

# CS-Studio: Alarms

BEAST

# BEAST architecture

- Alarm Server
  - Handles Alarm logic
  - Stores alarm configuration
- Alarm Clients
  - GUI's display alarms
  - GUI's provide tools to handle alarms (enable, acknowledge, open related display, show guidance)
  - Annunciator
  - Alarm message loggers

# Alarm Perspective

The screenshot displays the CS-Studio Alarm Perspective. The interface includes a menu bar (File, Edit, Search, CS-Studio, Window, Help), a toolbar, and a title bar with window controls. The main area is divided into several panels:

- Alarm Area Panel:** Contains four colored boxes representing different areas: Common environment (green), Linac (pink), Booster (magenta), and Storage ring (yellow).
- Alarm Tree:** A hierarchical tree view on the left showing the structure of the alarm system. It includes nodes for NSLS2\_OPR, Area: Common environment, Area: Linac (undefined-ack'd/No Connection), System: Vacuum (undefined-ack'd/No Connection), System: Diagnostics, System: RF (invalid-ack'd/READ\_ALARM), System: Magnet Systems, System: Radiation Monitoring (major-ack'd/STAT), System: Controls, System: Smoke Detectors, System: Source (major-ack'd/STATE\_ALARM), and PV: LN(EGUN) Trip-Sts (major-ack'd/STAT).
- Alarm Table [NSLS2\_OPR]:** A table displaying current and acknowledged alarms. The table has columns for PV, Description, Alarm Time, Current Status, Alarm Severity, Alarm Status, and Alarm Value.

**Current Alarms (6)**

PV	Description	Alarm Time	Current Status	Alarm Severity	Alarm Status	Alarm Value
SR:C11-VA{P}...	Cell 11 straight Average Vacuum Press...	2016/05/06 0...	OK	NO_ALARM	MINOR	LOLO_ALAR... 5.58475E-10
FE:C11A-VA{P}...	Cell 11 Front End Average Vacuum Pre...	2016/05/06 0...	OK	NO_ALARM	MINOR	LOLO_ALAR... 1.793750000...
BR:CS-BI{BPM}...	Booster Cavity Straight BPM 1	2016/05/06 0...	OK	NO_ALARM	INVALID	LINK_ALARM Comm_Fail
BR:A3-BI{BPM}...	Booster Arc3 BPM 6	2016/05/05 1...	OK	NO_ALARM	MAJOR	LINK_ALARM PT ON
BR:A3-BI{BPM}...	Booster Arc3 BPM 3	2016/05/05 1...	OK	NO_ALARM	MAJOR	LINK_ALARM PT ON
BR:A2-BI{BPM}...	Booster Arc2 BPM 1	2016/05/05 2...	OK	NO_ALARM	MAJOR	LINK_ALARM OK

