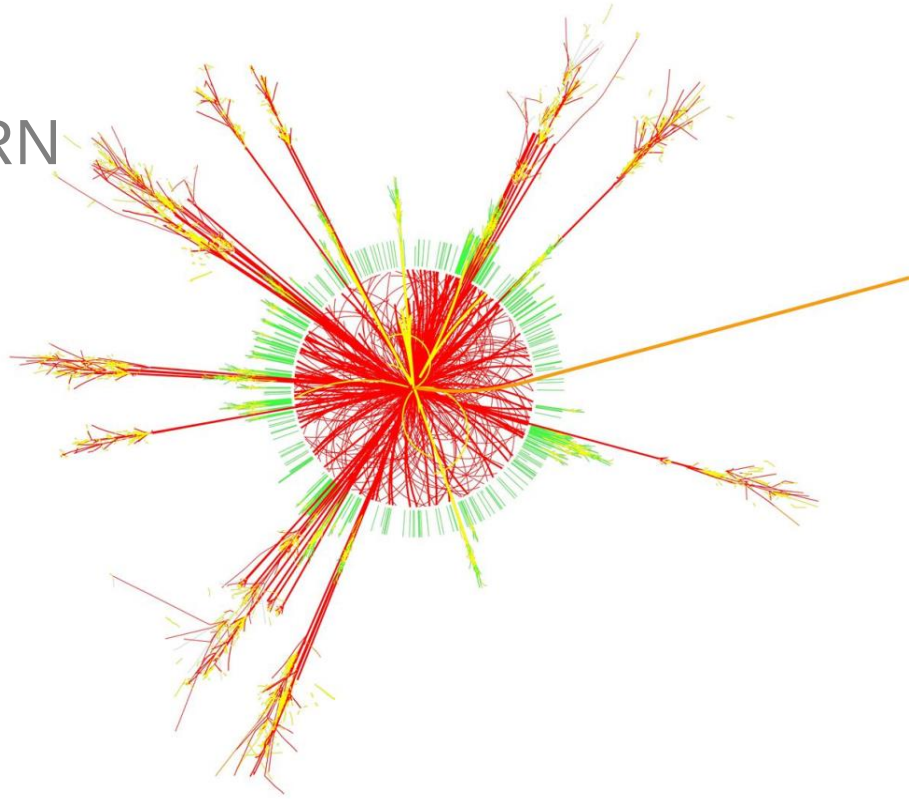
Studenci PK w CERN (Grupa Chłodnicza) obszary aktywności studentów w czasie stażu.

