

§1. Refresh Plan of DC Power System of LHD Superconducting Magnet

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The LHD has six superconducting coil set to and six dc power supplies are used to excite these coils. Fig. 1 shows a circuit diagram of the IV power supply that is one of the power supplies. All power supplies are controlled with a computer system shown as Fig. 2. The base system that are steady state power supplies and main part of the computer system were constructed from 1994 to 1995. In 2007, pulse power supplies are installed for IV and IS coils to enhance the current response, and the motor driven polarity exchangers, which one is also shown in Fig. 1, were made in 2009.

Although the power supplies are enhanced, the original control devices that are programmable logic controller (PLC) installed in thyristor rectifier, control circuit that are installed in the thyristor rectifiers and computer system have been continuously used. Although this power system operates 20 years without sever problem, some components became overage and it became difficult to maintenance. For example, the dc filter in the main circuit uses many electrolytic capacitors but they deteriorate with time. The real time computers were built based on VME bus system but many modules including CPU board used in the system were discontinued.

Therefore we plan to replace the computer system and refresh some part of power supplies from 2013 to 2015. When we replace the computer or PLC, the softwares on the new control system are transferred from current system because they have enough reliability.

The main devices used in the current computer system and new computer system are shown in table 1.

The schedule of refreshment is as follows;

In 2013, PLC in the thyristor rectifiers are replaced. The new hardware of real-time computers and plant simulator were constructed.

In 2014, the hard ware of voltage monitor computer, interface between real time computers and thyristor rectifiers, softwares running on the real time computers will be constructed. At the same time, the electrolytic capacitors used in dc filter will be replaced.

And in 2015, supervisor computer and the software will be built and whole of new computer system will be built. Also the main control circuit in thyristor rectifiers will be replaced and some refreshment for some small modules used in thyristor rectifiers will be refreshed at this time.

With these renewal program, we expect that we can continue operating for future ten years with this DC power system.

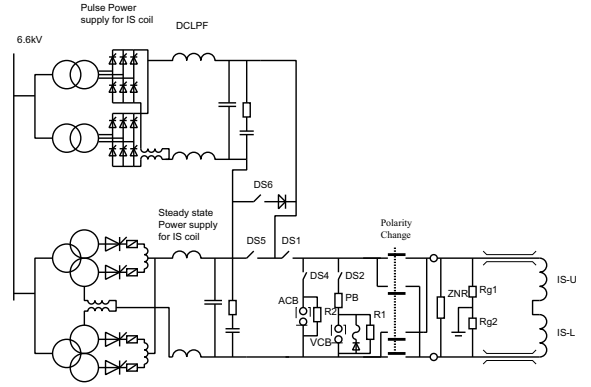


Fig. 1: Main circuit of DC power supplies for IV coil.

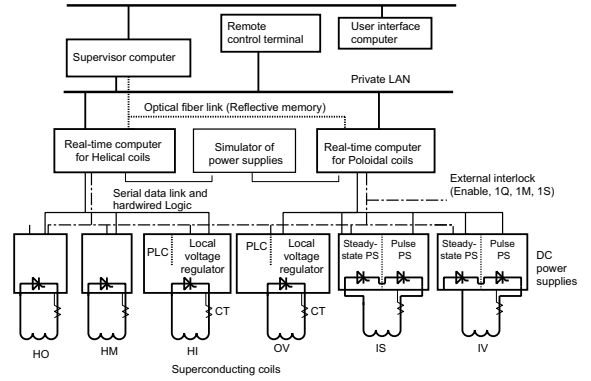


Fig. 2: Computer control system of the DC power supplies for LHD superconducting magnet.

Table I: Main component of computer system

	Current system	New system
Real-time computer		
Computer	VME	Compact PCI
Flame	MIPS R4600	Power PC
CPU	(150 MHz)	(1.4 G Hz)
Main memory	128 M byte	1 G byte
OS	VxWorks	VxWorks
LAN	10 base	1000 base
Supervisor computer		
CPU	Ultra SPARC	Intel CPU
OS	Sun OS	Linux
Main Memory	512 M byte	> 2 G byte
LAN	100 base	1000 base
Data connection	Reflective mem. 600 M bps	Reflective mem. 4.2 G bps