



Construction Projects Past, current & future

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Agenda

Large underground projects: past & future

LHC → *HL-LHC* → *FCC*

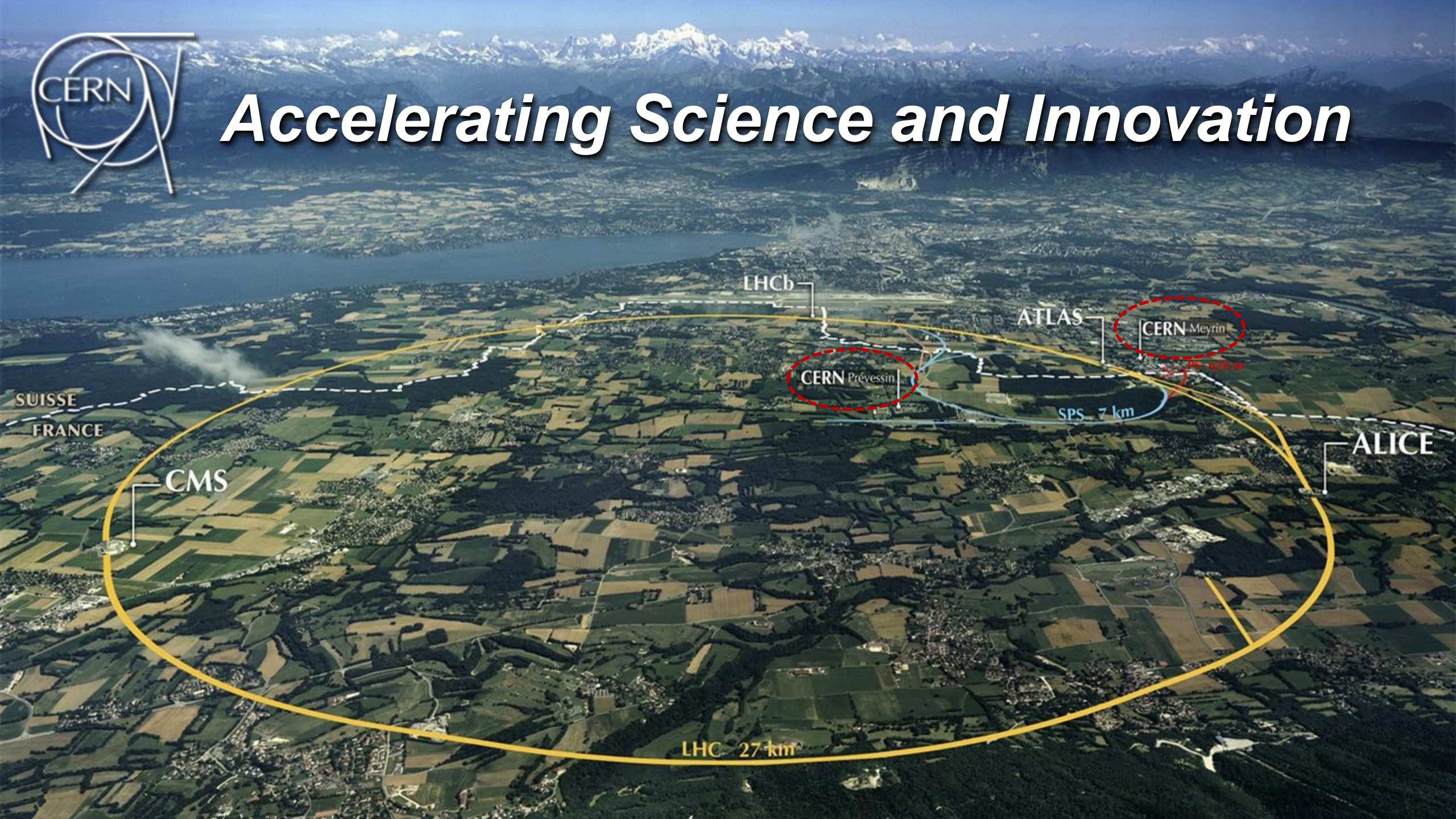
Large building projects: current & future

- *Prévessin Computing Center (FR)*
- *Science Gateway (CH)*
- Building 777 (FR)
- Building 140 (CH)

