

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

5th Workshop on LHCb Upgrade II
30th March 2020

François BUTIN, Kevin Buffet (CERN EN-EA)



ENGINEERING
DEPARTMENT

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: $2 \cdot 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$)
- Upgrade II: Luminosity expected to increase by factor 10 wrt upgrade I : up to $2 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
- 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

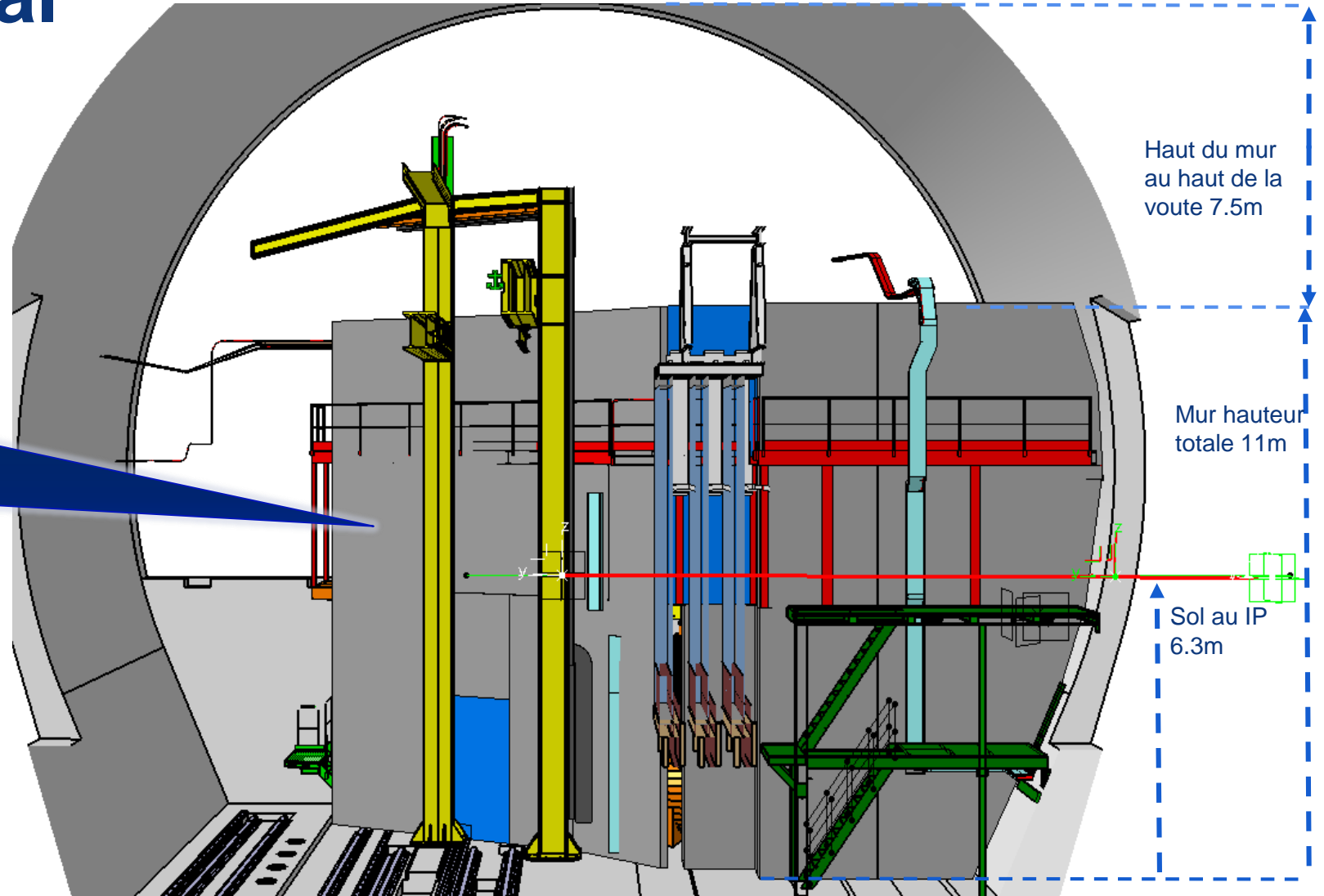


Boundary conditions: shielding wall

- 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

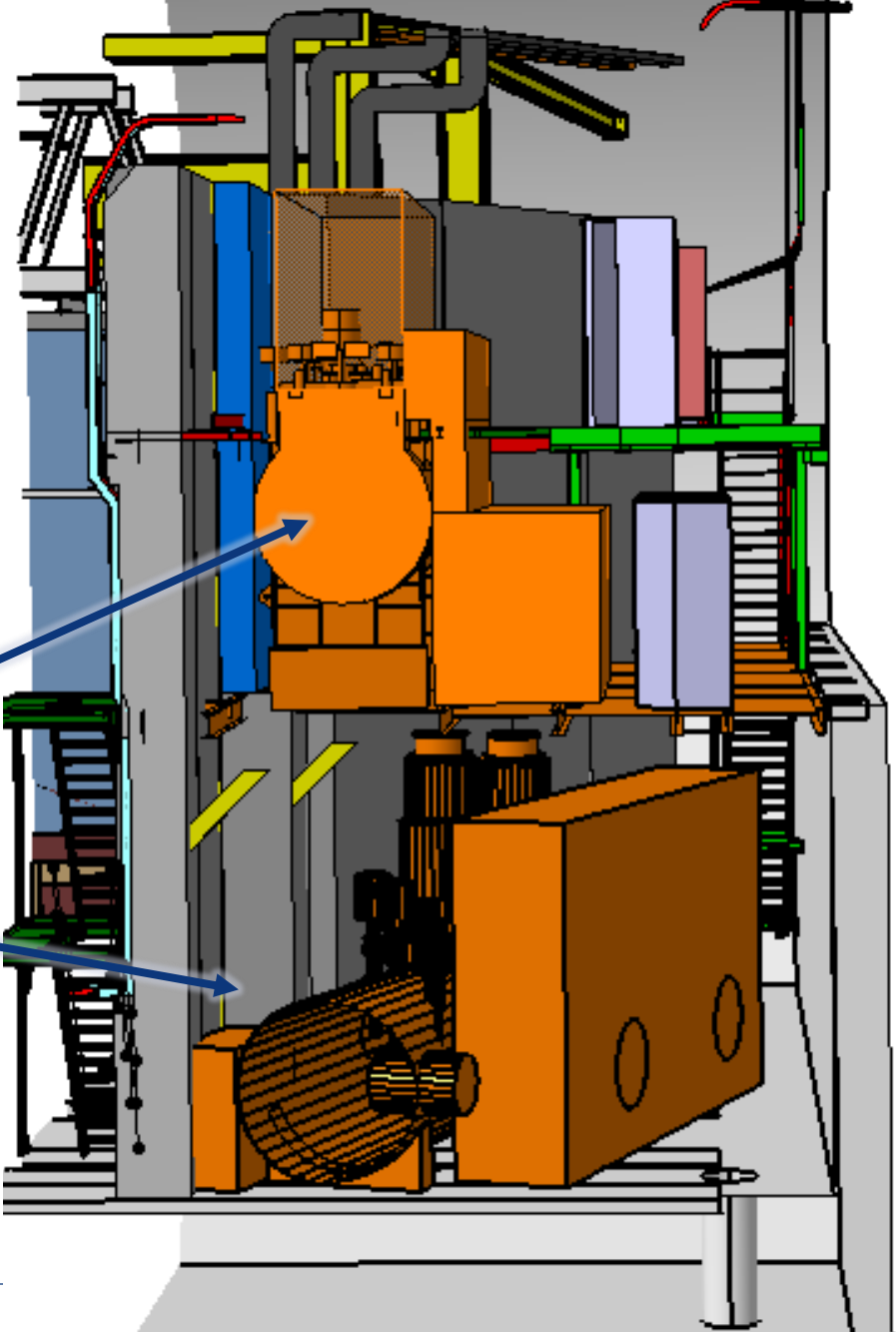
Shielding wall 11 m high to isolate LHC machine equipment in UX85



