



# LHC BLM

## System Readiness

### Summary of YETS 23-24 Changes

*244<sup>th</sup> Machine Protection Panel*

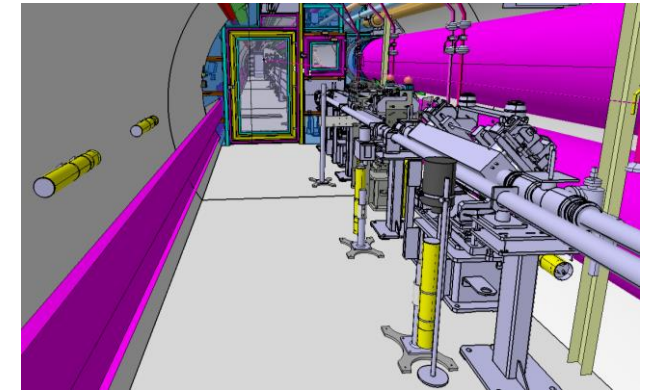
Mathieu Sacconi (SY-BI-BL) on behalf of the BLM team

08/03/2024

# Changes during YETS 23-24

## Monitors → some changes

1. 5 new IC & 10 SEM replaced by LICs at 6L7 [EDMS ECR LHC-BLM-EC-0019](#)
2. Temporary removal for vacuum intervention:
  - 2 reinstalled detectors in A4R1.C & A4L1.C: [BIBML-2920](#)
  - 2 reinstalled detectors in A4R5.C & A4L5.C: [BIBML-2919](#)
  - 1 reinstalled detector in A4L8.C & A4R8.C: [BIBML-2918](#)
3. Temporary removal for TDIS and MKI:
  - 1 IC of TDIS 4L2 [BIBML-2852](#)
  - 1 IC of TDIS 4R8 [BIBML-2854](#)
  - 2 detectors in SR8 (MKI8C exchange) [BIBML-2868](#), [EDMS ECR 2914318](#)



*New IC monitors in 6L7*

## Hardware → only a few preventive maintenance

1. Acquisition tunnel electronics: 1 replaced & 6 repaired BLECF (failing optical Tx GOH)
2. Processing surface electronics: 2 replaced BLETC in point 1R and 1C (optical receiver)
3. Rack temperatures: chilled water recovered in SR1; temperature & regulation to be double checked everywhere
4. Timing receiver: replaced CTRP in 5L (missing GMT events sometimes) [BIBML-2952](#)

# Changes during YETS 22-23 (cont'd)

## Firmware → minor changes

1. Threshold Comparator BLETC v1.2.5: firmware update to [add 2 running-sums to the capture buffer](#) [BIBML-2908](#)
2. Combiner & Survey BLECS v.05-12-2023: firmware update to get a better [display the injection interlock inhibit timers](#) (rename the counter for clarity and un-swap MSB/LSB) [BIBML-2904](#)

## Software and Databases → major changes

1. [LSA & Layout database update](#) (SEM replaced by IC, ...) [BIBML-2947](#)
2. [Driver migrated to EDGE3](#) (auto-generation from Gateware): current driver version 2.3.1
3. Changes in [FESA](#), version 5.28.0:
  - Added PM on-demand (study data from 4 RS), tested 3 times per minute for 3h20mn [BIBML-2908](#)
  - New 100Hz collimation data publish in block @1Hz [BIBML-2934](#)
  - Change the way to call the driver from FESA (read individual registers, instead of a single block)
  - Clean-up unused properties/fields [BIBML-2914](#)
4. Update of [expert GUIs](#): BLMLHC\_expert, InternalParameters, Thresholds, tunnel electronic FIPreset, ...

# BLM LHC System State

All BL YETS Activities are completed.

Optical links: are working perfect.

One count: none.

10pA offset: perfect.

Fix-display: all green.

Expert Application: all green.