Procurement & Contract Strategy



Accelerating Science and Innovation



LHCb

ATLAS

CERN Meyrin

CERN Prévessin

SPS 7 km

ALICE

CMS

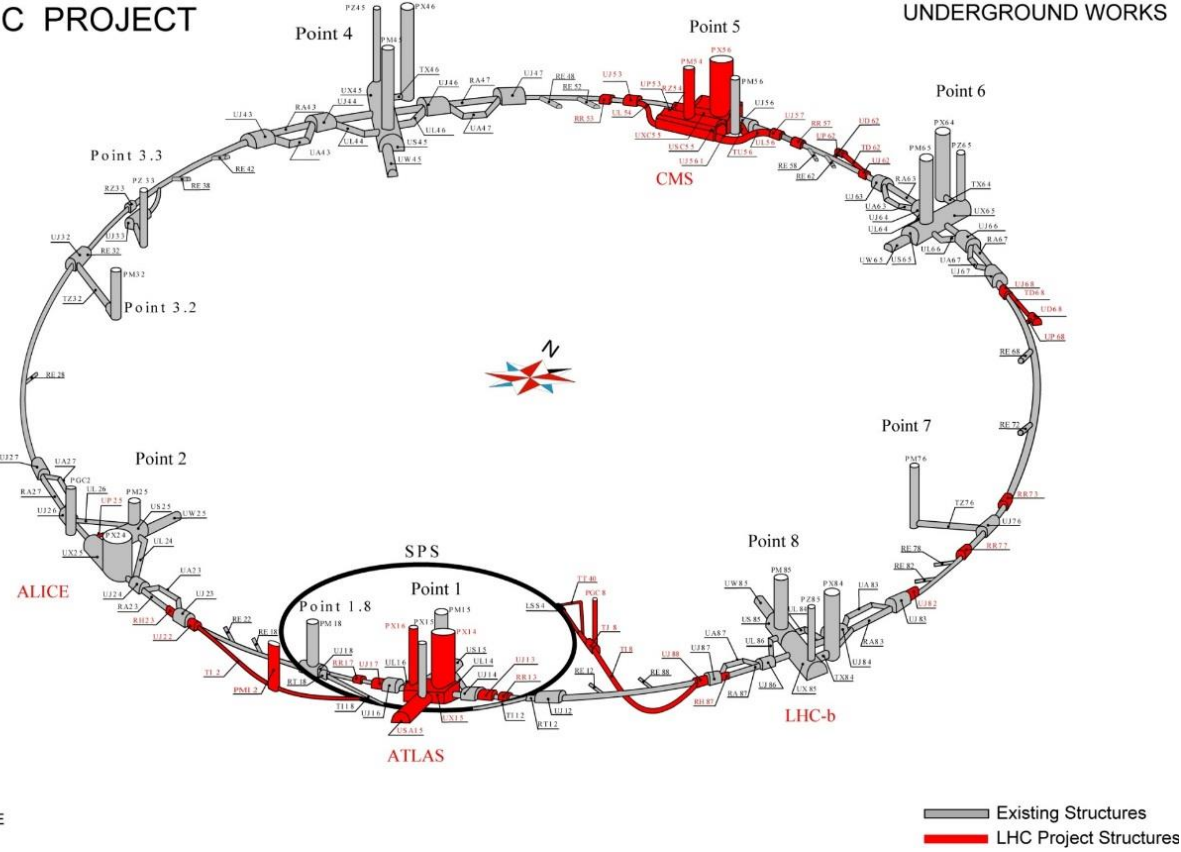
LHC 27 km

SUISSE
FRANCE

Civil works for LHC project

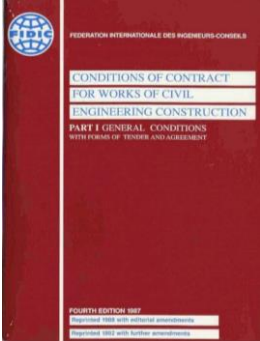
LHC PROJECT

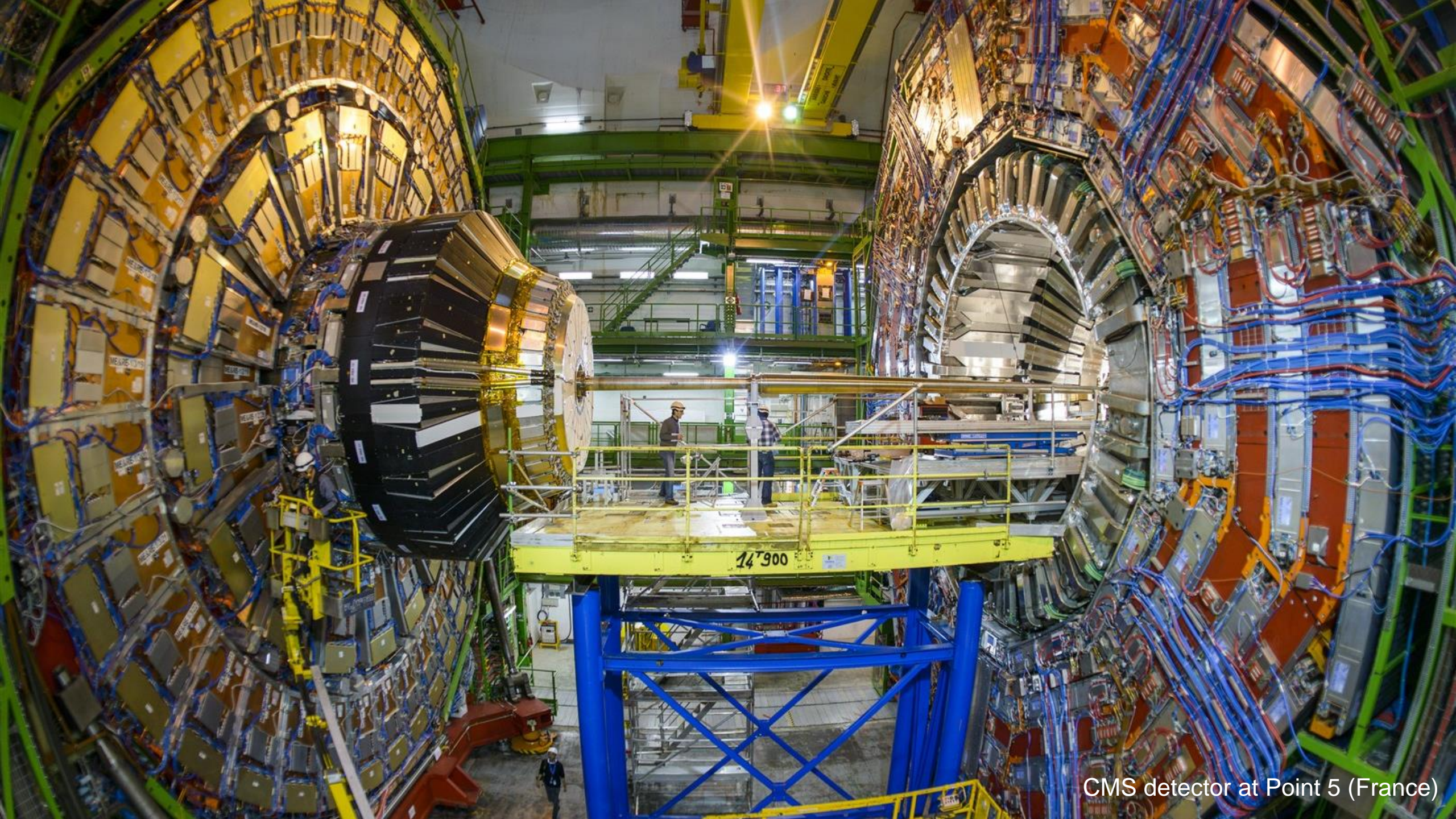
UNDERGROUND WORKS



- 27km LEP tunnel built in '80s;
- Replace LEP accelerator by LHC accelerator and ATLAS/CMS detectors;
- LHC buildings, shafts, caverns & tunnels added between 1998-2005;
- FIDIC Red Book – Works of Civil Engineering Construction (4th Ed, 1992);
- 4 lots, total value \approx 500 MCHF;
- Sites in CH & FR.

