

# FCC Feasibility Study Status

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on behalf of FCC collaboration & FCCIS DS team



Swiss Accelerator  
Research and  
Technology

<http://cern.ch/fcc>



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Commission

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photo: J. Wenninger

## **Status and progress on**

- **Implementation activities**
- **Site investigations and environmental studies**
- **Civil engineering**
- **Cooling water supply concepts**
- **Excavation material management**

## **Mid-term review update**



## Meetings with municipalities concerned in France (31) and Switzerland (10)

PA – Ferney Voltaire (FR) – site experimental

## PB – Présinge/Choulex (CH) – site technique

## PD – Nangy (FR) – site experimental

## PF – Roche sur Foron/Etaux (FR) – site technique

## PG – Charvonnex/Groisy (FR) – site experimental

## PH – Cercier (FR) – site technique

**PJ – Vulbens/Dingy en Vuache (FR) site experimental**

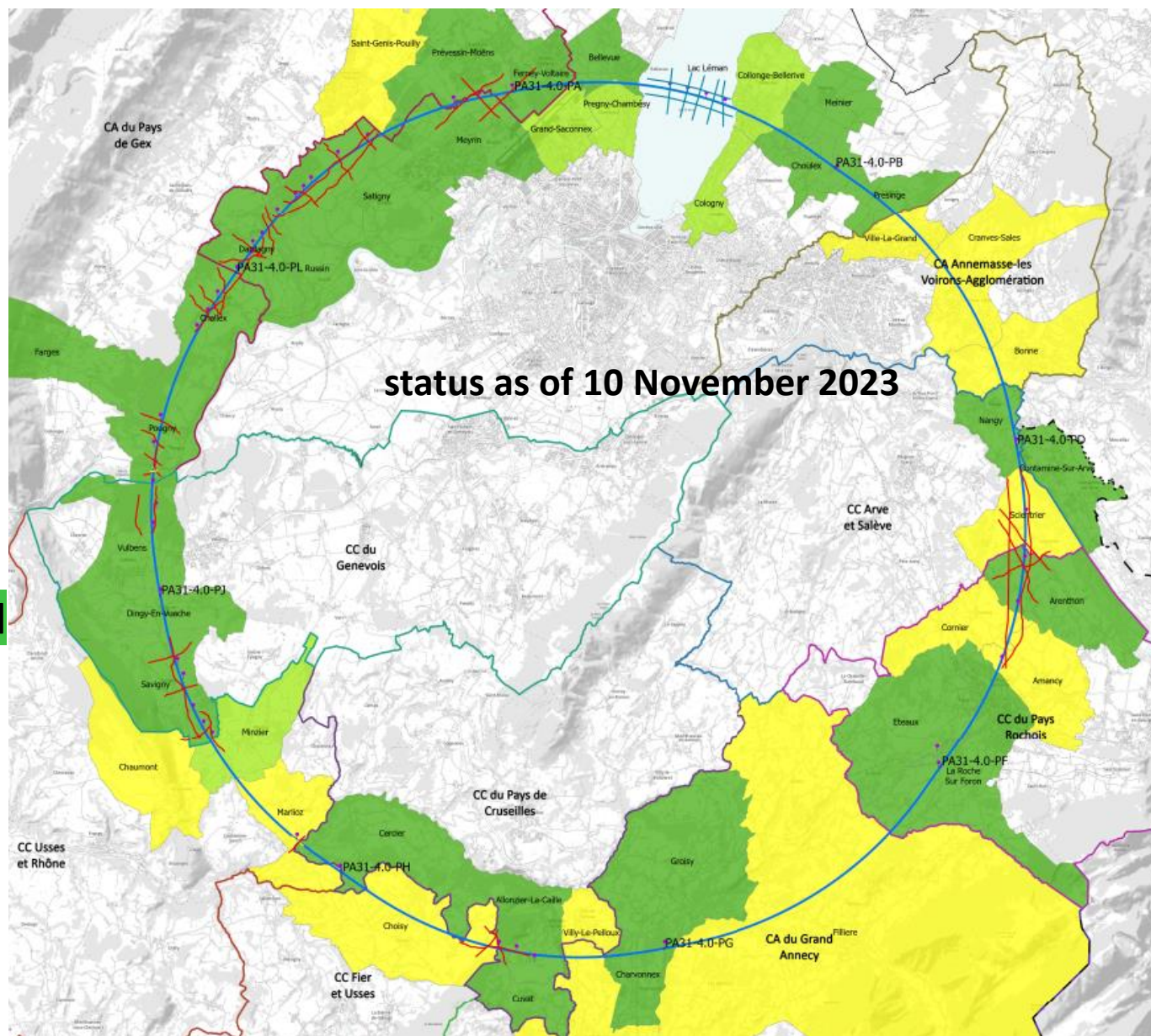
## PL – Challex (FR) – site technique

## Individual meeting

Individual meeting planned

## Collective meeting

**The support of the host states is greatly appreciated and essential for the study progress!**



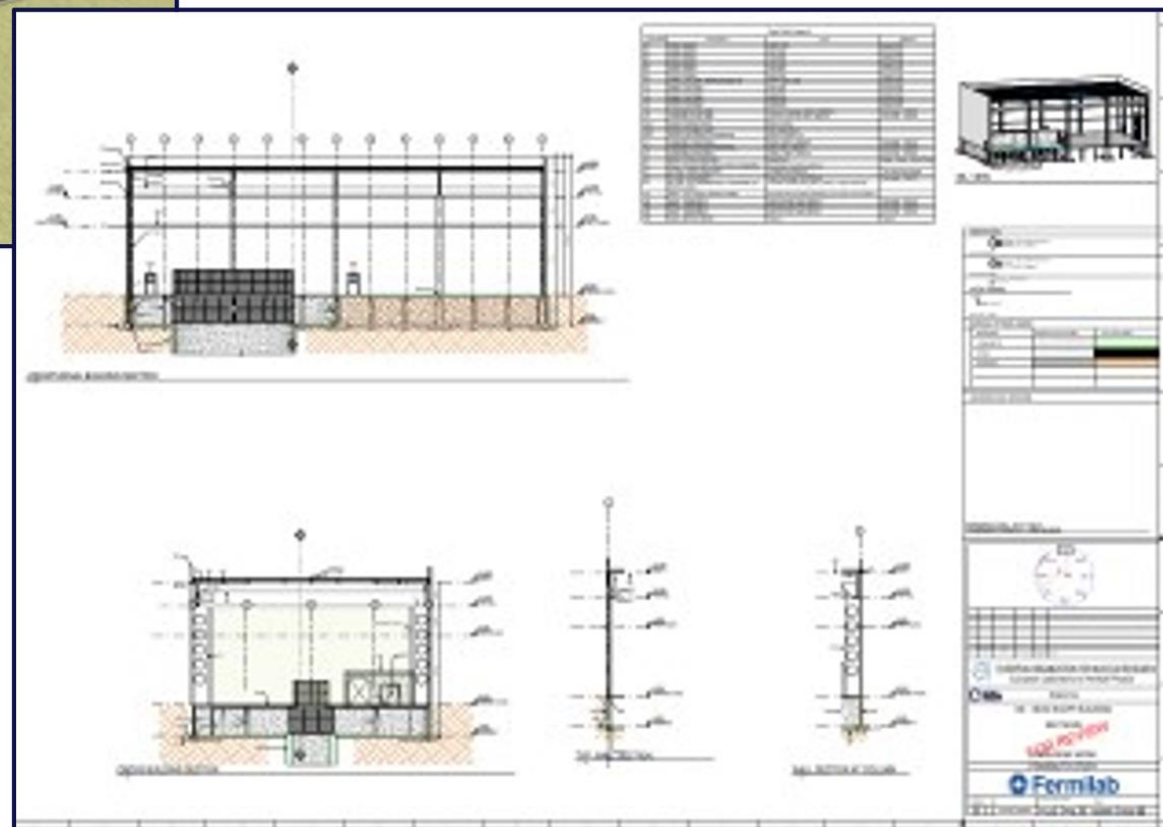
# CE surface progress



**Generic study of experiment  
site and technical site by  
FNAL**

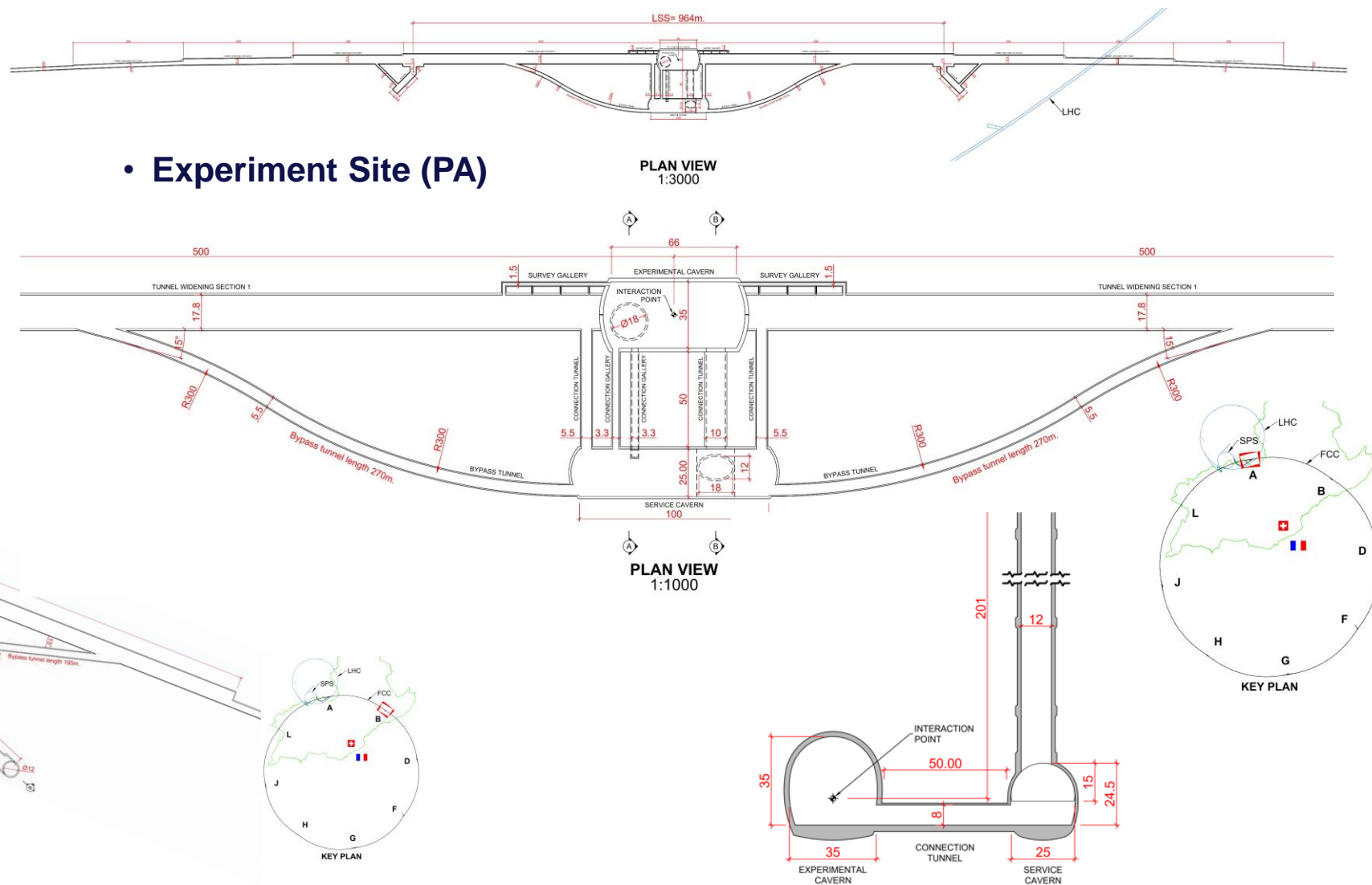
## Examples of Fermilab Deliverables

- bills of quantities extracted from FNAL designs
- basis for cost estimate by consultant with experience on industrial constructions in CH-FR area.
- next steps: individual integration studies and design optimization with municipalities concerned

