



DSL Modifications Update

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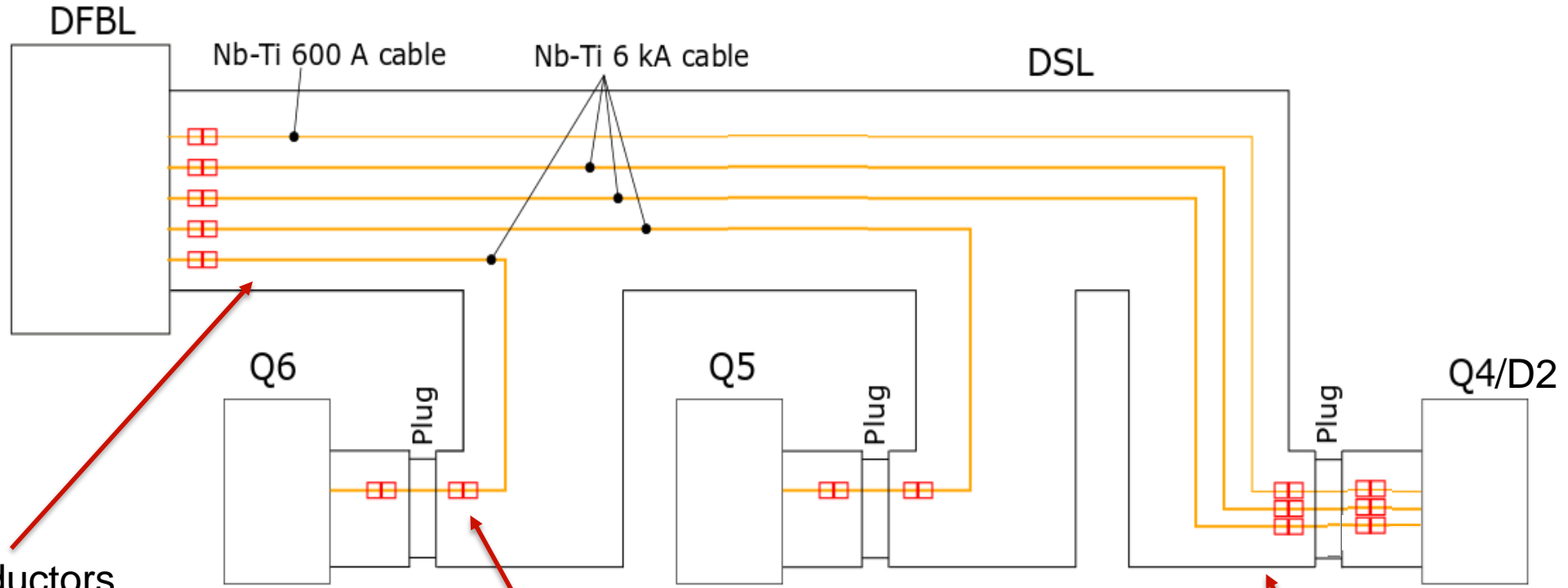
28/11/2024



Summary of Previous Meeting

- TE-CRG plan to store DSL in its translated position in the LHC tunnel during LS3 core drilling.
 - Avoids complex transport of 25m and 36m sections of DSL.
 - Minimises number of splices required in the conductor.
 - Reduces resource and time required for intervention.
- Latest developments:
 - Understanding impact of civil works on DSL.
 - Conceptual development of protection/rotation system for DSL.
 - Study of DSL translation process.

