Latest Plans for FCC Civil Engineering and Site Investigations

FCC Feasibility Study

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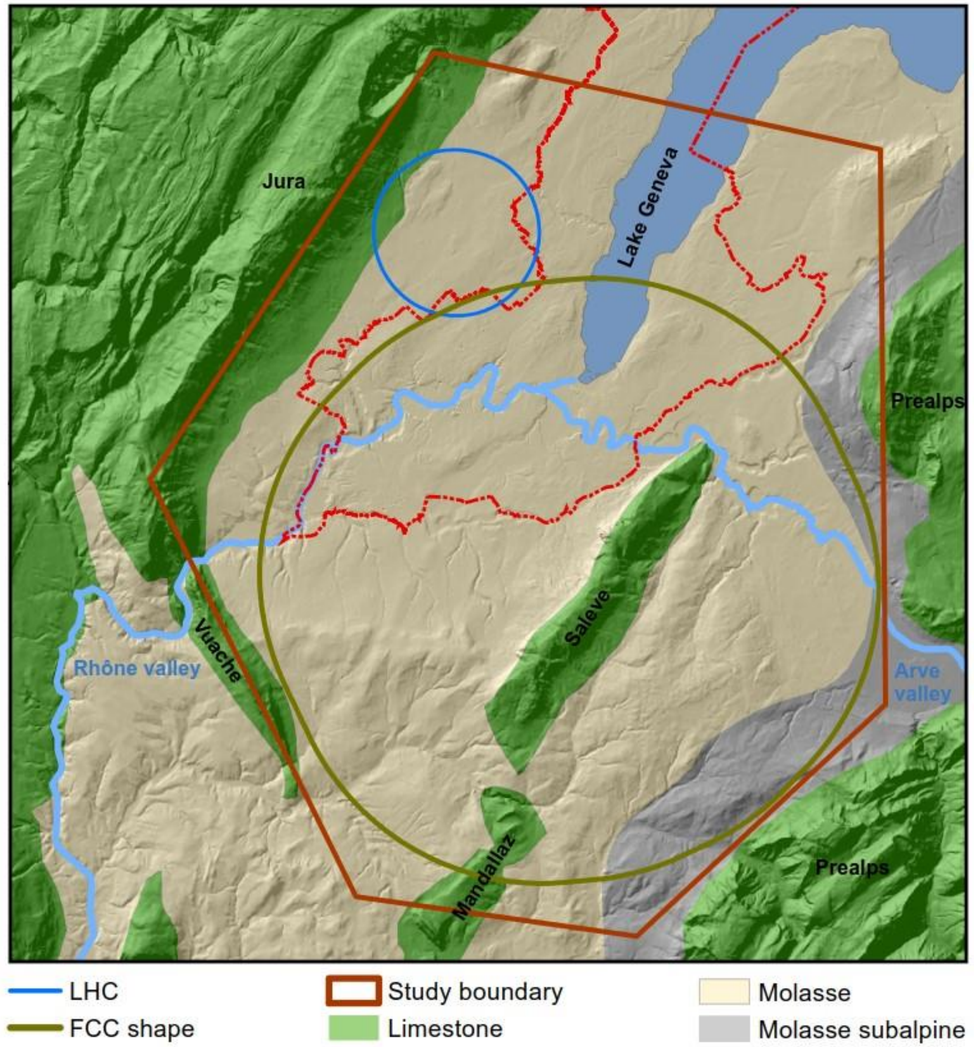
FCC Civil Engineering Studies

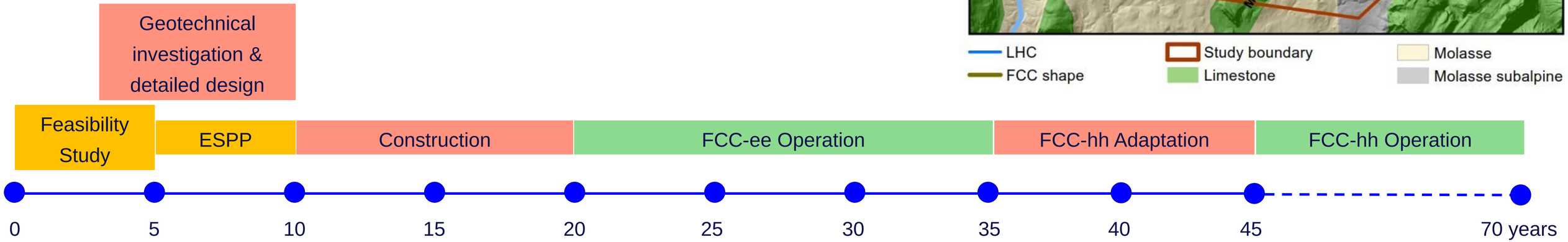
Feasibility study of FCC construction at CERN

Mid-term review 2023

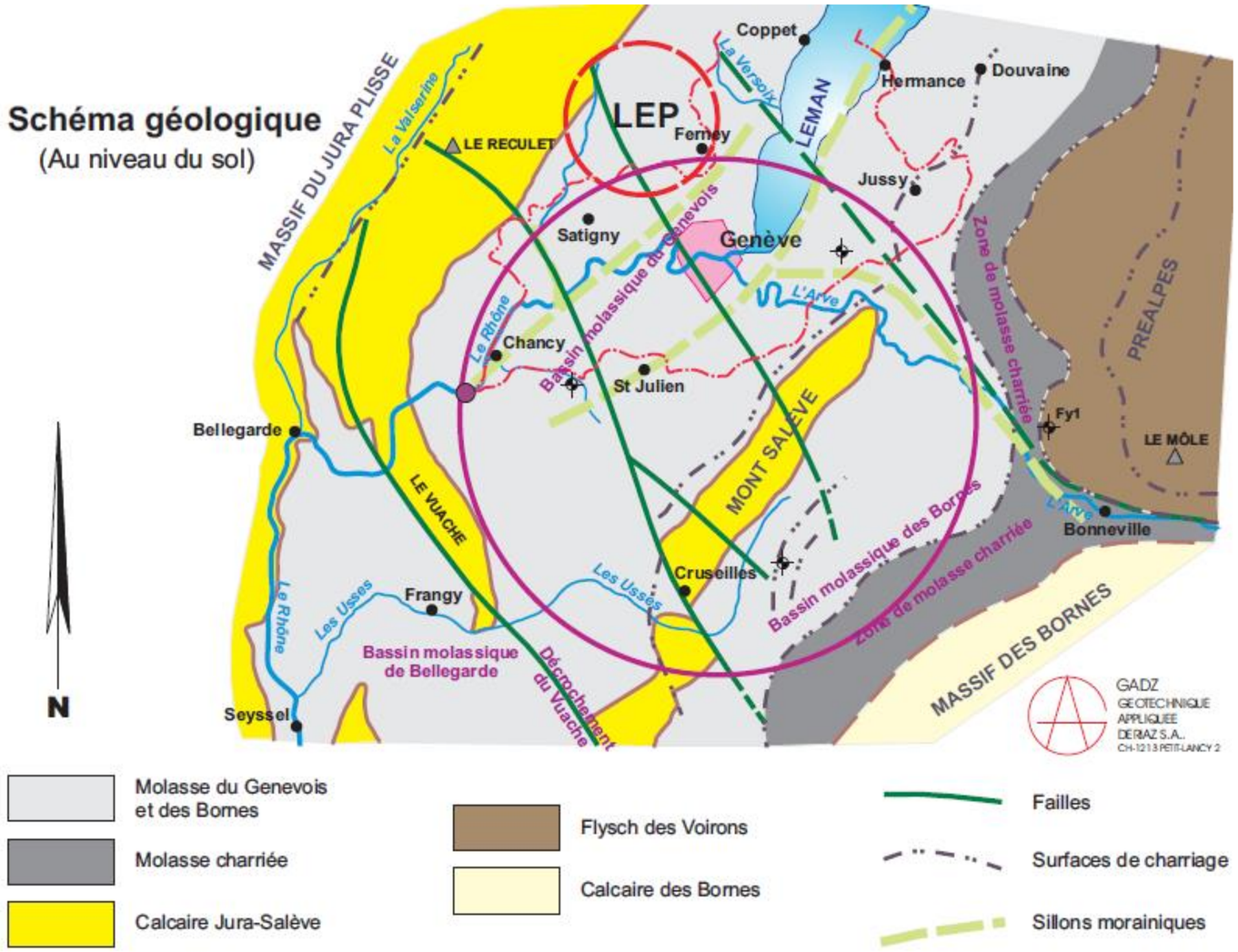
Geological site investigations 2024

Feasibility study delivery 2025





Geology



Molasse

- Mixture of sandstones, marls and formations of intermediate composition
- Relatively weak rock (Avg. 5.5 - 48 Mpa)
- Good excavation rock
- Relatively dry and stable
- Faulting due to the redistribution of ground stresses
- Structural instability (swelling, creep, squeezing)

Moraines (Quaternary Deposits)

