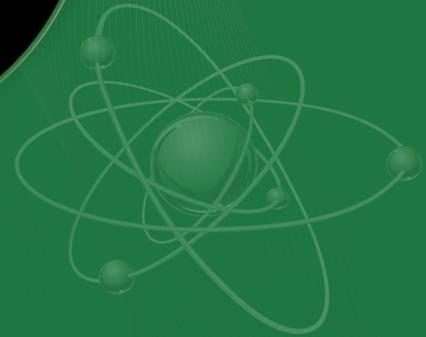
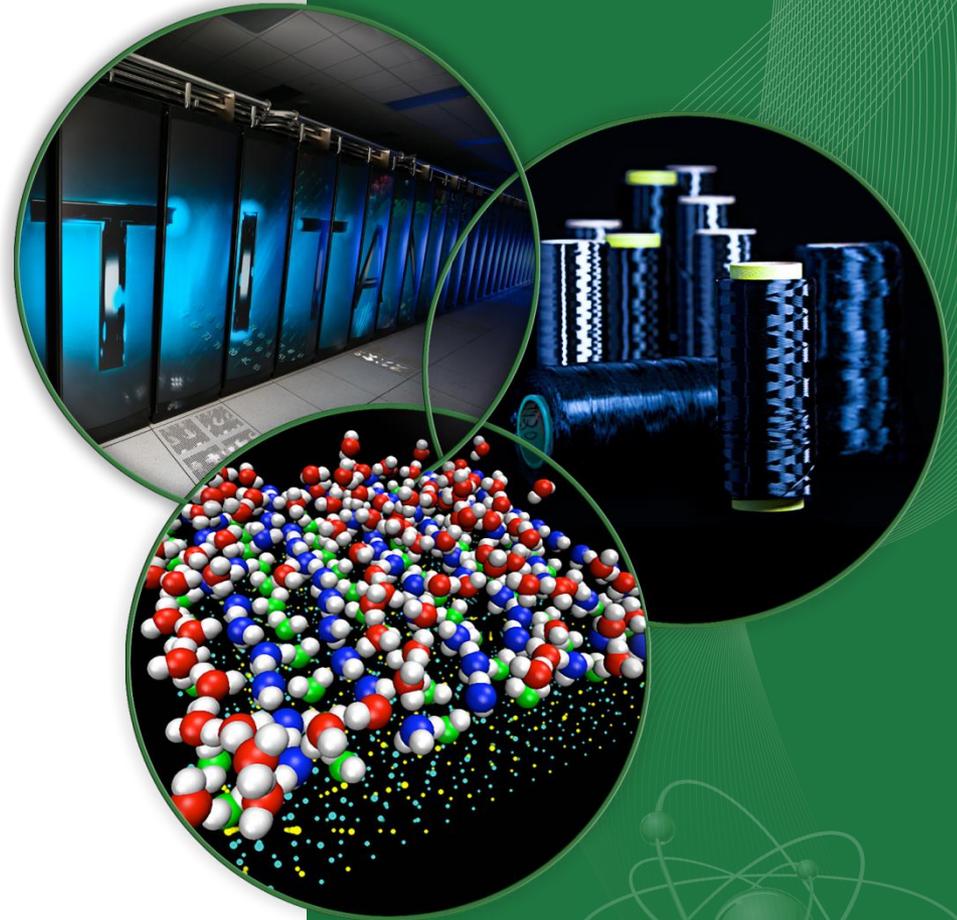


