

# Control System Studio

- CSS -

## Alarm Handling

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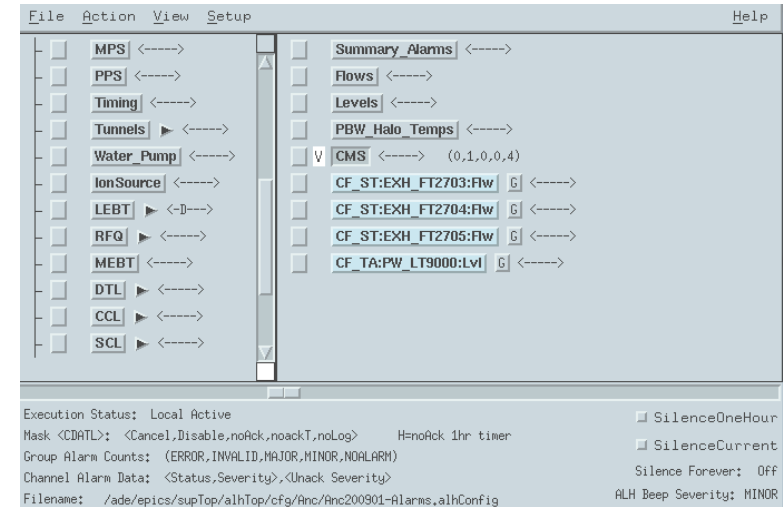


# Previous Attempts at SNS

ALH; manual “summary” displays; generated soft-IOCs + displays

## Issues

- GUI
  - **Static** Layouts
  - **N clicks** to see active alarms
- Configuration
  - .. was bad → Always **too many alarms**
  - **Changes** required contacting one of the 2 experts, wait ~days, restart CA gateway, hope that nothing else broke
- **Information**
  - Operator guidance?
  - Related displays?
  - Most frequent alarm?
  - Timeline of alarm?

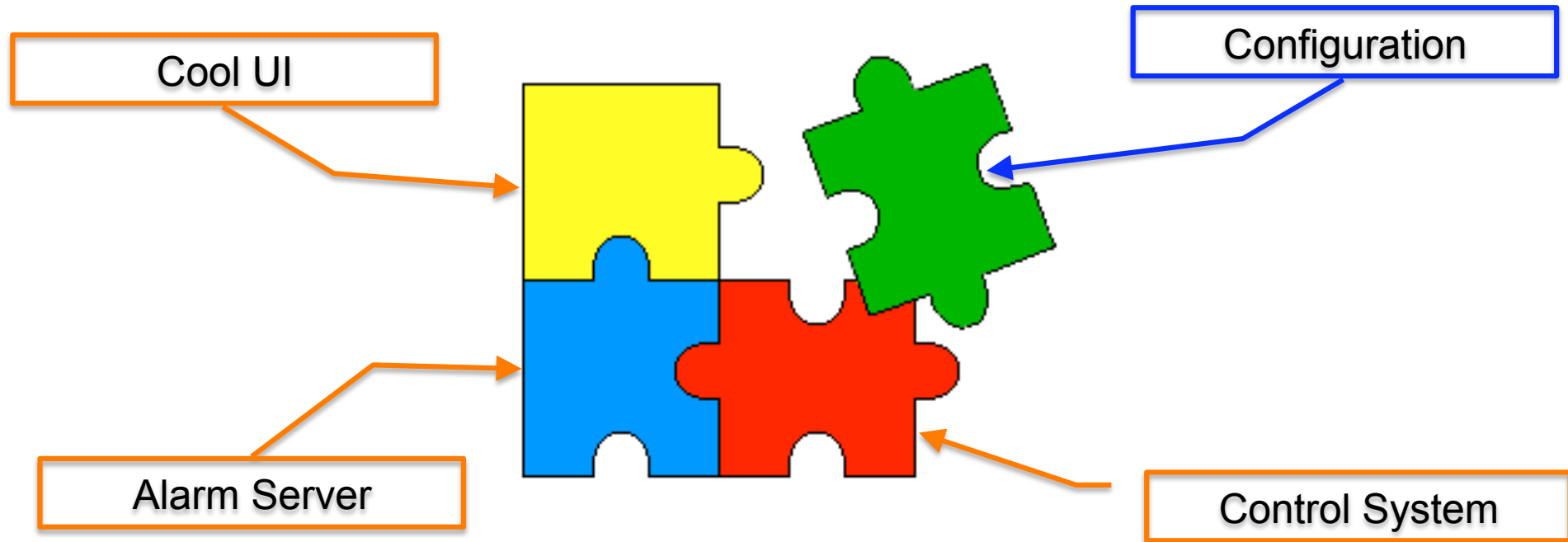


# Now: Best Ever Alarm System Tool



***Yes, alarms are always a little scary...***

# Alarm System Components

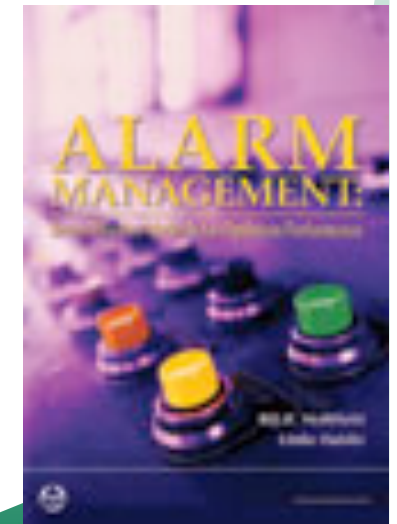


1. What you see

2. Technical details

3. How to use it

B. Hollifield, E. Habibi, "Alarm Management: Seven Effective Methods for Optimum Performance", ISA, 2007



# 1. What you see

## Alarm GUI used by Operators

# What you see: Alarm Table

- **All current alarms**
  - new, ack'ed
- **Sort by PV, Descr., Time, Severity, ...**
- **Optional: Annunciate**



The screenshot shows a software window titled "Alarm Table" with a search bar and two tables. The "Current Alarms" table has columns for PV, Description, Time, Current Seve, Severity, Status, and Value. The "Acknowledged Alarms" table has the same columns. The "Current Alarms" table contains two rows: one with a MAJOR severity and one with an OK severity. The "Acknowledged Alarms" table contains two rows: one with an INVALID severity and one with a MAJOR severity.

PV	Description	Time	Current Seve	Severity	Status	Value
ICS_MPS:FPAR_CCL_BS:FR	* mps fault	2009/04/15 16:22:50	MAJOR	MAJOR	LINK_ALARM	0
CF_KL:DIWS_AIT4306B:Rs	Check polishing loop resistivity for KL4	2009/04/15 15:50:58	OK	MINOR	HIGH_ALAR	2.5

PV	Description	Time	Current Seve	Severity	Status	Value
TMod:Summary_MPS:Alarm	Moderator System MPS Trip or PLC	2009/04/13 08:19:02	INVALID	invalid-ack'ed	READ_ALARM	Ready
HEBT_Coll:CT2:Cond	Hebbit collimator outlet flow conduct	2009/04/13 08:19:02	MAJOR	majr-ack'ed	LOLO_ALARM	0.016

- **Acknowledge one or multiple alarms**
  - Select by PV or description
  - BNL/RHIC type un-ack'

# Another View: Alarm Tree

- All alarms
  - Disabled, inactive, new, ack'ed
- Hierarchical
  - Optionally only show active alarms
  - Ack'/Un-ack' PVs or sub-tree

The screenshot displays a software window titled "Alarm Tree" with a standard toolbar at the top. The main content area shows a tree view of alarms. The root node is "Area: BeamPermit (MAJOR/MAJOR/LINK\_ALARM)" with a red circle icon. It has two sub-nodes: "System: MPS FPAR fault (MAJOR/MAJOR/LINK\_ALARM)" and "System: MPS FPL fault (OK/OK/OK)". The "MPS FPL fault" system has two PVs: "PV: FE\_MPS:MIOC1A:status\_sum" and "PV: ICS\_Tim:Gate\_BeamOn:Switch". The next major node is "Area: CF (OK/MINOR/HIGH\_ALARM)" with a yellow circle icon. It contains "System: Cooling\_Tower (OK/OK/OK)" and "System: Klystron\_Gallery\_Temp (OK/MINOR/HIGH\_ALARM)". The "Klystron\_Gallery\_Temp" system has 15 PVs, each with a green circle icon and a status string like "(OK/OK/OK)". The PV "PV: CF\_KL:DIWS\_AIT4306B:Rs" is highlighted with a yellow background. Below it are more PVs, including "PV: CF\_KL:DIWS\_PT4303B:suction (OK/OK/OK)", "PV: CF\_KL:DIWS\_PT4303C:disch (OK/OK/OK)", "PV: CF\_KL:DIWS\_TT4300A:T (OK/OK/OK)", "PV: CF\_KL:DIWS\_TT4302A:T (OK/OK/OK)", "PV: CF\_KL:DIWS\_TT4303A:T (OK/OK/OK)", "PV: CF\_KL:DIWS\_TT4306A:T (OK/OK/OK)", and "PV: CF\_KL:PKL02VFDB\_SFlow:Sts (OK/OK/OK)". Further down are "System: Potable\_Water\_Tank (OK/OK/OK)", "System: Site\_Power\_Other\_UPS (OK/OK/OK)", "Area: Diagnostics (OK/OK/OK)", "Area: HP\_Mod\_Smoke (OK/OK/OK)", and "Area: HP\_Mod\_V\_Mon (OK/OK/OK)". The bottom status bar shows "Not logged in" and a small icon.

