Fermilab

SDC SOLENOID DESIGN NOTE #183

TITLE: Status Report on SDC Solenoid, September 16, 1992

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These are the viewgraphs showed by Akira Yamamoto in a presentation at the SDC collaboration meeting at the SSCL on September 16, 1992.

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SDC

SUPERCONDUCTING SOLENOID MAGNET

to be presented by

TAKA KONDO (KEK) & RICH STANEK (FERMILAB)

1. STATUS OF THE PROTOTYPE R&D AND DESIGN STUDY

2. PREPARATION FOR THE DOE REVIEW IN OCTOBER

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*to be presented at the SDC collaboration meeting at SSCL on September 15 - 18, 1992.

1. STATUS OF THE PROTOTYPE R&D AND DESIGN STUDY

1.1 PROTOTYPE MAGNET R&D

- HIGH STRENGTH AL-STAB. SUPERCONDUCTOR:	COMPLETED.
- NEW COIL WINDING MACHINE :	COMPLETED.
- PRACTICE WINDING :	IN PROGRESS.
- PROTOTYPE COIL WINDING TO BE STARTED:	IN NOVEMBER.
- ISOGRID VACUUM WALL:	IN MACHINING.
- HONEYCOMB VACUUM WALL:	IN ASSEMBLE.
- GENERAL STATUS:	TWO MONTH DELAY

1.2. DESIGN STUDY OF CRYOGENICS

- SSCL HAS JOINED IN THE SDC CRYOGENICS DESIGN STUDY.

- TWO MAJOR TECHNICAL DECISIONS REQUIRED TO PROCEED WITH THE FURTHER CRYOGENICS DESIGN:

  - CRYOGEN FOR RADIATION SHIELD : LN2 or GHE

    - Advantage of LN2 : More standard cryogenics, SSCL prefers this option,

    - Advantage of GHe : No refilling of cryogen during operation,

  - POSSIBILITY TO ELIMINATE OF CONTROL DEWAR:

    - Advantage : Simplified Cryogenics scheme,

    - To be studied: Reliable Operation in terms of Two phase He Quality.

2. PREPARATION FOR THE DOE REVIEW

2.1. OUTLINE FOR THE PRESENTATION

1. Introduction - - - Performance Requirements and Design Goal
2. Engineering Design Status
3. Prototype R & D Plan and Status
4. Fabrication Process with Flow Diagram
5. Responsibilities and Management Plan
6. Cost Estimate and Funding Source Expected
7. Schedule and Mile Stones
8. Summary

2.2 BRIEF DESCRIPTION OF THE PRESENTATION

1) INTRODUCTION

- Performance Requirements and Design Goal:

  $B = 2$ T with Transparency of $X = 1.2\ X_o$ and $\lambda = 0.25\ \lambda_i$,

  Field (integral) Uniformity of approx. 20 % in a tracking volume,

2) ENGINEERING DESIGN STATUS

- Magnet Conceptual Design Study being completed,

  Mechanical Safety : Elastic Design with Strain Level of $\varepsilon < 0.1$ %,

  Quench Safety : Maximum Temperature of $T < 100$ K after quench,

  Ic Safety Margin : I op / Ic = 50 % (T-margin = 2.5 K),

- Key Technologies developed to realize performances with safety:
  - High Strength Aluminum Stabilizer ,

    Yield Strength : Factor 3 improved ===> Saving $\Delta X = 0.4$

  - Honeycomb/Isogrid Vacuum Wall,

    Transparency : Factor 3 improved ===> Saving $\Delta X = 0.2$

  * Integrated improvement in Transparency

  $X = 1.8 - (0.2 + 0.4) = 1.2$ ===> 30 %

  - Pure Al Strip : Fast Quench Propagator

    T-max.. after Quench : ===> $T < 100$ K

3) Prototype R&D Plan and Status

- *Prototype magnet with Full Diameter and 1/4 Length*

  To evaluate:

  - Coil winding Technique in large scale inner coil winding,
  - Performance of High Strength Aluminum Stabilizer in terms of Mechanical and Quench stability.
  - Quench Safety (@ $T < 100$ K after quench).
  - Overall magnet reliability with $B = 2$ T and with $X = 1.2\, X_o$
  - Reality and reliability of large scaled Isogrid/Honeycomb Vacuum Wall.

