LHC BLM SYSTEM:
CHANGES FORESEEN FOR THE 2012 RUN

Christos Zamantzas for the BLM team.

Some reminders of the major modifications in 2011

SHORT SUMMARY OF 2011

Changes in the FPGA code

- ■ **Code improvements** after review of the code by the external auditors.
  - ▪ Modest changes mostly related to maintainability, documentation and robustness in future changes.

- ■ **Serials check** have been added on acquisition and processing parts.
  - ▪ Connected to Beam Permit
  - ▪ Changes are (indirectly) tracked in LSA DB (and MTF/LAYOUT)

- ■ **Monitor filter** values stored with the critical settings on the electronics.
  - ▪ Published with the 1 Hz data
  - ▪ Visible in the fixed display and LSA database

■ **Modification of the Capture buffer**

- ▪ Dynamic change of the recording length and type of data

  - ▸ 40 µs integral with 512 samples/channel or
  - ▸ 2.56 ms integral with 43'690 samples/channel

- ▪ Multiple filtering criteria through updated FESA class (by S. Jackson)

- ▪ Second concentrator added (by M. Misiowiec)

- ▪ Change was transparent to the IQC

- ▪ New client: UFO buster (by T. Baer)

Changes in external software

- Addition in SIS: continuous monitoring of the Voltages used by the monitors and acquisition system
  - Documentation available[1]
  - Later change to provide as a setting the allowed time in fault

- Improvement in the Sanity Checks
  - Raw data extraction when checks fail

[1] https://svnweb.cern.ch/cern/wsvn/be-bi-bl/electronics/blm/bletc/doc/MonitoringTunnelVoltages.pdf

Technical Stops

Fully packed weeks with corrective actions for

- Noise mitigation
  - exchange of several long signal cables

- Maintenance
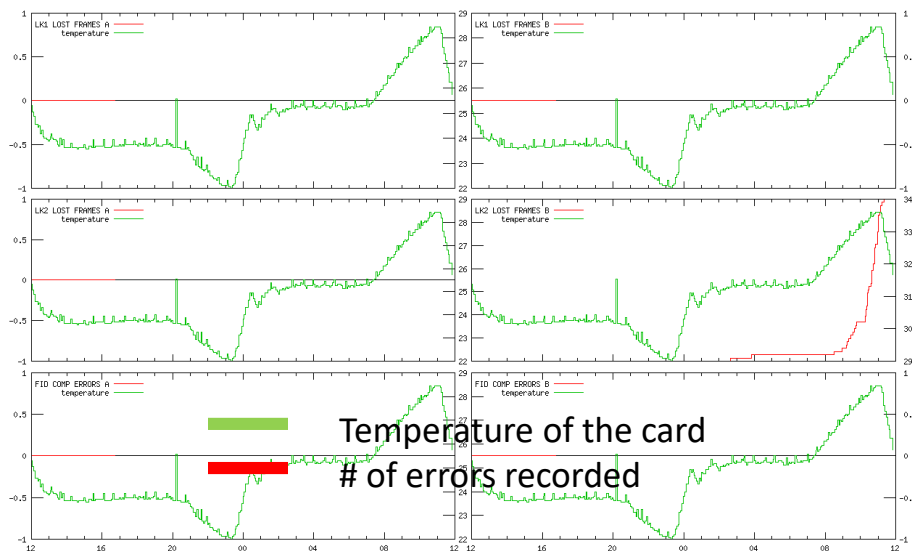 - exchange several degraded components

- Measurements
  - addition of mobile monitors, diamonds, LICs
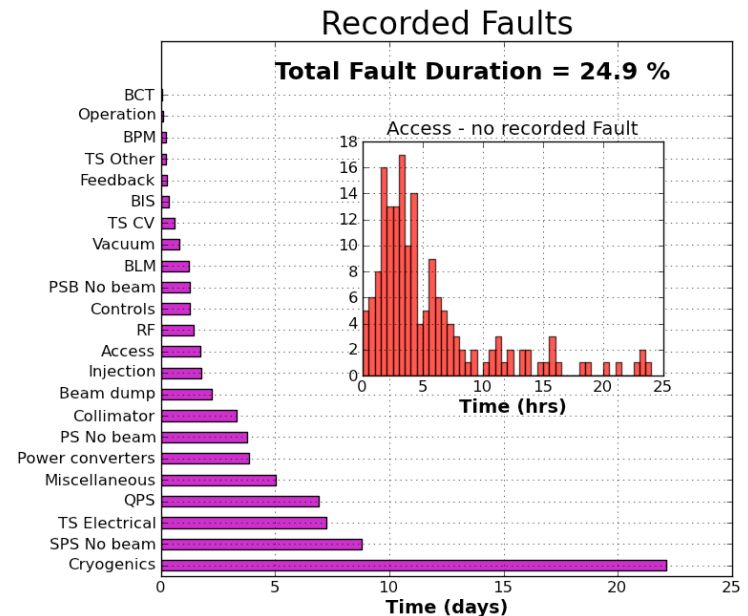
Preventive system fault analysis

