Status Summary for the CS Model Coil Testing
April 21, 2000

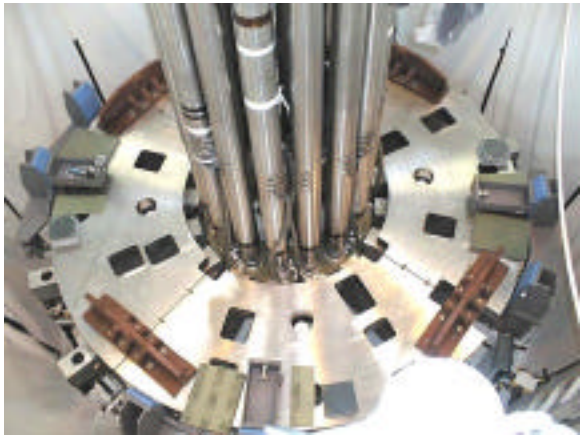
Prepared by

J.V. Minervini and R.J. Thome

Massachusetts Institute of Technology
Plasma Science and Fusion Center
Technology and Engineering Division
Cambridge, MA

CSMC Has Been Installed at JAERI and Testing has Begun

US Inner Module arrives in Japan

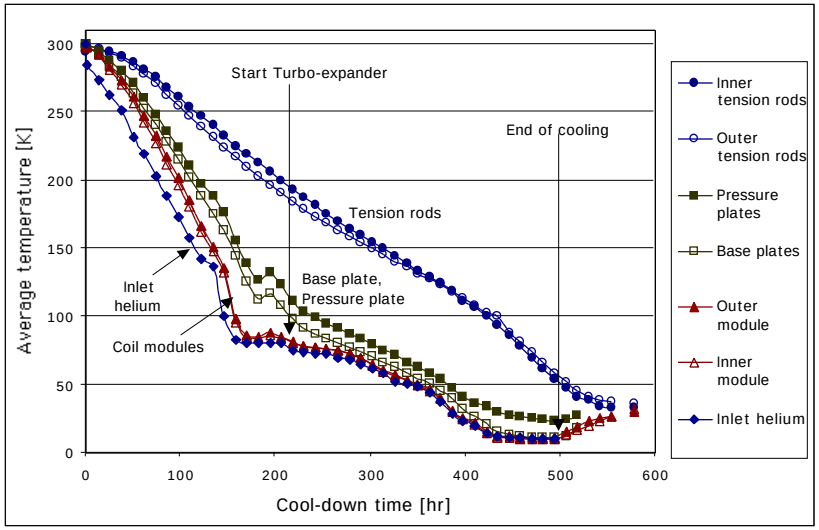


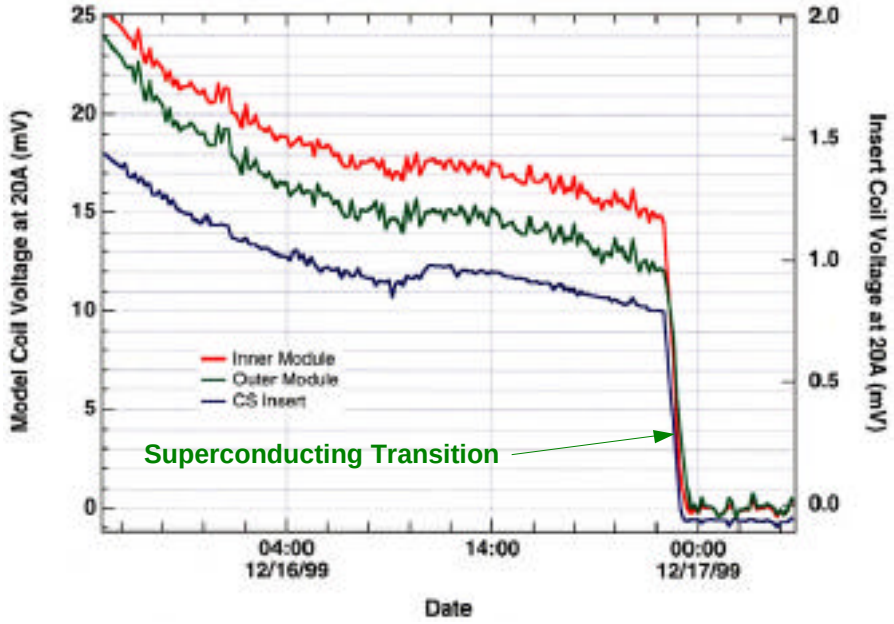
Base structure and tie rods provided by US being assembled at JAERI

