Feedback on Controls from 2015 Operation

Marine Pace, on behalf of BE-CO.

Evian Workshop 15-17 Dec 2015

Outline

- Looking back at LS1
- LHC commissioning & controls operation in 2015
- Outcome from the LS1 Controls Review (highlights)
- Outlook for coming years

Outline

- Looking back at LS1
- LHC Commissioning & controls operation in 2015
- Outcome from the LS1 Controls Review (highlights)
- Outlook for coming years

Looking back at LS1

- HW Consolidation
  - LS1 was a unique opportunity for CO & EQ GPs to perform a massive HW renovation plan.
  - 420 LHC Front-End Computers upgraded
  - 200 new machines for WorldFIP Gateways, new CPUs, doubling of Quench Detection System segments

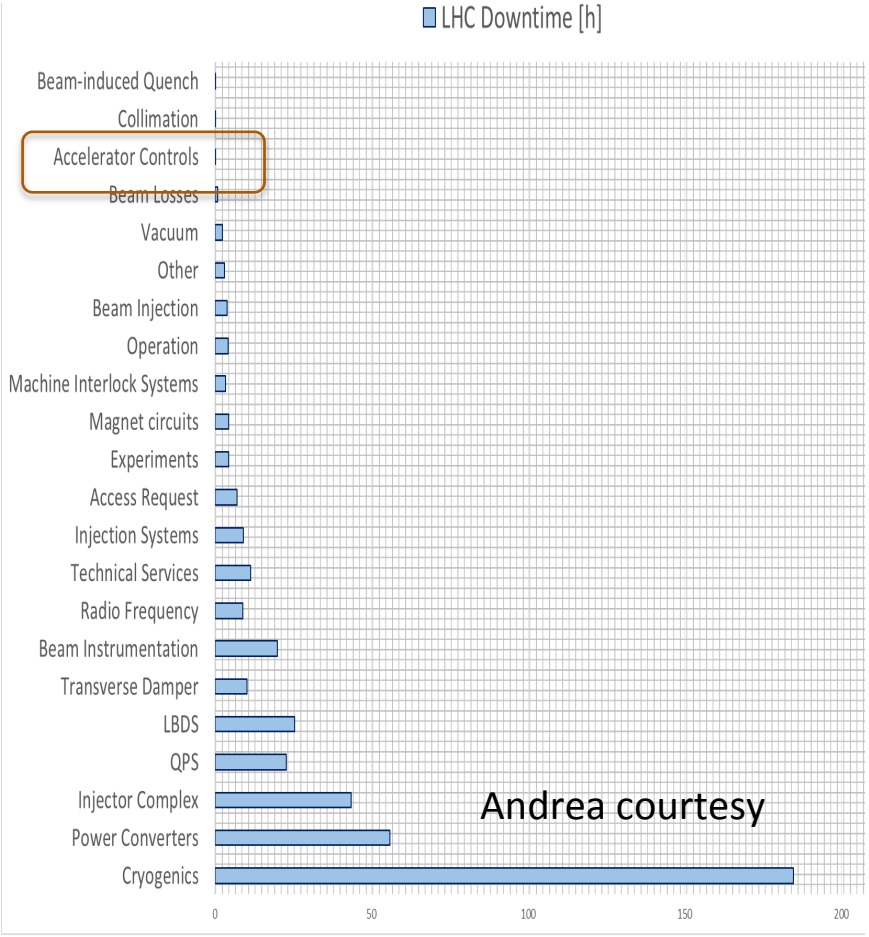
- SW Upgrades and Consolidation
  - Upgrade of the control system to the latest controls framework versions (FESA, CMW/RDA, LSA)
  - With non-backward compatible changes on some major frameworks
  - Important impact on equipment and operation developers, mainly for LHC injectors

-> Detailed analysis in next slide (LS1 Review)

Commissioning & controls operation in 2015

LHC start-up after LS1 was flawless, starting one year later than injectors

Very good overall reliability & stability in 2015



Controls operation in 2015 - Technical

- Some failures with 2 important systems
  - **JMS** (Java Messaging Service), impact on LSA, SIS…
    - 11h downtime
    - Issues solved. Stable since November 2015. Monitoring added.
  - **DTM** (Timing distribution to applications) time-out, impact SIS, LOGGING,..
    - 3h30 downtime
    - Legacy software
    - Progressive deployment of new DTM system in operation in 2016
- Impact of RDA2 -> RDA3 migrations
  - Holes in logged data & spurious LASER alarms, if RDA client not restarted
  - Solution to notify clients upon migration event available at start up 2016.
- Freezing of WorldFIP gateways on Kontron machines
  - Rare occurrences
  - Mid term solution: insourced development of a new WorldFIP master.
    - Progressive installation will start in this YETS & finish by end of LS2 of new in-house bus arbiters cards and associated high-level libraries to replace the WorldFIP Bus Arbiters (WorldFIP master) for all LHC systems (Power converters, QPS, Cryogenics, ..)
    - This will complete the insourcing of the WorldFIP technology inside BE-CO

Controls operation in 2015 - Organisation

- BE-CO Support
  - Standardised best-effort support across all machines since 2014 following the SPS-LHC model.
  - Remarkable reliability of new HW installations. The few interventions concern only remaining non-renovated systems.
- Tracking of issues and upgrades
  - Exploitation Management: follow-up of issues + requests during Operation
  - Smooth Upgrades Working Group (SUWG): coordination of upgrades during technical stops+YETS
    - Worked well, provided all groups play the game
    - Technical stops essential also for HW preventive maintenance
  - Issue reporting via E-LOGBOOK to JIRA
    - Extensively used by injectors -900 issues created in 2015.
    - Efficient collaborative tool for CO & EQ GP (EPC,..)

