

HL-LHC: crab cavity integration in LHC

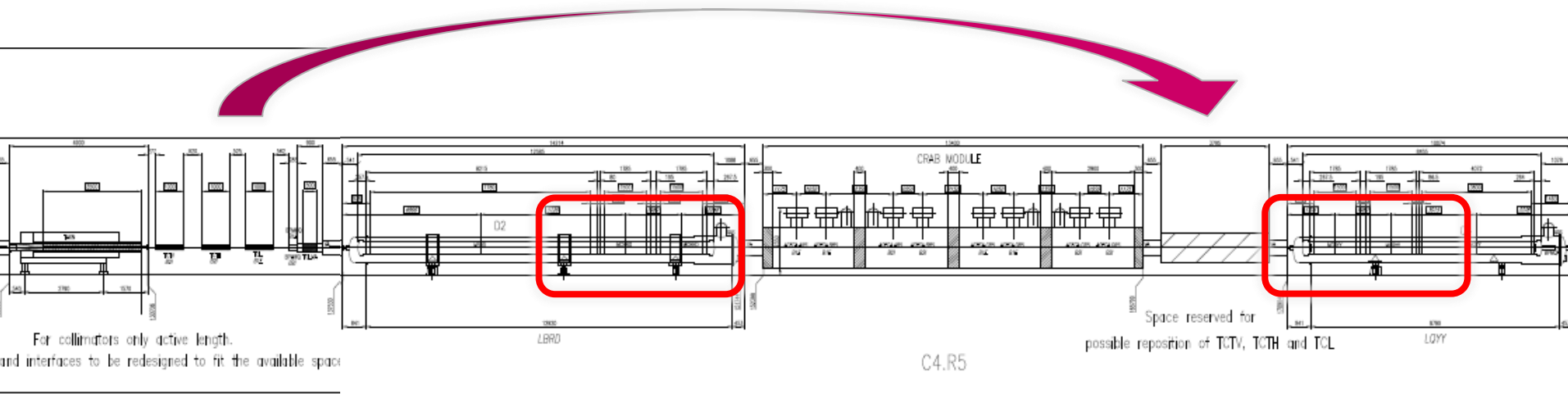
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P. Fessia C. Magnier.

Presented by P. Fessia

Summary

- HL-LHC lay-out, few observations
- Crab services in the baseline civil engineering approach
- Crab services in the option civil engineering approach
- Some pros/cons/open issues

IR1-IR5 the machine lay-out



The space between D2 and Q4 is very limited especially if the options of the swap in position of the collimators will be taken.

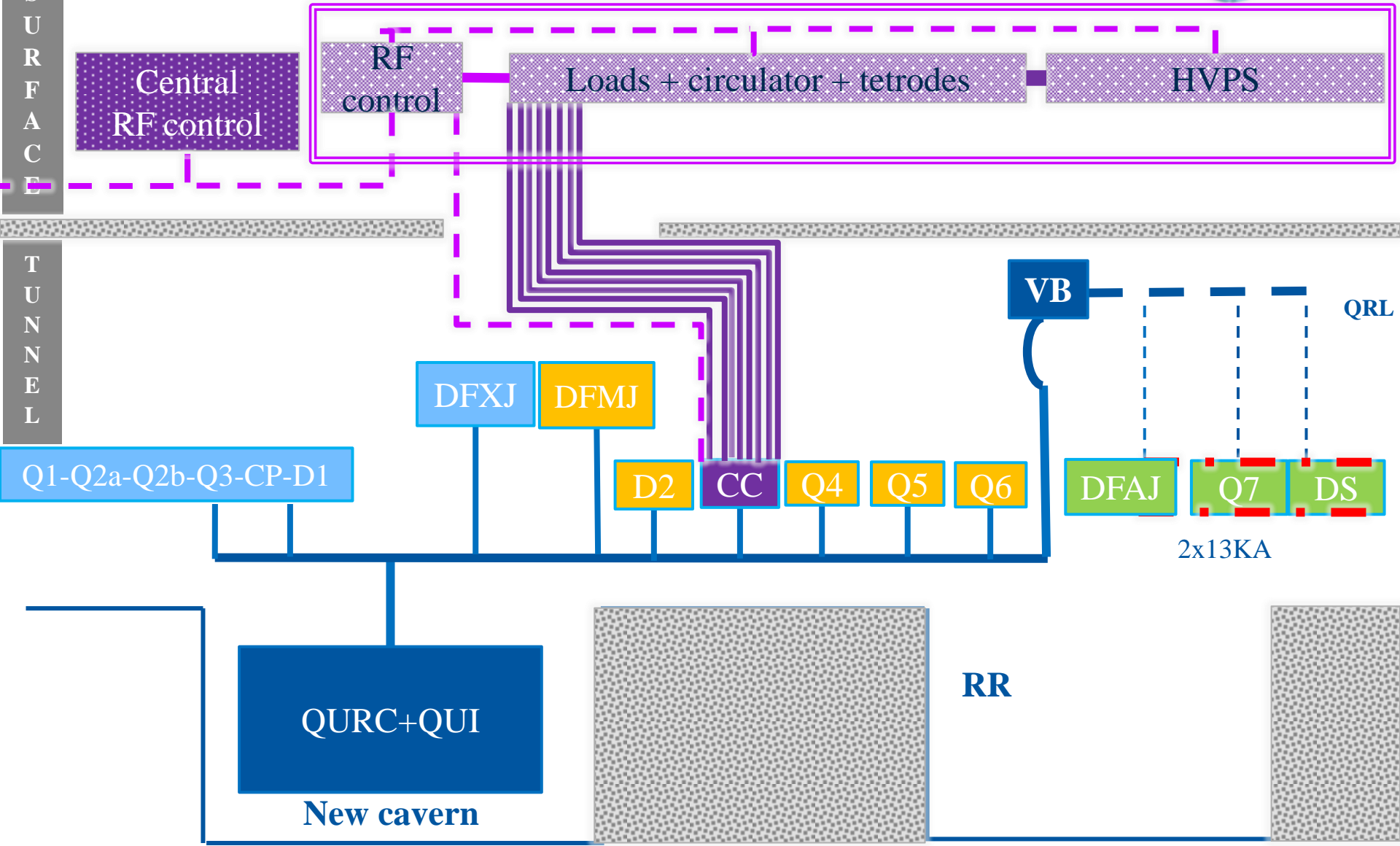
In addition the Q4 and D2 correctors probably will need more space
 Today lay-out foresees independent crab modules for improved modularity and easier maintenance