# Guidance, Related Displays, Commands

**Alarm Tree**

- Area: BeamPermit (OK/OK/OK)
- Area: CF (OK/MINOR/HIGH\_ALARM)
  - System: Cooling\_Tower (OK/OK/OK)
    - System: Cooling Tower Fans (OK/OK/OK)
    - System: Cooling\_Tower\_Pumps (OK/OK/OK)
    - PV: CF\_CU:TWR2\_TW\_Trouble:Sts (OK/OK/OK)
    - PV: CF\_CU:TWR\_FT4017:Flw (OK/OK/OK)
    - PV: CF\_CU:TWR\_TT4016:T (OK/OK/OK)
    - PV: CF\_CU:TWR\_TT4017:T (OK/OK/OK)
    - PV: CF\_CU:TWR\_TT4018:T (OK/OK/OK)
  - System: Klystron\_Gallery\_Temp (OK/OK/OK)
  - System: Potable\_Water\_Tank (OK/OK/OK)
  - System: Site\_Power\_Other\_UPS (OK/OK/OK)
- Area: Diagnostics (OK/OK/OK)
- Area: HP\_Mod\_Smoke (OK/OK/OK)
- Area: HP\_Mod\_V\_Mon (OK/OK/OK)
- Area: HPRF\_PLC\_Check (OK/OK/OK)
- Area: HPRF\_Rack\_Sts (OK/OK/OK)
- Area: ICS (OK/OK/OK)
- Area: MPS (OK/OK/OK)
- Area: PPS (OK/OK/OK)
- Area: Timing (OK/OK/OK)
- Area: Tunnels (OK/OK/OK)
- Area: Water\_Pump (OK/OK/OK)
- Area: IonSource (OK/OK/OK)

**Context Menu:**

- Look at Cooling Tower Overview...
- Check tower water pump
- CF Overview
- Cooling Tower Overview Screen
- Cooling Tower Water Pumps Scre...
- Tower Water Pump Screen
- Rationalization
- Configure Item
- Rename Item
- Duplicate Item
- Move item
- Remove selected Items

**Alarm PV: CF\_CU:TWR2\_TW\_Trouble:Sts**

**Purpose of Alarm**

Indicates insufficient tower water problem, either flow or elevated temperature or pump failure. Flow (5500gpm) and temperature limits are fixed in the PLC. For changes see contacts listed below.

**Operator Guidance**

Look at tower water pump screen. There should be 3 pumps running. If not, attempt turn-on via operator screen.

If that fails, turn them on manually at CUB. If all fails, call contacts listed below.

**Failure Consequence**

MAJOR consequence: Beam will be off for 12 hours, cold box will trip, ...

TODD: List the top 3 critical items and response times in each case to avoid shutdown.

**Operator Response Time Available**

Usually less than 5 minutes in order to prevent further temperature increase.

TODD: Response time depends on beam power. How should this be factored into response?

**Contacts**

Water System Mechanical Engineers: Greg Irby, Jerry Ferguson Control System Contact: Frank Brantley

Check tower water pump

Look at tower water pump screen. Three pumps should be running. If not, attempt to turn on via operator screen. If that fails, turn them on manually at CUB.

OK

- ✓ Basic Text
- ✓ Open EDM/OPI screen
- ✓ Open web page
- ✓ Run ext. command

**Hierarchical:**  
Including info of parent entries

**Merges Guidance etc. from all selected alarms**



# Integrated with other CSS Tools

☑ Alarms

☑ History of PV

☑ EPICS Config.

The screenshot displays the Control System Studio (SNS) interface. On the left, a tree view shows the system hierarchy, including areas like 'Area: BeamPermit (OK/OK/OK)' and 'Area: CF (OK/MINOR/HIGH\_ALARM)'. A list of PVs is shown, with 'PV: CF\_KL:DIWS\_AIT4306B:Rs (OK/MINOR/HIGH\_ALARM)' highlighted in yellow.

The main window features a graph titled 'CF\_KL:DIWS\_AIT4306B:Rs [Mchm]' showing a blue line plot of the PV value over time from 2009/04/13 to 2009/04/15. The y-axis ranges from 0.9 to 3.9. The graph shows a step increase followed by a gradual rise and a sharp drop.

Below the graph is the 'Alarm Table' section, which displays a table of current alarms:

PV	Description	Time	Current Severity	Severity	Status	Value
CF_KL:DIWS_AIT4306B:Rs	Check polishing loop resistivity for KL4	2009/04/15 15:50:58	OK	MINOR	HIGH_ALARM	2.5

A 'PV Fields Viewer' dialog box is open, showing configuration details for the selected PV. It includes fields for 'PV Name/Filter', 'Field', 'Record Type', 'IOC Name', and 'Boot File'. Below these fields is a table of field configurations:

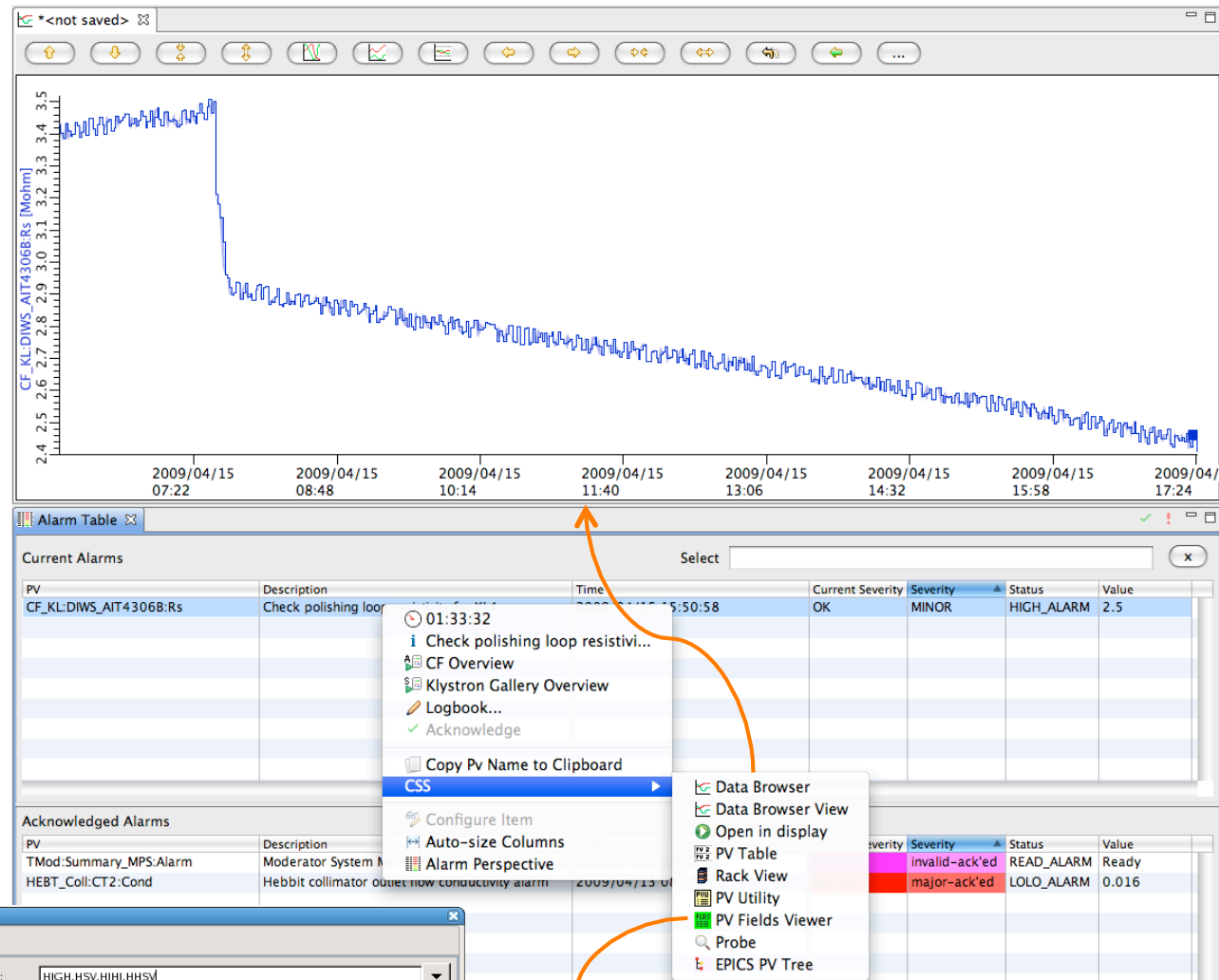
Field	DBD Type	Value in File	Live Value
HHSV	DBF_MENU	MAJOR	MAJOR
HIGH	DBF_DOUBLE	2.5	2.5
HIHI	DBF_DOUBLE	3.0	3.0
HSV	DBF_MENU	MINOR	MINOR

At the bottom of the dialog, there is a table showing alarm status for different fields:

Field	Severity	Status	Value
HIGH	valid-ack'd	READ_ALARM	Ready
HSV	valid-ack'd	LOLO_ALARM	0.016

# CSS Context Menus Connect the Tools

Send alarm  
PV to any  
other CSS  
PV tool

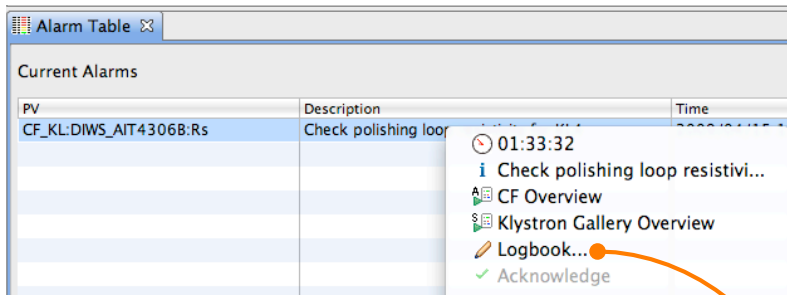


The 'PV Fields Viewer' window shows the configuration for PV CF\_KL:DIWS\_AIT4306B:Rs. It includes fields for 'Field' (HIGH,HSV,HIHI,HHSV), 'Record Type' (ai), and 'IOC Name' (cf-ics-loc-kl). Below these fields is a table of field values:

Field	DBD Type	Value in File	Live Value
HHSV	DBF_MENU	MAJOR	MAJOR
HIGH	DBF_DOUBLE	2.5	2.5
HIHI	DBF_DOUBLE	3.0	3.0
HSV	DBF_MENU	MINOR	MINOR

for the Department of Energy

# E-Log Entries



Create electronic logbook entry

Enter name, password, maybe edit the alarm information

User name: joe

Password: .....

