FCC-ee MDI meeting

– Civil Engineering

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Cost & Schedule Study

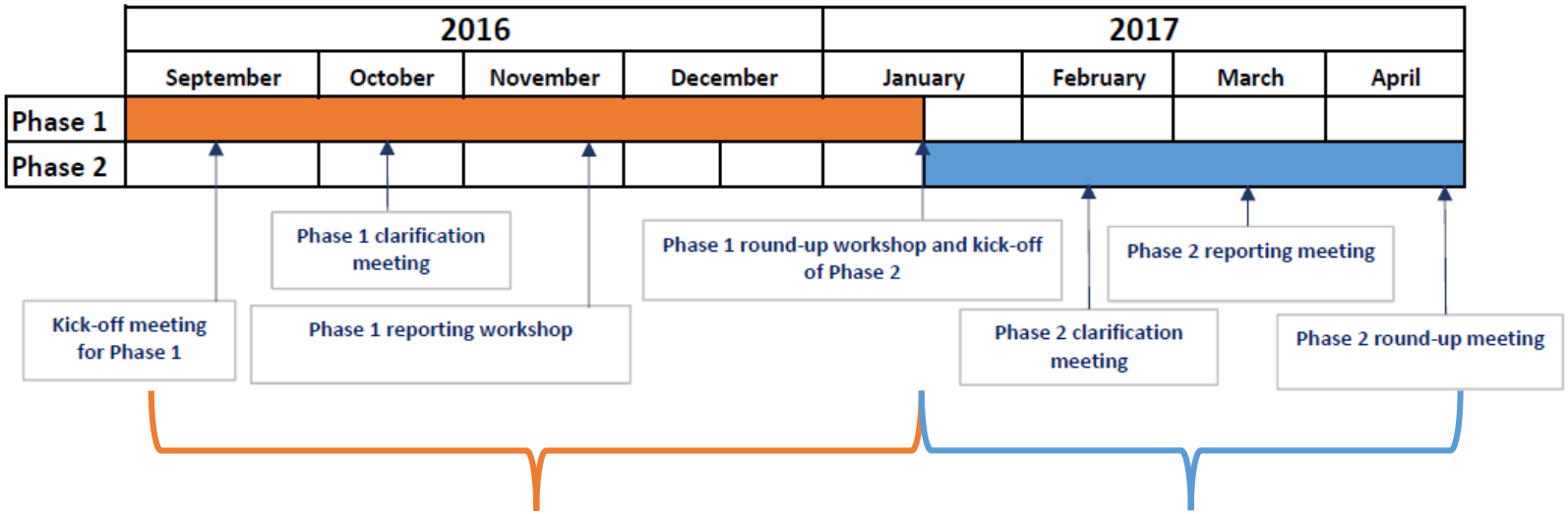
Two companies have been awarded contracts to undertake a cost & schedule study:

- ILF
  - Gotthard Base Tunnel : Cost Analysis
  - Ceneri Base Tunnel 15km tunnels
  - Brenner Base Tunnel :55km tunnels

- Geonconsult / Synaxis
  - HSR Graz, Styria, Austria: 2x33km tunnels
  - Tel Aviv LRT, Red Line : 9Km tunnels, 6.5m diameter
  - CMS shafts/caverns
  - Lausanne Railway Station, East Exit
  - Several surface buildings at CERN (eg POPS, ISOLDE)

Cost & Schedule Study

The study is split into 2 phases, the ee machine requirements are to be considered in Phase 2.



