



LHC ECR: LHC-Y-EC-0021

**LHC safety system modifications due to
HL-LHC during LS2**

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HSE-RP, EN-EL, EN-CV, HSE-FB

HL-LHC TCC, 7 June 2018

LHC ECR

- ECR:
 - LHC-Y-EC-0021
 - EDMS: 1970015
- PLAN: 11105
- Safety-related systems:
 - Access system
 - Doors and shielding
 - ODH detection
 - Automatic fire detection
 - Evacuation system and BIW
 - Red telephones
 - CSAM
 - Radiation monitoring
 - Emergency lighting and AUG
 - Fire fighting equipment
 - CV equipment
 - Networking

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LHC

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REFERENCE LHC-Y-EC-0021		








Date: 2018-06-06

ENGINEERING CHANGE REQUEST		
LHC Safety System Modifications Due To HL-LHC During LS2		
<p>BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):</p> <p>The new HL-LHC caverns will be connected to the LHC tunnel during LS2 via emergency exit galleries UPR. During the run 3 the UPR galleries need to be closed off from the HL-LHC galleries with end-of-zone doors supervised by the LASS. In addition, ODH detection, automatic fire detection, evacuation/BIW system, red telephones, RAMSES radiation monitoring, and Technical Network connectivity need to be installed.</p>		
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<p>DOCUMENT SENT FOR INFORMATION TO: LMC members, LSC members, ATS groups leaders.</p>		
<p>SUMMARY OF THE ACTIONS TO BE UNDERTAKEN:</p> <ul style="list-style-type: none"> • Include the new access doors in the UPRs and UAs galleries into the LASS and LACS. • Install ODH detection, automatic fire detection, evacuation/BIW system, and red telephones. • Install a Ramses monitoring station outside of each interlocked zone in the new HL-LHC galleries and • Install Technical Network connectivity in UPRs and UAs. 		
<p><small>Note: When approved, an Engineering Change Request becomes an Engineering Change Order. This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use.</small></p>		




ACCESS SYSTEM

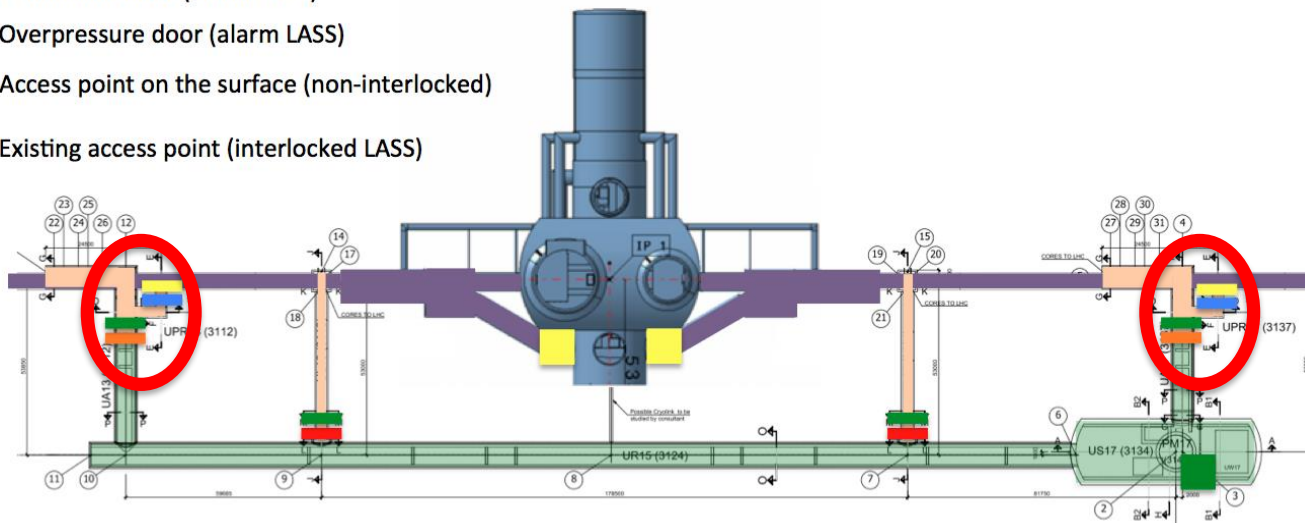
- 4 new sectors: UPR13, UPR17, UPR53, UPR57.
- 4 new end-of-zone doors
- 4 new sector doors
- 8 new ventilation doors
- 12 new patrol boxes
- 4 new racks