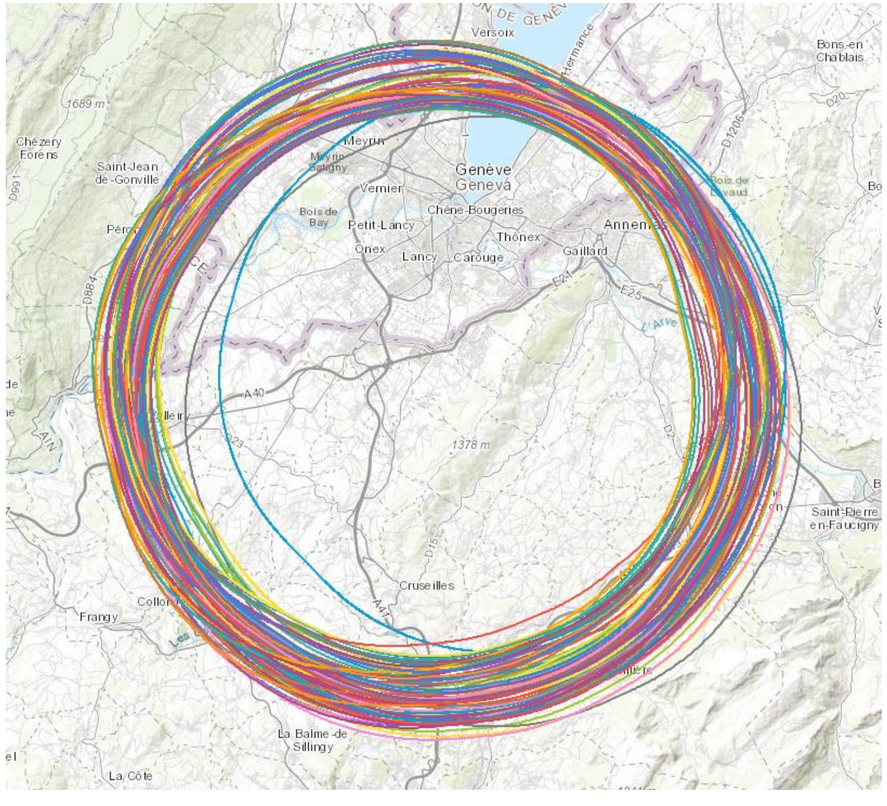
- Glacial deposits comprising gravel, sands silt and clay
- Water bearing unit
- Unfavourable tunneling

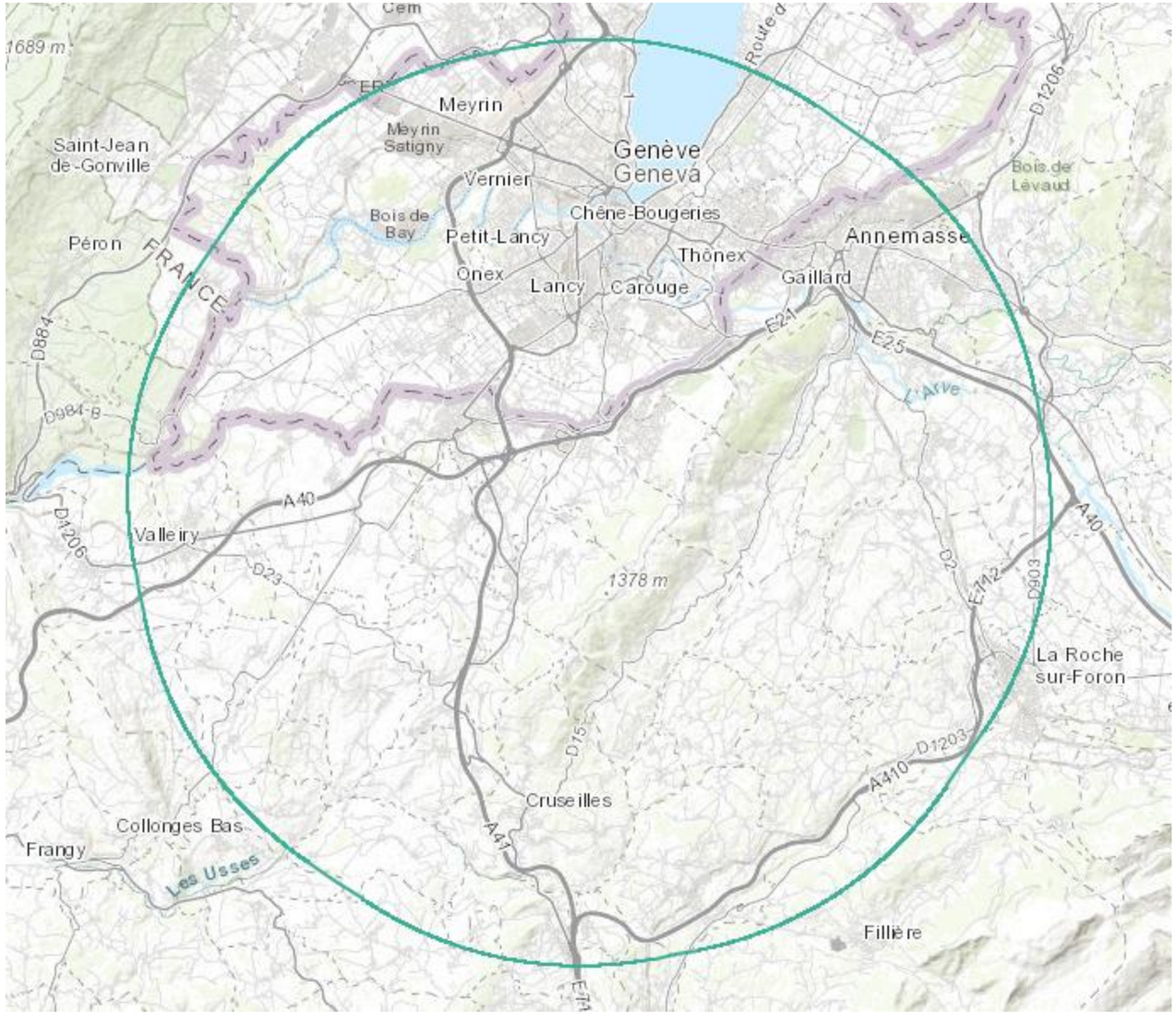
Limestone

- Hard rock
- Good tunneling rock
- Fractures and karsts likely present
- High inflow rates during LEP construction (600L/sec)
- Rock mass instabilities

PA31-3.2 Alignment

90.6 km circumference
Swiss molasse basin
Lake crossing
River (moraine) crossings
Mountain topography
Geneva metropolitan area





