

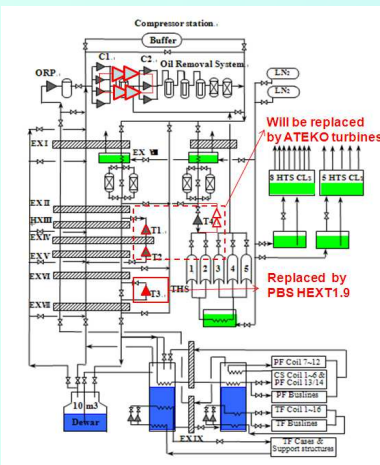
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INTRODUCTION

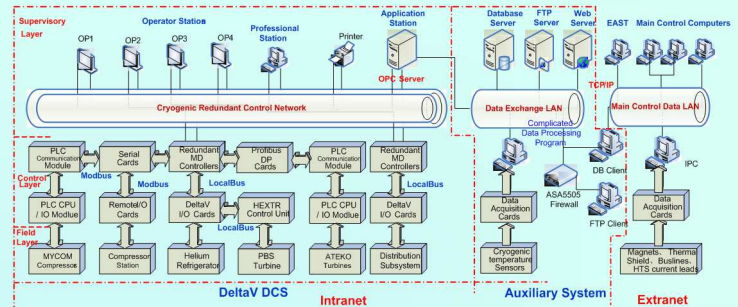
- EAST (Experimental Advanced Superconducting Tokamak) is the first full superconducting experimental Tokamak fusion device.
- EAST has been carried out ten campaigns since the end of 2005.
- The cryogenic system is to cool down the superconducting magnets and relating components.
- The total cold mass of EAST is about 250 tons.
- EAST cryogenic control system (ECCS) is based on DeltaV DCS of Emerson Corporation.
- Many control components have been running beyond the expected lifetime.
- This paper presents the current status and upgrade solutions of the cryogenic control system.



Basic parameters

- **Equivalent Refrigeration**
~3.5kW@4.5K(+Shield Cooling)
- **2 Refrigeration Cycle**
Modified Claude Cycle with 3 turbines (LHe temperature level) Brayton Cycle with 1 Turbine (80K for thermal shields)
- **Temperature level**
4.5K/3.5K
Oil ring pump to reduce pressure
- **Cryogenic Users:**
SC magnets (TF/PF/CS coils & Cases)
HTS Current leads
THS Shields
Cryopumps, NBI, inject pellet

Control system overview



Current Status of Present System

- Operate on Windows NT operating system
- New hardware have no drive supports
- The manufacture have no supports for old DeltaV version.
- New instrumentation and new solutions can not integrate in DCS system
- The performance of control system gradually decrease.
 - ✓ The load of MD controller is approach to 90%;
 - ✓ Historical data query is slow and operational management efficiency decreased
 - ✓ The communication efficiency decreased with error rising, occasional packet and network clogging

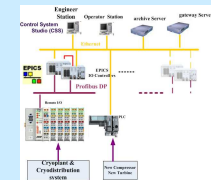
Upgrade to the new system

Upgrade of DeltaV system

- ◆ The DeltaV version upgrade from V6.3 to V12.3
- ◆ Windows NT upgrade to Windows 7
- ◆ PCs and switch will be replaced
- ◆ New Profibus DP card will be installed in the DCS system
- ◆ PI database will be replaced by SQL database.

ECCS based on EPICS

- ◆ CSS will be the framework software
- ◆ The central I/O system will be converted to the Profibus field bus.



Compressor Station



Helium refrigerator coldbox



New PBS Turbine



Distribution Valve Box



Cryogenic Control Room



Local Control Cabinet

CONCLUSION

- ◆ The upgrades of EAST cryogenic control system have been discussed in this paper.
- ◆ There are one near term and future plan for the upgrades. The DeltaV system upgrades have been implemented on September 2015 and will be tested in the new EAST campaign.
- ◆ In the future, the new EAST cryogenic control system based on EPICS will be designed and implement