SEM conversion factors all good after concentrator restart

Only a few connectivity checks warnings remain. To be done:

- Data analysis for 100 modulation cycles and HV ramps
- Noise analysis

→ Modulation thresholds to adjust *WIP, not blocking*



BLMLHC Fixed Display (27/02/24)

Consistency	BP_BIS	BP_TC	Connectivity	CFC_TEST	DET_DAC	DET_SHO	DET_PGSA	STOP_JVJ	MANUAL_CTRL
ABORT1	ABORT1	ABORT1	ABORT1	ABORT1	ABORT1	ABORT1	ABORT1	ABORT1	ABORT1
SRLL									
SRLC									
SRLR									
SRRL									
SR3C									
SR2C									
SR4C									
SR5C									
SR6C									
SR7C									
SR8C									
SR9C									
SR10C									
SR11C									
SR12C									
SR13C									
SR14C									
SR15C									
SR16C									
SR17C									
SR18C									
SR19C									
SR20C									
SR21C									
SR22C									
SR23C									
SR24C									
SR25C									
SR26C									
SR27C									
SR28C									
SR29C									
SR30C									
SR31C									

BLMLHC Expert Application (27/02/24)

Expert Monitor Name	Monitor Name	Dcum	Hardware Channel	Cable Connect.	BIS Connected	Masked	Min Ampl	blecsHVLfgain	Max Ampl	Min Phase	blecsHVLfph...	Max Phase
BLMTI.04L7.B1E10.TCP.CH.44L7.B1	BLMTI.04L7	1992037	HC.BUM.SR7.C.BLETC.02.CH.02	true	false	true	8000	15305	16000	35	63	110
BLMTI.05L7.B2I10.TCSPM.ESL7.B2	BLMTI.M5L7	1987904	HC.BUM.SR7.C.BLETC.04.CH.01	true	true	true	10000	15875	17500	25	63	110
BLMTI.04R7.B2I10.TCSPM.B4R7.B2	BLMTI.F4R7	2000203	HC.BUM.SR7.C.BLETC.09.CH.05	true	true	true	10000	15107	16010	25	62	110
BLMQI.07R1.B1E10.MQM.XRP	BLMQI.C7R1	26072	HC.BUM.SR1.R.BLETC.02.CH.10	true	true	false	5047	12447	13071	18	66	94
BLMBI.14R1.B0720.MBB-MBA.14R1	BLMBI.B14R1	57850	HC.BUM.SR1.R.BLETC.06.CH.03	true	true	false	5204	13650	14000	17	66	92
BLMDL.9822.B2C10.13.200.DUMP	BLMDL.629825.B2	98220	HC.BUM.SR6.C.BLETC.08.CH.08	true	false	true	10	671	32767	5	84	255
BLMEI.05R6.B1E20.LESS	BLMEI.D5R6	1687715	HC.BUM.SR6.C.BLETC.14.CH.10	true	false	true	10000	17378	18000	25	64	110
BLMDI.5860.B1I10.377.203	BLMDI.685860.B1	58600	HC.BUM.SR6.C.BLETC.15.CH.09	true	false	true	7383	16552	16575	35	83	145
BLMDI.5850.B1I10.377.203	BLMDI.685861.B1	58610	HC.BUM.SR6.C.BLETC.15.CH.10	true	false	true	7737	16328	17106	34	83	143
BLMDI.6850.B1I10.497.254	BLMDI.686850.B1	68500	HC.BUM.SR6.C.BLETC.15.CH.11	true	false	true	7644	16504	16967	34	83	144
BLMDI.6851.B1B10.497.254	BLMDI.686851.B1	68510	HC.BUM.SR6.C.BLETC.15.CH.12	true	false	true	7685	16594	17028	34	83	144
BLMDI.8010.B1I10.617.306	BLMDI.688010.B1	80100	HC.BUM.SR6.C.BLETC.15.CH.13	true	false	true	7705	16709	17058	34	83	144
BLMDI.9590.B1I10.750.306	BLMDI.689590.B1	95900	HC.BUM.SR6.C.BLETC.15.CH.15	true	false	true	7283	15859	16426	34	83	144
BLMDI.9591.B1B10.750.306	BLMDI.689591.B1	95910	HC.BUM.SR6.C.BLETC.15.CH.16	true	false	true	7306	15799	16459	35	83	145
BLMDL.9822.B1C10.13.200.DUMP	BLMDL.689825.B1	98220	HC.BUM.SR6.C.BLETC.16.CH.08	true	false	true	10	590	32767	5	93	255
BLMTS.04L1.B1I10.TCIPV.4L1.B1	BLMTS.C4L1	2651415	HC.BUM.SR1.C.BLETC.03.CH.11	true	true	true	50	621	17000	21	81	200
BLMTS.04L1.B2E10.TANAL.4L1	BLMTS.D4L1	2651923	HC.BUM.SR1.C.BLETC.03.CH.12	true	false	true	50	600	17000	21	80	200

