

P8 SEU mitigation measures on cryo system for 2025 and 2026 LHC physics Run (and LS3).

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with the material of B. Ivent, B. Bradu, F. Morant & L. Delprat

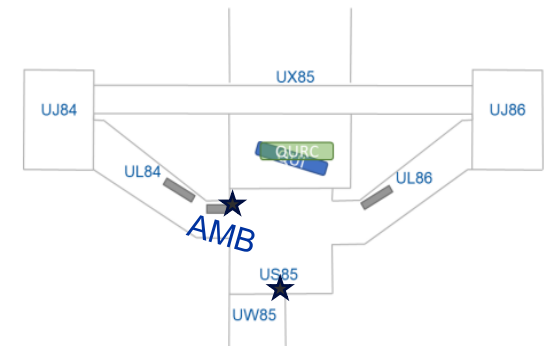


FIGURE 1 P8 UNDERGROUND POSITION OF COLD BOXES

QURCA P8 US85 / UL84 (elevator exit)

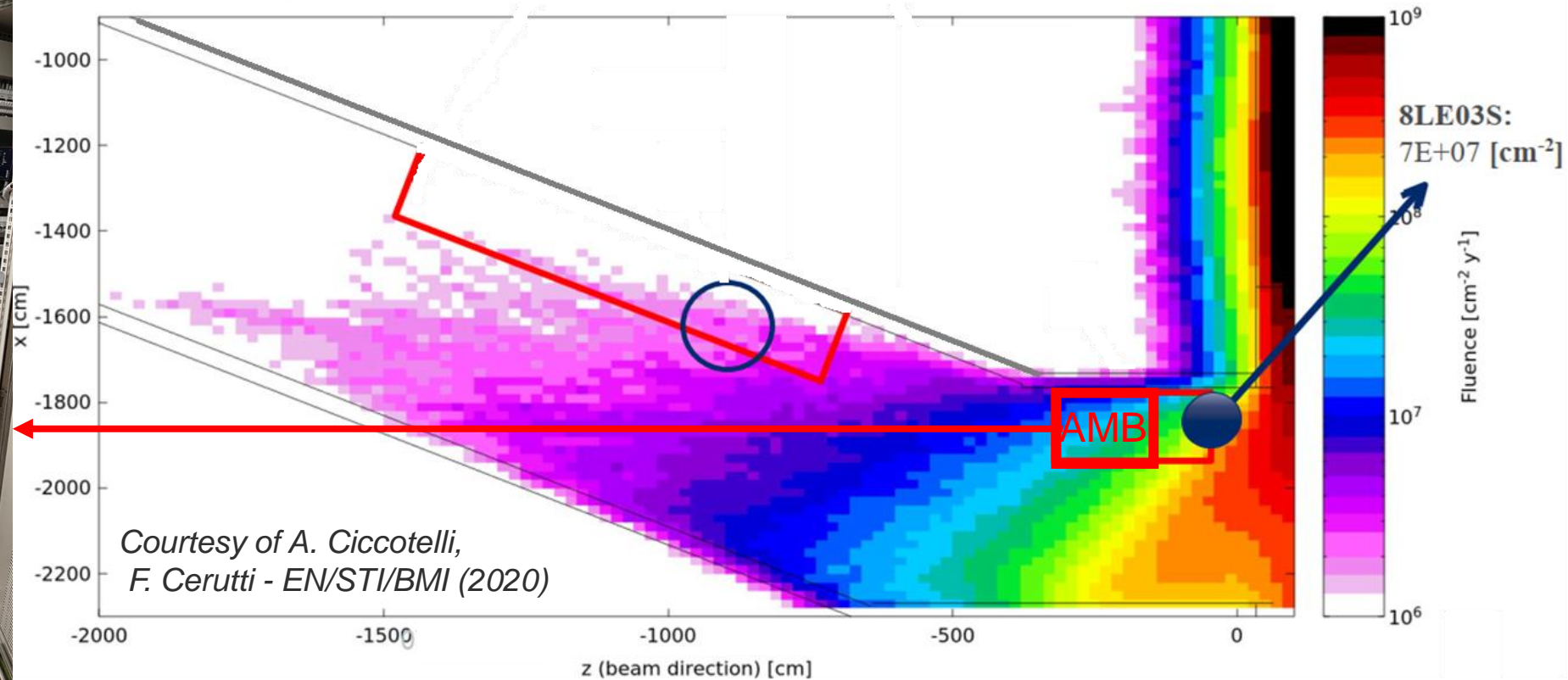


AMB location today and HEH fluence (2024)