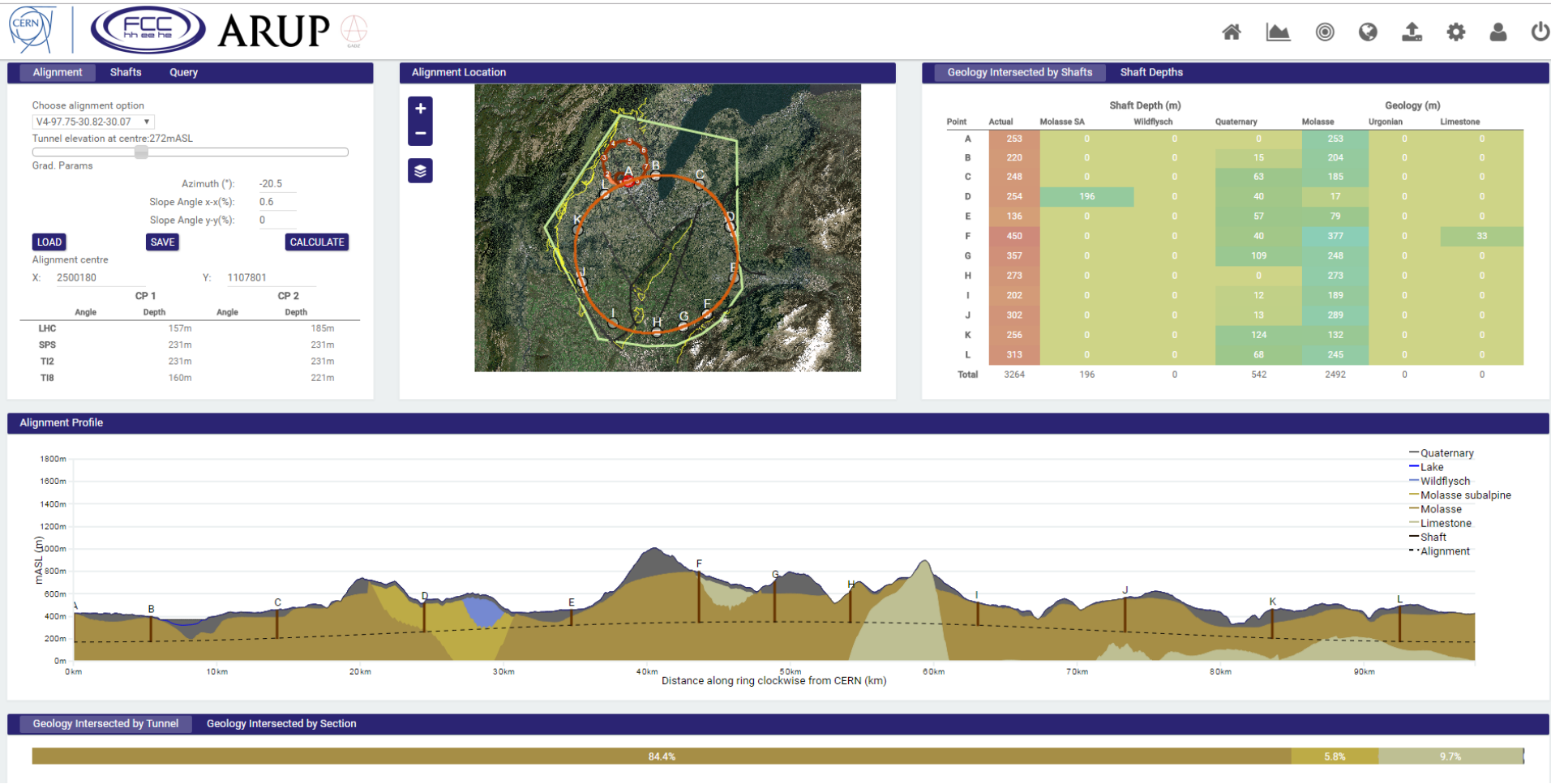
Estimate for baseline design

Estimates for options including ee machine requirements

Layouts considered for optimisation

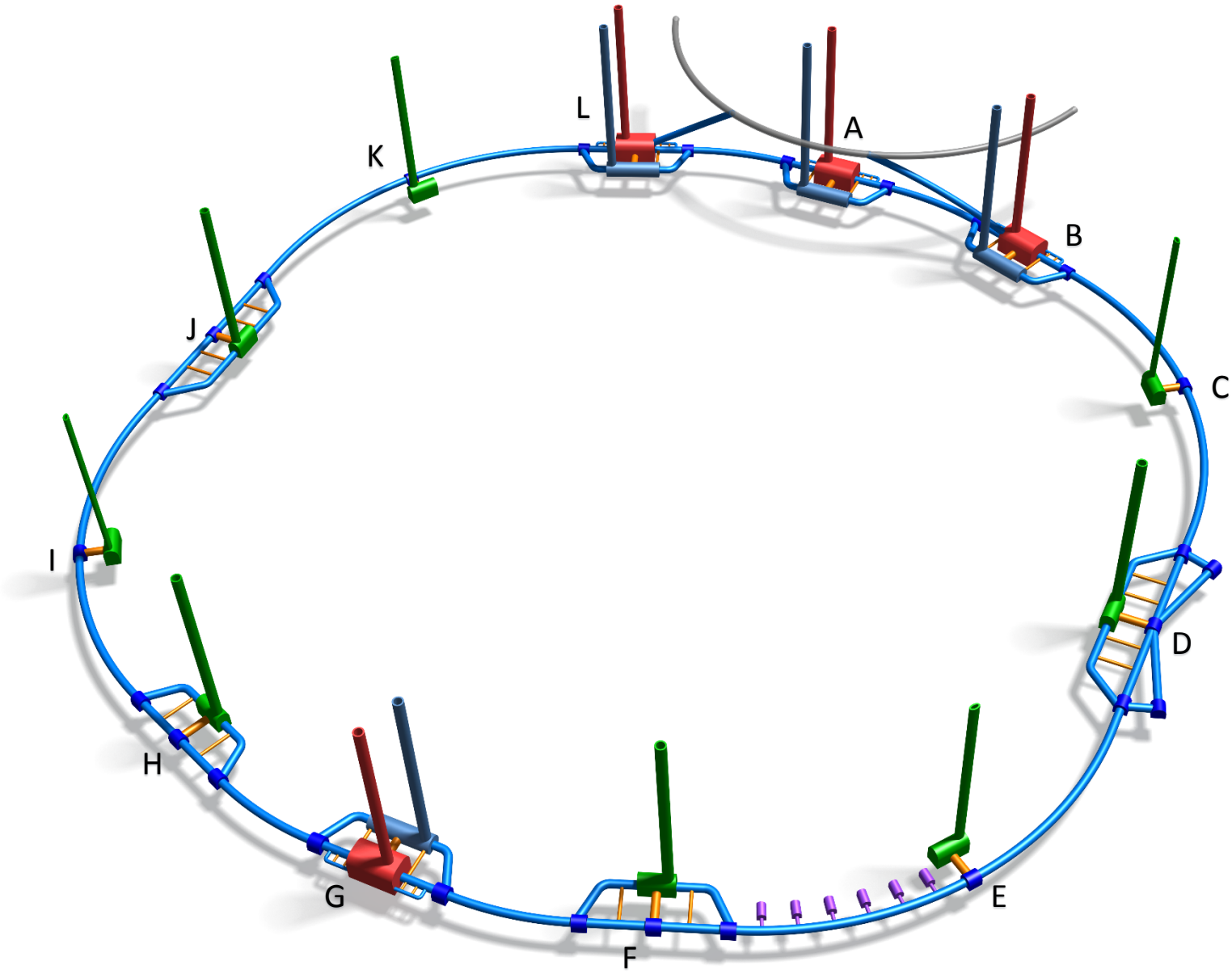
	Shape summary	Circumference	LSS A&G	LSS F&H&B&L	ESS length	Width	Height
V1	Current baseline	99.97	1.4	1.4	4.2	30.63	31.29
V2	Widest (D to J) [2.7km wider than baseline]	99.97	1.4	2.8	1.4	33.31	29.3
V3	Shortest (A to G) [2.2km shorter than baseline]	97.75	1.4	2.1	1.4	32.16	29.07
V4	[Similar width to baseline but 1.2km shorter (A to G)]	97.75	1.4	1.4	2.8	30.82	30.07
V5	Unsymmetrical	97.75	1.4	1.4 (BL) 2.8 (FH)	2.8	31.5	30.51