Logbook: Operations

Title: Current Alarms

Text:

Received this alarm while turning the puple thingy on.

Fixed it by turning the second valve from the left three clicks clockwise.

Check polishing loop resistivity for KL4  
PV: CF\_KL:DIWS\_AIT4306B:Rs  
Time: 2009/04/15 15:50:58.735057000 (Duration 01:14:23)  
Severity/Message: MINOR/HIGH\_ALARM  
Value: 2.5  
Current Severity: OK

Cancel OK

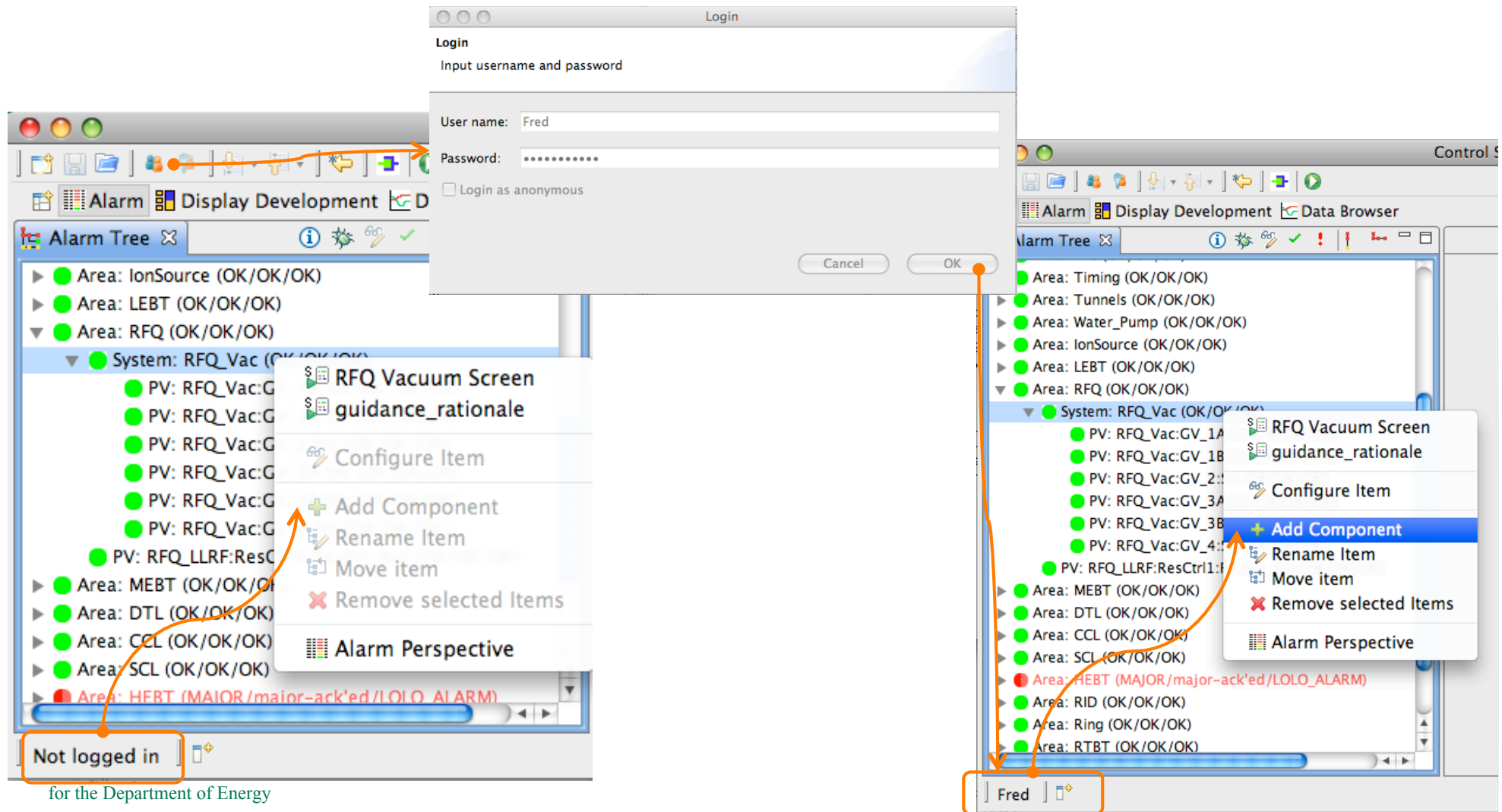
- **“Logbook”** from context menu creates text w/ basic info about selected alarms. Edit, submit.

- **Pluggable implementation, not limited to Oracle-based SNS ELog**

# Online Configuration Changes

.. may require Authentication/Authorization

☑ Log in/out while CSS is running



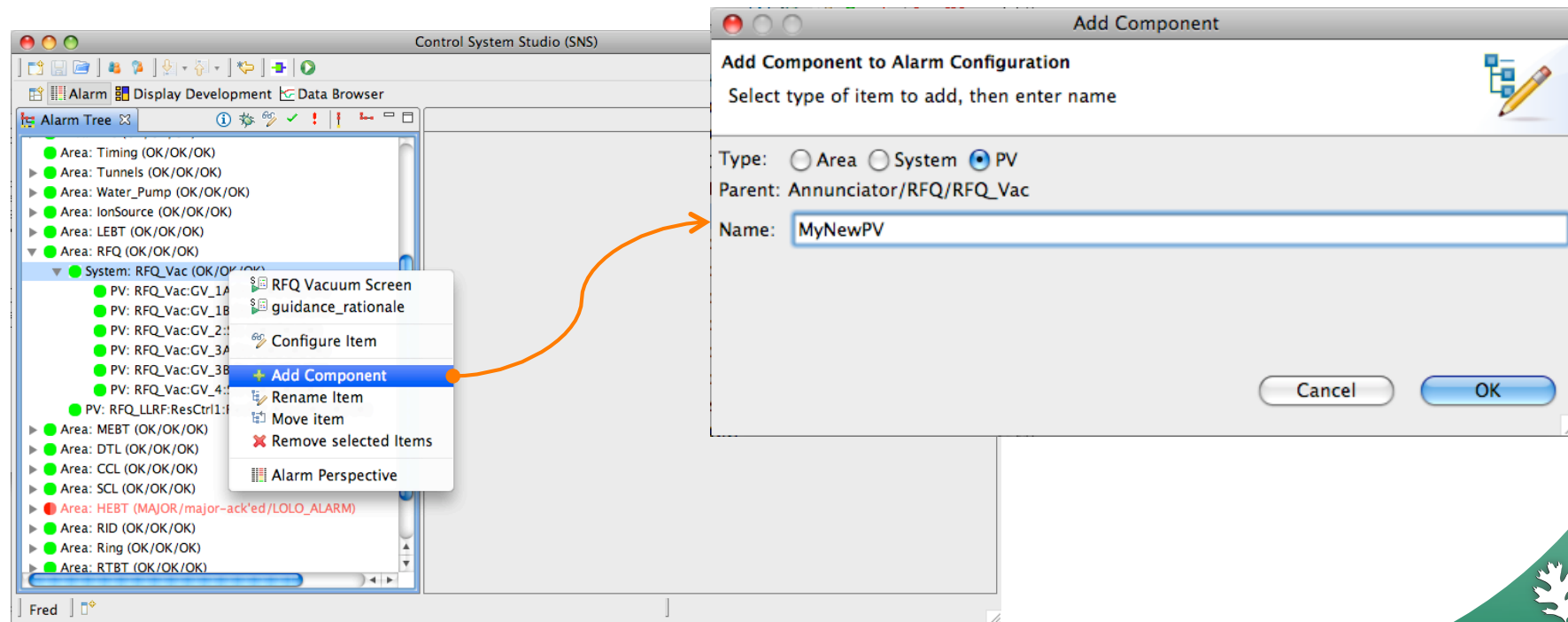
# Add PV or Subsystem

1. Right-click on 'parent'

2. "Add ..."

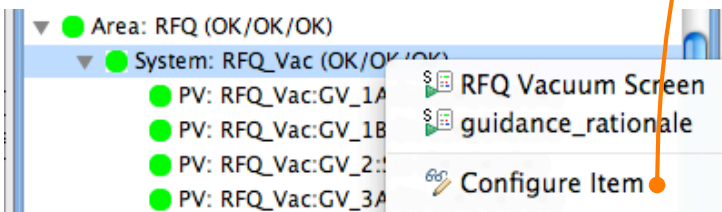
3. Enter name

Online. No search for config files, no restarts.