Access elements

-  Grated end-of-zone door (interlocked LASS)
-  Solid end-of-zone/ventilation door (interlocked LASS)
-  Grated sector door (interlocked LASS)
-  Ventilation door (alarm LASS)
-  Overpressure door (alarm LASS)
-  Access point on the surface (non-interlocked)
-  Existing access point (interlocked LASS)

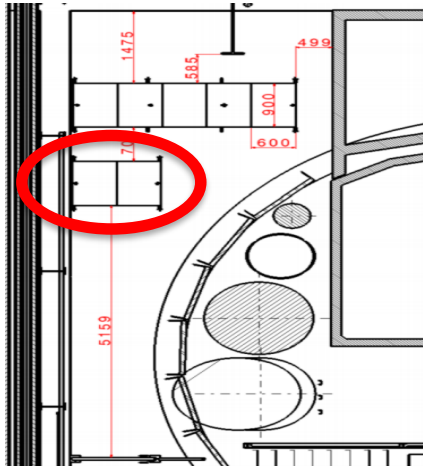
Zoning

-  Inner triplet area (interlocked LASS)
-  Non-accessible HL-LHC galleries (interlocked LASS)
-  Accessible HL-LHC galleries (non-interlocked)

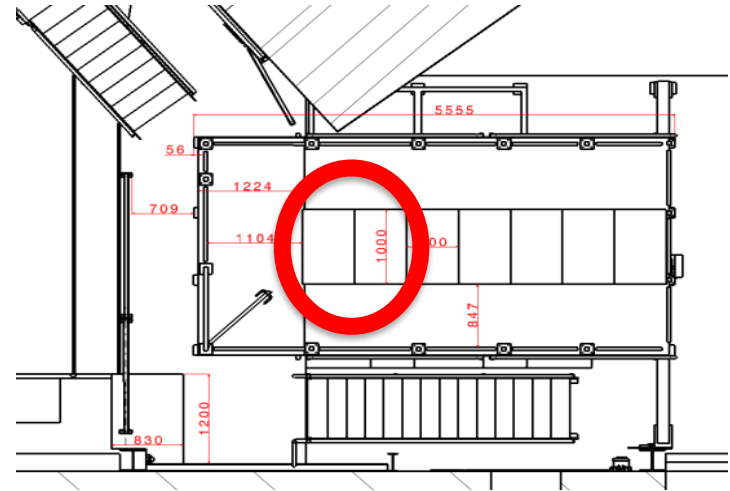


ACCESS SYSTEM

New racks at SD1



New racks at SD5



Opening / Patrol box

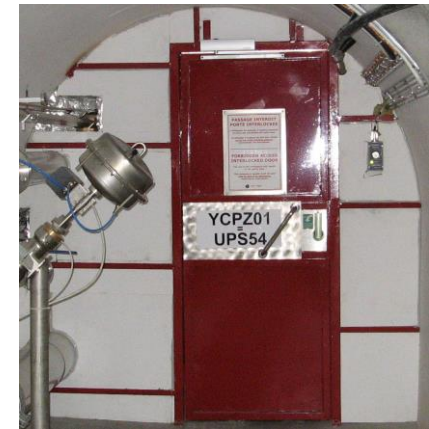
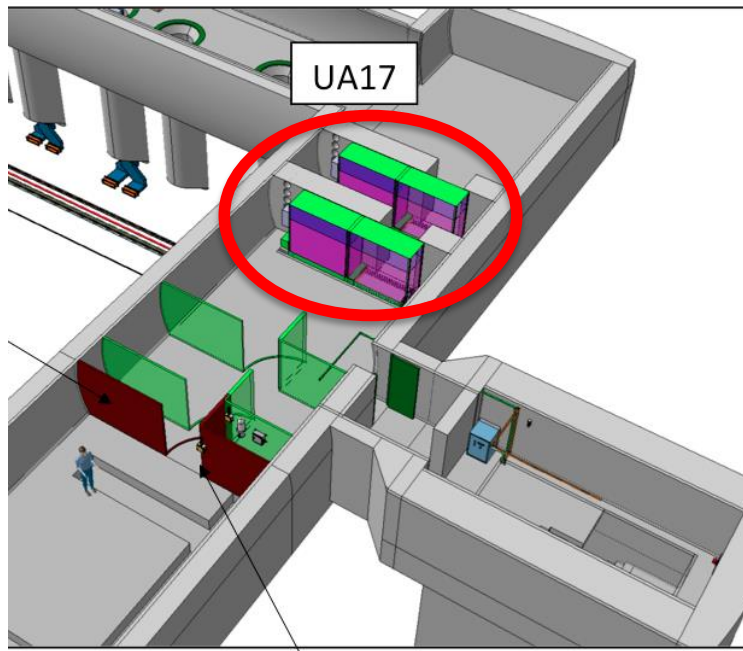