Civil Engineering Sub Surface

8 surface sites

13 shafts

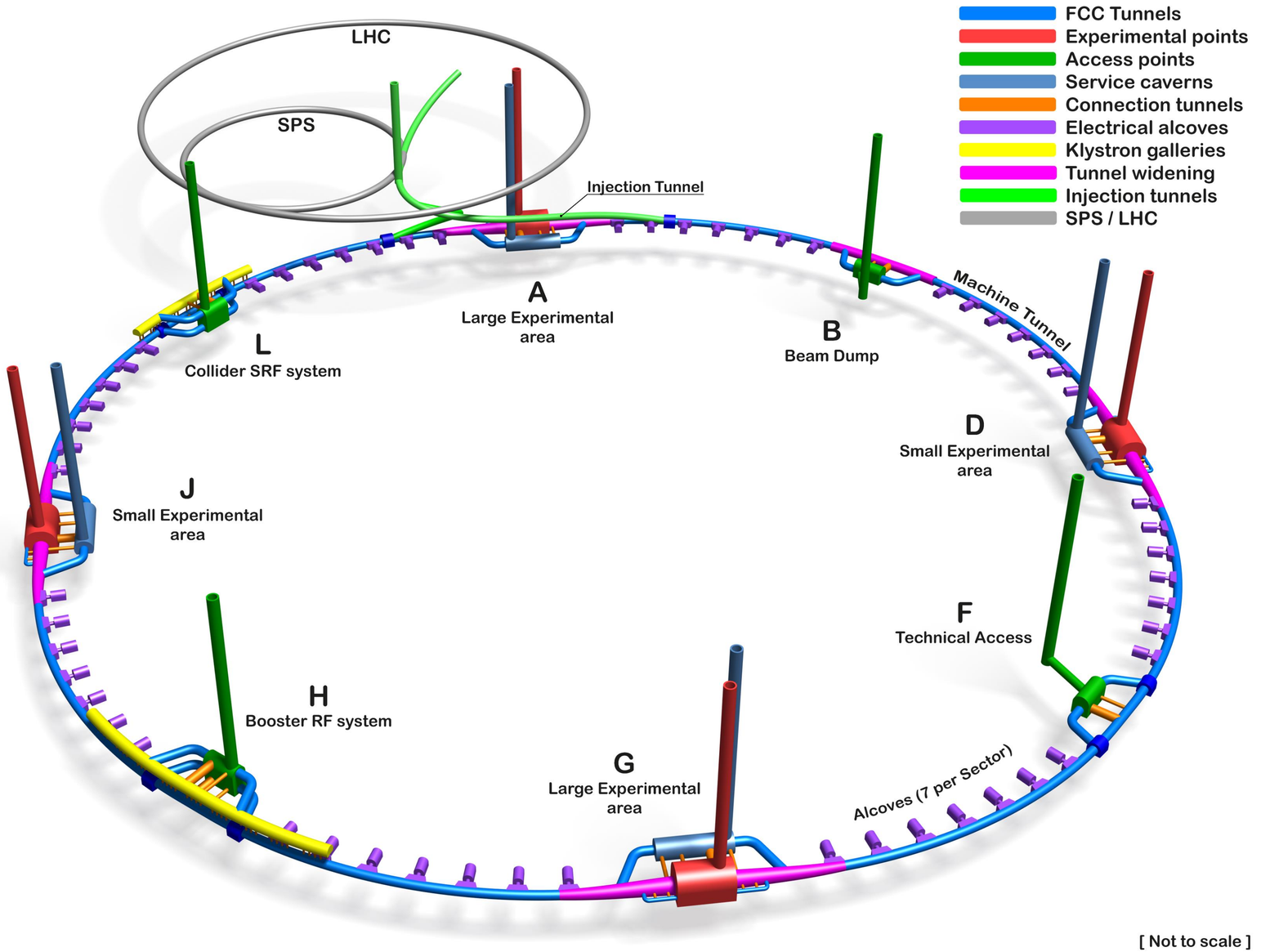
4 experiment caverns

8 service caverns

Beam dump

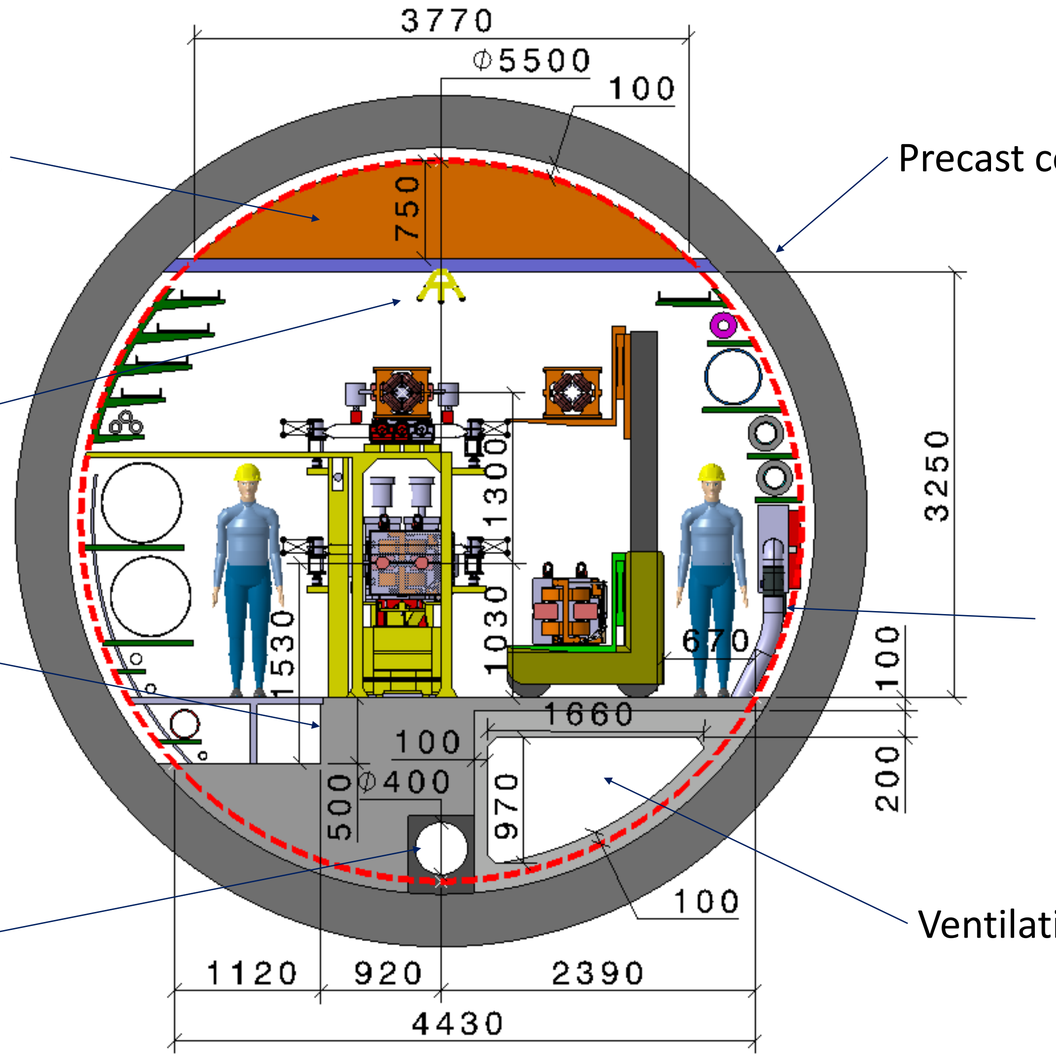
RF klystron galleries

SPS injection lines



[Not to scale]

