

Strategy of detector solenoid construction

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Introduction

- Among the detector components to be transported to the cavern, superconducting solenoid is the biggest one, and the construction method gives impacts to other issues of ILC
 - Surface assembly hall design
 - Road, tunnels, bridges, and port for the access to the central region
 - Overall schedule
- Strategy of detector solenoid construction should be determined as soon as possible

Solenoid design

- Global parameters

	ILD	SiD
Coil outer radius [mm]	3970	3112
Coil length [mm]	7350	5586
Cryostat outer radius [mm]	4400	3392
Cryostat length [mm]	7810	6066
Cold mass [t]	168	130
Number of modules	3	2
Module length [mm]	2450	2793
Module weight [t]	56	65
Winding layers	4	6

Coil winding option 1

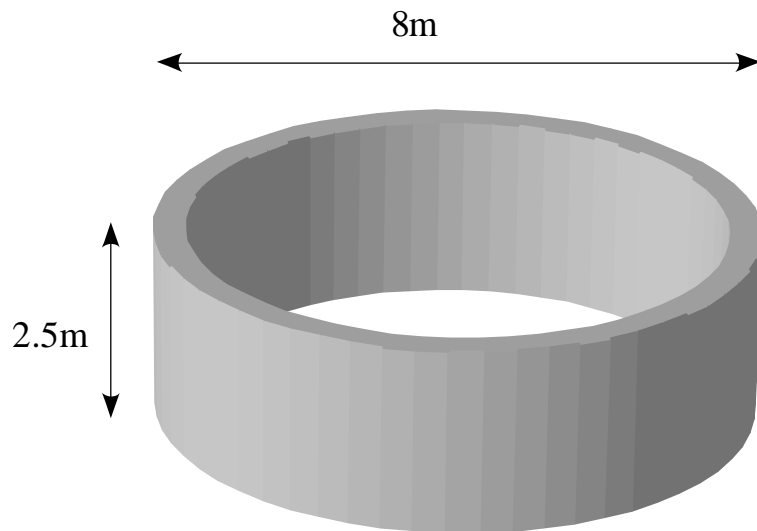
- Winding at a factory
 - Each module is made at a factory
 - Modules are transported to the surface assembly hall on site, and assembled into one solenoid
 - Merits
 - Construction of modules can be started before completion of the assembly hall construction
 - We don't need winding machine in the assembly hall → less space is needed for the assembly hall
 - Demerits
 - Module transportation issues

Coil winding option 2

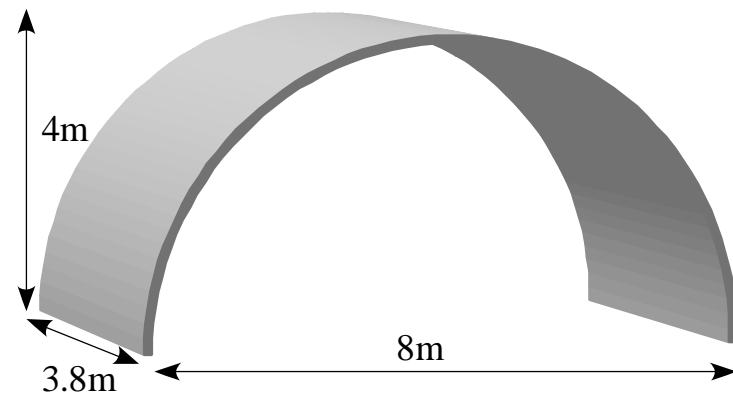
- Winding on site
 - Superconducting cable is made at a factory
 - Spools of SCC for one layer of one module (2.6km for ILD) is transported to the assembly hall on site
 - Coil winding and assembly of modules in the assembly hall
 - Merit
 - No transportation issue (a spool of SCC is much smaller than a coil module)
 - Demerit
 - We have to wait for the completion of the assembly hall construction on site

Transportation issue

- Coil modules are large ($\phi 8\text{m} \times 2.5\text{m}$ for ILD) and heavy (65t for SiD)
- Access road (and tunnels) should be wide enough and bridges should be strong enough



Solenoid module



Anti-DID module

Access to the site

- A possible route for Kitakami site (street view available for >50%)



