



Logistics and Civil engineering at Point 1 and 5 for HL-LHC

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Outline and motivations

- Important Civil Engineering works will start in 2018, have a peak during LS2, conclusion in 2022-2023
- The installation and de-installation of the worksites can be **invasive**, although **outside of LS2**
- The surface daily activity can **interact with** the rest of the **LS2 activities**
 - In matter of space
 - In matter of personnel and trucks movement
- The **opening** of the HL-LHC world towards the tunnel: analysis of the **impact**

Disclaimer

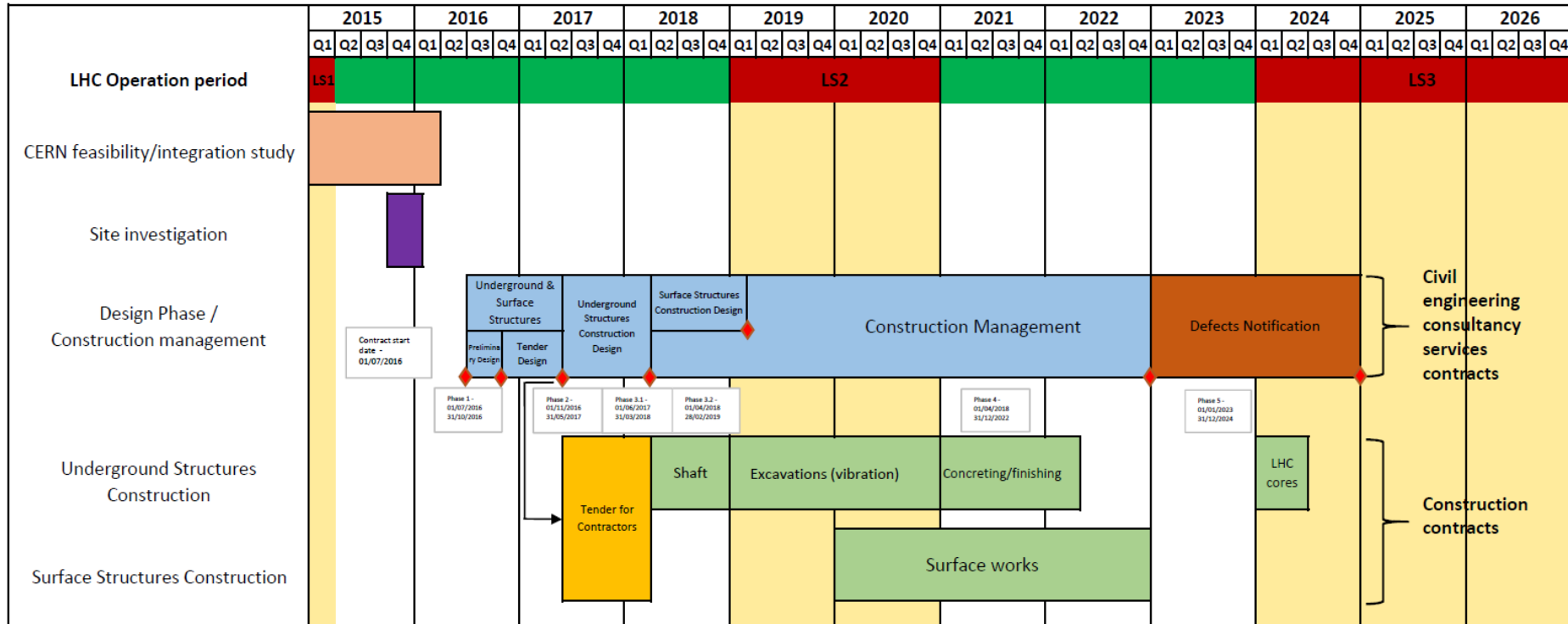
- This is what we know today
- Several measures have been already taken for impact minimization
- Some of the points are under scrutiny: for example for safety aspects of the openings to LHC tunnel where we recently progressed
- This is an occasion to launch discussions to sort out all pending points
- Acknowledgments for discussions with Natacha, Pieter, Laurent, Marzia *et al.*