Internship programmes at CERN
17th December 2013

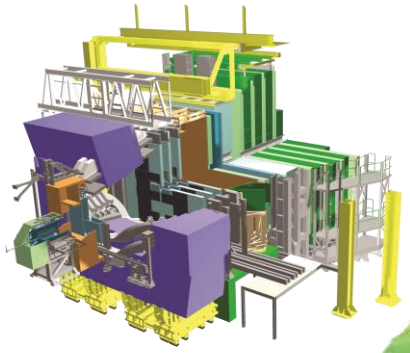
CERN PH-DT
L. Zwalinski

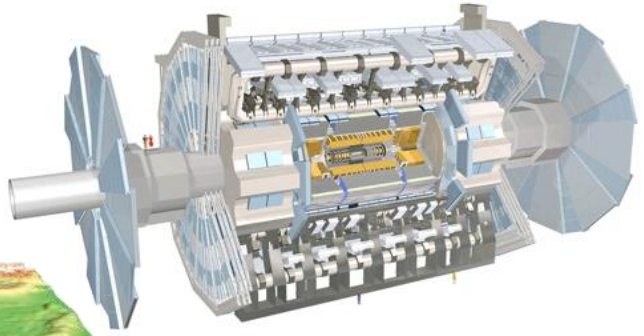


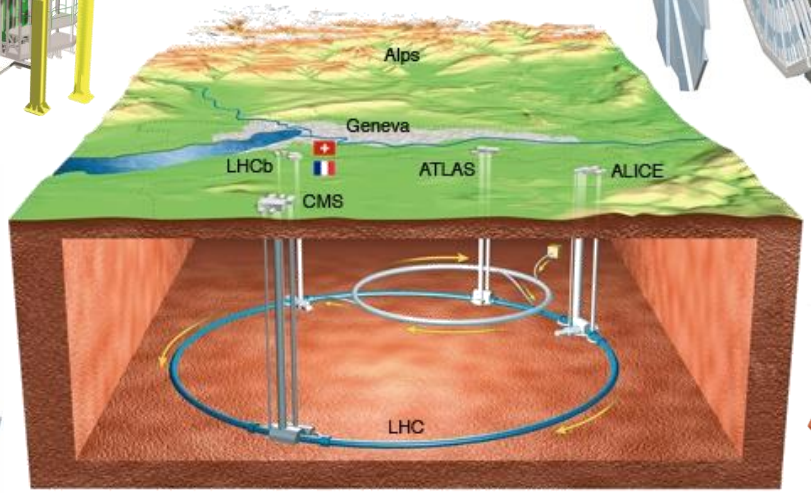
Introduction

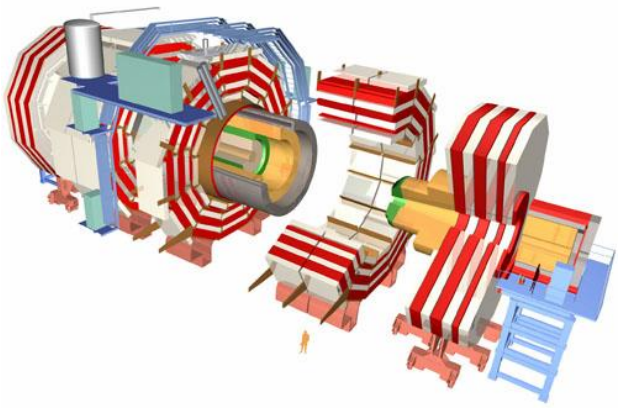
Detector Technology (DT)

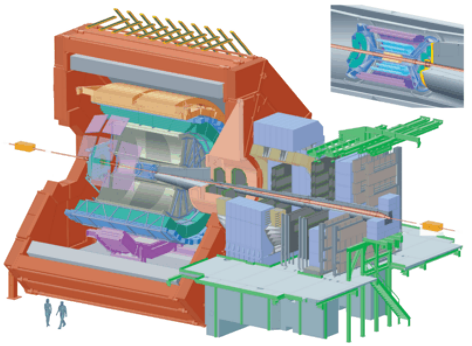
The mandate of the PH-DT group comprises development, construction, operation and maintenance of particle detectors for the experiments at CERN. The group clusters common services and infrastructure which are available to all experiments at CERN, e.g. gas system support, cooling support, thin film lab, silicon facility with bond lab, irradiation facilities, magnet support, B-field mapping, instrumentation and **controls**.











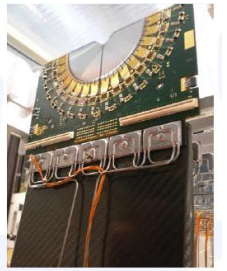
Detector Cooling – CO_2

Why do we want to use CO_2 for HEP cooling systems ?

- **Significant saving of cooling hardware** (material budget) into the detector due to the physical properties:
  - large latent heat of evaporation
  - low liquid viscosity
  - high heat transfer coefficient
  - high thermal stability due to the high pressure
- Very practical fluid to work
- Practical range of the detector application -45^{0}C to +25^{0}C

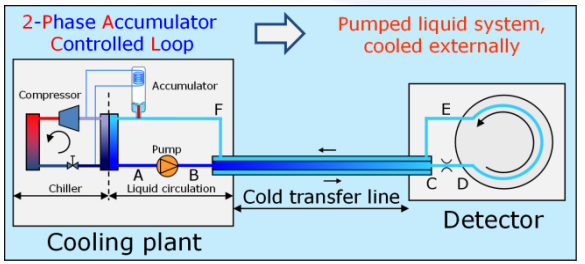
Where CO_2 cooling is currently used ?