Control System Studio: Overview

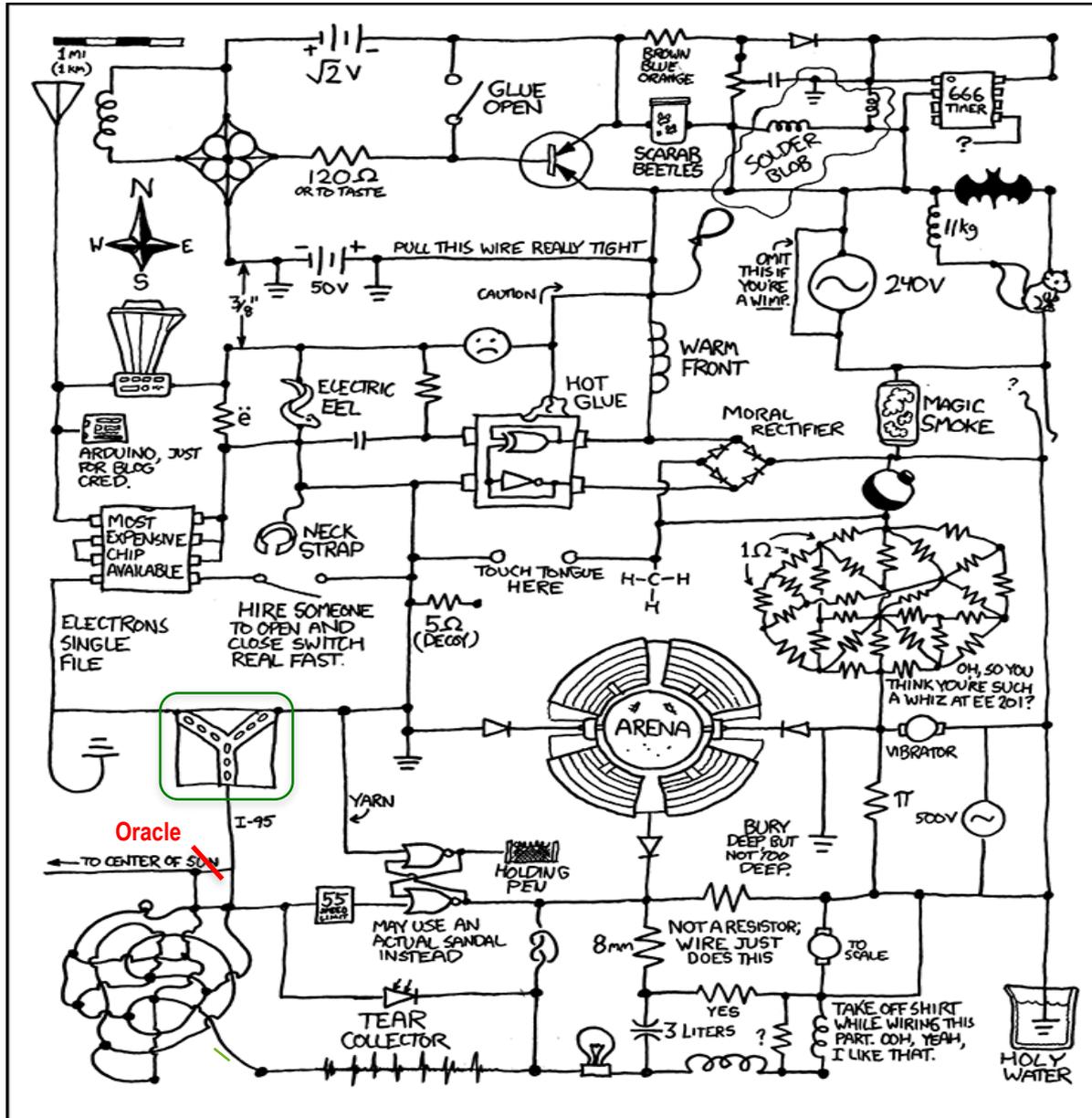
Kay Kasemir,

SNS/ORNL

June 2014



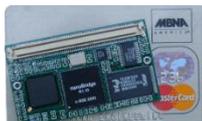
What EPICS looks like



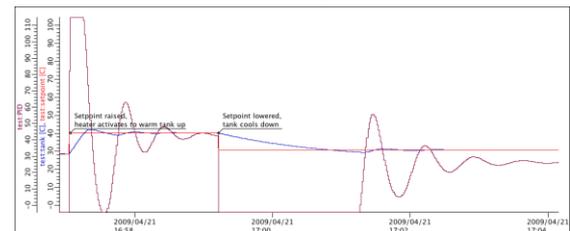
<http://xkcd.com/730/>

EPICS: Distributed System

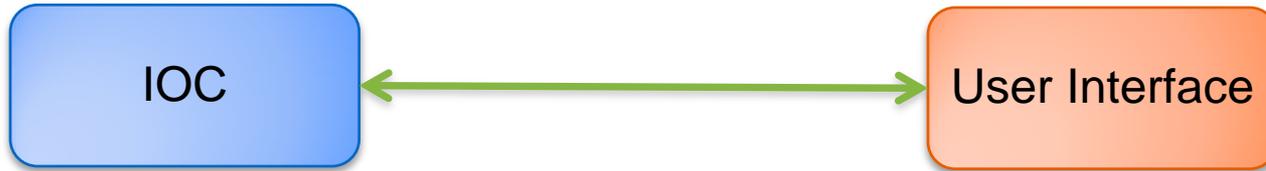
Servers



Clients



Over the years



Since ~1990:

```
record(ai, "my_record")
{
    field(DTYP, "MyDevice")
    field(INP , "@channel2")
    field(SCAN, "1 second")
    ...
}
```

More supported platforms:
vxWorks, RTEMS, Linux, OS X, Windows, ..
68000, Intel, PPC, Arm, ..

1. edd/dm 198x
2. medm 199x
3. edm 200x
4. CS-Studio 201x

Also:
tcl/tk/ca, python/qt/ca, ..

Limited upward-compatibility.

Control System (CS) Studio