Very schematic timeline presented in 2016

APPENDIX L - Programme

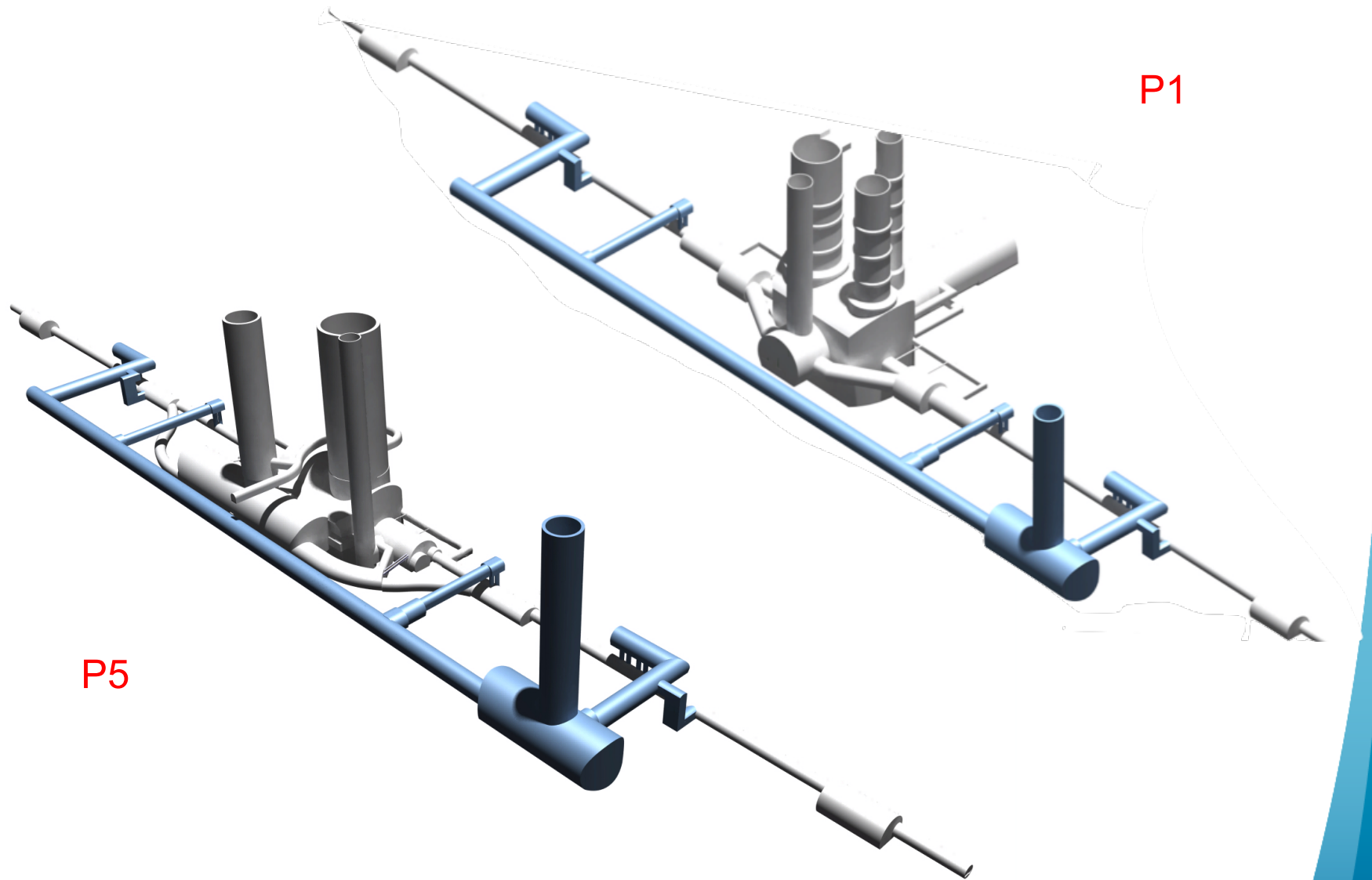
DATE: 13/05/2016

REVISION: 2



NOTE: Staged Handovers for the underground and surface structures is envisaged. The timing of these handovers will be agreed during Phases 1 & 2.

