

Control System Studio - CSS - Operational Integrated Environment

Kay Kasemir

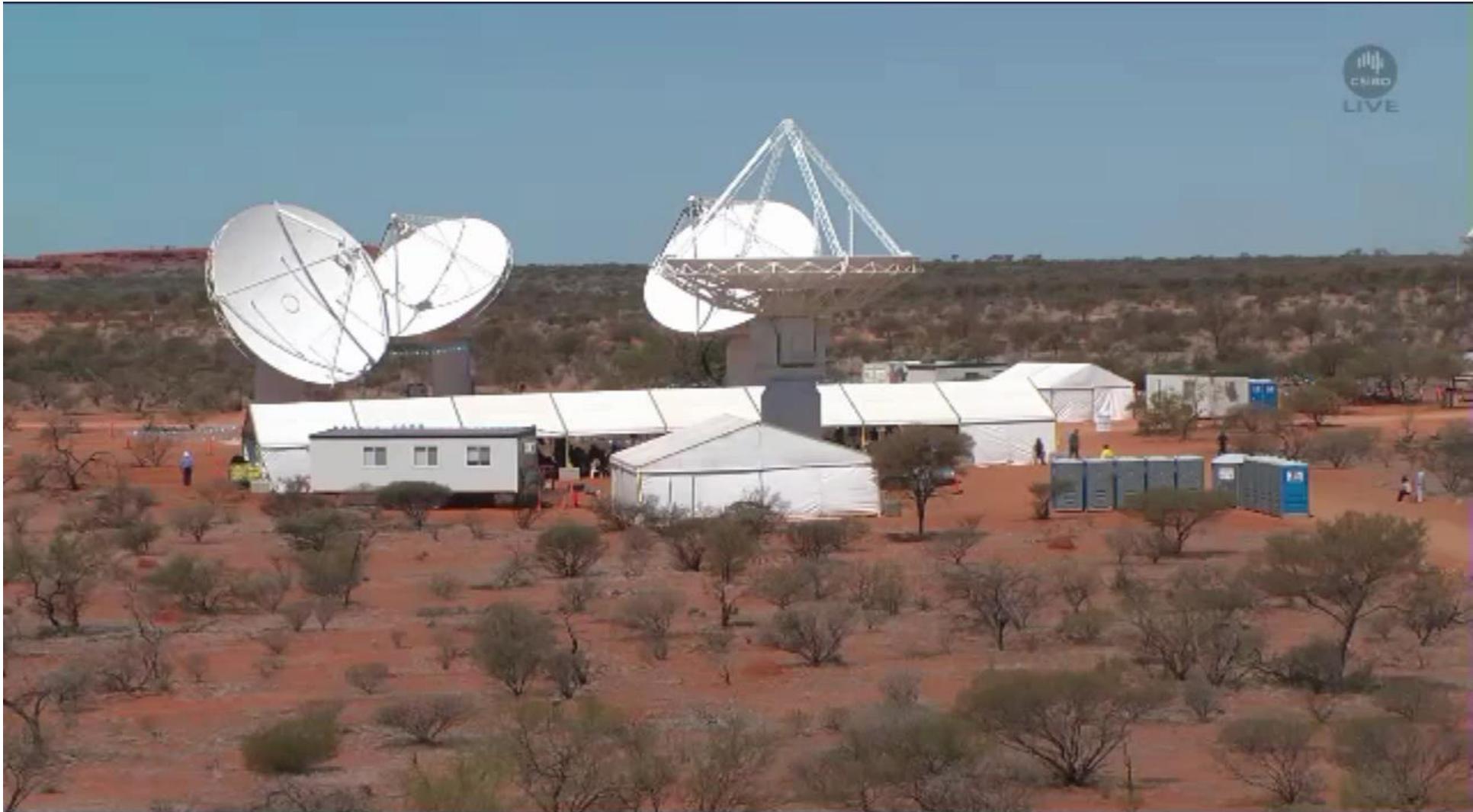
ORNL/SNS

kasemirk@ornl.gov

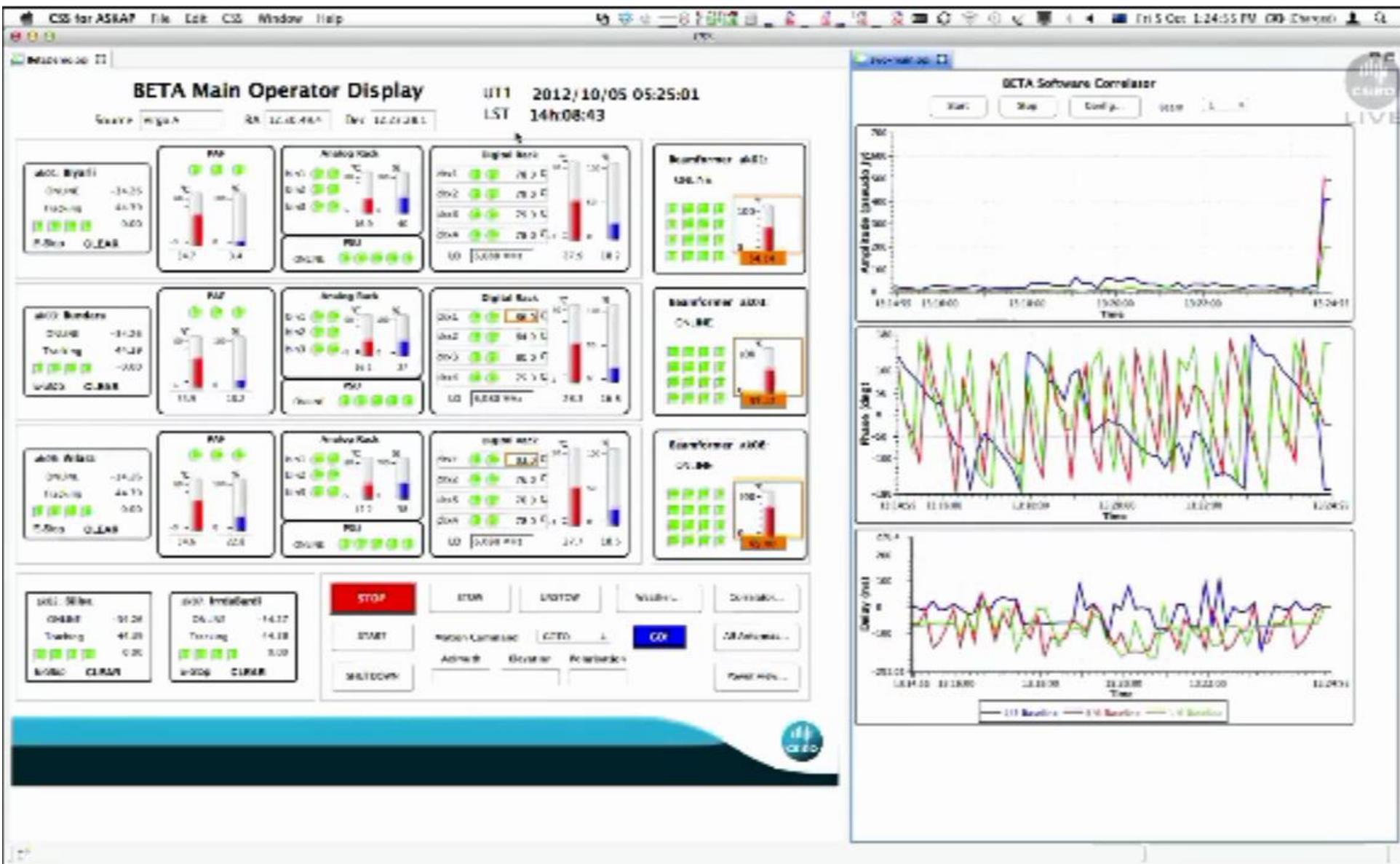
with input from Xihui Chen (SNS), Kunal Shroff (BNL)

Oct. 2012 EPICS Meeting, PAL, Korea

Australian Square Kilometre Array Pathfinder (ASKAP), Oct. 5, 2012



CSS for ASKAP



Original EPICS Operator Interfaces

Many disjoint tools

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

File Action View Setup Help

- MPS <----->
- PPS <----->
- Timing <----->
- Tunnels >----->
- Water_Pump <----->
- IonSource <----->
- LEBT >----->
- RFQ >----->
- MEBT <----->
- DTL >----->
- CCL >----->
- SCL >----->

- Summary_Alarms <----->
- Flows <----->
- Levels <----->
- PBW_Halo_Temps <----->
- CMS <-----> (0,1,0,0,4)
- CF_ST:EXH_FT2703:Flw <----->
- CF_ST:EXH_FT2704:Flw <----->
- CF_ST:EXH_FT2705:Flw <----->
- CF_TA:PW_LT9000:Lvl <----->

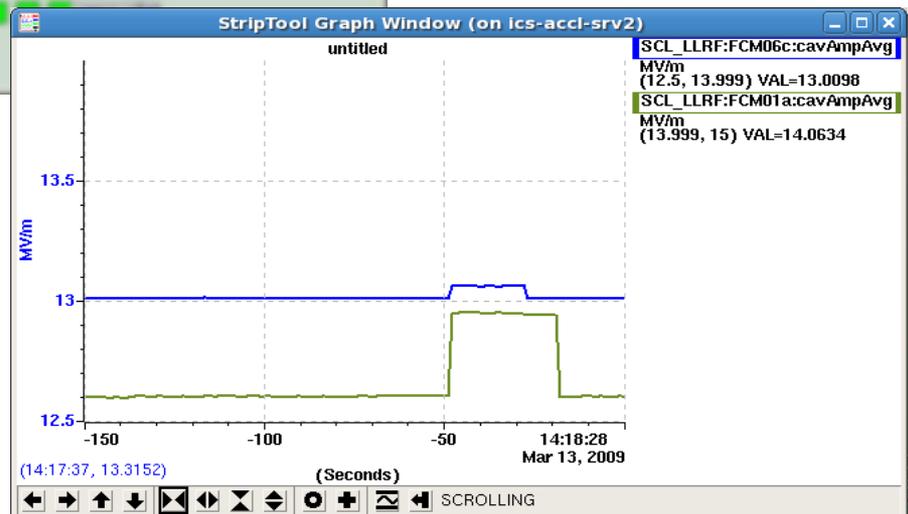
Execution Status: Local Active SilenceOneHour

Mask <CDATL>: <Cancel,Disable,noAck,noAckT,noLog> H=noAck 1hr timer SilenceCurrent

Group Alarm Counts: (ERROR,INVALID,MAJOR,MINOR,NOALARM) Silence Forever: OFF

Channel Alarm Data: <Status,Severity>, <Unack Severity> ALH Beep Severity: MINOR

Filename: /ade/epics/supTop/alhTop/cfg/Anc/Anc200901-Alarms.alhConfig



probe (on ics-accl-srv2)

SCL_LLRF:FCM01a:cavAmpAvg

14.064 MV/m

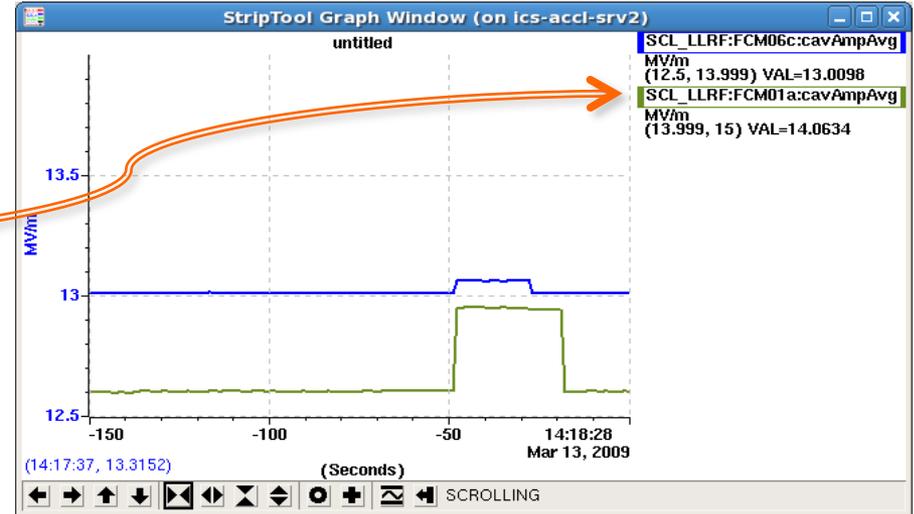
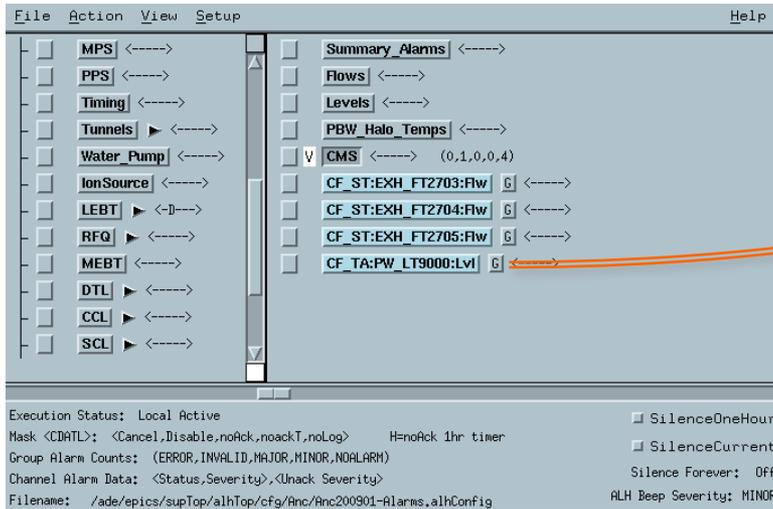
NO ALARM NO ALARM

SCL_LLRF:FCM01a:cavAmpAvg

Start Stop Version Quit

Adjust Hist Info Format

PV Name Exchange?



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

CSS Work Flow: React to Alarm

PV	Description	Time	Current Severity	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...

CSS Example: React to Alarm!

The screenshot shows a software interface titled "Alarm Table" with two main sections: "Current Alarms" and "Acknowledged Alarms".

