

# Control System Studio; Implementing CS Applications for, with or in spite of Eclipse

**Kay Kasemir**  
kasemirk@ornl.gov

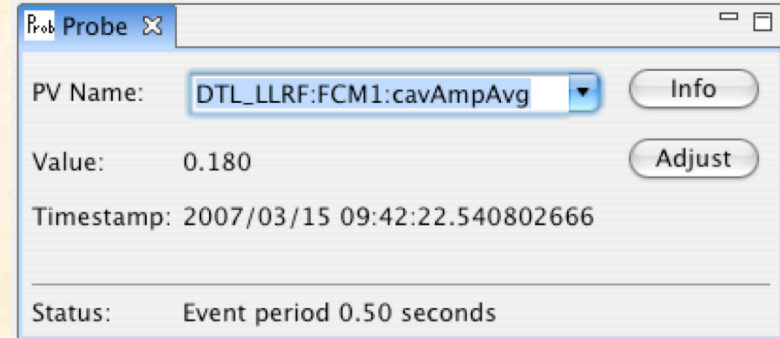
DESY EPICS Meet, April 2007

# Overview

- **Hurry through applications**
  - Probe, Table Viewer, PV Tree, CS Clock, Data Browser
- **What's different under Eclipse**
  - ... to the user
  - ... to the implementer
- **Not necessarily in that order**

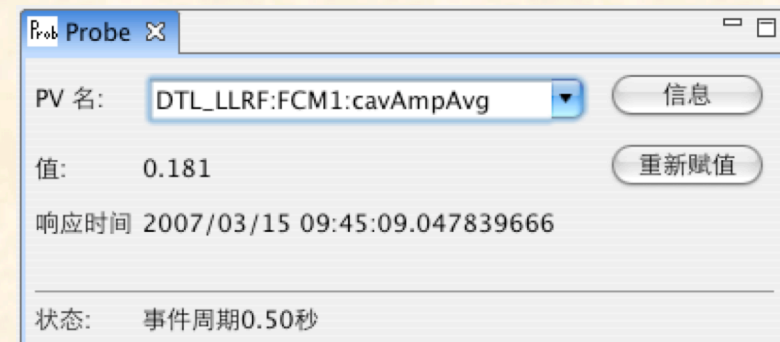
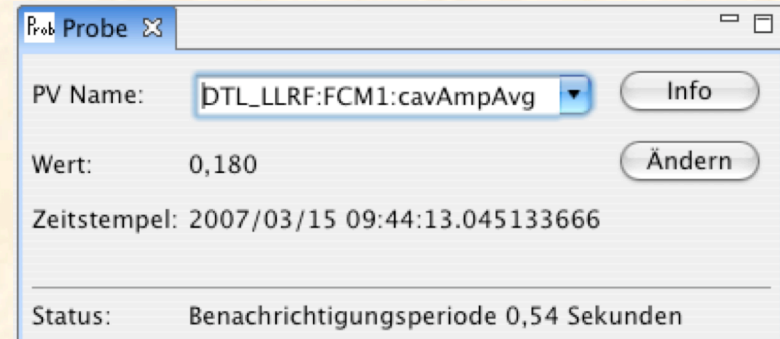
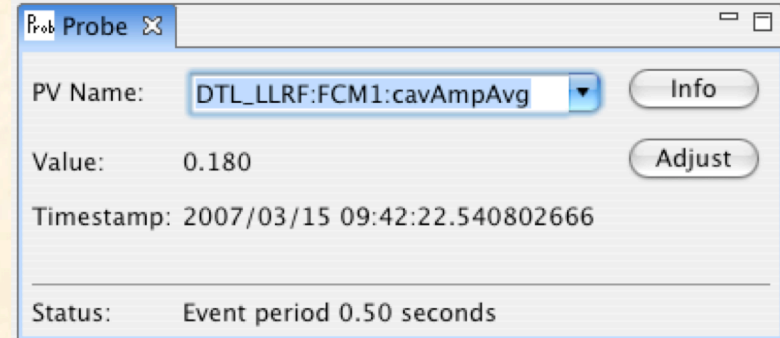
# Probe

- Ken Evans started this
- Enter PV...
  - Or select recent PV
- ...get value
  - with time, status, event rate



# Probe

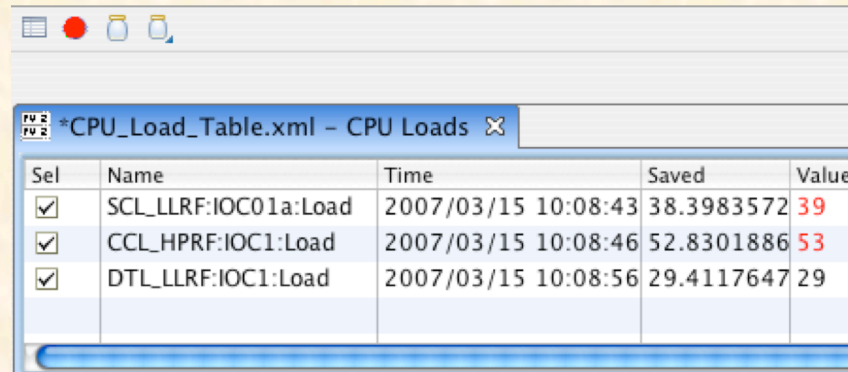
- Ken Evans started this
- Enter PV...
  - Or select recent PV
- ...get value
  - with time, status, event rate
- Localized!
  - English (well, American...)
  - Deutsch
  - Simplified Chinese for



