



Upgrade of the ABB control system for North area Helium compressors with a PREMIUM UNICOS

Accelerator Technologies Department – Cryogenics Group
Control and Electricity

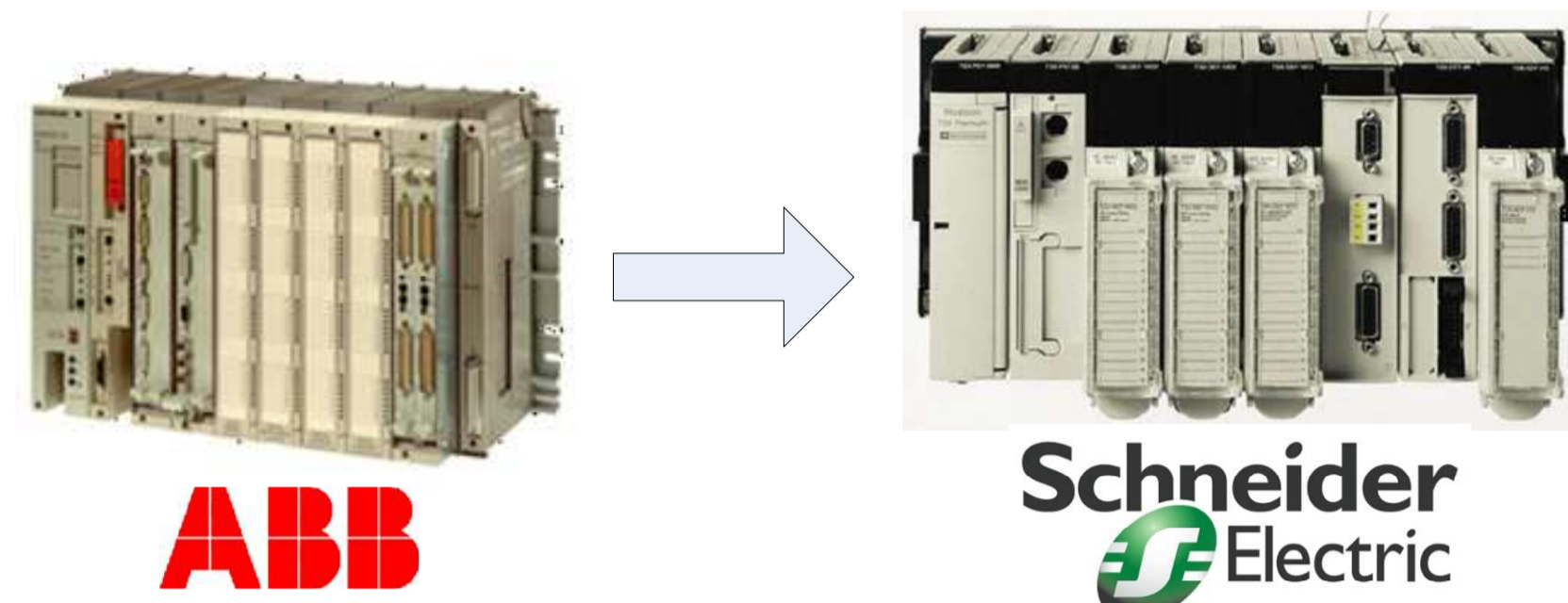


ANALYSIS

Upgrade project

Several cryogenic installations of the CERN experiments are still controlled by old obsolete ABB control systems.

In order to integrate the new CERN/UNICOS framework, they need to be upgraded to Schneider Electric equipments.