Geology of chosen layout

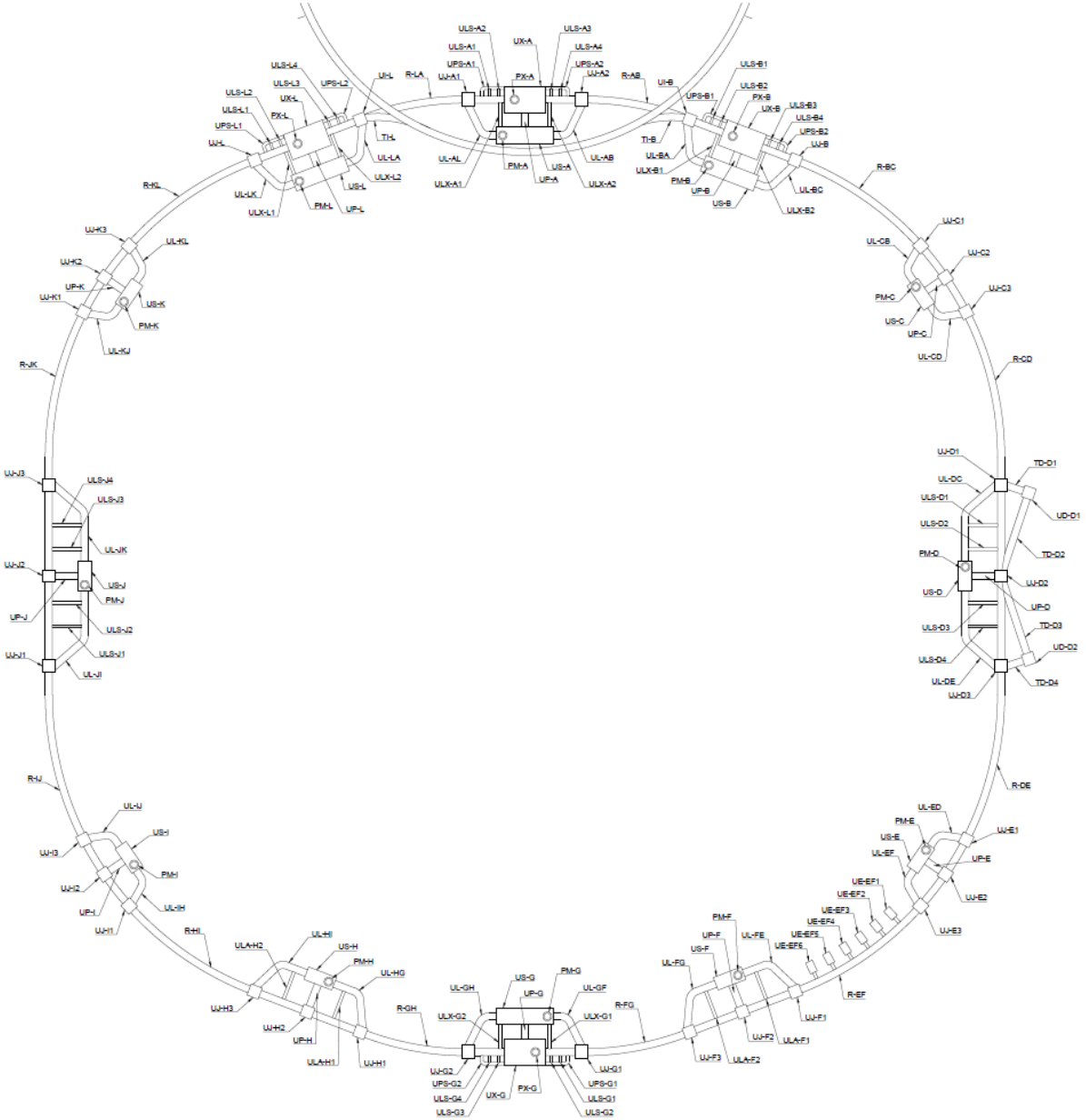


- Length = 97.75 km
- Minimises length of tunnel in the limestone, apart from the unavoidable location between H & I, only a small length of tunnel in Jura limestone.
- Avoids any tunnel length being in the moraines