Main Beam Tunnel



Smoke extraction duct

Precast concrete tunnel segments

Tunnel monitoring / maintenance robot

In-situ concrete floor

Tunnel invert drainage

Ventilation duct

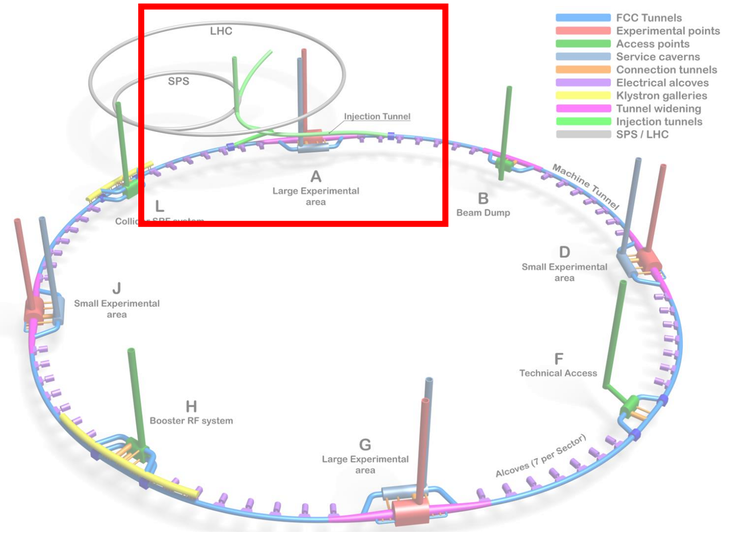
Credit: Fani Valchkova-Georgieva

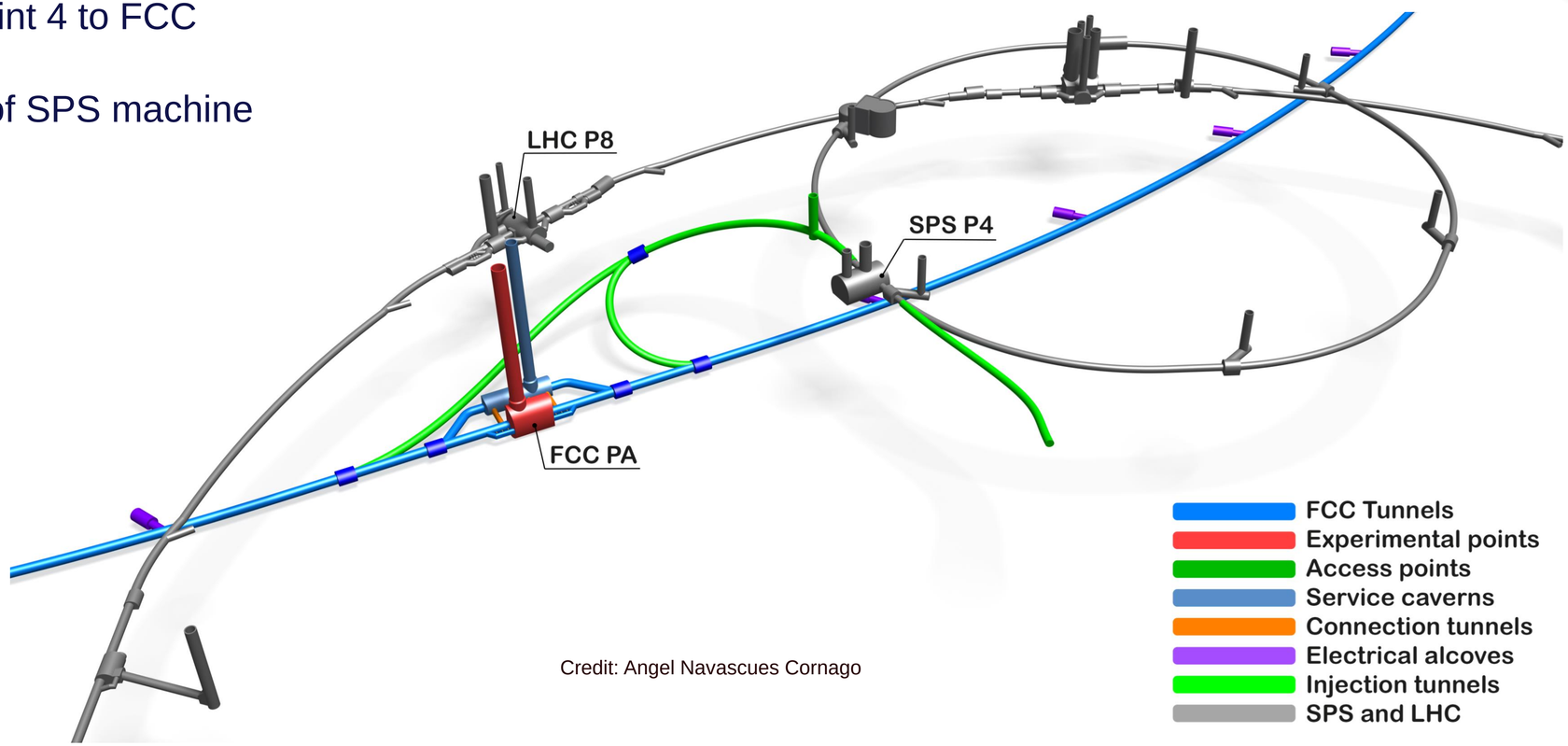
SPS Injection Lines

CERN Prevessin LINAC to SPS Point 4

SPS Point 4 to FCC

Reuse of SPS machine

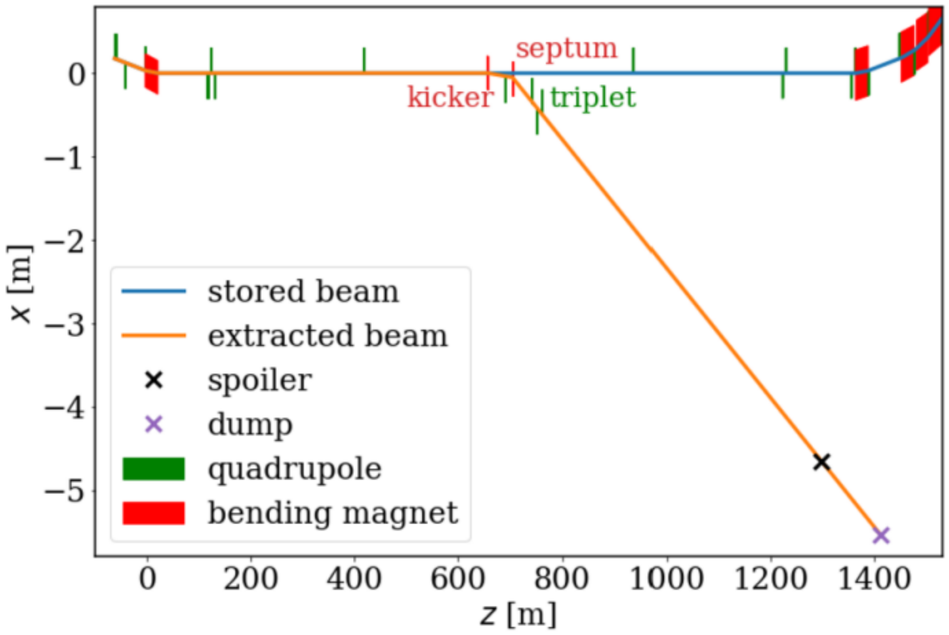


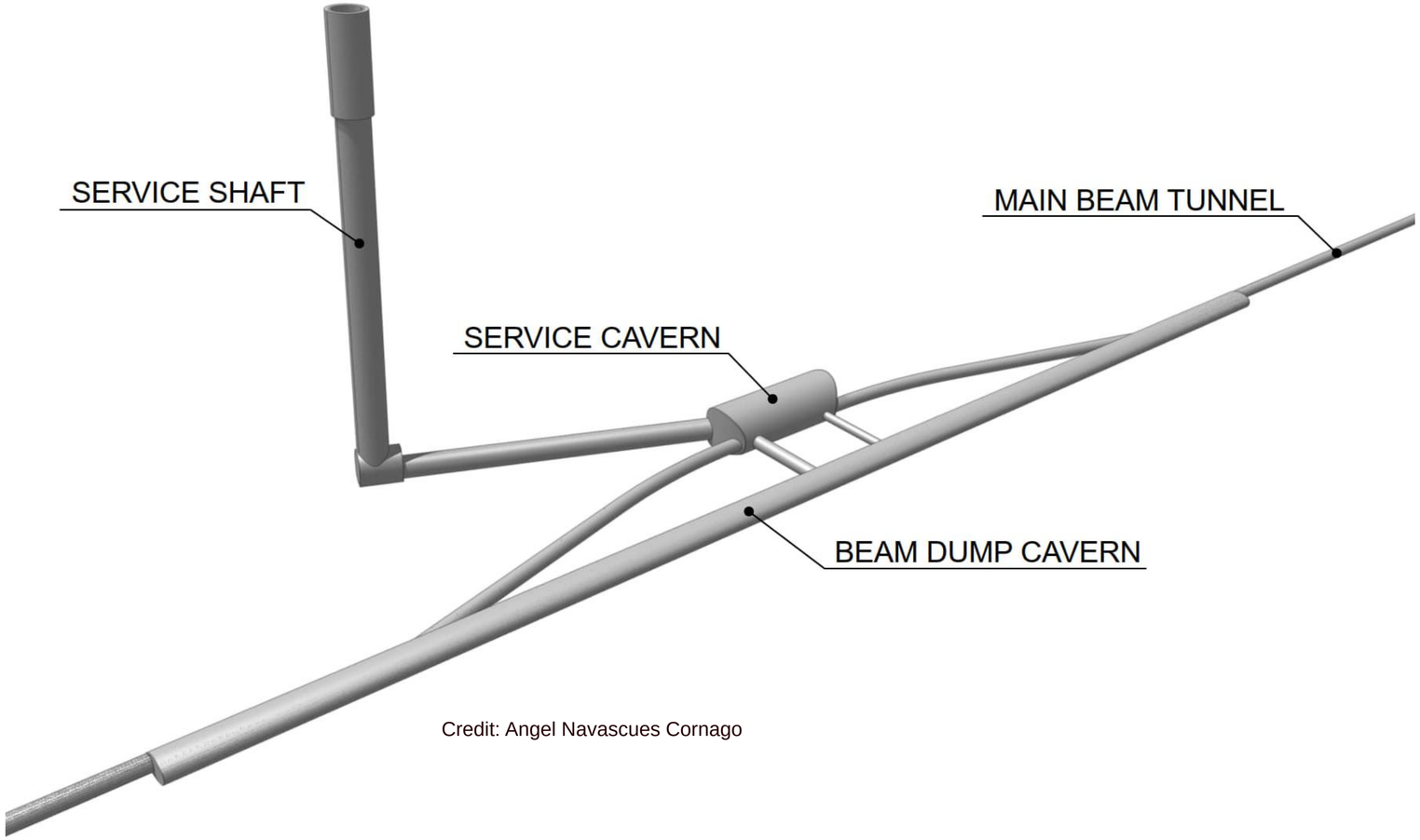


Credit: Angel Navascues Cornago

FCC-ee Beam Dump – Point B

660m length cavern
e^+ and e^- beam dumps
10mrad septum angle
5.5m separation of dump and beam
700m length extraction line





