

PLC Factory

PLC Based Control Systems workshop
ICALEPCS 2019

Emilio Asensi
Project Engineer

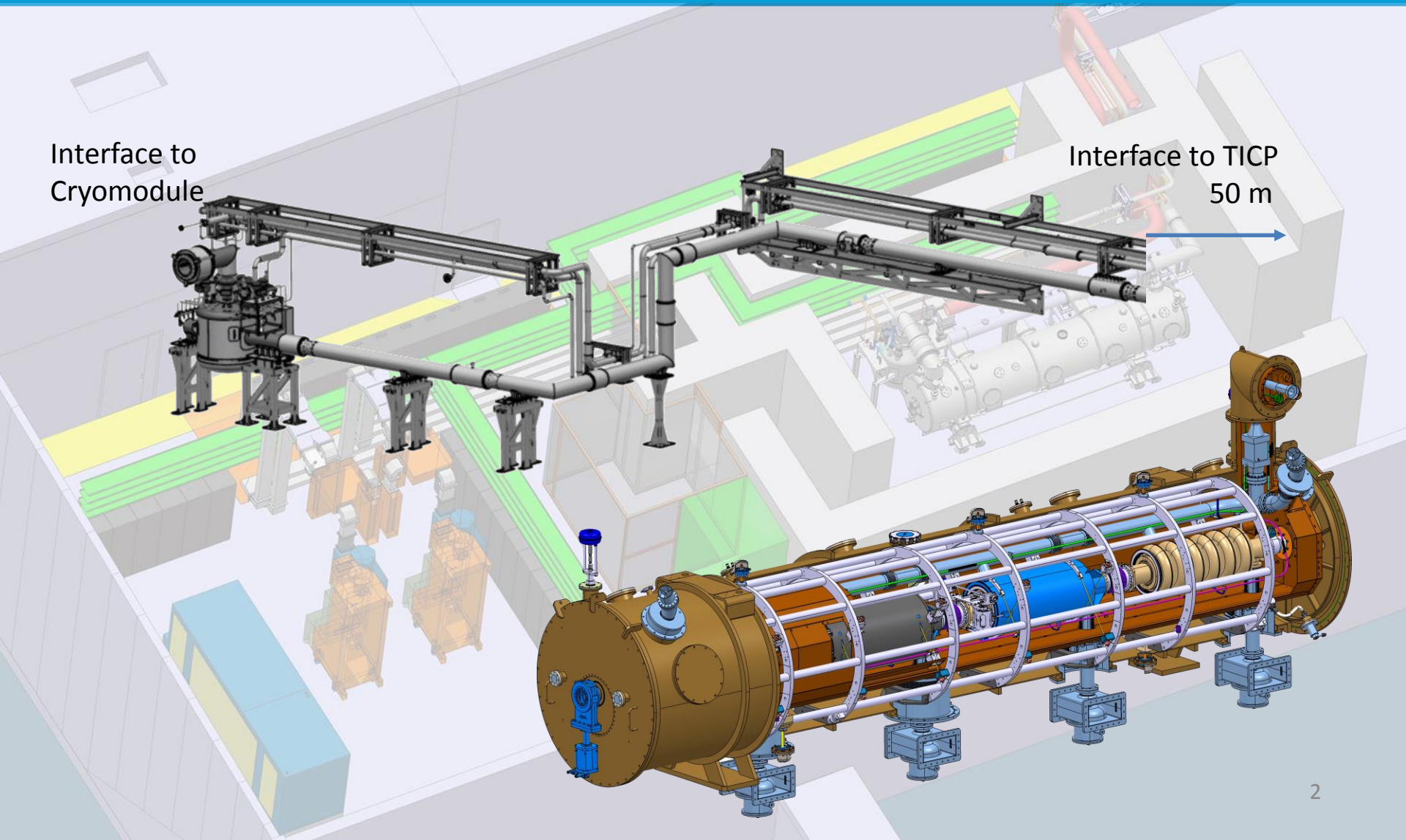
www.europeanspallationsource.se
05 October 2019

With slides of K. Vestin
and M. Boros
(both in this conference)