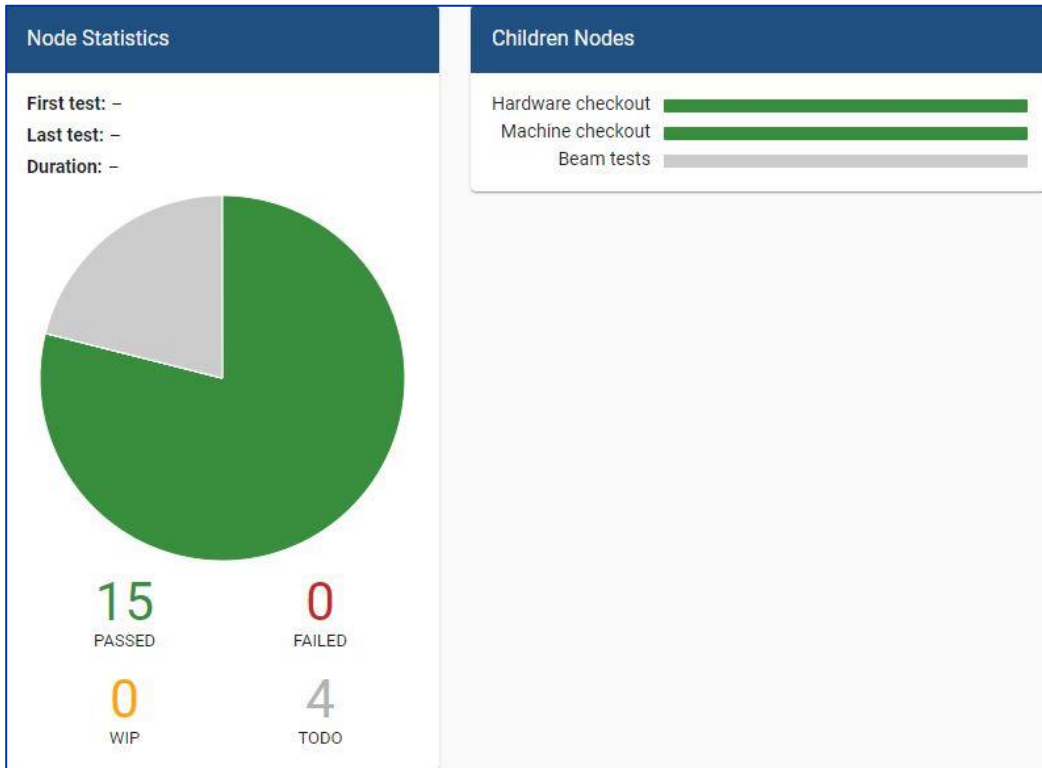
BLMLHC Connectivity-Modulation warnings (27/02/24)

Thank you to the whole BL Team !



# BLM LHC System readiness

## BLM MPS Checklist



## Hardware Checkout

ID	Status
MPP/BLM - LSA	Completed
MPP/BLM - HW1 - High voltage modulation	Completed
MPP/BLM - HW2 - 10pA signal monitoring	Completed
MPP/BLM - HW3 - Optical line comparison	Completed
MPP/BLM - HW4 - 100pA signal	Planned
MPP/BLM - HW5 - Radioactivate source	Planned
MPP/BLM - HW6 - EMC	Planned
MPP/BLM - HW7 - Beam energy reception	Completed
MPP/BLM - HW8 - BLETC & BLECS v. DB comparison	Completed
MPP/BLM - HW9 - Remove beam permit	Completed
MPP/BLM - HW10 - User permit transmission (BLETCs)	Completed
MPP/BLM - HW11 - User permit transmission (BLECs)	Completed

Completed  
26<sup>th</sup> Feb 24

Done by BI experts.

Only after LS2.  
Could be greyed in the checklist.