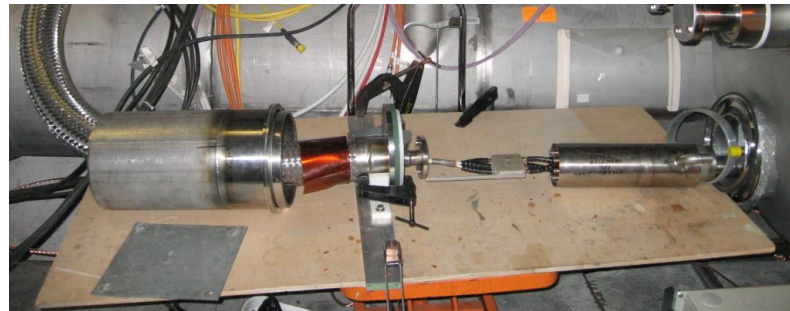
LHC DSL Current Electrical Schematic



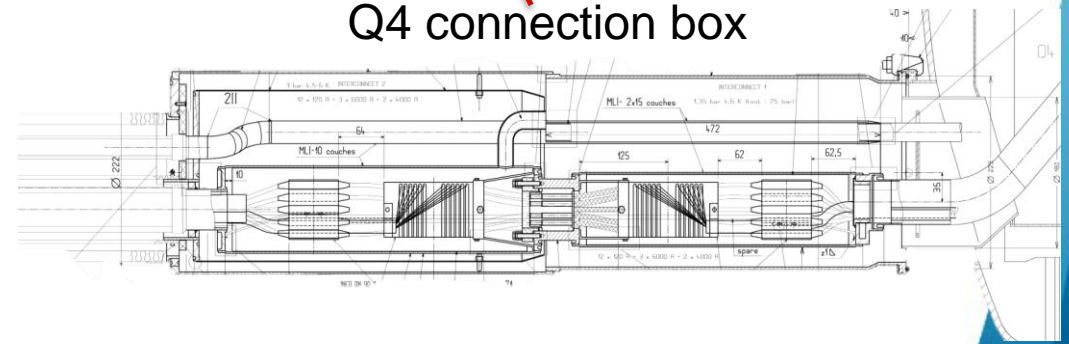
Custom conductors



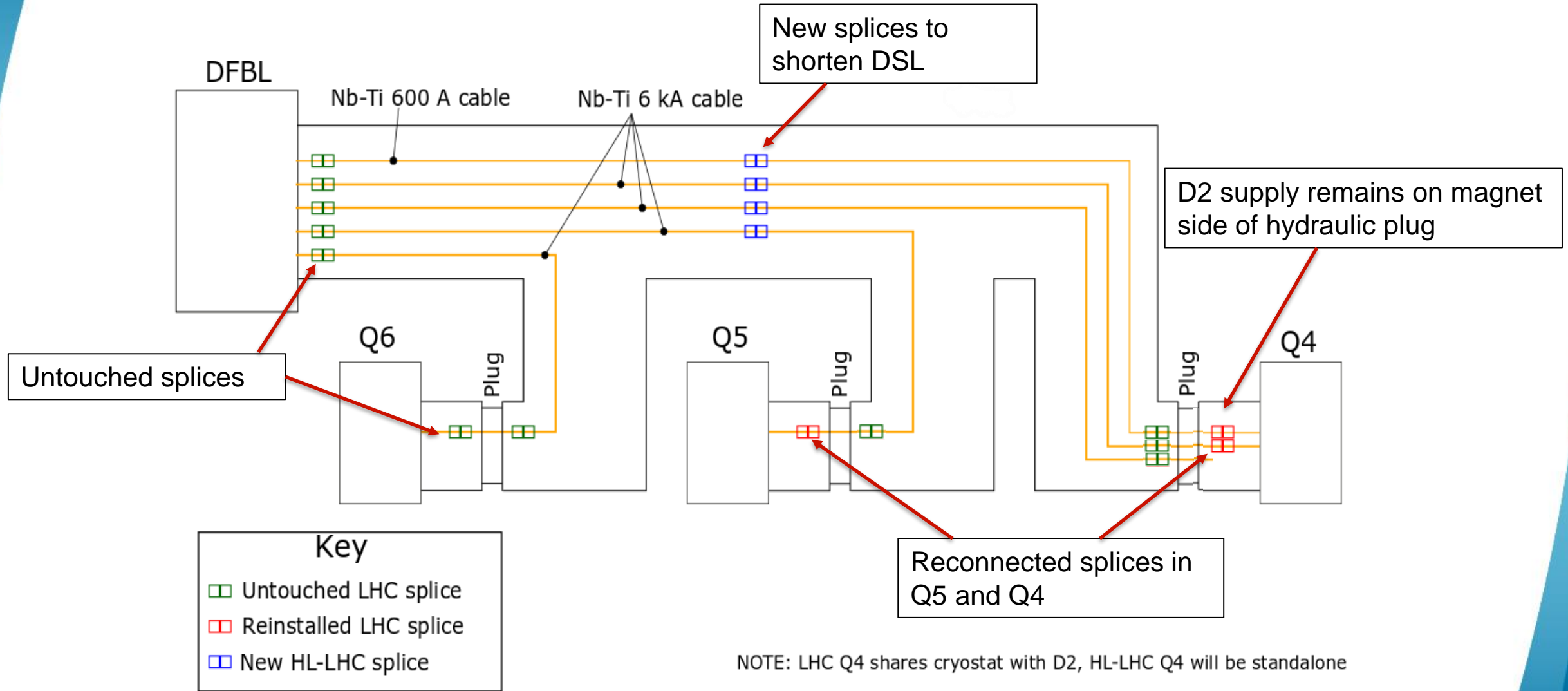
Connection Box



Q4 connection box

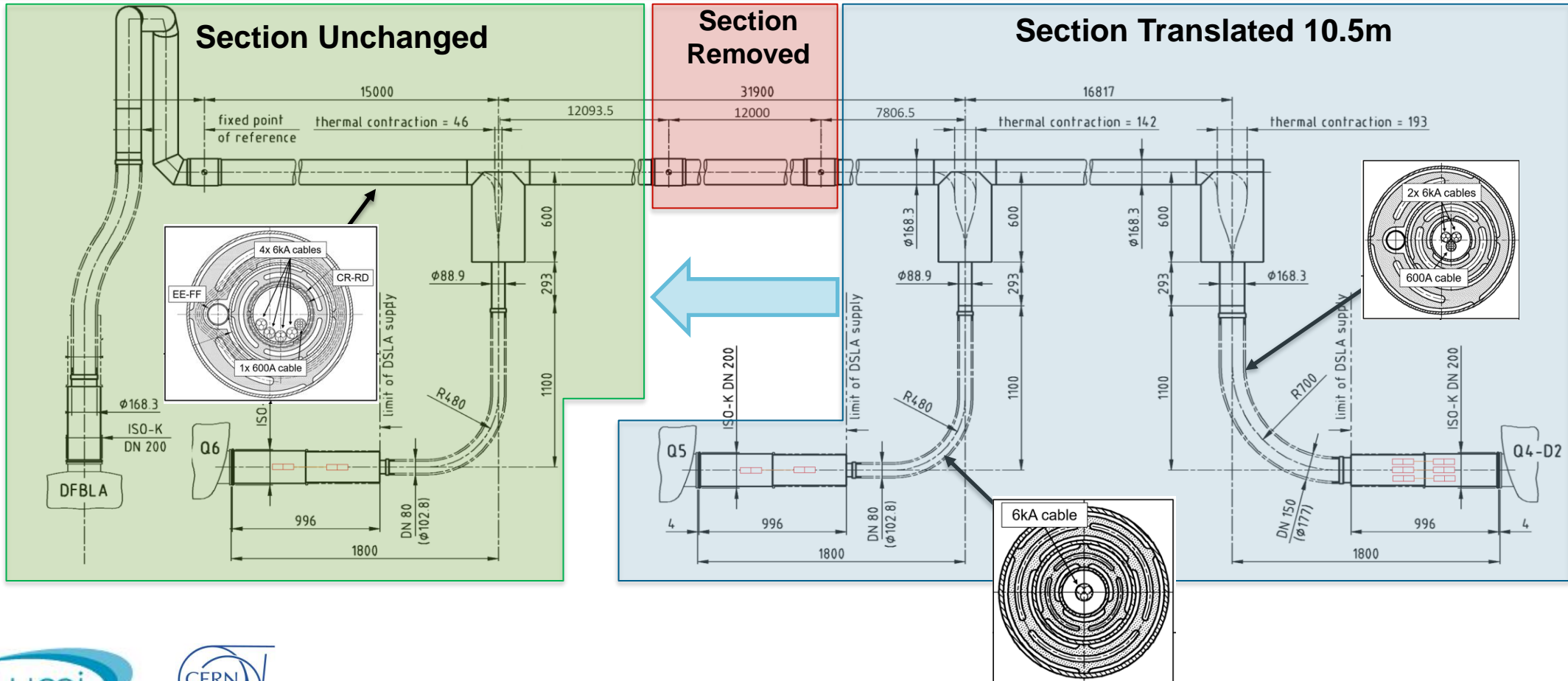


HL-LHC DSL Baseline: Electrical



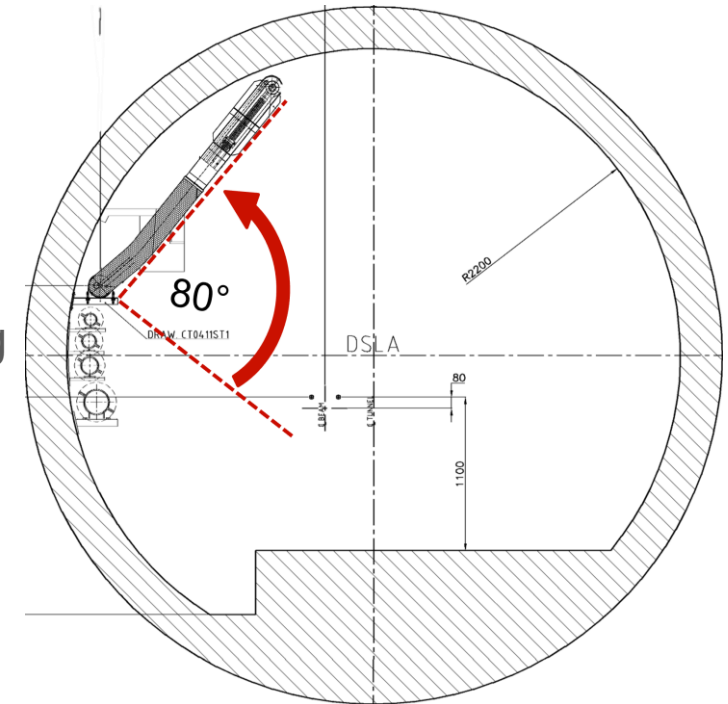
LHC Superconducting Link (DSL) Modifications

- DSL provides electrical current to the Q6, Q5 and Q4/D2 magnet.