- *Status:*

  - Conductor and Coil Winding Machine completed
  - Coil Winding will be started soon.
  - Program to be completed in another two years.

5) RESPONSIBILITIES BEING DISCUSSED FOR THE DETECTOR MAGNET

- MAJOR TECHNICAL AND FUNDING RESPONSIBILITIES BEING DISCUSSED AMONGST KEK, FERMILAB, SSCL AND SDC TECHNICAL MANAGER:

- CONCEPTUAL DESIGN :	KEK, FERMILAB & SSCL
- PROTOTYPE R&D :	KEK & FERMILAB
- MAGNET FABRICATION :	KEK
- CRYOGENICS FABRICATION:	KEK & SSCL
- POWER SUPPLY FABRICATION:	KEK & SSCL
- CONTROL SYSTEM* :	SSCL
- INSTALLATION & SYSTEM INTEGRATION* :	SSCL
- OPERATION OF THE MAGNET SYSTEM	SSCL
- TECHNICAL CONSULTATION	FERMILAB

* KEK will not be able to be responsible in local construction, installation and system integration including control system due to hardness to know local situation and compatibility in detail in the SSCL.

6) COST ESTIMATE AND FUNDING SOURCE EXPECTED

- BASIC CONSIDERATION FOR THE COST ESTIMATE

  - JAPAN WILL BE RESPONSIBLE TO PROVIDE "ELEMENTS"

    Material, Labor, tool cost   combined together

    Engineering & management cost   10%   in R & D work
                                                                     20%   in main work

    Each elements will be tested in Japan (if possible) in prior to shipping.

  - JAPAN WILL ASSIST SYSTEM INTEGRATION AND TEST AT SSCL IN

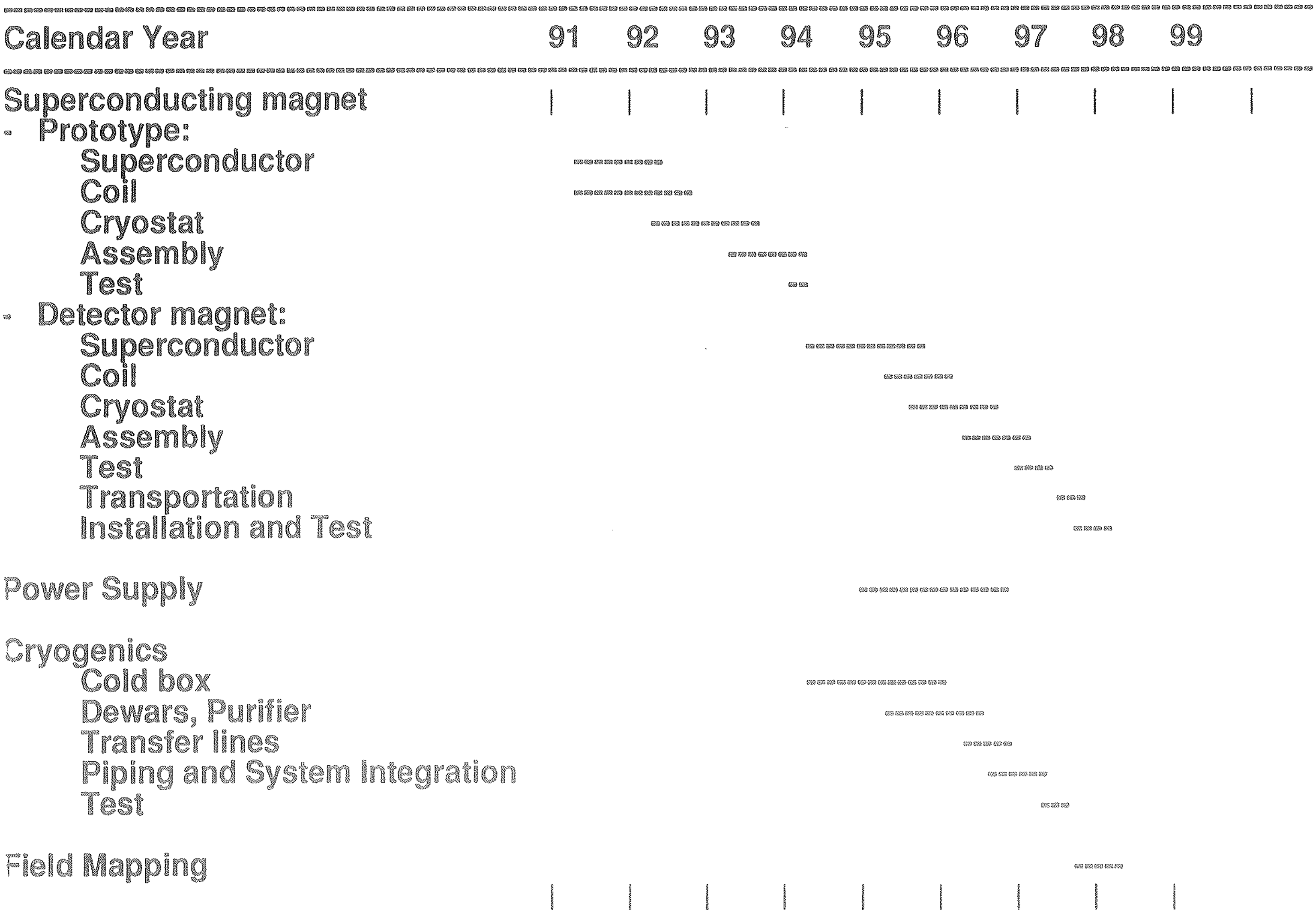
    Technical consulting and assistance in some field work (such as field joint in magnet and inspections for interface and testing the system).

