The Design Status of CSNS Experimental Control System

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Introduction

To meet the increasing demand from user community, China decided to build a world-class spallation neutron source, called CSNS(China Spallation Neutron Source). CSNS construction is expected to start in 2011 and will last 6.5 years. The control system of CSNS is divided into accelerator control system and experimental control system. CSNS Experimental Control System is based on EPICS architecture。

The main tasks of experimental control system includes:

- •providing the global communication platform for the whole target station and instruments;
- •providing global monitoring and database service;
- •providing TPS(Target station Protection System);
- •providing interface to the front end controls ;
- •fan-out of T0 related signals to where needed;
- •interface with the accelerator control system with their cooperation;
- • coordinating the PPS work for the target station and instruments;
- •local control tasks as required..

Key Issues and Difficulties

◆**Stability and reliability of the key path and devices**
system self-check is a way to stability and reliability. All sub system is required to have self-check ability, and the result of self check can be displayed on the center control room. All the status must be stored in database for trouble shooting in the future.

◆**System scalability, maintainability and configurability**
For long term running, system scalability, maintainability and configurability are main issues that we should be focused on.

◆**Budget**
For any system, budget is always the main limits.

◆**Interface with the front end control**
In instruments, there are always many types of devices for different purpose. So, how to integrate all these devices to the whole control system is a big difficulty in front of us.

System architecture

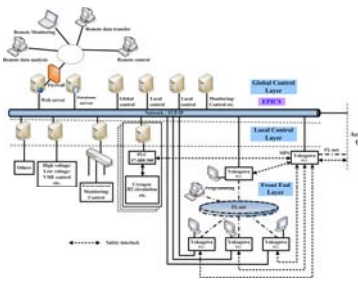

Figure 1: System Architecture

CSNS Experimental Control System includes
✓global control layer (GCL),
✓local control layer (LCL)
✓front end layer (FEL)

Global control layer and local control layer are based on EPICS.

Function test system

A function test system has been established with the heavy water control simulation involved in.
Function test system will be upgraded to developing system in Beijing and Dongguan. VNC, DNS ,VPN, network, EPICS software, database, archiving and others have all been tested in function test system.

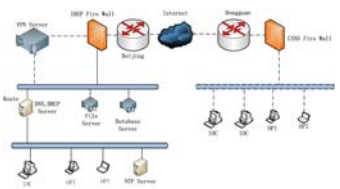

Figure 2: Structure of function test system now and future upgrade. Solid line means what we have already implemented. Dash line means the segment will be build when lab in Dongguan is ready.

System Design

➢**EPICS**

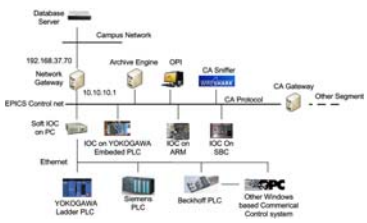

Figure 3: EPICS system architecture. In this figure, all components have been integrated into EPICS are shown.

➢**TPS**

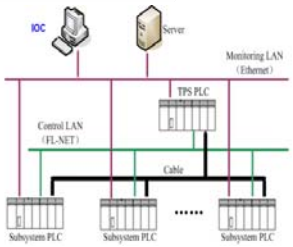

Figure 4: TPS architecture

Database and network

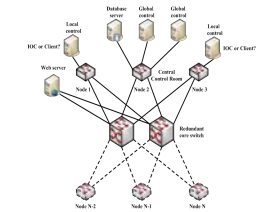

Figure 5: Global control net. The core switch is redundant to avoid shutdown of whole system. And links to core switch is also redundant. The failure of other switch only impact local sub-system.

➢**FRONT CONTROL**

•PLC from YOKOGAWA in Japan and Control system from Beckhoff in Germany are used in front control layer.
•The two systems are also test in function test system, and have been integrated into EPICS system.

Device Control

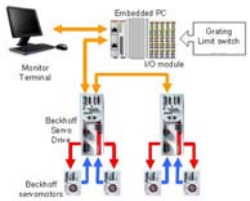

Figure 6: Architecture of sample of HIPD.

Figure 7: IOC based on ARM.

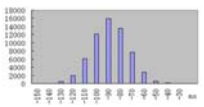

Figure 8: Time resolution test of sequence events Recording. EL1252 module sends a pulse and all EL2252 measure this pulse and takes a timestamp. Results shows the accuracy is better than 1us

Next To Do

✓setup of the development system(a prototype system of entire CSNS experimental control system)
✓long-term stability and speed study of MySQL;
✓ study of CSS and other tools in EPICS further;
✓integration the device into EPICS;
✓design of self-check and alarm system;
✓design of fan-out system of T0 related signals;
✓ implementation of TPS and PPS will be done

Reference

[1] Hesheng Chen et al, “CSNS Concept Design Report”, 2009.
[2] Hesheng Chen et al, “CSNS Preliminary Design Report”, 2011

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