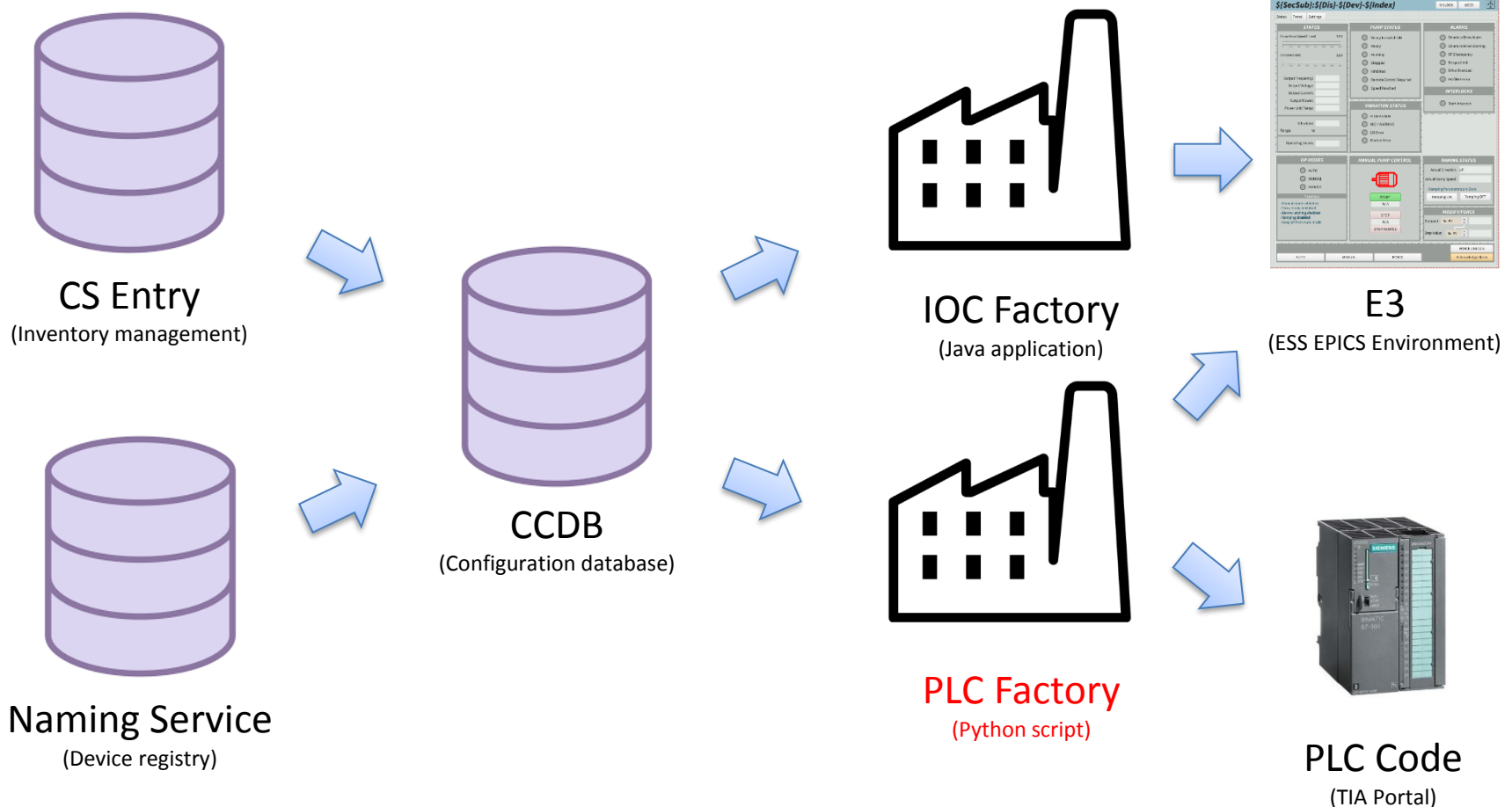
Context

Interface to
Cryomodule

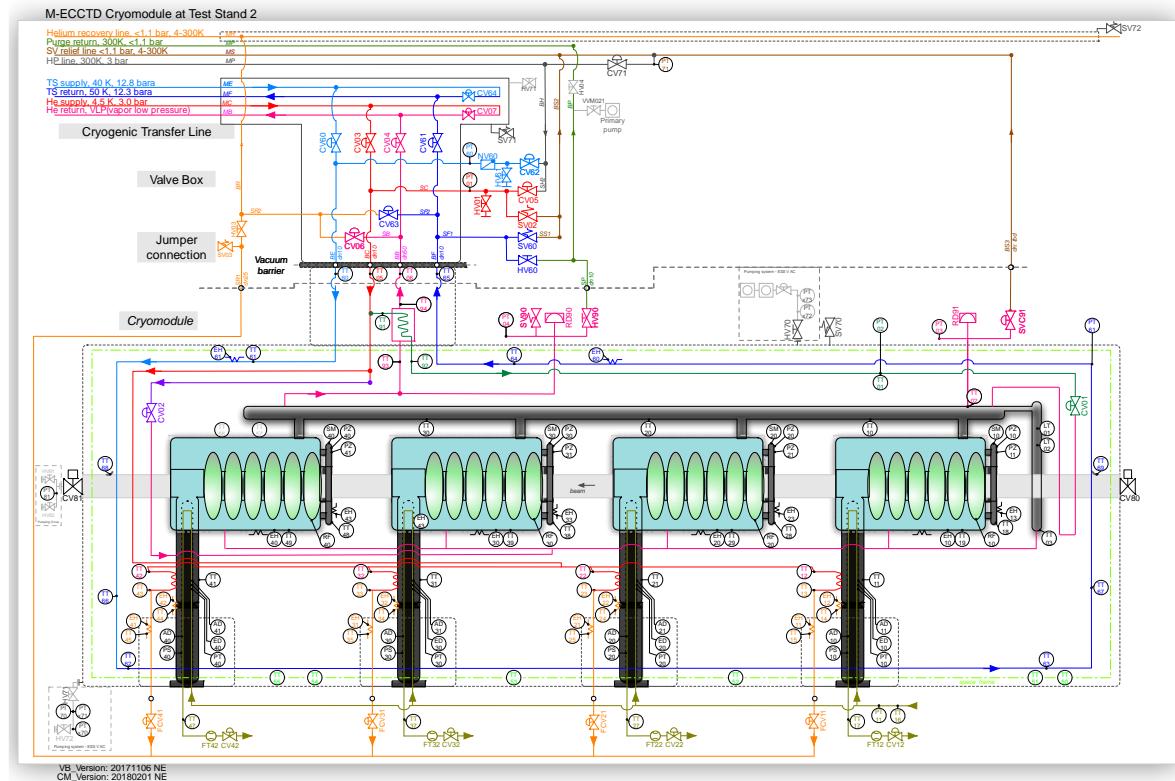
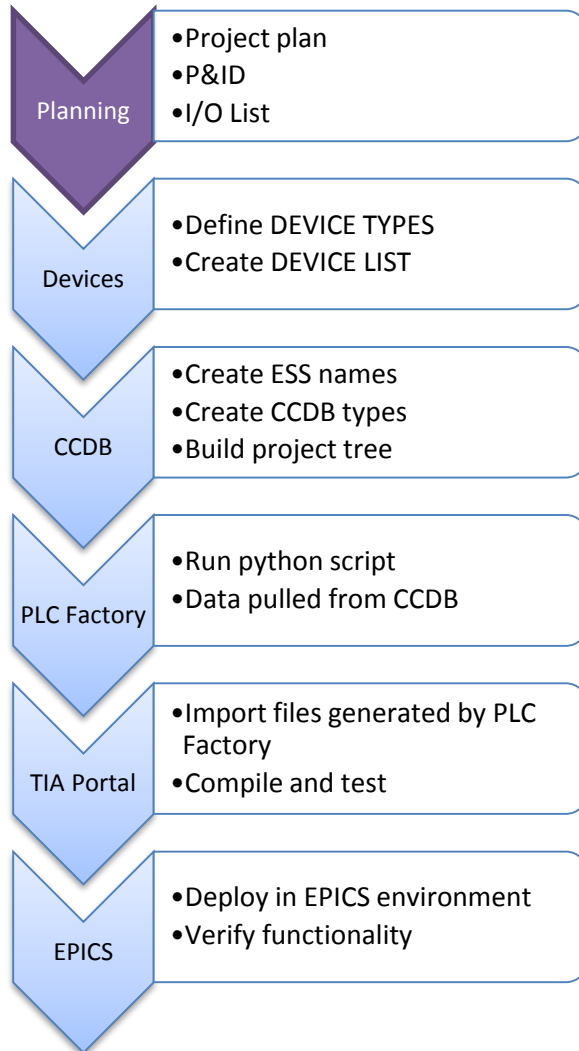
Interface to TICP
50 m