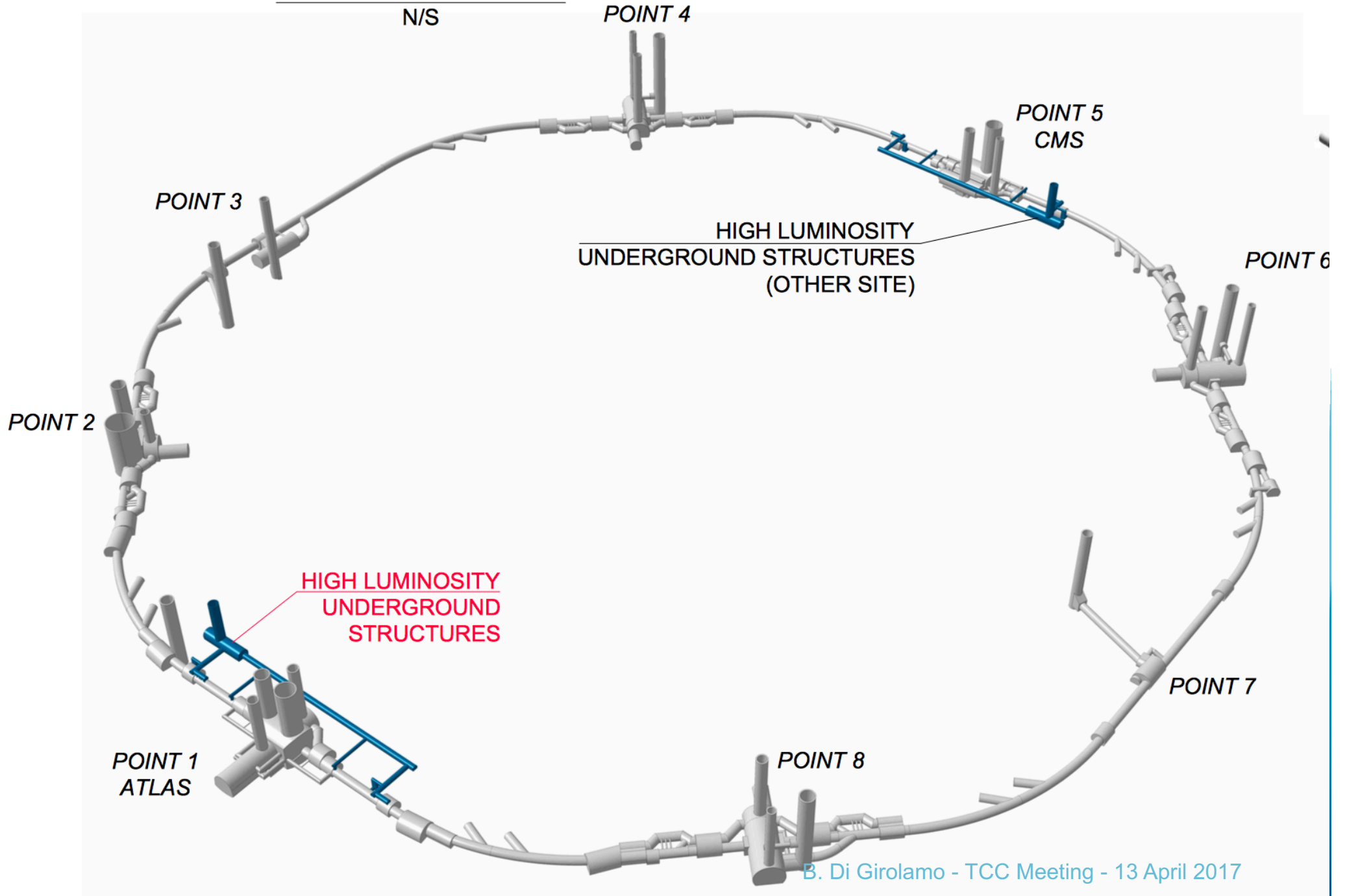
Point 1 and 5 Underground works



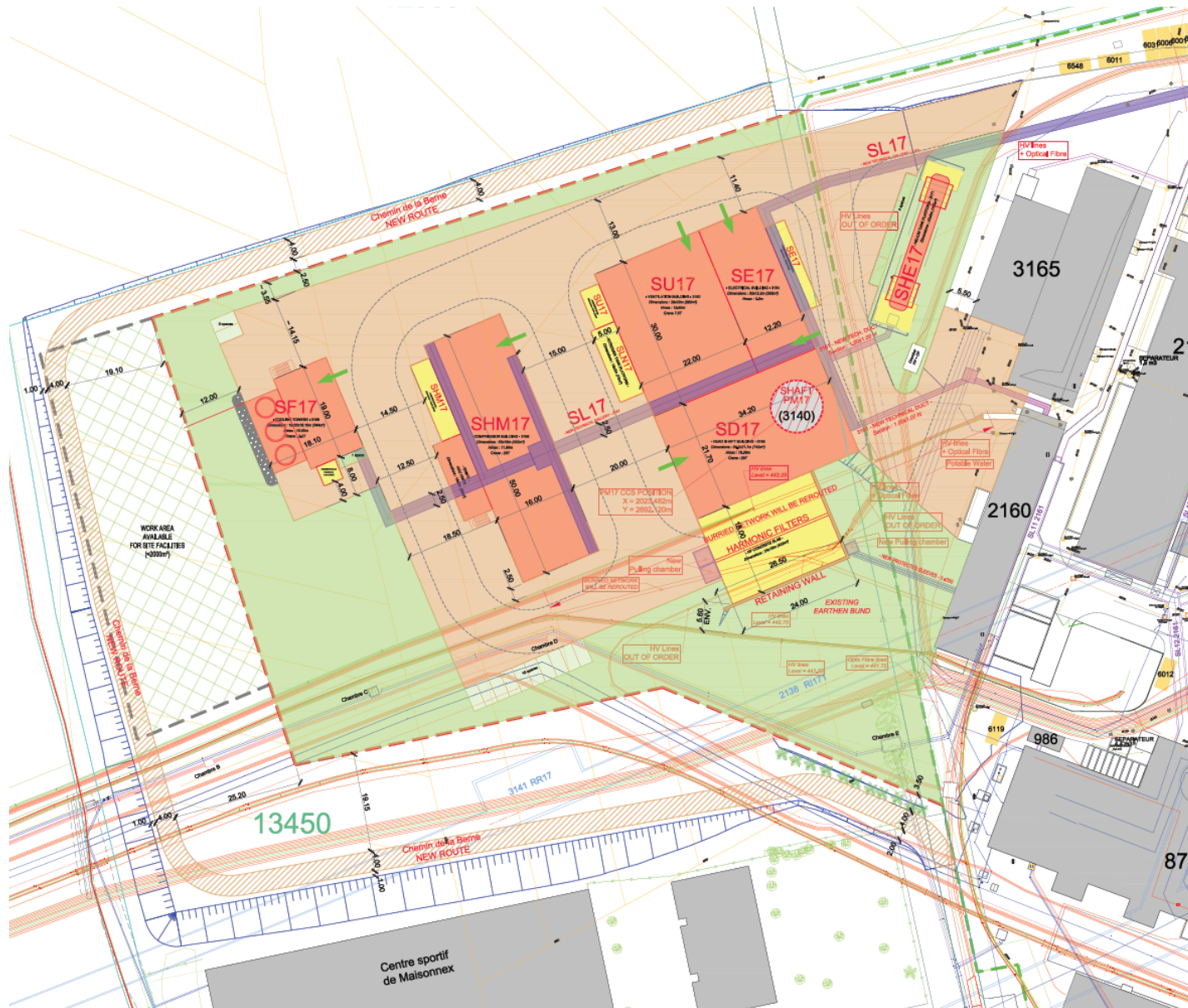
UNDERGROUND

- LHC (Large Hardron Collider) -
EXISTING UNDERGROUND

Underground global view



Point 1 Surface



Point 5 Surface



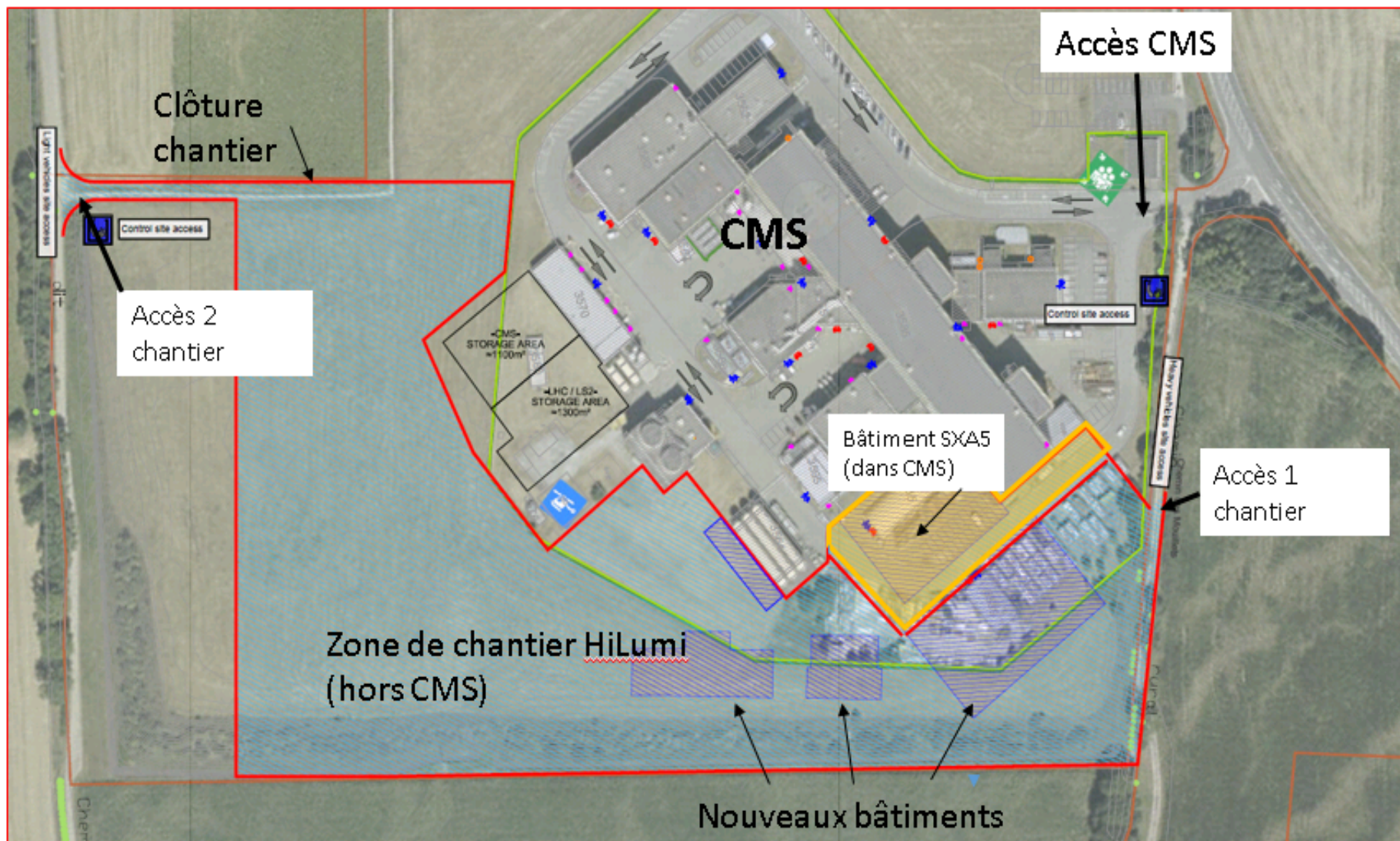
Possible interactions

- Worksite mobilization and demobilization
 - Underground: Q2 2018 – Q1 2022
 - Surface: **Q1 2020** – Q1 2023
- Worksite in-out
 - Dream today is complete independence for logistics (see next slides)
 - Dust is not respecting that: need of discussions on this unpredictable factor
- Creation of new technical galleries and connections
 - Before end LS2 to ensure no disruptions in connections with existing ones
- Openings of HL-LHC to Tunnel
 - **Q1-Q3 2020**
 - It deserves more discussion in coming slides

Worksite independency plans

- The strategy is to have access to worksite and evacuation from worksite independently from the in-out of P1 and P5
- This strategy seems easy at Point 5 and with pending issues to be resolved for Point 1
- If all that works:
 - Also the site **mobilisations** and **demobilisations** look **less invasive** as the underground work starts and ends are outside of LS2 bracket and for the surface the start, being inside LS2 at the moment, can go via the **independent entrance**
 - **Possible roundabout in front of Point 1?**