Baseline Schematic



2D with naming convention

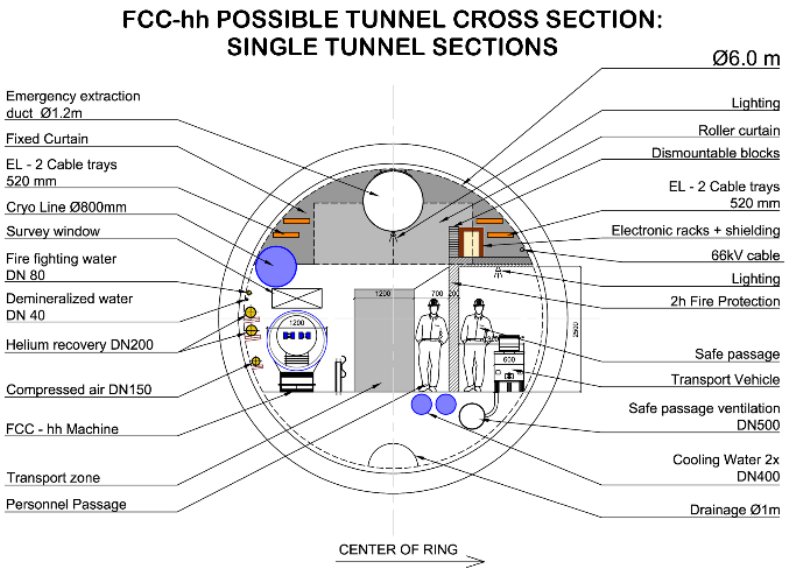


Dimensions

Structure	Locations	Dimensions
Experimental shafts	L,A,B,G	⌀ 15 m
Experimental caverns	L,A,B,G	30(w) x 35(h) x 70(l)
Service caverns at experimental points	L,A,B,G	20(w) x 15(h) x 120(l)
Regular service shafts	A,B,D,F,G,H,J,L	⌀ 12 m
Machine lowering service shafts	C,E,I,K	⌀ 18 m
Regular service caverns	D,F,H,J	15(w) x 15(h) x 100(l)
Machine lowering service caverns	C,E,I,K	22(w) x 15(h) x 100(l)
Alcoves	Every 1.5 km	6(w) x 6(h) x 25(l)

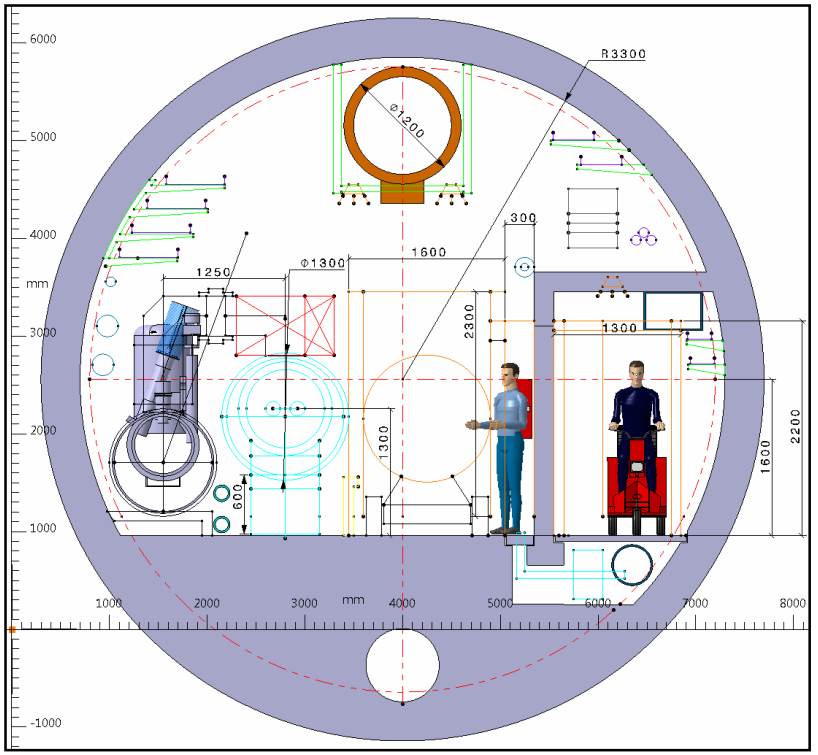
Single tunnel cross-section

6.0m tunnel



6.0m adopted for
C&S Phase 1

6.6m tunnel



03/08/2016

- BACK UP

Functional Sections of FCC-ee