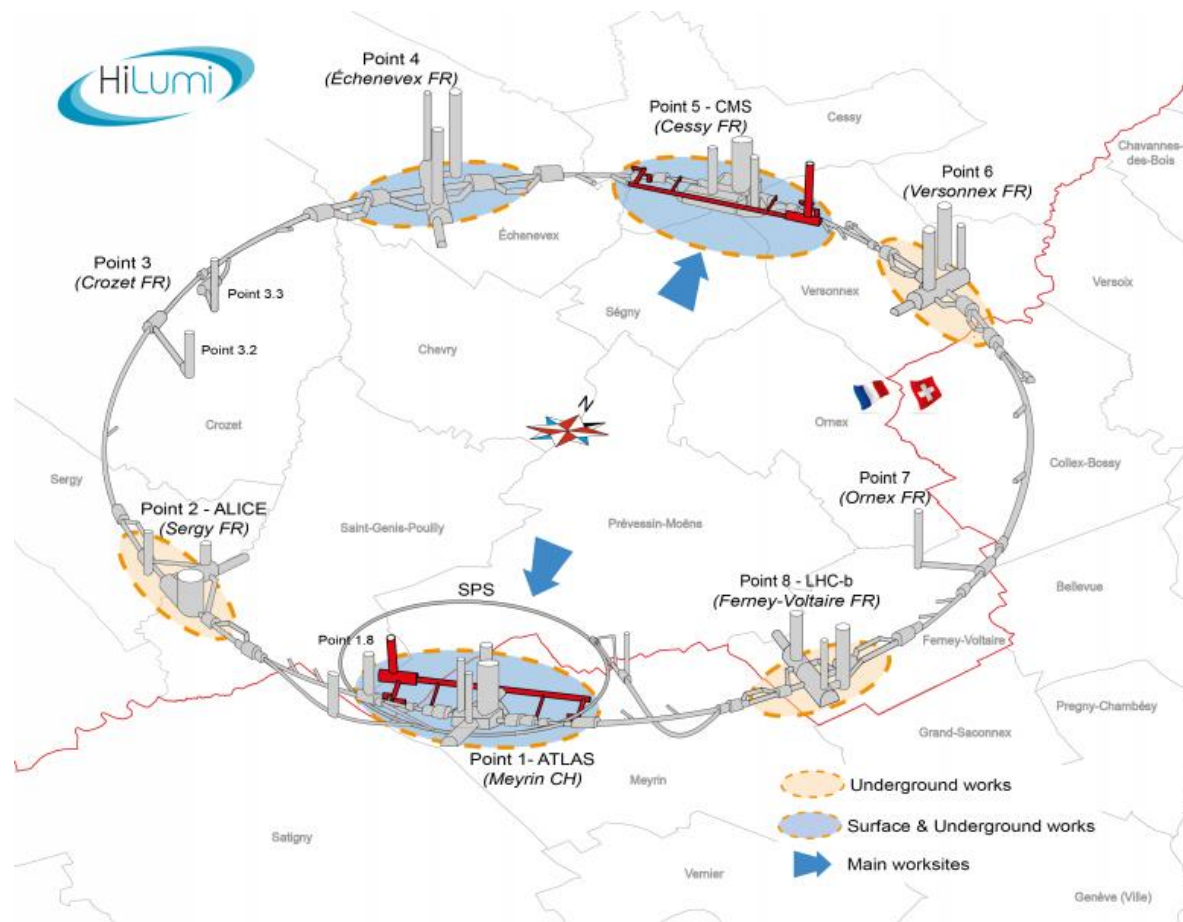
TS-CE
2005



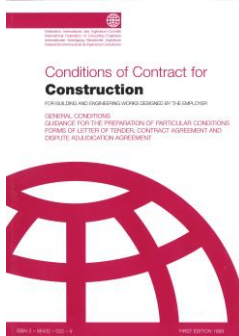


CMS detector at Point 5 (France)