If the space would get much more reduced we could be obliged to revert to a solution with a continuous cryostat leading to necessity to connect the cryostat external envelopes among them

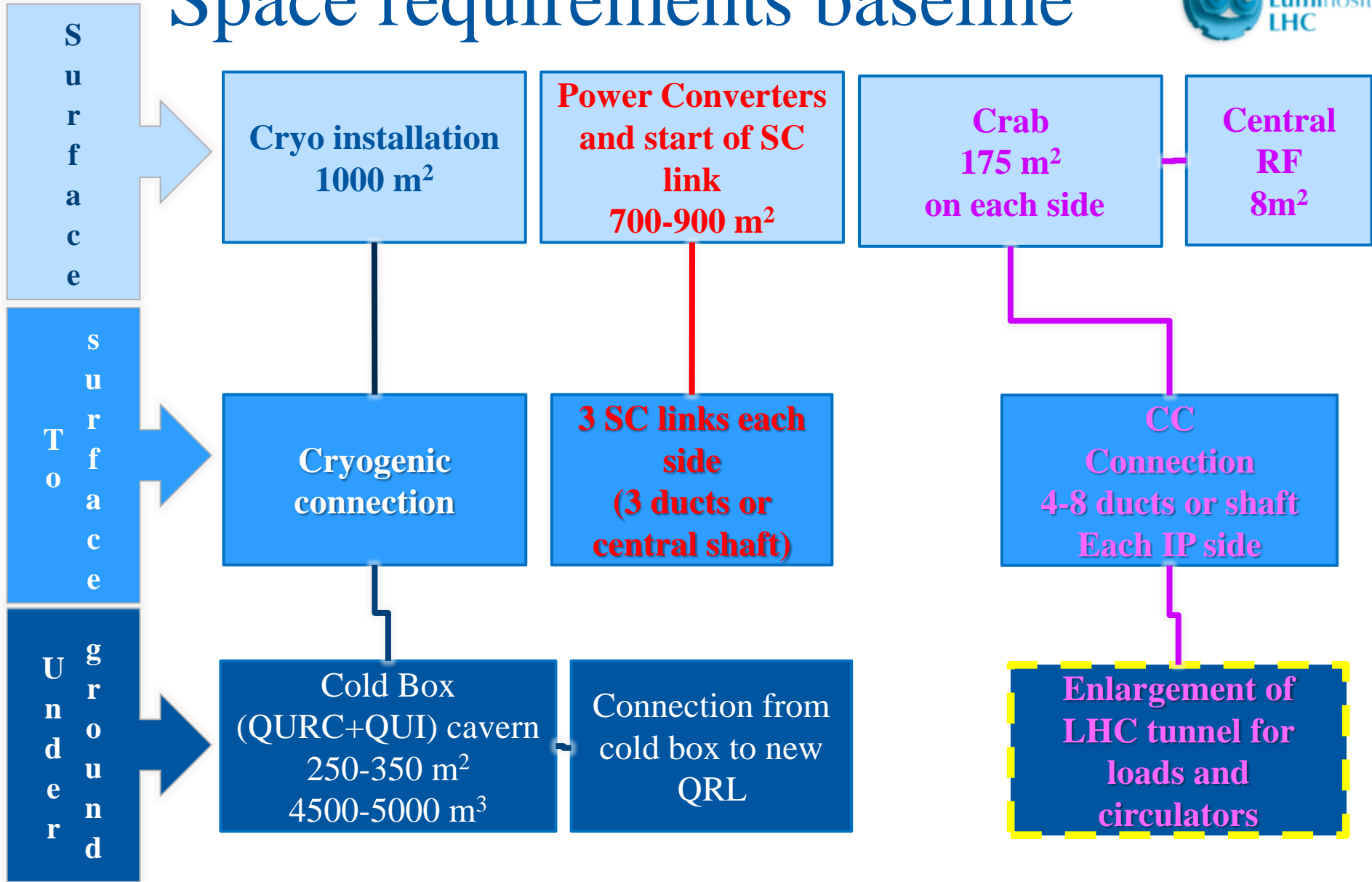
Pt1 & Pt 5: crab cavity RF services concept

