LHC BLM SYSTEM:
COMMISSIONING STATUS

Machine Protection Panel 17/04/2015

Christos Zamantzas on behalf of the BLM team.

Overview

- Status of checks performed during:
  - Hardware Commissioning
  - Machine Checkout
  - Beam Tests
- Outstanding issues

STATUS OF CHECKS PERFORMED

Hardware and Machine Checkout

- All Hardware Commissioning and Machine Checkout checks completed successfully.
- See attached xls file for some details (more info will be added) and
- MPS document LHC-OP-MPS-0009 v.3.1 for explanations on reasons and conditions
- Those include:
  - 11 Hardware checks
  - 3 Machine Checkout checks

Beam Tests

Status	Rep.	Action	Responsible	Comments
1	S	**Validate Interlock Request functionality of the BLM crates.**	Christos	Multiple requests have already been requested by the majority of the crates since start-up.
	FW-CS	Decrease thresholds to very low value (trim application).		
	FW-TC	Inject low intensity pilots in regular intervals in Beam 1 and/or Beam 2.		
		At each interval close sequentially collimator jaws around the ring in order to force different BLM crates to trigger interlock requests.		
		Aim to have the majority of crates at least once.		
		Time estimate: 2h		
2	S	**Validate Interlock Request functionality of the BLETC modules.**	Christos	Several beam dump requests from steady-state losses (especially at 15R8).
	FW-TC	Decrease thresholds to very low value (trim application).		
	FW-CS	Inject a low intensity pilot in Beam 1 and/or Beam 2.		
	FW-CF	Create a local bump until an interlock request is sent by the system.		
		Aim to have up to the 1.3 s Running Sum measurement over its Threshold value.		
		Time estimate: 1h		
3	S	**Measure the interlock request system latency.**	Christos	Data should be available from the first beams, but not yet checked.
	FW-TC	Decrease thresholds to very low value (trim application).		
	FW-CS	Close one TCP collimator jaw in Point 3 and a second in Point 7 in order to block completely the passage of beam.		
	FW-CF	Inject a low intensity pilot in Beam 1 and Beam 2.		
		Calculate the system latency to initiate an interlock request by making the difference between the timestamps recorded by the BIS and the Injection Kicker. (for added accuracy the propagation delays can be removed for the beam to reach from the injection region to the detector the requested the interlock)		
		Time estimate: 2h		
4	S	**Test interface of direct BLMs with the beam dumping system (same test as 7.3.4 of [1]).**	Ewald	Higher intensity needed.
		Reduce the voltage setting of the abort threshold.		
		Dump the injected beam on the collimator TCDQ and TCSG (with local bump). The threshold must have been lowered sufficiently, to provoke a beam dump request.		
		Record the beam dump.		
		This test must be repeated for each beam and for both TCDQ and TCSG.		
		From the amount of lost beam and the BLM reading, deduce the nominal threshold setting.		
		Are there variations with respect to the impact conditions?		
		Measure delay between the time where the loss signal exceeds the threshold and the time of the beam dump (time stamps in logging DB).		
		Time estimate: 2h (without the two accesses: could be scheduled during injection tests)		
5	S, O	**Threshold and reaction time of BLMs at collimators at 450 GeV.**	Jorg	
		A powering failure is initiated on the selected circuit. Any FMCM or powering interlock must be masked to ensure that the BLM system will see the beam loss as first protection system.		
		The post-mortem data is analyzed to determine the losses, the beam intensity, beam position at the moment when the BLM system removed its USER_PERMIT and at the moment when the beam was dumped.		
		Time estimate: 1h		
6	S, O	**Threshold and reaction time of BLMs at collimators at 7 TeV (or physics energy), after successful completion of the previous test at 450 GeV.**	Jorg	
		A powering failure is initiated on the selected circuit. Any FMCM or powering interlock must be masked to ensure that the BLM system will see the beam loss as first protection system.		
		The post-mortem data is analyzed to determine the losses, the beam intensity, beam position at the moment when the BLM system removed its USER_PERMIT and at the moment when the beam was dumped.		
		Time estimate: 1h		