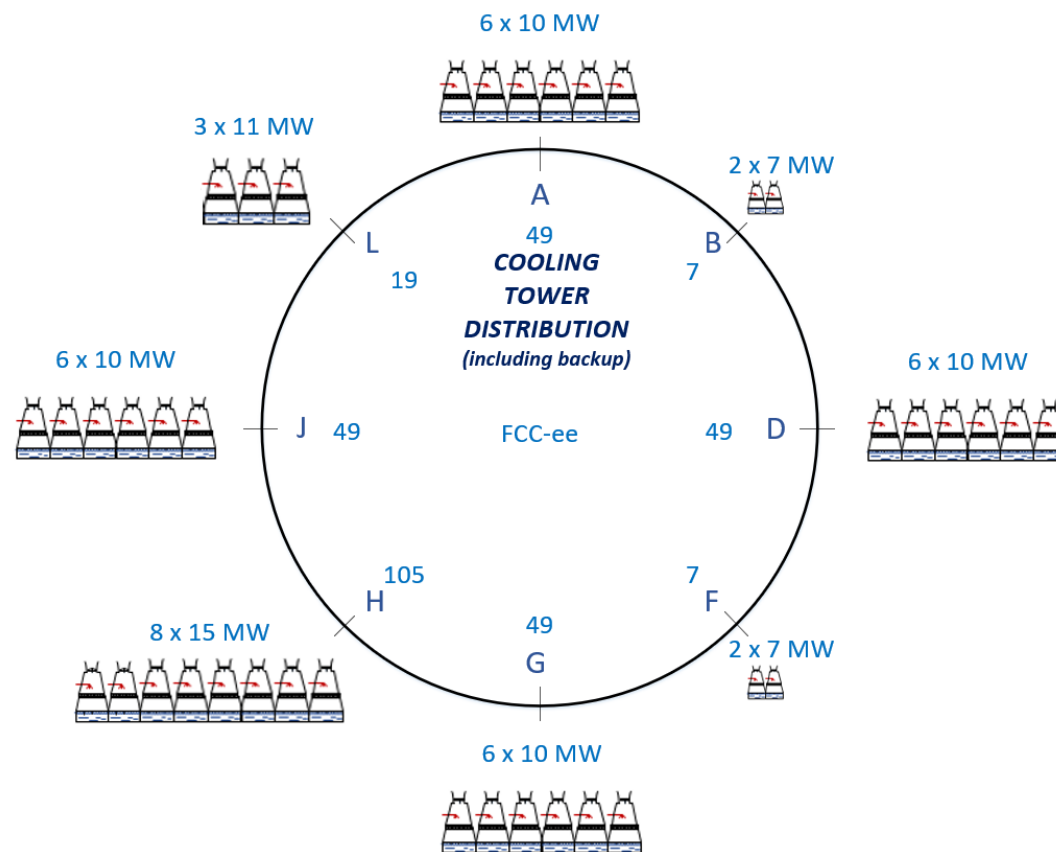
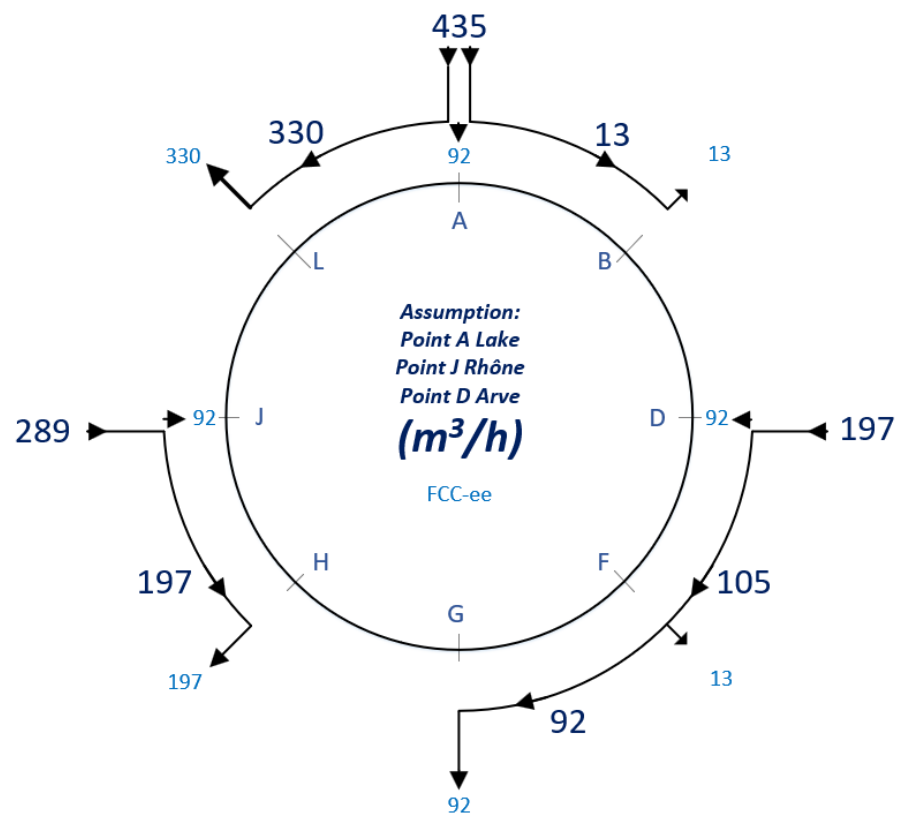