- AMB MECOS (Active Magnetic Bearings of cold compressors) are located today at the UL84 right extremity (US85 side)
- MECOS AMB radiation sensitivity = one failure each 10^8 HEH/cm² (data obtained after radiation tests in HiRadMat)
- Fluka simulations in 2020 were indicating a fluence of $\sim 5 \cdot 10^7$ HEH/cm² at this location for an integrated lumi in LHCb of 10 fm^{-1}
- AMB4 is the most exposed electronic device (but AMB 1,2,3 are also at risk !)

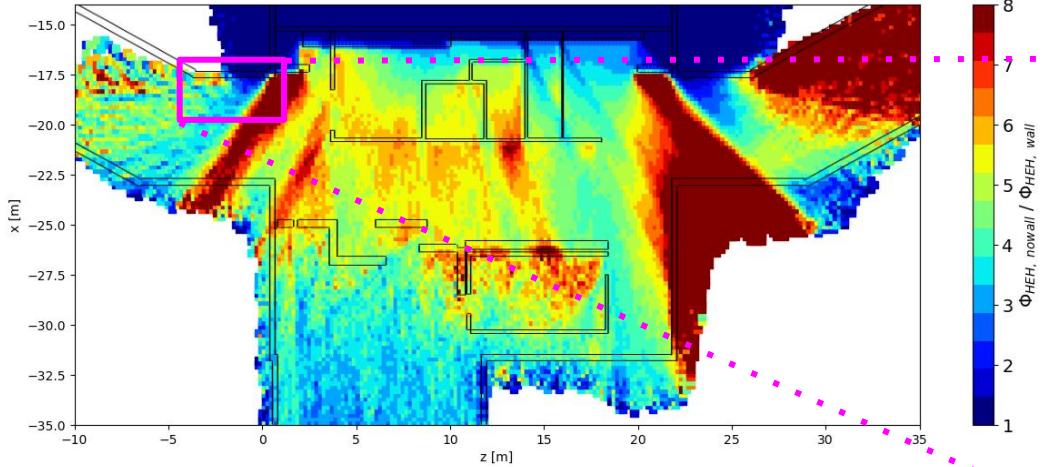


High Energy Hadron (HEH) fluence for 10 fm^{-1} accumulated in LHCb with Run3 config