■ Daily **automatic** analysis of all link's performance

(by A.Nordt and M.Dabrowski)

- ▪ Unavailability due to errors from communication link failures **reduced** dramatically.
- ▪ The number of cards exchanged in 2011 has remained constant.

Example of the daily optical link report

A. Macpherson at
LHC Beam Operation Workshop 2011

Listing actions currently under development or on our boards

MODIFICATIONS & ADDITIONS PROPOSALS

Statuses (firmware)

■ Connect the tunnel low voltage checks in the beam permit logic
  ▪ The HV check is for LS1 and requires large scale hardware modifications

Table: Cases of BLECF statuses that WILL issue a beam dump request

Field	Condition	Beam Permit	ALARM	Comment
~~Status_HV [x 2]~~	~~FALSE then~~	~~False~~	~~WARNING~~	~~High Voltage nominal (> 1450 V),~~
Status_2.5V [x 2]	FALSE then	False	WARNING	Power supply of 2.5 V available,
Status_M5V [x 2]	FALSE then	False	WARNING	Power supply of -5 V available,
Status_P5V [x 2]	FALSE then	False	WARNING	Power supply of +5 V available,

ATTN: The above 4 cases for each BLECF are excluded from the beam dump if either of the following conditions is satisfied:
• The BLECF module has "0000" as Card ID defined in the LSA DB (i.e. it is not installed).
• All 8 channels of the BLECF module are set to "not connected to BIS" (i.e. card is not part of the Machine Protection System).

■ Change in the energy value sent to the logging and displays
  ▪ max value of all the energy values received in the last second

Dedicated buffers

- **Change the Study buffer (UFO search)**
  - Modify firmware to store 80 us samples
  - If possible, modify RT-server to increase the number of samples transmitted

  NOTE: The limit in increasing the number of samples is in the CPU type. We expect in the future to increase to 43,690 samples/channel.

- **Change in the XPOC data delivery**
  - Modify RT-server to push the data in the PM transaction type
  - Not tested yet.

Automatic/fast Collimator BBA

- New dedicated buffer for automatic and faster Collimator Beam Based Alignment
  - Continuous transmission to collimation client
  - UDP packets at 12.5 Hz
  - From each monitor the 82 ms integration period
  - Should be useful also for the loss maps

- First tests with "dummy" data were successful
  - UDP packets were consistent and on time
  - Load in the CPU and VME was acceptable

Changes in electronics

- **Add spare processing cards on every Point for connecting new mobile monitors.**
  - Less actions in the operational crates
  - Less experts involved to be needed

  Supporting MCS and LSA Settings DB modifications have already been completed and tested this month

- **Exchange of the acquisition crate backplanes of ½ arc in Pt6 with newer version**
  - Improve and provide better stability
  - Improve the reset functionality

  Large scale test before LS1 to validate design.

Cable exchanges

- **Exchange of 20 multiwire signal cables** (by E. Effinger)
  - on average 250 m each
  - ~ 120 monitors affected
  - NG18 cables to be replaced by NES18-S
    (i.e. "NES18 Special" with two extra copper shielding)
  - Reduce noise due to cross-talk in the SS
    (hopefully mitigate the issue shown this week during the LHC Beam Operation Workshop)

NOTE: from A. Nordt's analysis:

The installation of the two NES18 cables in cell 11 of R3 has lead to a reduction in the maximum noise by:
  - factor of 2 (on MB element, 700 m length)
  - factor of 3 (on MQ element, 730m length)

Injection Losses

Two step strategy for the mitigation of the injection losses with the use of LIC monitors:

1. Start with a first set of monitors for both beams
   - Investigate behaviour (and reliability)
   - Check correctness of the LIC's conversion factor
   - Check correctness of the calculated thresholds

2. Complete modification (if need) with additional monitors during the consecutive Technical Stops

Please let us know of requests well in advance of the TS

Monitor type exchanges

Exchange the IC with LIC monitors in the **injection region**

■ Reduced list by W. Bartmann:

Pt2:
- BLMQI.08L2.B2I10_MQML
- BLMEI.06L2.B1E10_MSIB   (** will remove the filter already installed)
- BLMEI.04L2.B1E10_TDI.4L2.B1 (* already not connected to the BIS)

Pt8:
- BLMQI.03R8.B1I30_MQXA
- BLMEI.04R8.B2E10_MBXB
- BLMEI.04R8.B2E10_TDI.4R8.B2 (* already not connected to the BIS)
- BLMEI.06R8.B2E10_MSIB   (** will remove the filter already installed)

The installation will be done in a way that can be reverted quickly and safely.