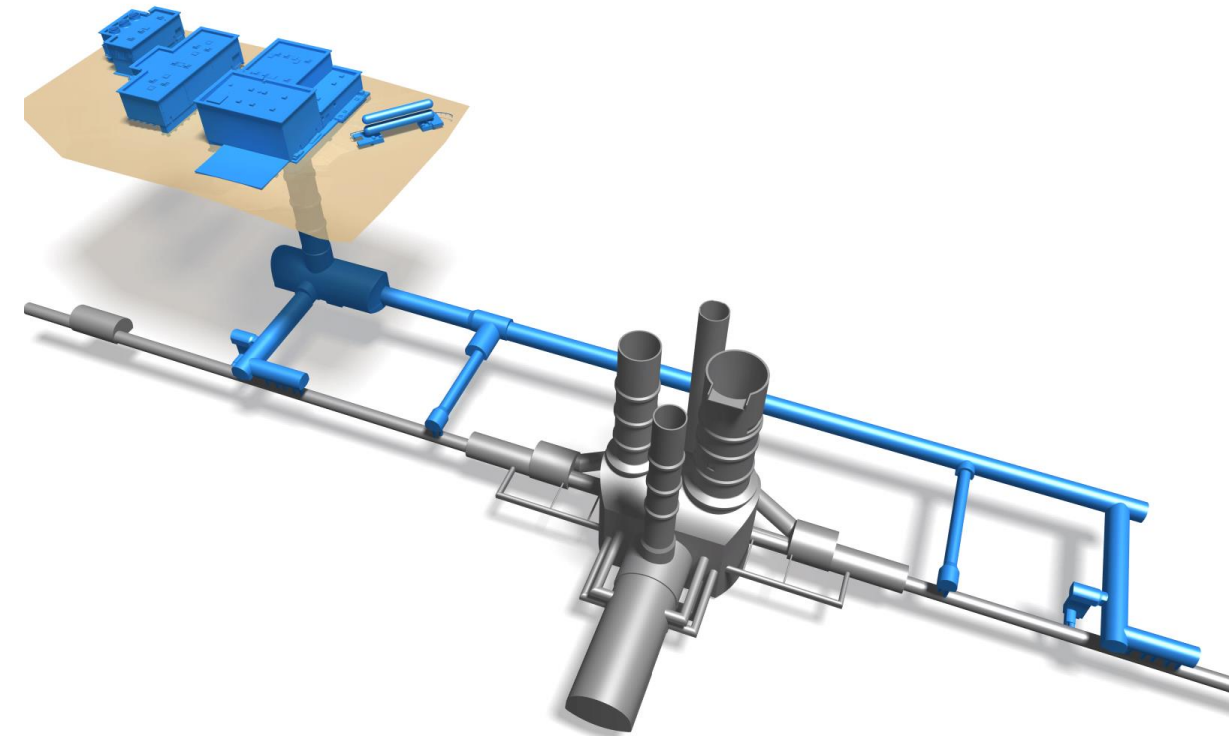
Civil works for HL-LHC project



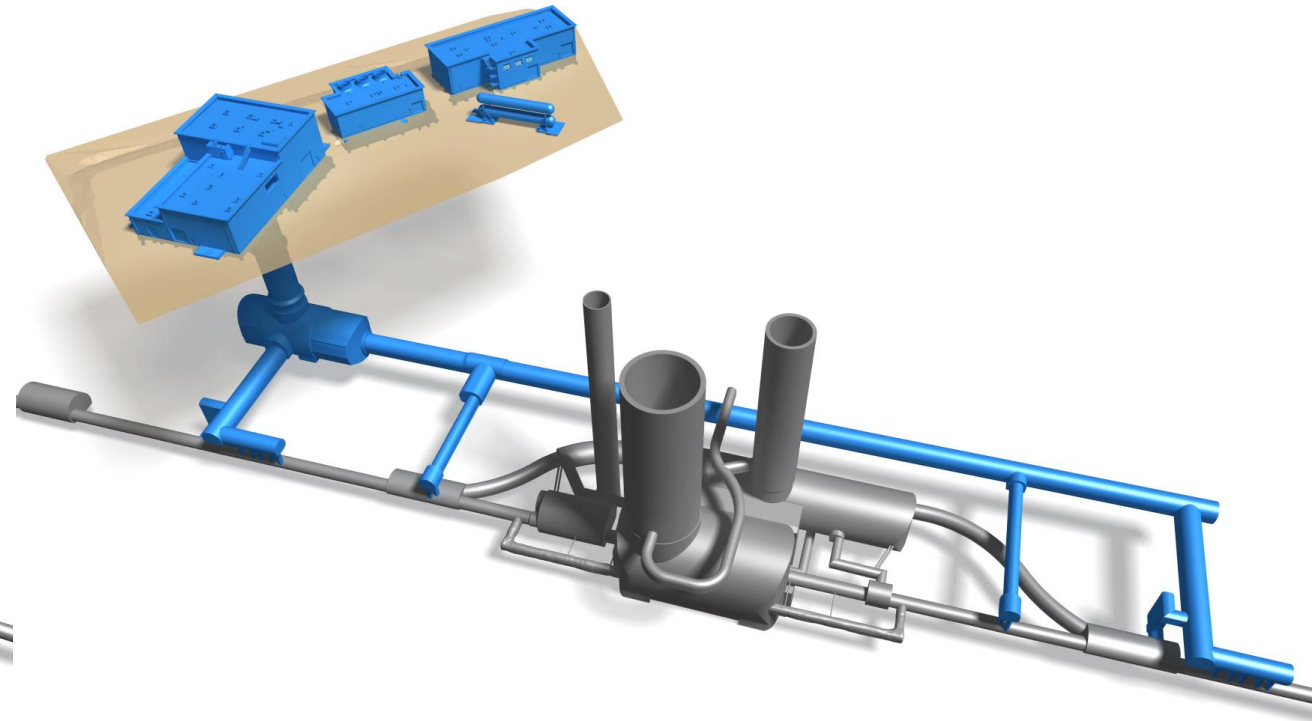
- Upgrade LHC to HL-LHC accelerator to generate ≈ 10 times more particle collisions;
- HL-LHC buildings, shafts, caverns & tunnels added between 2018-2022;
- FIDIC Red Book – Conditions of Contract for Construction (1st Ed, 1999);
- Contract amended to include special features related to tunnelling;
- 2 lots, total value ≈ 170 MCHF;
- Sites in CH & FR.



Civil works for HL-LHC project



Point 1 (CH)



Point 5 (FR)

Surface Works – 5 tech buildings at each Point



PM17 Shaft



HL-LHC underground works at Point 1 (Switzerland)

PM17 Shaft



HL-LHC underground works at Point 1 (Switzerland)

US/UW57 Cavern



HL-LHC underground works at Point 5 (France)

US/UW17 Cavern



US/UW17 Cavern



HL-LHC underground works at Point 1 (Switzerland)

US/UW17 Cavern



HL-LHC underground works at Point 1 (Switzerland)

UR15 Main Gallery



HL-LHC underground works at Point 1 (Switzerland)

UR15 Main Gallery



HL-LHC underground works at Point 1 (Switzerland)

UA13 Secondary Gallery



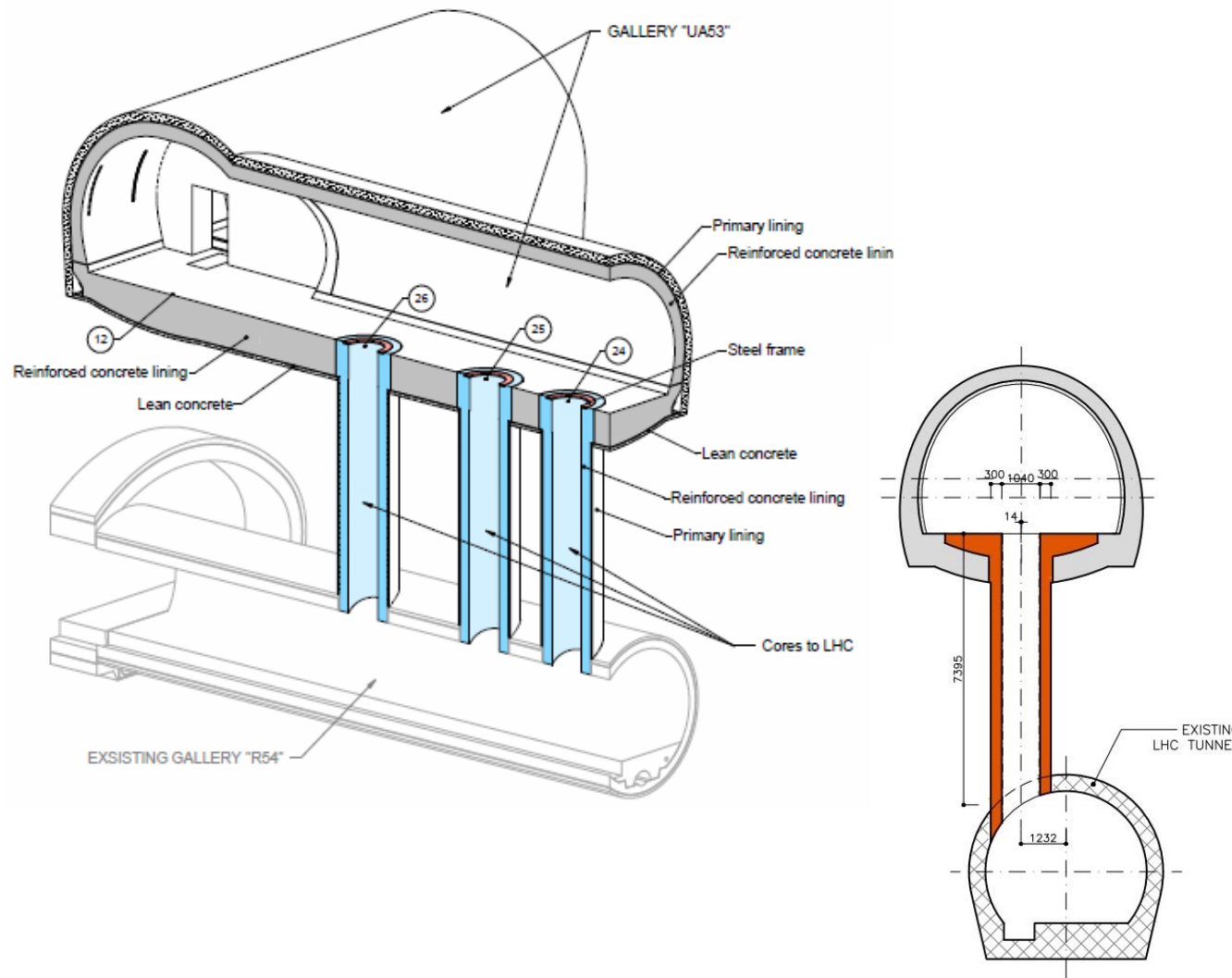
UA13 - UR15 Intersection



Photo Credit: J. V. V. V.

