

DATABASES FOR SUPPORT OF TESTING AND ANALYSIS OF SUPERCONDUCTING MAGNETS AT THE SSC LABORATORY*

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ABSTRACT

More than 10000 superconducting magnets for the Superconducting Super Collider (SSC) will be tested (warm or cold) at the vendors' plants and/or the SSC Magnet Test Lab (MTL). The collection and analysis of this vast amount of data is a very important procedure required for understanding the behavior of these magnets and their ability to consistently meet systems requirements. This paper describes the functions and inter-relationships of the computer databases, present and planned, from the MTL data acquisition stage through the permanent archive of magnet construction and test results. The user-friendly interface for accessing the archive database for standard analysis and reporting activities is described.

PURPOSE

The superconducting magnets for the SSC Laboratory (SSCL) accelerator complex will be provided by the Magnet Systems Division (MSD). Some of these magnets will be built 'in house', but most will be built by industrial vendors under contract to MSD. The Test Department of the Magnet Systems Division is developing a central database of SSC superconducting magnet information. The goal is to integrate all the data that is relevant for the analysis of test results into a network-accessible data management system and provide a menu-driven user interface that facilitates access to this data.

MagCom SCOPE

The central database, named MagCom, contains measurement data and configuration information for the magnets' major components (e.g. cable measurements, records of which cable was used in each coil, which coils went into each magnet), measurements and process parameters from major fabrication stages, and the test results on completed magnets.[1,2] These data will facilitate the correlation of magnet performance with the properties of its constituents and production processing. This database will not have the full set of design and as-built information that will be maintained by CAD (Computer Aided Design) and MRP (Manufacturing Resource Planning) systems, but will obtain relevant input from such systems. A subset of the MagCom database will be the equipment configuration and raw data files from the SSCL Magnet Test Laboratory (MTL).

At the present we are concentrating on importing the data for the R&D series of 50 mm aperture dipole magnets built at Fermi National Accelerator Laboratory (FNAL) and Brookhaven National Laboratory (BNL). These include 7 magnets constructed at FNAL by a team from General Dynamics and 5 magnets constructed at BNL by a team from Westinghouse. These two dipole series have the same magnetic cross section but differ in collar, yoke, and end design. There are also several quadrupoles constructed at Lawrence Berkeley Laboratory (LBL). The 5 dipoles and 1 quadrupole for the ASST (Accelerator Surface String Test) to be completed by fall 1992 have come from this set.

The data currently available include cable electrical tests, configuration highlights (cable used in each coil, coil location in each magnet), coil azimuthal size measurements, summaries of warm and cold magnetic measurements, quench run summaries, and strain gauge runs.

MagCom USAGE

The MagCom database is implemented using the Sybase relational database management system in a UNIX environment on a SUN 4/280 server connected to Internet (grumpy.ssc.gov) and DECnet (SSCSUN). It is also available by dial-up to the SSCL computing modem (214-708-9500), with specification of the server name (grumpy) after the connection is made. We have established a general user account 'mdbuser' for non-SSCL people. This is a 'restricted account' that allows only database menu access and running of the standard reports. If you wish to register for use of this account, contact us by computer mail at sysadmin.grumpy.ssc.gov or call 214-708-2928. Figure 1 summarizes the access information.

The database text menu system is accessed by typing the command 'magcom'. Some help messages and the main menu will then appear. There is a tree of menus that allow selection from our standard reports. (See Figures 2 and 3) The user is given the option of seeing the screen display of the selected report, writing a file copy of the report, or both. The file version is written to a directory called 'results' in the login account (either mdbuser or the user's own grumpy account), and can then be transferred by ftp to the user's host computer system for printing. Our general help documents are available through the magcom menu.

We are developing a graphical user interface (GUI) based on X-windows, with pull down menus that will allow 'point and click' selection of data to be displayed in tabular or plot format or written to a file for input to analysis programs.