- **Experiment Site (PA)**

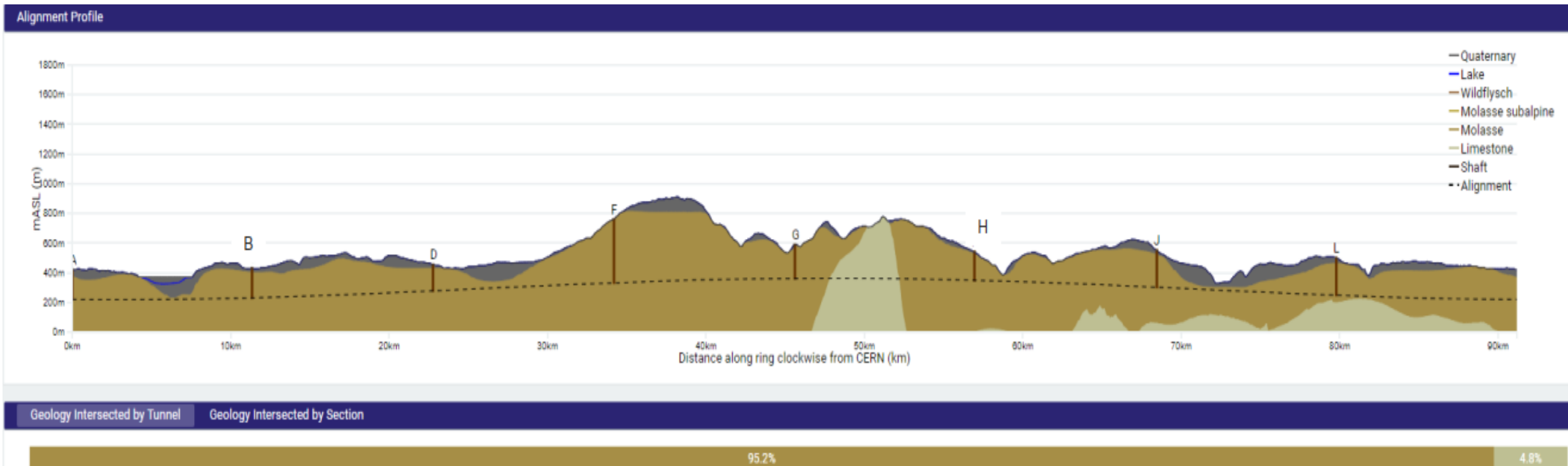


# Cooling water supply concept



- Potential sources of cooling water Geneva lake (PA), Rhone (PJ) and Arve (PD).
- Existing line with lake water provided by SIG to CERN LHC P8 (LHCb) sufficient for FCC-ee.
- Pipework in the tunnel will connect the remaining points to points PA, PD and PJ.
- Main cooling towers placed at experiment points (PA, PD, PG, PJ), and RF sites (PL, PH).

# FCC tunnel implementation

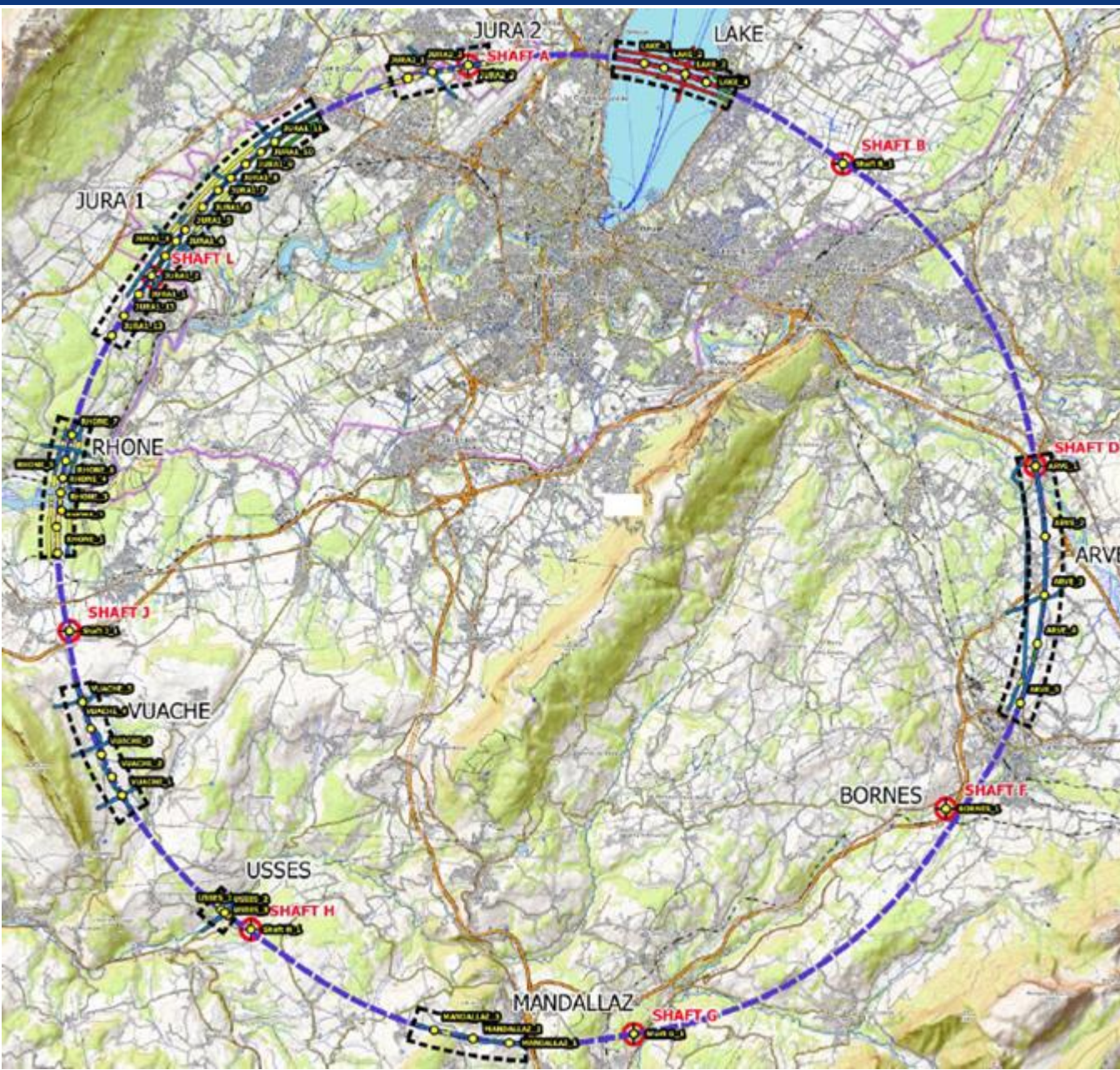


## Tunnel implementation summary

- 91 km circumference
- 95% in molasse geology for minimising tunnel construction risks
- 8 surface sites with ~5 ha area each.



# Status of subsurface investigations



- **Site investigations in areas with uncertain geological conditions:**
  - Optimisation of localisation of drilling locations ongoing with site visits since end 2022.
  - **Work with FR and CH ongoing to obtain autorisations for start of seismic investigations and drillings in Q2 2024.**
- **Contracts Status:**
  - Contract for engineering services and role of Engineer during works, active since July 2022
  - Tendering for execution contracts is ongoing towards contract placement in December 2023 and mobilization from January 2024.