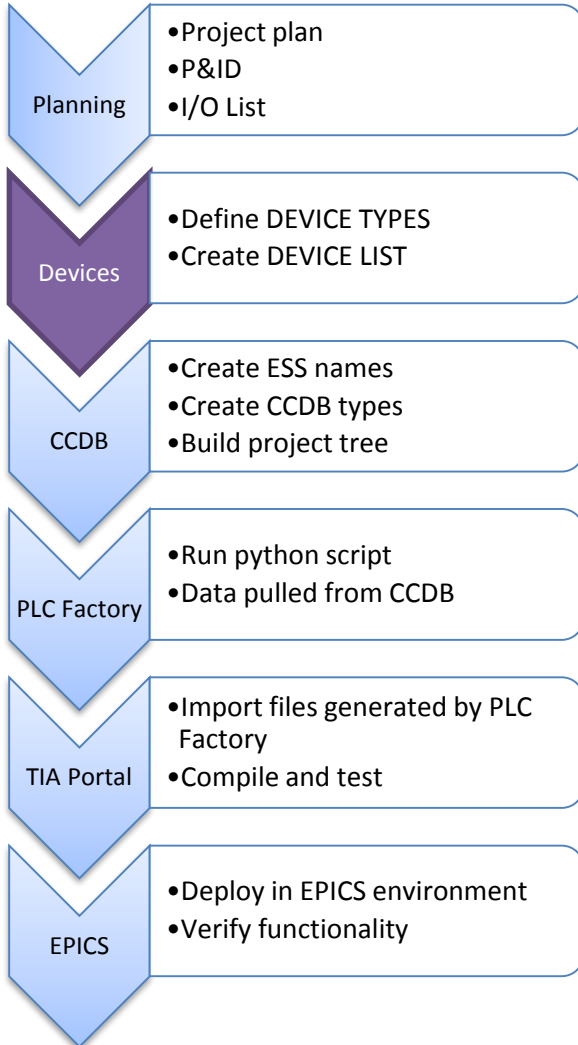
Overview of tool chain for automatic code and configuration at ESS



PLC Factory - Workflow



PLC Factory - Workflow



```

GitLab  Projects  Groups  Activity  Milestones  Snippets  Search or jump to...
ICS_LIBRARY_DEFL...  Version: 1.0
# Author: Miklos Boros, Emilio Asensi
# Date: 17-05-2018
# Version: v1.0
# Note: Based on CMS_CV.def

#####
# STATUS BLOCK
define_status_block()

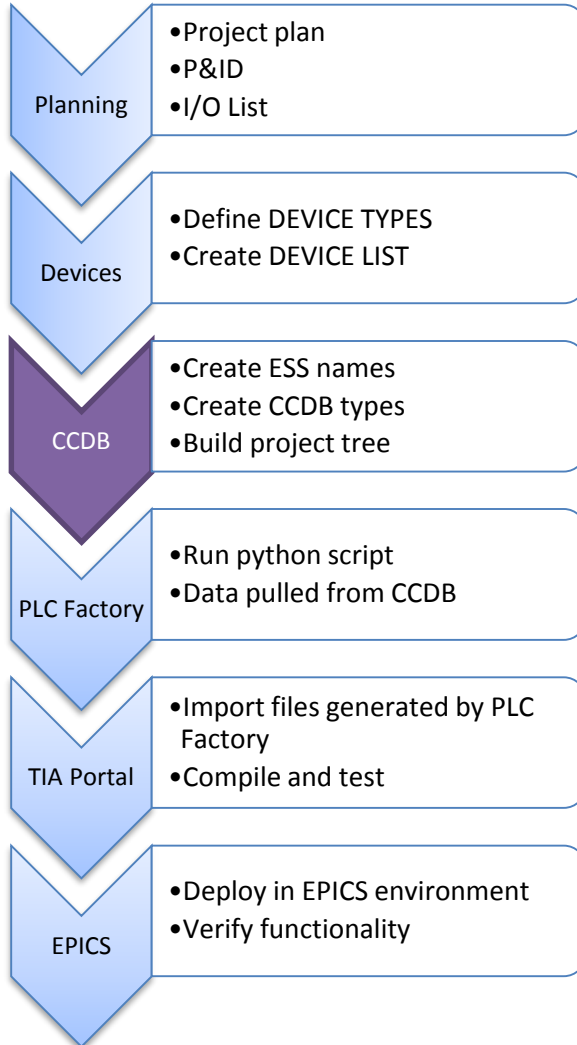
#Operation modes
add_digital("OpMode_Auto", PV_DESC="Operation Mode Auto", PV_ONAM="True", PV_ZNAM="False")
add_digital("OpMode_Manual", PV_DESC="Operation Mode Manual", PV_ONAM="True", PV_ZNAM="False")
add_digital("OpMode_Forced", PV_DESC="Operation Mode Forced", PV_ONAM="True", PV_ZNAM="False")
add_analog("ValveColor", "INT", PV_DESC="BlockIcon valve color")

#Valve states
add_analog("ValvePosition", "REAL", PV_DESC="Valve Position AI", PV_EGU="%")
add_analog("ValveSP", "REAL", PV_DESC="Valve Setpoint", PV_EGU="%")
add_analog("ValveMV", "REAL", PV_DESC="Valve Control AO", PV_EGU="%")
add_digital("Opening", PV_DESC="Valve opening", PV_ONAM="Opening", PV_ZNAM="NotMoving")
add_digital("Closing", PV_DESC="Valve closing", PV_ONAM="Closing", PV_ZNAM="NotMoving")
add_analog("StatusRB", "BYTE", PV_DESC="Valve ReadBack Status")
add_analog("DiscretePosition", "INT", PV_DESC="Valve Discrete Position (0-3)")
add_analog("DiscreteStatus", "BYTE", PV_DESC="Valve Discrete Status")
add_analog("DiagnosticsCB01", "BYTE", PV_DESC="CheckBack byte 01")
add_analog("DiagnosticsCB02", "BYTE", PV_DESC="CheckBack byte 02")
add_analog("DiagnosticsCB03", "BYTE", PV_DESC="CheckBack byte 03")

#Inhibit signals (set by the PLC code, can't be changed by the OPI)
add_digital("Inhibit_Manual", PV_DESC="Inhibit Manual Mode", PV_ONAM="InhibitManual", PV_ZNAM="AllowManual")
    
```

