

SESAME's Control System Status

Fall 2014 EPICS Collaboration meeting
22/10/2014

Presented by:

Ibrahim Saleh

What is SESAME?

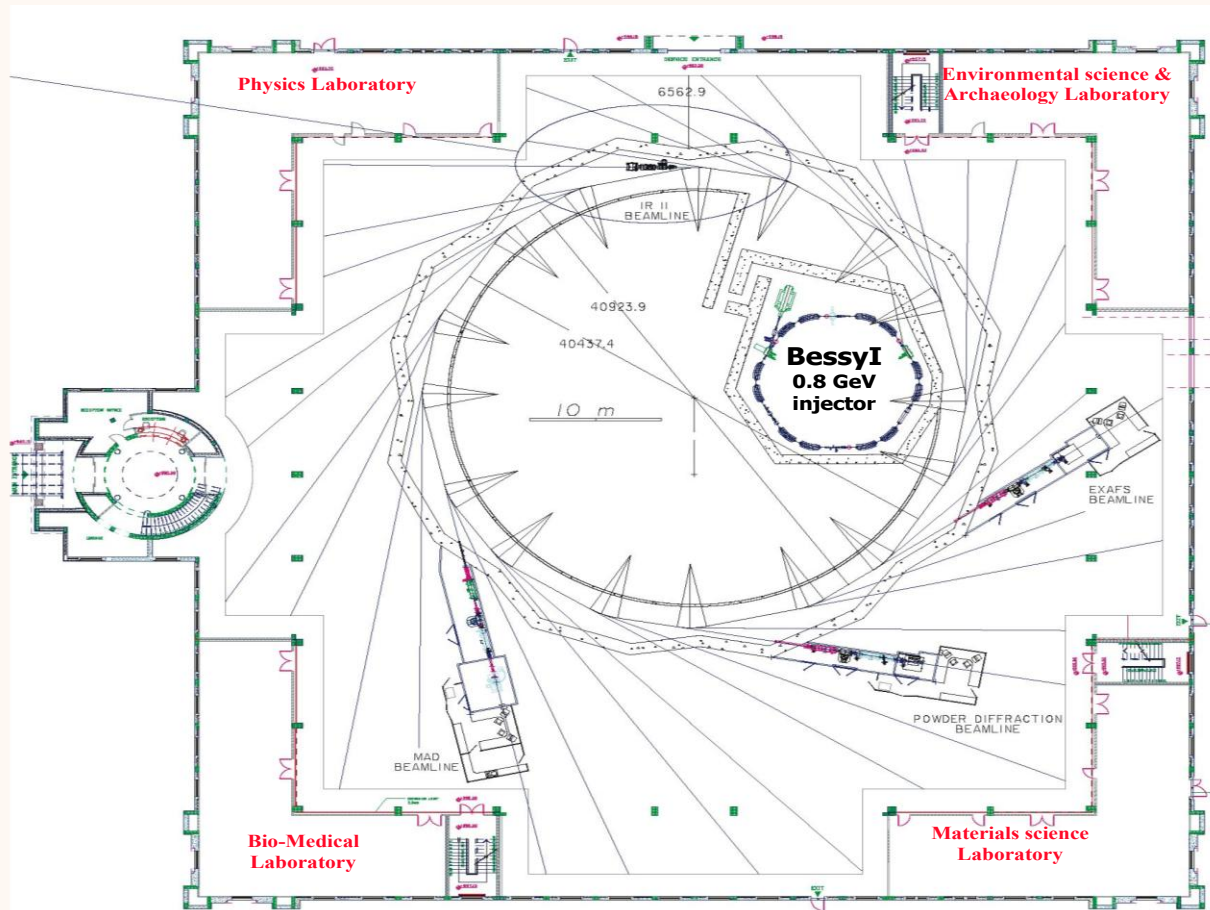
- SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East)
- First international 3rd generation Synchrotron Light Source in the Middle East region
- Under construction near Amman (Jordan)
- Expected to become operational in 2016



SESAME-Members:

Bahrain, Cyprus, Egypt, Israel, Iran,
Jordan, Pakistan, Palestine, Turkey





Energy; **2.5 GeV**

Circumference; **133m**

Emittance; **26 nm-rad**

12 Insertion Devices

13 Bend Magnet beam lines

Maximum beam line length;
37m

12 straight sections are
available for IDs with lengths
up to 3.9 m

Space for future full energy
injector in the main ring
tunnel

- **SESAME's injector (Microtron and Booster Ring) have been commissioned**
- **Commissioning of the storage ring is expected in 2016**

Control Group



Ibrahim Saleh



Abdallah Ismail



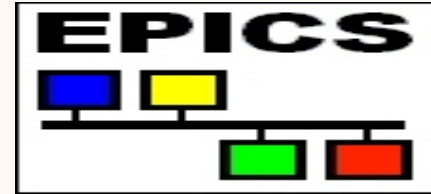
Yazan Dabain

Outline:

- Overview
- Infrastructure
- Booster Control System
- IOCs Development
- Clients Development
- Archive System
- Alarm Handler
- Future Work

Overview

- Control System Implementation uses (EPICS) base 3.14.12
- Clients are implemented using a custom build of Control System Studio (CSS) based on V.3.16
- Servers are implemented as EPICS Input/Output Controllers (IOCs)
 - Soft IOCs (Linux Machines)
 - Hard IOCs (Libera, VME)



Overview

- Siemens S7 PLCs are used for the machine interlocks
- Allen Bradley PLC is used for the Personal Safety System (PSS).
- Git version Control System is used to track development & documentation
- Development and administration platforms use Scientific Linux 6.4



Infrastructure

- **Twelve virtual servers** reserved to run the following:
IOCs, Archiver, Alarm Handler, GIT Repository,
Elog server, Bugzilla, Wiki server and File transfer servers
- All workstations and servers have been migrated to **Scientific Linux 6.4**
- All clients, servers, and controllers are connected to an isolated **machine network**.
- A version control system is used to track development using **GIT**. Separate repositories exist for: IOCs, clients, documentation, required software packages and CSS

Infrastructure

- Issues tracking (including bugs and tasks) is done using **Bugzilla**.
Any group may submit a bug/task for any other group
- **ELOG** is used by operators to write information during the commissioning, which makes it easy for other people to access this information through a Web interface, browse entries, search, download files, and optionally add, update, delete or comment on entries
- **MediaWiki** server has been recently installed. Documents will be transferred to this wiki to enable easy access

