



Status Report of the ATLAS Central Solenoid

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Goals of the Central Solenoid

- ◆ Providing $B = 2$ Tesla field in the ID region.
- ◆ Thinnest possible design: $X_{\text{coil}} < 0.7 X_0$ at $\eta=0$.
- ◆ Common vacuum vessel with LAr barrel cryostat.
- ◆ Stable and easy operation for long runs.

Main features of the Solenoid

- ◆ Single layer coil inside the support cylinder.
- ◆ High-strength Al-stabilized superconductor.
- ◆ Triangle supports between coil and inner warm vessel (IWV).
- ◆ Indirect cooling by forced 2-phase He flow (with thermo-siphon as back-up)
- ◆ Helium supply by ATLAS common cryogenics system.

Solenoid Coil Fabrication-1

◆ Superconductor

- 6 km completed by Furukawa Electric Co. (Mar. 1998).
- 6 km completed by Hitachi Cables Co. (Dec. 1998).
- Yield strength > 100 MPa (specification : 85 MPa).
- Conductor test welding joint, $R_{\text{joint}} < 1 \times 10^{-9}$ ohm.

◆ Coil support cylinder

- Completed by Oxford Instruments (Aug. 1998).
- Within the tolerance of < 1 mm in diameter.

Solenoid Coil Fabrication-2

◆ Coil winding at Toshiba

- Bonding strength exceeded the specification (Mar. 99).
- Test coil winding performed twice (Dec. 98, Feb. 99).
- Coil winding started in April and ended in June 1999.
- Coil curing is successfully completed in July 1999.

◆ Test cryostat (IWV, inner warm vessel)

- Design identical to the final BNL design.
- Completed and vacuum leak tested in Nov. 1999.

Solenoid Coil Fabrication -3

- ◆ Inner and outer radiation shield
 - Design completed and fabrication in progress at Toshiba.
- ◆ Triangle support
 - Completed by Arisawa Co. (July 1998)
 - Coil successfully mounted with triangle supports (Nov.99).
 - Tangential spring constant of the coil support assembly was measured to be working as predicted.
 - Axial sliding (to absorb coil contraction) was examined and a defect was found. Its design upgrading is underway.

Cryogenics-1

◆ Chimney

- Contraction of the cold part is carefully considered.
- Fabrication completed at Toshiba in Apr. 2000.

◆ Control Dewar (CD) and Valve Unit

- Magnetically sensitive parts are installed in Valve Unit.
- Designed with close contact/approval with CERN.
- Current leads of 8 kA.
- Major cryogenic active parts were made in Europe.
- Fabrication completed at Toshiba in Apr. 2000.

Cryogenics-2

◆ PLC cryogenics control system

- Constructed by the KEK cryogenics team led by Y. Doi.
- Designed with close contact with CERN experts.
- Software takes care of all possible operational modes.
- “Astonex“ of Yokogawa Electric Co.
- To be used for the Solenoid test in Japan. Its “functional logic” to be transferred to the test in CERN building 180.

Cryogenics Test of Chimney and Control Dewar

- ◆ Tests done at Toshiba in May and June, 2000.
- ◆ The goal of 8 + 2 kA operation is accomplished.
- ◆ Thermo-siphon cooling is proven to work.
- ◆ Slow-down w/o LHe supply can be done in 20 min.
- ◆ Quench propagation in full length of Chimney is 3 sec. $\ll L/R$ of the coil.
- ◆ Chimney in normal stands up 8 kA for > 90 sec.
- ◆ PLC cryogenics control system worked well.

IWV Exchange - 1

- ◆ An agreement was established among **BNL**, **KEK** and **CERN** to exchange the Inner Warm Vessels.
- ◆ Final-IWV was completed by **BNL/KHI**(Kawasaki) in conjunction with the LAr barrel cryostat.
- ◆ Test-IWV with same design built by **KEK/Toshiba**.
- ◆ Both IWVs were successfully vacuum tested.
- ◆ Final-IWV: **KHI** → **BNL** → **CERN** → **KEK** →
→ **Toshiba**.

IWV exchange – 2

- ◆ Test-IWV: Toshiba → KEK → CERN → KHI.
- ◆ CERN contracted extra works to KHI.
- ◆ Actually Toshiba moved Test-IWV to KHI and received Final-IWV at KHI.
- ◆ KEK/Toshiba mounts the coil on Final-IWV.
- ◆ BNL/KHI proceeds further construction of LAr cryostat with Test-IWV.
- ◆ Many thanks to BNL, CERN, and LAr community.

Near Future Plan

- ◆ Assembling the coil and inner/outer radiation shields on the Final-IWV (June-Sep. 2000).
- ◆ Setting up for test.
- ◆ Cooldown and excitation test at Toshiba in Nov. 2000.
- ◆ If the test is successful, the Solenoid system will be shipped to CERN in 2001.