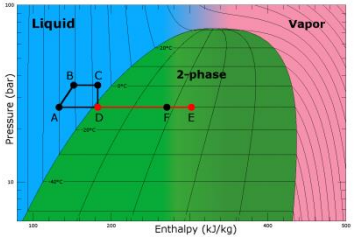
- **AMS-TTCS** (Tracker Thermal Control System)
  Q = 150 W T = +15 ^{0}C to -20 ^{0}C
- **LHCb-VTCS** (Velo Thermal Control System)
  Q = 1500 W (2 x 750 W) T = +8 ^{0}C to -30 ^{0}C



Where it is planned to use CO_2 cooling systems ?

- At CERN:
  phase 1 upgrades: ATLAS IBL and CMS pixel phase 1
  phase 2 upgrades: under consideration
- Out of CERN:
  KEK Belle-2, ILC





Detector Cooling – CO_2

Detector Cooling – CO_2 at CERN

Experiment	Project name	PLC/DAQ Brand	Project status	Cooling power
ATLAS	SR1	Siemens	Completed	2kW
	IBL	Schneider	Under development	2x3.3kW
CMS	TIF	Schneider	Completed	8kW
	Pixel phase 1	Schneider	Under development	15kW
General purpose ATLAS & CMS	CORA	Siemens	Completed	2kW
ATLAS & Belle	MARCO	Siemens	Completed	1kW
ATLAS & CMS & LHCb ILC-PPC founded by AIDA project	TRACI	Siemens NI LabVIEW DAQ	Completed	100W



CMS TIF
- ~240 I/Os
- 1x Schneider PLC
- UNICOS framework
- WinCC OA - SCADA
- In operation

ATLAS IBL
- ~670 I/Os
- 3x Schneider PLCs
- UNICOS framework
- WinCC OA - SCADA
- Under installation

TRACI
- ~ 20 I/Os
- Siemens PLC or NI DAQ
- Portable
- 5 units in operation
- 1 unit in assembly phase

MARCO
- ~110 I/Os
- 1x Siemens PLC
- UNICOS framework
- WinCC OA - SCADA
- Local HMI
- **Movable**
- In operation

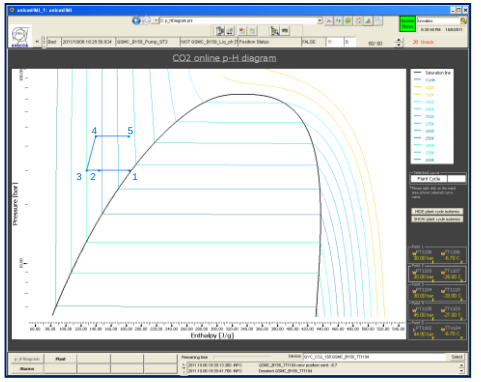
SR1
- ~140 I/Os
- 1x Schneider PLC
- UNICOS framework
- WinCC OA - SCADA
- In operation

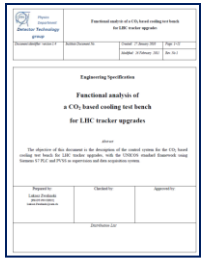
CORA
- ~70 I/Os
- 1x Siemens PLC
- UNICOS framework
- WinCC OA - SCADA
- In operation

