



# BLM Thresholds Changes in the EYETS 2016/2017

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On behalf of the BLM TWG

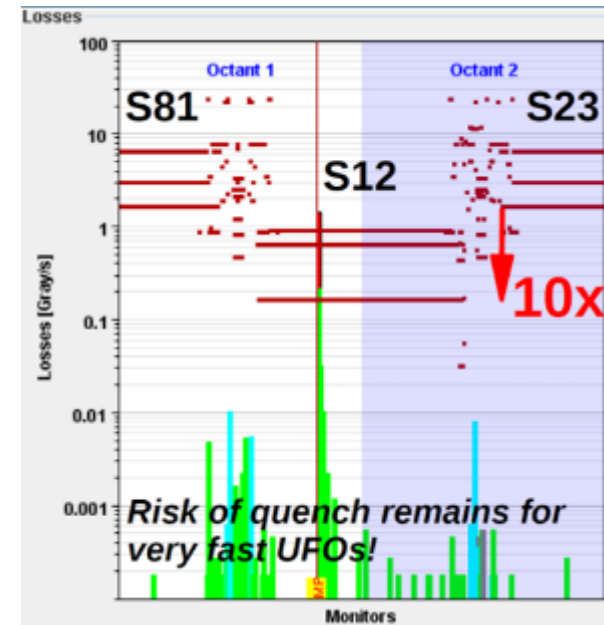
with valuable inputs from the experiment groups

# Introduction

- Five categories of the proposed threshold changes
  1. Reverting sector 1-2 BLM thresholds (309 BLMs)
  2. New thresholds for BLMs close to the ALICE experiment (3 BLMs)
  3. New thresholds for IPQ position 3 BLMs (64 BLMs)
  4. New BLMs at the new AFP RPs (2 BLMs)
  5. New BLMs at the new collimators in IR7 (3 BLMs)
- Implementation schedule

# Sector 1-2 BLMs

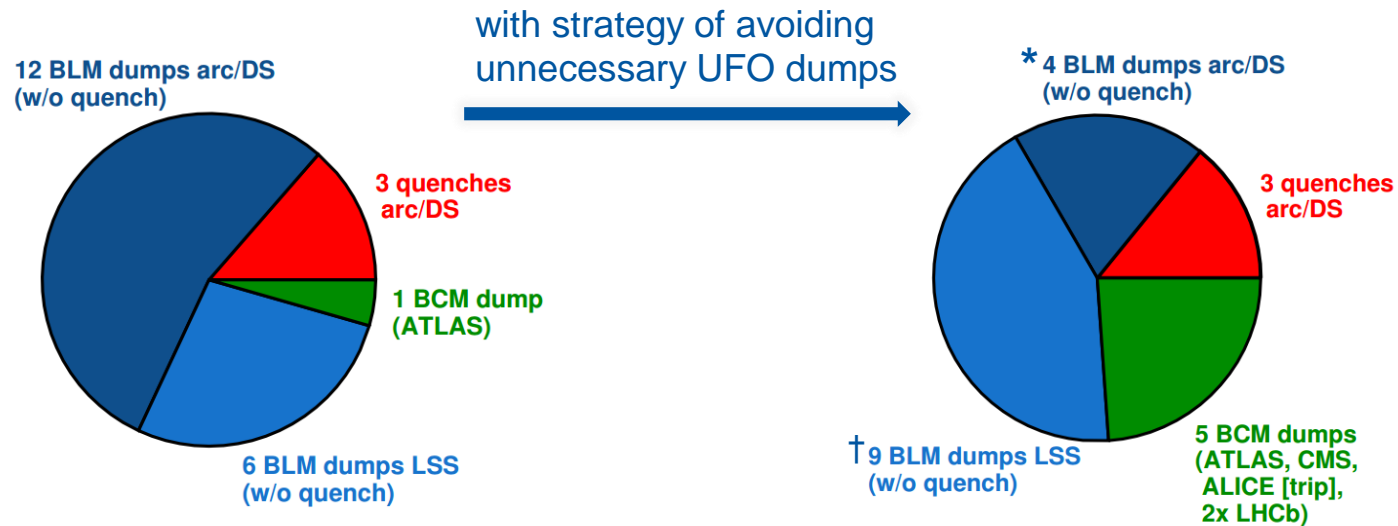
- August 2016, suspected inter-turn short in MB.A31L2:
  - to **reduce the probability of UFO induced quenches** in the ARC and DS of S12 for the MQ and MB
  - Applied thresholds 3x below the quench level, 10x lower than other sector's arc BLM (short losses up to 640  $\mu$ s)
  - Special families are created for the affected BLMs
- After replacement of MB.A31L2 during EYETS 16/17:
  - to **revert S12 BLM thresholds to avoid unnecessary UFO dumps** (consistent with other sectors' ARC/DS BLMs)
  - 3x above quench level for short losses up to 640  $\mu$ s, at quench level for longer period losses
  - BLMs will be moved back to their respective families, monitor factor changed to standard values



