

ILD solenoid magnet construction in Kitakami-site

1. Preliminary consideration about manufacturing and assembly

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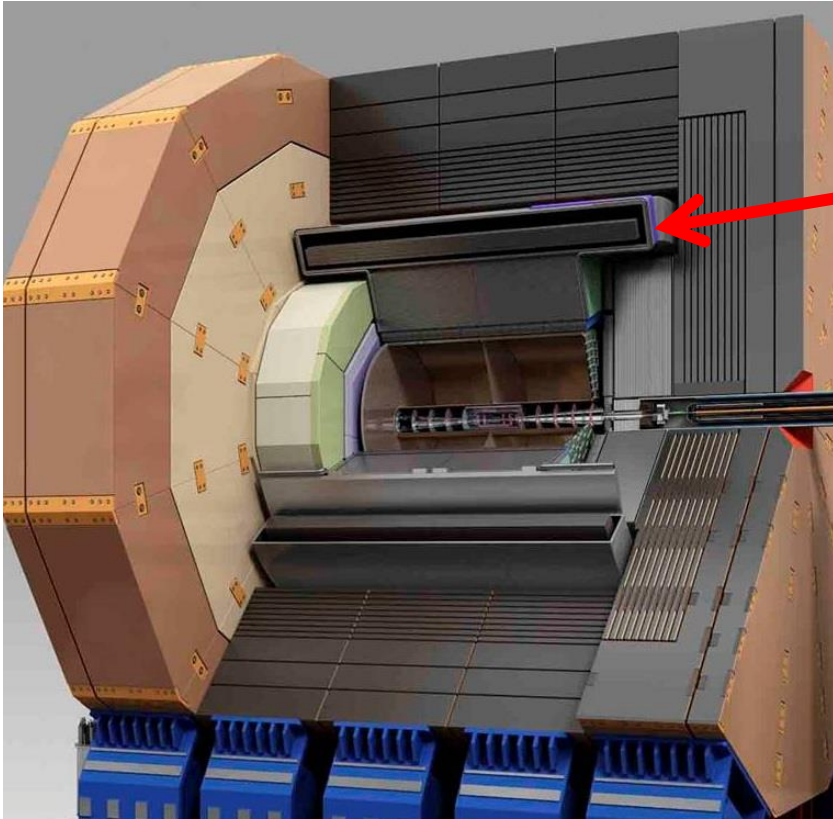
Preliminary consideration about manufacturing and assembly

Introduction

- We, Makida & Okamura and Sugimoto, discussed how to manufacture ILD solenoid with factory engineers, who have experiences with on-site manufacturing of a large superconducting poloidal magnet set in NIFS (Nat'l Ins. Fusion Science).
- We introduce the meeting minutes.
- We have started to make a specific plan of manufacturing a ILD solenoid in Japan Kitakami sites in collaboration with Tohoku Univ.

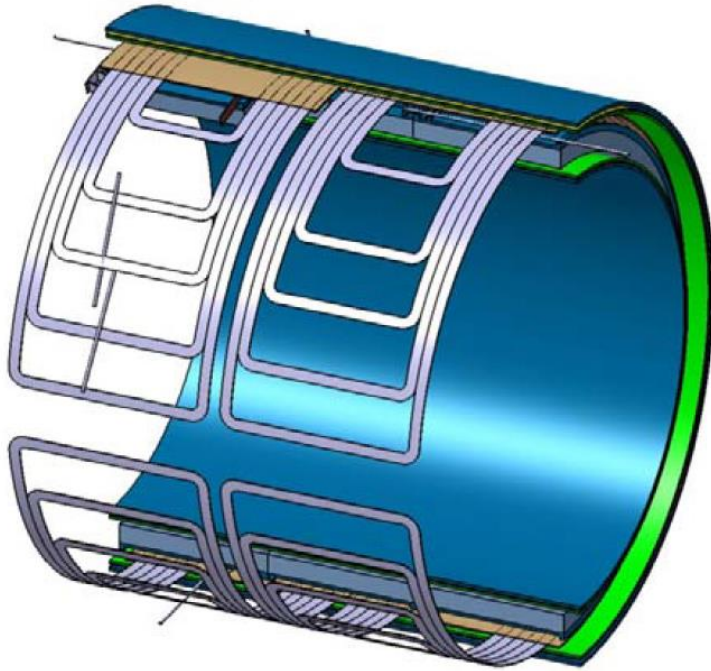
ILD magnet design (1)