Current Alarms Table:

PV	Description	Time	Curre...everity	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	18.5
MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault		OR	MAJOR	LOLO_ALARM	0.00

Acknowledged Alarms Table:

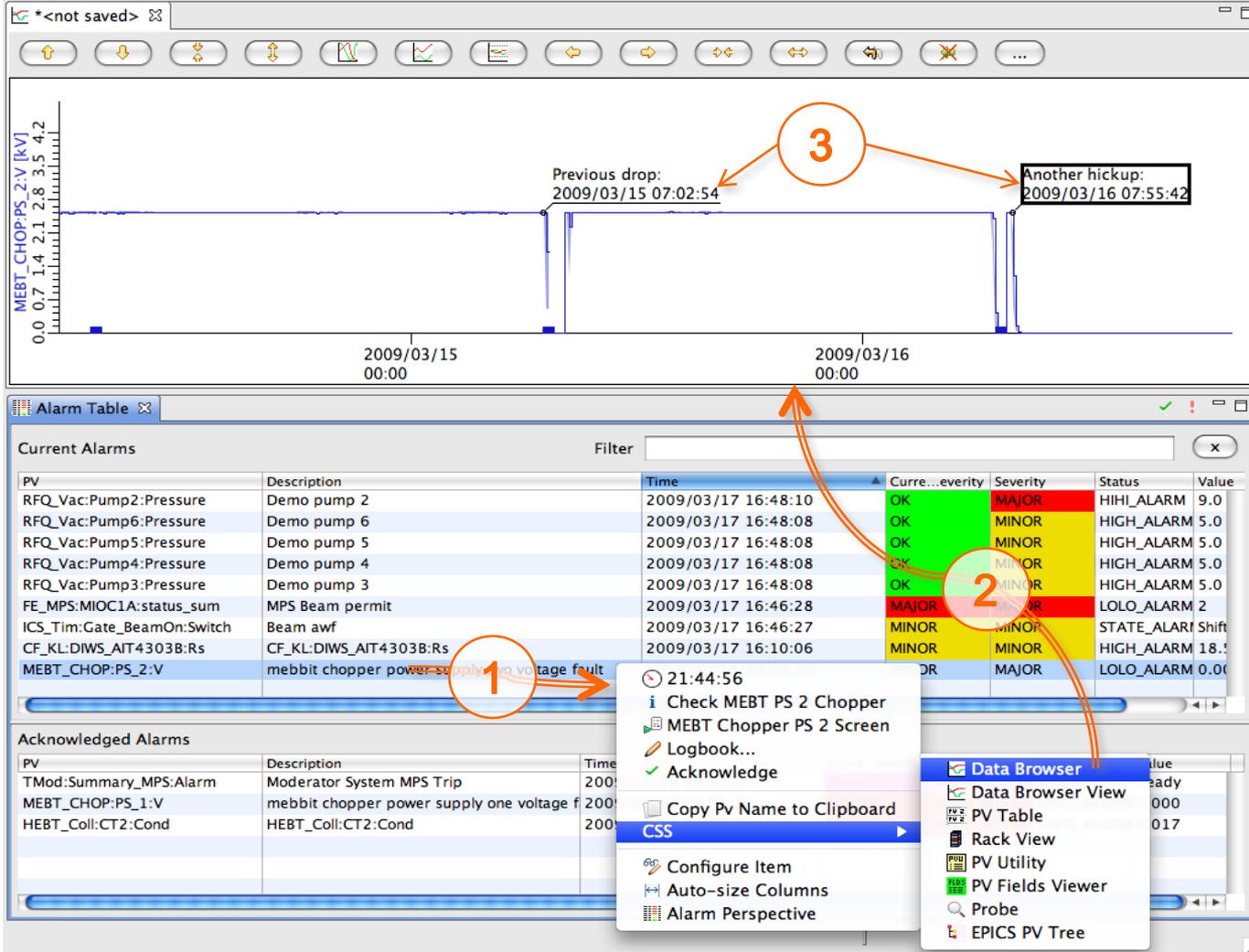
PV	Description	Time
TMod:Summary_MPS:Alarm	Moderator System MPS Trip	200...
MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage f	200...
HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	200...

Context Menu (Right-click on MEBT_CHOP:PS_2:V):

- 21:44:56
- 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
- Data Browser
- Data Browser View
- PV Table
- Rack View
- PV Utility
- PV Fields Viewer
- Probe
- EPICS PV Tree

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

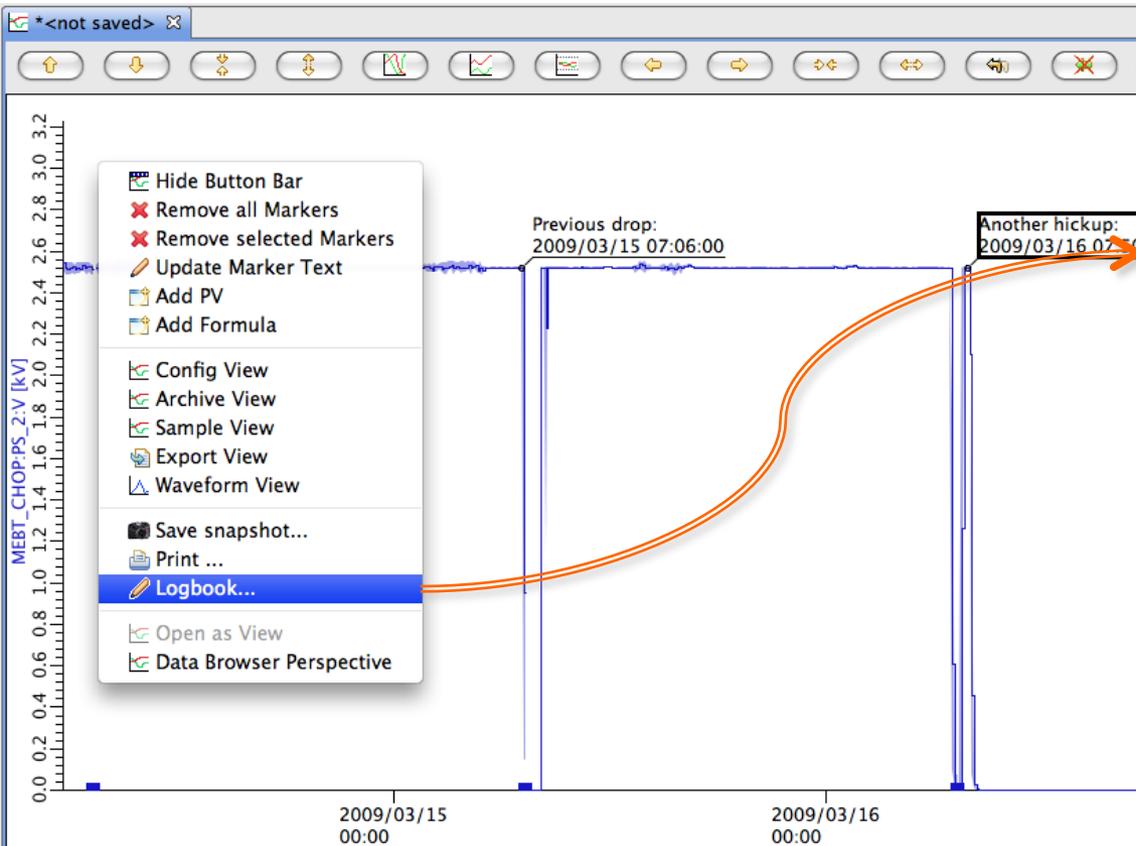
Example Work Flow: React to Alarm...



Inspect history of PV, annotate, ...

Finally: Make Logbook Entry

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



Logbook Entry

Create electronic logbook entry

Enter user, password, maybe edit text.
Snapshot of current plot will be attached.

User name: Fred

Password:

Logbook: Electrical Systems

Title: Data Browser Snapshot

Text:

Just got another chopper trip.
This time was different, though,
because we did this and not that,
while before we tried that and not this.

Called Jim who suggested to wiggle
the blue cable before resetting

Attached image was created by Data Browser

Attached Image...

Cancel OK

What is CSS?

a) To End Users:

- Integrated control system user interface



b) To Developers:

- A Collaboration
- An Architecture
- A Toolkit



<http://www.wendolene.co.uk/Pictures/Happy.jpg>

<http://www.citytowninfo.com/images/education-articles/how-to-become-a-software-engineer-2.jpg>

CSS: A Collaboration

- **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, ...

CSS: Software Toolkit

It's BIG

- Repository: ~ 1.500.000 lines of Java Code

You pick what you need

- SNS uses ~300.000 (20%)

Perl cloc tool on July 2011 cs-studio3.0 repo and SNS source snapshot, excluding zip files

CSS Plugin Examples

- **Application Plug-Ins**

- Strip-Chart: Data Browser 
- OPI: SDS, BOY 
- Alarms: NAMS, BEAST 
- Archive: DESY Archive, BEAUTY
- Utilities: Probe, Clock  , PV Tree  , Psychiatrist 

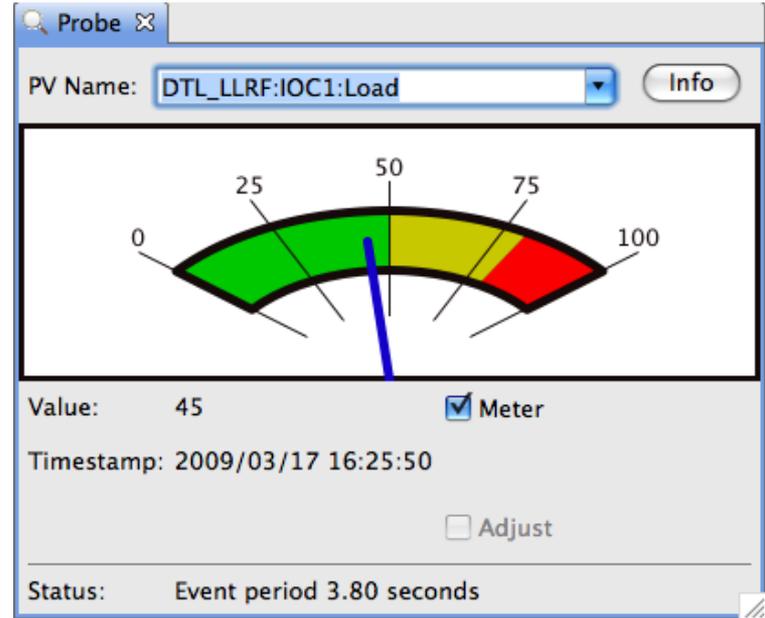
- **Library Plug-Ins**

- 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

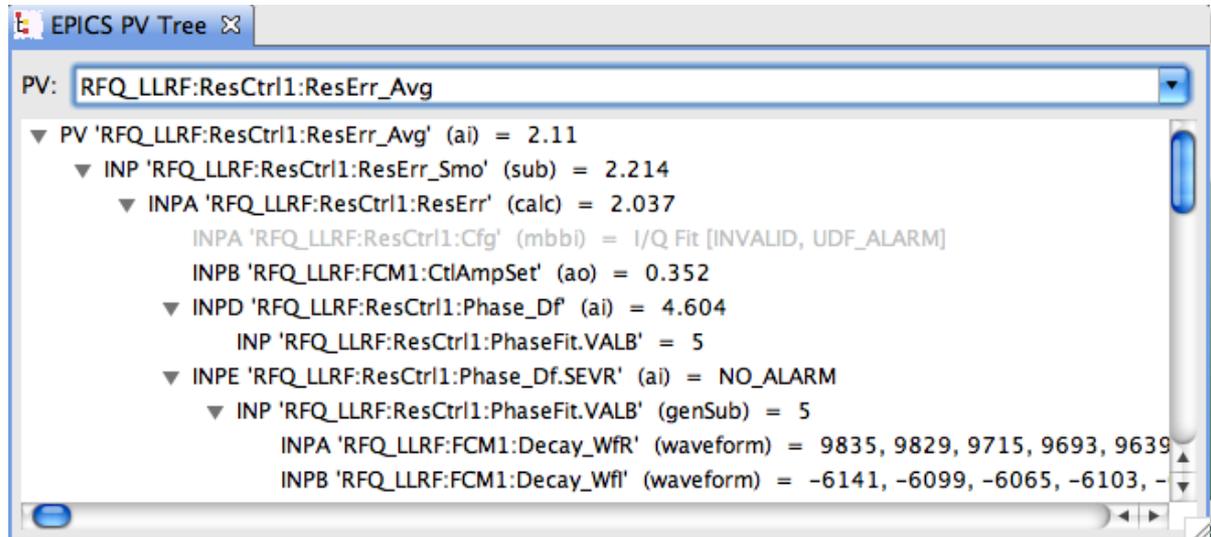


EPICS PV Tree

- Trace PV links

Both:

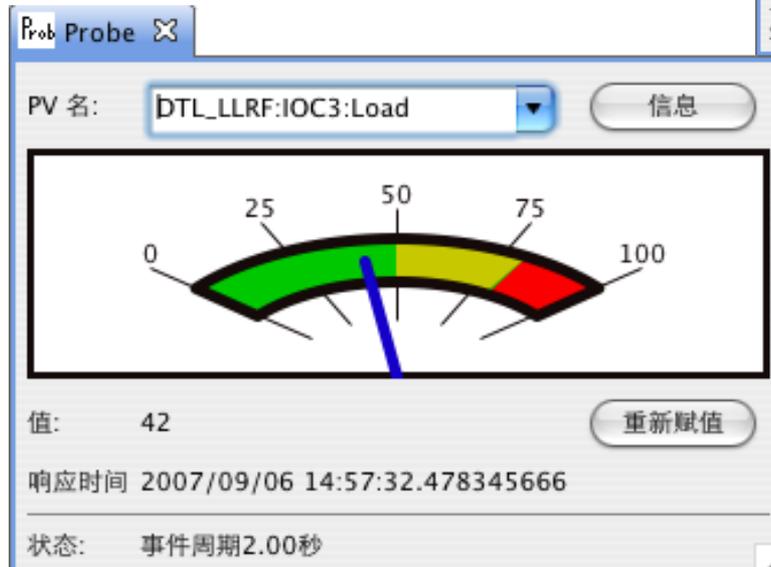
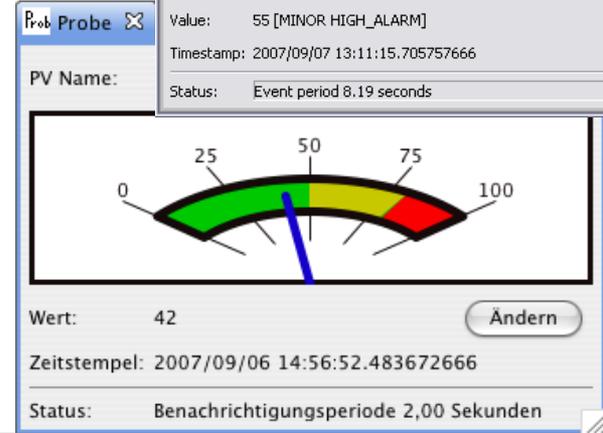
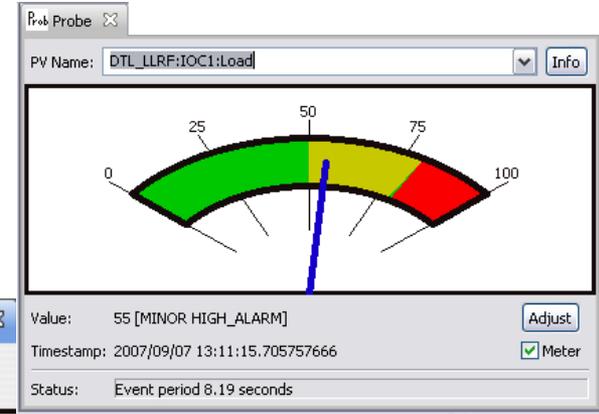
- ✓ Resize
- ✓ PV Name Drop-down history



Localization

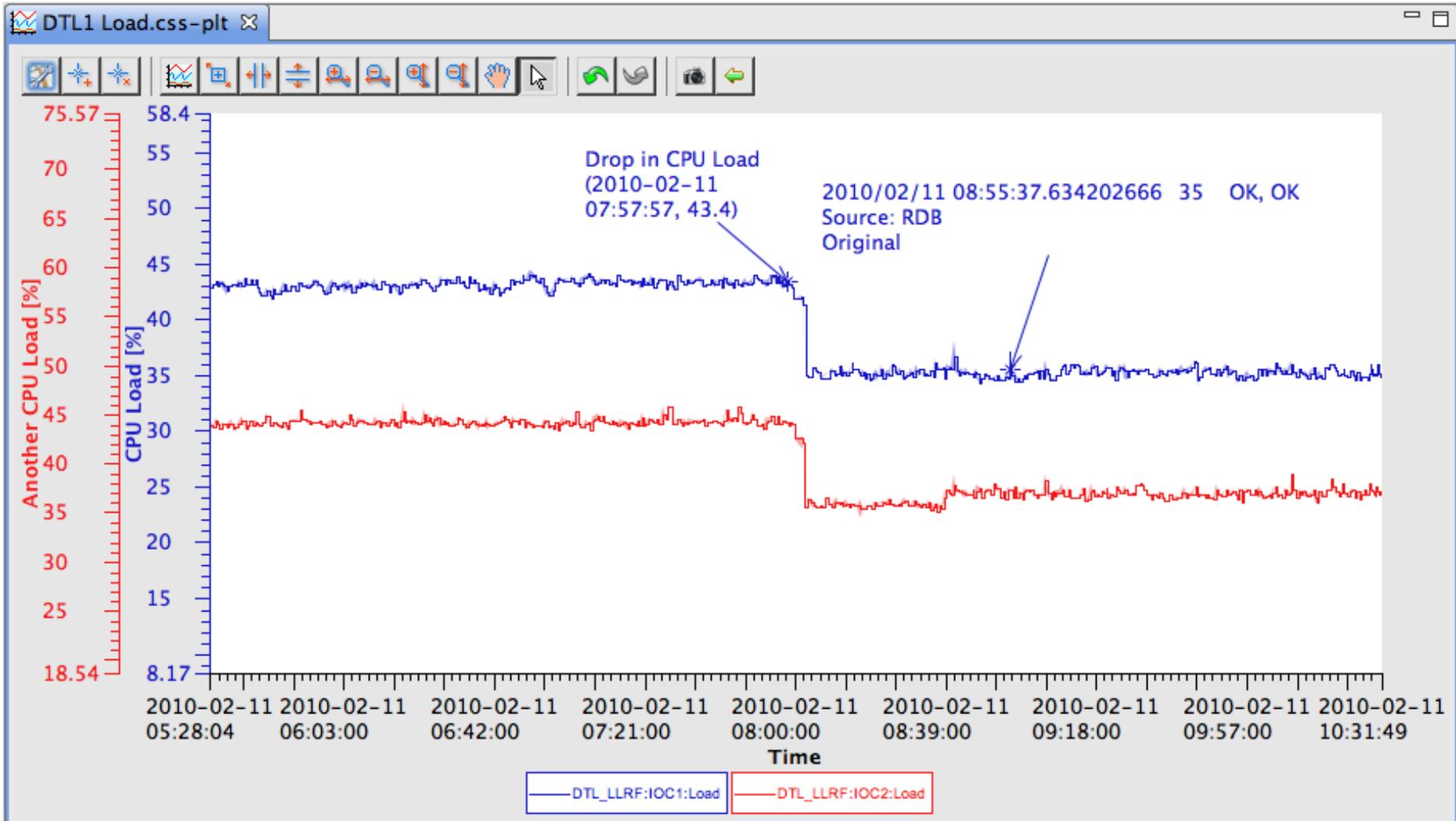
CSS Translations

- All: (US) English
- Most: German
- One: Chinese
- Next: Korean?



