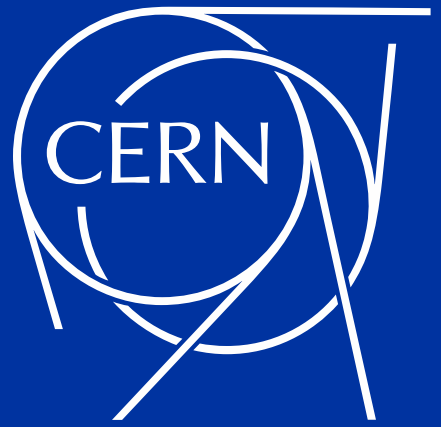


Forward Physics Facility (FPF)

Civil Engineering Study Update

Kincső Balázs, John Osborne SCE-DOD-FS

Date: 27/05/2021

Introduction

- Experimental Requirements and CE considerations
- Option 1: Alcoves in the UJ 12
- Option 2: Purpose built facility
- Next Steps

Experimental requirements and CE consideration

Requirements:

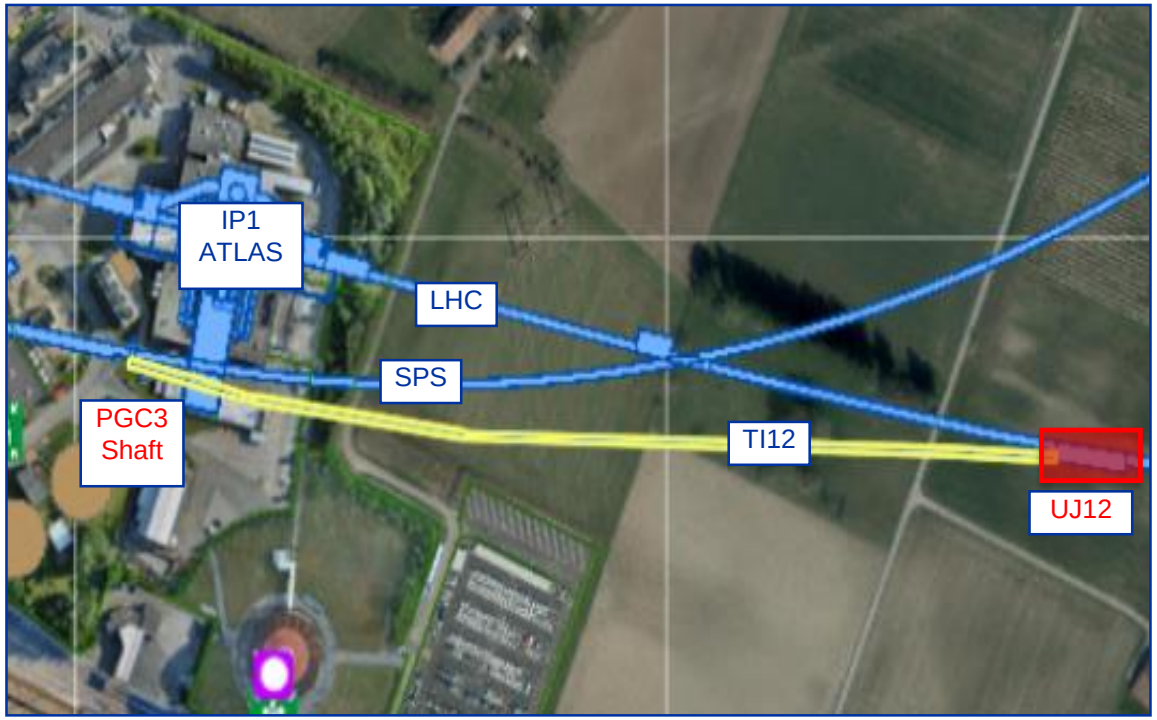
- Experimental area approx. 500-600 m away from LHC P1 or P5 on the Line of sight (LoS)
- Space for experiments
- Access needed for construction, installation and maintenance

CE considerations:

