UNICOS: UNIFIED INDUSTRIAL CONTROL SYSTEM

CPC (CONTINUOUS PROCESS CONTROL)

BASIC COURSE

SESSION 4: SCADA

CERN EN/ICE group

Outline

1. Introduction
   - ✓ Architecture
   - ✓ Terms
2. Basic Features
   - ✓ Environment & login
   - ✓ Widget & faceplate information
   - ✓ Panels (Navigation), Trending
   - ✓ Device overview
3. Diagnostic Features
   - ✓ Events & Alarms
   - ✓ Diagnostics: System Integrity & System Status,
   - ✓ Front-ends
   - ✓ Access control setup
4. OWS

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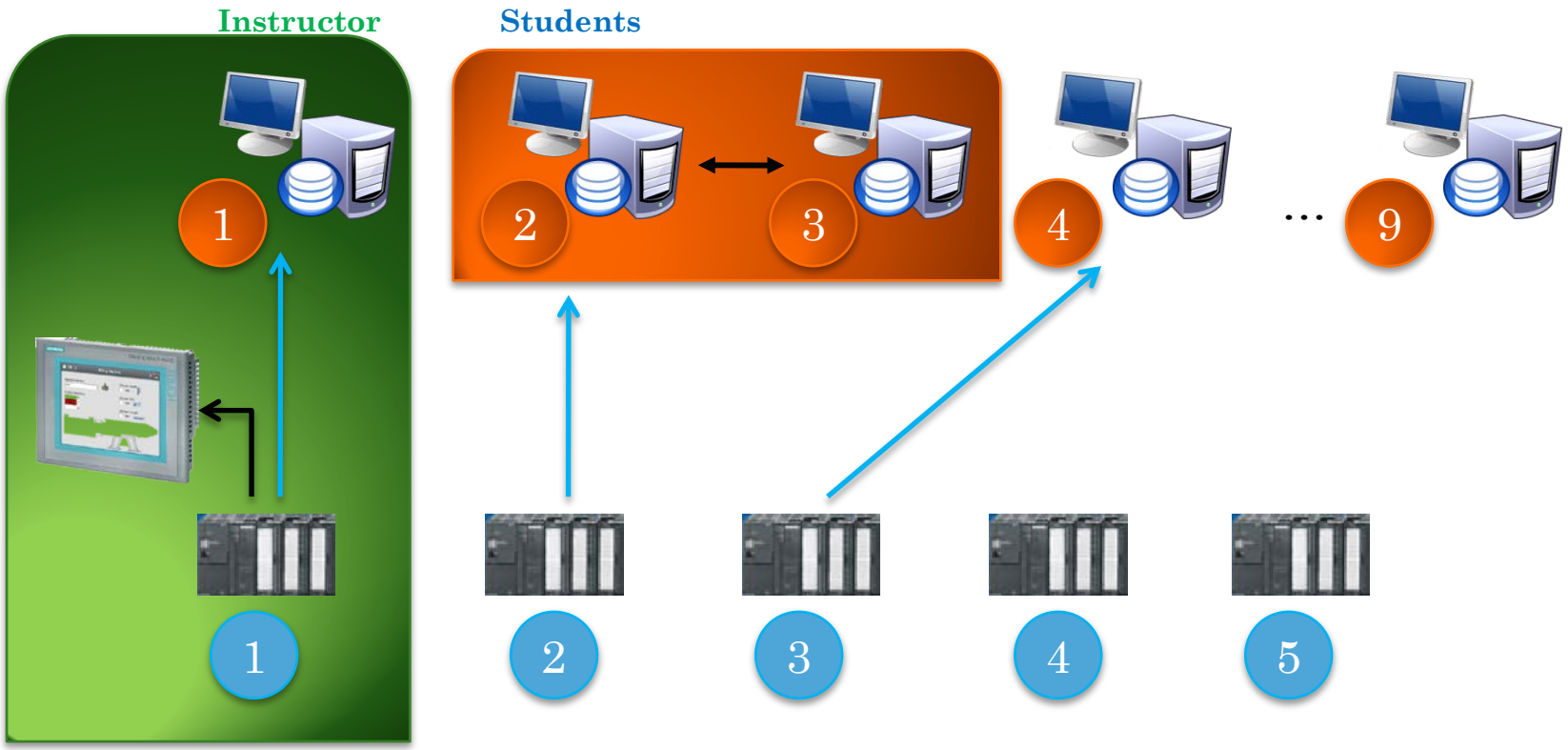
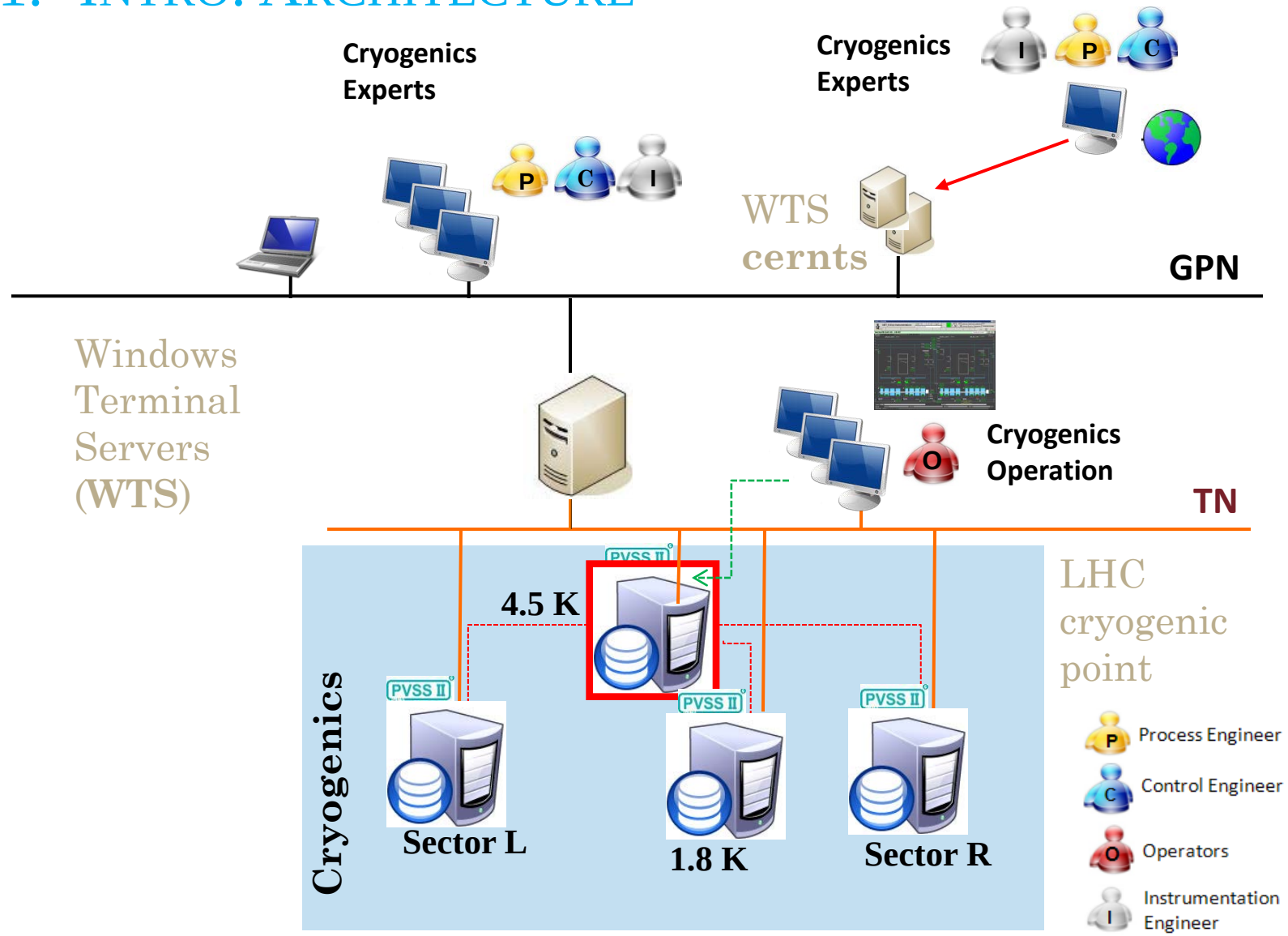
1.- INTRO: SCADA SYSTEM

- Supervisory, Control and Data Acquisition



1.- INTRO: ARCHITECTURE

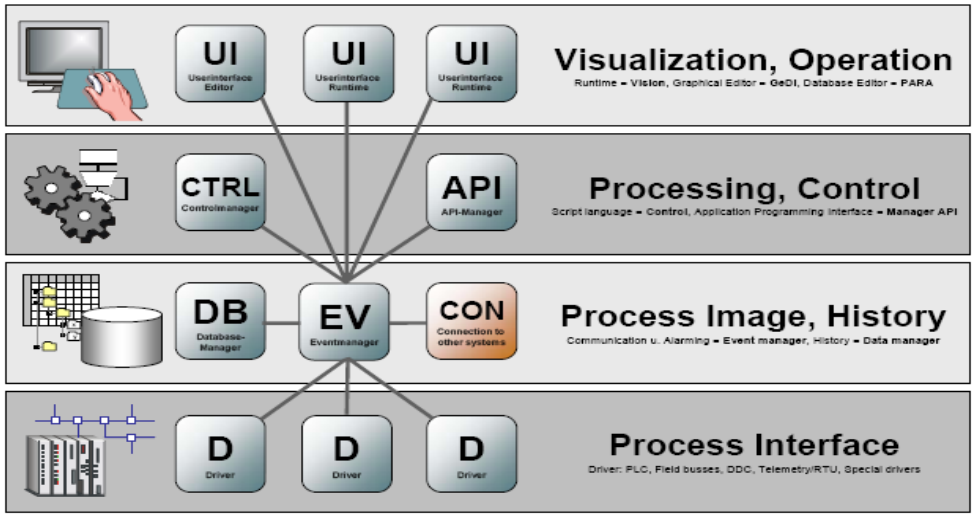


1.- Intro: WinCC OA Architecture

- Modular architecture: Managers

- Drivers (D): Process Interface (PLCs,…)
- Central processing: Event manager (EV) holds the current image of the process variables in memory
- Data Manager (DB) parameterization and archiving of value changes
- User interface (UI) : graphical display

Managers can run in different machines!



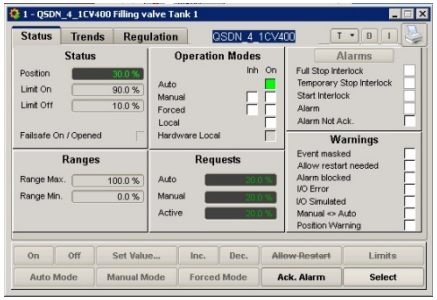
INTRO: UNICOS WINCC OA FEATURES

- Uniform look and feel
  - ✓ Widgets, faceplates
  - ✓ Tags Naming as in PLC
- Devices connection
  - ✓ Directly set-up on application import
  - ✓ Diagnostics
- System Integrity
  - ✓ Checks that all the SCADA features are working fine
  - ✓ Automatic reaction
  - ✓ Report
- Reporting tools
  - ✓ Event list
  - ✓ Alarm list
  - ✓ Messages
  - ✓ Trending
- Access Control

1.- Intro: Terms

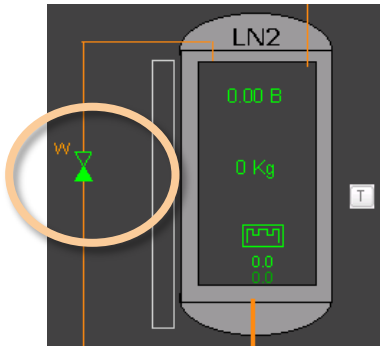
- Device: Process Component, the devices can be the sensors (temperature, pressure…), actuators (Motor, valve…), controllers, PCOs, …

- Faceplates: Overlap panel presenting all dynamic values, status and information associated to a device.



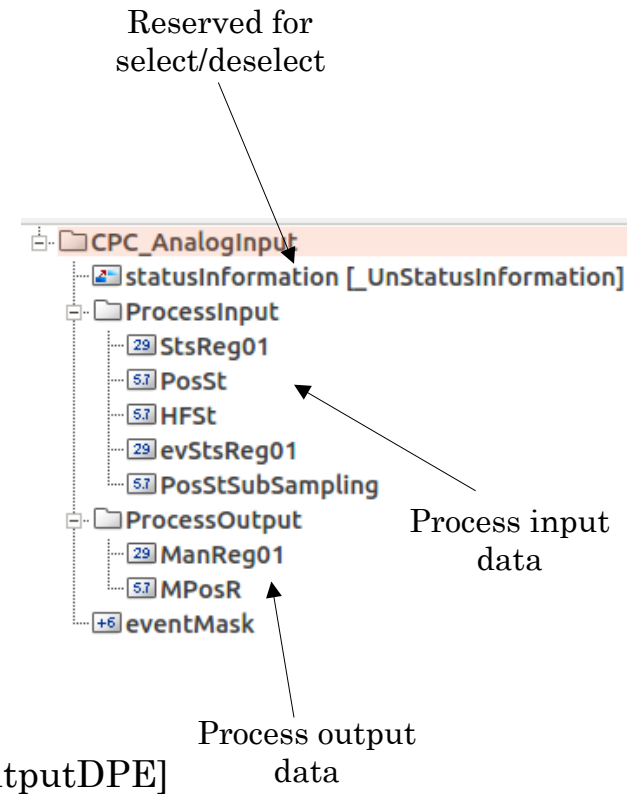
- Panels: Panels are windows used to represent the status of the process by observing animated objects.
  - ✓ Background panel: Panel covering the entire display
  - ✓ Pop-up panel : the overlap panel covers part of the display it can be moved and eventually will be closed when the base panel from where it has been opened is closed (child Panel)

- Widgets: mimics or widget are small display elements presenting a device in a synoptic with a subset of its associated dynamic values, status and information



- Trends
  - ✓ Trend Plot : panel presenting on the same time base several trend curves
  - ✓ Trend Page : panel presenting several trend plot in the same window.

1.- INTRO: WINCC OA DEVICE



- Device type = WinCC OA DPT.
- Device name
  - ✓ Widget:

[WCCOASystemName]:[WCCOAAlias]

E.g.: dist_1: QSDN_4_1LT400

  - ✓ Trending:

[WCCOAystemName]:[WCCOAAlias].[leafProcessInput/OutputDPE]

E.g.: dist_1: QSDN_4_1LT400.ProcessInput.PosSt

- DP name

[WCCOASystemName]:[prefix]-[FrontEnd]-[Application]-[DpType]-[#####]

E.g.: un-CFP_LABO_BEN-QSDN-CPC_AnalogInput-10000

1.- Intro: project name convention

- Project name = System name

- Directories:
  - ✓ Project:

PVSS_projects/[ProjectName]/[ProjectName]

E.g.: PVSS_projects/QSDN/QSDN

  - ✓ Installed components:

PVSS_projects/[ProjectName]/installed_components

E.g.: PVSS_projects/QSDN/installed_components

1.- HANDS-ON: CREATE A PROJECT

- Project name
  - QSDN
- System name
  - QSDN:

- Directories:
  - ✓ Project:
    PVSS_projects/QSDN/QSDN
  - ✓ Installed components:
    PVSS_projects/QSDN/installed_components

Procedure in unicos wincc oa ucpc page - download

PROJECT CREATION

- Follow path convention!

1. Create the project
2. Install fw installation (unzip)
3. Install unicos packages using fwInstal
4. Install cpc package using fwInstal

- Get components (2-4) from:

1. UAB project/Baselines
2. cern.ch/unicos -> download section

- Unzip the components (3, 4) to the temporal dir

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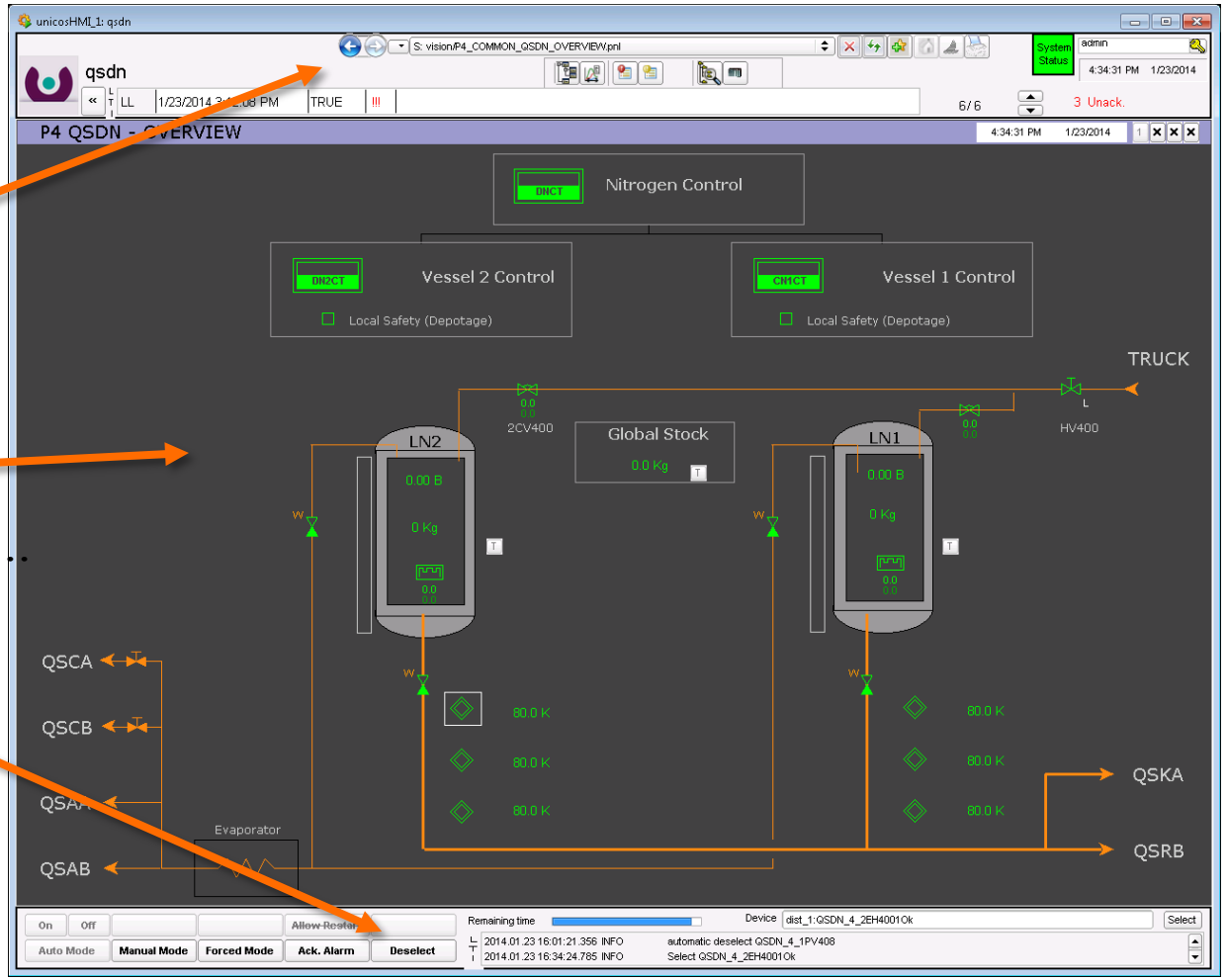
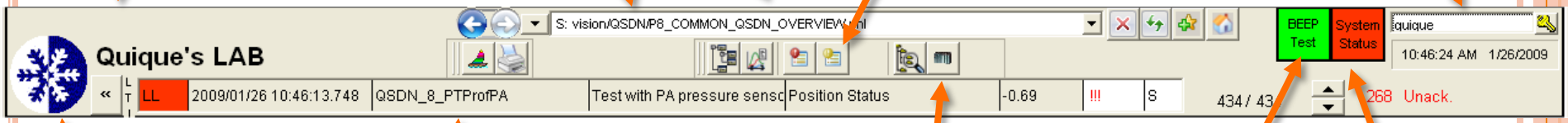
2.- BASICS: LAYOUT

Same layout on each display

- Header
  - ✓ Fix area (toolbar)
- Process area
  - ✓ Synoptics, trends ,…
- Footer
  - ✓ Contextual area



2.- BASICS: HEADER



Panel, trend horizontal navigation

Logo, application name

Navigation Panel

UNICOS utiltites:
WindowTree, TrendTree
AlarmList, EventList, etc.

