

Phoebus Alarm System: Alarm Server

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Alarm System

Alarm Server

- Monitor PVs
- Track alarms, acknowledgement

Alarm UI

- Configure (add PVs, guidance, links to displays)
- Show current state
- Acknowledge alarms
- Open guidance, related displays, email, log, ..

The screenshot displays the Alarm System interface with three main panels:

- Alarm Area Panel:** A grid of buttons representing different areas, color-coded by status (green for normal, red for major/high alarm, pink for invalid).
- Alarm Tree:** A hierarchical tree view of the alarm system structure.
- Alarm Table [CCR]:** A table showing current and acknowledged alarms.

Alarm Table [CCR] - Current Alarms (2)

PV	Description	Alarm Time	Current Severi	Current Status
ICS_Opr:RFQ:VacuumAlarm	Attention. R F Q vacuum alarm	2018-05-30 08:45:40	OK	NO_ALARM
CF_RN:DIWS_AIT4601B:Rs	Hebbit Ring RTBT Magnets DI water polishing loop	2018-05-30 03:28:11	MAJOR	HIGH_ALARM

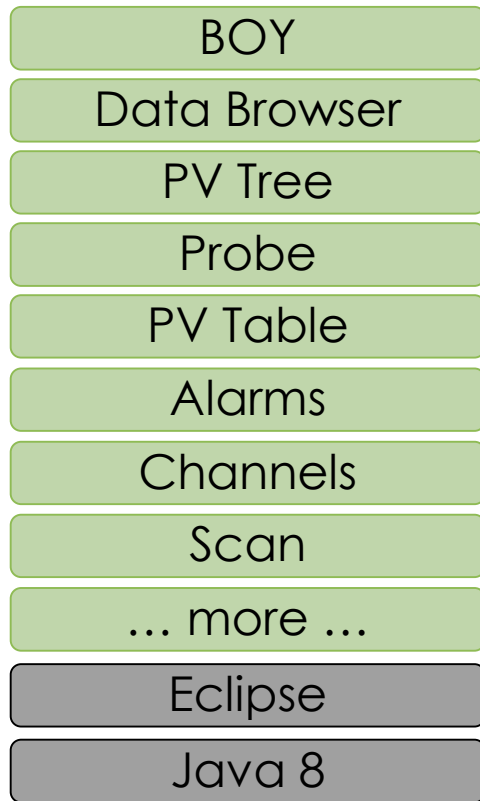
Alarm Table [CCR] - Acknowledged Alarms (13)

PV	Description	Alarm Time	Current Severi	Current Status
Test_LLRF:Cav_RFQ1:OK	Process Variable	2018-05-17 01:59:54	MAJOR	STATE_ALARM
Test_HPRF:Xmtr101:RP_Flt	BTF rf transmitter fault	2018-05-25 10:24:11	MAJOR	STATE_ALARM
Test_HPRF:PPSwitch_RFQ:Sum	Attention. Attention. BTF RFQ PPS is inhibited	2018-05-23 15:36:30	MAJOR	HIHI_ALARM
SpRFQ_Cool:TestStand:WaterLea	Attention. B T F Water Leak Alarm	2018-05-29 12:13:48	INVALID	READ_ALARM

