Full EPICS database for MicroBooNE Control System, with alarms/warnings/status displays and list of what else is needed

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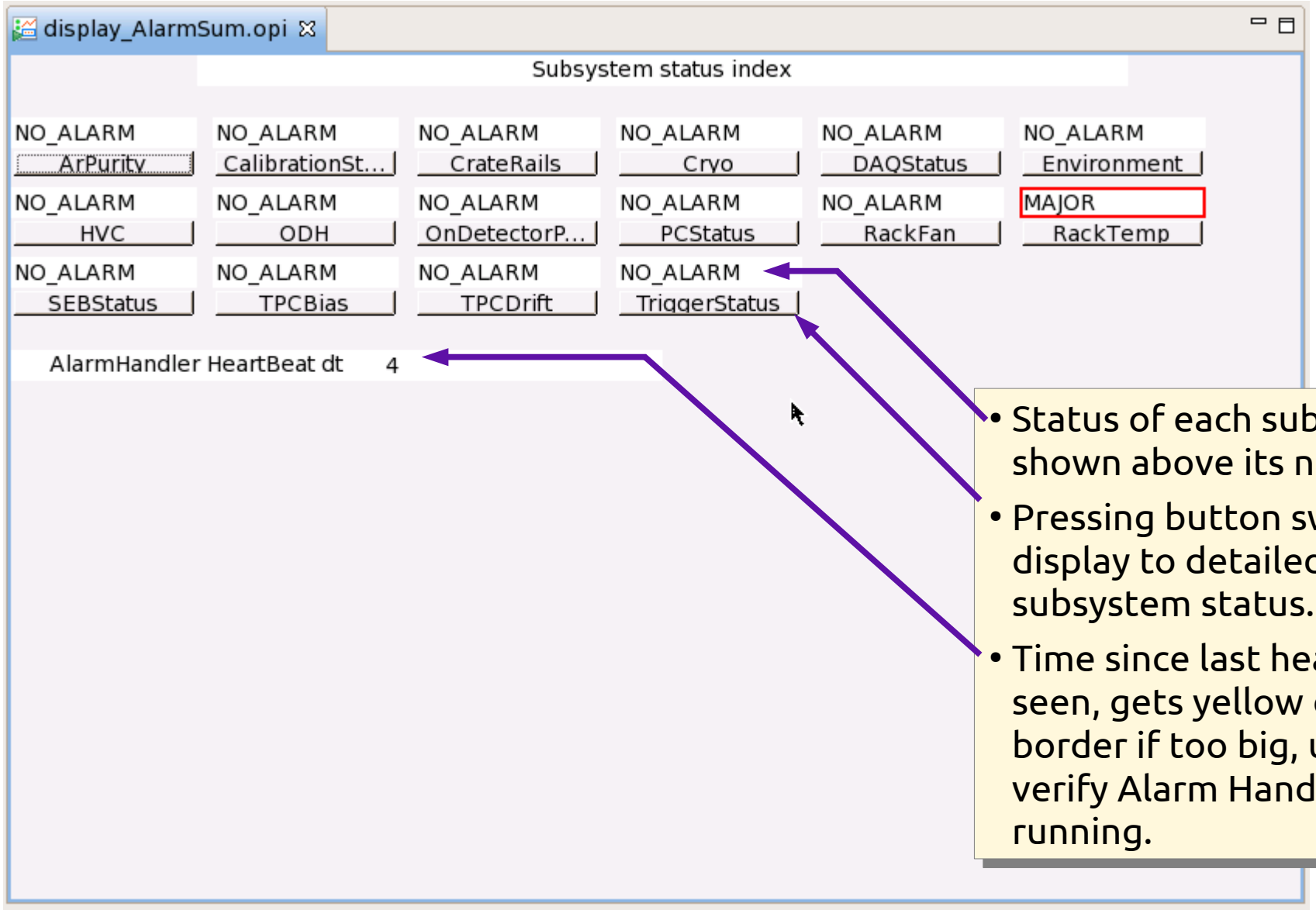
What's in this talk

- Status displays, alarms, and warnings
- PV naming convention, DB structure
  superceded by MicroBooNE-doc-2386
- Summary spreadsheets
- Subsystems needing IOCs to be written
- Information needed for each subsystem