Current user (login), date & time

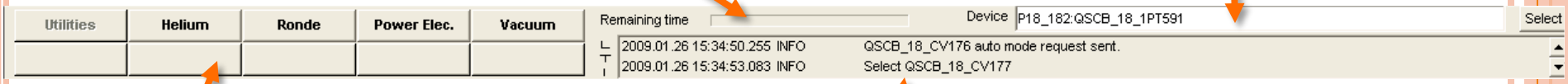
Management menu
Configuration menu

Alerts row

Front-end diagnostics

Beep

System Status



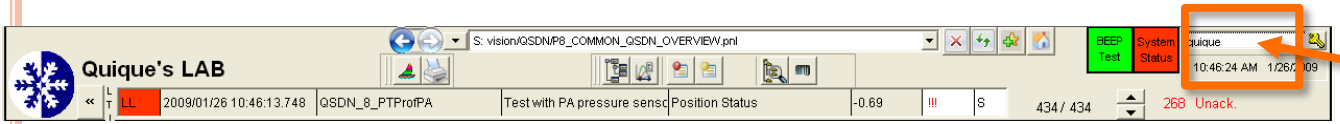
Remaining select time

Device to select or
Last device selected

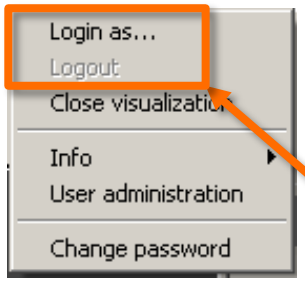
Contextual area

Right-click: history of all received messages

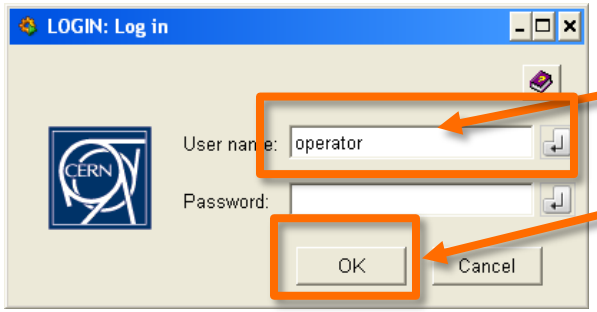
2.- BASICS: LOGIN



1 Right click
On the Current User name
Or click on the "key"

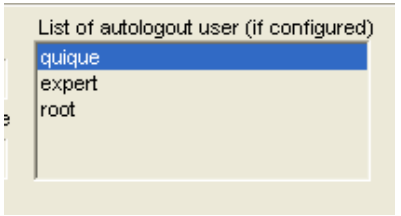


2 Click Login as



3 Enter a user / password

4 Click Login

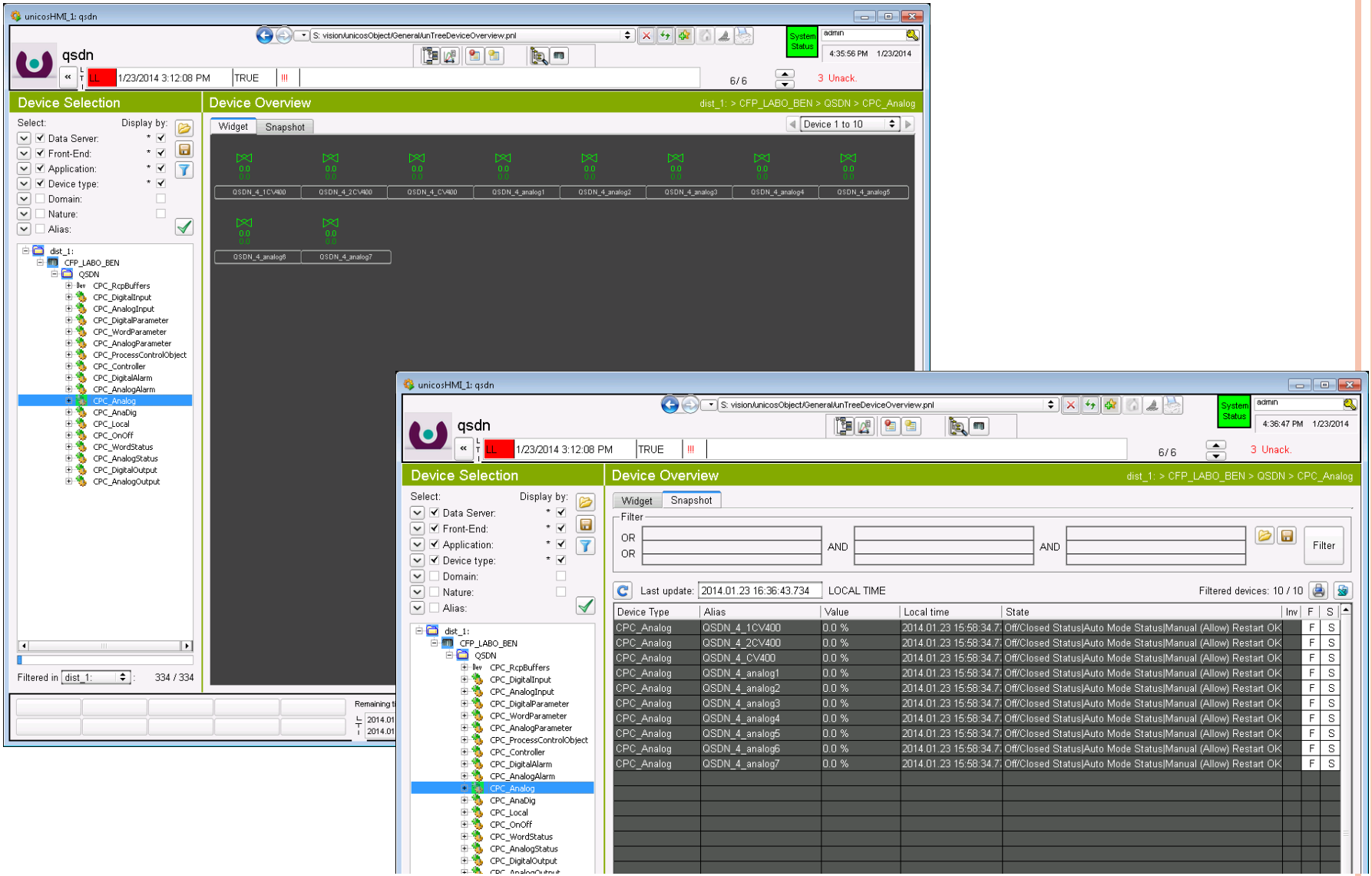


Default users:

- root
- admin
- expert
- operator
- monitor

As default the "**expert**" login is configured to be log off automatically after ½ hour of inactivity

2.- BASICS: DEVICE TREE OVERVIEW



2.- BASICS: WIDGETS ANIMATION

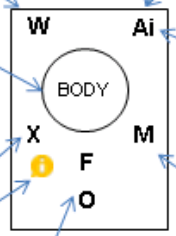
(W) DATA QUALITY (warnings)	Object	Letter	Color	Priority
Invalid data	all	N	Cyan	highest
Old (data not up to date)	all	O		
Field object with an alarm blocked IO object with IOError blocked	Field, I/O	B	Orange	
IO error	all excep xPAR, xSTATUS	E		
IO simulated		S		
Forced <> Auto	PCO, Field, I/O	W		
Manual <> Auto				
Position Warning				
Configuration Warning	AA	C		lowest

(Ai) ALARM & INTERLOCKS	Object	Letter	Color	Priority
Full stop interlock	PCO, Field	F	Red	highest
Temporary Stop Interlock		S		
Start Interlock		I		
Alarm		A		
Position Alarm (Local)	Local	P		
Manual Restart Required (after a full stop interlock)	PCO, Field	R	Orange	lowest

(Ai) Info (Alarm objects)	Object	Letter	Color	Priority
Alarm condition	DA	A	Red	highest
High Threshold alarm	AA, AI, AIR, AO, AOR	HH		
Low Threshold alarm		LL		
High Threshold warning		H	Orange	lowest
Low Threshold warning		L		

BODY	Color	Priority
Data not accessible	Magenta	highest
Invalid	Cyan	
Alarm Unacknowledged	Red Blinking	
Alarm	Red	
Warning /Man. Restart required	Orange	
Forced mode	Yellow	
Auto/Manual mode	Green	lowest

Widget



(M) Mode & Working State	Object	Letter	Color	Priority
Hardware Local Mode	PCO, Field, PID	HL	White	highest
Local Mode		L	White	
Auto Mode		none		
Manual Mode		M	White	
Forced Mode		F	Yellow	
Inhibit Manual/Forced		h	White	lowest

(X) Additional Information	Letter	Color
Controller mode (up to 3 letters)	A,M,F,L,R,P,T	White

(Ai) MASK & BLOCK info	Object	Letter	Color	Priority
Alarm Blocked (PLC)	PCO,	B	Yellow	highest
Alarm Masked (only SCADA)	Field,	M		lowest
Event Masked (only SCADA)	all	e		

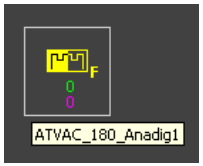
Comment notification

(F) Feedback & (O) Order		Color
Feedback value		Green
Order value		Green

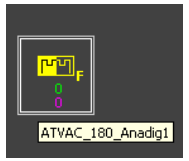
Analog	AI,AS	Analog	Analog	Analog	OnOff	AI,AS	PID	Analog	OnOff	OnOff	DA	AA	AA	
Data Invalid	No refresh Data	Data not connected	Forced Mode	Auto Regulated & order: 17.1 stat: 16.3	Warning & Forced Mode	Forced Mode & Event Masked	Manual & Regulation & Simulated	Inhibit Manual mode activate	Temporary Stop Interlock	Start Interlock active	Alarm On	Blocked alarm	Warning High	

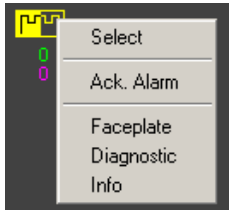
2.- BASICS: WIDGET INTERACTION

- Mouse over
- Mouse click
  - ✓ Select if user authorized: at least "operator"
- Mouse double click
  - ✓ Select, open faceplate
- Mouse right click
  - ✓ Menu
- Device selected:
  - ✓ White box around
  - ✓ Contextual button opened in context area
  - ✓ Device name set in the footer of the Graphical Frame

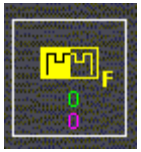


Device selected
mouse over

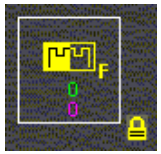




Device selected

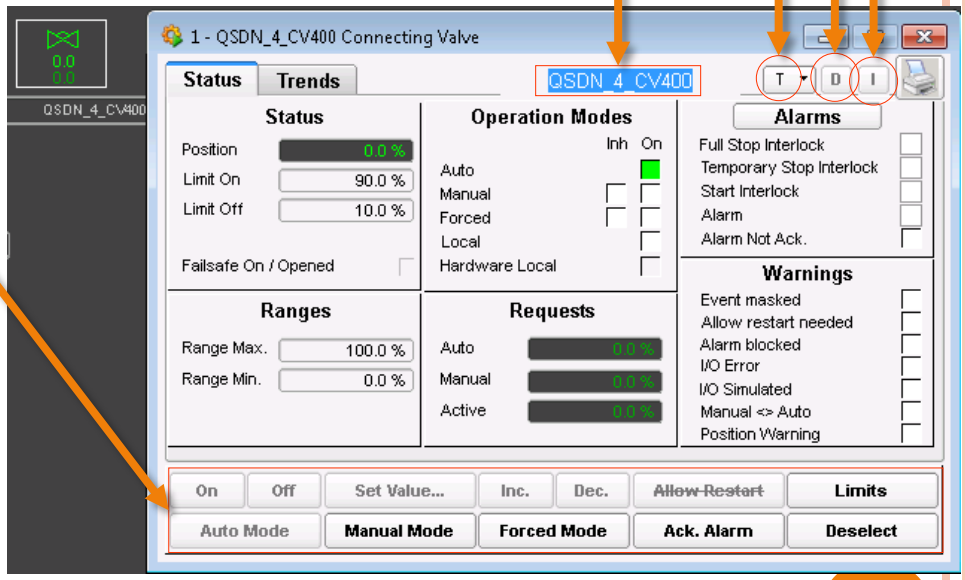


Device selected
By another UIM
No action possible

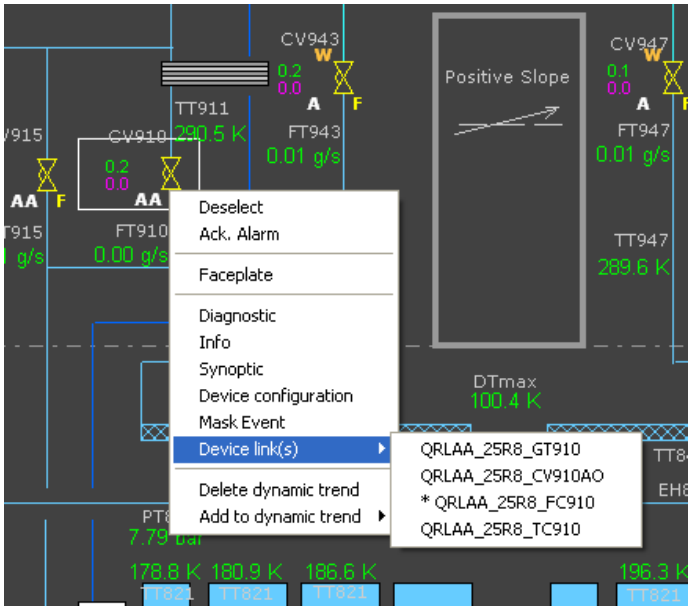


2.- Basics: Faceplate information

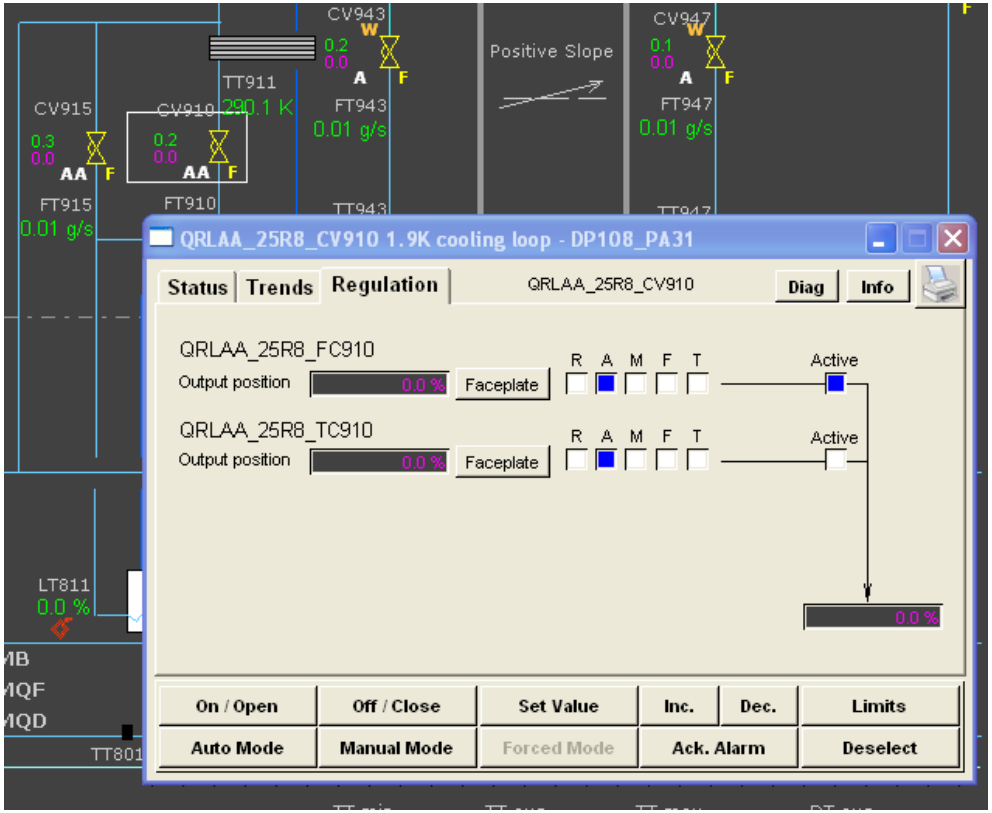
- Status (data) area
- Trend area
- Info: HTML page
- Diagnostic: custom panel
- Trends: Popup
- Menu (widget)
- Contextual button
  - ✓ Per device type
  - ✓ Animation depend on the state of the device



2.- BASICS: CONTROLLERS I (DEVICE LINKS)

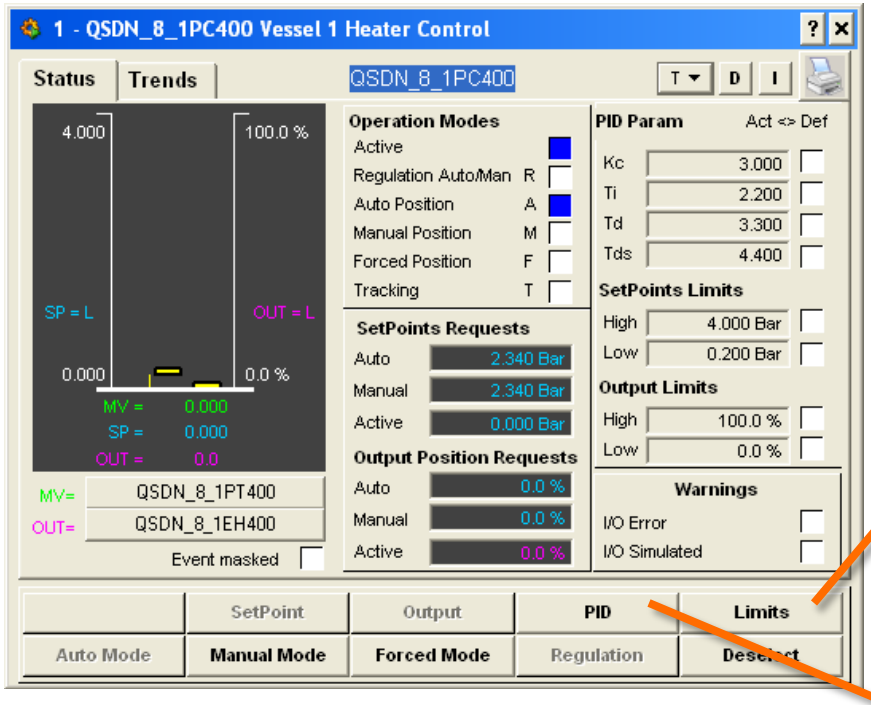


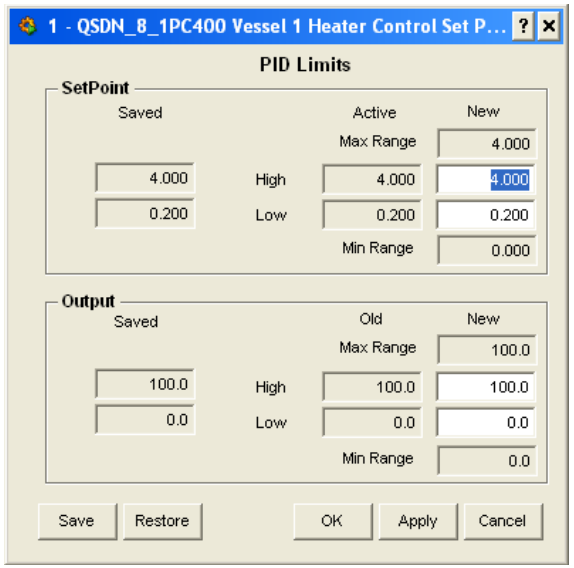
- Opening the Faceplate of the controller through the controlled object:
- right click on the analog widget
- Device links selection (feedbacks & controllers)
- Or by the TAB “regulation”

