Upgrade of the MPD/TOF test stand Gas System and Control Software

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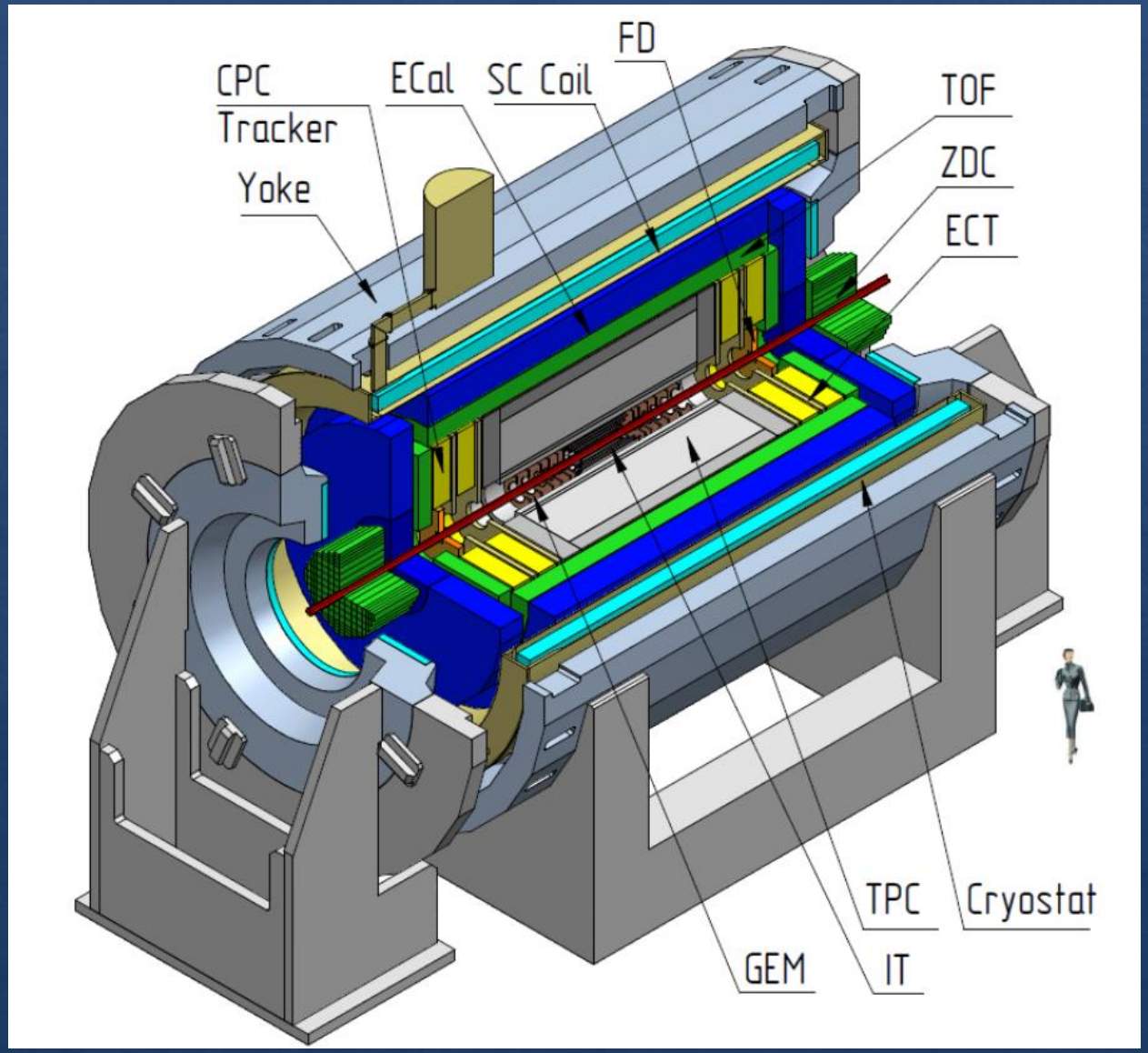
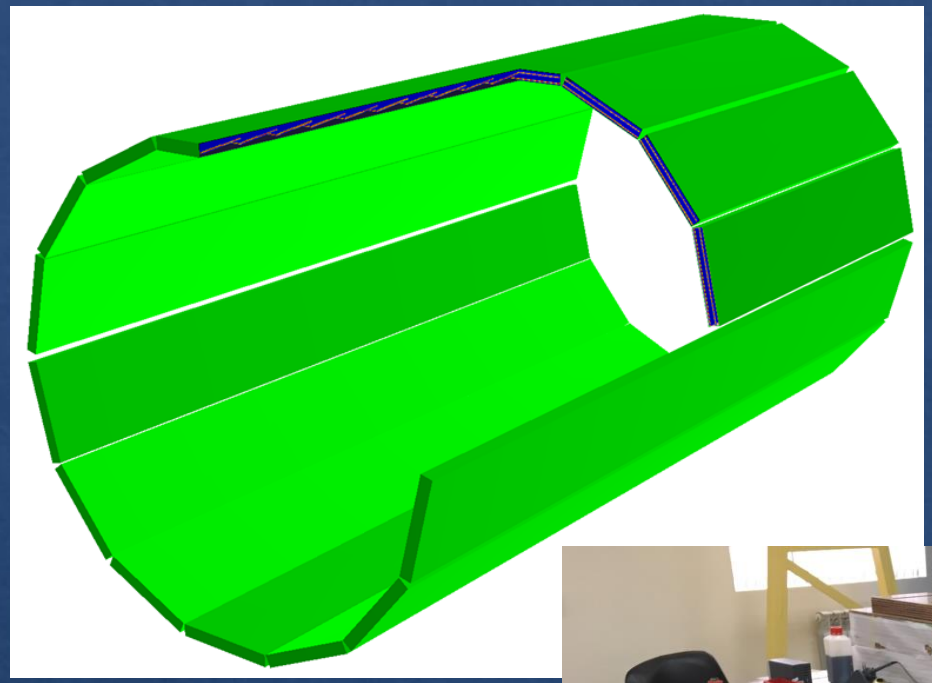
Presentation Outline