HL-LHC underground works at Point 1 (Switzerland)

Vertical Cores to connect to LHC



- Connections between HL-LHC galleries and LHC tunnel;
- 12 - \varnothing_i 1m vertical cores at both Point 1 and 5 (24 cores);
- Design & build approach;
- Logistic constraints due to CERN operations and equipment (de-) installation activities;
- Invitation to Tender ongoing.

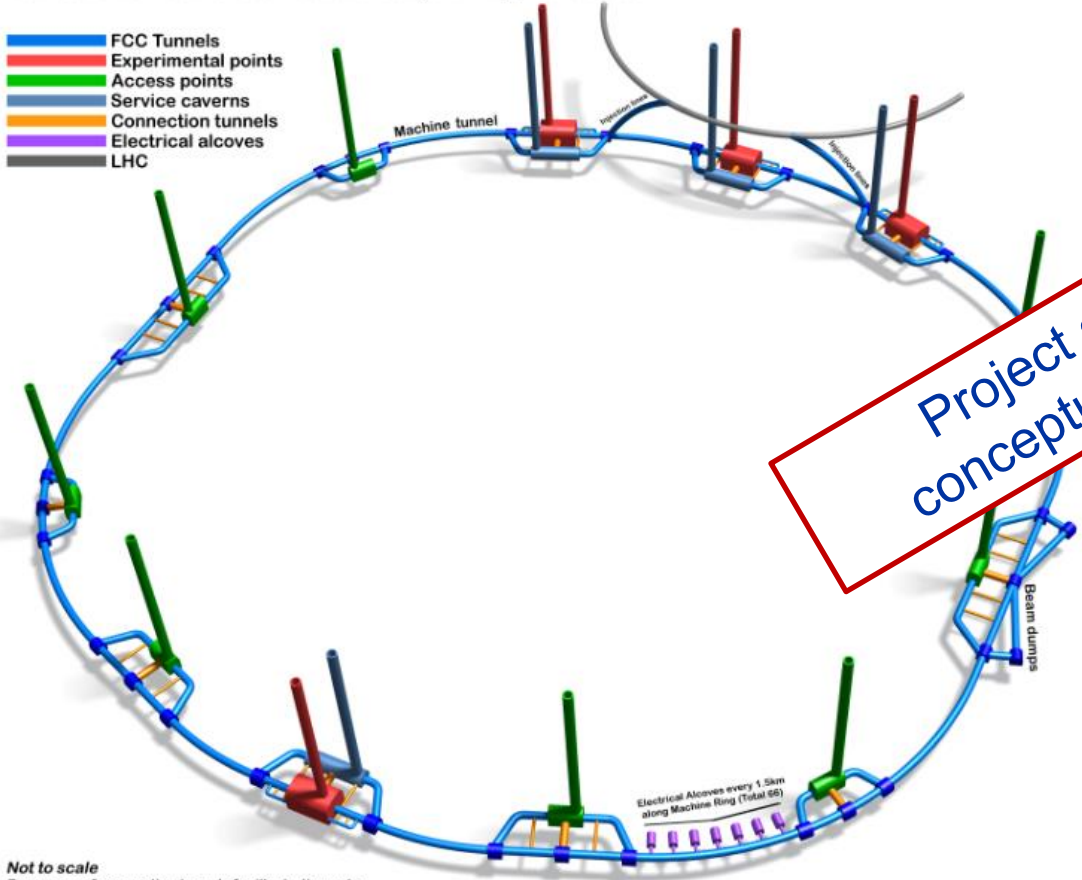
CERN's 100 km Future Circular Collider (FCC)

FUTURE CIRCULAR COLLIDER (FCC) - 3D Schematic

Underground Infrastructure - Single Tunnel Design

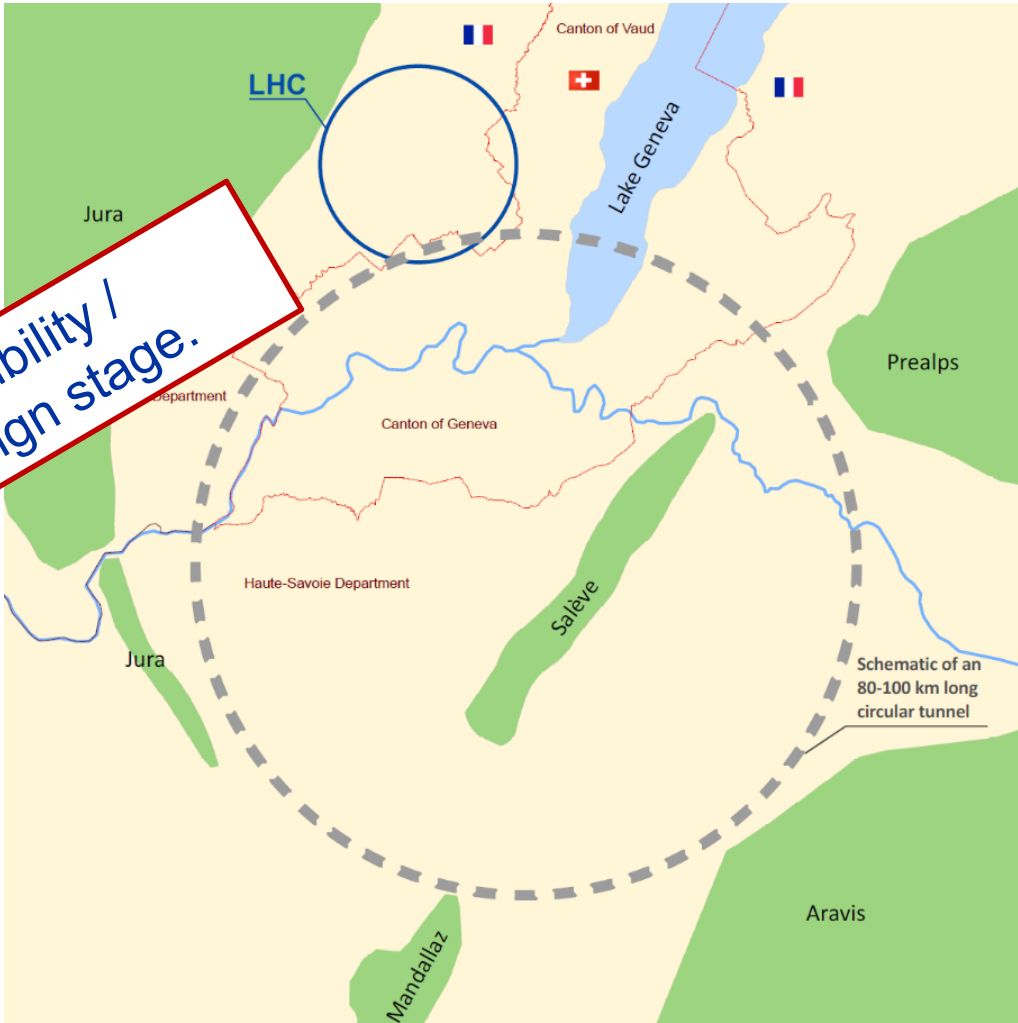
John Osborne - Charlie Cook - Joanna Stanyard - Ángel Navascués