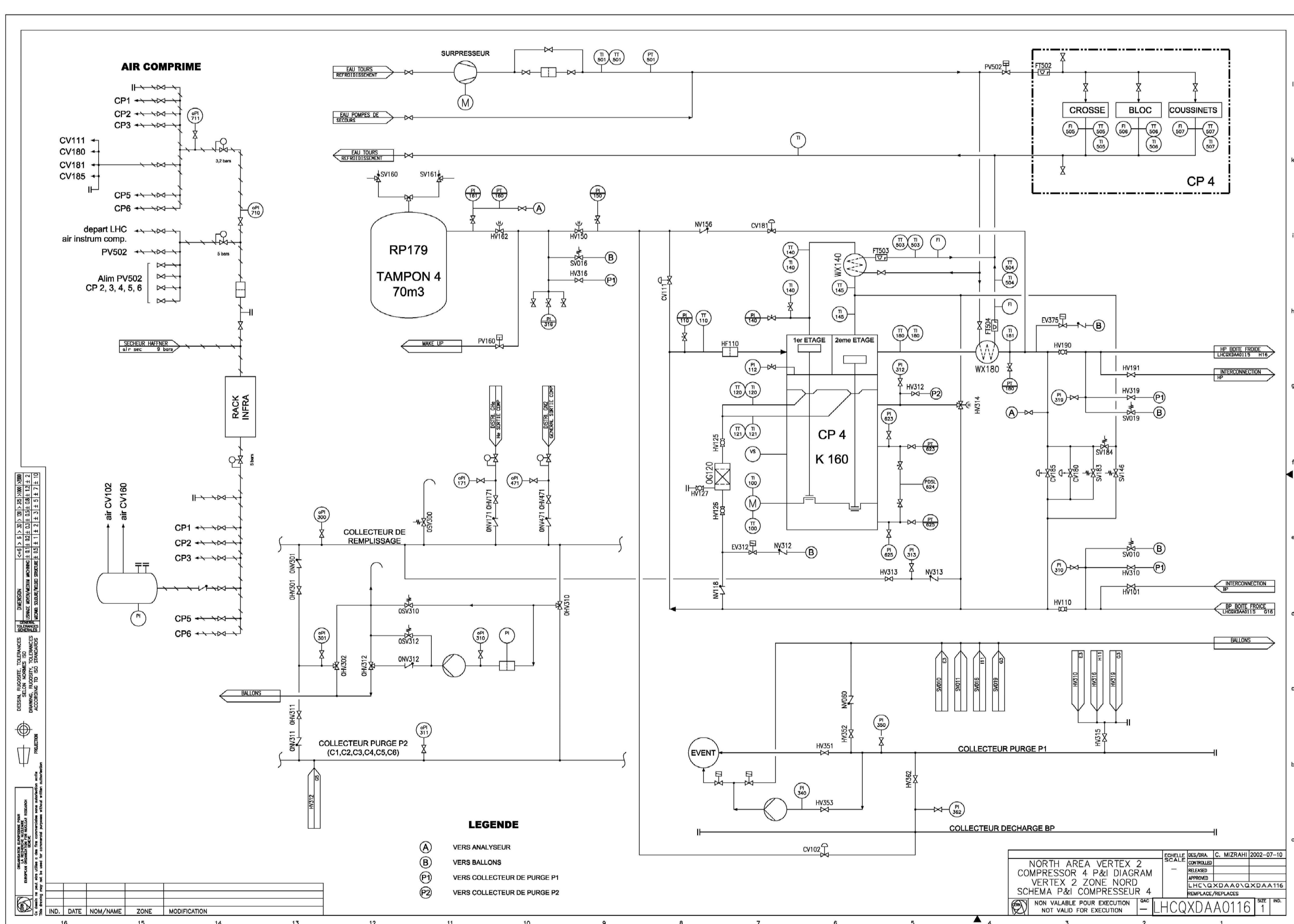


Installations which need to be upgraded :

- Cryolab (5 PLCs)
- SM18 helium storage (2 PLCs)
- CAST (Compressor & Cold Box) (2 PLCs)
- North Area (Compressors, Infrastructure & Clients) (10 PLCs)
- West Area (Compressor & Cold Box) (2 PLCs)

Upgrade of the pistons compressors

Piping & Instrumentation Diagram



6 pistons compressors which provide a compression from 1200 mBar to 12 Bar , controlled by 3 ABB PLCs working for more than 15 years.