Booster Control System



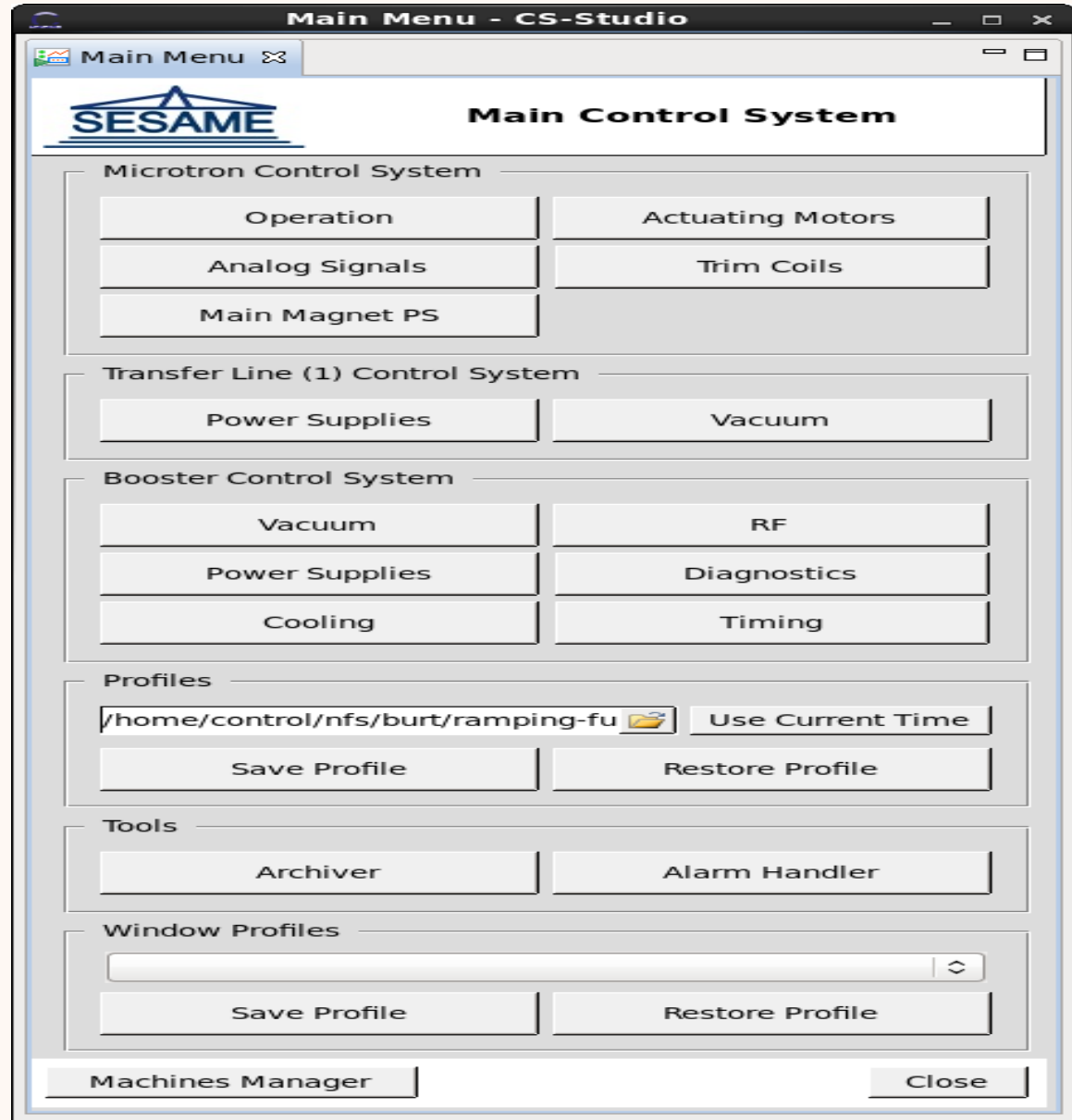
General Architecture



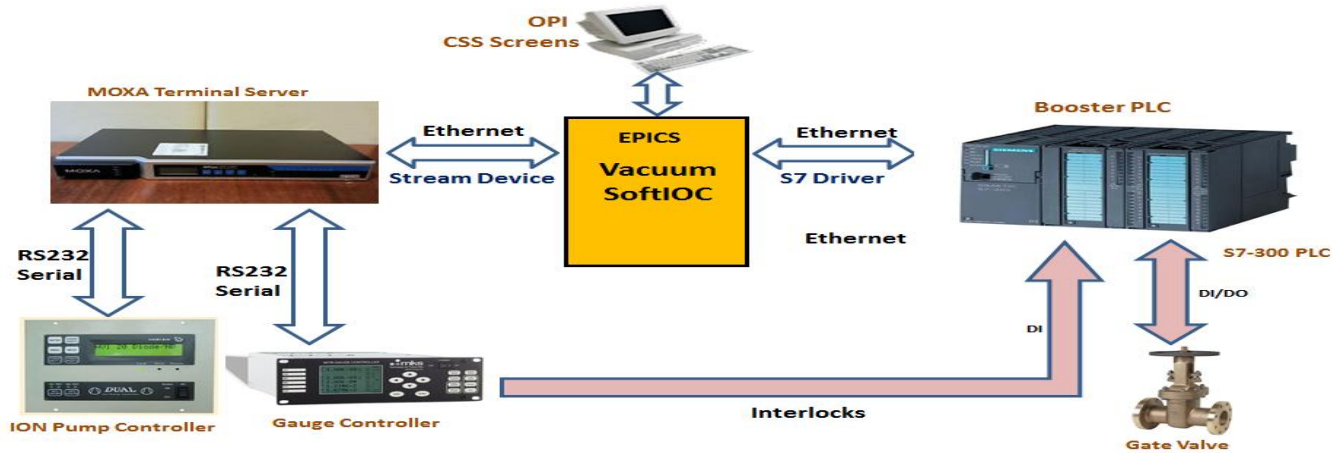
Booster Ring

Booster Control System

- Vacuum
- Power Supplies
- RF
- Diagnostics
- Cooling
- Timing
- PSS



Booster Control System - Vacuum



Vacuum Control Architecture

Overview - Vacuum System - CS-Studio

Booster Control System Vacuum System

	IMG Pressure	PI Pressure	Ion Pump Pressure	Ion Pump Current	Valve State Open Closed	Valve Interlock Source	Valve Fault
Cell 01	1.6E-8 mbar	2.4E-3 mbar	1.8E-8 mbar	1.92E-5 mA	<input type="radio"/> <input type="radio"/>	N/A	N/A
Cell 02	1E-8 mbar	2.4E-3 mbar	8.3E-9 mbar	7.51E-6 mA	<input checked="" type="radio"/> <input type="radio"/>	NO INTERLOCK	NO FAULT
Cell 03	1.3E-8 mbar	3.5E-3 mbar	6.1E-8 mbar	6.71E-5 mA	<input checked="" type="radio"/> <input type="radio"/>	NO INTERLOCK	NO FAULT
Cell 04	N/A	N/A	9.9E-9 mbar	1.09E-5 mA	<input type="radio"/> <input type="radio"/>	N/A	N/A
Cell 05	4.1E-8 mbar	1.6E-3 mbar	2.5E-7 mbar	3.19E-4 mA	<input checked="" type="radio"/> <input type="radio"/>	NO INTERLOCK	NO FAULT
Cell 06	N/A	N/A	1.9E-8 mbar 2.8E-8 mbar	2.13E-5 mA 3.12E-5 mA	<input type="radio"/> <input type="radio"/>	N/A	N/A

Voltage		Error State	Status
Ion Pump Controller			
Channel 1	6999.00 V	NO ERRORS FOUND	<input checked="" type="checkbox"/> Off <input checked="" type="checkbox"/> On
Channel 2	6999.00 V	NO ERRORS FOUND	<input checked="" type="checkbox"/> Off <input checked="" type="checkbox"/> On

Ion Pump Cable Interlocks		
<input type="radio"/> Cell 01 - IP 1	<input type="radio"/> Cell 02 - IP 1	<input type="radio"/> Cell 03 - IP 1
<input type="radio"/> Cell 04 - IP 1	<input type="radio"/> Cell 05 - IP 1	<input type="radio"/> Cell 06 - IP 1
<input type="radio"/> Cell 06 - IP 2		

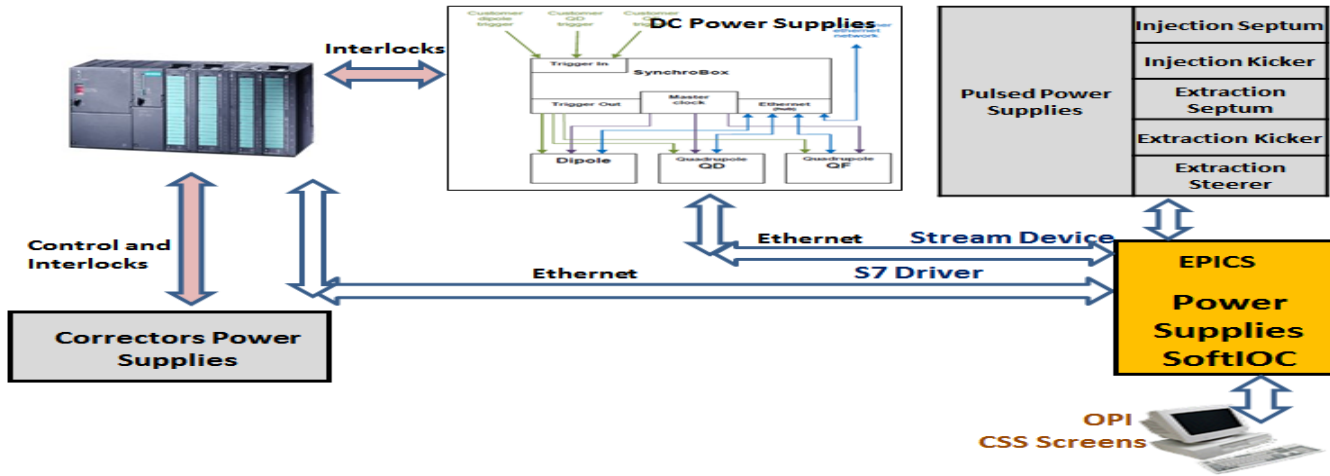
Gauge Controllers Expert Panel | Ion Pumps Expert Panel | Valves Expert Panel | Close

Vacuum Main OPI



Vacuum Rack

Booster Control System – Power Supplies



Power Supplies Control Architecture



DC Power Supplies

The screenshot shows the 'Booster Control System Power Supply - Overview' interface. It features several data tables and control panels:

DC Power Supplies	State	Operation Mode	Instantaneous Current	Instantaneous Current (A)	Trigger Mask	L/R Mode	Interlock
BM	PULSE ON	WAVEFORM	145.45 A	24.50	1073740060	REMOTE	Details...
QF	PULSE ON	WAVEFORM	83.79 A	2.65	1073740056	REMOTE	Details...
QD	PULSE ON	WAVEFORM	77.78 A	2.26	1073740055	REMOTE	Details...
S-Box	IDLE	N/A	N/A	N/A	N/A	N/A	Details...

Booster Correctors	Current	Current (A)	Remote Mode PS	Inv
BOC01-PS-CR1	- 0.00 A	- 0.00	●	●
BOC02-PS-CR1	- 0.01 A	- 0.00	●	●
BOC03-PS-CR1	- 0.14 A	- 0.15	●	●
BOC04-PS-CR1	+ 0.00 A	+ 0.00	●	●
BOC05-PS-CR1	+ 0.01 A	+ 0.00	●	●
BOC06-PS-CR1	+ 0.26 A	+ 0.25	●	●

Pulsed Injection Power Supplies	Current (Get)	Voltage	Voltage (V)	Trigger Enable
Septum	7.7932E-4 A	690.02 V	690.00	Off <input type="checkbox"/> On <input type="checkbox"/>
Kicker	-2.3148E-5 A	340.06 V	340.00	Off <input type="checkbox"/> On <input type="checkbox"/>

Navigation buttons at the bottom: DC Power Supplies Panel, Corrector Power Supplies Panel, Pulsed Power Supplies Panel, Demagnetization, Close.