# Configure PV

- Again online
- Especially useful for operators to update guidance and related screens.



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Alarm Item Configuration

Item: Annunciator/RFQ/RFQ\_LLRF:ResCtrl1:ResErr\_Avg  
Configure guidance, related displays, ...

Description: Elevated R F Q resonance error

Alarm Delay [seconds]: 0

Alarm Count [within delay]: 0

Behavior:  Enabled  Latch  Annunciate

Enabling Filter:

Guidance:

Title	Detail
Check and fix resonance error	Check LLRF measurement of cavity residency error.
<Add>	<Add>

Displays:

Title	Command
RFQ LLRF	startedm -m S=RFQ,N=1,TN=
RFQ Chiller	startedm Cool
Rationalization	https://ics-web.sns.ornl.gov/v
<Add>	<Add>

Commands:

Title	Command
<Add>	<Add>

ID: 621 Last configured: 2009/04/14 16:46:17

Edit Row Data

Title: Check and fix resonance error

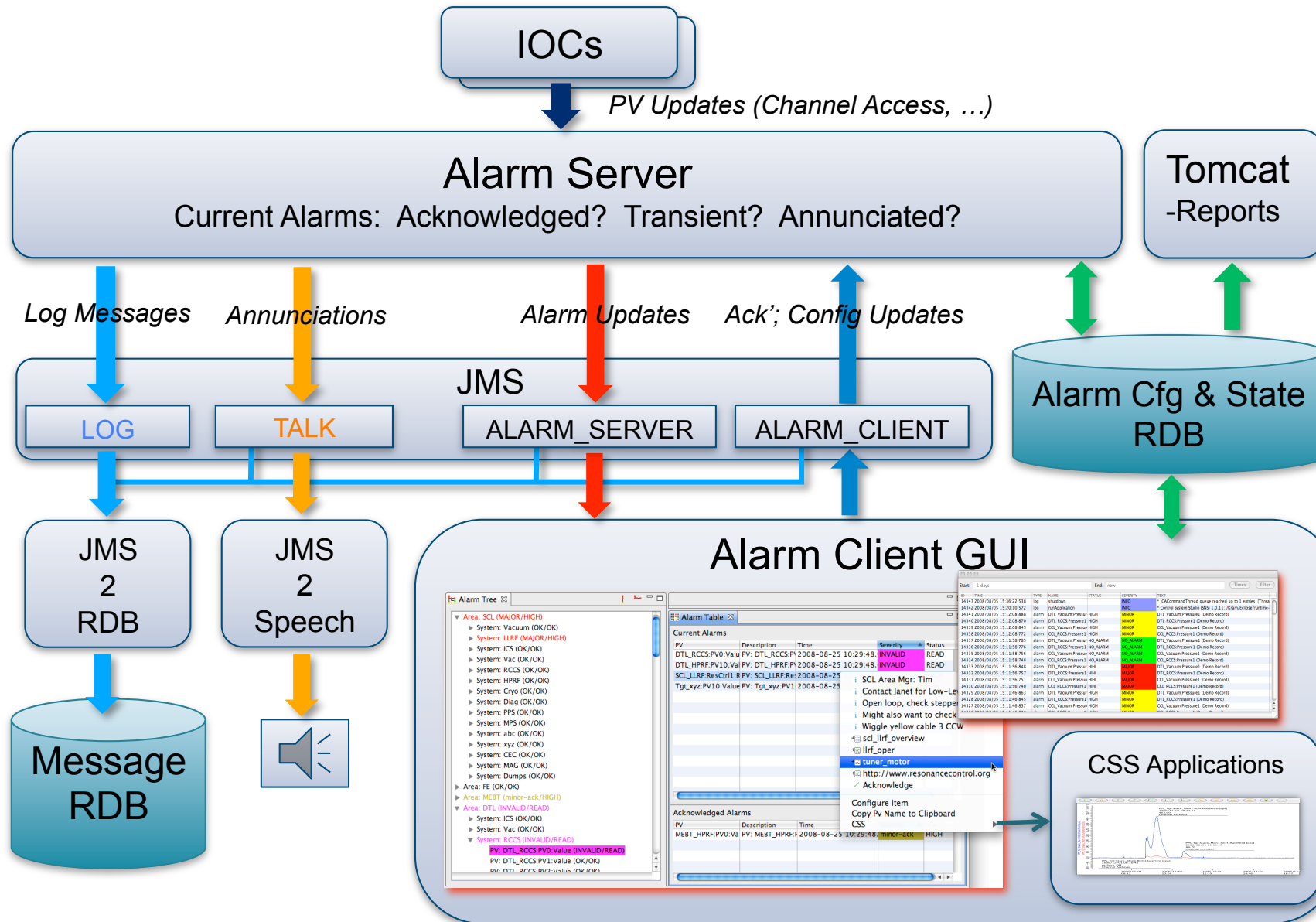
Details: Check LLRF measurement of cavity resonance error.  
Try to reduce error by adjusting LLRF pulse width as per the Daily Order.

Cancel OK

## **2. Technical details**

### **Behind the GUI; Tools to monitor performance**

# Technical View



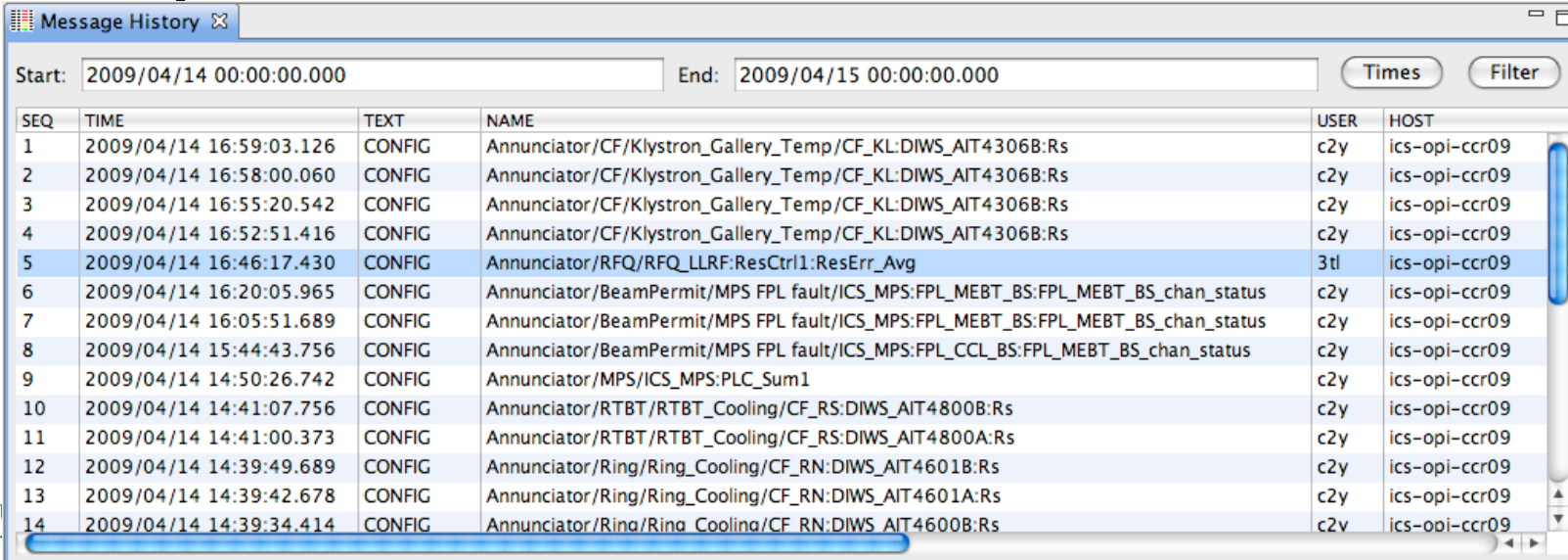


# General Alarm Server Behavior

- **Latch highest severity, or non-latching**
  - like ALH “ack. transient”
- **Annunciate**
- **Chatter filter ala ALH**
  - Alarm only if severity persists some minimum time
  - .. or alarm happens  $\geq N$  times within period
- **Optional formula-based alarm enablement:**
  - Enable if “(pv\_x > 5 && pv\_y < 7) || pv\_z==1”
  - ... but we prefer to move that logic into IOC
- **When acknowledging MAJOR alarm, subsequent MINOR alarms not annunciated**
  - ALH would again blink/require ack’

# Logging

- ..into generic CSS log also used for error/warn/info/debug messages
- Alarm Server: State transitions, Annunciations
- Alarm GUI: Ack/Un-Ack requests, Config changes
- Generic Message History Viewer
  - Example w/ Filter on TEXT=CONFIG



The screenshot shows a window titled "Message History" with a search filter set to "TEXT=CONFIG". The window displays a table of log entries with the following columns: SEQ, TIME, TEXT, NAME, USER, and HOST. The entries are sorted by time, showing various configuration messages from the Alarm Server and GUI.