TECHNICAL STUDY

Hardware standard

Schneider Electric

CPU Premium 575X4 Eth
TSX P57 5634M

Analog Inputs (AI 16 channels)
TSX AEY 1600

Analog Outputs (AO 8 channels)
TSX ASY 800

Rack 12 pos. extensible
TSX RKY 12EXT

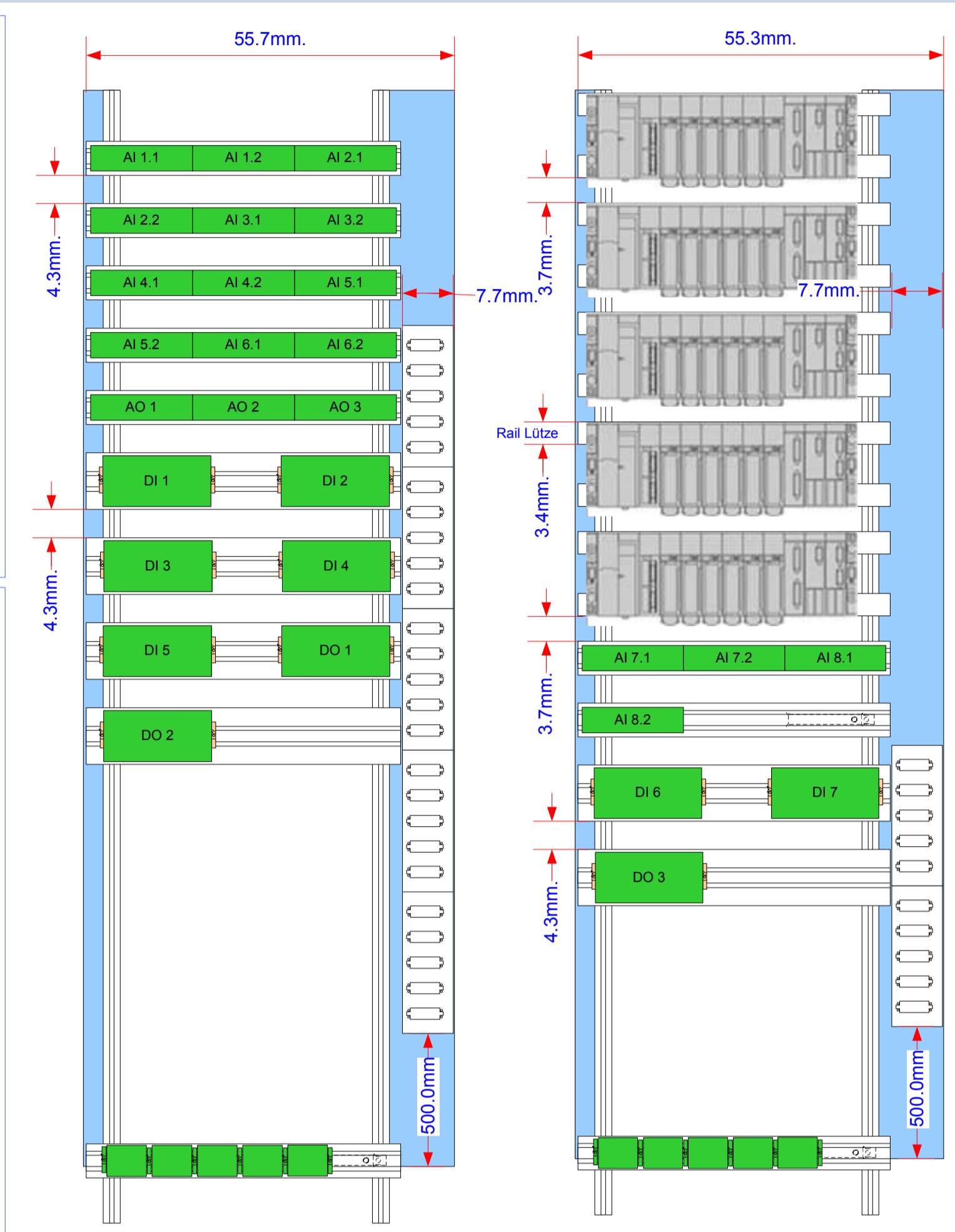
Digital Inputs (DI 32 channels)
TSX DEY 32D2K

Digital Outputs (DO 32 channels)
TSX DSY 32T2K

Alimentation 24Vdc 36W
TSX PSY 3610M

ANALOG I/O PHOENIX 8 channels
VARIOFACE UM 45 D26 SUB/S/MT/FSO3755
(Phoenix ref. 5811171)