Data Browser

Plot 'live' and 'archived' data over time



Data Browser: Search Archive, Config. Plot

Archive Search Navigator

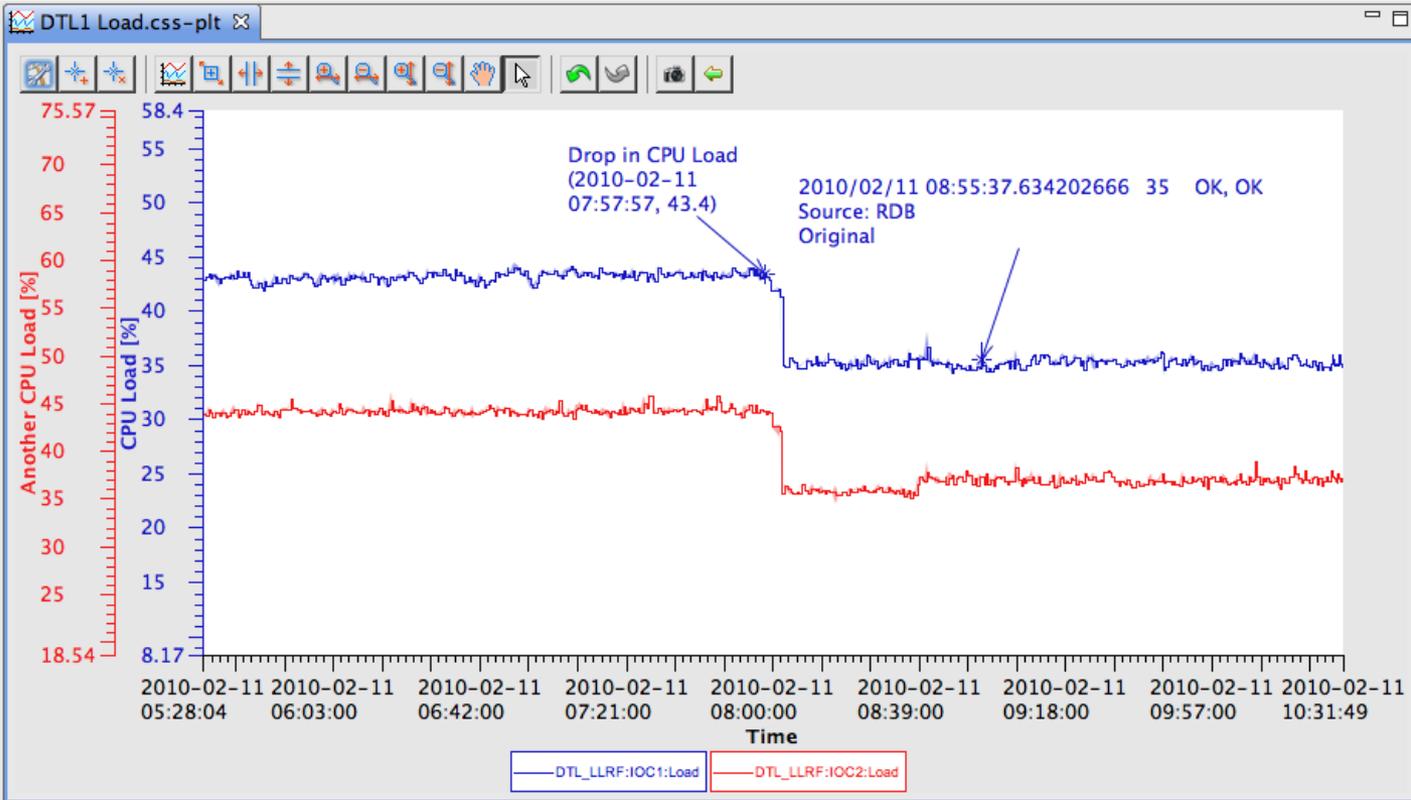
URL: jdbc:oracle:thin:@(DES... Info

Name	Description	Key
rdb	Oracle	1

Pattern: DTL_LLRF:IOC*:Loac Search

Add... Replace search results Reg.Exp.

PV Name	Name
DTL_LLRF:IOC1:Load	rdb
DTL_LLRF:IOC2:Load	rdb
DTL_LLRF:IOC3:Load	rdb
DTL_LLRF:IOC4:Load	rdb
DTL_LLRF:IOC5:Load	rdb
DTL_LLRF:IOC6:Load	rdb



Properties Export Samples

Traces Time Axis Value Axes Misc.

Trace	Item (PV, Formula)	Display Name	Color	Scan Period	Buffer Size	Line Width	Axis	Trace Type	Request
Show	DTL_LLRF:IOC1:Load	DTL_LLRF:IOC1:Load		0.0	100	0	CPU Load	Area	Optimized
Show	DTL_LLRF:IOC2:Load	DTL_LLRF:IOC2:Load		0.0	100	0	Another CF Area	Area	Optimized

Archive Data Sources

Name	Key	URL
RDB	1	jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS_LIST=(LOAD_BALANCE=OFF)(ADDRESS=(PR
- All -	1	xnds://ics-srv-web2.sns.ornl.gov/archive/cgi/ArchiveDataServer.cgi
- All - (last restart)	2	xnds://ics-srv-web2.sns.ornl.gov/archive/cgi/ArchiveDataServer.cgi

Alarm System (BEAST)

Tabular or Tree view, voice annunciations, ...

The screenshot displays the BEAST Alarm System interface. On the left is the 'Alarm Tree' view, showing a hierarchical structure of areas and processes. On the right is the 'Alarm Table' view, which is currently showing 'Current Alarms'. A search filter is present above the table. Below the current alarms table is the 'Acknowledged Alarms' table. Three callout boxes provide additional information: 'Select by Name, Description' points to the table headers, 'Sort by Time, Severity, ...' points to the table rows, and 'Acknowledge' points to a checkmark icon in the top right corner of the table window.

Alarm Tree

- Area: BeamPermit (MAJOR/major-ack'ed/LOLO_ALARM)
 - PV: FE_MPS:MIOC1A:status_sum (MAJOR/major-ack'ed)
 - PV: ICS_Tim:Gate_BeamOn:Switch (MINOR/minor-ack'ed)
- Area: CF (MINOR/MINOR/HIGH_ALARM)
- Area: Diagnostics (OK/OK/OK)
- Area: HP_Mod_Smoke (OK/OK/OK)
- Area: HP_Mod_V_Mon (OK/OK/OK)
- Area: HPRF_PLC_Check (OK/OK/OK)
- Area: HPRF_Rack_Sts (OK/OK/OK)
- Area: ICS (OK/OK/OK)
- Area: MPS (OK/OK/OK)
- Area: PPS (OK/OK/OK)
- Area: Timing (OK/OK/OK)
- Area: Tunnels (OK/OK/OK)
- Area: Water_Pump (OK/OK/OK)
- Area: IonSource (OK/OK/OK)
- Area: LEBT (OK/OK/OK)
- Area: RFQ (OK/OK/OK)
- Area: MEBT (MAJOR/MAJOR/LOLO_ALARM)
- Area: DTL (OK/OK/OK)
- Area: CCL (OK/OK/OK)
- Area: SCL (OK/OK/OK)
- Area: HEBT (MAJOR/major-ack'ed/LOLO_ALARM)
- Area: RID (OK/OK/OK)
- Area: Ring (OK/OK/OK)
- Area: RTBT (OK/OK/OK)
- Area: Target (INVALID/invalid-ack'ed/READ_ALARM)
- Area: Test (OK/MAJOR/HHI_ALARM)
 - System: LLRF (OK/OK/OK)
 - PV: Instr_BmLn:XXSTATE5216A:Sts (OK/OK/OK)
 - PV: RFQ_Vac:Pump2:Pressure (OK/MAJOR/HHI_ALARM)
 - PV: RFQ_Vac:Pump3:Pressure (OK/MINOR/HIGH_ALARM)
 - PV: RFQ_Vac:Pump4:Pressure (OK/MINOR/HIGH_ALARM)
 - PV: RFQ_Vac:Pump5:Pressure (OK/MINOR/HIGH_ALARM)
 - PV: RFQ_Vac:Pump6:Pressure (OK/MINOR/HIGH_ALARM)

Alarm Table

Current Alarms

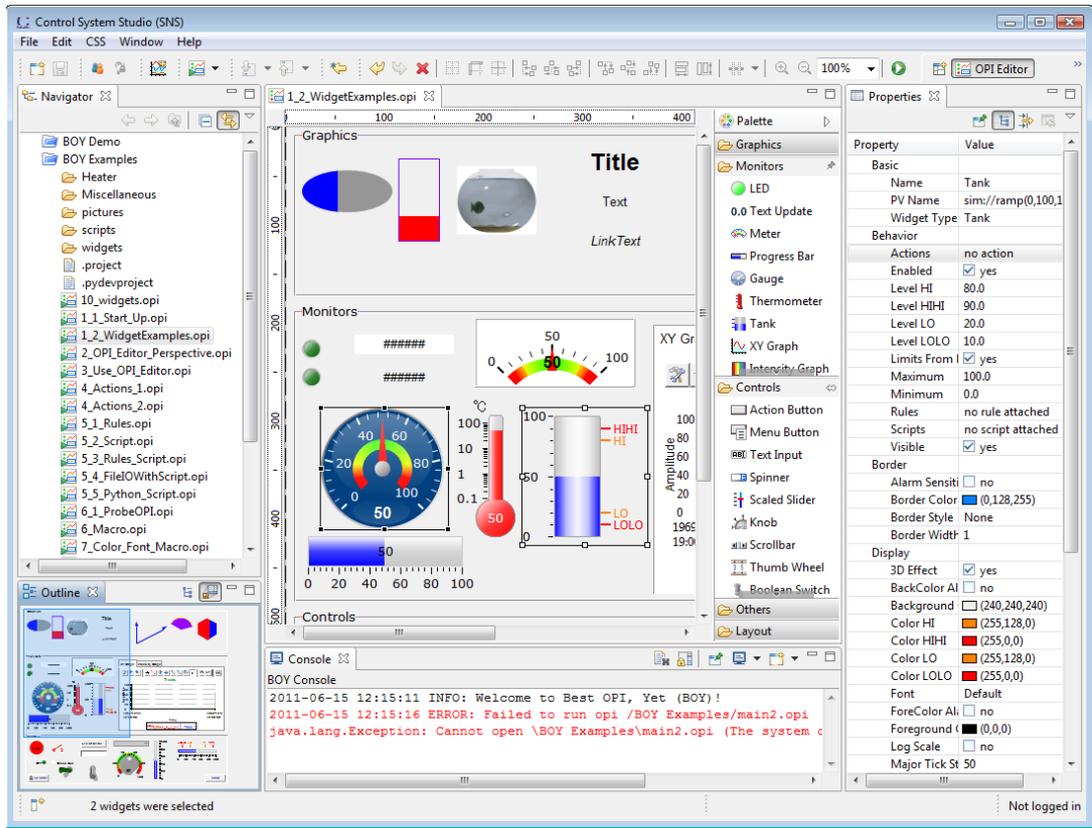
PV	Description	Time	Current Severity	Severity	Status	Value
CF_KL:DIWS_AIT4303B:Rs	CF_KL:DIWS_AIT4303B:Rs	2009/03/17 16:10:06	MINOR	MINOR	HIGH_ALARM	18.5
RFQ_Vac:Pump2:Pressure	Demo pump 2	2009/03/17 16:09:46	OK	MAJOR	HHI_ALARM	9.0
RFQ_Vac:Pump6:Pressure	Demo pump 6	2009/03/17 16:09:44	OK	MINOR	HIGH_ALARM	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

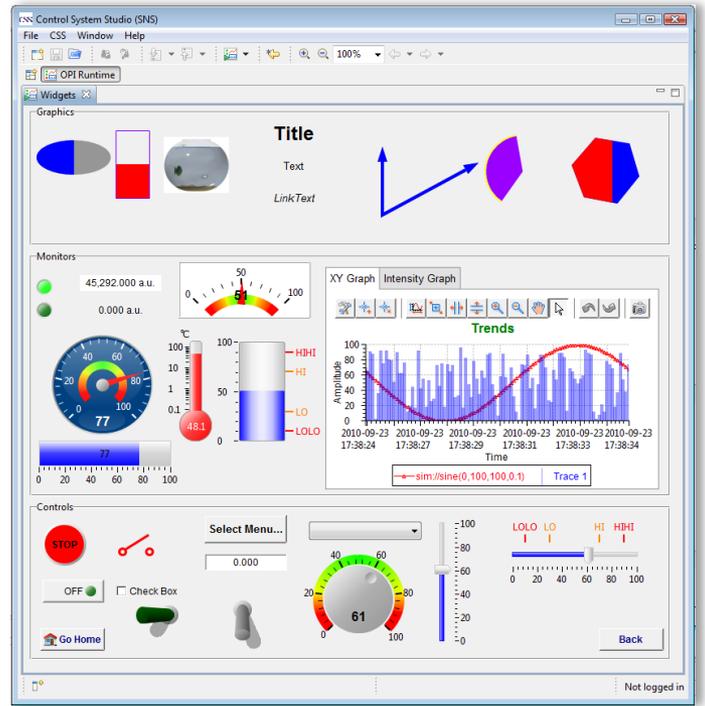
PV	Description	Time	Current Severity	Severity	Status	Value
TMod:Summary_MPS:Alarm	Moderator System MPS Trip	2009/03/16 19:05:09	INVALID	invalid-ack'ed	READ_ALARM	Ready
MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage fault	2009/03/16 19:05:10	MAJOR	major-ack'ed	LOLO_ALARM	0.000
HEBT_Coll:CT2:Cond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