SEQ	TIME	TEXT	NAME	USER	HOST
1	2009/04/14 16:59:03.126	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
2	2009/04/14 16:58:00.060	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
3	2009/04/14 16:55:20.542	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
4	2009/04/14 16:52:51.416	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
5	2009/04/14 16:46:17.430	CONFIG	Annunciator/RFQ/RFQ_LLR:ResCtrl1:ResErr_Avg	3tl	ics-opi-ccr09
6	2009/04/14 16:20:05.965	CONFIG	Annunciator/BeamPermit/MPS FPL fault/ICS_MPS:FPL_MEBT_BS:FPL_MEBT_BS_chan_status	c2y	ics-opi-ccr09
7	2009/04/14 16:05:51.689	CONFIG	Annunciator/BeamPermit/MPS FPL fault/ICS_MPS:FPL_MEBT_BS:FPL_MEBT_BS_chan_status	c2y	ics-opi-ccr09
8	2009/04/14 15:44:43.756	CONFIG	Annunciator/BeamPermit/MPS FPL fault/ICS_MPS:FPL_CCL_BS:FPL_MEBT_BS_chan_status	c2y	ics-opi-ccr09
9	2009/04/14 14:50:26.742	CONFIG	Annunciator/MPS/ICS_MPS:PLC_Sum1	c2y	ics-opi-ccr09
10	2009/04/14 14:41:07.756	CONFIG	Annunciator/RTBT/RTBT_Cooling/CF_RS:DIWS_AIT4800B:Rs	c2y	ics-opi-ccr09
11	2009/04/14 14:41:00.373	CONFIG	Annunciator/RTBT/RTBT_Cooling/CF_RS:DIWS_AIT4800A:Rs	c2y	ics-opi-ccr09
12	2009/04/14 14:39:49.689	CONFIG	Annunciator/Ring/Ring_Cooling/CF_RN:DIWS_AIT4601B:Rs	c2y	ics-opi-ccr09
13	2009/04/14 14:39:42.678	CONFIG	Annunciator/Ring/Ring_Cooling/CF_RN:DIWS_AIT4601A:Rs	c2y	ics-opi-ccr09
14	2009/04/14 14:39:34.414	CONFIG	Annunciator/Ring/Ring_Cooling/CF_RN:DIWS_AIT4600B:Rs	c2y	ics-opi-ccr09

# Logging: Get timeline

- Example: Filter on TYPE, PV

Select filter criteria:  
Which Property should contain what value?

Property: NAME Matching Value: %SCL\_HPRF:Mod15:V\_Mon%

... AND ...

Property: (no filter) Matching Value:

... AND ...

Property: (no filter) Matching Value:

... AND ...

Property: (no filter) Matching Value:

... AND ...

Property: (no filter) Matching Value:

Value patterns support SQL wildcards '%', '\_'

Cancel OK

Message History

Start: 2009/04/12 07:00 End: 2009/04/12 20:31

TIME	TYPE	TEXT	SEVERITY	USER
2009/04/12 08:31:38.020	talk	MAJOR alarm: mps fault	MAJOR	alarms
2009/04/12 08:31:29.292	talk	MAJOR alarm: Check S C L 15 Modulator voltage	MAJOR	alarms
2009/04/12 08:31:28.207	talk	MAJOR alarm: S C L 15 modulator is standby	MAJOR	alarms

Message History

Start: -5 day End: now

6. All OK

Times Filter

TIME	DELTA	TYPE	TEXT	NAME	STATUS	SEVERITY	CURRENT_SEVERITY	USER	APPLI...ON-ID	HOST
2009/04/12 20:30:29.522	00:00:00.039	alarm	STATE	SCL_HPRF:Mod15:V_Mon	OK	OK	OK	alarms	AlarmServer	ics-srv-sc
2009/04/12 20:30:29.483	08:16:59	alarm	ACK	SCL_HPRF:Mod15:V_Mon				accl-oper	CSS	ics-opi-c
2009/04/12 12:13:30.319	00:01:42	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	OK	alarms	AlarmServer	ics-srv-sc
2009/04/12 12:11:47.332	01:03:08	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	MAJOR	alarms	AlarmServer	ics-srv-sc
2009/04/12 11:08:38.729	00:02:06	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	OK	alarms	AlarmServer	ics-srv-sc
2009/04/12 11:06:32.713	02:31:01	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	MAJOR	alarms	AlarmServer	ics-srv-sc
2009/04/12 08:35:31.364	00:04:02	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	OK	alarms	AlarmServer	ics-srv-sc
2009/04/12 08:31:29.283	01:15:20	alarm	STATE	SCL_HPRF:Mod15:V_Mon	LOW_ALARM	MAJOR	MAJOR	alarms	AlarmServer	ics-srv-sc
2009/04/12 07:16:09.109	00:00:00.014	alarm	STATE	SCL_HPRF:Mod15:V_Mon	OK	OK	OK	alarms	AlarmServer	ics-srv-sc

3. Alarm Server  
annunciates

2. Alarm Server  
latches alarm

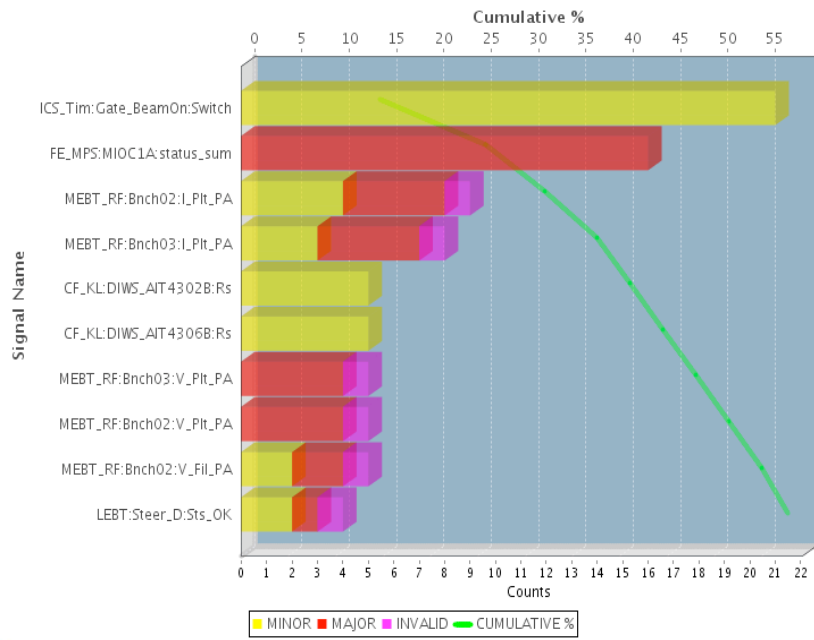
1. PV triggers,  
clears,  
triggers again

5. Ack'ed by operator

4. Problem fixed

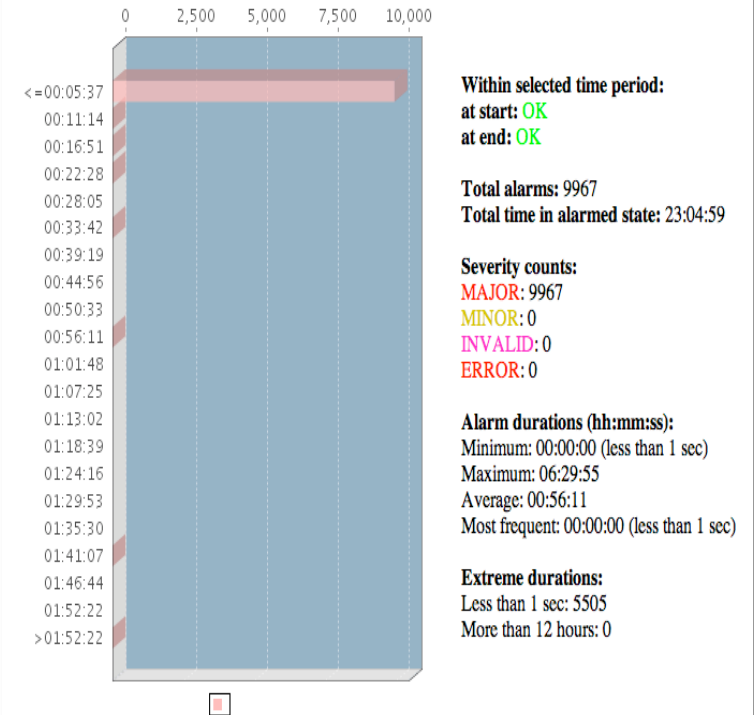
# All Sorts of Web Reports

Pattern: %, 17-Mar-2009 00:00 for 0 days 24 hours (-)

