Best Ever Alarm System Toolkit

Kay Kasemir,

Xihui Chen,

Katia Danilova,

SNS/ORNL

kasemirk@ornl.gov

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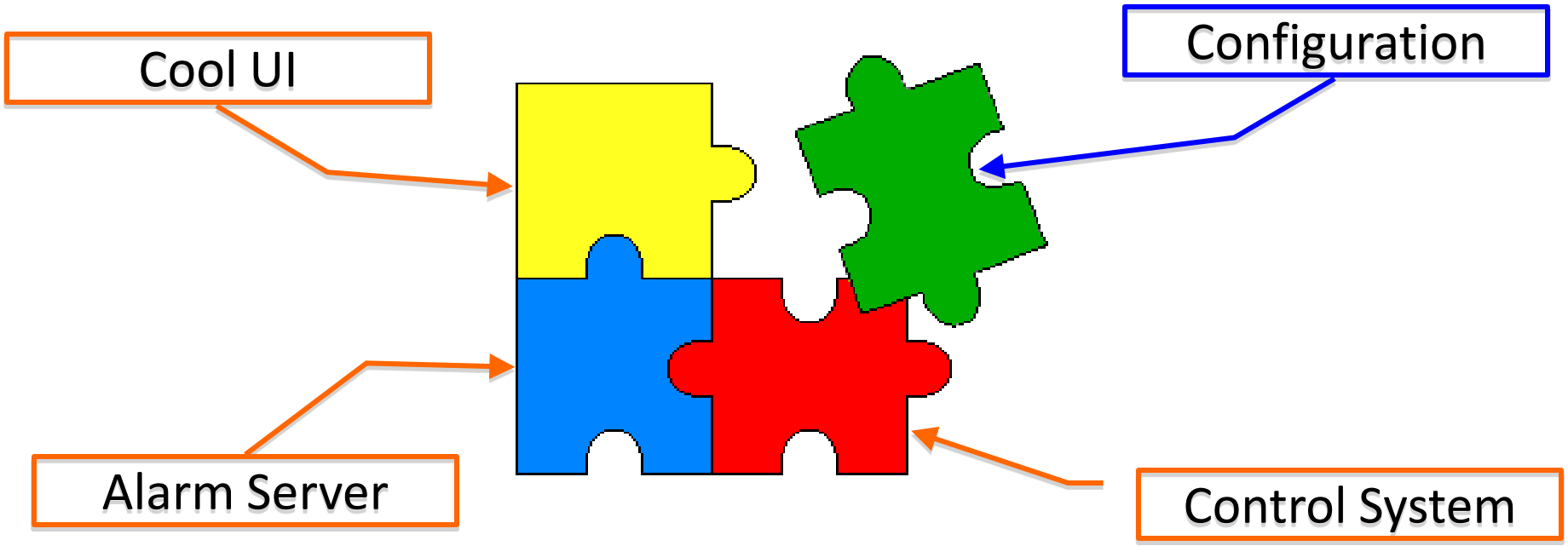
Alarm System Components

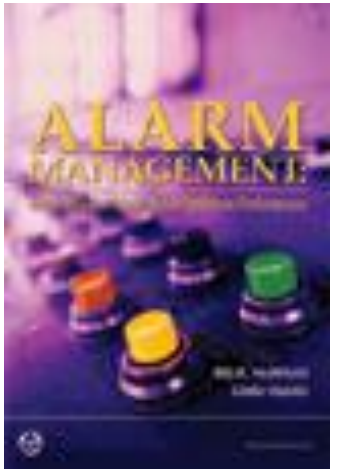


This talk: Alarm System Technology

See also:

”Alarms Philosophy”, Karen White (this conference)

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



Previous Attempts at SNS, Inspiration

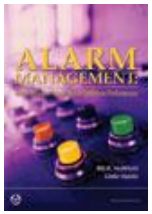
EPICS "ALH", Generated soft-IOCs and EDM screens

- Old technology
- Static UI layout
- N clicks to see (some of the) active alarms
- Configuration changes were hard (so config. was left in bad shape)

DESY Alarm System

Matthias Clausen, "Alarm Management System", PCaPAC, Oct 2008, Slovenia and "Managing Alarms ... the CSS Way", this conference

- ✓ Modern technology, linked into Control System Studio
- Different infrastructure: LDAP vs. RDB
- How does a PV turn into an alarm?



Ideas from "Alarm Management: ..." book

- Need multiple views of alarms
- Alarms must have guidance, links to related displays
- Need tools to monitor alarm rate, stale alarms, ... to continually improve configuration

New End-User View: Alarm Table

Acknowledge one or multiple alarms

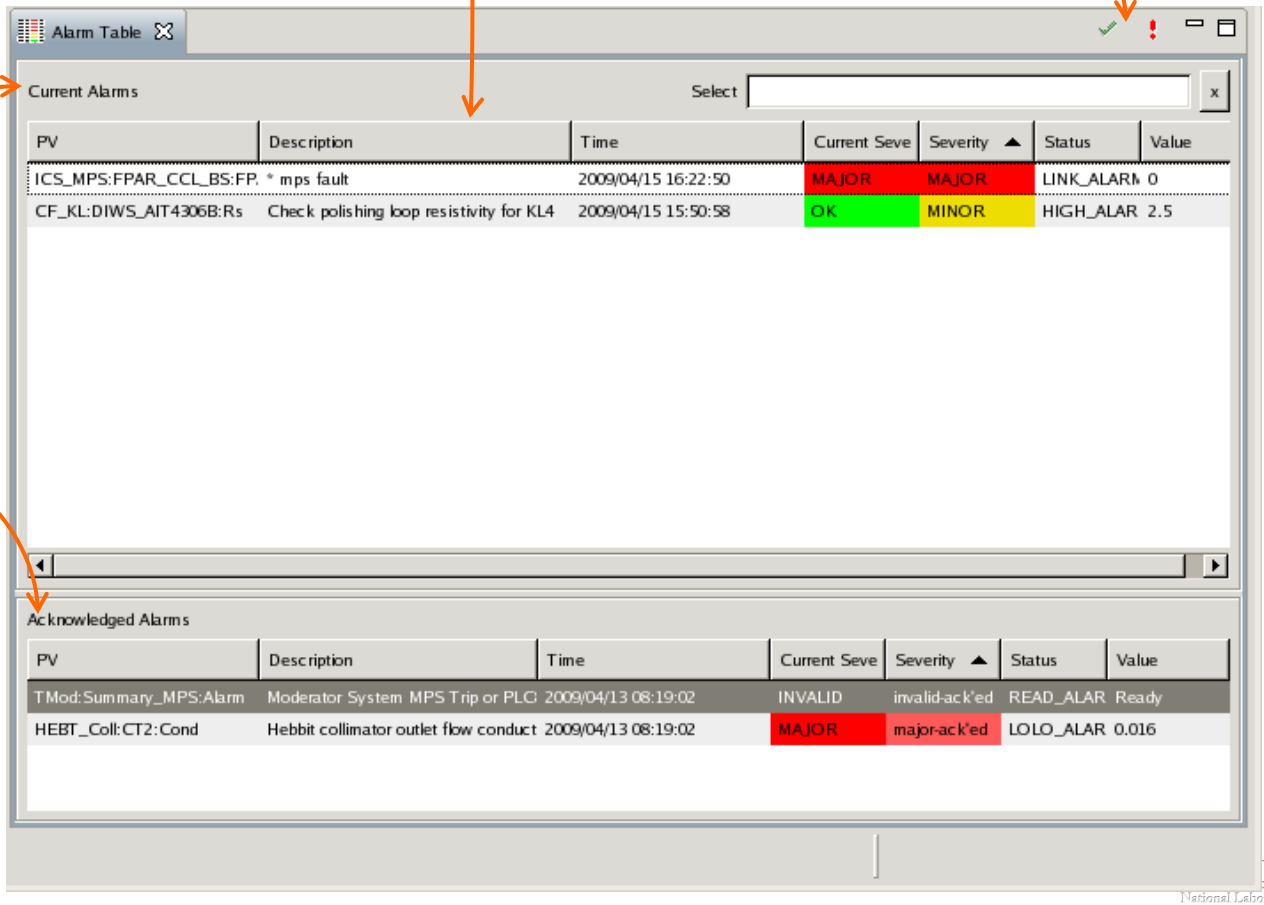
- Select by PV or description
- BNL/RHIC type un-ack'