Junction box



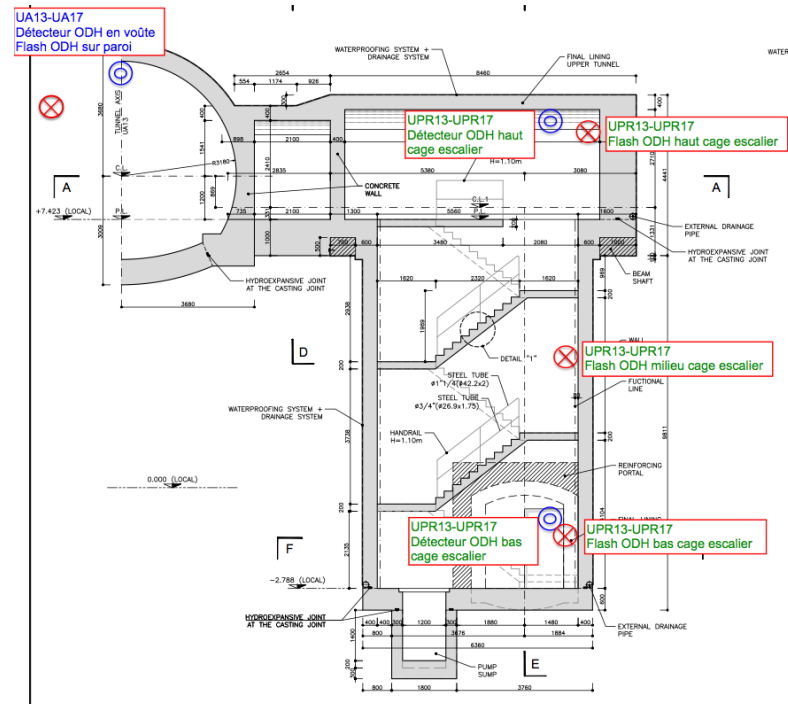
DOORS AND SHIELDING

- 4 grated sector doors.
- 4 regular ventilation doors.
- 4 overpressure doors: 60 mbar overpressure to He MCI. Also 90 min fire resistance.
- 4 end-of-zone / fire doors: 90 min fire resistance.
- Mobile shielding at the top of UA.
- Chicane at the bottom of UPR.



OXYGEN DEFICIENCY HAZARD (ODH) DETECTION

- 1 ODH detector in UA13, UA17, UA53, UA57.
- 2 ODH detectors in UPR13, UPR17, UPR53, UPR57.
- 1 ODH flash signal in UA13, UA17, UA53, UA57.
- 3 ODH flash signals (one at top, one at middle, one at bottom) in UPR13, UPR17, UPR53, UPR57.
- Cabling for each individual ODH detector from service areas of Point 1 and Point 5.