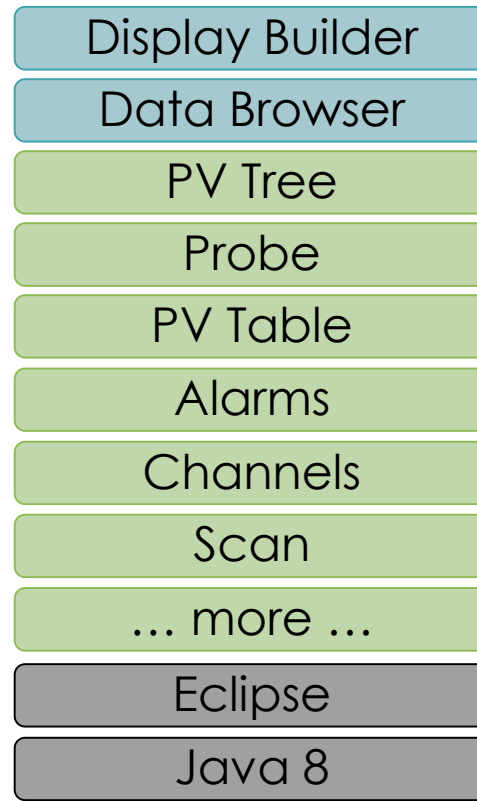
A context menu is open over the 'Hebbit Ring RTBT Magnets DI water polishing loop' alarm, showing options such as 'Check Ring DI Water Cooling Lo...', 'Contact water group personnel', 'Cooling Overview Screen', 'rationale_guidance', 'HEBT/Ring/RTBT Magnets DI Wate...', 'Copy to clip-board', 'Acknowledge', 'Configure Item', 'Disable Alarms', 'Alarm Perspective', and 'Create Log Entry'.