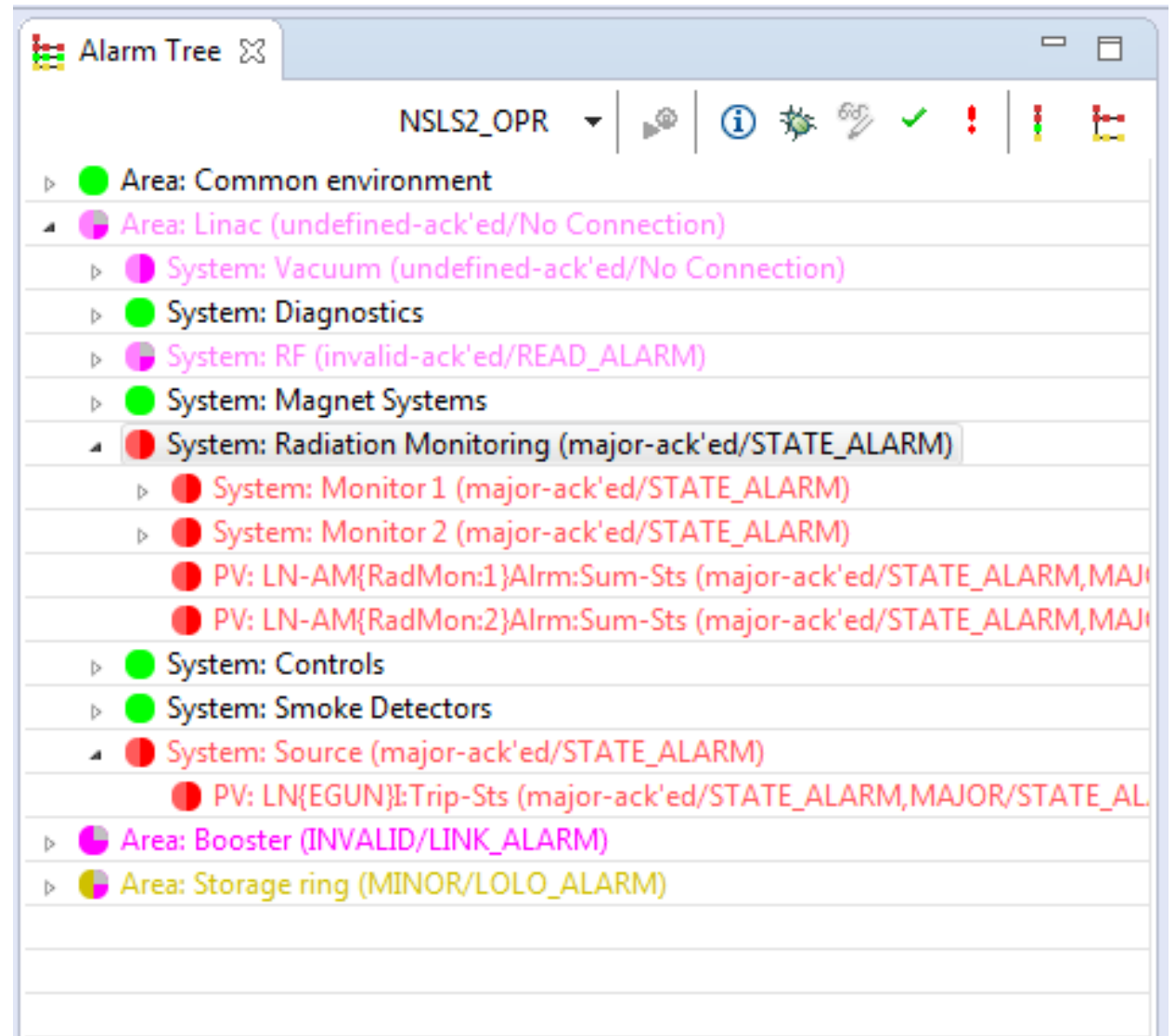
**Acknowledged Alarms (183)**

PV	Description	Alarm Time	Current Status	Alarm Severity	Alarm Status	Alarm Value
XF:28IDA-AM{...}	I.D. 28 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALA...	invalid-ack'...	STATE_ALA... Comm.
XF:23IDA-AM{...}	I.D. 23 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALA...	invalid-ack'...	STATE_ALA... Comm.
XF:17IDA-AM{...}	I.D. 17 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALA...	invalid-ack'...	STATE_ALA... Comm.
XF:16IDA-AM{...}	I.D. 16 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALA...	invalid-ack'...	STATE_ALA... Comm.
XF:11IDA-AM{...}	I.D. 11 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALA...	invalid-ack'...	STATE_ALA... Comm.

The bottom right corner of the window shows the name "Kunal Shroff".

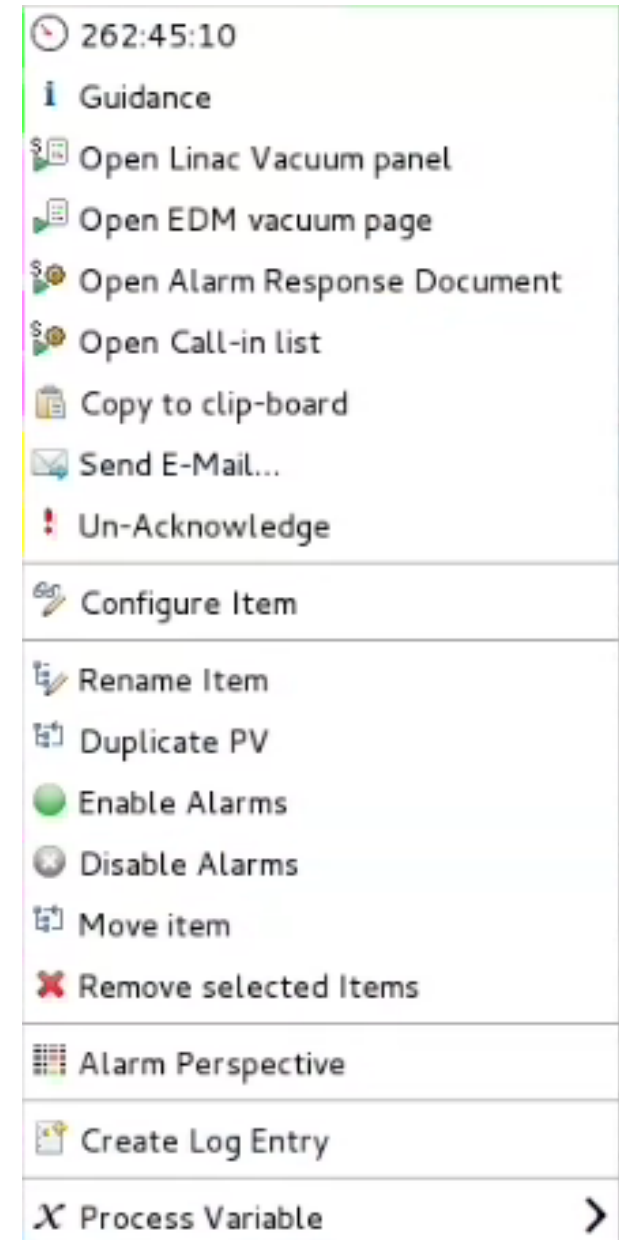
# Alarm Tree

- Hierarchical view of alarms
  - Organizes alarms by Area, System, (sub system), PV
  - Organizes guidance and actions
- Alarm handling tools
  - Acknowledge/Un-acknowledge
  - Enable/Disable
  - Guidance, Instructions, and
- Alarm configuration actions



# Alarm Context Menu

- Alarm information
- Alarm handling instructions and actions
- Alarm configuration tools



# Alarm Table

ConsoleAlarm Table [NSLS2\_OPR]

Current Alarms (6)

Select

PV	Description	Alarm Time	Curre...	Current Status	Alarm Severity	Alarm Status	Alarm Value
SR:C11-VA{P:...	Cell 11 straight Average Vac...	2016/05/06 0...	OK	NO_ALARM	MINOR	LOLO_ALARM	5.58475E-10
FE:C11A-VA{...	Cell 11 Front End Average V...	2016/05/06 0...	OK	NO_ALARM	MINOR	LOLO_ALARM	1.79375000000000...
BR:CS-BI{BPM...	Booster Cavity Straight BPM 1	2016/05/06 0...	OK	NO_ALARM	INVALID	LINK_ALARM	Comm_Fail
BR:A3-BI{BPM...	Booster Arc3 BPM 6	2016/05/05 1...	OK	NO_ALARM	MAJOR	LINK_ALARM	PT ON
BR:A3-BI{BPM...	Booster Arc3 BPM 3	2016/05/05 1...	OK	NO_ALARM	MAJOR	LINK_ALARM	PT ON
BR:A2-BI{BPM...	Booster Arc2 BPM 1	2016/05/05 2...	OK	NO_ALARM	MAJOR	LINK_ALARM	OK

Acknowledged Alarms (183)

PV	Description	Alarm Time	Curre...	Current Status	Alarm Severity	Alarm Status	Alarm Value
XF:28IDA-AM{...	I.D. 28 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:23IDA-AM{...	I.D. 23 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:17IDA-AM{...	I.D. 17 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:16IDA-AM{...	I.D. 16 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:11IDA-AM{...	I.D. 11 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:10IDA-AM{...	I.D. 10 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.
XF:08IDA-AM{...	I.D. 8 Radiation Monitor	2016/05/05 1...	INVA...	STATE_ALARM	invalid-ack'ed	STATE_ALARM	Comm.

# Exercise: Handling Alarms

- We shall create an alarm by moving a motor beyond the safe range or +/- 15
- Motor setpoint pv
  - XF:31IDA-OP{Tbl-Ax:X1}Mtr
- Alarm PV
  - XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm

The image shows two screenshots of a process variable (PV) configuration interface. The top window is titled 'XF:31IDA-OP{Tbl-Ax:X1}Mtr' and the bottom window is titled 'XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm'.

