

Control System Studio,

CSS

Overview

Kay Kasemir

ORNL/SNS

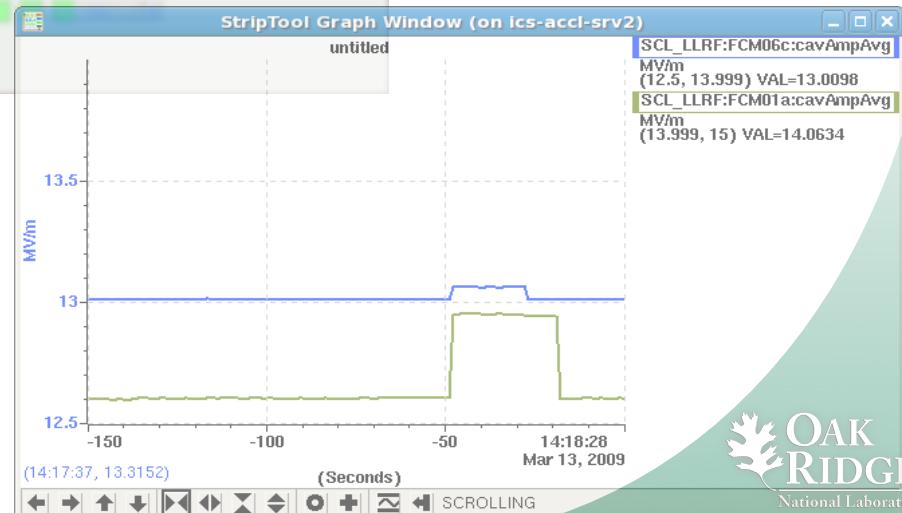
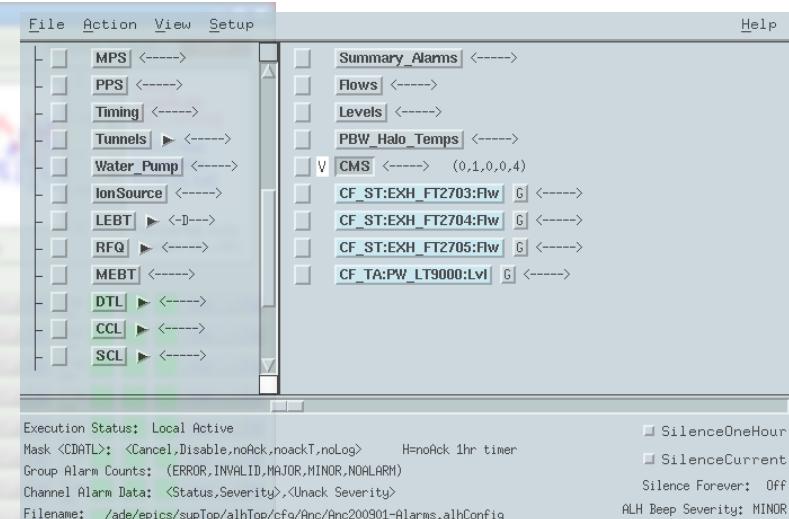
kasemirk@ornl.gov

Jan. 2013

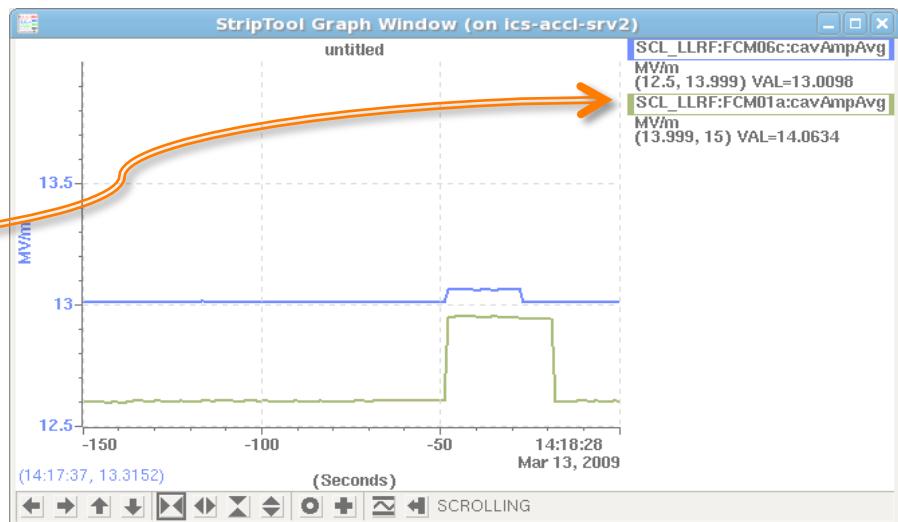
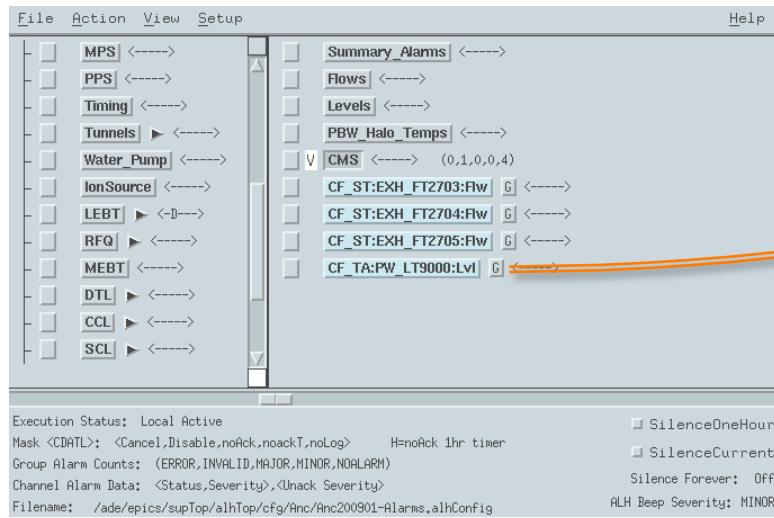
Original EPICS Operator Interfaces

Many disjoint tools

- Static layout
- Inconsistent Look
- Online help?
- primarily for Linux/X11



No Integration between Tools



- Note PV associated with Alarm
- Start StripTool
 - Add PV to StripTool
- Start Archive viewer
 - Add PV ..

CSS: A Collaboration

- Goal:
Portable, better integrated control system tools
- Started 2006 between DESY and SNS
 - Joined by CLS, APS, BNL, ITER, KEK/J-PARC, ...
- <http://sourceforge.net/apps/trac/cs-studio>
 - Wiki, Mailing lists
 - Source code: <https://github.com/ControlSystemStudio>