UX85 cut view towards C-side

Layout proposal

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

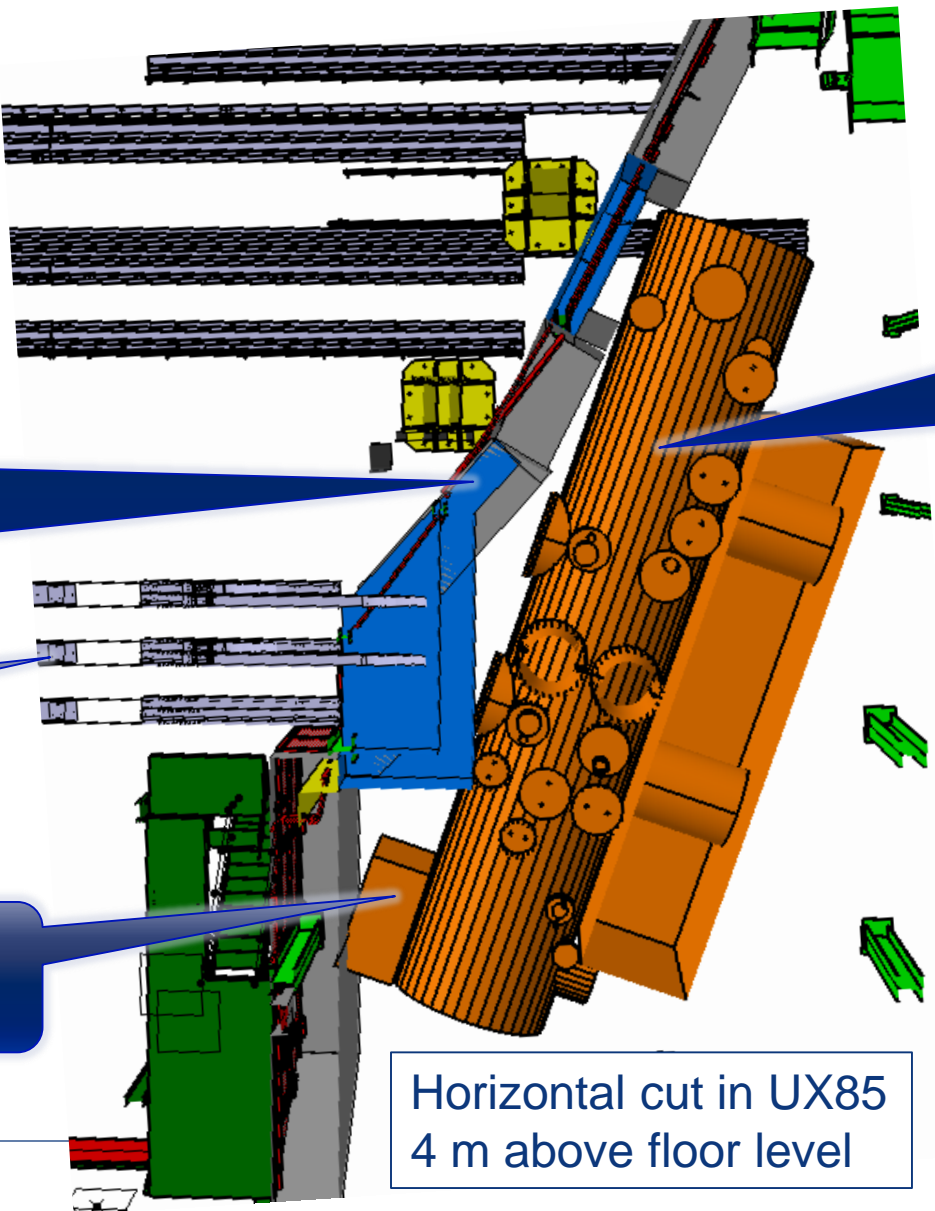
Sci-Fi

Pump to be
relocated

Horizontal cut in UX85