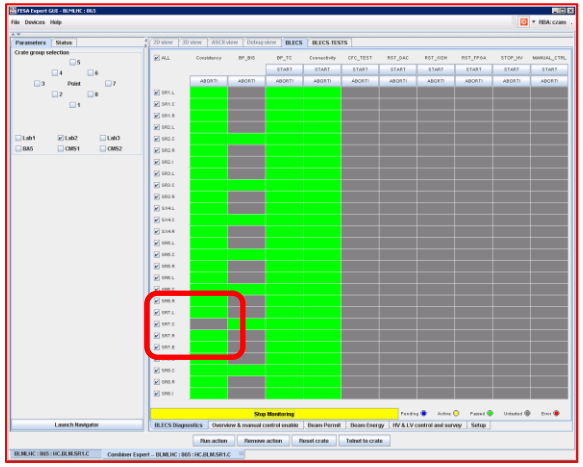
OUTSTANDING ISSUES

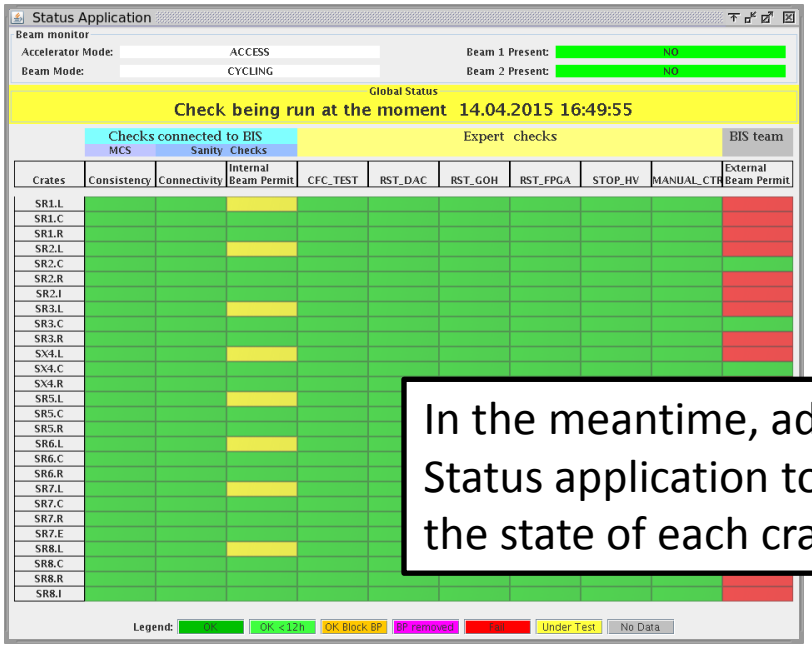
Sanity Checks

BIBML-937: Sanity Checks' result in the Sequencer does not always gets registered in the BLECS

- Three calls from the CCC that checks cannot complete
- MCS Check had passed (thus the Sequencer showed as green, but the BLECS did not get the result as TRUE to release the permit). During the retries, MCS was being skipped.

Not yet sure what is the cause.





In the meantime, added a Status application to show the state of each crate

Post-Mortem Data (I)

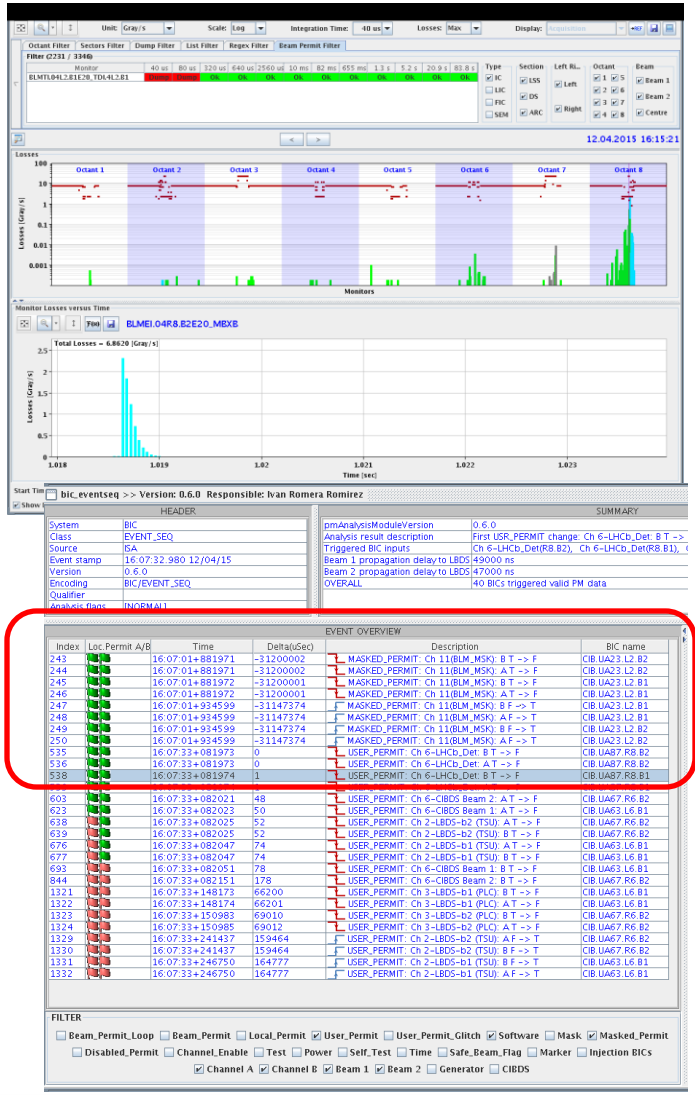
BIBML-934:PM Data show interlock from beam 1 when beam 2 was injected [2015/04/12]

- Interleaved injections & BIS masks enabled

SR2 Interlocks (MASKED)	GPM Event (from beam 2)
16:07:02	16:07:33
16:14:50	16:15:21

- Introduced when fixed BIBML-905 : Not all channels above threshold are reported to the PM data
  - Readout of the data takes much longer with current version of FPGA/CPU causing BeamPermit flags sometimes to be lost.