Power Supplies Main OPI

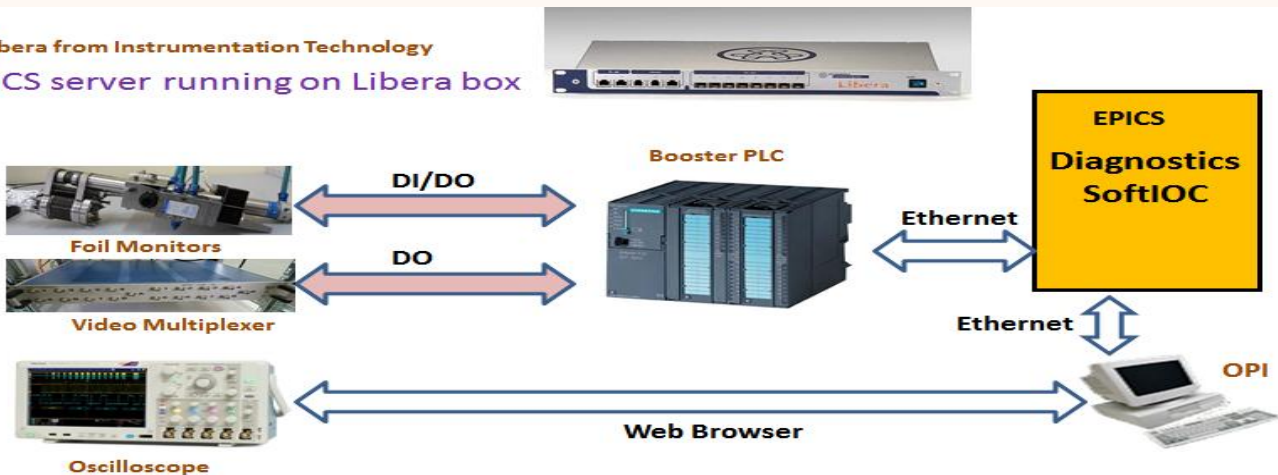


Power Supplies PLC

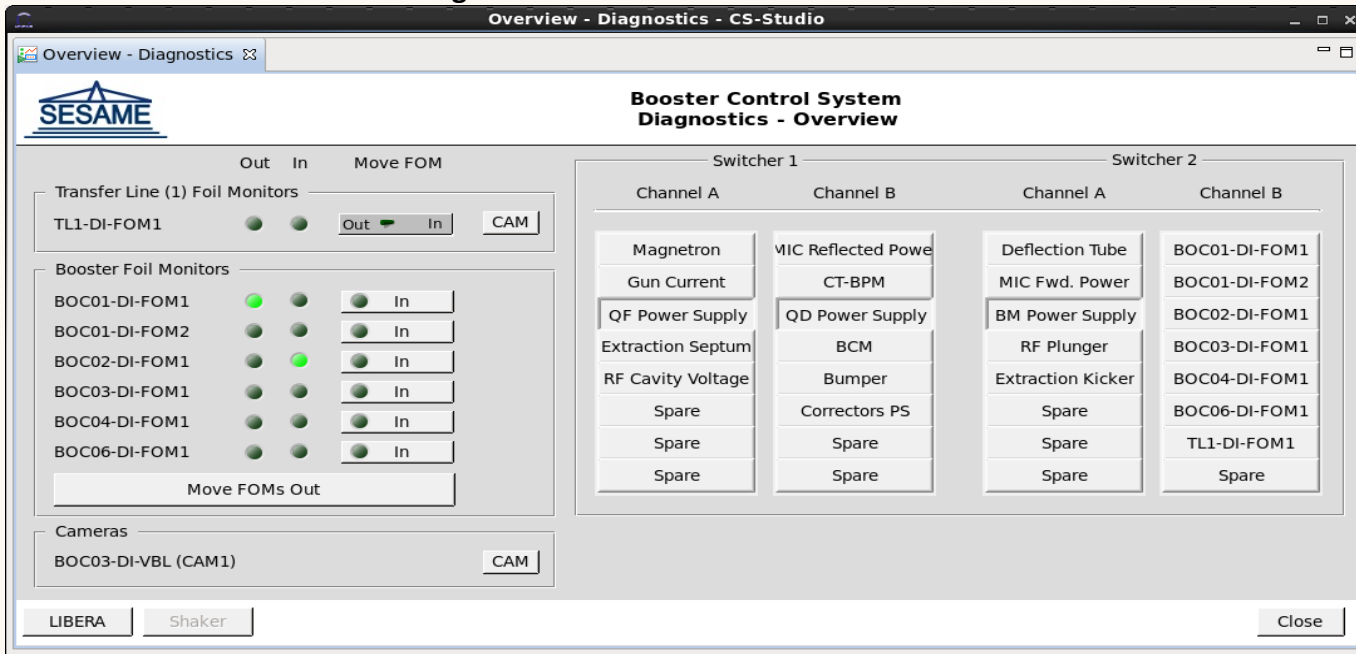
Booster Control System - Diagnostics

Libera from Instrumentation Technology

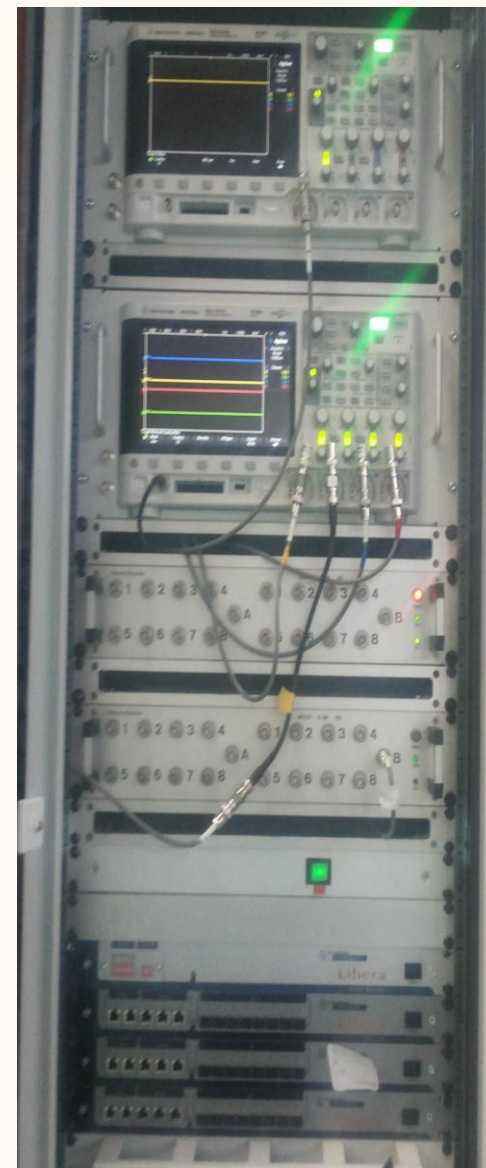
EPICS server running on Libera box



Diagnostics Control Architecture

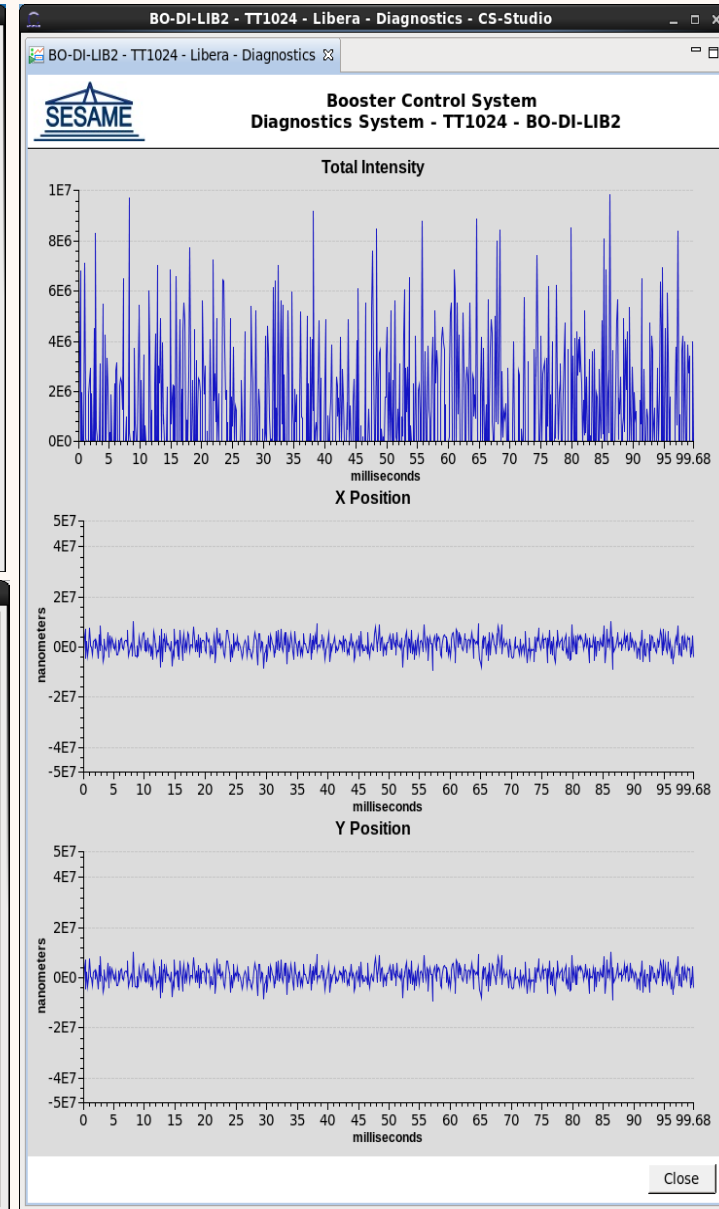
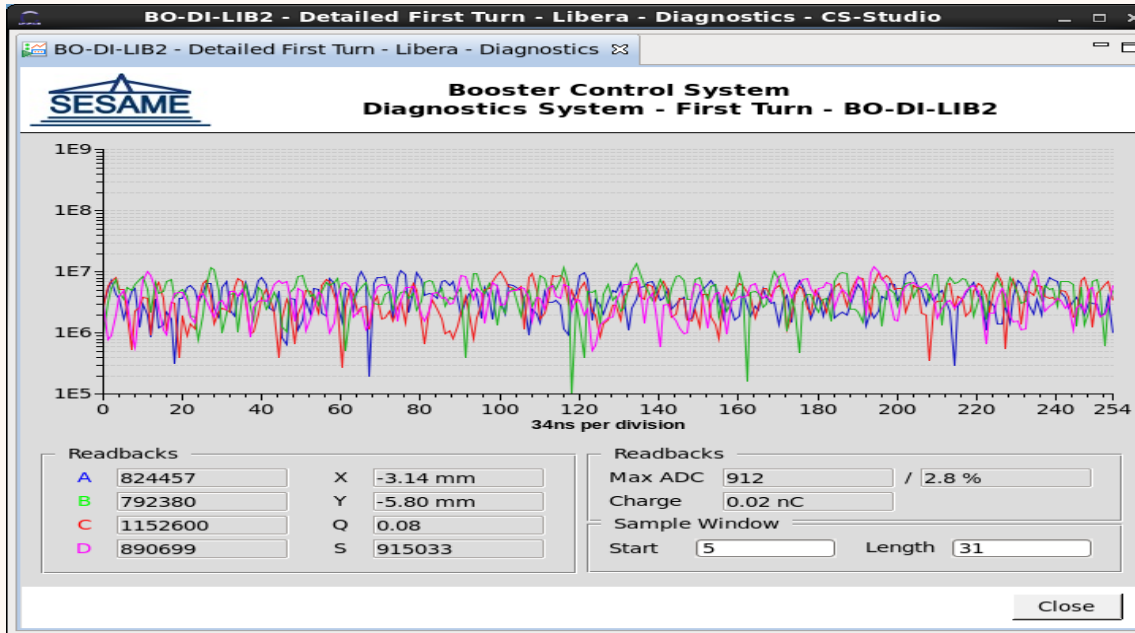
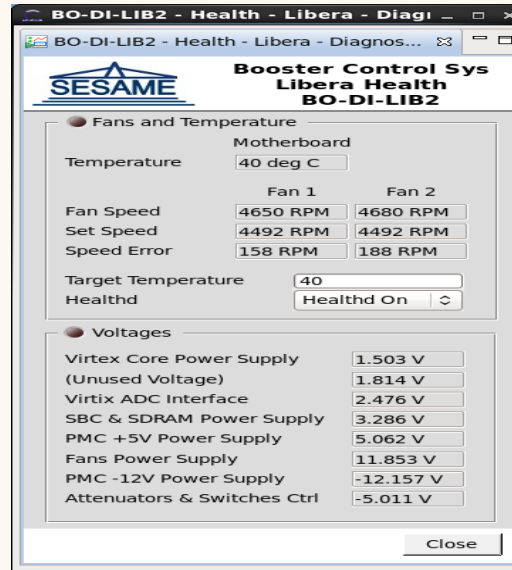
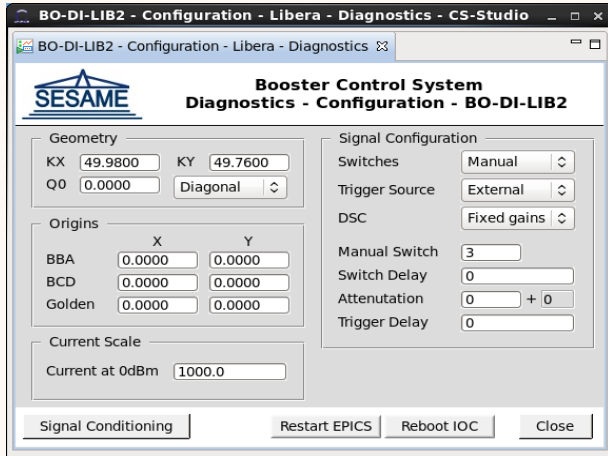