- Q5-Q4 section to be translated by 10.5m toward Q6.
- The D2 supply will no longer required.



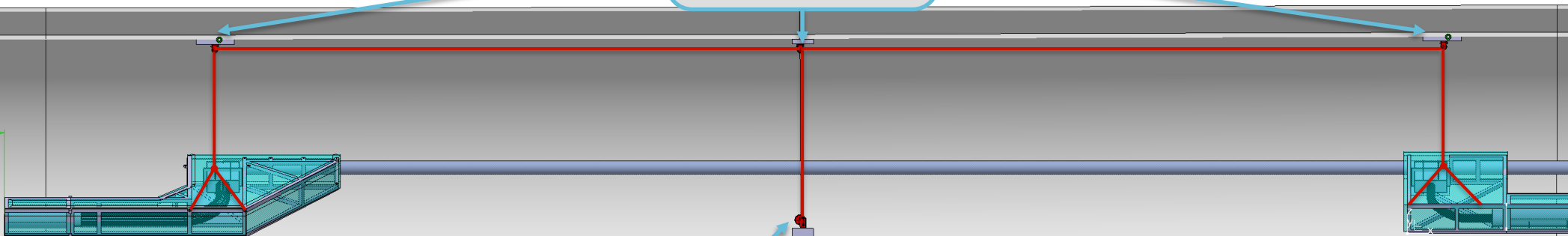
DSL Storage and Rotation

- The DSL will be translated to the HL-LHC position for storage and rotated against tunnel wall.
- The tooling to rotate the DSL must:
 - Rotation of DSL by 80° .
 - Support the mass of each DSL branch, approximately 200kg at each branch.
 - Lift both branches simultaneously to avoid unbalanced loading.
 - Rotate the DSL slowly to avoid damaging the conductor.



Hoists and anchor plates

Winch



DSL Position with Civil Works: Core Drilling

- In HL-LHC position the DSL will be 18m from the nearest core.
- C. Biot confirms:
 - Main SAS is required for core drilling and local SAS will be used for wall and floor grinding.
 - Current planned location for main SAS is by the Q4 → compatible with DSL storage.