Access to the site

- Present bottle neck will be solved by the bypass road



Access to the site

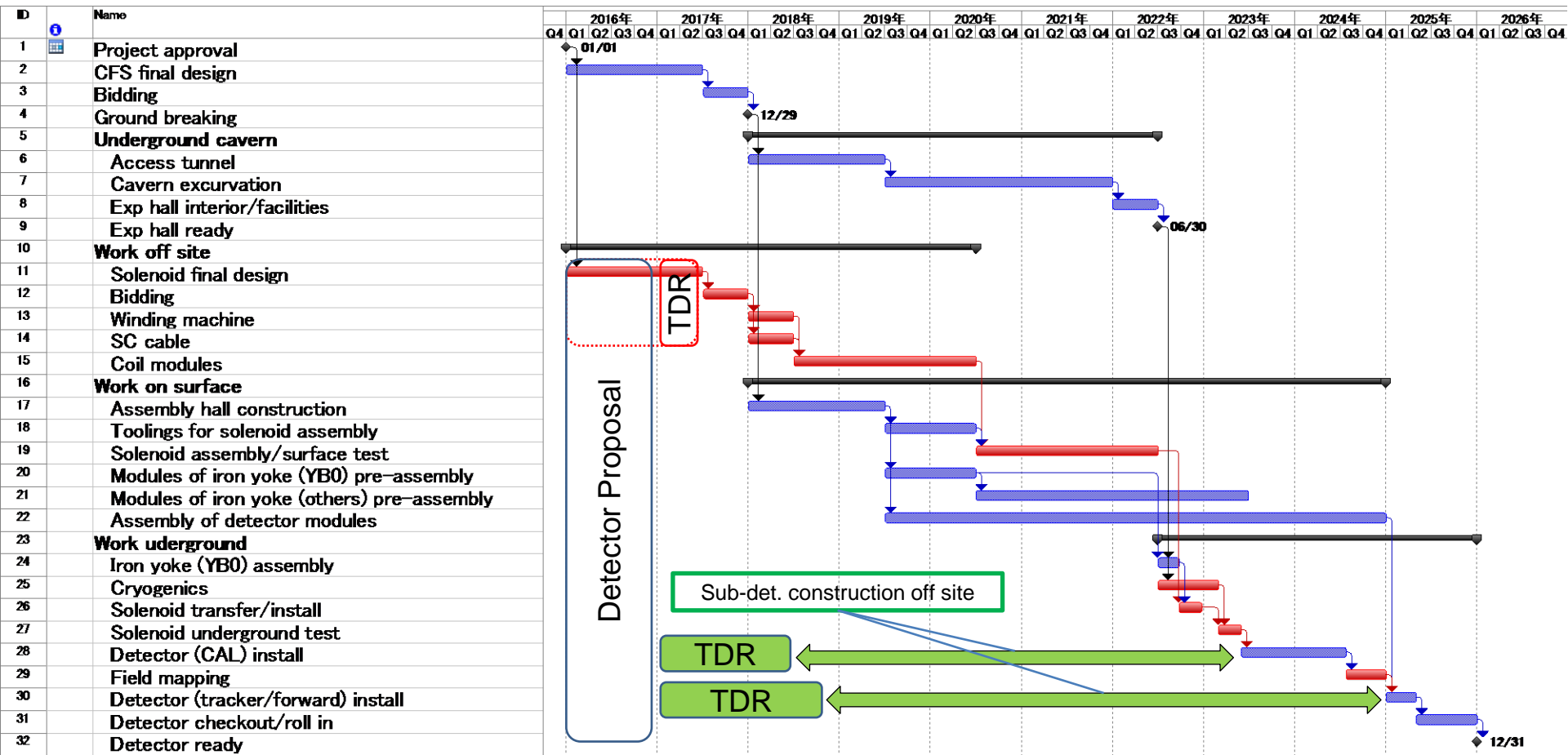
- Tunnel looks OK



Solenoid construction method

- Y.Makida and T.Okamura discussed construction of superconducting solenoid with people of a company
- Suggestions of the company
 - Both options are feasible
 - They showed a construction time line which is much longer than we expected → **Coil winding on site has a risk of delay of overall schedule**
 - Coil winding on site might require an additional machine tool to make the mandrel → **cost increase**
- They prefer coil winding at the factory rather than winding on site

A possible scenario



Conclusion

- There are two options of superconducting solenoid construction: winding on site or winding at a factory
- Both options are feasible
- Coil winding at a factory seems less risky and preferable
- Detailed dimensions of access road/tunnels should be confirmed
- More discussion on the time line is necessary