Diagnostics Main OPI

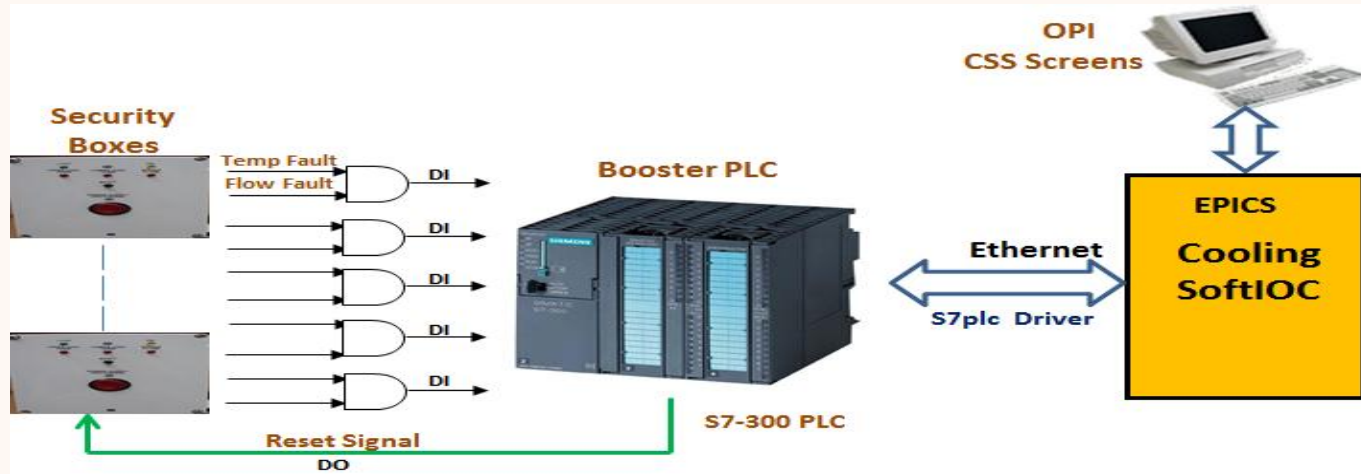


Diagnostics Rack

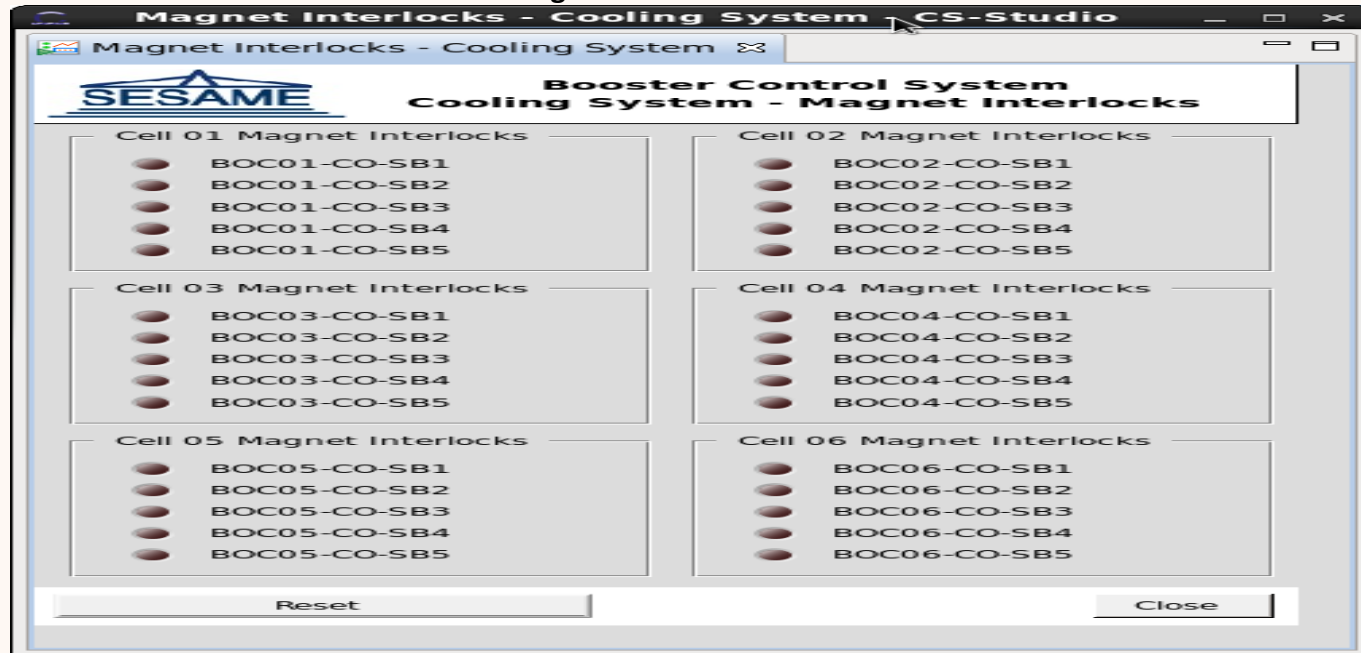
➤ New CSS Libera Screens



Booster Control System - Cooling



Cooling Control Architecture



Cooling Main OPI



Cooling Rack

Timing Control System

- VME Crate from PSI
 - One EVG card
 - One EVR card



Timing Hardware

Timing System - CS-Studio

SESAME

**Booster Control System
Timing System**

	Local Delay	Pulse Width	Event Number	
Event Receiver				
RF-AMP	66820.019 μ s	60.000 μ s	16	Disabled Enabled
BM	86710.019 μ s	2.000 μ s	16	Disabled Enabled
INJ-SEPT	0.000 μ s	2.000 μ s	17	Disabled Enabled
INJ-KICK	172.260 μ s	4.000 μ s	17	Disabled Enabled
MICROTRON	32.000 μ s	30.000 μ s	18	Disabled Enabled
BPM	40.000 μ s	2.000 μ s	19	Disabled Enabled
TL1-DI-CAM1	0.330 μ s	6.000 μ s	20	Disabled Enabled
BOC03-DI-CAI	200000.000 μ s	6.000 μ s	20	Disabled Enabled
QF	86820.019 μ s	2.000 μ s	16	Disabled Enabled
QD	86820.019 μ s	2.000 μ s	16	Disabled Enabled
SPECTRUM	5.000 μ s	2.000 μ s	18	Disabled Enabled

	Local Delay		Event Number	
Event Generator				
START	0.000 μ s	384 ns	16	
INJ	117118.252 μ s	117118208 ns	17	
PREINJ0	117242.252 μ s	117242240 ns	18	
BPM	117243.252 μ s	117243136 ns	19	
CAM	117243.252 μ s	117243264 ns	20	