**Top Window: XF:31IDA-OP{Tbl-Ax:X1}Mtr**

- PV Formula: XF:31IDA-OP{Tbl-Ax:X1}Mtr
- Value: 0.000
- Timestamp: 2016/05/06 08:22:02.109204625
- New Value: 16
- Status: Connected

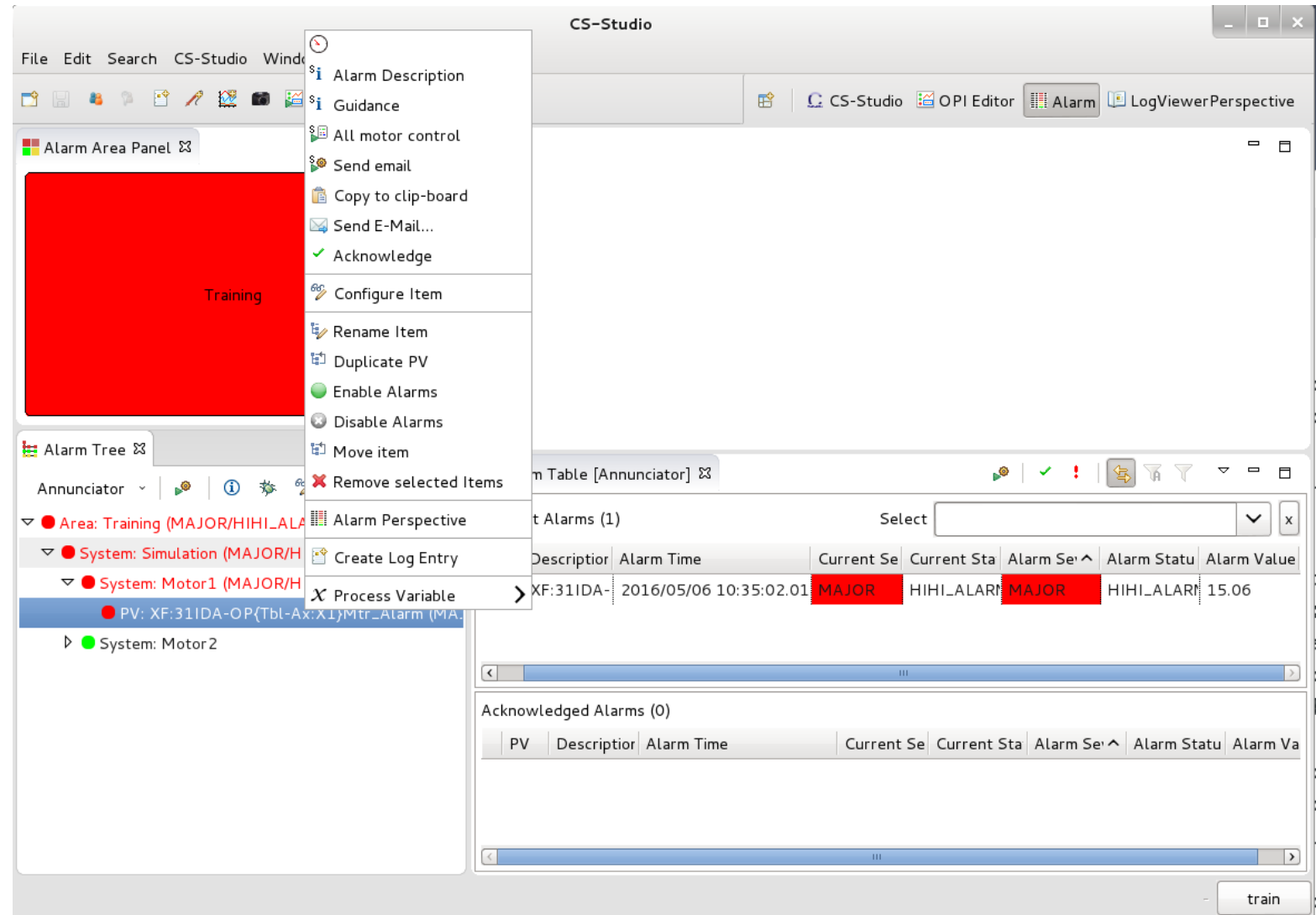
**Bottom Window: XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm**

- PV Formula: XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm
- Value: 0
- Timestamp: 2016/05/06 08:22:02.008740599
- New Value: 0
- Type: VDouble
- Display limits: 0 - 0
- Alarm limits: -15 - 15
- Warning limits: NaN - NaN
- Control limits: 0 - 0
- Unit:
- Status: Connected