- █ FCC Tunnels
- █ Experimental points
- █ Access points
- █ Service caverns
- █ Connection tunnels
- █ Electrical alcoves
- █ LHC



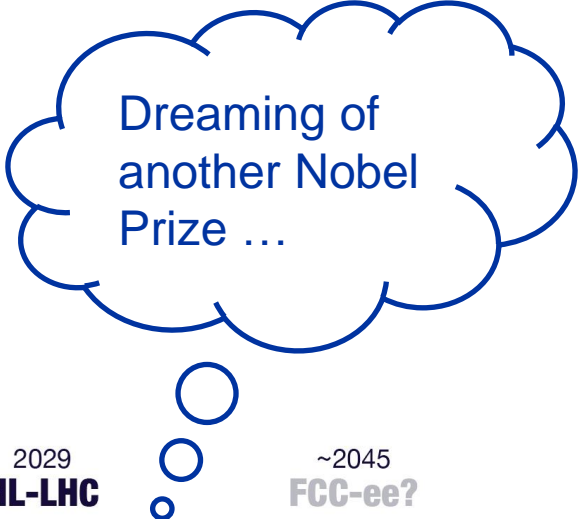
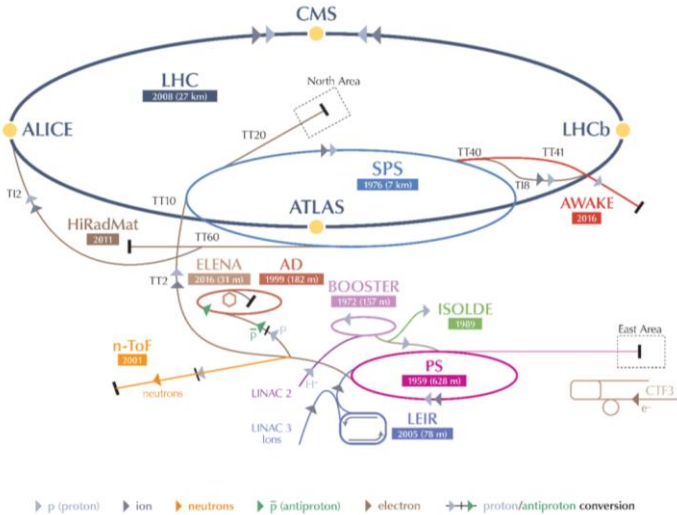
Not to scale
Frequency of connection tunnels for illustration only

Project at feasibility / conceptual design stage.



Schematic of an 80-100 km long circular tunnel

CERN Timeline



1954 **CERN** 1957 **SC** 1959 **PS** 1971 **ISR** 1977 **SPS** 1981 **SPS Collider** 1989 **LEP** 2008 **LHC** 2029 **HL-LHC** ~2045 **FCC-ee?**



1958
Rare pion decay

1965
First observation of antinuclei

1983
Discovery of W/Z bosons

1989
Discovery of three neutrinos

2012
Discovery of Higgs boson

2014
FCC study

NAME OF ACCELERATOR
Size of the accelerator ring
 Scientific discoveries
 Technological advances
 Nobel Prizes

1968
MWPC electronic particle detection

1976
Touchscreen
 1977
First PET image at CERN

1984
Nobel Prize W/Z bosons

1990
World Wide Web
 1992
Nobel Prize MWPC

2013
Nobel Prize Higgs boson

Prévessin Data Center

© Image by Equans



- New 4 MW data center, scalable to 8 & 12 MW; building and building services by Contractor, IT equipment by CERN;
- Employer's requirements incl. performance specification with $PUE < 1.15$ (Power Usage Effectiveness) and strict temperature T_i control;

- 10 years Operation & Maintenance;
- FIDIC White Book – Client/Consultant Model Services Agreement (5th Ed, 2017) for Employer's Representative;
- FIDIC Gold Book – Conditions of Contract for Design, Build and Operate Projects (1st Ed, 2008)
- Value \approx 33 MEUR;
- Site in France.



Science Gateway

<https://sciencegateway.cern/>



© Images by RPBW

- New CERN visitor center with exhibitions, conference space, labs, restaurant, etc;
- Educational center for STEM, fundamental research & societal impact;
- 5 buildings, $\approx 7'000\text{m}^2$, built 2020-2023;
- FIDIC Red Book – Conditions of Contract for Construction (2nd Ed, 2017);
- Value ≈ 65 MEUR;
- Site in Switzerland.



New tertiary buildings 777 / 140 – Key Features

Develop buildings with an architectural quality that surpasses the existing feel of an industrial and laboratory site;

Create new buildings in which CERN staff and users truly feel at home and happy to work;

Construct environmentally friendly and state-of-the-art buildings; aiming towards net zero carbon, considering operational and embodied carbon; (using LCA)

Obtain appropriate levels of energy, sustainability and health & safety certification; (e.g. Minergie, BREEAM, WELL, SNBS, or other)