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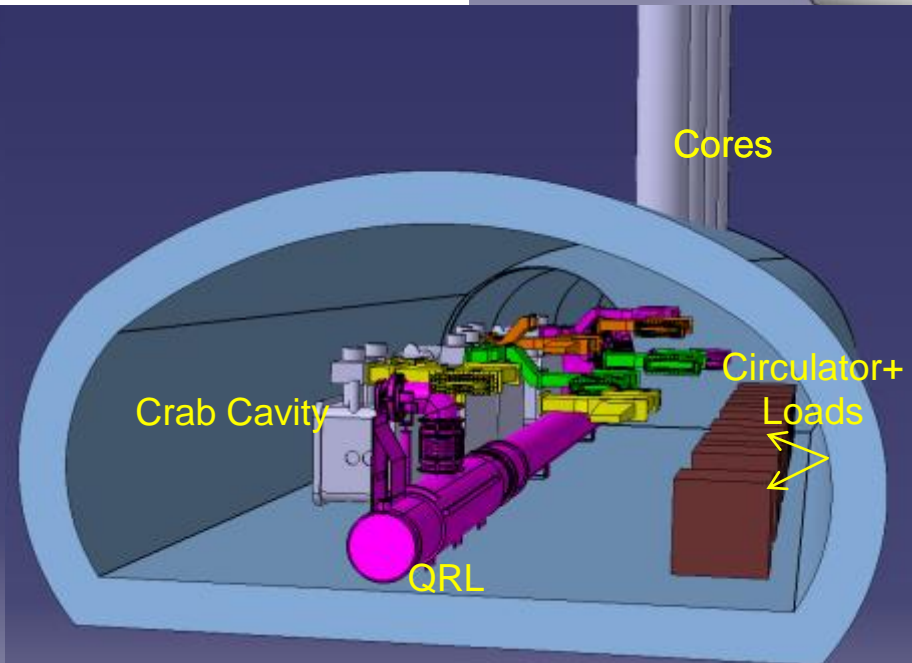
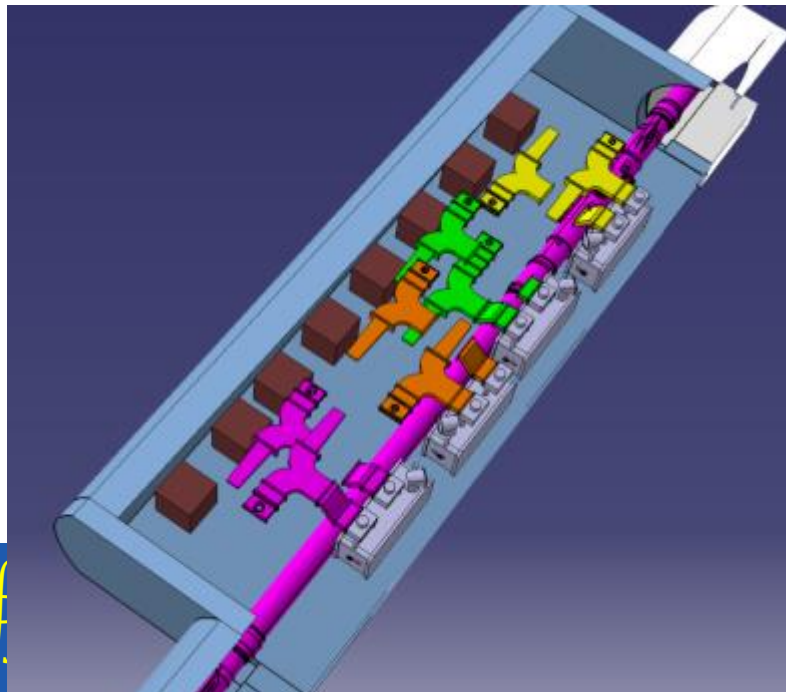


Space requirements baseline



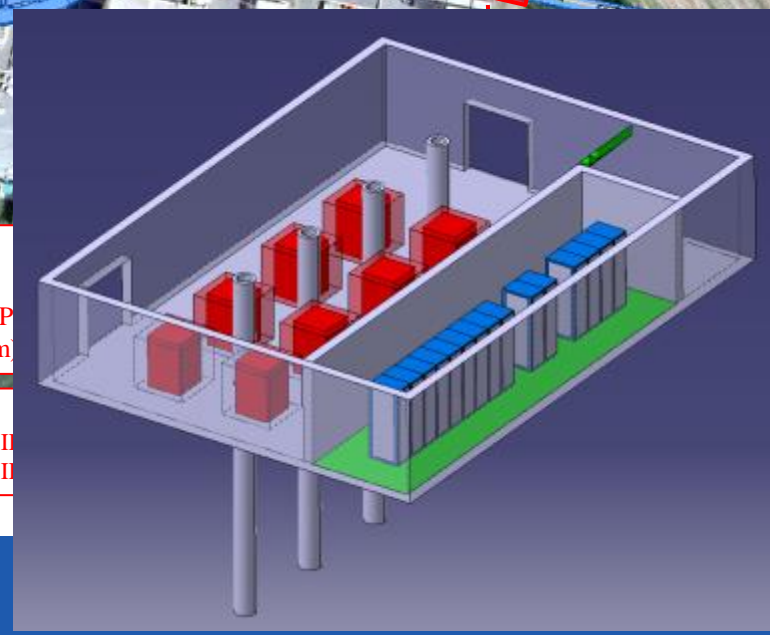
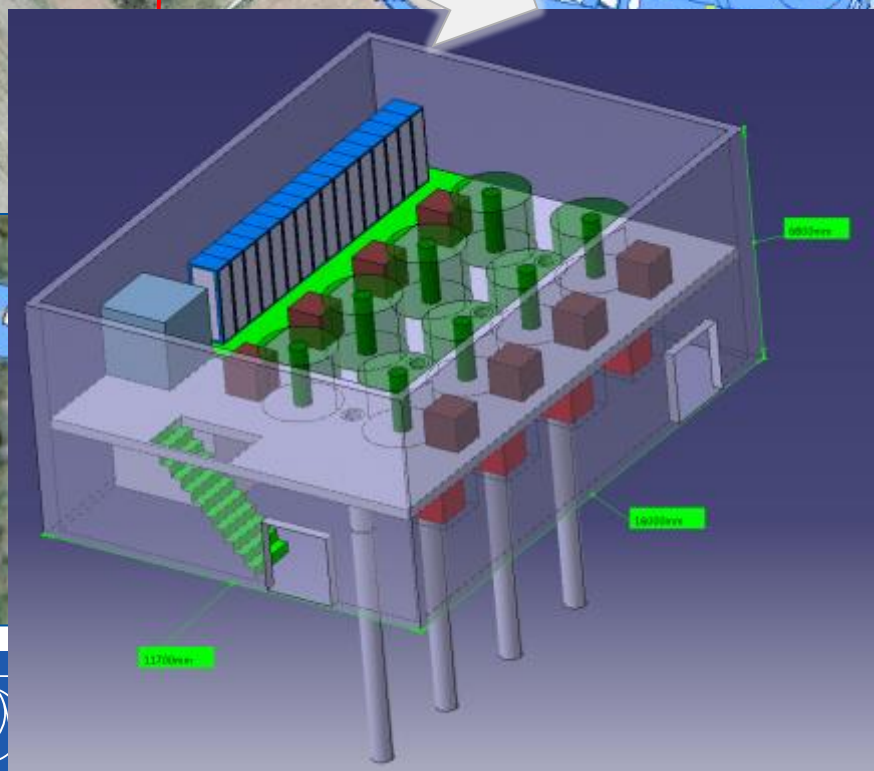
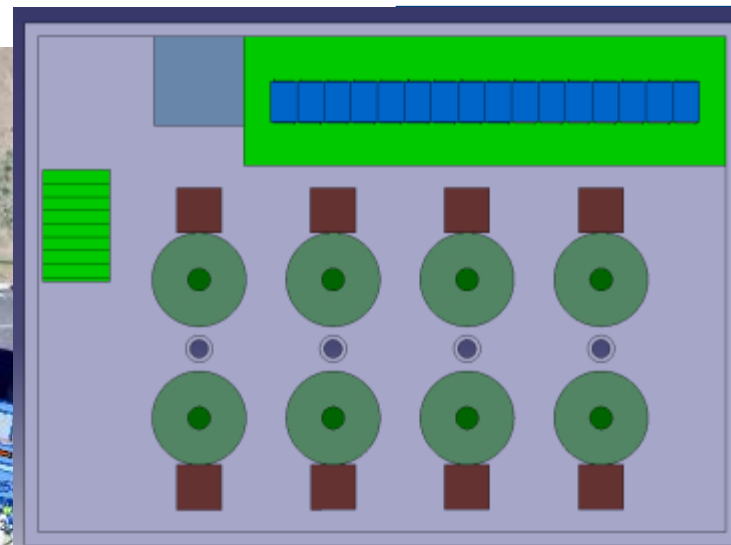
Baseline underground II: crab cavities