6-1) COST ESTIMATE AND SHARE OF RESPONSIBILITIES IN JAPAN
[Very preliminary as of 9/12/92 - - - not yet consistent with cost break-down]

WBS	Items	SDC-US Estimate [in US-M$]	Japanese' share (@ 1$/130Yen) [%]	[in US-M$]
4.1.1.	Superconducting solenoid	29.1	97	28.1
4.1.2.	Power Supply	1.6	88	1.4
4.1.3.	Control dewar	0.6	100	0.6
4.1.4.	Control and Instrumentation	0.5	25	0.25
4.1.5.	Safety Report	0.2	0	0
4.1.6.	Assembly and test	0.5	20	0.1
4.1.7.	Field mapping	0.9	0	0
4.1.8.	Program management	0.6	50	0.3
		34.0		30.9
4.2.1.	Refrigeration system	5.6	98	5.5
4.2.2.	Transfer system	1.8	0	0
4.2.3.	Auxiliary support	0.1	0	0
4.2.4.	Vacuum system	0.5	80	0.4
4.2.5.	Safety report	0.1	0	0
4.2.6.	Assembly and test	0.2	20	0.04
4.2.7.	Program management	0.2	50	0.1
		8.5	71	6.0
		42.4	87	36.9

* System integration work (such as Installation and system integration, piping, cabling, control and bus work) is not assumed in Japanese Responsibility

7) SCHEDULE AND MILE STONE



8) Summary

- SDC SOLENOID MAGNET WILL BE DEVELOPED AS A COOPERATIVE WORK AMONGST KEK, FERMILAB AND SSCL.

- PROTOTYPE MAGNET R&D IS IN PROGRESS

  KEY TECHNOLOGIES :

  HIGH STRENGTH AL STABILIZED SUPERCONDUCTOR
  COIL WINDING
  ISOGRID / HONEYCOMB VACUUM WALL

- KEK IS EXPECTED TO BE RESPONSIBLE FOR PROVIDING SOLENOID MAGNET, POWER SUPPLY AND CRYOGENICS ELEMENTS.

- SSCL IS EXPECTED TO BE RESPONSIBLE FOR INTEGRATING AND OPERATING THE SYSTEM.

- THE SYSTEM IS TO BE READY BY THE END OF 1997.