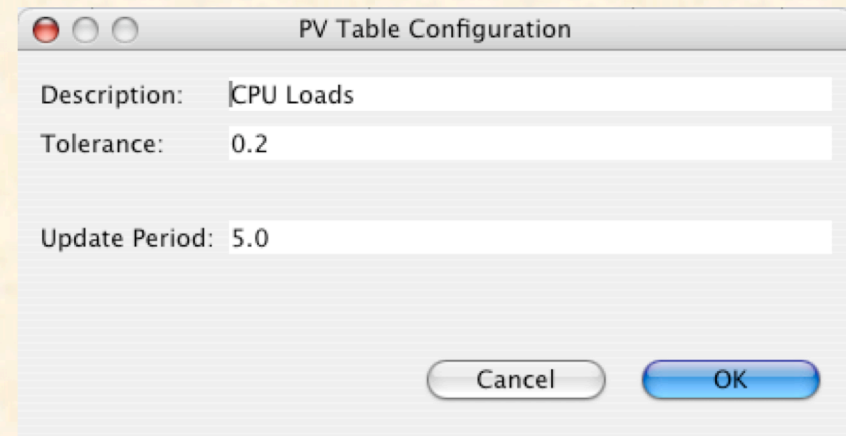


# PV Table

- **Save/restore tool**
  - Like BNL Parameter Page, XAL Score
- **List of PVs**
- **Show current time, value**
- **Save Value Snapshot**
  - Compare w/ current
  - Restore saved value



Sel	Name	Time	Saved	Value
<input checked="" type="checkbox"/>	SCL_LLRF:IOC01a:Load	2007/03/15 10:08:43	38.3983572	39
<input checked="" type="checkbox"/>	CCL_HPRF:IOC1:Load	2007/03/15 10:08:46	52.8301886	53
<input checked="" type="checkbox"/>	DTL_LLRF:IOC1:Load	2007/03/15 10:08:56	29.4117647	29



PV Table Configuration

Description: CPU Loads

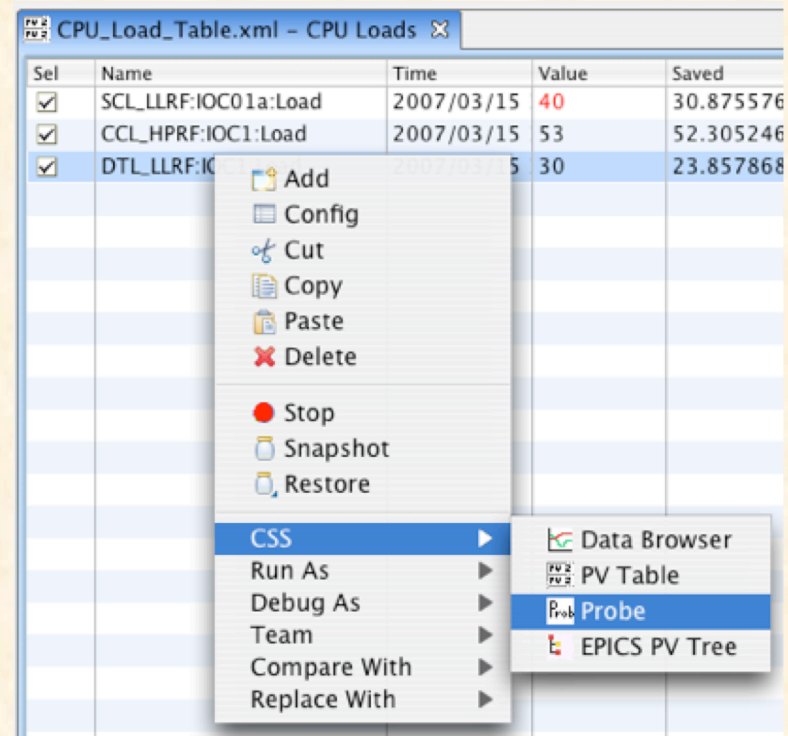
Tolerance: 0.2

Update Period: 5.0

Cancel OK

# Context Menu of PV Table

- ... lists all CSS apps that understand a PV
- Allows e.g. opening 'Probe' on the selected PV
- Compare current EPICS Tools
  - Start the other app
  - Copy/paste
    - Ctrl-C? Meta-C?
    - Middle-Button?
    - Ctrl-left click

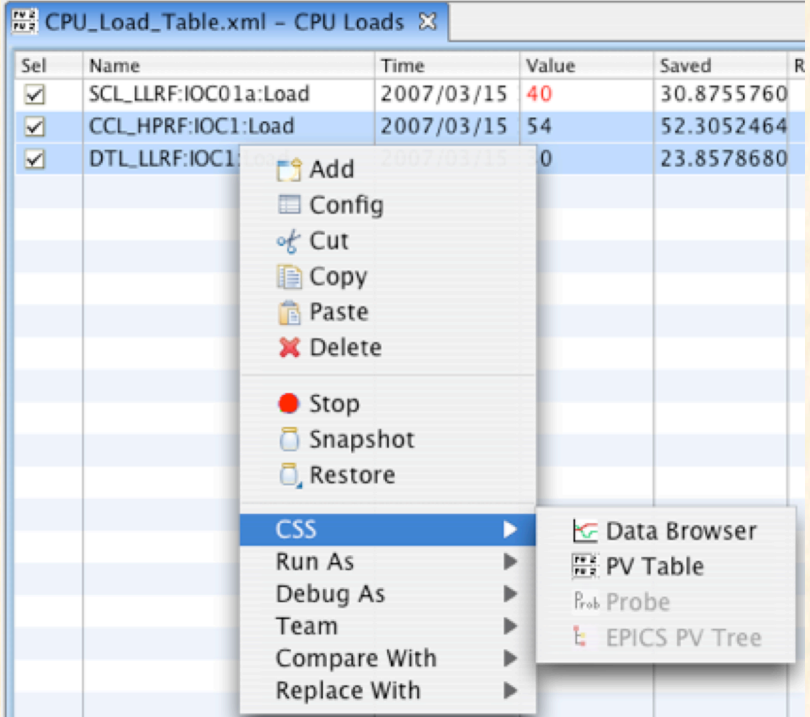


# Context Menus, Eclipse "Object Contributions"

- **Probe informs Eclipse that it can handle a "Process Variable".**
  - **CSS core defines "Process Variable", "Front End Computer", ...**
  - **All CSS apps are encouraged to do this.**
- **PV Table tells Eclipse about the currently selected PV (one or more) in the table.**
  - **All CSS apps are encouraged to publish their current selection.**

# Context Menus: Wait, there's more!

- Probe registered to handle one PV.
  - Others handle one or more...