Credit: Angel Navascues Cornago

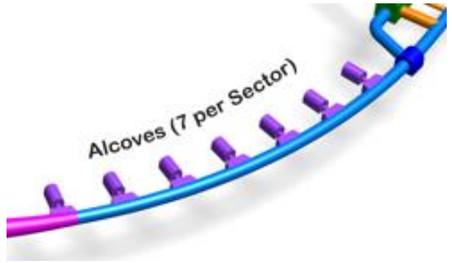
Alcoves and Passing Bays

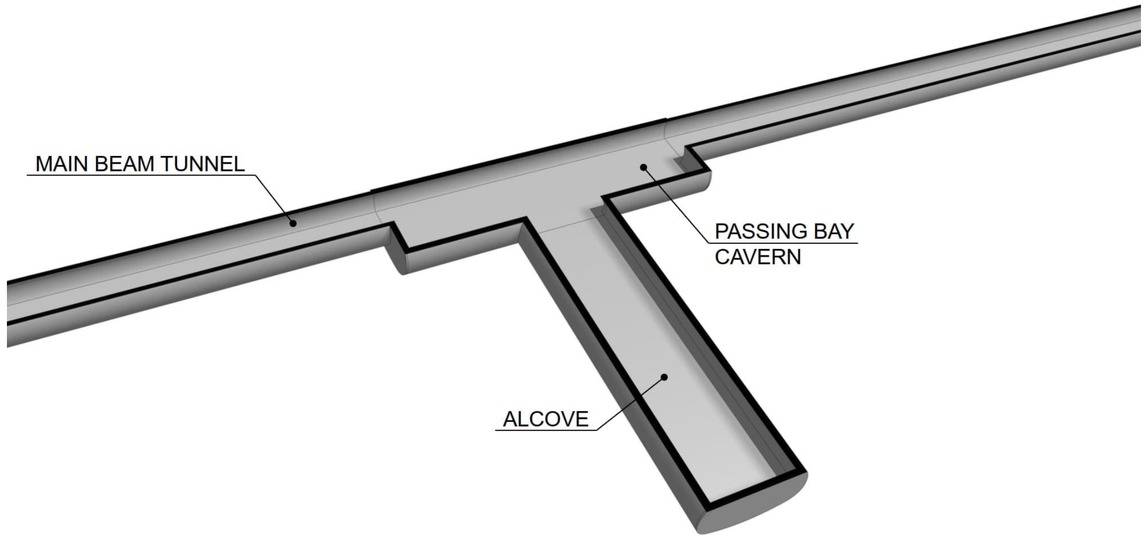
7 Alcoves per sector

Every 1.6km

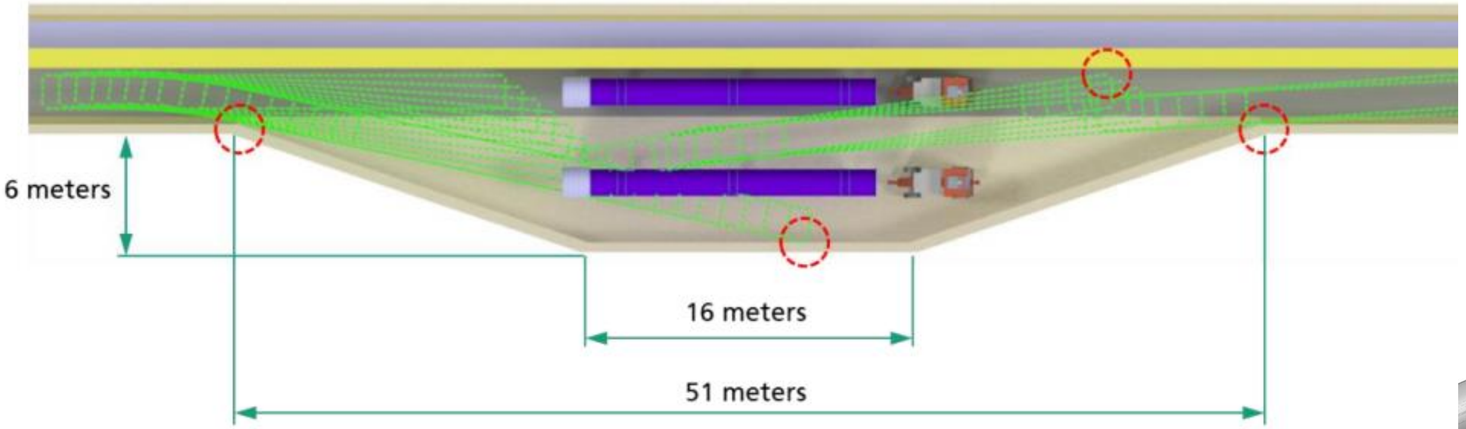
Passing bays included

Larger alcoves near FCC points for additional EL

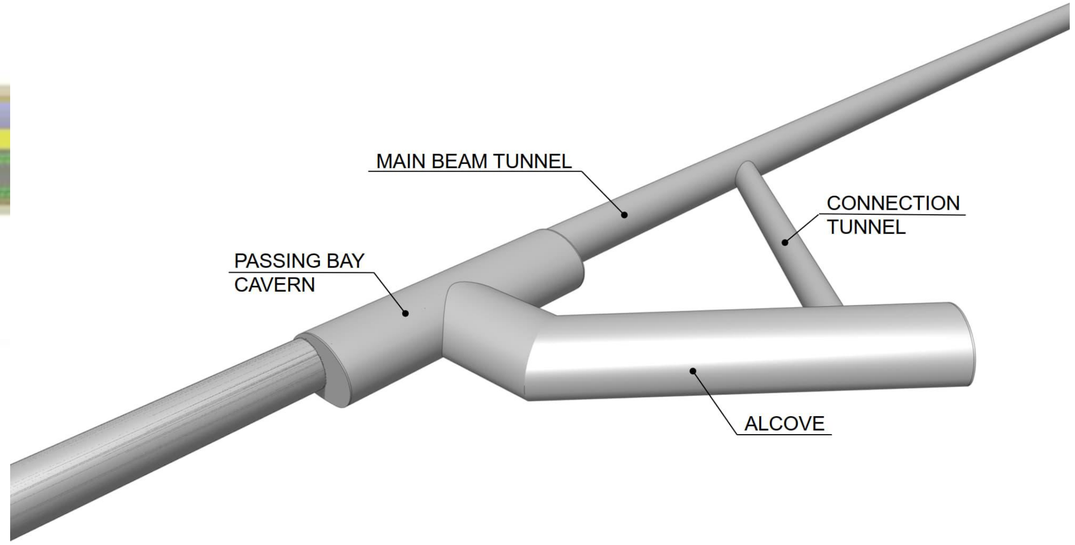




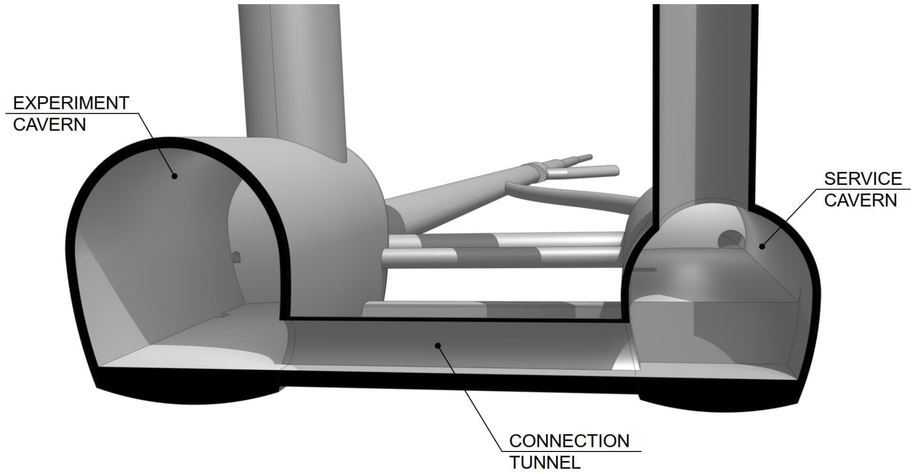
Credit: Angel Navascues Cornago

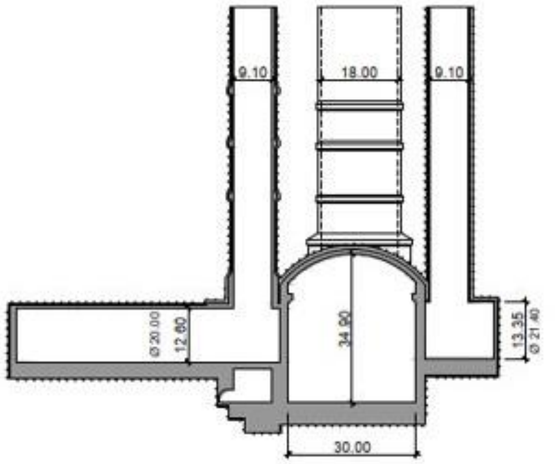


Credit: Fraunhofer Institute

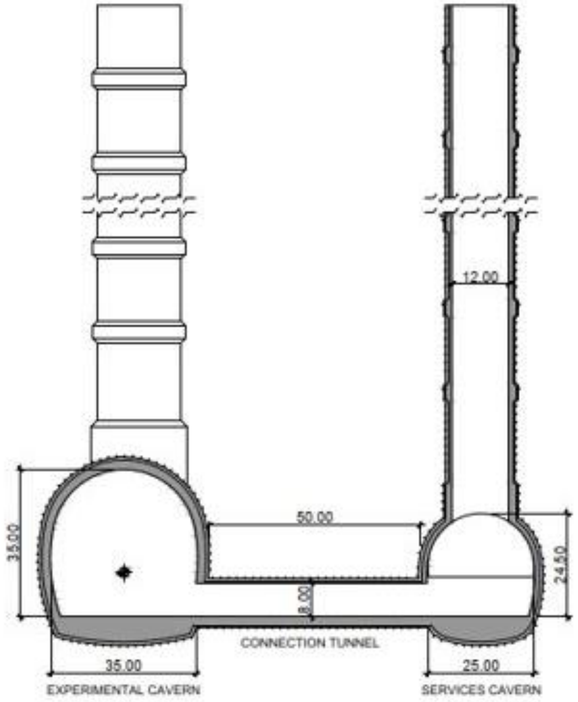


Caverns

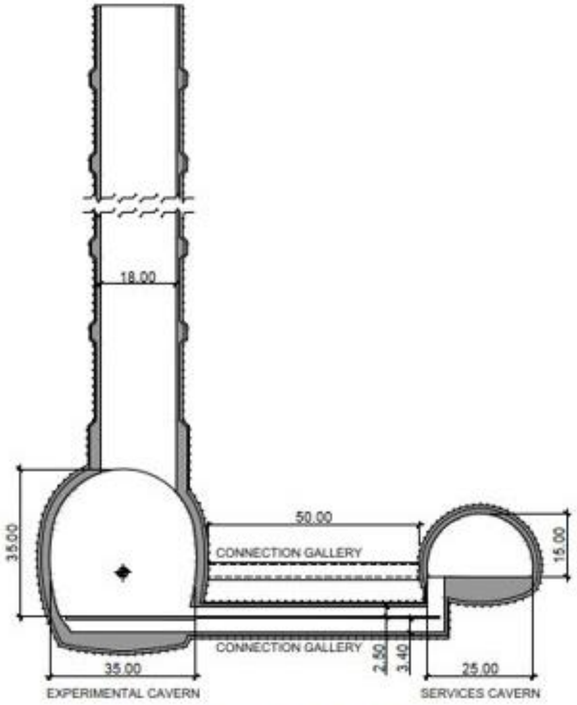




ATLAS (LHC)



SECTION A-A
1/500



SECTION B-B
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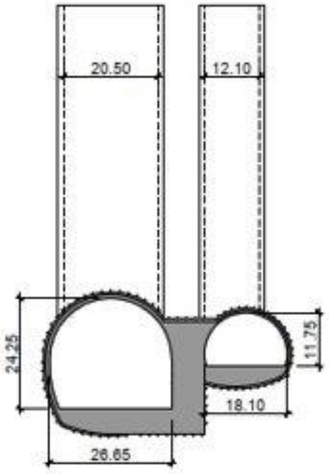
FCC



CMS (LHC)