Device name	Description	Device type
TS2-010CRM:Cryo-FCV-031	Cavity 3 helium flow setpoint	ICS_MFC
TS2-010CRM:Cryo-FCV-041	Cavity 4 helium flow setpoint	ICS_MFC
TS2-010CRM:Cryo-CV-001	Helium manifold cavities 2K supply	ICS_CV
TS2-010CRM:Cryo-CV-002	Helium 4K cavities filling	ICS_CV
TS2-010CRM:Cryo-EH-010	Heater in helium tank, Cavity 1	ICS_EH_AO
TS2-010CRM:Cryo-EH-020	Heater in helium tank, Cavity 2	ICS_EH_AO

PLC Factory - Workflow



Planning

- Project plan
- P&ID
- I/O List

Devices

- Define DEVICE TYPES
- Create DEVICE LIST

CCDB

- Create ESS names
- Create CCDB types
- Build project tree

PLC Factory

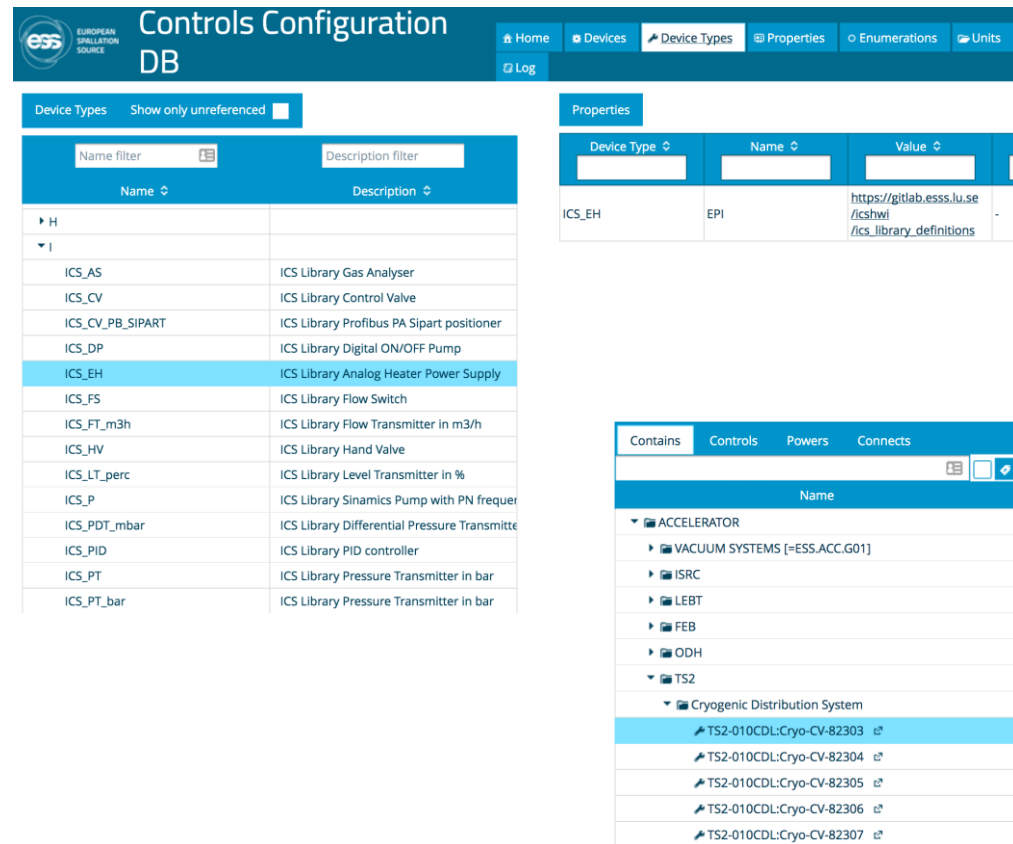
- Run python script
- Data pulled from CCDB