Sondage A89 (2007) incliné de 45° de 125 ml (surface plateforme estimée: 12 x 12 m soit environ 150 m²)



Drilling works on the lake



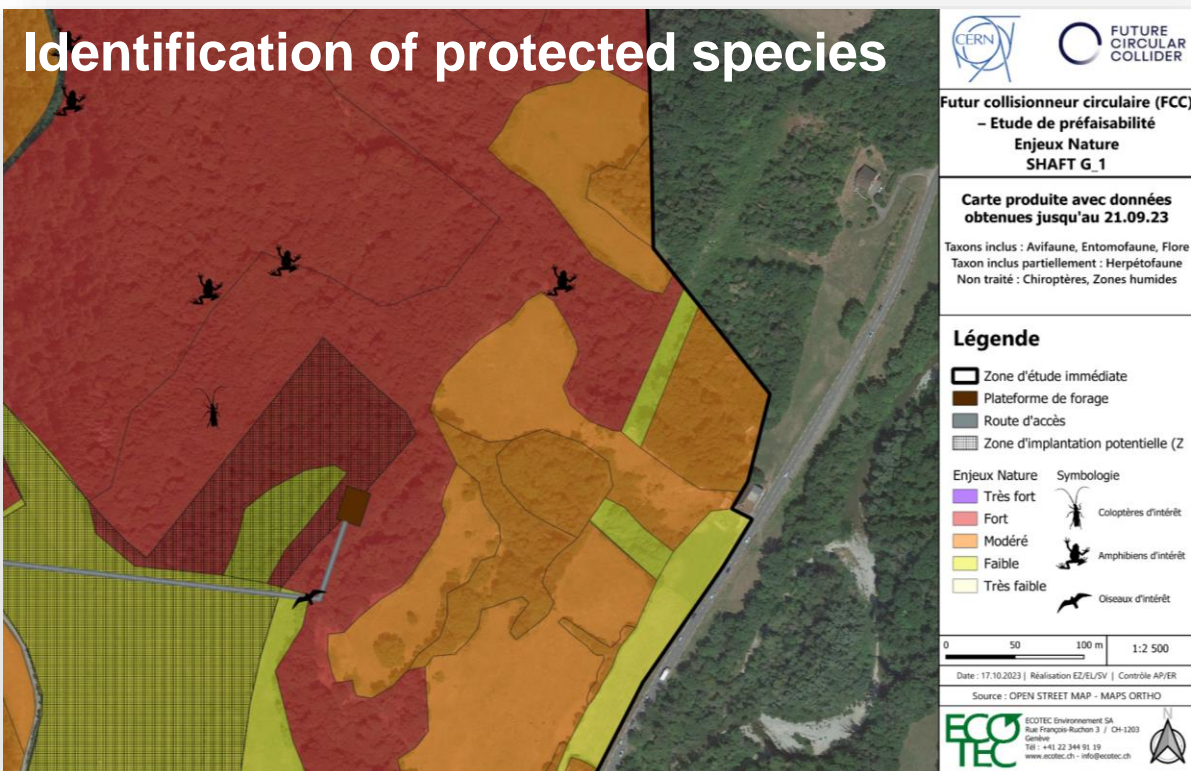
## Studies of environmental aspects ongoing

- **Studies of relevant environmental aspects over 18 months (> 4 seasons to see full cycle) with a consortium of specialized companies**
- **Necessary inventory for the “Avoid-reduce-compensate” approach and costing (compensation measures)**
- **Input for surface site designs, installation and operation aspects**
- **Pre-requisite for the required initial state report, before an environmental impact assessment**
- **Exhaustive list of topics covered:**
  - Topography, geology, hydrogeology, surface water, natural risks, urbanistic planning, fauna & flora survey, habitats and wetland analysis, soil quality and pollution, noise, light, radiation, technological risks, demography, economic activities, landscape and visibility, patrimony
- **Central management of all data in an “Environmental Information System” to be able to document the evolutions of the territory, the civil construction designs and the technical infrastructure development integrated with classical “Geographical Information System”**