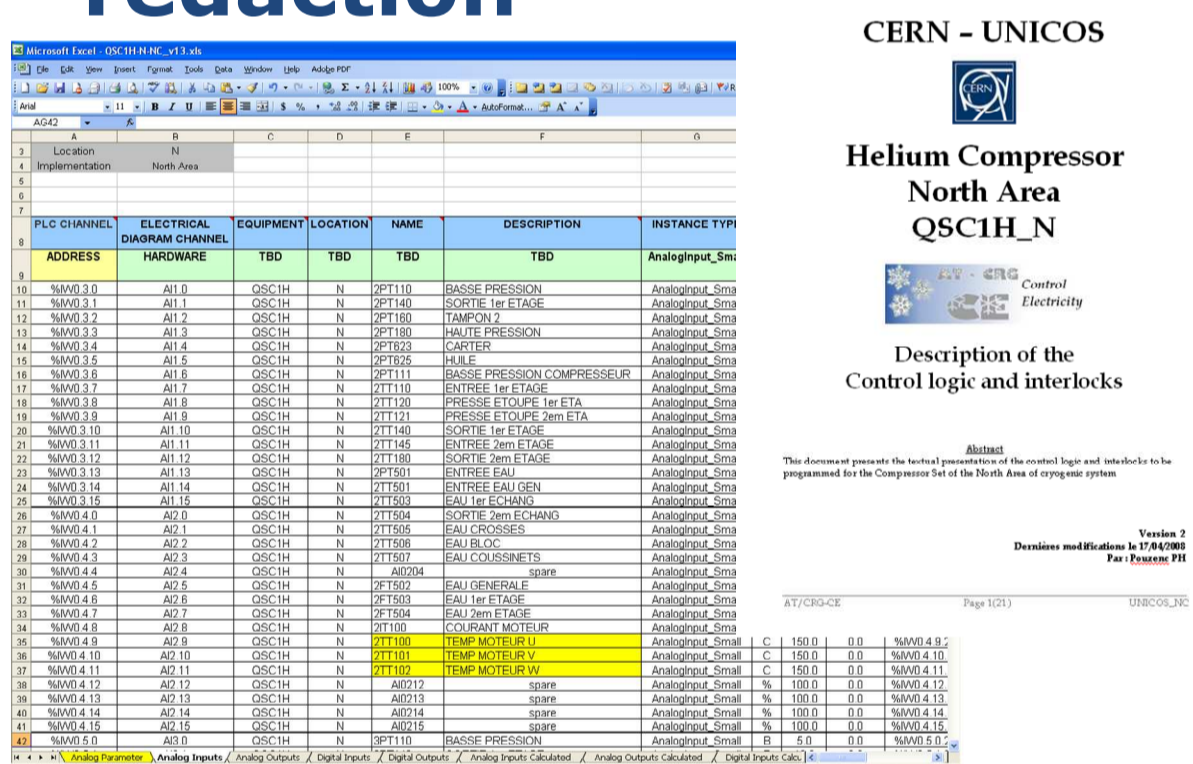
DIGITAL I/O PHOENIX 32 channels
VARIOFACE FSO5604
(Phoenix ref. 5913257)



