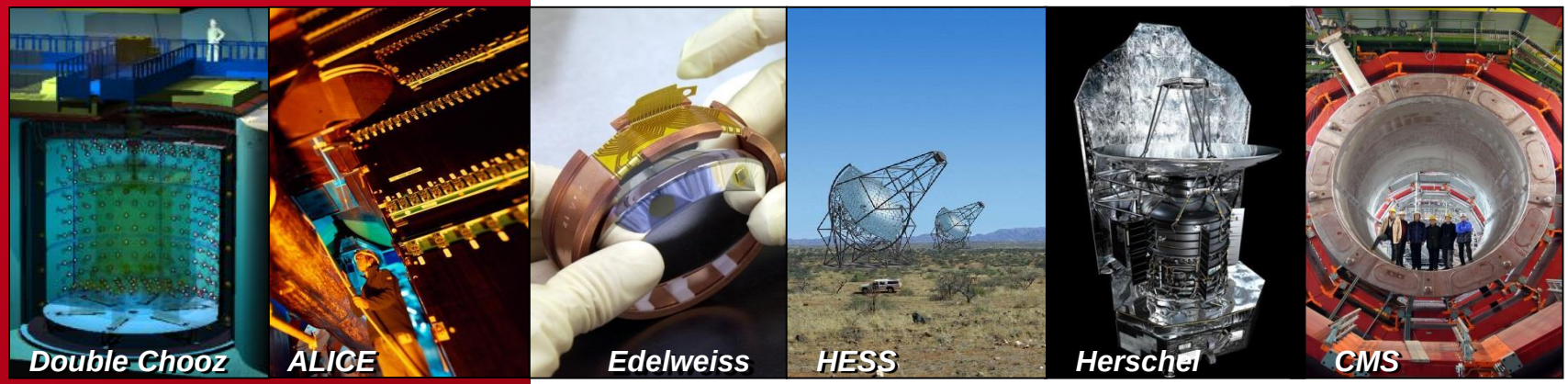
DE LA RECHERCHE À L'INDUSTRIE

cea

EPICS TOOLS FOR SMALL EXPERIMENT BASED ON PLC

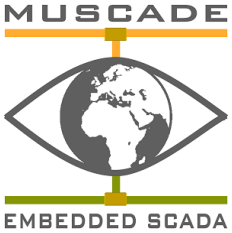


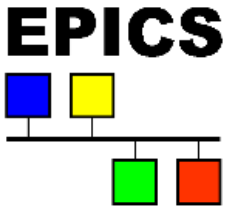
Irfu

Katy SAINTIN & Paul LOTRUS

June 2019

CONTEXT





Small Experiments
- In-house projects
- 2 developers

Functions :
- Windows OS
- SIEMENS PLC Protocol
- Optimized archiving
- Tool to build server
- Tool to build GUI
- Web remote access

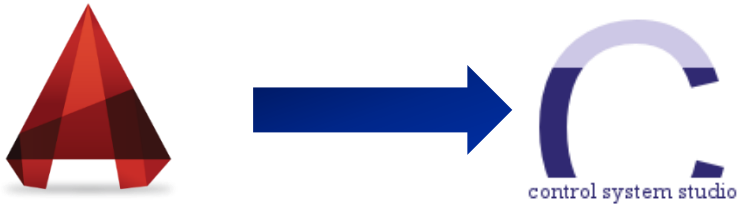
Big facilities :
- International projects
- EPICS community

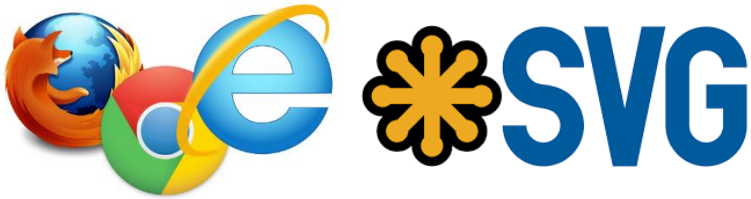
Functions :
- Linux OS
- Numerous Drivers
- Archiving Appliance
- CSS BOY to build a GUI

R&D EPICS

- **Plcparsertool**

- **CAFE Java** (**C**hannel **A**ccess **F**or **E**PICS)

- **DXF2OPI** 

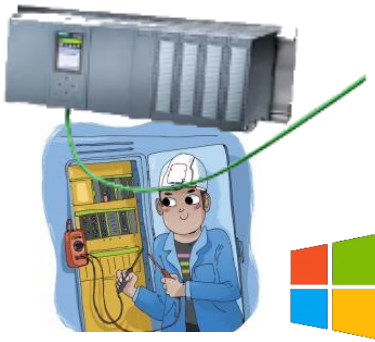
- **MOONARCH** (**M**emory **O**ptimizer **O**n **ARCH**iver Appliance)
- **EPICS WEB** 

- **DATABROWSER**

PLC PARSER TOOL

Generate all EPICS files for build an EPICS IOC

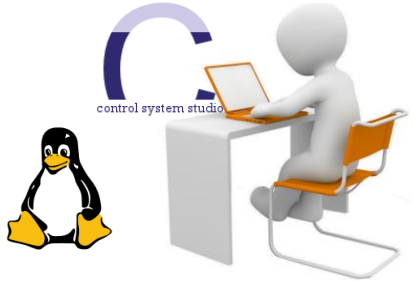
- db file
- include.dbd file
- cmd file for protocol configuration