TIA Portal

- Import files generated by PLC Factory
- Compile and test

EPICS

- Deploy in EPICS environment
- Verify functionality



Controls Configuration DB

Home Devices **Device Types** Properties Enumerations Units

Log

Device Types Show only unreferenced

Name filter Description filter

Name	Description
▶ H	
▼ I	
ICS_AS	ICS Library Gas Analyser
ICS_CV	ICS Library Control Valve
ICS_CV_PB_SIPART	ICS Library Profibus PA Sipart positioner
ICS_DP	ICS Library Digital ON/OFF Pump
ICS_EH	ICS Library Analog Heater Power Supply
ICS_FS	ICS Library Flow Switch
ICS_FT_m3h	ICS Library Flow Transmitter in m3/h
ICS_HV	ICS Library Hand Valve
ICS_LT_perc	ICS Library Level Transmitter in %
ICS_P	ICS Library Sinamics Pump with PN frequer
ICS_PDT_mbar	ICS Library Differential Pressure Transmitter
ICS_PID	ICS Library PID controller
ICS_PT	ICS Library Pressure Transmitter in bar
ICS_PT_bar	ICS Library Pressure Transmitter in bar

Properties

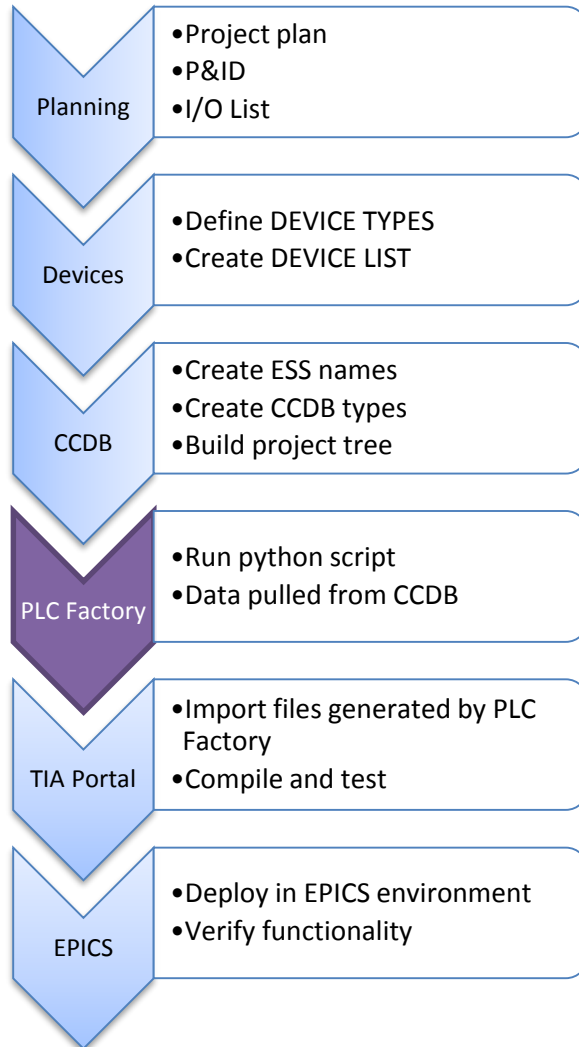
Device Type	Name	Value
ICS_EH	EPI	https://gitlab.ess.lu.se/icswhw/ics_library_definitions