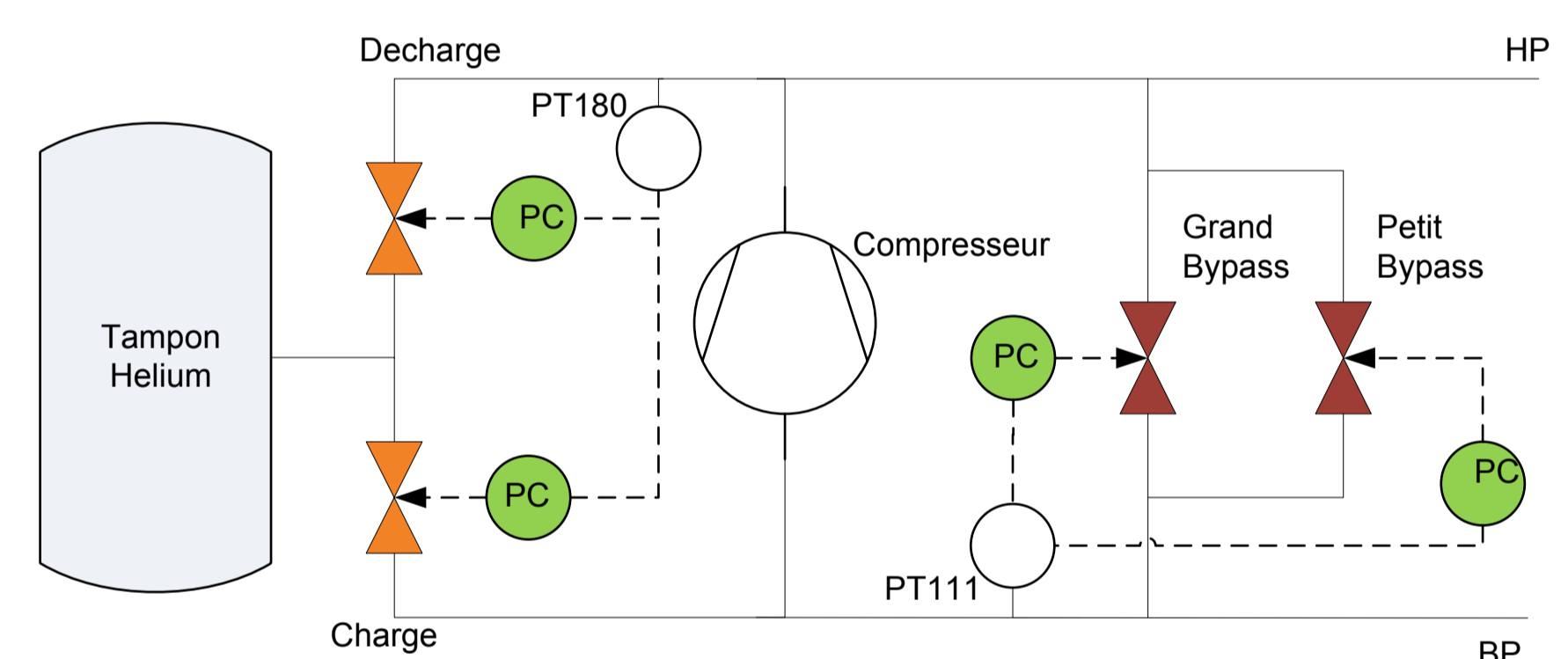
All of I/O cards are connected to the hard signals via the Phoenix Contact pre-cabing module to facilitate and improve the compatibility between the different sensors.

UNICOS (Unified Industrial Control System)