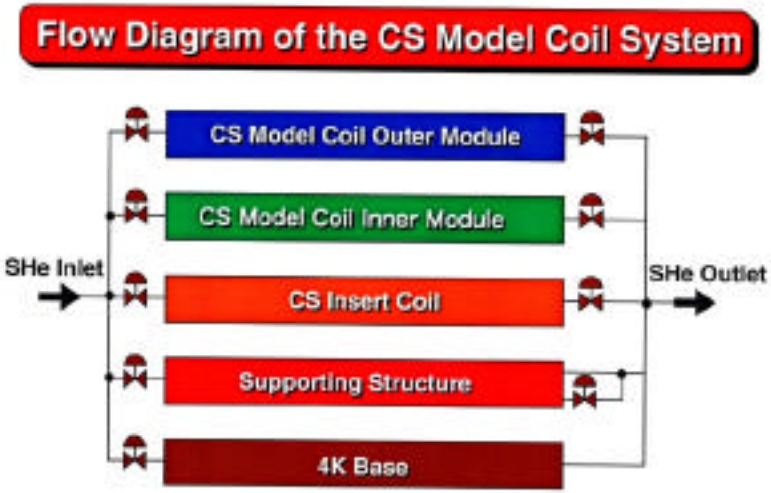
CS Model Coil Inner Module brought above the vacuum tank (June 9, 1999)

Closing of the Vacuum Tank (October 7th, 1999)