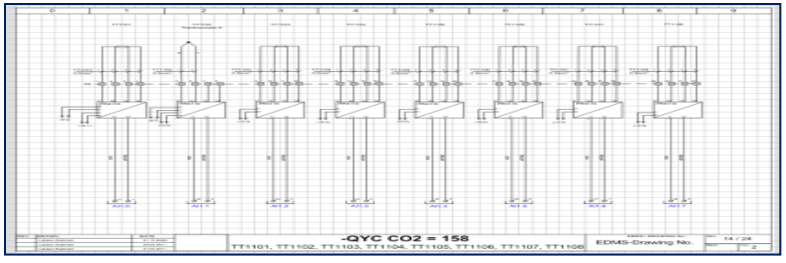
Detector Cooling – control

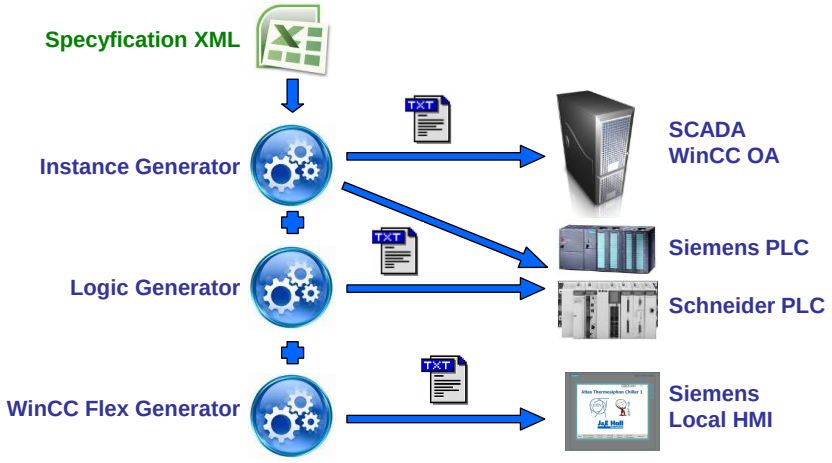
Detector Cooling – control main tasks

- PLC programming Siemens and Schneider
- Siemens WinCC OA SCADA design and programming
- Siemens WinCC Flexible local HMI design and programming
- Electrical schematics design
- Control/electrical equipment selection
- Power distribution calculations
- Cable cross section calculations
- Using UNICOS framework of CERN
- Cabling schemes/schedules design
- Participation or performing commisioning