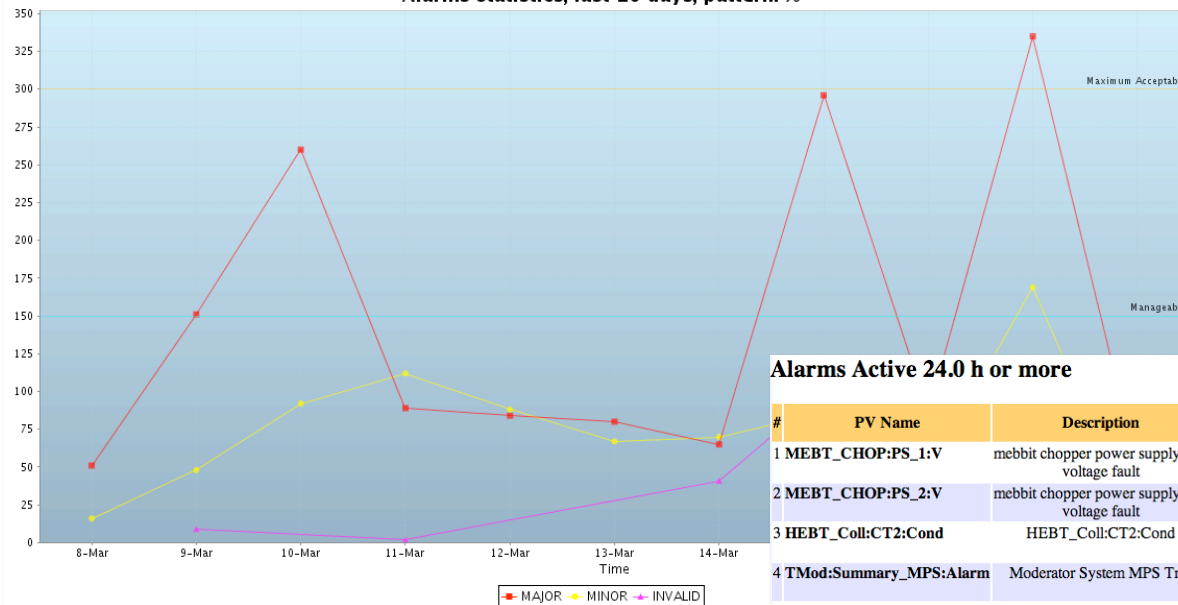


## Statistics based on CURRENT SEVERITY:

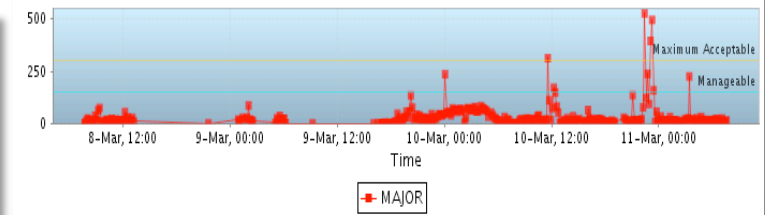
Alarms duration frequency (hh:mm:ss)



Alarms Statistics, last 10 days, pattern: %



Alarms on time line (10 min slices)



Alarms Active 24.0 h or more

#	PV Name	Description	Path	Alarm Time	..Duration [HH:MM:SS]	Severity	Alarm Message	Current Severity
1	MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage fault	/Annunciator/MEBT	2009-03-16 13:17:35	42:58:57	MAJOR_ACK	LOLO_ALARM	MAJOR
2	MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault	/Annunciator/MEBT	2009-03-16 13:17:35	42:58:57	MAJOR_ACK	LOLO_ALARM	MAJOR
3	HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	/Annunciator/HEBT/HEBT_Cooling	2009-03-14 20:22:50	83:53:42	INVALID_ACK	READ_ALARM	MAJOR
4	TMod:Summary_MPS:Alarm	Moderator System MPS Trip	/Annunciator/Target/CMS	2009-02-07 09:25:09	934:51:23	INVALID_ACK	READ_ALARM	INVALID

### **3. How to use it**

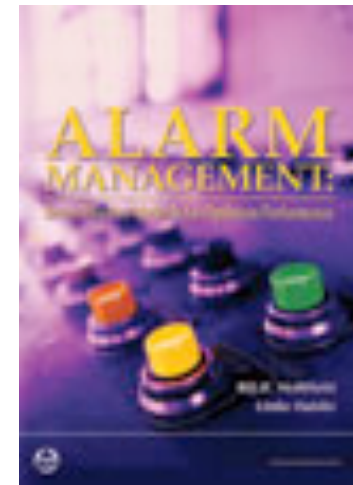
**This may be more important  
than the tools!**

# Best Ever Alarm System Tools, Indeed

.. but Tools are only half the issue

Good configuration requires plan & follow-up.

B. Hollifield, E. Habibi,  
"Alarm Management:  
Seven (??) Effective Methods  
for Optimum Performance", ISA, 2007



# Alarm Philosophy

## Goal:

### Help operators take correct actions

- Alarms with guidance, related displays
- Manageable alarm rate (<150/day)
- Operators will respond to every alarm  
(corollary to manageable rate)

# What's a valid alarm?

- **DOES IT REQUIRE IMMEDIATE OPERATOR ACTION?**
  - What action? Alarm guidance!
    - Not “make elog entry”, “tell next shift”, ...
    - Consider consequence of no action
- Is it the best alarm?
  - Would other subsystems, with better PVs, alarm at the same time?



# How are alarms added?

- **Alarm triggers: PVs on IOCs**
  - But more than just setting HIGH, HIHI, HSV, HHSV
  - HYST is good idea
  - Dynamic limits, enable based on machine state,...

**Requires thought, communication, documentation**

- **Added to alarm server with**
  - **Guidance: How to respond**
  - **Related screen: Reason for alarm (limits, ...), link to screens mentioned in guidance**
  - **Link to rationalization info (wiki)**

# Impact/Consequence Grid

Category	So What	Minor Consequence	Major Consequence
Personnel Safety		PPS independent from EPICS?	
Environment, Public		Can EPICS cause contained spill of mercury?	Uncontained spill??
Cost: <b>Beam Production, Downtime, Beam Quality</b>	No effect  Beam off < 1 sec?	<b>Beam off &lt;10 min</b>  <\$10000	<b>Beam off &gt;10min</b>  >\$10000

- **Mostly: How long will beam be off?**

## .. combined with Response Time

Time to Respond	Minor Consequence	Major Consequence
>30 Minutes	NO_ALARM	MINOR
10..30 minutes	MINOR	MAJOR
<10 minutes	MAJOR	MAJOR + Annunciate

– This part is still evolving...

# Example: Elevated Temp/Press/Res.Err./...

- Immediate action required?
    - Do something to prevent interlock trip
  - Impact, Consequence?
    - Beam off: Reset & OK, 5 minutes?
    - Cryo cold box trip: Off for a day?
  - Time to respond?
    - 10 minutes to prevent interlock?
- ↓
- **MINOR? MAJOR?**
  - Guidance: “Open Valve 47 a bit, ...”
  - Related Displays: Screen that shows Temp, Valve, ...

# “Safety System” Alarms

- **Protection Systems not per se high priority**
  - Action is required, but we’re safe for now, it won’t get worse if we wait
- **Pick One**
  - “Mommy, I need to gooo!”
  - “Mommy, I went”

(Does it require operator action?  
How much time is there?)

# Avoid Multiple Alarm Levels

- **Analog PVs for Temp/Press/Res.Err./....:**
  - Easy to set LOLO, LOW, HIGH, HIHI
- **Consider:**
  - Do they require *significantly different* operator actions?
  - Will there be a lot of time after the HIGH to react before a follow-up HIHI alarm?
- **In most cases, HIGH & HIHI only double the alarm traffic**
  - Set only HSV to generate single, early alarm
  - Adding HHSV alarm assuming that the first one is ignored only worsens the problem

# Bad Example: Old SNS 'MEBT' Alarms

- Each amplifier trip:  $\geq 3$  ~identical alarms, no guidance
- Rethought w/ subsystem engineer, IOC programmer and operators: 1 better alarm

#	Date	Type	Name	Severity	TEXT
1	2009-03-16 13:46:20.255	talk		MAJOR	MAJOR alarm: MEBBIT two power amplifier trip
2	2009-03-16 13:46:19.962	talk		MINOR	MINOR alarm: MEBBIT two power amplifier trip
3	2009-03-16 13:45:56.241	talk		MAJOR	MAJOR alarm: S C L 18 modulator in standby
4	2009-03-16 13:45:25.963	talk		MAJOR	MAJOR alarm: MEBBIT two power amplifier trip
5	2009-03-16 13:45:25.891	talk		MINOR	MINOR alarm: MEBBIT two power amplifier trip
6	2009-03-16 13:45:25.884	talk		MAJOR	MAJOR alarm: MEBBIT two power amplifier trip
7	2009-03-16 13:23:09.202	talk		MINOR	MINOR alarm: DTL 3 RCCS CV one valve open limit is exceeded

MEBT_RF:Bnch02:V_Plt_PA	MEBBIT two power amplifier trip
MEBT_RF:Bnch02:V_Fil_PA	MEBBIT two power amplifier trip
MEBT_RF:Bnch02:I_Plt_PA	MEBBIT two power amplifier trip

ky9 Preferences

AlarmHandling/ HPRF\_PA\_Alarm

FrontPage » AlarmHandling/RFQVacAlarm » AlarmHandling » AlarmHandling/Alarms » HPRF\_PA\_Alarm

Alarm PV: MEBT\_RF:Bnch\*:V\_Plt\_PA

**Purpose of Alarm**

Indicates MEBT high power RF amplifier problem: Plate voltage dropped, so amplifier won't be able to provide sufficient RF to cavity.

**Operator Guidance**

- Verify that the plate voltage is indeed off.
- Turn OFF the plate voltage through EPICS.
- At the amplifier, observe the fuses to determine which phase/phases blew.
- Change all three fuses according to procedure.
- Turn on plate voltage.
- Ramp up RF power slowly.
- After two fuse changes, call for RF support.

**Failure Consequence**

Minor Consequence: Beam will be off while MEBT is off, but recovery is usually quick as soon as for example the fuses are replaced.

**Operator Response Time Available**

The sooner operators respond, the sooner beam is back up. Since this might require calling RF personnel, the sooner they're called, the better.

**Contacts**

Mark Middendorf, Mike Clemmer for MEBT RF,  
Alan Justice for IOC.