4 m above floor level

Valve box to be
rotated by 3° and
translated by 1 m

Piping above valve
box to be adapted



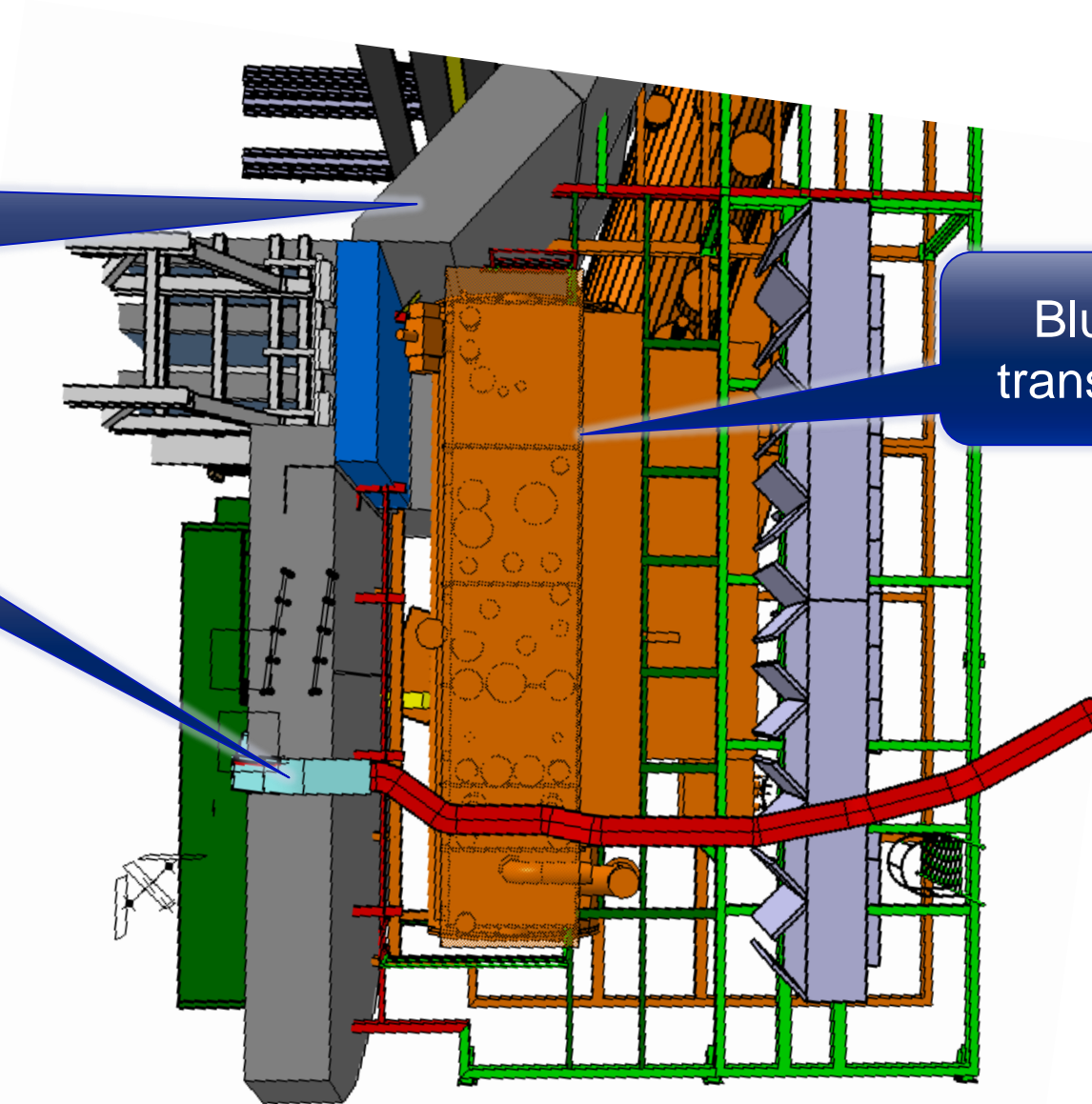
First floor

Shielding wall:
Mix of concrete and
iron panels

Optical
fibres

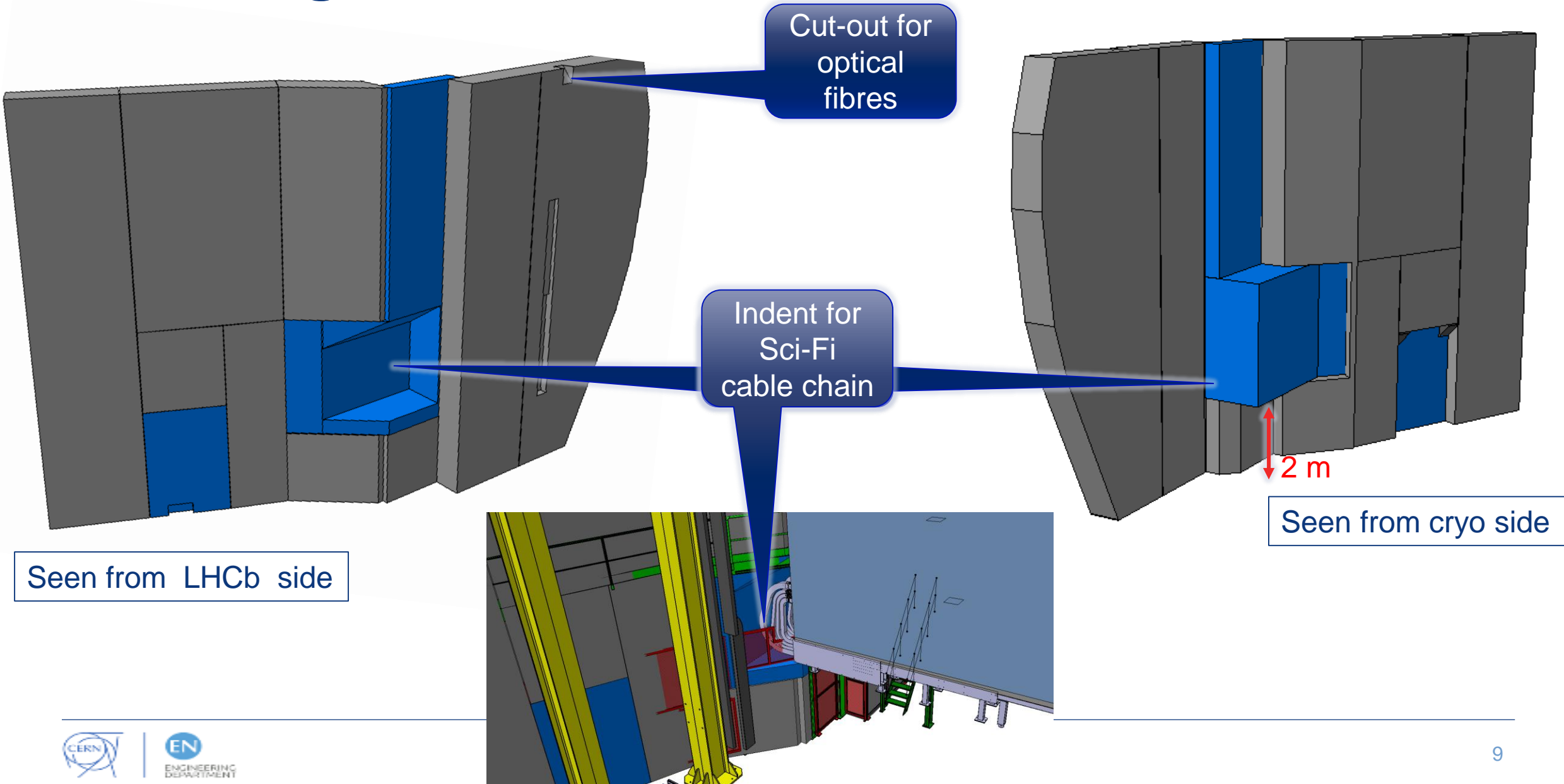
Blue fridge to be
translated by 45 cm

Blue fridge and command panel



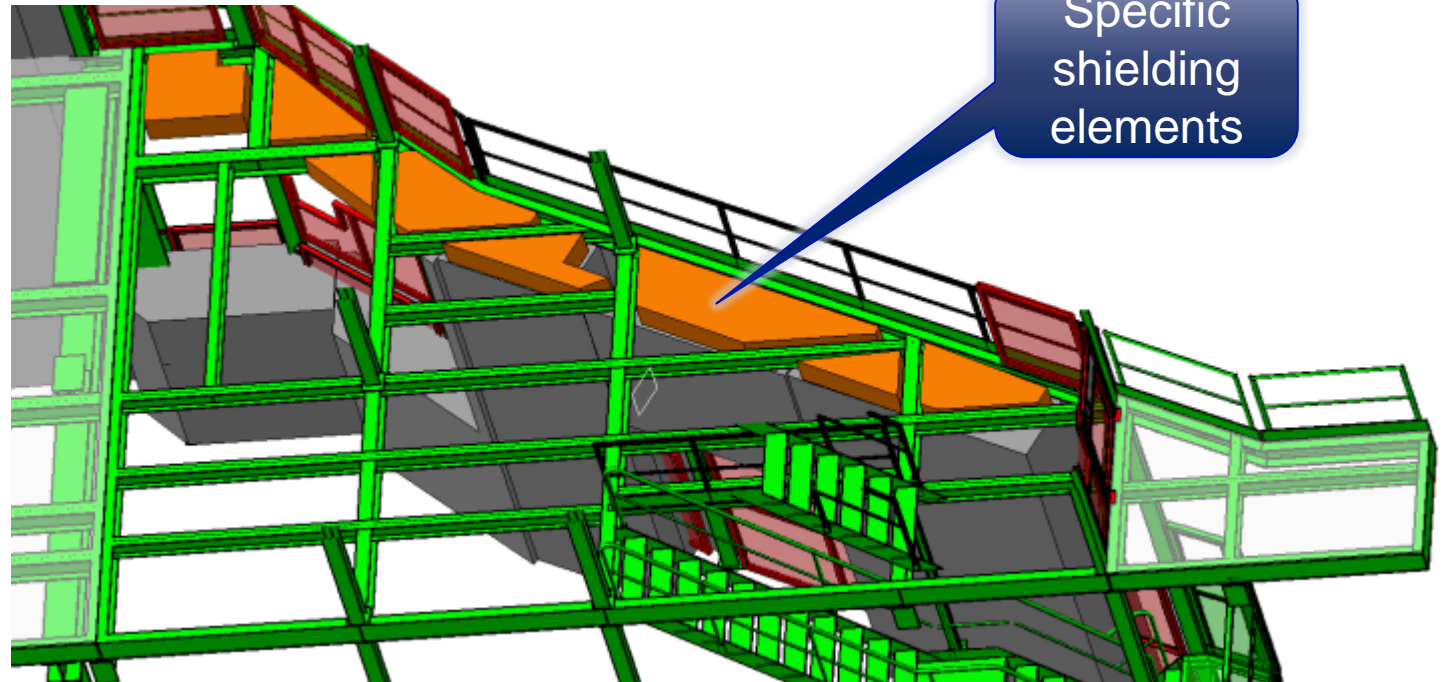
Horizontal cut in UX85
11 m above floor level

Shielding wall details



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 modifs
- 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**