Point 5 worksite

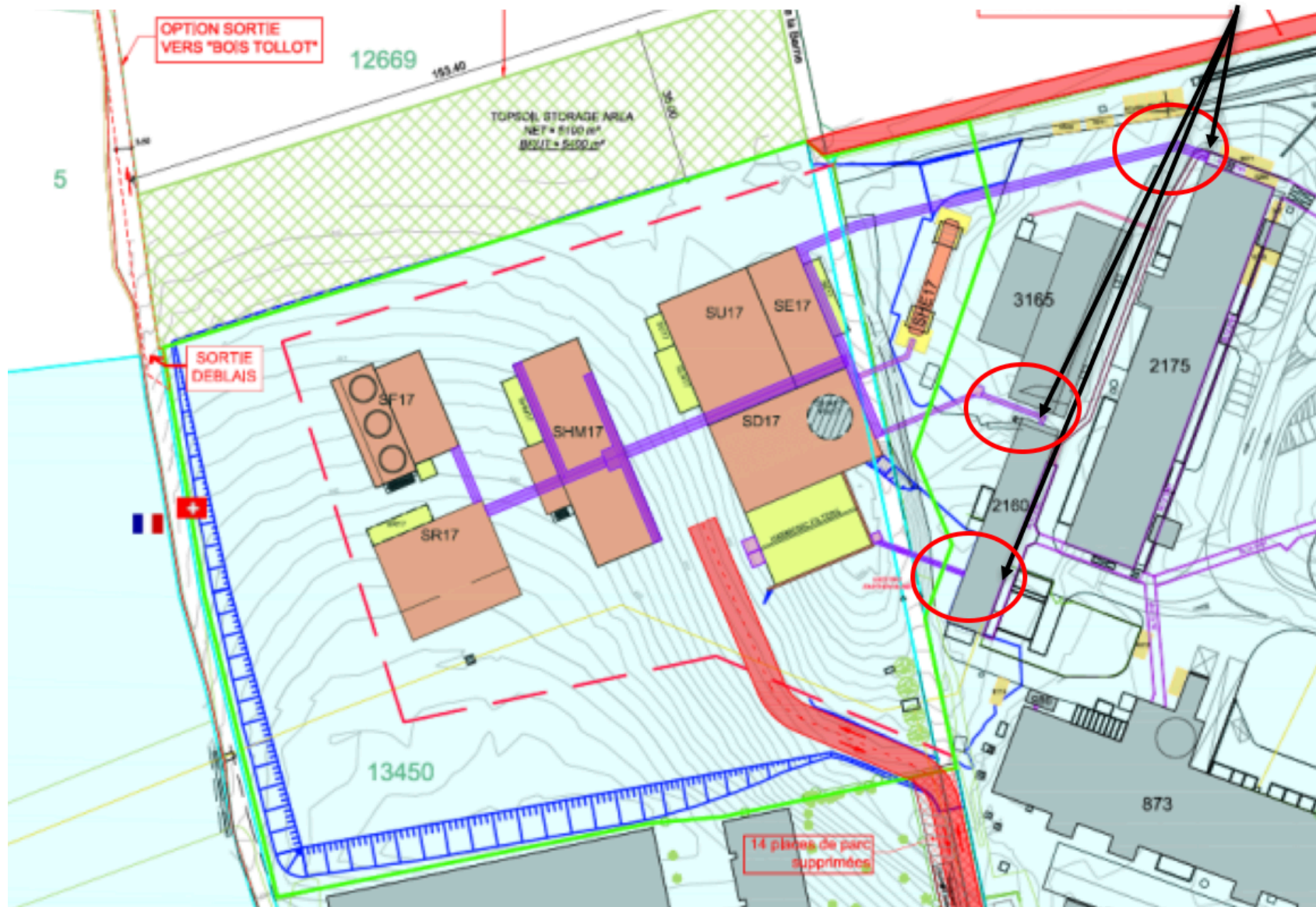


Analysis of unavoidable points of contacts

- Dust: pending a more serious analysis to be done
 - Discussion with EN/CV started, first ideas being evaluated
- Technical galleries
- Opening of HL-LHC communication to LHC tunnel

Point 1 Technical galleries

connections



Point 5 technical galleries

connections



Impact of technical galleries

- It looks more invasive for the Point 5 circulation
- Less critical on Point 1
- We had some thoughts if to work on these after the end of LS2, BUT
 - We increase the connection risk: not wise to delay
 - Therefore these have to be done within LS2 time boundaries
 - **Some constraints in Point 1 to be clarified, coming from LHC LS2 works**

Impact in existing premises

- The locations of the worksites were/are occupied by other items (hangar, barracks, tools)
- These are displaced to new slabs or moved on the same point or elsewhere
- The **HL-LHC Project covers** these slabs in a **1:1 functionality**
- However if additional services are needed on the slabs or bigger slabs are needed (for base de vie for LS2 as example) effort can be combined at costs sharing

