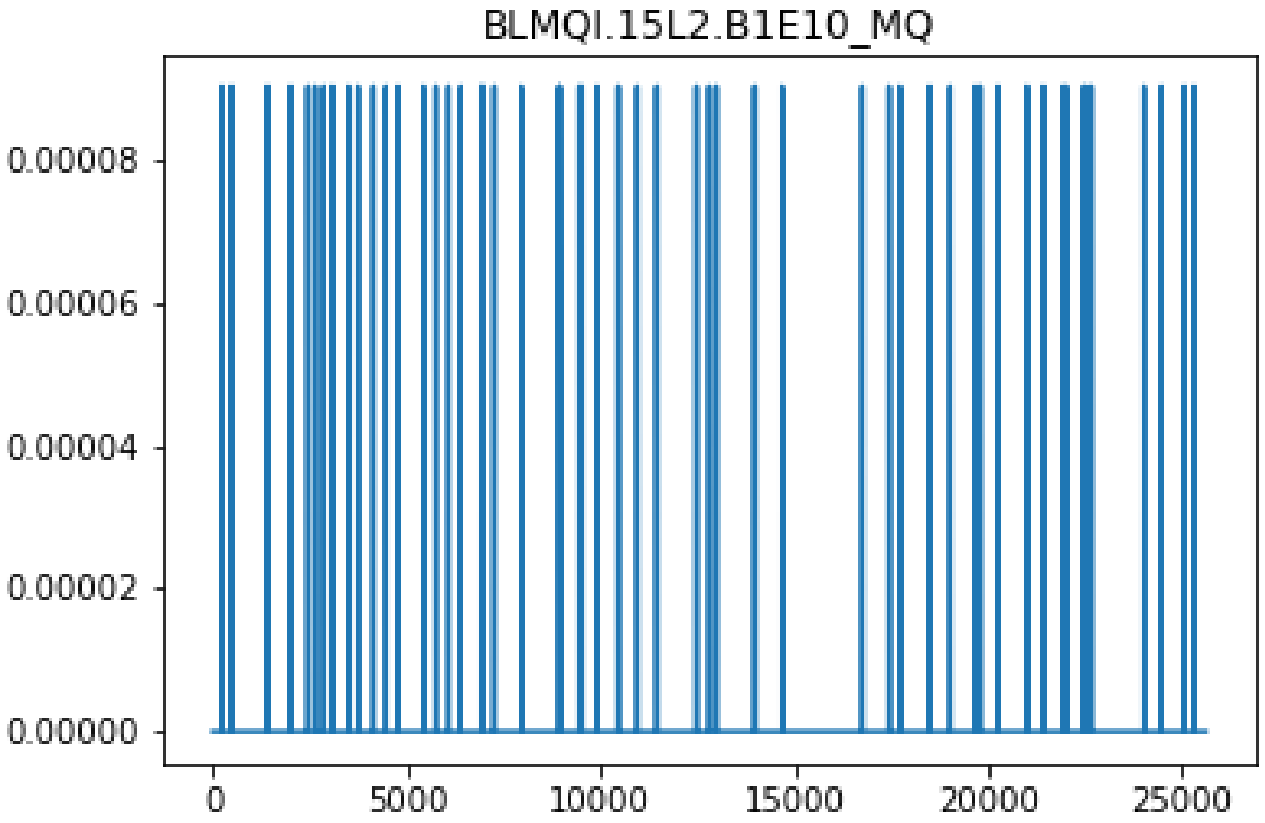

BLMM.HC.BLM.SR2.C.CD15.CH12 normalized by BLMQI.16L2.B2I30_MC
losses ratio
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
25300 25325 25350 25375 25400 25425 25450
time in bits

