

# ADS Injector I Cryogenic Control System

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## Background

Accelerator driven sub-critical system (ADS) in China is a kind of transmutation machine to minimize the nuclear wastes. The control system of the project is shown in Fig.1.

As one of the important parts in ADS injector I which is been built in IHEP, CAS, it needs two cryomodules operate at 2K cryogenic environment to realize 10MeV proton beam energy. Each cryomodule includes seven Spoke-012 cavities and seven solenoids.

## Overall Design of Cryogenic control system

Cryogenic system of ADS injector I mainly includes: main valve box, refrigerator, cryomodules, 2K pumping system, recovery & purification system.

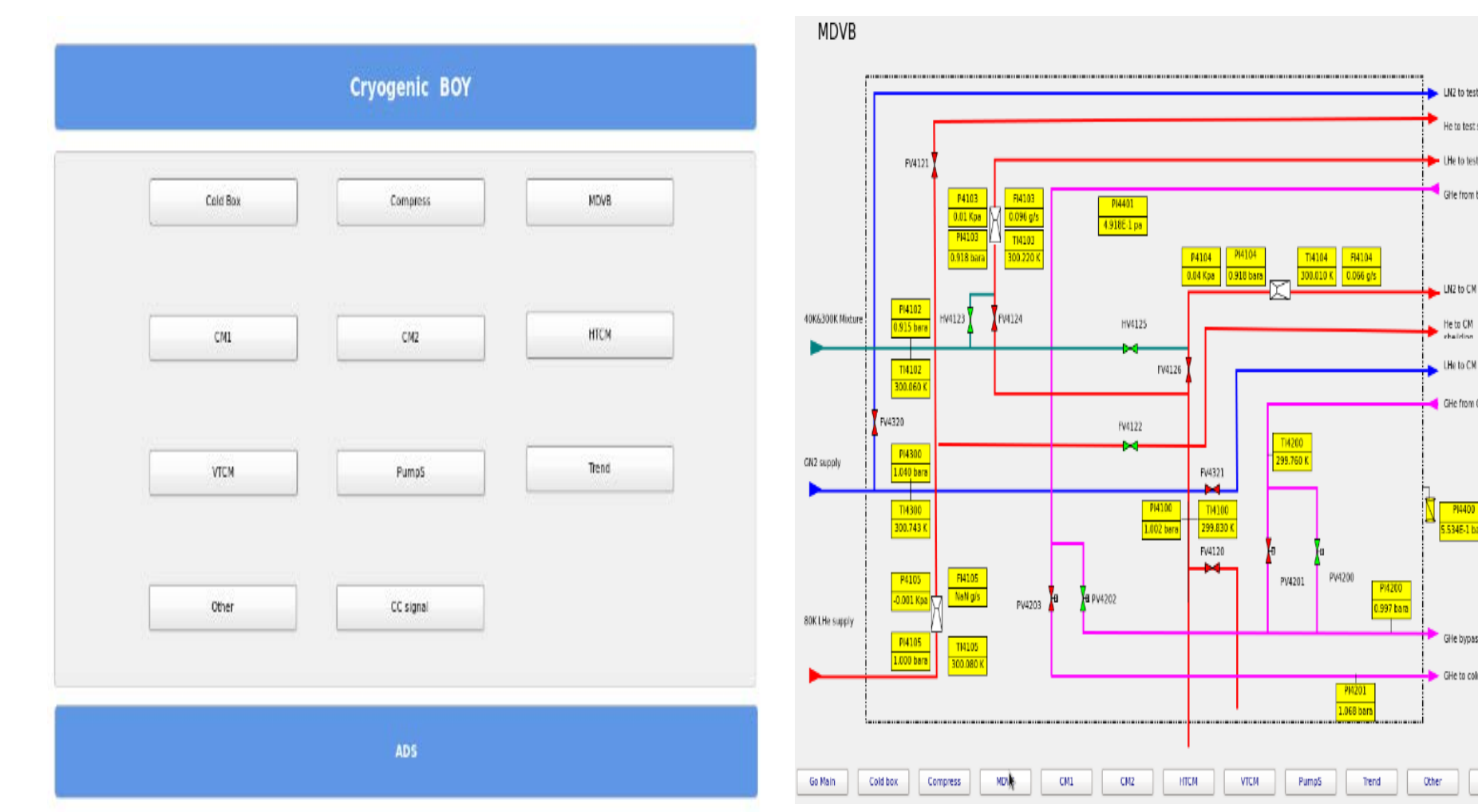
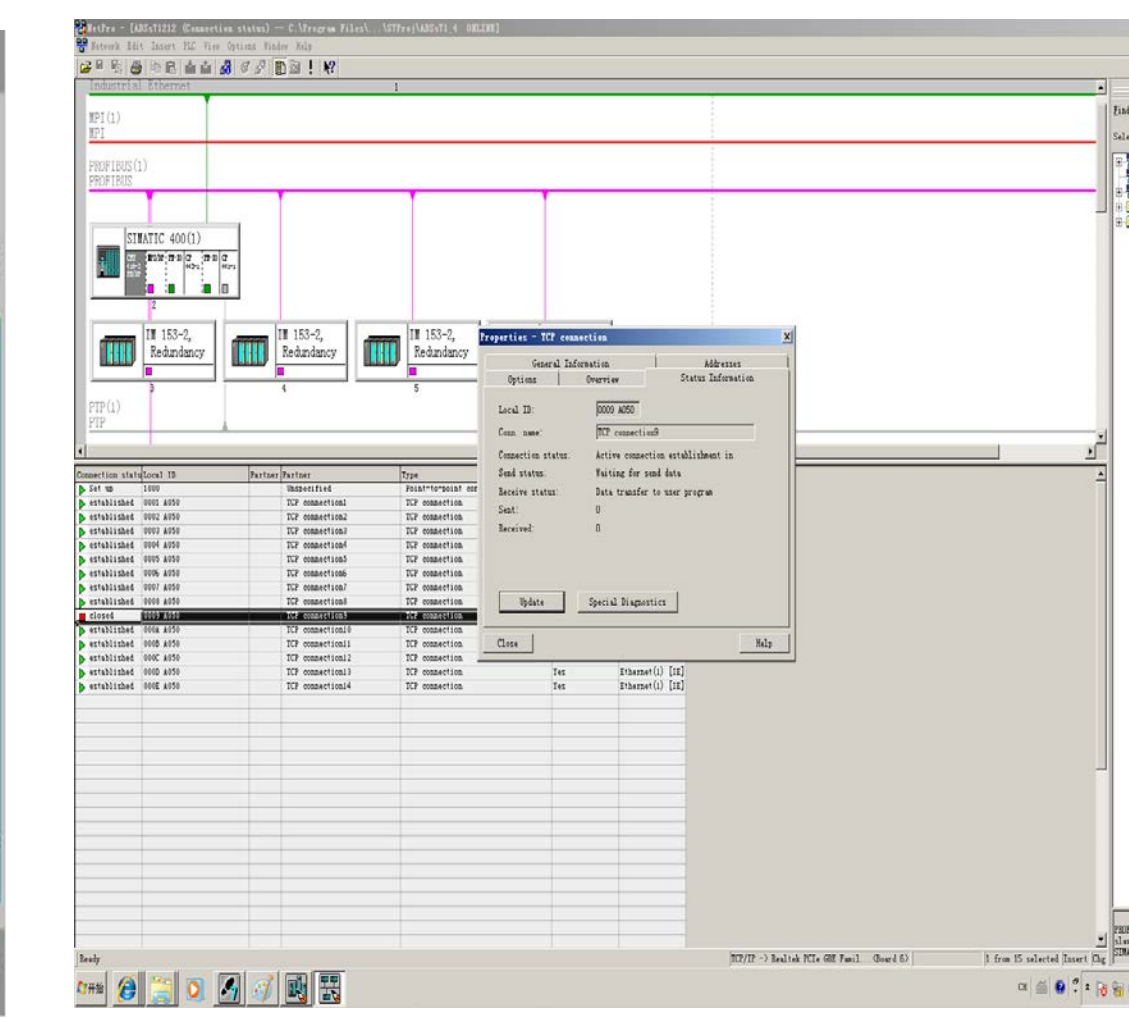
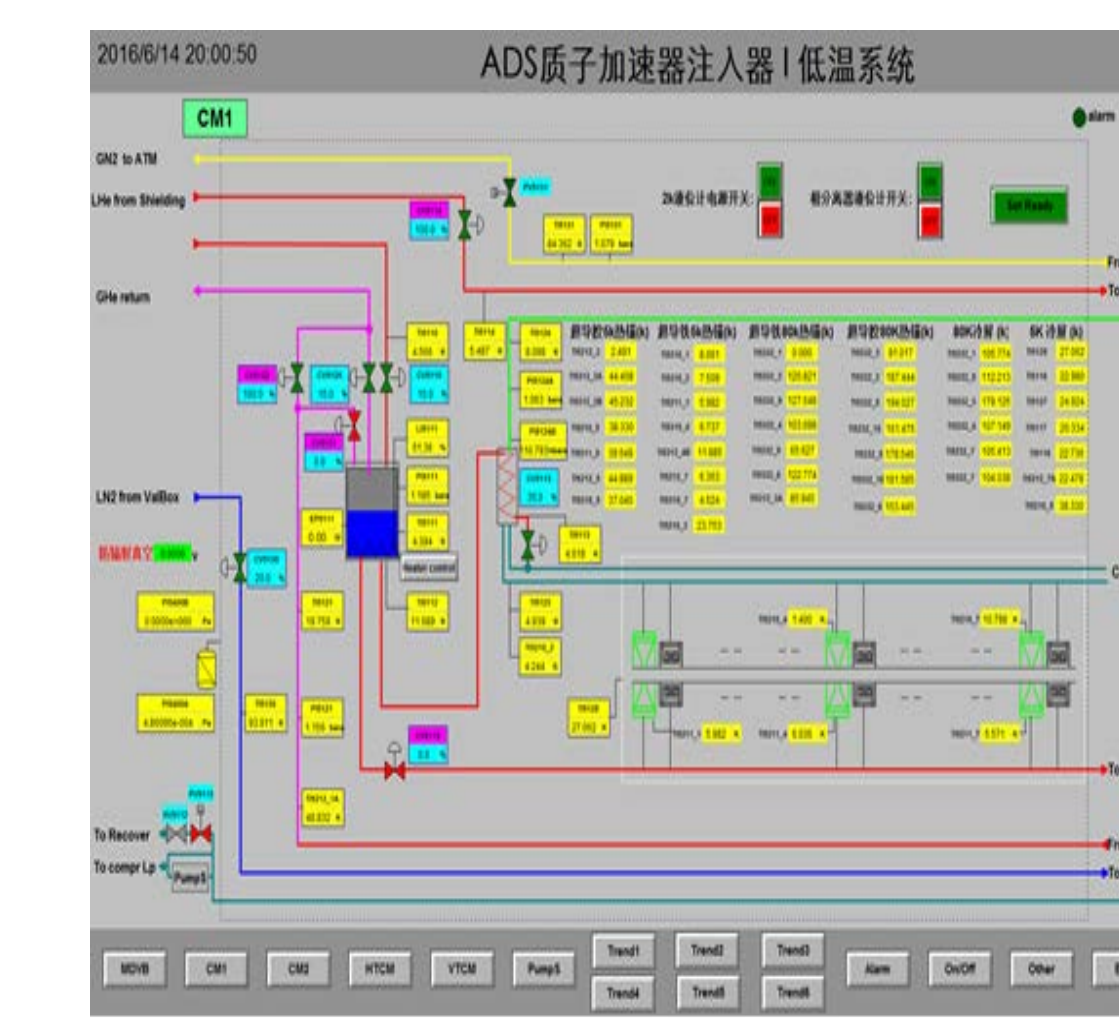