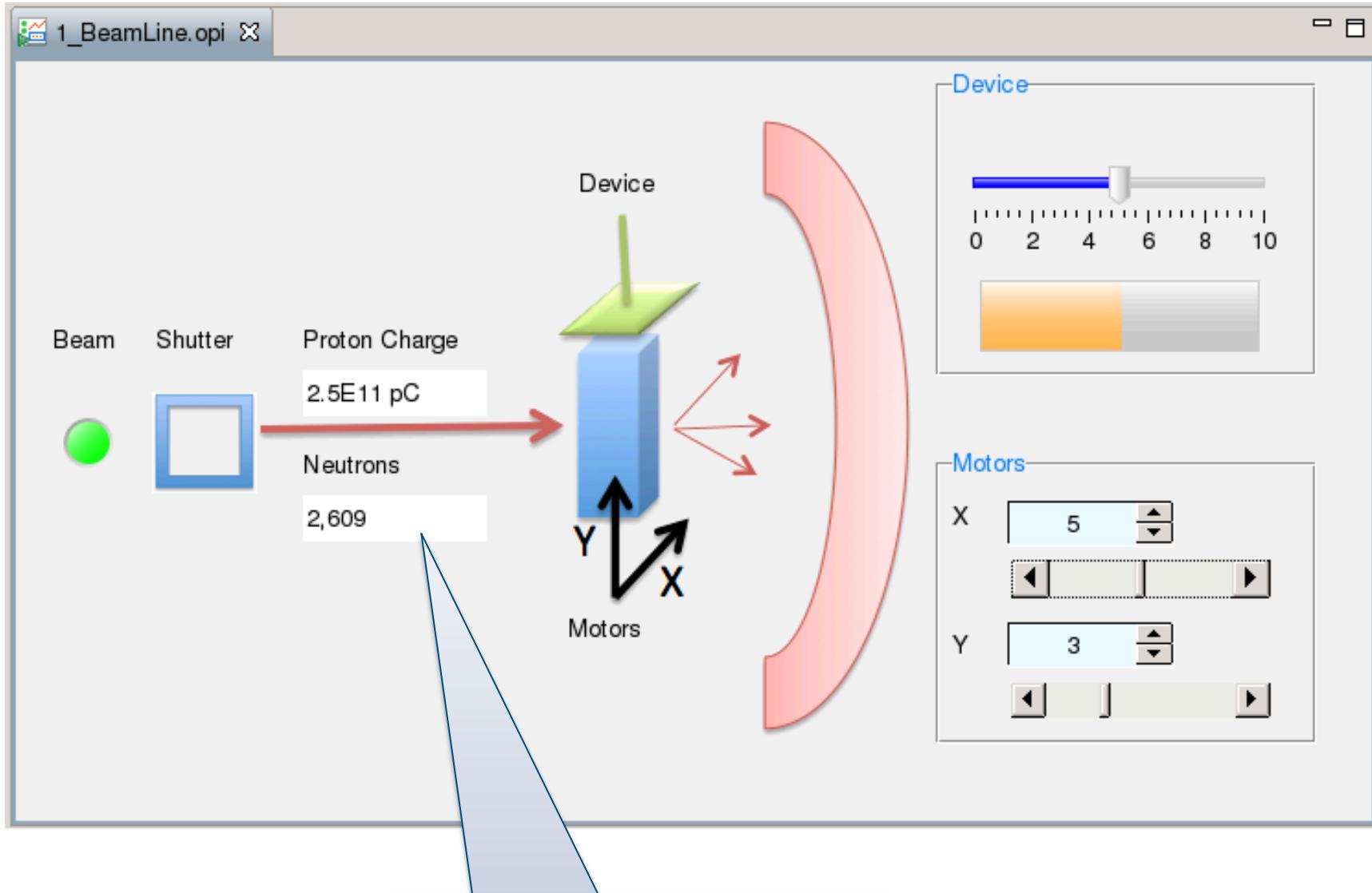
CSS: Control System Architecture

- Portable environment (**Windows, Linux, OS X**)
- Free development tools

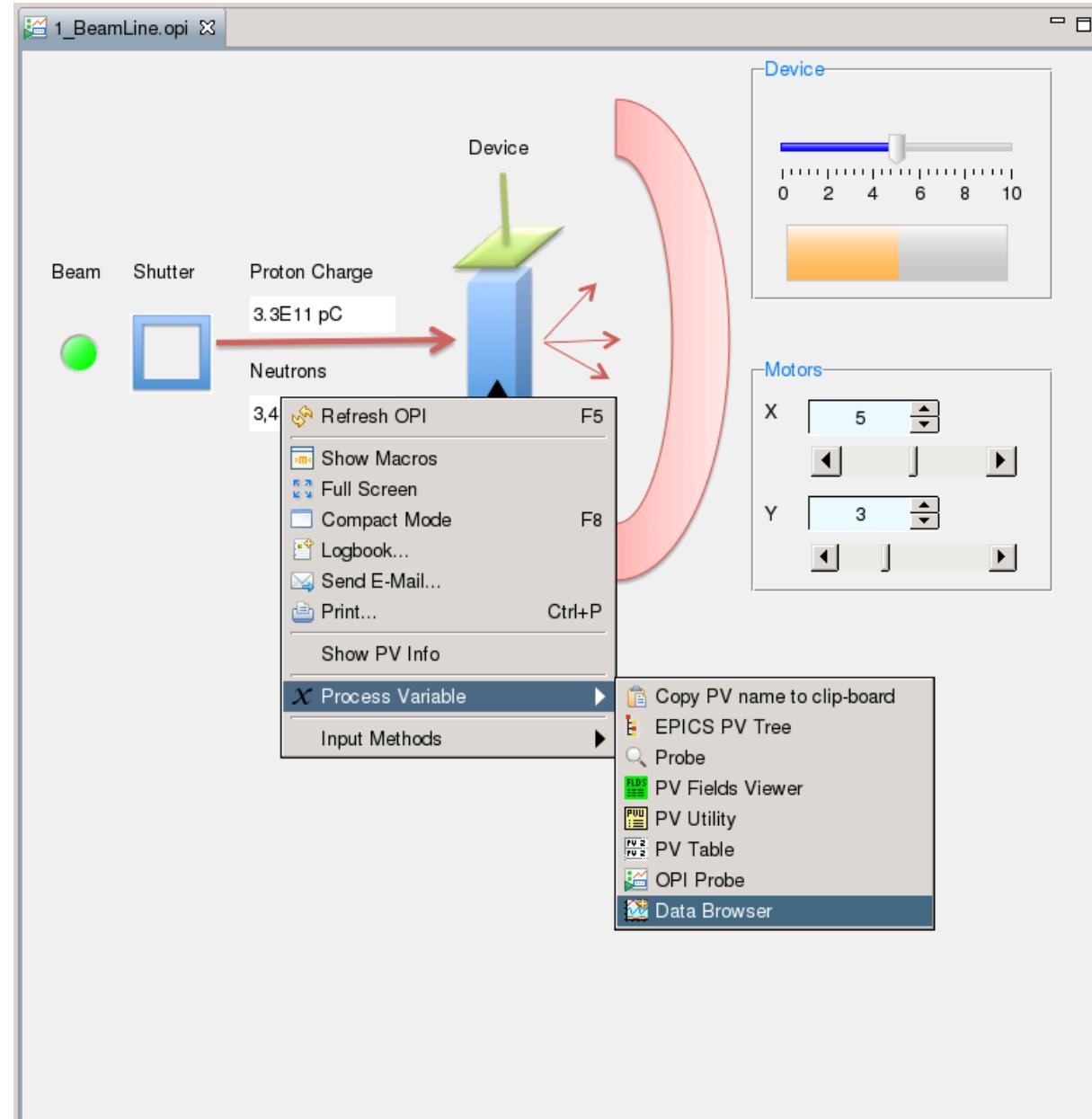


- Plug-Ins, Extension points, Registry
- Rich Client Platform (RCP): Windows, menus, help, preferences, online update, ...

Assume this Beam Line GUI



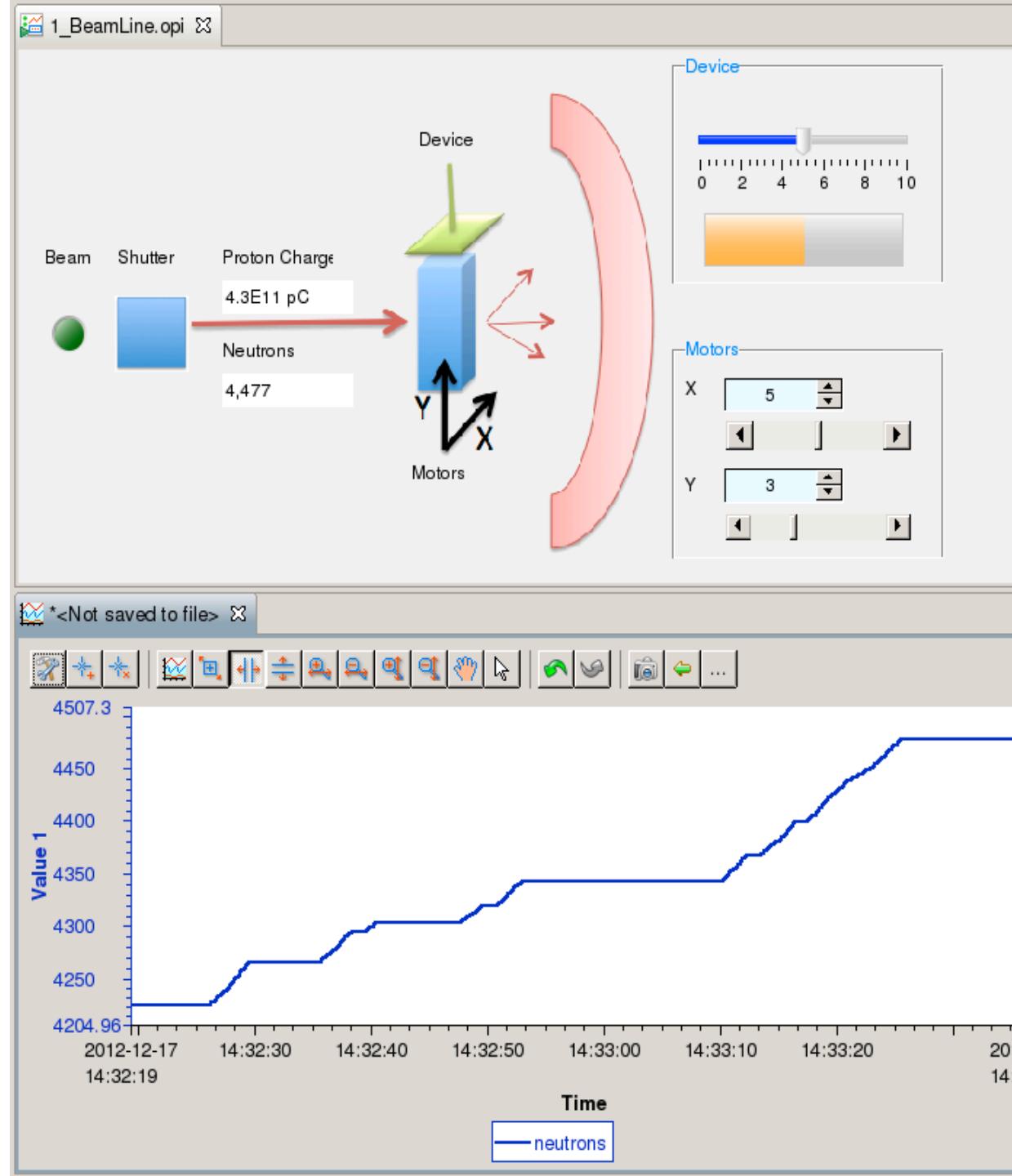
Right click on the neutron count...



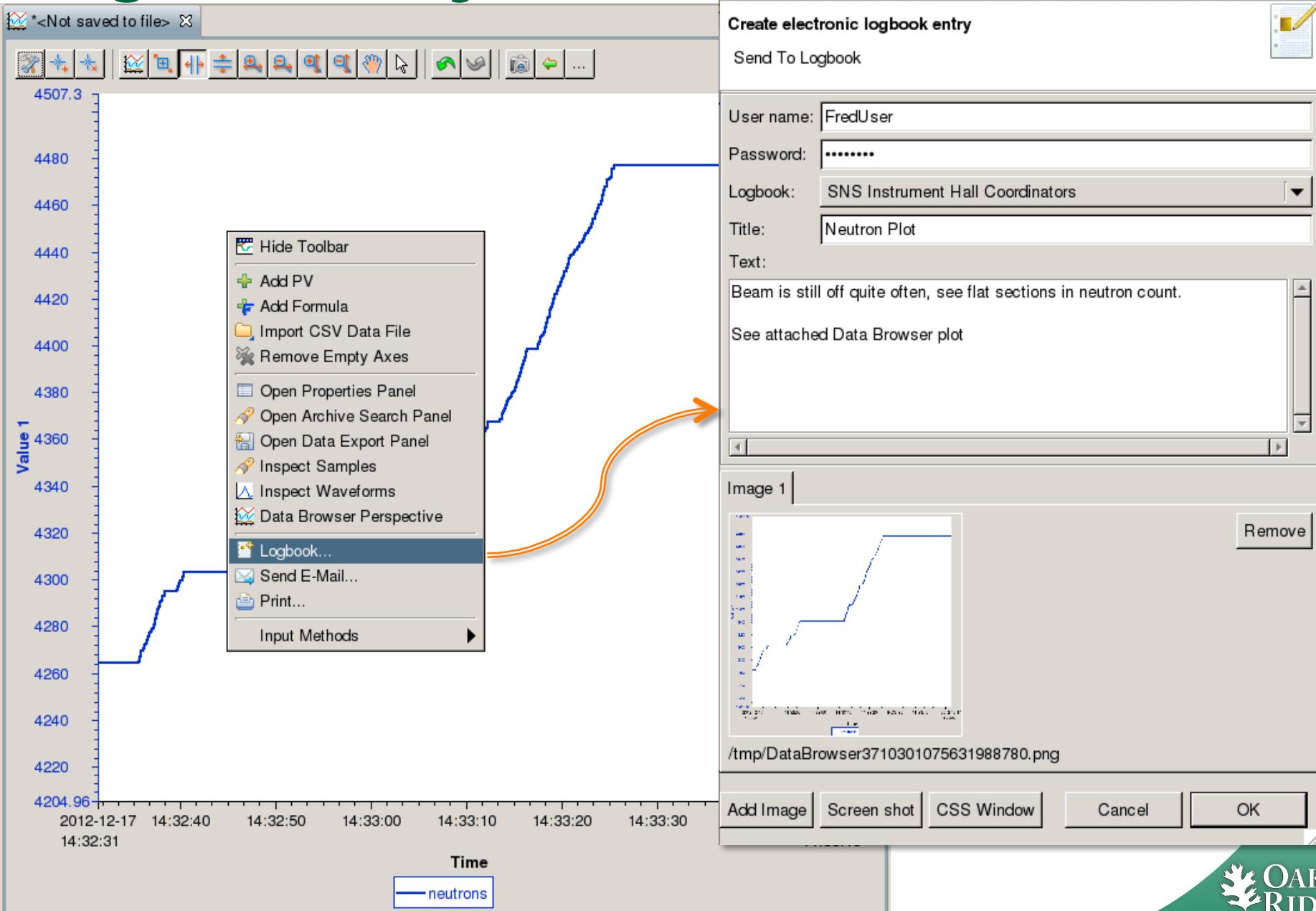
'Data Browser' is listed as one of the tools that handle Process Variables...

Plotting...

- Data Browser started
- PV added
- Starts showing samples over time
- Can also query historic data, if available



Logbook Entry...



Accelerator Example: React to Alarm

Alarm Table X

Current Alarms		Filter						
PV	Description	Time	Curre...	Severity	Status	Value		
CF_KL:DIWS_AIT4303B:Rs	CF_KL:DIWS_AIT4303B:Rs	2009/03/17 16:10:06	MINOR	MINOR	HIGH_ALARM	18.5		
RFQ_Vac:Pump2:Pressure	Demo pump 2	2009/03/17 16:09:46	OK	MAJOR	HIHI_ALARM	9.0		
RFQ_Vac:Pump6:Pressure	Demo pump 6	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0		
RFQ_Vac:Pump5:Pressure	Demo pump 5	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0		
RFQ_Vac:Pump4:Pressure	Demo pump 4	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0		
RFQ_Vac:Pump3:Pressure	Demo pump 3	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0		
MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault	2009/03/16 19:05:10	MAJOR	MAJOR	LOLO_ALARM	0.000		

CSS includes an alarm system.

Operator notices an alarm...

Example Work Flow: React to Alarm.