June 2018: Port to Phoebus

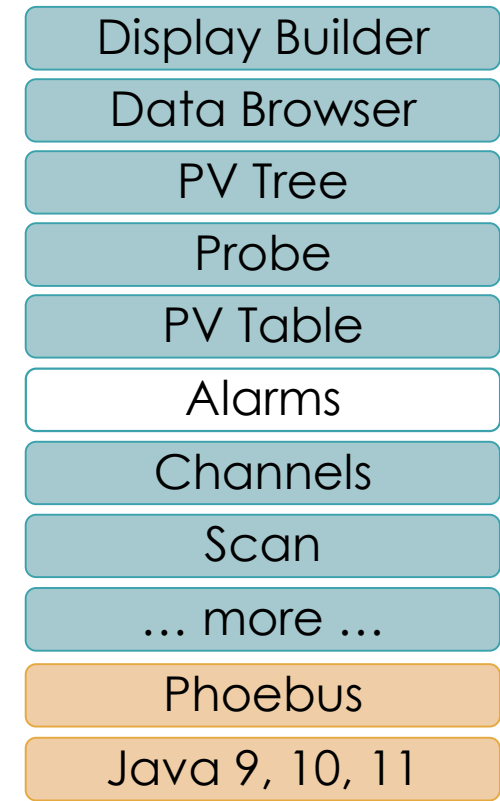
JavaFX SWT



CS-Studio, 2010



Since ~2016



2018

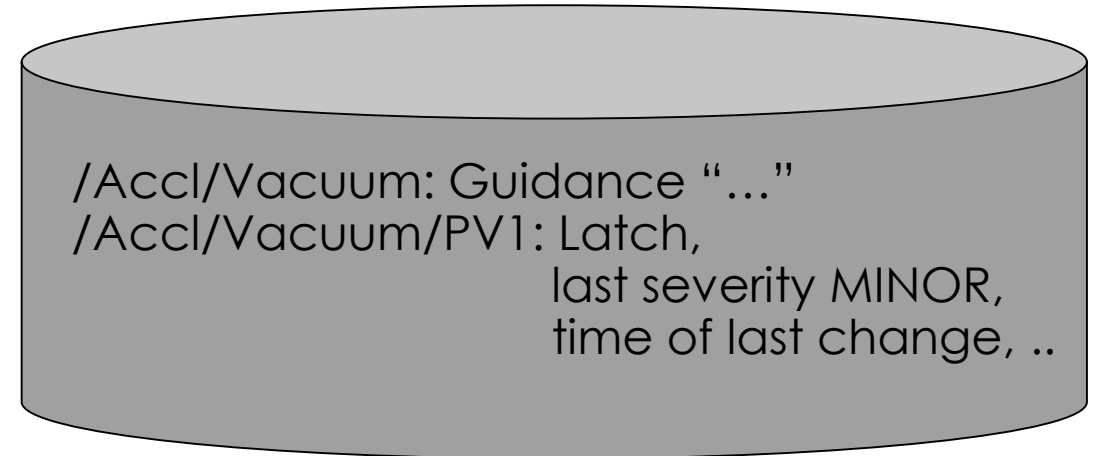
Reconsidered Original Architecture

- 'Static' Relational Database

- ✓ Configuration
- ✓ Persists last state
- Cannot get updates

- 'Dynamic' Message Service

- ✓ Send acknowledgements
- ✓ Get State updates
- Cannot get configuration