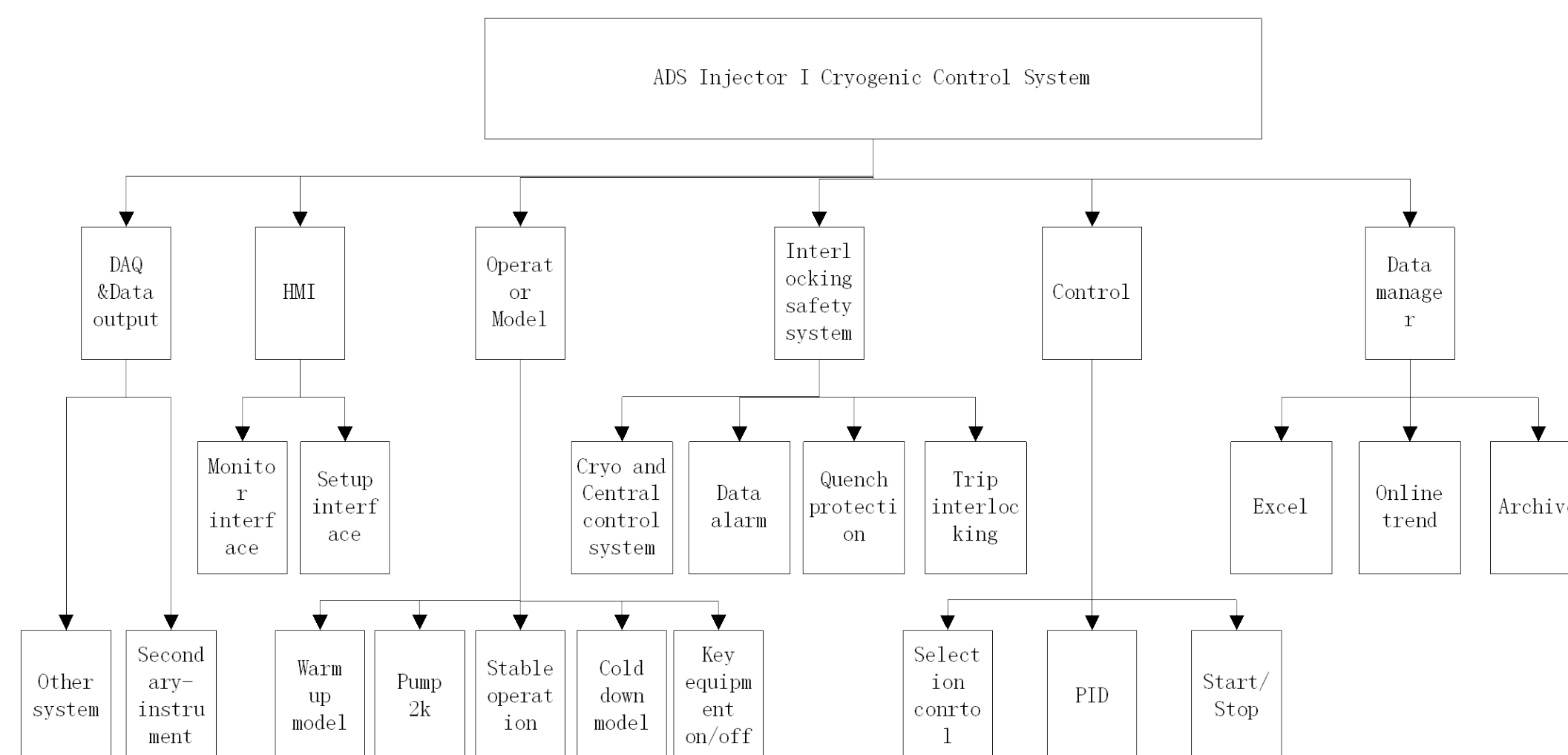
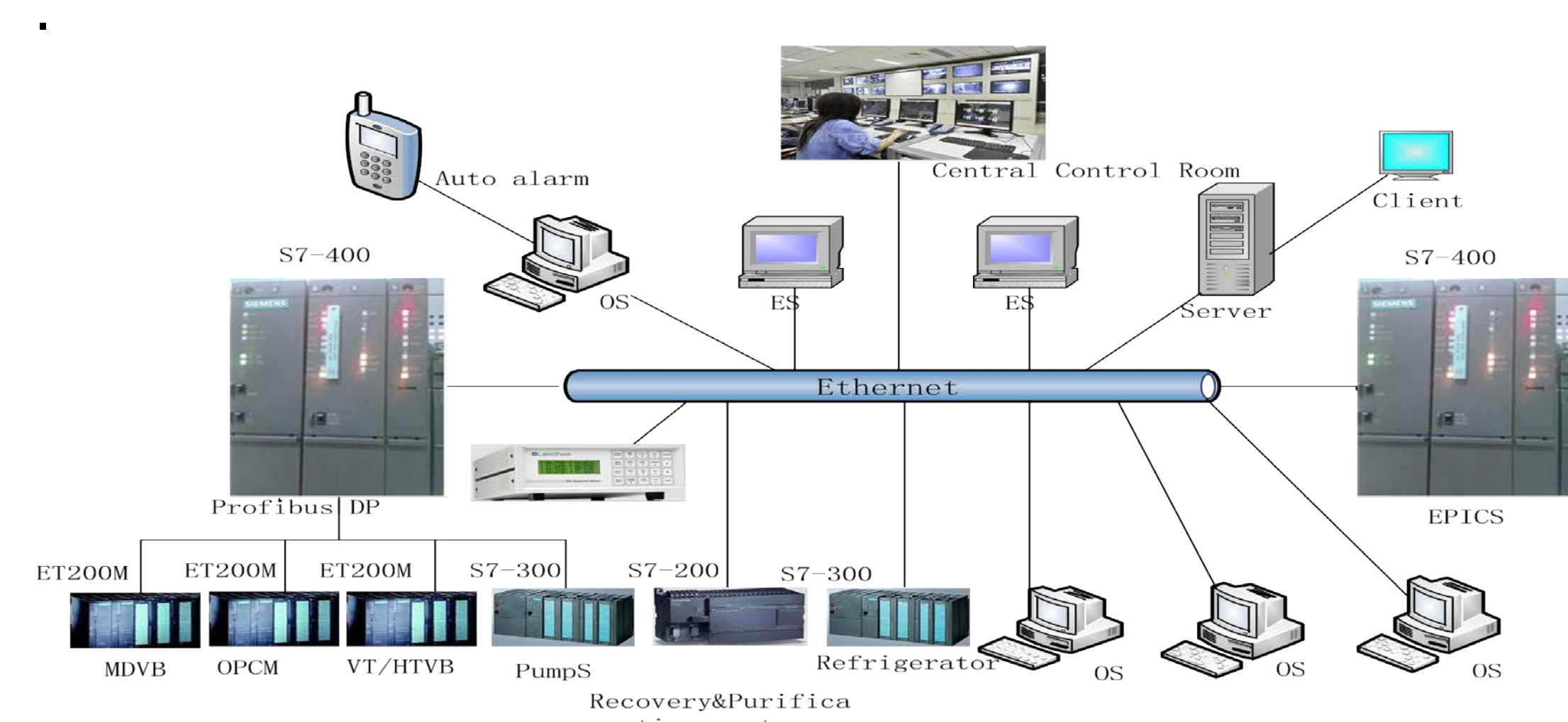
- **Three modes of the cold box:** refrigeration mode, liquefaction mode and mixed mode;
- **Hardware:** S7-300 ET200 S7-400
- **Software:** step7 wincc v7.0 wincc flexible, Epics;

