LHC & CMS status

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Fermilab - CMS Center

All Experimenters’ meeting
Monday, 2 March 2009
Outline

- LHC status.
- CMS status.
- CMS commissioning w/o beam.
The new schedule **delayed by six weeks wrt the previous**:
- implementation of new enhanced protection system for the busbar and magnet splices.
- installation of pressure-relief valves to reduce collateral damage in case of a repeat incident.
- application of more stringent safety constraints.
- scheduling constraints associated with helium transfer and storage.

Run during the Winter months (**gain 20 weeks of Physics running independent of “slip”**).
LHC should not be operated until the full Quench System is tested and operational.

Gain 20 weeks of physics in 2010 by running during winter months
LHC: Chamonix Conclusions (II)

Shutdown 08-09

Key Drivers | Maintenances | Priorities | Activities – service areas, LSS, Arcs | Schedule | Critical Points
---|---|---|---|---|---

- **Intermediate cool-down & QRL warm-up (Stand Alone)**
- **Activities**
  - Arc
  - LSS
- **Flushing & ELQA at warm**
- **Cool-down**
- **Powering tests**
- **Cold check-out**
LHC consolidation news

- First dipoles fitted in SM18 with new pressure-relief valves.
- Next, the procedure applied to warmed-up sectors.
- Improved calorimetric method of measuring the inter-splice resistance (1 nOhm sensitivity).
- Work to improve anchoring of 104 Short Straight Sections.
- Sector 67 warming up to replace a dipole with internal 50 nOhm splice resistance.
- Dipole in S12 with 100 nOhm splice removed, opened and confirmed lack of solder in the splice.
- Start of massive campaign to re-analyze data taken during the previous cold testing checking for abnormal splice resistance.
LHC: 2009/2010 Run

• DG’s message on 10 Feb:
  • first beams in the LHC at the end of September 2009.
  • collisions in late October.
  • short technical stop over Xmas.
  • run through to autumn 2010.

• Machine Protection tested with beam (testing at 0.5 TeV energy steps).
• 4 TeV, 5 TeV beams (no higher in 2010).
• Intensity limited until QPS symmetric mode is completely tested.
• Physics with 5 TeV beams.
• Estimated p-p integrated luminosity:
  • during first 100 days of operation \(\sim 100\text{pb}^{-1}\)
  • during next 100 days of operation \(\sim 200\text{pb}^{-1}\)
• Heavy ions towards the end of 2010.
**LHC: 2009/2010 luminosity**

**Approximate!!!**

**LHC 2009 - 2010 luminosity performance - estimate**

A path to the total integrated luminosity quoted at Chamonix 2009 while keeping the total intensity to a reasonable level. Necessarily approximate.

<table>
<thead>
<tr>
<th>Month</th>
<th>Comment</th>
<th>Turn around time</th>
<th>Availability</th>
<th>Max number bunches</th>
<th>Protons/Bunch</th>
<th>Min beta*</th>
<th>Peak Luminosity cm⁻²s⁻¹</th>
<th>Integrated Luminosity</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Beam commissioning</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2</td>
<td>Pilot physics, partial squeeze, gentle increase in bunch intensity, 40%</td>
<td>Long</td>
<td>Low</td>
<td>43</td>
<td>$3 \times 10^{10}$</td>
<td>4 m</td>
<td>$1.2 \times 10^{30}$</td>
<td>100 - 200 nb⁻¹</td>
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<tr>
<td>3</td>
<td>2.5% nominal beam intensity</td>
<td>5</td>
<td>40%</td>
<td>43</td>
<td>$5 \times 10^{10}$</td>
<td>4 m</td>
<td>$3.4 \times 10^{30}$</td>
<td>~ 2 pb⁻¹</td>
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<td>4</td>
<td>9% nominal beam intensity, 75 ns</td>
<td>5</td>
<td>40%</td>
<td>156</td>
<td>$5 \times 10^{10}$</td>
<td>2 m</td>
<td>$2.5 \times 10^{31}$</td>
<td>~13 pb⁻¹</td>
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<tr>
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<td>15% nominal beam intensity, 75 ns</td>
<td>5</td>
<td>40%</td>
<td>156</td>
<td>$7 \times 10^{10}$</td>
<td>2 m</td>
<td>$4.9 \times 10^{31}$</td>
<td>~25 pb⁻¹</td>
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<td>6</td>
<td>9% nominal beam intensity, 75 ns*</td>
<td>5</td>
<td>40%</td>
<td>936</td>
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<td>2 m</td>
<td>$5.1 \times 10^{31}$</td>
<td>~30 pb⁻¹</td>
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<td>5</td>
<td>40%</td>
<td>936</td>
<td>$5 \times 10^{10}$</td>
<td>2 m</td>
<td>$1.4 \times 10^{32}$</td>
<td>~75 pb⁻¹</td>
</tr>
<tr>
<td>8</td>
<td>15% nominal beam intensity, 75 ns*</td>
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<td>10</td>
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Max number of filled bunches in the LHC is 2808 = 3 x 936

AEM, 2 March 2009  K. Kousouris
CMS opened in December 08.
CAVERN activities on schedule.
Ongoing Muon & HCAL repairs.
  - Muon Barrel Drift Tubes (DT), Barrel and Endcap Resistive PAD chambers (RPC), Endcap Cathode Strip Chambers (CSC) repairs (few per mille of channels) almost complete.
  - DT work on YB-1/2.
  - HCAL HPD swaps completed.
  - Leak detection on YEs and repair ongoing.
Tracker PP1 work in the shadow (ready by end of April, second one a month later).
Tracker cooling (this is the critical path for CMS shutdown activities).
Preshower: installation foreseen by next week at the PLUS end. MINUS end to follow soon.
Pixel platform being installed. Internal cooling pipe replacement (extra safety margin) and minor repairs. Will be re-installed at the end of April.
CMS 2009 schedule
(Proposed last Friday by the CMS Run co-ordinator)

• Midweek global runs to start in March (**first run on 4-5 March**) with partial detectors’ participation:
  • Data Acquisition (DAQ) & High Level Trigger (HLT).
  • L1 trigger.
  • Electromagnetic Calorimeter (ECAL) & Hadron Calorimeter (HCAL).
  • Muon detectors: RPC (RB, RE+), CSC (all but ME4+), DTs(#?).
• More MW runs to follow (proposal for 7 more until the end of May).
• CMS closed by end of May.
• CRUZET (**Cosmic RU*n at ZEro Tesla**) in early June and beginning of July.
• CRAFT (**Cosmic Run At Full Tesla**) in July and almost continuous running with 2-3 week interruption for cooling maintenance.
• Beam mode 2 weeks before circulating beam.
Despite the (very unfortunate) LHC delay, CMS is being commissioned with real data from the cosmic runs (355M events, 277M with magnetic field ON).

- Precious lessons for alignment, synchronisation of sub-systems, trigger, noise, magnetic field, data operations, etc.
- Development of more realistic MC simulation.
LHC is set to be operational in late October 09.

Physics run with p-p collisions @ 10 TeV CM energy until the end of 2010 (~300pb⁻¹).

CMS service operations on schedule.

CMS will be closed in the end of May 09 and cosmic runs will take place until mid September (2 weeks prior to beams’ circulation in LHC).

Ongoing intensive analysis of 2008 CRAFT data has boosted our understanding of the CMS detector.