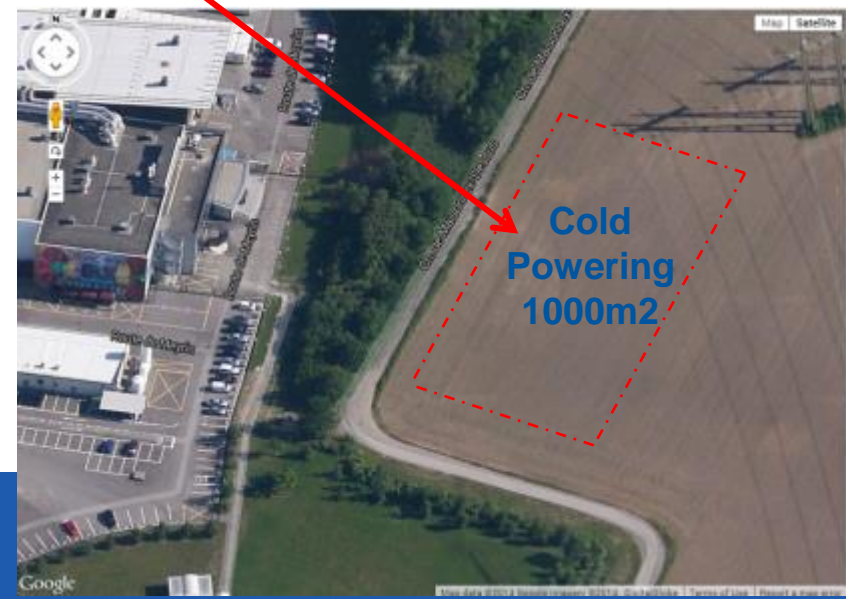
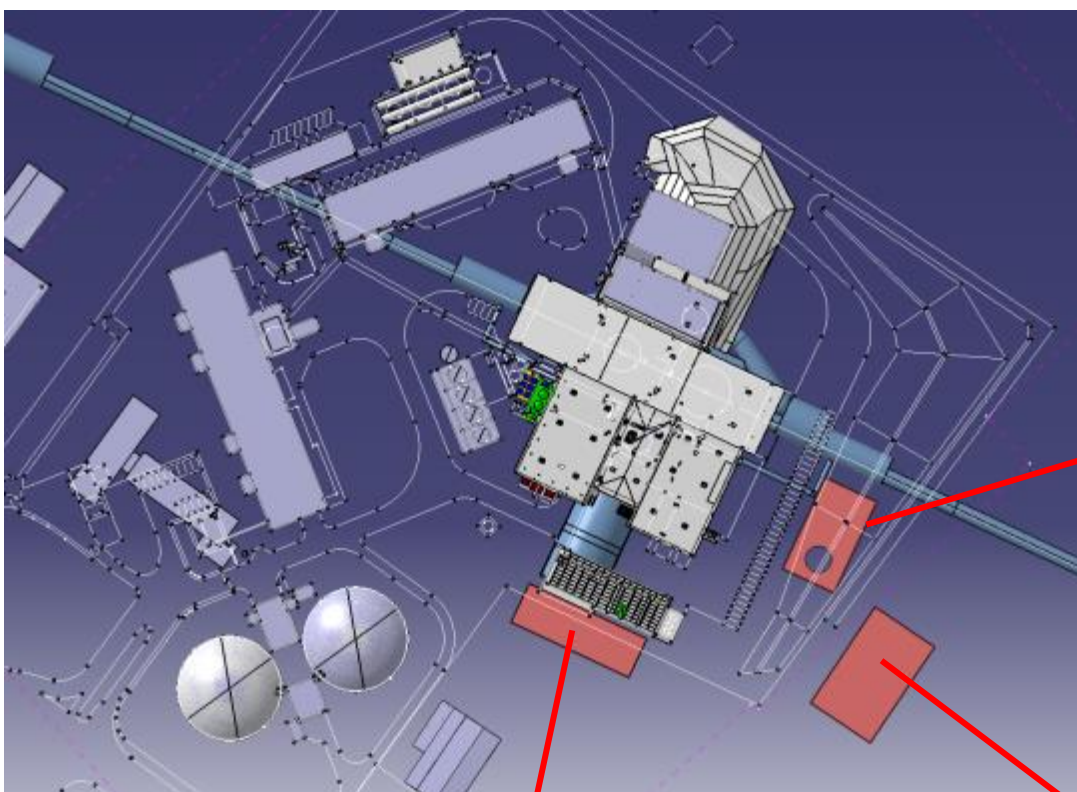
- Installation of loads and circulators underground to reduce coax diameter → 2 coax in the same core
- Enlargement required to comply with limited precision of long vertical cores add to install loads and circulators