Fix requires modification of the BLM FESA server

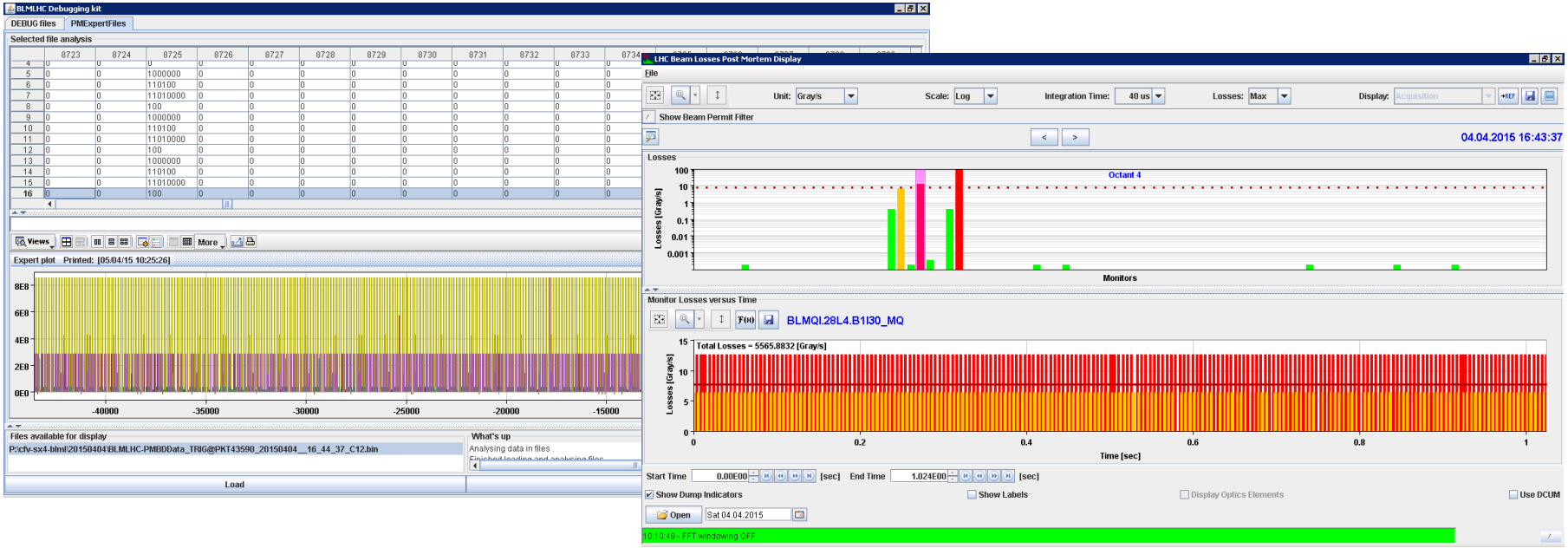


Post-Mortem Data (II)

BIBML-881: SX4.L.CD12 GPM Buffer not working correctly

- The issue is on the SRAM recording of the data.
- The spikes seen are the markers between channels.

Card has been exchanged (Note: had 5 similar cases in Run 1)

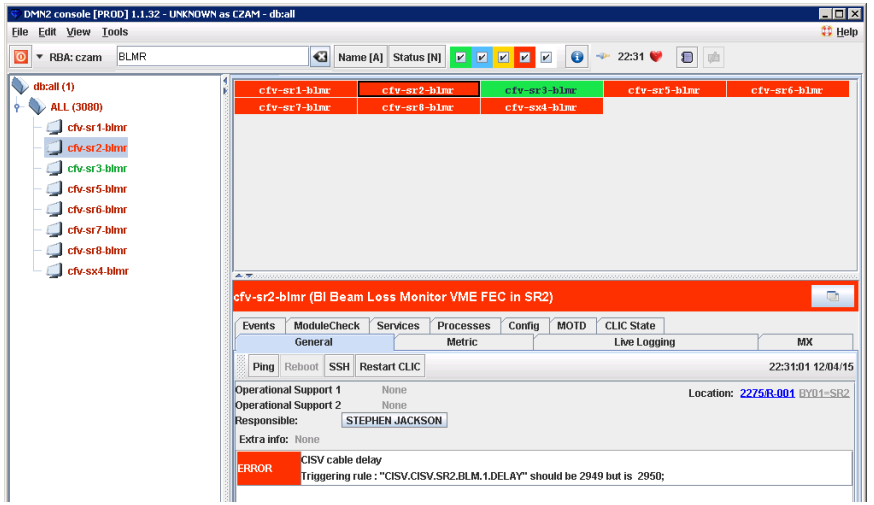


CISV

BIBML-936: All Sxx.R crates show a CISV error in DIAMON

- Showed up after the last CISV class release
- Sxx.R crates do not have a CISV.