## Tests with Beam

ID	Status
MPP/BLM - BT1 - Interlock request functionality of the BLM crates	Planned
MPP/BLM - BT2 - Interlock request functionality of the BLETC	Planned
MPP/BLM - BT3 - Interlock request system latency	Planned
MPP/BLM - BT4 - Test the interface of direct BLMs with the beam dumping system	Planned
MPP/BLM - BT5 - Injection Interlock Inhibit functionality	Planned

Scheduled  
12<sup>th</sup> Mar 24

1 block of tests in the CCC

**No need**  
No change on Direct Dump (neither on BLM nor LBDS) Already tested after LS2.

**Planned**  
Injection Inhibit test to be tested with beam by ABT & BI.

## Machine Checkout ("IST")

ID	Status
MPP/BLM - MC1 - User permit transmission	Completed
MPP/BLM - MC2 - Threshold values change with energy	Completed
MPP/BLM - MC3 - Missing HV detection and propagation to the SIS	Completed

Completed  
06<sup>th</sup> Mar 24

Done from the CCC by OP/BI experts.

Checklist - MPS - BLM

MPS BLM Commisisoning-EDMS-896394

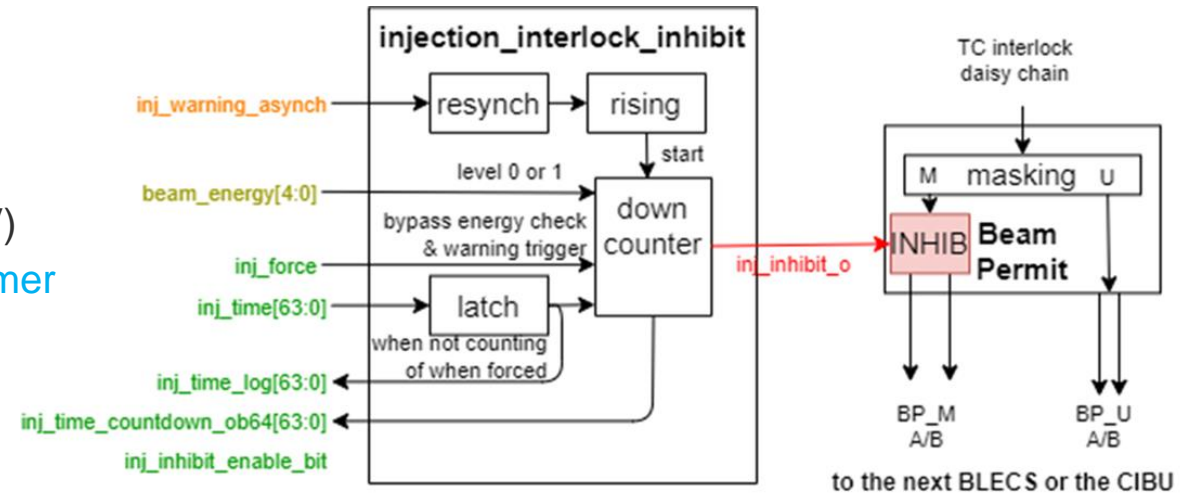
LHC planning 2024

# Injection Interlock Inhibit (BLM blinding)

## Blindable channels inhibit at injection to be commissioned with beam

- ABT+BI have prepared a [commissioning procedure](#):
  - Test with pilots & trains (12, 144, 288 bunches)
  - Measure the minimum blind time needed
  - Dedicate ~3h for commissioning in the CCC
  - The set of maskable channels to blind must be confirmed (& adjust monitor factors if needed).

- Technical details:
  - Feature present in [all crates](#), not only SR2-Inj & SR8-Inj
  - By default, it is [disabled](#) (and timer=0)
  - Active for energy levels 0 or 1 (SMPBeamEnergy < 491.4 GeV)
  - Triggered by injection warning (from BST) with [programmable timer](#) per crate (64b, 25ns resolution)
  - Acts only on [maskable channels](#)
  - Inhibits the interlock [output to BIC only](#) (all running sums still active, and dump requests logged)
  - [Tested successfully from BST master to BLM CIBU BIBML-2959](#)



Injection Interlock Inhibit FW Implementation

