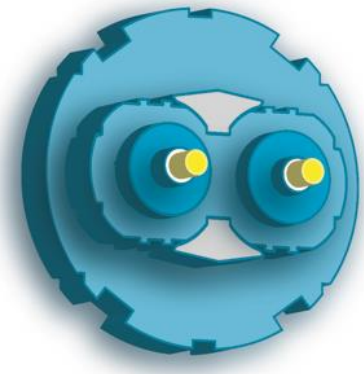

High Luminosity LHC

Conceptual Specifications review:

Layouts in LSS 4, ATLAS, CMS, LHCb, ALICE, Collimator bypass assembly and insulation vacuum system

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11th HL-LHC Technical Committee
CERN – 2nd September 2014

The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

- Thanks to everybody for their comments
- Dead line to implement them ?

HL-LHC LSS4 layout
EDMS 1361099

- Ensure vacuum performances:
  - ACS < 10^{-10} mbar with beams
  - Bakeout temperature to 200°C (300°C) for NEG (St.St)
  - Heating rate = 50 °C / h
- Vacuum sectorisation & instrumentation
- Interface to other systems:
  - variants minimisation
  - Offsets / transitions included into equipments
  - Circular apertures
- Cryogenic temperature : only new ACS
- Re-use of standard LHC interfaces

HL-LHC ATLAS vacuum system (1/2) EDMS 1361088

- From Q1L1 to Q1R1, Q1 excluded
- Valve sectorisation:
  - At Q1 to decouple warm to cryogenic temperature (interlocked)
  - Between TAS-Q1 to decouple experiment/machine (not interlocked)
- Q1-TAS:
  - Pumping system (L1 only, R1 need to be installed)
  - Pure Ne/pumping injection (L1 only, R1 need to be installed)
  - Rupture disk
  - Remote tooling
  - Robust component, “quick” flanges
  - Permanent bakeout system (compatible with other systems)

HL-LHC ATLAS vacuum system (2/2) EDMS 1361088

- Experimental cavern:
  - Permanent bakeout
  - TAS area to be redesigned wrt to ALARA
  - Al chambers for radioactivity reasons
  - Conflat bolted technology, “quick flange” type connection in hot radiation areas, no sliding RF fingers
  - Remote alignment of chambers (avoid people during WTS)
  - Ne venting during long stops (> 10 days)
- Assumptions:
  - Same central chamber since LS1.
  - TAS to be exchanged implies venting / re-commissionnning of the ATLAS vacuum system

HL-LHC CMS vacuum system (1/2) EDMS 1361089

- From Q1L5 to Q1R5, Q1 excluded
- Valve sectorisation:
  - At Q1 to decouple warm to cryogenic temperature (interlocked)
  - Between TAS-Q1 to decouple experiment/machine (not interlocked)
- Q1-TAS:
  - Pumping system (L&R installed)
  - Pure Ne/pumping injection (L&R installed)
  - Rupture disk
  - Remote tooling
  - Robust component, "quick" flanges
  - Permanent bakeout system (compatible with other systems)

HL-LHC CMS vacuum system (2/2) EDMS 1361089

- Experimental cavern:
  - No permanent bakeout: tbd if needed for ALARA
  - TAS area to be redesigned wrt to ALARA
  - Al chambers for radioactivity reasons
  - Conflat bolted technology, “quick flange” type connection in hot radiation areas, no sliding RF fingers
  - Remote alignment of chambers (avoid people during WTS)
  - Ne venting during long stops (> 10 days)
- Assumptions:
  - Same central chamber since LS1
  - Al chambers installed during LS2: no intervention between TAS5L and TAS5R during LS3
  - TAS to be exchanged during LS3 implies venting / re-commissionnning of the CMS vacuum system

HL-LHC LHCb vacuum system (1/2) EDMS 1361090

- From Q1L8 to Q1R8, Q1 excluded
- Valve sectorisation:
  - At Q1 to decouple warm to cryogenic temperature (interlocked)
  - Between Cavern-Q1 to decouple experiment/machine (not interlocked)
- Q1-cavern:
  - Rupture disk
- LHCb vacuum sectors:
  - Requires a complete NEG re-activation in case of opening

HL-LHC LHCb vacuum system (2/2) EDMS 1361090

- Experimental cavern:
  - VELO has a gas balance system operating at atmospheric pressure and UHV. Used to perform Ne venting
  - VELO system must be baked to 180-200°C (@50 °C / h) to suppress electron cloud
  - Al chambers preferred for radioactivity reasons
  - Conflat bolted technology, “quick flange” type connection in hot radiation areas, no sliding RF fingers
  - Remote alignment of chambers (avoid people during WTS)

- Assumptions:
  - Part of the detector to be equipped with permanent bakeout during LS2.
  - New VELO and VCDBV installed during LS2: no vacuum (mechanical, bakeout, NEG activation) interventions in the cavern during LS3

HL-LHC ALICE vacuum system (1/2) EDMS 1361091

- From Q1L2 to Q1R2, Q1 excluded
- Valve sectorisation:
  - At Q1 to decouple warm to cryogenic temperature (interlocked)
  - Between Cavern-Q1 to decouple experiment/machine (not interlocked)
- Q1-Cavern:
  - Pumping system (R2 only)
  - Pure Ne/pumping injection (R2 only)
  - Rupture disk

HL-LHC ALICE vacuum system (2/2) EDMS 1361091

- Experimental cavern:
  - RB24 vacuum sector with a manual valve on the left side of ALICE central chamber
  - RB26 vacuum chambers equipped with permanent bake out system
  - Al chambers preferred for radioactivity reasons
  - Conflat bolted technology, “quick flange” type connection in hot radiation areas, no sliding RF fingers
  - Remote alignment of chambers (avoid people during WTS)

- Assumptions:
  - New central chamber installed during LS2: no vacuum (mechanical, bakeout, NEG activation) interventions in the cavern during LS3

HL-LHC Collimator-bypass assembly EDMS 1361087

- Install in some dispersion areas
- Room temperature collimator
- Vacuum sectorisation & instrumentation of both beam pipes
- RF ball compatible
- Bake able room temperature lines
- “quick flange” type connection, integrated functionalities to gain lenght
- Re-use of standard LHC interfaces
- New design, with continuous beam screen on 2nd pipe, under study
- Assumptions:
  - Installation around IP2 during LS2.
  - Installation areas during LS3 will be defined by WP5 (collimation)

HL-LHC Insulation vacuum system EDMS 1361095

- LSS1 and LSS5
- He leak rate, at component level, < 10^{-10} mbar.l/s
- Permanent turbo-molecular pumping
- Compatible with LHC insulation system
- Re-use of LHC standard
- In high radiation areas, specific seals have to be foreseen to replace Viton in NBR

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