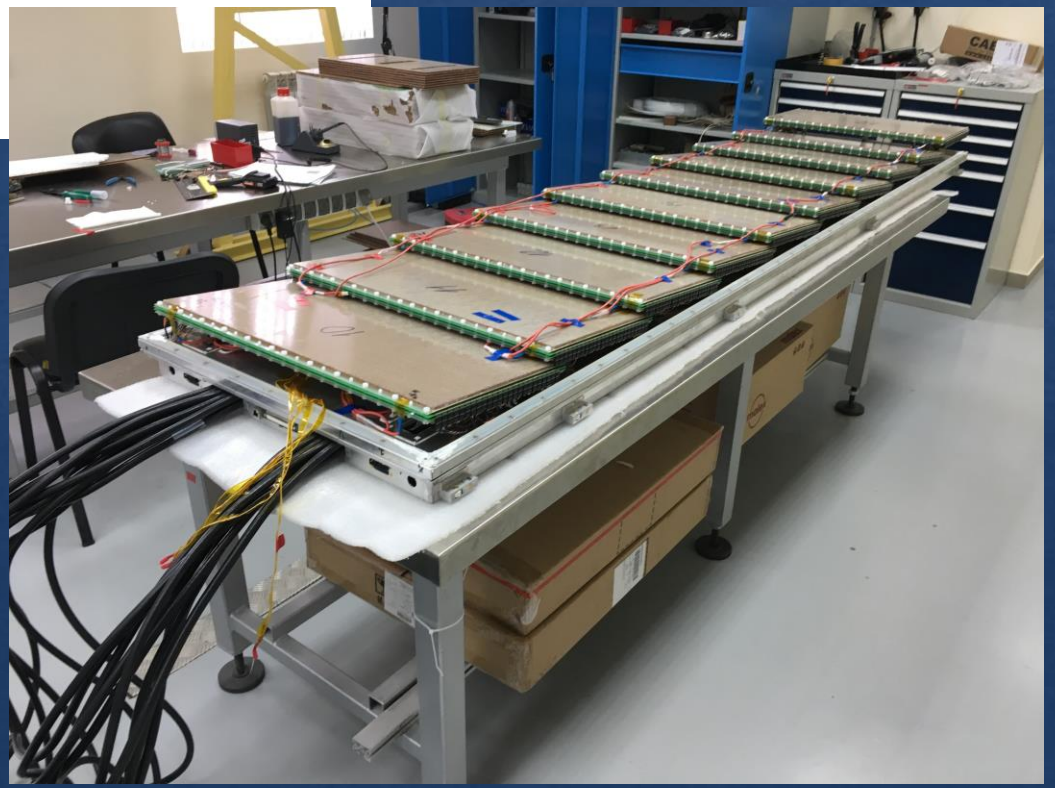
- MPD/TOF
- Gas System
- Control Software
- Further development

