§32. Central Control System for LHD Experiment

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The LHD Control Group is charged in designing and constructing the following systems; central control system, man-machine system, control LAN, plasma control system, control data acquisition system, electromagnetic measurement system, magnetic surface measurement system, gas puffing system and pellet injection system. Each outlines related to these systems are described in the separate sections of this annual report.

As for the LHD control system, we started the construction of the main unit of the Central (Chu-Oh) COntrol System (COCOS) in April based on the design philosophy;

(1) flexibility for the physics experiment,
(2) reliability for the large machine, and
(3) extensibility for the central control system.

The design philosophy (1) requires human-friendly man-machine interface and advanced real-time plasma control systems, the item (2) requires reliable protective interlock systems with hardwires, and the requirement (3) leads to the distributed and modularized control/ instrumentation systems.

The COCOS is composed of the central control unit (central console, central control board, central control computer, and the timing board), the torus instrumentation unit (torus instrumentation computer board and protective interlock board), the LHD Man-machine System(LMS), the control data acquisition system, the LHD experimental LAN and the uninterrupted power supply(UPS) systems. These systems use a variety of computers such as UNIX engineering work station, Windows-NT personal computers, VME computer boards with real time OS (VxWorks) and programmable logic controllers.

The design of the COCOS had been started almost 10 years ago, and at that time the large-sized processing computer was considered as a main control computer, and later changed to several engineering workstations. Now, some client-server systems by Windows-NT are added for control and data acquisition. These central systems and more than 50 sub-systems are connected by FDDI network.

The present mission of the LHD project is to produce a first plasma as soon as possible. The COCOS central console and central board with programmable logic controllers directly connected with hard wires will be used for this initial purposes. Especially, the protective interlock system requires hardwires for simplicity and reliability. In addition to this, we can use the flexible man-machine system LMS in the COCOS.

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.

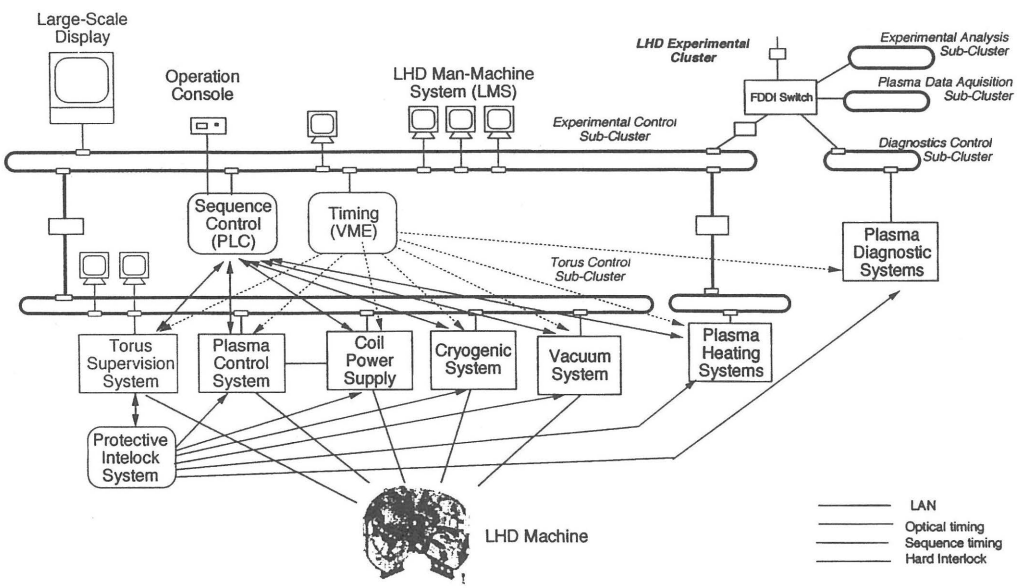

Fig.1 LHD Central Control System (COCOS)