BOY – Best OPI, Yet

Operator Interface Editor

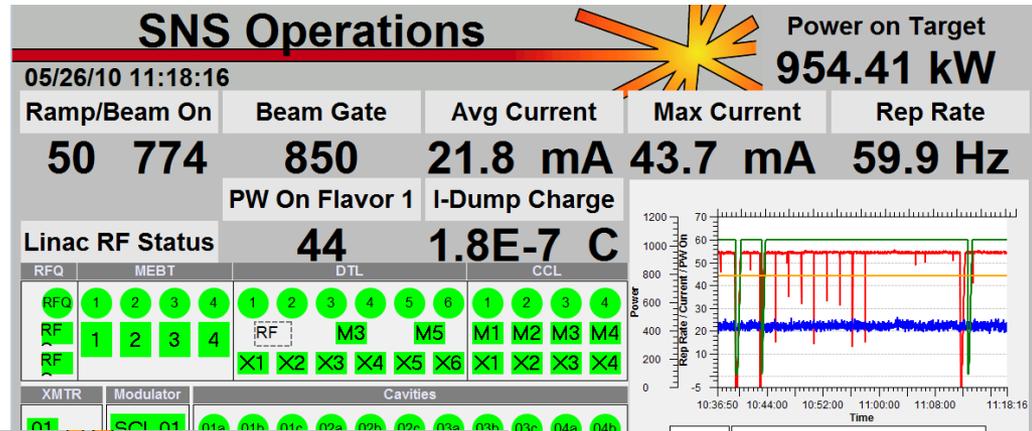


Runtime

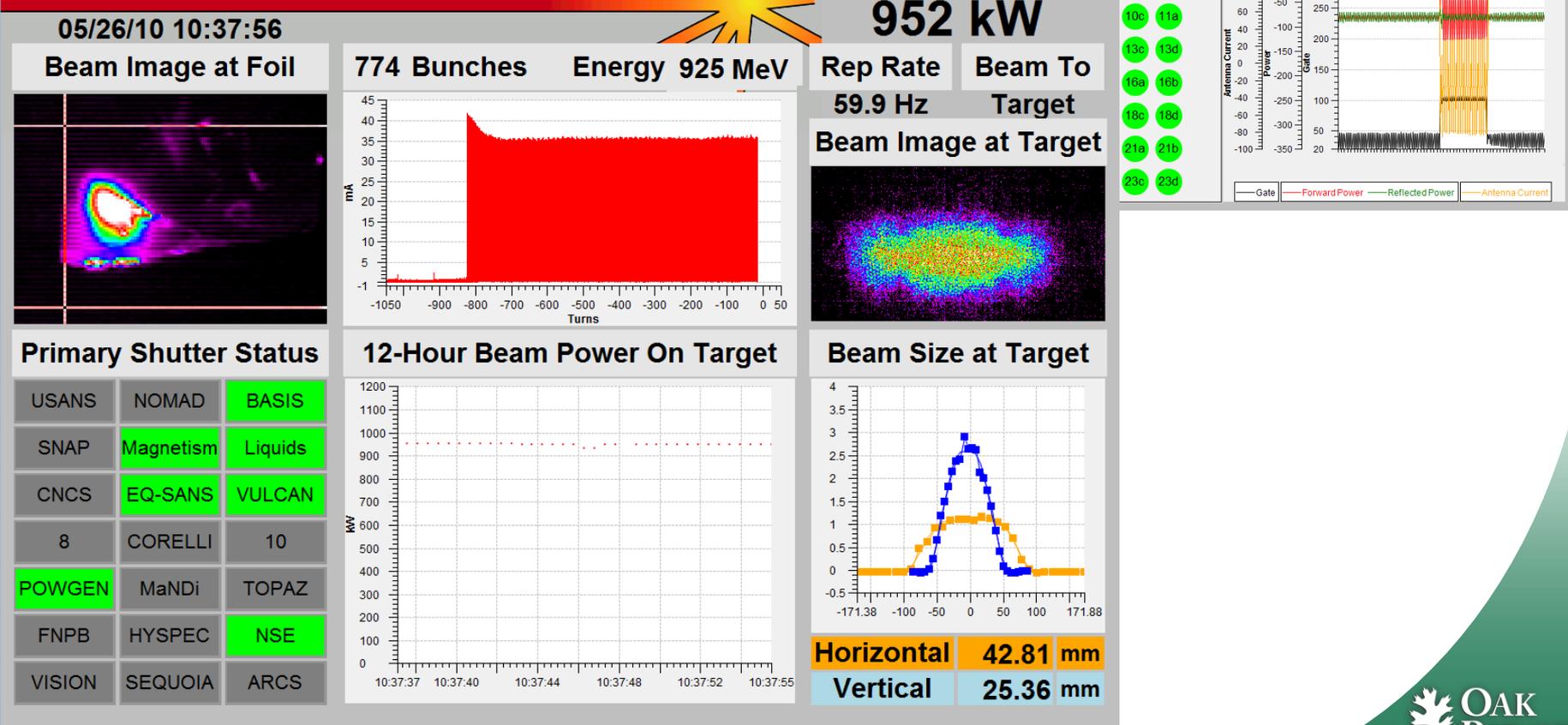


SNS Examples

- Top-level displays created by operators

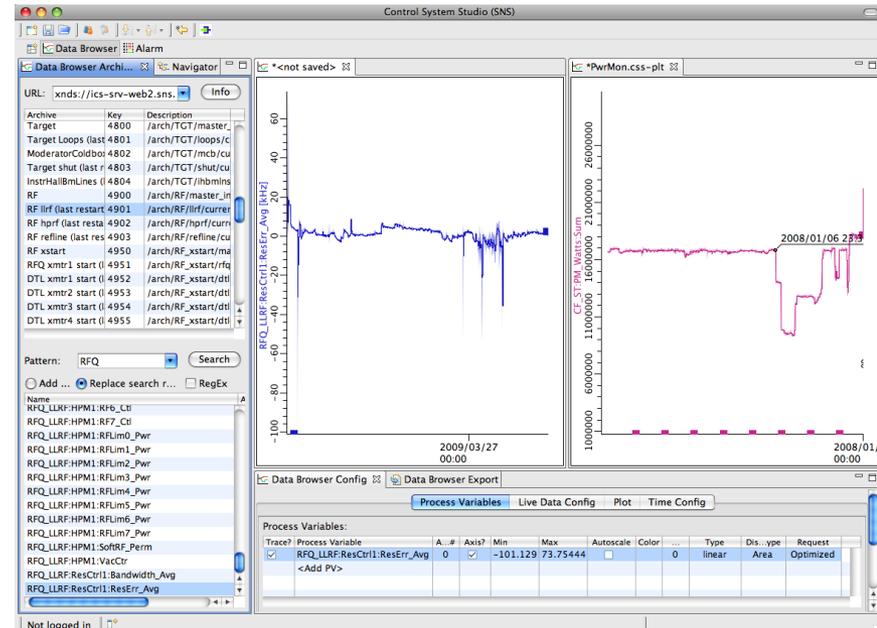
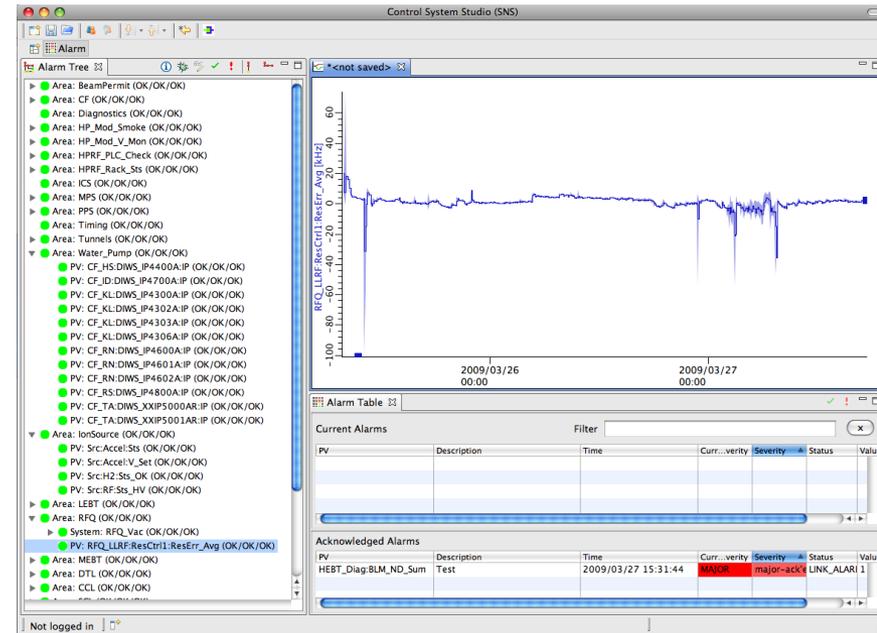


SNS Central Control Room



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

The screenshot displays the 'Alarm Table' window in the CSS software. It is divided into two main sections: 'Current Alarms' and 'Acknowledged Alarms'. The 'Current Alarms' section contains a table with columns for PV, Description, Time, Current Severity, Severity, Status, and Value. The 'Acknowledged Alarms' section contains a similar table. A context menu is open over the 'MEBT_CHOP:PS_2:V' alarm in the 'Current Alarms' table. The menu items include: 21:44:56, Check MEBT PS 2 Chopper, MEBT Chopper PS 2 Screen, Logbook..., Acknowledge, Copy Pv Name to Clipboard, CSS (highlighted), Configure Item, Auto-size Columns, and Alarm Perspective. A sub-menu is also visible, listing various tools: Data Browser, Data Browser View, PV Table, Rack View, PV Utility, PV Fields Viewer, Probe, and EPICS PV Tree.

PV	Description	Time	Current Severity	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	18.5
MEBT_CHOP:PS_2:V	mebbit chopper power supply two voltage fault		MAJOR	MAJOR	LOLO_ALARM	0.00

PV	Description	Time
TMod:Summary_MPS:Alarm	Moderator System MPS Trip	2009/03/17 16:48:10
MEBT_CHOP:PS_1:V	mebbit chopper power supply one voltage fault	2009/03/17 16:48:10
HEBT_Coll:CT2:Cond	HEBT_Coll:CT2:Cond	2009/03/17 16:48:10

(SNS) PV Fields Viewer

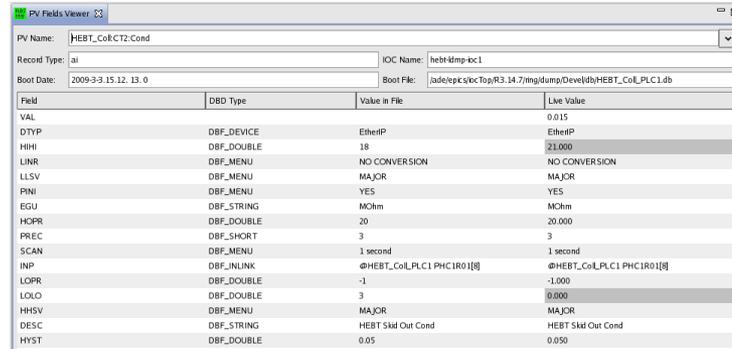
Field	DBD Type	Value in File	Live Value
VAL			0.015
DTYP	DBF_DEVICE	EtherIP	EtherIP
HIHI	DBF_DOUBLE	18	21.000
LINR	DBF_MENU	NO CONVERSION	NO CONVERSION
LLSV	DBF_MENU	MAJOR	MAJOR
PINI	DBF_MENU	YES	YES
EGU	DBF_STRING	MOhm	MOhm
HOPR	DBF_DOUBLE	20	20.000
PREC	DBF_SHORT	3	3
SCAN	DBF_MENU	1 second	1 second
INP	DBF_INLINK	@HEBT_Coll_PLC1 PHC1R01[8]	@HEBT_Coll_PLC1 PHC1R01[8]
LOPR	DBF_DOUBLE	-1	-1.000
LOLO	DBF_DOUBLE	3	0.000
HHSV	DBF_MENU	MAJOR	MAJOR
DESC	DBF_STRING	HEBT Skid Out Cond	HEBT Skid Out Cond
HYST	DBF_DOUBLE	0.05	0.050

Detailed configuration info for a PV

@SNS: Info in Oracle, live data from EPICS

PV Fields Viewer: Site-Specific?

Fine, but how would I benefit from an SNS-specific tool?

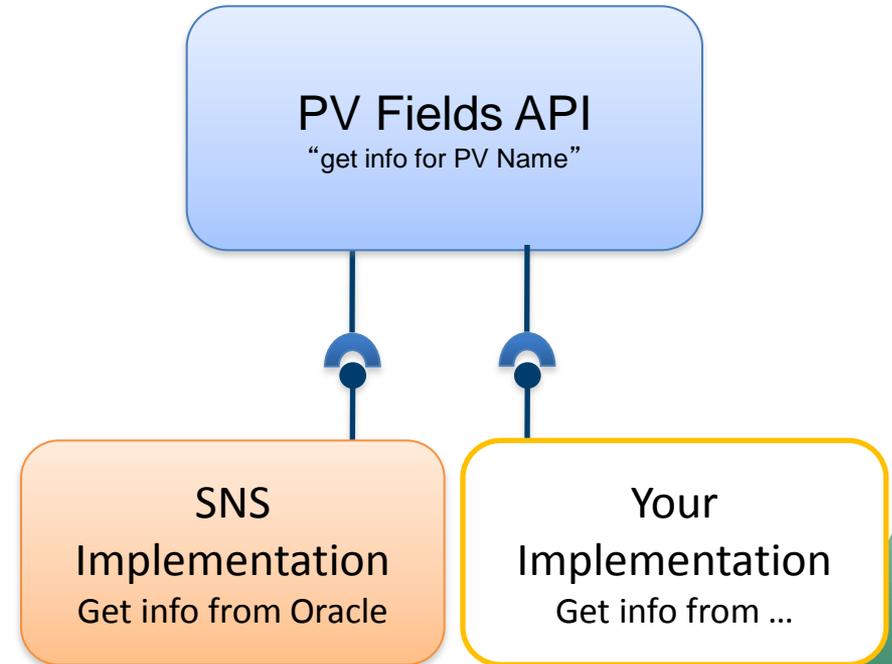


The screenshot shows a window titled 'PV Fields Viewer: 03'. It contains a table with columns: Field, DBD Type, Value in File, and Live Value. The table lists various fields and their corresponding values.