1st CSMC Cool-down was completed in December 1999

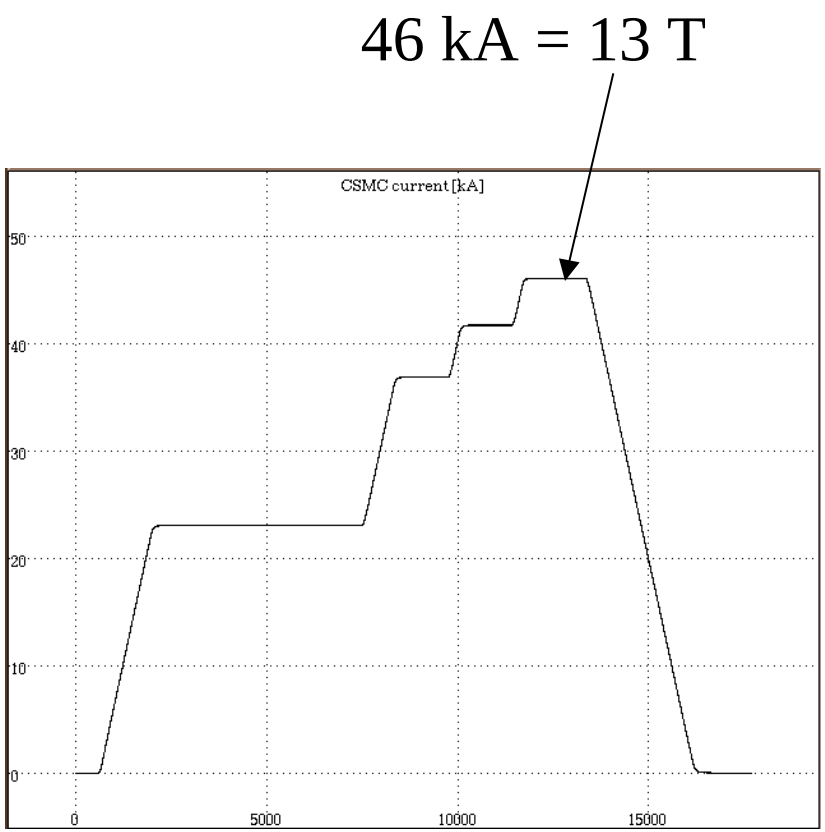




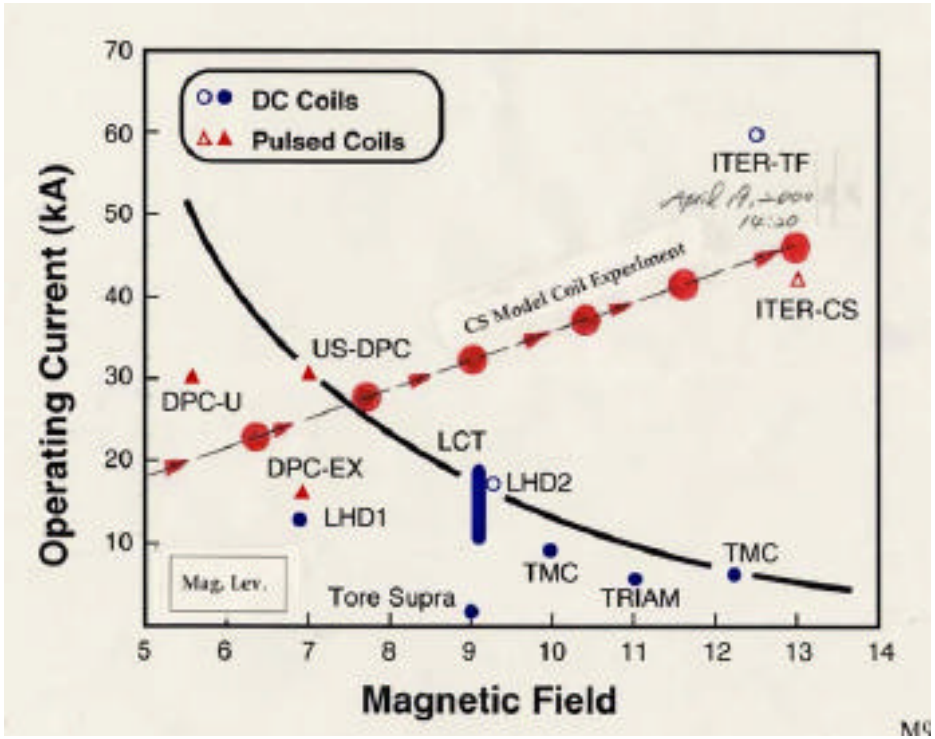


- CSMC became superconducting on 12/17/99
- As structure cooled down a helium leak developed in a structure cooling line
- Coil was warmed up to RT by February
- Leak was found, fixed and cryostat closed
- Cool-down began again March 13, 2000 and reached the superconducting transition temperature on April 4, 2000

13T Achieved on April 19, 2000



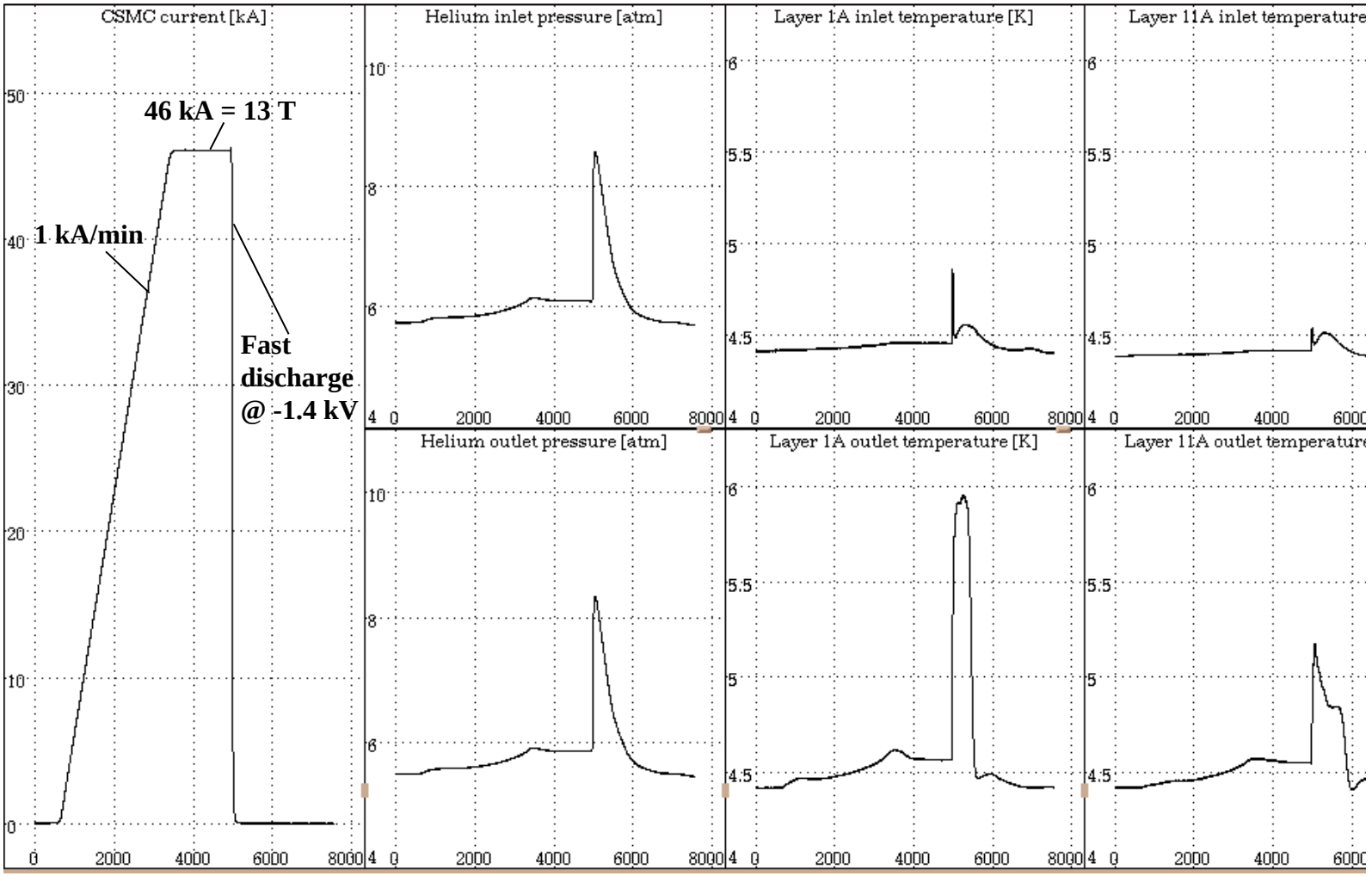
CSMC shot 26019001, taken on Apr. 19, 2000.
The up and down ramps are at rate of 1kA/min.
The stored energy at 46 kA is 640 MJ.
No training or quench was observed.