The screenshot shows the EPICS Alarm Table interface. The 'Current Alarms' section lists several alarms, including 'Demo pump 2' and 'Demo pump 6'. The 'Acknowledged Alarms' section lists 'Moderator System MPS Trip' and 'MEBT_Chopper_PS_2_V'. A context menu is open over the entry for 'mebbit chopper power supply two voltage fault'. The menu options include:

- 21:44:56
- i Check MEBT PS 2 Chopper
- MEBT Chopper PS 2 Screen
- Logbook...
- Acknowledge
- Copy Pv Name to Clipboard
- CSS
- Configure Item
- Auto-size Columns
- Alarm Perspective

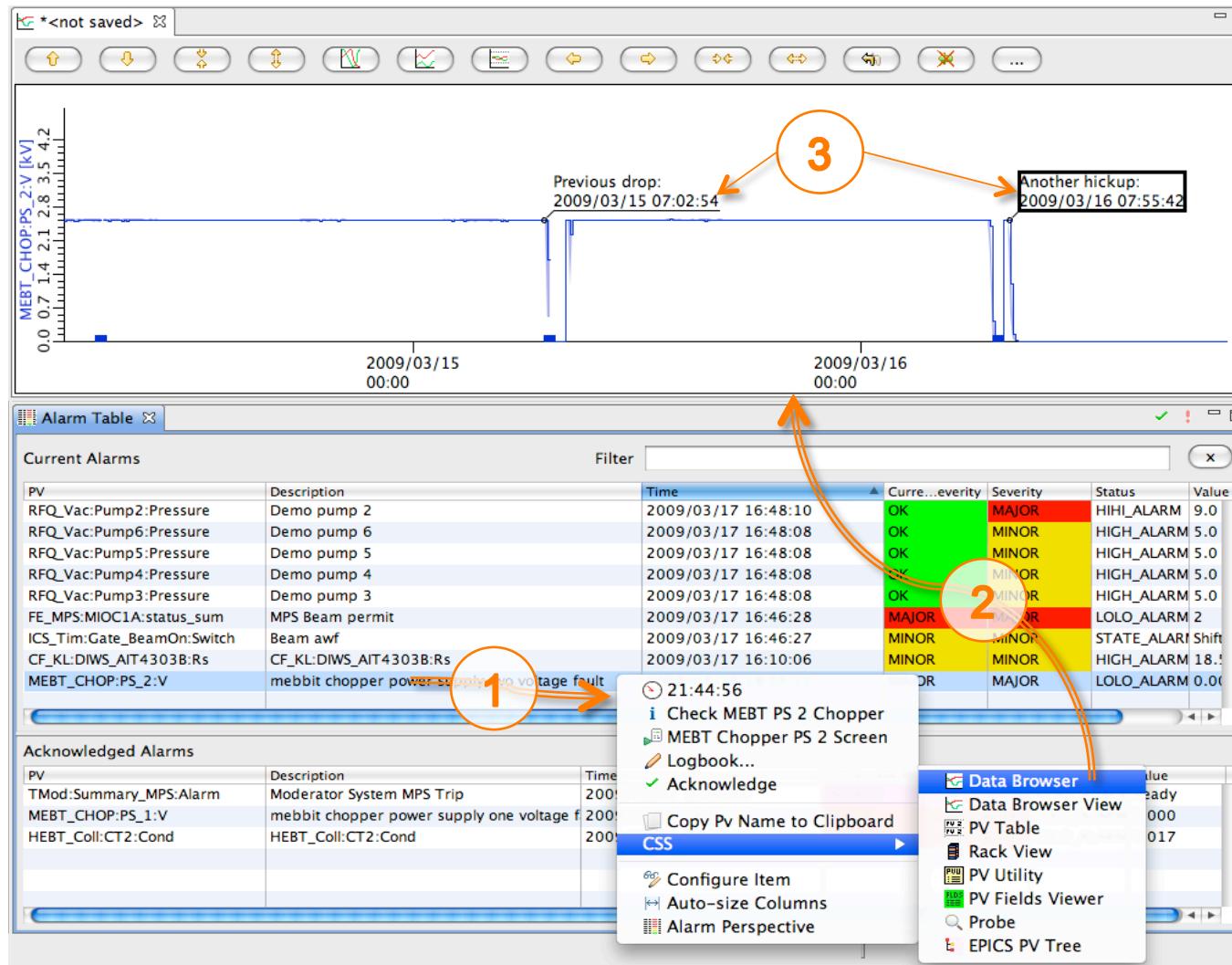
On the right side of the interface, there is a 'Data Browser' window listing various PV tables and utility tools.

PV	Description	Time	Current State	Severity	Status	Value
RFQ_Vac:Pump2:Pressure	Demo pump 2	2009/03/17 16:48:10	OK	MAJOR	HIHI_ALARM	9.0
RFQ_Vac:Pump6:Pressure	Demo pump 6	2009/03/17 16:48:08	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump5:Pressure	Demo pump 5	2009/03/17 16:48:08	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump4:Pressure	Demo pump 4	2009/03/17 16:48:08	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump3:Pressure	Demo pump 3	2009/03/17 16:48:08	OK	MINOR	HIGH_ALARM	5.0
FE_MPS:MIOC1A:status_sum	MPS Beam permit	2009/03/17 16:46:28	MAJOR	MAJOR	LOLO_ALARM	2
ICS_Tim:Gate_BeamOn:Switch	Beam awf	2009/03/17 16:46:27	MINOR	MINOR	STATE_ALARM	Shift
CF_KL:DIWS_AIT4303B:Rs	CF_KL:DIWS_AIT4303B:Rs	2009/03/17 16:10:06	MINOR	MINOR	HIGH_ALARM	18.9
MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault		DR	MAJOR	LOLO_ALARM	0.00

PV	Description	Time	Current State	Severity	Status	Value
TMod:Summary_MPS:Alarm	Moderator System MPS Trip	2009/03/17 16:46:28	MAJOR	MAJOR	LOLO_ALARM	0.00
MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage f	2009/03/17 16:46:27	MINOR	MINOR	STATE_ALARM	0.00
HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	2009/03/17 16:46:27	MINOR	MINOR	STATE_ALARM	0.017

Context menu of alarm... (“right click”)

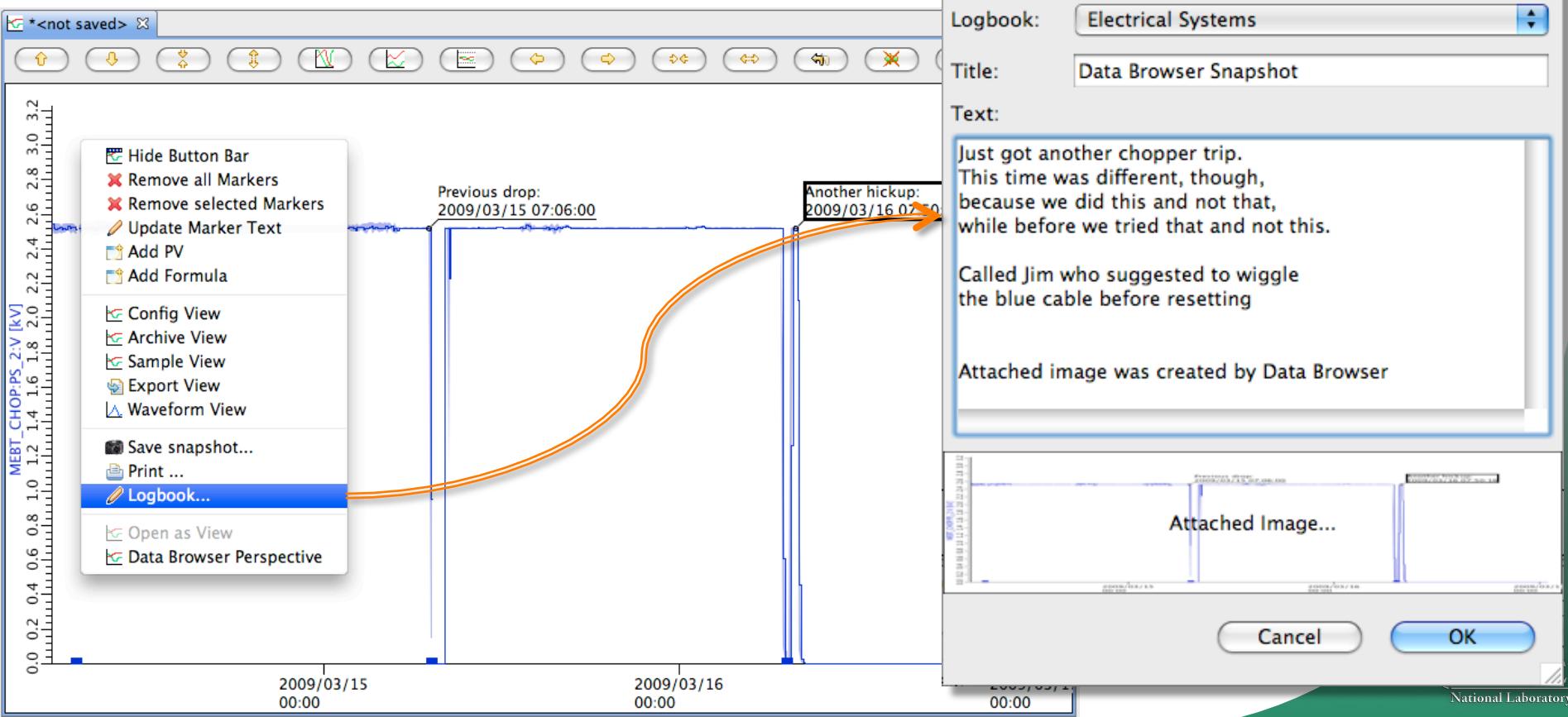
Example Work Flow: React to Alarm...



Inspect history of PV, annotate, ...

Finally: Make Logbook Entry

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



CSS: Toolkit

- **Application Plug-Ins**

- Strip-Chart: Data Browser 
- OPI: BOY 
- Alarms: BEAST 
- Automation: Scan System
- Utilities: Probe, Clock , PV Tree , Psychiatrist 

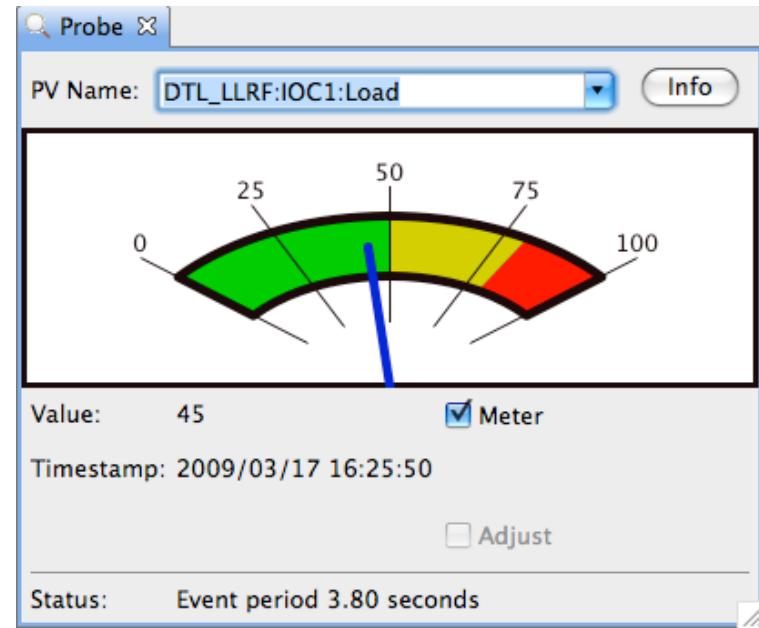
- **Library Plug-Ins**

- Control system data types (PV, Sample, ...), Life data access, Historic Data Access, Logbook , E-Mail, Authentication, Authorization, ...
- Extension Points
 - Life data: Channel Access, Simulated, Local PVs
 - Historic Data: XML-RPC, RDB, ...
 - Authentication: Kerberos, LDAP, ...