Credit: Angel Navascues Cornago

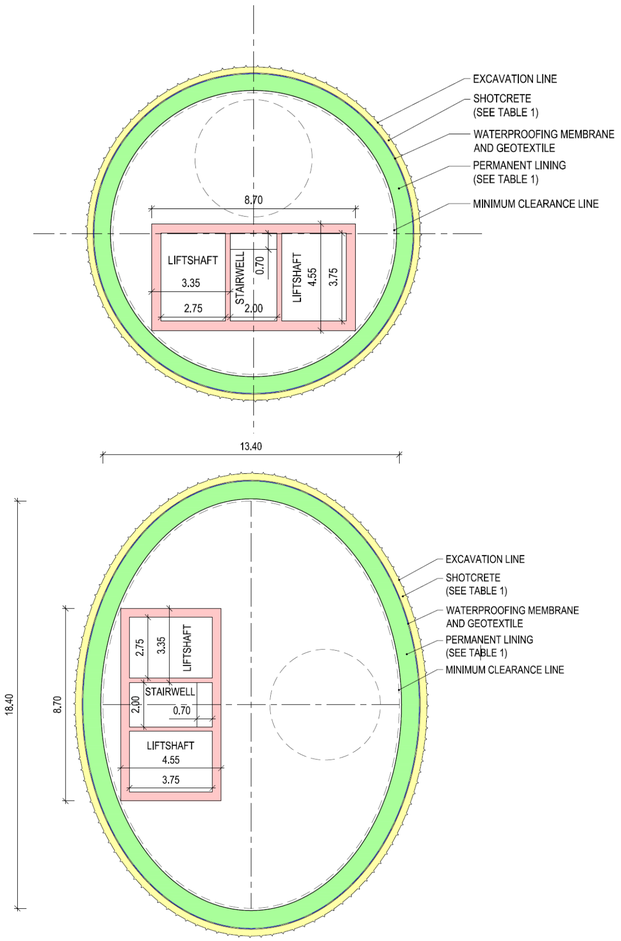
Shafts

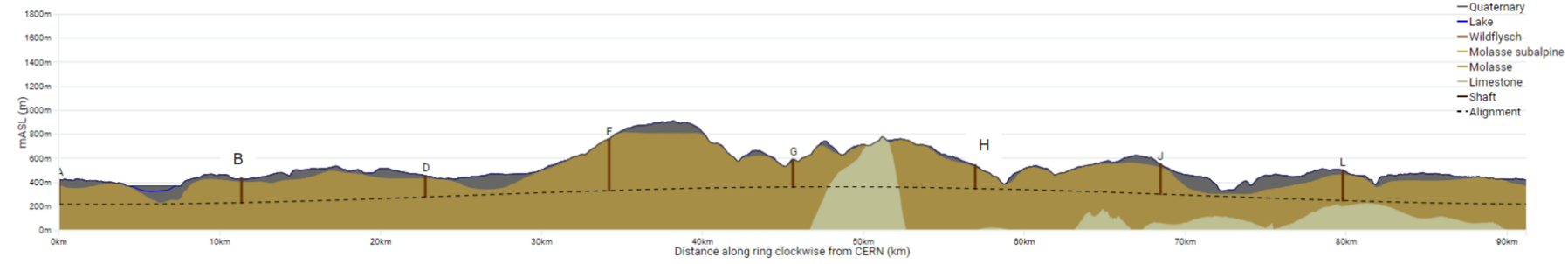
Shaft depths, 180m to 400m

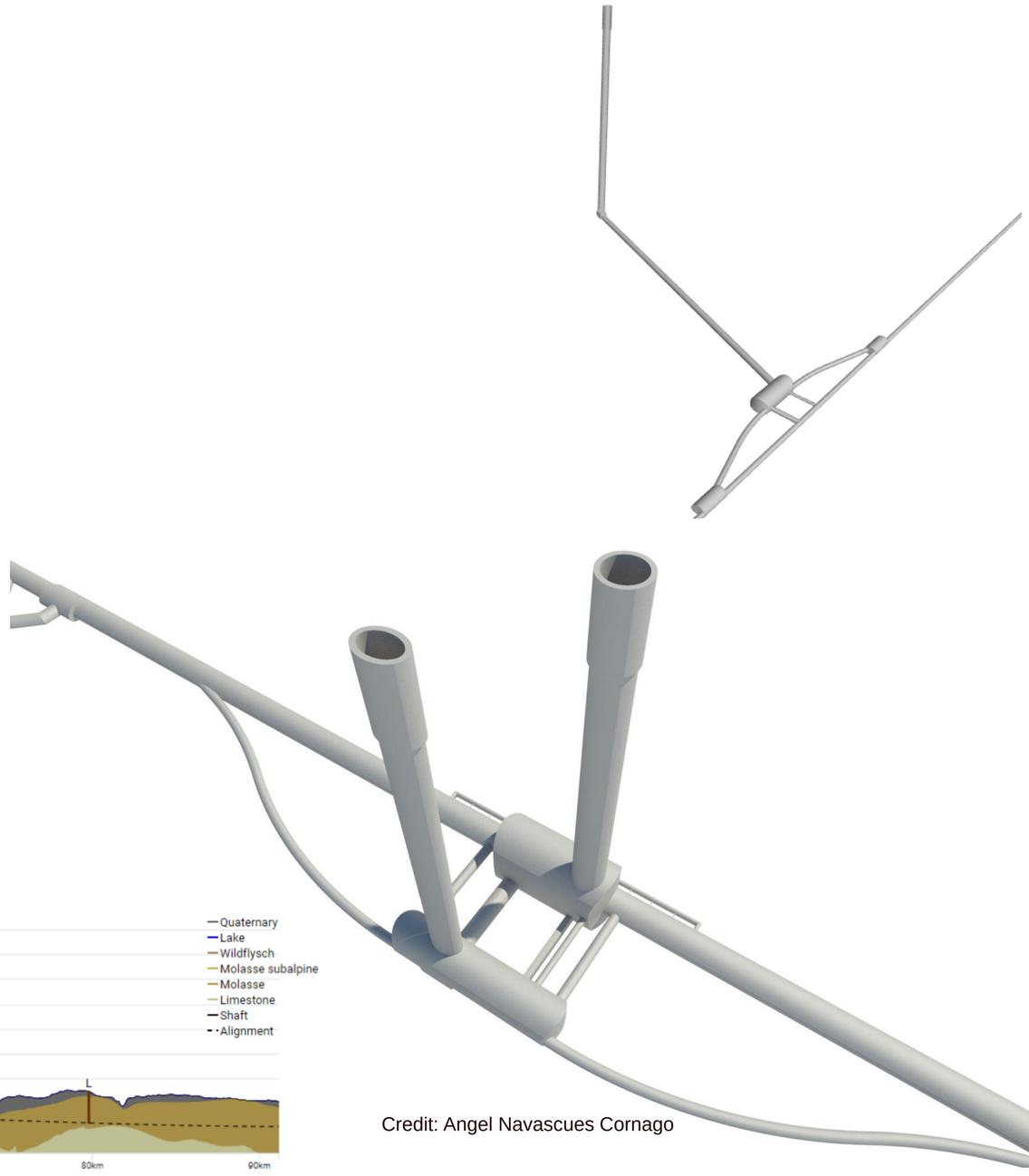
18m elliptical

18m circular

12m circular





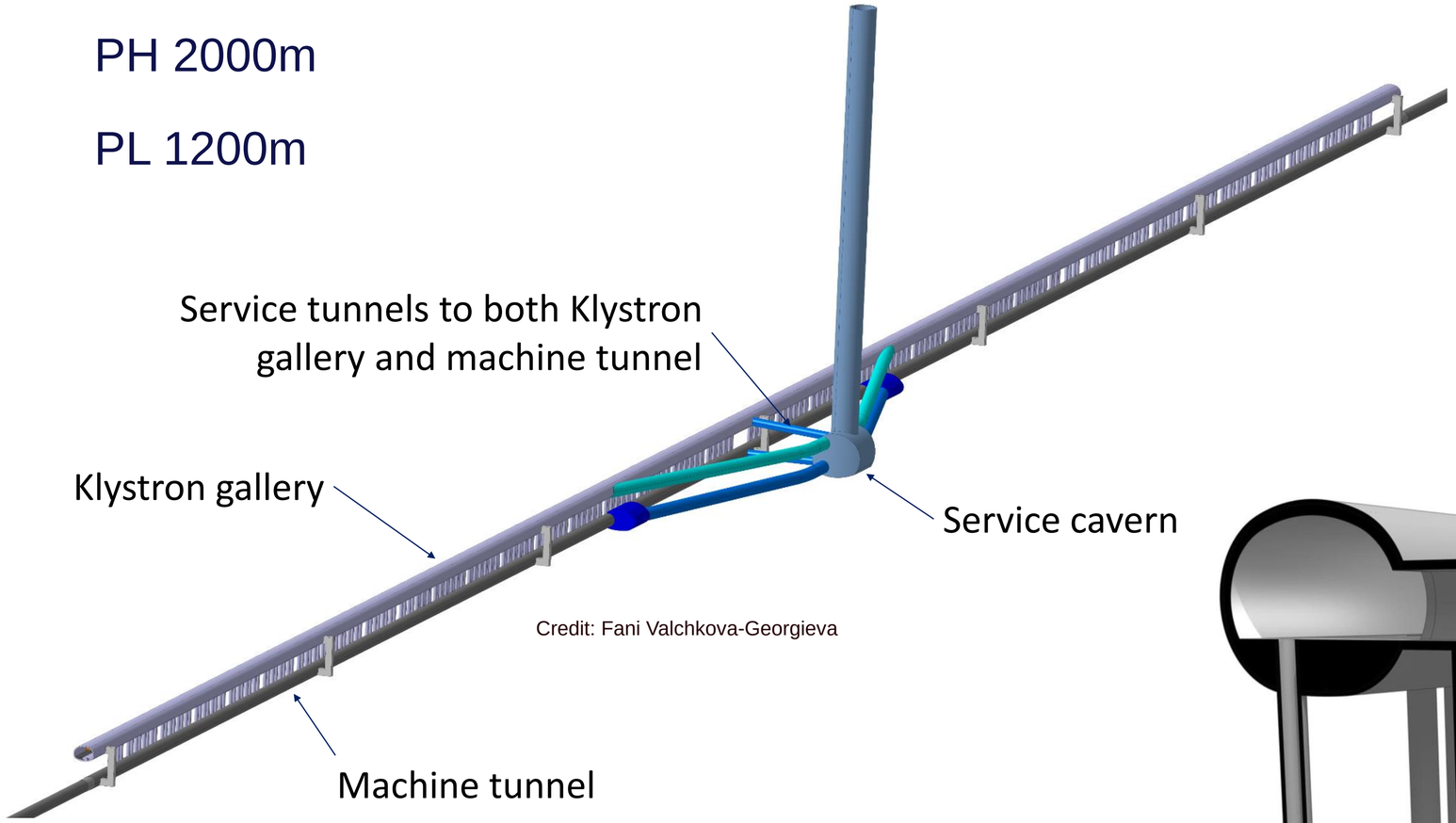


Credit: Angel Navascues Cornago

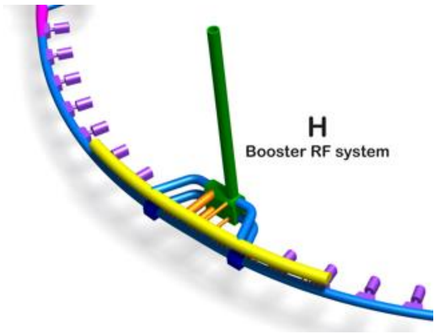
Klystron Galleries

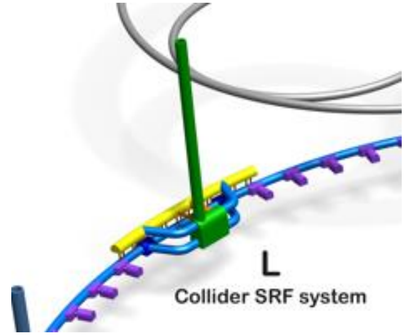
PH 2000m

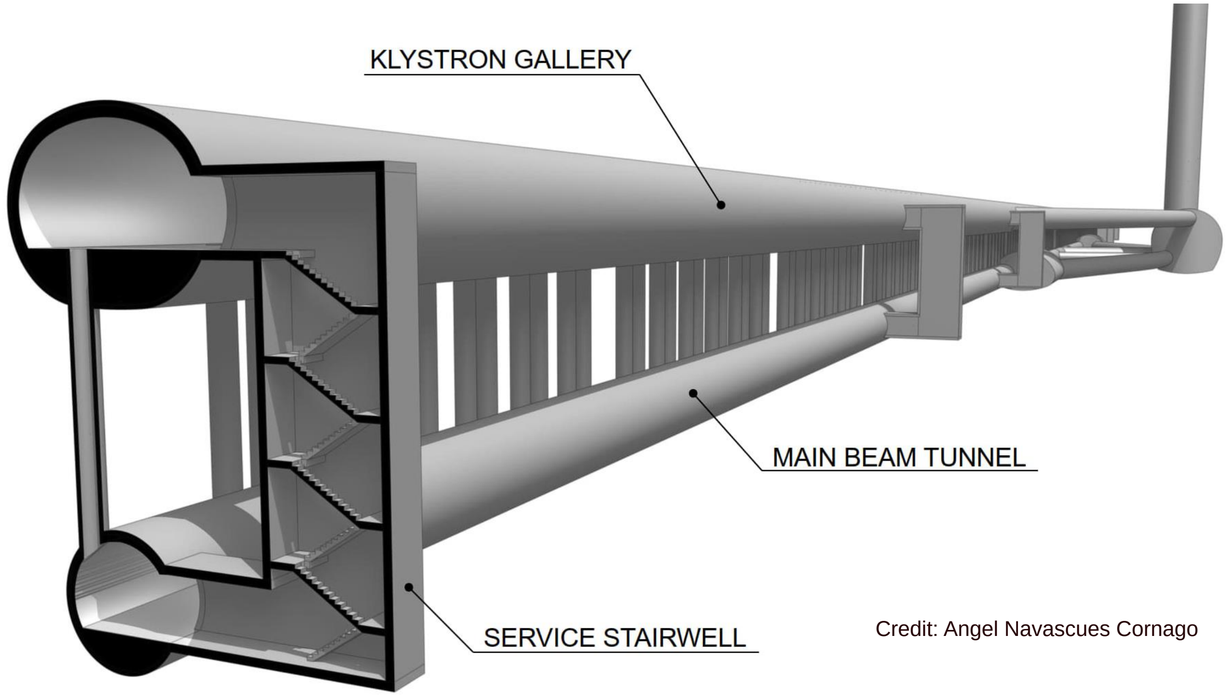
PL 1200m



Credit: Fani Valchkova-Georgieva







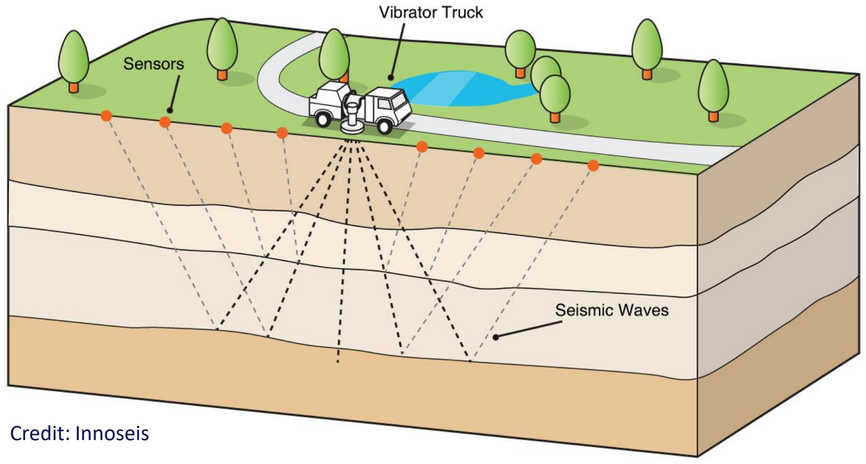
Credit: Angel Navascues Cornago

Areas of Geological Uncertainty

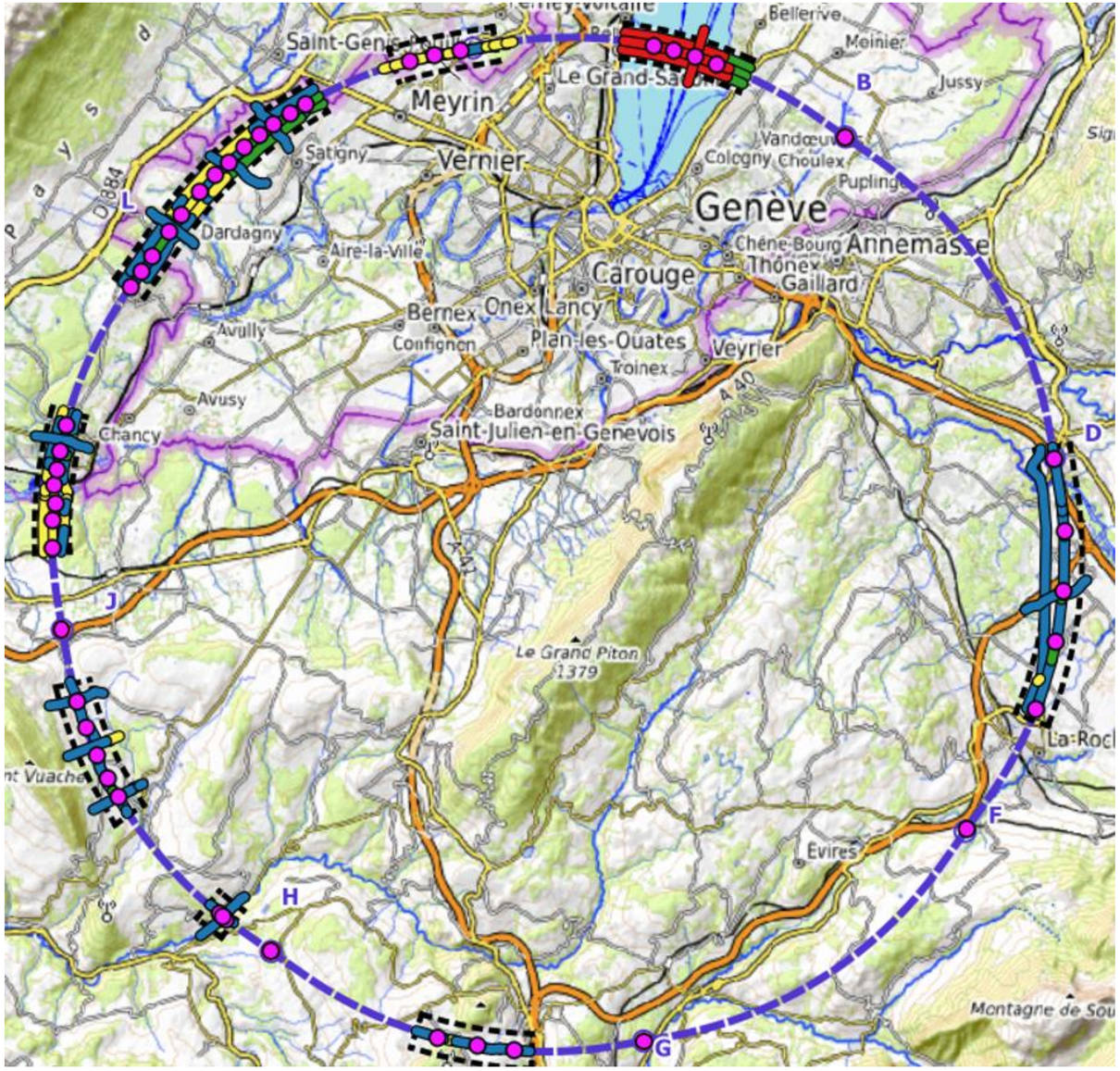

Exploration Drilling, CERN 2020