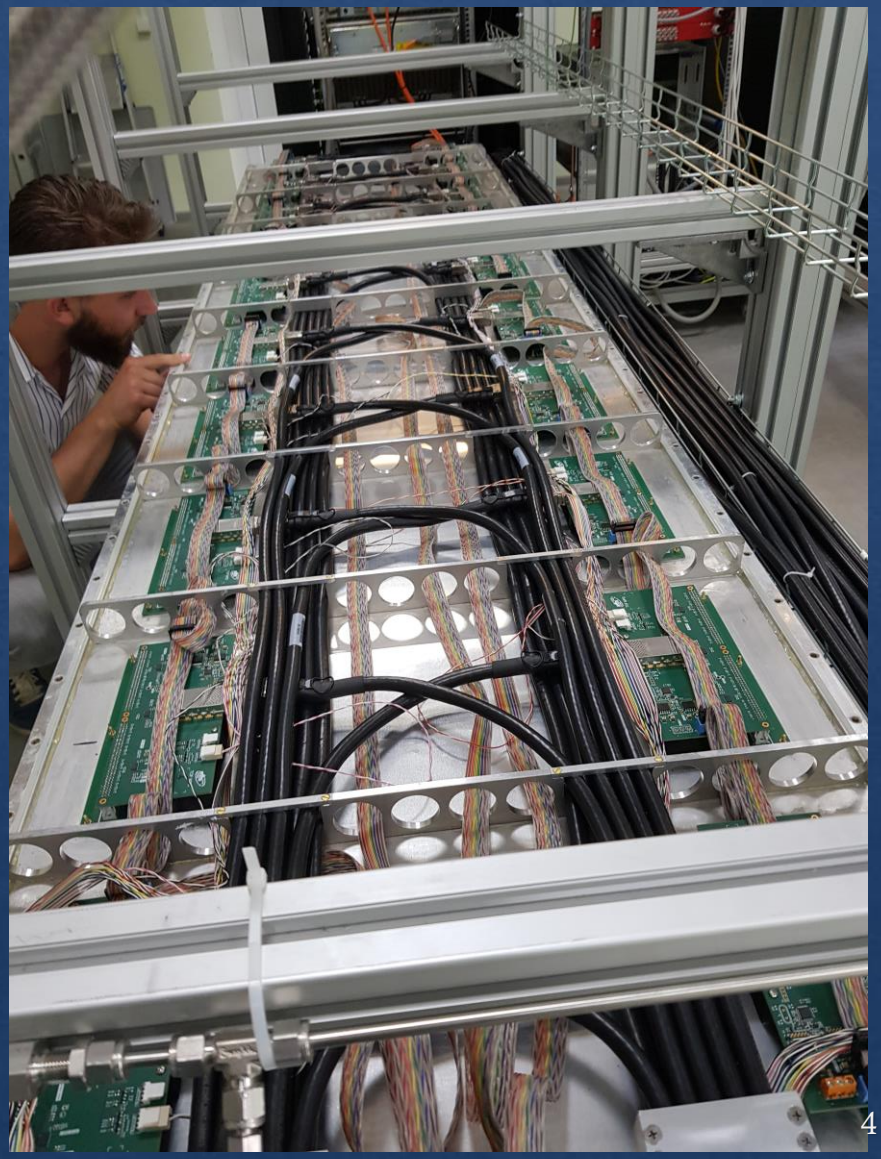
MPD – Multi Purpose Detector



TOF – Time-Of-Flight

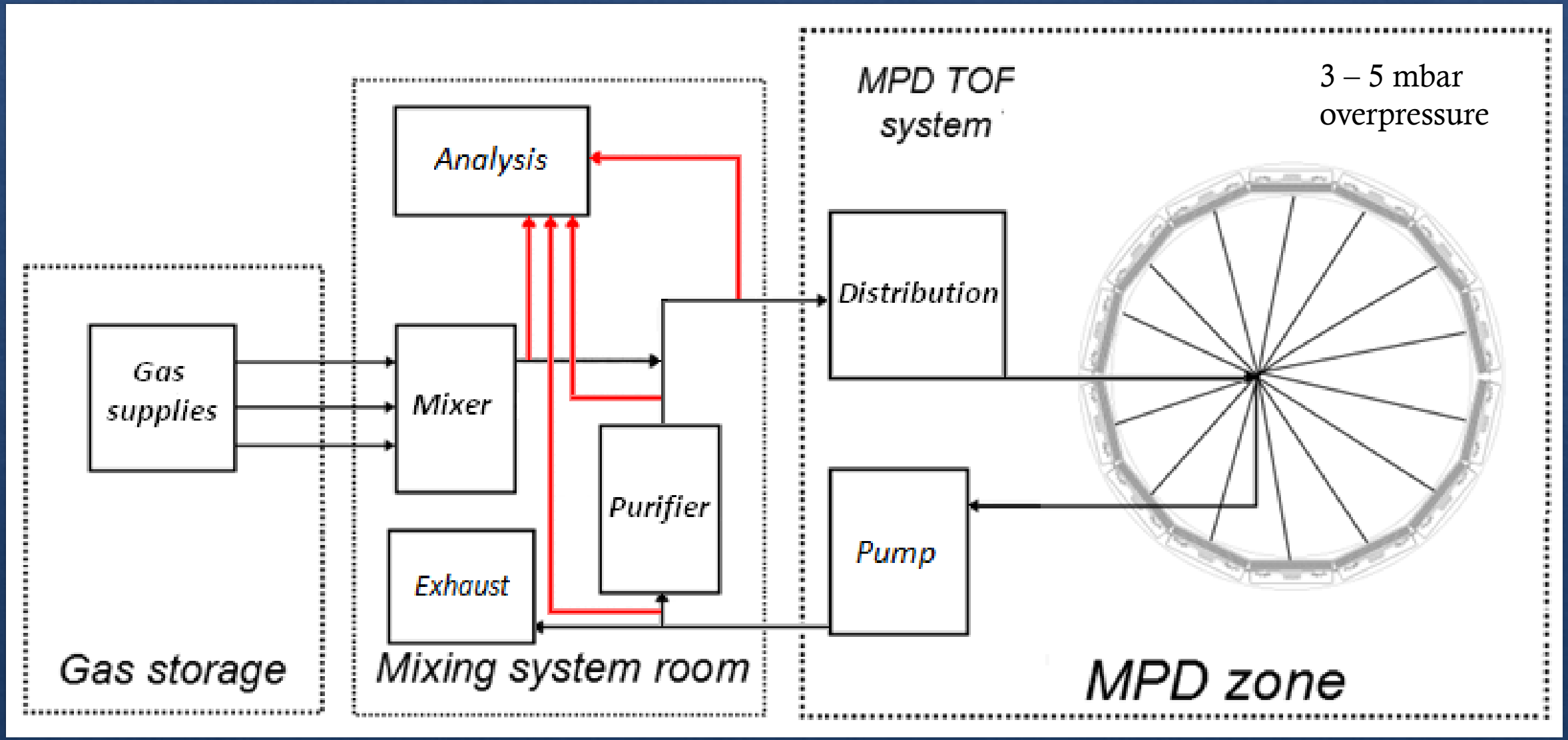




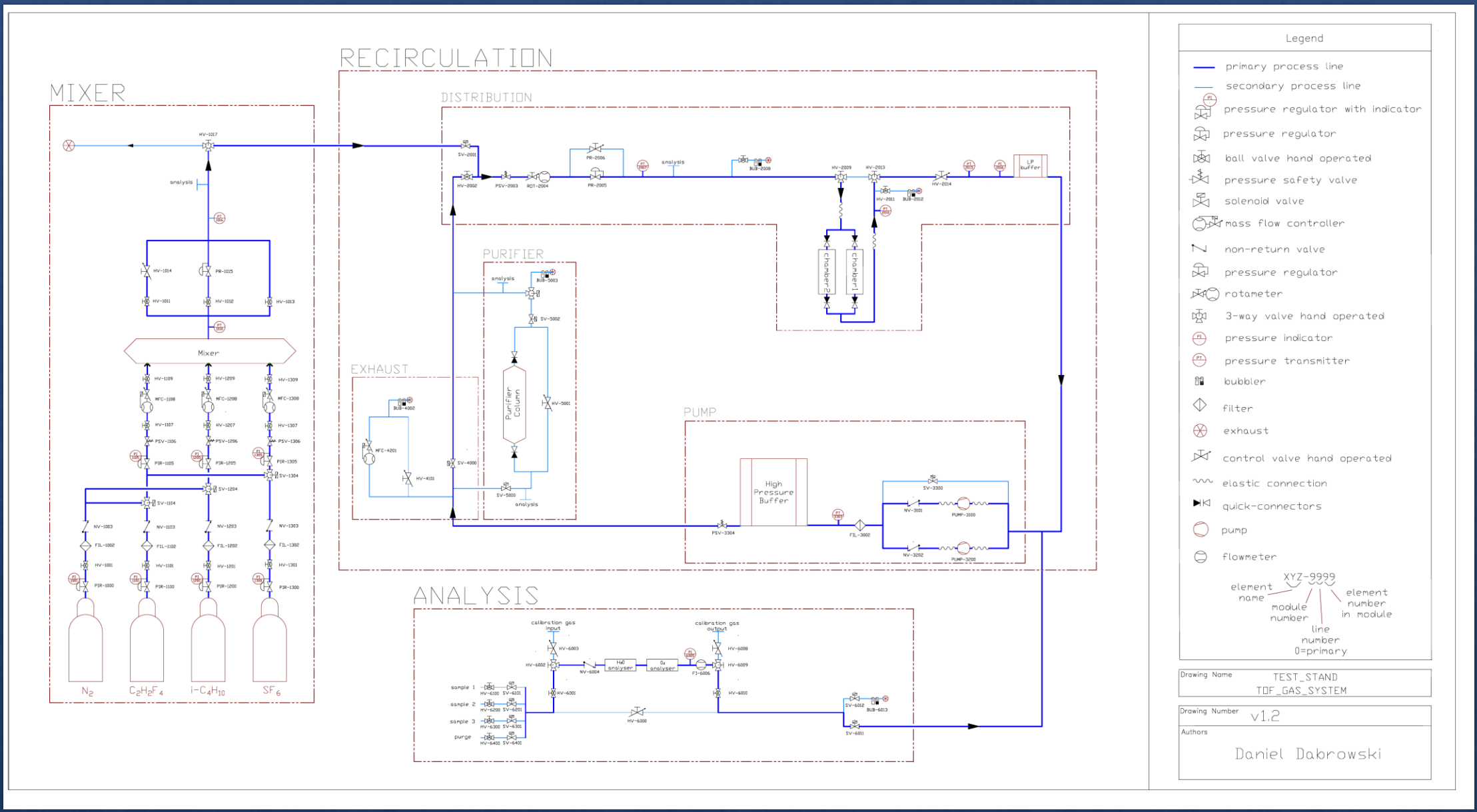


Gas System

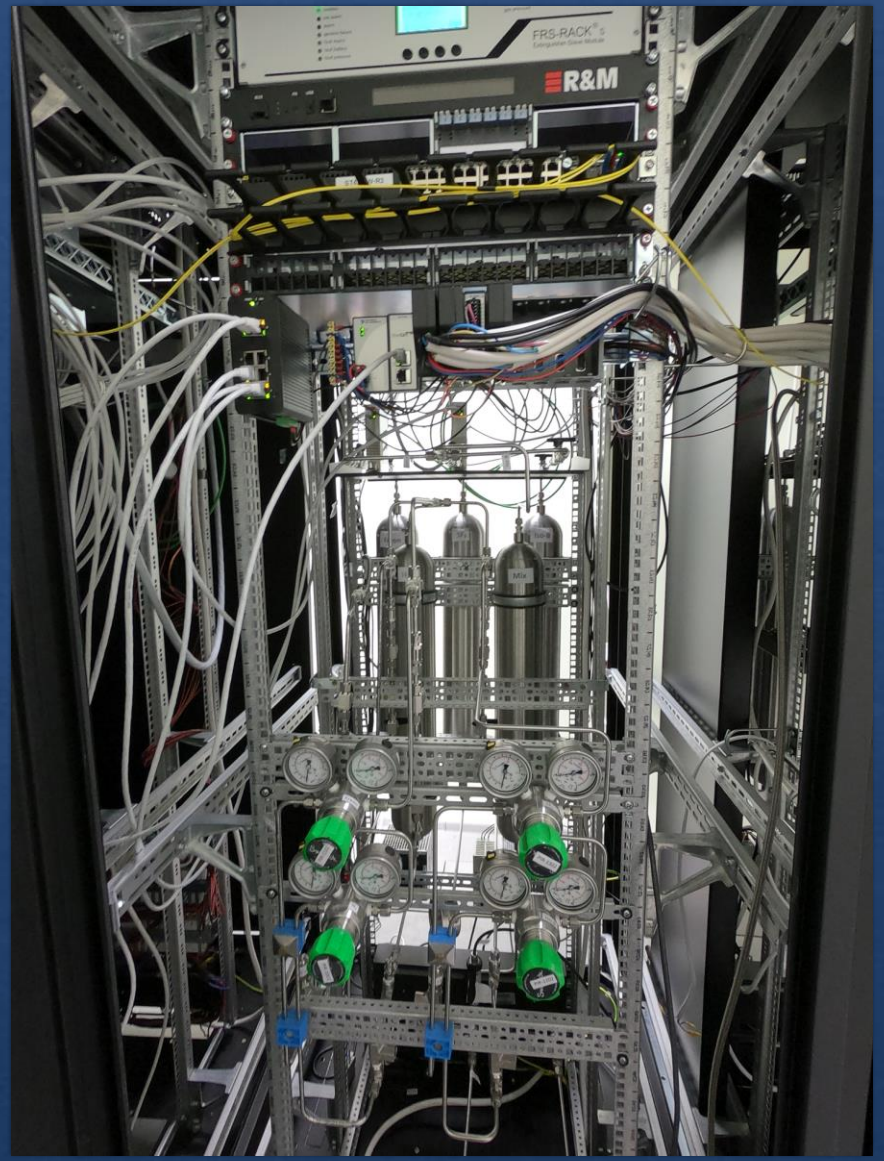
Gas System


MPD TOF system
3 – 5 mbar overpressure
Analysis
Distribution
Gas supplies
Mixer
Purifier
Exhaust
Pump
Gas storage
Mixing system room
MPD zone

Gas System


MIXER
RECIRCULATION
DISTRIBUTION
PURIFIER
EXHAUST
PUMP
ANALYSIS
Mixer
Purifier Column
High Pressure Buffer
LP buffer
chamber2
chamber1
N2
C2H2F4
i-C4H10
SF6
Legend
primary process line
secondary process line
pressure regulator with indicator
pressure regulator
ball valve hand operated
pressure safety valve
solenoid valve
mass flow controller
non-return valve
pressure regulator
rotameter
3-way valve hand operated
pressure indicator
pressure transmitter
bubbler
filter
exhaust
control valve hand operated
elastic connection
quick-connectors
pump
flowmeter
XYZ-9999
element name
module number
line number 0=primary
element number in module
Drawing Name
TEST_STAND TDF_GAS_SYSTEM
Drawing Number
v1.2
Authors
Daniel Dabrowski