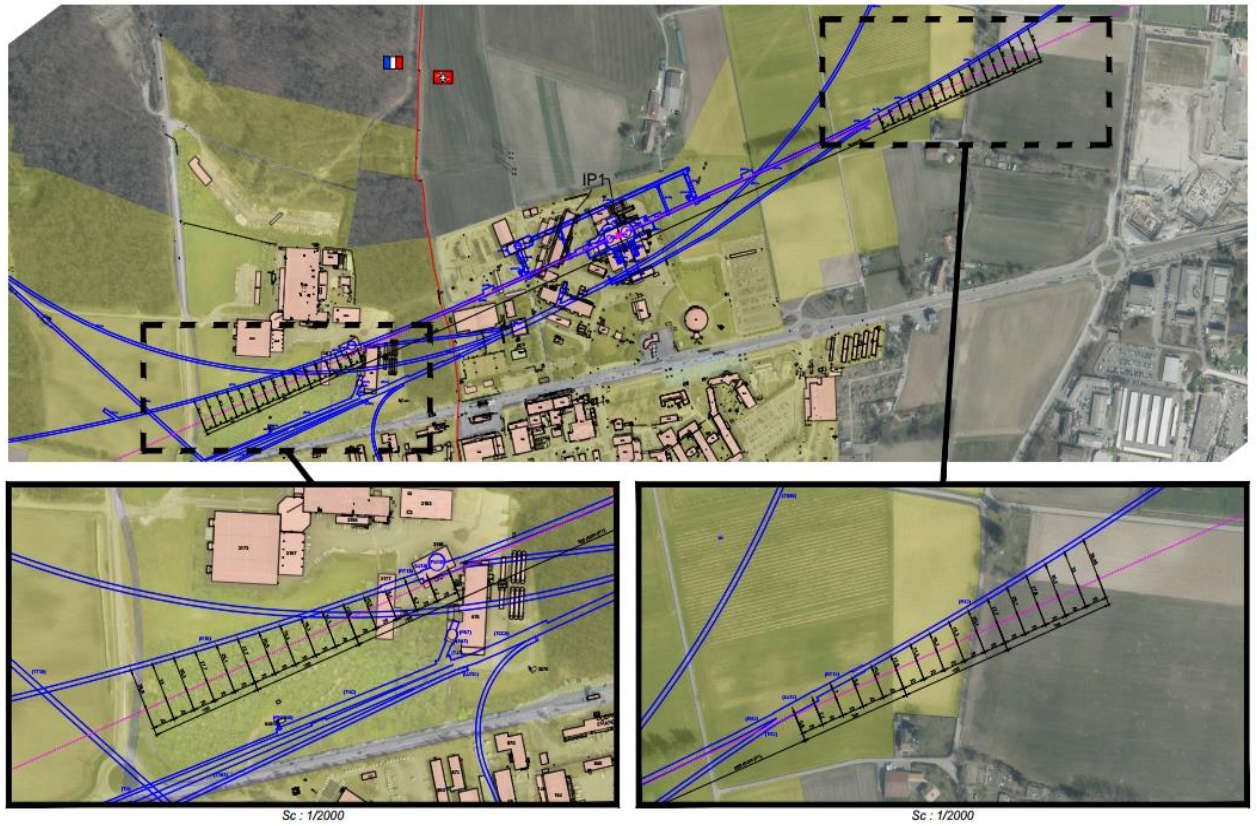
- Existing infrastructure
- Access for construction
- Disruption to LHC machine
- Geology
- Cost

CE Study Update- Considered options

- **Option 1 – UJ12 Alcoves**

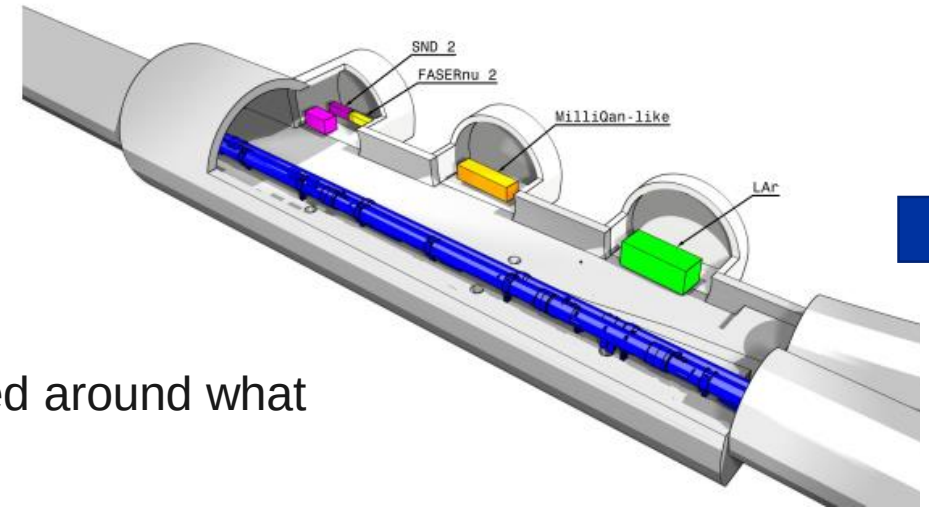


- **Option 2 – Purpose built facility**

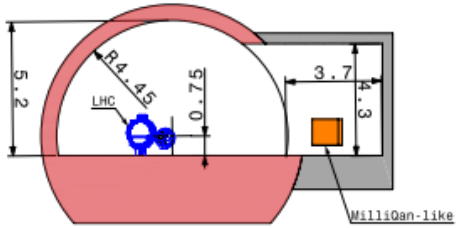


Option 1 – Alcoves in UJ12

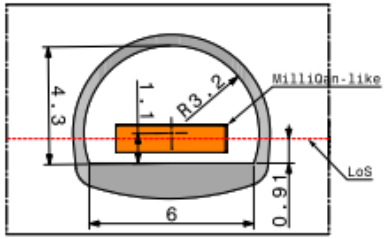
- **Advantages**
  - Lowest cost and disruption
- **Disadvantages**
  - Experiments need to be designed around what is possible
  - Likely only 2-3 alcoves possible around 3mØ
  - Stability of existing cavern
  - All existing services in UJ12 need to be removed



