

CERN-INTERA FUTURE CIRCULAR COLLIDER

Roddy Cunningham 17.02.2025





The Future Circular Collider

The FCC is being studied as the successor to the LHC

- 91km circumference tunnel located in Geneva at the foothills of the Alps
- Feasibility study to be presented at next European Strategy for Particle Physics Update (ESPP)
- Planned construction is foreseen to begin in the early 2030s
- A two-stage operation is planned, first FCC-ee then FCC-hh







70 years



FCC Underground Infrastructure

- 8 surface sites
- 13 shafts
- 4 experiment caverns
- 8 service caverns
- Beam Absorber
- A new LINAC



Credit: Angel Navascues Cornago



Main Beam Tunnel





Shafts

13 Shafts

Depths range from 180m to 400m

- 2 x 18.4m elliptical
- 4 x 18m circular
- 7 x 12m circular



Credit: Angel Navascues Cornago











FCC



ATLAS (LHC)



CMS (LHC)

Credit: Angel Navascues Cornago



Experimental Area





Site Investigation Studies (i)

ILF/GADZ 2020/21

Definition of 'Areas of Geological Uncertainty' for the preferred alignment scenario(s) Input into footprint exploration –comparison of scenarios and Geological Risks Assessment

Initial proposals of site investigations in targeted areas to reduce the uncertainty of the geological model

Cost estimates and schedule for target site investigation campaign ILF/GADZ study focused on the construction risks for underground works

Université de Genève 2021-current

Updating 3D geological model

Technical reporting on hydrogeological, tectonic and seismic characteristics of the Geneva region

Data gathering of existing and new data from drilling and geophysics campaigns













Site Investigation Studies (ii)

QUANTUM 2022-2025

Detailed analysis of 'Areas of Geological Uncertainty' for the amended alignment and updated geological models Optimization of proposed SSI campaign scope of works Preparation of Technical Specifications for SSI Contractor MS and IT Cost estimates and schedule for SSI Site visits and preparation of site drawings, survey requirements and works schedules

Act in the role of Engineer during the execution of the Works













Subsurface Site Investigation Campaign 1

The site investigation campaign will remove some level of uncertainty in current 3D geological model and provide a better understanding of:

- The molasse-moraine and molasse-limestone interfaces along the proposed alignment
- Vertical profiling of shafts for PA, PD, PF and PL

The investigations are split into 2 work packages consist of:

- 2D seismic geophysics
- Fully and partially cored boreholes

The campaign started in October 2024 and will last until December 2025





Site Investigations

Geophysics:

FUTURE CIRCULAR COLLIDER

- Total of over 80km of seismic investigation, both seismic reflection and refraction
- Both on land and on the lake

Boreholes:

- 29 boreholes in total
- 4 boreholes on the lake
- Fully and partially cored boreholes
- Some equipped with piezometres









Subsurface Site Investigation Campaign 2

Post-feasibility Investigation Works (i)

A larger campaign of ground investigations

FUTURE CIRCULAR COLLIDER

- Targeted boreholes around the experimental and technical caverns and their access shafts
- Geophysics and boreholes at regular intervals along the entire alignment
- Sufficient in detail to allow for the tender of construction works packages
- Market Survey for Consultant to be launched early Q2 2025 with qualified bidders being invited to tender in Q3 2025
- Consultants to define investigations campaign, produce technical specifications for Invitation to Tender, manage permitting/environmental issues and act as Engineer during works
- Consultant should have expertise in underground design (similar the infrastructure for the FCC), knowledge of the local geology and experience in permitting and environmental studies

Post-feasibility Investigation Works (ii)

- Additional supplementary investigations in areas where gaps still exist to be identified by design consultant
- These will allow the engineer to fully design the full scope of works





Project schedule

c	CDR	ESPP Update	e						Feasib	oility Report	ESPP Update	Project						
Civil engineering FCC pre-construction schedule	2019 Q1 Q2 Q3 Q4	2020 4 Q1 Q2 Q3 Q4	2021 Q1 Q2 Q3 Q4	2022 Q1 Q2 Q3	20 Q4 Q1 Q2	023 Q3 Q4	2024 Q1 Q2 Q3	2 Q4 Q1 Q	2025 2 Q3 Q4	2026 Q1 Q2 Q3 Q4	2027 Q1 Q2 Q3 Q4	2028 Q1 Q2 Q3	2029 Q4 Q1 Q2 Q3	203 3 Q4 Q1 Q2 Q	0 20 3 Q4 Q1 Q2	31 2032 Q3 Q4 Q1 Q2 Q3 Q	2033 4 Q1 Q2 Q3	20 3 Q4 Q1 Q2
LHC Operation Period	l	LS2		L	HC run 3					LS3								
HL-LHC Operation															HL-LHC			
Teritorial impact		Plac	ement optimisa	ation														
Site Investigations					SS1						Main Site Inv	estigation S	\$2	Additio Investiga	onal otions			
Areas of uncertainty study (ILF/GADZ)																		
Market Survey for SI Consultants																		
Call for tender for the SI Consultants																		
SI Consultants Contractors Tender																		
SI Consultants' supervison and reporting																		
Call for tender for SI Contractors																		
Call for tender for Si Contractors																		
SSI1 works phase																		
SS2 Main Site Investigations works phase																		
Feasibility Report preparation																		
(Design_Cost & Schedule Lindate)					Phase 1			Phase 2										
			<u> </u>							I	<u> </u>		I	I	I			I
Consultant Contracts										Contract and t	ender strategy	Market Survey	Tender and Award	Preliminary design	/ Tender design	Construction De	sign	
Construction Contracts															Market Survey	Tender and Aw	ard	Constructio