$\Phi_{\text{HEH, no wall}} / \Phi_{\text{HEH, wall}}$ at Different Heights

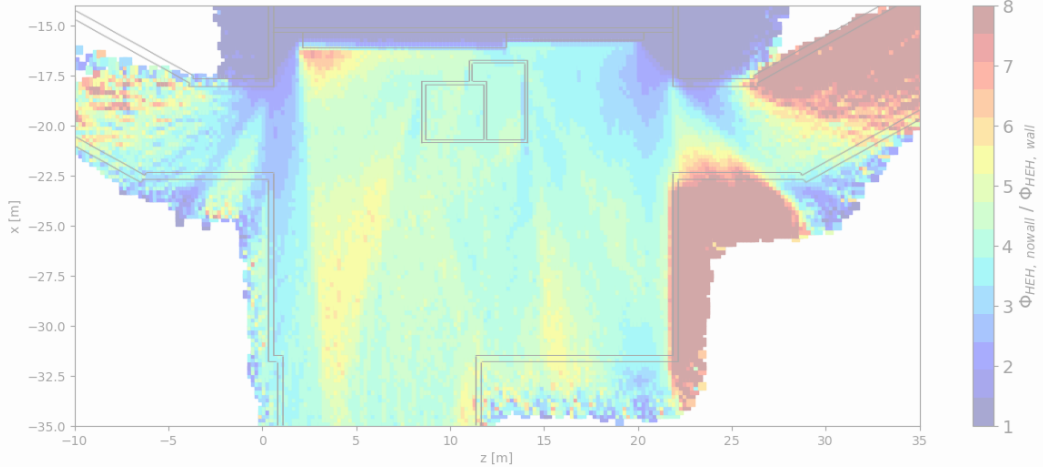
$y = 0 \text{ m} \pm 1.1 \text{ m}$



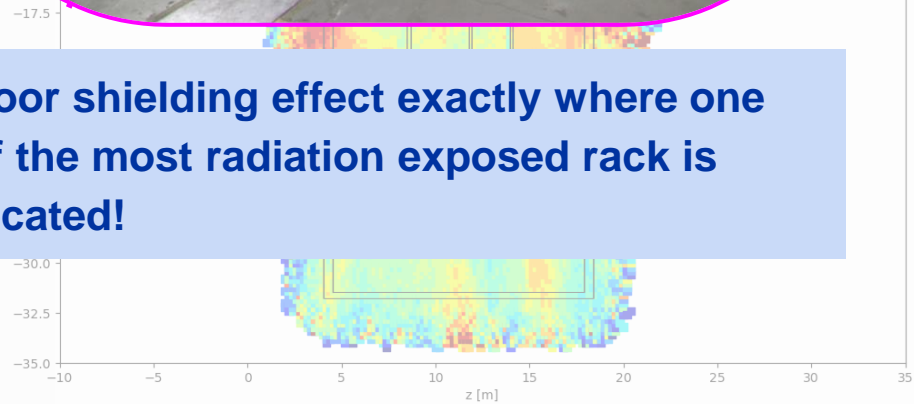
$y = 7 \text{ m} \pm 1.1 \text{ m}$



$y = 3 \text{ m} \pm 1.1 \text{ m}$

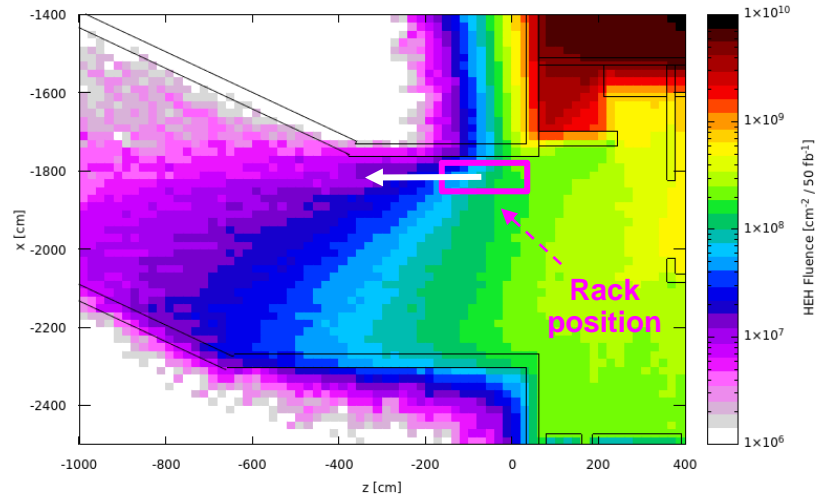


Poor shielding effect exactly where one of the most radiation exposed rack is located!