Basic CSS Tools

Probe

- Current value of a PV

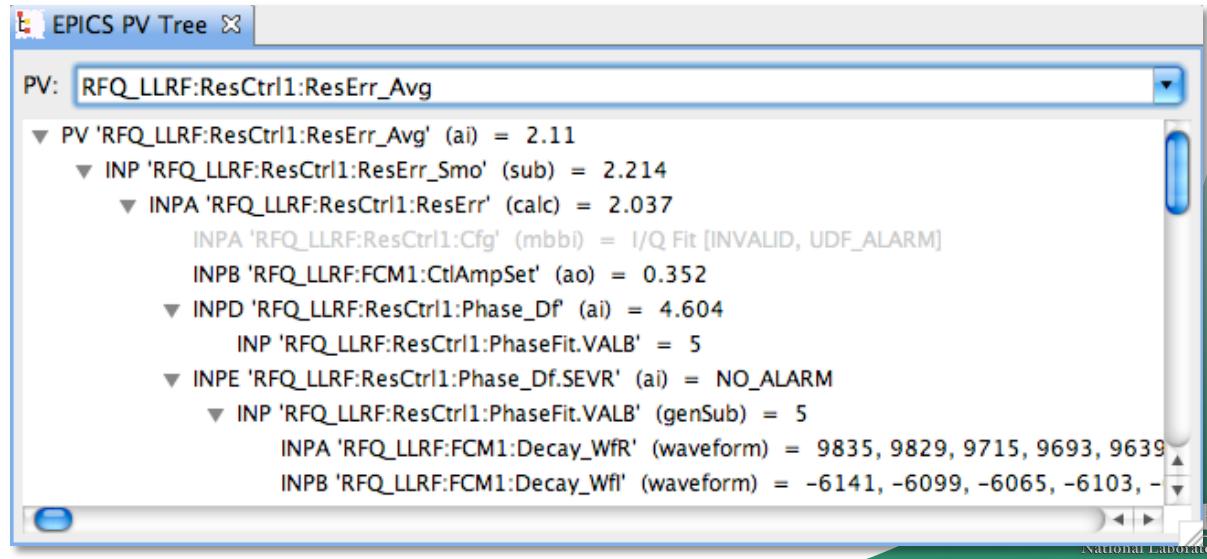


EPICS PV Tree

- Trace PV links

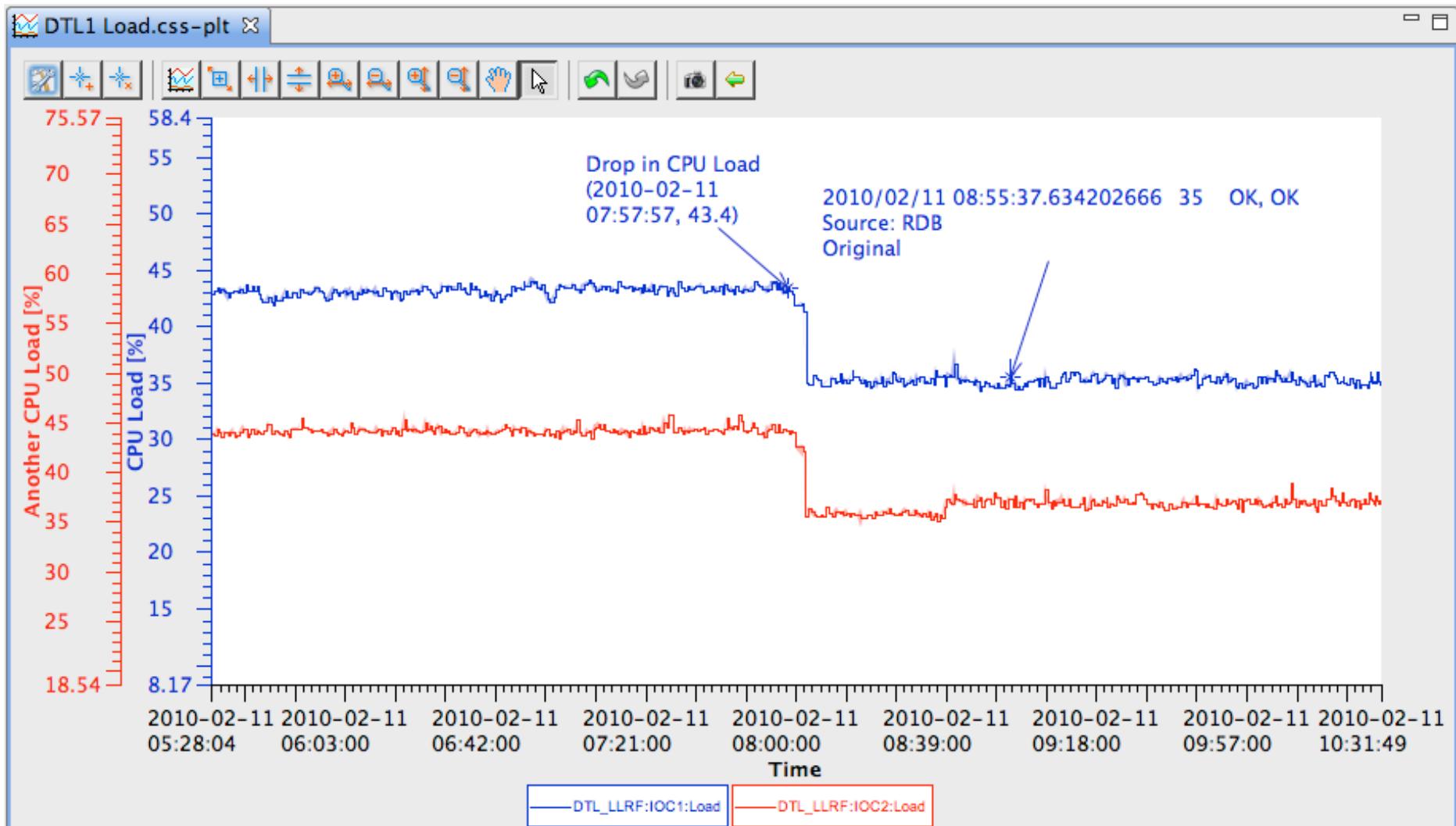
Both:

- ✓ Resize
- ✓ PV Name Drop-down history

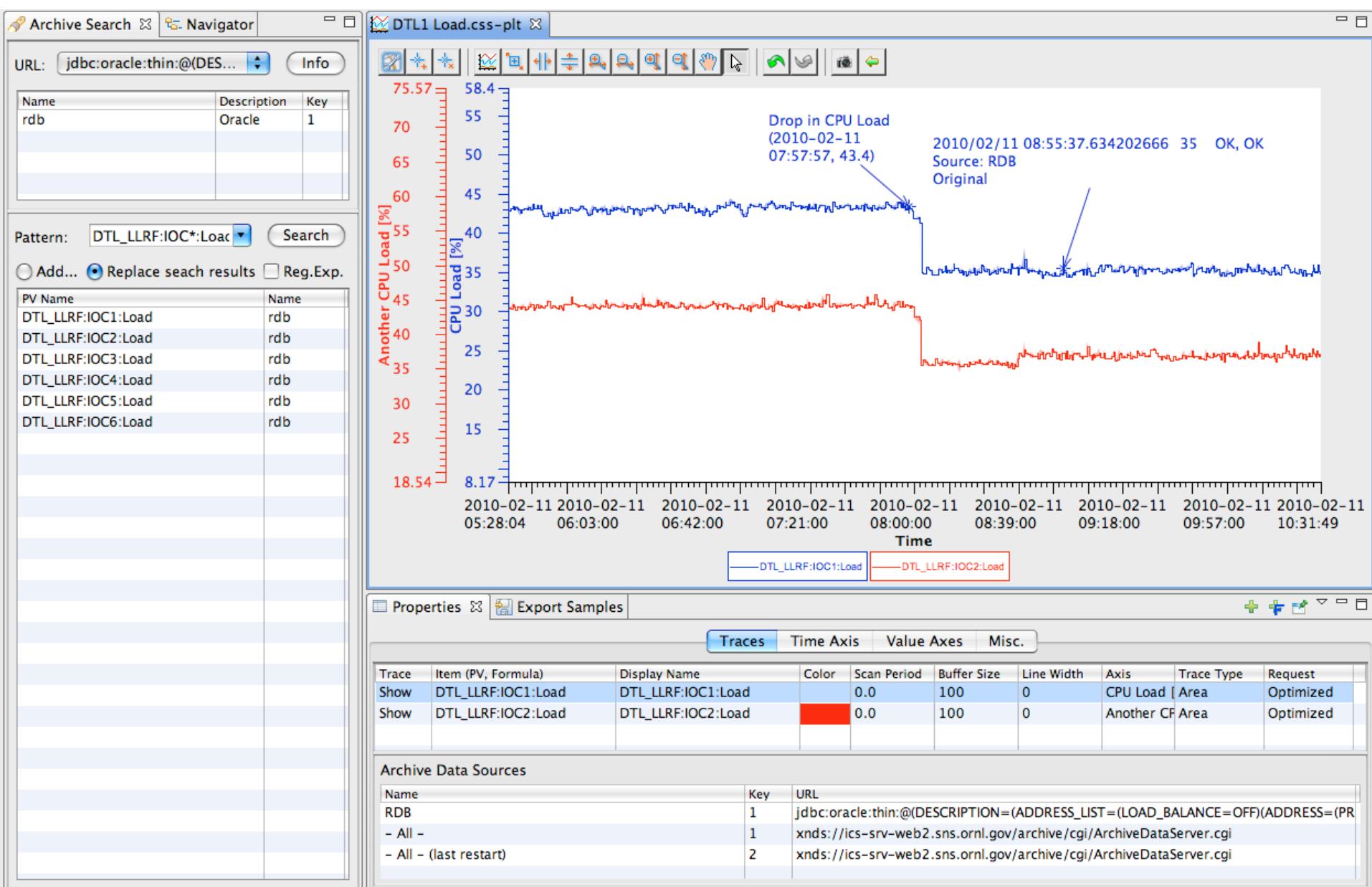


Data Browser

Plot ‘live’ and ‘archived’ data over time



Support for Historic Data Sources



Alarm System (BEAST)

Tabular or Tree view, voice annunciations, ...

The screenshot displays the BEAST alarm system interface with two main windows: 'Alarm Tree' and 'Alarm Table'.

Alarm Tree Window: Shows a hierarchical tree of alarm areas. Some areas are in red (e.g., BeamPermit, MEBT) and others in green. A tooltip 'Select by Name, Description' points to the tree area.

Alarm Table Window: Shows a table of current alarms. The columns are: PV, Description, Time, Current severity, Severity, Status, and Value. A tooltip 'Sort by Time, Severity, ...' points to the table area.

Annotations:

- A callout box labeled 'Select by Name, Description' points to the Alarm Tree window.
- A callout box labeled 'Acknowledge' points to the Acknowledged Alarms section of the Alarm Table window.

