

§39. Design and Construction of the Central Control System by the LHD Control Group

Yamazaki, K., Yamaguchi, S., Nishimura, K., Yamada, H., Watanabe, K.Y., Sakakibara, S., Shoji, M., and the LHD Control Group

The LHD Control Group is charged in designing and constructing the following major systems; central control system, man-machine system, control LAN, plasma control system, control data acquisition system, electromagnetic measurement system, magnetic surface measurement system, plasma production system, and the uninterrupted power supply (UPS) system for the LHD Control Building. Several outlines related to these systems are described in the separate sections of this annual report.

Among the above-mentioned control systems, one of the most important systems in LHD is the central control system called COCO (Central Operation and Control, or Chu-Oh Control) system (Fig. 1) which is now under design and construction. This COCO system is divided into three parts; the Central Control Part, the Torus Instrumentation Part and the Utility Part.

The Central Part is composed of Central Console, Central Control Board, Central Control Computer (Work Station), and the Timing Board. On the other hand, the Torus Instrumentation Part

is composed of the Torus Monitor Board and the Protective Interlock System. The COCO system and other sub-control systems are connected by ATM/FDDI Control network cables, control interlock hard wires and timing optical fibers.

The LHD machine operation is expected to be classified into six modes; shut-down mode, facility operation mode, vacuum exhaust mode, coil cooling mode, coil operation mode and plasma experiment mode. These modes are defined for clarifying the personnel entrance permission with respect to electricity and vacuum, the magnetic field hazard and the possible radiation exposure. Its sequential control is carried out by the COCO central sequencer and timing system. For simplifying the construction of a reliable COCO system, we will firstly use hardwired connection between the COCO system and the sub systems. Especially, the protective interlock system requires hardwires for simplicity and reliability. In addition to this, we will add a flexible man-machine system in the COCO system.

The LHD superconducting magnet will be operated for about 10 hours per day, and the number of short-pulsed plasma operations with 10 second duration will be typically 50 - 100 shots per day. Different from the present conventional pulsed fusion machines, the LHD machine is going to be operated in steady state (more than 1 hour pulse length) and requires interactive control of the machine and the plasma, especially in the plasma control system.

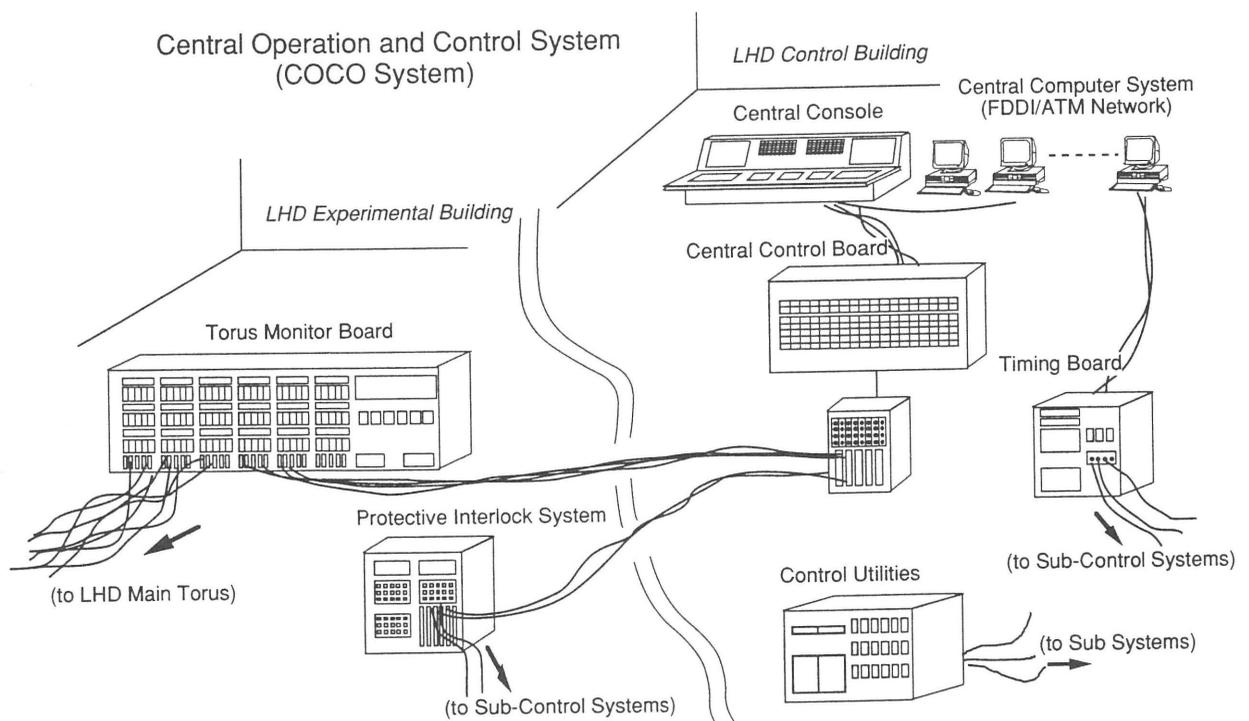


Fig. 1 LHD COCO System Architecture