We will load production and testing data into the database as soon as it is released by the magnet builder, so that MagCom can serve as the source for all public data. We do not allow the magnet vendors to enter data directly into the database or archive; data files can be sent on magnetic tapes or transferred over the network to a special directory on our server (grumpy). A table-driven input procedure will process the file, checking for problems. If the data appears to be in correct form, it will be loaded into the database and the file will be stored in our archive system. Standard programmed procedures will also be used to run the analysis programs that generate the tabular reports and graphs used by the magnet analysis staff.

MTL PLANS

The Magnet Test Laboratory (MTL) will be required to extensively test thousands of superconducting magnets prior to their installation in the Super Collider. It has been decided to use an object-oriented, tool-based approach to MTL software design, with the tools based on industry standards whenever possible. The hardware platform is a networked system based upon SPARC architecture workstations and servers. These machines are off-loaded from real-time tasks by a VME based front-end system, controlled by a Motorola MV147 card with a 25 MHz 68030 microprocessor. The operating system is UNIX, and the prime programming language is ANSI standard C, with C++ being used for some graphical interface and data design. We intend to provide a FORTRAN interface library, particularly for the development of post-test applications.[3]

MTL test operations will depend upon databases of configuration information for the test stands and previous test results for the magnets under test. These will be permanently archived in the MagCom system, but will be copied to a local caching system during tests, as there may be unpredictable delays in retrieving data across the network.

The configuration database will contain calibration data and information on the availability of equipment. For each test, records will be kept specifying the instrumentation being used, gain settings, the calibration files that pertain, etc.

The MTL magnet test results that will be permanently archived in the MagCom data system include the raw data files, analysis results, and a reference to the configuration of the test stand equipment when the test was run. The results of previous tests on a magnet, whether at MTL or at the vendors, will be retrieved from MagCom for comparison during tests.

REFERENCES

1. Ball, M.J. et al., "The Magnet Database System", presented at the International Industrial Symposium on the Super Collider, New Orleans, LA, USA, March 4-6, 1992 (SSCL-Preprint-53, to be published in Supercollider 4).
2. Baggett, P., et al., "The Magnet Database System", Supercollider 3, M. McAshan, ed., Plenum Press, New York (1991).
3. Lambert, J.D. et al., "Software Design Philosophy for the SSCL Magnet Test Laboratory", presented at the International Industrial Symposium on the Super Collider, New Orleans, LA, USA, March 4-6, 1992 (SSCL-Preprint-47, to be published in Supercollider 4).

Access:

- (1) grumpy.ssc.gov on Internet
access by
> rlogin grumpy.ssc.gov
or > rlogin 143.202.112.10
- (2) SSCSUN on DECnet
access by
> SET HOST SSCSUN
- (3) modem dial-in to SSCL
computing at 214-708-9500;
specify server name (grumpy)
after connection

General User Account : mdbuser
(UNIX is case sensitive)

Register with: sysadmin@grumpy.ssc.gov

MagCom menu access after login:
> magcom

Fig. 1: MagCom Access Information

SSC Superconducting Magnets
MagCom Database Main Menu

1. Data by Cable ID
2. Data by Coil ID
3. Data by Magnet ID
4. Strand Data
5. Documents
6. Help files
- X. EXIT

To get a simple listing of all cables, coils,
or magnets, pick the configuration summary
from the corresponding menu.

Enter your selection:

Fig. 2. MagCom Main Menu

MAGNET MENU

Summary reports - start at specified
magnet ID, print in landscape mode;

Detail reports - for one specified
magnet ID, print in portrait mode.

1. Configuration summary: magnet -
coil - cable (portrait mode)
2. Cable properties summary
3. Configuration detail
4. Coil and cable detail
5. Magnet features menu
6. LBL dipole menu
7. Quench summary
8. Magnet instrumentation menu
9. Koldweld summary
10. Koldweld detail
11. Transfer functions detail
12. Collared coil mole meas. detail
13. Magnet mole meas. detail
14. RRR from Instr. Data Book
15. Coil azimuthal meas. summary
16. FNAL RRR meas.avg.,warm & cold
17. Coil azimuthal meas. detail - dipole
18. Coil azimuthal meas. detail - quad
19. FNAL cable/coil summary
(landscape mode)
- X. Exit to main menu

Enter your selection:

Fig. 3. MagCom Sub-menu: Magnets