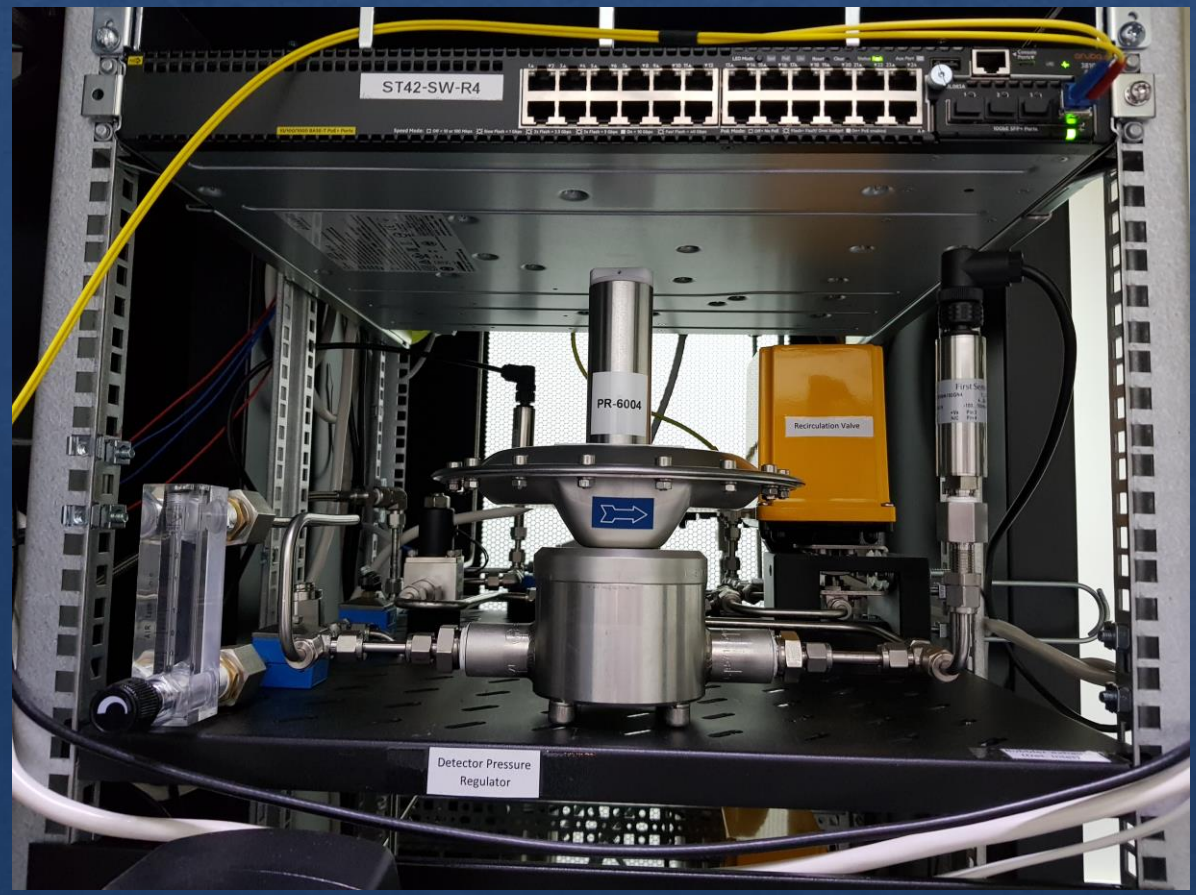
Gas System



Gas System - modifications

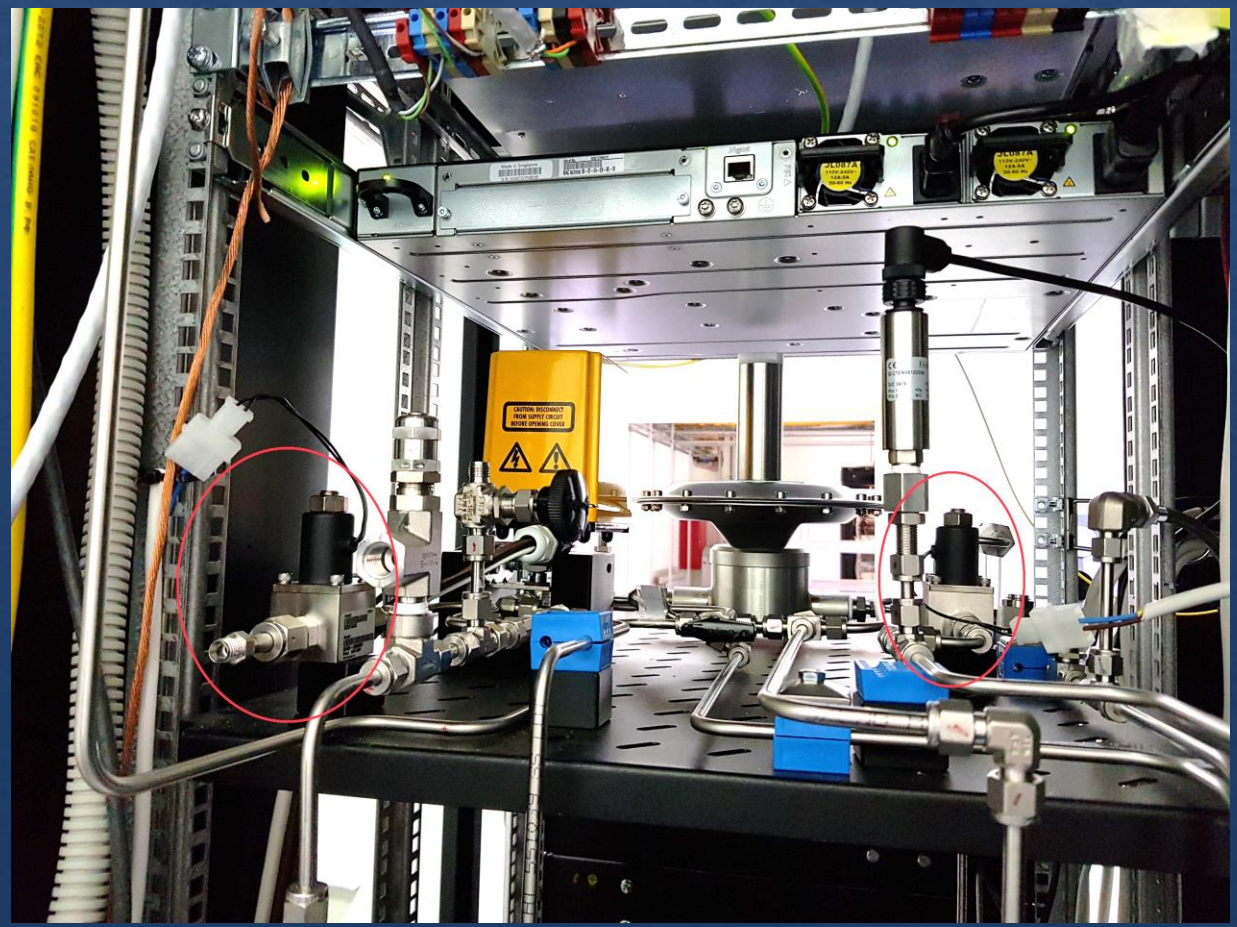
Gas System - modifications

- **Regulator Zimmerli ZM-R15**
- Valves MKS 248A



Gas System - modifications

- Regulator Zimmerli ZM-R15
- **Valves MKS 248A**



Control Software

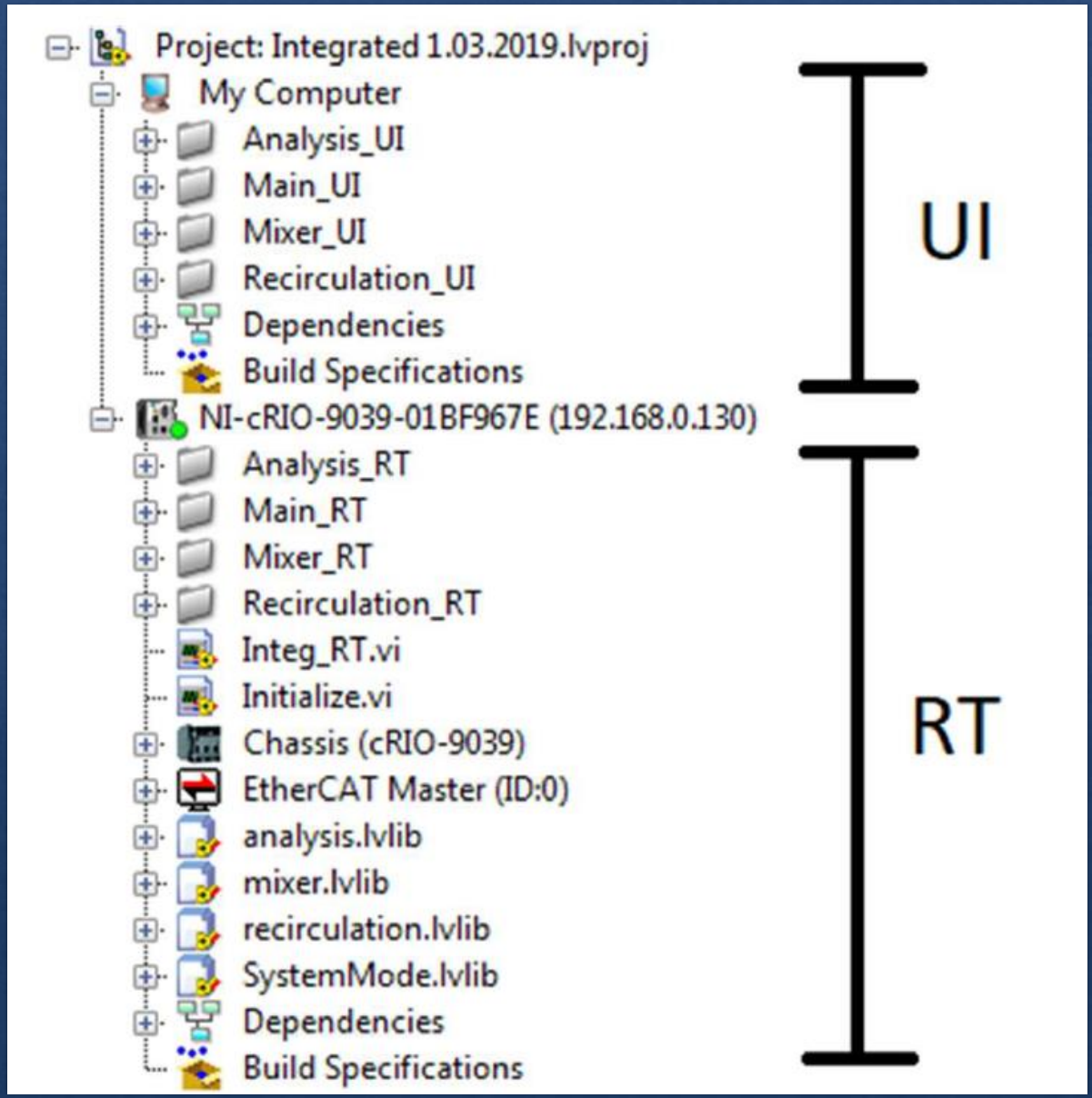
Control software - hardware

- **NI cRIO 9039**
  - **NI 9208 – 16-channel +/-20mA analog input module**
  - **NI 9375 – 16-channel 24V digital input/output module**
  - **NI 9264 – 16-channel +/-10V analog output module**
- PXIe-1085 Computer