Alarm Table PV Fields Viewer

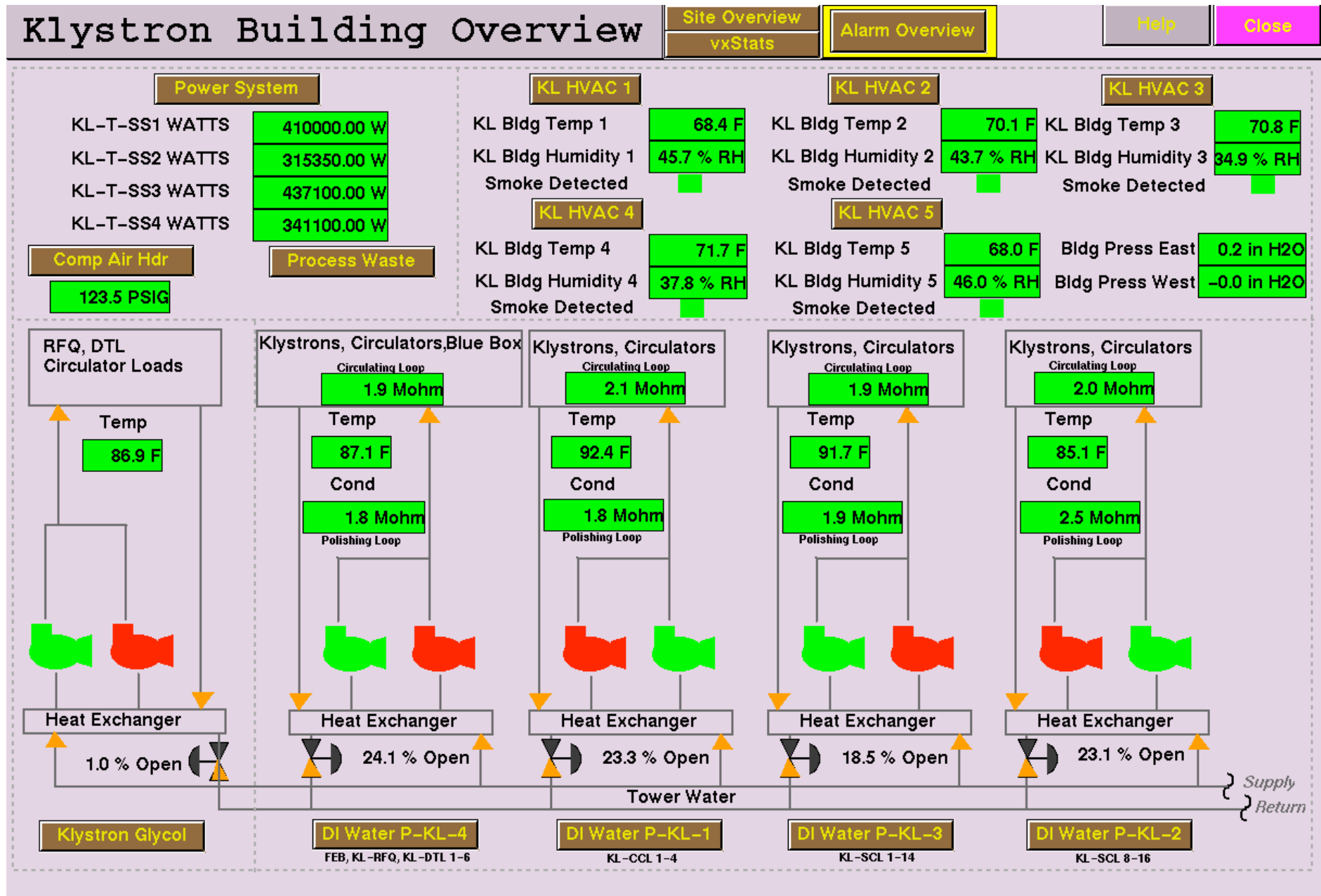
PV Name: MEBT\_RF:Bnch02:V\_Plt\_PA

Record Type: ai IOC Name: fe-ctl-ioc2

Boot Date: 2009-1-23.10.40.6.0 Boot File: mebt/R2-2-1/db/rfq-mebt.db

Field	DBD Type	Value in File	Live Value
VAL			
LINR	DBF_MENU	LINEAR	LINEAR
HSV	DBF_MENU	MINOR	MINOR
HHSV	DBF_MENU	MAJOR	MAJOR
MDEL	DBF_DOUBLE	0.005	0.00
INP	DBF_INLINK	@0xe 1 3 6	@0xe 1 3 6
EGU	DBF_STRING	kV	kV
LOLO	DBF_DOUBLE	6.5	5.00
LSV	DBF_MENU	MINOR	MINOR
PREC	DBF_SHORT	2	2
LOPR	DBF_DOUBLE	0.0	0.00
DESC	DBF_STRING	PA Plate V	PA Plate V
SCAN	DBF_MENU	I/O Intr	I/O Intr
DTYP	DBF_DEVICE	Group3 C	Group3 C
HOPR	DBF_DOUBLE	10.0	10.00
EGUL	DBF_DOUBLE	-10.75	-10.75
LOW	DBF_DOUBLE	6.8	5.20
LLSV	DBF_MENU	MAJOR	MAJOR
EGUF	DBF_DOUBLE	10.75	10.75
HIHI	DBF_DOUBLE	7.5	7.50
HIGH	DBF_DOUBLE	7.2	7.20

# Alarms for Redundant Pumps

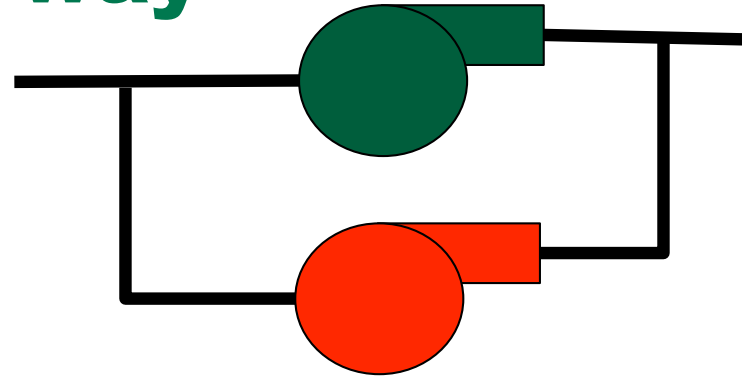




# Alarm Generation: Redundant Pumps the wrong way

- **Control System**

- Pump1 on/off status
- Pump2 on/off status



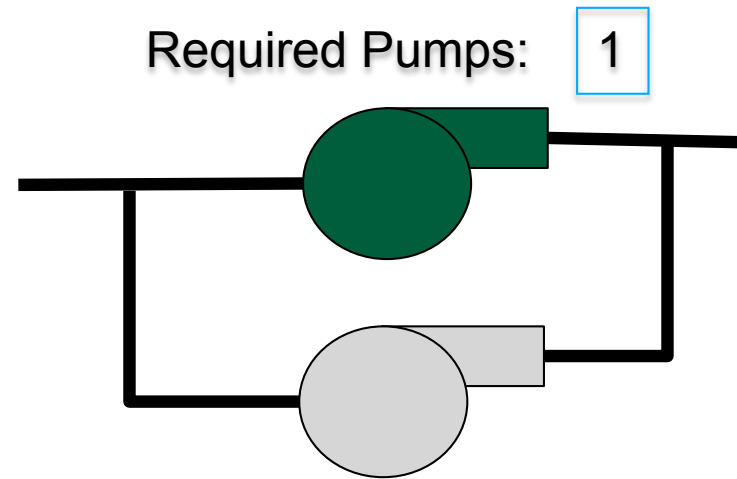
- **Simple Config setting: Pump Off => Alarm:**

- It's normal for the 'backup' to be off
- Both running is usually bad as well
  - Except during tests or switchover
- During maintenance, both can be off

# Redundant Pumps

- **Control System**

- Pump1 on/off status
- Pump2 on/off status
- Number of running pumps
- Configurable number of desired pumps