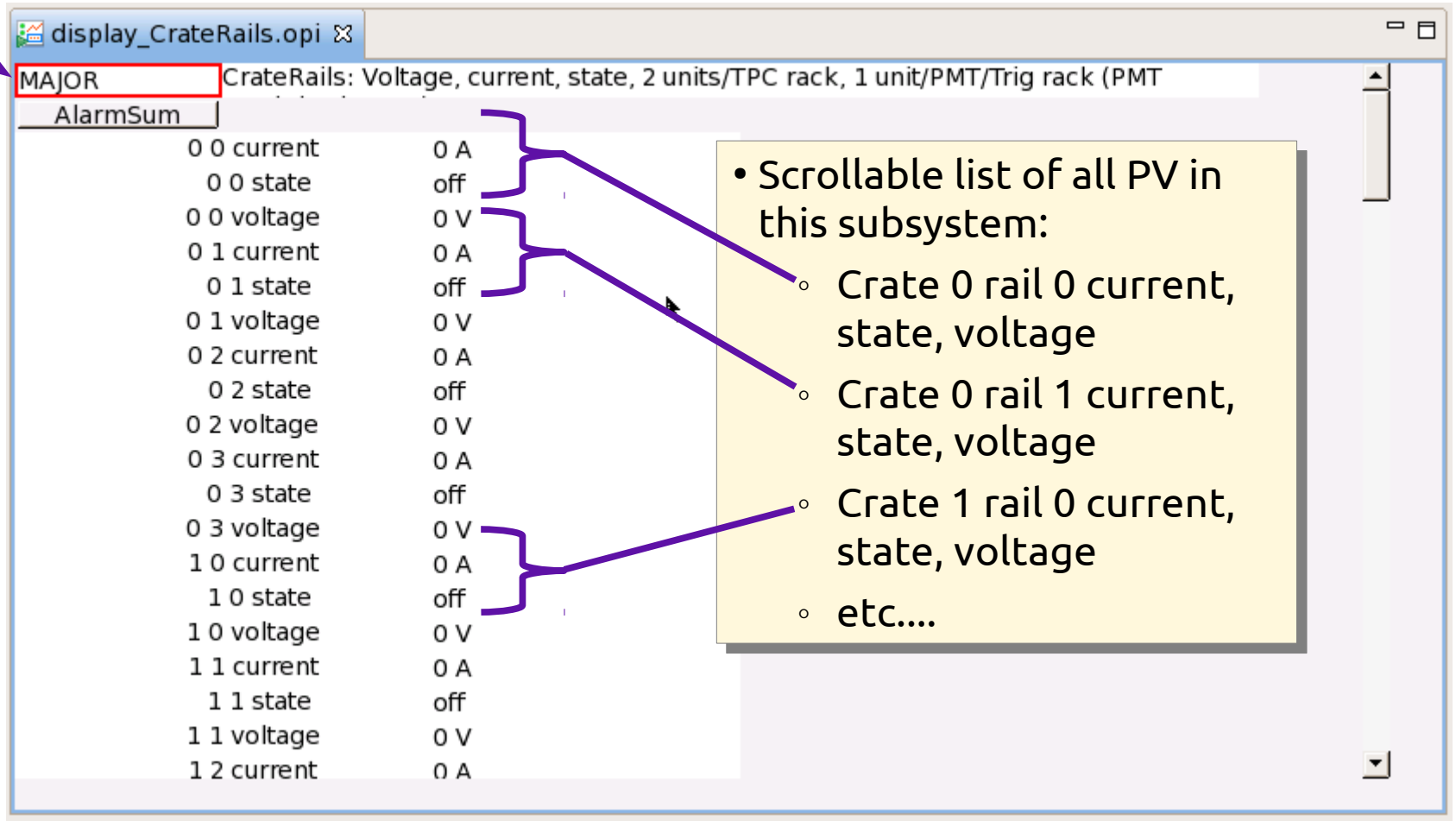
Subsystem status index display



- Status of each subsystem shown above its name.
- Pressing button switches display to detailed subsystem status.
- Time since last heart beat seen, gets yellow or red border if too big, used to verify Alarm Handler is running.