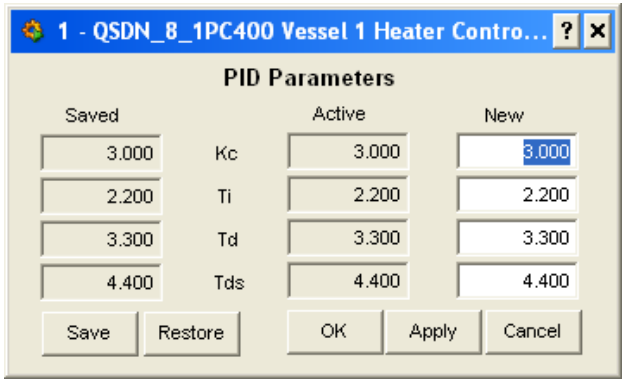


- In both cases there is an indication about which controller is active (this feature depends on the logic programmed)

2.- BASICS: CONTROLLERS II (FACEPLATE & DEFAULT PARAMETERS)

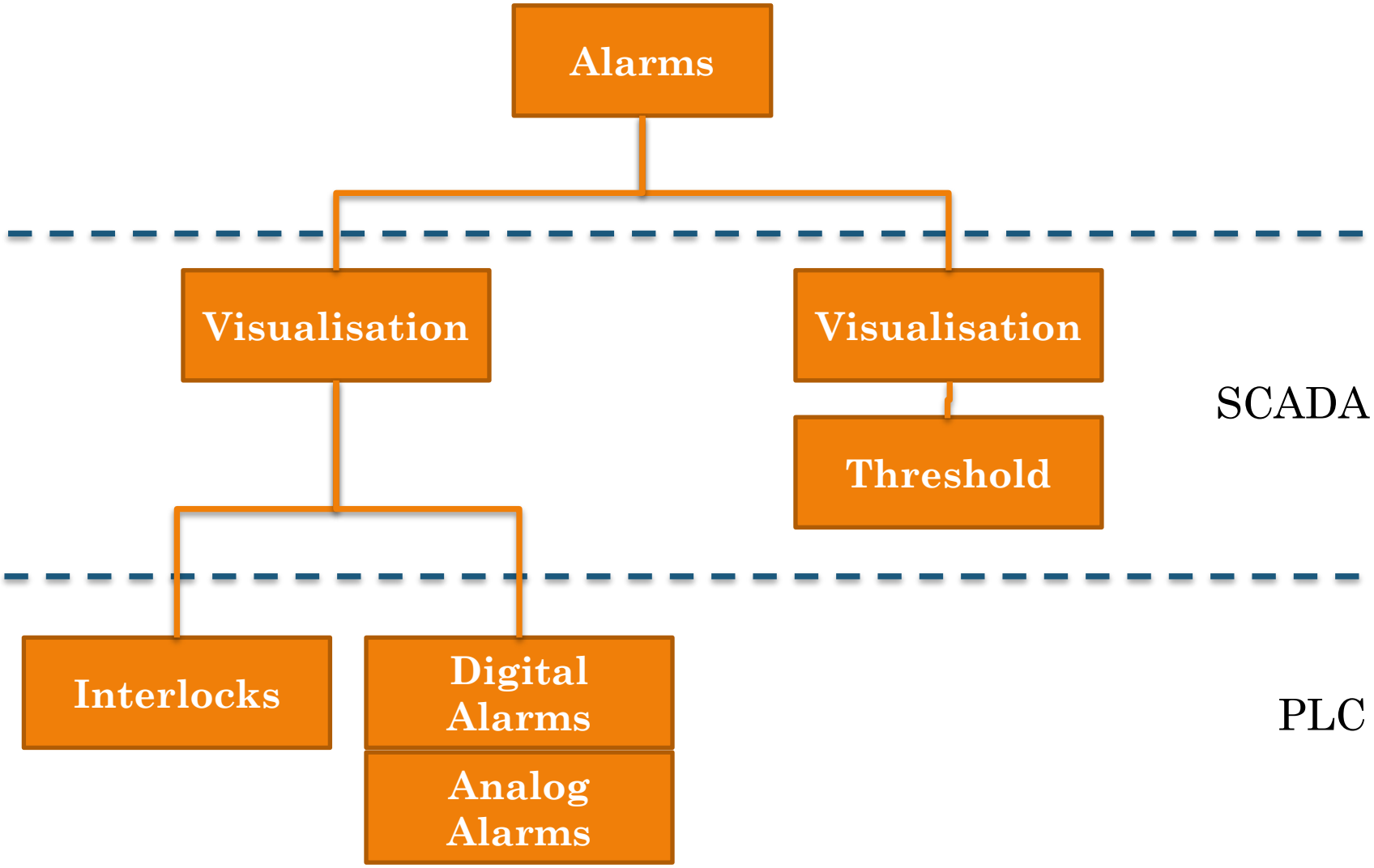






Default parameters are tagged as "Saved" parameters.
There are two possible actions:
1."**Save**" to assign the current parameters to the default ones.
2."**Restore**" to assign the default parameters to the current ones.

2.- BASICS: ALARMS I: PRINCIPLE



2.- Basics: Alarms I: animation

Alarm widget shows the alarm state according to:

- Not active

- Active and not acknowledged by the operator (blinking)

- Active (acknowledge done)

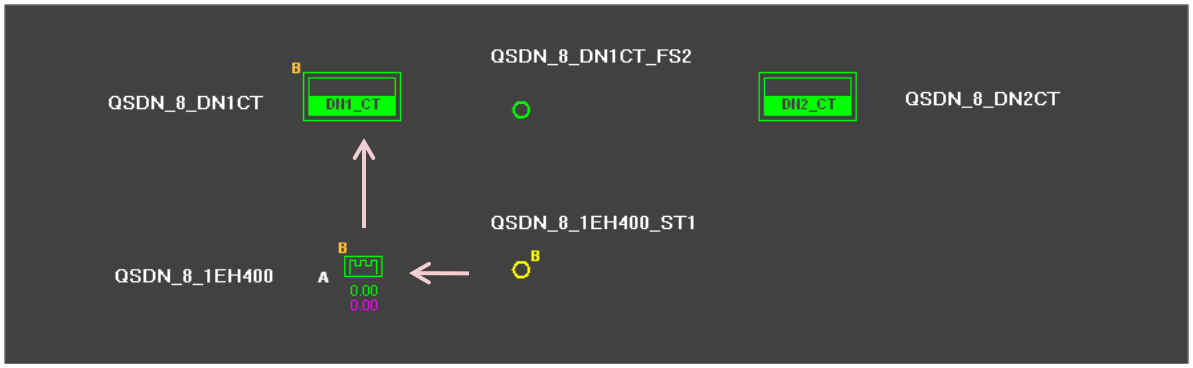
- Not active and not acknowledged (blinking border)

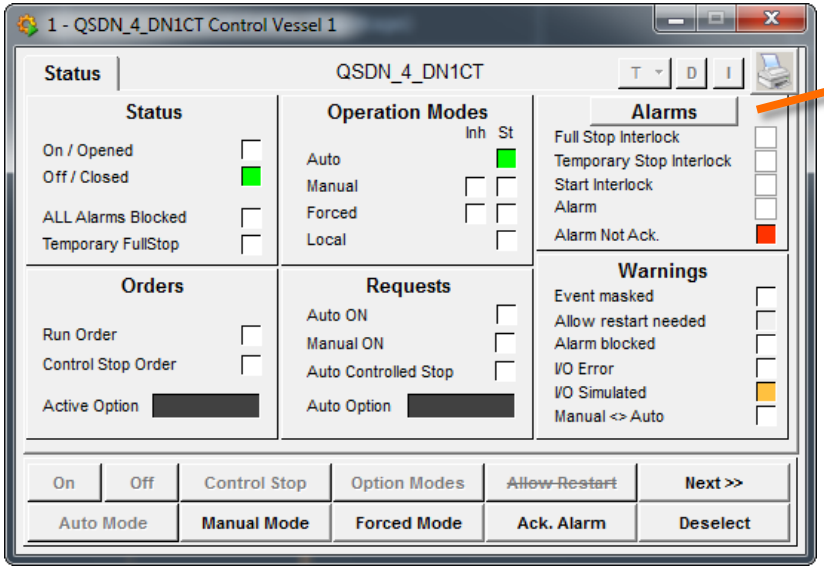
- Blocked (by the user)

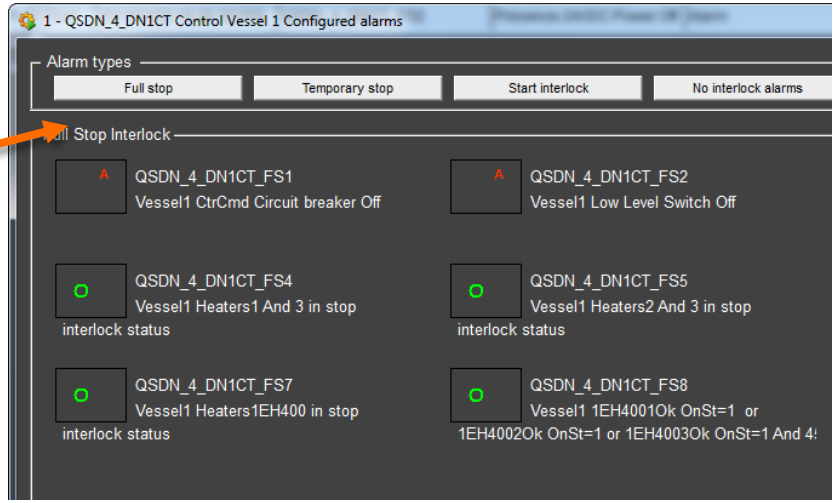
- Blocked but alarm present in the input.
(W = position warning)
The alarm will be active after unblock action!

2.- BASICS: ALARMS II: PROPAGATION

Alarms are propagated to their parents to allow showing a possible blocking action by the user in a dependent object.







alarms associated to a device (analog, PCO, …)

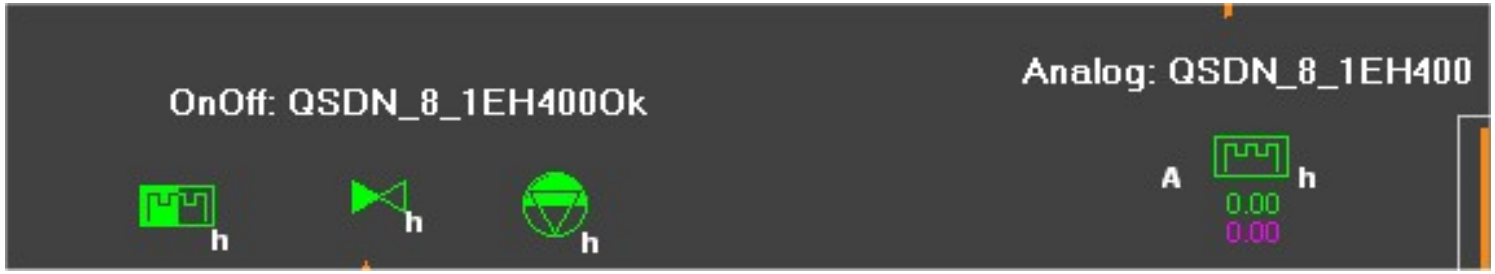
2. - Basics: Interlocks for Field Objects

- Start Interlocks
  - In case of a START interlock in a field object: the body of the widget won't change its color and only the letter (I) will change to red. Still the alarm is going to be generated!.

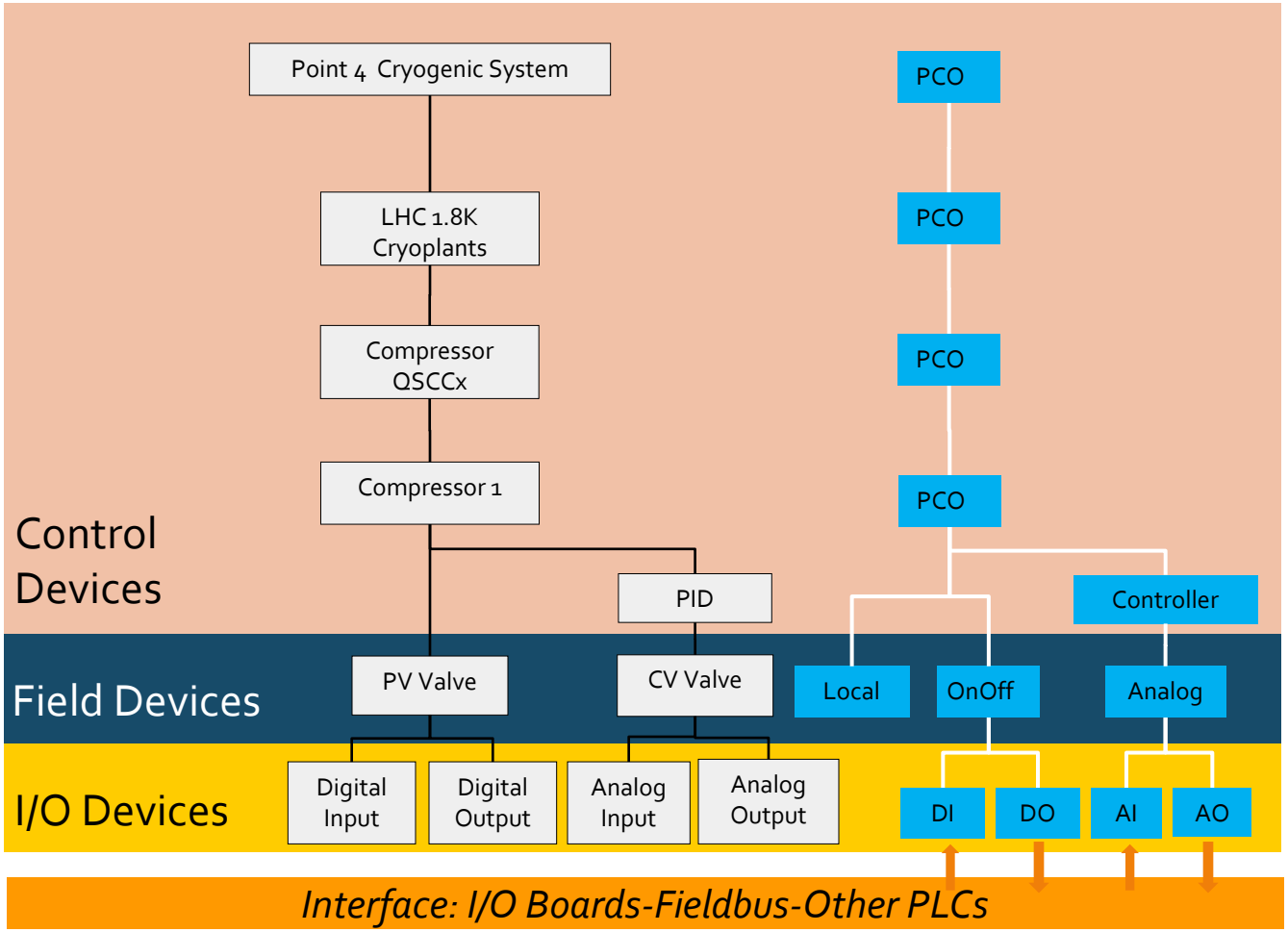
- Temporal Stop Interlock
- Full Stop Interlock
- Alarm

2. - BASICS: MODES

- Auto Inhibit Manual/Forced mode
  - Whenever the Auto Inhibit Manual/Forced pins are used in the user logic code, there will be a visible indication (“h”) in both the widgets and faceplates (apart of inhibiting the corresponding buttons).