Solenoid Parameter



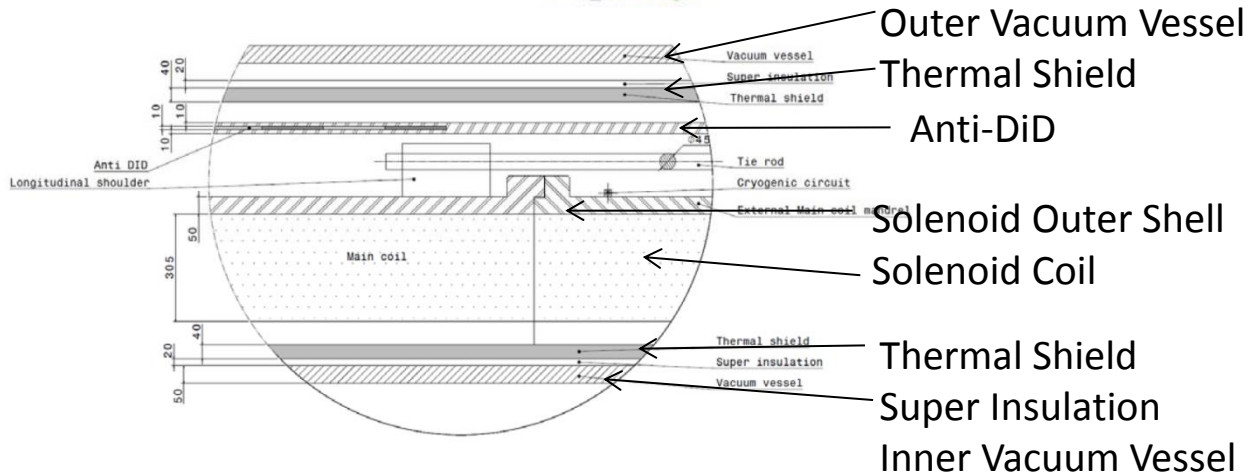
Coil I.D. (mm)	7230
Coil O.D. (mm)	7940
Coil Length(mm)	7350
Cold Mass (ton)	170
Central Field (T)	4
Maximum Field on Cond. (T)	4.6
Nominal Current (kA)	22.4
Inductance (H)	9.2
Stored Energy (GJ)	2.3
E/M (Stored Energy per cold mass)(kJ/kg)	13

ILD magnet design (2)



Anti DiD I.D. (mm)	8380
Total Length(mm)	6820
Dipole Field on Beam Axis (T)	0.035
Maximum Field on Cond. (T)	2.0
Nominal Current (kA)	615
Inductance (H)	23
Stored Energy (GJ)	4.4

Anti DiD Parameter (Ver.1) by F. Kircher & B.Parker



Cryostat I.D. (mm)	6880
Cryostat O.D. (mm)	8800
Cryostat L (mm)	7810

On-site winding or Factory winding?