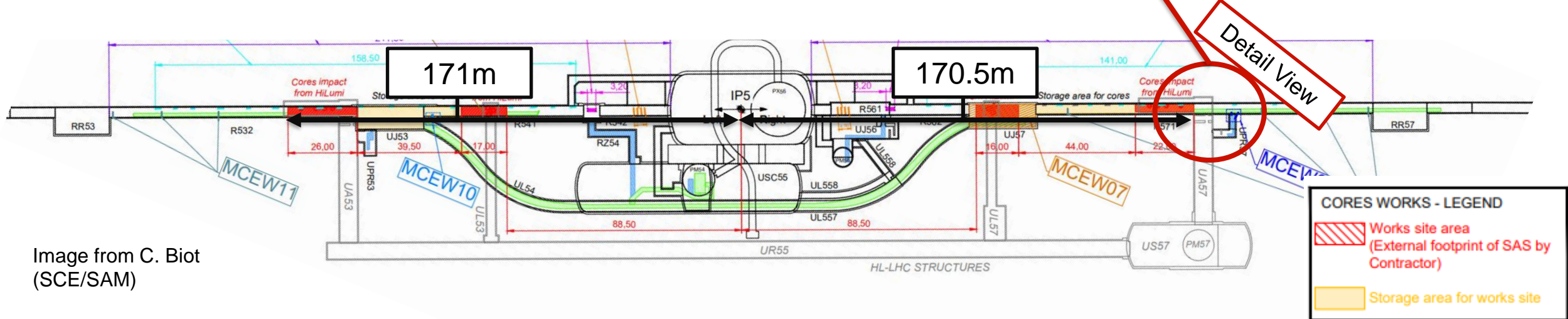
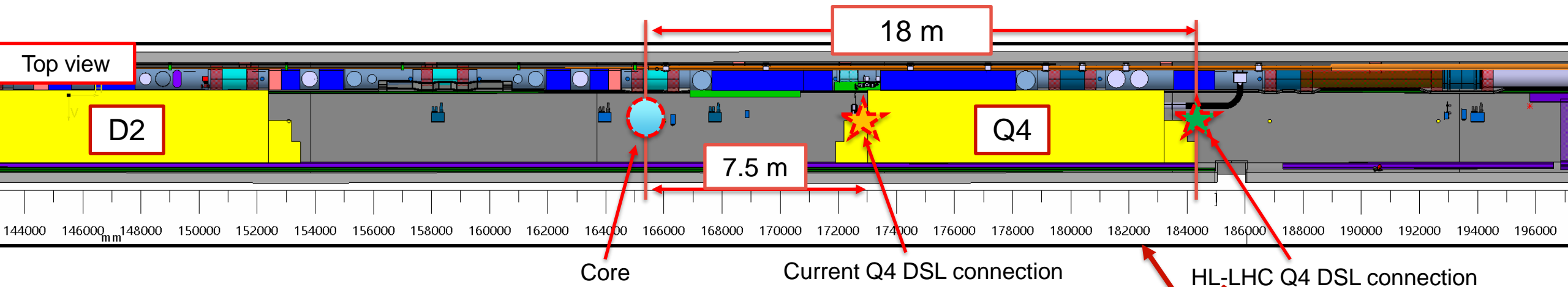