/Accl/Vacuum/PV1: Acknowledged

/Accl/Vacuum/PV1: Severity now MINOR_ACK

/Accl/Vacuum: Guidance was changed

All tools need to interface both APIs and 'merge' information



Message Streaming Platform

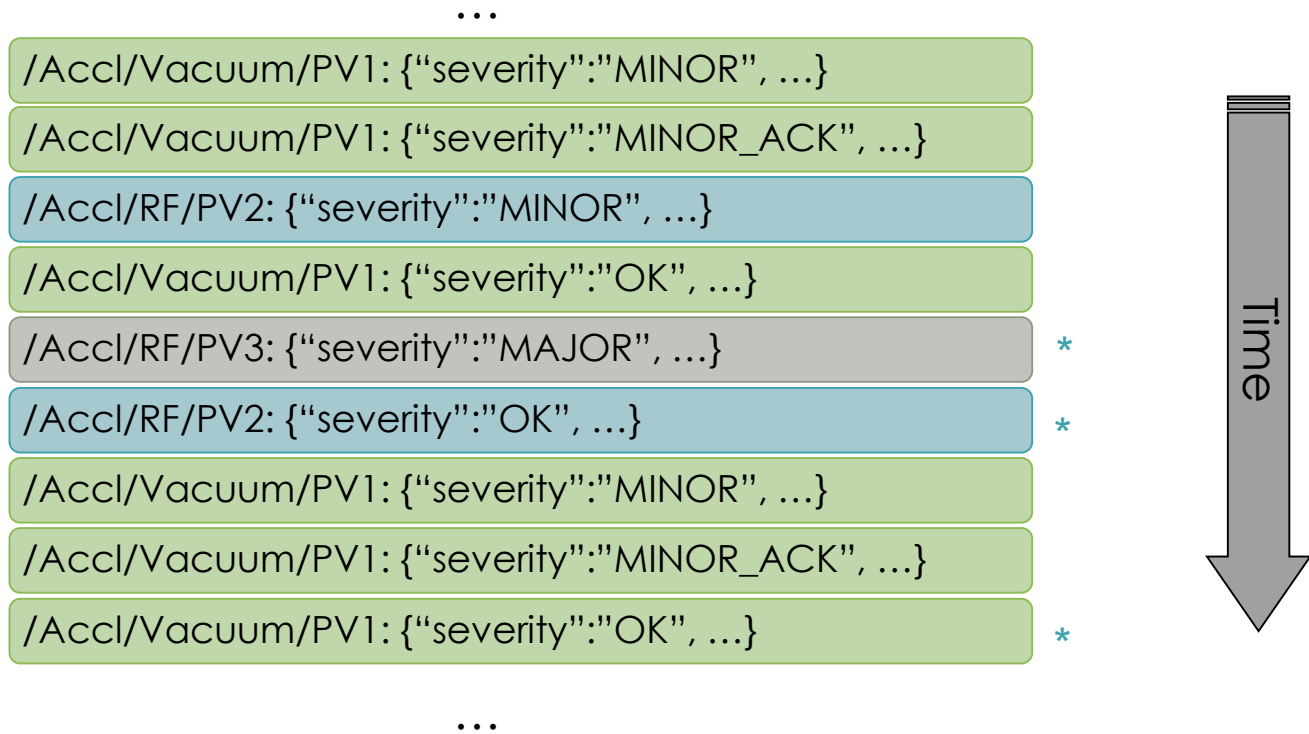
- a) Send message and forget
- b) Persist messages until disk is full
- c) 'Compact' messages to only keep most recent update

Combines 'static' RDB and 'dynamic' message service.