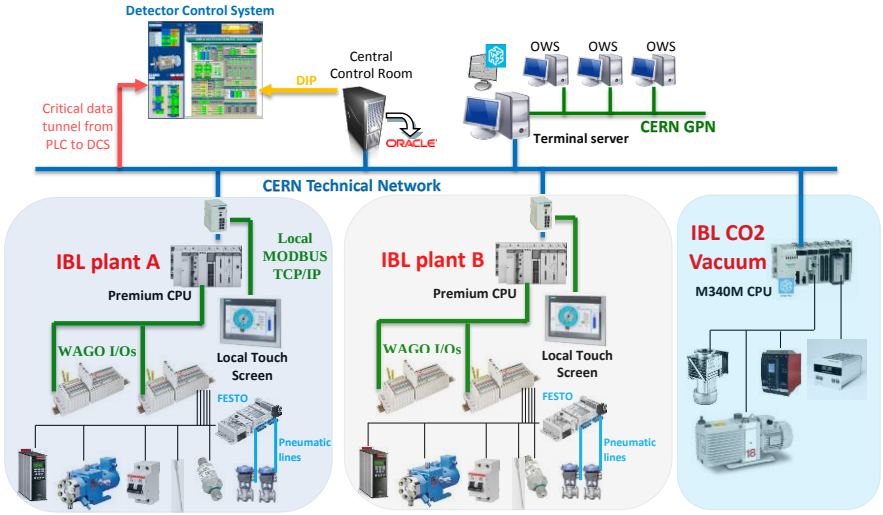


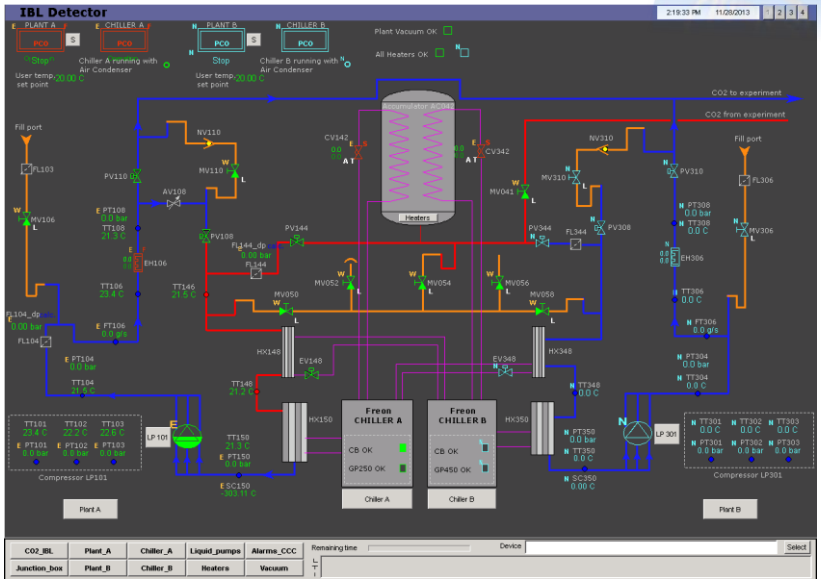


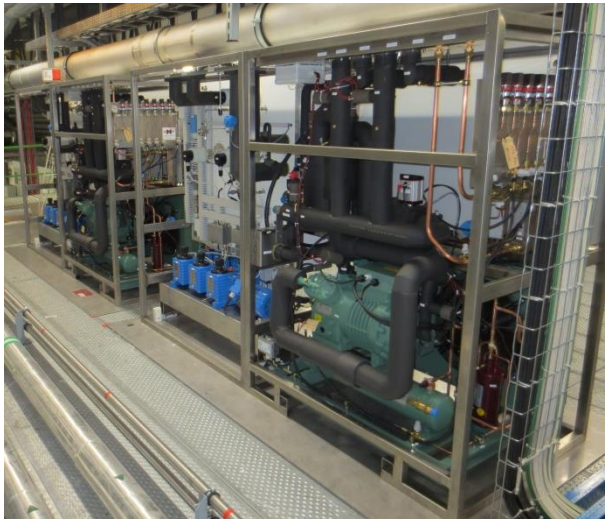


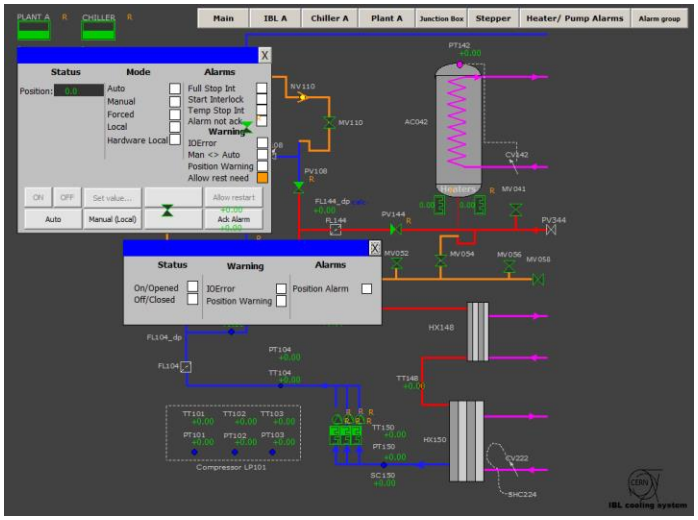
Detector Cooling – application example

Detector Cooling – CO_2 at CERN, ATLAS IBL





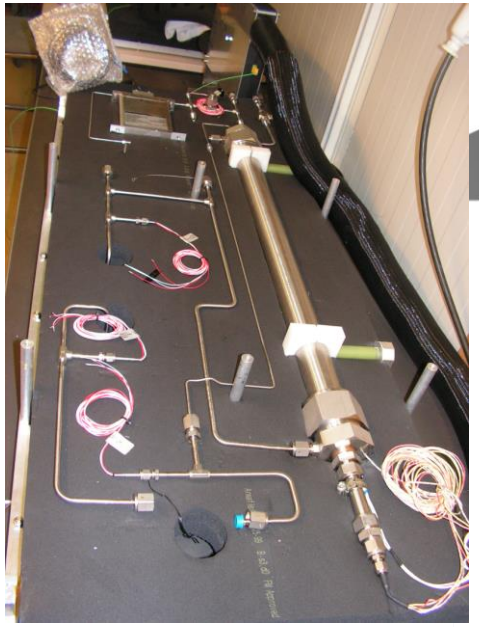


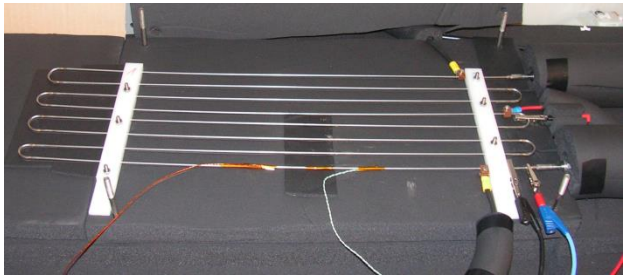