Sort by column

All current alarms

- active
- ack'ed

Optional: Voice Annunciation



Another View: Alarm Tree

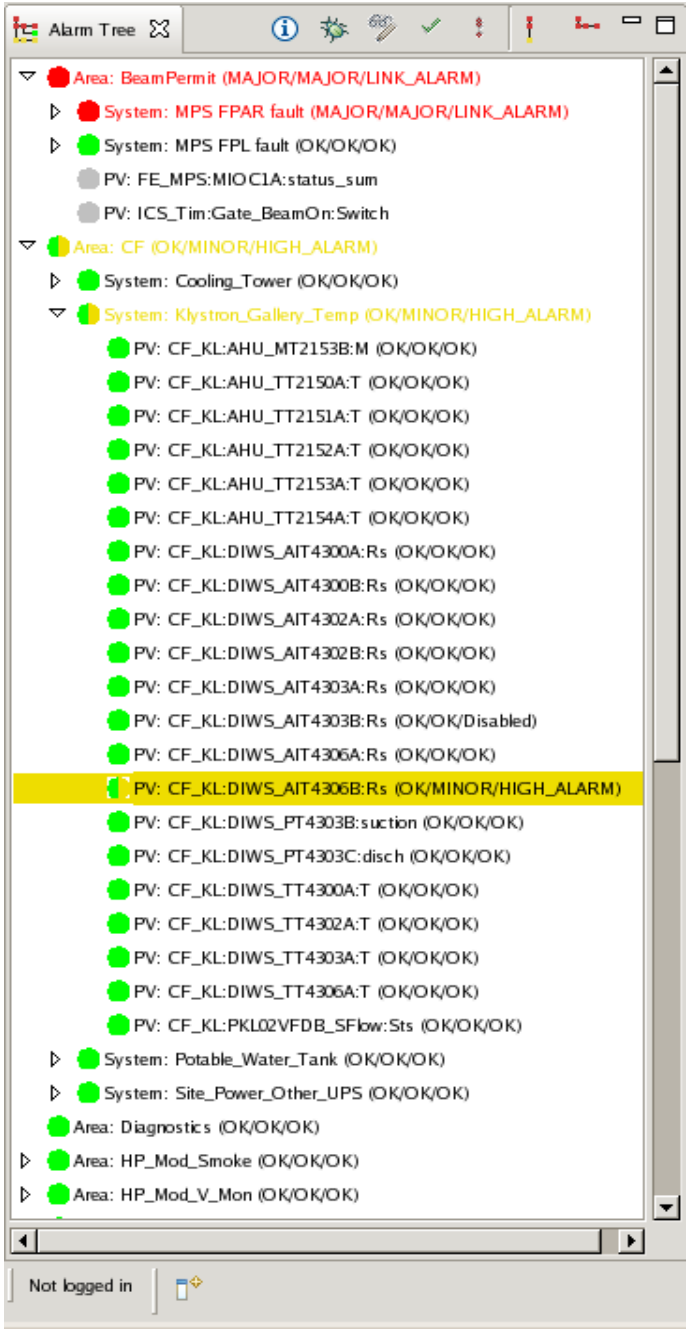
See complete configuration

- Active, ack'ed, inactive, disabled

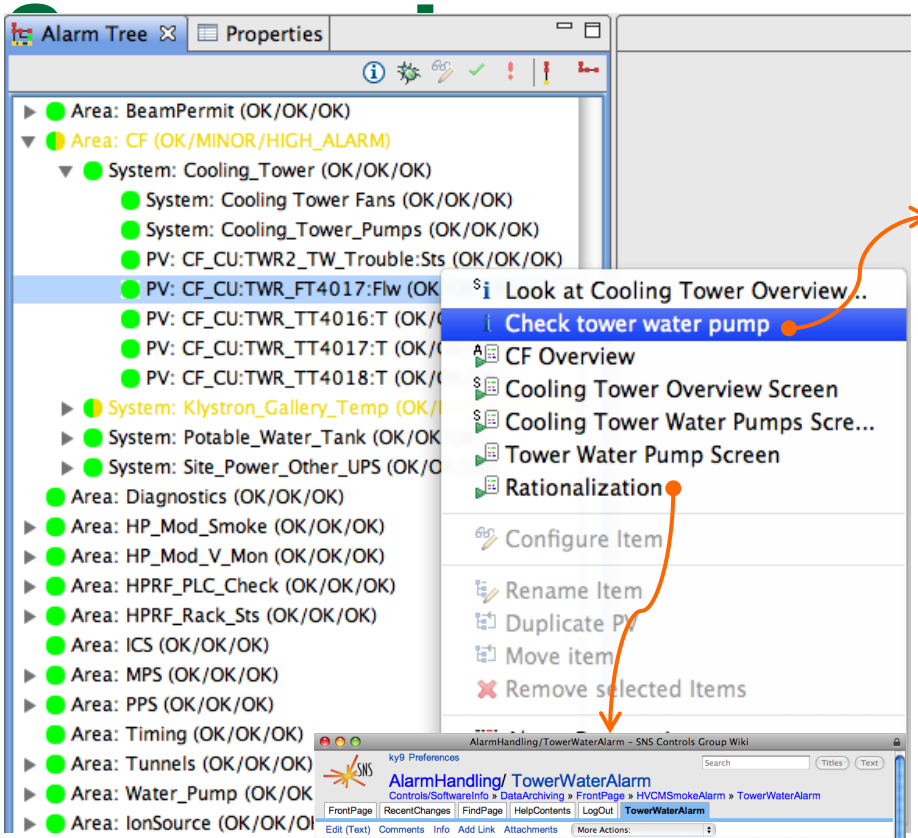
Hierarchical

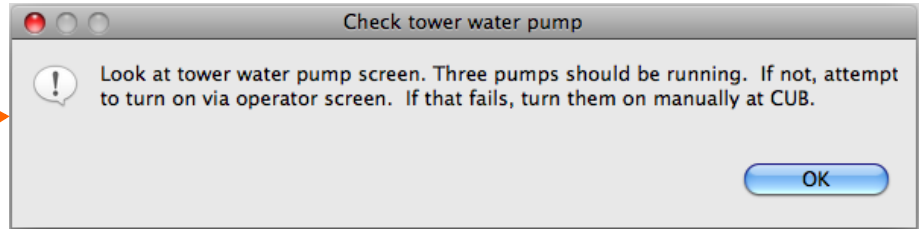
- Optionally only show active alarms
- Ack'/Un-ack' PVs or sub-tree