One API for all tools.

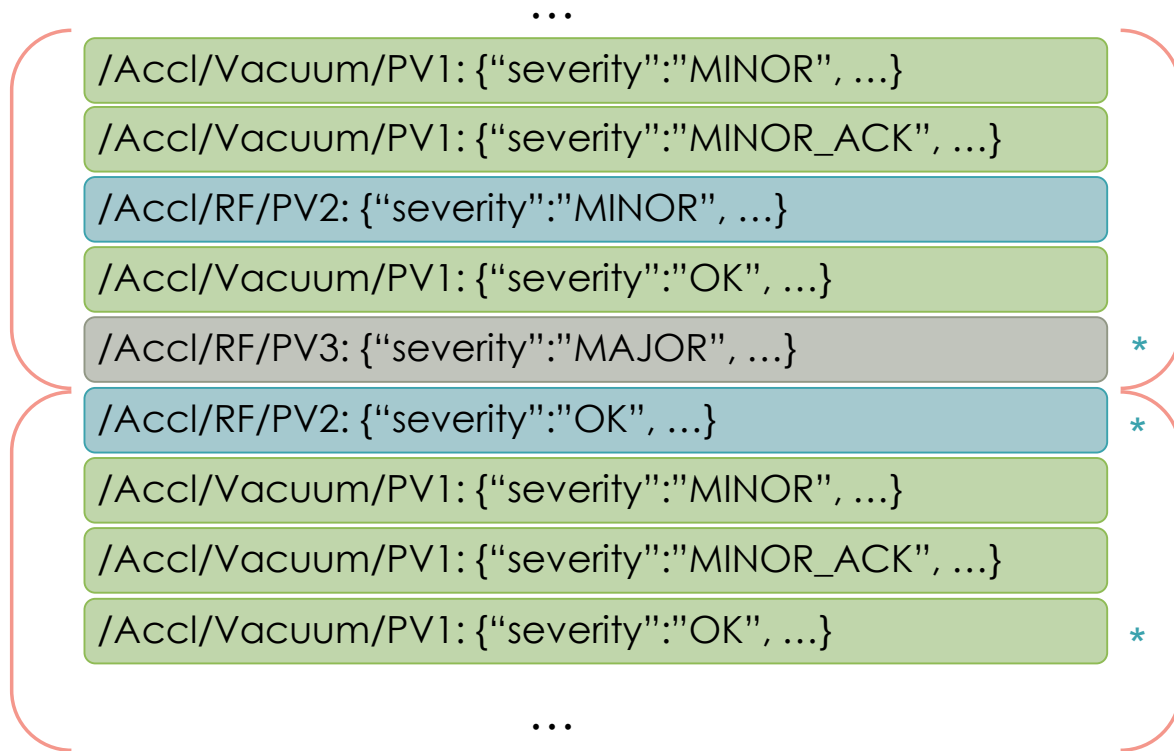
Clients tend to only need the most recent item state