PLC Programmer

SIEMENS S7

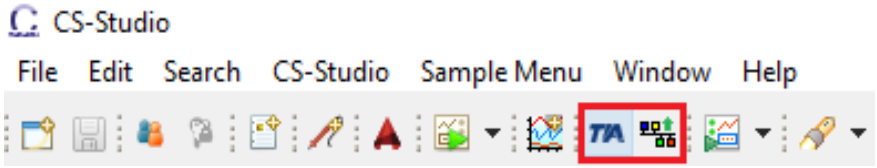
Modbus



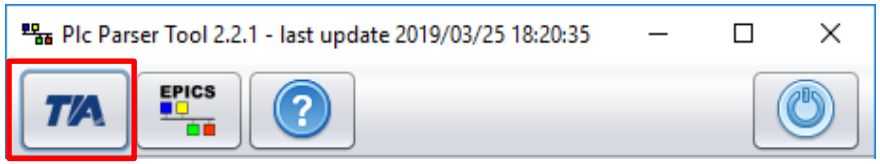
EPICS Programmer

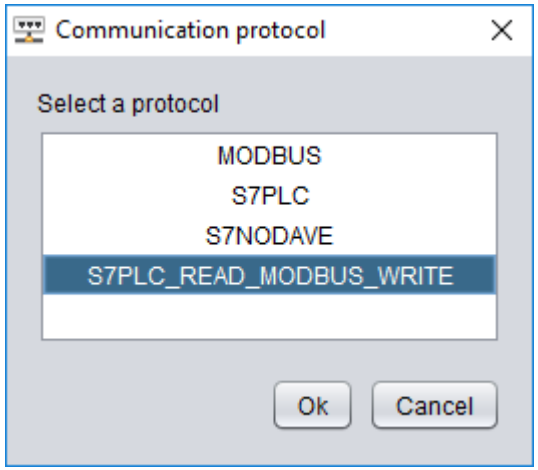
PLC PARSER TOOL

CSS plugin



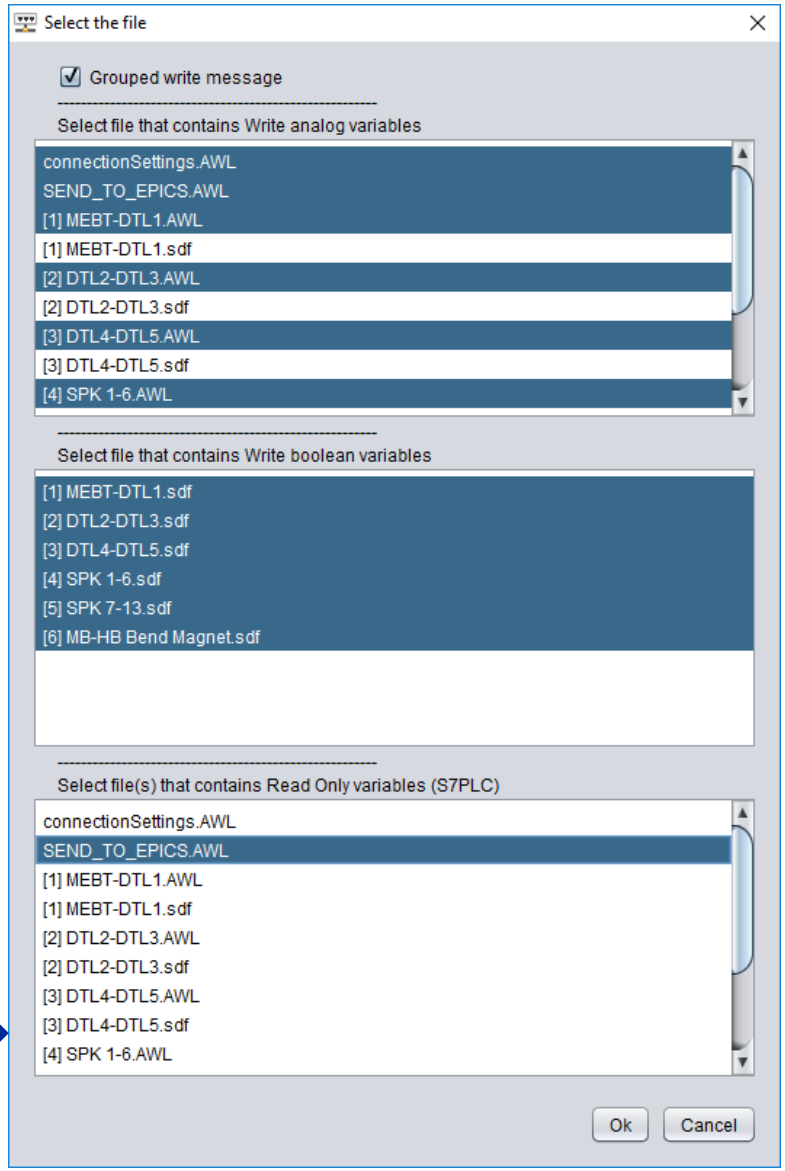
Standalone



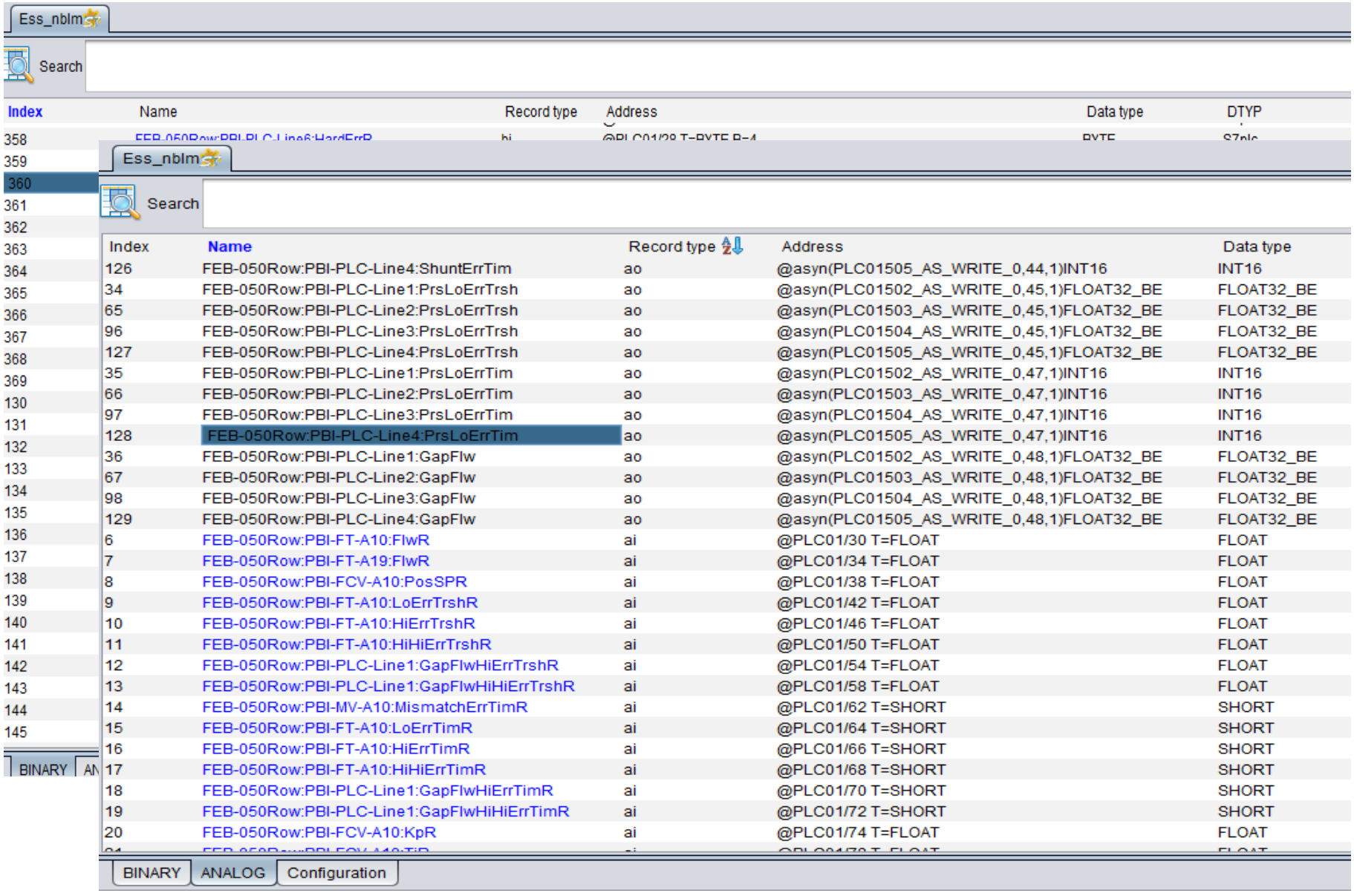


Modbus

SIEMENS S7



PLC PARSER TOOL



Ess_nblm

Search

Index	Name	Record type	Address	Data type	DTYP
358	FEB-050Row:PBI-PLC-Line6:HardErrR	bi	@PLC01/28 T=BYTE B=4	BYTE	S7plc

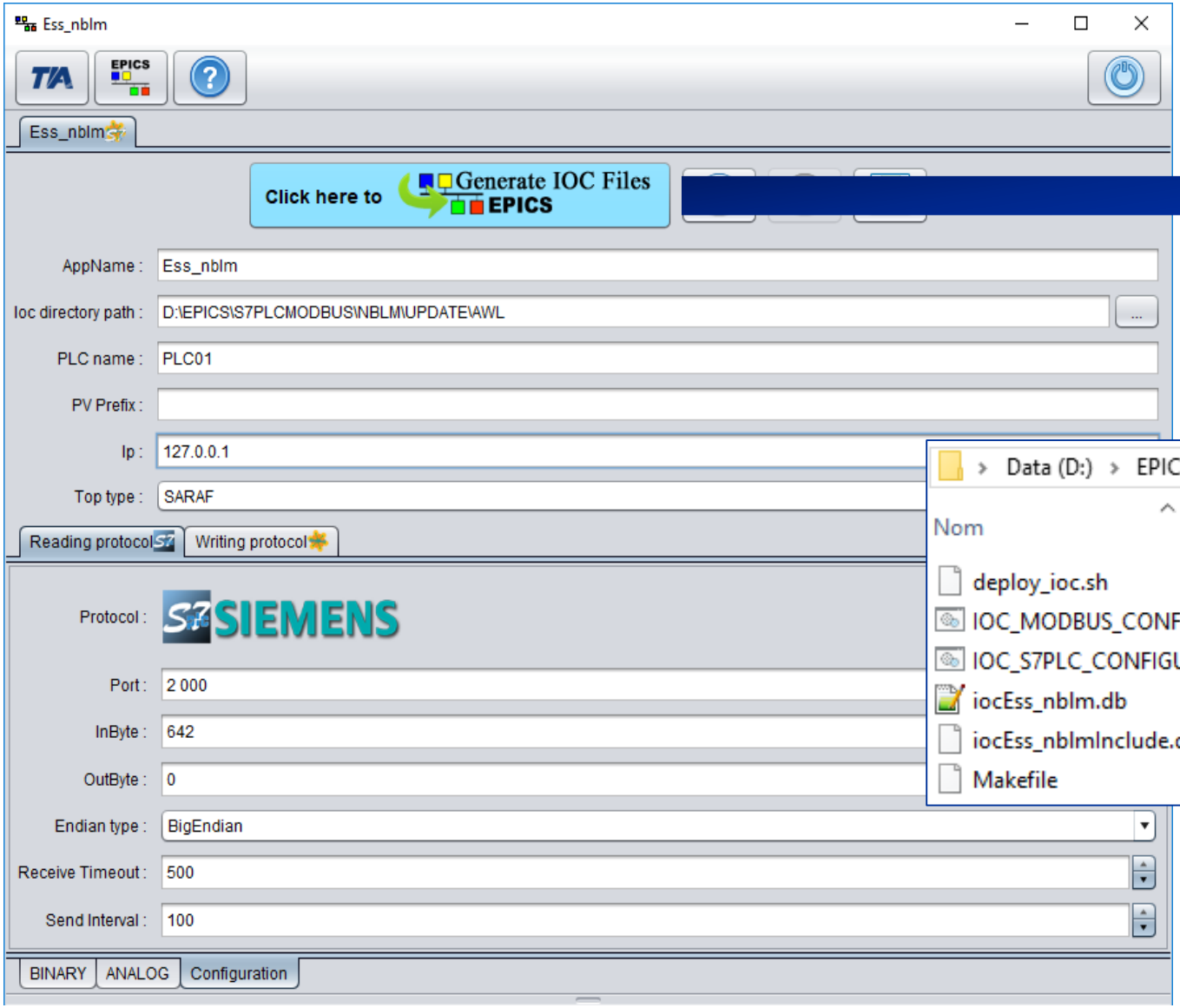
Ess_nblm

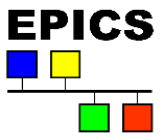
Search

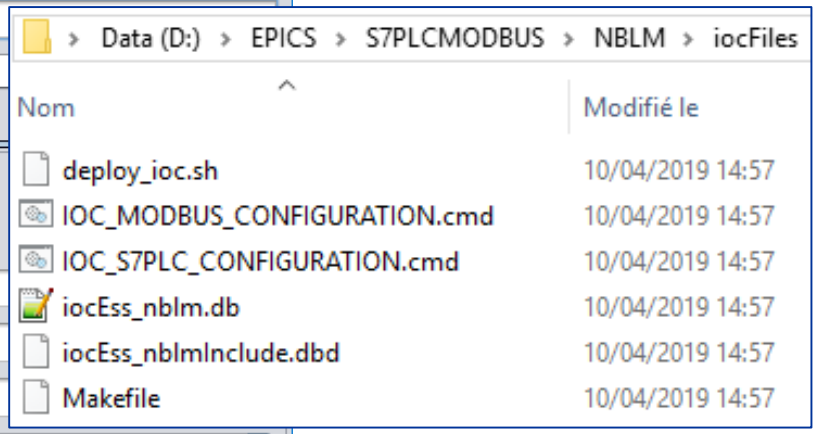
Index	Name	Record type	Address	Data type
126	FEB-050Row:PBI-PLC-Line4:ShuntErrTim	ao	@asyn(PLC01505_AS_WRITE_0,44,1)INT16	INT16
34	FEB-050Row:PBI-PLC-Line1:PrsLoErrTrsh	ao	@asyn(PLC01502_AS_WRITE_0,45,1)FLOAT32_BE	FLOAT32_BE
65	FEB-050Row:PBI-PLC-Line2:PrsLoErrTrsh	ao	@asyn(PLC01503_AS_WRITE_0,45,1)FLOAT32_BE	FLOAT32_BE
96	FEB-050Row:PBI-PLC-Line3:PrsLoErrTrsh	ao	@asyn(PLC01504_AS_WRITE_0,45,1)FLOAT32_BE	FLOAT32_BE
127	FEB-050Row:PBI-PLC-Line4:PrsLoErrTrsh	ao	@asyn(PLC01505_AS_WRITE_0,45,1)FLOAT32_BE	FLOAT32_BE
35	FEB-050Row:PBI-PLC-Line1:PrsLoErrTim	ao	@asyn(PLC01502_AS_WRITE_0,47,1)INT16	INT16
66	FEB-050Row:PBI-PLC-Line2:PrsLoErrTim	ao	@asyn(PLC01503_AS_WRITE_0,47,1)INT16	INT16
97	FEB-050Row:PBI-PLC-Line3:PrsLoErrTim	ao	@asyn(PLC01504_AS_WRITE_0,47,1)INT16	INT16