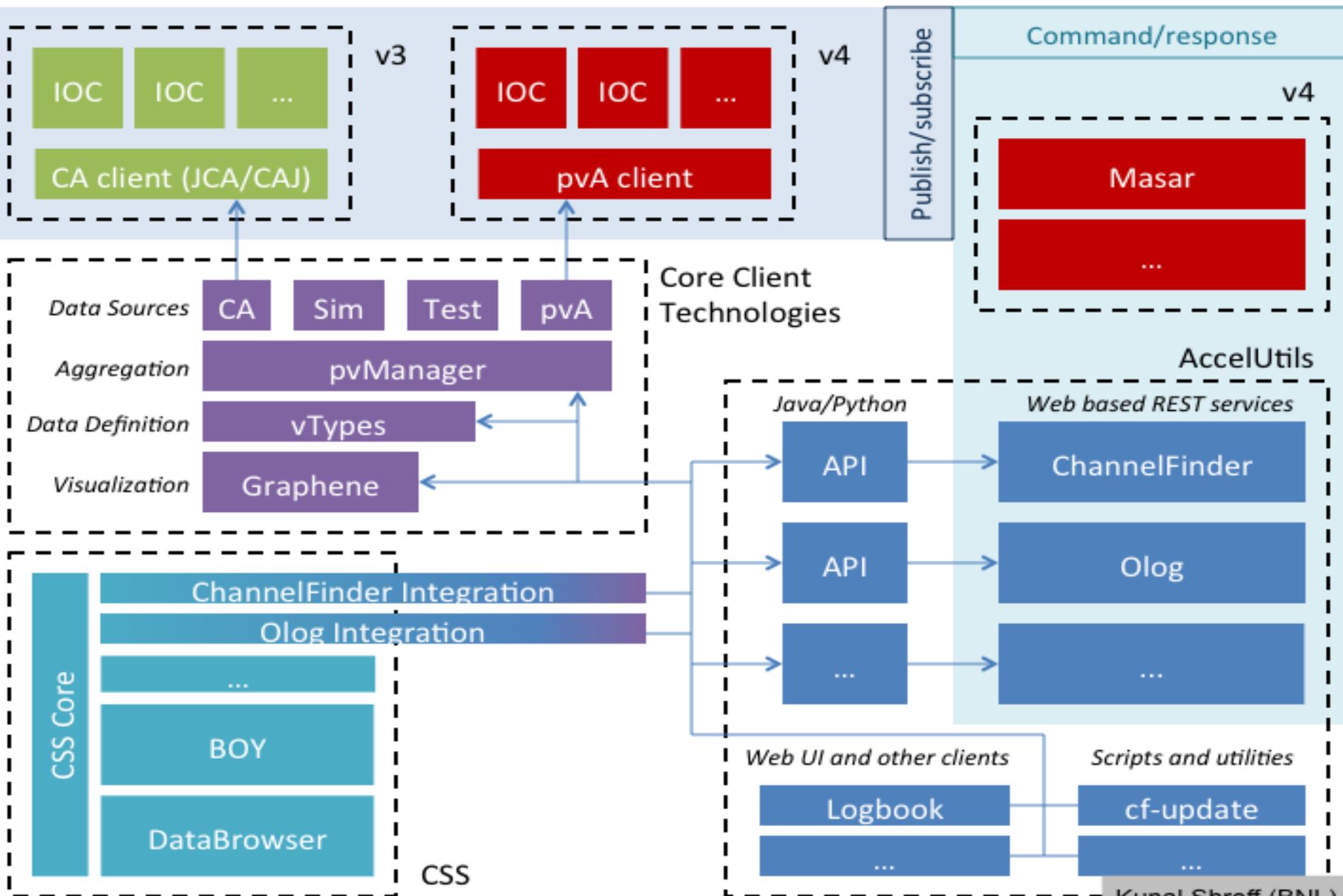
Field	DBD Type	Value in File	Live Value
VAL			0.015
DTYP	DBF_DEVICE	EtherIP	EtherIP
HIHI	DBF_DOUBLE	18	21.000
LINR	DBF_MENU	NO CONVERSION	NO CONVERSION
LLSV	DBF_MENU	MAJOR	MAJOR
FINI	DBF_MENU	YES	YES
EGU	DBF_STRING	MChm	MChm
HCJR	DBF_DOUBLE	20	20.000
PREC	DBF_SHORT	3	3
SCAN	DBF_MENU	1 second	1 second
INP	DBF_INLNK	@HEBT_CoL_PLC1 PHC1R0 [0]	@HEBT_CoL_PLC1 PHC1R0 [0]
LOPR	DBF_DOUBLE	-1	-1.000
LOLO	DBF_DOUBLE	3	0.000
HHSV	DBF_MENU	MAJOR	MAJOR
DESC	DBF_STRING	HEBT Skid Out Cond	HEBT Skid Out Cond
HYST	DBF_DOUBLE	0.05	0.050

It's "Pluggable"!

You can provide the glue code to your EPICS config in RDB, LDAP, text files



CSS Integration at NSLS-II (BNL)



Channel Viewer

Control System Studio (NSLSII)

File Edit CSS Window Help

OPI Editor Alarm Data Browser CSS perspective

Channel Viewer

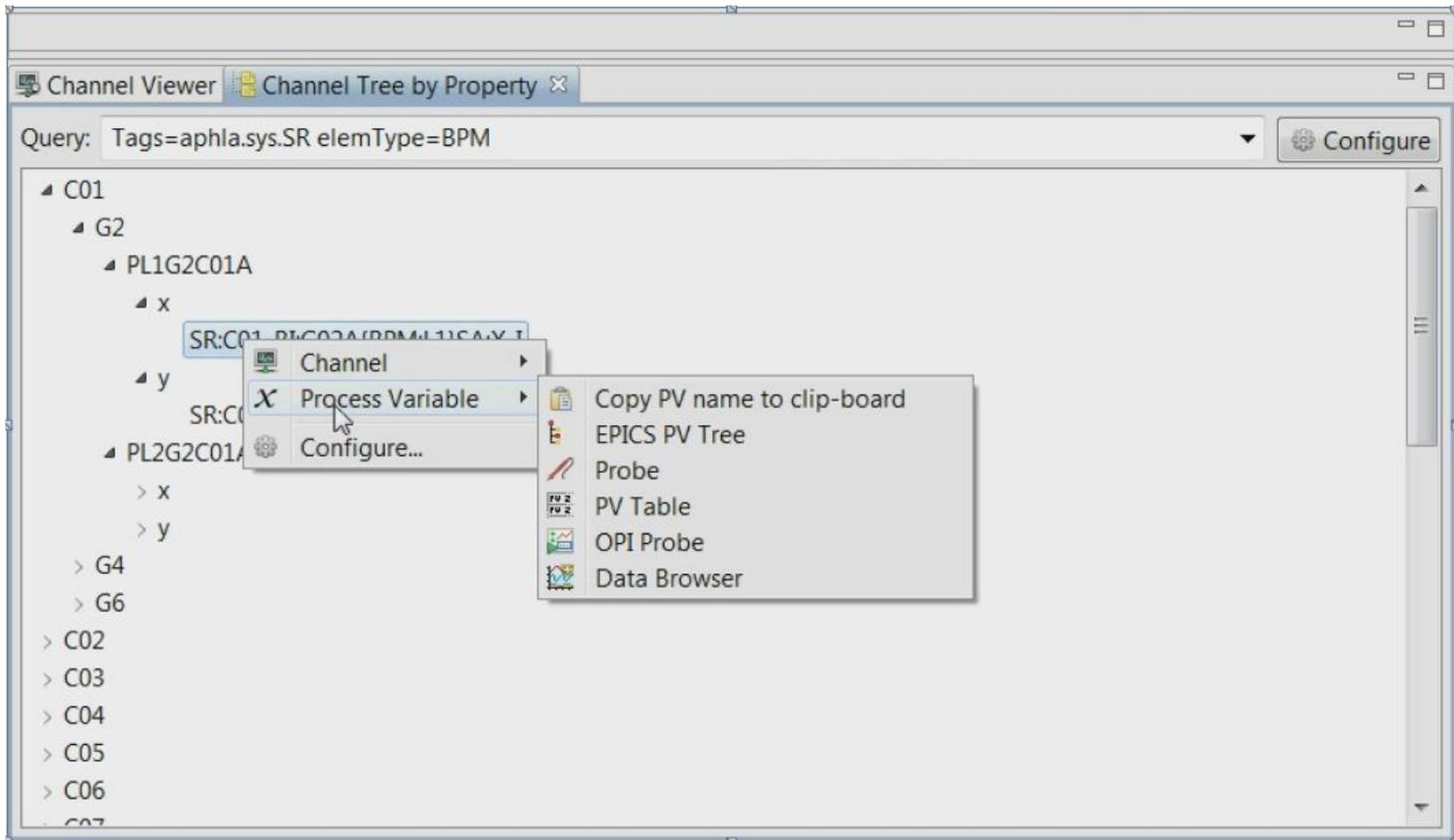
Query: * cell=C01 girder=G2 elemType=SEXT,QUAD

Channel Name	cell	girder	elemType	elemName	elemPosition	elemField	elemIndex	system	elem
V:1-SR:C01-MG:G2{QL2:134}FId:SP	C01	G2	QUAD	ql2g2c01a	31.6966	k1	134	V:1-SR	0.448
V:1-SR:C01-MG:G2{QL3:145}FId:I	C01	G2	QUAD	ql3g2c01a	32.8997	k1	145	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL2:134}FId:I	C01	G2	QUAD	ql2g2c01a	31.6966	k1	134	V:1-SR	0.448
V:1-SR:C01-MG:G2{QL3:145}FId:SP	C01	G2	QUAD	ql3g2c01a	32.8997	k1	145	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL1:125}FId:SP	C01	G2	QUAD	ql1g2c01a	30.5361	k1	125	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL1:125}FId:I	C01	G2	QUAD	ql1g2c01a	30.5361	k1	125	V:1-SR	0.275
V:1-SR:C01-MG:G2{SL3:141}FId:SP	C01	G2	SEXT	sl3g2c01a	32.4622			V:1-SR	0.2
V:1-SR:C01-MG:G2{SL1:121}FId:SP	C01	G2	SEXT	sl1g2c01a	29.8986			V:1-SR	0.2
V:1-SR:C01-MG:G2{SL3:141}FId:I	C01	G2	SEXT	sl3g2c01a	32.4622			V:1-SR	0.2
V:1-SR:C01-MG:G2{SL2:132}FId:I	C01	G2	SEXT	sl2g2c01a	30.9986	k2	132	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL2:132}FId:SP	C01	G2	SEXT	sl2g2c01a	30.9986	k2	132	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL1:121}FId:I	C01	G2	SEXT	sl1g2c01a	29.8986	k2	121	V:1-SR	0.2

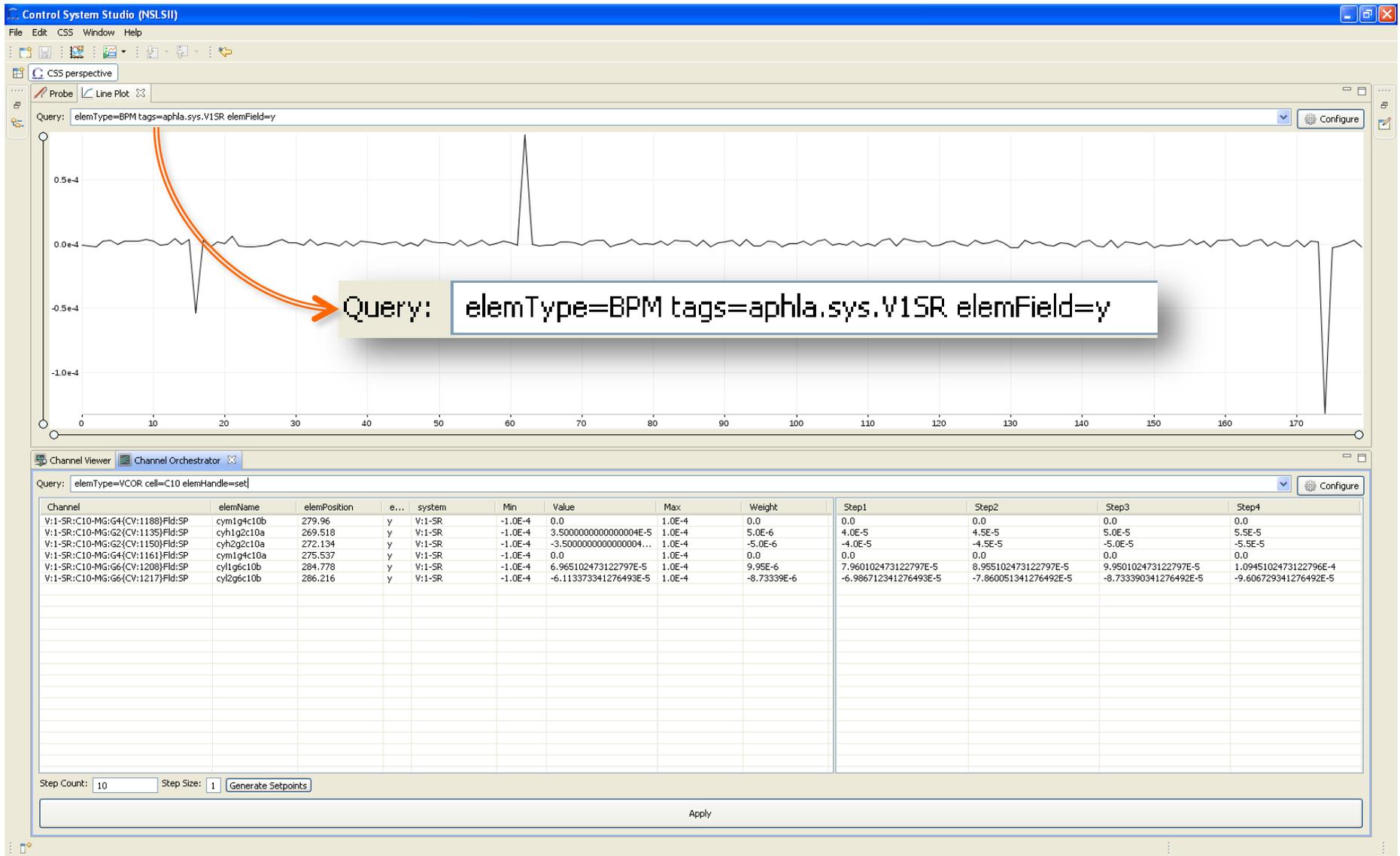
Context menu options:

- Channel
- Process Variable
- Configure...
- Copy PV name to clip-board
- EPICS PV Tree
- Probe
- PV Table
- OPI Probe
- Data Browser

Channel Tree by Property



Channel Orchestrator / Line Plot



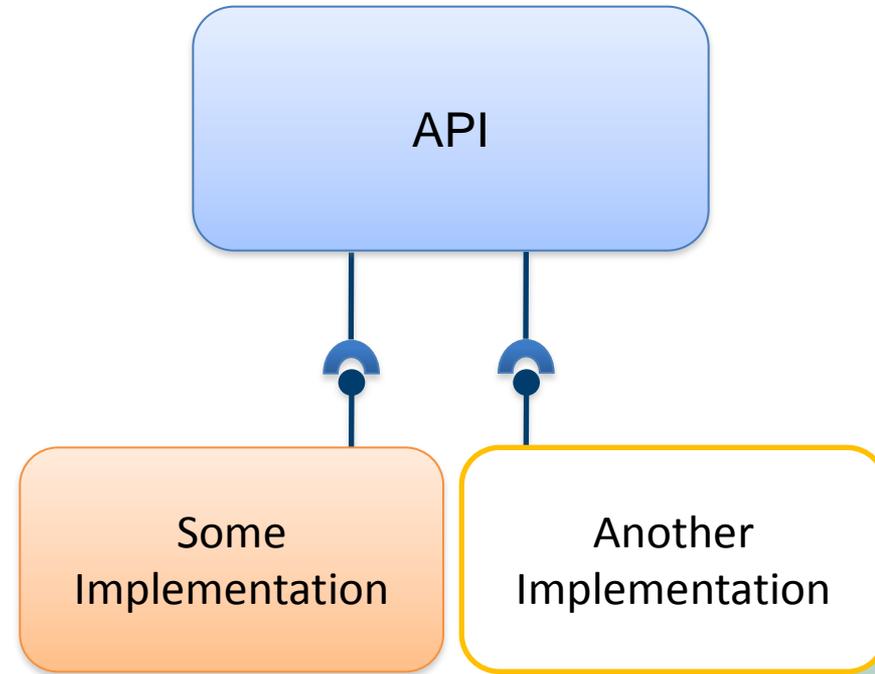
Other “Pluggable” Examples

- **APIs**

- Live Data Access
- Historic Data Access
- Authentication
- ...

- **Implementations**

- EPICS Channel Access, Simulated
- Chan.Arch XML-RPC, RDB, ...
- Kerberos, LDAP
- ...



CSS Continues to Evolve: PV Access

- `org.csstudio.utility.pv`
 - Basic PV ‘subscribe’ mechanism
 - Provides EPICS time, severity, status, meta data
 - “Works” for BOY, AlarmServer, ArchiveEngine, ...
- `org.csstudio.utility.pvmanager`
 - Allows code like

```
PVManager.read(mapOf(newValuesOf(channels("channel1", "channel2", "channel3")))).maxRate(ofHertz(1));
```
 - To do: write support, EPICS severity/status, ..