The screenshot shows a window titled "CPU\_Load\_Table.xml - CPU Loads". It contains a table with the following data:

Sel	Name	Time	Value	Saved	R
<input checked="" type="checkbox"/>	SCL_LLRF:IOC01a:Load	2007/03/15	40	30.8755760	
<input checked="" type="checkbox"/>	CCL_HPRF:IOC1:Load	2007/03/15	54	52.3052464	
<input checked="" type="checkbox"/>	DTL_LLRF:IOC1	2007/03/15	0	23.8578680	

A context menu is open over the table, listing the following options:

- Add
- Config
- Cut
- Copy
- Paste
- Delete
- Stop
- Snapshot
- Restore
- CSS
- Run As
- Debug As
- Team
- Compare With
- Replace With

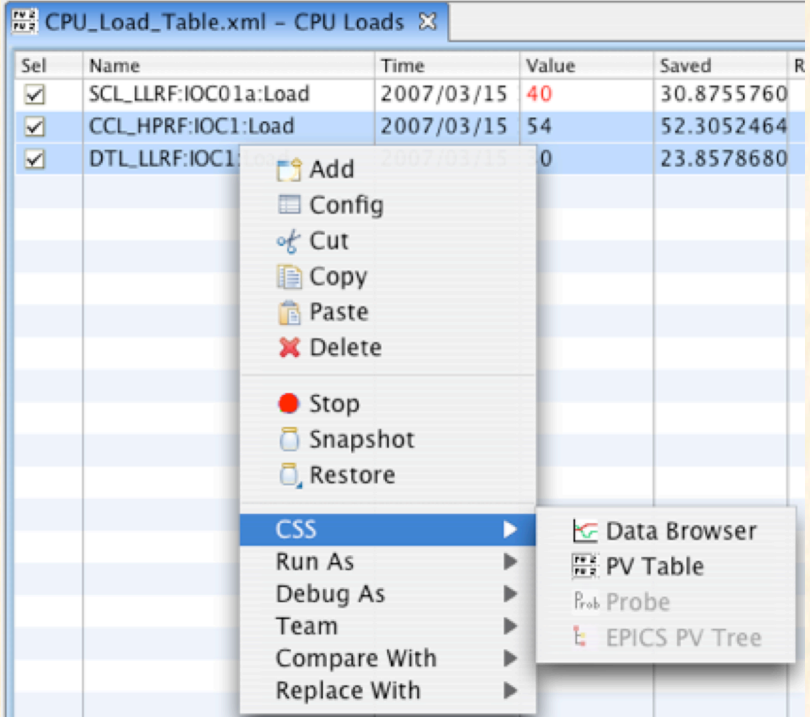
The "CSS" option is expanded, showing a sub-menu with the following options:

- Data Browser
- PV Table
- Prob Probe
- EPICS PV Tree



# Context Menus: Wait, there's more!

- Probe registered to handle one PV.
  - Others handle one or more...
- Early CSS core work provided a "Mouse Button 3" library to register and query "Process Variable" handlers etc.



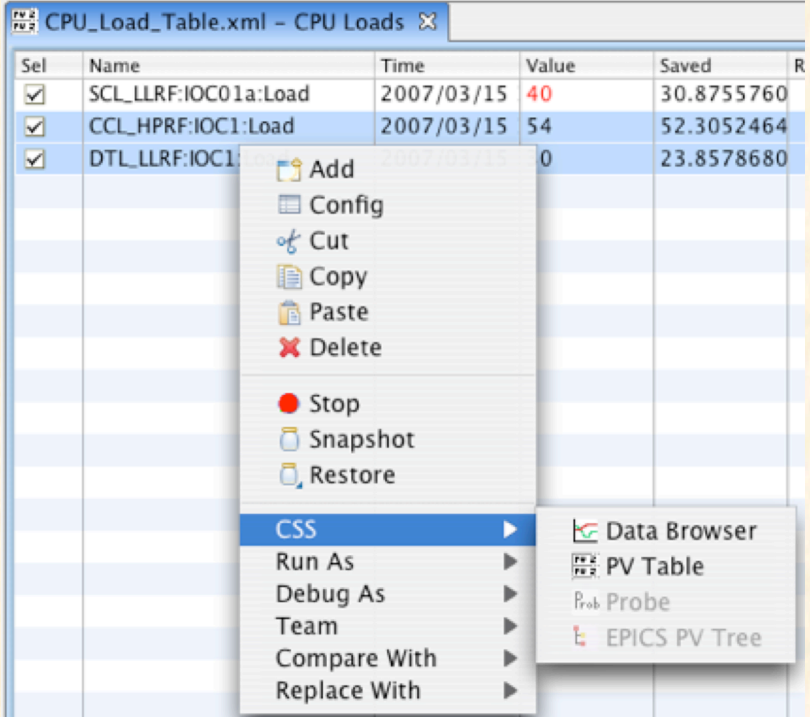
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A context menu is open over the table, listing various actions: Add, Config, Cut, Copy, Paste, Delete, Stop, Snapshot, Restore, CSS, Run As, Debug As, Team, Compare With, and Replace With. The "CSS" option is highlighted, and a sub-menu is visible with the following items: Data Browser, PV Table, Prob Probe, and EPICS PV Tree.