Monitor exchanges for Beam 1

Monitor to be exchanged

Monitor to be exchanged

Losses for B2 injection
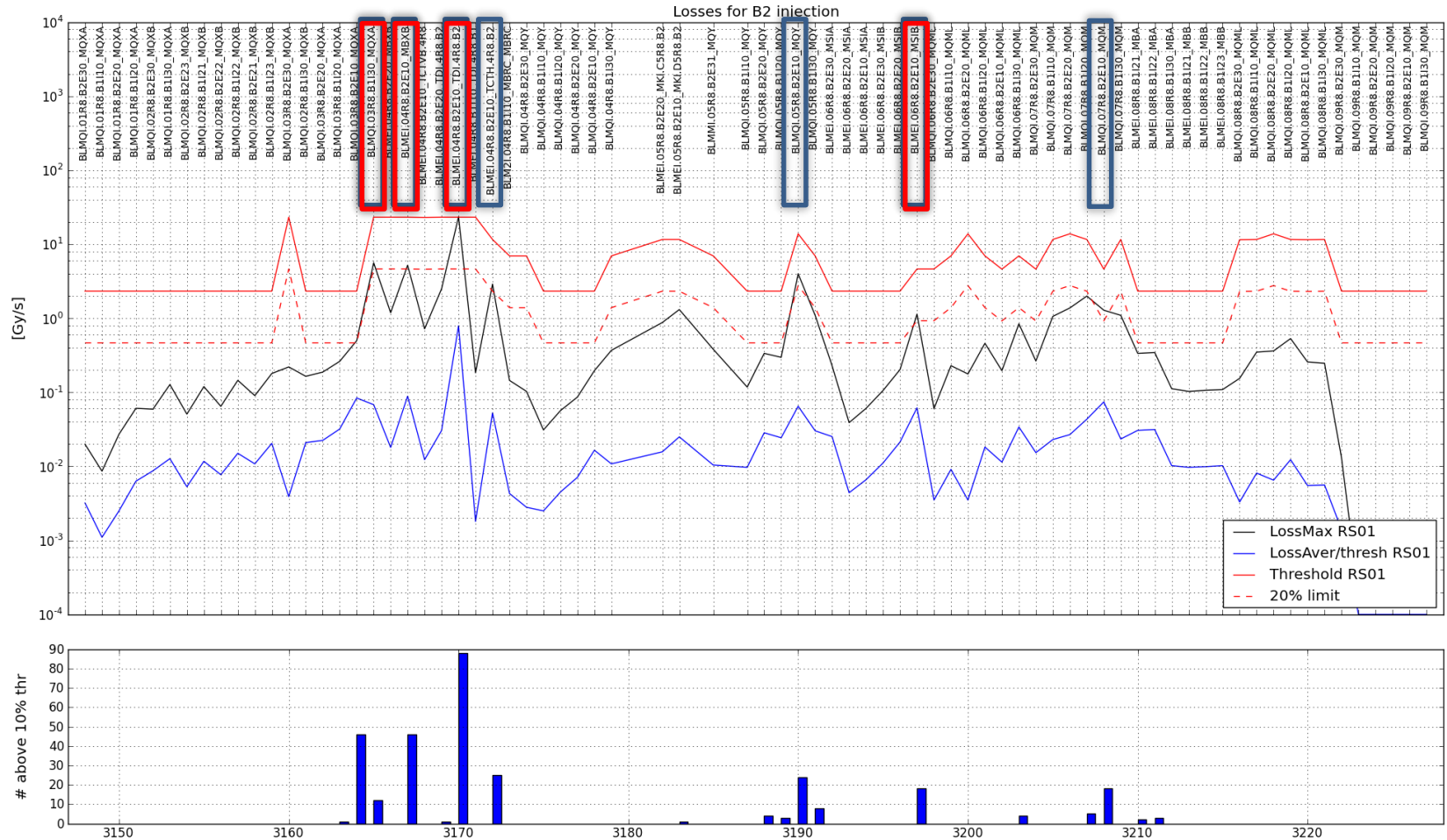
CPU processes

- **Add the CISV monitoring FESA process** (by B. Todd and M. Kwiatkowski)
  - check firmware version,
  - status of the GMT and
  - reception of the SMP.

