Long shutdown 1
LHC Machine Status Report

K. Foraz
June 12th, 2013
- Introduction
- LHC
  - Preliminary phase
  - SMACC project
  - R2E project
  - Maintenance and consolidation of Infrastructure
- Injectors
- Conclusion
Take all measures for a safe and reliable operation of LHC @ 7TeV/beam

- Consolidate superconducting magnets and circuits ➔ SMACC
- Relocate radiation sensitive electronics ➔ R2E
- Perform full maintenance of all equipment's
- ....

Warm-up ➔ Maintenance & consolidation ➔ Cool-down

Powering tests ➔ Powering tests
LHC LS1 schedule (v3.0)
Introduction

LHC
  - Preliminary phase
  - SMACC project
  - R2E project
  - Maintenance and consolidation of Infrastructure

Injectors

Conclusion
LHC Preliminary tests

- Powering tests
  - 40 circuits were tested: (almost) all circuits were powered up to 7 TeV equivalent current
  - 773 successful tests were executed in 10 days

- All circuits reached the nominal 7 TeV equivalent current, but
  - RD3.L4, commissioning stopped at 6.9 TeV (long training), but can be possibly pushed further
  - RQ5.R2 – I_Nom reduced to 4100 A from 4310 A (OK for 7 TeV)
  - RCBYHS5.R8 – Tested successfully to 20 A, but cannot be powered up to the nominal 72 A (a similar failure was observed on the same corrector in 8L and that was replaced with a normal conducting magnet)
  - RQLT11.R5B1 – I_Nom reduced to 450 A from 550 A
  - RQLT11.L6B1 – I_Nom reduced to 350 A from 400 A
  - RCSSX3.L1 – I_Nom reduced to 60 A from 72 A
  - RQLT9.R3B2 – I_Nom reduced to 425 A from 450 A
LHC Preliminary tests

- Electrical Quality Assurance (ELQA)
  - ELQA at 1.9K and at room temperature were performed in all sectors and are just finished
  - 37 NCs revealed. Most of them will be solved at warm, during SMACC. No showstopper!

- Warm-up is finished
LHC Preliminary leak tests

Leak tests

- Arc subsectors all tested: 20 internal helium leaks identified
  - 14 identified to component (for repair).
  - For 6 leaks not identified to component, further tests to be performed in phase 2.

- QRL
  - 2 existing internal leak known
  - 5 new internal leaks – under investigation

- After warm-up and before consolidation RF ball tests are performed in each sector
  - 6/8 sectors tested
  - 2 PIMs collapsed
Introduction

LHC

- Preliminary phase
- SMACC project
- R2E project
- Maintenance and consolidation of Infrastructure

Injectors

Conclusion
The main 2013-14 LHC consolidations

1. 1695 openings and final reclosures of the interconnections
2. Complete reconstruction of 1500 of these splices
3. Consolidation of the 10170 13kA splices, installing 27 000 shunts
4. Installation of 5000 consolidated electrical insulation systems
5. 300 000 electrical resistance measurements
6. 10170 orbital welding of stainless steel lines
7. 18 000 electrical Quality Assurance tests
8. 10170 leak tightness tests
9. 4 quadrupole magnets to be replaced
10. 15 dipole magnets to be replaced
11. Installation of 612 pressure relief devices to bring the total to 1344
12. Consolidation of the 13 kA circuits in the 16 main electrical feedboxes
- **W opening**
  - Completed in sector 56
  - In progress in sector 67

- **Interconnection train**
  - Sector 56
  - Sector 67
SMACC progress

- DFBA consolidation in sectors 56, 67, 81
- DN200 in progress in sector 78 (not started in sector 81)
- Magnets replacement in sector 78

1st sleeves cut in DFBAK HCM

Magnet exchange

DN200

12/06/2014

K. Foraz - 114th LHCC
- Introduction

- LHC
  - Preliminary phase
  - SMACC project
  - R2E project
  - Maintenance and consolidation of Infrastructure

- Injectors

- Conclusion
R2E project - Goal

- **2008-2011**
  - Analyze and mitigate all safety relevant cases and limit global impact

- **2011-2012**
  - Focus on long downtimes and shielding

- **LS1 (2013/2014)**
  - Final relocation and shielding

- **LS1-LS2 (2015-2018)**
  - Tunnel equipment and power converters

---

Downtime

- ~400 hours
- ~250 hours

---

Annual Cumulated Luminosity

- Aiming for <0.5 dumps / fb-1
- ~12 dumps / fb-1
- ~3 dumps / fb-1

---

12/06/2014 K. Foraz - 114th LHCC
R2Eproject during LS1

Point 4
UX45
US45
UL44/46

Point 5
UJ/UP56
UL557/8
RR53/57

Point 6
UJ76
TZ76

Point 7

Point 8
US85
UL84/86
UA83/87

12/06/2014
K. Foraz - 114th LHCC
R2E project progress

- Point 1
  - Power converter dismantling in progress
  - Electrical infrastructure in progress

- Point 5
  - Power converters disconnected
  - Preparation and protection before drilling in progress
  - Piping installation almost finished

- Point 7
  - Power converters disconnection and cable removal in progress
  - TZ76 – demolition wall in progress
Introduction

LHC
- Preliminary phase
- SMACC project
- R2E project
- Maintenance and consolidation of Infrastructure

Injectors

Conclusion
Maintenance and consolidation of 400kV and 60kV

June 3rd – August 3rd

Power limited to 50 MW
- Full maintenance of all the equipment in progress

- Several consolidation and upgrade in progress according to schedule
  - Demineralised water production
  - Additional cooling towers
  - UPS replacement
  - Replacement of the ducts of water cooled cables
  - ...
  - And of course cabling!

12/06/2014

K. Foraz - 114th LHCC
Introduction

LHC
- Preliminary phase
- SMACC project
- R2E project
- Maintenance and consolidation of Infrastructure

Injectors

Conclusion
Main activities

- Preliminary powering tests complete
- Full maintenance of all the equipment
- PS Booster & PS
  - Installation of the new access systems
  - Cooling and ventilation renovation
  - Upgrade of the RF systems
  - Improve the radiation shielding over the PS and Septum 16
- SPS
  - Consolidation of 18kV transformers
  - Replacement of irradiated cables in BA1 and in TCC2
  - Installing new Fibres systems in BA5, BA6 and BA1
  - New coated magnets in BA5
  - Major consolidation of the valves – CV
  - Vertical realignment in BA6

Progress status

- Overall progress is good
- Introduction
- LHC
  - Preliminary phase
  - SMACC project
  - R2E project
  - Maintenance and consolidation of Infrastructure
- Injectors
- Conclusion
Dashboards

- General and detailed progress
  http://lhcdashboard.web.cern.ch/lhcdashboard/ls1/
General progress

So far, so good
throughout accelerator complex

LHC
- Preparatory phase almost complete
  - Machine is warm
  - Electrical preliminary tests complete
- SMACC
  - IC train in 2 sectors – good progress
  - 1st magnets exchanged
- R2E
  - Good progress
  - Preparatory works almost finished
- Infrastructure activities on schedule