# Context Menus: Wait, there's more!

- Probe registered to handle one PV.
  - Others handle one or more...
- Early CSS core work provided a "Mouse Button 3" library to register and query "Process Variable" handlers etc.
- Eclipse already does all that!

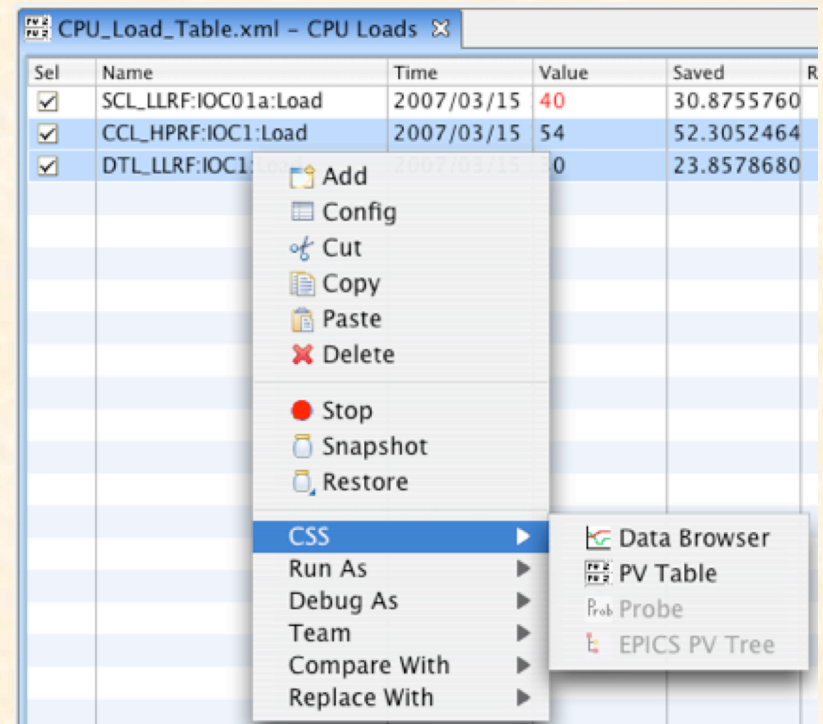


Sel	Name	Time	Value	Saved	R
<input checked="" type="checkbox"/>	SCL_LLRF:IOC01a:Load	2007/03/15	40	30.8755760	
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- Add
- Config
- Cut
- Copy
- Paste
- Delete
- Stop
- Snapshot
- Restore
- CSS
  - Data Browser
  - PV Table
  - Prob Probe
  - EPICS PV Tree
- Run As
- Debug As
- Team
- Compare With
- Replace With

# Context Menus: Wait, there's more!

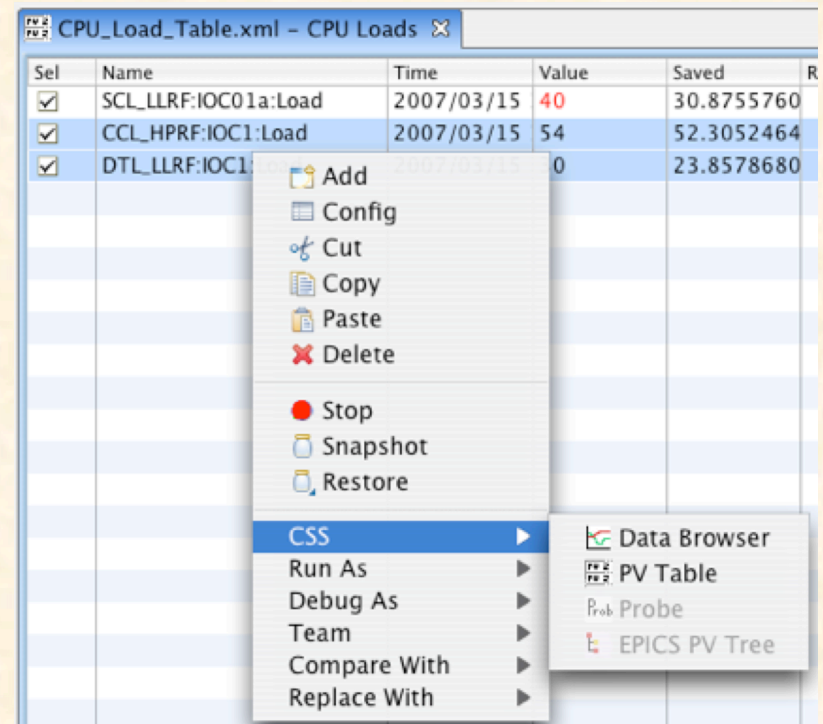
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- PV Table doesn't even know that Probe exists



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# Context Menus: Wait, there's more!