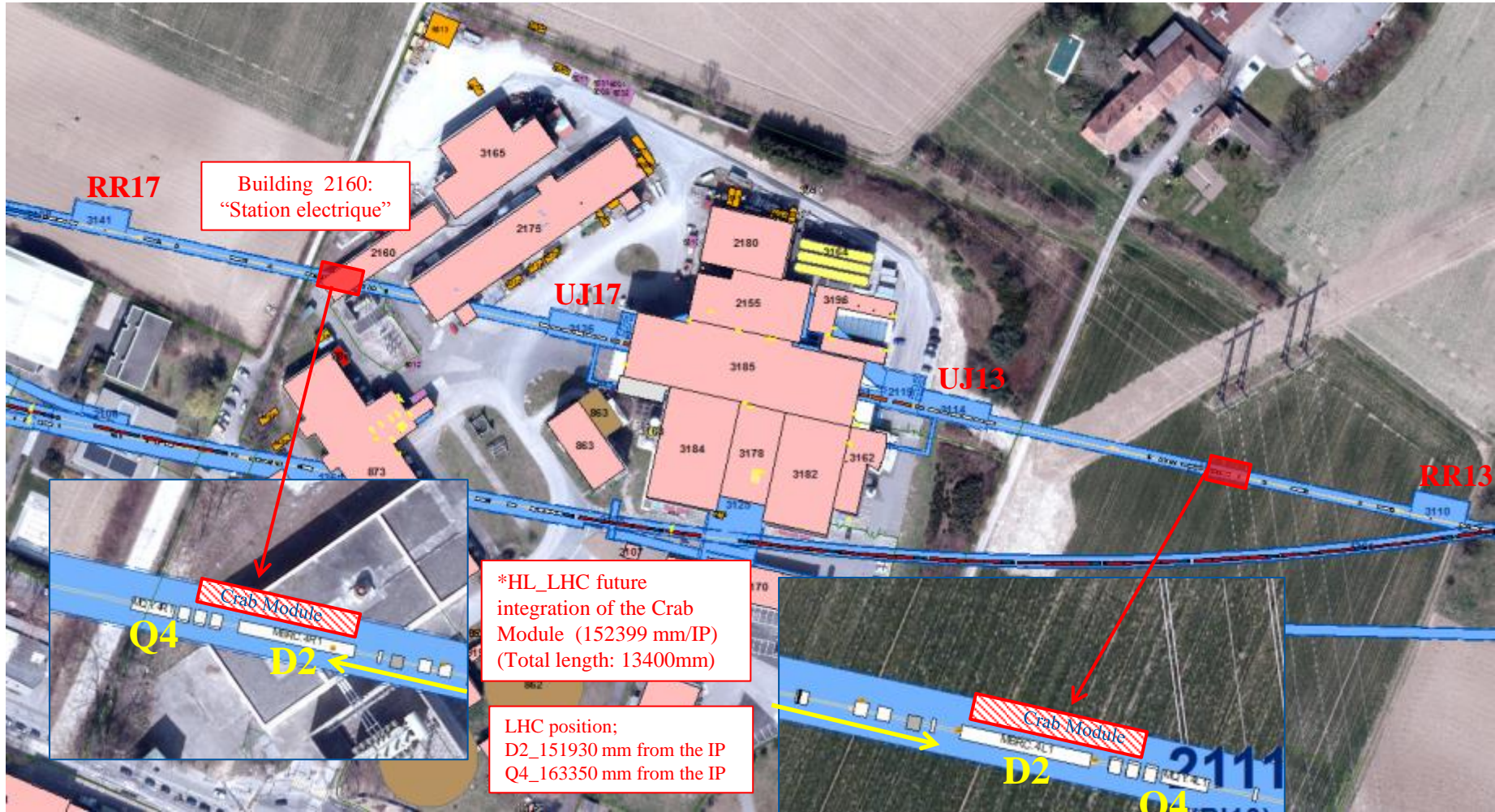
Baseline surface I: crab cavities

Crab Module position
~ 152399 mm/IP
Total length: 13400 mm





POINT 1 Surface building



Surface buildings and cores for Crab

LSS1R : impossible to drill core and build an other CE work directly up the crab

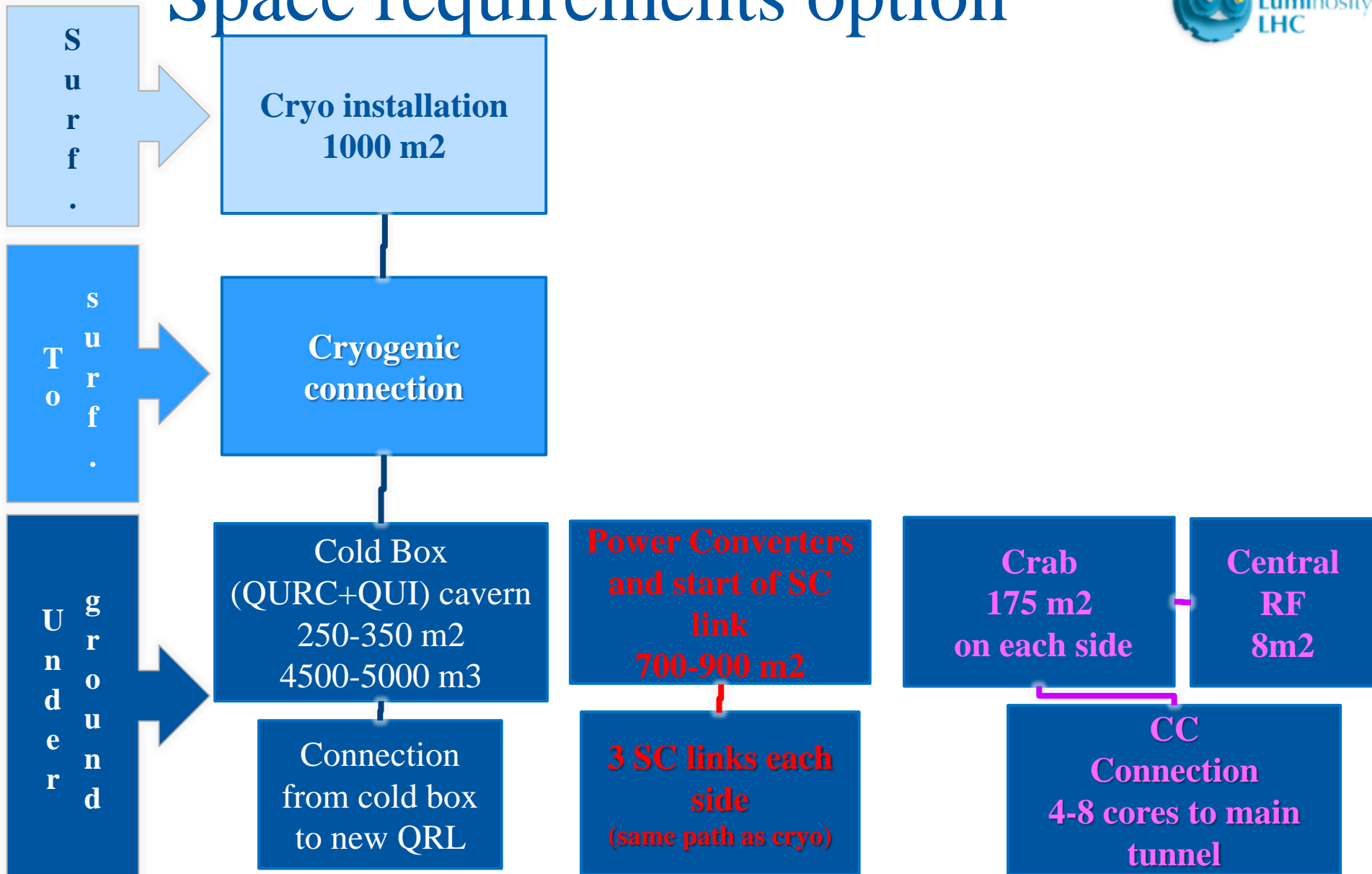


LSS1L : HT line in the area