AUTOMATIC FIRE DETECTION (AFD)

- 2 fire detection tubes to UA13/UPR13 from sampling units in service areas of P1.
- 2 fire detection tubes to UA17/UPR17 from sampling units in service areas of P1.
- 2 fire detection tubes to UA53/UPR53 from sampling units in service areas of P5.
- 2 fire detection tubes to UA57/UPR57 from sampling units in service areas of P5.
- 2 new sampling units in service areas of P1 and P5 (1 unit / 2 tubes).
- 4 point-detectors, one in each UA overpressure sas. Cabling is to be pulled from the service areas.



Waiting for confirmation from RP that radiation levels at the UPRs are compatible with placing sampling units there → installation / cost optimization possible.

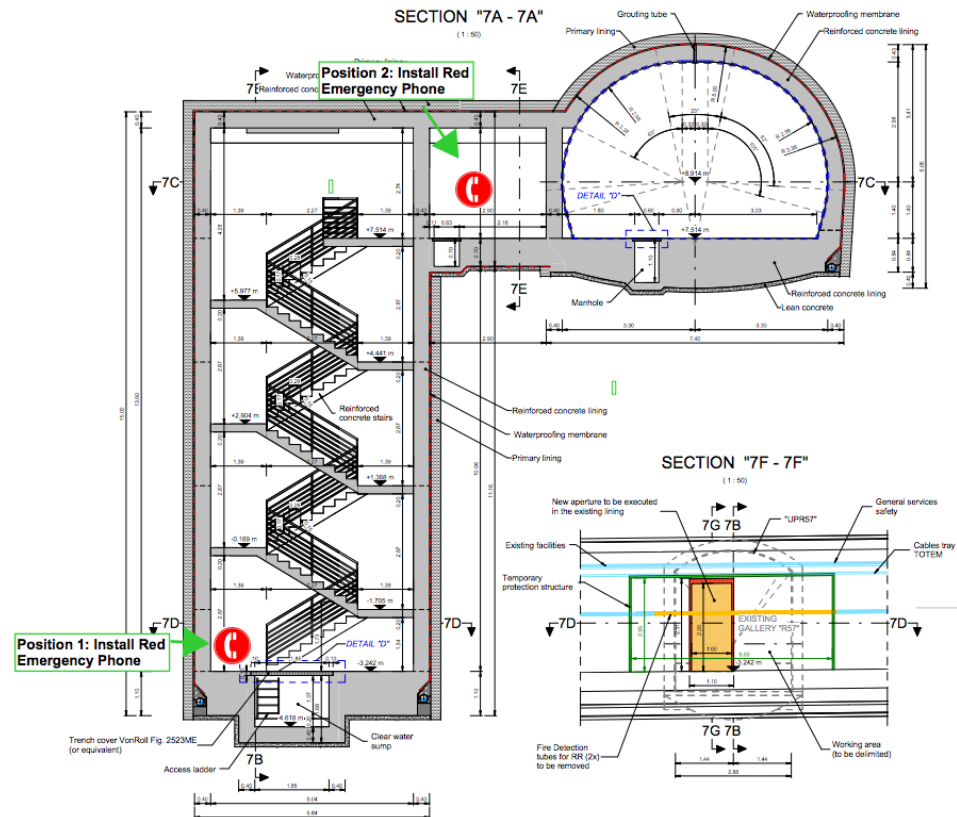
EVACUATION SYSTEM AND BIW

- 2 sirens for evacuation signal and BIW inside every UPR (UPR13, UPR17, UPR53, UPR57), one at the top of stairs, one at the bottom
- 2 evacuation buttons (break-glass device) in each UPR (UPR13, UPR17, UPR53, UPR57), one at the top of stairs, one at the bottom.
- Standard signalisation of evacuation routes to be installed by HSE / TSOs.