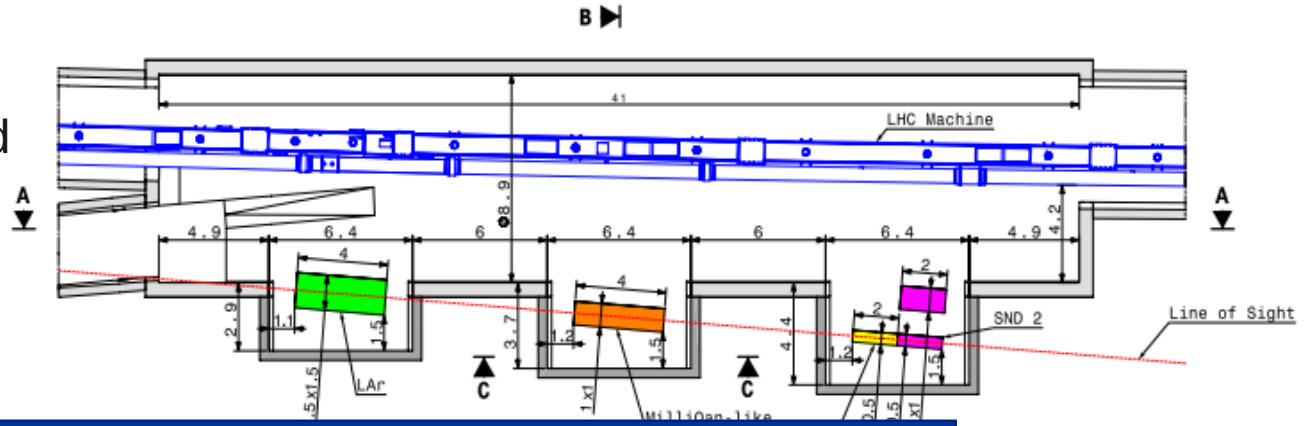
3D view



Alcove Cross Section at B-B



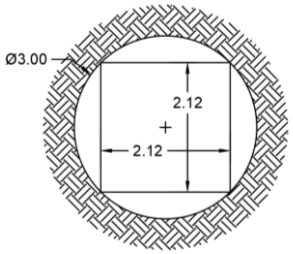
Typical Alcove Cross Section C-C

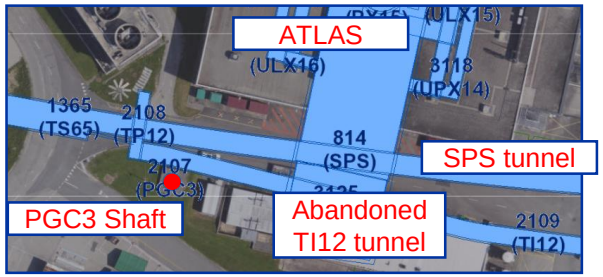


Plan view showing widening and alcoves

Option 1 – SPS Beam Dump tunnel eye enlargement as a reference

- **Easier access compared to UJ12**
  - Access via 3m PGC3 shaft and via TT12





- **Single enlargement**
- **Part of the services kept during the CE works**

Option 1 – Very Preliminary Cost Estimate for CE works

Preliminary Cost Estimate

Ref.	Description of works	Cost [CHF]
1.	**CE Works Alcoves**	**10,866,870**
1.1	Alcove 6.4*2.9 m	2,864,902
1.2	Alcove 6.4*3.7 m	3,655,220
1.3	Alcove 6.4*4.4 m	4,346,748
2.	**Engineering and consultancy**	**1,630,031**
3.	**Minor Works**	**287,281**
3.1	Site investigation	74,524
3.2	Miscellaneous	212,757
Total Cost		**12,784,182**

Methodology

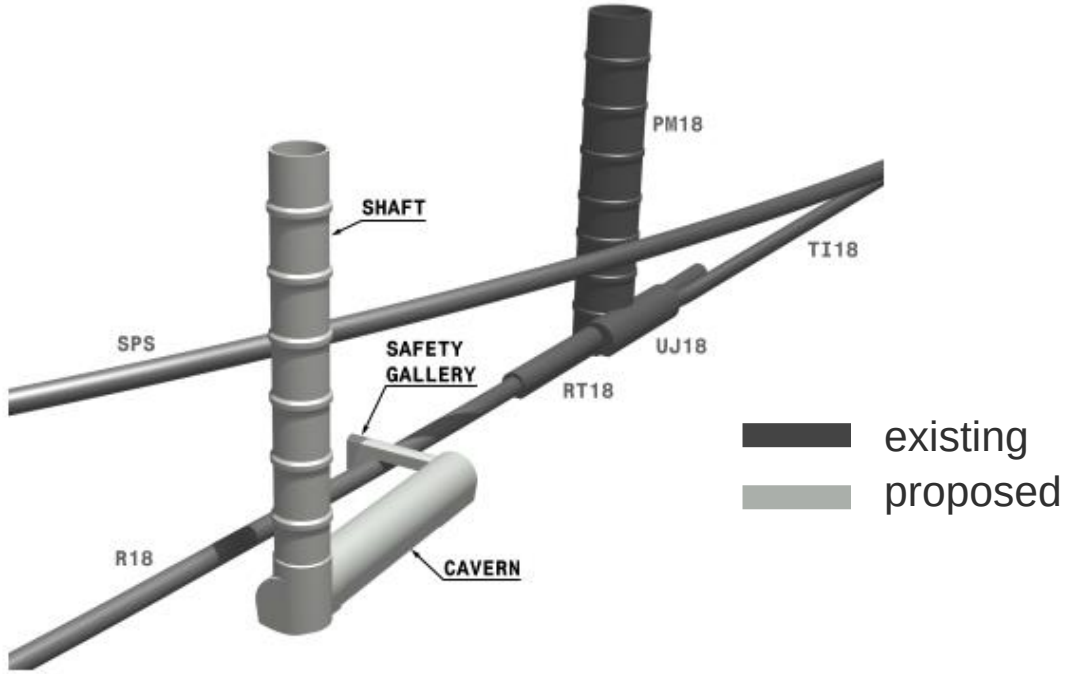
- Comparative Costing
- SPS Dump Facility Tunnel eye enlargement as reference point
- Cost Estimate Class 4 – total could be 50% higher and 30% lower than the given estimate