Current Alarms Table Data:

PV	Description	Time	Current severity	Severity	Status	Value
CF_KL:DIVS_AIT4303B:Rs	CF_KL:DIVS_AIT4303B:Rs	2009/03/17 16:10:06	MINOR	MINOR	HIGH_ALARM	18.5
RFQ_Vac:Pump2:Pressure	Demo pump 2	2009/03/17 16:09:46	OK	MAJOR	HIGH_ALARM	9.0
RFQ_Vac:Pump6:Pressure	Demo pump 6	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump5:Pressure	Demo pump 5	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump4:Pressure	Demo pump 4	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0
RFQ_Vac:Pump3:Pressure	Demo pump 3	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	5.0
MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault	2009/03/16 19:05:10	MAJOR	MAJOR	LOLO_ALARM	0.000

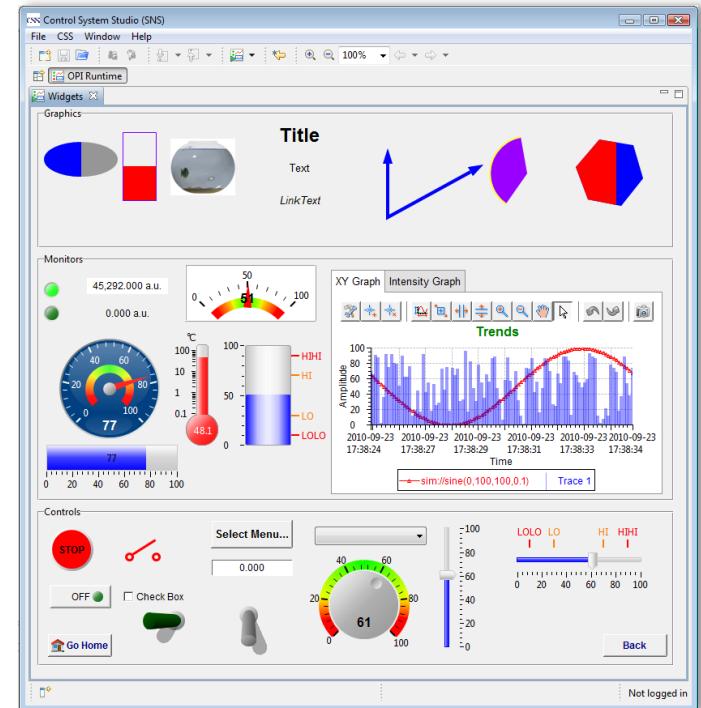
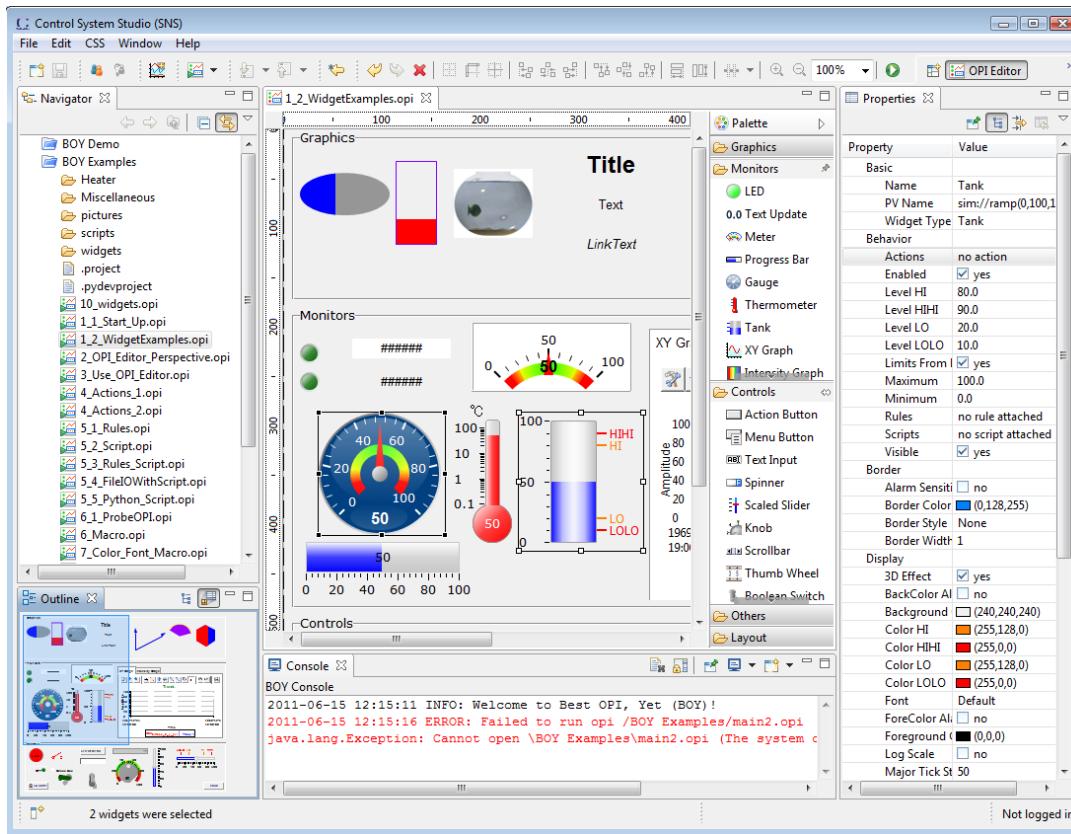
Acknowledged Alarms Table Data:

PV	Description	Time	Current severity	Severity	Status	Value
TMod:Summary_MPS:Alarm	Moderator System MPS Trip	2009/03/16 19:05:09	INVALID	invalid-ack'd	READ_ALARM	Ready
MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage f	2009/03/16 19:05:10	MAJOR	major-ack'd	LOLO_ALARM	0.000
HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	2009/03/16 19:05:10	MAJOR	major-ack'd	LOLO_ALARM	0.017
FE_MPS:MIOC1A:status_sum	MPS Beam permit	2009/03/17 16:05:00	MAJOR	major-ack'd	LOLO_ALARM	2
ICS_Tim:Gate_BeamOn:Switch	Beam awf	2009/03/17 16:04:59	MINOR	minor-ack'd	STATE_ALARM	Shifted

BOY – Best OPI, Yet

Operator Interface Editor

Runtime

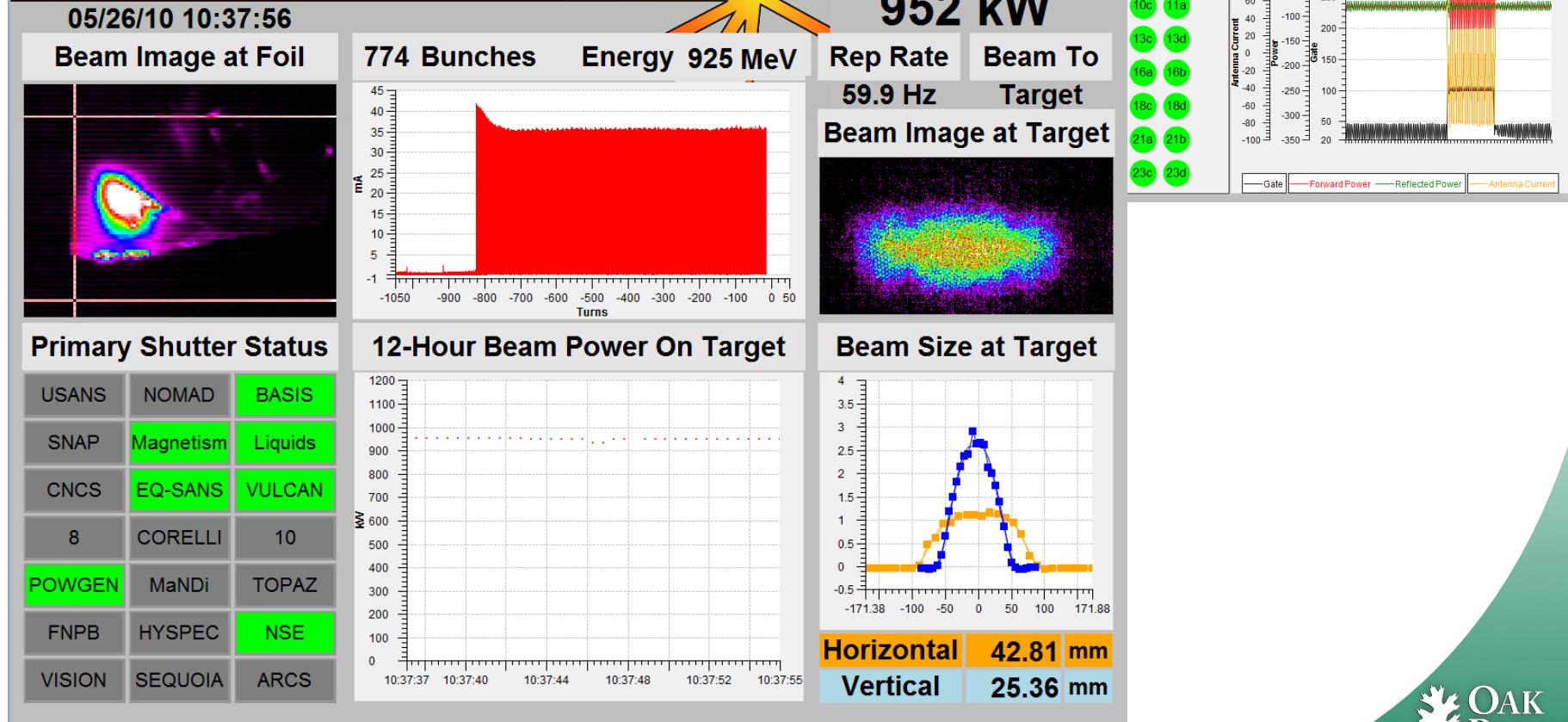


- Select widget, enter PV name, done
- No programming, no compilation, ...

SNS Examples

- Top-level displays created by operators

SNS Central Control Room

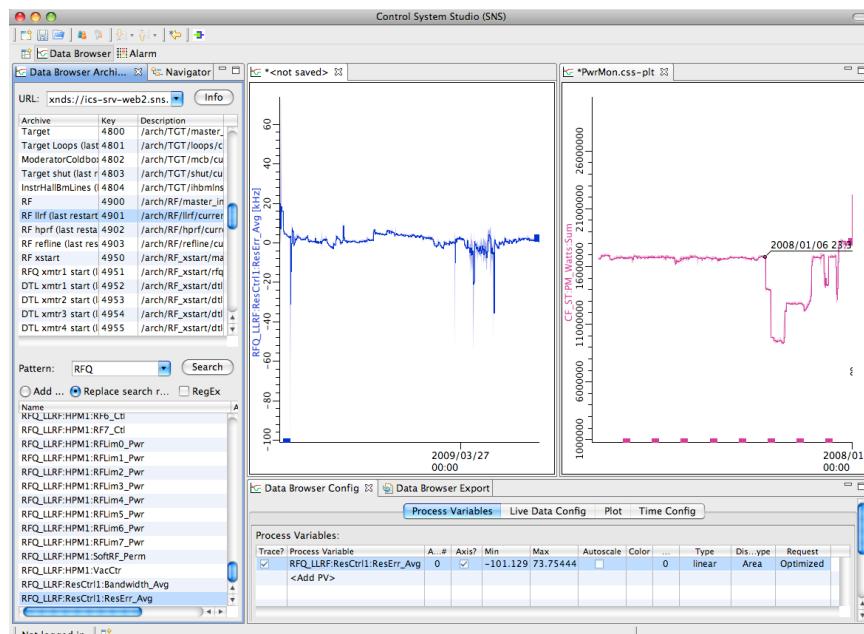
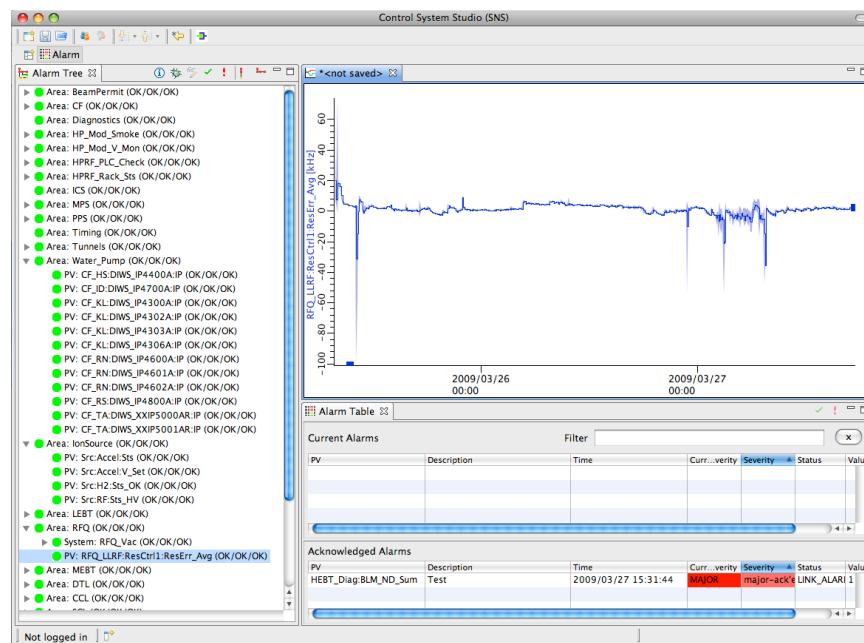