Users choose to display table and/or tree



Guidance, Related Displays





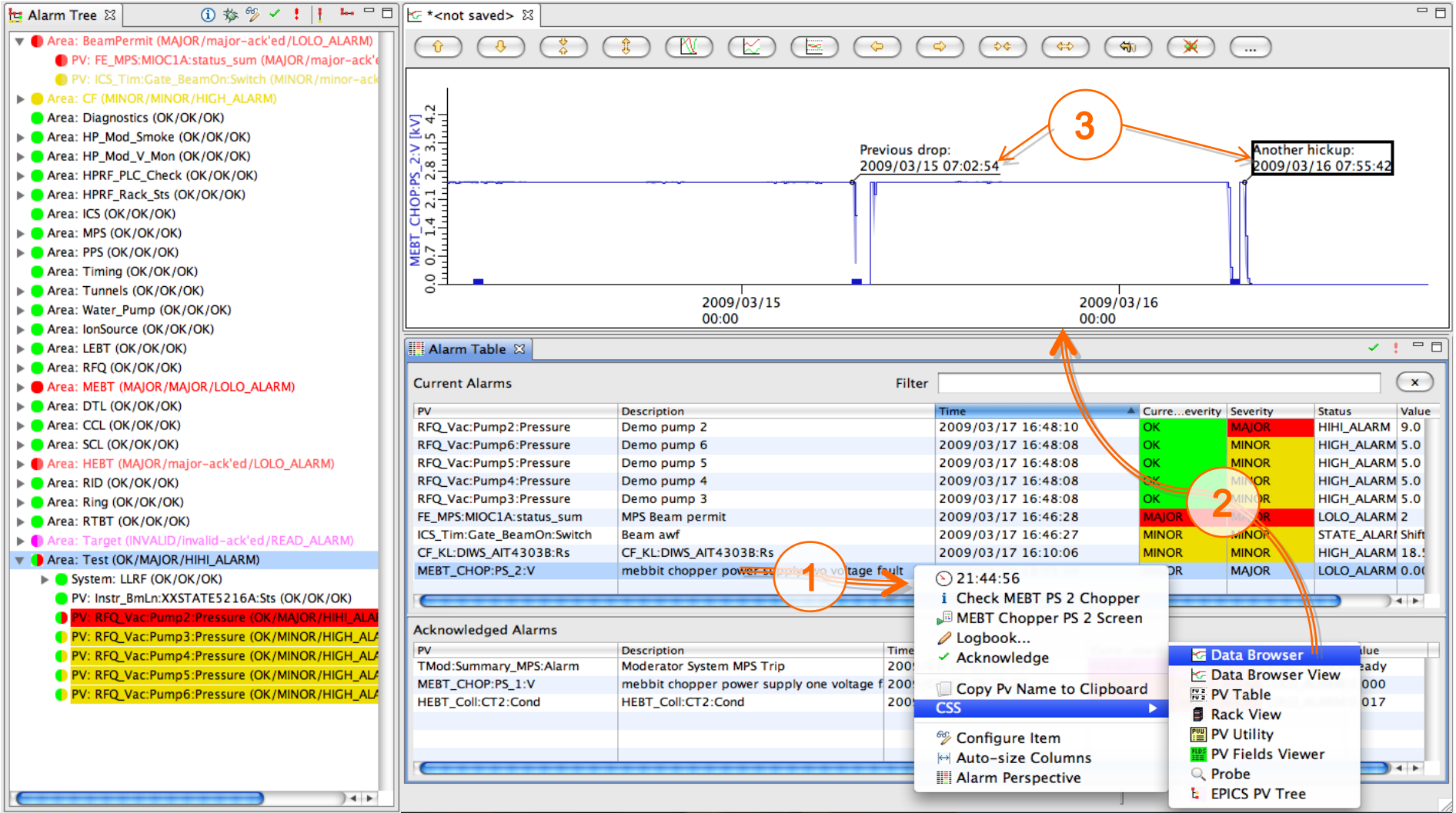
- ☑ View Guidance Texts
- ☑ Start related displays (EDM)
- ☑ Open Web pages
- ☑ Run ext. commands

Hierarchical:

- Including info of parent entries
- Merges Guidance etc. from all selected alarms

