ALICE-LHC Interface: Upgrading for Run 3

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Outcome

• Scope of this meeting;

• Project description;

• Collection of requirements, desiderata and suggestions for the action list.
Scope of the meeting

• In the LHC_IF programming meeting on Jan. 23rd 2019, the re-writing of the project was considered as the best guarantee to effectively interface the new online systems;

• The definition of a new architecture is then mandatory,

• To define the architecture then the action list, the collection of:
  - Requirements;
  - Desiderata,
  - Suggestions

are extremely important, we count on you!
Project description

LHC_IF Artistic view as it was in Run 2 (By A. Franco)
Tasks, people and institutions

• **PL and DPL**: G de Cataldo (INFN Bari, It) and G. Valentino (CIT department, University of Malta);
• **LHC_IF Software coordinator engineer**: A. Franco (INFN Bari, It),
• **Beam instrumentation**: resp. A. di Mauro (CERN, CH); responsible of BPTX, BLS control software: O. Pinazza (INFN Bologna, It/ALICE DCS),
• **BCM hardware and software**: di Mauro, de Cataldo, A. Franco
• **b-by-b calculations (VdM scan, lumi, bkgd,..)**: I. Kralik (Slovak Academy of Sciences (SK));
• **LHC_IF infrastructures**: DCS (P. Chochula, CERN, CH as contact person).
• **Documentation, project operation and data analysis tools**: O. Visnyei (now in maternity, Wigner Institute, Budapest, Hungary).

Emma, the youngest newcomer in LHC_IF!
(With the permission of Orsi)
LHC_IF functionalities

• collect parameters and real time machine status from LHC;
• monitor Bunch By Bunch, via Interaction Record (IR), and total luminosity in ALICE;
• publish to LHC relevant ALICE information (e.g.): experiment status, luminosity and background;
• publish information about the Luminosity Region (HLT and DQM sources)
• produce LHC data files (GRP) for the reconstruction in the Offline;
• send to the E-Log Beams and Luminosity info;
• archive relevant data for offline Data Analysis;
LHC_IF services

• **control/coordinate** with ACC:
  • the Van Deer Meer Scan procedure
  • the Automatic Luminosity Levelling
• **ensure** the experiment protection against High Collision Rate;
• **monitor and control** the LHC clock Phase Shift;
• **ensure** the LHC - ALICE Beam Injection Handshake procedure;
• **maintenance** of the Control software for the Beam Instrumentation:
  • Bean Loss Scintillator (BLS),
  • Beam Phase and Intensity Monitoring (BPIM),
  • Beam Condition Monitor (BCM)
• **provide** the main panel on the Big Screen in ACR;
• **provide** the Shift Leader User Interface and the relevant workstation.
Production of Scientific papers

- The operational results achieved following the deployment of the new luminosity leveling routine were published in various fora:
  - CERN Courier
  - ALICE internal note
  - ICALEPCS conference (in preparation)
LHC_IF documentation

- A CERN SharePoint website was created to host documentation related to the LHC_IF project:
  - LHC_IF Mandate
  - BCM Operation and Manual
  - Shift Leader UI
  - LHC_IF Data Analysis Interface
  - VdM procedure

https://espace.cern.ch/LHCInterfaceProject/
The infrastructure

The infrastructures of the LHC IF consisted of eight nodes: seven Worker Nodes, one Operator Node;

Data flows were stored in the DCS ORACLE DB server;

GRP, VdM scan, BbyB data files were stored in the DCS File Server infrastructure;

Luminosity Files (aka Massi Files) on the CERN AFS repository.
Data Exchange between ALICE and LHC (I)

• **LHC parameters** and variables subscribed on several DIP servers;
  • 129 items related to RunControl, Machine and Beam monitoring
  • mostly are real time data archived in the DCS DB;

• **ALICE parameters** and variables sent to LHC over DIP:
  • 63 items related to Experiment Status, total Luminosity, Background, Bunch by Bunch luminosity;

• **ALICE luminosity per Fill** data files (aka Massi Files) sent to LHC for the trend view:
  • Total and B-by-b luminosity info per Fill;
  • In the year 2018: 292 fills, 449k files for a total of 13.78 Gbytes;
  • The files were transferred into the AFS repository with the TELEPORT mechanism.
Data Exchange between ALICE and LHC (II)