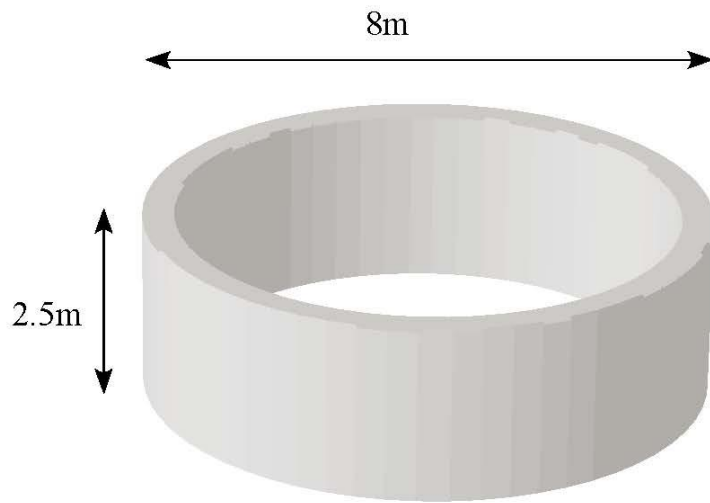
	On-site winding	Factory winding
Lead time	↓ It is impossible to complete the manufacture and performance test of the solenoid in 3 years after the completion of the assembly shop.	↑ Before the assembly shop become in service, R&D of manufacturing and fabrication of modules can start in the industrial facility.

Lead Time of Manufacture

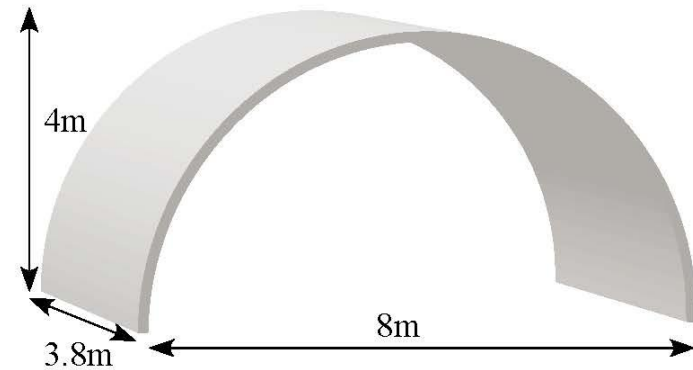
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Assembly Shop Construction													
Experimental Hall Construction													
Factory Winding													
R&D of Coil													
Module Manufacture													
Module Test													
Module Assembly													
Solenoid Performance Test													
Installation into Hall													
On-site Winding													
R&D of Coil													
Module Manufacture													
Module Test													
Module Assembly													
Solenoid Performance Test													
Installation into Hall													

On-site winding or Factory winding?

	On-site winding	Factory winding
Transportation of parts or modules	<p>↑ There is no problems for transportation of coil parts and conductors.</p>	<p>↓ Transportation of single solenoid module of $\phi 8\text{ m} \times \text{L}2.5\text{ m}$ and single anti-DID of $\text{W}4.2\text{ m} \times \text{L}3.4\text{ m} \times \phi 8.4\text{ m}$ needs special route without obstructions. The modules can be carried in with $\text{W}3.8\text{ m} \times \text{H}9\text{ m}$.</p>



Solenoid module



Anti-DID module

On-site winding or Factory winding?

	On-site winding		Factory winding	
Manufacturing machine and tools	↓	Machining of a 8 m external cylinder needs a large vertical lathe of ten M\$.	↑	It is possible to use the industrial machines and tools. Of course, a special winding machine should be developed.
Manufacturing Cost	-	Dispatching industrial engineers and technicians for several years. Large machining tools.	-	Transportation and route improvement.
<p>Anyway specific winding machine, curing pot for impregnation etc. must be developed.</p> <p>Factory engineers informed that there is small difference of total cost.</p>				

Other matters affecting cost & lead time

- Module number and size
 - In present plan, 3 solenoid modules and 4 poles constituting anti-DID are assembled in the assembly shop.
 - **Coil assembly in the factory can become possible** by other constitutions , 2 solenoid modules with 4 poles or 4 solenoid modules with 8 poles.
 - Shorter schedule and Lower cost.
 - Field re-calculation is required in the case of 4S and 8DP.
 - **More improved route is required in the case of 2S +4DP**

Examination of Land Transportation

- From Kesennuma harbor to ILC site.
- Cargo size : $\varnothing 8$ m, H 2.5 m, Mass 50 ton can be transported.
- We will discuss about cargo size of half solenoid with one dipole set with a magnet factory.
- Then we will ask the transport company whether the larger cargo can be transported or not.