## Siemens plc Control

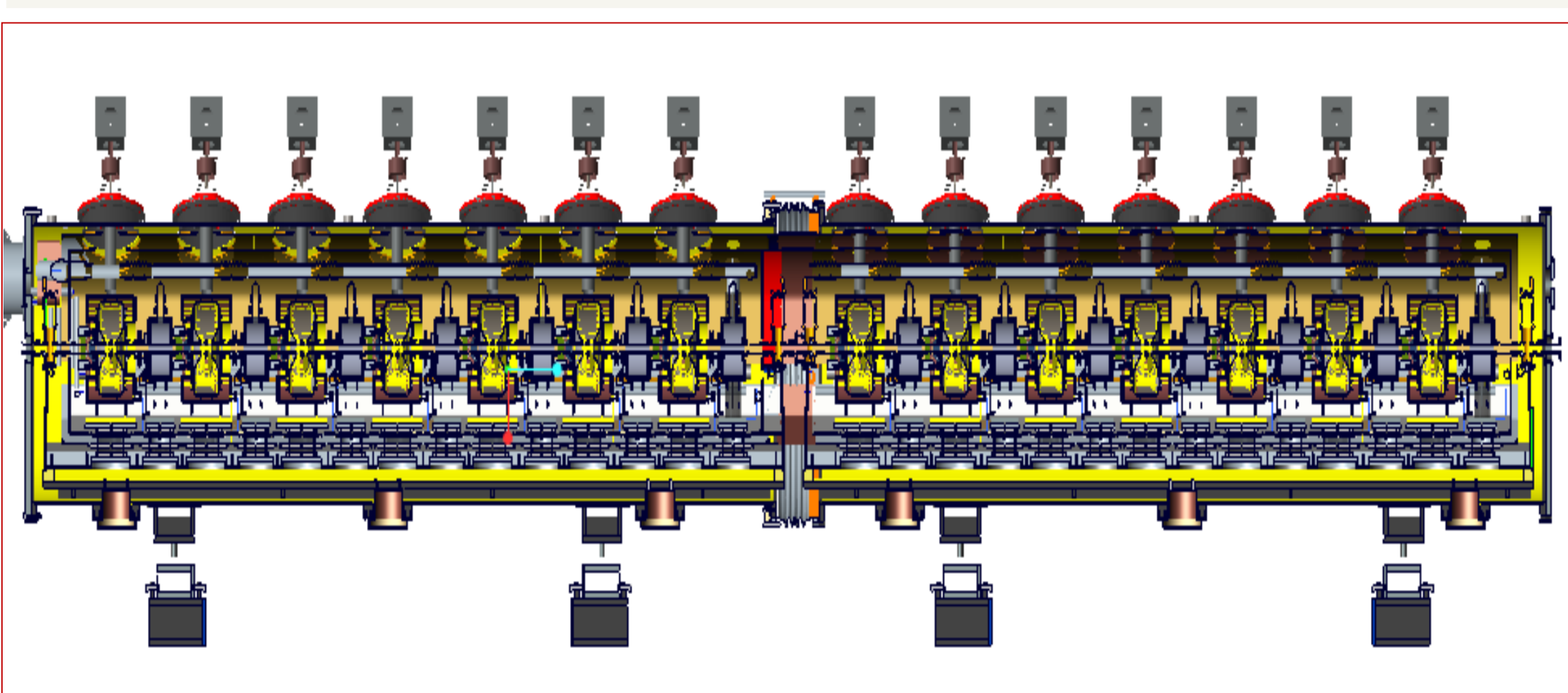
Through the control system front pressure, temperature, flow rate and other process variables, ADS injector I cryogenic system is operated stably of 4k/2k. We adopts PIC control integrate to realize the automatic intelligent control of the superconducting devices. The main function of PLC is building temperature real-time monitor system, logical control system, controlled by using PID of closed loop, safety interlock system, automatic SMS alarm system etc.