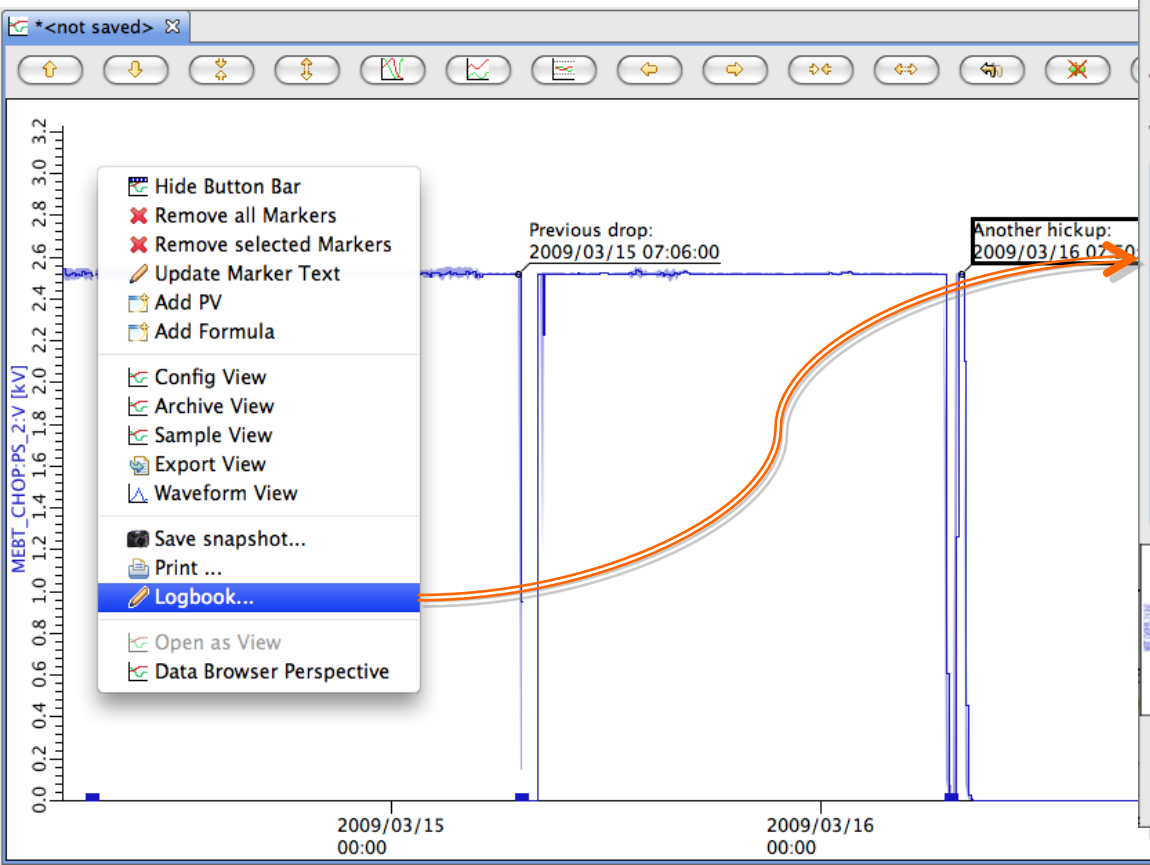
CSS Integration: Alarm → Data Browser

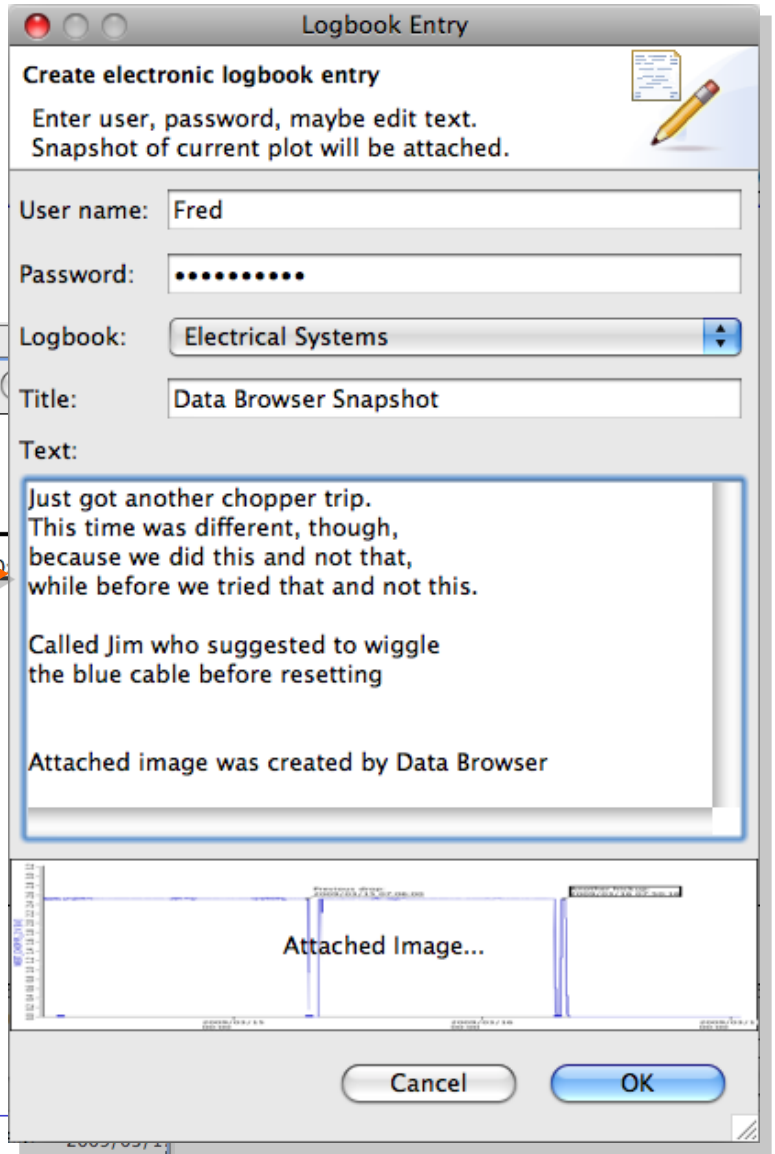
1. Context menu: Alarm Duration, Guidance, Displays, …
2. Select Data Browser for PV in alarm
3. View history, annotate