- DataBase redaction
- UNICOS specification redaction

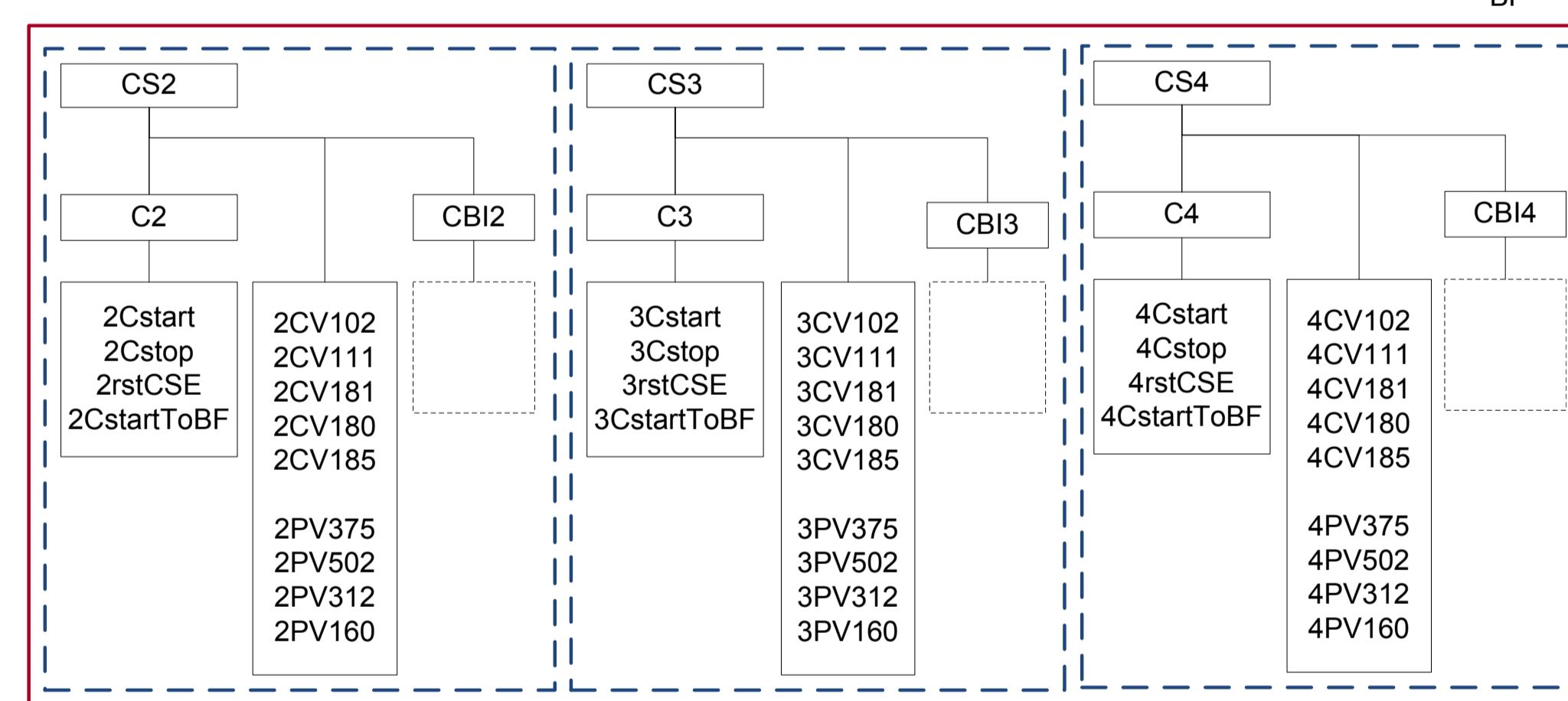


Scheme of a compressor including the valves controllers for the high and the low pressure.