Operating Current and Field Compared with Other Systems

Plot courtesy of H. Tsuji, JAERI, Naka, Japan

Ramp to Full Current and Fast Discharge

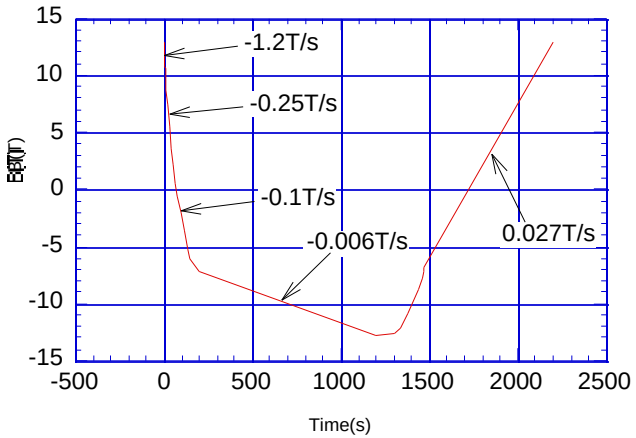


Fast discharge with L/R =18 s results in peak field rate of -0.7 T/s

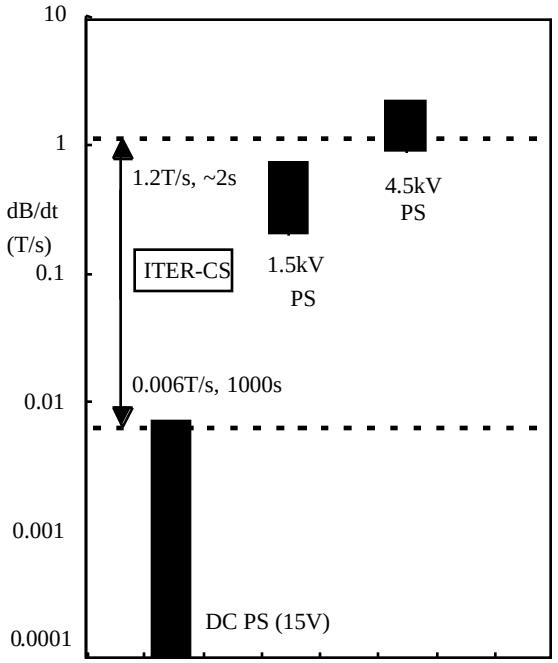
AC losses during fast discharge cause increase in helium temperature and pressure, but no quench.

Summary of Facility Capability

- **Test facility can drive CSMC beyond CS requirement**
  - **Low voltage power supplies for DC tests**
  - **JT-60 power supply for AC tests**
  - **5 kW Refrigerator and Heaters for He Temperature Control**
  - **Separate circuits for CSMC and Insert Coil**



dB/dt req'd for full size CS



Power supplies can exceed requirement

CSMC and 3 Insert Coils to be Tested

- **CSMC = JA Outer Module + US Inner Module (13 T)**
  - **Design current operation at 4.5 K (done)**
  - **Design current operation at 5.3 K**
  - **Current sharing temperature for selected layers**
  - **Pulse testing to simulate CS cycle and determine AC losses**
  - **Ramp rate limitation testing**
  - **Measurement of quench characteristics**

- **3 Insert Coils**
  - **Nb_3Sn CS-type conductor (installed now)**
  - **Nb_3Sn TF-type conductor**
  - **Nb_3Al TF-type conductor**

Only a small part of the testing is complete

Testing and Analysis are Important to Save $'s

- **1st Objective: achieve the design point for DC & AC operation**
  - **validate design methods, design criteria and fabrication processes for conductor, joints, coil and structure**
- **2nd (Major) Objective: Determine margins so as to modify design criteria and reduce cost**

Requirement: Test participation, theory and code modifications