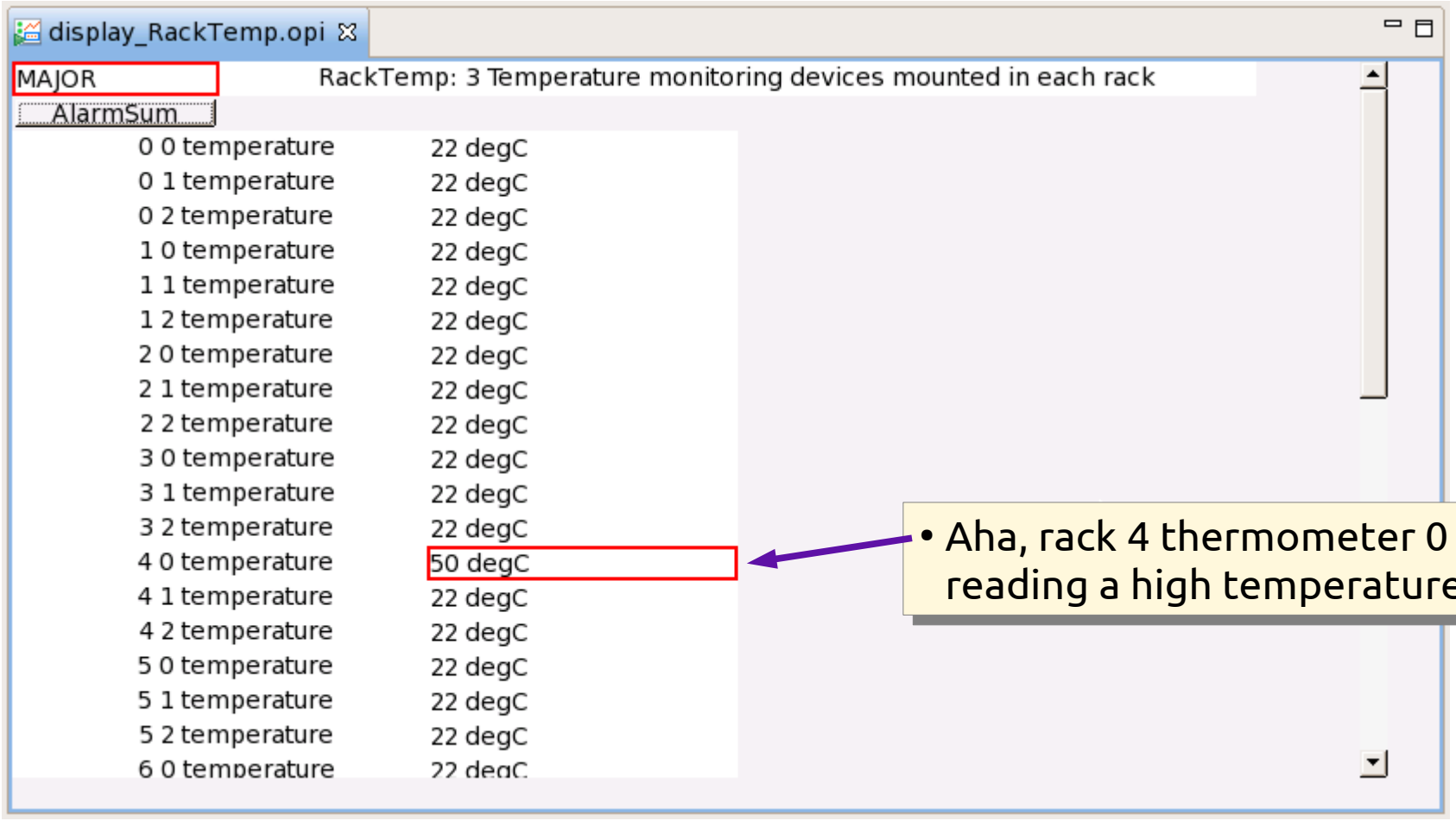
Detailed subsystem status for CrateRails

- Master alarm sum and button to go back to index. (Here it shows a severity of “major” due to RackTemp.)