128	FEB-050Row:PBI-PLC-Line4:PrsLoErrTim	ao	@asyn(PLC01505_AS_WRITE_0,47,1)INT16	INT16
36	FEB-050Row:PBI-PLC-Line1:GapFlw	ao	@asyn(PLC01502_AS_WRITE_0,48,1)FLOAT32_BE	FLOAT32_BE
67	FEB-050Row:PBI-PLC-Line2:GapFlw	ao	@asyn(PLC01503_AS_WRITE_0,48,1)FLOAT32_BE	FLOAT32_BE
98	FEB-050Row:PBI-PLC-Line3:GapFlw	ao	@asyn(PLC01504_AS_WRITE_0,48,1)FLOAT32_BE	FLOAT32_BE
129	FEB-050Row:PBI-PLC-Line4:GapFlw	ao	@asyn(PLC01505_AS_WRITE_0,48,1)FLOAT32_BE	FLOAT32_BE
6	FEB-050Row:PBI-FT-A10:FlwR	ai	@PLC01/30 T=FLOAT	FLOAT
7	FEB-050Row:PBI-FT-A19:FlwR	ai	@PLC01/34 T=FLOAT	FLOAT
8	FEB-050Row:PBI-FCV-A10:PosSPR	ai	@PLC01/38 T=FLOAT	FLOAT
9	FEB-050Row:PBI-FT-A10:LoErrTrshR	ai	@PLC01/42 T=FLOAT	FLOAT
10	FEB-050Row:PBI-FT-A10:HiErrTrshR	ai	@PLC01/46 T=FLOAT	FLOAT
11	FEB-050Row:PBI-FT-A10:HiHiErrTrshR	ai	@PLC01/50 T=FLOAT	FLOAT
12	FEB-050Row:PBI-PLC-Line1:GapFlwHiErrTrshR	ai	@PLC01/54 T=FLOAT	FLOAT
13	FEB-050Row:PBI-PLC-Line1:GapFlwHiHiErrTrshR	ai	@PLC01/58 T=FLOAT	FLOAT
14	FEB-050Row:PBI-MV-A10:MismatchErrTimR	ai	@PLC01/62 T=SHORT	SHORT
15	FEB-050Row:PBI-FT-A10:LoErrTimR	ai	@PLC01/64 T=SHORT	SHORT
16	FEB-050Row:PBI-FT-A10:HiErrTimR	ai	@PLC01/66 T=SHORT	SHORT
17	FEB-050Row:PBI-FT-A10:HiHiErrTimR	ai	@PLC01/68 T=SHORT	SHORT
18	FEB-050Row:PBI-PLC-Line1:GapFlwHiErrTimR	ai	@PLC01/70 T=SHORT	SHORT
19	FEB-050Row:PBI-PLC-Line1:GapFlwHiHiErrTimR	ai	@PLC01/72 T=SHORT	SHORT
20	FEB-050Row:PBI-FCV-A10:KpR	ai	@PLC01/74 T=FLOAT	FLOAT

