LHCb Experimental Area / machine zone
Shielding wall implementation for Upgrade II
Feasibility study

5th Workshop on LHCb Upgrade II
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Objectives / Assumptions

• **Goal:** Check feasibility to protect the LHC machine equipment in UX85 for Upgrade II conditions

• **Assume** that configuration of LHC machine equipment after LS2 is OK for radiation situation of Upgrade I (Run 3 and 4: $2.10^{33}$ cm$^{-2}$ s$^{-1}$)

• Upgrade II: Luminosity expected to increase by factor 10 wrt upgrade I: up to $2.10^{34}$ cm$^{-2}$ s$^{-1}$

• As a consequence: radiation dose rate to equipment expected to increase in the same proportion (x10)

• **Objective:** keep the LHC machine equipment of UX85 / US85 to the same level of dose rate as during Run 3 and 4

• **Means:** Relocate as much as possible + implement an additional 80 cm concrete or 40 cm iron shielding wall in UX85 protecting LHC machine equipment
Boundary conditions: cryo equipment

- Large cryogenic equipment on the US side of UX85 is known to be sensitive to higher dose rates than Upgrade I
- Relocation of this large cryo equipment to another cavern or surface is a multi-million project not considered here
- “Small” displacements considered “acceptable” by TE-CRG
Boundary conditions: shielding wall

• Shielding wall proposed to be made of concrete panels: 80 cm thickness is expected to be adequate in terms of shielding efficiency
• Shape of concrete panels can be adapted to local specificities
• Iron plates 40 cm thick can be used when not enough space for 80 cm concrete, but kept to a minimum for cost reasons
• Metallic structure supporting floors and equipment to be integrated in the shielding wall, locally modified when needed
• Shielding efficiency, handling, installation, stability to be checked with specialists
Layout proposal

Shielding wall 11 m high to isolate LHC machine equipment in UX85

UX85 cut view towards C-side
Move equipment by «small» amounts
To create enough space for shielding wall

Hauteur du niveau du bas 4.9m
Ground floor

- Shielding wall: Mix of concrete and iron panels
- Sci-Fi
- Pump to be relocated
- Valve box to be rotated by 3° and translated by 1 m
- Piping above valve box to be adapted
- Horizontal cut in UX85 4 m above floor level
First floor

Shielding wall:
Mix of concrete and iron panels

Blue fridge to be translated by 45 cm

Horizontal cut in UX85
11 m above floor level

Blue fridge and command panel

Optical fibres
Shielding wall details

- Indent for Sci-Fi cable chain
- Cut-out for optical fibres

Seen from LHCb side

Seen from cryo side

2 m
Metallic structures

- A number of metallic structures to be modified / relocated
- Main support of floors are critical: integrate in shielding wall
Shielding wall: next steps

- Proposed layout: 280 t concrete, 130 t iron
- Check with Fluka simulation team if proposed shielding is adequate
- Check with transport specialists if displacement of large objects are feasible
- Check with cryo specialists feasibility and cost of the displacements
- Check with metallic structures specialists the proposed mods
- Adapt project consequently
- Perform finite element static and dynamic stability checks of the wall structure
- Check with civil engineering specialist for optimizations
- Conclude on feasibility study by end 2020
- Perform detailed analyses 1st semester 2021
- Objective: take advantage of LS3 (Dec 2024 – Mid 2027) to perform main tasks