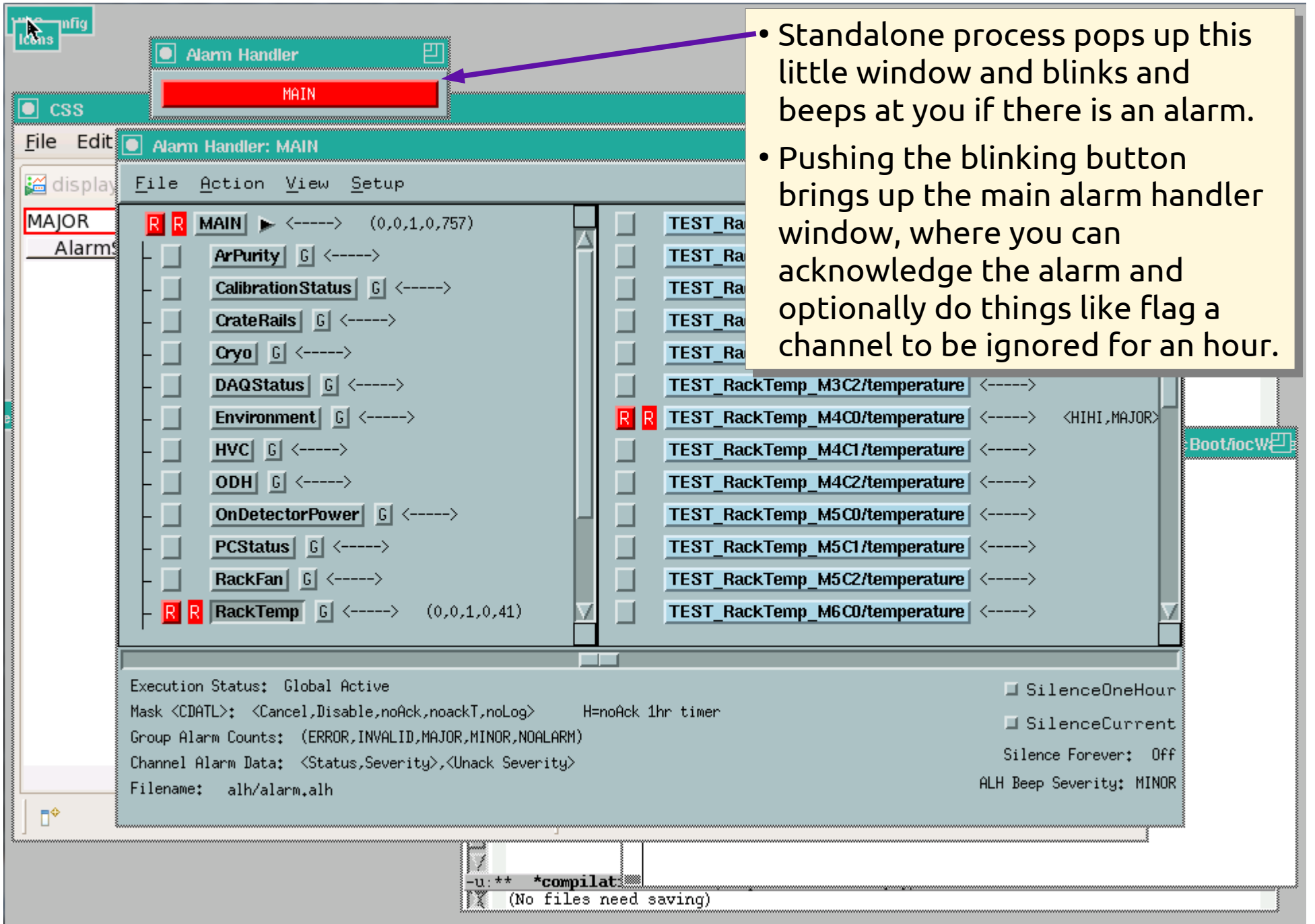


- Scrollable list of all PV in this subsystem:
  - Crate 0 rail 0 current, state, voltage
  - Crate 0 rail 1 current, state, voltage
  - Crate 1 rail 0 current, state, voltage
  - etc....

Detailed subsystem status for RackTemp



Alarm Handler



- Standalone process pops up this little window and blinks and beeps at you if there is an alarm.
- Pushing the blinking button brings up the main alarm handler window, where you can acknowledge the alarm and optionally do things like flag a channel to be ignored for an hour.

Classic EPICS Alarm Handler (ALH)

- Something beyond the “Index” display is needed to alert us if/when new alarms come in on top of old ones.
- I've configured the tried-and-true ALH.
  - One standalone executable, independent of CSS.
  - Display is Motif-based. Run in common VNC control window accessed by whoever is on shift.
  - Heartbeat variable on CSS-based status display makes sure it is running.
  - It was easy to set up.

What about CSS Alarm Table/Tree/Server (BEAST)

- There is a CSS-based Alarm system (“Beast Ever Alarm System Toolkit”):
  - It has more “moving parts” and “plumbing” (i.e., components and interconnections beyond basic EPICS), and seems significantly more complicated to configure and run.
  - I also found it off-putting that its manual announces “The system described in here is not used in a production environment at this time.” The manual is dated 2010, and may be out of date, but if so then I find that to be off-putting too.
- ALH meets the basic requirements for alarms and is ready to use now. With more work, it could be replaced by a CSS-based AlarmServer plus AlarmTable in display, but I don't see a requirement to do so.