Evolving: Logbook support

a) Current CSS Logbook API

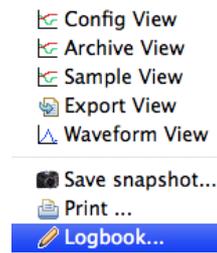
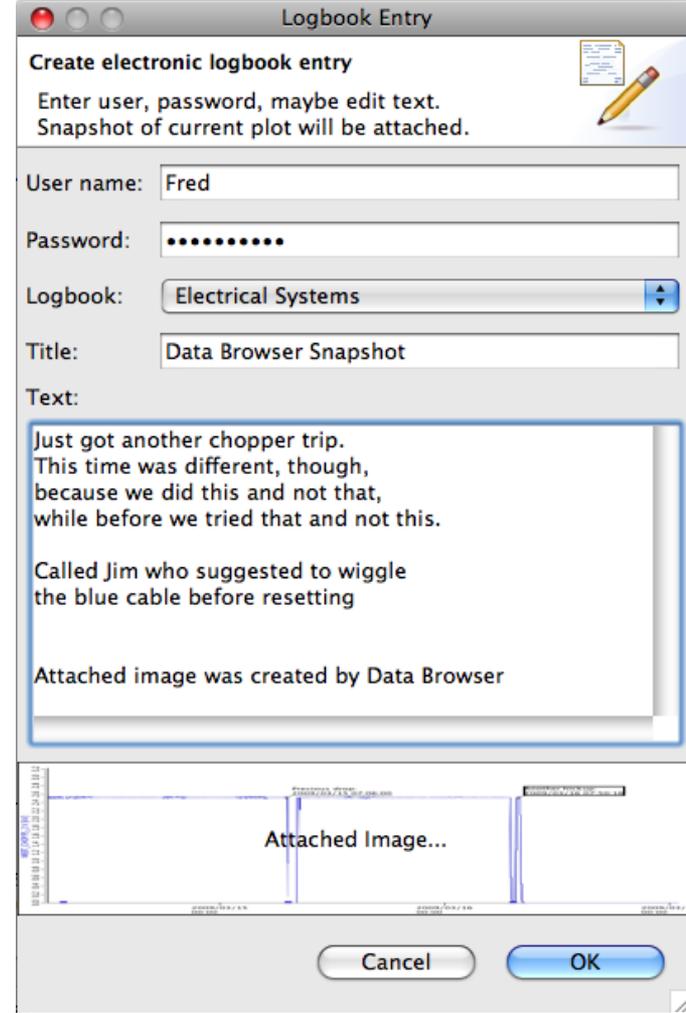
- Basic support for sending current alarms, OPI screenshot, ... to logbook

b) NSLS-2, FRIB “OLog”

- ‘Tags’, ..

Combined:

- ‘Tags’ and other entry properties
- Logbook Reader



CSS and Olog

The screenshot shows the Control System Studio (NLSII) interface. The main window displays a table of log entries. The selected entry is a shift summary from October 5, 2012, detailing the activities of Charles Gardner and Feng Gao.

Date	Description	Owner	Logbooks
Sep 27, 2012	tetstetst	shroffk	Electronics ...
Sep 27, 2012	wftsdg	shroffk	LOTO
Sep 27, 2012	This is another test Entry	shroffk	Mechanical...
Oct 5, 2012	Shift Summary 6/15/2012 Charles Gardner and Feng Gao:Today we studie...	shroffk	Operations
Oct 5, 2012	510 pC at ICT1. 500pC at FC2. Here is the spectrum. 0.18% FWHM, and 90...	shroffk	Operations
Oct 5, 2012	510 pC at ICT1. 500pC at FC2. Here is the spectrum. 0.18% FWHM, and 90...	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations

Date: Oct 5, 2012
Owner: shroffk
Logbooks: Operations
Tags: RF Area

Description:
Shift Summary 6/15/2012 Charles Gardner and Feng Gao:
Today we studied on LLRF behaviors on AC power cycling.
1. All five LLRFs AC power was cycled localled for 10 times, the output phase against M.O. did not jump;
2. For Kly1 LLRF AC power was also cycled 3 times using EDM GUI, no phase jump;
3. SPB amplifier AC power was also cycled 5 times, the phase of the output RF power did not jump;
4. The LLRFs and amplifiers were cooled down during lunch time for 1 hour and a half then turned back on, no phase jump;
5. SPB amplitude was change from 0.1 to 0.23, the phase shift is on the jitter level.

Attachments:

Edit Entry
Submit

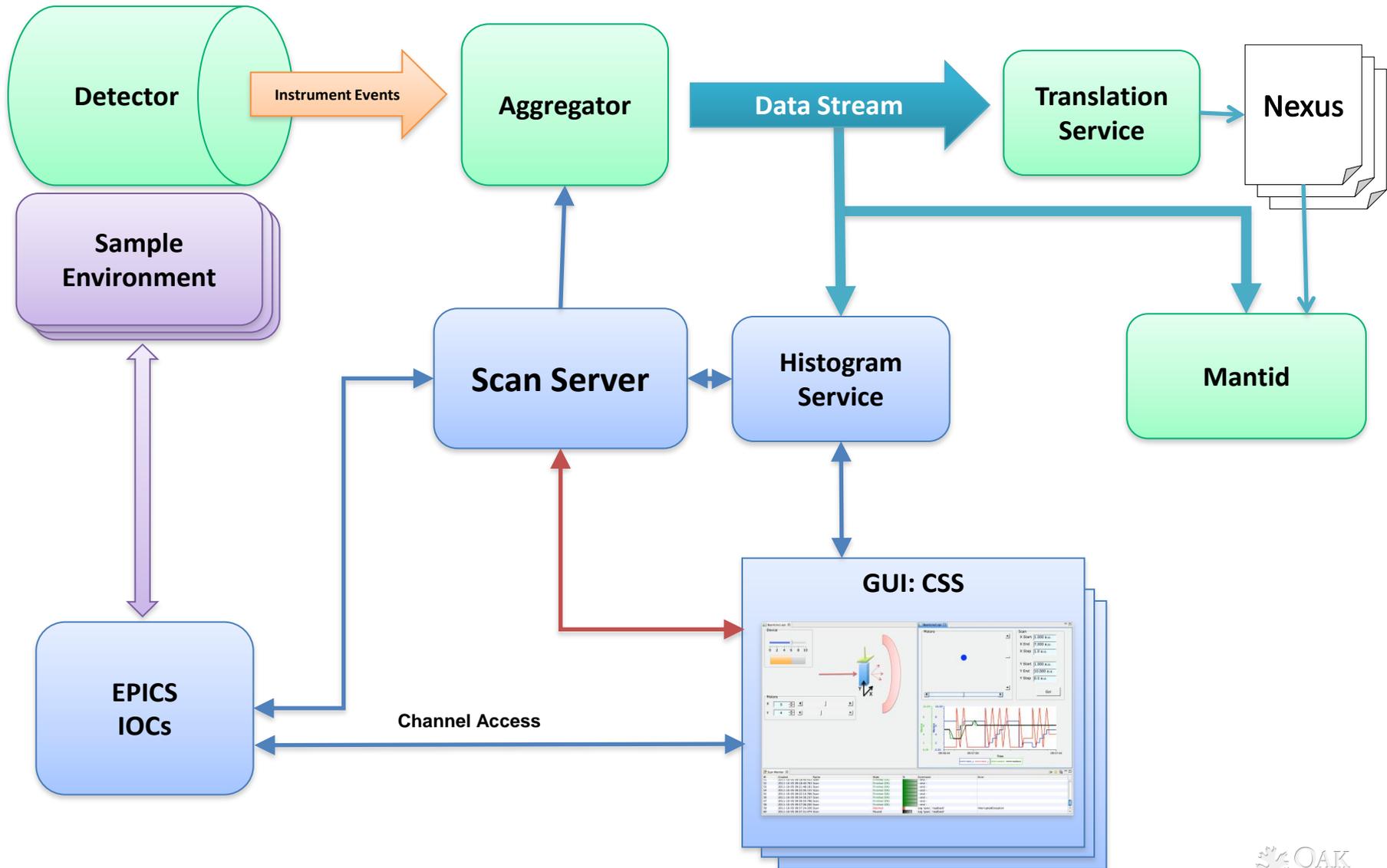
CSS and Olog

The screenshot displays the Control System Studio (NSLII) interface. The main window shows an alarm log entry for the date Oct 5, 2012, with the description "Attached is the beam at -1.2A and +0.8A on Steerer01H". The log entry includes a 2D spectrum plot (LN VPS) and a system diagram. The system diagram shows a complex arrangement of components, including a beam line with various magnets and detectors. The 2D spectrum plot shows a distribution of beam parameters, with a color scale ranging from 0 to 2000. The system diagram includes a legend and a list of components.

Date	Description	Owner	Logbooks
Oct 5, 2012	510 pC at ICT1. 500pC at FC2. Here is the spectrum. 0.18% FWHM, and 90% with +/-0.5%	shroffk	Operations
Oct 5, 2012	510 pC at ICT1. 500pC at FC2. Here is the spectrum. 0.18% FWHM, and 90% with +/-0.5%	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations
Oct 5, 2012	Attached is the beam at -1.2A and +0.8A on Steerer01H	shroffk	Operations

Date: Oct 5, 2012
Attached is the beam at -1.2A and +0.8A on Steerer01H
Owner: shroffk
Logbooks: Operations
Tags: Bumps
Edit Entry
Submit

SNS Plan: CSS for Instrument Automation



“Scan” from BOY

1. Configure

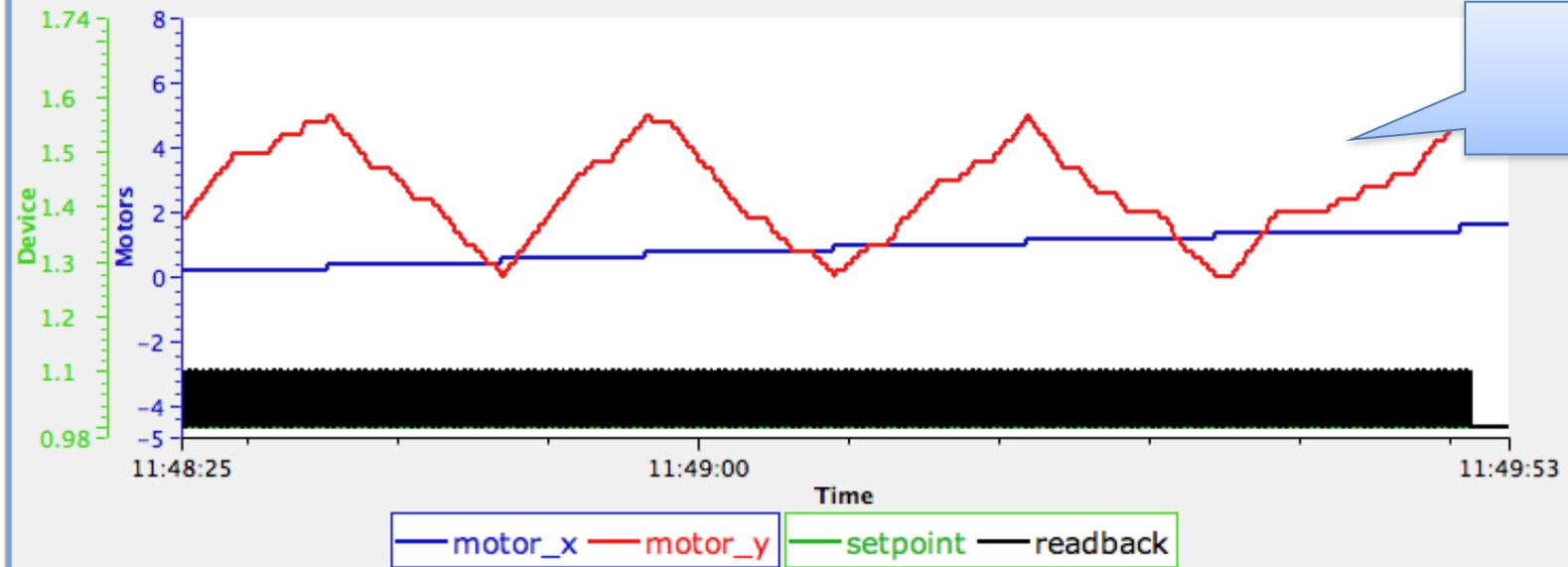
The interface is divided into three main sections:

- Beam:** Shows a green circle for the beam status, a blue square for the shutter, and a neutron count of 336,338.
- Motors:** A large empty area with a blue dot in the center, representing the motor positions.
- Scan:** Configuration parameters for the scan:

	X	Y
Start	0.0 a.u.	0.0 a.u.
End	5.0 a.u.	5.0 a.u.
Step	0.200 a.u.	0.200 a.u.
Neutrons	3.0 a.u.	
Name	XY Scan2	
Up/Down	<input type="checkbox"/>	
Active	<input checked="" type="checkbox"/>	

A "Go!" button is located at the bottom right of the Scan panel.

2. Start



3. Monitor

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

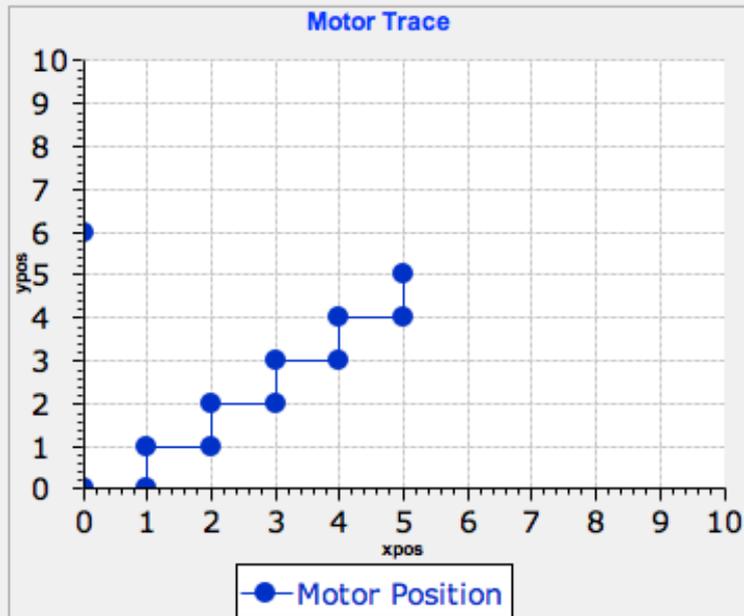
Submit Scan

in workspace

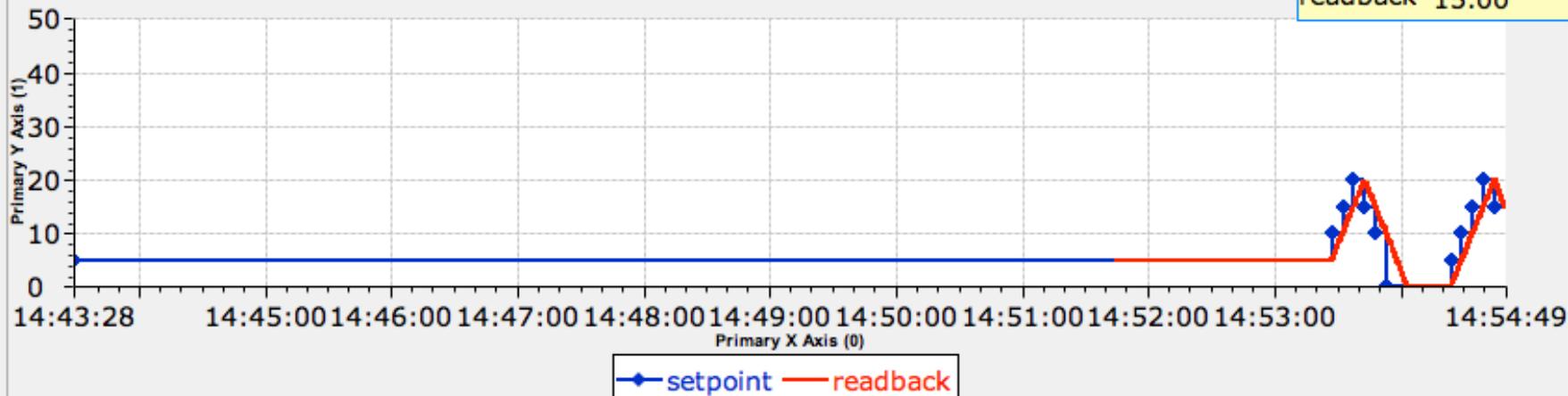
Load from .csv ...