Quick Control

Enable/disable DC power supplies trigger

Disable Enable

Frequencies Control

System Freq. 1.000 Hz 1 Hz \updownarrow

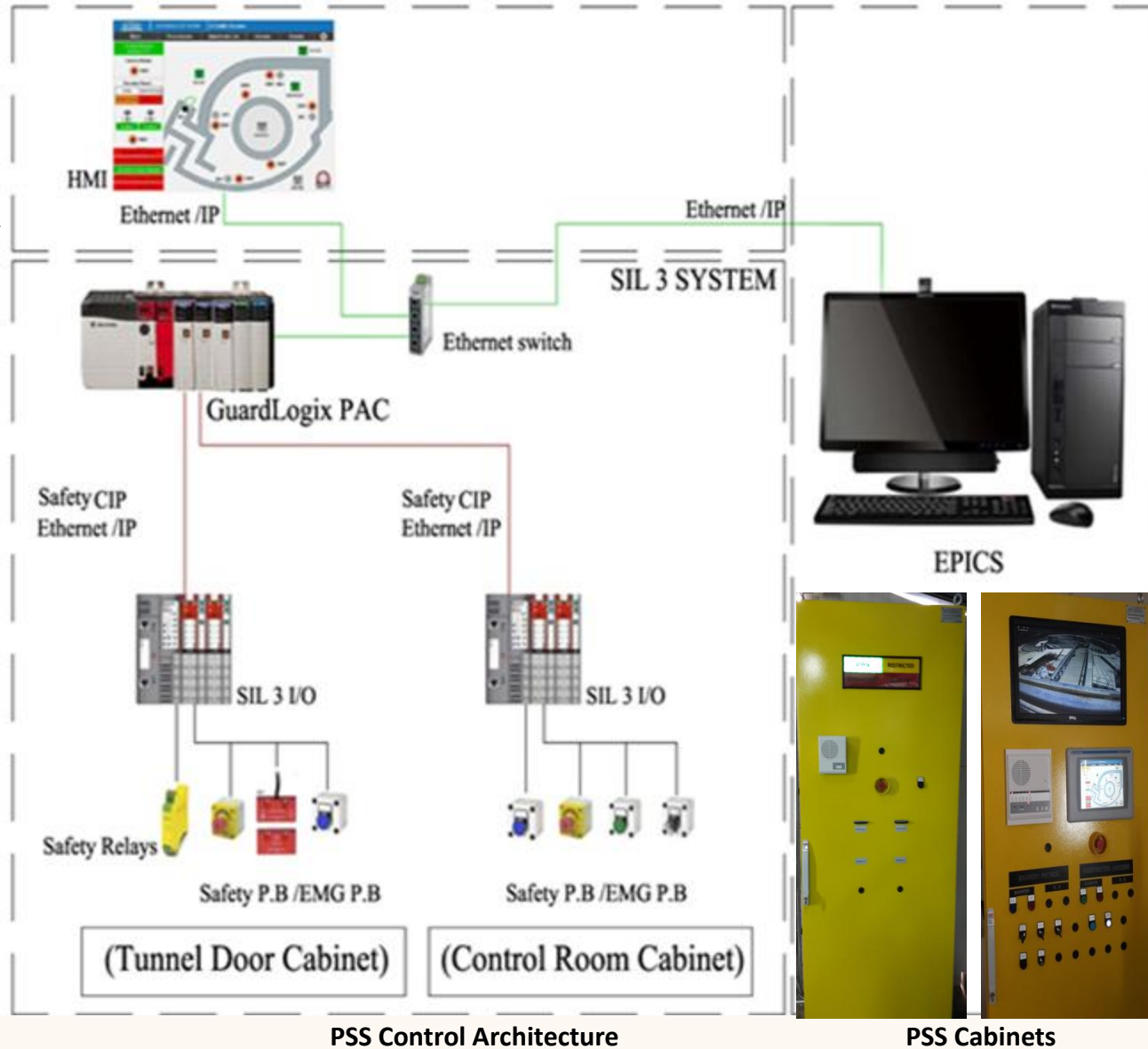
Microtron Freq. 1.00 Hz # of Pulses \updownarrow pulses

Update System Frequency Close

Timing Main OPI

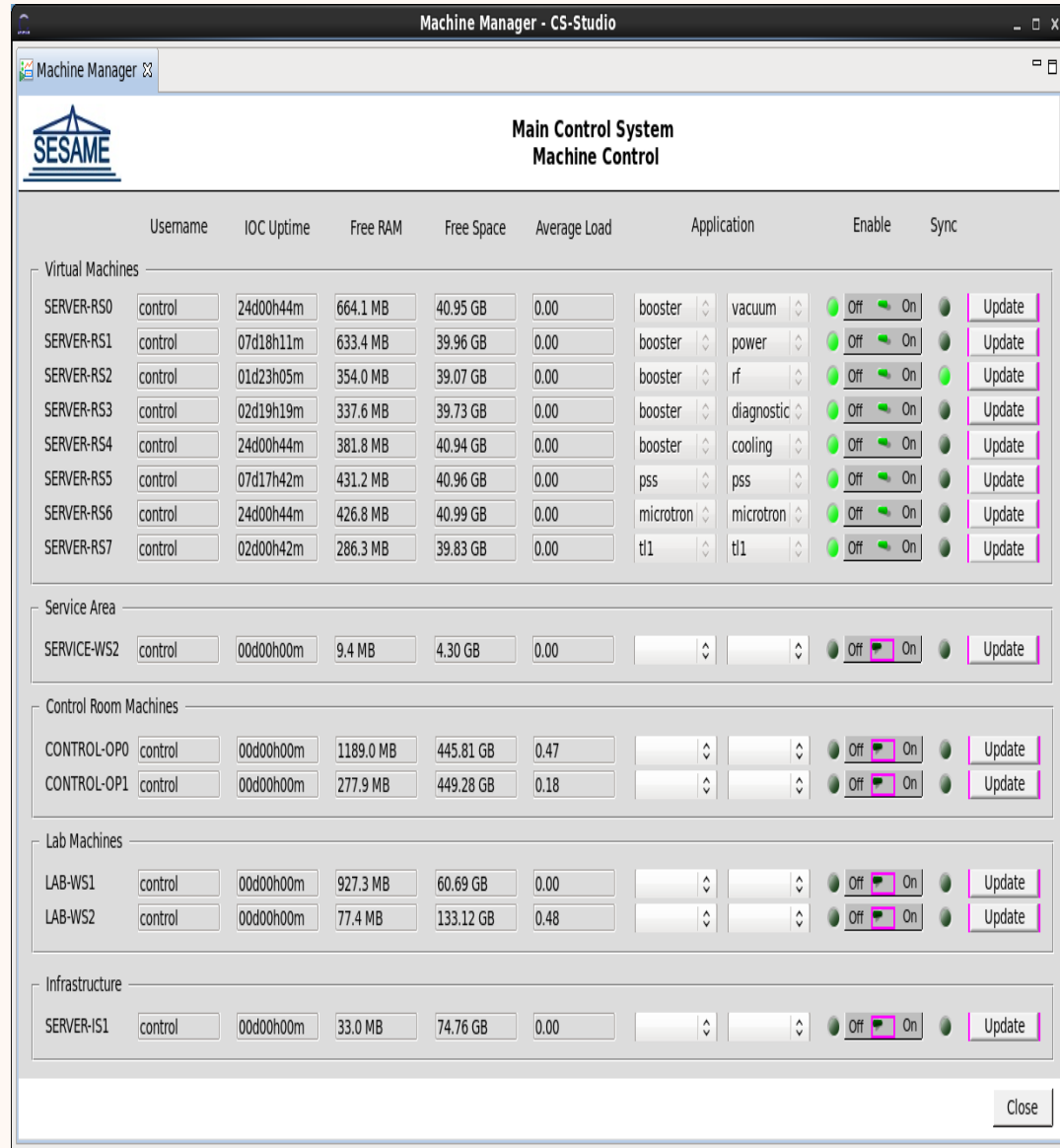
PSS Control System

- **EtherIP** driver/device support module interfaces Allen Bradley Guard Logix safety PLC via Ethernet to EPICS IOC
- The PSS IOC monitors the safety interlocks and showing them on the CSS



➤ IOC Manager

- Enable/Disable the IOCs
- Synchronize IOCs with the version control repository
- Monitor the uptime, free RAM, free space and the average load of the IOCs
- Manage the development machines and other infrastructure servers.



Machine Manager - CS-Studio

**Main Control System
Machine Control**

	Username	IOC Uptime	Free RAM	Free Space	Average Load	Application	Enable	Sync
Virtual Machines								
SERVER-RS0	control	24d00h44m	664.1 MB	40.95 GB	0.00	booster vacuum	Off On	Update
SERVER-RS1	control	07d18h11m	633.4 MB	39.96 GB	0.00	booster power	Off On	Update
SERVER-RS2	control	01d23h05m	354.0 MB	39.07 GB	0.00	booster rf	Off On	Update
SERVER-RS3	control	02d19h19m	337.6 MB	39.73 GB	0.00	booster diagnostic	Off On	Update
SERVER-RS4	control	24d00h44m	381.8 MB	40.94 GB	0.00	booster cooling	Off On	Update
SERVER-RS5	control	07d17h42m	431.2 MB	40.96 GB	0.00	pss pss	Off On	Update
SERVER-RS6	control	24d00h44m	426.8 MB	40.99 GB	0.00	microtron microtron	Off On	Update
SERVER-RS7	control	02d00h42m	286.3 MB	39.83 GB	0.00	tl1 tl1	Off On	Update
Service Area								
SERVICE-WS2	control	00d00h00m	9.4 MB	4.30 GB	0.00		Off On	Update
Control Room Machines								
CONTROL-OP0	control	00d00h00m	1189.0 MB	445.81 GB	0.47		Off On	Update
CONTROL-OP1	control	00d00h00m	277.9 MB	449.28 GB	0.18		Off On	Update
Lab Machines								
LAB-WS1	control	00d00h00m	927.3 MB	60.69 GB	0.00		Off On	Update
LAB-WS2	control	00d00h00m	77.4 MB	133.12 GB	0.48		Off On	Update
Infrastructure								
SERVER-IS1	control	00d00h00m	33.0 MB	74.76 GB	0.00		Off On	Update

Close

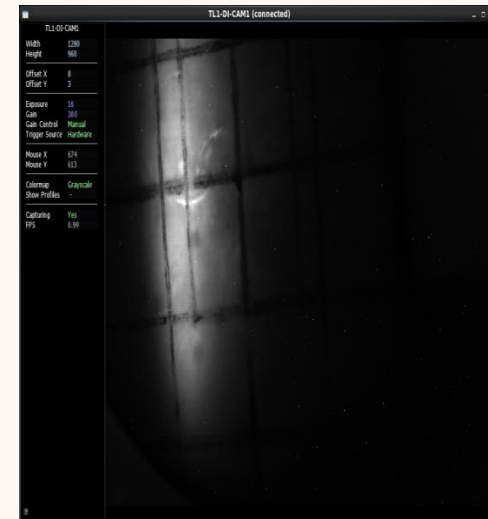
IOCs Manager OPI

➤ Basler GIGE Camera Driver

- Ace acA1300-30gm GigE camera, no drivers available
- Purpose: Speed up scientific analysis, system integration
Needed image, gain, exposure, ROI, and trigger control
- Record types: Bi, bo, longin, longout, waveform
- Device support: Asynchronous processing (I/O thread)
- Driver support: One thread per device, message passing
- Device driver: Shared C++ libraries from Basler