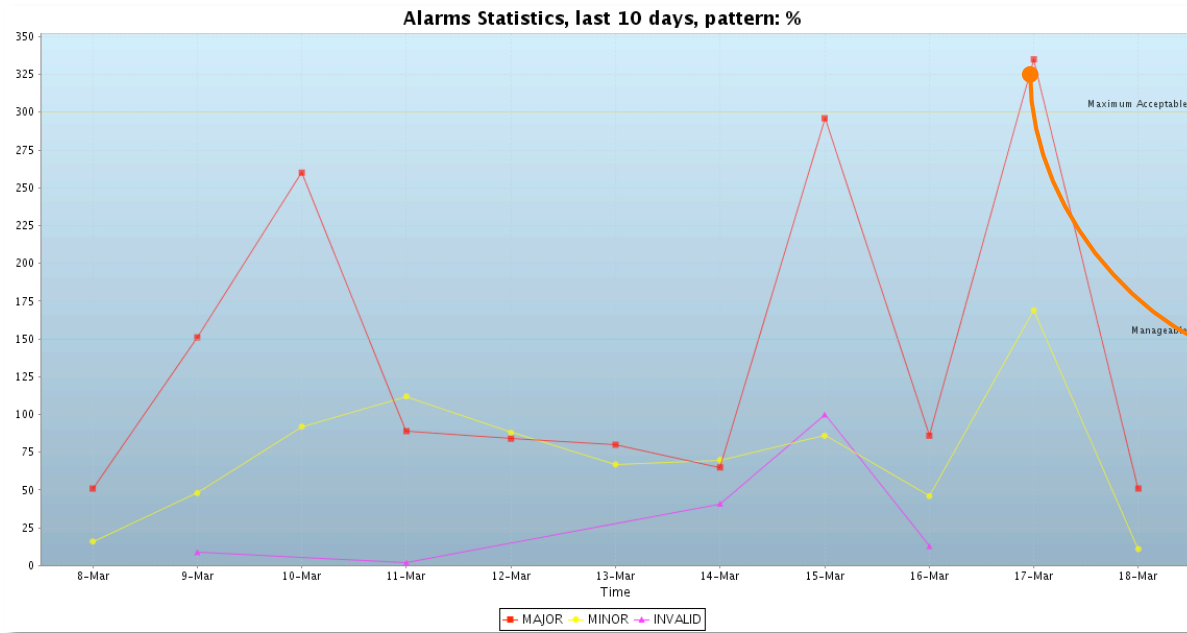


- **Alarm System: Running == Desired?**

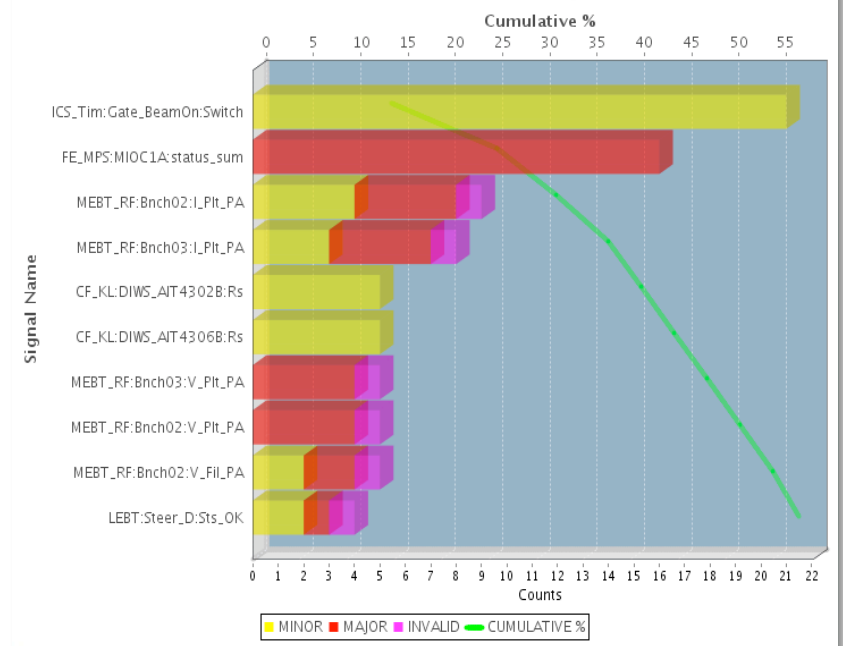
- ... with delay to handle tests, switchover

- **Same applies to devices that are only needed on-demand**

# Weekly Review: How Many? Top 10?



Pattern: %, 17-Mar-2009 00:00 for 0 days 24 hours (-)

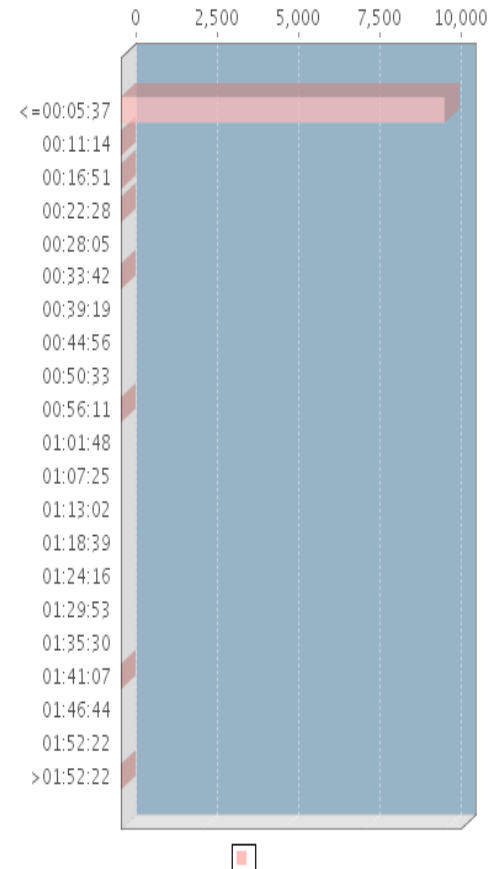


# A lot of information available

- How often did PV trigger?
- For how long?
- When?
- Temporary issue?  
Or need HYST,  
alarm delay,  
fix to hardware?

## Statistics based on CURRENT SEVERITY:

Alarms duration frequency (hh:mm:ss)



Within selected time period:

at start: OK

at end: OK

Total alarms: 9967

Total time in alarmed state: 23:04:59

Severity counts:

MAJOR: 9967

MINOR: 0

INVALID: 0

ERROR: 0

Alarm durations (hh:mm:ss):

Minimum: 00:00:00 (less than 1 sec)

Maximum: 06:29:55

Average: 00:56:11

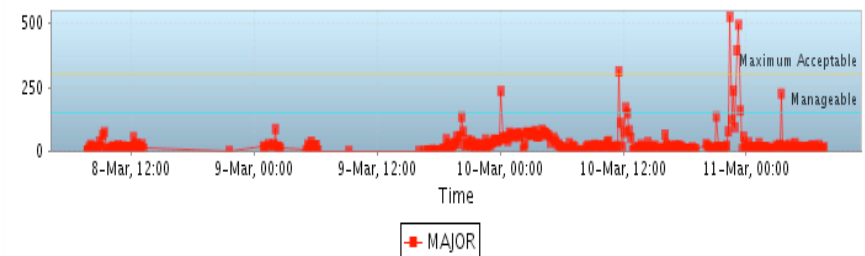
Most frequent: 00:00:00 (less than 1 sec)

Extreme durations:

Less than 1 sec: 5505

More than 12 hours: 0

Alarms on time line (10 min slices)



# Weekly Check: Stale, Forgotten?

## Alarms Active 24.0 h or more

#	PV Name	Description	Path	Alarm Time	...Duration [HH:MM:SS]	Severity	Alarm Message	Current Severity
1	MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage fault	/Annunciator/MEBT	2009-03-16 13:17:35	42:58:57	MAJOR_ACK	LOLO_ALARM	MAJOR
2	MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault	/Annunciator/MEBT	2009-03-16 13:17:35	42:58:57	MAJOR_ACK	LOLO_ALARM	MAJOR
3	HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	/Annunciator/HEBT/HEBT_Cooling	2009-03-14 20:22:50	83:53:42	INVALID_ACK	READ_ALARM	MAJOR
4	TMod:Summary_MPS:Alarm	Moderator System MPS Trip	/Annunciator/Target/CMS	2009-02-07 09:25:09	934:51:23	INVALID_ACK	READ_ALARM	INVALID

## List of disabled alarms matching '%'

#	PV Name	Path	Description	Guidance	Displays	Commands	Latching	Annunciating	Alarm Delay	Chatter Threshold	Config Time
1	<a href="#">FE MPS:MIOC1A:status_sum</a>	/Annunciator/BeamPermit	MPS Beam permit	2	2	0	no	yes	10 sec	5	2009-04-02 14:14:27
2	<a href="#">ICS Tim:Gate_BeamOn:Switch</a>	/Annunciator/BeamPermit	Beam awf	1	1	2	no	yes	5 sec	0	2009-04-02 14:14:35
3	<a href="#">CF KL:DIWS_AIT4303B:Rs</a>	/Annunciator/CF/Klystron_Gallery_Temp	Check polishing loop resistivity for KL2	1	2	0	yes	yes	5 sec	0	2009-03-20 16:27:03
4	<a href="#">HEBT_Coll:PT3:P</a>	/Annunciator/HEBT/HEBT_Cooling	Hebbit momentum dump inlet cooling water pressure alarm	1	3	0	yes	yes	0 sec	0	2009-03-23 14:48:56
5	<a href="#">HEBT_Coll:PT4:P</a>	/Annunciator/HEBT/HEBT_Cooling	Hebbit momentum dump cooling water outlet flow alarm	1	3	0	yes	yes	0 sec	0	2009-03-23 14:51:21
6	<a href="#">CF RN:DIWS_AIT4601A:Rs</a>	/Annunciator/Ring/Ring_Cooling	Hebbit Ring RTBT magnets DI water circulating loop conductivity alarm	2	3	0	yes	yes	0 sec	0	2009-03-23 15:47:49
7	<a href="#">TGT He:IOC1:TI_6501_ALM:HiHi Alarm</a>	/Annunciator/Target/CMS	CMS Helium Temp Hi Hi	1	1	0	yes	no	0 sec	0	2009-03-25 12:15:37
8	<a href="#">TGT He:IOC1:TI_6501_ALM:Hi Alarm</a>	/Annunciator/Target/CMS	CMS Helium Temp Hi	1	1	0	yes	no	0 sec	0	2009-03-25 12:16:08

# Summary

- **BEAST operational since Feb'09**
  - Needs a logo
  - For now without BEAUtY
  - DESY AMS is similar and has been operational for longer
- **Pick either, but good configuration requires work in any case**
  - Started with previous “annunciated” alarms
    - ~300, no guidance, no related displays
    - Now ~330, all with guidance, rel. displays
  - “Philosophy” helps decide what gets added and how
    - Immediate Operator Action? Consequence? Response Time?
  - Weekly review spots troubles and tries to improve configuration