Export to .csv file

Scan



setpoint: 10
readback 15.00



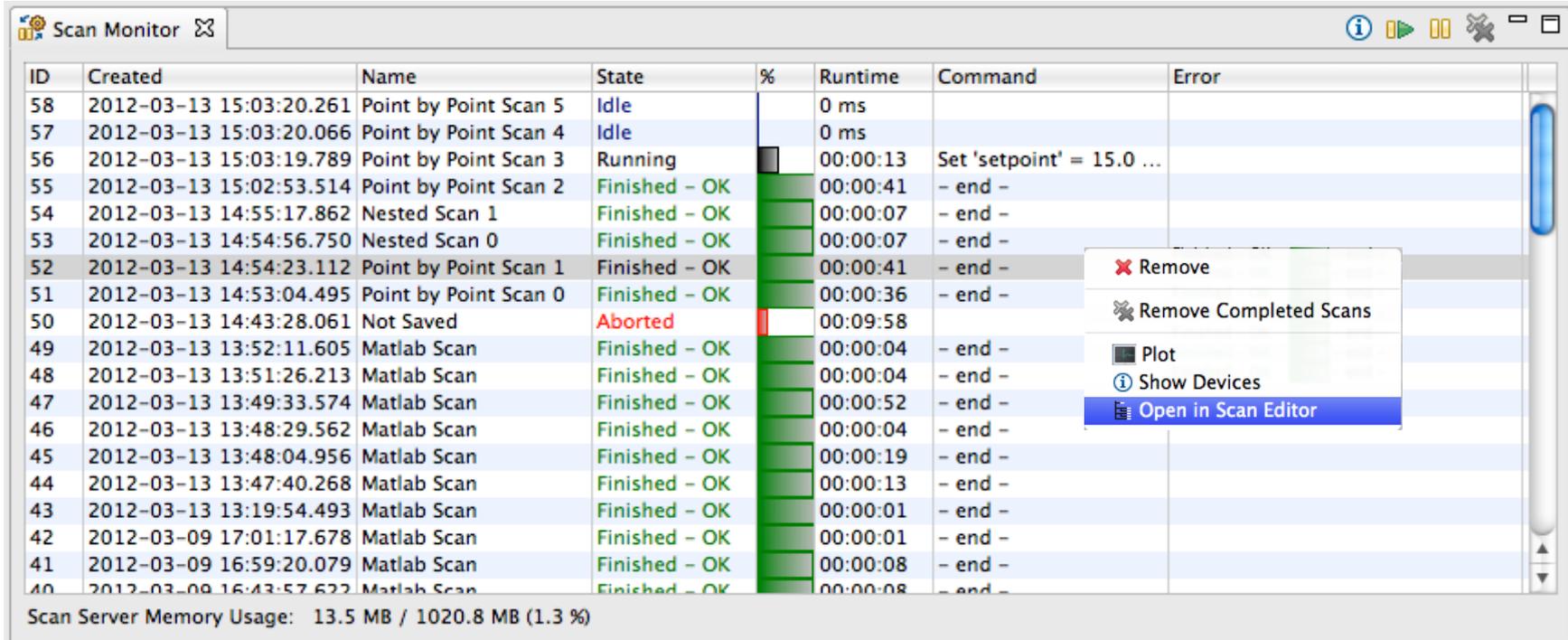
Current Running

Point by Point Scan Current

Set 'ypos' = 5.0 (wait for

79%

Scan Monitor



The screenshot shows the Scan Monitor application window with a table of scan data. A context menu is open over the row with ID 52, showing options: Remove, Remove Completed Scans, Plot, Show Devices, and Open in Scan Editor (highlighted).

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

Scan Server Memory Usage: 13.5 MB / 1020.8 MB (1.3 %)

List Scans on Server

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

Scan Editor

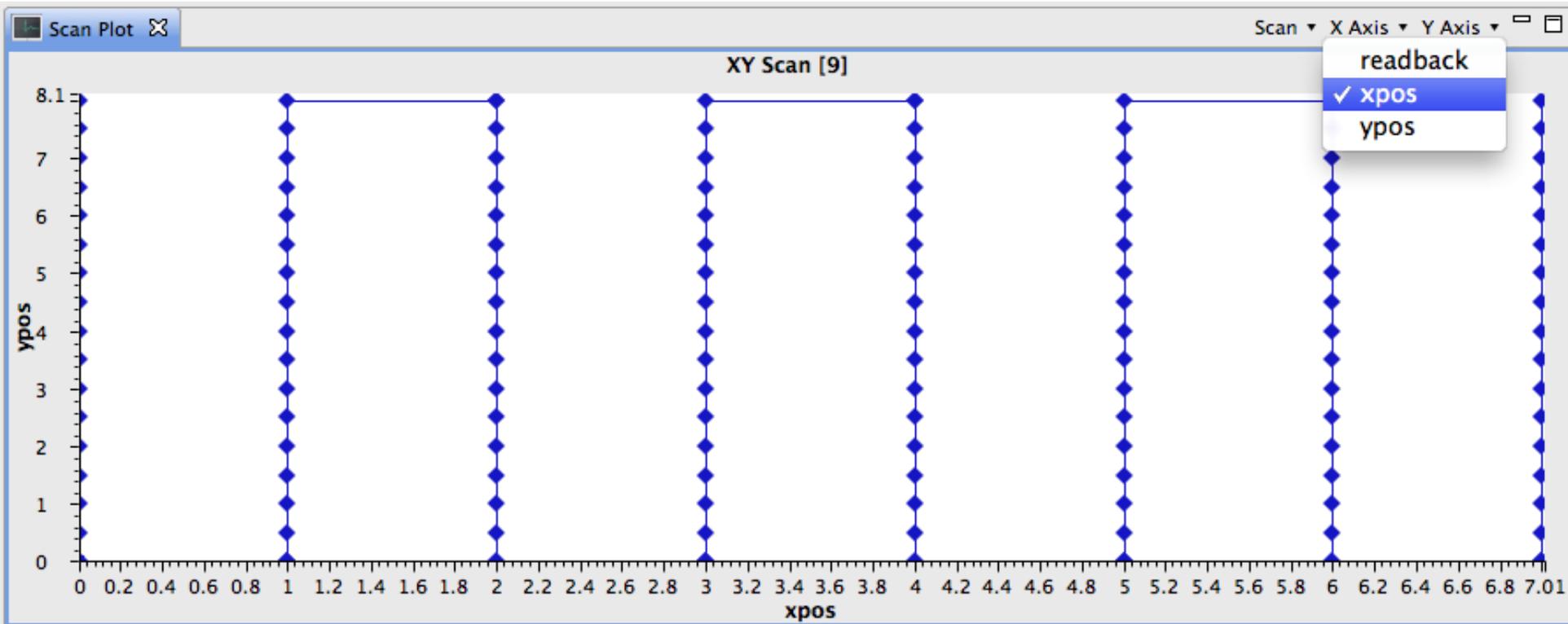
The screenshot displays the Scan Editor interface. On the left, the Navigator shows a file tree with 'demo.scn' selected. A red arrow points from the text 'Open, save' to this file. The central editor shows a sequence of commands for a scan, including setting a setpoint, waiting for a readback, and looping through x and y positions. A context menu is open over the editor, with 'Submit Scan' circled in red. On the right, the Scan Command Palette shows a 'Wait' command with parameters. The Properties panel below it shows a table with the following data:

Property	Value
1. Device Name	pcharge
2. Comparison	to increase by
3. Desired Value	1.0E12
4. Tolerance	0.1
5. Time out (secon...	0.0

Red circles highlight the 'Desired Value' and 'Tolerance' rows in the table. The text 'Set parameters' is written below the table. The bottom right corner of the interface shows 'Not logged in'.

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

Scan Plot



- Plot variables used by scan
- Get data from Running or Finished scans

Simulation Mode

powgen.scn

- * = Set 'xpos' = 0.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 0.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 5.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 3.5E12
- * = Set 'xpos' = 1.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 1.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 10.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 1.75E12
- * = Set 'xpos' = 2.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 2.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 15.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 3.5E12
- * = Set 'xpos' = 3.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 3.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 20.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 1.75E12
- * = Set 'xpos' = 4.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 4.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 15.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 3.5E12
- * = Set 'xpos' = 5.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 5.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 10.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 1.75E12
- * = Set 'xpos' = 6.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 6.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 0.0 (wait for 'readback' +-0.1)
- ⌚ Wait for 'pcharge' to increase by 3.5E12

Scan Simulation

Simulation:

```
00:00:00 - Set 'xpos' = 0.0 (wait for 'xpos' +-0.1)
00:00:01 - Set 'ypos' = 0.0 (wait for 'ypos' +-0.1)
00:00:02 - Set 'setpoint' = 5.0 (wait for 'readback' +-0.1)
00:00:03 - Wait for 'pcharge' to increase by 3.5E12 [was 0.0]
01:00:03 - Set 'xpos' = 1.0 (wait for 'xpos' +-0.1) [was 0.0]
01:00:13 - Set 'ypos' = 1.0 (wait for 'ypos' +-0.1) [was 0.0]
01:00:18 - Set 'setpoint' = 10.0 (wait for 'readback' +-0.1) [was 5.0]
01:00:23 - Wait for 'pcharge' to increase by 1.75E12 [was 3.5E12]
01:30:23 - Set 'xpos' = 2.0 (wait for 'xpos' +-0.1) [was 1.0]
01:30:33 - Set 'ypos' = 2.0 (wait for 'ypos' +-0.1) [was 1.0]
01:30:38 - Set 'setpoint' = 15.0 (wait for 'readback' +-0.1) [was 10.0]
01:30:43 - Wait for 'pcharge' to increase by 3.5E12 [was 5.25E12]
02:30:43 - Set 'xpos' = 3.0 (wait for 'xpos' +-0.1) [was 2.0]
02:30:53 - Set 'ypos' = 3.0 (wait for 'ypos' +-0.1) [was 2.0]
02:30:58 - Set 'setpoint' = 20.0 (wait for 'readback' +-0.1) [was 15.0]
02:31:03 - Wait for 'pcharge' to increase by 1.75E12 [was 8.75E12]
03:01:03 - Set 'xpos' = 4.0 (wait for 'xpos' +-0.1) [was 3.0]
03:01:13 - Set 'ypos' = 4.0 (wait for 'ypos' +-0.1) [was 3.0]
03:01:18 - Set 'setpoint' = 15.0 (wait for 'readback' +-0.1) [was 20.0]
03:01:23 - Wait for 'pcharge' to increase by 3.5E12 [was 1.05E13]
04:01:23 - Set 'xpos' = 5.0 (wait for 'xpos' +-0.1) [was 4.0]
04:01:33 - Set 'ypos' = 5.0 (wait for 'ypos' +-0.1) [was 4.0]
04:01:38 - Set 'setpoint' = 10.0 (wait for 'readback' +-0.1) [was 15.0]
04:01:43 - Wait for 'pcharge' to increase by 1.75E12 [was 1.4E13]
04:31:43 - Set 'xpos' = 6.0 (wait for 'xpos' +-0.1) [was 5.0]
04:31:53 - Set 'ypos' = 6.0 (wait for 'ypos' +-0.1) [was 5.0]
04:31:58 - Set 'setpoint' = 0.0 (wait for 'readback' +-0.1) [was 10.0]
04:32:08 - Wait for 'pcharge' to increase by 3.5E12 [was 1.575E13]
05:32:08 Total estimated execution time
```

- Simulated PV changes
- Estimates times

```
<!-- Simulation information for a PV
Slew rate is in [units of the device] / second
The (simulated) neutrons change at about 7/sec -->
-->
<pv>
  <name>neutrons</name>
  <slew_rate>7</slew_rate>
</pv>
<!-- Proton charge: About 3.5e12 / hour = 9.7e8 / sec -->
<pv>
  <name>pcharge</name>
  <slew_rate>9.7222e+08</slew_rate>
</pv>
```

Monitor, Adjust Live Scan

Scan 'Not Saved' [50]: Paused, 17% done

- * = Set 'xpos' = 0.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 0.0 (wait for 'ypos' +-0.1)
- * = **Set 'setpoint' = 5.0 (wait for 'readback' +-0.1)**
- Log 'readback'
- * = Set 'xpos' = 1.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 1.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 10.0 (wait for 'readback' +-0.1)
- Log 'readback'
- * = Set 'xpos' = 2.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 2.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 15.0 (wait for 'readback' +-0.1)
- Log 'readback'
- * = Set 'xpos' = 3.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 3.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 20.0 (wait for 'readback' +-0.1)
- Log 'readback'
- * = Set 'xpos' = 4.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 4.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 15.0 (wait for 'readback' +-0.1)
- Log 'readback'
- * = Set 'xpos' = 5.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 5.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 10.0 (wait for 'readback' +-0.1)
- Log 'readback'
- * = Set 'xpos' = 6.0 (wait for 'xpos' +-0.1)
- * = Set 'ypos' = 6.0 (wait for 'ypos' +-0.1)
- * = Set 'setpoint' = 0.0 (wait for 'readback' +-0.1)
- Log 'readback'

Scan Info

Active Command

Adjust properties of live scan

Property	Value
▼ Set	
1. Device Name	xpos
2. Value	2.0
3. Wait for readback	yes
4. Readback Device	xpos
5. Tolerance	active
6. Time out (seconds; 0 to disable)	ypos

Scripted Scan

Jython editor,
debugger

Jython console

```
*custom_scan
"""Example for custom scan from shell"""

from scan_client import *

# Simple scans
# Move motor X 1 ... 10
scan('Simple 1D', ('xpos', 1, 10));

# Move motors X and Y, log the readback
scan('Simple 2D', ('xpos', 1, 10), ('ypos', 1, 10, 0.5), 'readback')

# Connect to server for more detailed custom scans
client = ScanClient()
cmds = [
    DelayCommand(2.0),
    LoopCommand('xpos', 1, 5, 0.1,
        [
            SetCommand('setpoint', 1),
            WaitCommand('readback', Comparison.EQUALS, 1.0, 0.5, 0.0),
            SetCommand('setpoint', 5),
            WaitCommand('readback', Comparison.EQUALS, 3.0, 0.5, 0.0),
            LogCommand(['xpos', 'readback'])
        ]
    ),
]

# Schedule for execution on server
seq = CommandSequence(
seq.dump()
```

- Run As
 - 1 Jython Run
 - 2 Jython unit-test
 - 3 Python Run
 - 4 Python unit-test
 - Run Configurations...
- Debug As
- Team
- Compare With
- Replace With
- PyDev

```
Console
PyDev Console [0]
>>> import sys;
>>> print('%s %s' % (sys.executable or sys.platform, sys.version))
java1.6.0_29 2.5.2 (Release_2_5_2:7206, Mar 2 2011, 23:12:06)
[Java HotSpot(TM) 64-Bit Server VM (Apple Inc.)]
>>>
>>> sys.path.append('/Kram/MerurialRepos/cs-studio/products/SNS/plugins/org.csstudio.scan/examples')
>>> from scan_client import *
>>> scan(('xpos', 1, 10))
10L
N-dimensional scan that logs arbitrary number of readings
based on nested loops.
Arguments:
* Optional scan name
* One or more scan specifications: ('device', start, end[, step])
* Names of device to log in addition to loop'ed devices
Examples:
# Scan 'xpos' from 1 to 10, stepping 1, automatically logging 'xpos'
```