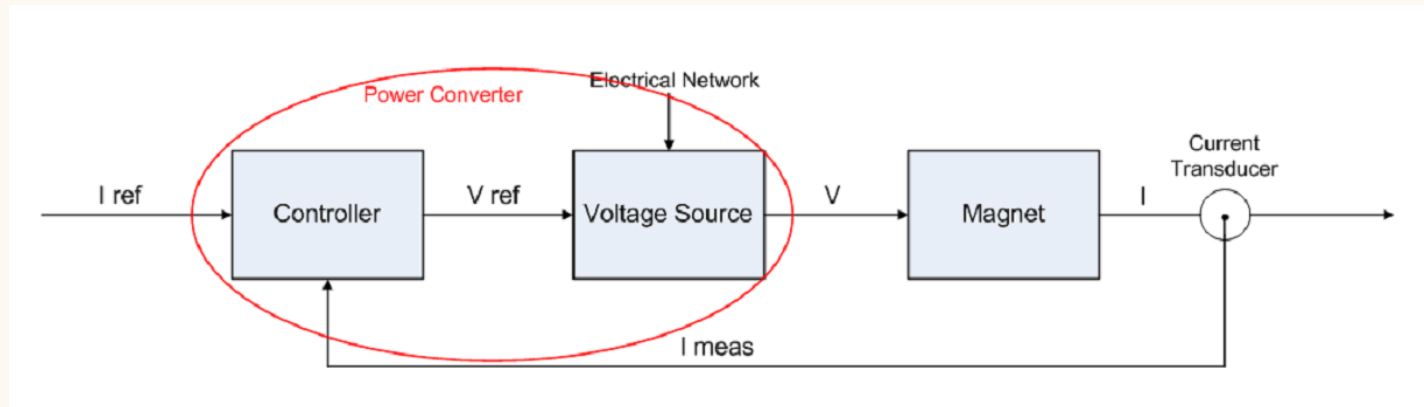
Basler GIGE Camera



Beam Image

➤ Storage Ring Power Supplies Control System

- Current controlled power supplies have 2 loops; a fast voltage feedback loop and slow current feedback loop
- We bought a power supply which already contains the voltage feedback loop from industry (Voltage Source)
- The current feedback loop is then implemented using PSI power supplies controllers



➤ Storage Ring Power Supplies Control System

- Control room communicates with gateways
- Gateway distributes commands to power supplies

Reference current

Waveforms

Triggering and synchronization

Fast orbit feedback

Parameterization

Firmware upgrades

- Power supply drives magnet

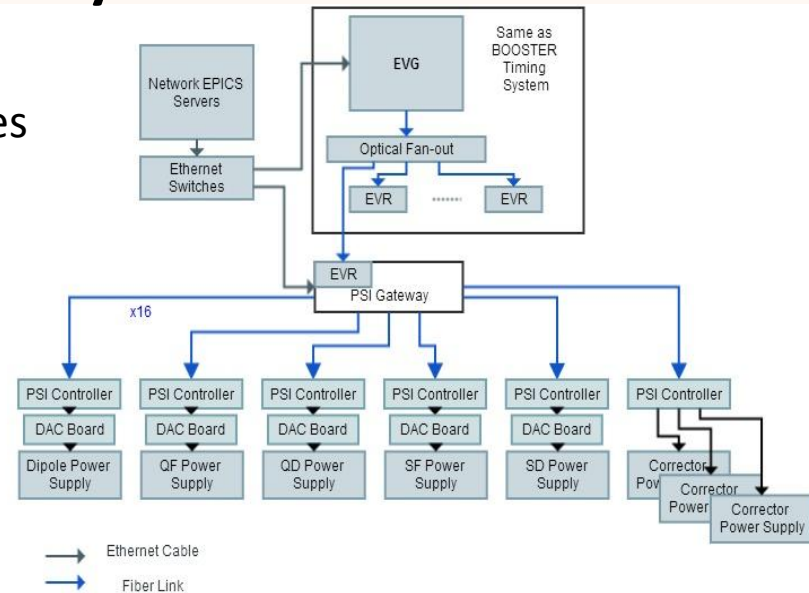
Triggering and tracking response and

jitter < 100us

Over damped response

Settling time within 50ppm < 1ms

Phase margin > 60



Architecture



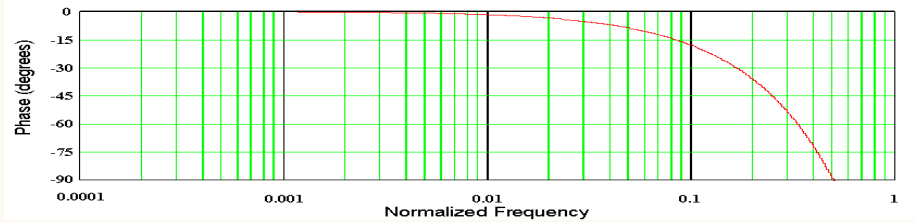
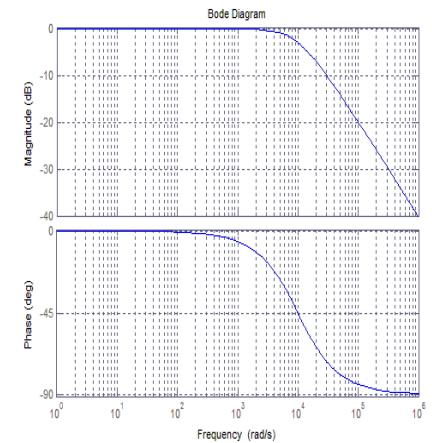
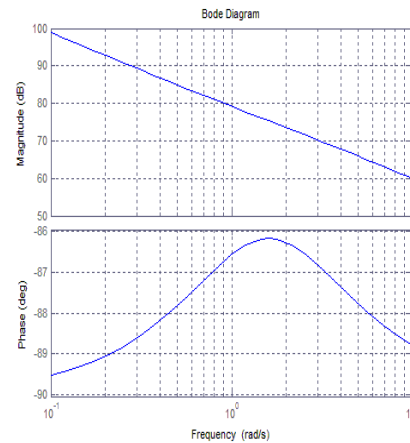
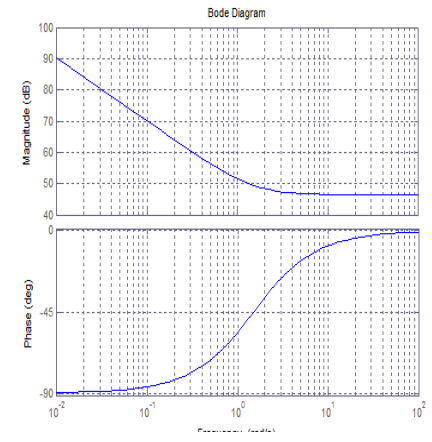
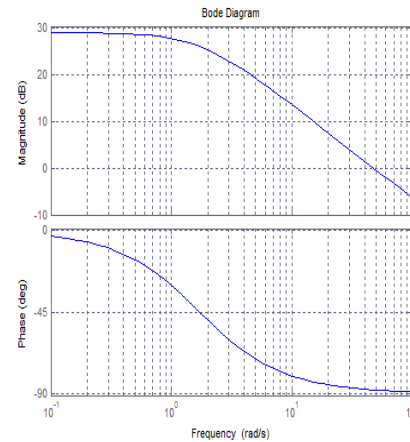
Gateway



Controller²⁴

➤ Storage Ring Power Supplies Control System

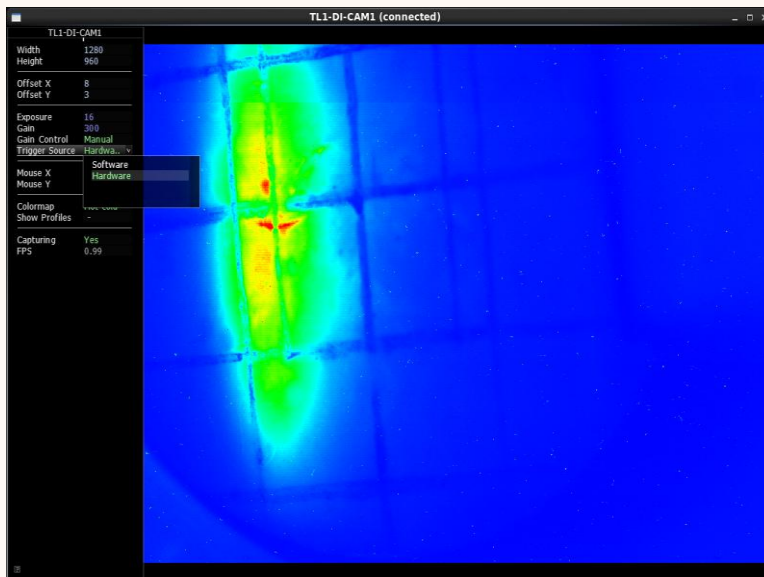
- Controller design requirements
 - Overdamped response
 - Settling time < 1ms
 - Error band < 50ppm
 - Phase margin > 60
- PI Controller design procedure
 - Gp has dominant real pole due to magnet
 - Place zero to cancel dominant pole
 - Place pole at origin
 - Close the loop and set bandwidth
 - Select sampling rate to achieve phase margin
- Design equations:
 - $K_i = W_p$, $10\tau = 1\text{ms}$, $BW = 1/\tau$,
 - $K_p = L \cdot BW$, $F_s > 4F_c$



Clients Development

➤ Basler GIGE Camera Client

- Uses EPICS client framework
- Built using C, OpenGL, SDL and AntTweakBar
- Provide an interface to control basler camera parameters such as: image size, offset, gain, exposure and trigger source
- Provides different color maps



Camera Client

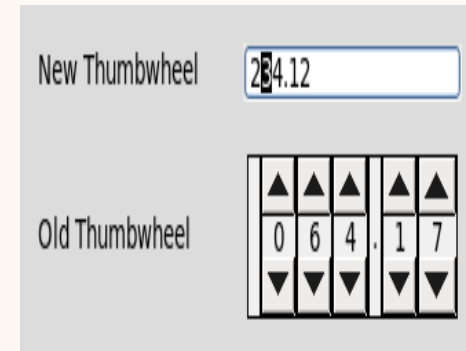
Clients Development

➤ SESAME CSS

- A custom SESAME build based on CSS v3.16



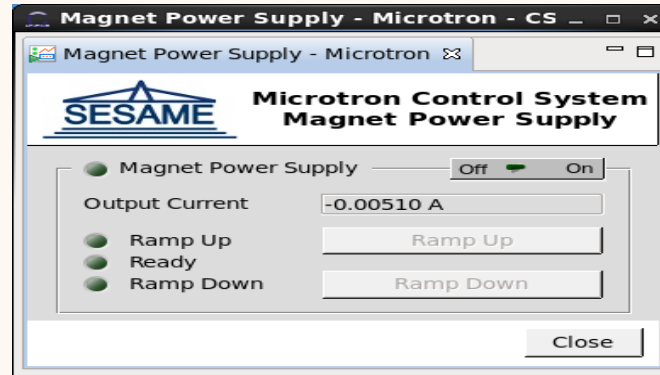
- Adding archiver and alarm handler to be integrated with the CSS
- CSS starts in run-time mode directly without showing the eclipse development windows.
- Adding a thumbwheel function to the input box widget to provide a compact fine-tunable control to PVs