BINARY ANALOG Configuration

PLC PARSER TOOL







CAFE JAVA (CHANNEL ACCESS FOR EPICS)

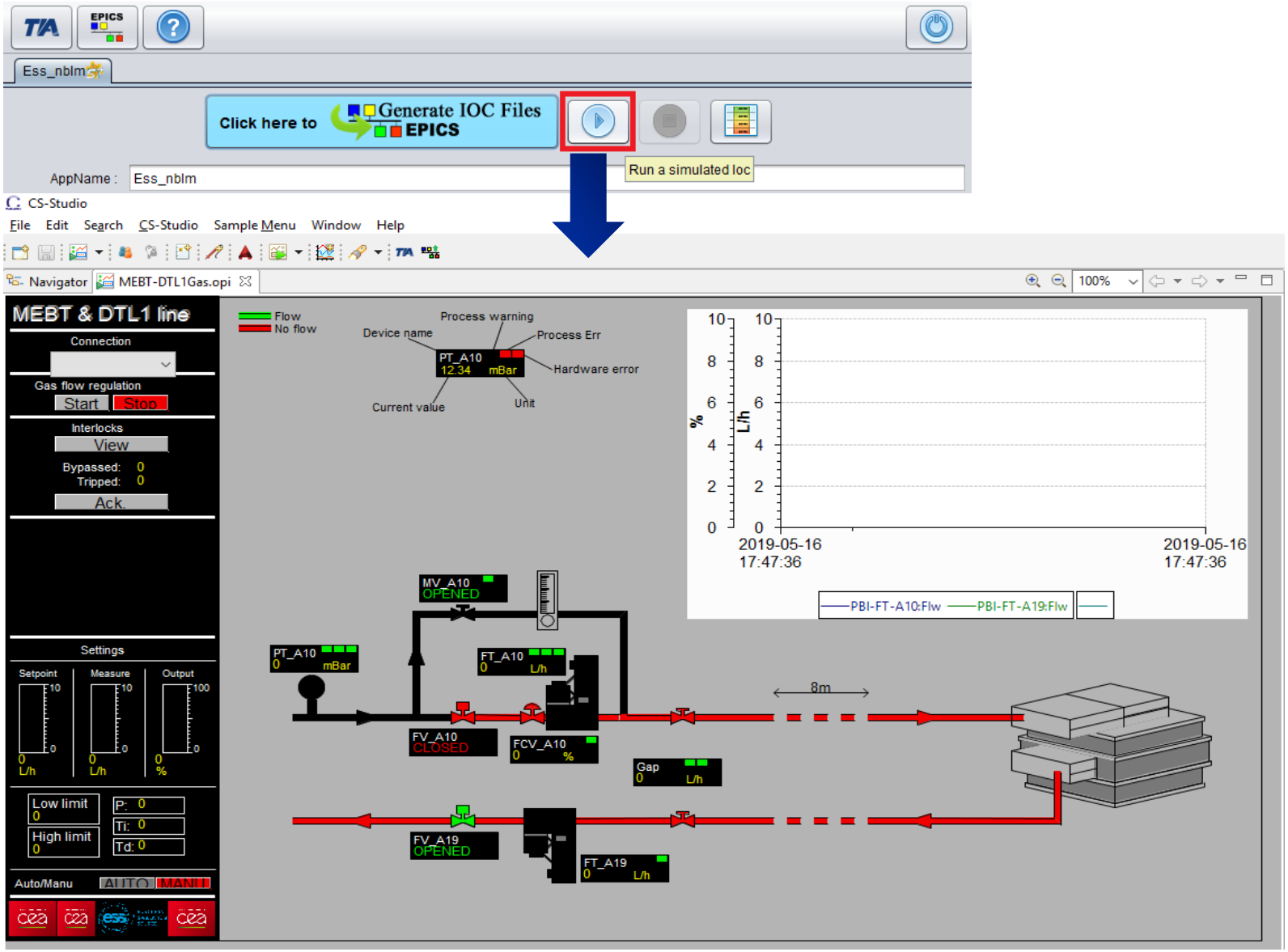
API dedicated EPICS :

- Based on CAJ (Channel Access for Java)
  - Pure Java implementation of Channel Access
  - http://epics-jca.sourceforge.net/caj/
- Read Process Variable
- Write Process Variable
- Run a Channel Access Server (Java IOC)

Applications :

- Simulated java IOC EPICS
- EPICS Generic Control Panel
- Muscade IOC EPICS
- …

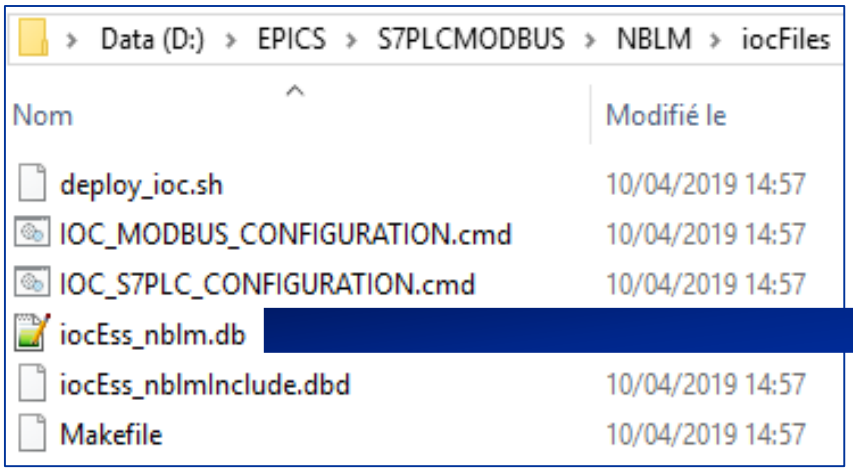
CAFE JAVA – RUN SIMULATED IOC

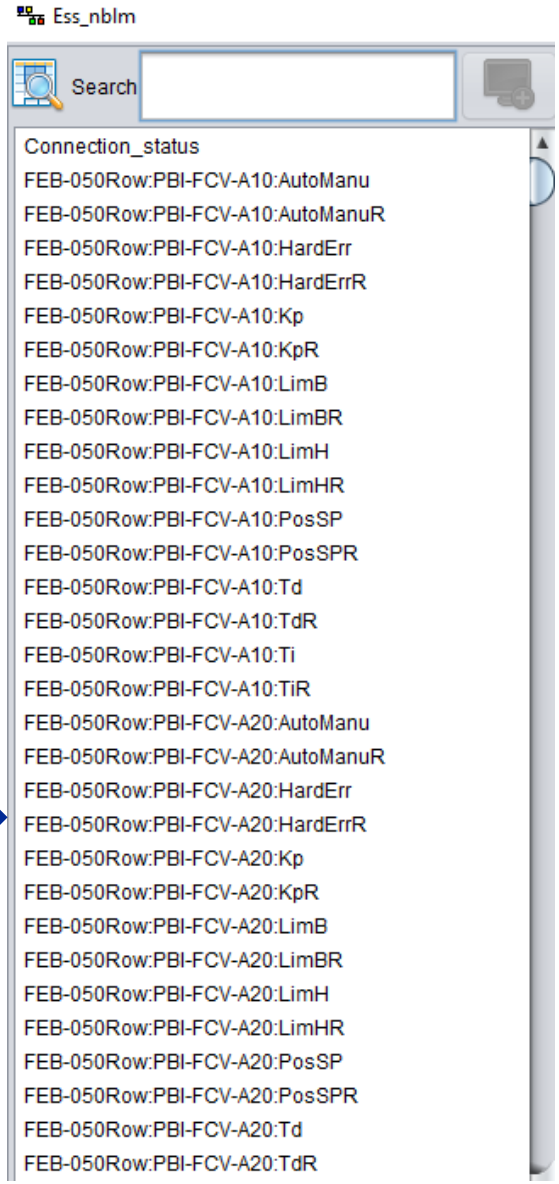


EPICS GENERIC CONTROL PANEL

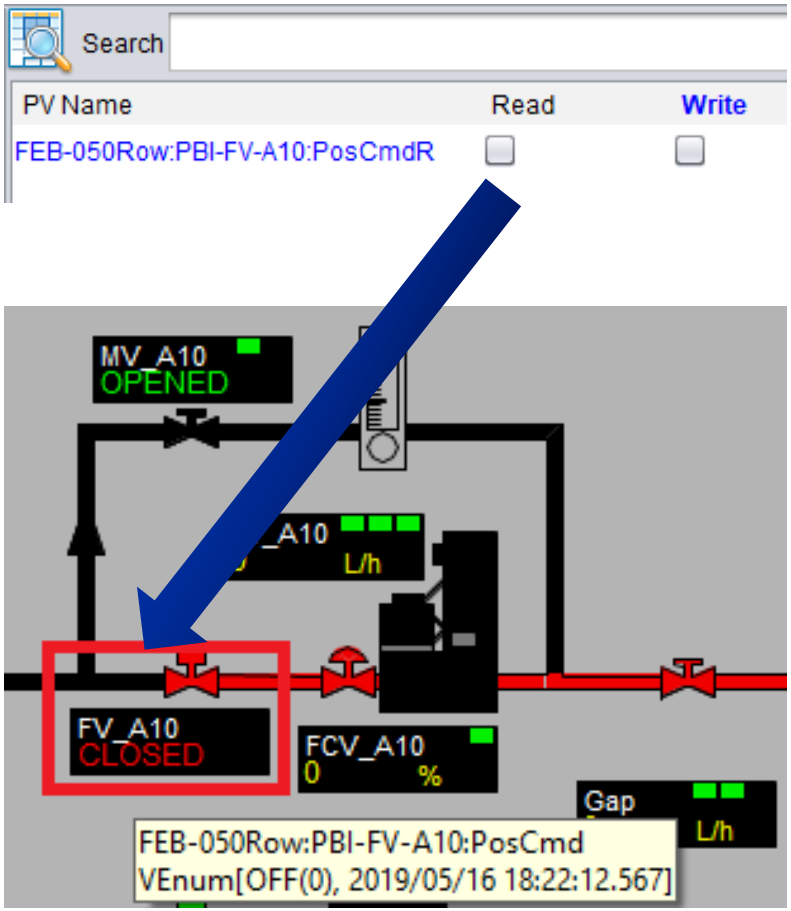
- PV list built from EPICS db file
- Test the IOC without a synoptic
- Works in CSS or in stand alone mode