Electronic Rack at UL84 Entrance - HEH Fluence

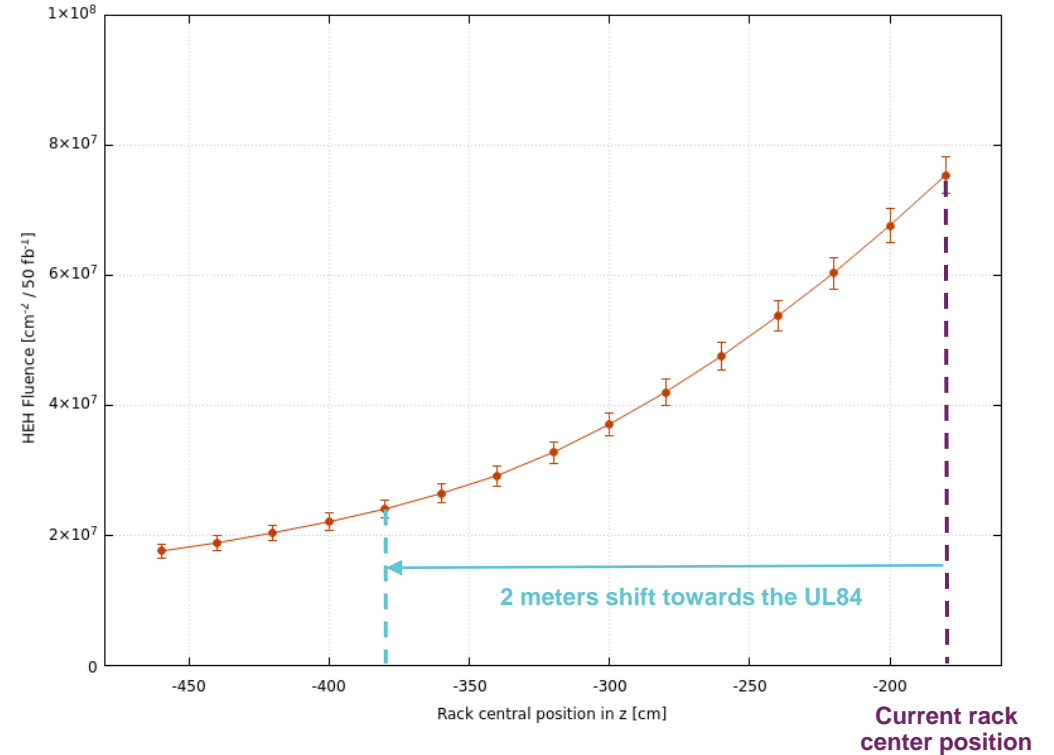
$$y = 0 \text{ m} \pm 1.1 \text{ m}$$



The region where the rack is located showcases a steep gradient in HEH fluence

- Moving the rack by a few meters could lead to a significant decrease in its radiation exposure!

HEH fluence z-profile averaged within the electronic rack



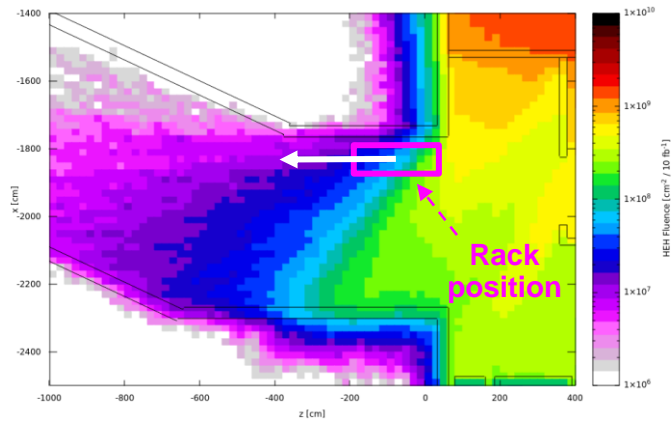
HEH fluence averaged within the rack drastically decreases from $7.5 \cdot 10^7$ to $2.4 \cdot 10^7 \text{ cm}^{-2} / 50 \text{ fb}^{-1}$ shifting it towards the UL84 by 2 meters

- Such a shift leads to a factor ~ 3 drop of the mean HEH fluence within the rack!