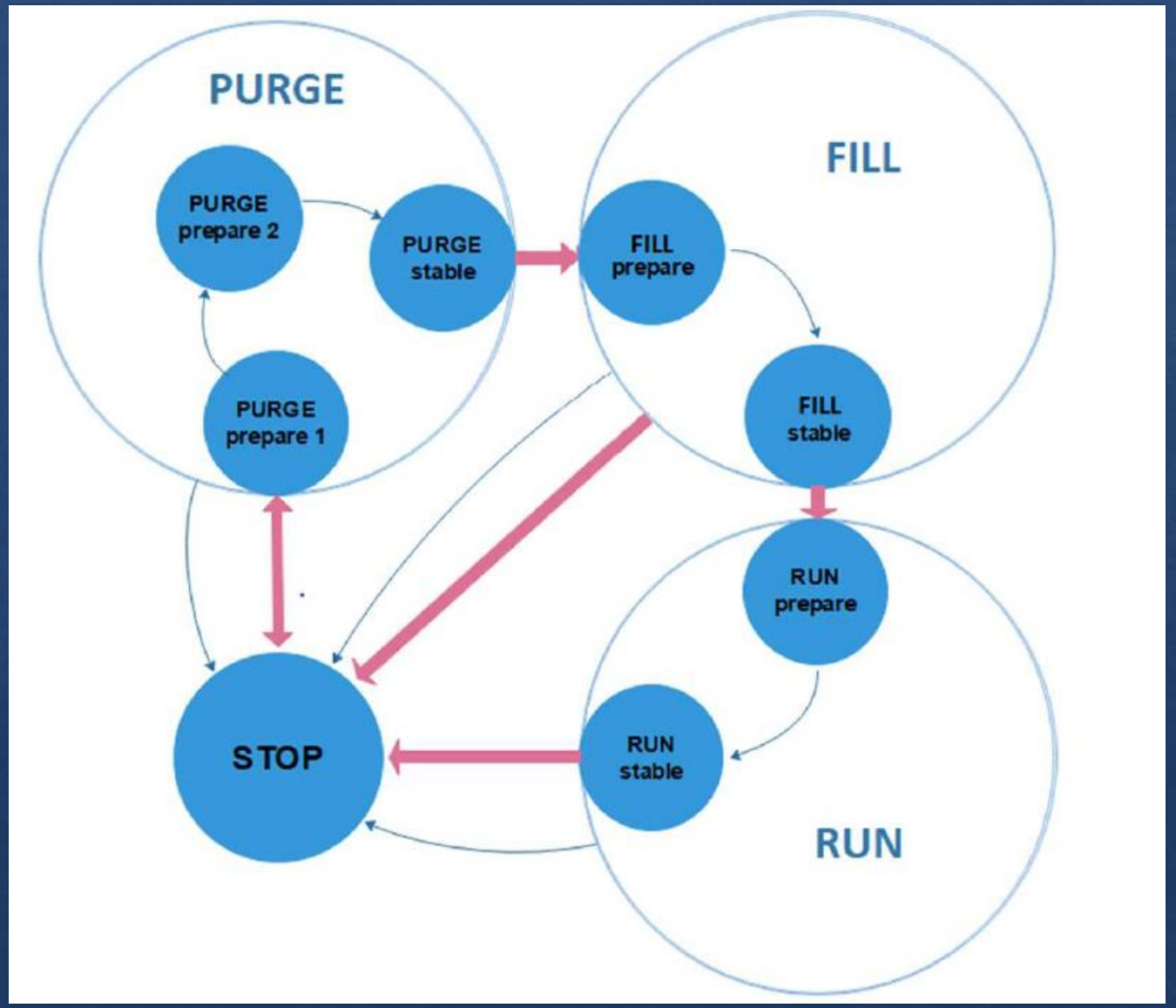
Control software - hardware

- NI cRIO
- **PXIe-1085 Computer**

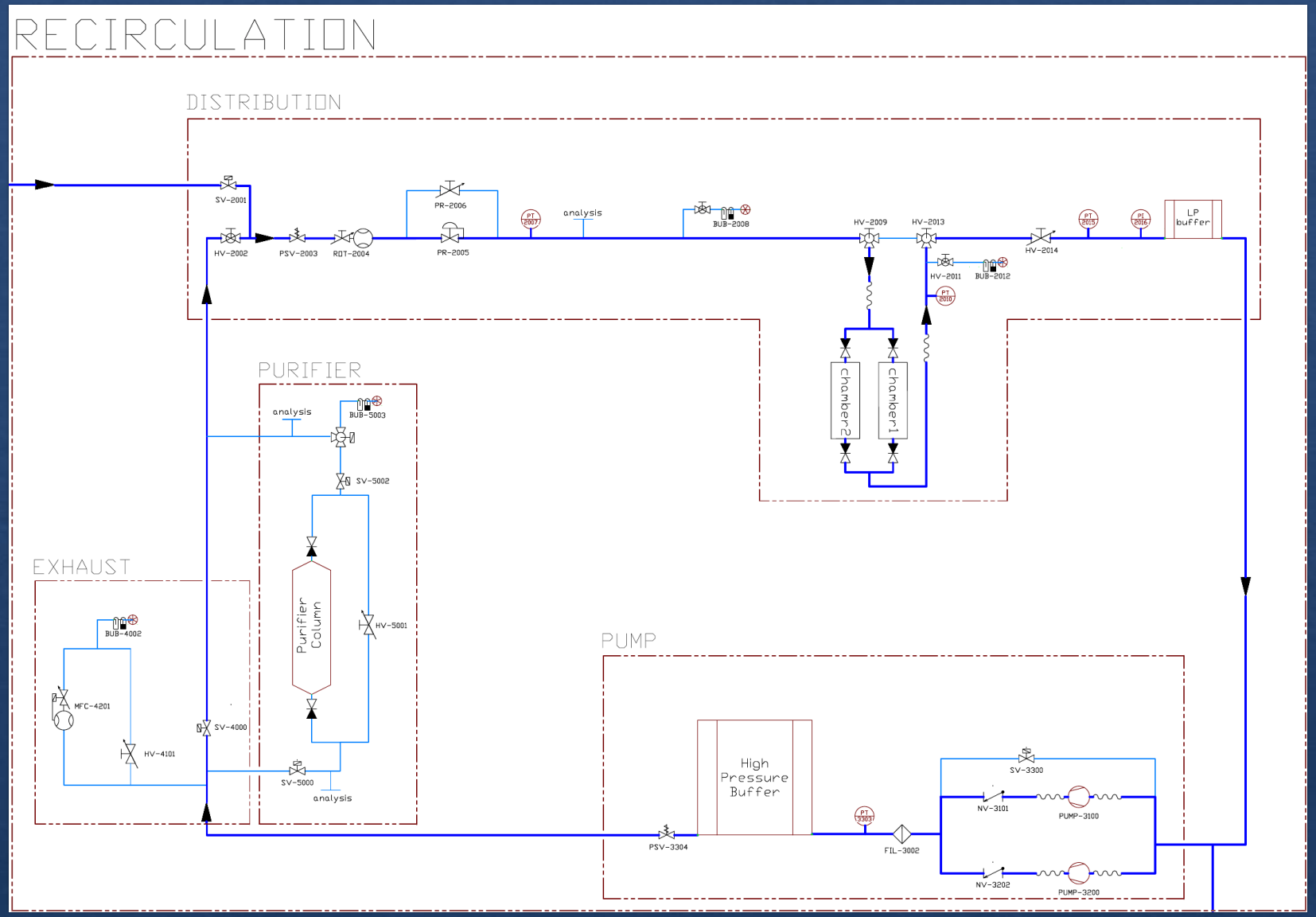
Control software



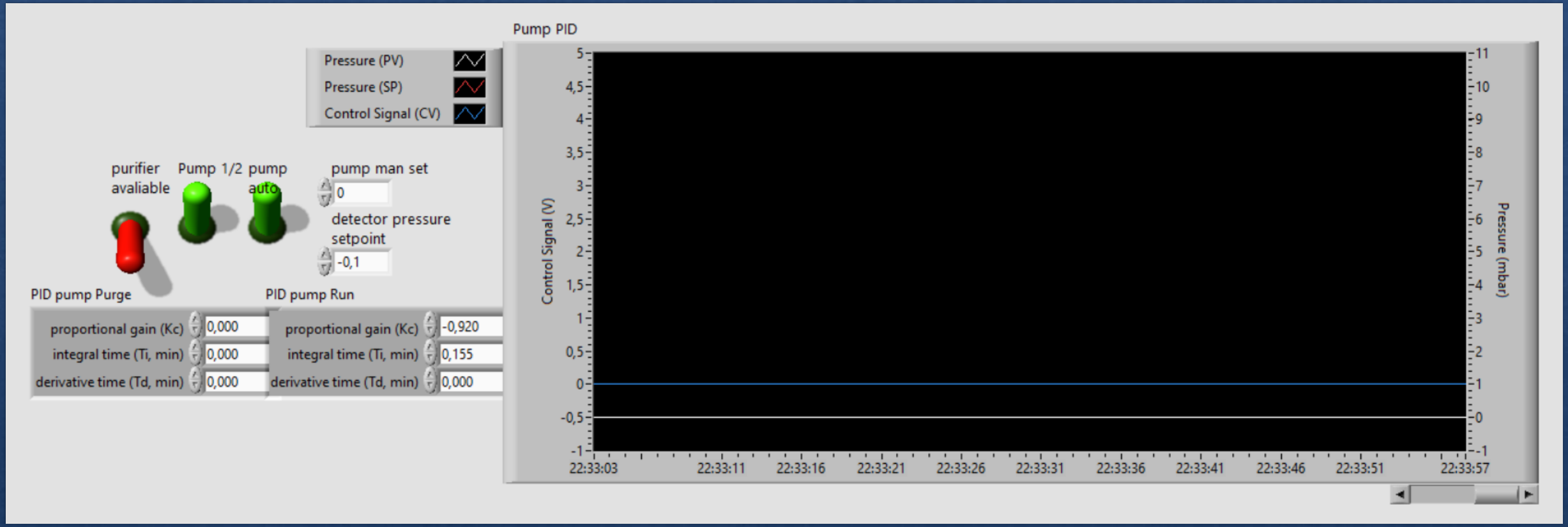
Control software – finite-state machine



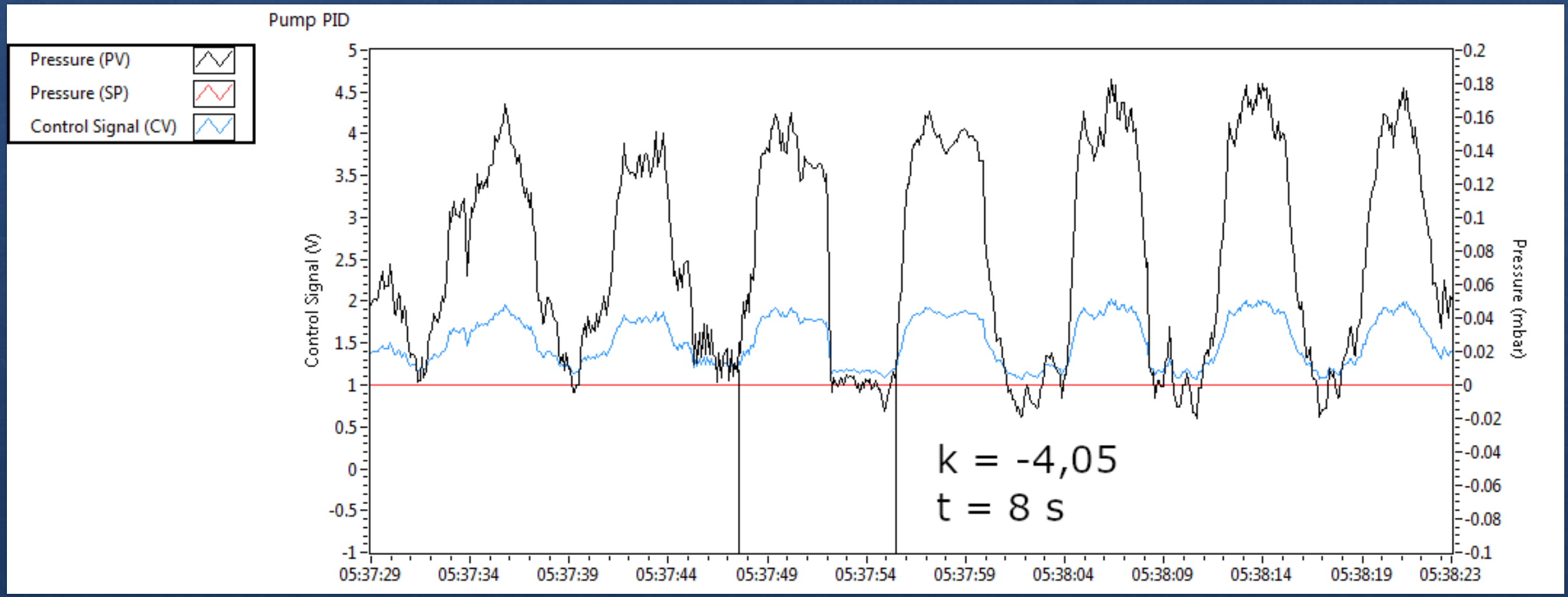
Control software - pump



Control software - pump