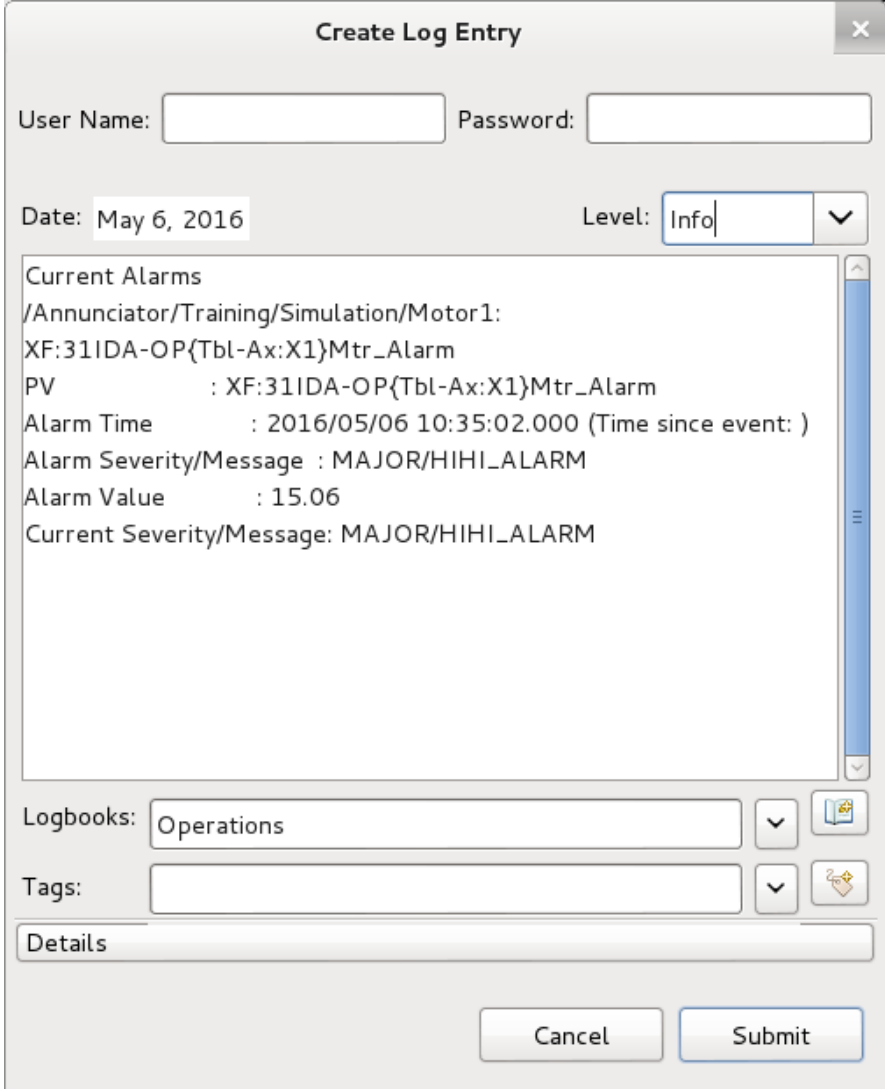
# Exercise: Handling Alarms

- Open the context menu which contains
  - Alarm Description
  - Guidance (how the alarm should be handled)
  - Actions to open related opi screens and/or commands



# Exercise: Handling Alarms

- Acknowledge alarm
- Create a log entry for the alarm
- Open related motor control opi and set the motor position set point with in the appropriate range

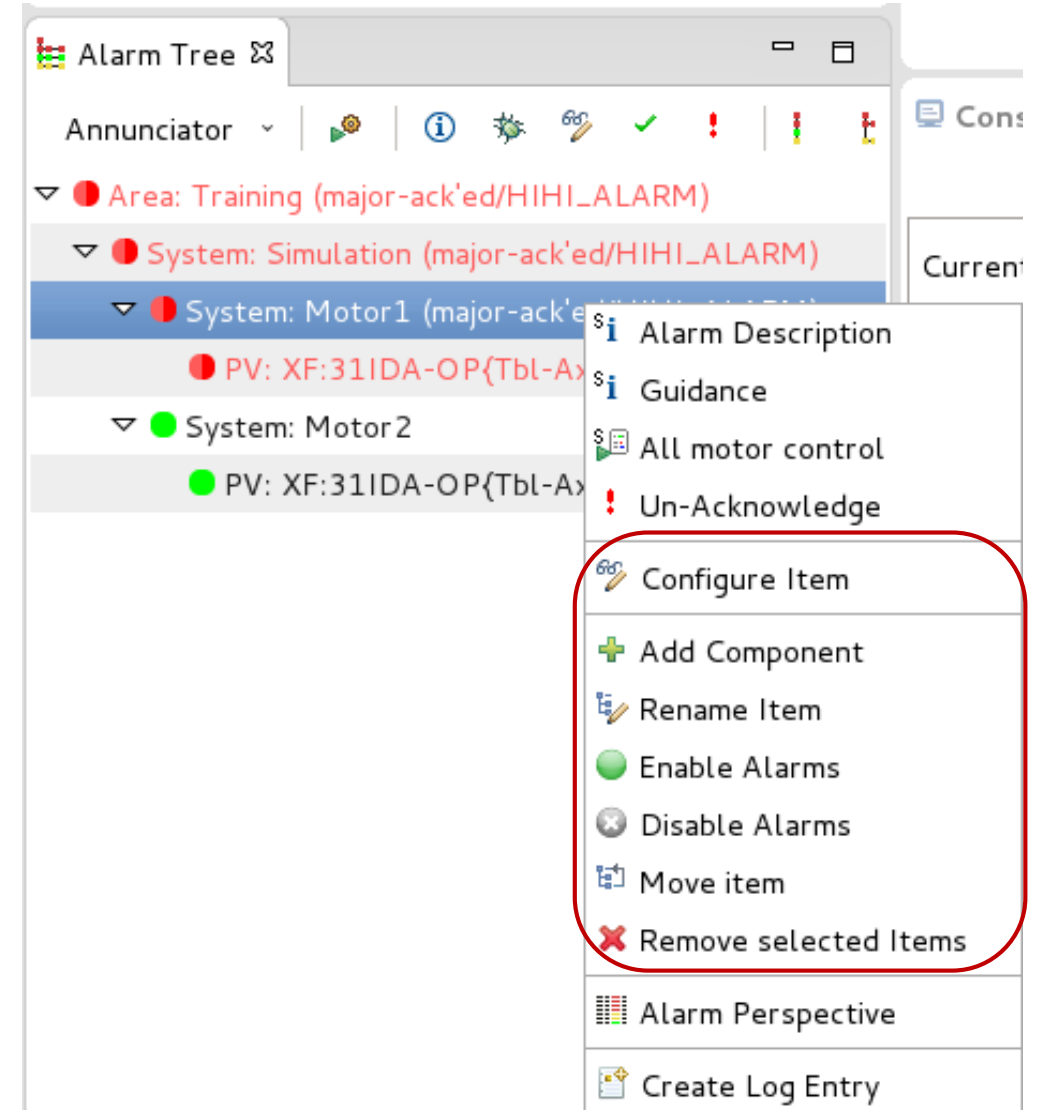


The screenshot shows a 'Create Log Entry' dialog box with the following fields and content:

- User Name:** [Empty text box]
- Password:** [Empty text box]
- Date:** May 6, 2016
- Level:** Info (dropdown menu)
- Current Alarms:**
  - /Annunciator/Training/Simulation/Motor1:
  - XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm
  - PV : XF:31IDA-OP{Tbl-Ax:X1}Mtr\_Alarm
  - Alarm Time : 2016/05/06 10:35:02.000 (Time since event: )
  - Alarm Severity/Message : MAJOR/HIHI\_ALARM
  - Alarm Value : 15.06
  - Current Severity/Message: MAJOR/HIHI\_ALARM
- Logbooks:** Operations (dropdown menu)
- Tags:** [Empty text box] (dropdown menu)
- Details:** [Empty text box]
- Buttons:** Cancel, Submit

# Configuring BEAST

- The context menu of the alarm tree provides commands to
  - Add/Remove new alarm components
  - Reorganize existing components in the alarm hierarchy
  - Configure the information and actions associated with alarms



# BEAST configuration dialog

- Guidance:  
These are simple text messages which can be used to
  - Describe the alarm condition, including possible causes
  - Provide information/instructions on how this alarm should be handled

Alarm Item Configuration

Item: /Annunciator/Training/Simulation

Configure guidance, related displays, ...