## EPICS Control

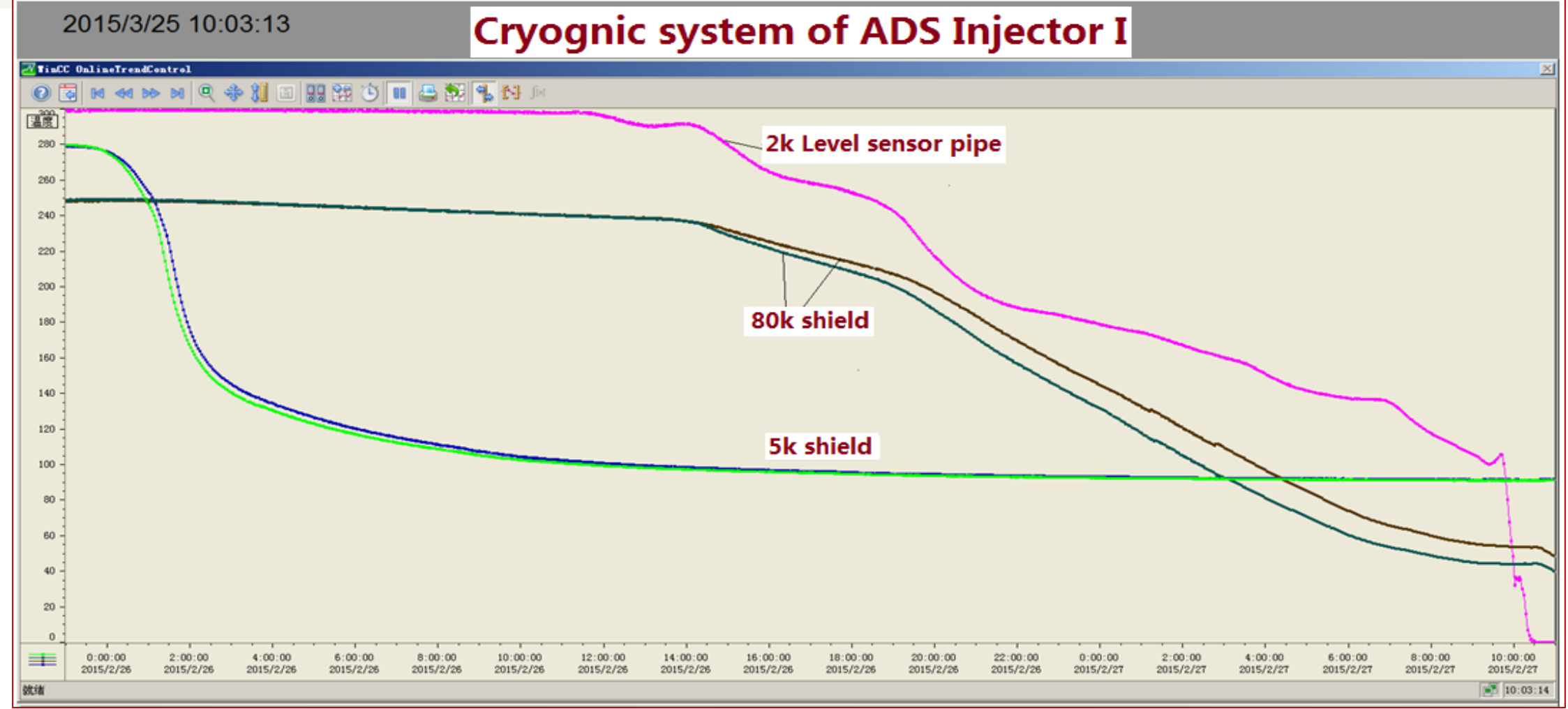
EPICS is developed to integrate dates from pump system, refrigerator system, cryogenic equipment