Contains Controls Powers Connects

Name

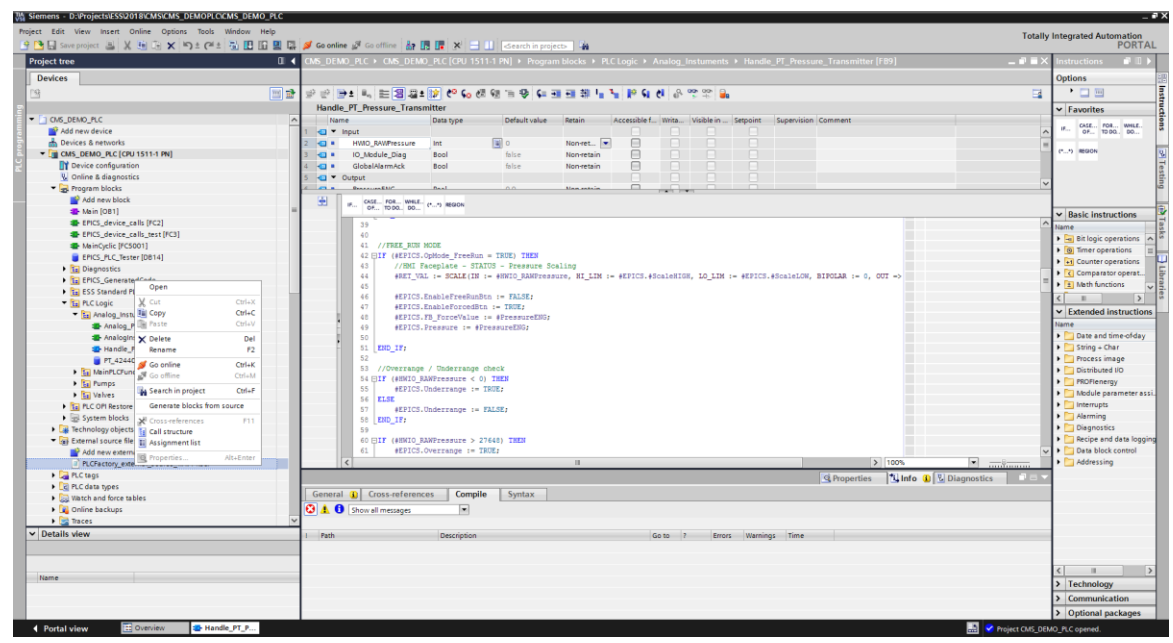
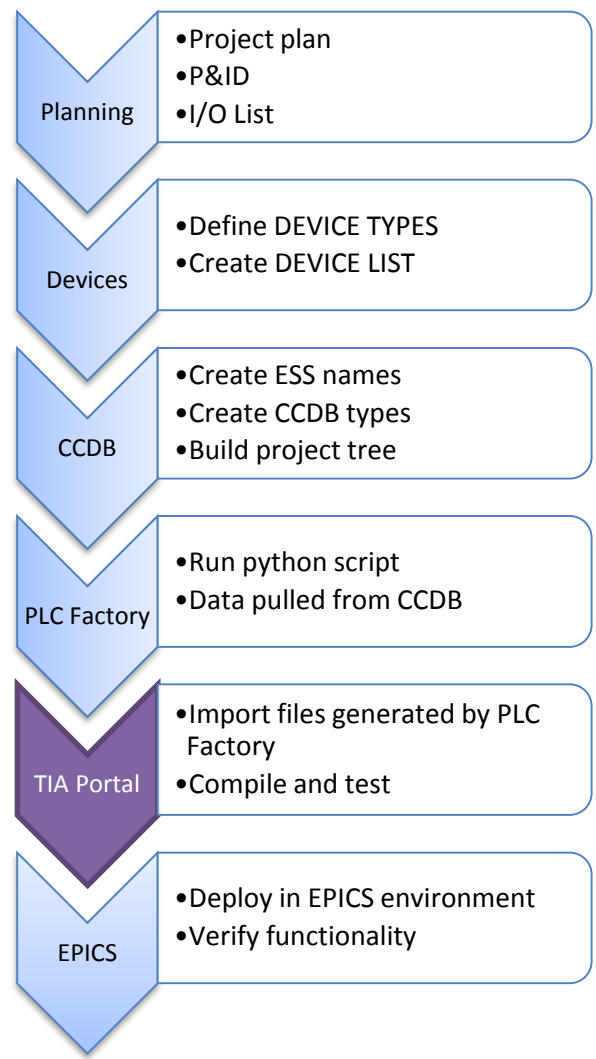
- ACCELERATOR
 - VACUUM SYSTEMS [=ESS.ACC.G01]
 - ISRC
 - LEBT
 - FEB
 - ODH
 - TS2
 - Cryogenic Distribution System
 - TS2-010CDL:Cryo-CV-82303
 - TS2-010CDL:Cryo-CV-82304
 - TS2-010CDL:Cryo-CV-82305
 - TS2-010CDL:Cryo-CV-82306
 - TS2-010CDL:Cryo-CV-82307

PLC Factory - Workflow

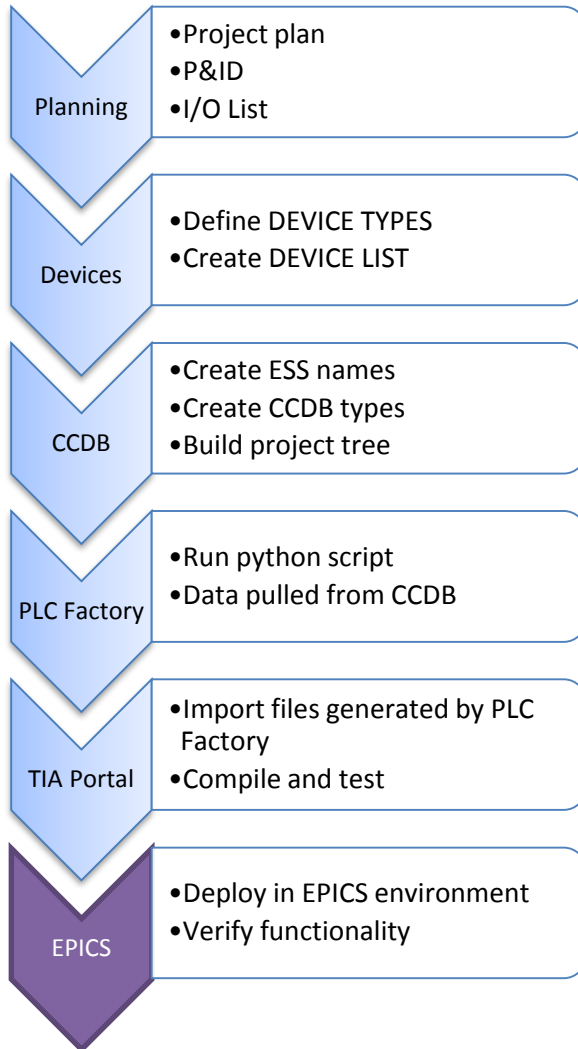
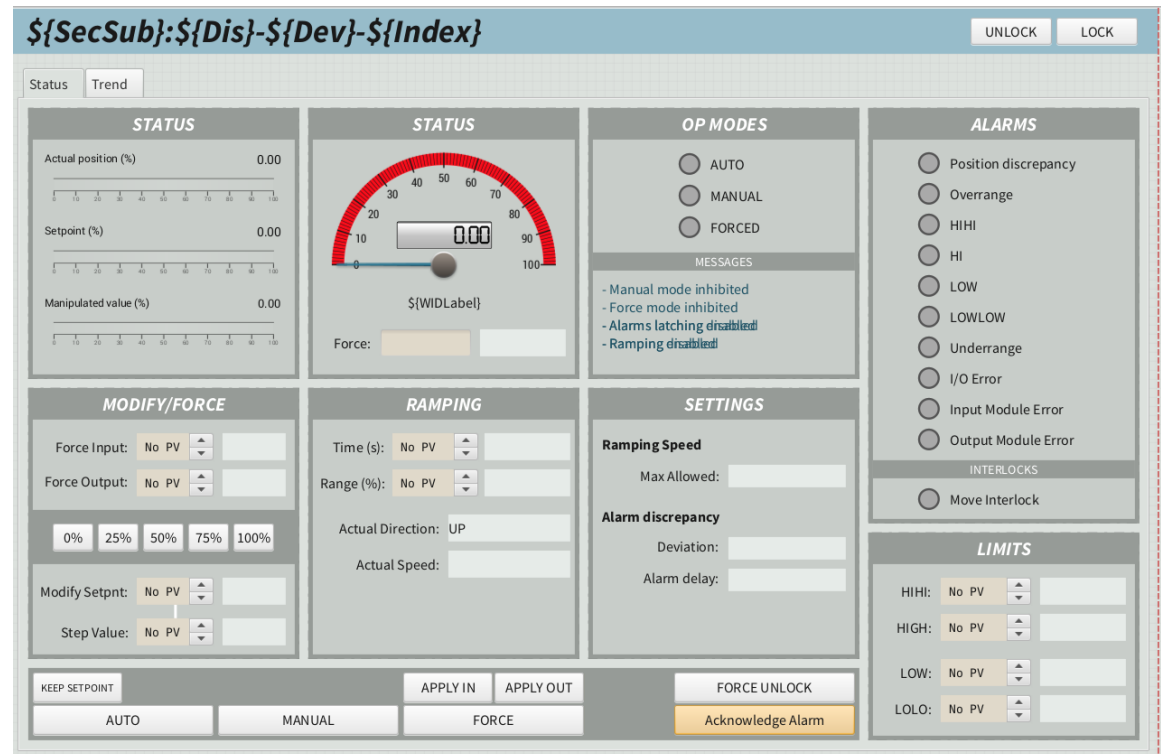


```
python plcfactory.py -d TS2-010CRM:Cryo-PLC-001 --plc-interface=14 --eee
```