Waiting for assistance from DIAMON team (might need later also from Timing)

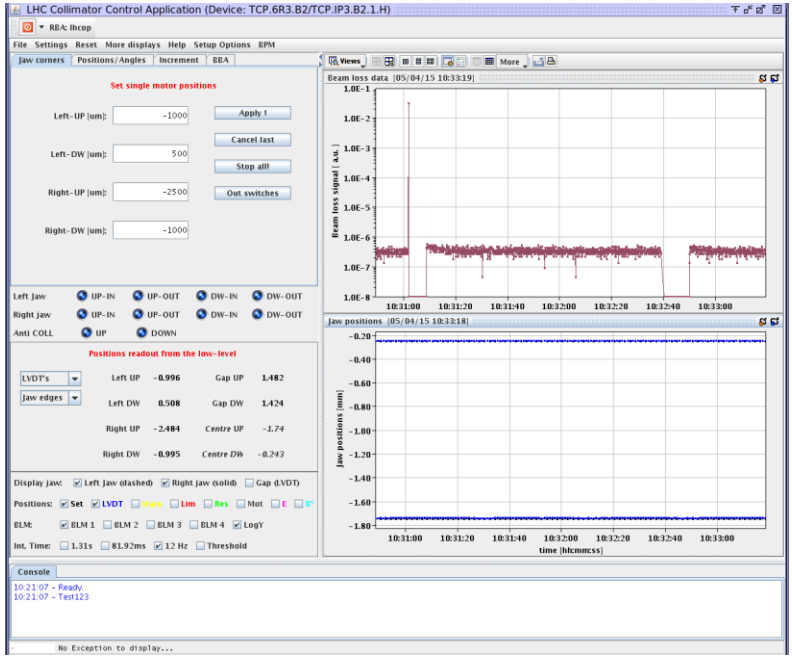


Collimation Data (12 HZ)

BIBML-906: Collimation data (12 Hz) are missing during injection

- When beam injected data unavailable for ~ 800 ms.
- Issue occurs due to IQC data readout.

No easy fix; issue will remain at least until new FPGA/FESA code



Capture and IQC Concentrators

BIBML-945: Capture Concentrator does not provide data from the two injection crates

BIBML-949: IQC Concentrator does not provide data from the two injection crates

- Both concentrators did not get updated after LS1

Capture is fixed and IQC will be in the next days.

List of detectors missing from IQC:

BLMTI.04L2.B2I10_TDI.4L2.B2
BLMTI.04L2.B1E10_TDI.4L2.B1
BLMTI.04L2.B1E20_TDI.4L2.B1
BLMTI.04R8.B2E20_TDI.4R8.B2
BLMTI.04R8.B2E10_TDI.4R8.B2
BLMTI.04R8.B1I10_TDI.4R8.B1

Detector Filters

BIBML-948: Status of filters after LS1

Actually two separate issues with new and old filter boxes

- Wrong connections of filters to channels
  - Filter boxes were installed before the reconnections for the injection interlock inhibit changes

  All 11 filter boxes affected have now been corrected
- Error in the production of new filter boxes
  - Did not make use of the latest design
  - Minor difference in the response between designs
  - All will be replaced for consistency

  Point 2 & 8 corrected (point 8 to be installed)

  Remaining points sequentially when access allowed

Drive of Parameters

BIBML-888: Drive of parameters is unreliable

- Background:
  - Global Drive sends ~ 4 million values at the processing electronics (at ~400 modules).
  - With the new CPUs, sometimes we get 2-3 values wrong after a drive;
  - MCS Check (part of the regular checks) catches this inconstancy always.
- Issue appeared after the upgrade of the CPU
- Not sure what is the cause; access on the VME bus during update

Workaround and additional protection added:

- Added in the server a check when the parameters are written to the flash. Retries, if not equal, and if finally not successful gives exception
- Added the result of the regular check (once per minute) in the SIS property At the moment, checked before injection.
- No issues with driving since then

Summary

Commissioning:

- Hardware and Machine checkout checks completed
- Some tests with beam to be planned

System Issues:

- No machine protection critical issues
- Some work needed to improve tools and availability