RED TELEPHONES

- 2 red telephones in each UPR (UPR13, UPR17, UPR53, UPR57), one at top of stairs, one at the bottom.
- Cabling for red telephones in each UPR from the service areas of P1 and P5 (one cable per two phones).

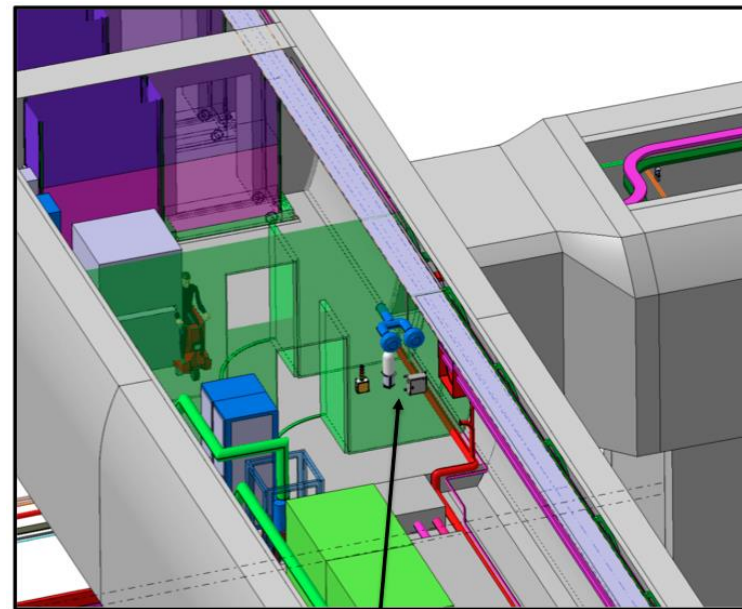


CERN SAFETY ALARM MONITORING (CSAM)

- Some of the equipment to be installed in the UPRs will be connected to the currently existing CSAM installation at P1 and P5 for safe delivery of level-3 alarms:
 - The red telephones.
 - Equipment by CV: pumps, ventilators.
- No extension of the current CSAM service on sites 1 and 5 is currently foreseen as the existing capacity should be sufficient.

RADIATION MONITORING

- 1 “Crome” radiation monitor and 1 signalling flash light outside of the interlocked zone of each UA gallery (UA13, UA17, UA53, UA57).
- 1 extra signalling flash outside the protective wooden wall in the UA during the CE works.
- 1 uninterruptible power unit on the interlocked side of each UA gallery.