2. – BASICS: HIERARCHY. RECALL



2. - BASICS: HIERARCHY

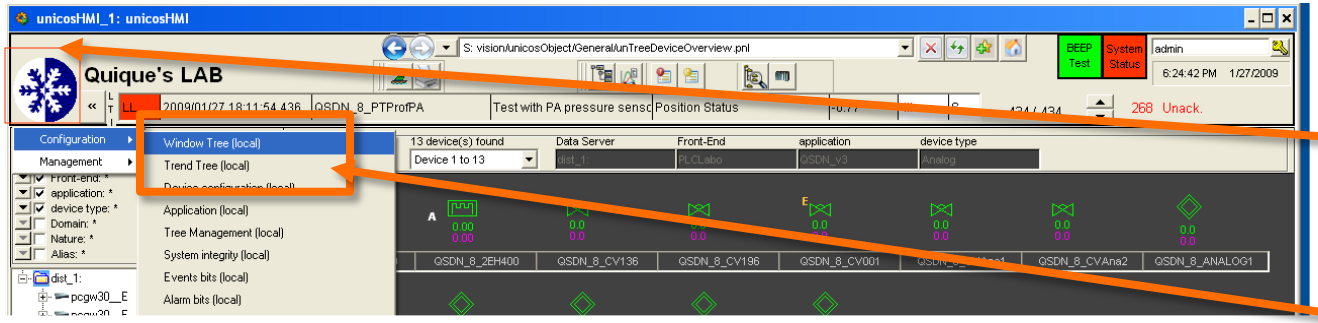
- Master:
- Parents:
- Children:
- FS:

HANDS-ON: GENERATE AN ALARM

- We will:
  - Trigger an alarm from PLC

  - See it in action on SCADA

2.- Basics: Window / Trend Tree

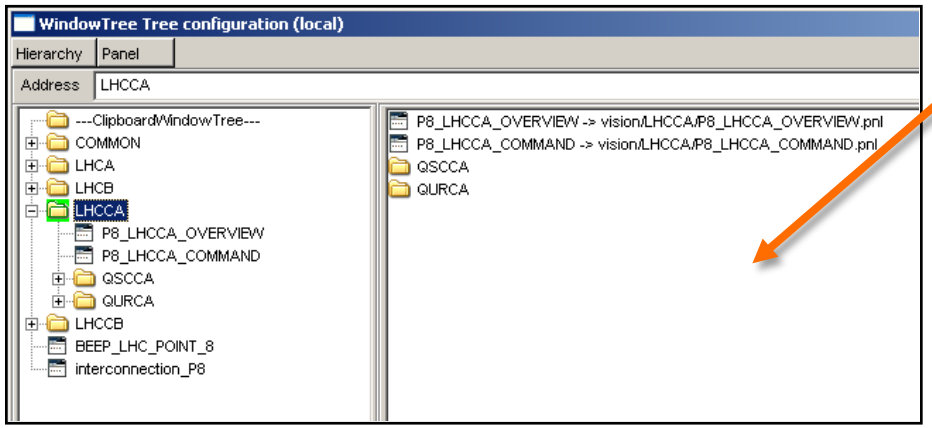


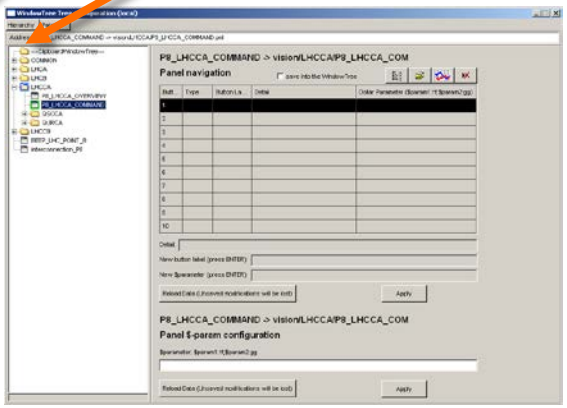
1 Click

2 Select

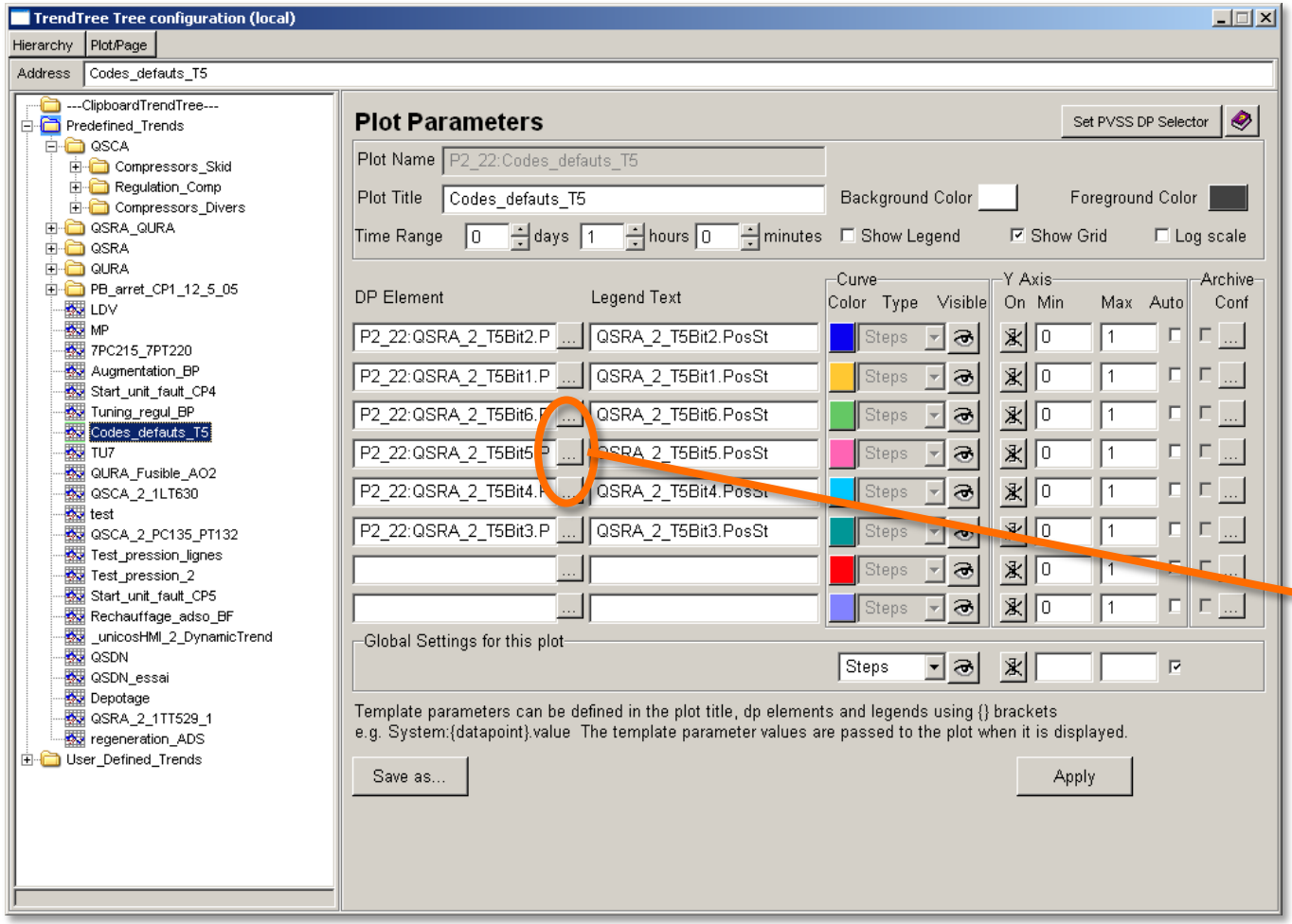
3 Explore to find your panel or the folder where to put the Panel

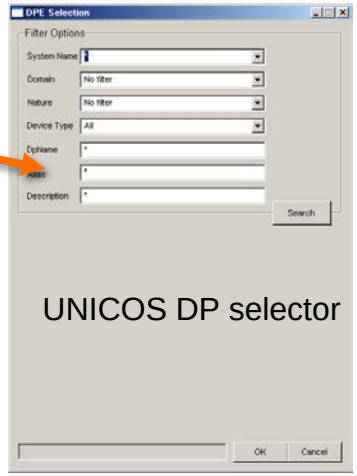
4 For each panel, you can define its navigation





2.- BASICS: PLOT CONFIGURATION

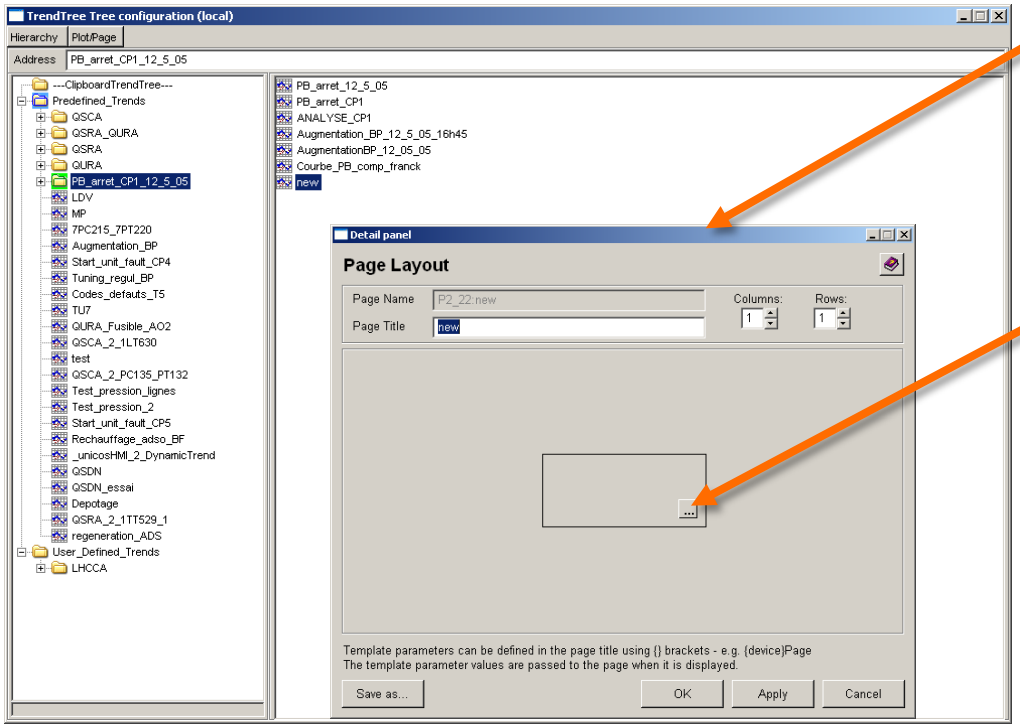




UNICOS DP selector

2.- BASICS: TREND PAGE CONFIGURATION

Creating a new trend page



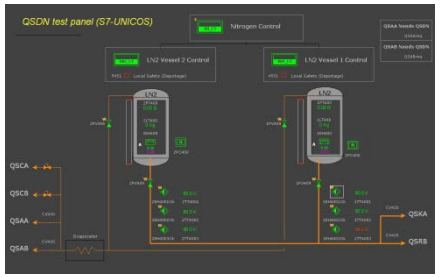
1. go to configuration, trend tree, select a directory where you want to create it
2. Click right and choose new page
3. Choose an existing trend and apply

2.- Hands-on: add a trend plot

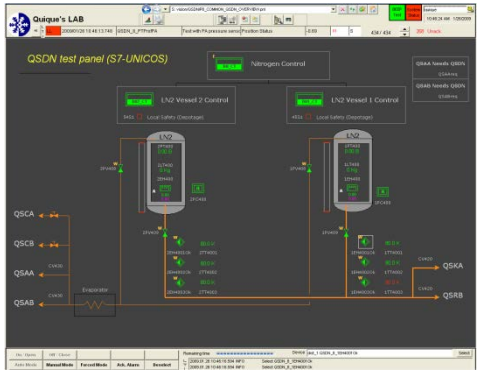
- We will:
  - Create a trend plot
  - Create a trend page

2.- HANDS-ON: EDIT PANELS

- We will:
  - Create this panel with Gedi



  - Add it to the UNICOS HMI



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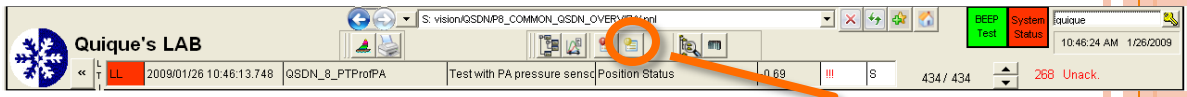
   - ✓ Access control setup
4. OWS

3.- DIAGNOSTIC: EVENT LIST



Filter: object, alias, etc, Save, load filter, etc.