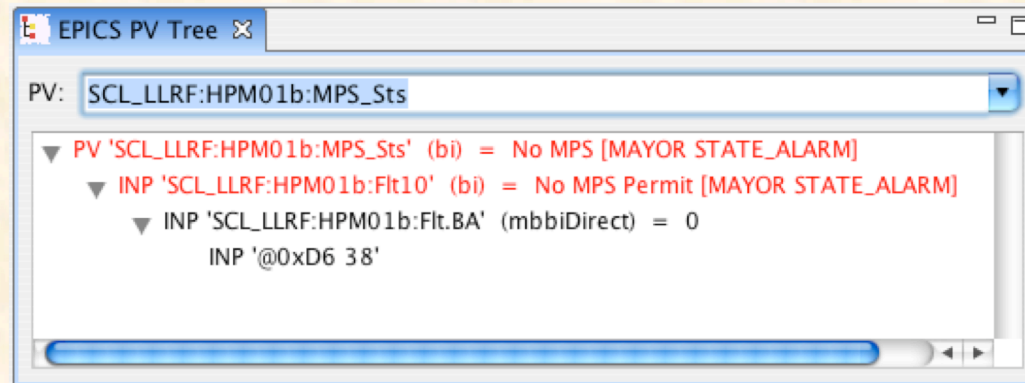
- Probe registered to handle one PV.
  - Others handle one or more...
- Early CSS core work provided a "Mouse Button 3" library to register and query "Process Variable" handlers etc.
- Eclipse already does all that!
- PV Table doesn't even know that Probe exists
- Eclipse automatically loads Probe when first needed





# EPICS PV Tree

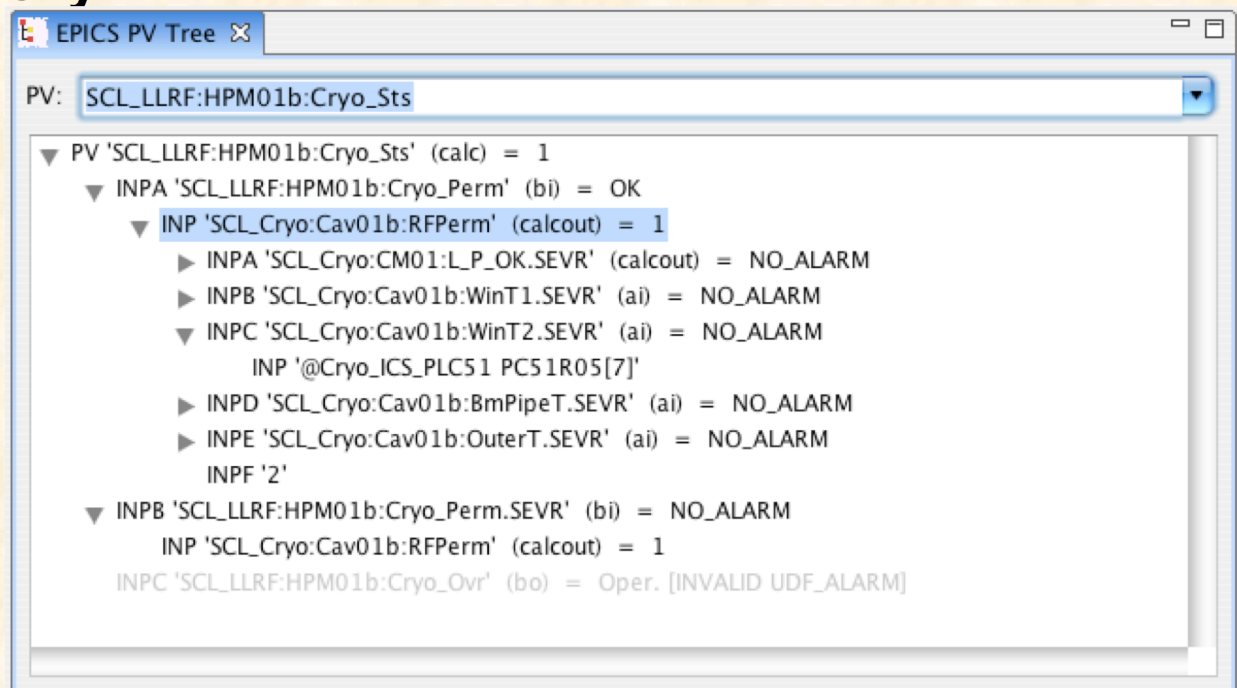
- Enter PV
  - Or select previous PV
- Get live info on
  - Record type/value/status/severity
  - INP/DOL link hierarchy



```
EPICS PV Tree
PV: SCL_LLRF:HPM01b:MPS_Sts
▼ PV 'SCL_LLRF:HPM01b:MPS_Sts' (bi) = No MPS [MAYOR STATE_ALARM]
  ▼ INP 'SCL_LLRF:HPM01b:Ft10' (bi) = No MPS Permit [MAYOR STATE_ALARM]
    ▼ INP 'SCL_LLRF:HPM01b:Ft.BA' (mbbiDirect) = 0
      INP '@0xD6 38'
```

- **Disclaimer:**

EPICS makes it impossible to introspect the actual link hierarchy, because that would be hidden inside the DBD files and code loaded by the actual IOC. In the case of a custom CA server, there is no link hierarchy at all. This program simply contains hard-coded and incomplete knowledge about the 'common' EPICS record types.



```
EPICS PV Tree
PV: SCL_LLRF:HPM01b:Cryo_Sts
▼ PV 'SCL_LLRF:HPM01b:Cryo_Sts' (calc) = 1
  ▼ INPA 'SCL_LLRF:HPM01b:Cryo_Perm' (bi) = OK
    ▼ INP 'SCL_Cryo:Cav01b:RFPerm' (calcout) = 1
      ► INPA 'SCL_Cryo:CM01:L_P_OK.SEVR' (calcout) = NO_ALARM
      ► INPB 'SCL_Cryo:Cav01b:WinT1.SEVR' (ai) = NO_ALARM
      ▼ INPC 'SCL_Cryo:Cav01b:WinT2.SEVR' (ai) = NO_ALARM
        INP '@Cryo_ICS_PLC51 PC51R05[7]'
      ► INPD 'SCL_Cryo:Cav01b:BmPipeT.SEVR' (ai) = NO_ALARM
      ► INPE 'SCL_Cryo:Cav01b:OuterT.SEVR' (ai) = NO_ALARM
        INPF '2'
    ▼ INPB 'SCL_LLRF:HPM01b:Cryo_Perm.SEVR' (bi) = NO_ALARM
      INP 'SCL_Cryo:Cav01b:RFPerm' (calcout) = 1
      INPC 'SCL_LLRF:HPM01b:Cryo_Ovr' (bo) = Oper. [INVALID UDF_ALARM]
```

# Prime example for Context Menu

- Often useful to see the 'CALC' for a tree item
  - Get probe via context menu
  - add ".CALC"
  - voila!