Building 777 Site

Site in the heart of CERN Préveessin

Offices for ≈ 500 ATS staff

Workshops & labs

New Restaurant 3

Approx. 12'000 m²

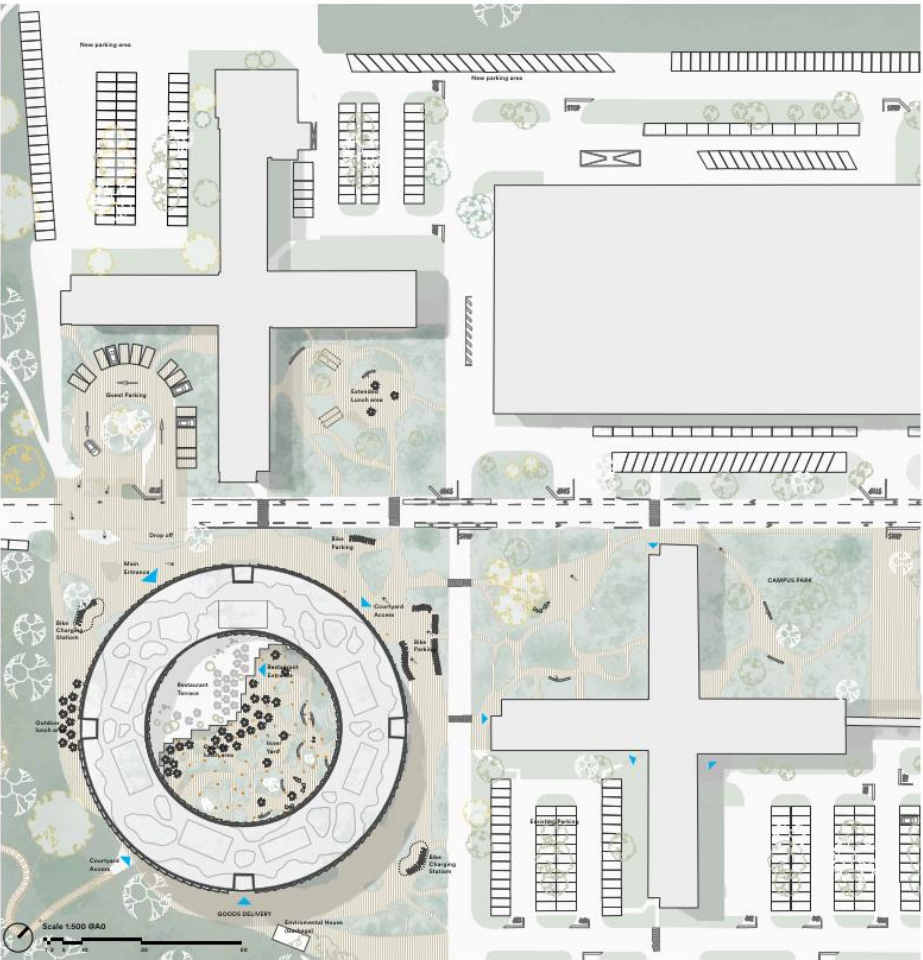
International architectural tender

Mass timber structure



Building 777

<https://building777.web.cern.ch/>



<https://youtu.be/7CyiNPHG4t8>

Building 140

Site in the heart of CERN Meyrin

Offices and workshops for
Experimental Physics (EP)

Learning center (classrooms)

