

Current Status and Perspectives of the Cryogenic Control System of EAST



Liangbing Hu Ming Zhuang Zhiwei Zhou

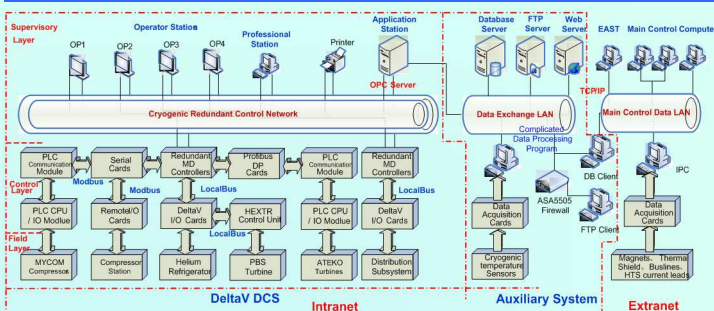
Institute of Plasma Physics, Chinese Academy of Sciences Hefei, 230031, China

E-mail: huliangbing@ipp.ac.cn

INTRODUCTION

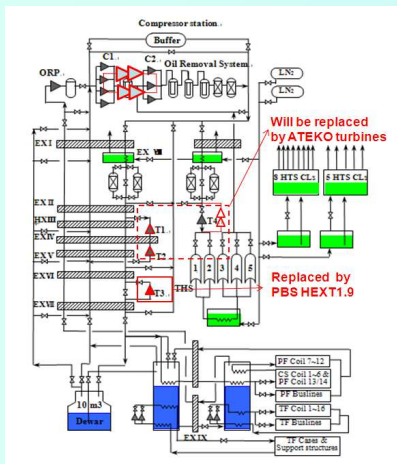
- EAST (Experimental Advanced Superconducting Tokamak) is the first full superconducting experimental Tokamak fusion device.
- EAST has been carried out ten campaigns since the end of 2005.
- The cryogenic system is to cool down the superconducting magnets and relating components.
- The total cold mass 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.

Control system overview



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



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

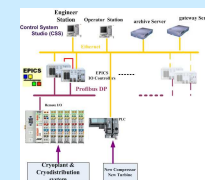
Upgrade to the new system

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.



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



Compressor Station



Helium refrigerator coldbox



New PBS Turbine



Distribution Valve Box



Cryogenic Control Room



Local Control Cabinet