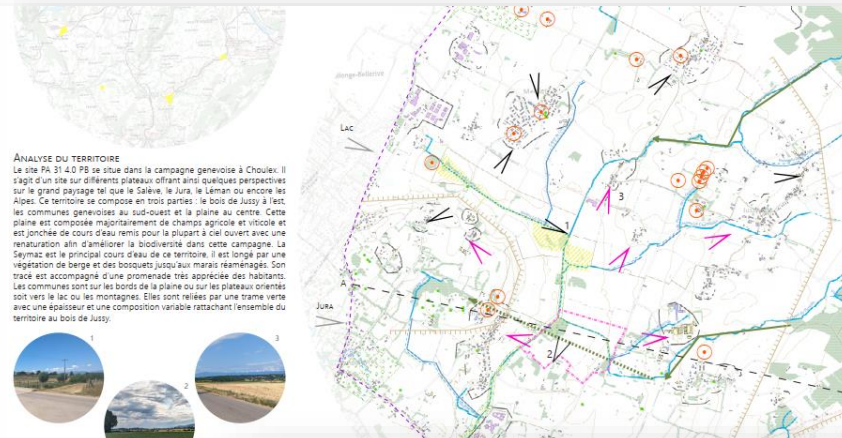




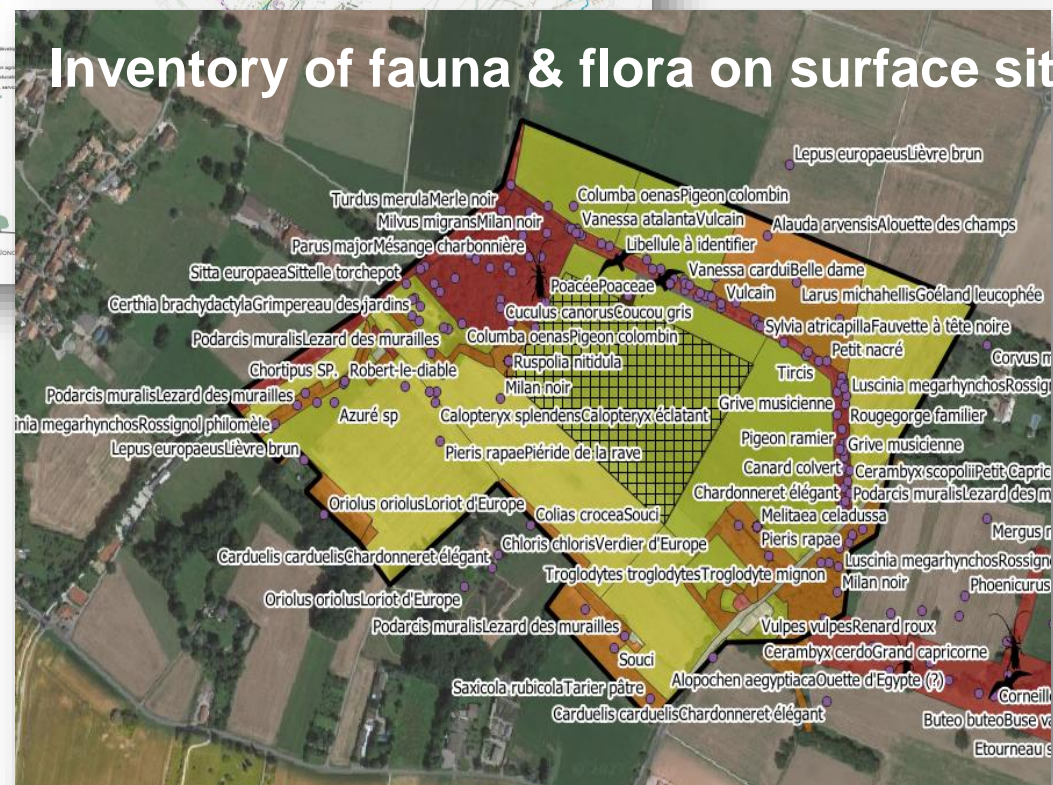
## Identification of protected species



Description of surrounding, views to be preserved, architectural aspects to be Considered.



## Inventory of fauna & flora on surface site

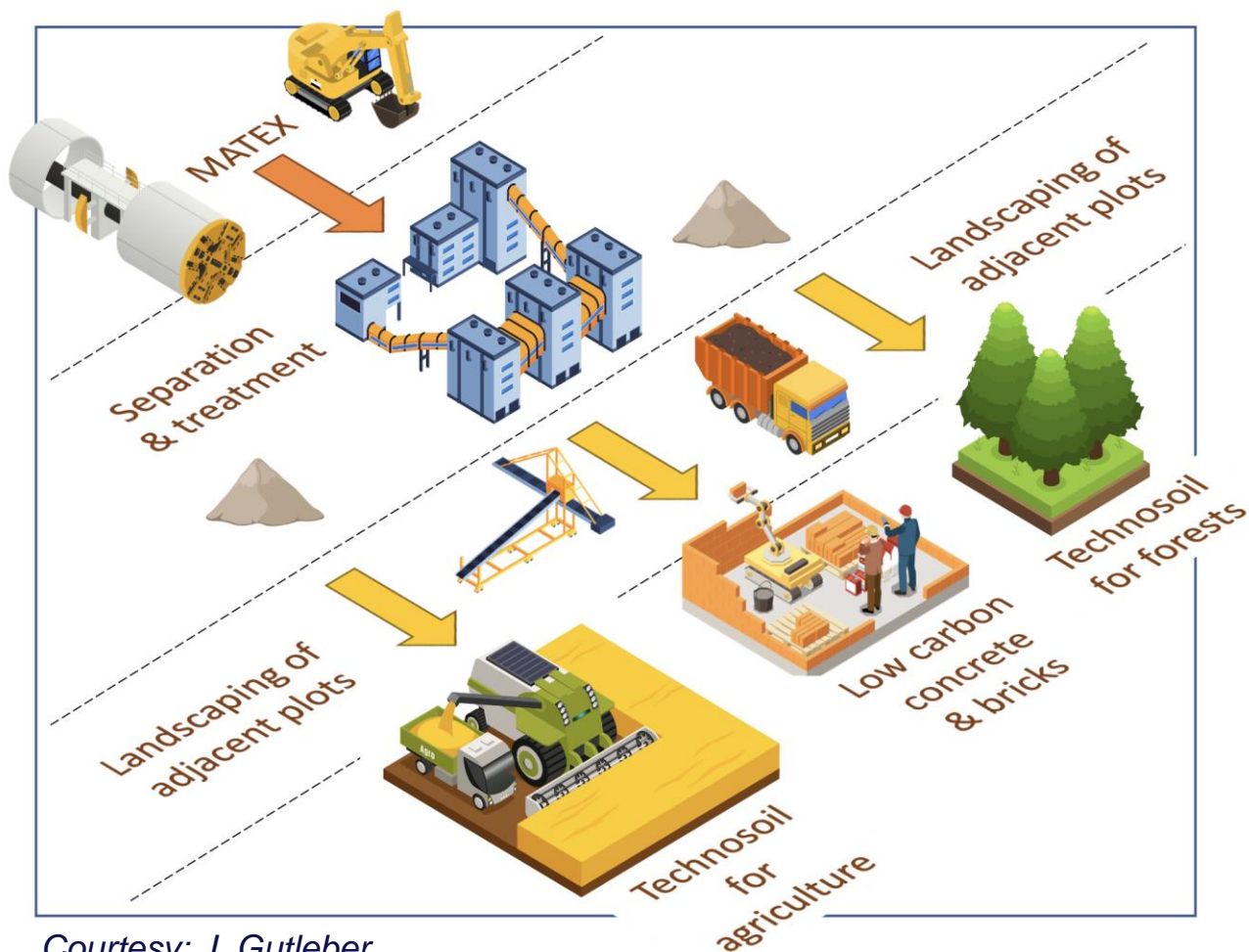


Determination of quality of the top soil and potential pollution, determination of the economic land value



# Excavation material management

An innovative local approach for excavated materials:



Courtesy: J. Gutleber

**Excavated material from FCC subsurface infrastructures: 6.5 Mm<sup>3</sup> in situ, 8.4 Mm<sup>3</sup> excavated (bulk factor 1.3)**

2021-2022: International competition “**Mining the Future**”, launched with the support of the EU Horizon 2020 grant agreement 951754, to find **innovative and realistic ideas for the reuse of Molasse (95% of excavated materials)**