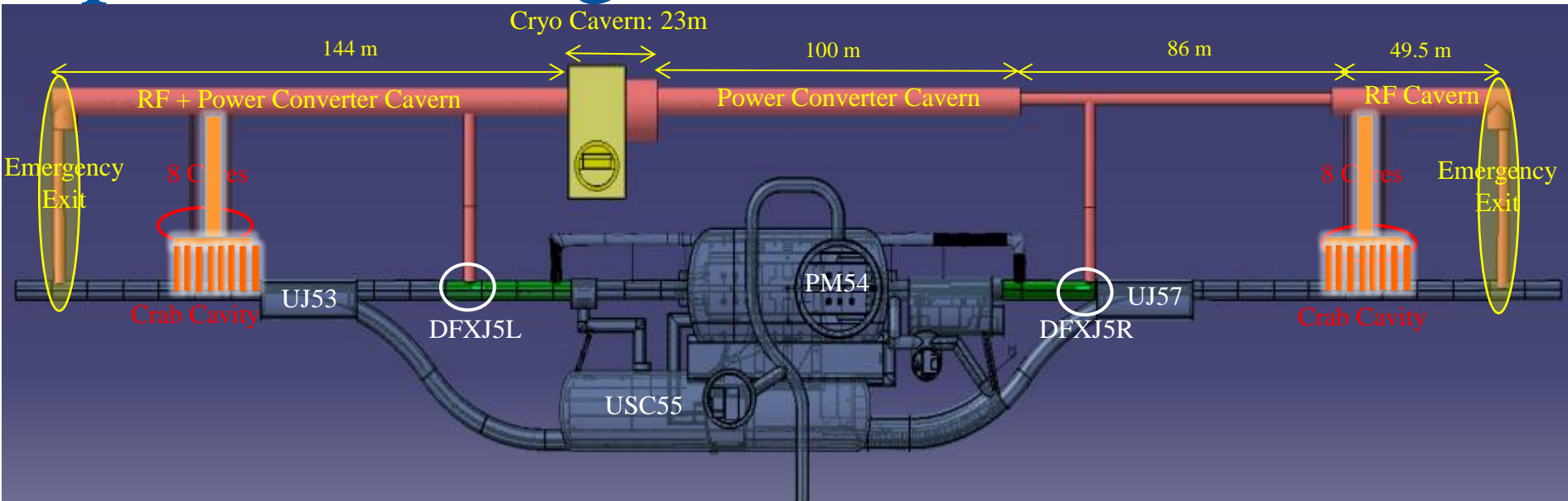


HL-LHC IR 1,5 MAIN SYSTEM DISTRIBUTION OPTION

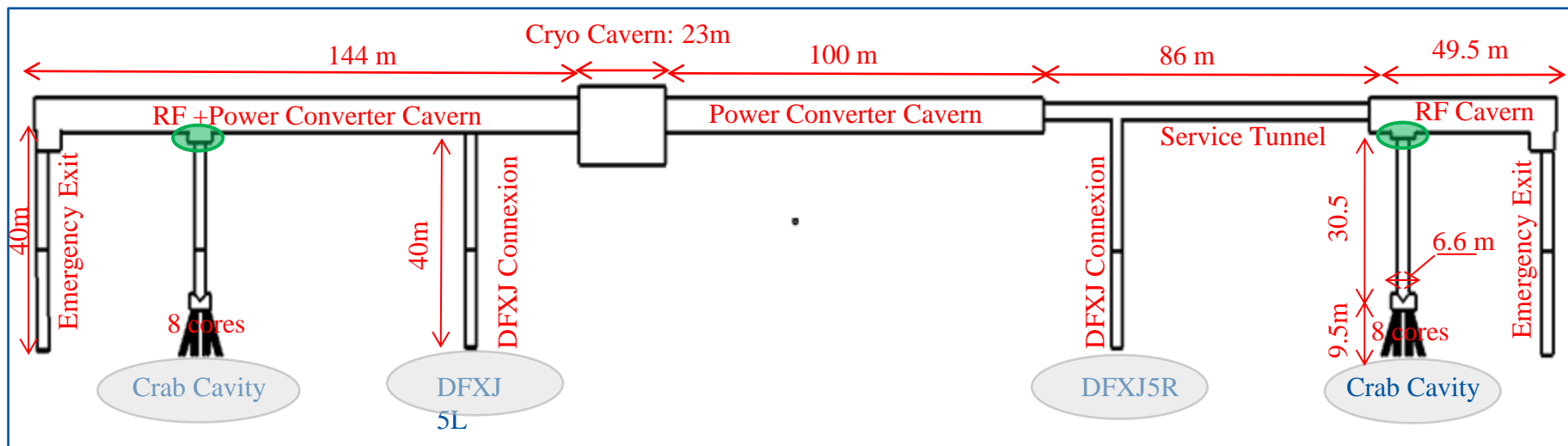
Space requirements option



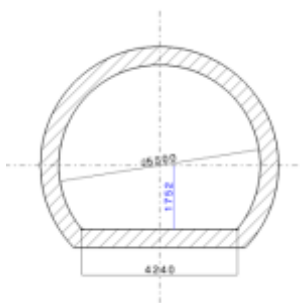
Option: underground



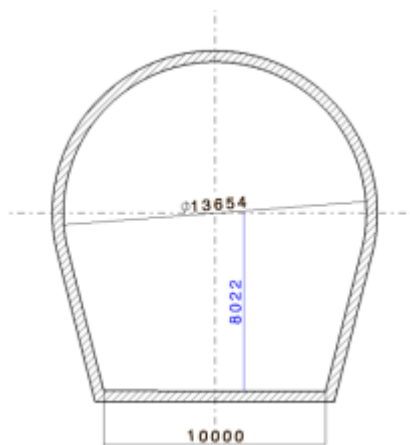
Option A: Civil engineering underground facilities



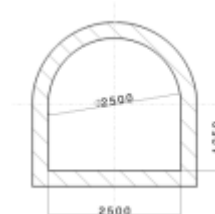