Example on Point 1

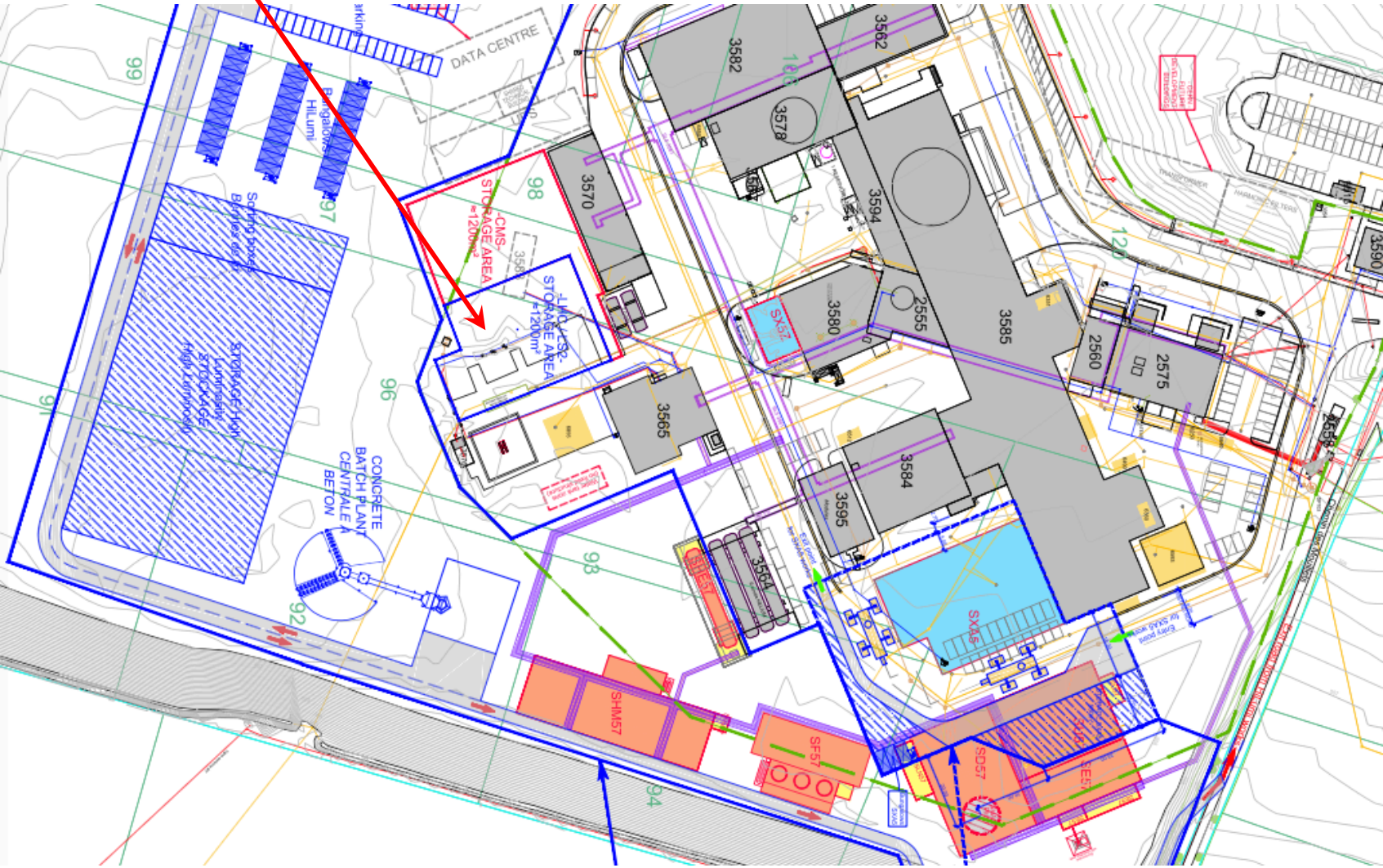
- Containers moved next to LHCf premises
- In the freed up location slab for tools storage as they currently located in the future worksite area

Note two locations (130 and 300m²) have been marked for LHC storage areas during LS2. Please also note that containers will be shift next to 2180 building, as discussed:



Example in Point 5

Compensating for removed storage

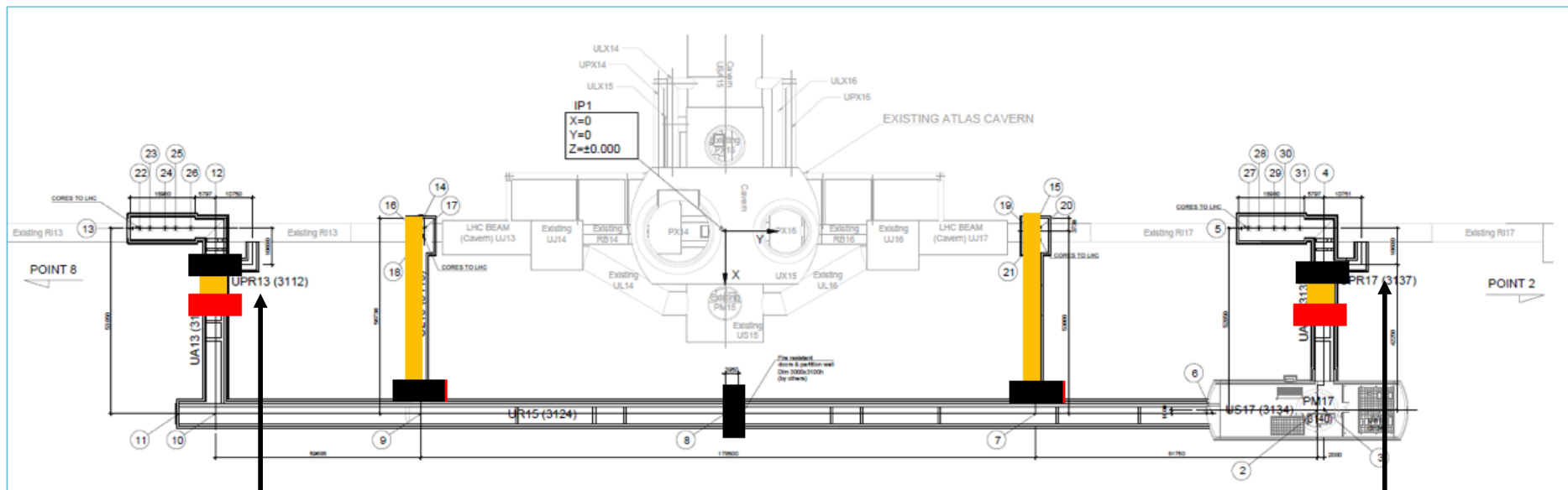


Where the tunnels meet

Pressurised buffer zones + 25 Pa ■

Ventilation door ■

Fire resistant door ■



UPRX3

UPRX7

Where the tunnels meet

- This is a complicated matter
- First proposal to minimize impact on services in the tunnel (not to move too many cables and cable trays and maybe much more)
 - On side UJ53 the opening is a real 2.3 m high opening (no impact on detector cables)
 - On sides UJ13, 17, 57 the opening is a man-hole of 1 m by 1 m (avoiding impact on detector cables and other services)

Refused by HSE

Where the tunnels meet: personal safety aspects

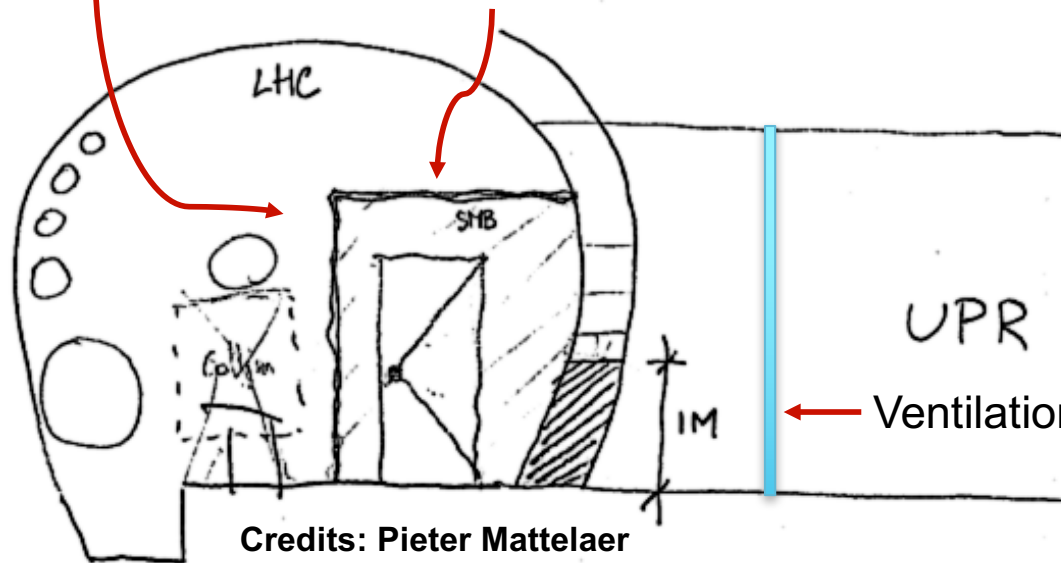
- For safety of the personnel working in the HL-LHC underground premises we need the possibility to evacuate in LHC in case of emergency and to allow firemen to attack a fire also from the LHC tunnel
- Having man-holes is a safety compromise (not validated by HSE), but it is a temporary situation
 - Although available from 2020 they would be usable only after the end of CE works in 2022 when then installations in the underground will start
 - No powered equipment apart from lighting, light soldering,...
- Here we forget about manhole vs. door (that is a different discussion) and **concentrate on impact to realize the openings. A possible solution has been identified limiting to large openings only on far ends.**
 - **Discussions continue**

Where the tunnels meet

- Going into details
 - Space limitations
 - Opening vs. schedule of cooldown vs. schedule of shutdown

He flux to be blocked if needed

Reduce this space taken by protection of works

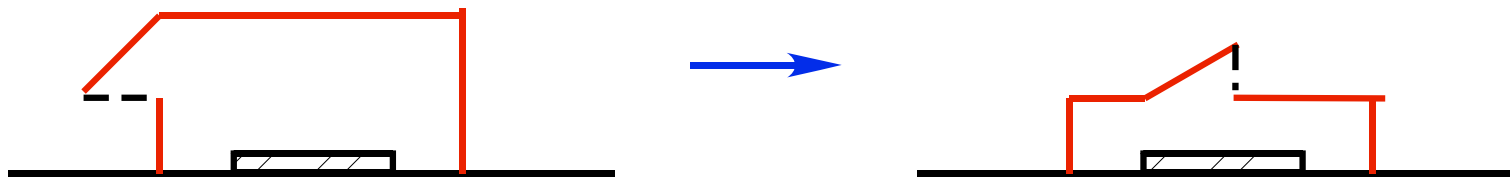


Credits: Pieter Mattelaer

Where the tunnels meet: overcoming space limitations

- To overcome space limitations:
 - There is already discussion with Collimation to displace the collimators in front of the worksite for space and ALARA constraints if necessary
 - There is a proposal to change the door opening to reduce the need of space for the protecting structure around the worksite
 - How long would it be needed? Let's try to answer

LHC top view



Where the tunnels meet: schedule

- Civil Engineering dates are, today, for finished premises:
 - Section UPRX3 + UAX3 – 30/09/2020
 - Section UPRX7 + UAX7 – 30/06/2020
- Cooldown phase and critical phase 300 to 80 K
 - This translates into 3 weeks critical period in approximatively Aug-Sep 2020 in all of the interested arcs (in the current version of the planning, thanks Marzia!)
 - The opening dates in the current engineering planning are:
 - Arc 1-2 – ~ Jan 2020
 - Arc 8-1 – ~ **Aug 2020**
 - Arc 5-6 – ~ Jan 2020
 - Arc 4-5 – ~ **Aug 2020**