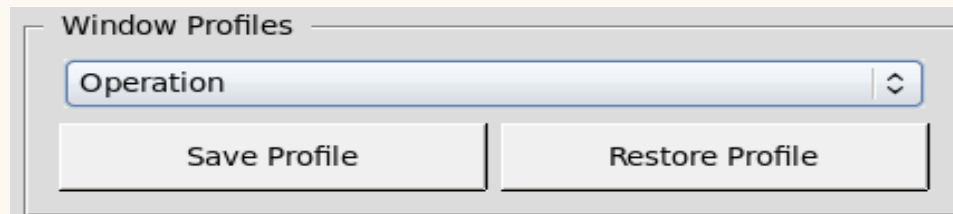
Clients Development

➤ SESAME CSS

- Showing screen names on windows title bar



- Only one instance of identical windows allowed at a time
- Adding window profiles saving and loading to arrange the CSS workspace



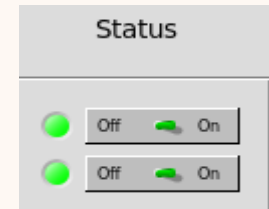
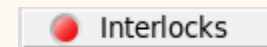
Clients Development

➤ SESAME CSS Standards

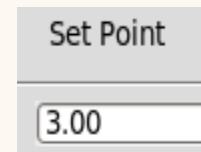
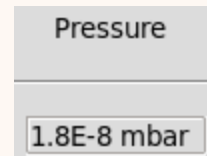
All CSS screens follow a standard interface to ease and clarify usage for operators

Examples:

- Color coding LEDs: green LEDs show on/off state, red LEDs show interlock signals, yellow LEDs used for limit switches



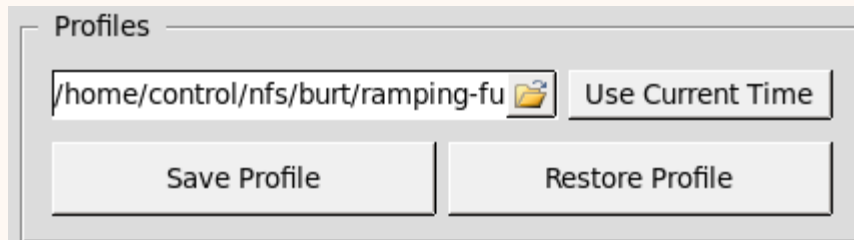
- All reading fields have a gray background, while write-able fields have a white background



- Tables are used throughout to monitor and control the devices

➤ BURT (Back Up and Restore Tool)

- Saves machine state and restores it later
- Uses a network file system to provide saved profiles on all operator's computers