Guidance:

Title	Detail
Alarm Description	The motor position setpoint is beyond the safe operat
Guidance	Open the motor control opi and set a motor position v
<Add>	<Add>

Displays:

Title	Command
All motor control	/home/train/cs-studio-training/demo-opis/motor/03_den
<Add>	<Add>

Commands:

Title	Command
<Add>	<Add>

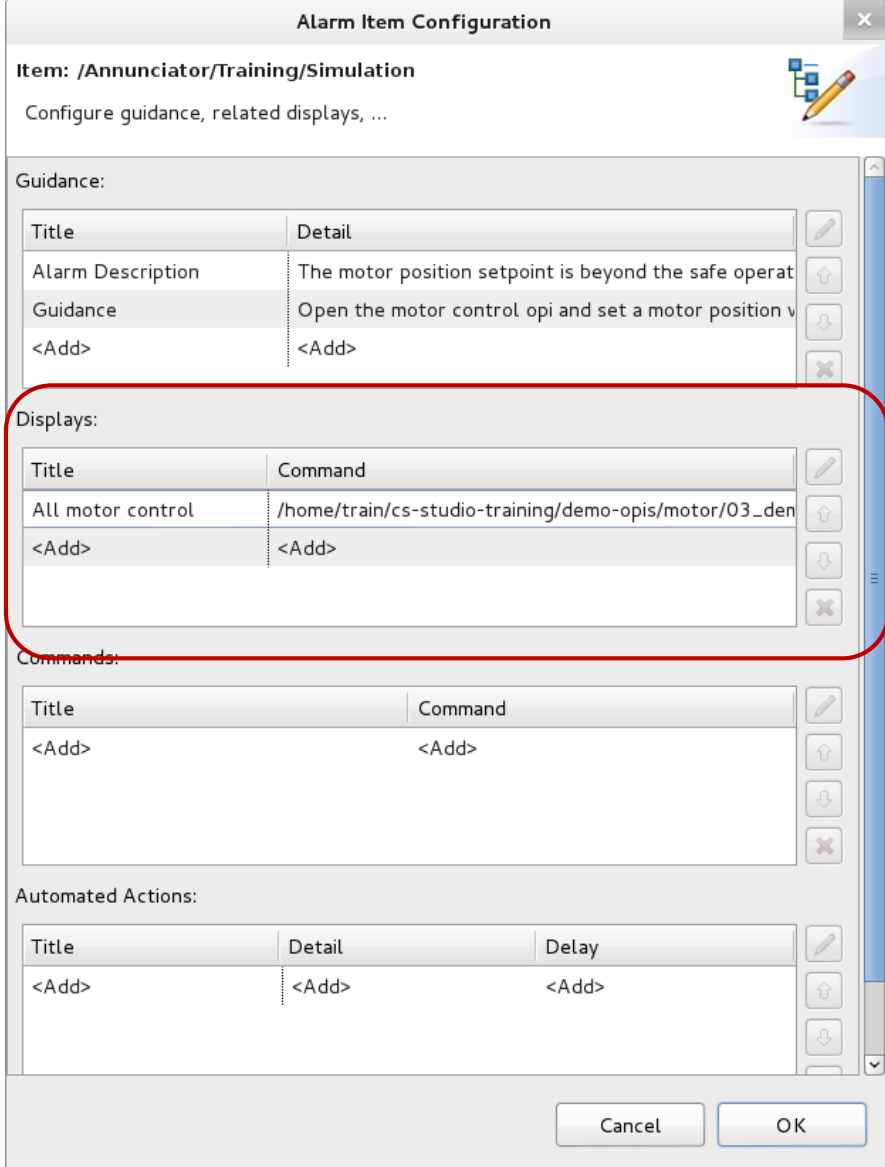
Automated Actions:

Title	Detail	Delay
<Add>	<Add>	<Add>

Cancel OK

# BEAST configuration dialog

- Links alarms with the related opi screens
  - Allow users to directly open BOY/databrowsers files without navigation
  - Link to .opi, .plt,



Alarm Item Configuration

Item: /Annunciator/Training/Simulation

Configure guidance, related displays, ...

Guidance:

Title	Detail
Alarm Description	The motor position setpoint is beyond the safe operat
Guidance	Open the motor control opi and set a motor position v
<Add>	<Add>

Displays:

Title	Command
All motor control	/home/train/cs-studio-training/demo-opis/motor/03_den
<Add>	<Add>

Commands:

Title	Command
<Add>	<Add>

Automated Actions:

Title	Detail	Delay
<Add>	<Add>	<Add>

Cancel OK

# BEAST configuration dialog

- Commands:
  - Allows defining actions which invoke external commands
- Automated Actions:
  - If alarms persist for a certain time without being acknowledged or cleared, and automated notification can be generated.

The screenshot shows the 'Alarm Item Configuration' dialog box. At the top, the title bar reads 'Alarm Item Configuration'. Below it, the 'Item' path is '/Annunciator/Training/Simulation/Motor1'. A subtitle says 'Configure guidance, related displays, ...'. The dialog is divided into four main sections: 'Guidance', 'Displays', 'Commands', and 'Automated Actions'. Each section contains a table with columns for configuration. The 'Guidance' table has 'Title' and 'Detail' columns. The 'Displays' table has 'Title' and 'Command' columns. The 'Commands' table has 'Title' and 'Command' columns, with one row filled: 'Reset Motor Position' with command 'caput XF:31IDA-OP{Tbl-Ax:X1}Mtr 0.0'. The 'Automated Actions' table has 'Title', 'Detail', and 'Delay' columns. On the right side of each table are icons for edit, up, down, and delete. At the bottom, there is a status bar showing 'ID: 9 Last configured: 2016/05/06 12:30:07.000' and 'Cancel' and 'OK' buttons.