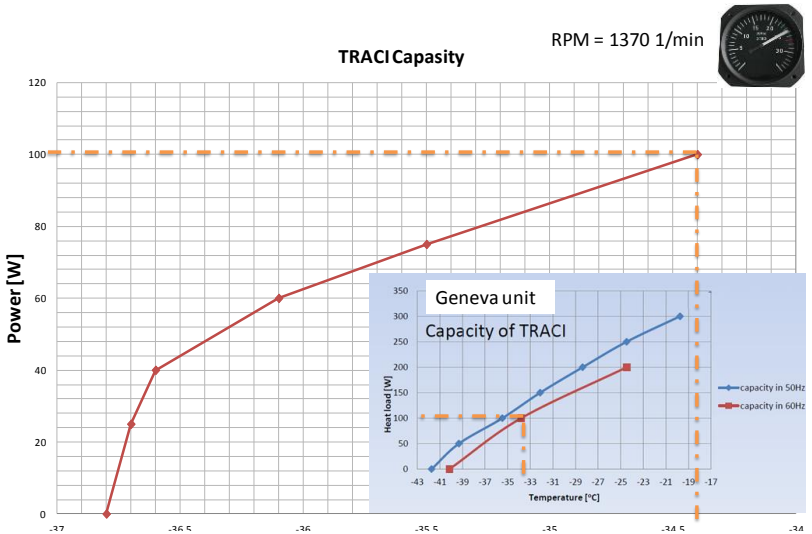
Detector Cooling – mechanics

Detector Cooling – mechanics main tasks

- CATIA cooling plant design
- CATIA control cabinets design
- CATIA test bench designs
- Cooling plants performance tests
- Test stands assembly
- Cooling plant assembly
- NI Lab View programming
- Data analysis