PI architecture – 2nd Ziegler-Nichols method

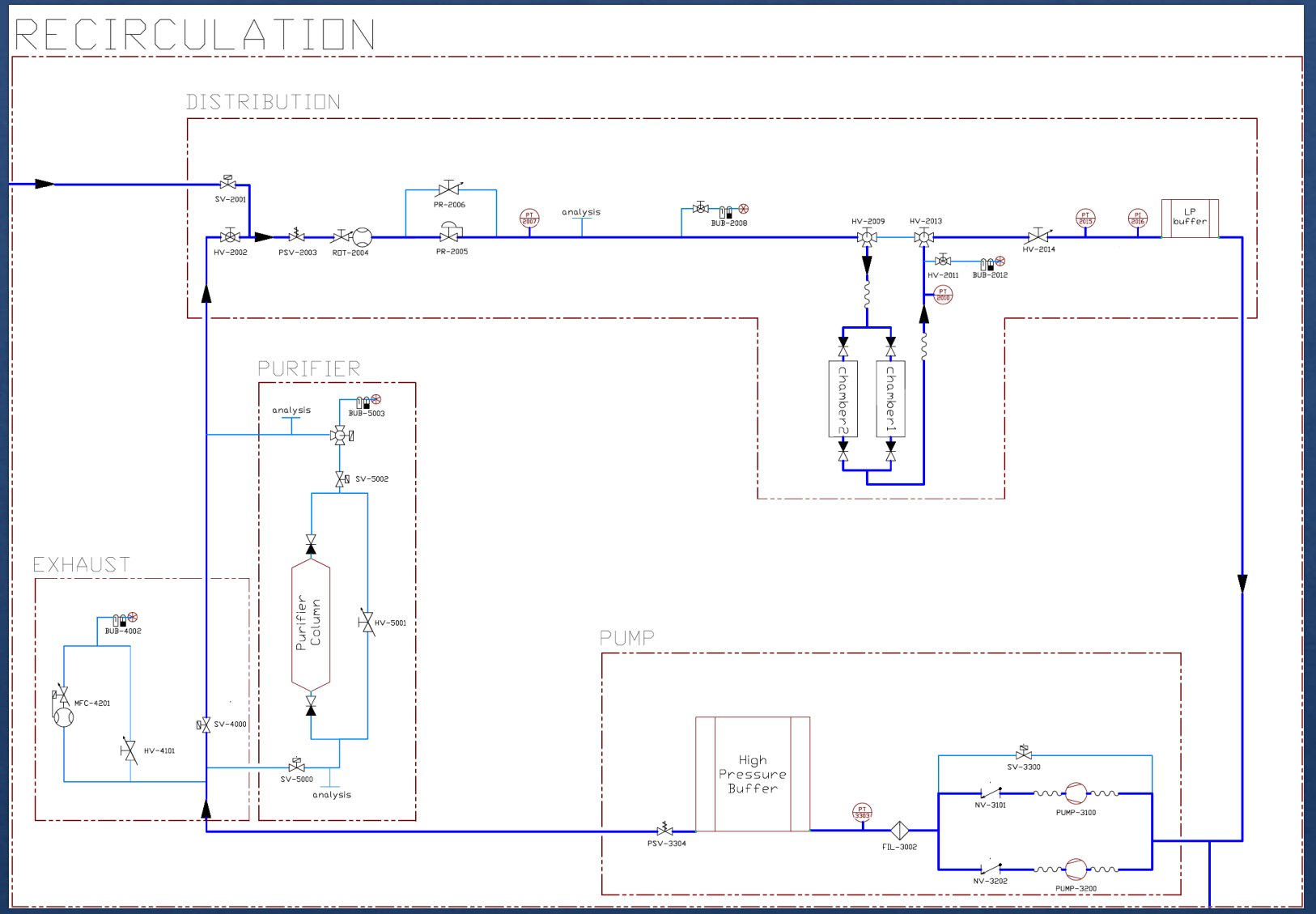


PI architecture – 2nd Ziegler-Nichols method

- $K_{cr} = -4{,}05$
- $T_{os} = 8\ s$

- Theoretical values
  - $K_p = 0{,}45 \cdot K_{cr} = -1{,}82$
  - $T_i = 0{,}85 \cdot T_{os} = 6{,}8\ s$
- Applied values
  - $K_p = -0{,}92$
  - $T_i = 9{,}3\ s$