The screenshot displays two windows from the EPICS control system. The top window, titled 'Prob Probe', shows the configuration for a probe named 'SCL\_Cryo:Cav01b:RFPerm.CALC'. Its value is the logical expression  $((A+B+C+D+E)<F)?1:0$ . The timestamp is '2007/03/15 10:23:47.261709666' and the status is 'OK'. The bottom window, titled 'EPICS PV Tree', shows a hierarchical tree of process variables. The selected PV is 'SCL\_LLRF:HPM01b:Cryo\_Sts'. The tree structure is as follows:

- ▼ PV 'SCL\_LLRF:HPM01b:Cryo\_Sts' (calc) = 1
  - ▼ INPA 'SCL\_LLRF:HPM01b:Cryo\_Perm' (bi) = OK
    - ▼ INP 'SCL\_Cryo:Cav01b:RFPerm' (calcout) = 1
      - ▶ INPA 'SCL\_Cryo:CM01:L\_P\_OK.SEVR' (calcout) = NO\_ALARM
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      - INPF '2'
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      - INPC 'SCL\_LLRF:HPM01b:Cryo\_Ovr' (bo) = Oper. [INVALID UDF\_ALARM]

# Control System Clock

- Very stylish



# Control System Clock

- Very stylish
- No confusion about "4 am" vs. "4 pm"





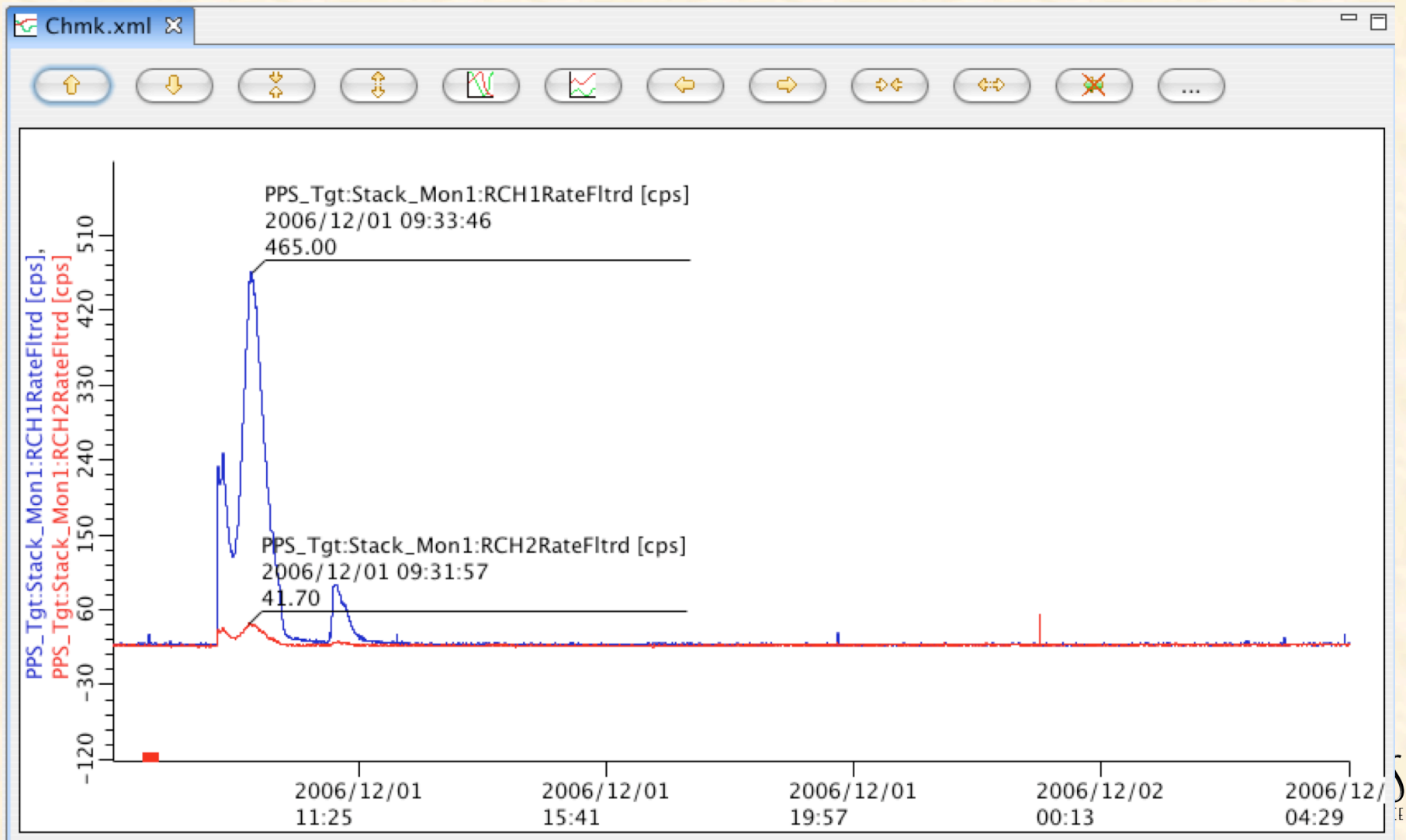
# Control System Clock

- **Very stylish**
- **No confusion about "4 am" vs. "4 pm"**
- **Relieves schedule pressure by adding a whole hour to your day**