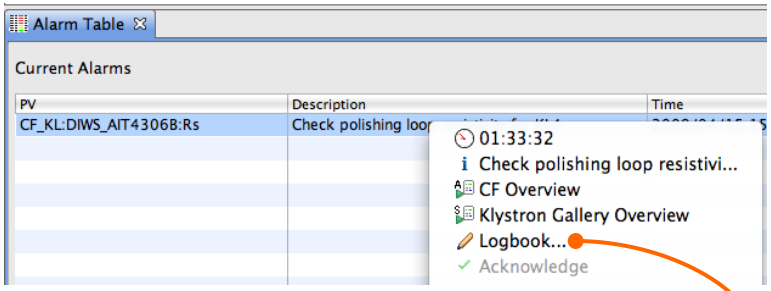
Data Browser → Electronic Logbook

After inspecting alarm PV's history, post commented plot to E-Log

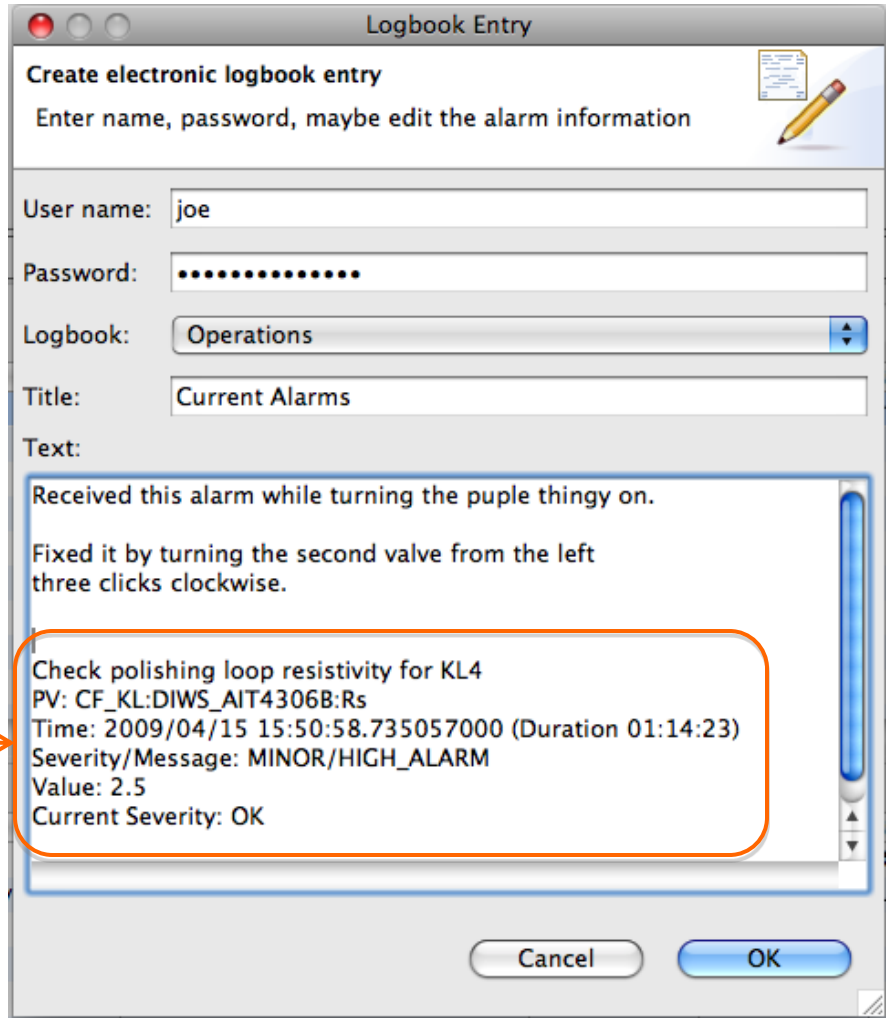




Directly from Alarm to E-Log



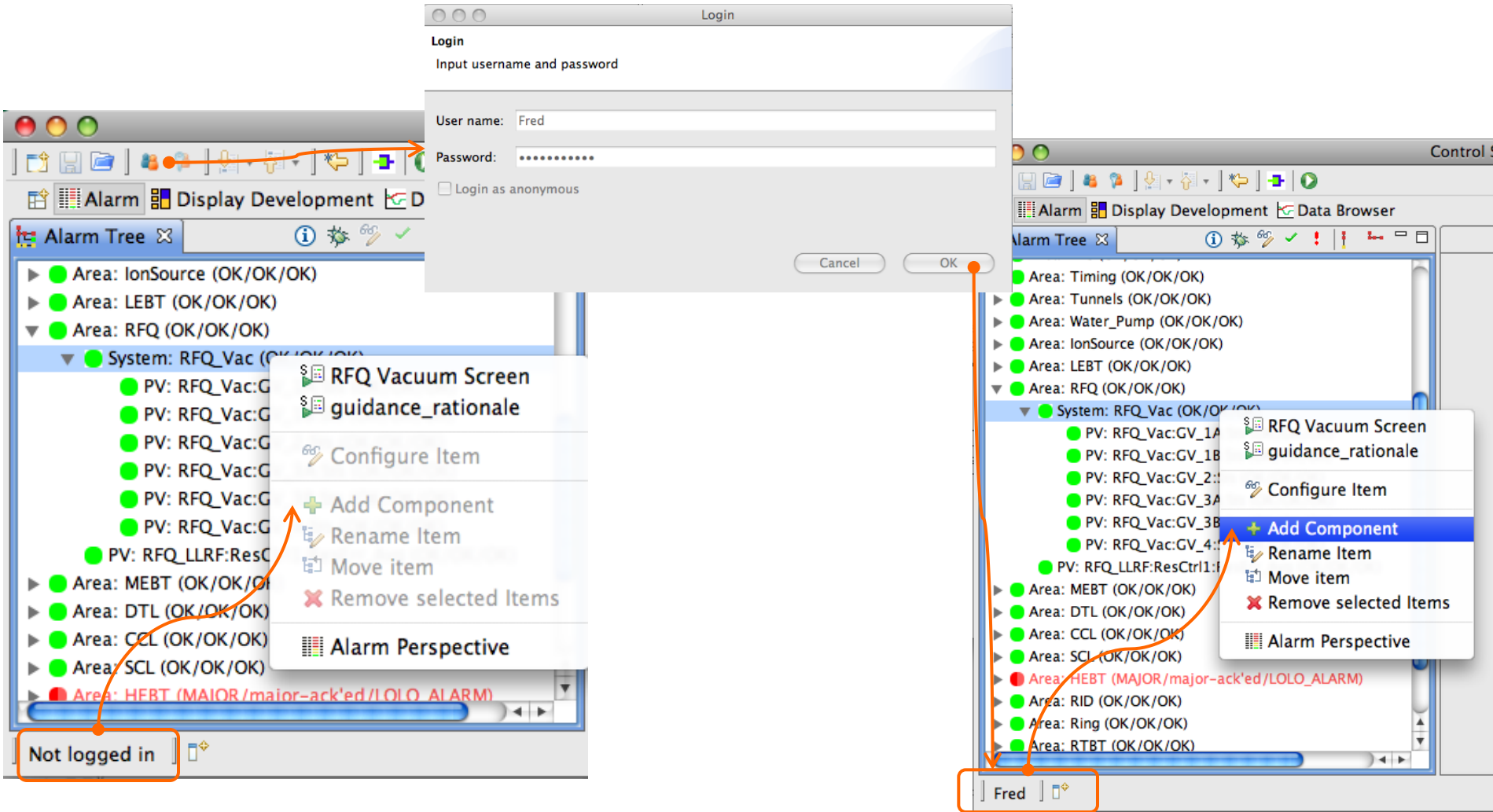
- "Logbook" from context menu creates text w/ basic info about selected alarms. Edit, submit.



Online Configuration Changes

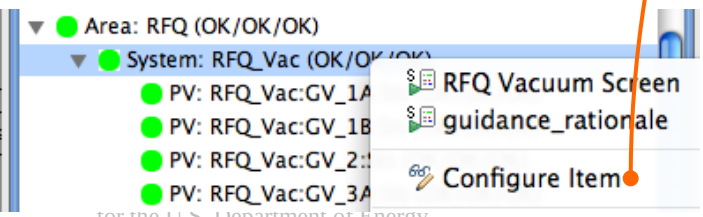
.. may require Authentication/Authorization (LDAP)