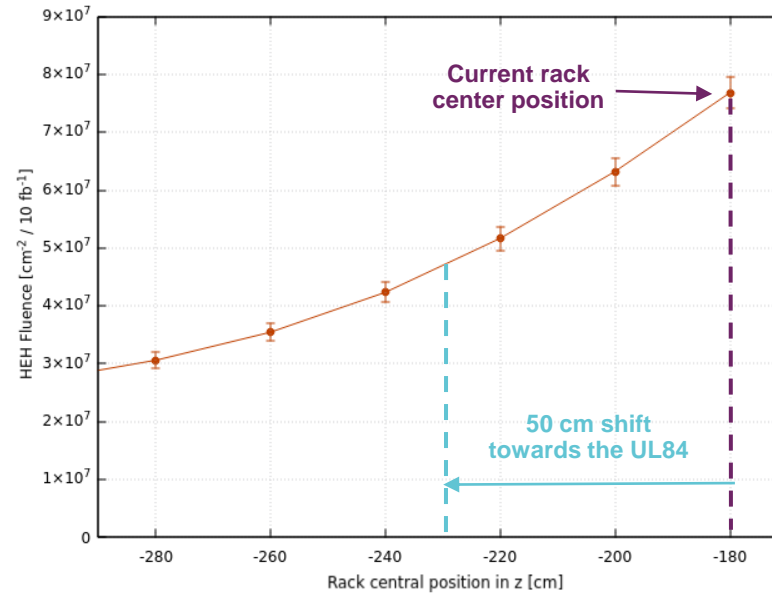
Electronic Rack at UL84 Entrance - HEH Fluence - Current Layout