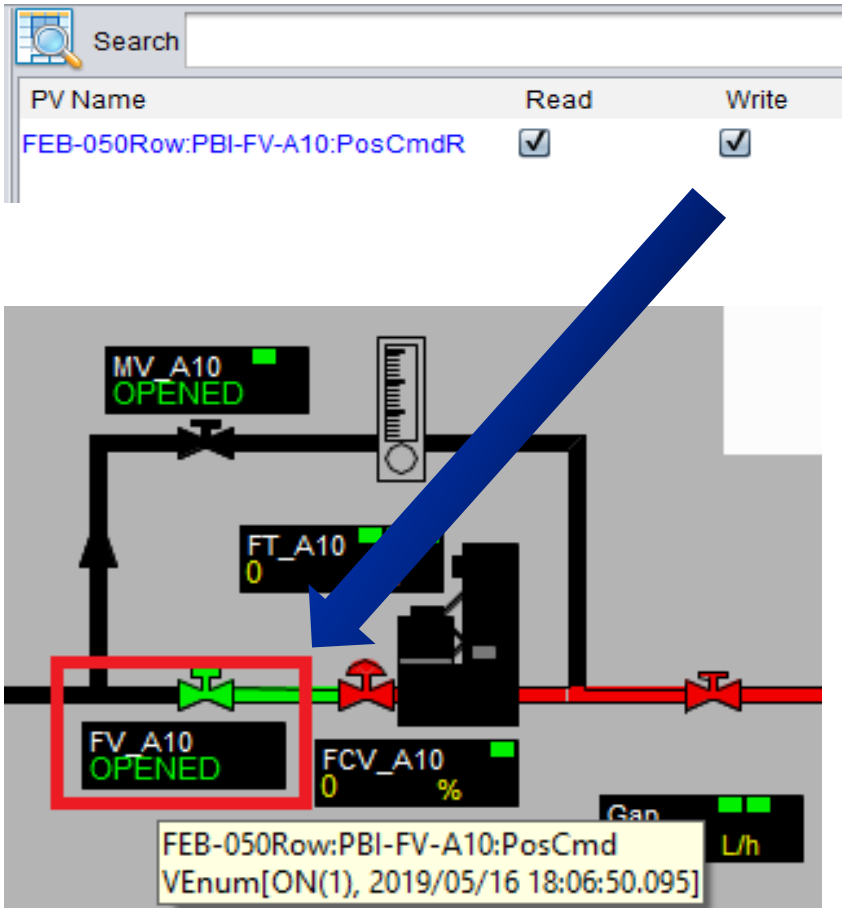
EPICS





EPICS GENERIC CONTROL PANEL

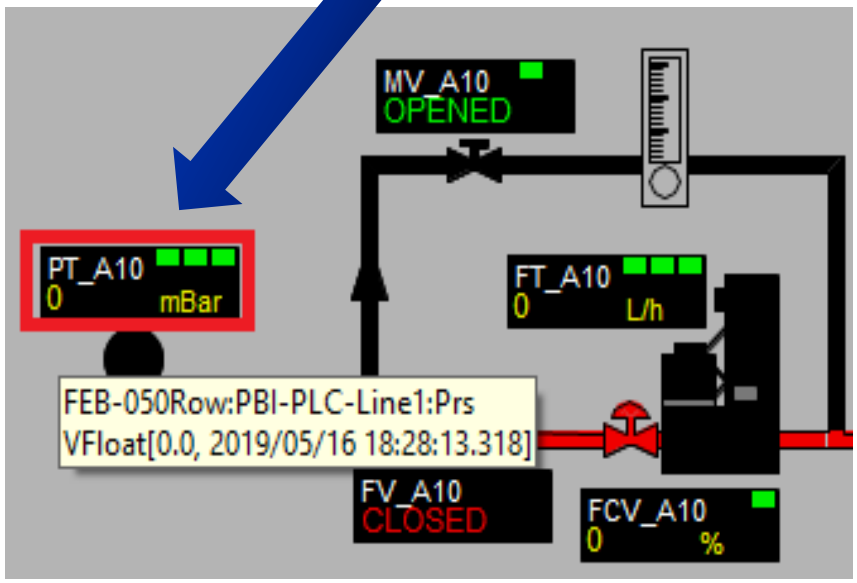




EPICS GENERIC CONTROL PANEL

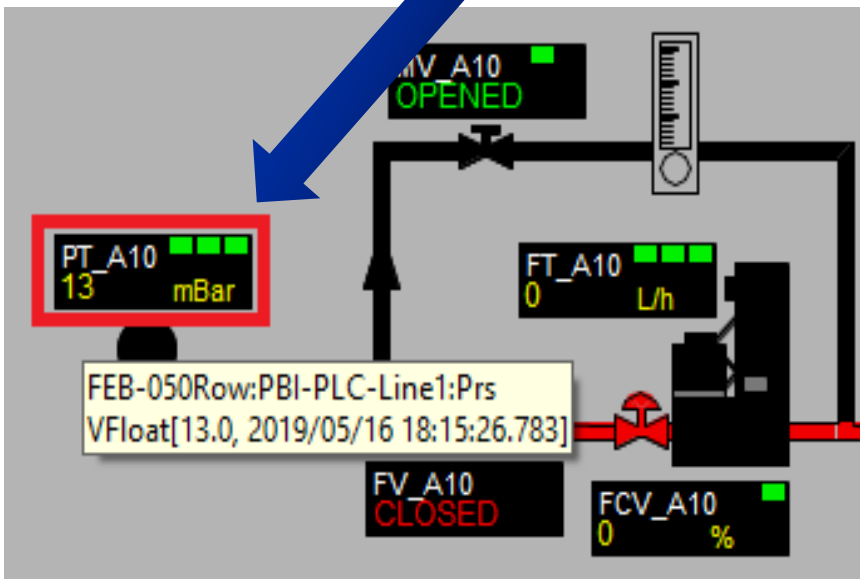
Search

PV Name	Read	Write
FEB-050Row:PBI-PLC-Line1:PrsR	0.0	0.0

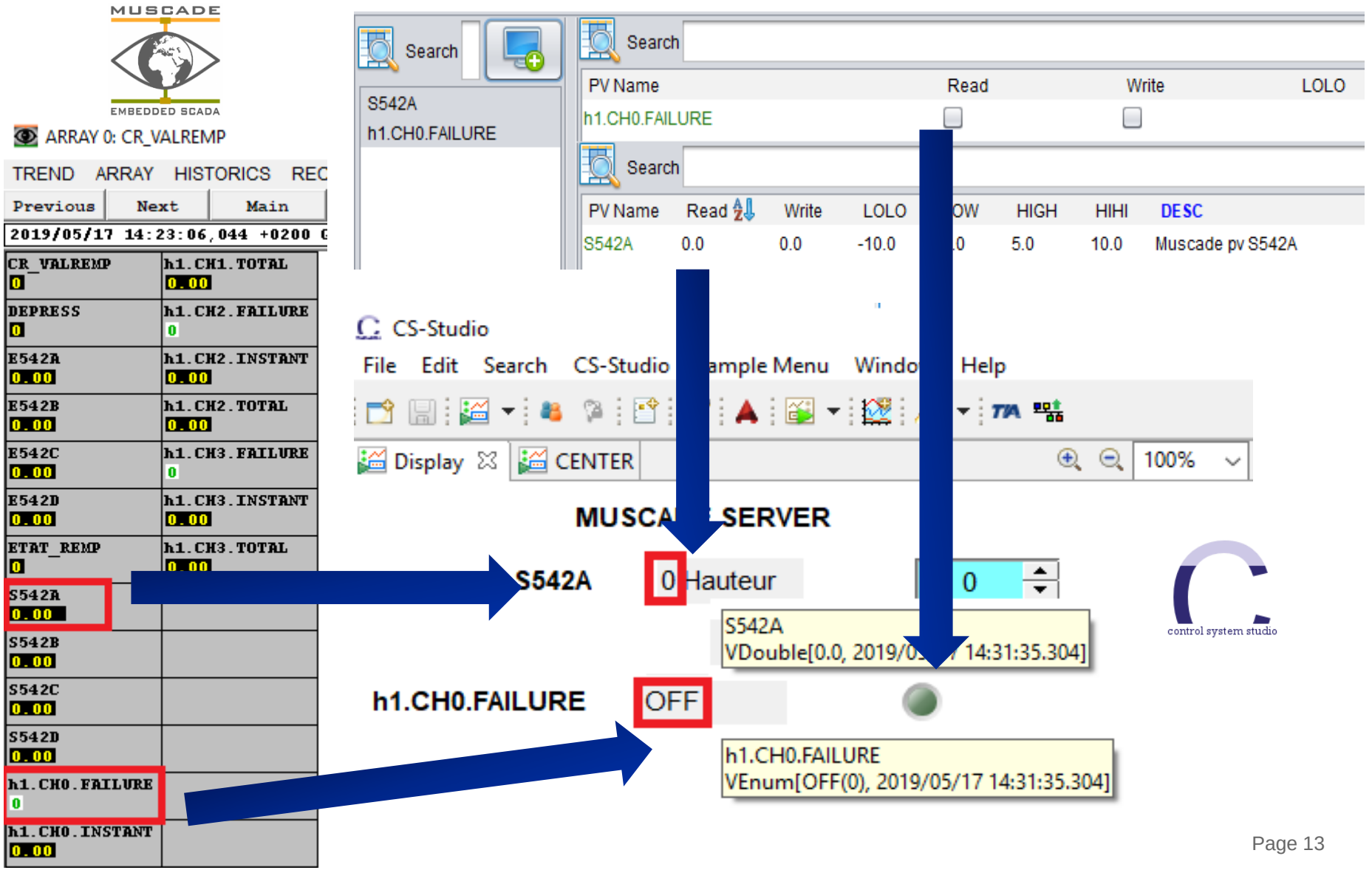


Search

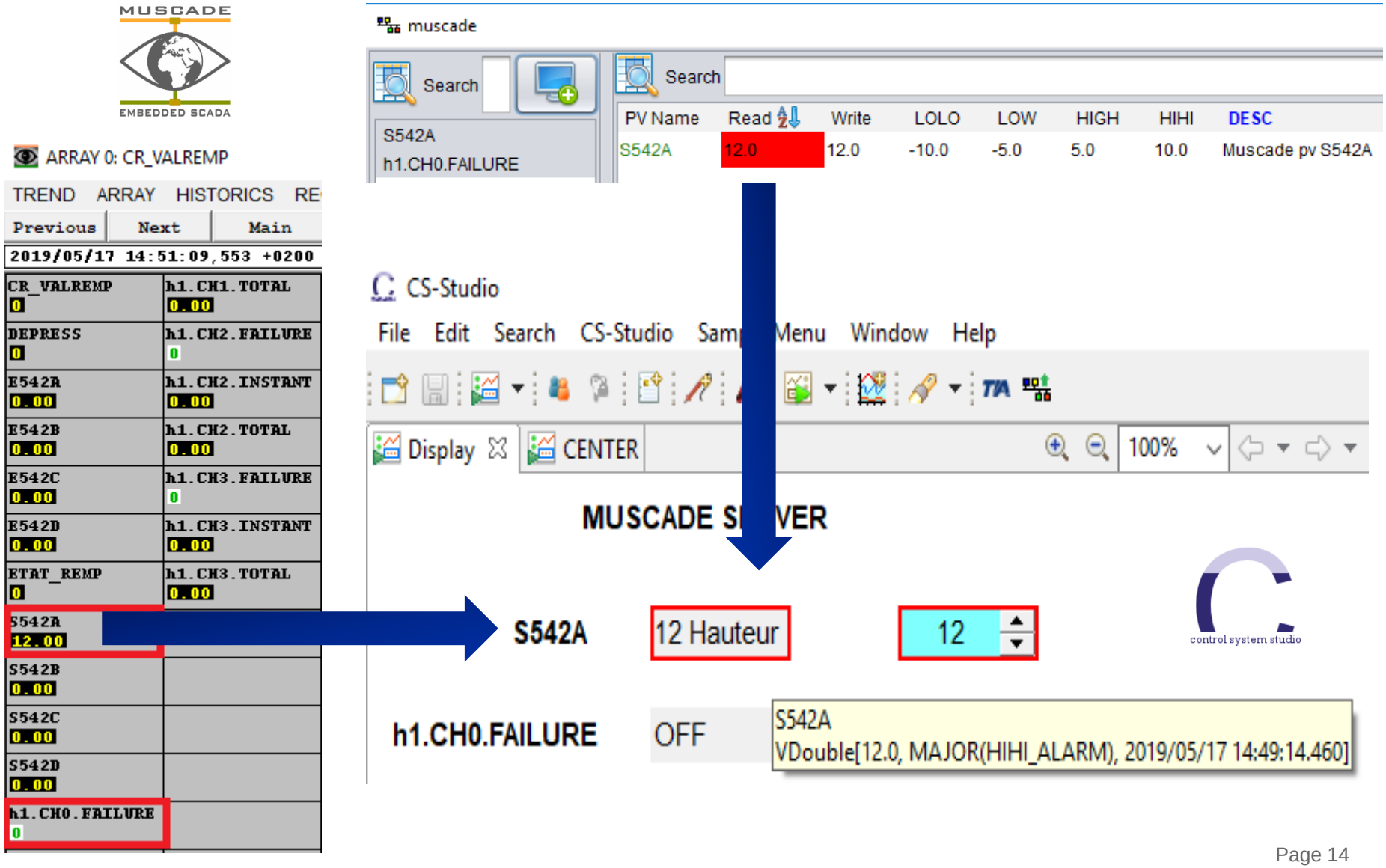
PV Name	Read	Write
FEB-050Row:PBI-PLC-Line1:PrsR	13.0	13.0