Assumptions

- Removal of the existing services and equipment from the UJ12 not included
- Services (CV, electricity etc.) not included

Option 2 – Purpose built facility

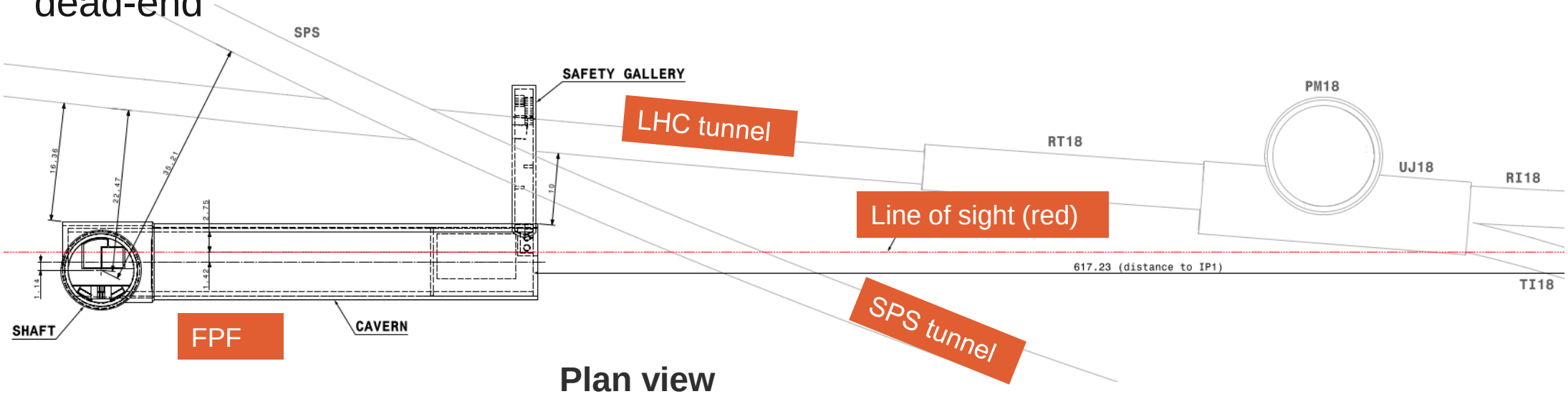
- **Advantages**
  - Designed around needs of experiments
  - Size/ length not constrained
  - Construction access far easier
- **Disadvantages**
  - More expensive
  - Construction still need to be coordinated with LHC shutdowns



Option 2 – Purpose built facility

Proposed Layout

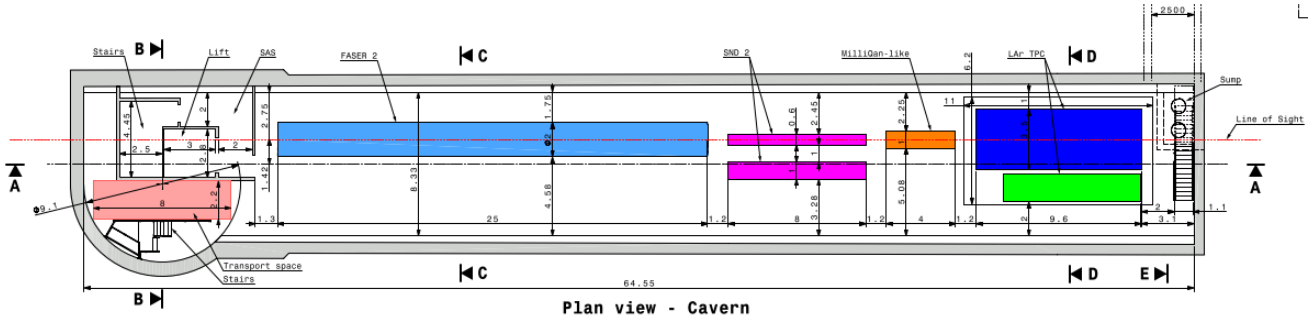
- 65 m long Experimental Cavern located on the LoS, approx. 612 m from IP1
- 9.1 m access shaft located on the top of the cavern
- Safety gallery connecting the cavern to the LHC to avoid dead-end