PLC Factory - Workflow



PLC Factory - Workflow

Motor Drive Control Interface

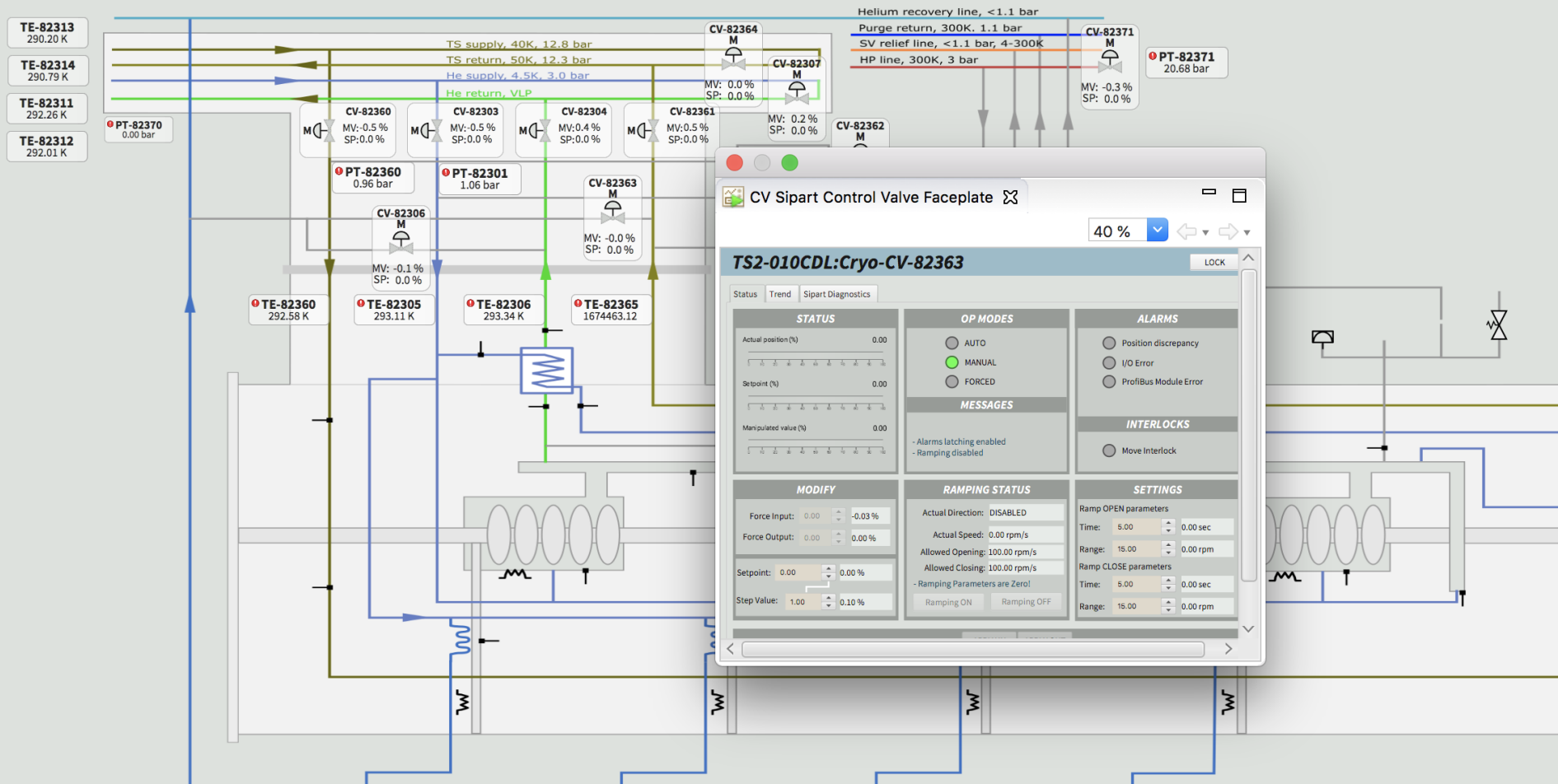
Header: `_${SecSub}:_${Dis}-${Dev}-${Index}` [UNLOCK] [LOCK]