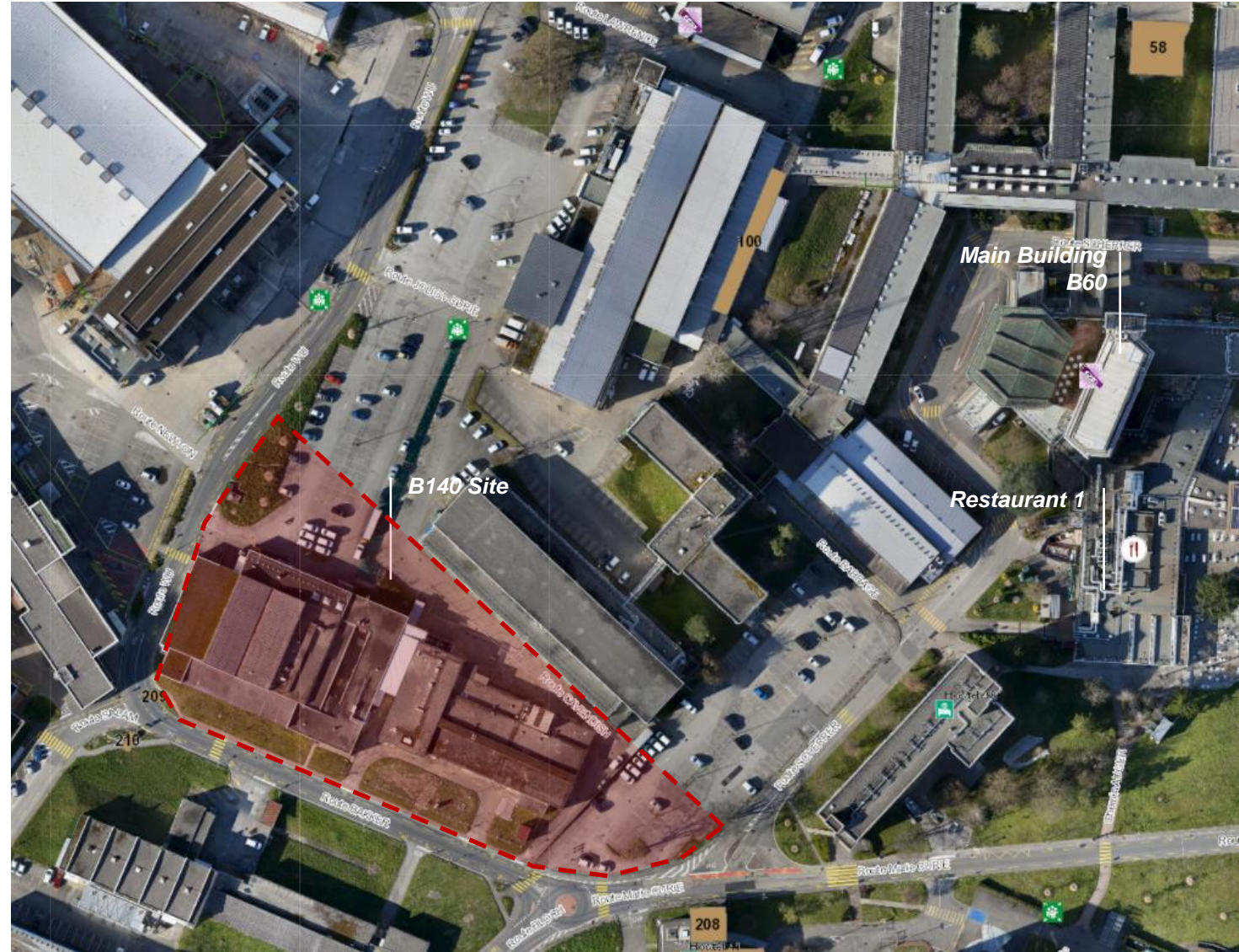
Plenary room & auditoria

Cafeteria

Construction in 2 phases

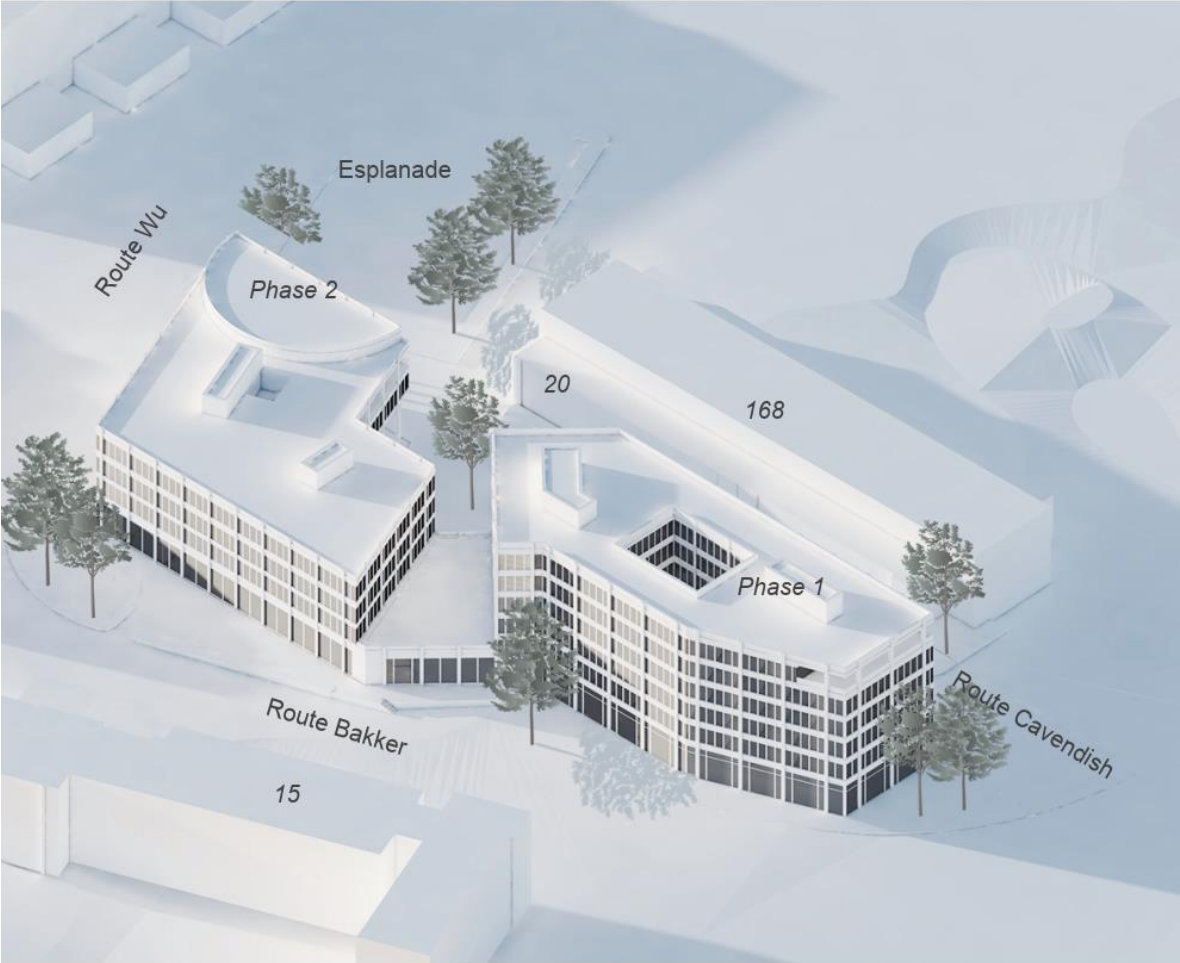
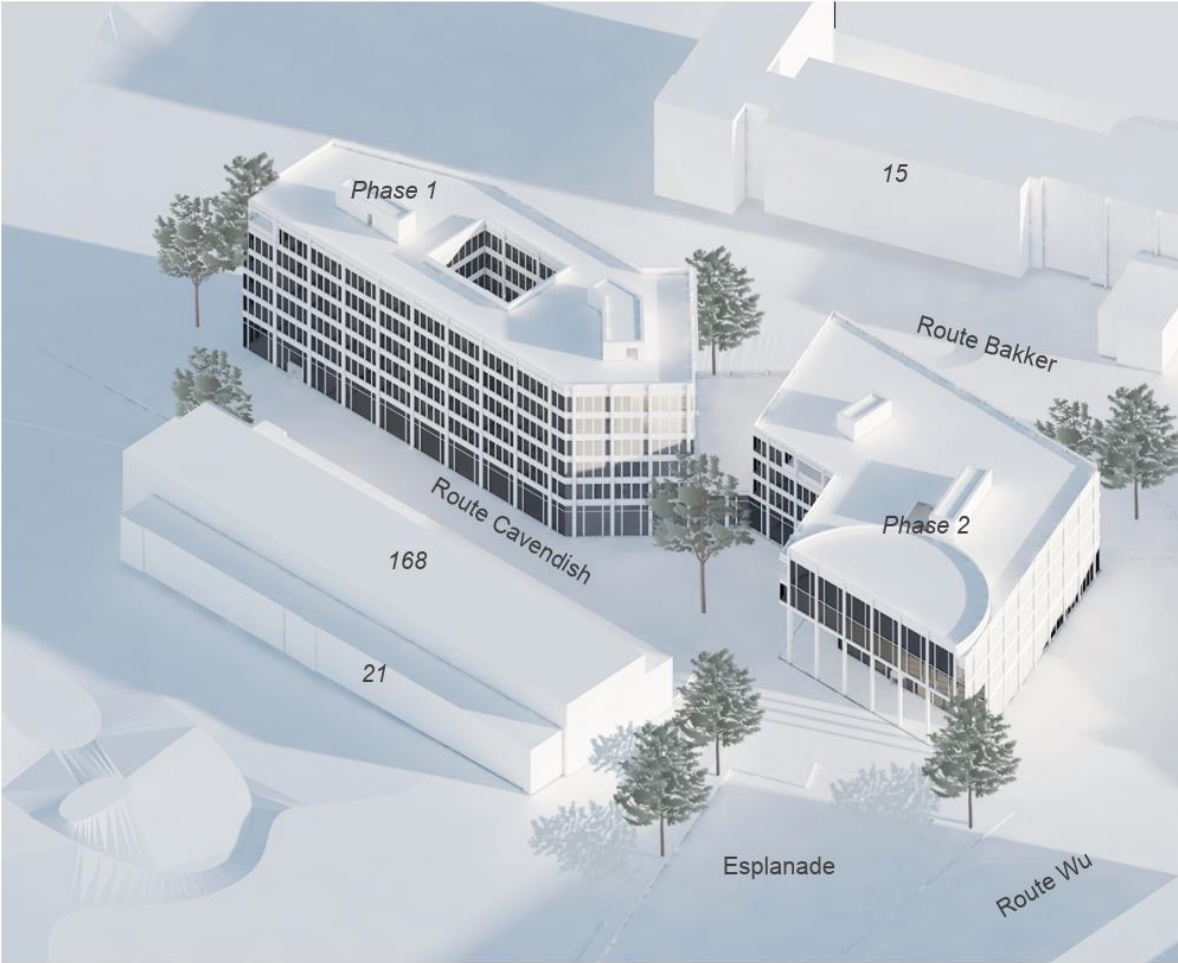
Approx. 16'000 m²

Architectural tender to be sent out



Building 140

Reference design by <https://cche.ch/>



Procurement & Contract Strategy

Consultant

Market Survey & Invitation to Tender; based on BVFM adjudication;

Agreement based on *FIDIC White Book (2017 Ed.)*, incl. CERN amendments;

Scope: design (up to tender) & construction administration;

Contractor

Market Survey & Invitation to Tender; based on lowest cost or BVFM adjudication;

Agreement based on *FIDIC Yellow Book (2022 Ed.)*, incl. CERN amendments;

Scope: construction documents & build.

For further information: <https://fidic.org/>





home.cern