# UFO induced dumps and quenches

2015 (22 events - 700h SB)

2016 (21 events - 1800h SB)



\* 3 dumps in S12, after reducing the thresholds

† with the increased thresholds would have avoided 6 dumps before July

(low thresholds was necessary for MP3's MQM analysis on potential issues with symmetric quenches)

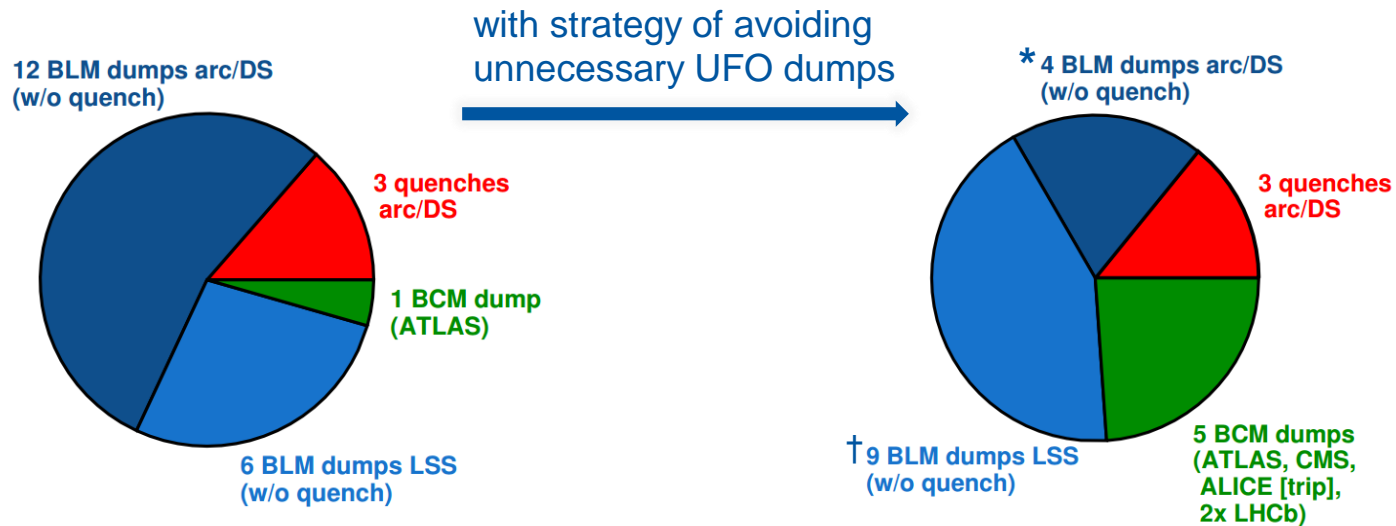
only 1 dump in L1 (a UFO-hot region, 4 dumps before increase) after threshold increased in July 2016

Plots and data courtesy of A. Lechner @2016 Evian workshop

# UFO induced dumps and quenches

2015 (22 events - 700h SB)