Outlook for 2016 Operation

- Feedback & requests from OP on controls
  - Organized in January 2016 with LHC and Injectors teams, like in 2015
  - This feedback allows us to tune our development priorities.
- Accelerator Fault Tracking (AFT)
  - New version in Q1 2016, with enhanced statistics and availability reports (cf Andrea's talk)
- Migration and integration tools
  - Much progress since LS1
  - Automation of data propagation from Controls Configuration DB to LSA DB
  - New tools for massive migrations: on-demand training sessions proposed to developers
  - User feedback is essential ASAP to further improve tools for EYETS/LS.
- Collaboration with OP developers – OP requests
  - Customized training: either via CO JTECH (Java Technical meetings) or CO service responsibles
  - Closer collaboration for application development: to be followed-up

Outline

- Looking back at LS1
- LHC Commissioning & controls operation in 2015
- Outcome from the LS1 Controls Review
  - Held on December 1, with one representative per EQ and OP Groups
  - Highlights today. Final report by reviewers in Feb 2016
- Outlook for coming years

Outcome of LS1 Controls Review
What worked well

- Hardware installation
  - A challenging context, huge job
  - 460 FECs @ LHC injectors to be dismantled with no doc & no way back
  - Completed on time, error-free
- Specification of upgrades by MCCs (Machine Controls Coordinator)
  - 50 EDMS specification docs to describe all upgrades
- CO-organized dry-runs for the whole injector chain
  - 30 dry-runs, proven useful -> Cf. Klaus' talk @ Chamonix 2014
  - Essential for debugging and to set milestones for CO + EQ GPs
  - Remarkable synergy in CO & friendly collaboration with EQ GPs + OP
- Support from CO experts
  - Good support towards operational and development issues
  - On-site help to EQ GPs to help them migrate classes faster

Outcome of CO LS1 Review
What can be improved

- Handling of non backward compatible changes on major software frameworks (CMW, FESA,…)
  - Upgrade controls to the latest framework versions had a large impact to the EQ and Operational developers
- Integration of frameworks and stable CO environment came too close to the end of LS1 for Injectors
  - EQ developers had to use beta versions and some work-arounds at the beginning of the migration
  - Systems had to be adapted and retested several times
- Efficient class/device migration tools not available at the beginning of LS1
  - Migrations for CO, OP, EQ GPs were painful and delayed.
  - Propagation from CCDB to LSADB & GUI not user-friendly enough

Requests from LS1 Review -> Actions for LSs

- Put in place & publish a global planning with all upgrades
  - EYETS 2016/17 will be used as pilot to fine tune for LS2.
- Improve internal synchronization of key framework releases (CMW, FESA,..)
  - Announce in advance non-compatible changes & measure impact with EQ/OP developers
- Provide a CO stable environment to equipment and operation developers well before the start of LS
  - Not evident how to put this in place. Discussions on-going.
- Formal agreement via ECRs for new development and major modifications
  - Ex: Specification of the API for each new FESA class
- Use CO3 to coordinate upgrades for the LS re-commissioning
  - Injector Re-commissioning Working Group (IRWG) -> Machine Controls Coordinators should be the CO links with OP/ABP Machine re-commissioners.

Summary

- CO had a large upgrade program for LS1 which generated many changes on the controls HW and SW infrastructure.
- Controls were ready for LHC startup but we acknowledge the high impact on equipment and operation developers.
- Controls for LHC 2015 operation worked well with no outstanding technical issues and very little downtime.
- From lessons learnt during LS1 and outcome of the LS1 CO review, CO will take actions to put in place a more efficient coordination with our users.

Time For Questions

LHC WorldFIP Infrastructure

Aim : install the new in-house bus arbiters cards and associated high-level libraries to replace the WorldFIP Bus Arbiters (WorldFIP master) for all LHC systems (Power converters, QPS, Cryogenics, ..)

Alstom PCI BA

FMC mezzanine board, to be plugged on the PCIe carrier (SPEC)

Activity	Impact
HW production • Bus Arbiter PCI cards done	BE/CO/HT + TE/MPE/EM
New device driver + SW libraries: Proof-of-concept OK	Power Converters, Cryogenics, QPS, Survey, Beam Instrumentation
Agreement + Testing : Backwards compatible layer for clients who keep the old API • Encourage clients towards the new API	Power Converters, Cryogenics, QPS, Survey, Beam Instrumentation
Planning, Commissioning	EN/MEF, BE/OP, LS2 CO Coord

Planning
Deploy the new master in selected places before LS2 to get confidence and a general replacement during LS2 : • TS 2016: install few non critical pilot(s) in LHC • EYETS 2016-17: install few pilot(s) • LS2: Full replacement

Budget
400 KCHF allocated in consolidation covering • cards production • FSUs Job

Cu/Optical repeaters were already insourced (GOFIP) and we plan to insource the Cu/Cu repeaters before LS2 to ensure adequate stock. No need to replace the existing ones so far as they are not giving any problem