Query time interval

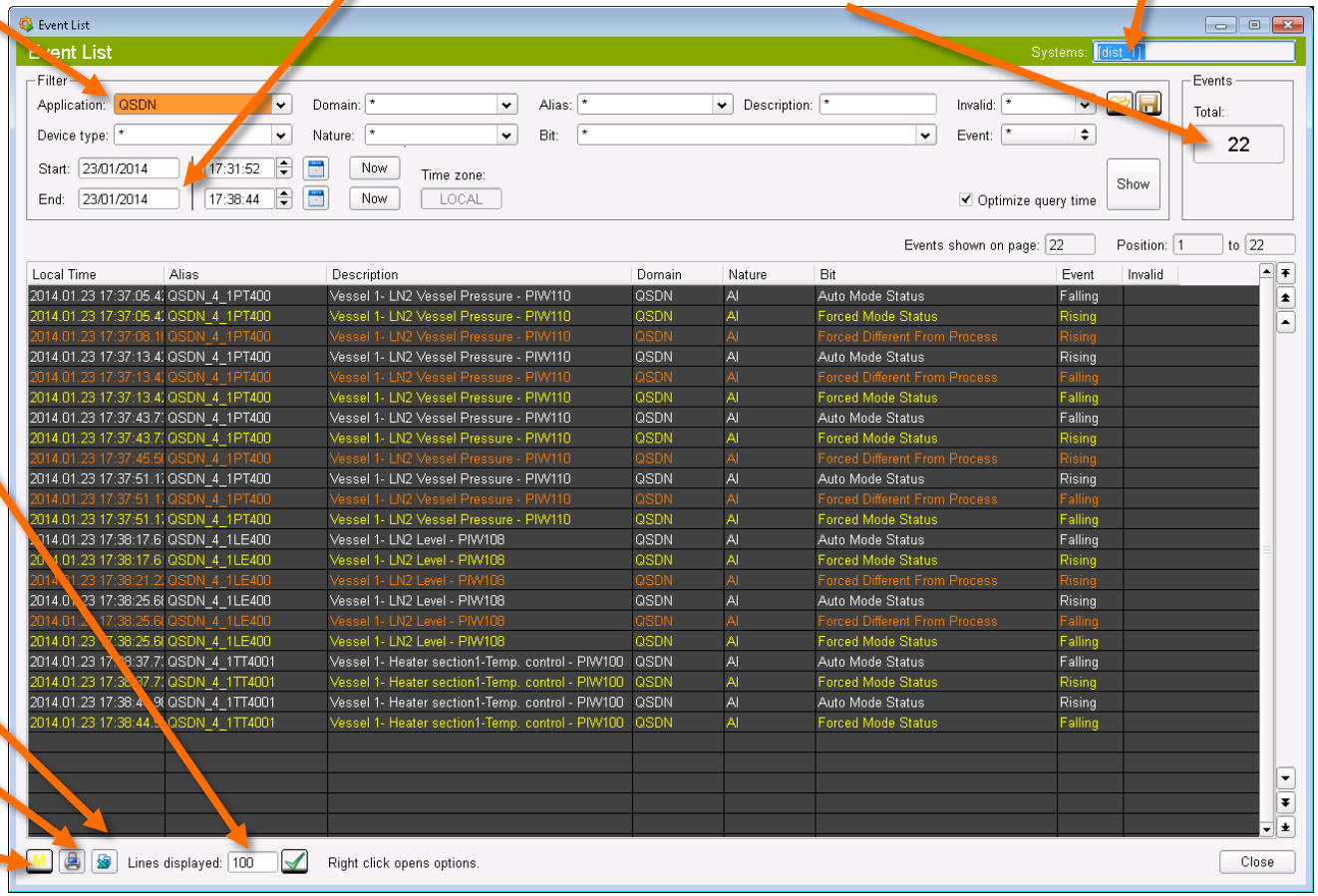
Number of found event

Maximum number of displayed line

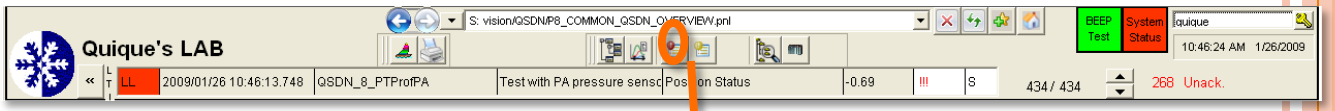
Export

Print

Display Masked events

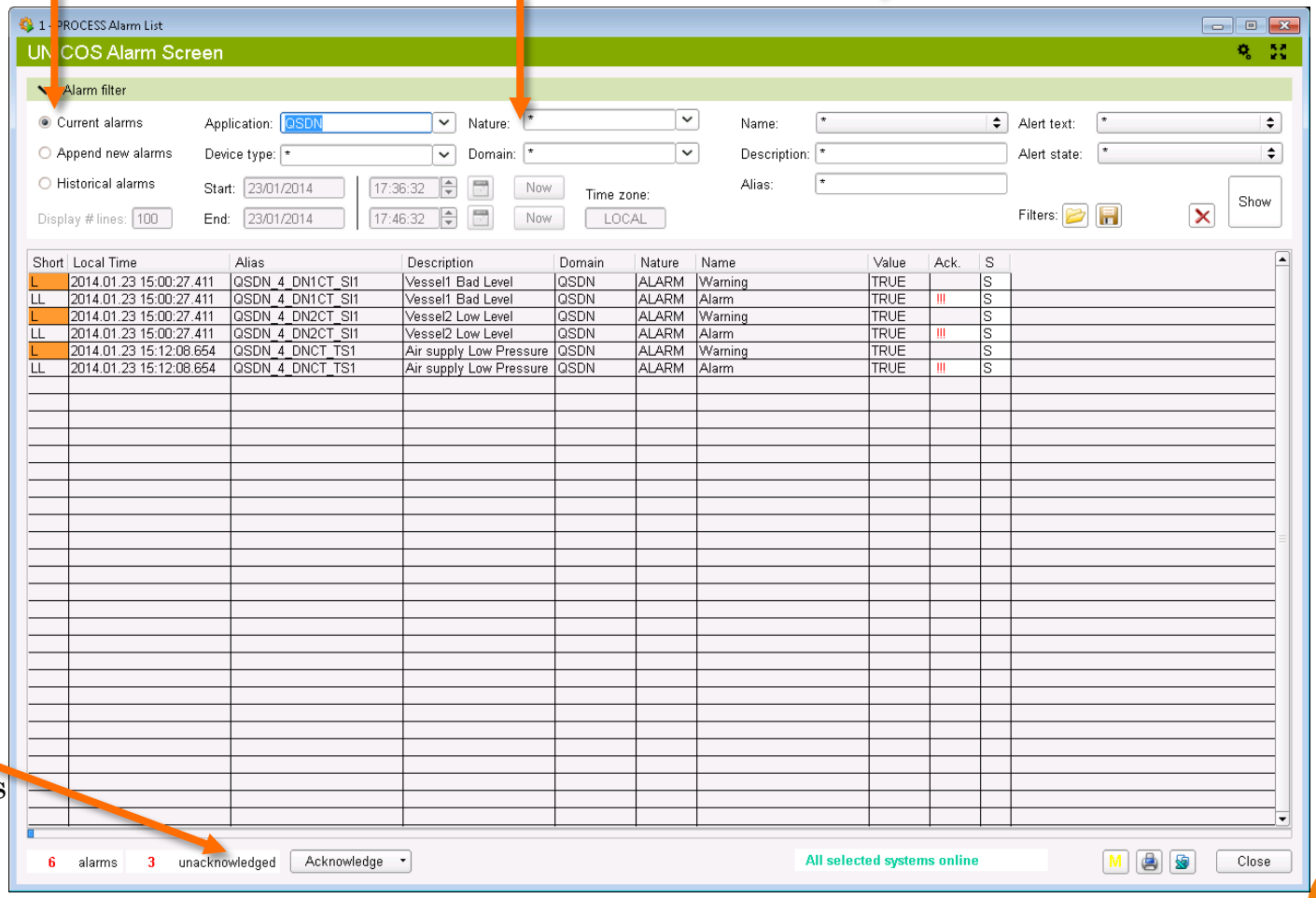


3.- DIAGNOSTIC: ALERT SCREEN: ALARMS



Mode of operation

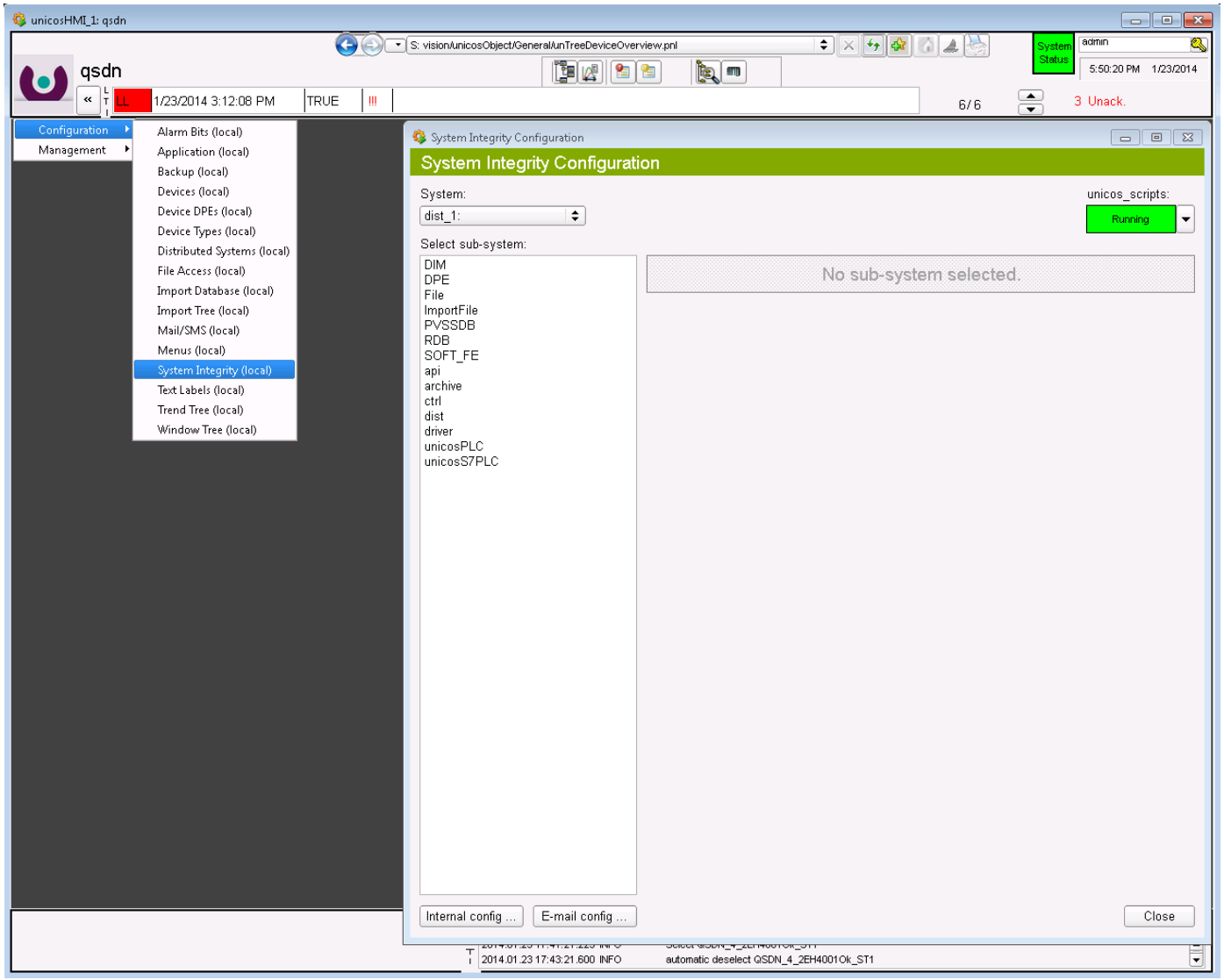
Filters: object type, alias, etc.



Acknowledge Visible alarms

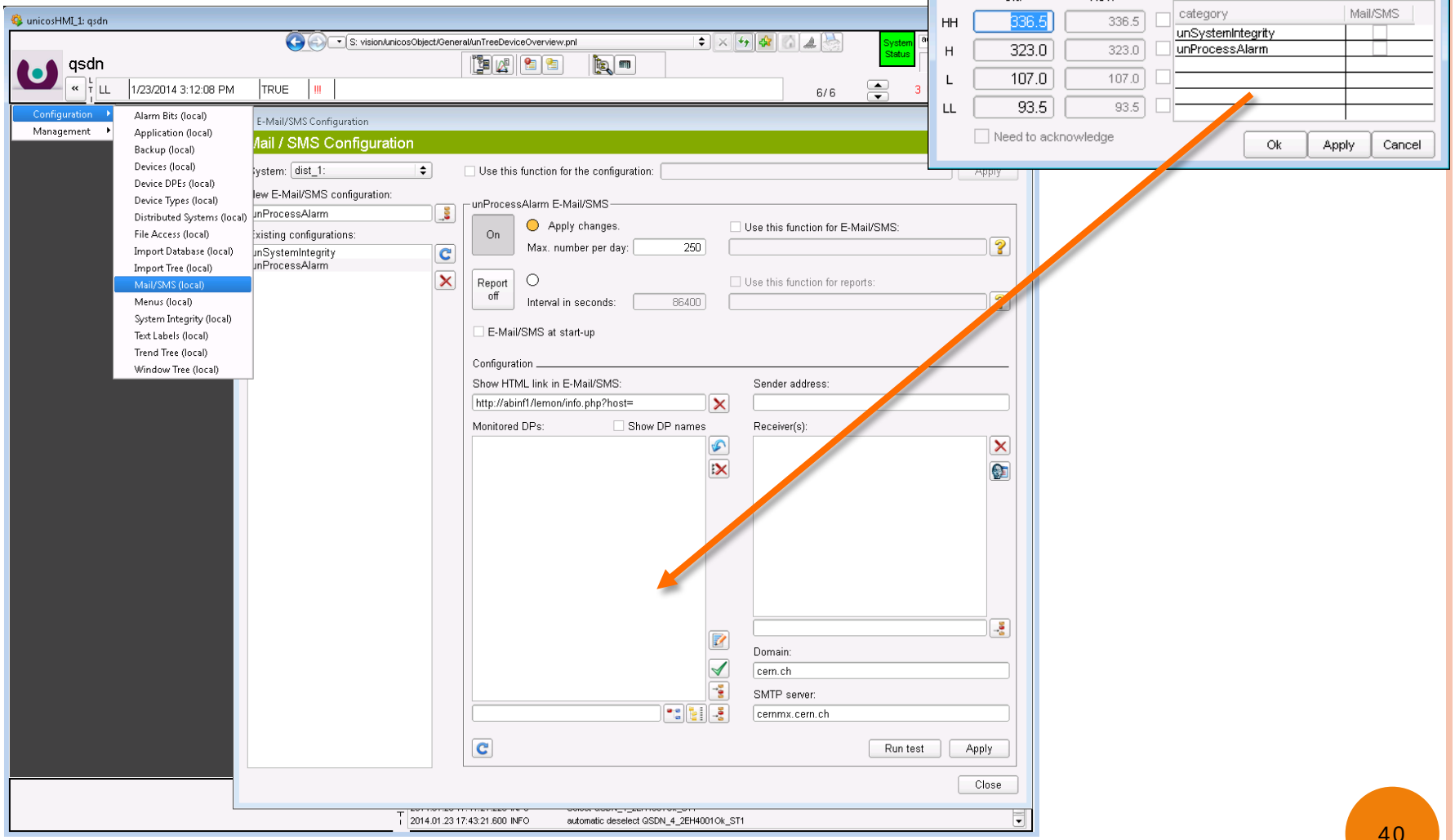
3.- Diagnostic: System Integrity Configuration

- Different components could be configured to be checked by the System Integrety: PLC, Archives, drivers, …



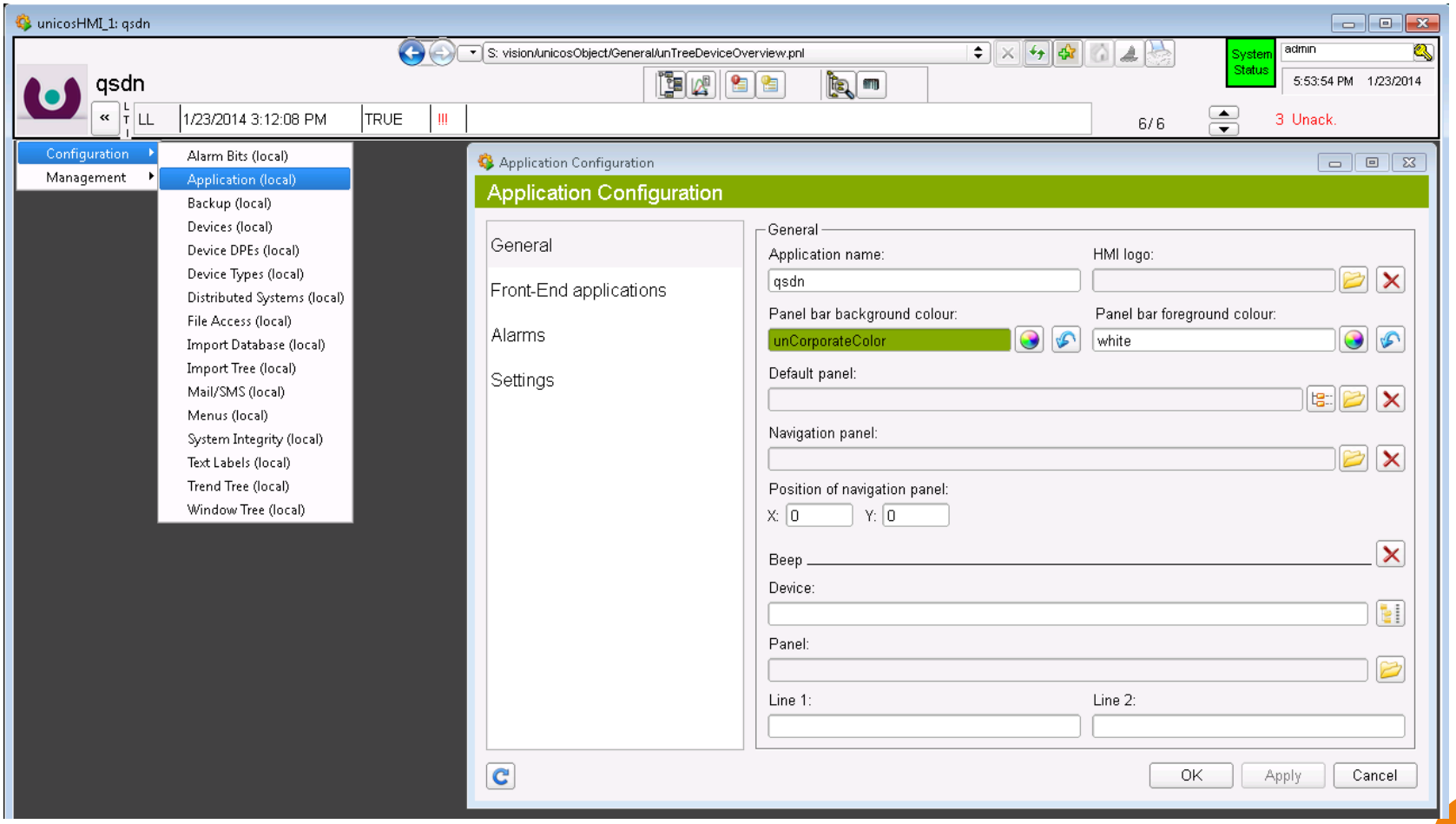
3.- Diagnostic: System Integrity notifications (email-sms)

- Notifications are configured via email (sms) through two different categories:
- System Integrity (admin users)
- Process Alarms (expert users)



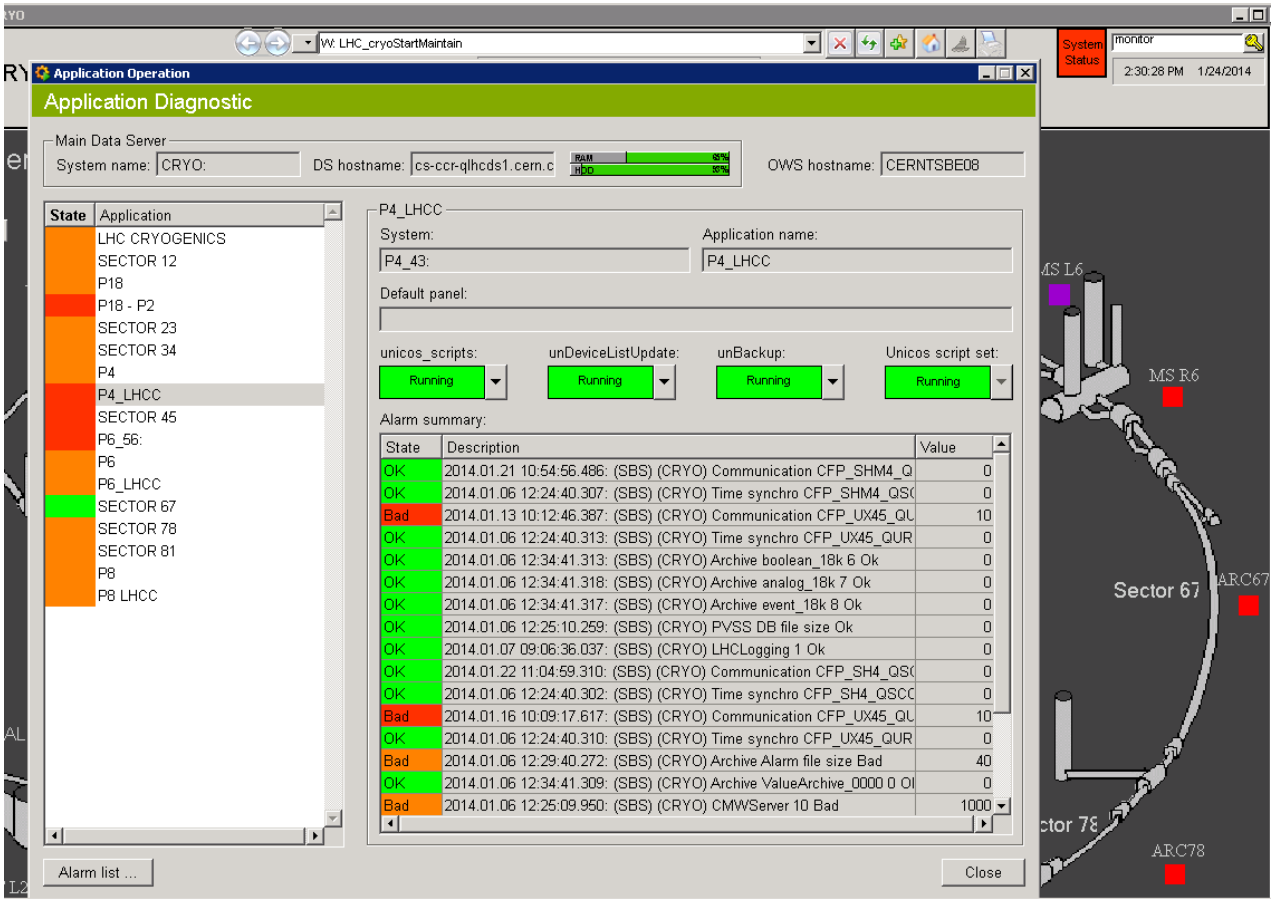
3.- Diagnostic: System Status Configuration (ADMIN rights)

- The animation of the system status square depends on the items that have been selected in the user application. Those items must be configured in the system integrity to become selectable for the configuration
- The BEEP must be configured with a unicos ALARM in this panel.



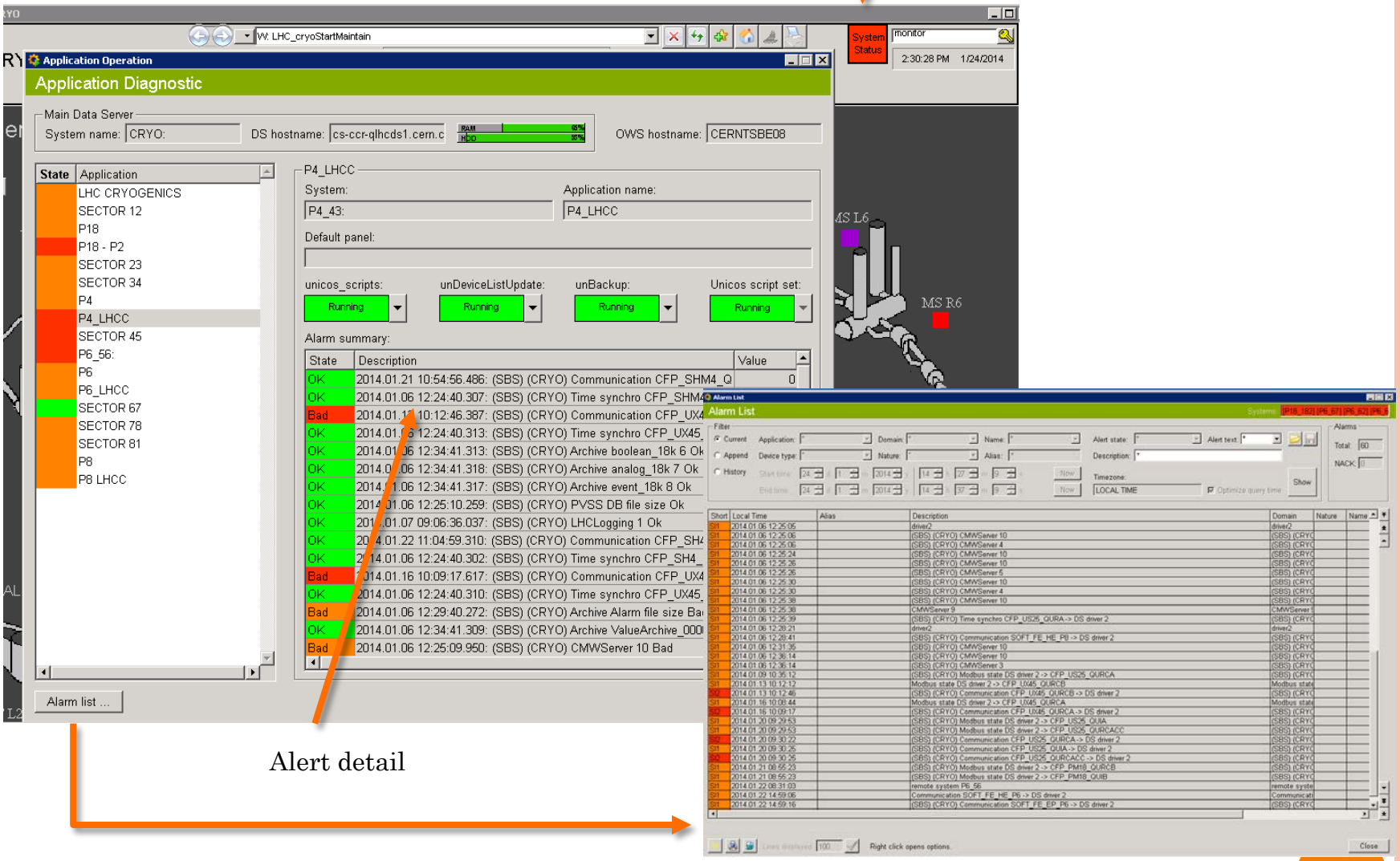
3.- Diagnostic: System Status

- The animation of the system status square depends on the items that have been selected in the user application. Those items must be configured in the system integrity to become selectable for the configuration
- There are two colors in the animation of the system status: red (critical) and orange (warning). …).