Flexible Layout

- Panels can be closed, reopened, repositioned

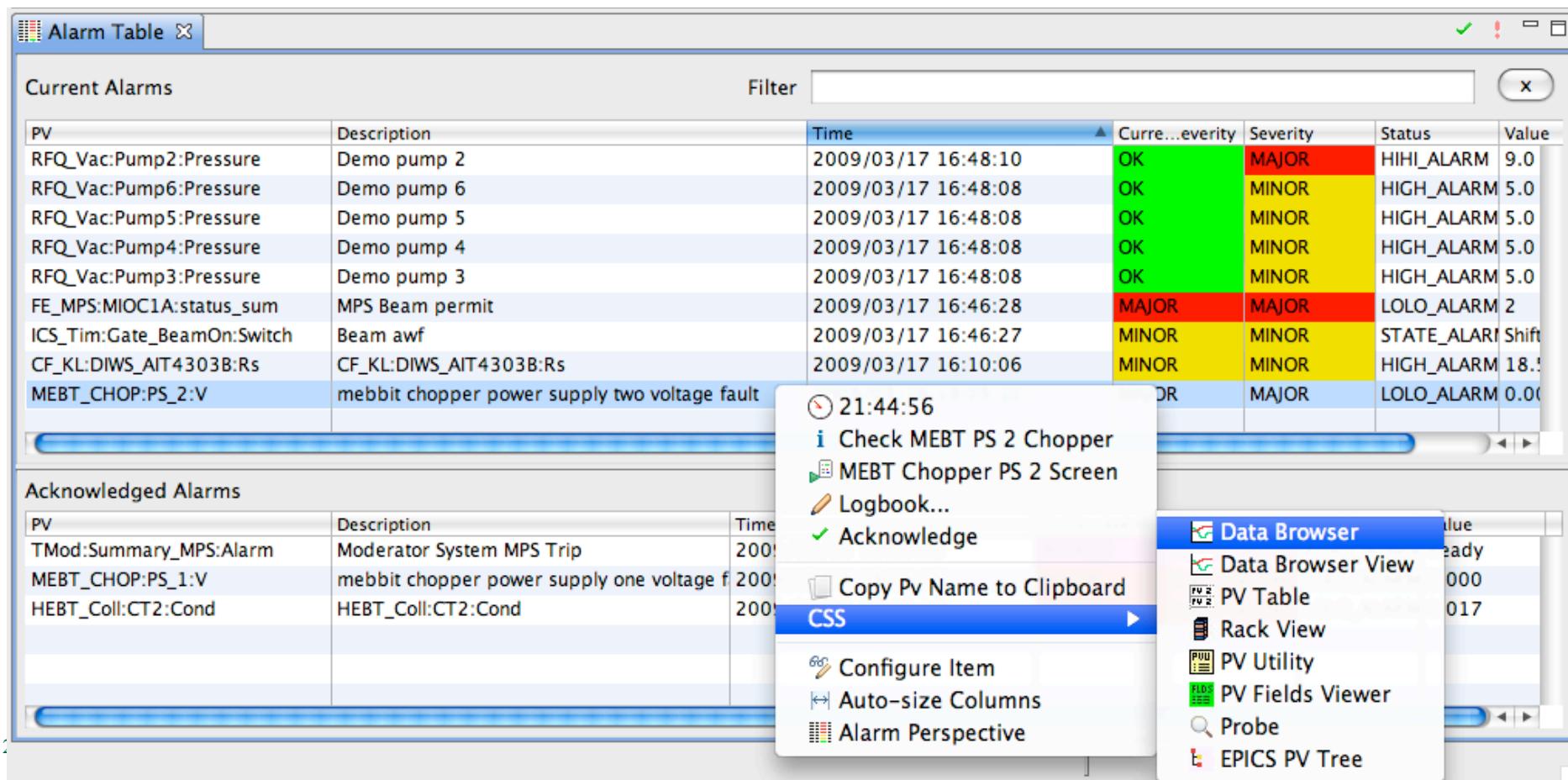
- Multiple Perspectives
 - Name, Save, Restore

- Multiple document instances share same configuration panels



CSS PV Exchange

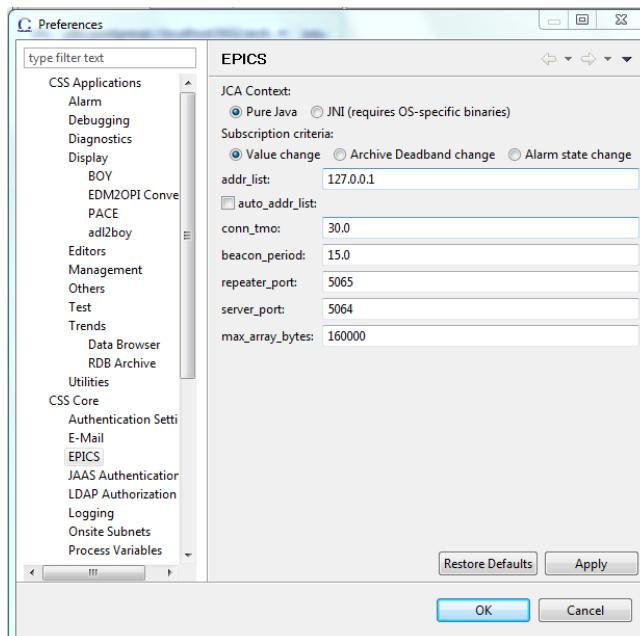
- PV in any CSS Tool
→ Context Menu → Select other PV Tools
 - Opens other tool with that PV



Integrated Help, Preferences

- Uniform access to settings, searchable help

- Applications
- Support Libraries
 - Logging
 - Control System access



Help - Css

Search: Go Scope: All topics

Content

EPICS Library

This provides the ChannelAccess (CA) client library for accessing Process Variables on EPICS IOCs via the network.

Preferences

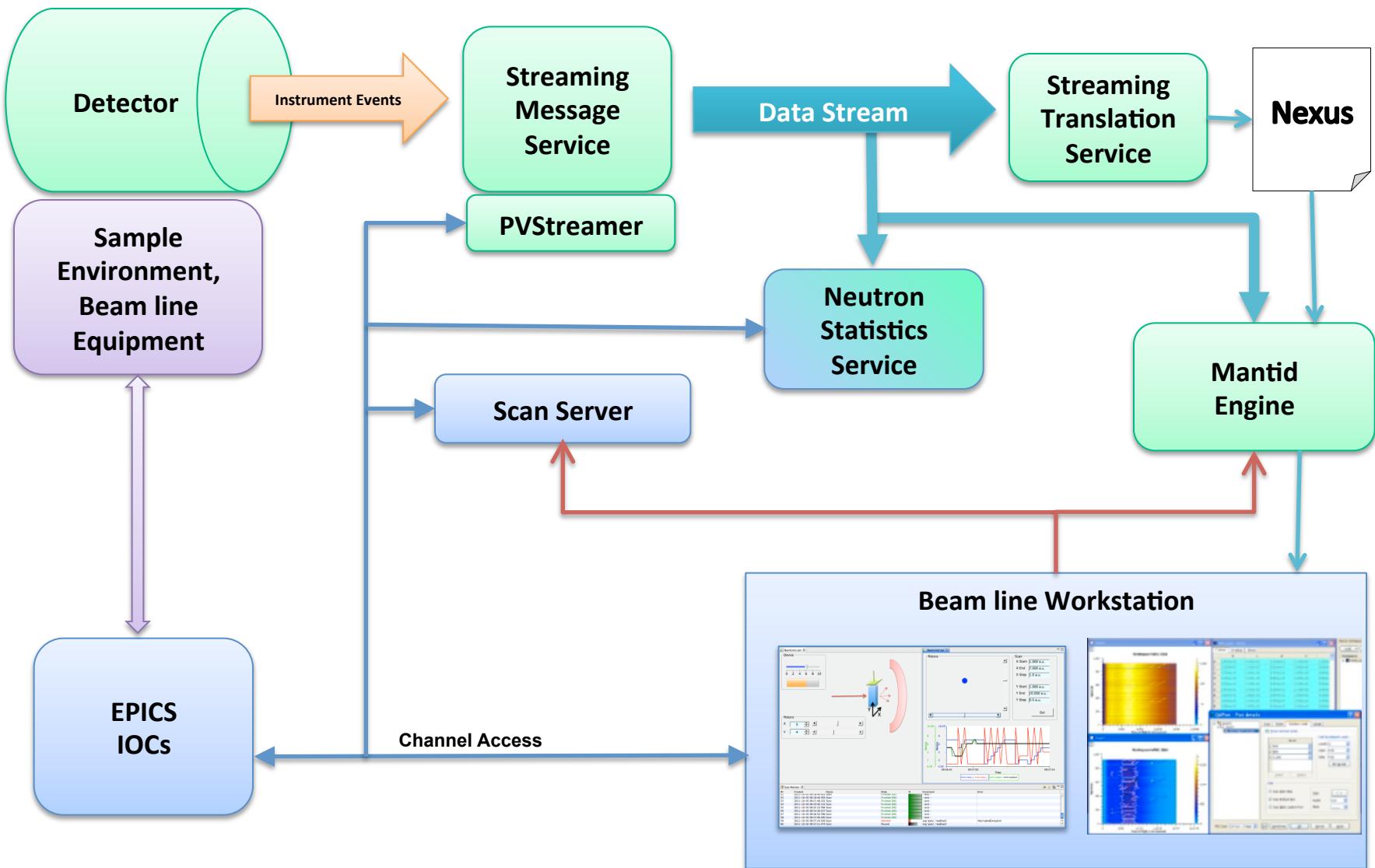
There are two main items to configure:

- **JCA Context:**
There is a pure Java as well as a JNI implementation available. The pure Java version is the default because it is easier to install and should work "out of the box", while the JNI implementation might provide maximum compatibility with existing EPICS installations.
- **addr_list and auto_addr_list:**
If all CA servers (IOCs) are on the same subnet as the computer running the CSS application, you can stay with the default: Empty addr_list, using auto_addr_list. Otherwise, if you need to access PVs on a gateway or in another subnet, list the IP addresses of IOCs or IOC subnets in the addr_list, and un-check the auto_addr_list. For details on this as well as the remaining settings, refer to the EPICS Channel Access reference manual.