2016 (21 events - 1800h SB)



The “avoid UFO dump” strategy paid off in 2016

ARC/DS region

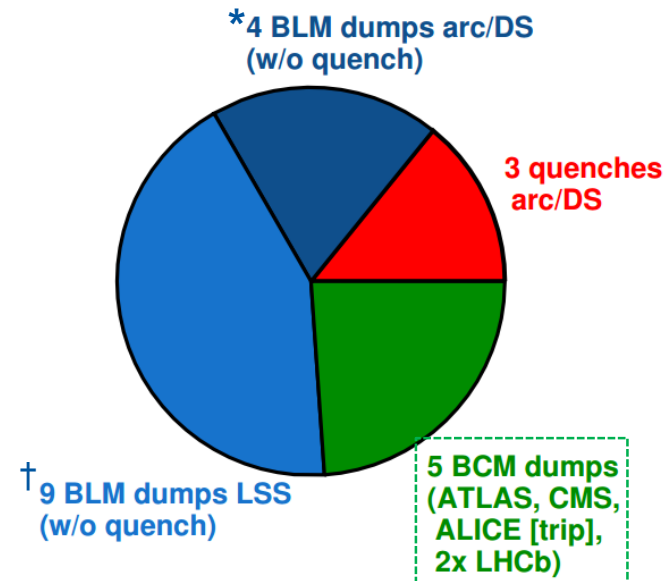
	Actual 2016	If we would have kept the 2015 threshold	If we would have applied a quench-preventing strategy a la S12 in all sectors
Dumps	4	11	71
Quenches	3	3	1 (UFO too fast)

Plots and data courtesy of A. Lechner @2016 Evian workshop

# UFO-induced BCM dumps

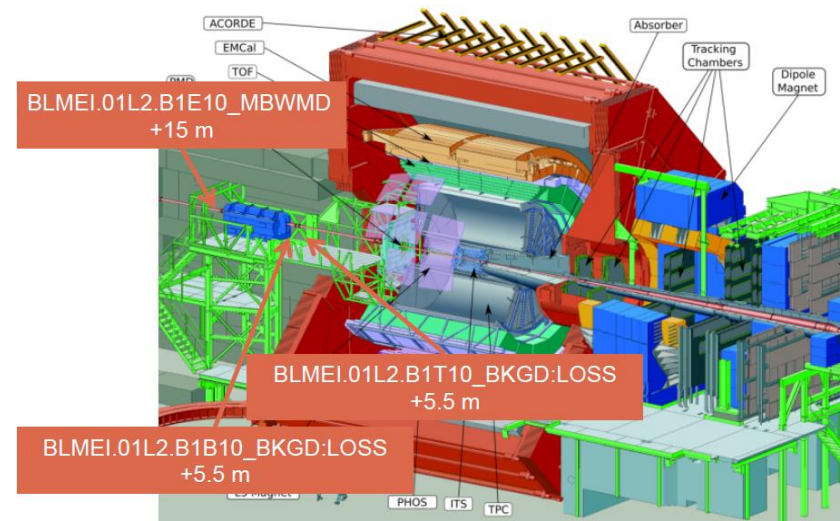
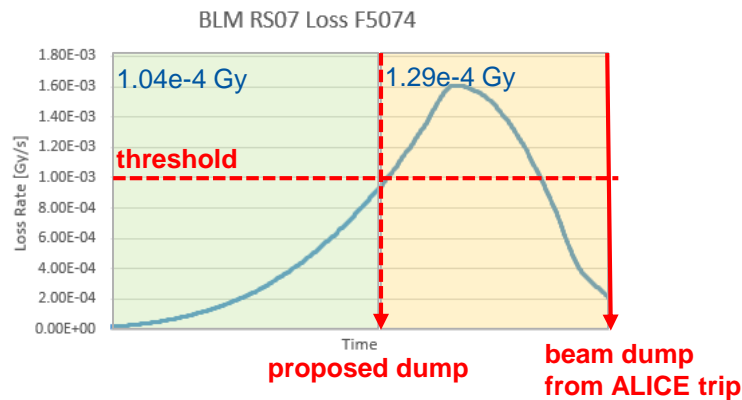
- Ring BLMs around experiments show small signals (<10% of thresholds) during the ATLAS (2015, 2016) and LHCb (2x 2016) BCM dumps
- A dedicated BLM TWG meeting with the experiments (Feb. 2017):
  - ATLAS confirmed there is little margin to increase the thresholds
  - **LHCb is investigating to adjust their BCM thresholds, which would require a modification of the firmware**
  - The CMS UFO dump gives 93% loss/thr. ratio in the triplet BLM
  - The ALICE UFO event tripped ALICE gaseous detectors and silicon pixel detectors