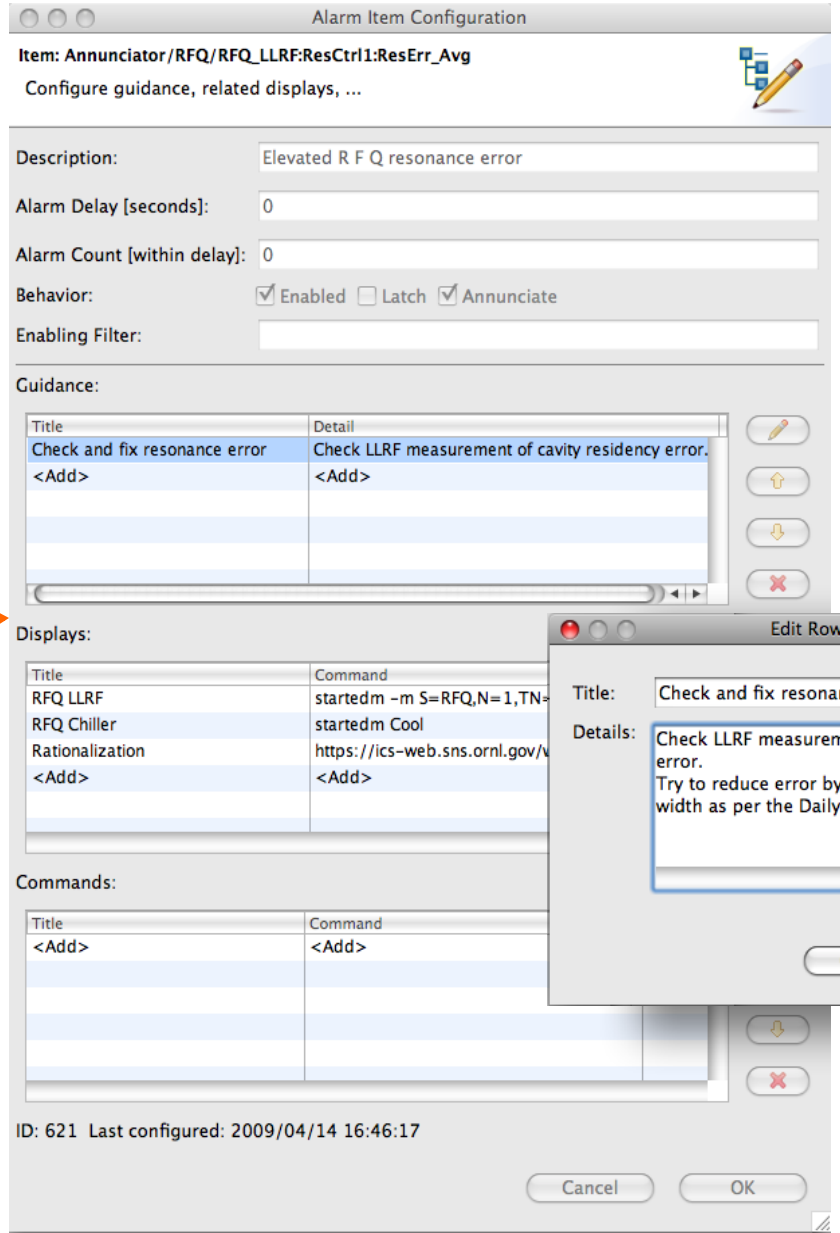
☑Log in/out while CSS is running



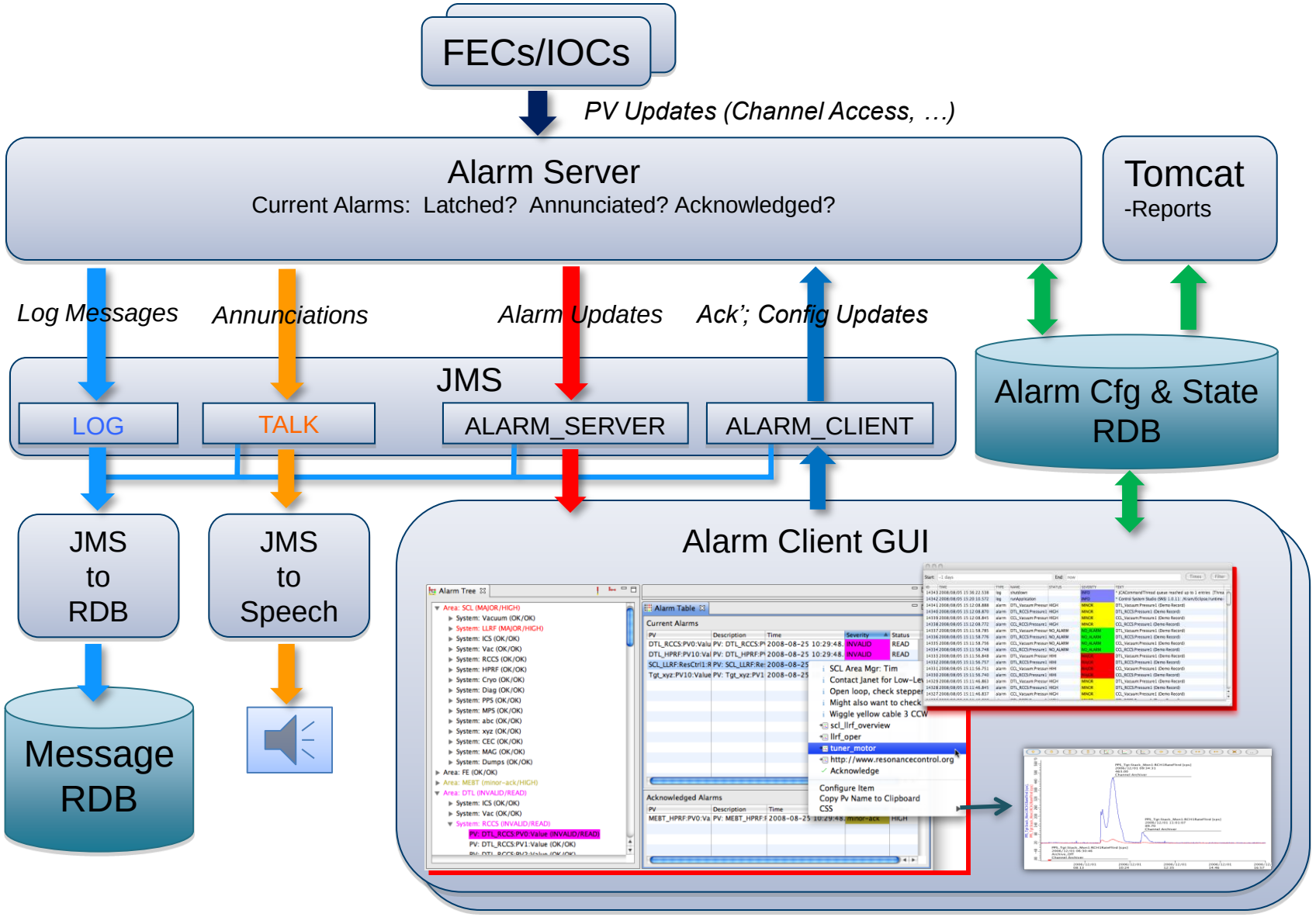
Configure PV

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





Technical View

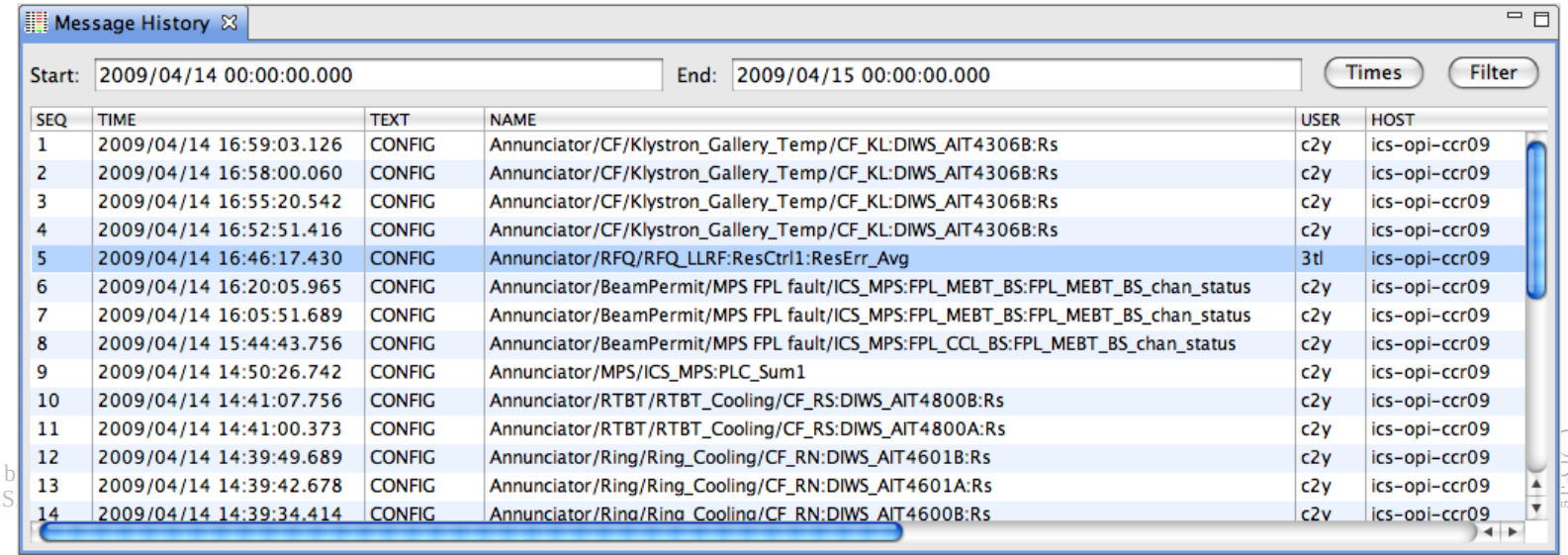


Alarm Server Options

- Latch highest severity, require acknowledgement?
- Annunciate?
- Chatter filter
  - Alarm only if severity persists some minimum time
  - .. or alarm happens >=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
- "Maintenance Mode": Invalid PVs don't annunciate, automatically acknowledged

Logging

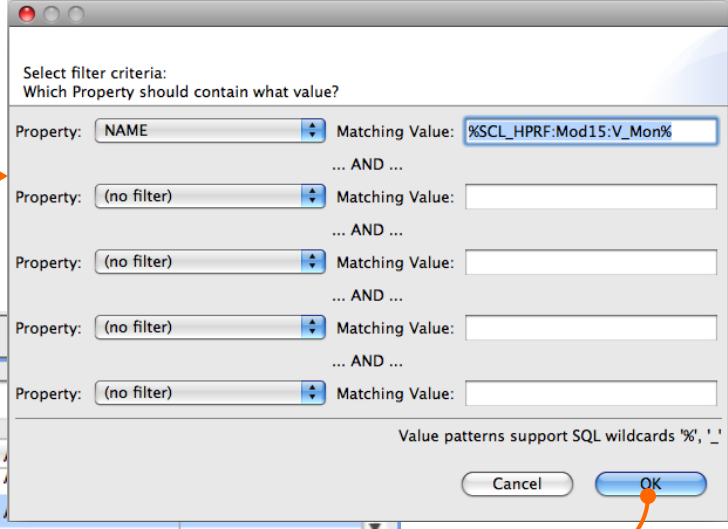
- ..into generic CSS log also used for error/warn/info/debug messages