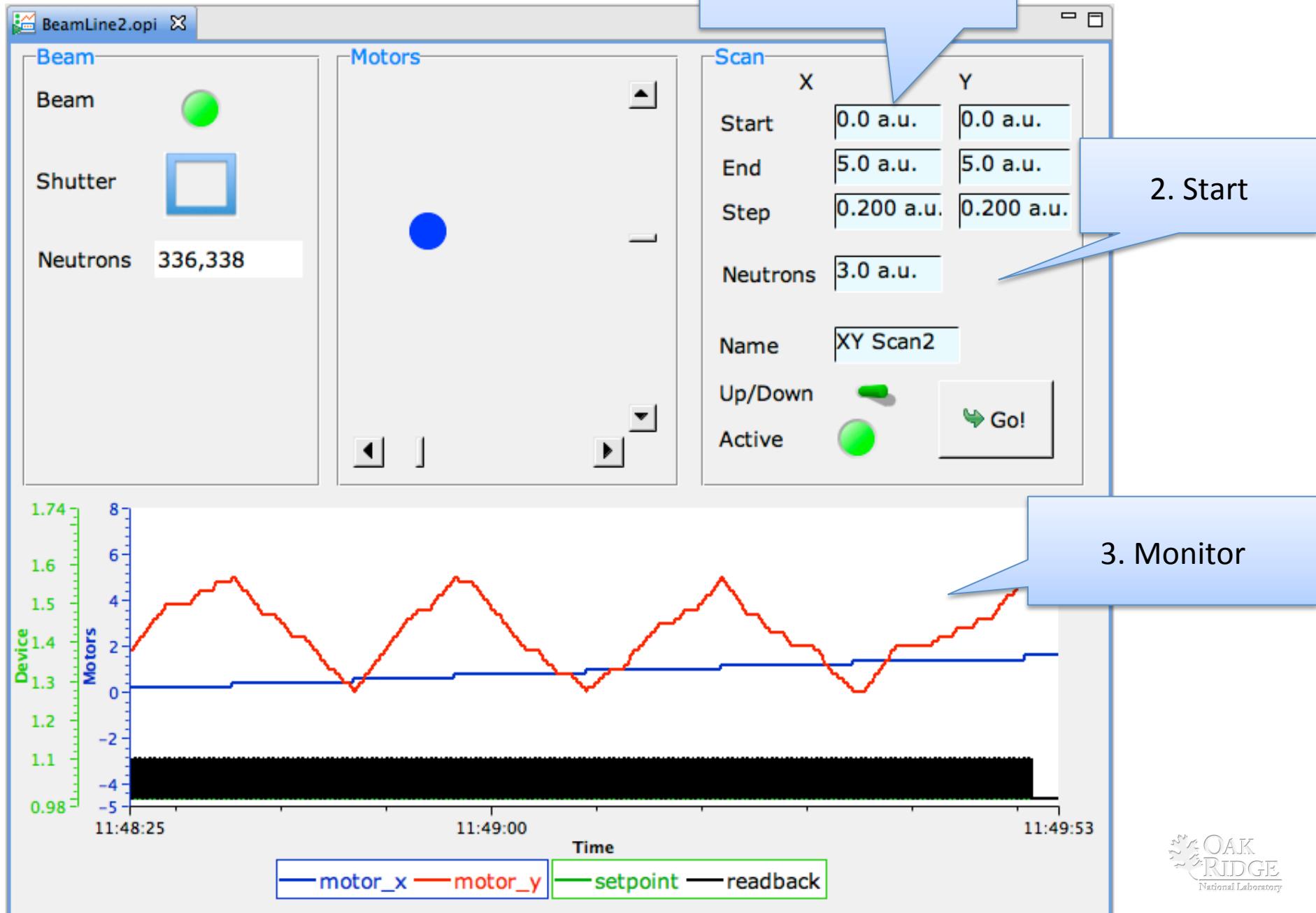
Note that changes require a restart of the application, they do not take effect at runtime!

Default Settings

Instrument Automation w/ Scan Server



“Scan” from BOY



Submit Scan from Table Example

Point by Point Scan Nested Scan

Points	xpos	ypos	setpoint
Point 1	0	0	5
Point 2	1	1	10
Point 3	2	2	15
Point 4	3	3	20
Point 6	4	4	15
Point 7	5	5	10
Point 8	6	6	0

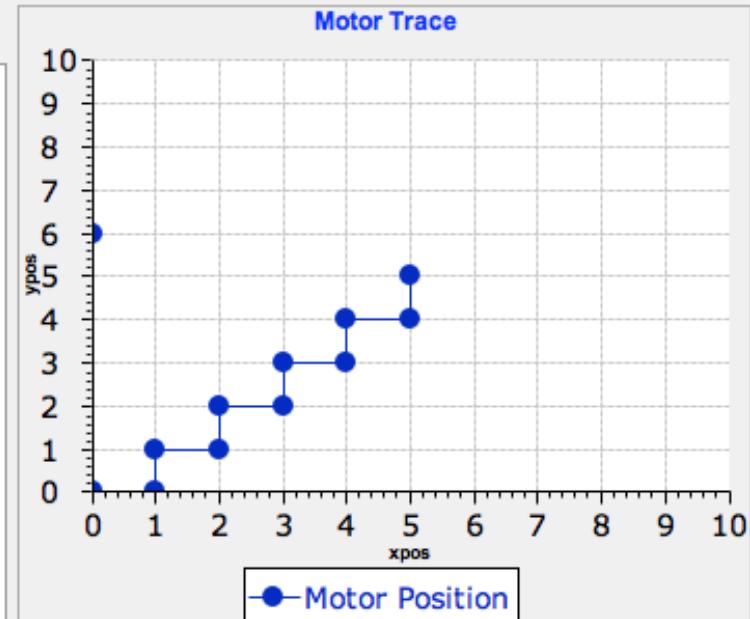
Submit Scan

in workspace

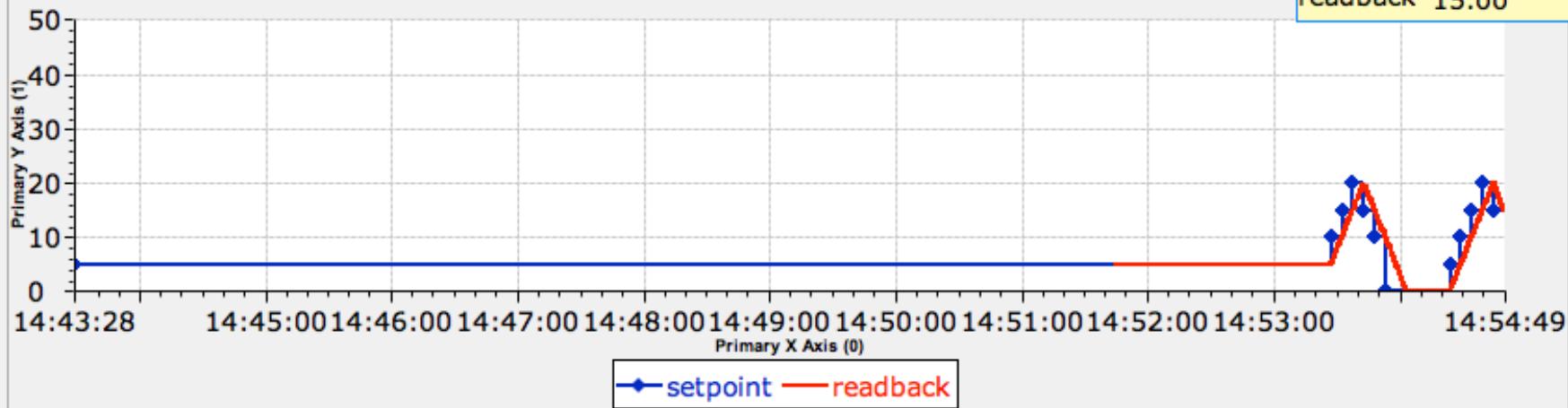
[Load from .csv ...](#)

[Export to .csv file](#)

Scan Running



setpoint: 10
readback 15.00



Current Running

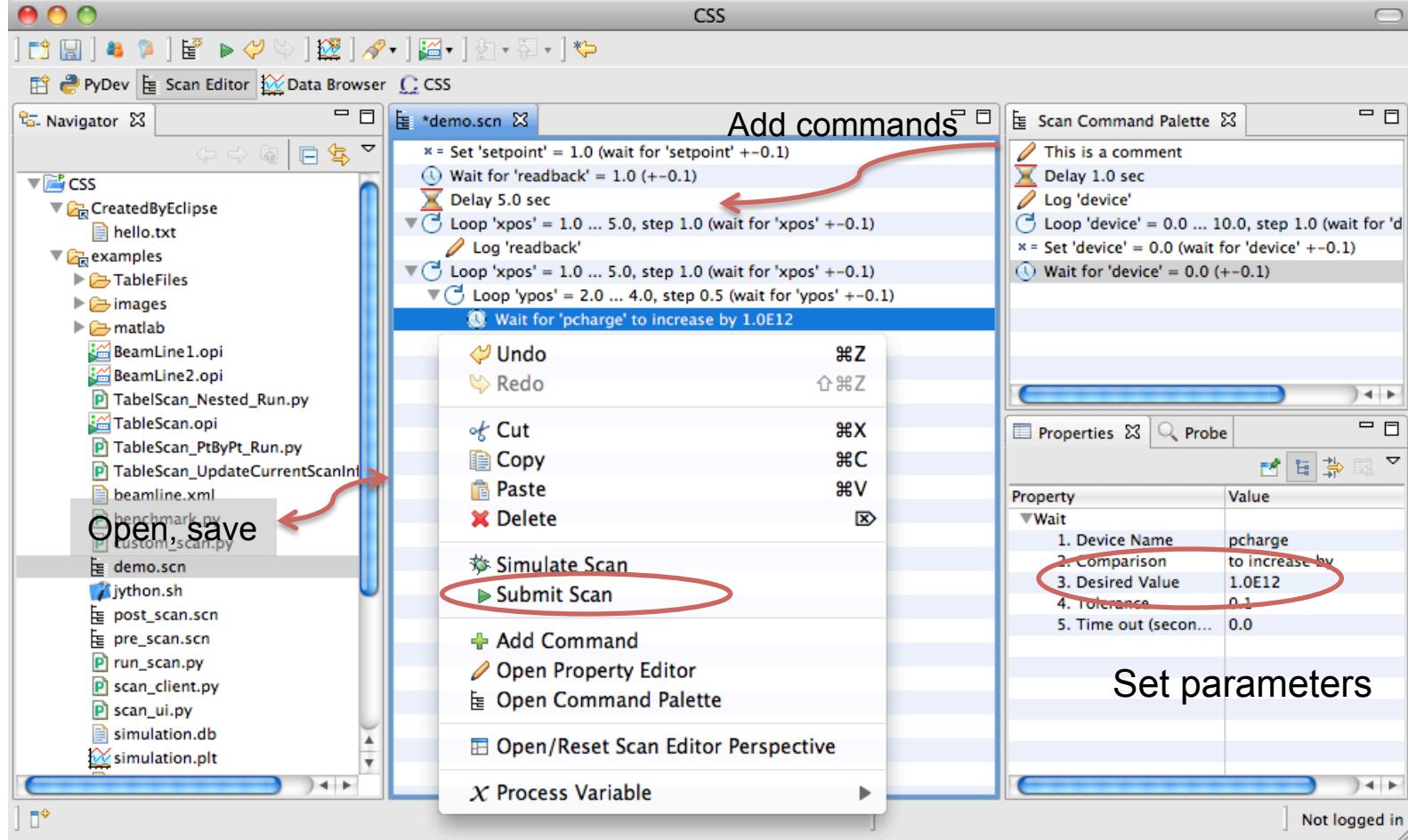
Point by Point Scan

Current

Set 'ypos' = 5.0 (wait for

79%

Scan Editor



- “Undo”
 - Drag/drop commands or PV names (also as XML text)
 - Device PVs (or alias) can be picked from beamline-specific configuration

Scan Monitor

The screenshot shows a software interface titled "Scan Monitor". The main window contains a table with columns: ID, Created, Name, State, %, Runtime, Command, and Error. The table lists numerous scans, mostly named "Point by Point Scan" or "Matlab Scan", with creation dates ranging from March 13, 2012, to March 9, 2012. The "State" column indicates the status of each scan, such as "Idle", "Running", or "Finished - OK". The "% Complete" column shows progress bars, and the "Runtime" column displays the duration of each scan. The "Command" column shows the specific command run, and the "Error" column is currently empty. A context menu is open over a row for a Matlab Scan from March 13, 2012, with options: "Remove", "Remove Completed Scans", "Plot", "Show Devices", and "Open in Scan Editor". At the bottom of the window, a status bar displays "Scan Server Memory Usage: 13.5 MB / 1020.8 MB (1.3 %)".