- Assume state updates from beginning of time



Kafka Message Store

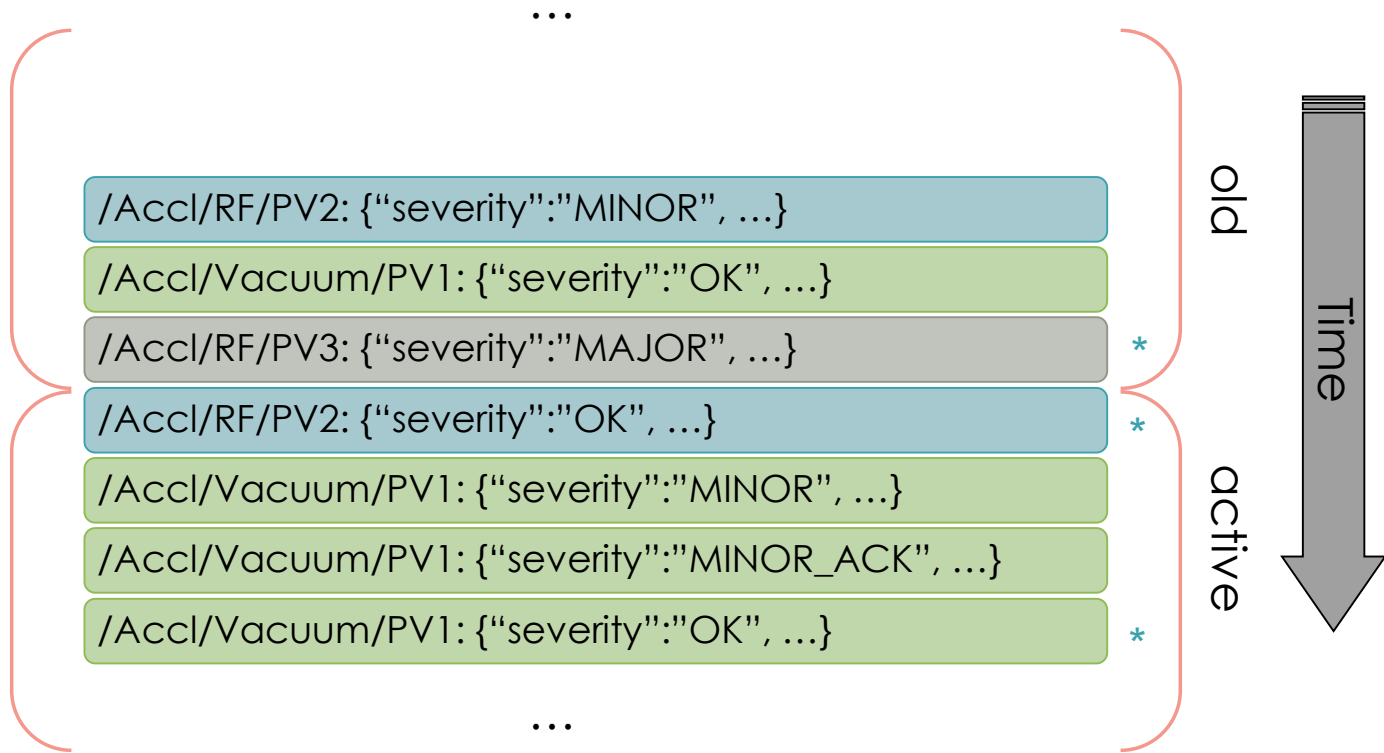
- New 'segment' for example every 10 seconds



'Compact':
Keep most recent message
for each item.

Compacted Kafka Message Store

- Keeps *single* older segment with *last* value for each item]
- Active segment for new messages



New clients get at least one message with most recent state for each item.

Maybe a few more recent updates from 'active' segment.

From then on, updates as state changes.

Kafka w/ compacted topics

May add a few extra messages on startup, but

- One API replaces RDB and message service
- Faster than reading initial state from RDB