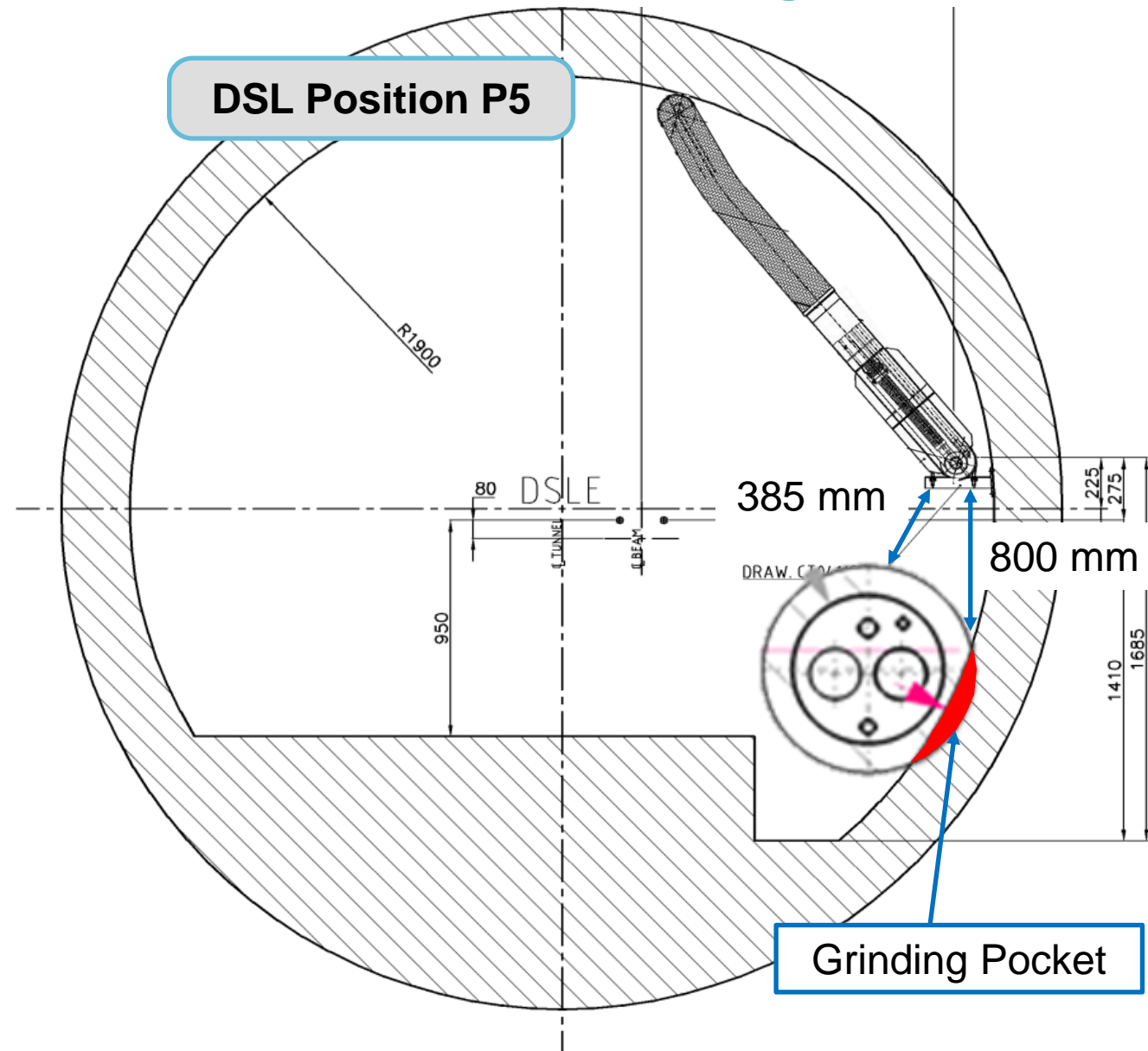