ID	Created	Name	State	%	Runtime	Command	Error
58	2012-03-13 15:03:20.261	Point by Point Scan 5	Idle	[Progress Bar]	0 ms		
57	2012-03-13 15:03:20.066	Point by Point Scan 4	Idle	[Progress Bar]	0 ms		
56	2012-03-13 15:03:19.789	Point by Point Scan 3	Running	[Progress Bar]	00:00:13	Set 'setpoint' = 15.0 ...	
55	2012-03-13 15:02:53.514	Point by Point Scan 2	Finished - OK	[Progress Bar]	00:00:41	- end -	
54	2012-03-13 14:55:17.862	Nested Scan 1	Finished - OK	[Progress Bar]	00:00:07	- end -	
53	2012-03-13 14:54:56.750	Nested Scan 0	Finished - OK	[Progress Bar]	00:00:07	- end -	
52	2012-03-13 14:54:23.112	Point by Point Scan 1	Finished - OK	[Progress Bar]	00:00:41	- end -	
51	2012-03-13 14:53:04.495	Point by Point Scan 0	Finished - OK	[Progress Bar]	00:00:36	- end -	
50	2012-03-13 14:43:28.061	Not Saved	Aborted	[Progress Bar]	00:09:58		
49	2012-03-13 13:52:11.605	Matlab Scan	Finished - OK	[Progress Bar]	00:00:04	- end -	
48	2012-03-13 13:51:26.213	Matlab Scan	Finished - OK	[Progress Bar]	00:00:04	- end -	
47	2012-03-13 13:49:33.574	Matlab Scan	Finished - OK	[Progress Bar]	00:00:52	- end -	
46	2012-03-13 13:48:29.562	Matlab Scan	Finished - OK	[Progress Bar]	00:00:04	- end -	
45	2012-03-13 13:48:04.956	Matlab Scan	Finished - OK	[Progress Bar]	00:00:19	- end -	
44	2012-03-13 13:47:40.268	Matlab Scan	Finished - OK	[Progress Bar]	00:00:13	- end -	
43	2012-03-13 13:19:54.493	Matlab Scan	Finished - OK	[Progress Bar]	00:00:01	- end -	
42	2012-03-09 17:01:17.678	Matlab Scan	Finished - OK	[Progress Bar]	00:00:01	- end -	
41	2012-03-09 16:59:20.079	Matlab Scan	Finished - OK	[Progress Bar]	00:00:08	- end -	
40	2012-03-09 16:43:57.622	Matlab Scan	Finished - OK	[Progress Bar]	00:00:08	- end -	

List Scans on Server

- Idle: To be executed next
- Running: With progress report
- Finished, Failed: Past runs

Thick Client vs. Web

✓ CSS: Integrated, rich, portable



Still: Needs to be installed on each user's computer..

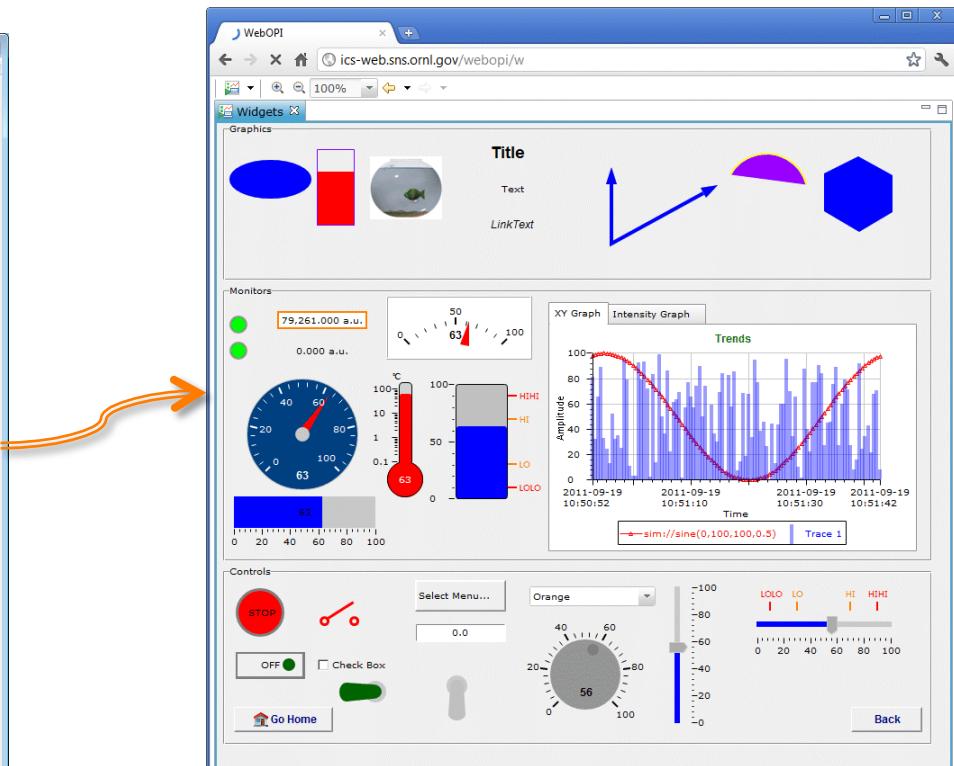
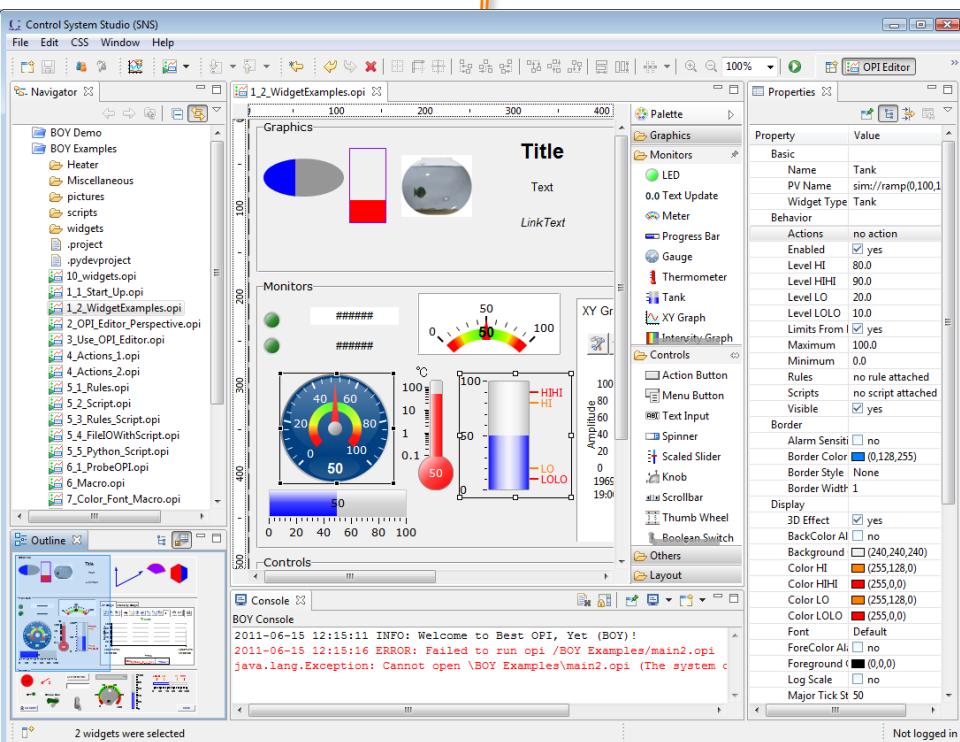
Accessible from phones,
tablets, toasters?



Web OPI

CSS is Desktop app, will probably remain so, but

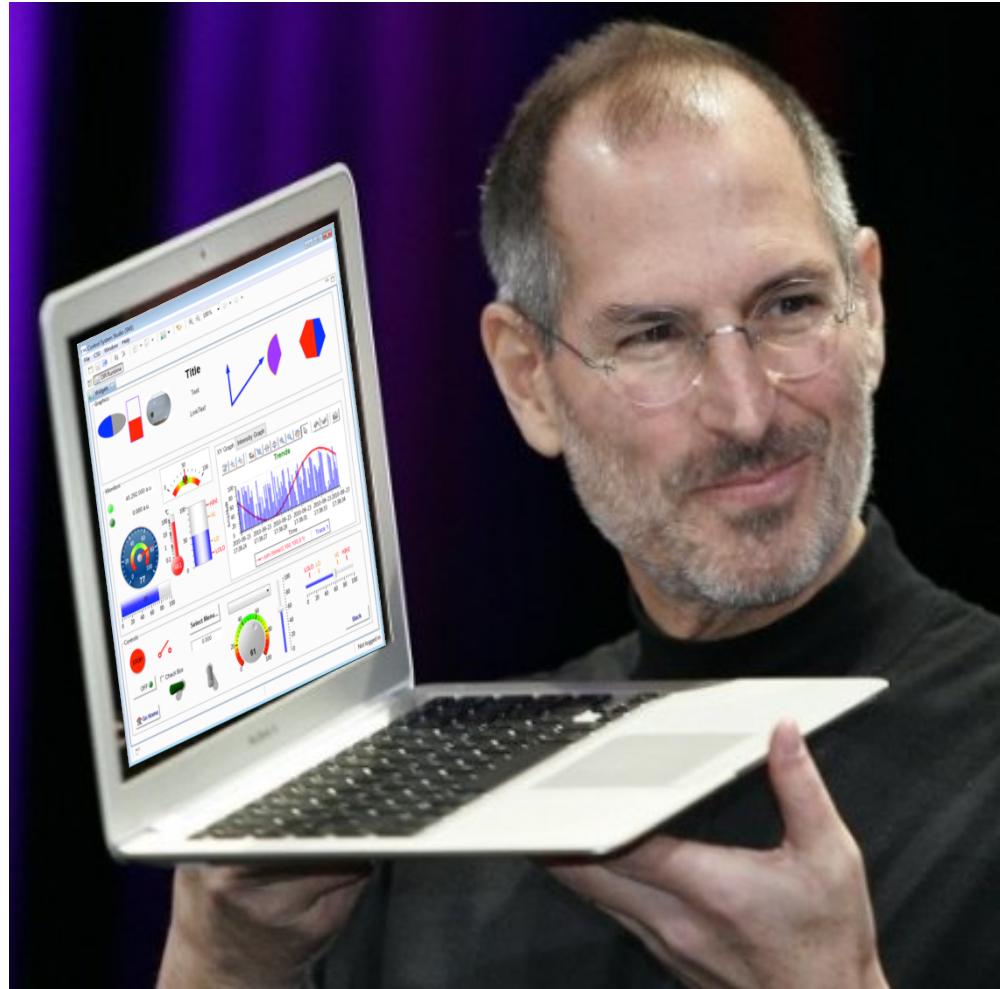
*.opi files can be viewed online!



What is CSS?

Integration of
various
control-system tools
into a
consistent product

Excellent
for
end-users!



Based on
<http://buzzynews.com/wp-content/uploads/2008/01/steve-jobs-presente-le-mac-book-air-ordinateur-portable-le-plus-fin-du-monde.jpg>