2023: **Definition of the “OpenSky Laboratory” project:**

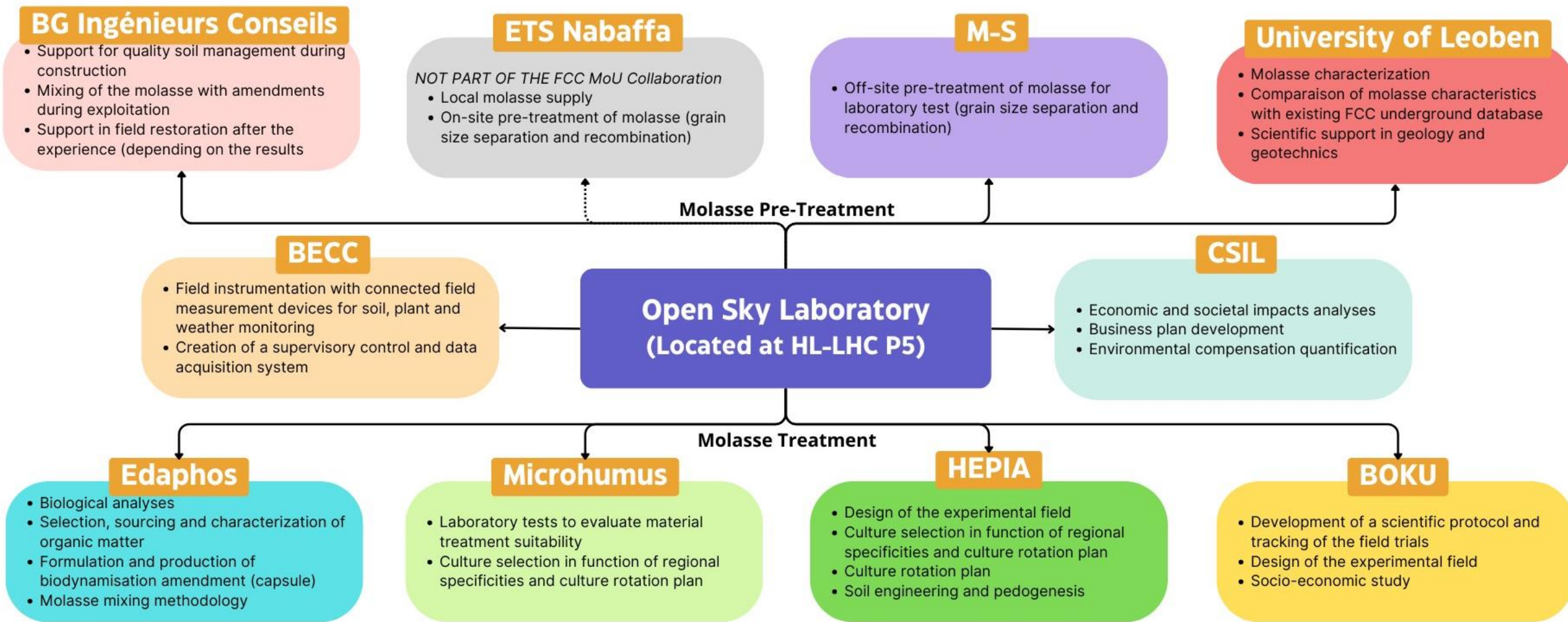
- **Objective:** Develop and test an innovative process to transform sterile “molasse” into fertile soil for agricultural use and afforestation.
- **Duration: 4 years (2024-2027)**

- 
- The site plan illustrates the proposed container terminal layout. Key features include:
- FENCE PROPOSAL**: A red dashed line indicating the perimeter fence.
  - UNLOADING AREA**: A designated area for unloading containers, marked with dimensions like 16.0m and 7.5m.
  - TRUCK COMPATIBLE ROAD**: A road designed for truck access, shown as a green path.
  - FORESEEN PITS FOR CULTIVATION TESTS**: Several circular pits marked with orange dots for agricultural testing.
  - FORESEEN PITS FOR TREES TESTS**: Circular pits marked with green dots for tree cultivation testing.
  - EXCAVATION MATERIAL STORAGE - H=2m**: A large rectangular area for storing excavation material, with dimensions 35.0m by 50.0m and a volume of V≈3000m³.
  - CONTAINER**: Individual container units are represented by small blue rectangles.
  - NETWORKS TRENCH L=100m**: A trench for utility networks, indicated by a red dashed line.
  - Existing fence (SF58)**: The current boundary of the site.
  - Future fence (SF59)**: The proposed new boundary.
  - SF58 (3586)**: A specific container or storage unit identifier.
  - SF59 (950)**: Another container or storage unit identifier.
  - FACILITATION BUILDING**: A building with dimensions 40x22m (880m²).
  - NORTH ARROW**: Located in the top left corner, pointing towards the top of the page.
  - Dimensions**: Various measurements are provided throughout the plan, such as 10.0m, 3.0m, 5.0m, 10.0m, 13.0m, 20.0m, 10.0m, 20.0m, 35.0m, 50.0m, 7.5m, 38.0m, 10.0m, 3.0m, 16.0m, 14.1, 69, and 67.



# OpenSky Laboratory : WHO?

A collaborative effort of industry and academic/educational institutes





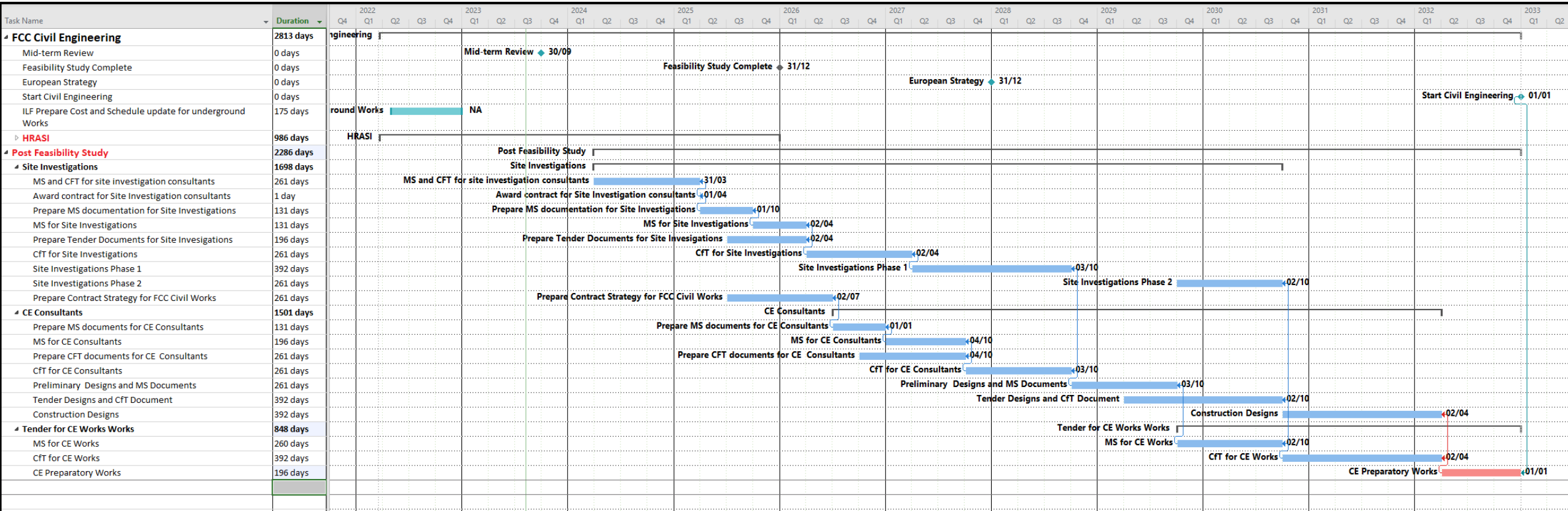
# Preparatory phase planning - authorisations and CE