Title	Detail
<Add>	<Add>

Title	Command
<Add>	<Add>

Title	Command
Reset Motor Position	caput XF:31IDA-OP{Tbl-Ax:X1}Mtr 0.0
<Add>	<Add>

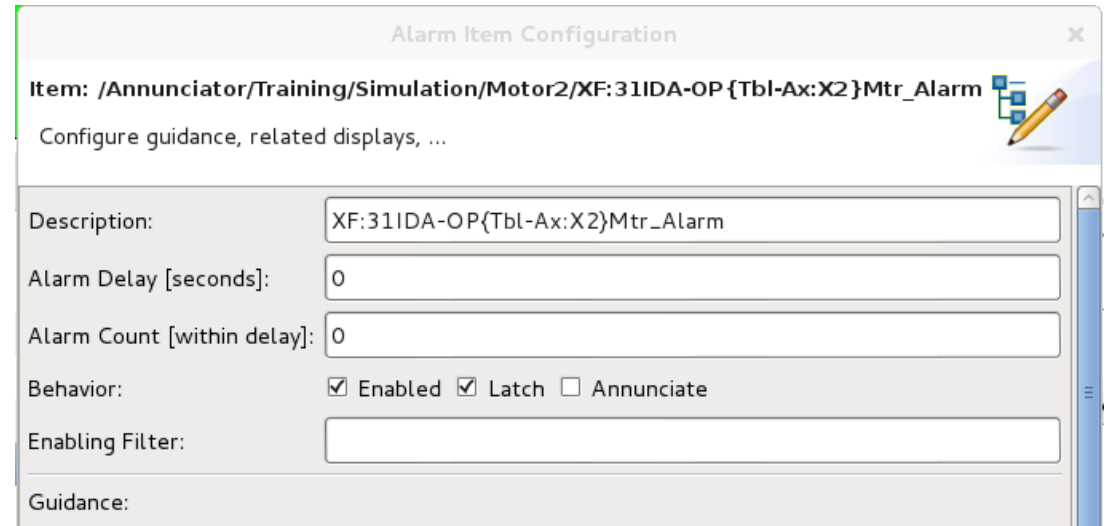
Title	Detail	Delay
<Add>	<Add>	<Add>

ID: 9 Last configured: 2016/05/06 12:30:07.000

Cancel OK

# BEAST configuration dialog

- Alarm Trigger PV Configuration
- Alarm Delay and Alarm Count
  - Wait for alarms that are active for at least the specified delay or occur more than the specified count
- Latch
  - The highest alarm states are remembered until acknowledged
- Enable (discouraged)
- Filter (discouraged)



The screenshot shows the 'Alarm Item Configuration' dialog box. The title bar is 'Alarm Item Configuration' with a close button. The main area displays the item path: '/Annunciator/Training/Simulation/Motor2/XF:31IDA-OP{Tbl-Ax:X2}Mtr\_Alarm'. Below this is a sub-header 'Configure guidance, related displays, ...' with a pencil icon. The configuration fields are: 'Description:' with the value 'XF:31IDA-OP{Tbl-Ax:X2}Mtr\_Alarm'; 'Alarm Delay [seconds]:' with the value '0'; 'Alarm Count [within delay]:' with the value '0'; 'Behavior:' with checkboxes for 'Enabled' (checked), 'Latch' (checked), and 'Annunciate' (unchecked); 'Enabling Filter:' with an empty text box; and 'Guidance:' with an empty text box.

Alarm Item Configuration

Item: /Annunciator/Training/Simulation/Motor2/XF:31IDA-OP{Tbl-Ax:X2}Mtr\_Alarm

Configure guidance, related displays, ...

Description: XF:31IDA-OP{Tbl-Ax:X2}Mtr\_Alarm

Alarm Delay [seconds]: 0

Alarm Count [within delay]: 0

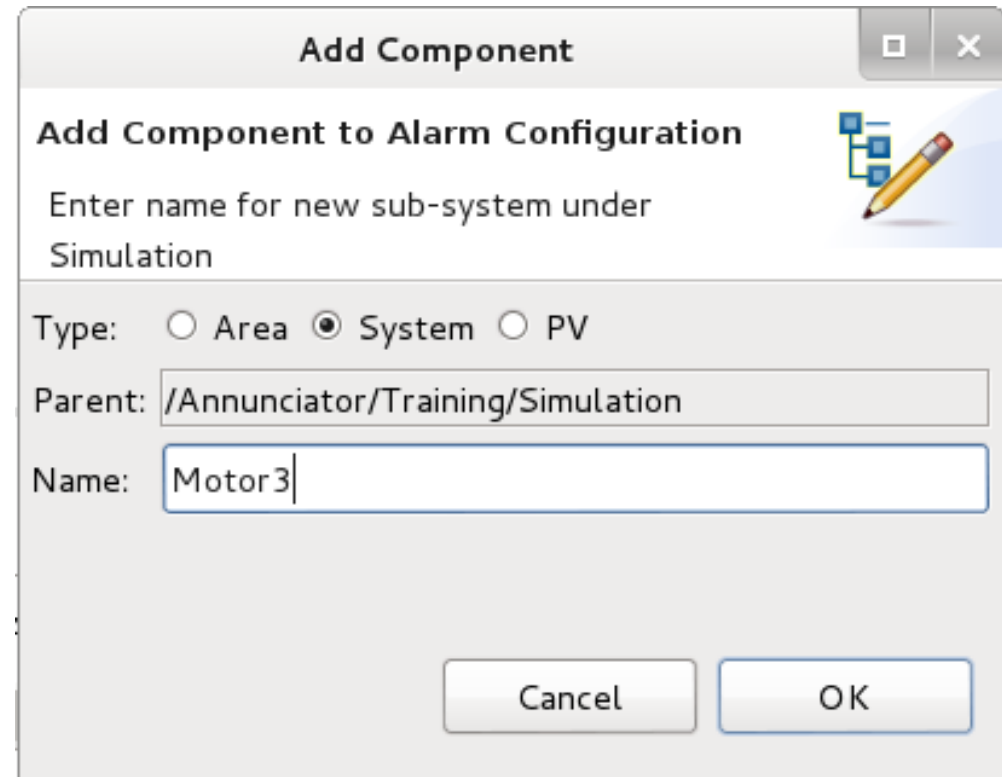
Behavior: ☒ Enabled ☒ Latch ☐ Annunciate

Enabling Filter:

Guidance:

# Exercise: Configuring Alarms

- Goal: To create a new set of alarms for Simulated Motor 3
- Under System: Simulation add a new component
  - Type: System
  - Name: Motor3



The screenshot shows a dialog box titled "Add Component" with a standard Windows-style title bar (minimize, maximize, close buttons). The main heading inside the dialog is "Add Component to Alarm Configuration". Below this, there is a text prompt: "Enter name for new sub-system under Simulation". To the right of this text is a small icon depicting a yellow pencil writing on a blue grid. The dialog contains three radio buttons for "Type": "Area", "System" (which is selected), and "PV". Below the radio buttons is a text field for "Parent:" containing the path "/Annunciator/Training/Simulation". Another text field for "Name:" contains the text "Motor3". At the bottom right of the dialog are two buttons: "Cancel" and "OK".