Power Converter (PC) and RF Cavern



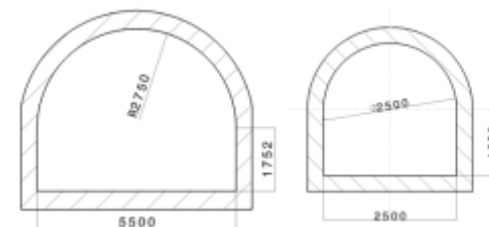
Cryogenic Cavern



Service Tunnel, DFXJ connexion and Crab Cavity tunnel



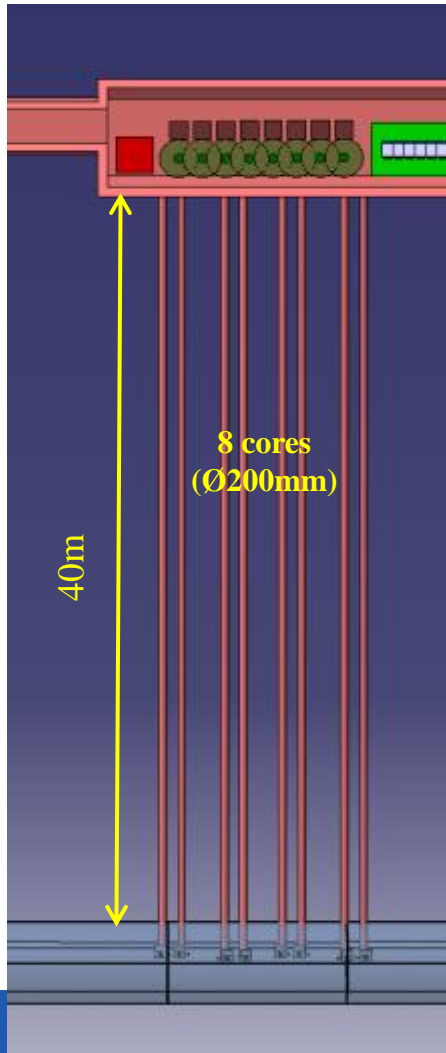
Emergency Exit



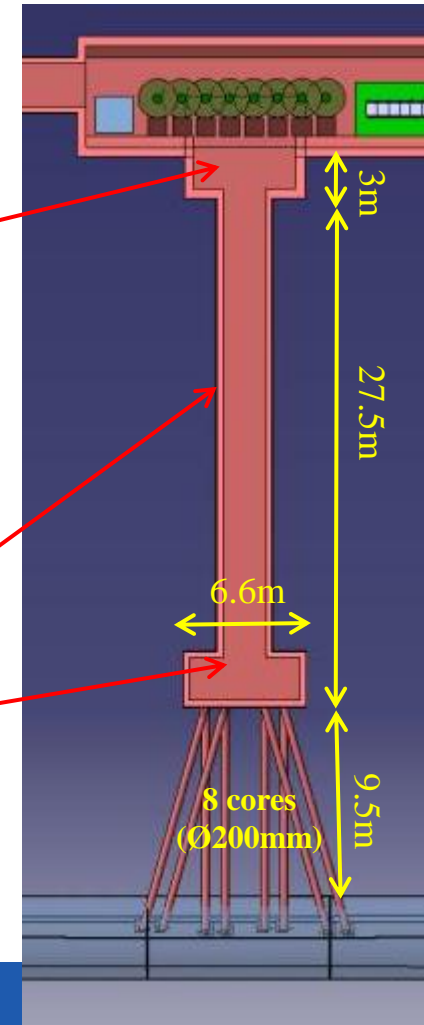
* Same section used for the local enlargement between the RF Cavern and the Crab Cavity tunnel