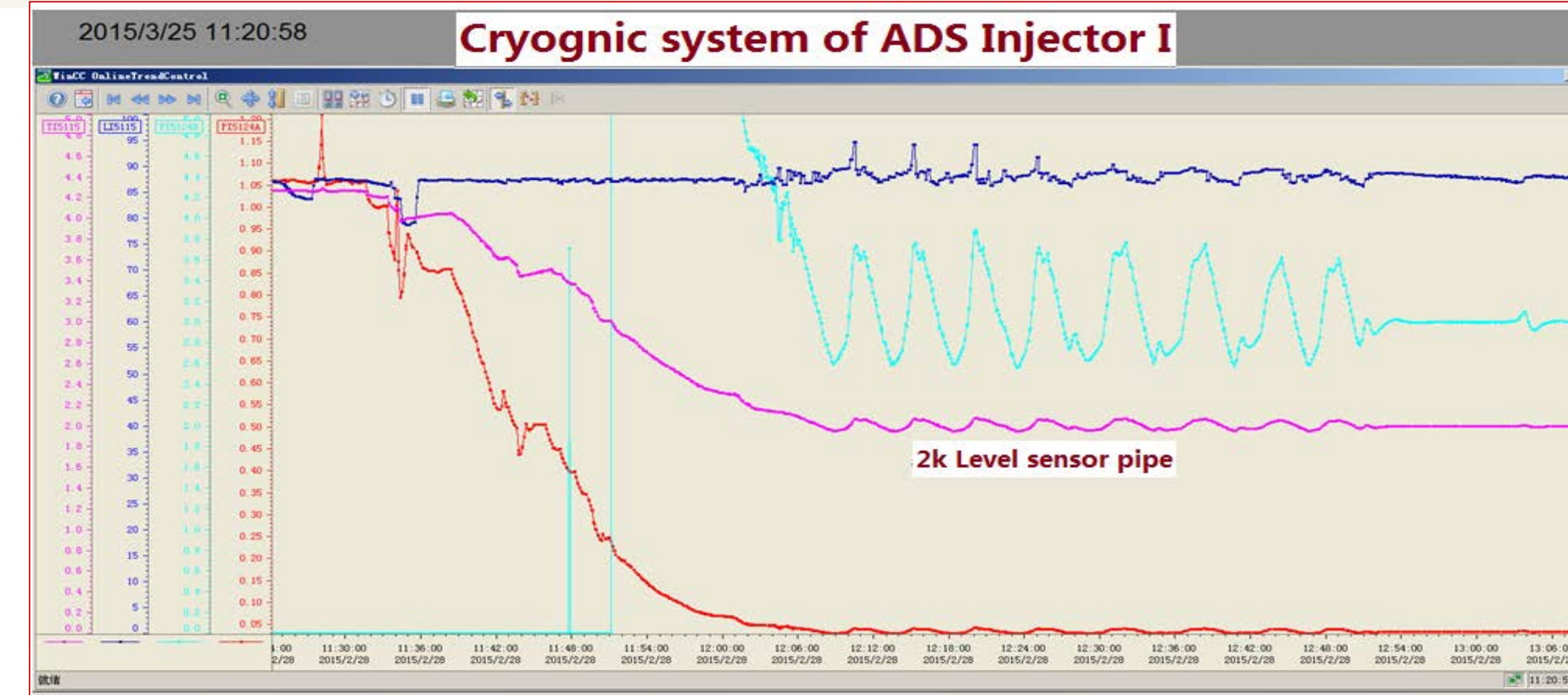
## Cool-down of test 4.2k&2k system