Importance of PV naming convention

(PV stands for “process variable”)

- All the displays, alarm panels, and the EPICS database containing all known slow control channels (758 at last count) were generated from two spreadsheets.
  - The spreadsheets are based on the slow control and monitoring system summary table in the TDR.
- This was possible to do efficiently because of a systematic naming pattern for the PVs:

*detector_subsystem_*M#C#/*variable*

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PV naming convention

(PV stands for “process variable”)

detector_subsystem_M#C#/variable

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- *detector* is used to separate MicroBooNE from PAB, software development tests, etc.
- *subsystem* is “CrateRails”, “RackTemp”, etc.
- Two numbers are used for “module” (or unit, crate, etc) and “channel”.
- *variable* can be “voltage”, “current”, etc.
- Examples: `PAB_HVC_M0C0/VOLT`
  `TEST_RackTemp_M4C0/temperature`

Summary spreadsheets

`uB-control-channels-primary.csv`

- Defines the names, types, descriptions, and number of units and channels for each subsystem.

`uB-control-channels-pvar.csv`

- Defines the variables in each channel for a given type, and optionally information such as units of measure (EGU), warning and alarm limits (LOLO, LOW, HIGH, HIHI), and other EPICS information.

These spreadsheets are deliberately simple.

3 sample rows from `uB-control-channels-primary.csv`

subsystem	Primary type	Short Description	# units	# ch/unit	# var/ch	Long Description
OnDetectorPower	RdOnlyPwrSuppMPOD	POWER LVPS	6	8	3	Voltage, current, state of power supply rails for on-detector electronics
CrateRails	RdOnlyPwrSuppWienerPL508	Rack LVPS - rails	10	4	3	Voltage, current, state, 2 units/TPC rack, 1 unit/PMT/Trig rack (PMT Lambda via VME)
RackTemp	DS1624	Rack temp.	14	3	1	3 Temperature monitoring devices mounted in each rack

- **Detailed information on names and numbers in table above is out of date, superceded by MicroBooNE-doc-2386**

See latest version of the full file in EPICS/make_db/uB-control-channels-primary.csv in the git master repository.
[https://cdcvs.fnal.gov/redmine/projects/uboonedaq/repository/revisions/master/show]

One example primary type PV definition in **uB-control-channels-pvar.csv**

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Environment	ai	temperature	EGU=degC	LOLO=10	LOW=16	HIGH=32	HIHI=40
	ai	humidity	EGU=%	LOLO=8	LOW=20	HIGH=70	HIHI=80
	ai	pressure	EGU=mbar				
	ai	linevoltage	EGU=Vrms	LOLO=104.4	LOW=114	HIGH=126	HIHI=127.2

Note it is possible, but not required, to use this file to define properties for every PV in a subsystem, such as “EGU” (engineering units) or alarm and warning levels. Individual channel values can be set separately. This file is not designed for specifying individual channel values.

See full file in EPICS/make_db/uB-control-channels-pvar.csv in the git master repository . [https://cdcvs.fnal.gov/redmine/projects/uboonedaq/repository/revisions/master/show]

Complete list of subsystems and primaries

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- ArPurity
- CalibrationStatus
- Cryo
- DAQStatus
- RackTemp
- Environment
- HVC (PMTs)
- RackFan
- ODH
- PCStatus
- TPCDrift
- OnDetectorPower
- TPCBias
- CrateRails
- SEBStatus
- TriggerStatus

(16 subsystems so far)

- ArPurity
- CalibrationStatus
- Cryo
- DAQStatus
- DS1624
- Environment
- HVBiRa
- kTeVfanPack
- ODH
- PCStatus
- RdOnlyPwrSuppGlassman
- RdOnlyPwrSuppMPOD
- RdOnlyPwrSuppWienerPL508
- SEBStatus
- TriggerStatus

(15 primary device types)

Subsystems needing IOCs to be written

- RdOnlyPwrSuppGlassman
- RdOnlyPwrSuppMPOD
- RdOnlyPwrSuppWienerPL508
- DS1624
- kTeVfanPack
- Environment
- ArPurity
- CalibrationStatus
- Cryo
- ODH
- SEBStatus
- TriggerStatus

Basically every one except the BiRa PMT HV controller and the DAQStatus and PCStatus “virtual” IOCs.

More information needed for each subsystem

(0) Contact person for each subsystem.

(1) Confirmation that the list of control system variables for each subsystem is complete, or corrections as needed.

(2) Ranges for “yellow” and “red” warnings, and “delta values” for triggering update of display and archive, for each variable.

(3) Who is going to write the IOC for each subsystem, if different from contact.