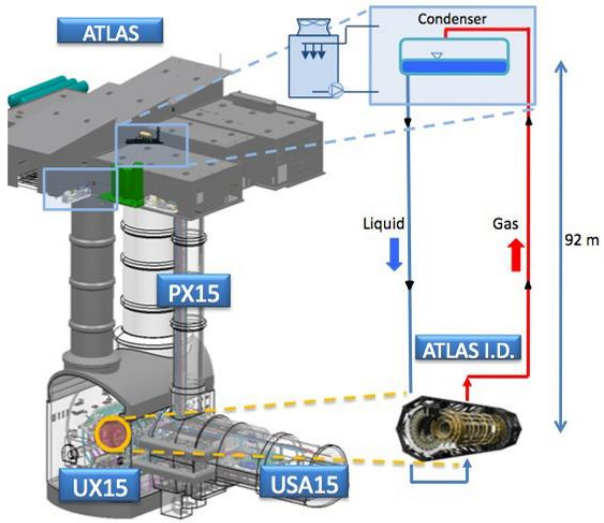
Conclusions

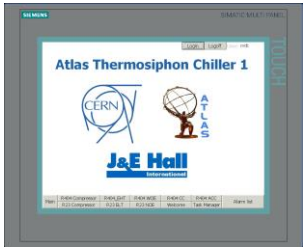
What are the requirements for the CUT students:

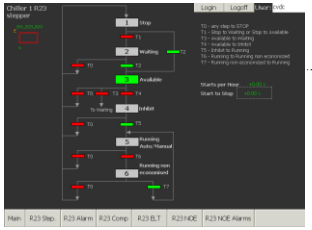
- Be open-minded
- Ability to work in a team
- Willingness to learn new technologies and techniques
- Be precise and accurate
- Take care about the details
- Don’t be afraid that you don’t know at the beginning how to do your task we will help You!
- **Our motto**: do it best that the results will have the highest quality

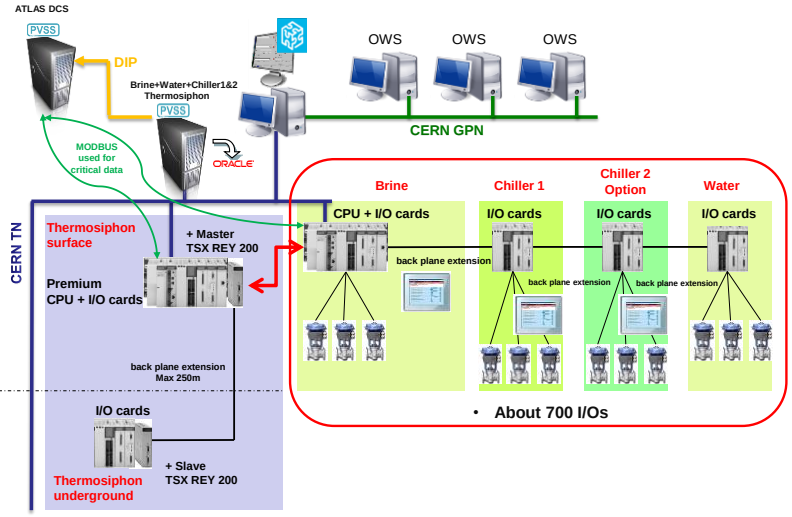
Detector Cooling – ATLAS Thermosiphon

Detector Cooling – Thermosiphon, ATLAS Inner Detector







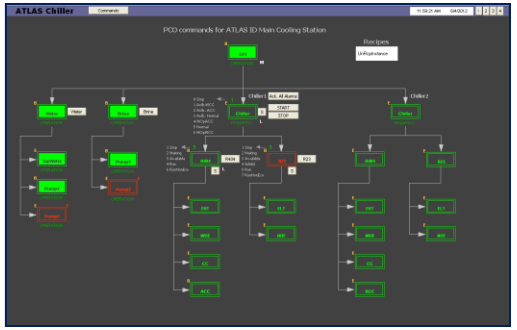


Main purposes:

- Cool down ATLAS silicon detectors (Pixel and SCT) to **-20⁰C** using perfluoropropane (C3F8)
- Replace existing oil-free compressors

System components:

- 2 independent Schneider PLCs one for Thermosiphon and one for Chiller+Brine+Water system
- UNICOS framework
- WinCC OA SCADA system
- Chiller designed and constructed by external company, **software fully done by CERN.**



System under commissioning