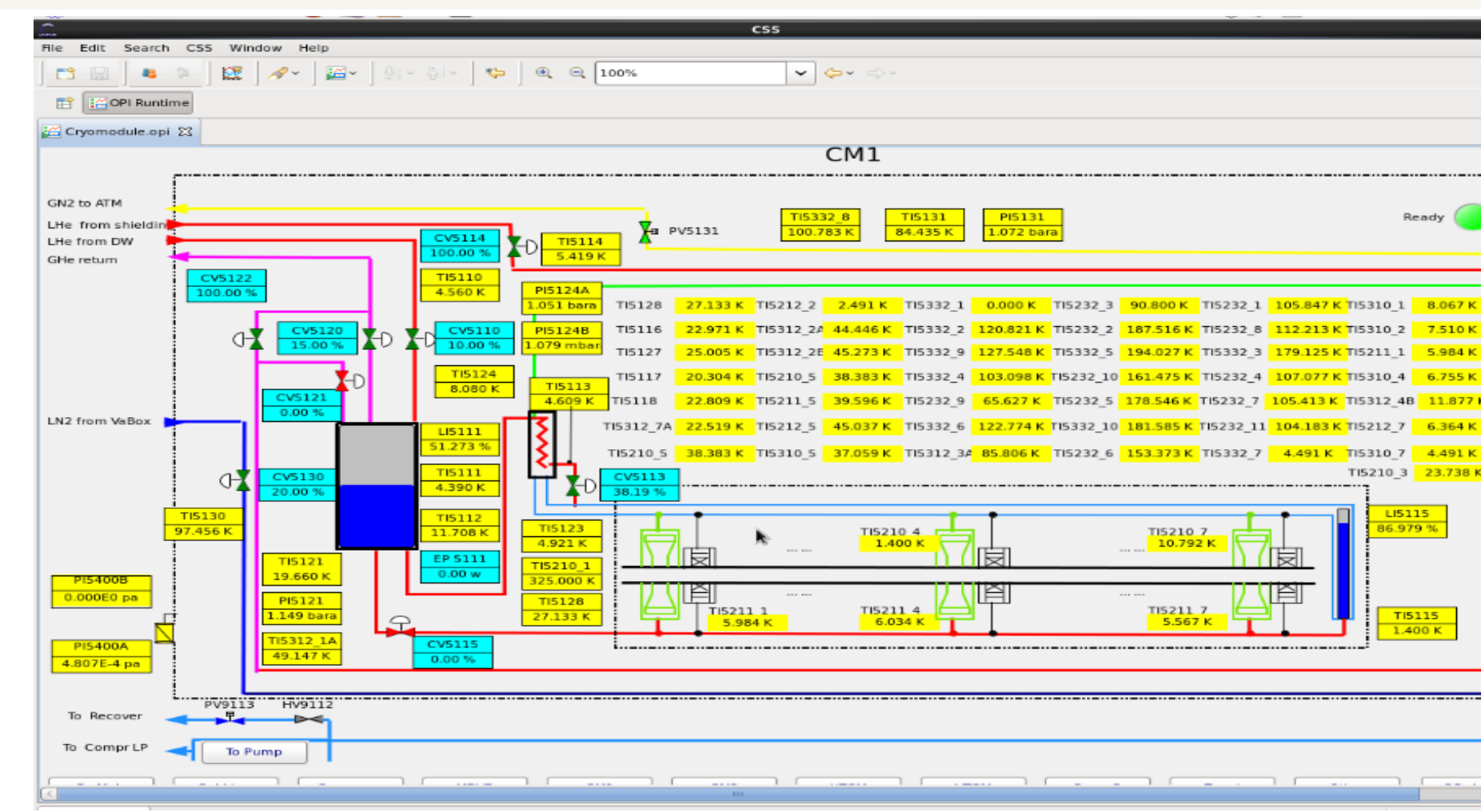
CM1&CM2



4.2K cool-down test



2K cool-down test



EPICS