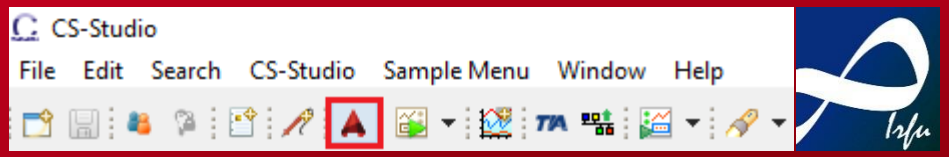
MUSCADE IOC EPICS

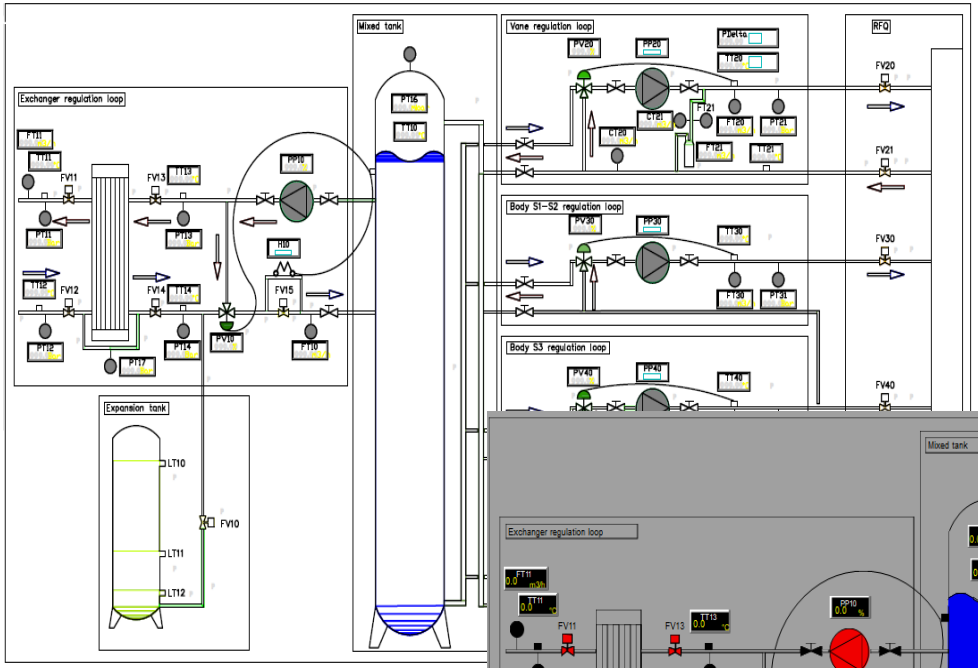


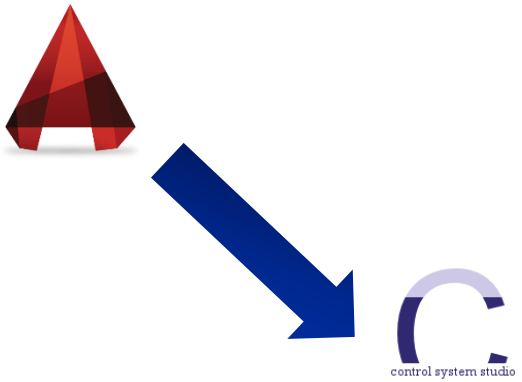
MUSCADE IOC EPICS

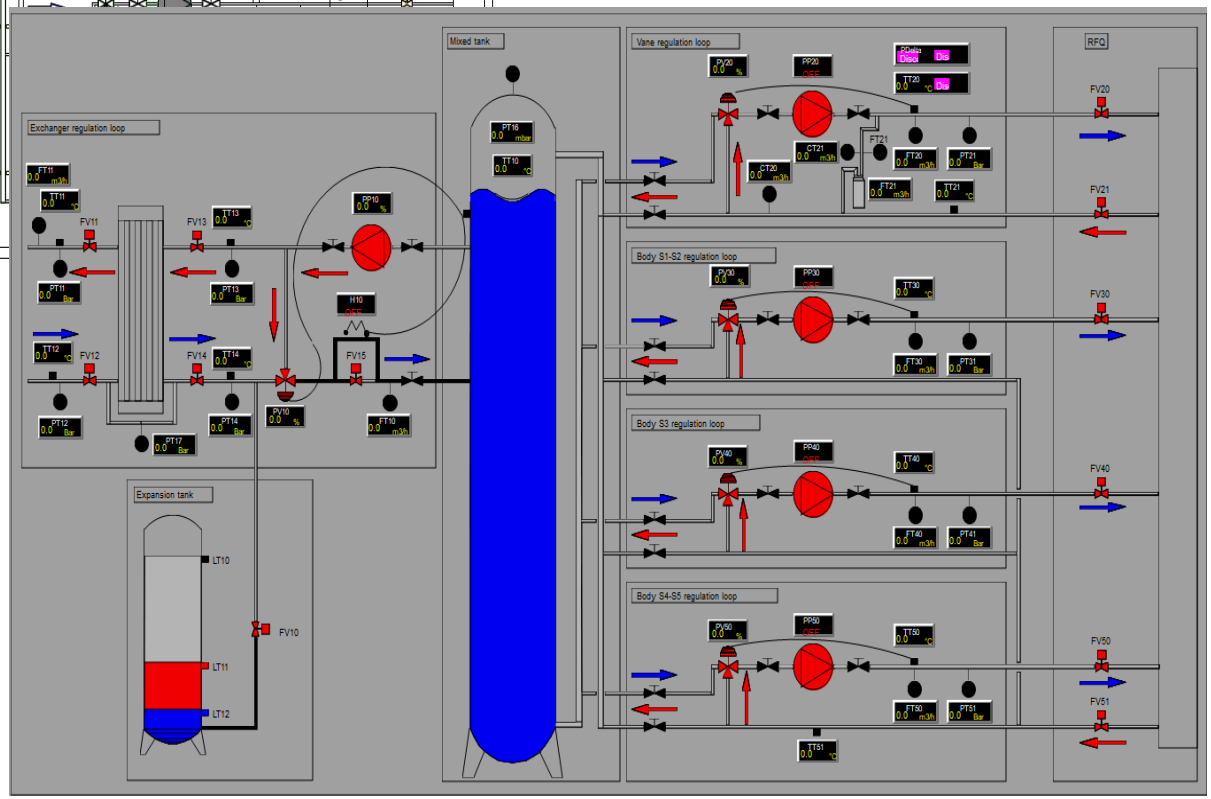


DXF2OPI CSS PLUGIN



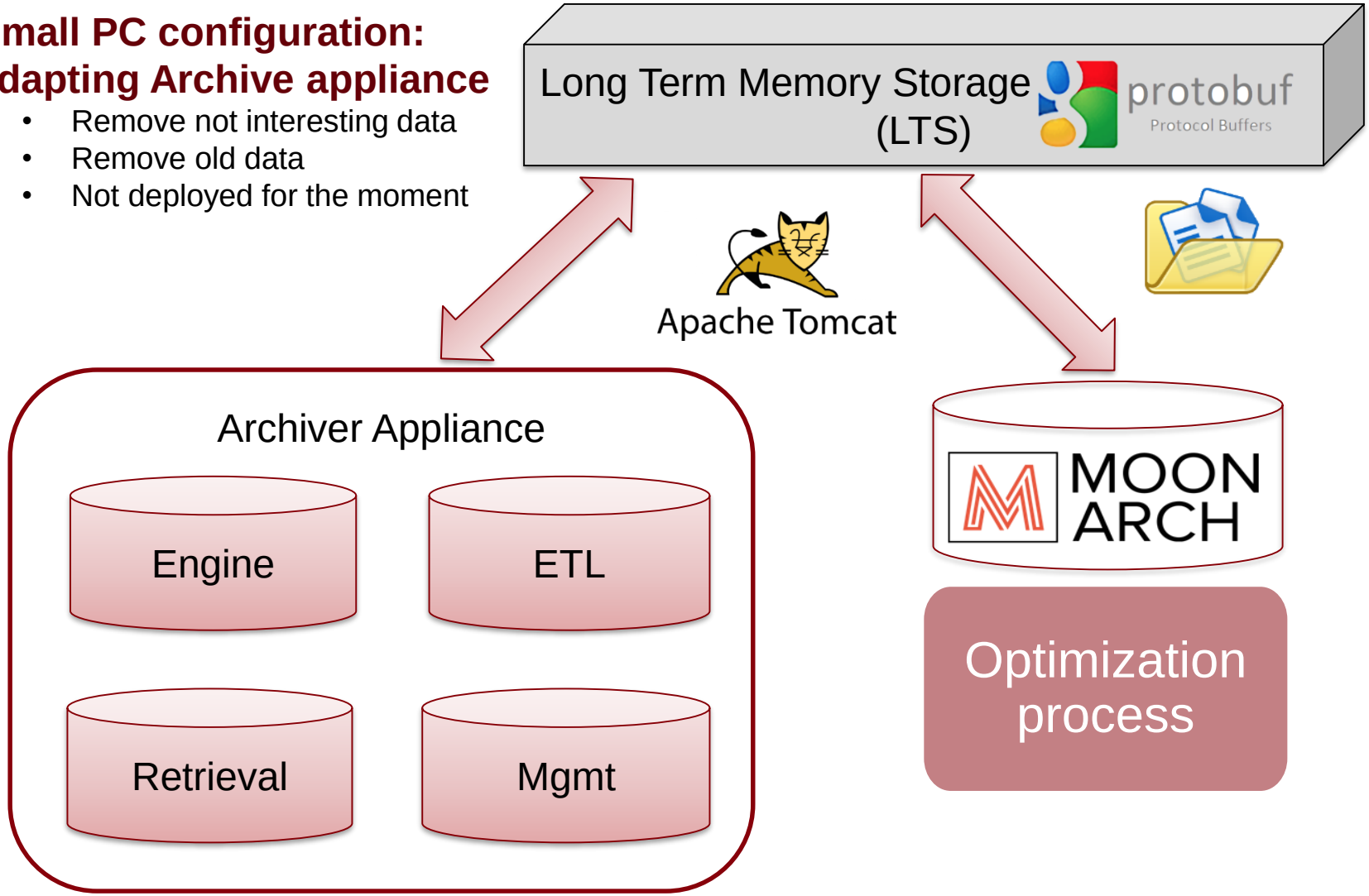




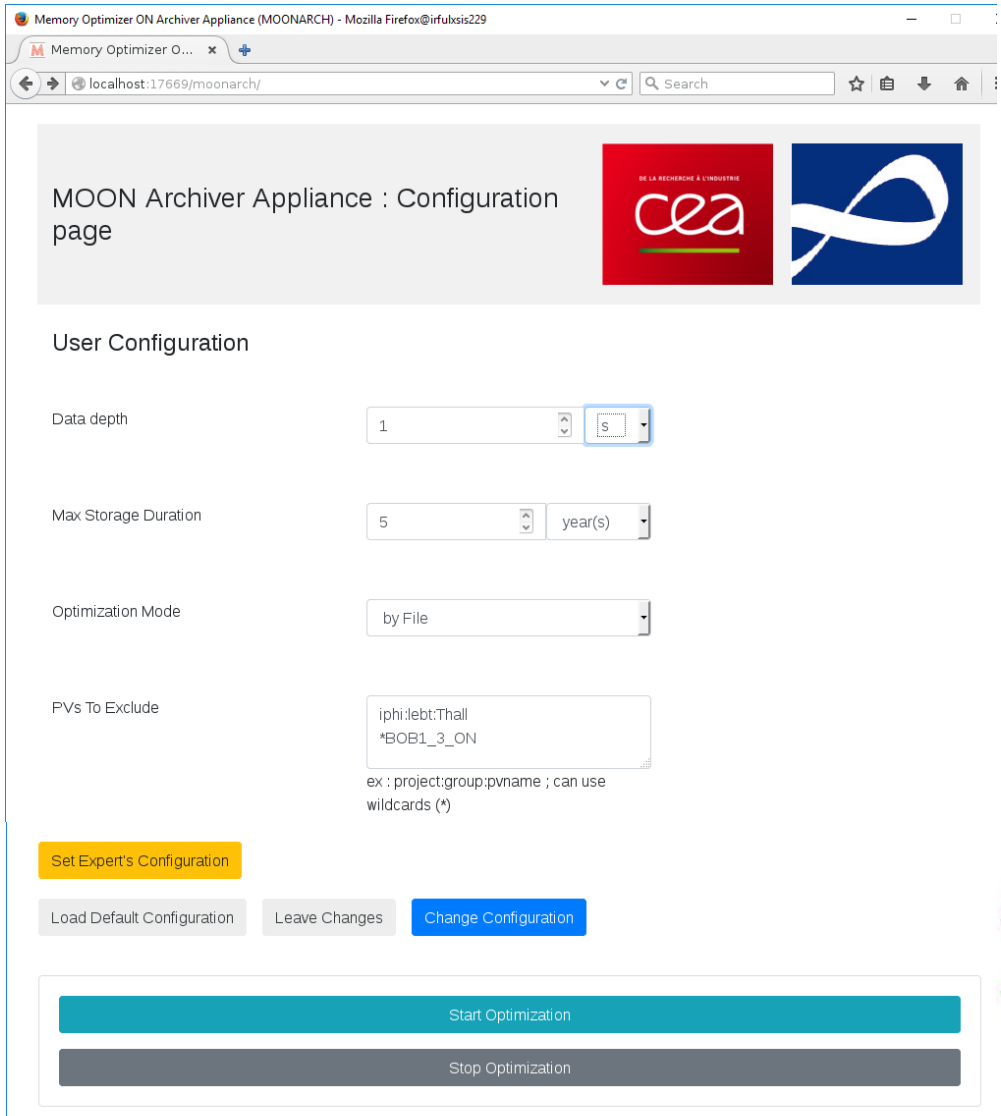


Small PC configuration: adapting Archive appliance

- Remove not interesting data
- Remove old data
- Not deployed for the moment

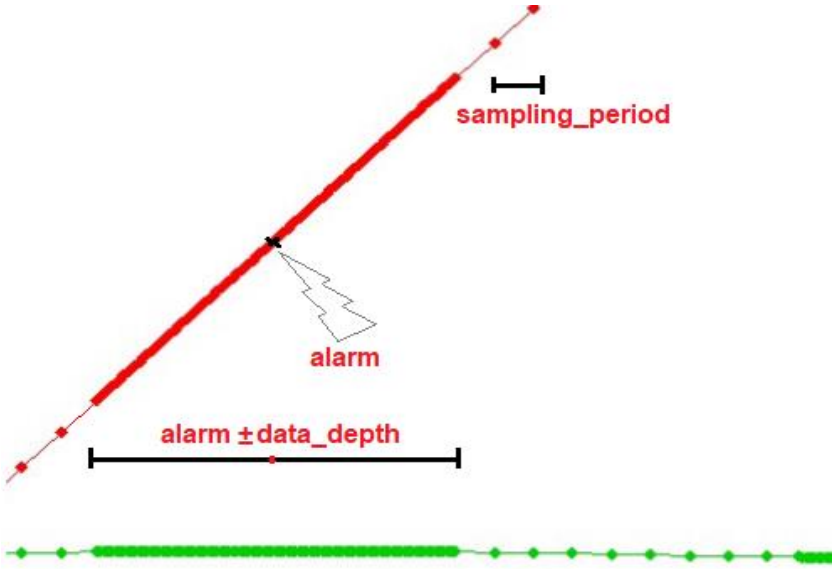


MOONARCH CONFIGURATION WEB PAGE

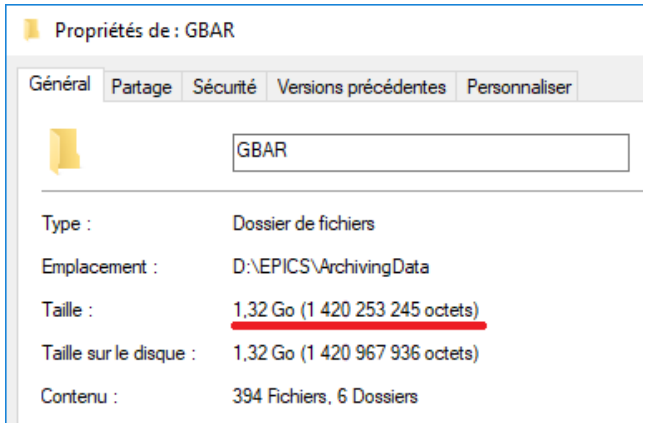


Parameters :

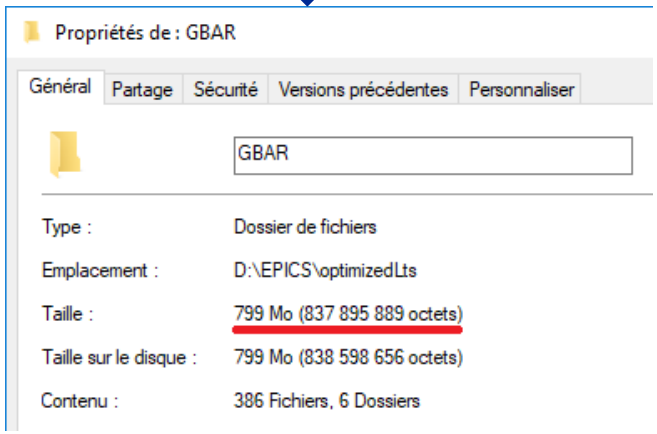
- Data depth
- Max storage duration
- Process variables to exclude
- Process period
- Optimization mode
- Process variables per task ...