# Data Browser

- "StripTool" + "Archive Viewer" for CSS

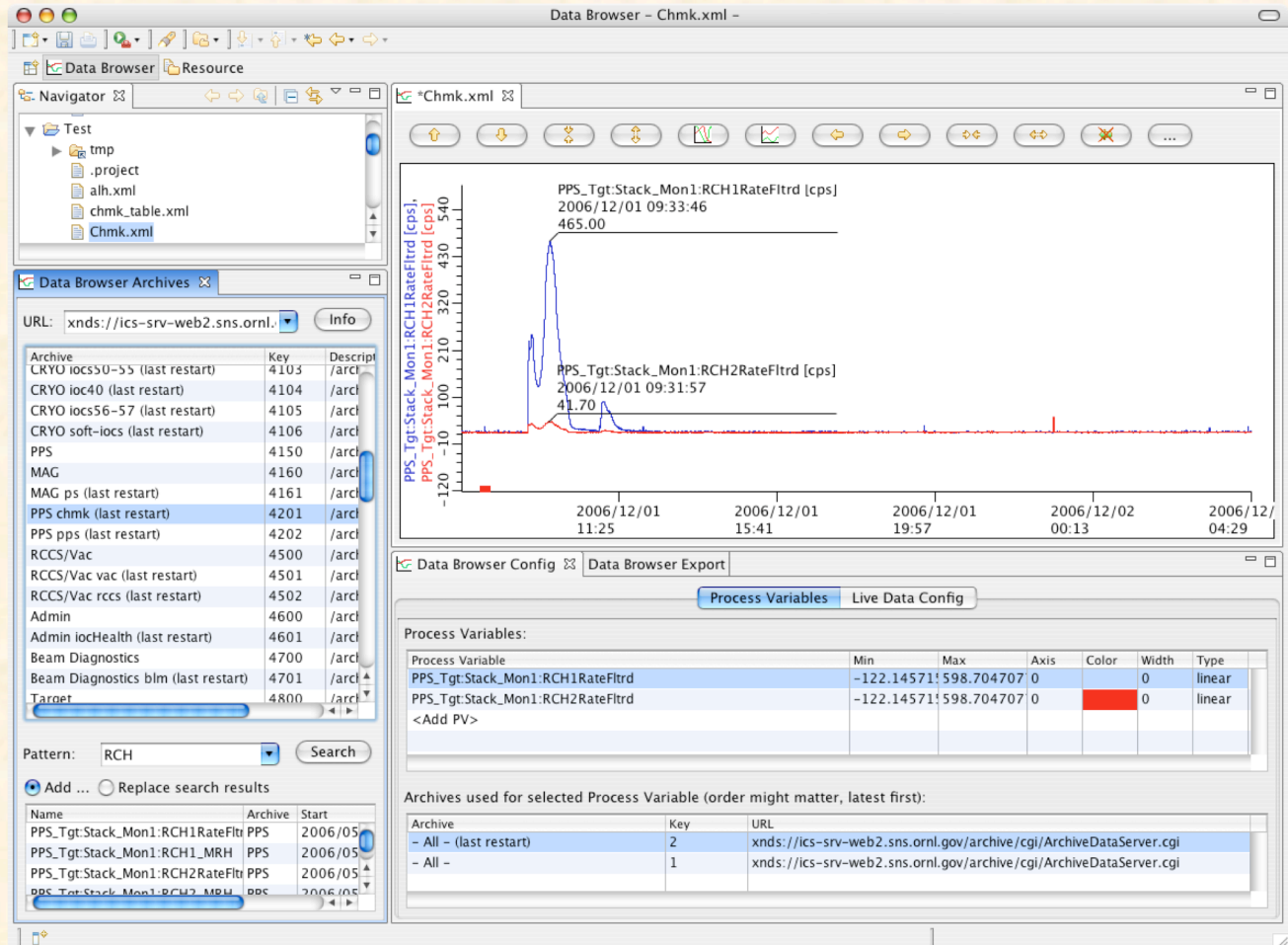


# Eclipse: "Editors", "Views"

- "Editors"
  - show document title, 'dirty' state, "Do you want to save" dialog on exit, save, save as, open when clicking on document in file navigator, ...
- "View"
  - Typically shows information not useful for per-instant save/restore
    - time, global settings, ...
  - ... or detail of current document
    - "Config" panel of Data Browser, outline, ...