**Add Component**

**Add Component to Alarm Configuration**

Enter name for new sub-system under Simulation

Type: ☐ Area ☒ System ☐ PV

Parent: /Annunciator/Training/Simulation

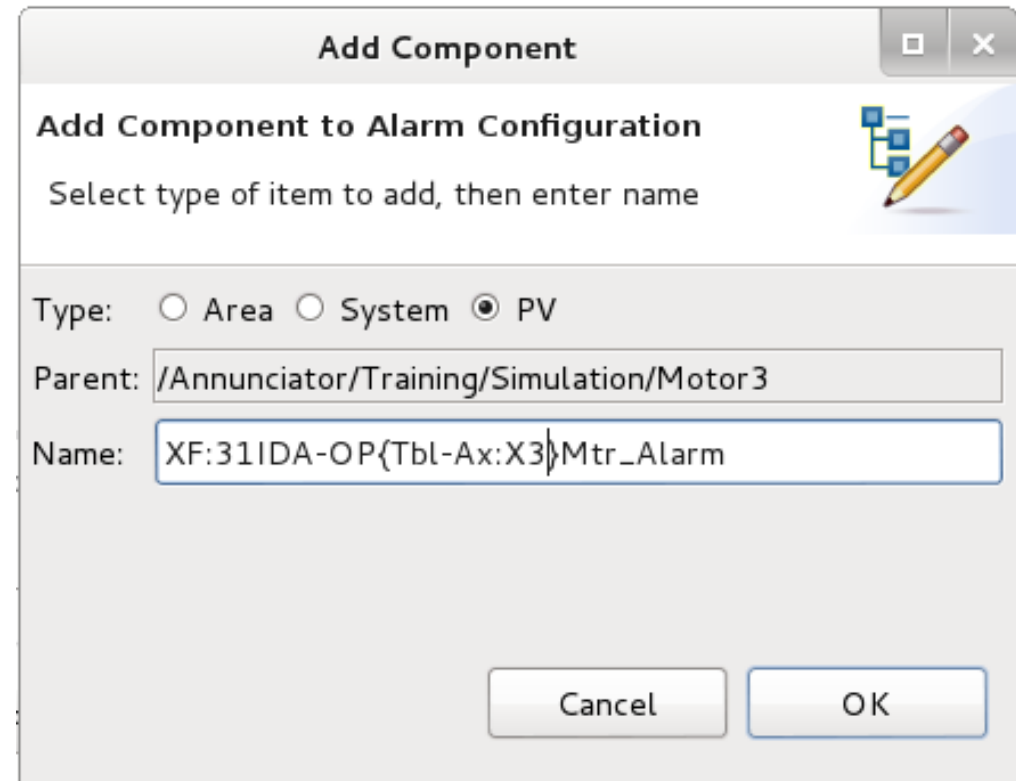
Name: Motor3

Cancel OK



# Exercise: Configuring Alarms

- Goal: To create a new set of alarms for Simulated Motor 3
- Under System: Motor3 add a new component
  - Type: PV
  - Name: XF:31IDA-OP{Tbl-Ax:X3}Mtr\_Alarm



The screenshot shows a dialog box titled "Add Component" with a close button in the top right corner. The main heading is "Add Component to Alarm Configuration", followed by the instruction "Select type of item to add, then enter name". To the right of this text is an icon of a pencil and a small tree diagram. Below the instruction, there are three radio buttons for "Type": "Area", "System", and "PV", with "PV" being selected. Below the type selection, there are two text input fields. The "Parent:" field contains the path "/Annunciator/Training/Simulation/Motor3". The "Name:" field contains the name "XF:31IDA-OP{Tbl-Ax:X3}Mtr\_Alarm". At the bottom right of the dialog are two buttons: "Cancel" and "OK".

**Add Component**

**Add Component to Alarm Configuration**

Select type of item to add, then enter name

Type: ☐ Area ☐ System ☒ PV

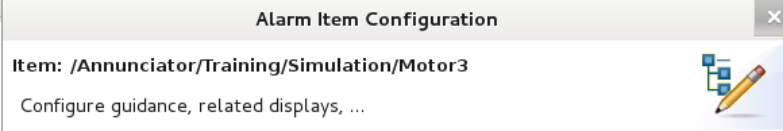
Parent: /Annunciator/Training/Simulation/Motor3

Name: XF:31IDA-OP{Tbl-Ax:X3}Mtr\_Alarm

Cancel OK

# Exercise: Configuring Alarms

- Add Guidance/Instructions on how this alarm should be handled
- Add a command that will reset the motor set point
  - Title:  
Reset Motor 3
  - Command:  
caput caput XF:31IDA-OP{Tbl-Ax:X3}Mtr 0.0



The image shows a screenshot of the 'Alarm Item Configuration' dialog box for the item '/Annunciator/Training/Simulation/Motor3'. The dialog has a title bar with a close button. Below the title bar, it says 'Item: /Annunciator/Training/Simulation/Motor3' and 'Configure guidance, related displays, ...'. There are four main sections: 'Guidance', 'Displays', 'Commands', and 'Automated Actions'. Each section has a table with columns for configuration. The 'Guidance' table has 'Title' and 'Detail' columns. The 'Displays' table has 'Title' and 'Command' columns. The 'Commands' table has 'Title' and 'Command' columns. The 'Automated Actions' table has 'Title', 'Detail', and 'Delay' columns. Each table has a '<Add>' row. To the right of each table are icons for adding, deleting, and moving items. At the bottom of the dialog are 'Cancel' and 'OK' buttons.