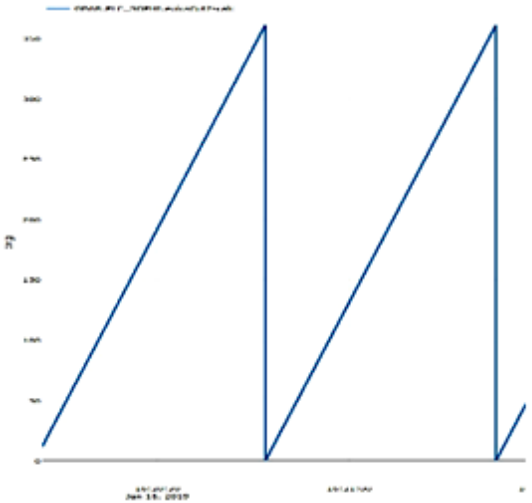


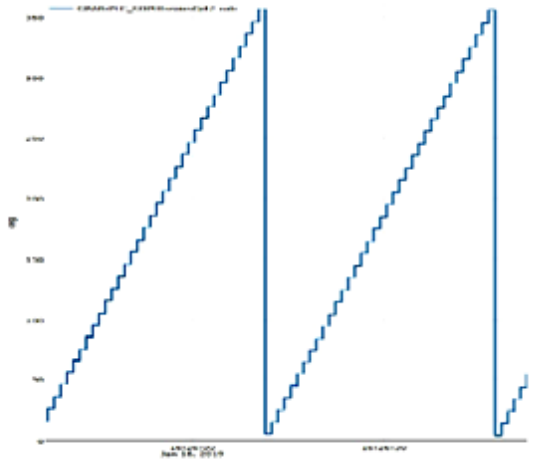
MOONARCH OPTIMIZATION PROCESS RESULT

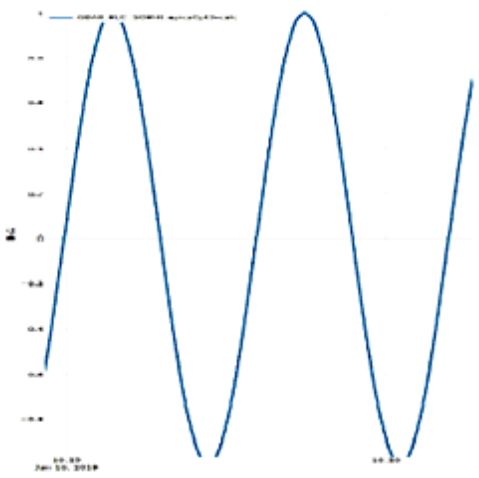


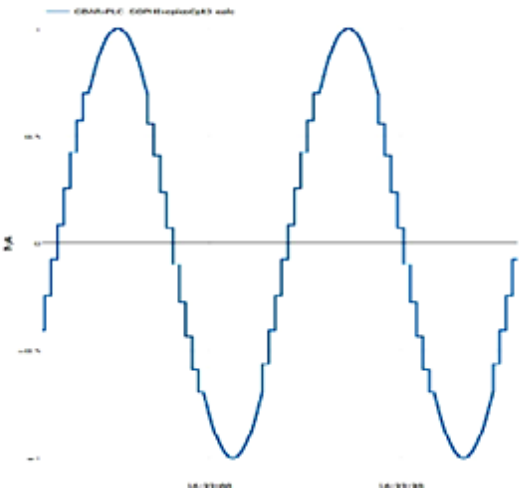
Memory size - 40 %



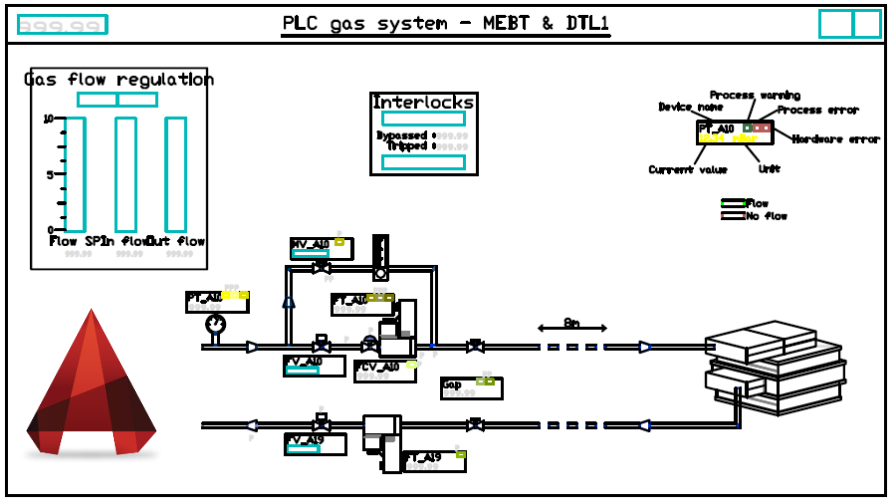


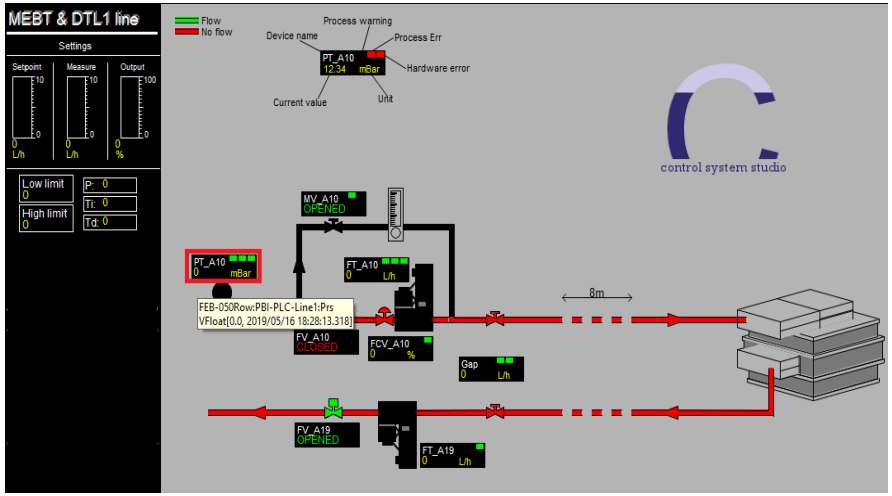




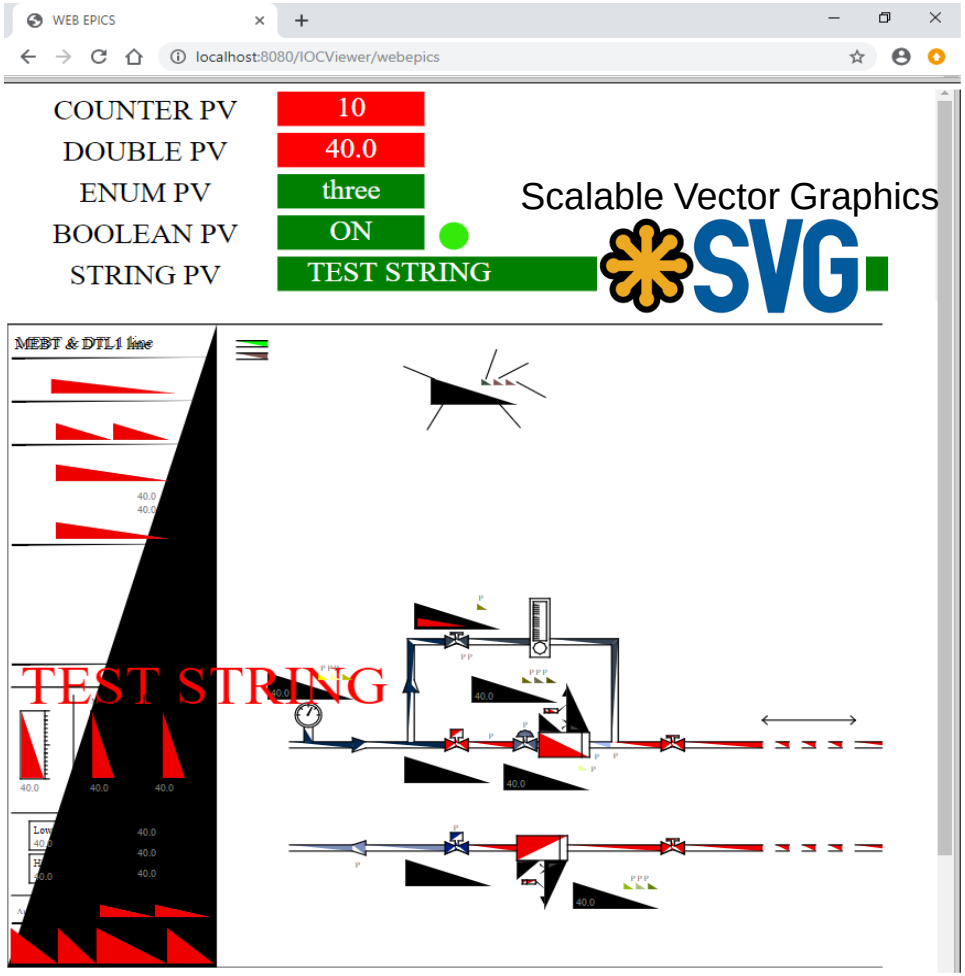


EPICS WEB


PLC gas system - MEBT & DTL1
Gas flow regulation
Interlocks
Process warning
Process error
Hardware error
Current value
Unit
Flow
No flow
Flow SP
In flow
Out flow
8m
Gap

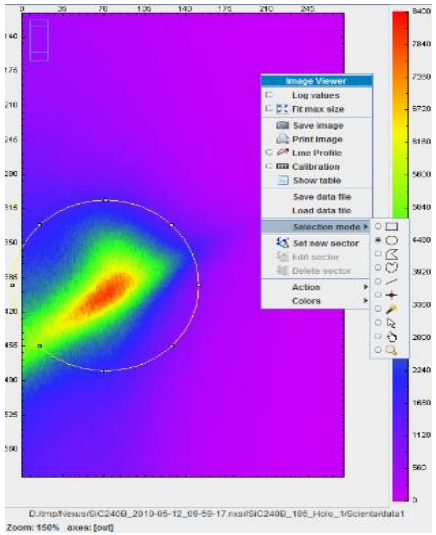

MEBT & DTL1 line
Settings
Setpoint
Measure
Output
Low limit
High limit
P:
Ti:
Td:
Flow
No flow
Process warning
Device name
Process Err
PT_A10
12.34 mBar
Hardware error
Current value
Unit
control system studio
MV_A10
OPENED
FT_A10
FEB-050Row:PBI-PLC-Line1:Prs
VFloat[0.0, 2019/05/16 18:28:13.318]
FV_A10
CLOSED
FCV_A10
Gap
FV_A19
OPENED
FT_A19
8m

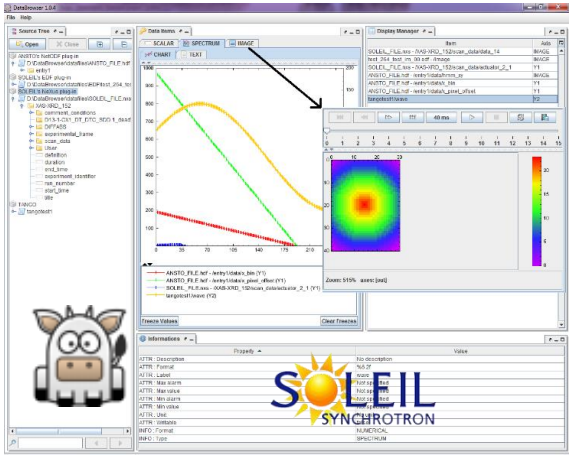
Web
EPICS
Apache Tomcat

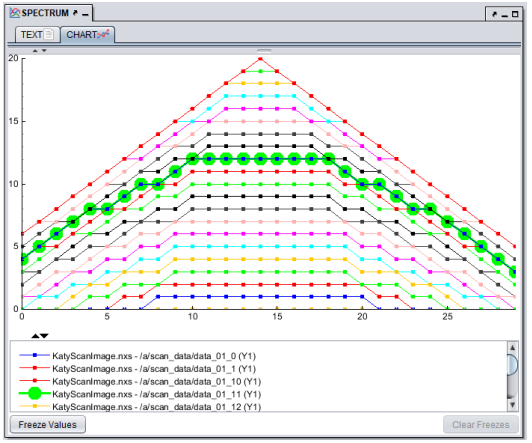

WEB EPICS
localhost:8080/IOCViewer/webepics
COUNTER PV
10
DOUBLE PV
40.0
ENUM PV
three
BOOLEAN PV
ON
STRING PV
TEST STRING
Scalable Vector Graphics
SVG
MEBT & DTL1 line
TEST STRING

DATABROWSER

http://wiki.synchrotron-soleil.fr/tikiwiki/tiki-index.php?page=How-browse-dowloaded-Nexus-files