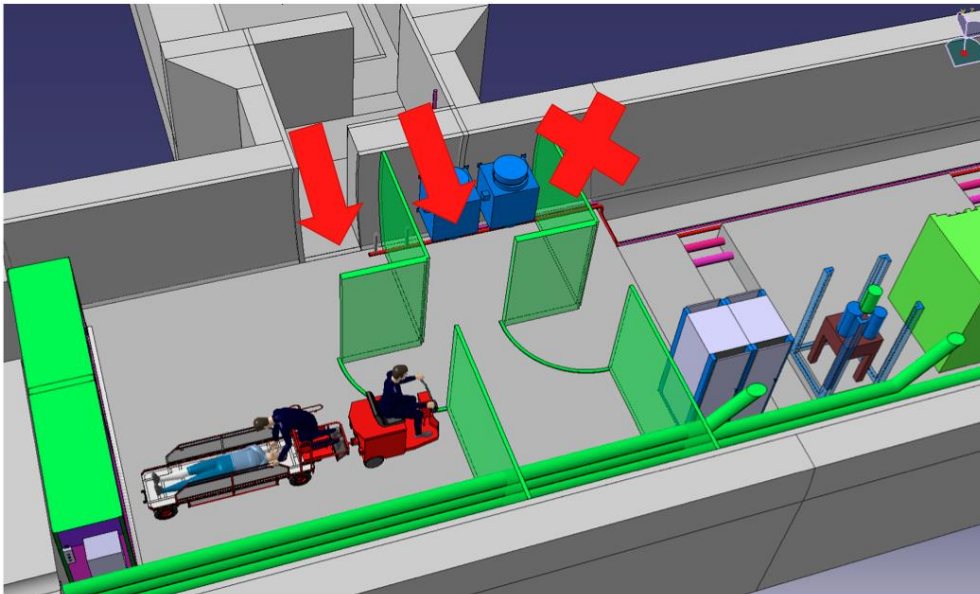
RP “crome” monitor

EMERGENCY LIGHTING AND AUG

- Emergency lighting is to be installed to the UPRs.
- AUG is to be installed in the UPRs, one button at the top, one at the bottom.

FIREFIGHTING EQUIPMENT

- In the final configuration after LS3 there will be RIA/STORZ installed for fighting fire. However, after LS2 these equipment will not yet be available.
- The Fire Brigade will position an electrical 2-seat tractor and a fire intervention trailer equipped with a CAFS (Compressed Air Foam System), spare SCBA (Self-Contained Breathing Apparatus), hose loads, forcible entry tools and extinguishers into the interlocked part of the UA.

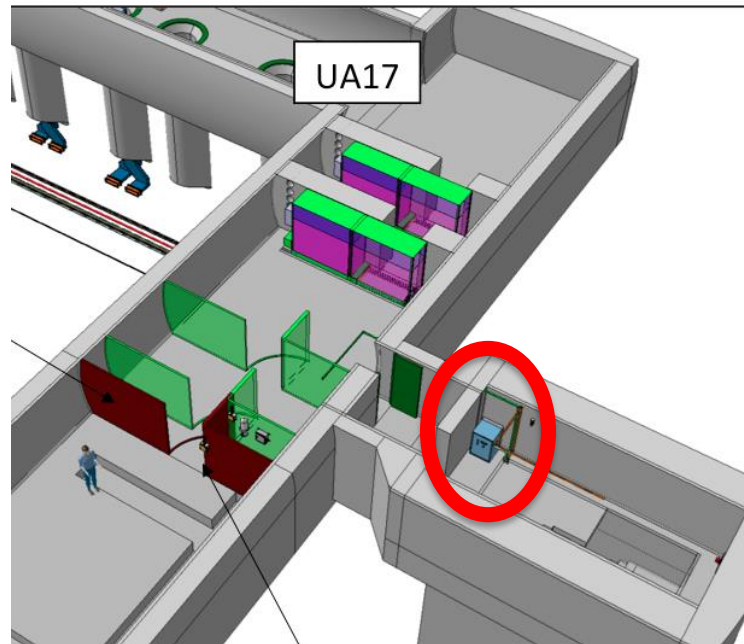


CV EQUIPMENT

- Pressurized sas in UA to keep radiated air from entering the UA: 25 Pa overpressure
- Sump pumps at the bottom of the UPR.

NETWORKING

- IT starpoint rack on the top level of each UPR.
- Fiber-optic cabling from the closest IT starpoint in the service areas of P1 and P5.
- Network sockets and local cabling from the starpoint rack to each socket: 6 sockets in each UA, 2 sockets at the top of each UPR and 4 sockets at the bottom of each UPR.
- Radiation monitoring and CV equipment connected to TN.



PREREQUISITES

- The LHC has to be in general access mode and the LASS is not solicited.
- UPR caverns are finalized by HL-LHC WP17.1.
- Access and ventilation doors are installed by HL-LHC WP17.10.

COST

- No cost to LHC consolidation budget. The estimated cost to HL-LHC project is:
 - Access system installation: 149 000 EUR
 - Access system cabling: 174 000 CHF
 - ODH detection (cabling included): 74 000 CHF
 - Fire detection / evacuation / BIW (cabling included): 149 000 CHF
 - Red telephones (cabling included): 20 000 CHF
 - Radiation monitoring: 170 000 CHF
 - IT Networking: 79 000 CHF
- Numbers for the other systems not added to the document yet.



Thank You!

Questions?