Buttons: Status | Trend

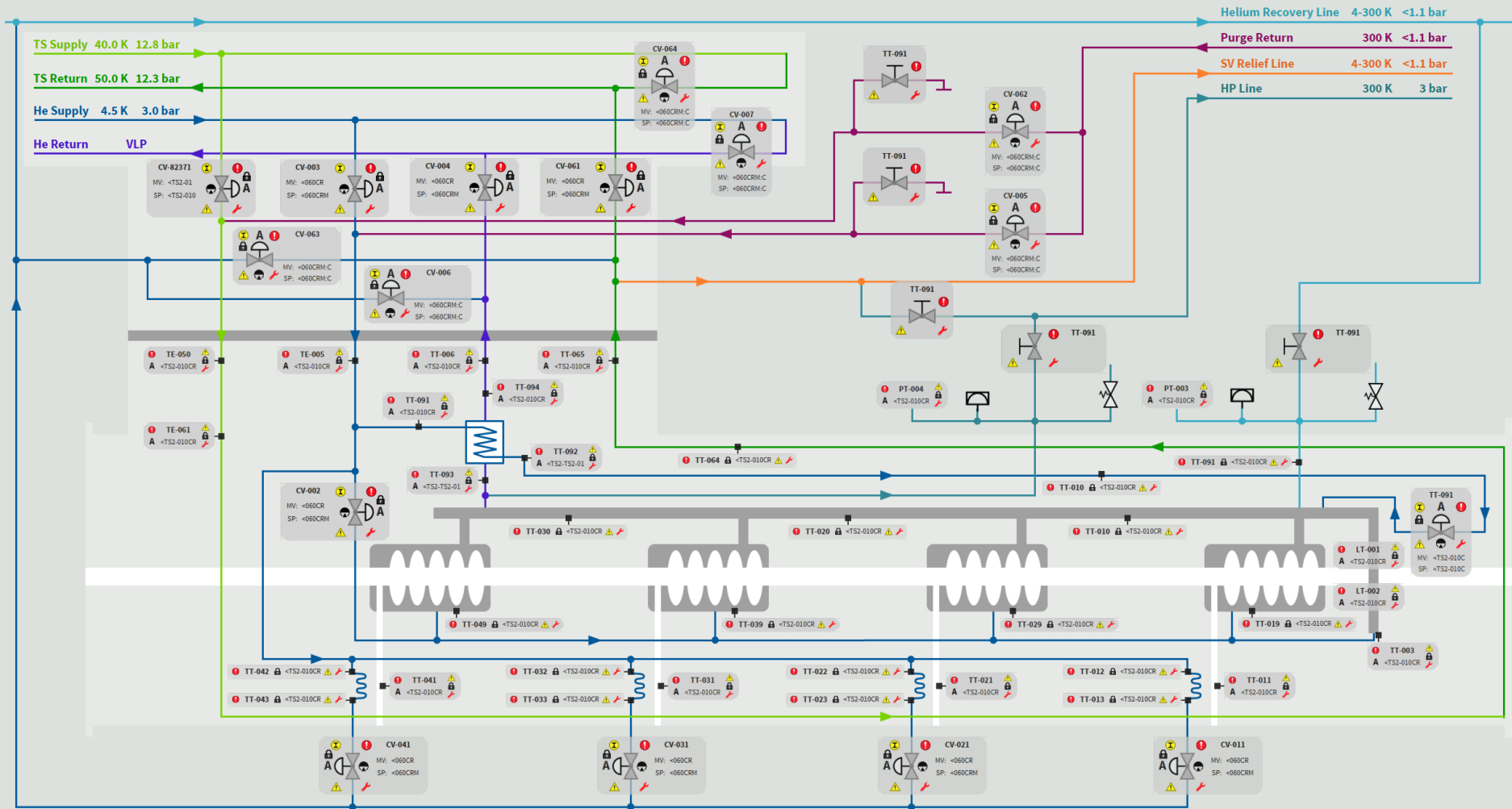
STATUS	STATUS	OP MODES	ALARMS
Actual position (%): 0.00 Setpoint (%): 0.00 Manipulated value (%): 0.00	Analog gauge showing 0.00 Force: [] []	<input type="radio"/> AUTO <input type="radio"/> MANUAL <input type="radio"/> FORCED	<input type="radio"/> Position discrepancy <input type="radio"/> Overrange <input type="radio"/> HIHI <input type="radio"/> HI <input type="radio"/> LOW <input type="radio"/> LOWLOW <input type="radio"/> Underrange <input type="radio"/> I/O Error <input type="radio"/> Input Module Error <input type="radio"/> Output Module Error
MODIFY/FORCE Force Input: No PV [] [] Force Output: No PV [] [] 0% 25% 50% 75% 100% Modify Setpnt: No PV [] [] Step Value: No PV [] []	RAMPING Time (s): No PV [] [] Range (%): No PV [] [] Actual Direction: UP Actual Speed: [] []	SETTINGS Ramping Speed Max Allowed: [] [] Alarm discrepancy Deviation: [] [] Alarm delay: [] []	INTERLOCKS <input type="radio"/> Move Interlock
KEEP SETPOINT <input type="button" value="AUTO"/>	<input type="button" value="MANUAL"/>	<input type="button" value="APPLY IN"/> <input type="button" value="APPLY OUT"/> <input type="button" value="FORCE"/>	LIMITS HIHI: No PV [] [] HIGH: No PV [] [] LOW: No PV [] [] LOLO: No PV [] []

Buttons: FORCE UNLOCK, Acknowledge Alarm

TS2 Cyomodule



TS2 Cryomodule





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SOURCE