3.- Diagnostic: System Status vs System Integrity

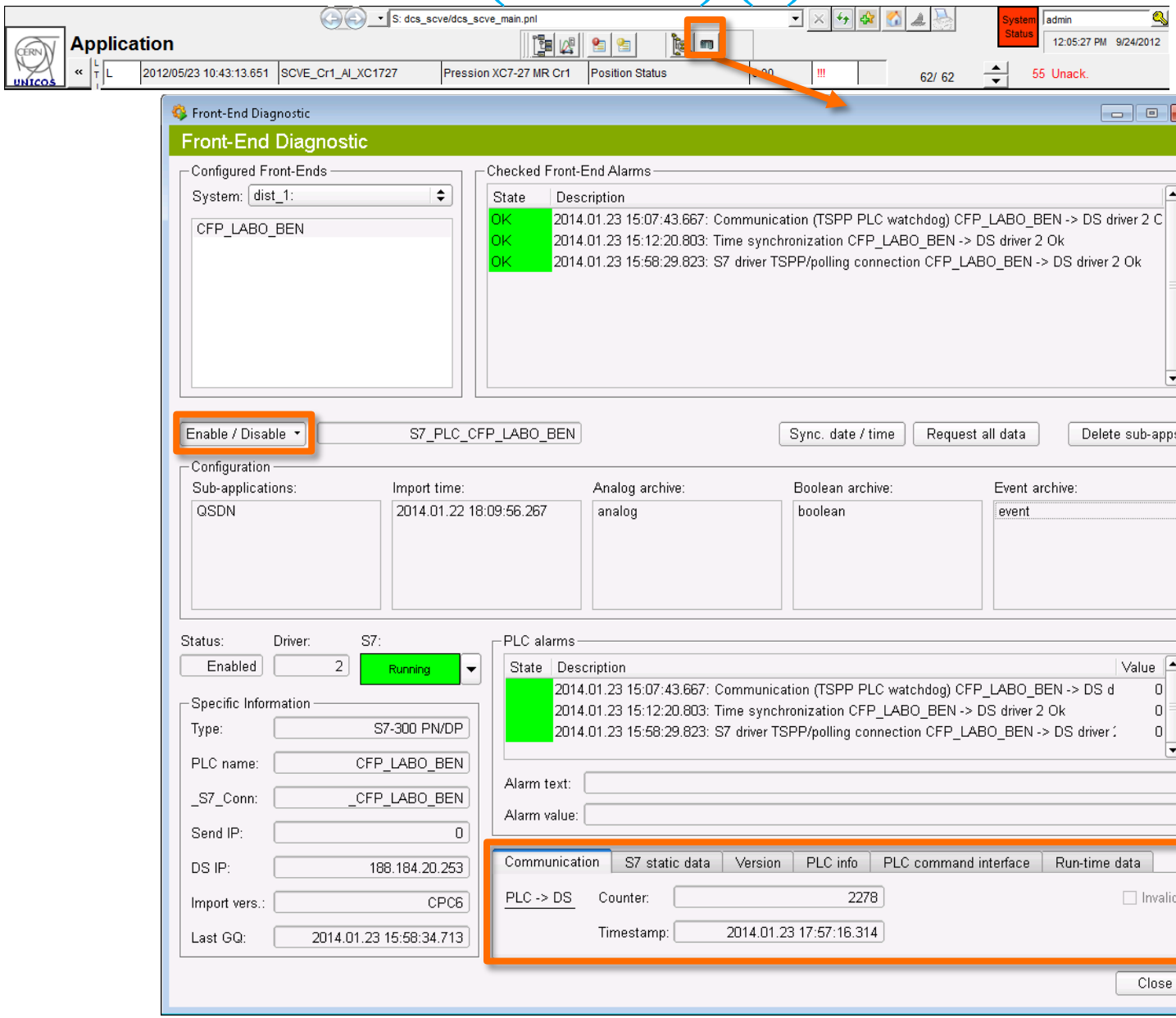
System Alert summary



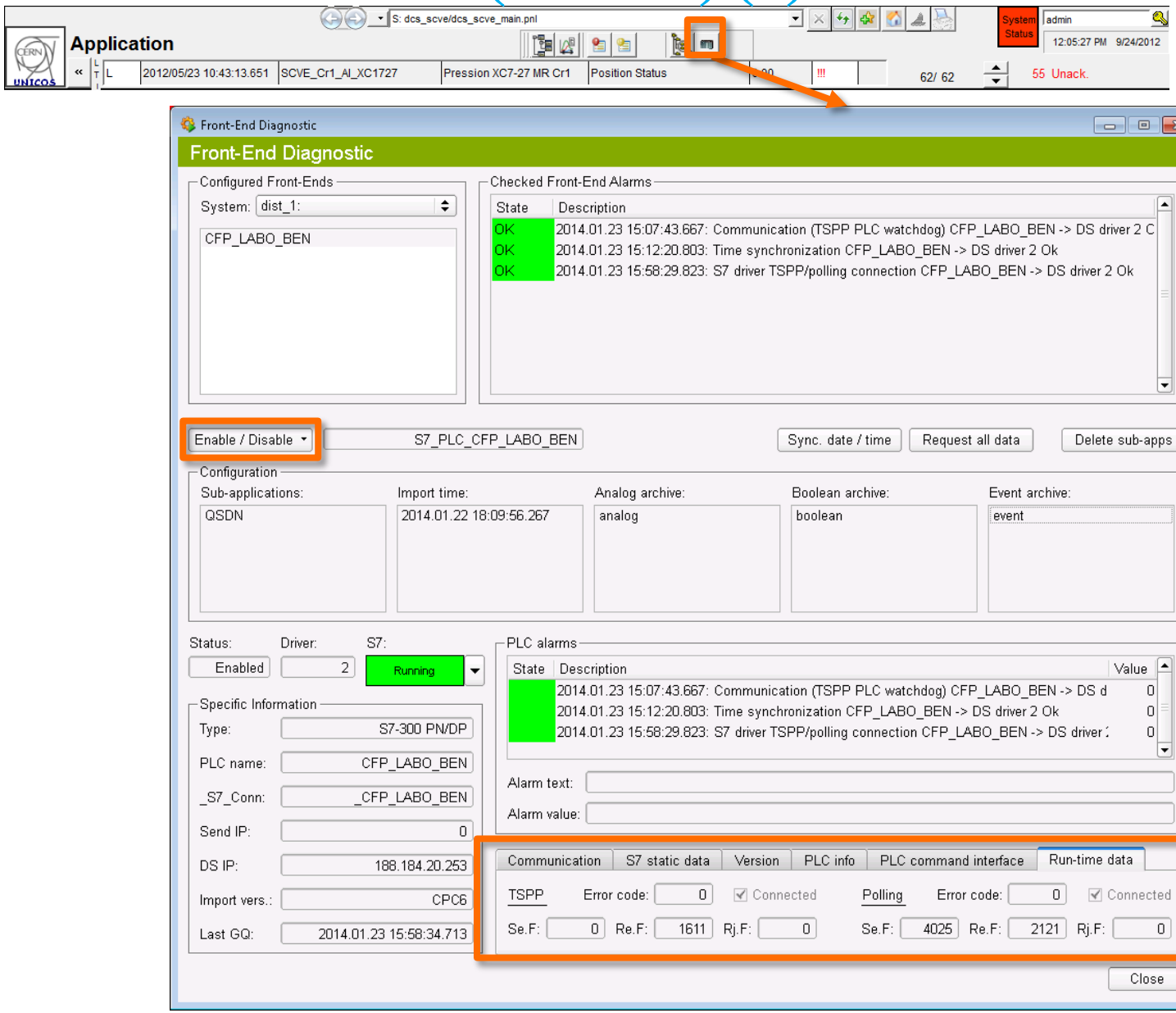
Alert detail

System Integrity
Alert History

3.- Diagnostic: Front-End diagnostics (PLC S7) (1)

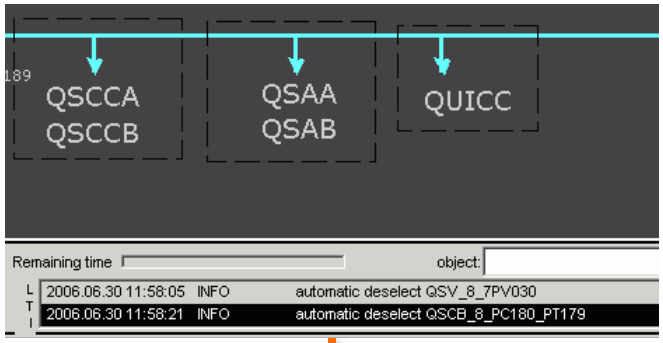


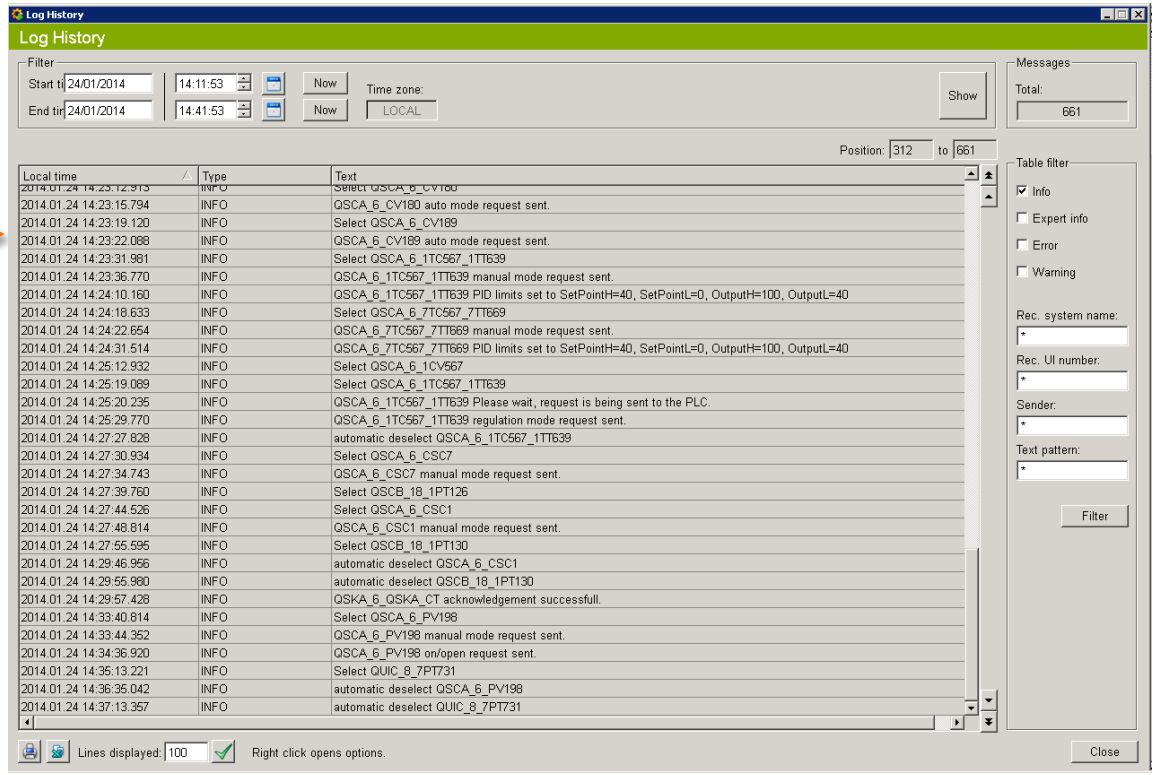
3.- Diagnostic: Front-End diagnostics (PLC S7) (2)



3. HANDS-ON: RE-IMPORT DEVICES

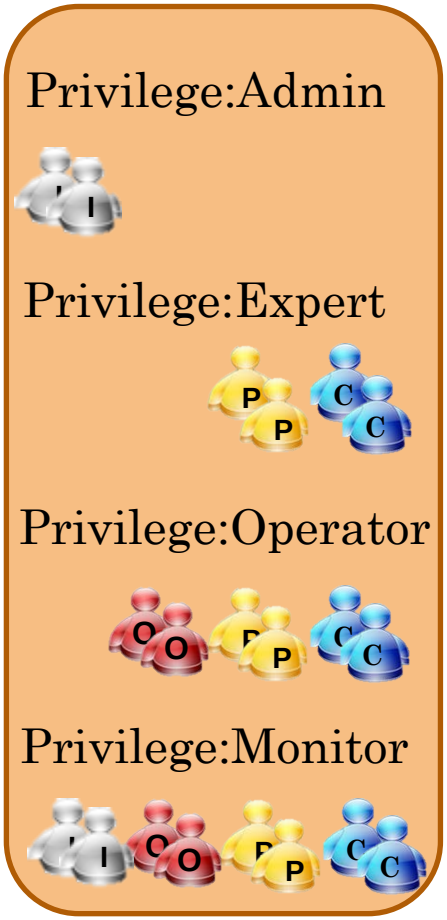
3.- Diagnostic: Other diagnostics (Log history)





3.- Diagnostic: Access Control

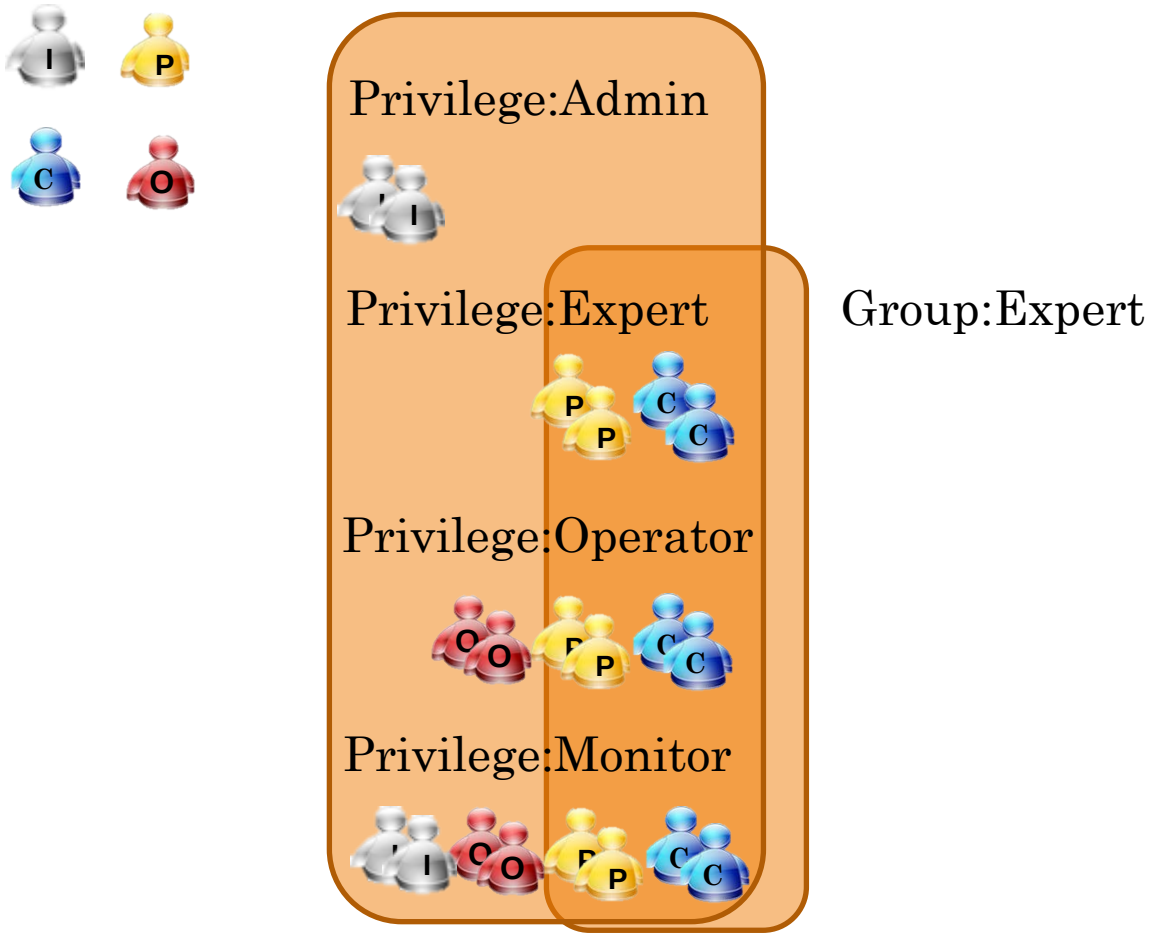
- AC principle:



https://edms.cern.ch/file/1056103/1/advancedCourse-AccessControl.pdf

3.- Diagnostic: Access Control

- AC principle:



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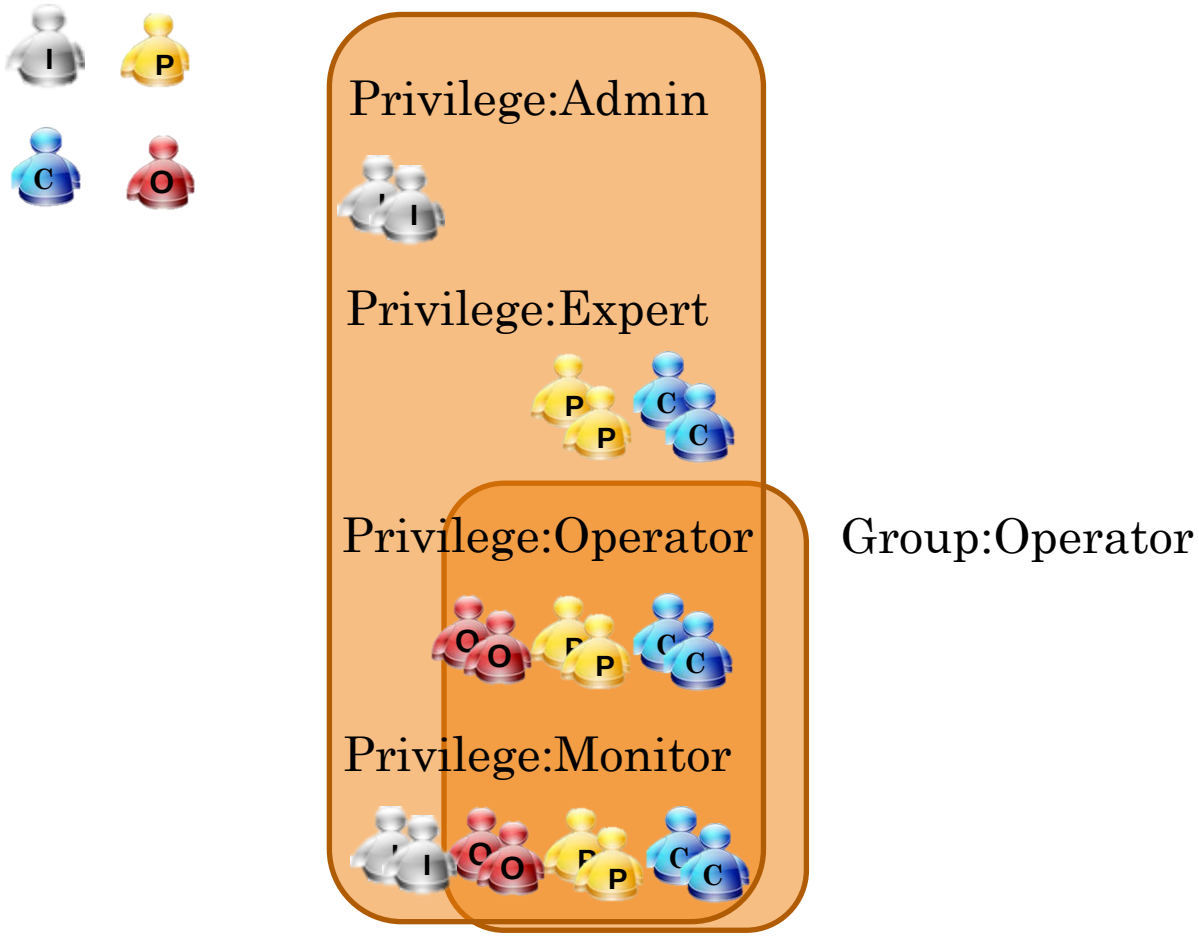
3.- Diagnostic: Access Control