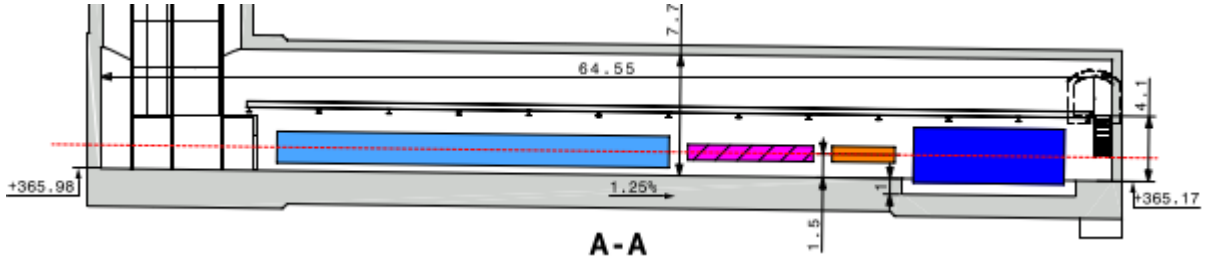


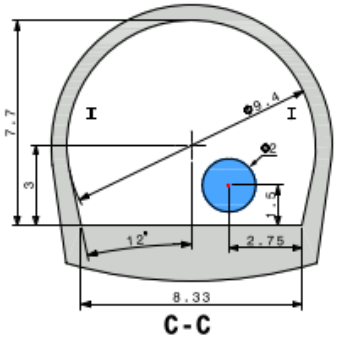
Plan view

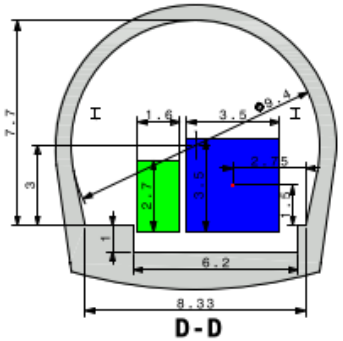
Option 2 – Underground structures

- 9.7 m wide cavern to allow access for transport and siting of some services
- Experiments centralised on the line of sight, 1.5m above the floor
- Floor parallel to the LoS, 1.25%fall
- Trench under the LAr detector to catch any escaped cold gas
- Concept based on overhead crane serving experiments along cavern length



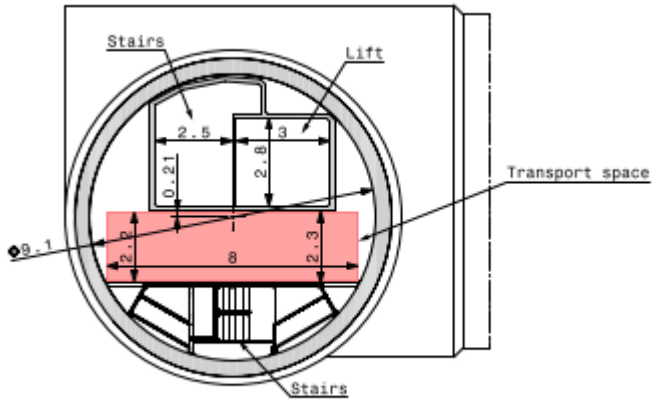




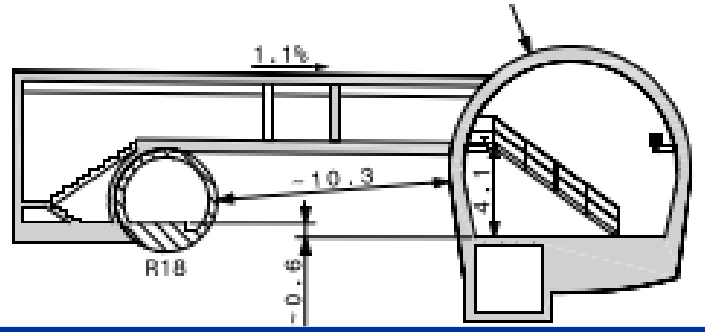


Option 2 – Underground structures

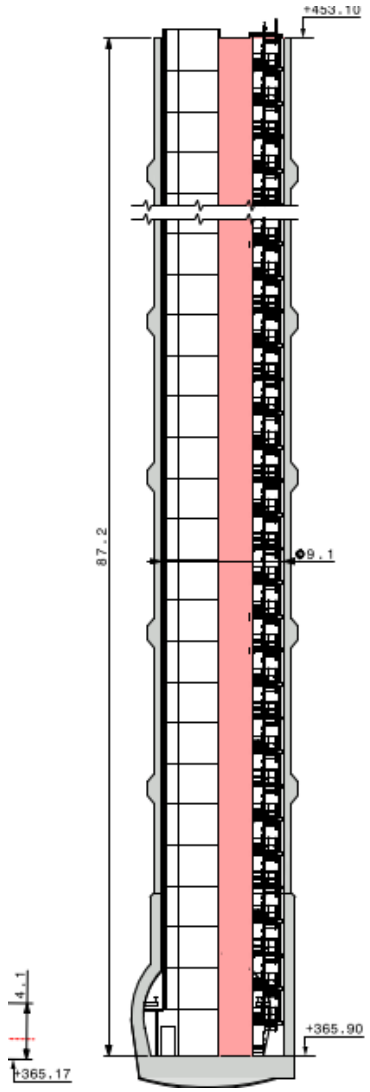
- 88m deep shaft includes lift and stairs for access and space reserved for transport
- Safety gallery connected to the LHC as per Safety requirements
- Ongoing discussions with the HE and RP department