The work on the diodes will trigger changes of date and sequence of interventions

Where the tunnels meet: measure to be adopted

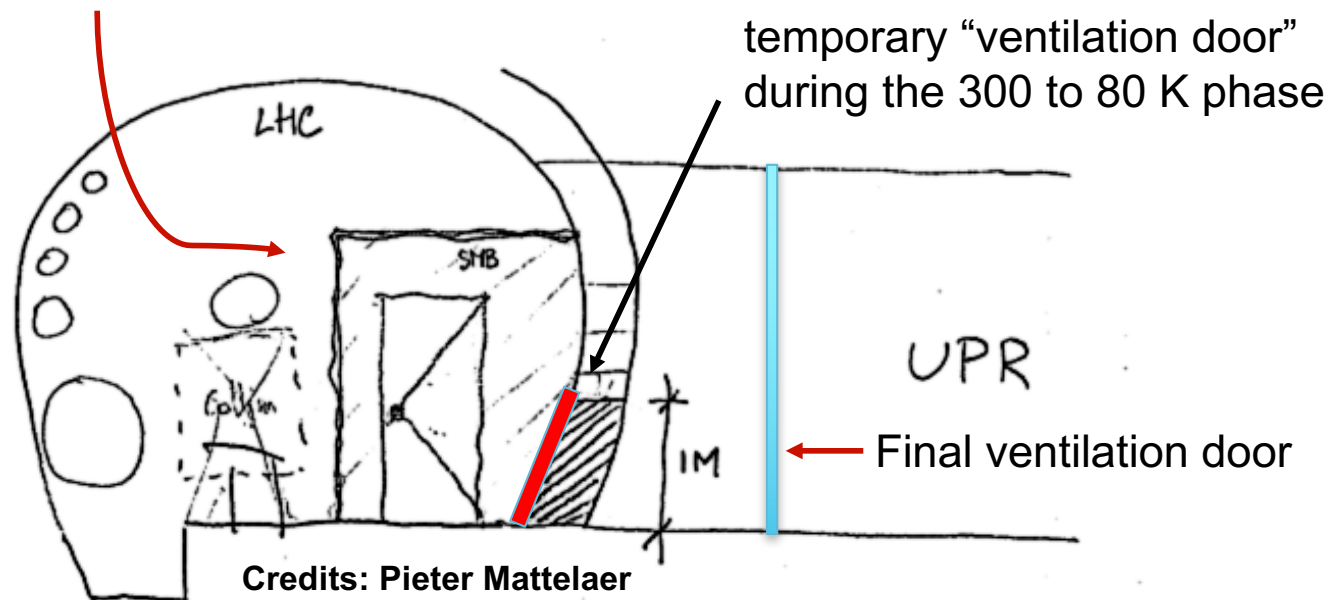
- As soon as the opening is present it becomes critical in the three weeks 300-80K phase
- Options:
 - Keep current planning and install a temporary blockage of the opening during the three critical weeks if no ventilation door is present (it might be the case of the far opening UPRX3)
 - Keep the current planning, but leave a X cm wall to be removed after the three critical weeks
 - Make the opening with a certain depth from LHC tunnel side at the beginning of LS2, continue working on the other side and remove the “recessed” wall when convenient. This mixes the previous two

Where the tunnels meet: measure to be adopted

- If present strategy and schedule, then there is a need of blocking work and installing a temporary plate for three weeks

Option 1

He flux to be blocked if needed



Where the tunnels meet: measure to be adopted

- If a thin wall is opened at the last moment there is no need of temporary plate
- The problem is pushed to later
- However it remains in a critical end of the shutdown
- If big size openings have to be done in all four openings, impacted cables and services have to be then re-installed towards the end of the shutdown

Option 2

Where the tunnels meet: measure to be adopted

Option 3

- If the openings are done at the beginning of the LS2 we need to schedule accordingly the activities in the interested areas:
 - Removal of cables if big size openings and installation after the openings are done
 - Protection in tunnel becomes again big enough: circulation difficult for some time
 - Restrictions for delicate activities as the spoils have to be evacuated via LHC
 - Presence of CE workers in LHC tunnel: training, accesses, restrictions
- It is an advantage to have the full LS2 to cure possible unforeseen happenings, dismount cables and cable trays and restore the situation well in advance

Where the tunnels meet: measure to be adopted

- The **Option 3** is the one we are exploring now
- Impact of activated elements (Collimators and TAN mainly) on the schedule
- Impact of dust and spoil evacuation
- Probably done by a different contractor than the rest of the CE works for HL-LHC
 - Targeting companies “used to LHC environment”
- Impact on other LS2 activities in the affected sectors

Conclusions

- A lot of effort had been put to minimize logistics interference between HL-LHC work and experiments and LHC maintenance during LS2
- Points of contact exist:
 - Dust: being discussed now
 - Technical galleries: refinement ongoing
- Points of higher attention are underground
 - An analysis of the scheduling of HL-LHC opening towards LHC vs. cooldown scheduling is ongoing and needs monitoring seen the uncertainty level
 - Discussions and decisions to be taken up to arrive to the final strategy of opening and when