To start the excavation of the first shafts in 2033, a significant amount of preparatory work is required. An initial consideration of these preparatory works including scheduling and resource aspects has been made:

2025-2026	<b>Permits and authorization for complementary site investigations</b>
	Tendering for environmental impact and authorisation processes contract, tendering for subsurface investigations
2027-28	<b>Complementary subsurface investigations</b>
	Tendering for CE consultants, environmental impact studies, public concertation
2028	<b>Project approval</b>
	Award of CE consultant contracts
2029-30	<b>Tender design</b>
	Preparing calls for tenders for CE construction,
	Project authorisations in France and Switzerland obtained
2031 mid 2032	<b>Construction design, Tendering for construction</b>
mid 2032	<b>Award of CE construction contracts</b>
	Preparation of site (road access, electricity, water...)
2033	<b>Ground breaking</b>



# Preparatory phase planning civil engineering



## Mid-term review setup and deliverables are defined in CERN/SPC/1183/Rev.2:

- *the scientific and technical results be reviewed by the FCC FS Scientific Advisory Committee, augmented by additional experts as needed;*
- *the cost and financial feasibility, which will focus on the first-stage project (tunnel, technical infrastructure, FCC-ee machine and injectors), be reviewed by a committee including external experts, as proposed in CERN/3588;*

### FCC Scientific Advisory Committee

**Riccardo Bartolini** (DESY), **Alain Chabert** (Société Française du Tunnel Routier Fréjus), **Heinz Ehrbar** (HEP), **Brigitte Fargevieille** (Électricité de France), **Belen Gavela Legazpi** (UAM), **Gudrun Hiller** (Dortmund), **Srinivas Krishnagopal** (BARC), **Peter Krizan** (Ljubljana), **Philippe Lebrun** (CERN, retired), **Peter McIntosh** (STFC), **Michiko Minty** (BNL), **Andrew Parker** (Chair, Cambridge), **Kyo Shibata** (KEK), **Roberto Tenchini** (Pisa)

### FCC Cost Review Panel

**Carlos Alejandre** (Fusion for Energy), **Austin Ball** (CERN, retired), **Umberto Dosselli** (INFN), **Heinz Ehrbar** (HEP), **Vincent Gorgues** (CEA), **Norbert Holtkamp** (Chair, Stanford), **Christa Laurila** (National Audit Office, Finland), **Ursula Weyrich** (German Cancer Research Centre), **Jim Yeck** (BNL), **Thomas Zurbuchen** (ETH Zürich)

CERN/SPC/1183/Rev.2 CERN/3654/Rev.2 Original: English 29 September 2022		
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE <b>CERN</b> EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH		
<i>Action to be taken</i>	<i>Voting Procedure</i>	
For recommendation	SCIENTIFIC POLICY COMMITTEE 330 <sup>th</sup> Meeting 25-26 September 2022	-
For decision	RESTRICTED COUNCIL 200 <sup>th</sup> Session 29 September 2022	Simple majority of Member States represented and voting
FUTURE CIRCULAR COLLIDER FEASIBILITY STUDY: PLANS AND DELIVERABLES FOR THE 2023 MID-TERM REVIEW		
This document describes the plans and deliverables for the mid-term review of the Future Circular Collider Feasibility Study, which is proposed to take place in autumn 2023. The Scientific Policy Committee is invited to recommend and the Council is invited to approve these plans and deliverables.		



## Scientific Advisory Committee: review technical deliverables

- D1: Definition of the baseline scenario
- D2: Civil engineering
- D3: Processes and implementation studies with the Host States
- D 4: Technical infrastructure
- D5: FCC-ee accelerator
- D6: FCC-hh accelerator
- (D7: Project cost and financial feasibility)
- D8: Physics, experiments and detectors

## Cost Review Panel Mandate: (review of D7)

- Review the methodology and assumptions used in producing the cost estimates
- Identify inaccurate or missing cost information
- Check the consistency of the cost estimates with respect to applicable reference work, e.g., recent large-scale infrastructure and accelerator projects
- Review the uncertainty estimates
- Identify potential areas of savings and cost mitigation for future work
- Advise the FCC study team on matters of cost estimation in view of preparation of the final Feasibility Study Report for end 2025

## Status

- Both SAC and CRP have formed expert groups for individual domains to interact with FCC team
- More than 30 topical review meetings during August and September 2023
- Final overall review meeting of SAC and CRP with FCC team 16-18 October 2023
- Complete set of documentation material submitted for CERN Council Committees begin November 2023
  - Future Circular Collider Mid-term Report
  - Executive Summary of the Future Circular Collider Mid-term Report
  - Updated Cost Assessment for the FCC Civil Engineering, Infrastructure and the FCC-ee Collider
  - Future Circular Collider Funding Model: A First Analysis
  - Cost Review Panel Mid-Term Review Report
  - Scientific Advisory Committee Mid-Term Review Report

## Further process

- Special meetings of CERN Scientific Policy Committee and Finance Committee: 20-22 November
  - SPC and FC Reports to Council by 31 December
- Special Council meeting on mid-term review: 2 February 2024

## **The first half of the FCC Feasibility Study will soon be completed with the mid-term review**

- End October 2023: Review committee reports available to Scientific Policy Committee and Finance Committee
- 20 – 22 November 2023: SPC and FC review meetings on mid-term review
- 2 February 2024: CERN Council meeting on mid-term review

### **Focus 2021 - 2023:**

- identifying best placement & layout and adapting entire project to new placement
- this provided the input for the mid-term review

Fruitful collaboration between scientific & technical actors, in close cooperation with the host state services concerned, at departmental/cantonal and local level. Direct exchange in place with communes concerned by surface sites. Environmental studies ongoing.

### **Focus 2024 - 2025:**

- Subsurface investigations, further optimization of implementation, surface sites, synergies, etc.
- Full design iteration in view of technical and cost optimisation of entire project