Plan view shaft



Section through the new cavern and the safety gallery

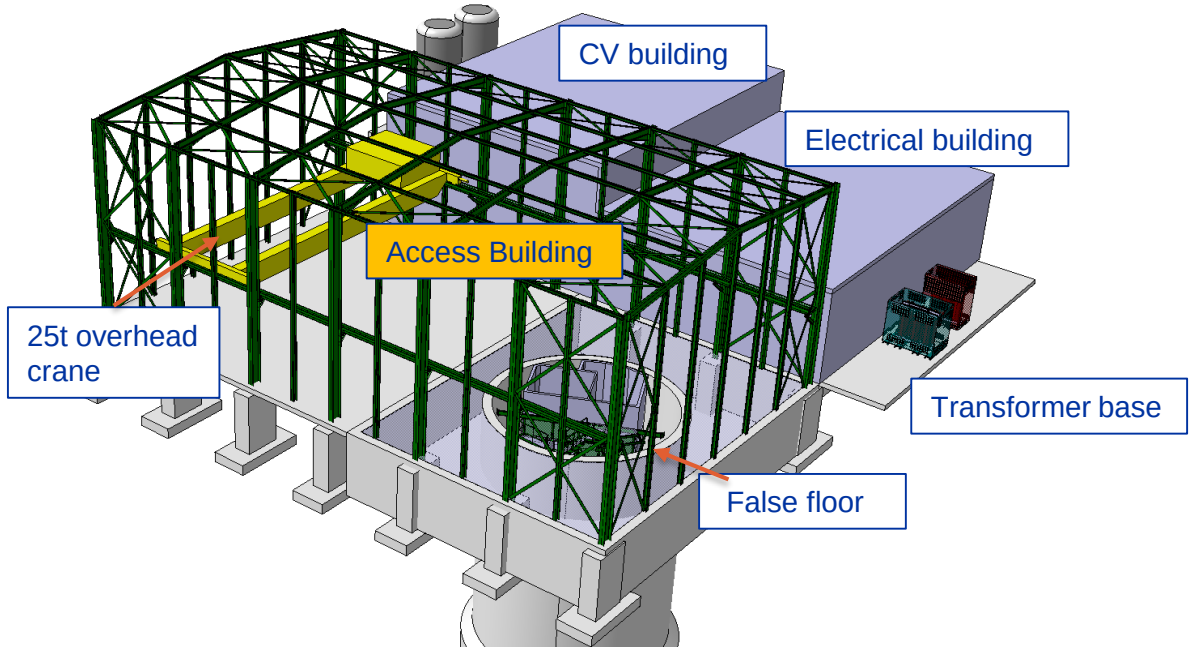


Cross section through the shaft

Option 2 – Surface buildings

Access building

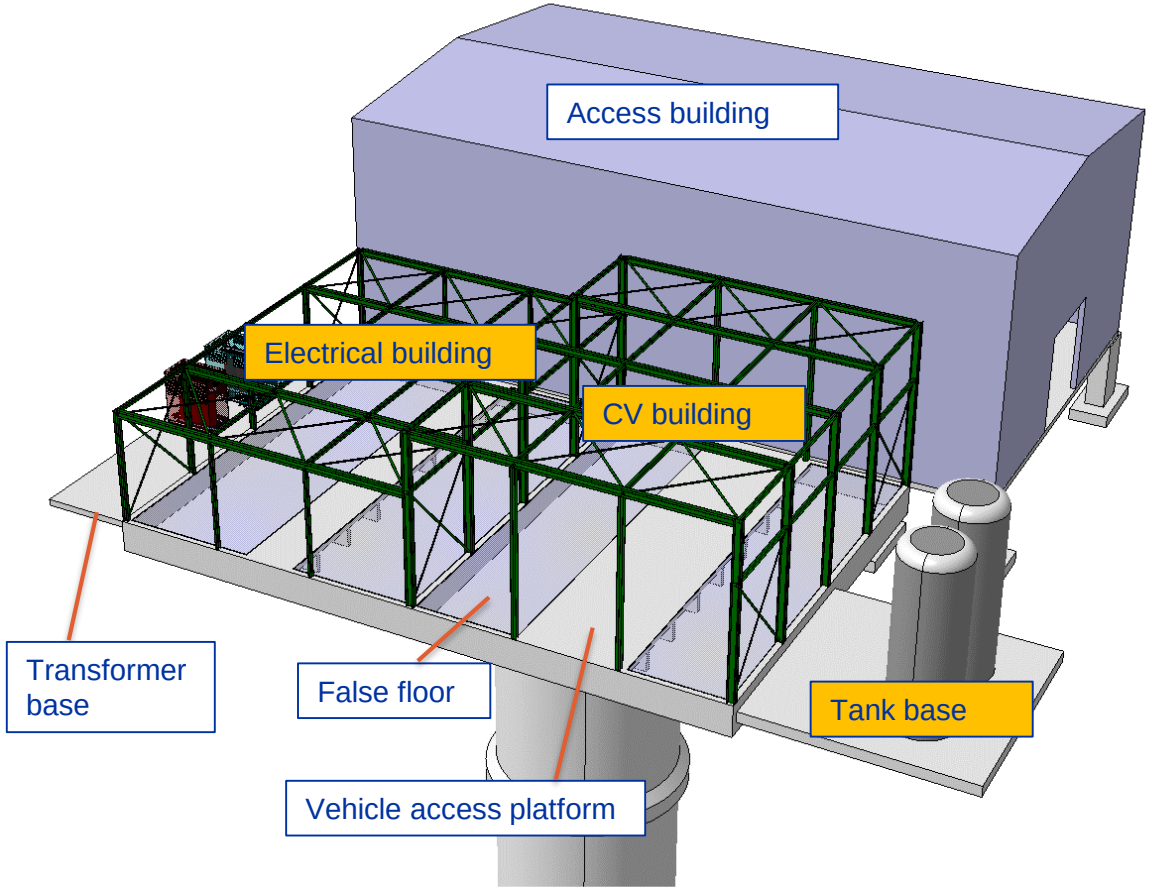
- Similar in size to SD1 and SD17
- Steel portal frame structure with concrete ground bearing floor
- 2.5 m deep false floor surrounding the shaft
- 25t overhead crane to lower the experiments to the floor level of the cavern



