



Cryogenic Controls for FAIR

Review on Cryogenics for FAIR

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Controls Situation for FAIR

Accelerator control system for FAIR is GSI in-kind contribution

Controls group has lots of experience for machine control, but no in cryogenics yet

Controls TAC in 2007 already advised to establish industrial controls section

Cryogenic controls solutions shall be provided by Controls group

General strategy for cryogenic controls at FAIR:

- Build up team and competence in industrial controls technology and solutions
- Make best use of solutions and experiences at CERN and collaborate!

GSI General Slow Controls Strategy

Use industrial controls and automation technologies and solutions wherever adequate

- Use PLCs and industrial I/O components
- Use SCADA System (supervision layer)
- Use and adapt CERN **UNICOS** framework for cryogenic controls, vacuum controls (and possibly more to come)

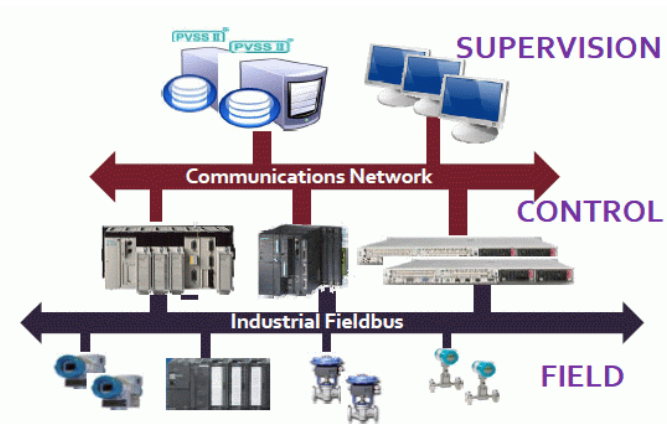
FAIR cryogenic controls (working model):

- Controls group: provides UNICOS framework, PLC technology and network, system installation and support
- Cryogenics group: responsible for cryogenic sensors & actuators, signal processing and implementation of control functions

UNICOS

Unified Industrial Control System

- UNICOS was developed at CERN, is de-facto standard framework to develop industrial control applications (cryogenics, cooling, vacuum, etc.)
- Based on commercial SCADA system WinCC/OA (Siemens), formerly PVSS2 (ETM)
- Applied in PLC (Siemens, Schneider)
- Based on a hierarchical object approach
- Provides a **method**: process analysis to control design
- Provides **libraries** for PLC & SCADA (OO)
- Provides **generation tools** for PLC & SCADA (automatic generation of code)
- Provides **uniform synoptic displays** for operation teams