- Alarm Server: State transitions, Annunciations
- Alarm GUI: Ack/Un-Ack requests, Config changes
- Generic Message History Viewer
  - Example w/ Filter on TEXT=CONFIG

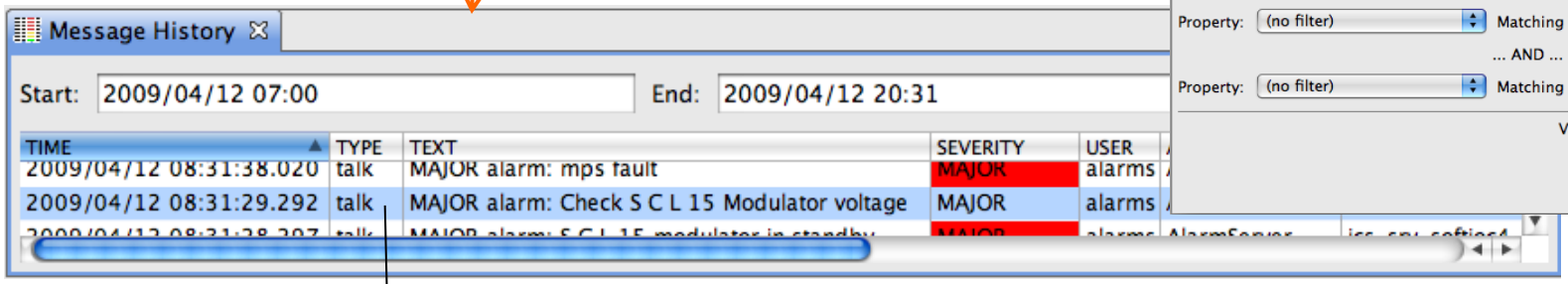


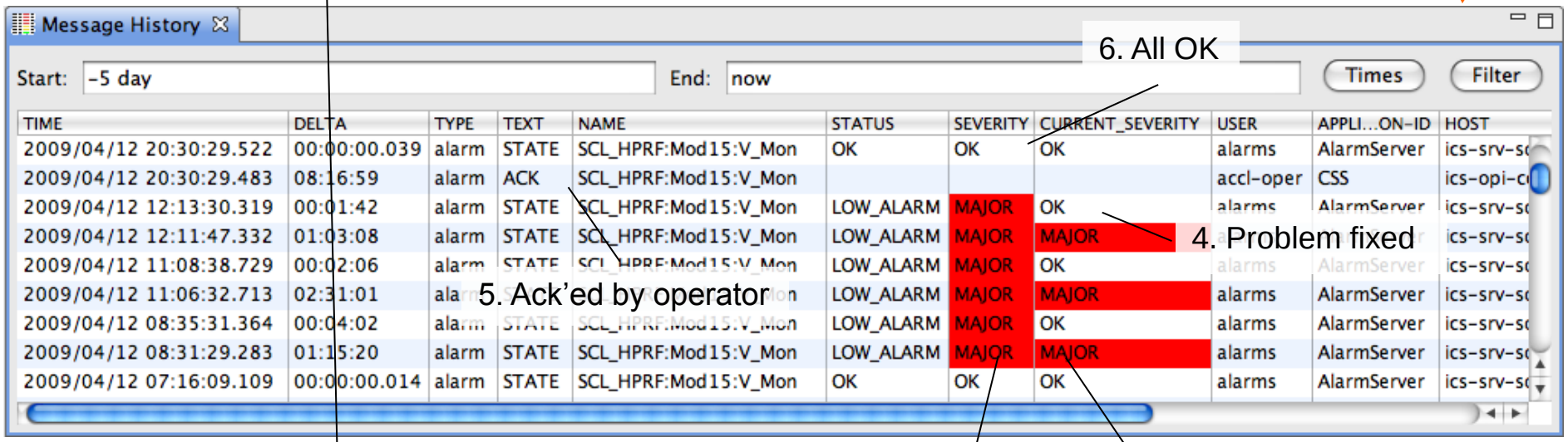
SEQ	TIME	TEXT	NAME	USER	HOST
1	2009/04/14 16:59:03.126	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
2	2009/04/14 16:58:00.060	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	c2y	ics-opi-ccr09
3	2009/04/14 16:55:20.542	CONFIG	Annunciator/CF/Klystron_Gallery_Temp/CF_KL:DIWS_AIT4306B:Rs	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_LLRF: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