Image from C. Biot
(SCE/SAM)

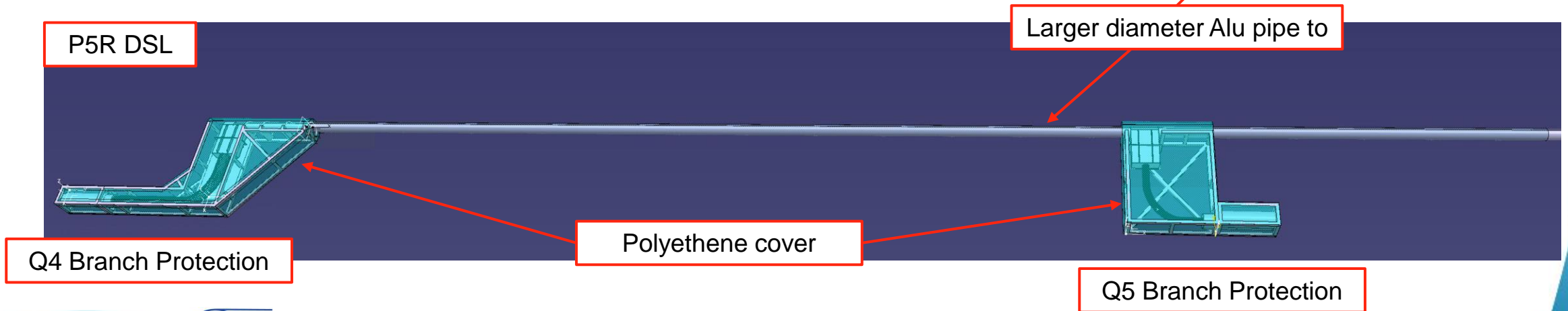
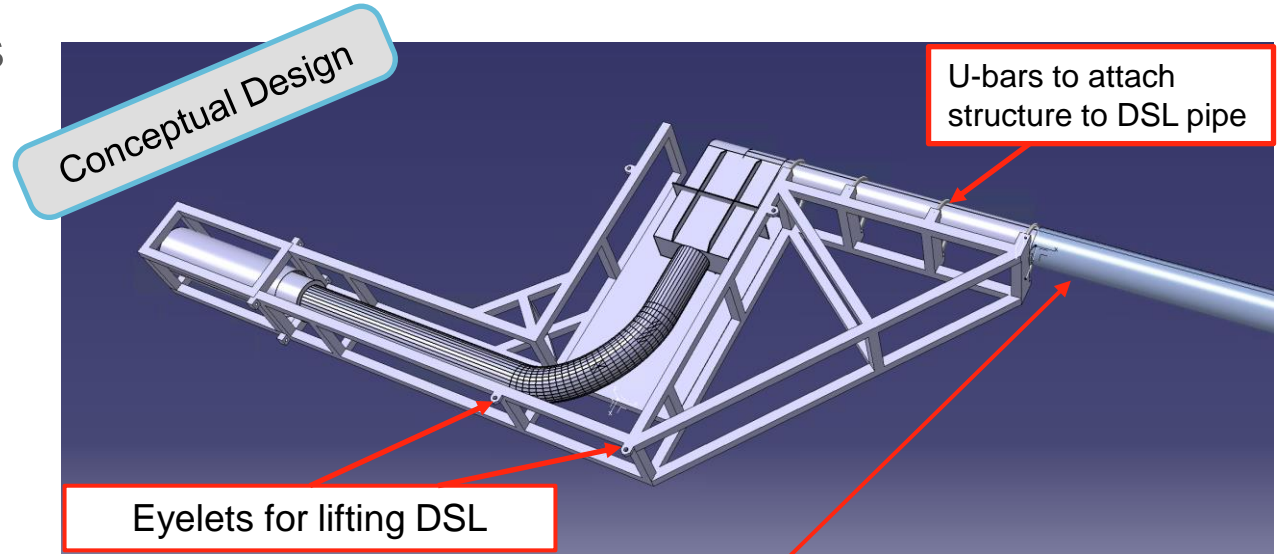
DSL Position with Civil Works: Wall Grinding P5

- Wall grinding is planned at P5 to allow welding of the QRL and QXL interconnections.
 - 800mm of vertical clearance from DSL pipe to cutting location.
 - SCE believes this is sufficient clearance, will discuss further with contractor.
 - DSL must be protected from dust and water spray from the grinding operation.
- 385mm clearance for rewelding QRL interconnections is acceptable for clearance.



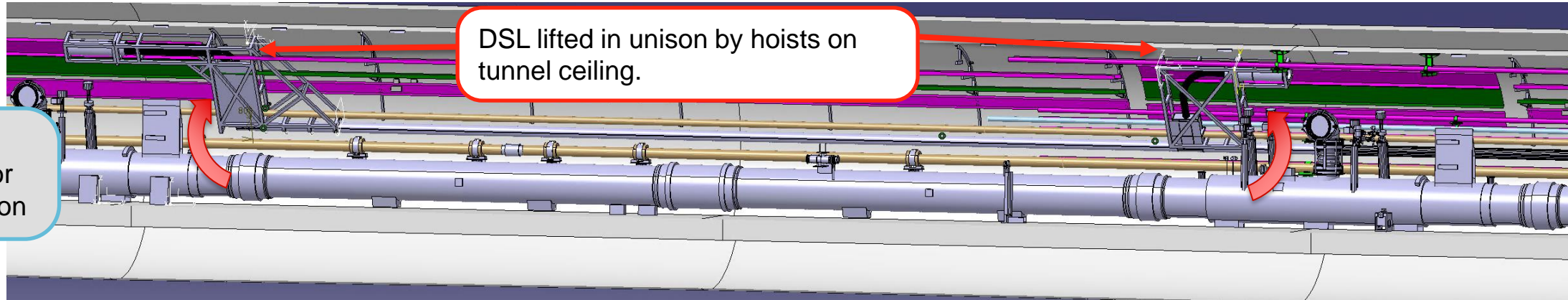
Protection of DSL

- The key function of the DSL protection is to:
 - Protect DSL from impacts, dust and water.
 - Restrain the flexible branches of the DSL.
 - Allows rotation of DSL.
 - Can be installed while the DSL and QRL are in its nominal position, after disconnection from the magnet.
 - Can be brought into tunnel via elevator.
 - Light enough not to break DSL supports.