2024 layout -
No Shielding Walls

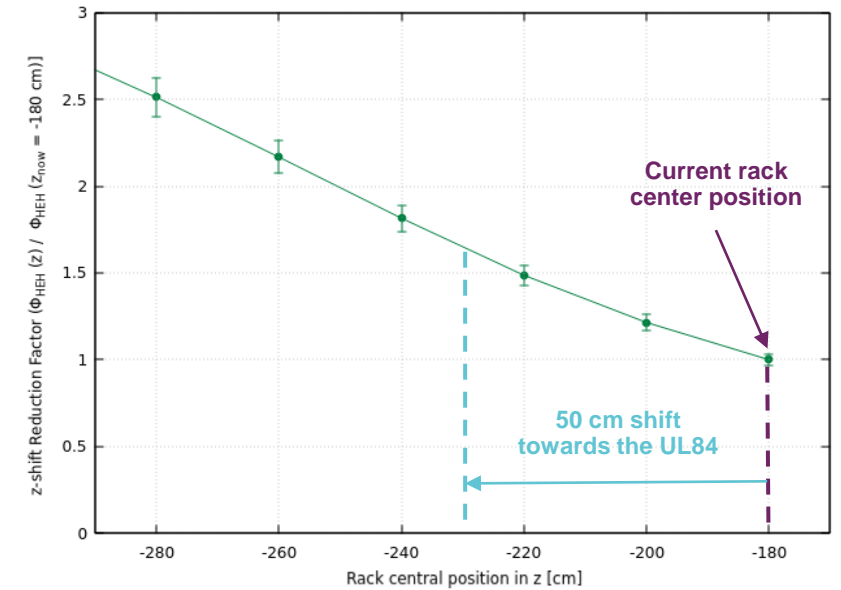
$y = 0 \text{ m} \pm 1.1 \text{ m}$



HEH fluence z-profile averaged within the rack



Reduction factor z-profile averaged within the rack



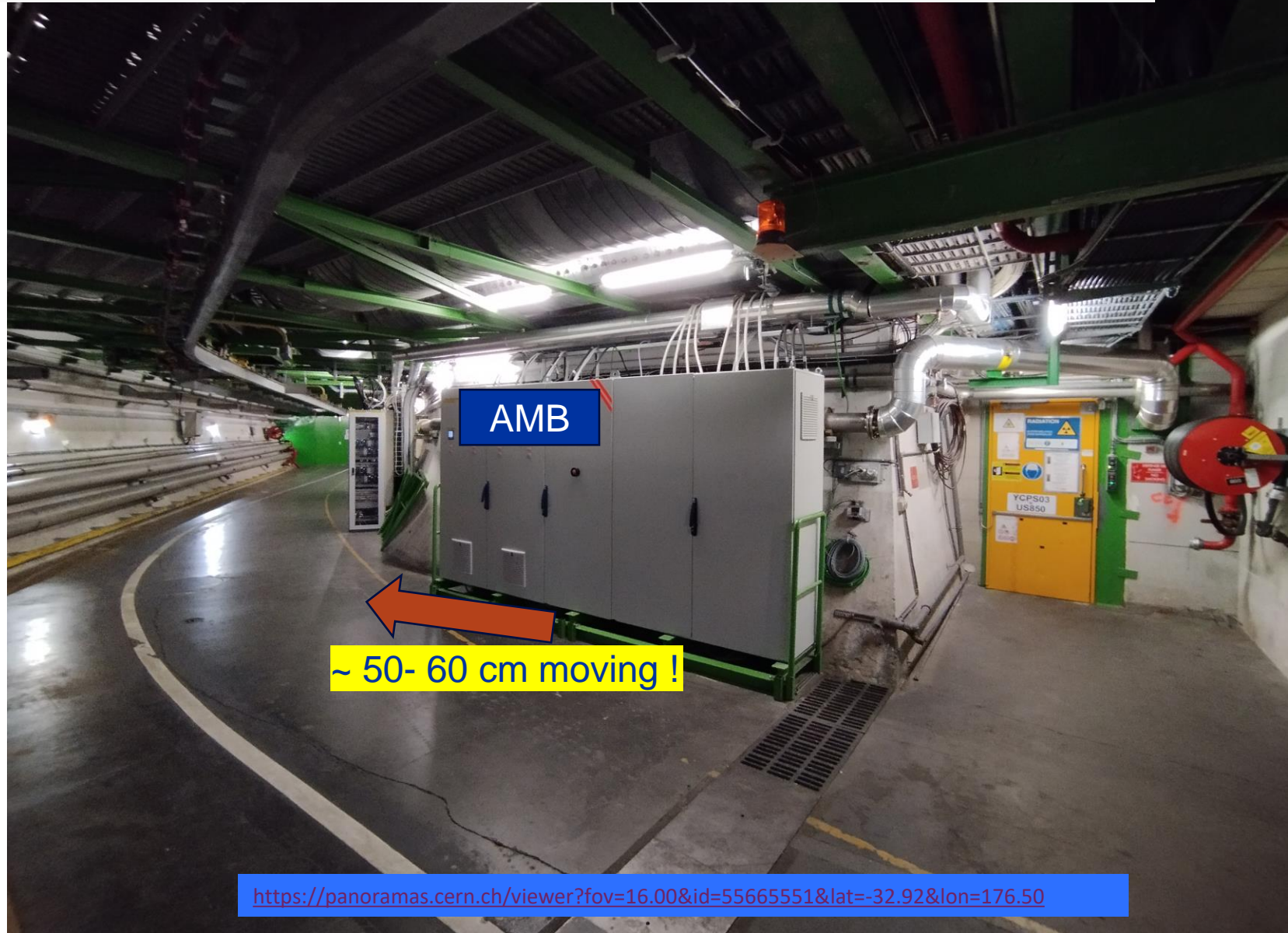
The region where the rack is exhibits an even steeper gradient in HEH fluence under the current configuration compared to conditions with a potential shielding wall in place:

→ An even greater impact is expected by shifting the rack towards the UL84

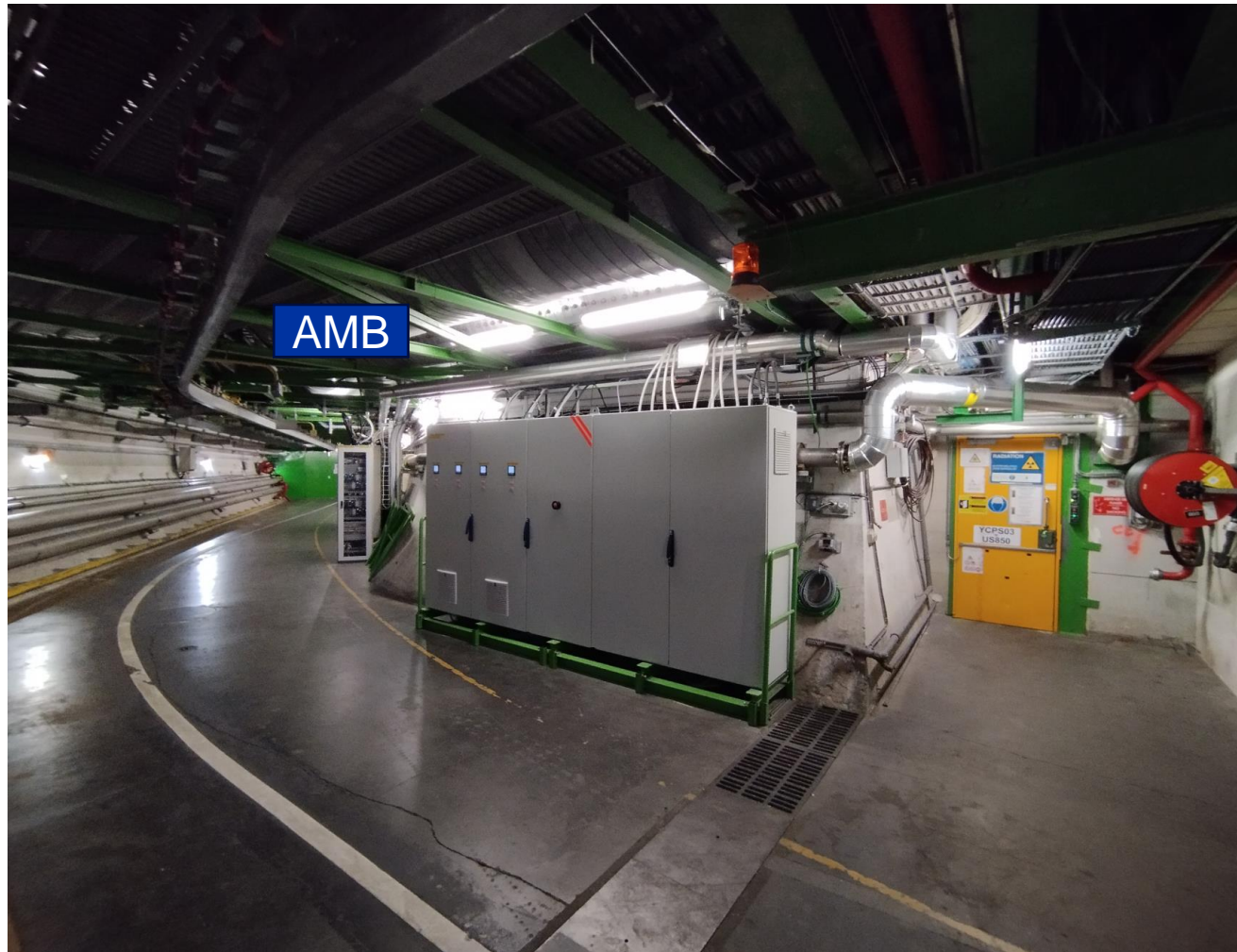
- **50 cm shift** towards the UL84 → **Factor ~ 1.6 drop** in the mean HEH fluence within the rack
- **60 cm shift** towards the UL84 → **Factor ~ 1.8 drop** in the mean HEH fluence within the rack

UL84 moving “Step by step”

1. ECR – TE-CRG
2. IMPACT – TE-CRG
3. Coordination/Integration – EN-ACE
4. Electrical Lock out – TE-CRG
5. Structure adaptation (Cutting) – EN-ACE
6. Blocking factors : assess cables length – TE-CRG
7. Moving – Transport
8. Recommissioning – TE-CRG



UL84 (elevator exit)



And.....