Title	Detail
Motor3 Guidance	Call jane doe (123)-555-6789
<Add>	<Add>

Title	Command
<Add>	<Add>

Title	Command
Reset Motor 3	caput XF:31IDA-OP{Tbl-Ax:X3}Mtr 0
<Add>	<Add>

Title	Detail	Delay
<Add>	<Add>	<Add>

Cancel OK

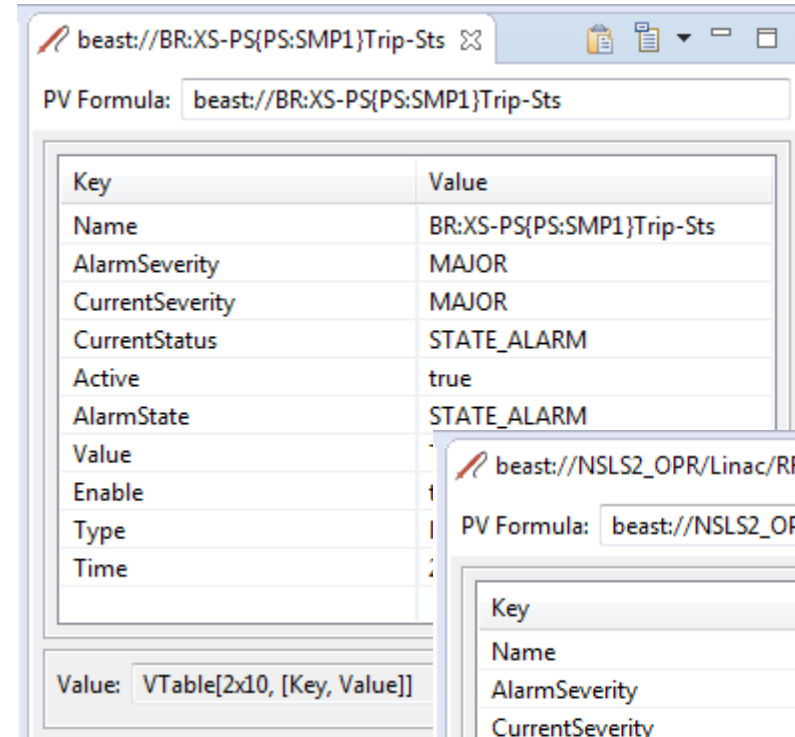
# Alarm Datasource

- 'beast' pvs can be used to connect to any node or leaf from the alarm tree.

*beast://alarm\_trigger\_pvName*

*beast://complete\_path\_to\_area*

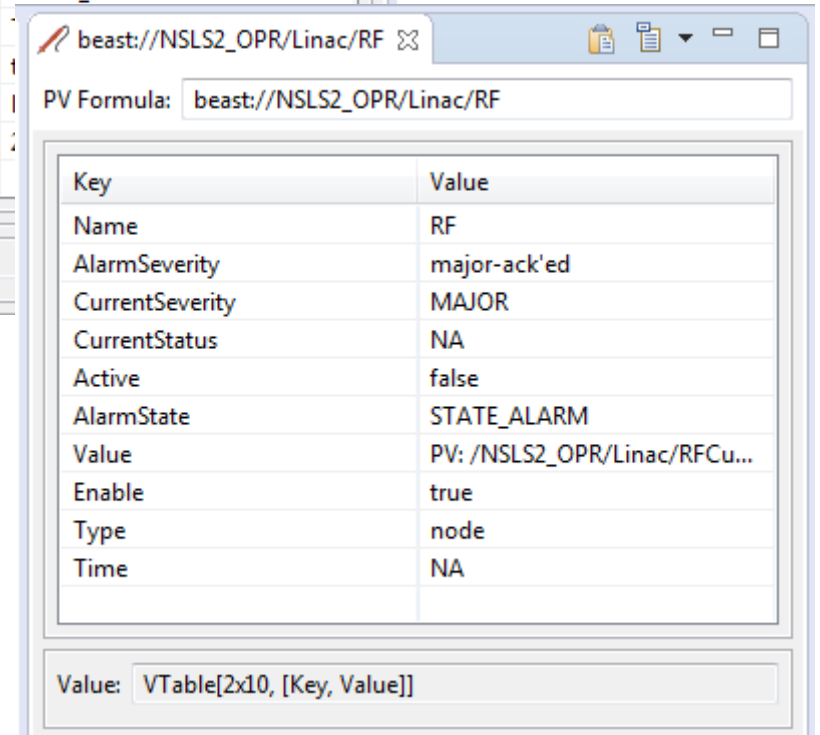
*beast://complete\_path\_to\_system*



The screenshot shows a window titled 'beast://BR:XS-PS{PS:SMP1}Trip-Sts'. It contains a table with the following data:

Key	Value
Name	BR:XS-PS{PS:SMP1}Trip-Sts
AlarmSeverity	MAJOR
CurrentSeverity	MAJOR
CurrentStatus	STATE_ALARM
Active	true
AlarmState	STATE_ALARM
Value	
Enable	
Type	
Time	

At the bottom, there is a 'Value:' field containing 'VTable[2x10, [Key, Value]]'.



The screenshot shows a window titled 'beast://NSLS2\_OPR/Linac/RF'. It contains a table with the following data:

Key	Value
Name	RF
AlarmSeverity	major-ack'ed
CurrentSeverity	MAJOR
CurrentStatus	NA
Active	false
AlarmState	STATE_ALARM
Value	PV: /NSLS2_OPR/Linac/RFCu...
Enable	true
Type	node
Time	NA

At the bottom, there is a 'Value:' field containing 'VTable[2x10, [Key, Value]]'.

# Alarm Datasource

- In addition of the table it is also possible to create a channel directly to some of the fields of the table
  - `beast://complete_path_to_system.AlarmSeverity`

The severity of the PV remembered by alarm server. When the PV is configured to "latch", the alarm server remembers the highest alarm severity of the PV until it is manually acknowledged.
  - `beast://complete_path_to_area.Acknowledge`

Returns a boolean value representing is the Alarm has been acknowledged. true if severity indicates an acknowledged alarm (AlarmSeverity is \*-ack'ed). false for unacknowledged or OK state.
  - `beast://complete_path_to_system.Active`

Creates a Channel which represents if the alarm is active.

# Exercise: Alarm Datasource