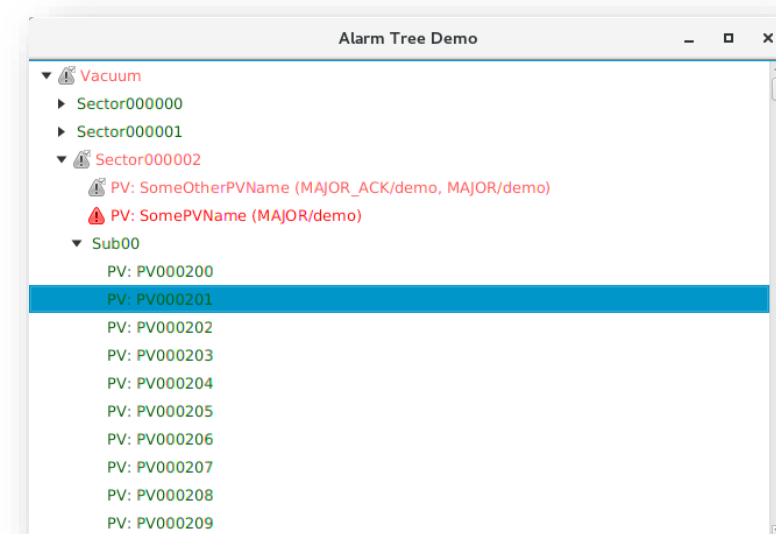
Initial Tests

2010 Test (PosgreSQL, JMS)

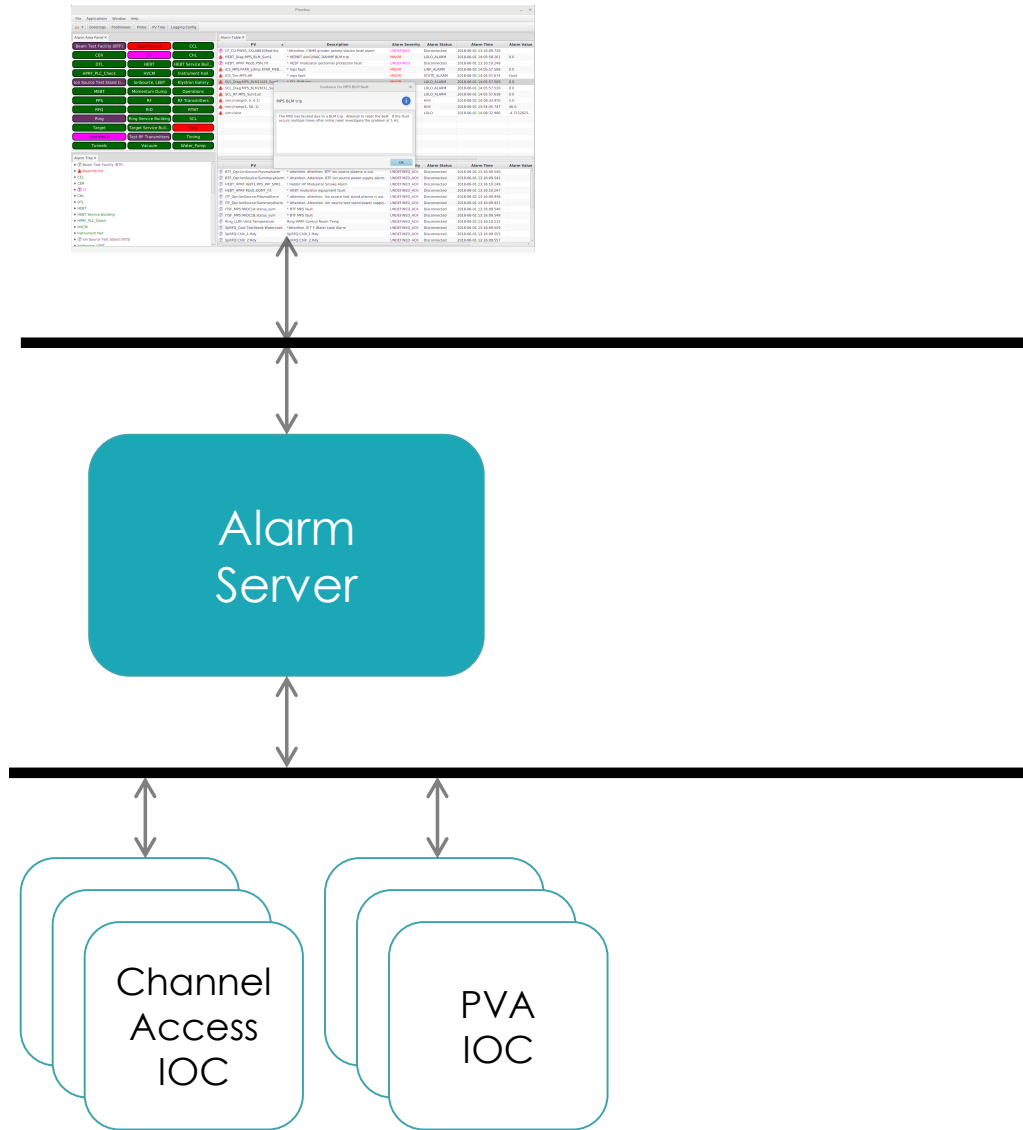
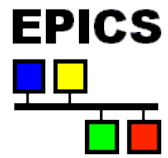
- Load hierarchy with 50000 PVs into RDB
 - 5 minutes
- Show config in new Alarm Tree
 - Nothing shown until all loaded after 30 seconds
- Handle Alarm Updates
 - 10 per second