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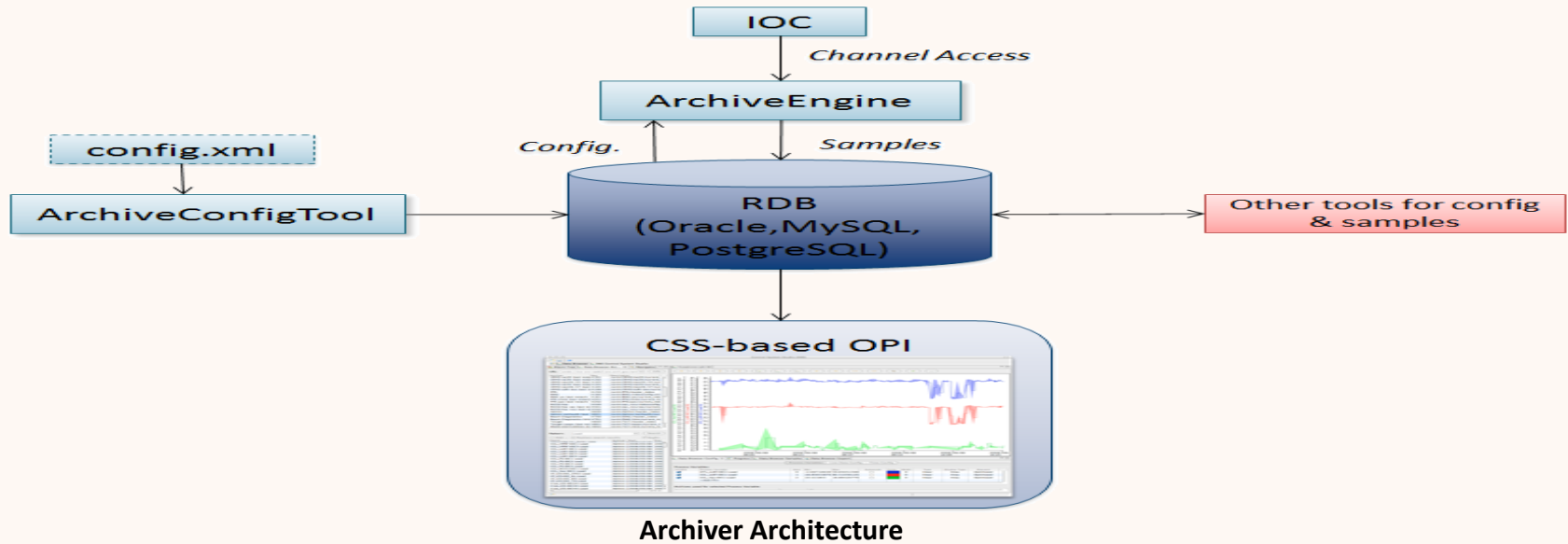
Wed28-nice-beam-at-extract.snp (nfs) - gedit
File Edit View Search Tools Documents Help
Open Save Undo
Wed28-nice-beam-at-extract.snp x
SDDS1
$parameter name=TimeStamp, type=string, fixed_value="Wed May 28
19:37:45 2014
", &end
$parameter name>LoginID, type=string, fixed_value="control ()", &end
$parameter name=EffectiveUID, type=string, fixed_value=504, &end
$parameter name=GroupID, type=string, fixed_value=504, &end
$parameter name=BurtKeywords, type=string, fixed_value="", &end
$parameter name=BurtComments, type=string, fixed_value="", &end
$parameter name=SnapType, type=string, fixed_value=Absolute, &end
$column name=ControlName, type=string, &end
$column name=Lineage, type=string, &end
$column name=BackupMsg, type=string, &end
$column name=RestoreMsg, type=string, &end
$column name=ControlMode, type=string, &end
$column name=Count, type=long, &end
$column name=ValueString, type=string, &end
&data mode=ascii, &end
! page number 1
33
MI-MA-TC1:reversePolarity1 pv - - - 1 "\reverse off\"
MI-MA-TC1:I1-set pv - - - 1 2.00000000000000e-01
MI-MA-TC1:reversePolarity2 pv - - - 1 "\reverse On\"
MI-MA-TC1:I2-set pv - - - 1 0.00000000000000e+00
MI-MA-TC2:reversePolarity1 pv - - - 1 "\reverse off\"
MI-MA-TC2:I1-set pv - - - 1 1.20000000000000e-01
MI-MA-TC2:reversePolarity2 pv - - - 1 "\reverse On\"
MI-MA-TC2:I2-set pv - - - 1 0.00000000000000e+00
TLL1-MA-CR3:reversePolarity1 pv - - - 1 "\reverse off\"
TLL1-MA-CR3:I1-set pv - - - 1 0.00000000000000e+00
TLL1-MA-CR3:reversePolarity2 pv - - - 1 "\reverse off\"
TLL1-MA-CR3:I2-set pv - - - 1 0.00000000000000e+00
TLL1-MA-CR4:reversePolarity1 pv - - - 1 "\reverse off\"
TLL1-MA-CR4:I1-set pv - - - 1 4.80000000000000e-01
TLL1-MA-CR4:reversePolarity2 pv - - - 1 "\reverse off\"
TLL1-MA-CR4:I2-set pv - - - 1 5.30000000000000e-01
TLL1-MA-CR5:reversePolarity1 pv - - - 1 "\reverse On\"
TLL1-MA-CR5:I1-set pv - - - 1 1.50000000000000e-01
TLL1-MA-CR5:reversePolarity2 pv - - - 1 "\reverse off\"
TLL1-MA-CR5:I2-set pv - - - 1 0.00000000000000e+00
TLL1-MA-CR6:reversePolarity1 pv - - - 1 "\reverse On\"
TLL1-MA-CR6:I1-set pv - - - 1 2.98000000000000e+00
TLL1-MA-CR6:reversePolarity2 pv - - - 1 "\reverse On\"
TLL1-MA-CR6:I2-set pv - - - 1 1.40000000000000e+00
TLL1-MA-TRP1-PS1:setCurrent pv - - - 1 1.28000000000000e+00
TLL1-MA-TRP1-PS2:setCurrent pv - - - 1 2.18000000000000e+00
TLL1-MA-TRP2-PS1:setCurrent pv - - - 1 4.80000000000000e-01
TLL1-MA-TRP2-PS2:setCurrent pv - - - 1 1.01000000000000e+00
BO-PS-IM:setCurrent pv - - - 1 2.40000000000000e+01
BO-PS-QF:setCurrent pv - - - 1 2.76000000000000e+00
BO-PS-QD:setCurrent pv - - - 1 2.29000000000000e+00
psinj_s_setvoltage pv - - - 1 6.80000000000000e+02
psinj_k_setvoltage pv - - - 1 2.00000000000000e+02
Plain Text Tab Width: 8 Ln 42, Col 54 INS

```

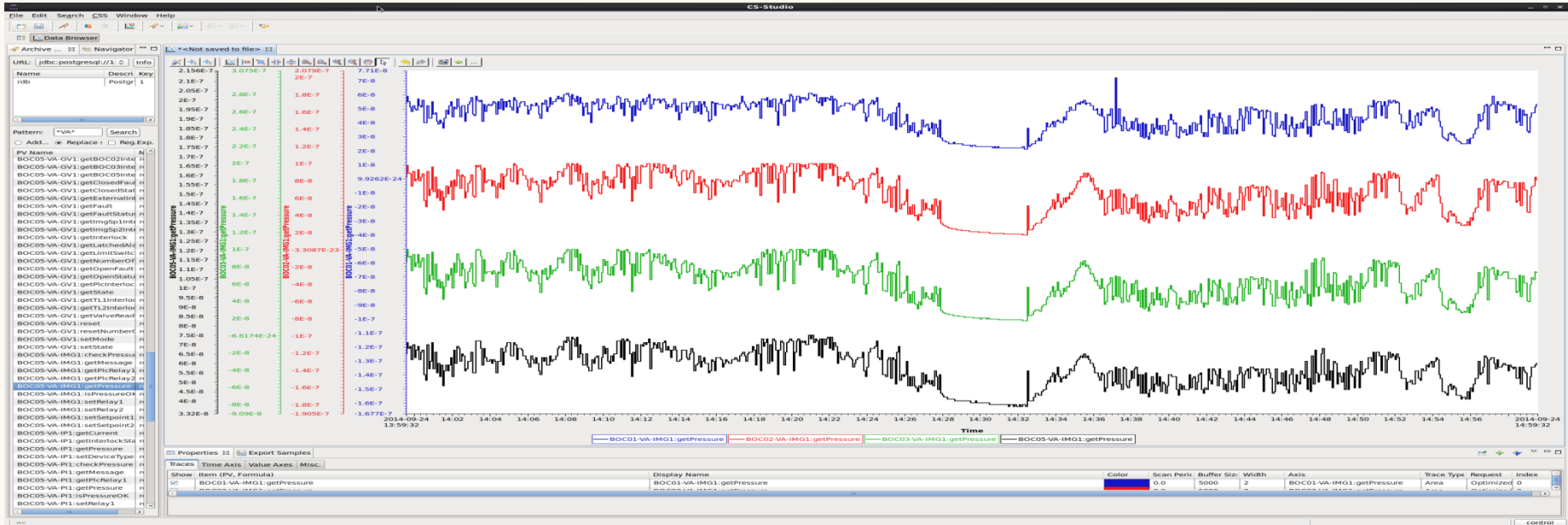
Archive System

- Uses BEAUTY (Best Ever Archive Toolset Yet) Archiver
- Integrates with CSS data browser
- Has ability to specify a time interval
- Show multiple PVs on the same plot
- Uses free PostgreSQL DB
- Installed on a virtual machine with access to EPICS IOCs
- Only PV reading changes are recorded in the database
- All PVs are monitored currently

Archive System



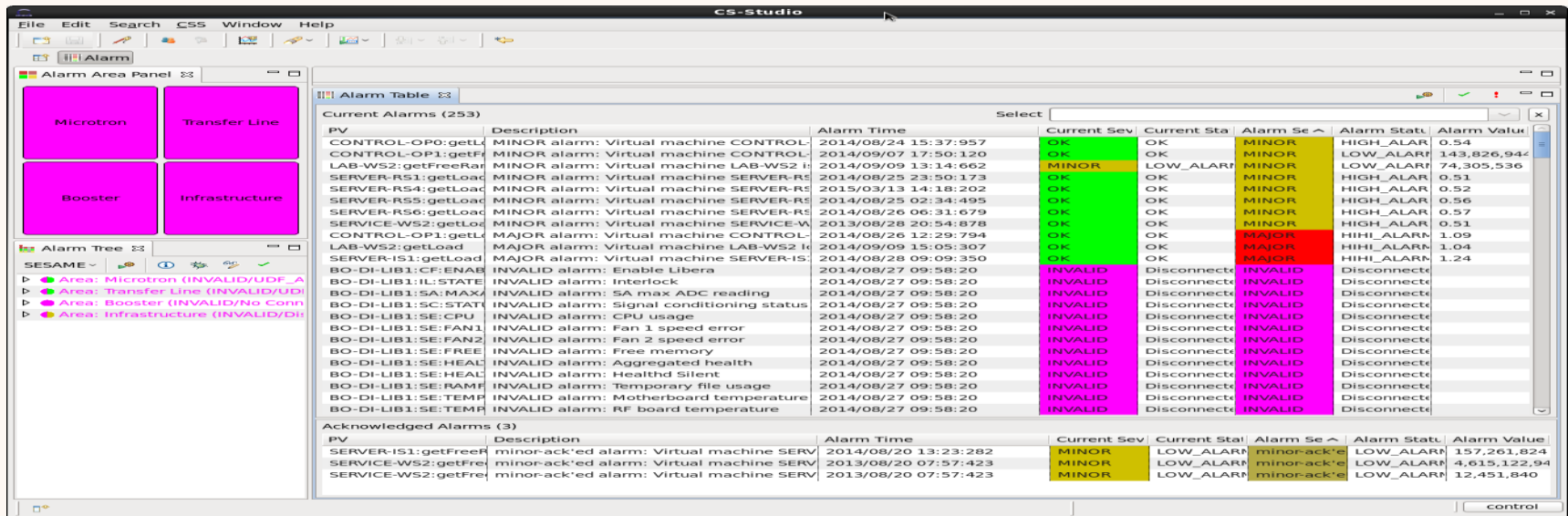
Archiver Architecture



Vacuum readings data browser

Alarm Handler

- Uses BEAST (Best Ever Alarm System Toolkit) Alarm Handler
- Integrates with CSS
- Divides alarms per system
- Alarms can be acknowledged
- Monitors Real-time alarms
- Uses PostgreSQL and Apache ActiveMQ
- Installed on a virtual machine with access to EPICS IOCs
- ANKA alarm creation server is used



The screenshot shows the CS-Studio Alarm Table interface. It displays a list of current alarms (253) and acknowledged alarms (3). The current alarms table includes columns for PV, Description, Alarm Time, Current Sev, Current Sta, Alarm Se, Alarm Stat, and Alarm Value. The acknowledged alarms table includes columns for PV, Description, Alarm Time, Current Sev, Current Sta, Alarm Se, Alarm Stat, and Alarm Value.

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Se	Alarm Stat	Alarm Value
CONTROL-OP0:getLoad	MINOR alarm: Virtual machine CONTROL-OP0	2014/08/24 15:37:957	OK	OK	MINOR	HIGH_ALAR	0.54
CONTROL-OP1:getLoad	MINOR alarm: Virtual machine CONTROL-OP1	2014/09/07 17:50:120	OK	OK	MINOR	LOW_ALAR	143,826,942
LAB-W52:getFreeRo	MINOR alarm: Virtual machine LAB-W52	2014/09/09 13:14:662	MINOR	LOW_ALAR	MINOR	LOW_ALAR	74,205,536
SERVER-R51:getLoad	MINOR alarm: Virtual machine SERVER-R5	2014/08/25 23:50:173	OK	OK	MINOR	HIGH_ALAR	0.51
SERVER-R54:getLoad	MINOR alarm: Virtual machine SERVER-R5	2015/03/13 14:18:202	OK	OK	MINOR	HIGH_ALAR	0.52
SERVER-R55:getLoad	MINOR alarm: Virtual machine SERVER-R5	2014/08/25 02:34:495	OK	OK	MINOR	HIGH_ALAR	0.56
SERVER-R56:getLoad	MINOR alarm: Virtual machine SERVER-R5	2014/08/26 06:31:679	OK	OK	MINOR	HIGH_ALAR	0.57
SERVICE-W52:getLoa	MINOR alarm: Virtual machine SERVICE-W	2013/08/28 20:54:878	OK	OK	MINOR	HIGH_ALAR	0.51
CONTROL-OP1:getL	MAJOR alarm: Virtual machine CONTROL-OP1	2014/08/26 12:29:794	OK	OK	MAJOR	HIHI_ALAR	1.09
LAB-W52:getLoad	MAJOR alarm: Virtual machine LAB-W52	2014/09/09 15:05:307	OK	OK	MAJOR	HIHI_ALAR	1.04
SERVER-IS1:getLoad	MAJOR alarm: Virtual machine SERVER-IS1	2014/08/28 09:09:350	OK	OK	MAJOR	HIHI_ALAR	1.24
BO-DI-LIB1:CF:ENAB	INVALID alarm: Enable Libera	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:IL:STATE	INVALID alarm: Interlock	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SA:MAX	INVALID alarm: SA max ADC reading	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SC:STAT	INVALID alarm: Signal conditioning status	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:CPU	INVALID alarm: CPU usage	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:FAN1	INVALID alarm: Fan 1 speed error	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:FAN2	INVALID alarm: Fan 2 speed error	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:FREE	INVALID alarm: Free memory	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:HEAL	INVALID alarm: Aggregated health	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:HEAL	INVALID alarm: Healthd Silent	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:RAMF	INVALID alarm: Temporary file usage	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:TEMP	INVALID alarm: Motherboard temperature	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
BO-DI-LIB1:SE:TEMP	INVALID alarm: RF board temperature	2014/08/27 09:58:20	INVALID	Disconnect	INVALID	Disconnect	
PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Se	Alarm Stat	Alarm Value
SERVER-IS1:getFreeR	minor-ack'ed alarm: Virtual machine SERV	2014/08/20 13:23:282	MINOR	LOW_ALAR	minor-ack'e	LOW_ALAR	157,261,824
SERVICE-W52:getFre	minor-ack'ed alarm: Virtual machine SERV	2013/08/20 07:57:423	MINOR	LOW_ALAR	minor-ack'e	LOW_ALAR	4,615,122,94
SERVICE-W52:getFre	minor-ack'ed alarm: Virtual machine SERV	2013/08/20 07:57:423	MINOR	LOW_ALAR	minor-ack'e	LOW_ALAR	12,451,840

Future Work

- Continue the work on the control system of the storage ring's power supplies and other subsystems
- Evaluation of a low cost, high performance controllers to be used in the storage ring control system
- Direct control of the timing system EVG and EVR cards by writing a driver for them and run a soft IOC on one of the Linux workstations

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Thank You