Lake Geneva Drillings

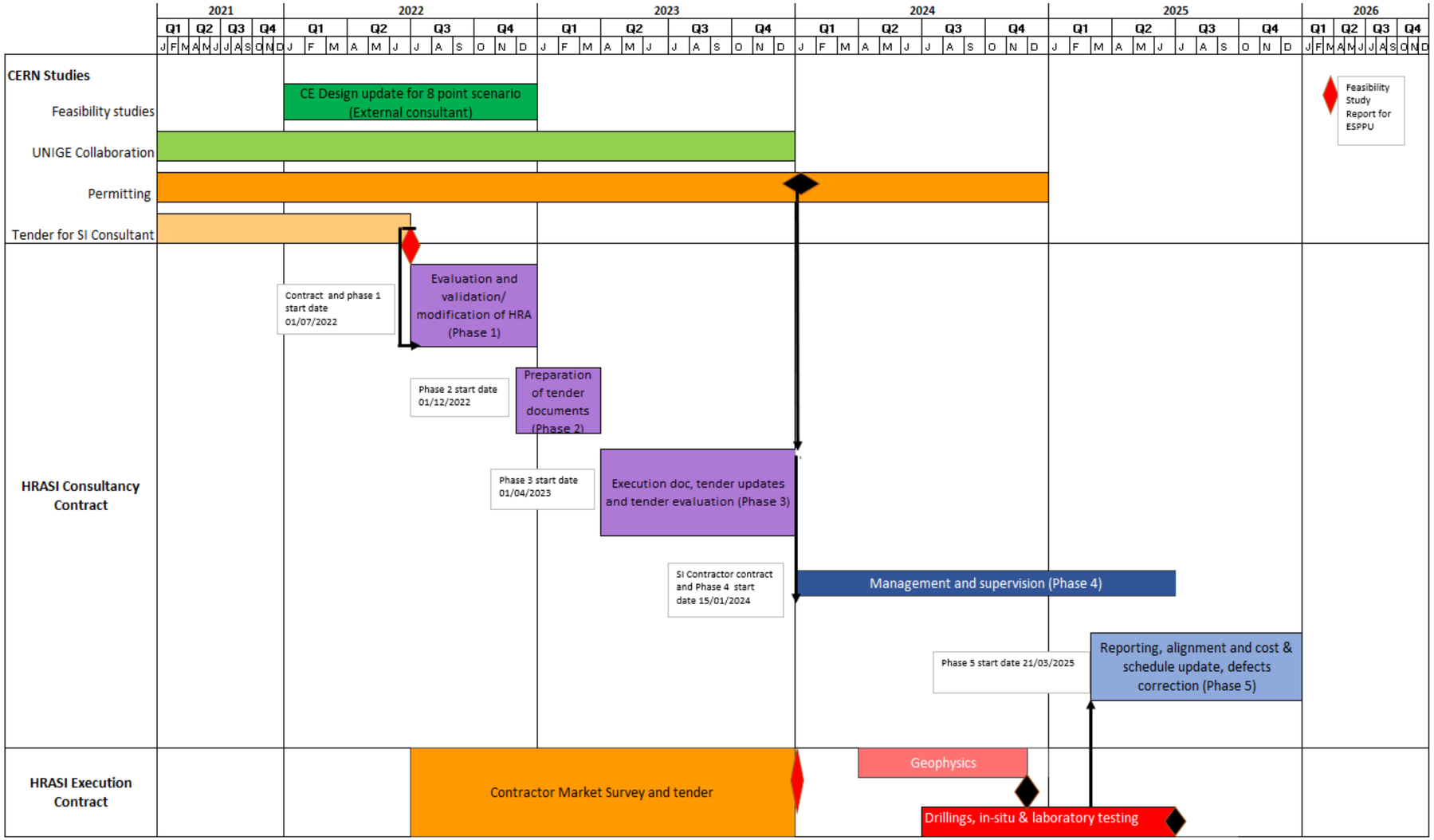
Credit: www.swissdrilling.ch



Credit: Innoseis



Ground Investigation Programme



MATEX Study

Study to estimate quantity and disposal of excavated material

Baseline TBM layout and direction of drives

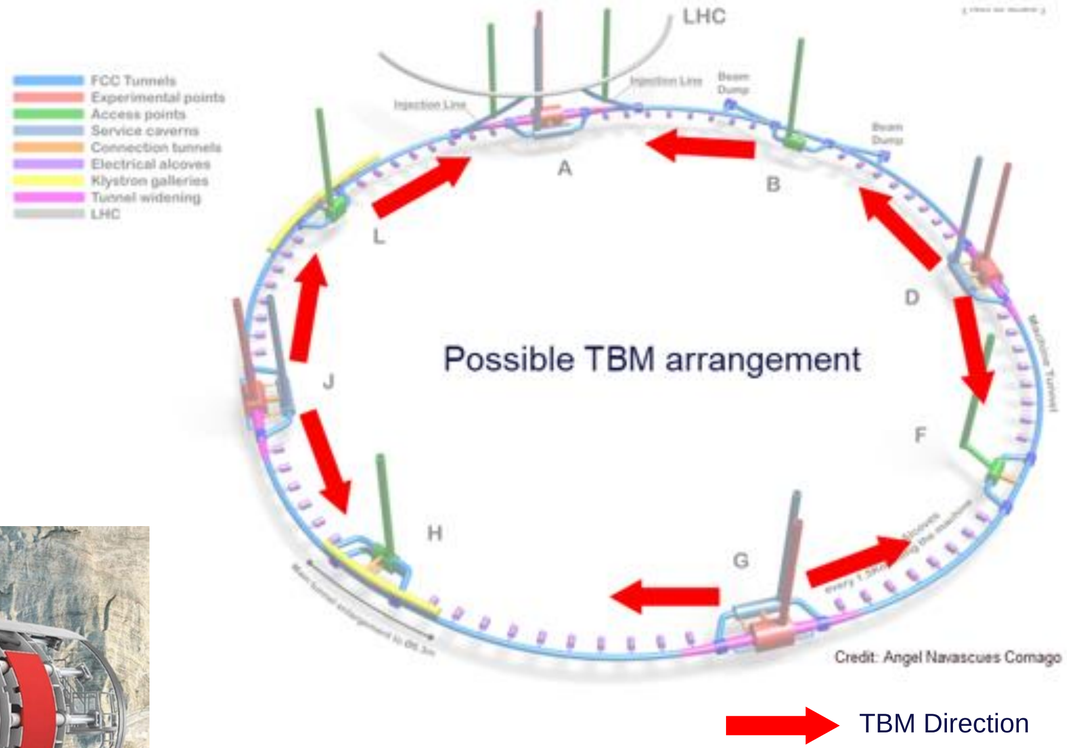
Balance of material between France and Switzerland

96% molasse

3% limestone

1% moraine

Total, 8,100,000 m^3



TBM Direction

Base. TBM	A	B	D	F	G	H	J	L	Inj. Prevessin	Inj. SPS	Total
Vol.	569,119	559,922	1,288,361	153,735	1,378,880	291,486	1,300,330	583,564	28,867	82,197	6,236,461
Bulk Vol.	739,855	727,898	1,674,869	199,856	1,792,544	378,932	1,690,429	758,633	37,527	106,856	8,107,399