... or use 'vi', shell

Thick Client vs. Web

✓ CSS: Integrated, rich, portable

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



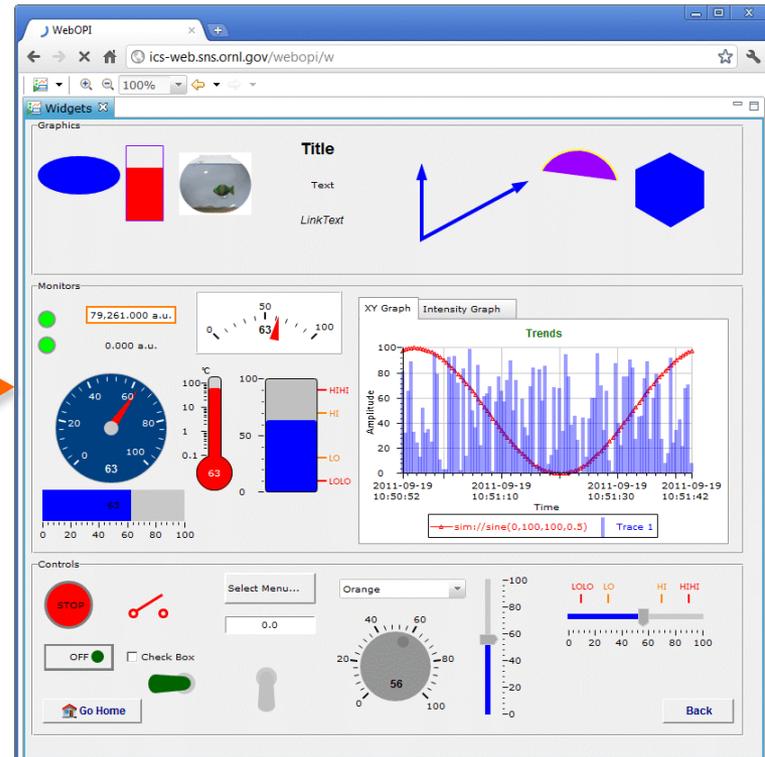
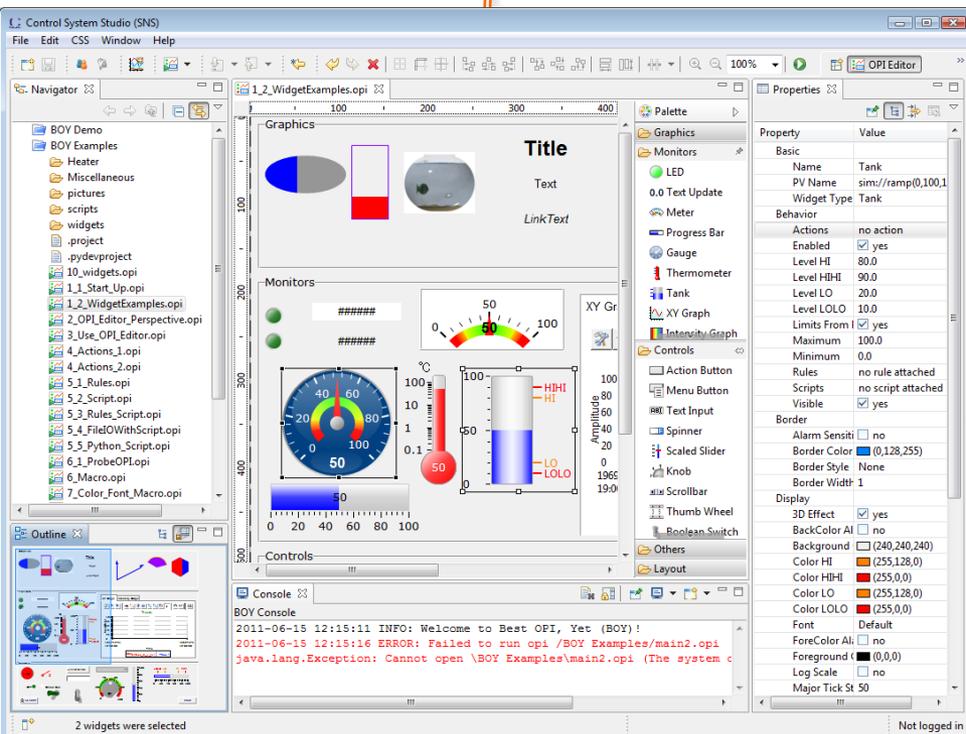
Accessible from phones, tablets, toasters?



Web OPI

CSS is Desktop app, will probably remain so, but

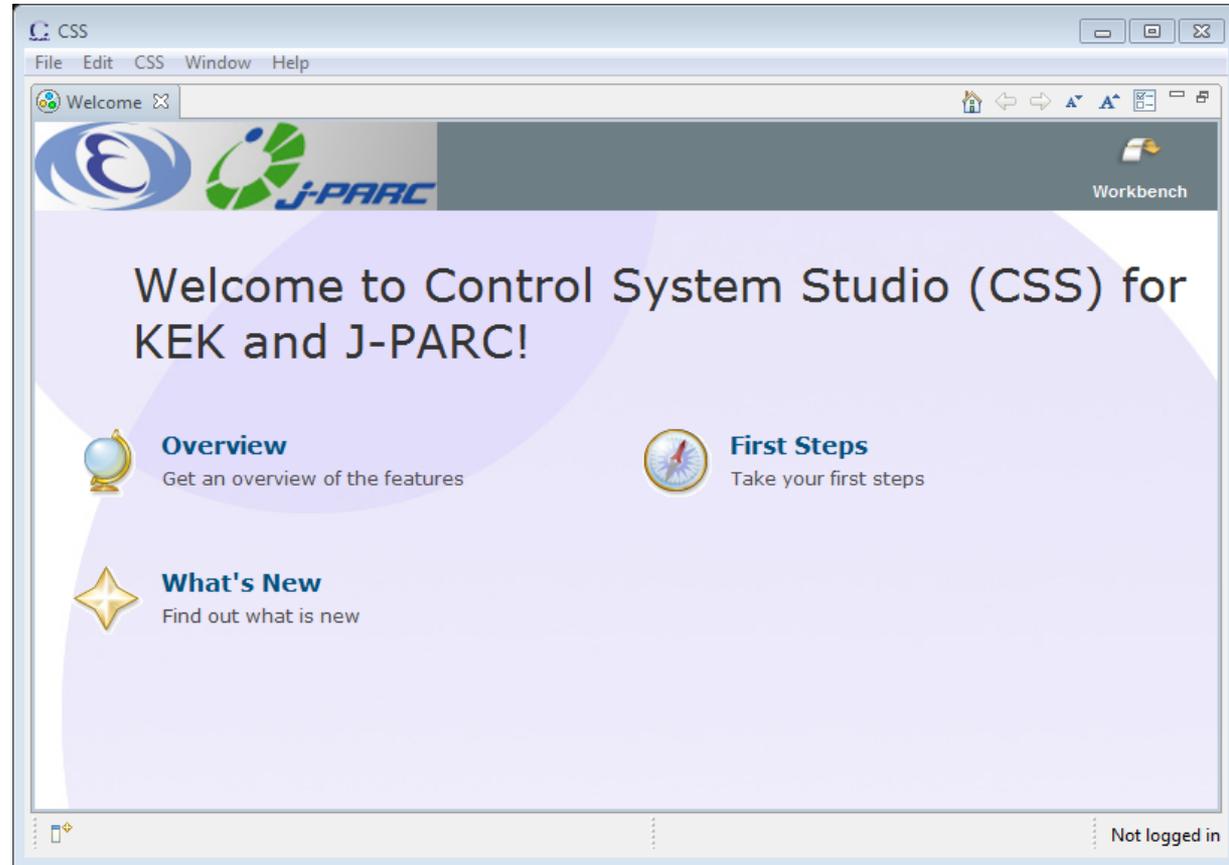
***.opi files can be viewed online!**



Site-Specific Setup

1. Product: Tools and settings for your users at your site.

Decide which
parts of CSS
you need.



Site-Specific Setup

1. Product for your users

2. Web site: Initial download

The screenshot shows a web browser window with the URL <https://ics-web.sns.ornl.gov/css/>. The page title is "Control System Studio - CSS". The left sidebar contains navigation links: "SNS CSS", "Products", "News", "Known Issues", "Uninstall, Update CSS", and "Docs". The main content area features the "Control System Studio - CSS" logo and a sub-header "Download". Below this, there is a paragraph explaining that the page is a collection of user interface tools and a link to "Source Forge". A "Download" section follows, with instructions to click one of the following links to download the "SNS Office version" of Control System Studio. Three buttons are visible: "Windows", "OS X", and "Linux". Below the "Windows" button, there is a "Windows 64" button. The instructions for each OS are as follows:

- Windows:** 1. Download the ZIP file for Windows to somewhere on your computer, for example the desktop. Windows 7 users with 64-bit Java should download the 64-bit version.
- OS X:** 1. Download the ZIP file for Mac OS X. 2. Double-click to unpack, which creates a "CSS_{version number}" directory. If
- Linux:** 1. Download the ZIP file for Linux (See [Products](#) for 64-bit x86_64). 2. Unpack, which creates a "CSS_{version number}" directory.

... Site-Specific Setup

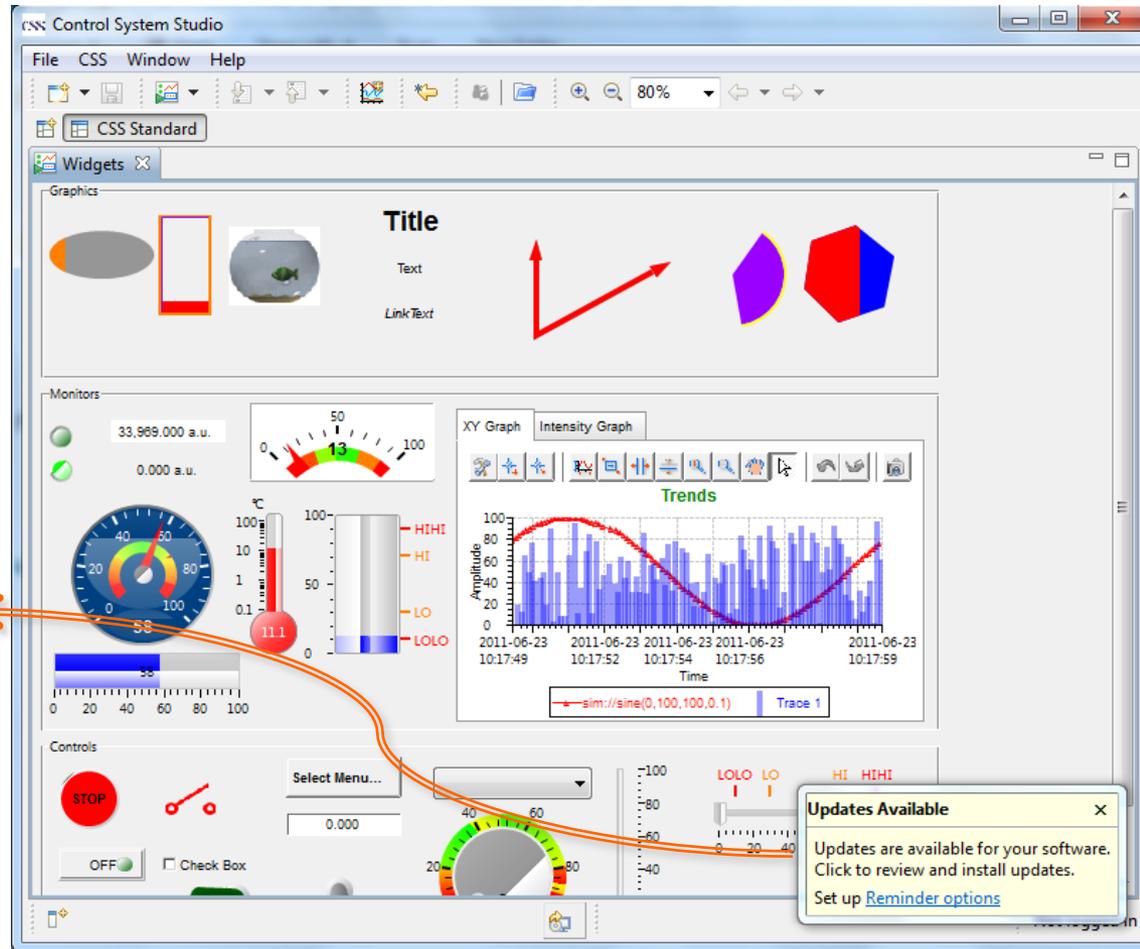
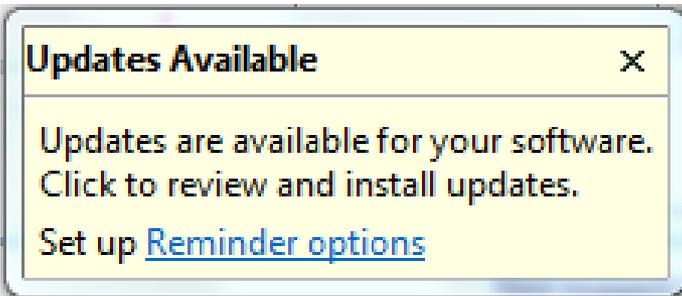
1. Product



2. Web site

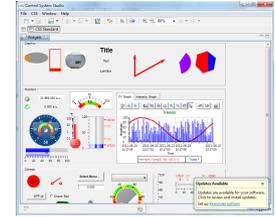


3. Automated updates



Need Site-Specific Setup

Developer:



End User: Happy



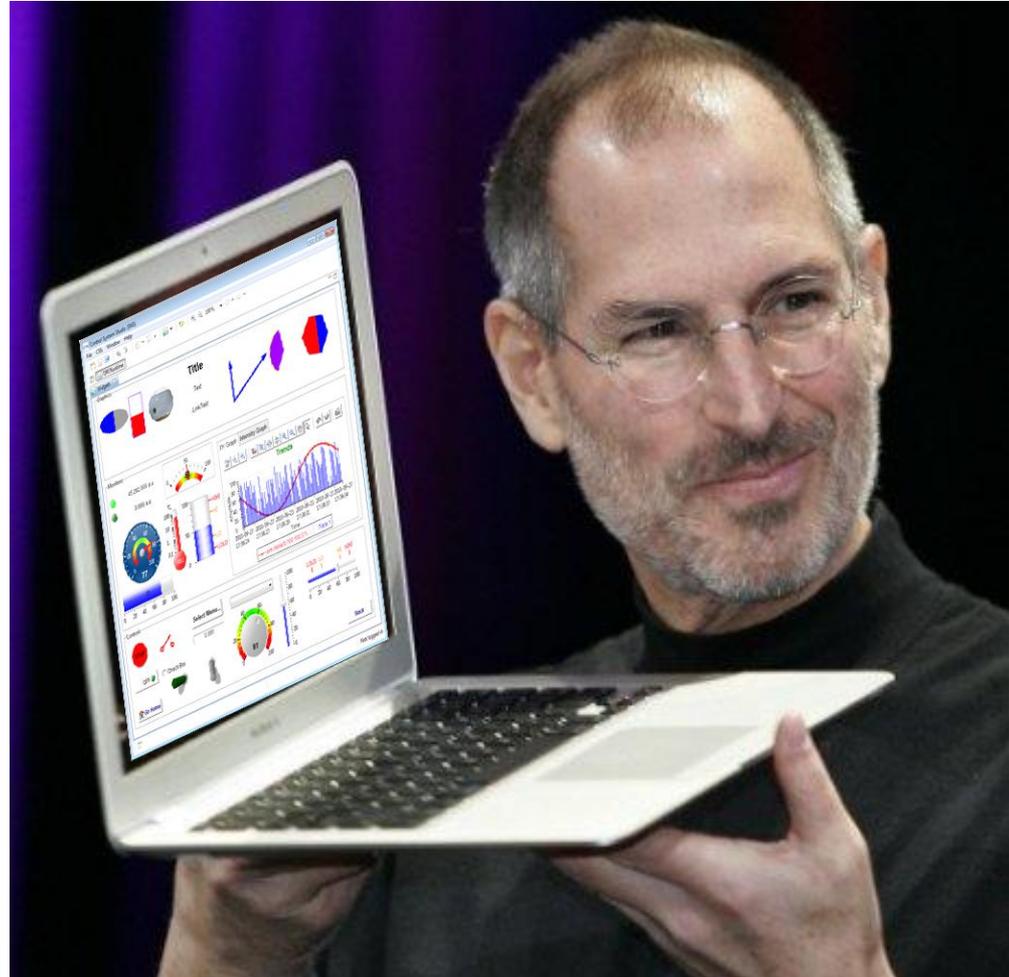
Steep Learning Curve for Developers

- ... but also many Books, online Tutorials
- Invest to learn it, and you' ll like it

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-lordinateur-portable-le-plus-fin-du-monde.jpg>

Links

- **CSS**

- SNS Products to try:

- <http://ics-web.sns.ornl.gov/css>

- Guide book, source-to-product:

- <http://cs-studio.sourceforge.net/docbook/>

- CSS Wiki:

- <http://sourceforge.net/apps/trac/cs-studio>

- **Eclipse**

- <http://www.eclipse.org/>