2016 (21 events - 1800h SB)



# Thresholds for 3 BLMs in ALICE cavern

- 3 BLMs installed in the ALICE cavern for monitoring purpose during LS1
  - 1 BLM on the compensator dipole, 2 next to the ALICE BCM
- Incident in 2016 (fill 5074):
  - Slow loss on TDI during an injection tripped TPC field cage
  - Loss duration out of BCM's integration range (40us ~ 1.28ms)
  - Based on the analysis of BLM data, the BLM RS07 (82ms) data would be able to dump the beam thus cut the dose on electronics

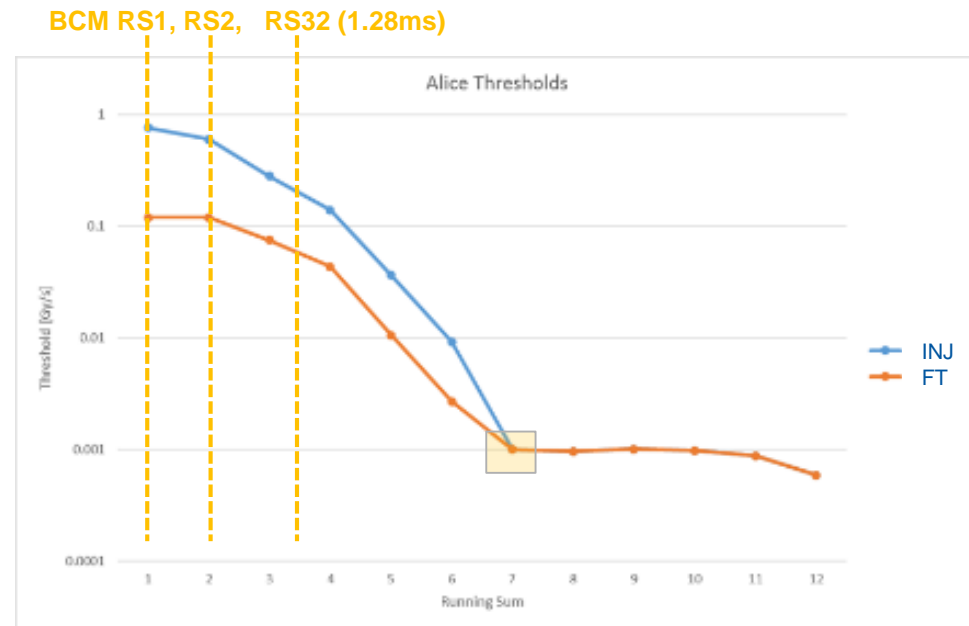


drawing courtesy of A. Alici



# Thresholds for 3 BLMs next to ALICE

- 2017 proposal – empirical thresholds:
  - **BLM thresholds consistent with BCM's thresholds up to 1.28 ms** (cross calibrated with BCM using shots on TDI in 2015)
  - **Based on BLM RS07 (~82ms) data from fill 5074** to define thresholds for RS07 - RS12
  - 3 BLMs will be **connected to BIS**
- New thresholds won't block normal beam operation
  - **No unnecessary warning/dump**, checked with 2016 all year data