- ALICE data display in the LHC infrastructure


http://lpc.web.cern.ch/lpc
LUMINOSITY Measurement

• In principle each ALICE detector could act as “Luminometer”;
• A standard Data Point was used as interface between the detector DCS and LHC_IF;
• The experiment luminosity source could be selected dynamically at run time;
• The Luminometers used during RUN2: AD, MTR, TOF, V0, and ZDC;
Lumi Levelling

• Based on the beam configuration a dedicated process provided LHC the sigma-step for the beam steering. OK in pp collisions...;
• Observed anomalies during Pb-Pb collisions, cross-checks needed;
• The beam separation was calculated and stored, useful for further offline analysis, if any.
Luminosity Region

- Two sources of the Lumi Region: HLT and DQM;
- DQM provided the online data, but HLT. The processing time (~1 min), made the info not usable online by LHC;
- No Lumi Region files were produced (neither by total nor by B-by-B lumi), missing manpower and low statistics in ALICE.
Van der Meer scan

- **Monitored** the procedure during the scan and sending data back to LHC;
- **Stored** all the relevant luminosity measurements from LHC, lumi sources or CTP;
- **Displayed** the VdM scan (in real time) on dedicated panel in ACR;
- **B-by-B data files** were produced by the IRMON software and used for the offline calculation of the cross section.
Bunch By Bunch measurements

- Bunch By Bunch Analysis:
  - Bunch Intensity,
  - Bunch Luminosity,
  - Injection schema
- The archive was done with RAIMA DB, not easy to maintain and to retrieve data;
- Additional backup done locally in ASCII files;
- During 2018: 4800 files were produced for a total of 25GBytes;
- During RUN2 no User show up asking for these data!
LHC Data files for the OFFLINE (GRP)

- 38 parameters were collected and packed for each RUN;
- File format: ASCII, multi pages with variable row length;
- For the year 2018: 4400 files for 11GBytes;
- The files were transferred with the File Exchange / Shuttle mechanism.
Data to/from ALICE E-LOG and Run control

• 25 items were exported to the e-log by DIP publications;
• The Luminosity and background Trends per Fill were exported by dcs_logbook library (http/curl - visual basic scripts);
• From e-log list of runs under way was subscribed;
• Form ECS run type and run number were subscribed to synchronize several processes.
High rate collisions experiment protection

- Monitored the collisions rate from V0, and sets alarms to groups of detectors to prevent data quality degradation;
LHC_IF – CTP: LHC clock Phase Shift monitor and control

- Monitored the LHC phase shift, provided alarms and shift reset;
- Controlled the clock type (local or LHC) letting the manual and automatic switch in CTP;
BEAM INSTRUMENTATION

Control software maintenance:

• Beam Loss Scintillator (BLS);
• Beam Phase and Intensity Monitoring (BPIM);
• Beam Condition Monitor (BCM).
BIG Screen in ACR

LHC-IF main panel in the ARC
LHC Interface : SHIFT LEADER UI

• The SL GUI for the experiment operation
Action List

• Waiting for your inputs  !!
• ...beam separation for PDP ?
• ...luminosity above target alarm signal ?
• ....
• To be completed!!
## LS2 planned activities

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Summary

• Noted down the Run2 Issues
• Collection of requirements, desiderata and suggestions.
• Preparing the action list and a plan of the LS2 activities
LHC Interface : LHC - ALICE Beam Injection Handshake procedure

- Follow the Beam Injection Handshake
- Manage the Beam Dump events

POST MORTEM trigger has been received

ALICE DUMPED THE BEAM

Reason: Value of RS32Sum over threshold on Station C.

WARNING ! The PM procedure has hanged up, DCS operator please perform the following procedure:

1. Check alarm screen for LHC_EXCHANGE alerts
2. Check the 'Warnings for DCS Operator' in the Details section of this panel for additional alerts
3. After the timeout has expired, the 'FORCE CLOSE' button will appear

Readout start time: 15:40:37
Estimated readout end time: 15:43:07

Beam Permit
Injection Permit 1
Injection Permit 2

Details...

Please call the LHC Interface expert
Force Close