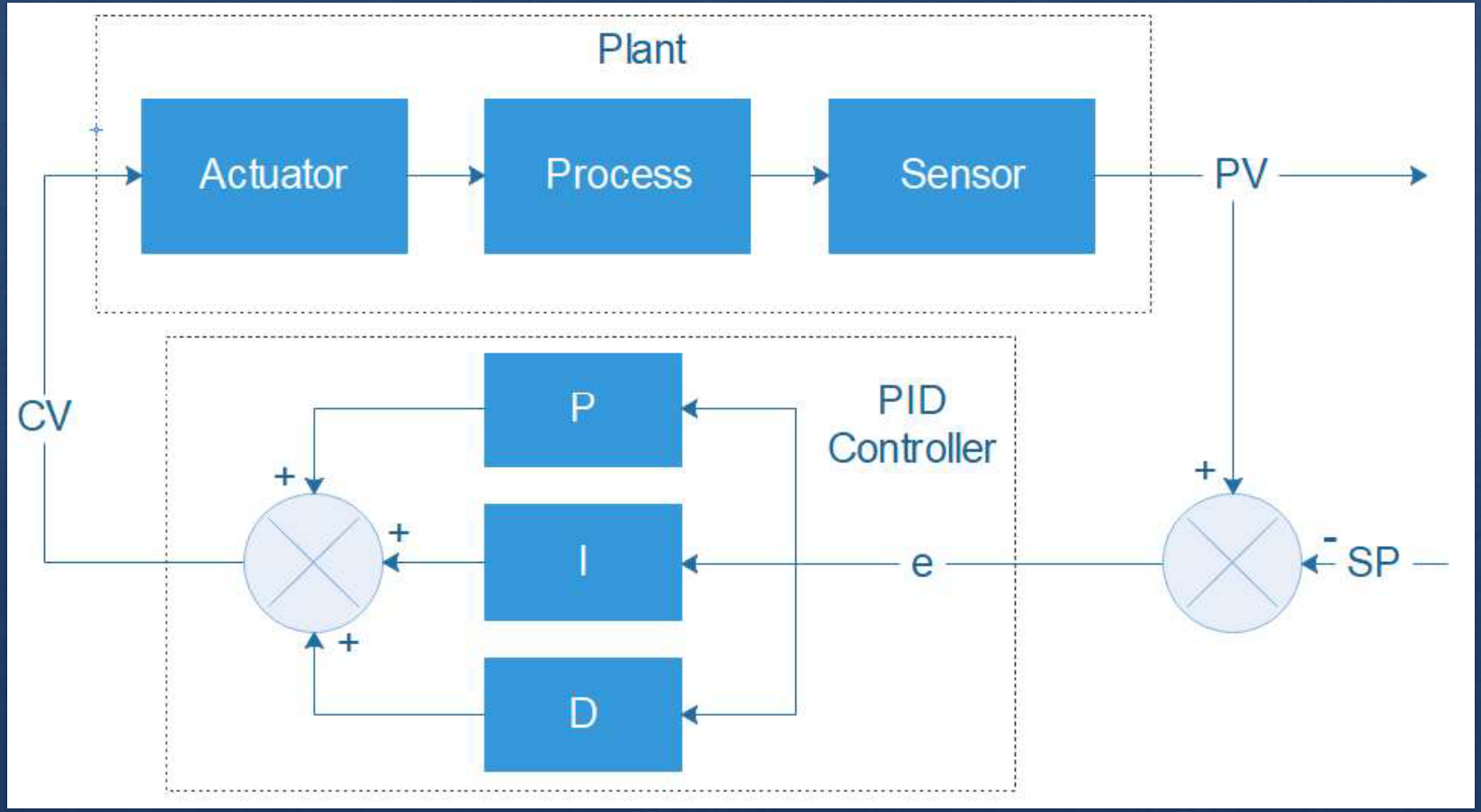
Control software - valves



Conclusions

- Pump PI works properly in all modes
- Initial settings
- Futher tests - long term work
- PID controllers architecture depend on number of used modules

Thank you for your attention

PID – what is it?

- PV – Proces Value
- SP – Set Point
- e – error
- CV – Control Value