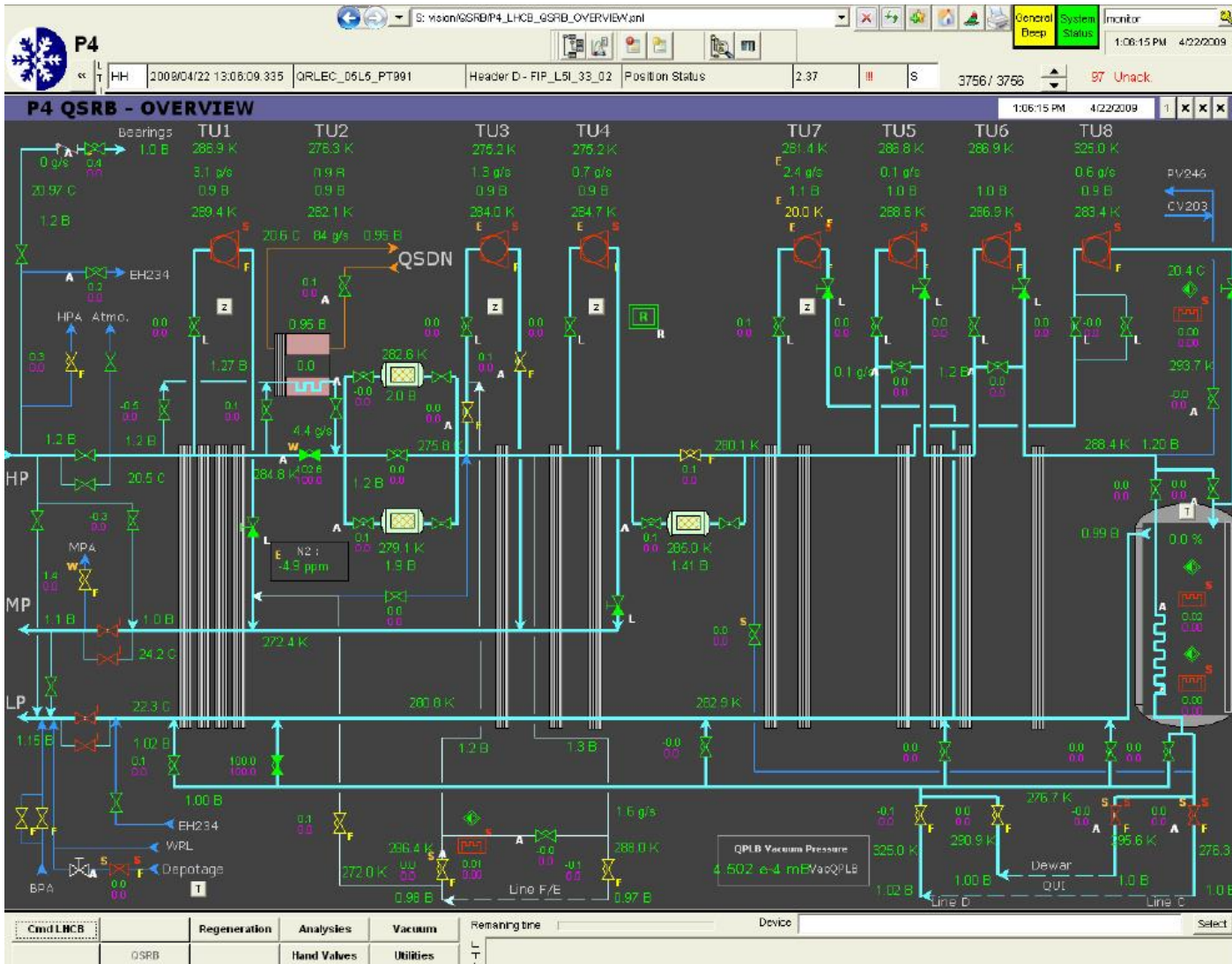


UNICOS

Unified Industrial Control System

- UNICOS was specifically designed for cryogenic control of LHC
- UNICOS is a mature system (operates LHC)
- Actively maintained by CERN and Siemens, development still goes on...
- Cryogenic industry (Linde, Air Liquide) has experience to deliver systems compliant for UNICOS control, specifications available
- Fits well in FAIR controls architecture (Siemens PLCs, Linux-based, etc.)
- Even simulation modules available (validation of the design, dimensioning, training of operators, etc.)

UNICOS



UNICOS – Minor Modifications for FAIR

- Restrict to Siemens PLCs (no Schneider PLCs)
- HMI for operators shall be multi-lingual (DE, EN)
- Implement PROFINET as state-of-the-art fieldbus
- Provide FAIR services package to integrate UNICOS into the FAIR accelerator control system
- Add interface for feed-forward control: dynamic heat load, specific modes of machine operation (pattern)

Controls for FAIR Cryo-Plant + Distribution

- Controls needed for Cryo-Plant + LHe distribution + local cryogenic systems
- Systems cannot be treated separately: tightly integrated system needed
- FAIR machine operation induces feed-forward to the overall cryo-system
- Good integration with accelerator control system needed (coherent control and presentation)
- Industry (Linde, Air Liquide) can provide turn-key systems for plants and only small distribution systems only; Controls would be outsourced
- Substantial optimization period during commissioning and in operation phase; later adaptations of the system expected
- Knowledge shall be with GSI/FAIR
- Industrial service contract to optimize to be avoided

Cryogenic Controls Strategy

Follow advice of CERN cyro-controls experts:

- Tender and delivery of FAIR Cryo-Plant with safety (self-protection) and basic control functionality only
- Delivery and implementation of Cryogenic controls hardware by GSI
- Implementation of control functionality by GSI Controls and Cryo group
- CERN supports with expertise, specifications, commissioning support, etc.
- FAIR cryo-plant “similar” to existing at CERN (specification and solutions may be re-used and adapted)
- Industry has experience to deliver along CERN specs

Present Status

Controls group has started to get into the field of industrial controls solutions (PLCs, SCADA, UNICOS).

An industrial controls team was formed (presently only 2 FTE)

- One experienced automation engineer was hired as project leader (mid 2010)
- Requirement specifications and technical interface specifications (for Vacuum controls) written (Slovenian in-kind)
- First hands-on experience SCADA (WinCC/OA) and UNICOS (e.g. pressure measurement at SIS-18 successfully implemented)

Next Activities, Outlook

- Expert Meeting with CERN EN-ICE on control of Cryogenics and Vacuum shall take place next month. Collaboration model and CERN involvement will be discussed, establish formal collaboration, total manpower assessment
- Further build up industrial controls team: +1 industrial automation engineer for UNICOS with complementary skills (summer) for cryo controls
- Delegate industrial controls team temporarily to CERN for training
- Implement UNICOS installations for old DESY cryo-plant (R3B magnet @GSI) for testing and building up competence (start 2012)
- Support in writing specifications for FAIR cryo-plant
- Participation of Controls engineers at FAIR SFRS magnet testing at CERN

Summary

- GSI Controls group started to establish industrial controls team
- Strategic decision to use and adapt UNICOS for cryogenic controls was taken
- A formal collaboration GSI-CERN on UNICOS shall be established
- FAIR cryo plant, distribution system and local cryogenics constitute one cryogenic system and shall be coherently controlled
- FAIR cryogenic system will be tightly linked with the machine control system
- Cryo plant shall be procured with safety and basic control functionality only
- Implementation of control hardware and control functionality by GSI controls and cryogenic groups