# IPQ position 3 BLM (Q4-Q6, all IRs except IR3/7)

- Current situation:
  - Master thresholds at electronic maximum, monitor factor  $\neq 1$   
(Applied Thresholds = MT \* MF)
- 2017 proposal – empirical thresholds:
  - Position 3 families use **20x Position 1 Family MT**
  - Unified **MF = 0.333** for all IPQ families (except special BLMs related to injection loss)
- New thresholds are checked with 2016 beam loss data
  - Enough margin for normal beam operation, **no unnecessary warning/dump**



# AFP RP BLMs

- 2 new BLMs for the new AFP Roman pots in cell 6L1
  - The AFP RPs are symmetric with respect to IP1
  - Use the **same thresholds as 6R1** AFP RP BLMs (in operation since 2016)
  - Thresholds might need to be adjusted if the AFP RPs move closer to the beam in 2017 and trigger warnings

# BLM at collimators in IR7

- New low-impedance collimator in cell 4R7, B2:
  - BLM **renamed** to reflect new element: BLMEI.04R7.B2I10\_TCSPM.D4R7.B2
  - **Add to BIS\*, maskable at low intensity (MD)**
  - Use **electronics maximum** as applied threshold
- New crystal collimators in cell 4R7 and 6R7, B2:
  - 2 new BLMs installed next to the goniometers
  - Not connected to BIS, only monitoring purpose

\* TCSPM will always be open during beam operation except for MD, jaws position are interlocked, jaws reach limit will trigger beam dump.

# Conclusion & Implementation

- 5 category of changes:
  1. Revert S12 arc/DS BLMs thresholds from quench-preventing to avoid UFO dumps (309 BLMs in 13 families)
  2. new ALICE BLM thresholds (3 BLMs, all add to BIS)
  3. new IPQ P3 BLM thresholds (64 BLMs in 3 families)
  4. Thresholds for new AFP RP BLMs: 2 BLMs
  5. Thresholds for IR7 new collimators BLMs: 3 BLMs (1 add to BIS)
- **We don't expect the new thresholds to give unnecessary warning/dump signal according to 2016 beam loss data (AFP BLMs may get warnings)**
- ECRs are under preparation
- Our plans are communicated with BE-CO (M. Sobieszek), necessary DB supports will be provided
- All changes (once approved) can be implemented to electronics before the beam commissioning (week of April 24.)

Thank you for your attention !

# ALICE BLM cross check with 2016 data

- All 3 BLMs show similar response to beam loss:

@Injection:

- would give 7 warnings and 2 dumps (all 3 BLMs over thresholds) due to high injection loss (ALICE BCM dumped 5 times (3w+2d) in these cases)
- would dump the F5074 which tripped ALICE (BLM RS07)
- would give one dump during 2016 beam commissioning, injection collimator setup (dumped by IP2 collimator BLM) (BLM maskable)

@FT:

- would dump the ALICE UFO event (all 3 BLM over thresholds, consistent with BCM)

# IPQ P3 BLMs

- Most beam loss <1% of the proposed thresholds
- Exceptions:
  - In total, 2 fills would trigger warning level (30~40%) of IP8 P3 BLMs due to bad injection quality
  - 1 injection with fault MKI-B2 would trigger P3 BLM beam dump (already dumped by large number of IP8 BLMs)
  - During beam dump, few MQY P3 BLMs in IP6 would have loss over thresholds. (this is the same for current thresholds, and common for P1 & P2 BLMs in IP6)



# BLMs in IR7

BLM	DCUM [m]	BIS
BLMTI.04R7.B2I10_TCSG.B4R7.B2	20004.03	1
BLMQI.04R7.B2I30_MQWA.A4R7	20054.29	1
BLMQI.04R7.B2I20_MQWB.4R7	20061.89	1
BLMTI.04R7.B2I10_TCSPM.D4R7.B2	20068.22	0?
BLMTI.04R7.B2I10_TCSG.D4R7.B2	20070.22	1
BLMQI.04R7.B2I10_MQWA.D4R7	20074.39	1

↑  
B2