2018 Test (Kafka)

- 100000 PVs into Kafka
 - 3 seconds
- Shows growing tree for 10 seconds
- 500 per second




Alarm Ecosystem

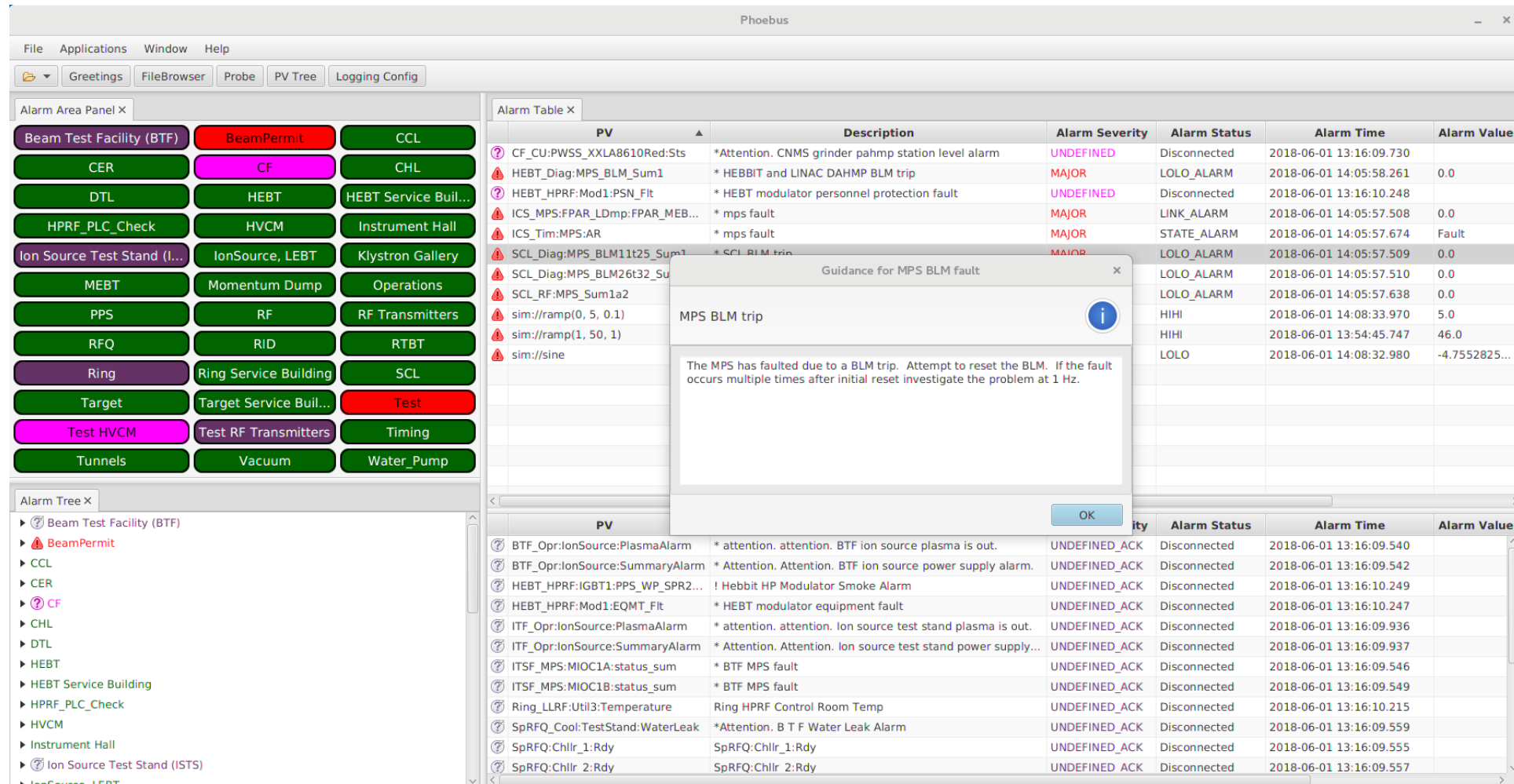


- Alarm configuration
 - Alarm State updates
 - Acknowledgement
-
- Live control system data

Alarm System Update for Phoebus

RDB & JMS → 

- Same XML import/export
- Similar UI
- Operational @ SNS beam lines since Jan. 2019
- Performance headroom



The screenshot displays the Phoebus alarm system interface. On the left, there is a grid of buttons representing different beam line components, such as 'Beam Test Facility (BTF)', 'BeamPermit', 'CCL', 'CER', 'CF', 'CHL', 'DTL', 'HEBT', 'HEBT Service Building', 'HPRF_PLC_Check', 'HVCM', 'Instrument Hall', 'Ion Source Test Stand (ISTS)', 'IonSource, LEBT', 'Klystron Gallery', 'MEBT', 'Momentum Dump', 'Operations', 'PPS', 'RF', 'RF Transmitters', 'RFQ', 'RID', 'RTBT', 'Ring', 'Ring Service Building', 'SCL', 'Target', 'Target Service Building', 'Test', 'Test HVCM', 'Test RF Transmitters', 'Timing', 'Tunnels', 'Vacuum', and 'Water_Pump'. Below this grid is an 'Alarm Tree X' showing a hierarchical view of the alarm system.

The main part of the interface is an 'Alarm Table X' with the following columns: PV, Description, Alarm Severity, Alarm Status, Alarm Time, and Alarm Value. The table lists several active alarms, including 'CF_CU:PWSS_XXLA8610Red:Sts' (UNDEFINED), 'HEBT_Diag:MPS_BLM_Sum1' (MAJOR), 'HEBT_HPRF:Mod1:PSN_Flt' (UNDEFINED), 'ICS_MPS:FPar_LDmp:FPar_MEB...' (MAJOR), 'ICS_Tim:MPS:AR' (MAJOR), 'SCL_Diag:MPS_BLM11t25_Sum1' (MAJOR), 'SCL_Diag:MPS_BLM26t32_Su...' (LOLO_ALARM), 'SCL_RF:MPS_Sum1a2' (LOLO_ALARM), and several 'sim://ramp' and 'sim://sine' alarms (HIHI).

A dialog box titled 'Guidance for MPS BLM fault' is overlaid on the table, providing instructions: 'The MPS has faulted due to a BLM trip. Attempt to reset the BLM. If the fault occurs multiple times after initial reset investigate the problem at 1 Hz.' The dialog includes an 'OK' button.