LS3 “QURCA-8-EMC01” cabinet relocation

Wall (of iron block) installation & relocation of QURCA-8-EMC01

EN/EL cabling necessary (minor but essential)

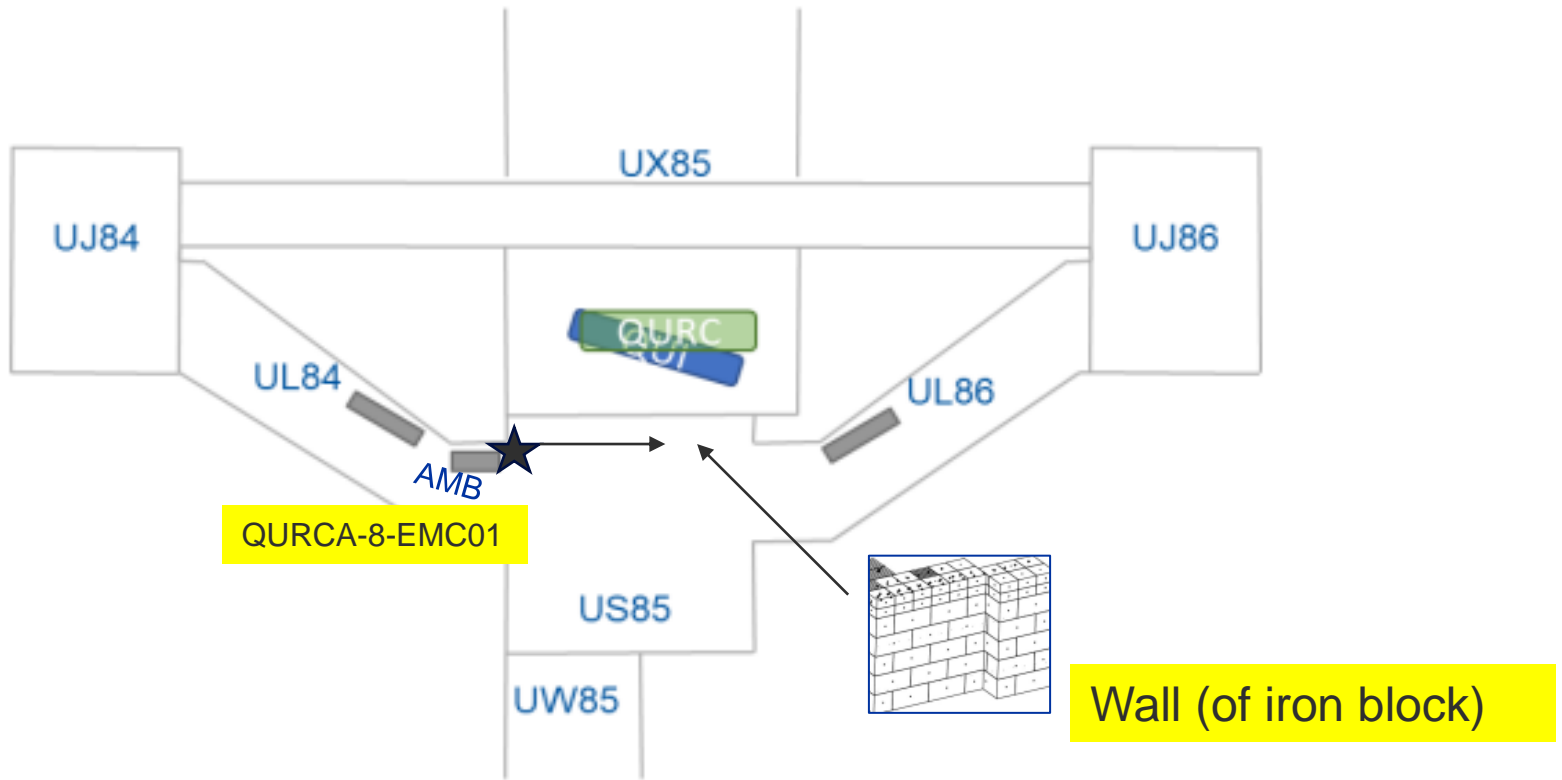


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