- 2PLC / 5 backplanes
- 490 Inputs
- 111 Outputs
- 15 PID controllers

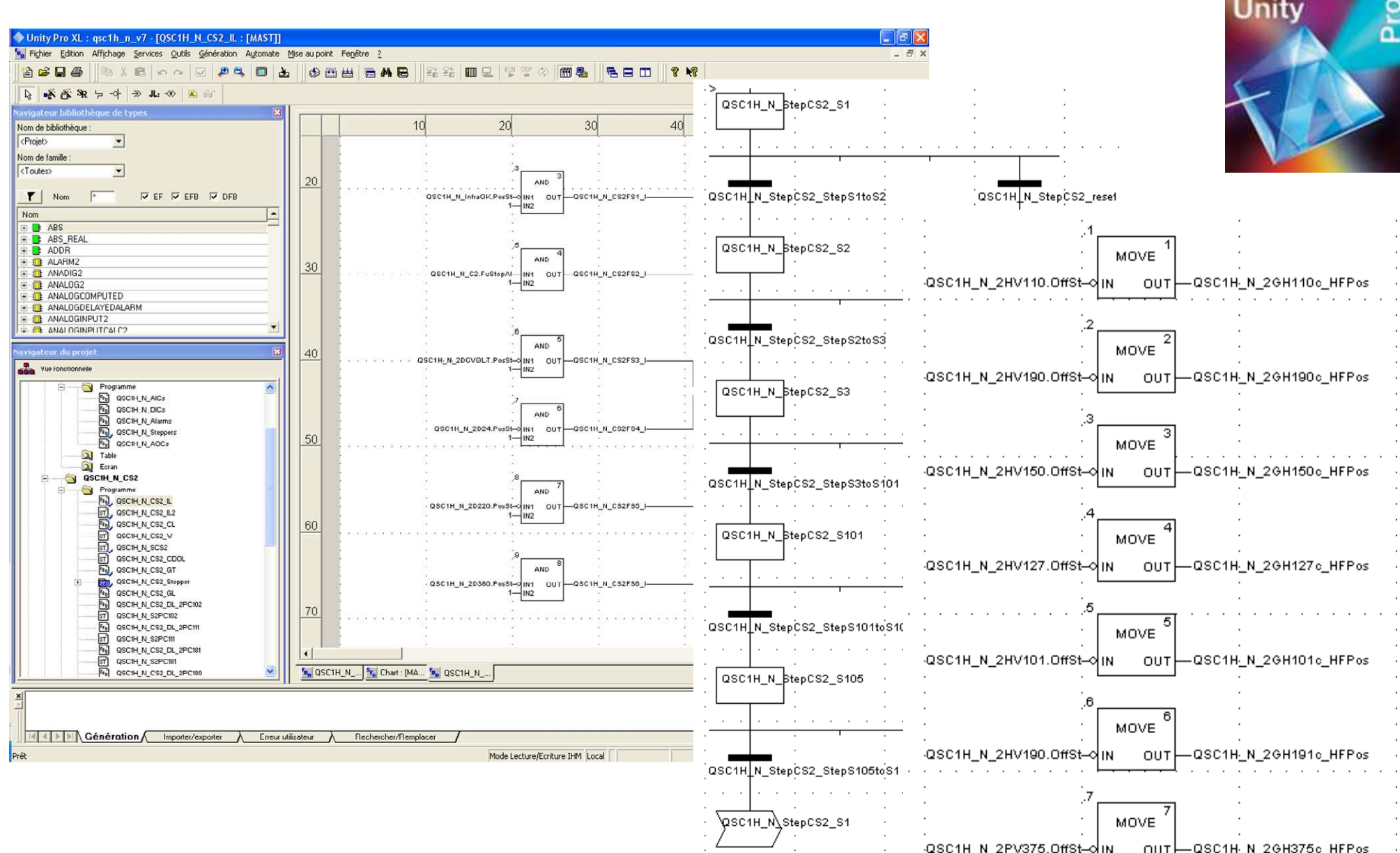
Decomposition of the installation in basic subsystems to facilitate the control.