Option 2 – Surface buildings

Service Buildings

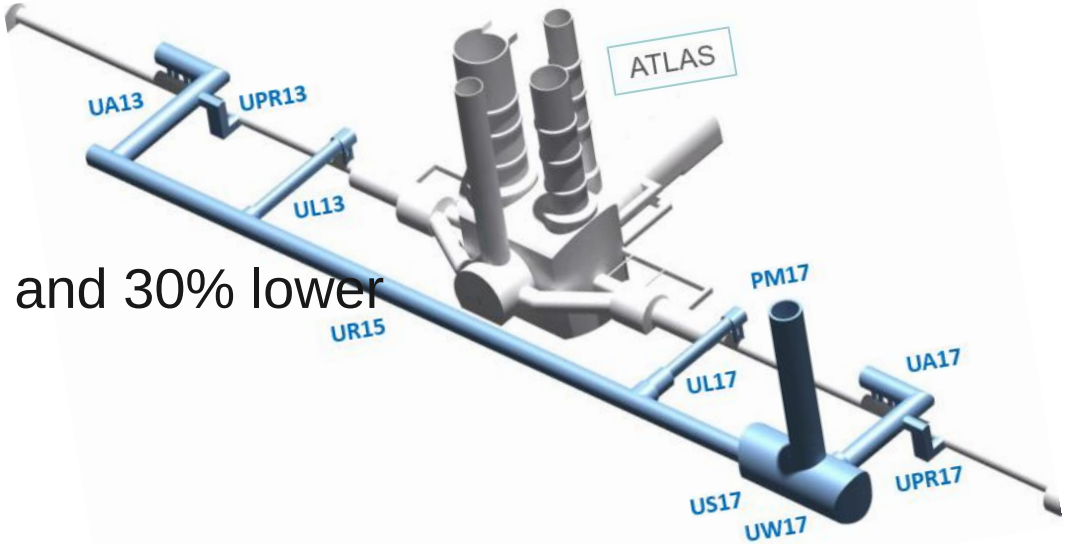
- Electrical, cooling and ventilation building adjacent to the access building
- Electrical building designed as a steel frame structure
- Similar size to HL-LHC point 1
- 1.2m deep false floor to allow the services to be distributed into the shaft with a concrete access platform for vehicles to enter the buildings



Option 2 – Costing Methodology

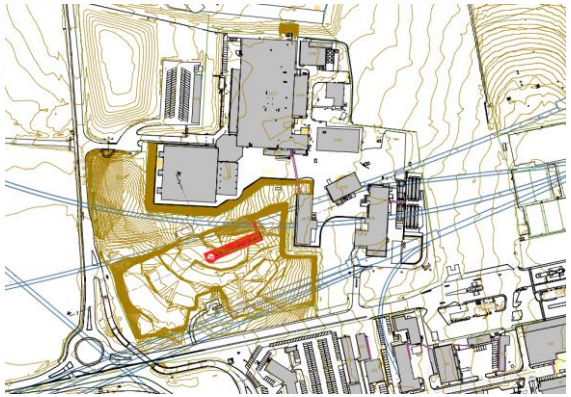
Methodology:

- Comparative Costing
- HL-LHC Point 1 as reference point
- Cost Estimate Class 4 – total could be 50% higher and 30% lower than the given estimate



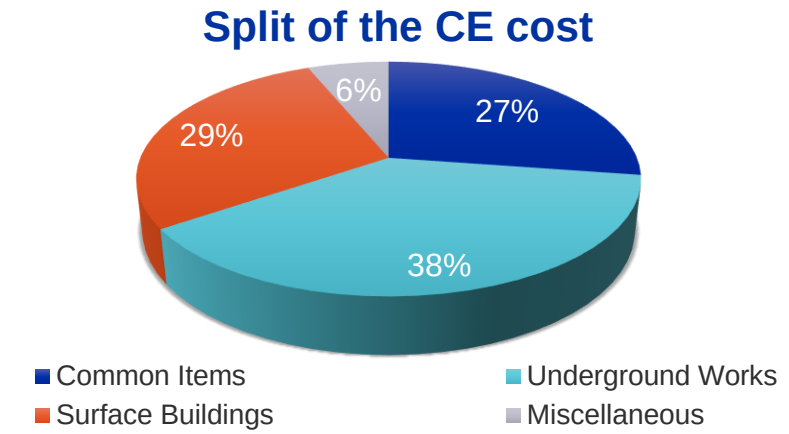
Assumptions:

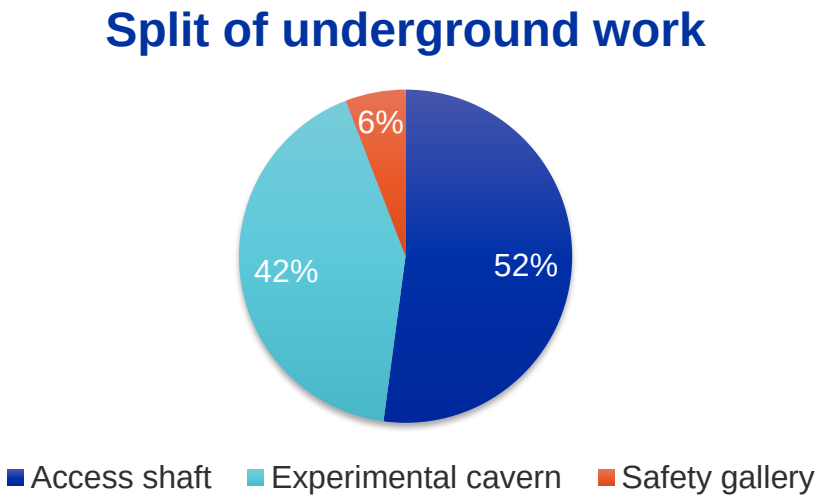
- Project Management included as % of the CE works
- Services (CE, electricity etc.) and technical galleries not included
- Environmental impact study not included
- Landscaping and excavation volume to be further studied



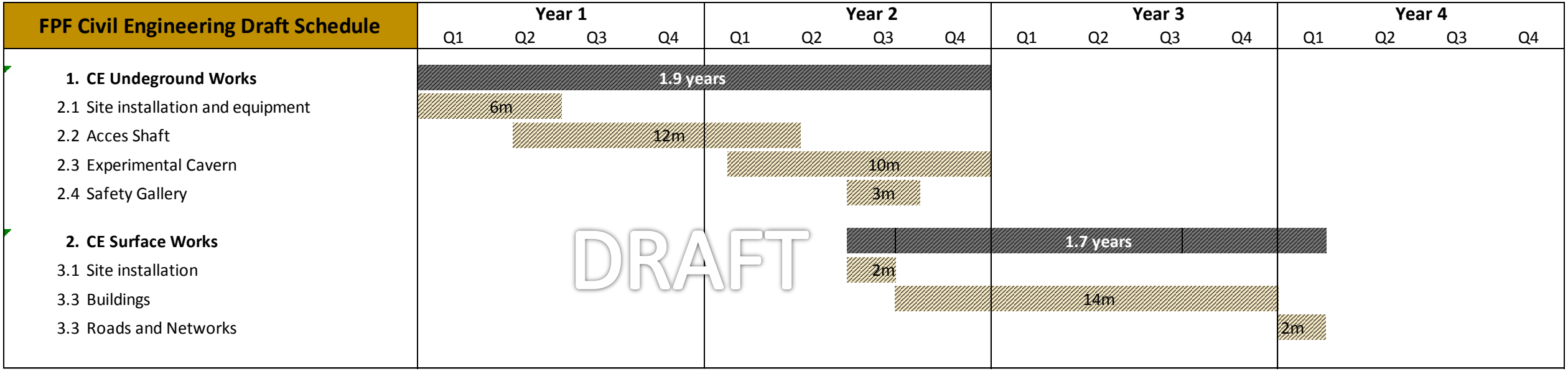
Option 2 – Very Preliminary Cost Estimate for CE

Ref.	Description of works	Cost [CHF]
1	**Common Items**	**6,356,824**
1.1	Contractual requirements (performance guarantee, insurances)	163,473
1.2	Specified requirements (Installation of barracks, Access road, Services etc.)	1,055,263
1..3	Method-related charges (Accommodations, Services, Site supervision, Project drawings)	5,054,772
1.4	Provisional sums	83,316
2	**Underground Works**	**8,859,608**
2.1	Site installation and equipment	3,689,097
2.2	Underground works	5,170,511
3	**Surface Buildings**	**6,598,589**
3.1	Generality	636,485
3.2	Top soils and Earthworks	882,051
3.3	Roads and Network	850,725
3.4	Buildings	4,229,328
4	**Miscellaneous**	**1,436,656**
4.1	Site investigation prior works	200,000
4.2	Project Management	1,236,656
	TOTAL CE WORKS	**23,251,677**





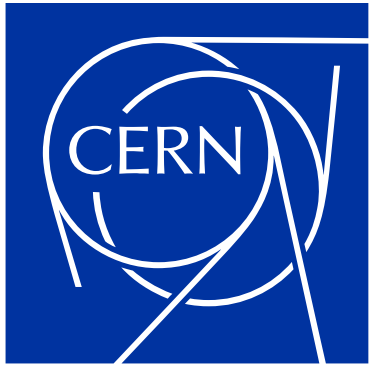
Option 2- Preliminary Schedule



Note: Pre-construction activities not included in the schedule

Next Steps

- **Develop concept design further with detailed input from Integration, Transport, CV, Cryogenic, Radiation Protection and Heath and Safety teams**
- **Decide on the option to further develop**
- **Progress with cost estimate and schedule**



Thank you!

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