Crab Cavity. Civil Engineering underground facilities

Option A



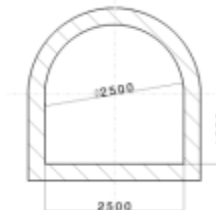
Option B



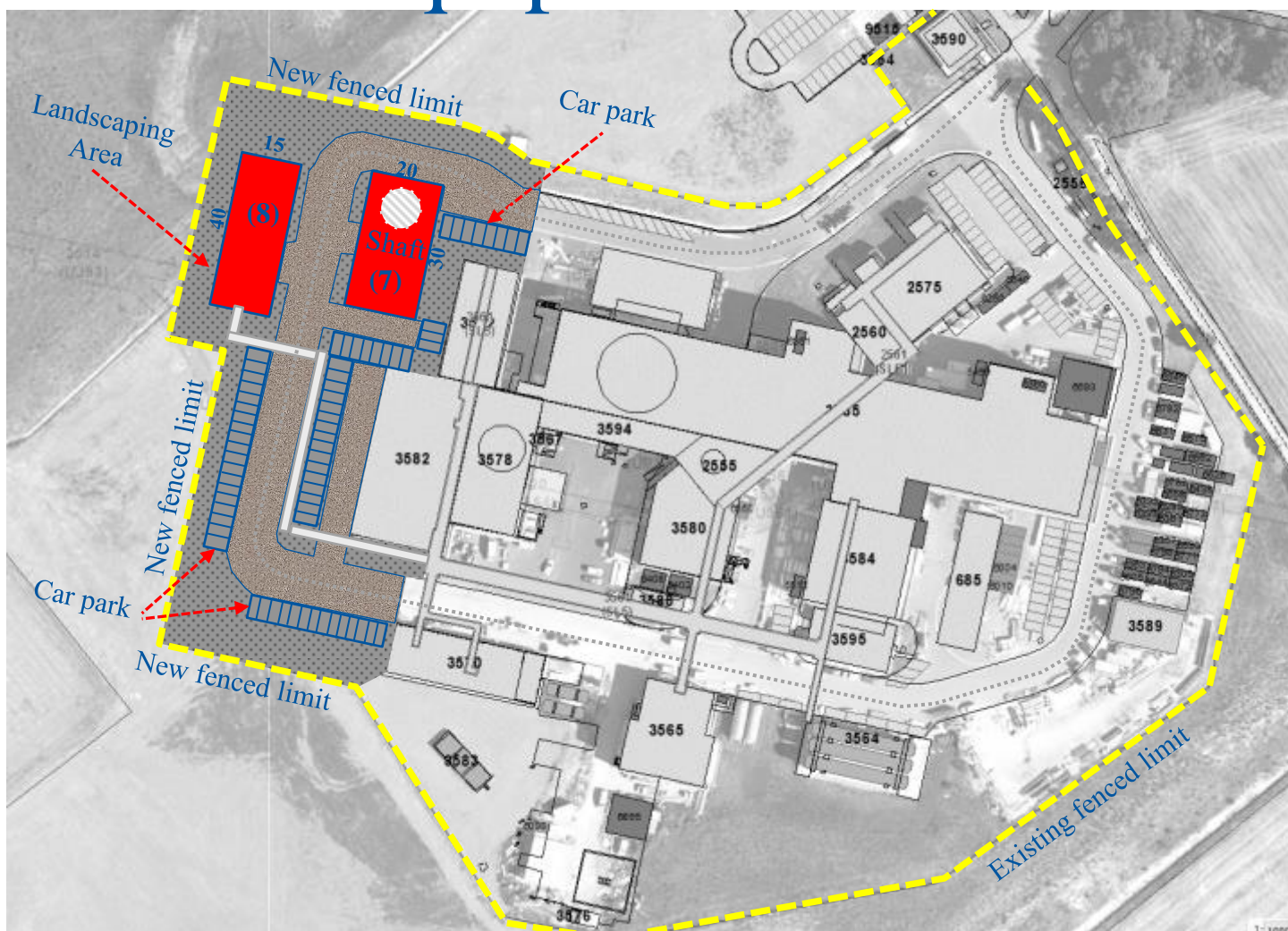
Crab Cavity Tunnel. Local enlargement



Crab Cavity Tunnel



Option surface: all other equipment



MACHINE SIDE, WITH NEW SHAFT + PC

7) SD (Steel)

- Dimension: 20 x 30 = 600m²
- Hmax = 12.0m
- Services (in;out): HV, water, SC Links ; ?
- Crane not costed (20t ?)

8) WARM COMPRESSOR (Conc)

- Dimension: 15 x 40 = 600m²
- Hmax = 9m
- Services (in;out): HV, water, Cryo pipes ; ?
- 20t crane not costed

10) PARKING, ROADS, GALLERIES

- Car Park: 20 places added
- New Road: 180m(L), 8m(W)
- New Access road: 70m(L), 6.5m(W)
- Galleries for services: 110m(L), Cross section 2.0m(W) by 2.5m(H)
- Landscaping: 6,600m²

Some open points and pros and cons



	Baseline	Option
Pros.	<ul style="list-style-type: none">- More margin to perform changes also near LS3- Easier equipment interchange in case of failure- Requires less pushed installation optimization to reduce volume	<ul style="list-style-type: none">- Equipment very near to crabs (sort cables)- Possibility to have other instrumentation in very short distance from the crab with a routing not crossing the LHC tunnel- Easier and cheaper installation of coax/wave guides
Cons.	<ul style="list-style-type: none">- More complex construction permits from the authorities and very crowded area- The vertical cores will have a precision respect to the target point of ± 50 cm therefore we need enlargement and in addition the connection system of the RF power capable to accept this unknown	<ul style="list-style-type: none">- Larger amount of underground work with more risk in planning. Requires advancement of works start to LS2- Decisions on services and space allocation to be FIXED early enough to allow work starting in LS2 (1 year from now)- Need to design tunnel for radiation attenuation
Open questions	<ul style="list-style-type: none">- Coax self weight resistance and possible volume of the weight supporting system: confirm that vertical assembly possible, with 2 coax in a 400 mm diameter core	<ul style="list-style-type: none">- Connection of the RF/coax to the crabs on the machine side important to define the paths and therefore the cores/tunnel geometry