% of Total	9%	9%	21%	2%	22%	5%	21%	9%	0%	1%	
Vol. France	534,959	42,143	1,204,564	153,735	1,378,880	291,486	1,300,330	201,784	28,867	39,638	5,176,386
% France	94%	8%	93%	100%	100%	100%	100%	35%	100%	48%	83%
Vol. Suisse	34,160	517,772	83,797	-	-	-	-	381,754	-	42,560	1,060,043
% Suisse	6%	92%	7%	0%	0%	0%	0%	65%	0%	52%	17%

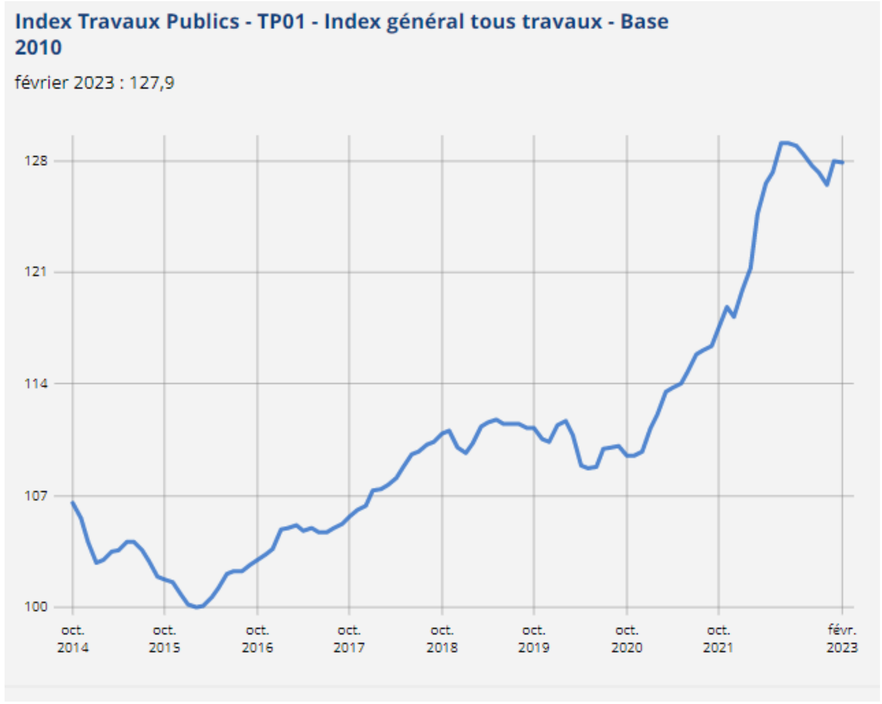
Construction Schedule Study

Construction schedule for each task

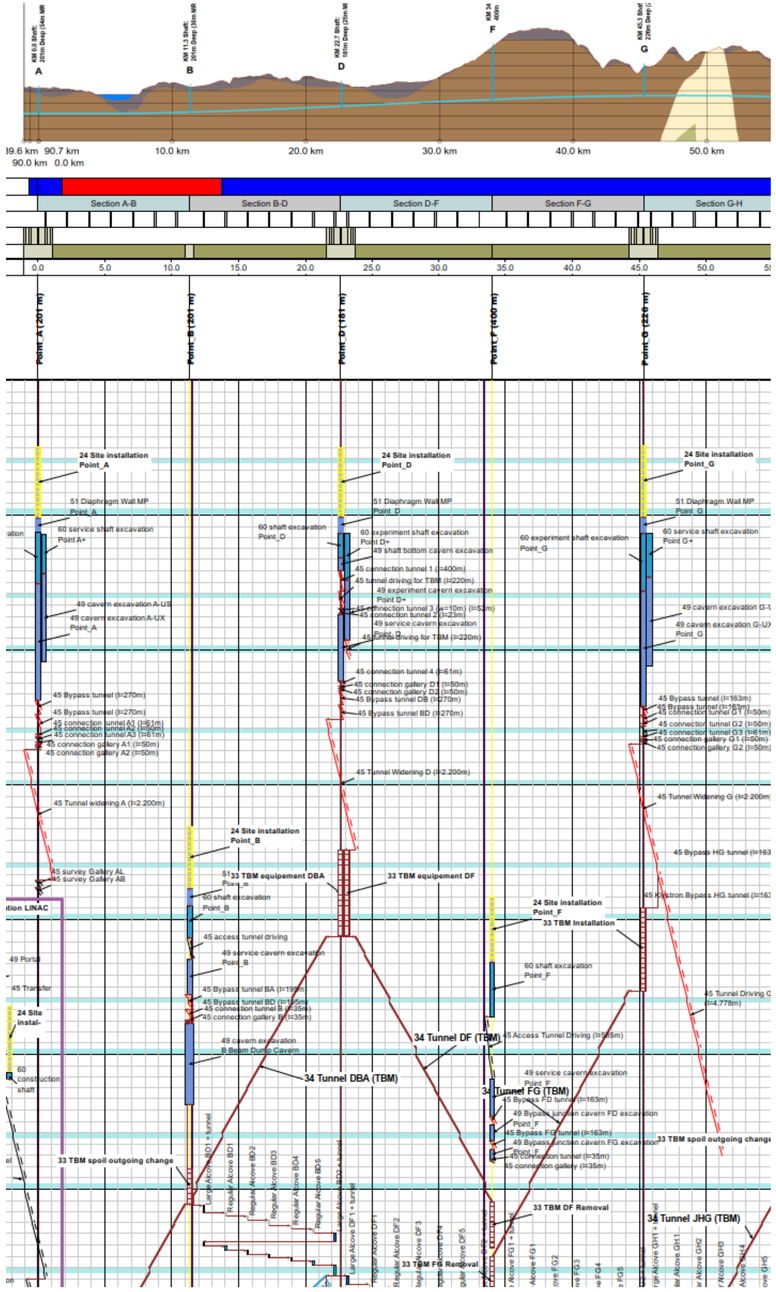
TILOS linear infrastructure tool

Bottom up cost estimate

High inflation environment



Source: https://www.insee.fr/en/statistiques/serie/001711007#Tableau



Credit: ILF

FUTURE CIRCULAR COLLIDER

Thank you for your attention.