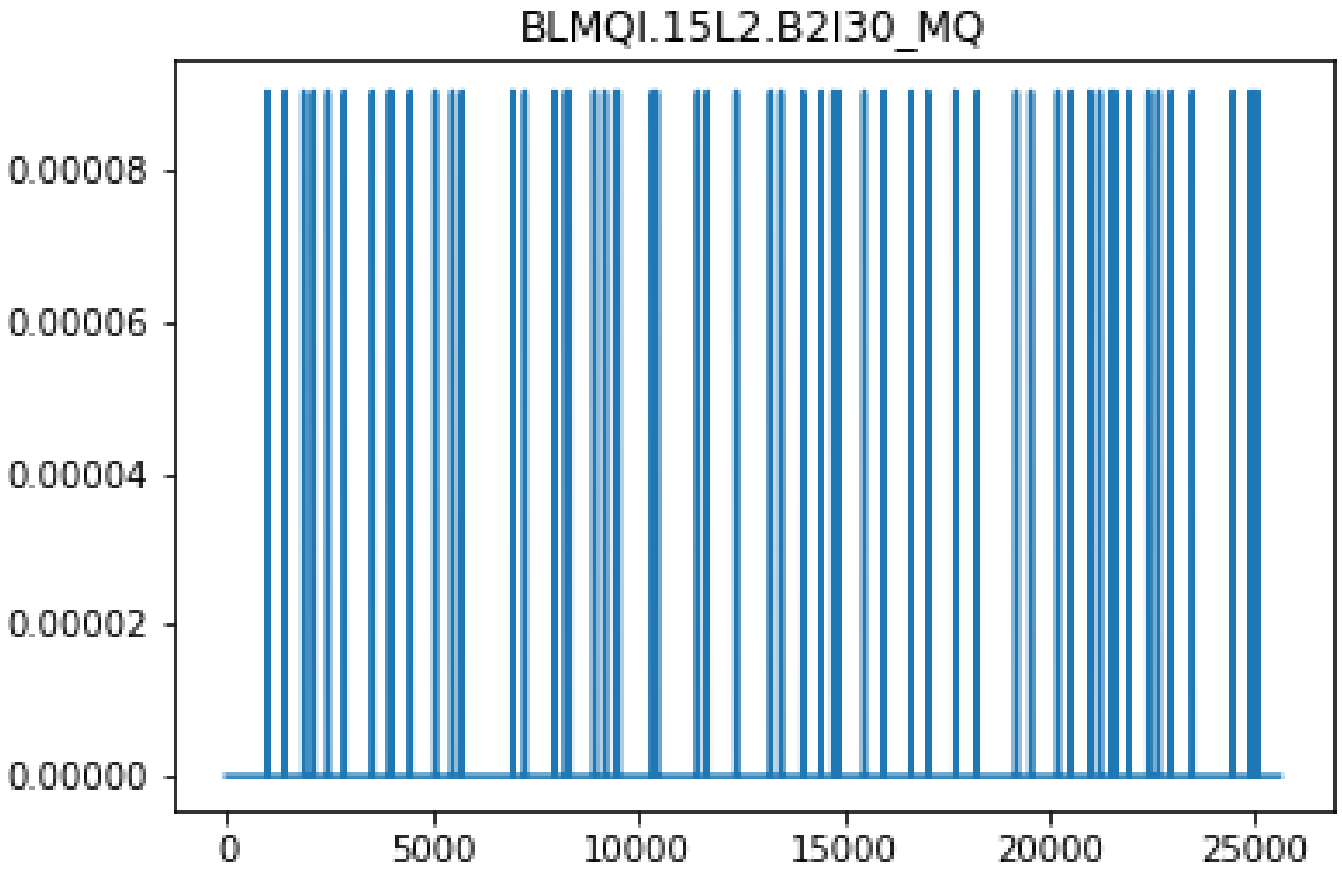

BLMM.HC.BLM.SR2.C.CD15.CH14
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
0
5000
10000
15000
20000
25000


BLMM.HC.BLM.SR2.C.CD15.CH15
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
25000


BLMM.HC.BLM.SR2.C.CD15.CH16
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
25000


BLMQI.16L2.B1E30_MQ
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
25200
25250
25300
25350
25400
25450
25500
25550


BLMQI.15L2.B1E10_MQ
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
25000


BLMQI.15L2.B2I30_MQ
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
25000