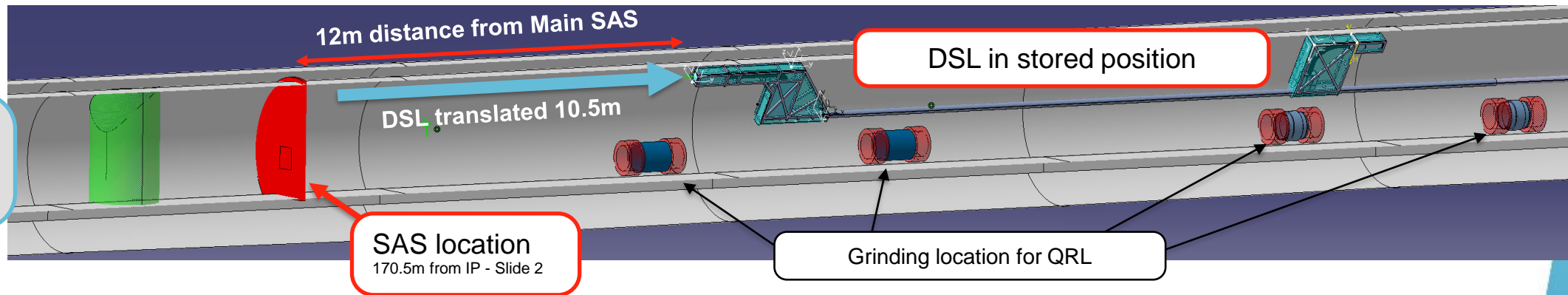


Deinstallation Activities with DSL – P5R

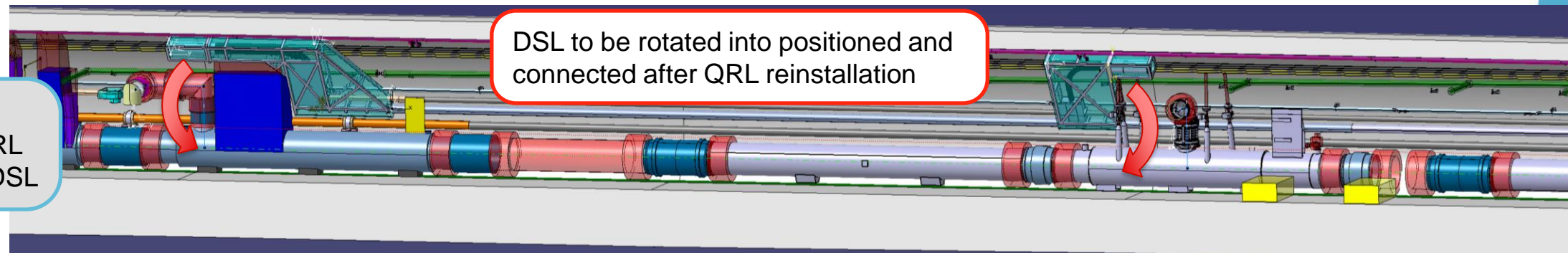
Step 1
DSL Rotated for
QRL deinstallation



Step 2
DSL translated
10.5m and stored



Step 3 and 4
Installation of QRL
Repositioning of DSL



DSL Integration Issues

- Deinstallation:
 - One cable tray clash with Q4 P5R DSL branch.
 - Helium ring line must be removed before rotation.
 - Warm recovery line removed with QRL after rotation.
- Reinstallation:
 - Warm recovery line installation with QXL before rotation of DSL into position.
 - Helium recovery line reinstallation after DSL rotated into position.

Conductor Spares

- Current situation:
 - 2.85km of 6kA cable currently used in DSL across P1 and P5.
 - MSC-LMF confirm they have no spare 6kA DCDD cable.
- HL-LHC intervention:
 - 400m of 6kA will be recovered from the removed sections of DSL in length of approximately 10m.
 - MSC-LMF will investigate if any HL-LHC 6kA conductor could be use as spare.

Next Steps

- Finalise design and order DSL protection/tooling.
- Develop method to translate DSL.
- Design and production of splice box with MSC-LMF.
- Define disconnection and reconnection of magnets with MSC.
- Solve open issues with tunnel integration.