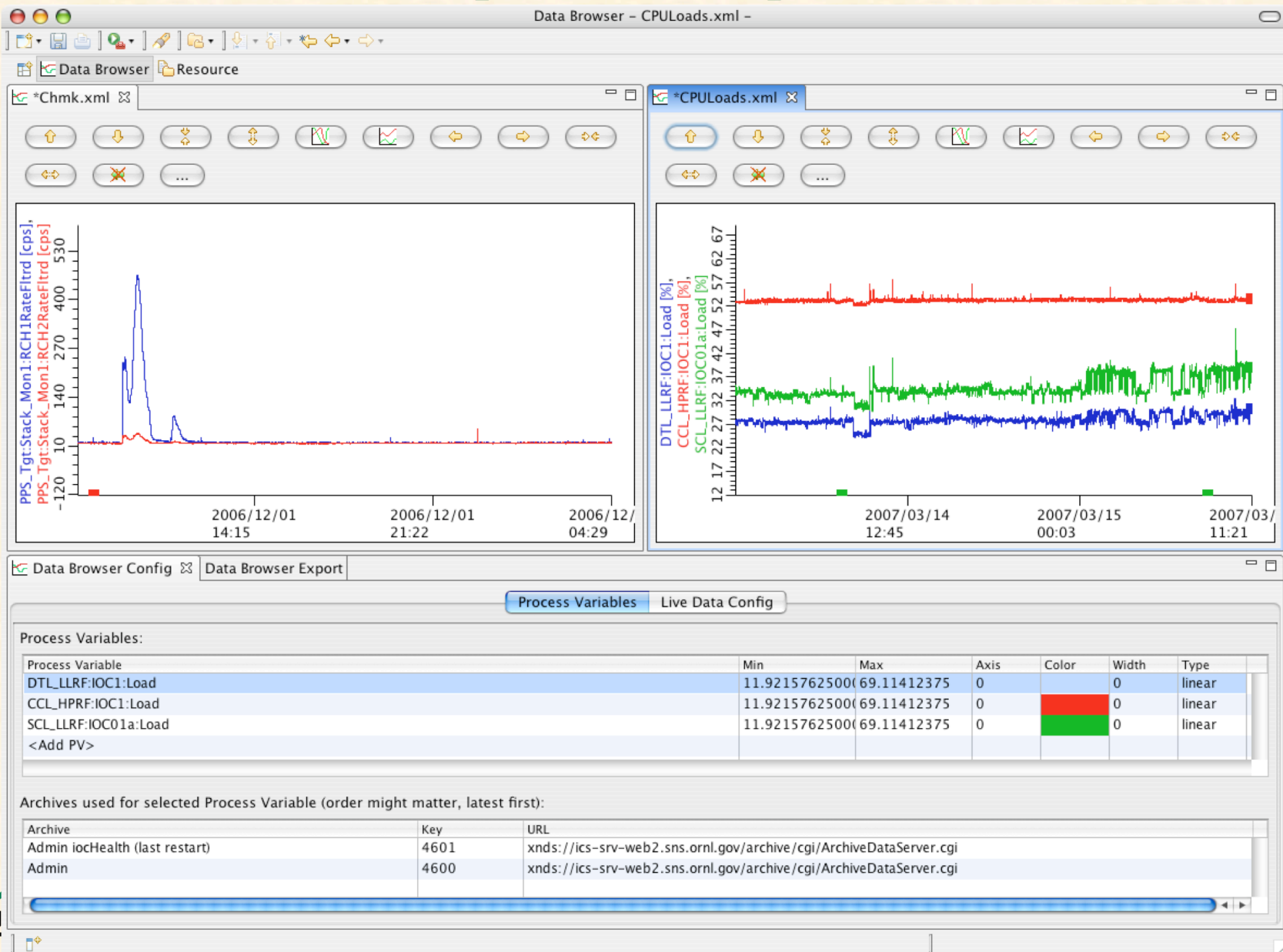
# Look & Feel: "Perspectives"

- Arrangement of views and editors
  - Named
  - modify/save/restore
- View closed, then reopened: Same location!





# Another Example Perspective



# Data Browser Features

- **"Live" data handling 99% like StripTool**
- **More interactive**
  - Zoom/pan whole plot
  - Select "Y" axis -> zoom/pan that "Y" axis
  - Drop PVs onto plot
    - Each PV added with own "Y" axis
  - ... drop onto existing Y axis
    - PVs added to that axis
- **Archive Access fully asynchronous**
  - "Zoom in": Immediate redraw, then refresh as data arrives
  - Ties into Eclipse "Progress" view

# Coding for Eclipse: Hard, but good

- This is not Visual Basic
- Learning curve:  
One month to the first "Hello, Eclipse"
- Hollywood Principle
  - "Don't call us, we will call you."
  - Examples:
    - Don't launch your app and open a document. Instead: App registers as a handler for a doc. type; wait for Eclipse to open it and your app if needed.
    - Don't add a menu. Contribute to existing menus.
- But almost everything does make sense.
  - Common look & feel. Not "Kay's" GUI, not "SNS feel", ...
  - Good books available. "Google" often answers questions.

# Drag & Drop

- **Eclipse allowed us to implement DnD specific to**
  - **Process Variable**
  - **Archive Data Source**
  - **PV with Archive Data Source**
  - **Front End Controller**
  - ...
- **Visual feedback:**
  - "Can this application accept a PV?"
- **... but so far no perfect, minimal, portable solution**
  - **One class per DnD data**



# Eclipse "Plugin" Packaging

- **Primarily: 'jar' file plus manifest that details what's visible, what's hidden, and what other plugins are required.**
  - Can also add images, HTML files, JNI libs
- **CSS advantage**
  - One plugin provides "Channel Access" to all apps.
    - Connections are shared.
    - Preference page instead of EPICS\_CA\_ADDR...
  - One plugin for basic archive API with "Extension points"
    - One extension for "Channel Archiver" data server
    - One for "DESY AAPI"
    - Load one/other/both, no need to recompile Data browser

# Coding: SWT/JFace vs. AWT/SWING

- **Similar, but no practical way to port code between them**
  - "bridge" allows AWT/SWING inside an SWT frame, but not trivial
- **Both have quirks/bugs/performance issues**
- **SWING much more common**
- **IMHO, SWT/JFace a bit nicer on Linux**
  - Can pick "Motif" or "GTK";  
AWT only generic "Metal" look.
- **Jface Table and Tree API much richer**
  - SWT closer to raw widgets

# Deployment Options

- **Add "Plugins" to**
  1. **ordinary Eclipse installation**
    - **With Java, XML, perl, vxWorks, C++, HAM Radio related plugins ....**
  2. **"Control System Studio" application**
- **Get plugins**
  - **Manually from 'zip' file**
  - **From "Update Site"**
    - **"Wizards" help to select required plugins**
- **All very neat to the end user, but requires quite some work by the maintainer of the update site**