Filter on TYPE, PV







6. All OK

4. Problem fixed

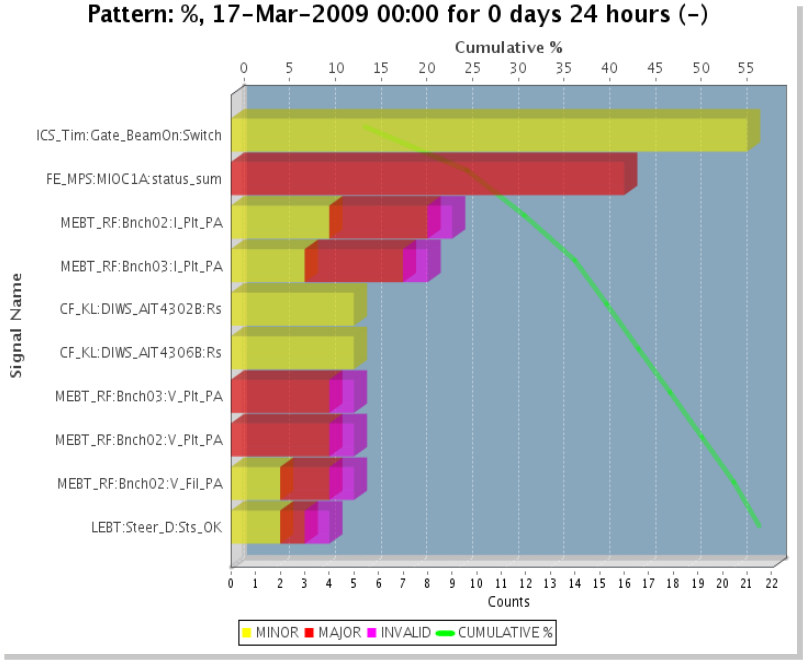
5. Ack'ed by operator

3. Alarm Server annunciates

2. Alarm Server latches alarm

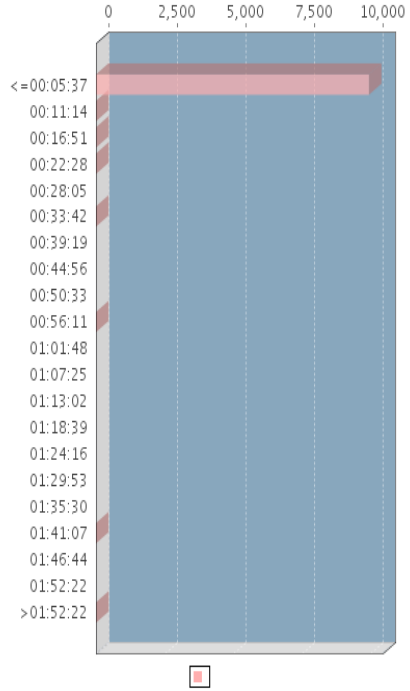
1. PV triggers, clears, triggers again

Numerous Web Reports



Statistics based on CURRENT SEVERITY:

Alarms duration frequency (hh:mm:ss)



Within selected time period:
at start: OK
at end: OK

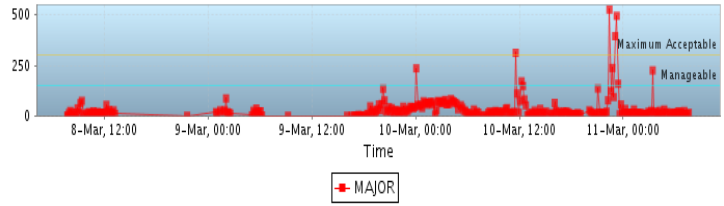
Total alarms: 9967
Total time in alarmed state: 23:04:59

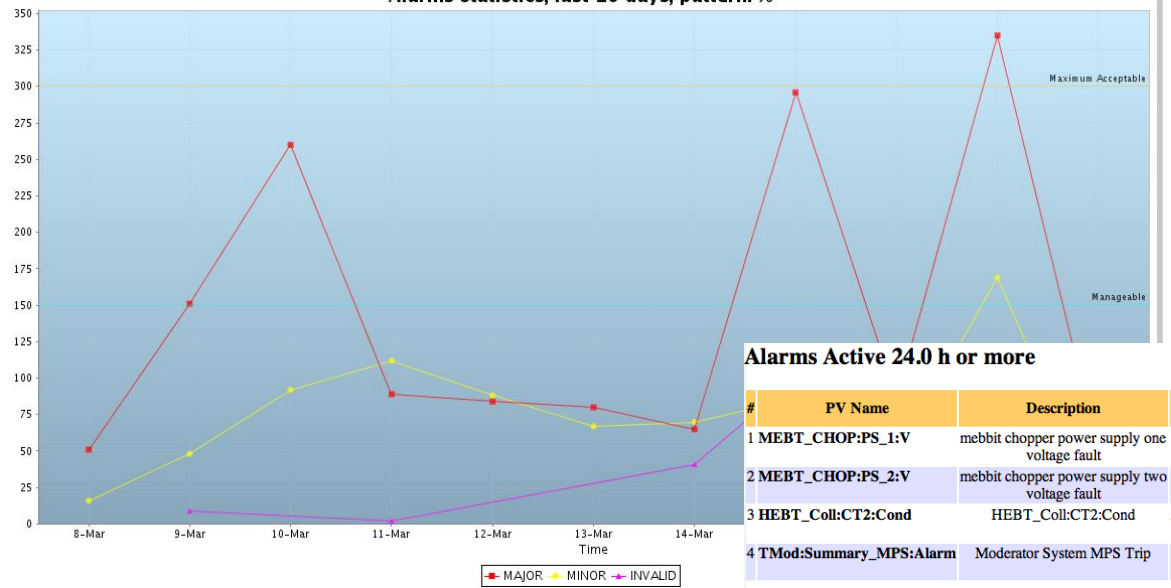
Severity counts:
MAJOR: 9967
MINOR: 0
INVALID: 0
ERROR: 0

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)





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

Summary

- Tools won't produce a good configuration, but help to improve it
  - Most frequent alarms?
  - Alarm 'noise'?
- BEAST operational at SNS since Feb'09
  - Started with previous ALH setup
    - ~300, no guidance, no related displays
    - Now ~400, all with guidance, rel. displays, links to operational procedures
  - Alarm Server stable through IOC reboots, online configuration changes, Oracle updates
- Alarm GUI is 'best ever' for SNS