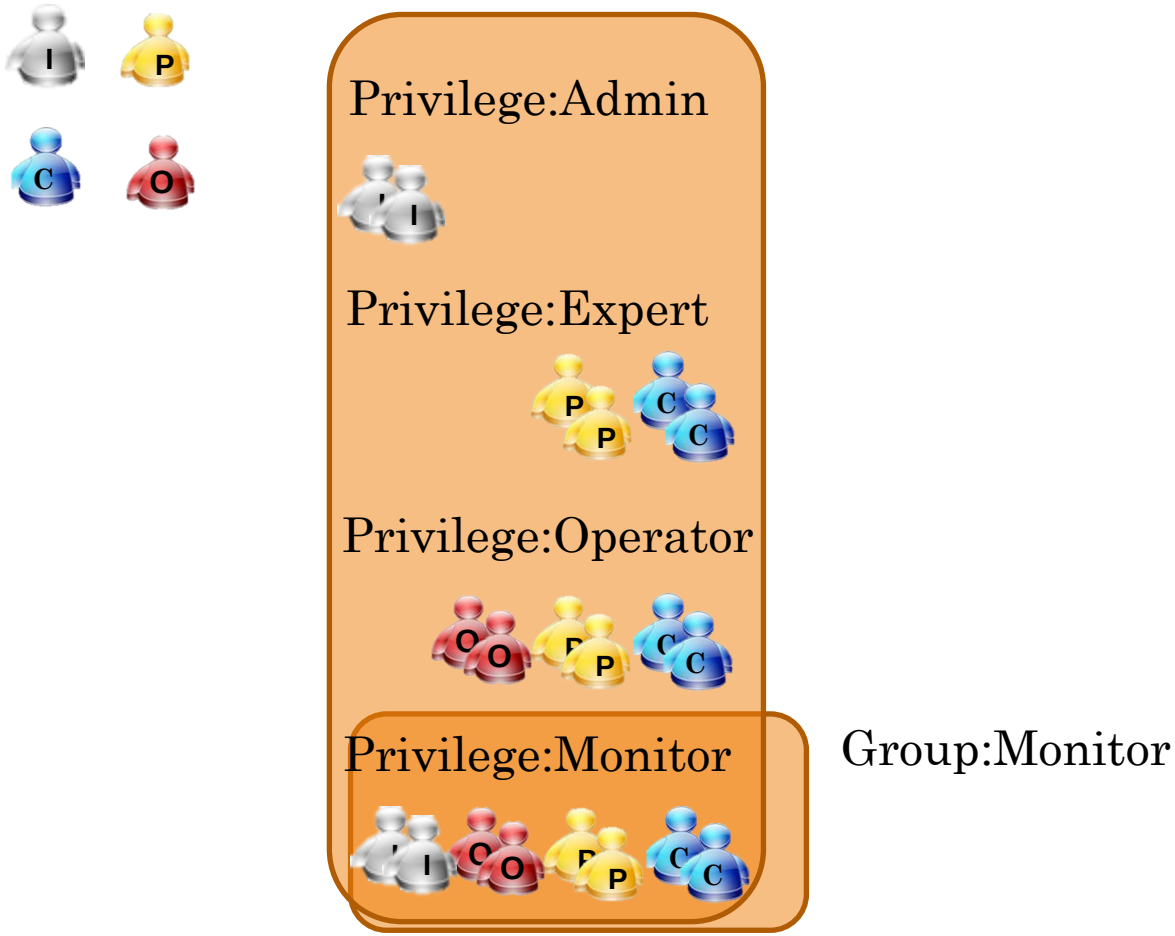
- AC principle:



https://edms.cern.ch/file/1056103/1/advancedCourse-AccessControl.pdf

3.- Diagnostic: Access Control

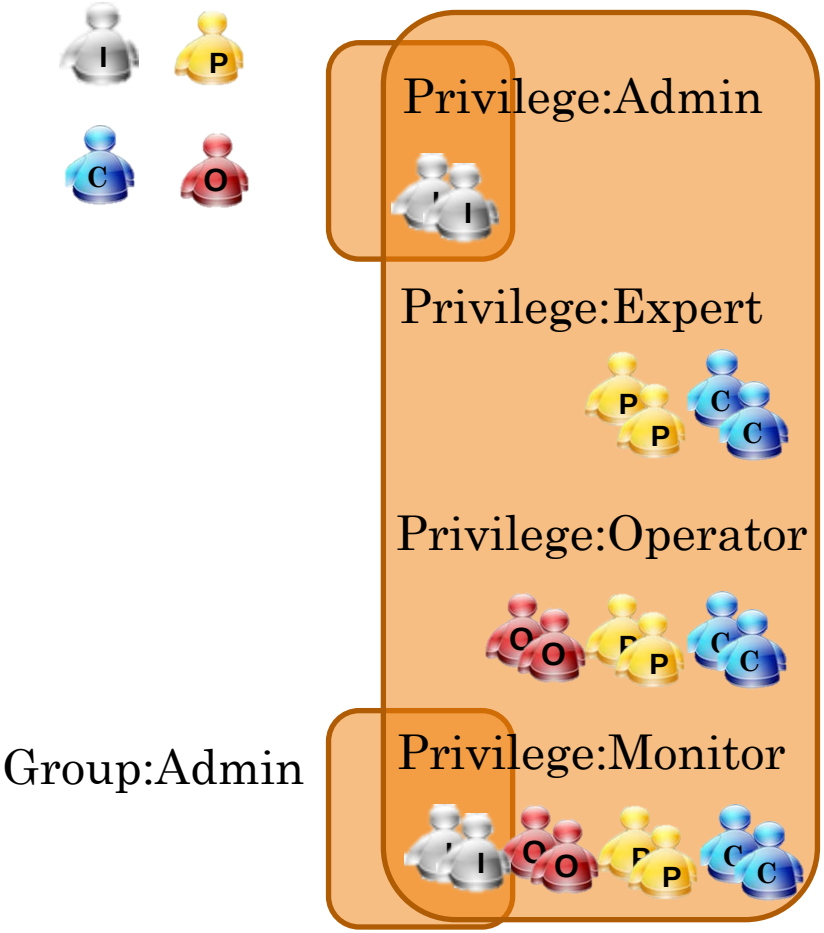
- AC principle:



https://edms.cern.ch/file/1056103/1/advancedCourse-AccessControl.pdf

3.- Diagnostic: Access Control

- AC principle:



https://edms.cern.ch/file/1056103/1/advancedCourse-AccessControl.pdf

3.- Diagnostic: Access Control

- AC principle:

Domain:Vessel1

Privilege:Admin

Privilege:Expert

Privilege:Operator

Privilege:Monitor

Domain:Vessel2

Privilege:Admin

Privilege:Expert

Privilege:Operator

Privilege:Monitor

https://edms.cern.ch/file/1056103/1/advancedCourse-AccessControl.pdf

3.- Diagnostic: Access Control

- Default UNICOS AC roles:

Group	Can act on the domains	With the privileges
admin	UNICOS	admin, expert, operator, monitor
expert	UNICOS	expert, operator, monitor
operator	UNICOS	operator, monitor
monitor	UNICOS	monitor

- Default UNICOS AC users:

User	Group
admin	admin
expert	expert
operator	operator
monitor	monitor

AC: protection from non-malicious, erroneous actions

3.- Hands-on: Access Control

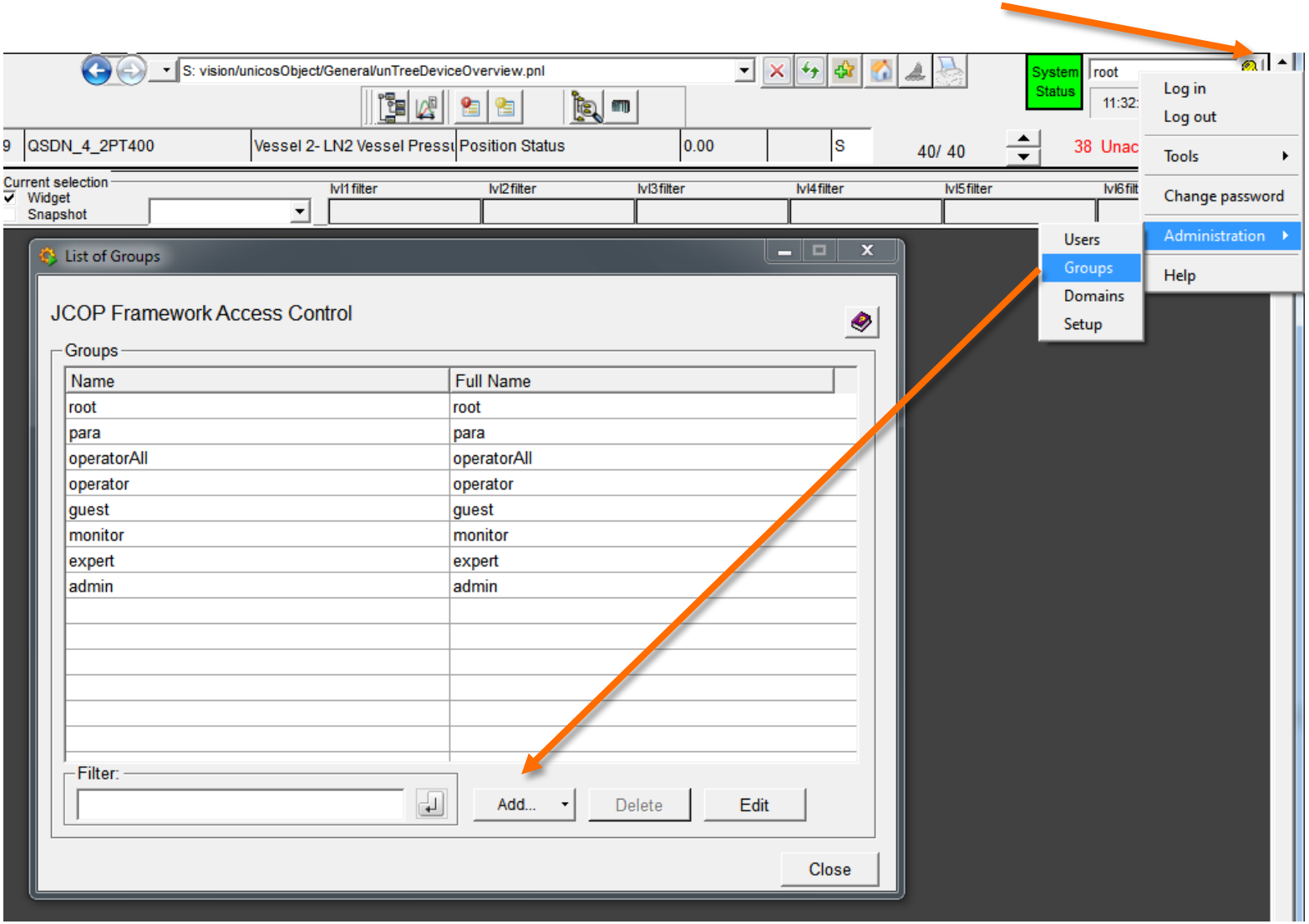
- Let's create new AC rules!
- We begin with new groups:

Group	Can act on the domains	With the privileges
cryoExpert	UNICOS	expert, operator, monitor
cryoOperator	UNICOS	operator, monitor
sysAdmin	UNICOS	admin, monitor

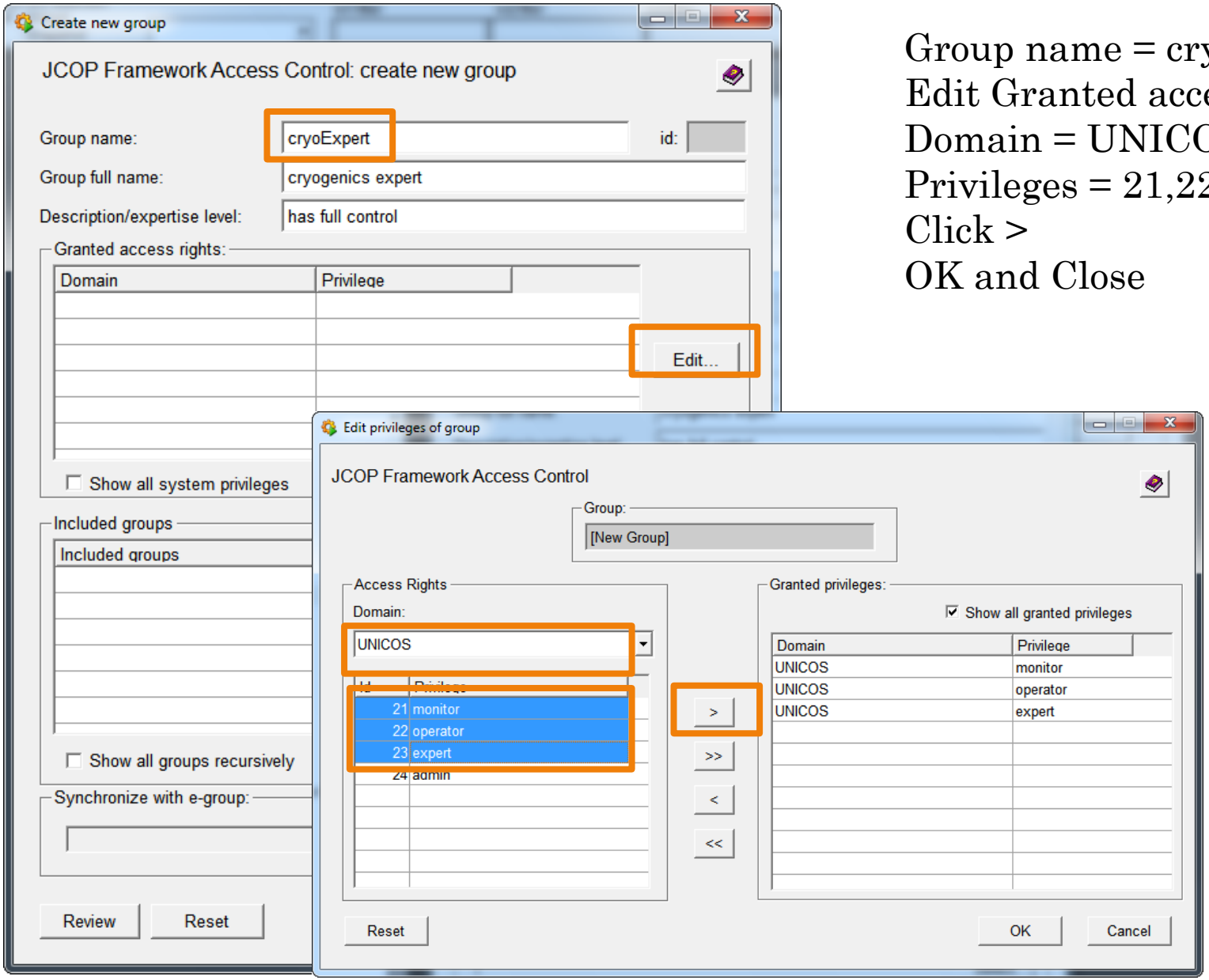
- How we set up AC in production: UNICOS_Access_Control_Domains.docx
- We recommend you to use e-groups!

3.- HANDS-ON: ACCESS CONTROL

Example: group cryoExpert
Log-in as root, right-click on the key/Administration/Groups



3.- HANDS-ON: ACCESS CONTROL



Group name = cryoExpert
Edit Granted access rights
Domain = UNICOS
Privileges = 21,22,23
Click >
OK and Close

3.- Hands-on: Access Control

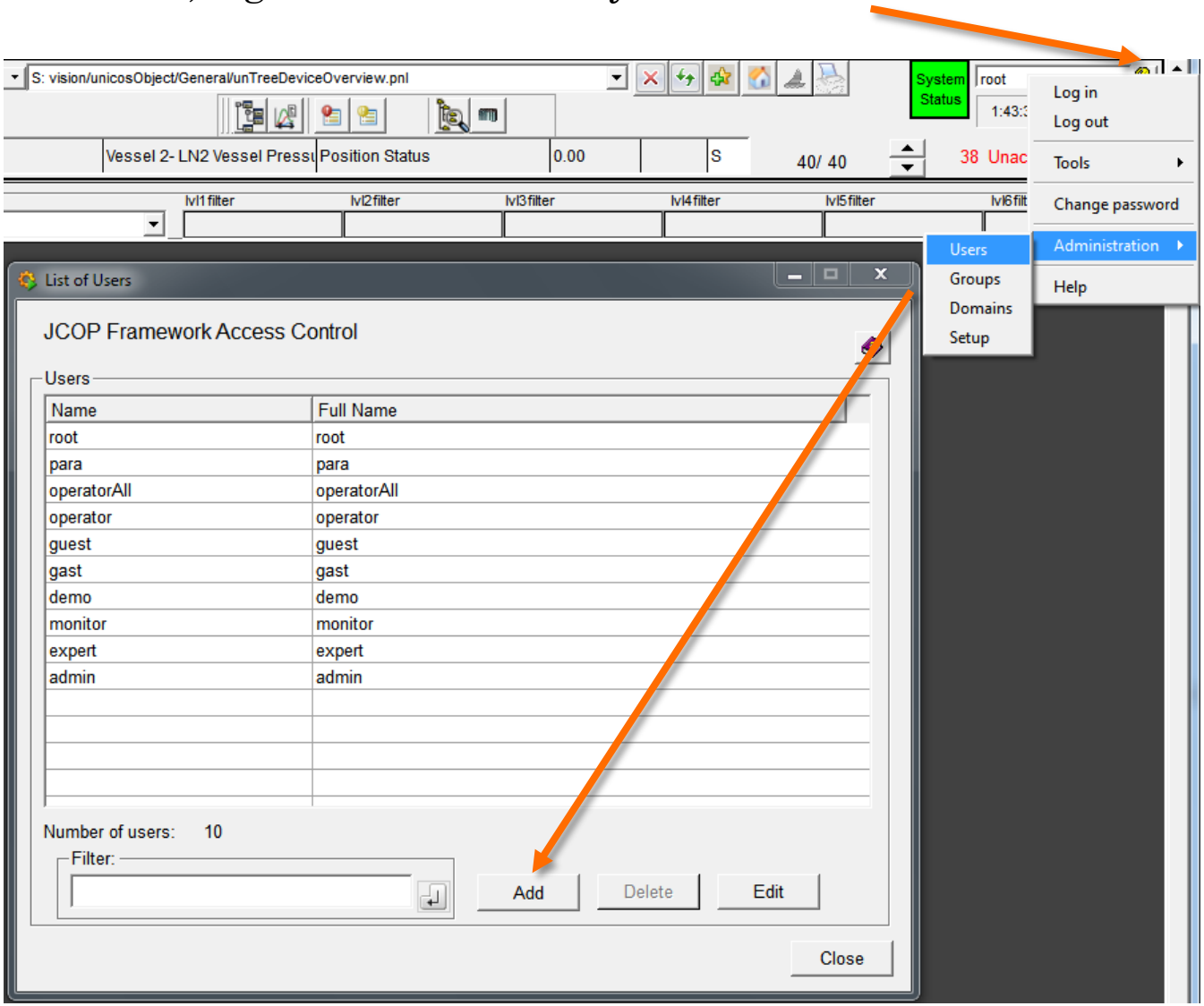
- Let's add new users:

User	Task	Group
fritz	He is the process engineer	cryoExpert
jean	He is the shifter	cryoOperator
maria	She manages the SCADA mainenance	sysAdmin

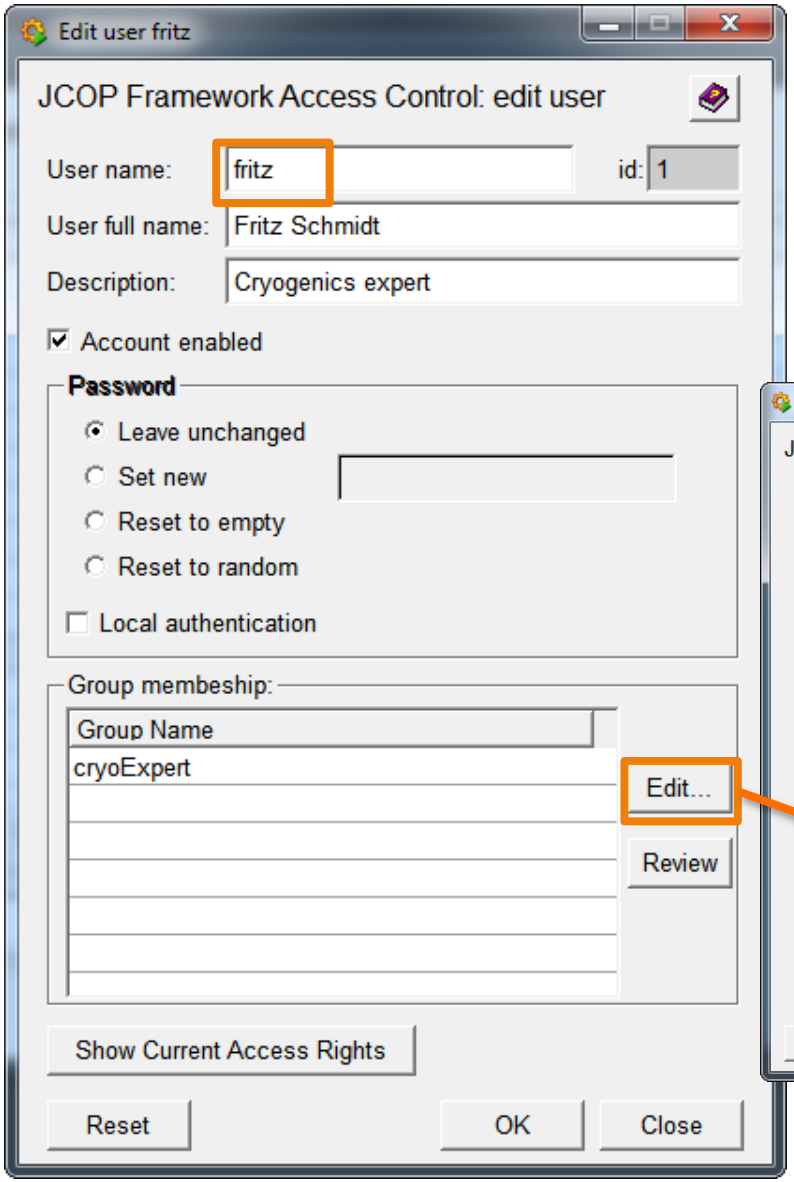
3.- HANDS-ON: ACCESS CONTROL

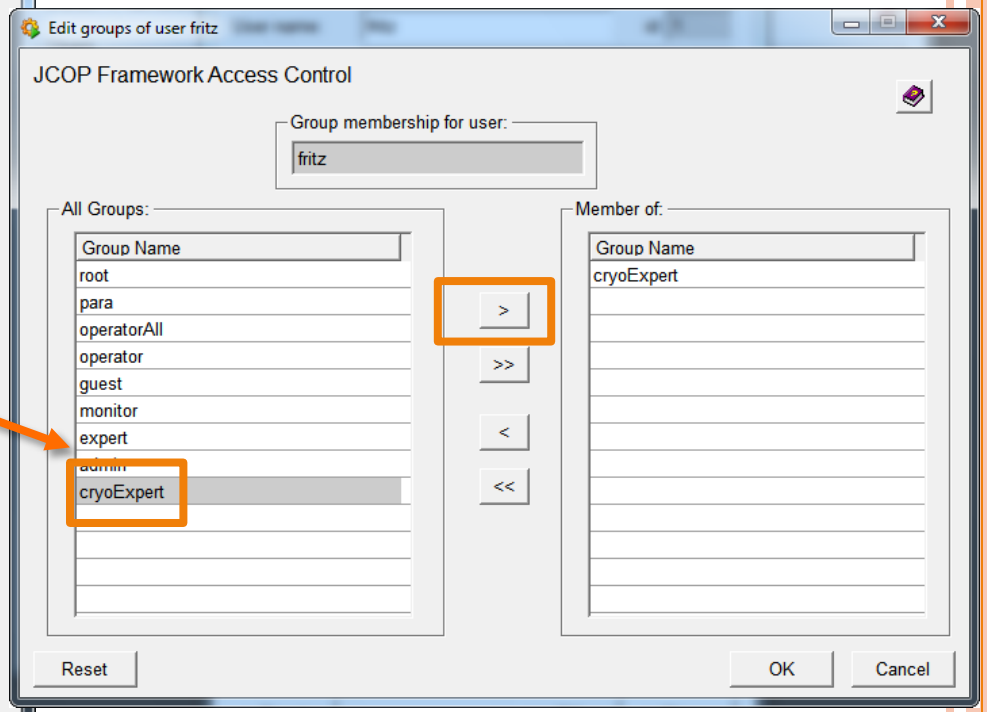
Example: adding fritz

Log-in as root, right-click on the key/Administration/Users



3.- HANDS-ON: ACCESS CONTROL





User name = fritz
Edit Group membership, add cryoExpert
Ok, Close

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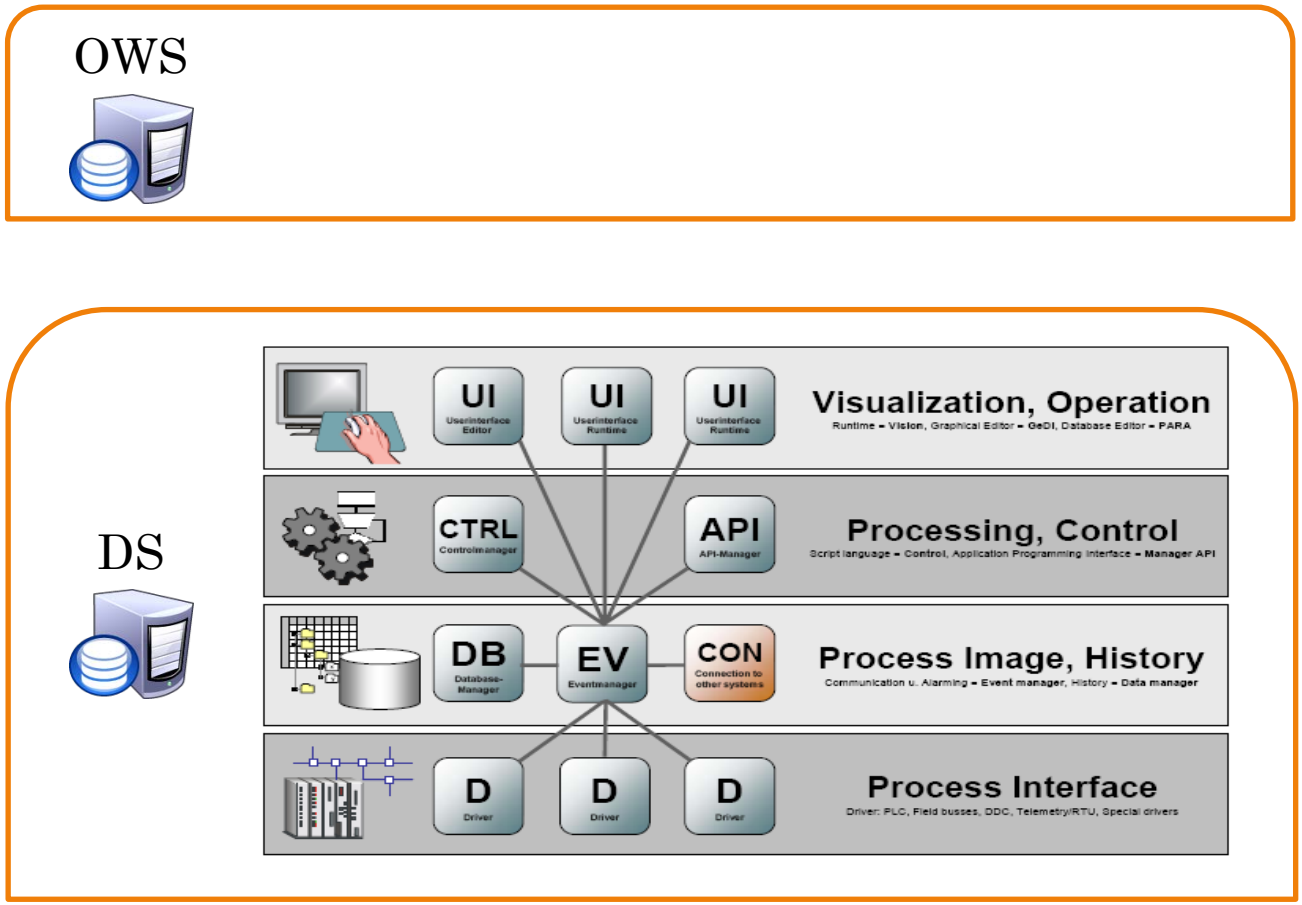
4. OWS

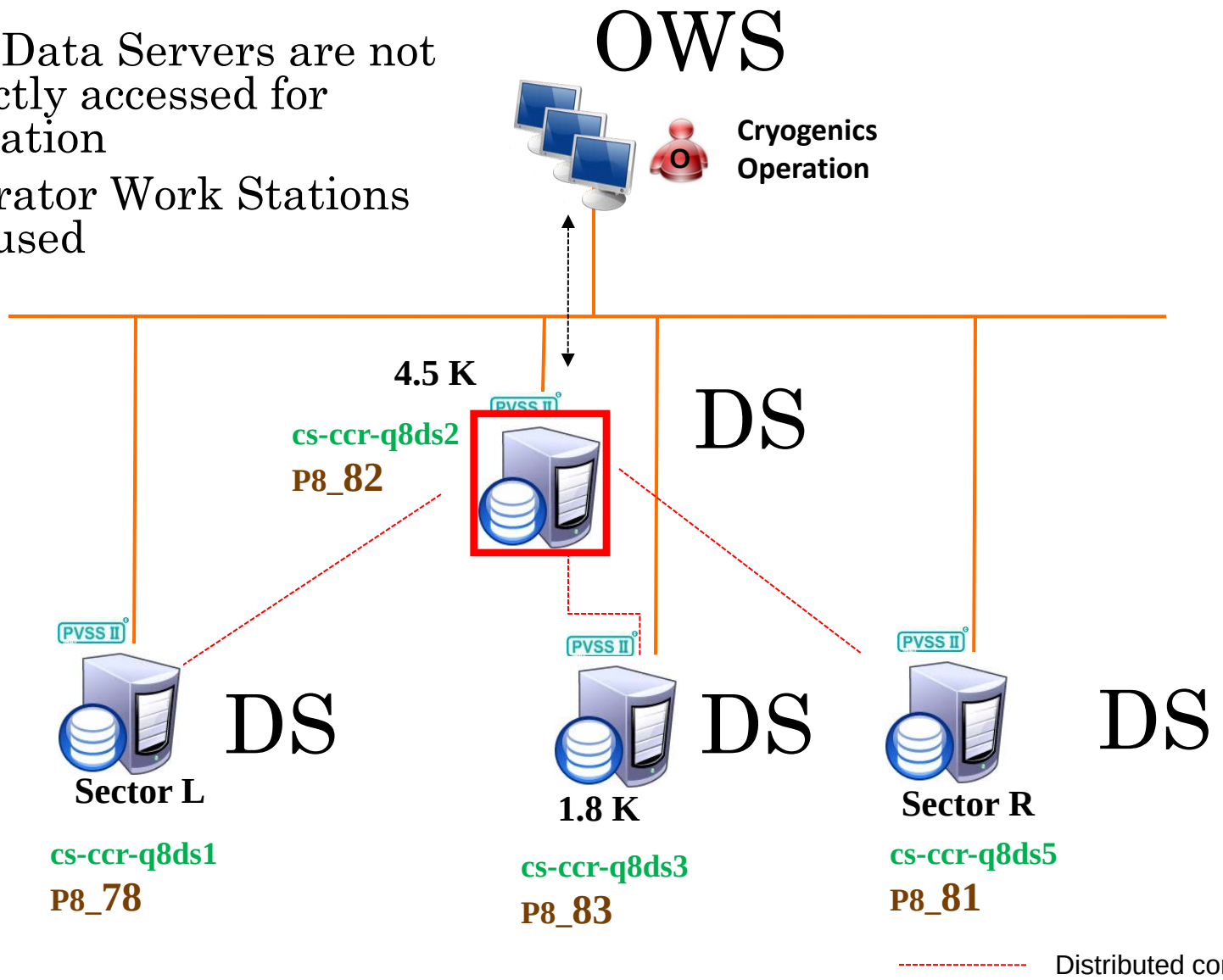
4. OWS: Remote UI = OWS

- OWS = Operator Work Station
  - package with a Remote UI WinCC OA project
- UI connection to the DS



4. OWS: REMOTE UI: WHY?

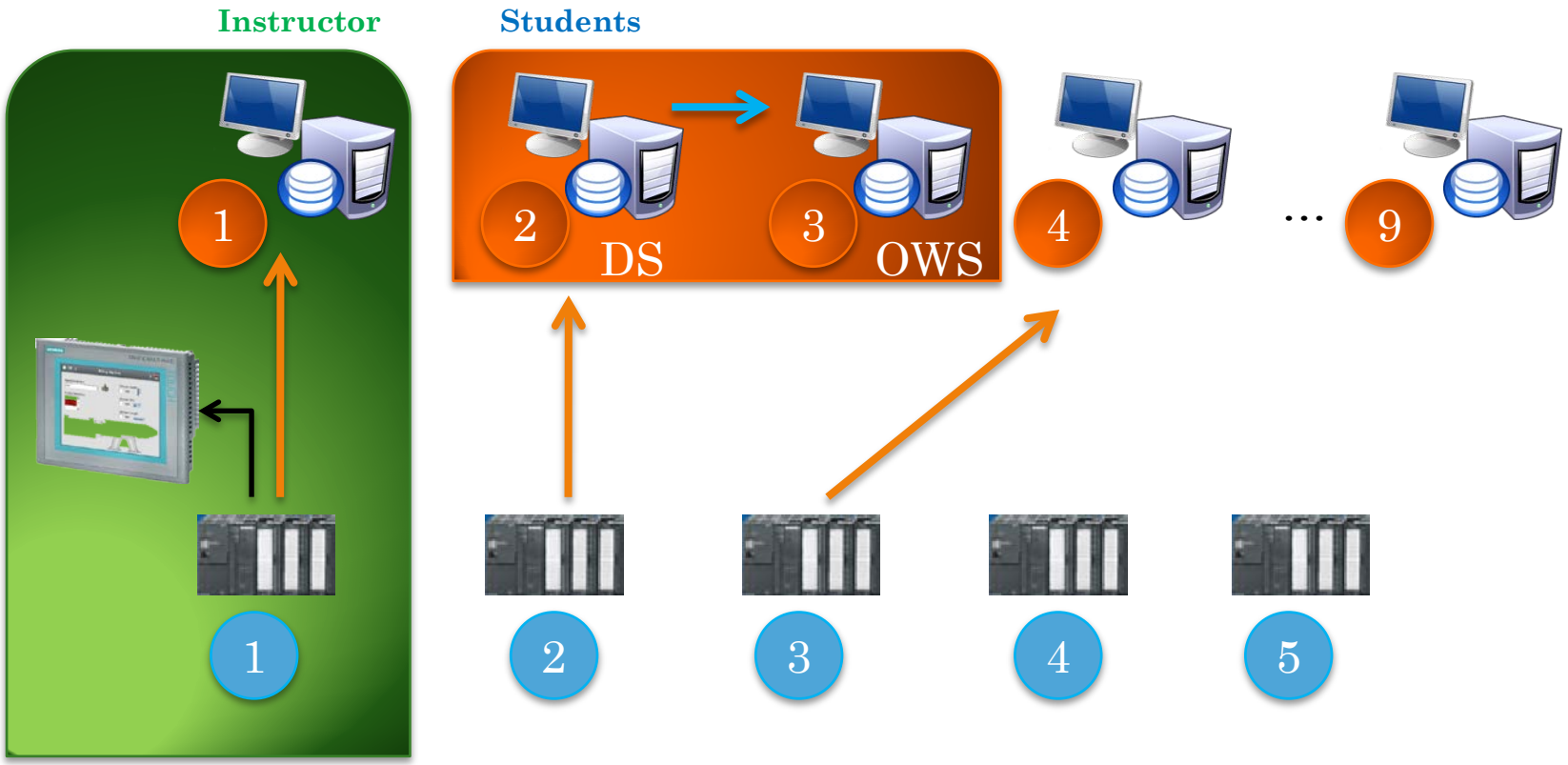
- The Data Servers are not directly accessed for operation
- Operator Work Stations are used



4. Hands-on: OWS Setup

We are now going to do this setup:

1 PLC → 1 DS → 1 OWS



4. Hands-on: OWS Setup

- Make your project accessible
  - With windows Explorer, go to your project directory
  - Setup the Share option, name the folder alias as PVSS_projects.
  - E.g. if you have PVSS_projects/QSDN/QSDN, share PVSS_projects, set it visible with the name PVSS_projects.

4. Hands-on: OWS Setup

- Get OWS
  - Install from CMF if possible!

  Or
  - download the OWS:

  http://j2eeps.cern.ch/wikis/display/EN/UNICOS+OWS
  - Unzip it to C:\temp
  - Run Install-unicos-wccoa-OWS.bat as admin
  - Open WinCC OA Project Administrator
  - Register the project [Ctrl+R] :
    - C:\dev_disk\PVSS_projects\OWS_3.11
- With Windows Explorer, go to

  C:\dev_disk\PVSS_projects\OWS_3.11\examples\unicosOWS-HMI
- Make a copy of unicosHMI.bat,
- Rename the copy to qsdnHMI.bat

4. Hands-on: OWS Setup

- Edit qsdnHMI.bat

```
::starting PVSS00ui with 1 screen

@echo OFF

set PVSS_PATH=C:\Siemens\Automation\WinCC_OA\3.11\bin

set DS_HOSTNAME=yourPcName

set DS_PROJECTPATH=PVSS_projects\QSDN\QSDN

start /B %PVSS_PATH%/WCCOAui -p
vision/graphicalFrame/unicosHMI.pnl -proj OWS_3.11 -
iconBar -menuBar -style windows +config
\\%DS_HOSTNAME%\%DS_PROJECTPATH%\config\config_ows
```

4. Hands-on: OWS Setup

- Run qsdnHMI.bat

UNICOS Downloads

- UNICOS CPC

  http://unicos.web.cern.ch/download-unicos

- Support Contact:

  icecontrols.support@cern.ch