  To be verified if there is no interference with the BLMLHC class
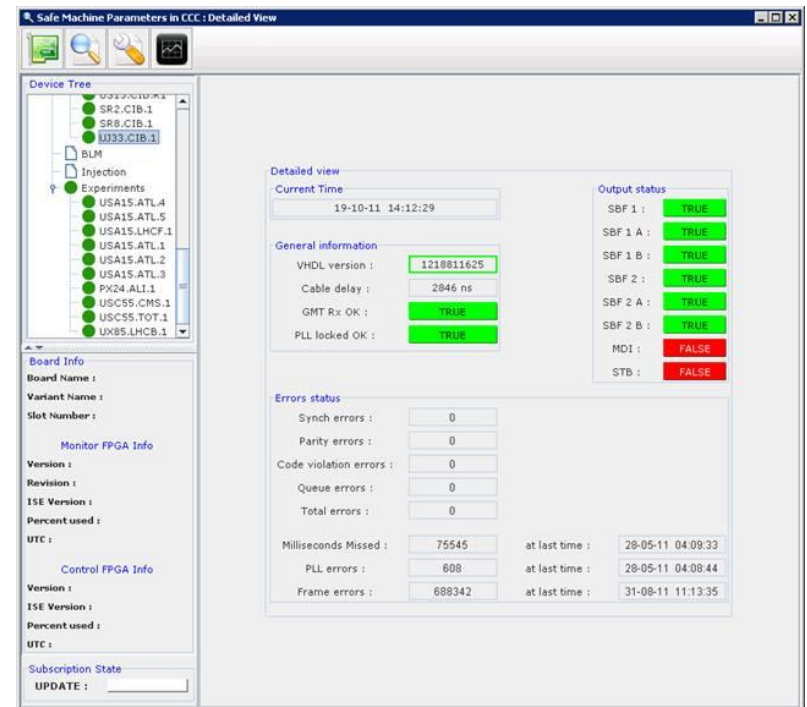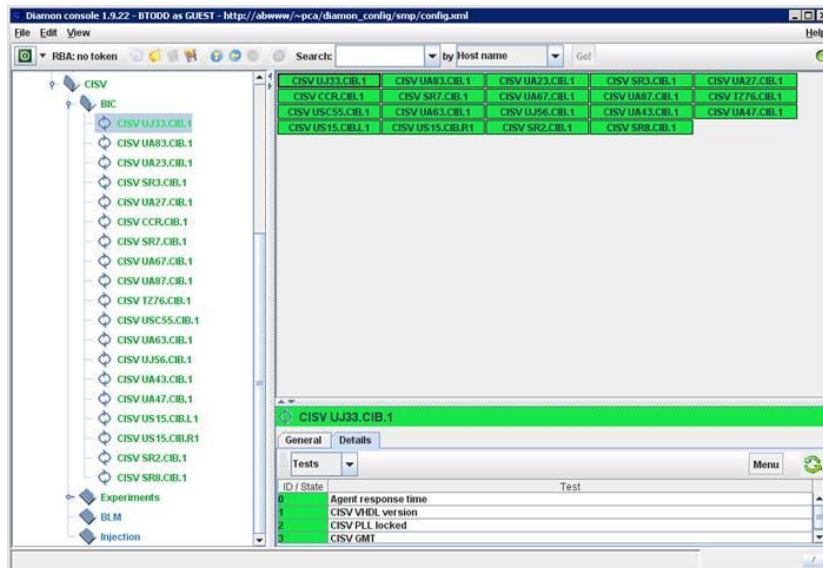
OP Software improvements

■ Deploy to Operations the **Check Statuses** application
  ▪ Add an "Exit Check Mode" button for the Connectivity check
  ▪ Decision by OP if it will be a separate or integrated to the Statuses app.

■ Complete the **BLM Management** application
  ▪ UI ready
  ▪ Some code missing for the actions

Summary

- Tunnel low voltages check will be connected to the beam permit logic.

- Change in the Energy value logged (will be the max seen in the last second).

- Changes to the Study buffer for better observations with the UFO Buster.

- New buffer and server for the Collimator Beam Based Alignment.

- Exchange of 20 signal cables for noise mitigation.

- Exchange of the acquisition crate backplanes in ½ a sector for large scale testing before LS1.

- Addition of spare processing cards on each point for new mobile monitors.

- Exchange of 7 IC monitors with LIC for the injection losses (first step).

- Additional server in the CPUs for the CISV monitoring.

Any change for which we will not feel 100% confident it will not be implemented

and best wishes for the New Year

THANK YOU

System Overview