REALISATION & TESTS

Programmation

- Reduced time source code production

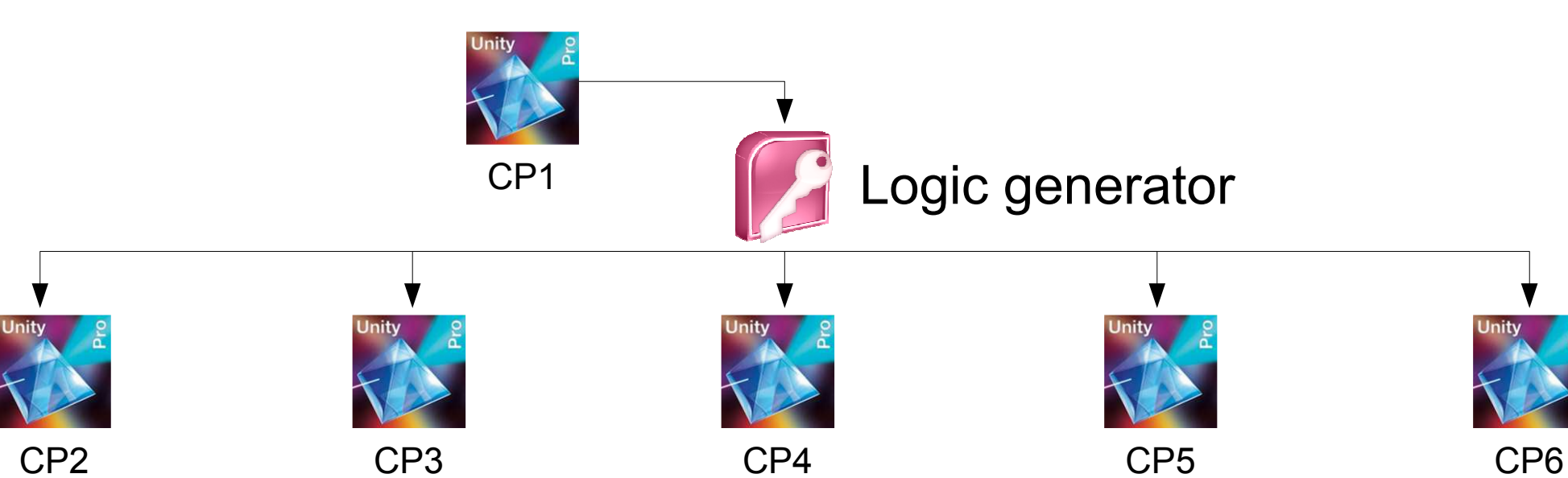
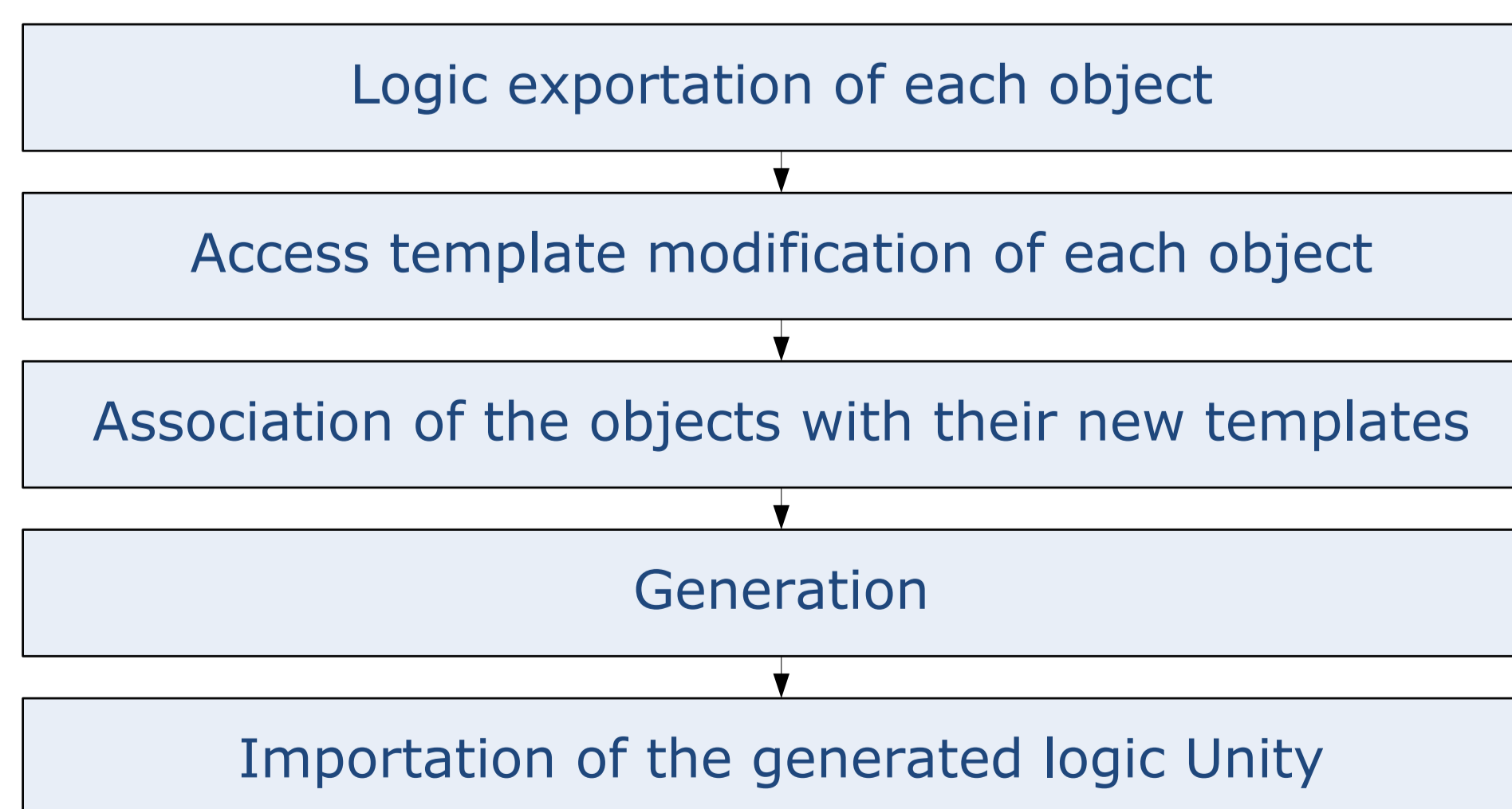


In order to minimize the time of source code production, only one compressor program is manually programmed. Then a duplication step performed by a UNICOS logic generator will automatically generate the source code for the five others compressors.

Generation

UNICOS logic generator

- Aim : Duplicate the program which is exactly the same as the 6 pistons compressors
- Method :



Simulation

To reduce the commissioning time during the migration, we will use a compressor cryogenic simulator to test virtually the logic mechanism. This will reduce considerably the risks of damaging the installation during initial test. The simulator could also be used for operation training.

The architecture for the simulation tests bench is composed of 3 powerful computers:

- A data server PVSS with server OFS.
- A simulator de CB with EcoSim Pro.
- A simulator de PLC with Unity Pro XL V3.0.