ESRF The European Synchrotron

SOLEIL SYNCHROTRON

COMETE GUI SOLEIL SYNCHROTRON

CDMA ansto

ESRF The European Synchrotron

SOLEIL SYNCHROTRON

Plugin HDF

Plugin NeXus

Plugin TANGO

Plugin EPICS

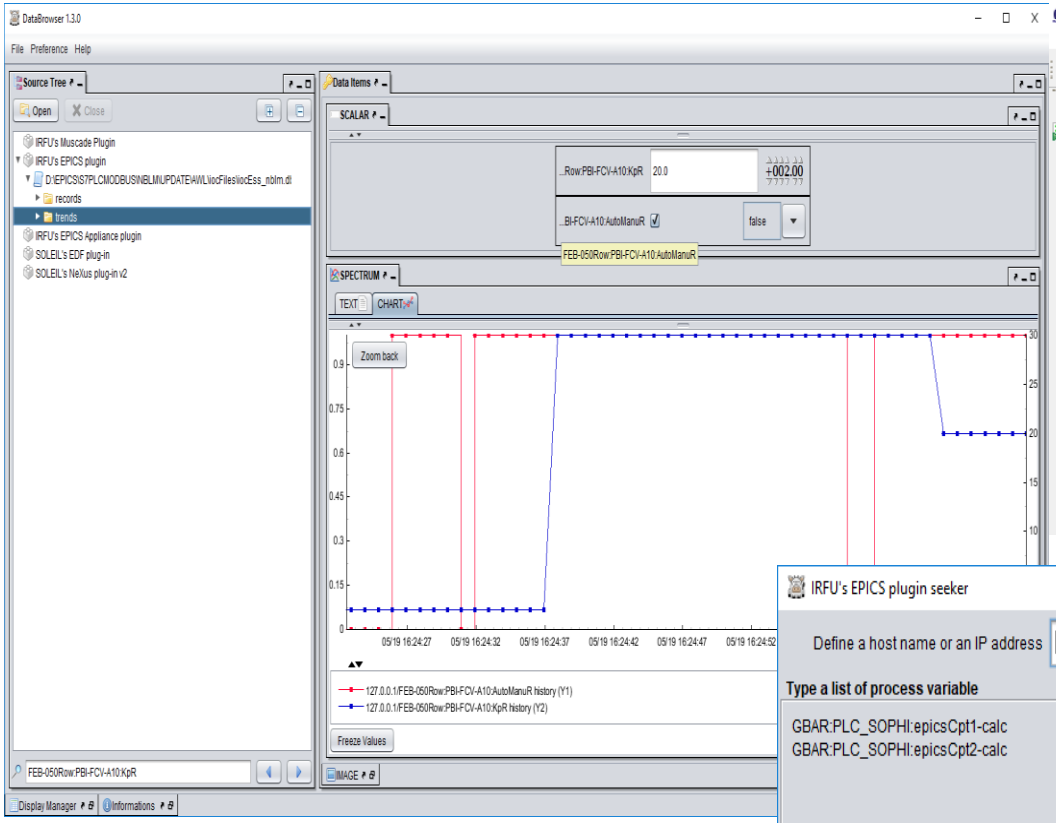
Plugin protobuf Protocol Buffers

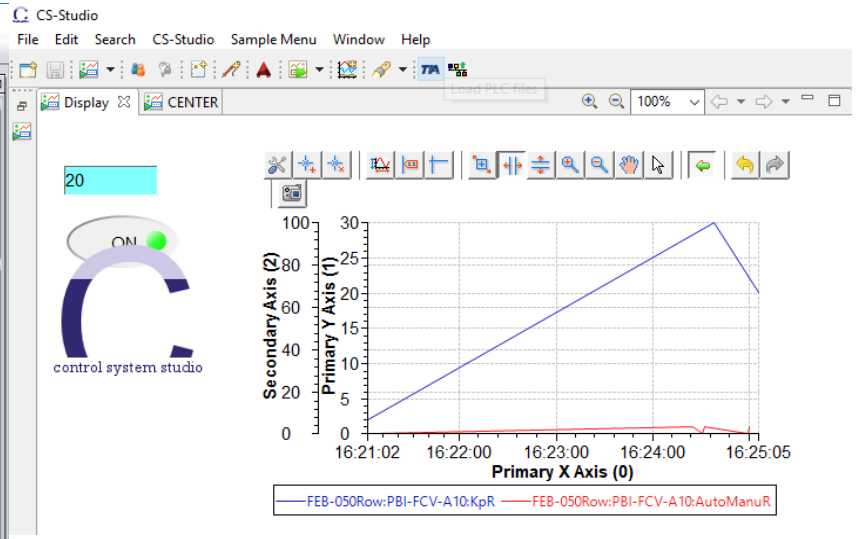
ansto

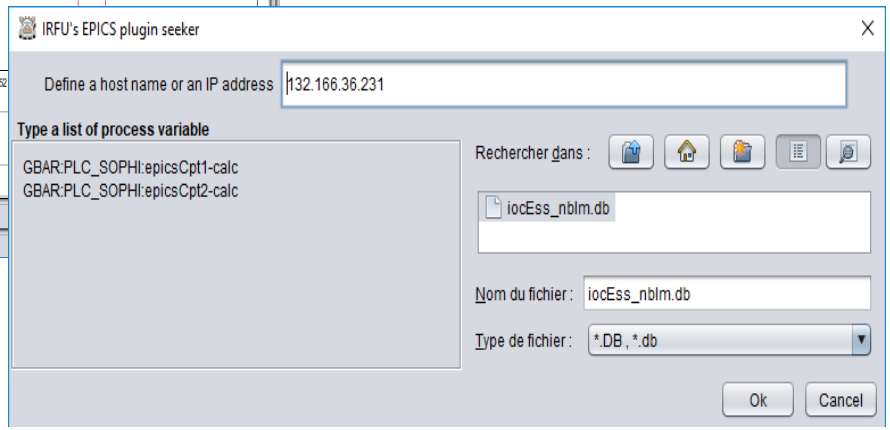
SOLEIL SYNCHROTRON

PLUGIN EPICS

CAJ : Channel Access for Java to read & write PV
VisualDCT : EPICS Visual Database Configuration Tool for parsing a EPICS db file

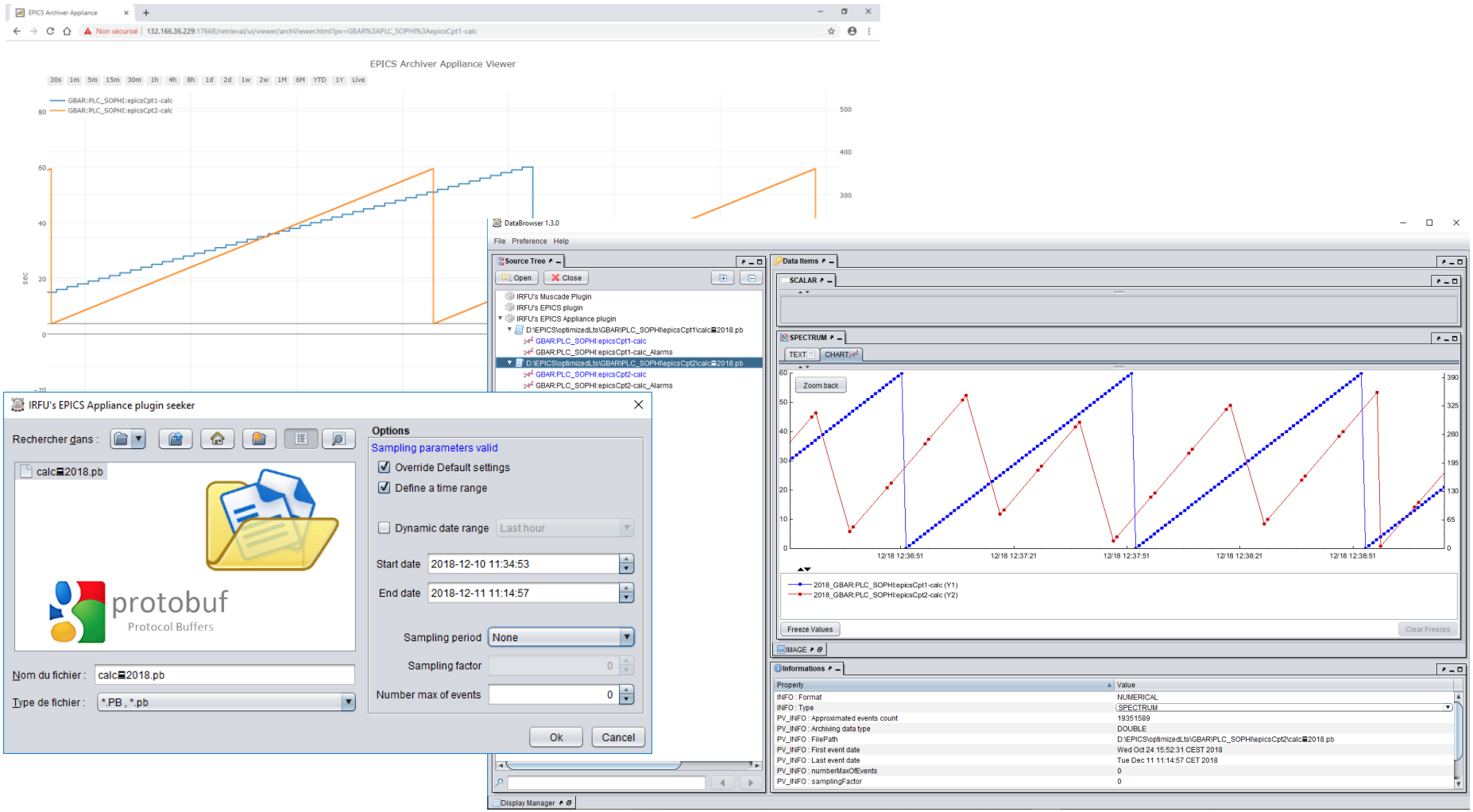






PLUGIN ARCHIVING APPLIANCE

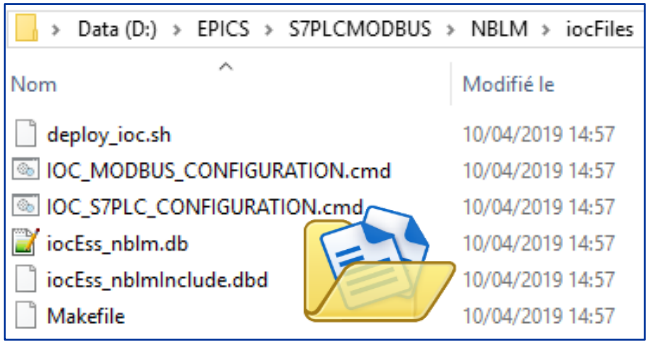
EPICS Archiver Appliance : Read Google Protobuf files

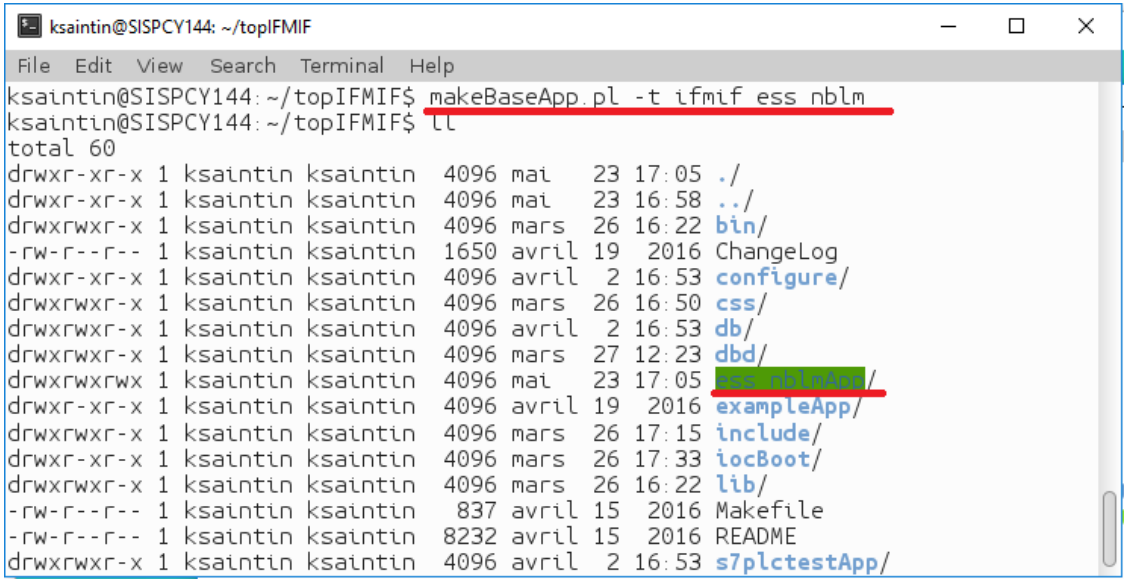


NEXT STEPS

PLC Parser Tool :

- Generate script deploy_ioc.sh for IOC Files deployment in an EPICS's top folder





Synoptic visualization :

- AutoCAD convert to BOB for PHEOBUS
- AutoCAD convert to SVG for EPICS Web
- mode, to replay a synoptic at a request time range

SVG

Apache Tomcat

Deployment automation :

- playbook for a full EPICS framework deployment on a small experiment

ANSIBLE

THANK YOU FOR YOUR ATTENTION!
ANY QUESTIONS?
memegenerator.net