User Interface tools

- Display editor & runtime
- Strip Chart
- Channel Access utilities

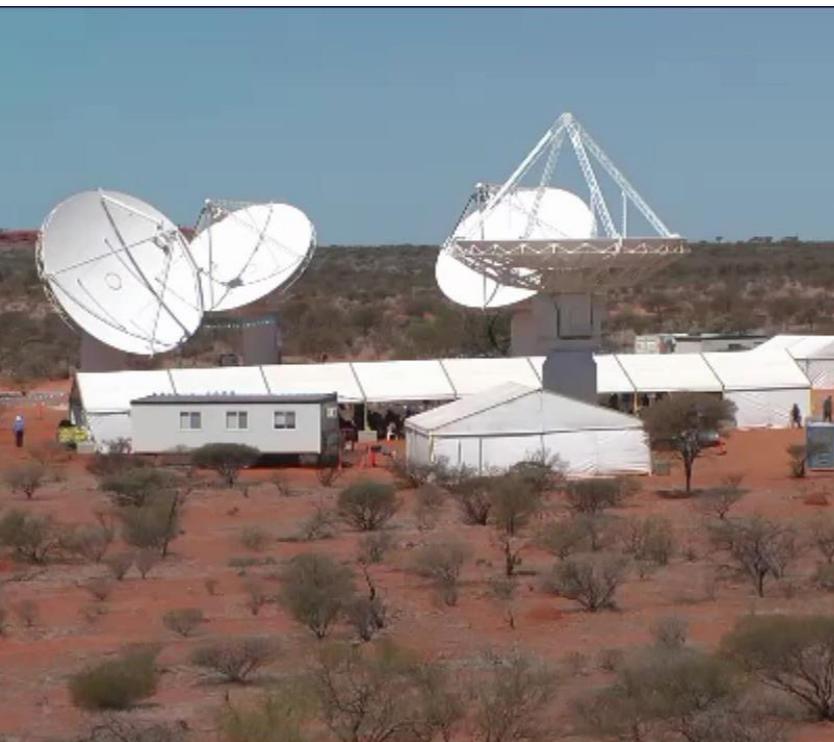
Also

- Archive system
- Alarm Handler
- Site-Specific support for logbook, IOC and channel information, ..

.. combined into an integrated, site-specific user-interface tool for Windows, Linux, OS X

What does CS-Studio look like?

Australian Square-Kilometer Array Pathfinder (ASKAP)



Oct. 2012, Juan Guzman, <http://www.aps.anl.gov/epics/tech-talk/2012/msg02113.php>

Hardware Monitor and Control Module

Date and Time: 2011/11/03 15:19:13 Set Fans Level (0=value<110)

Username: Unknown system PV'user'

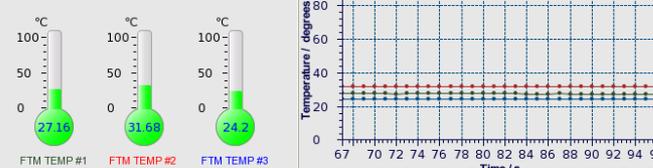
Hostname: fpcpsh.local

Used Memory:

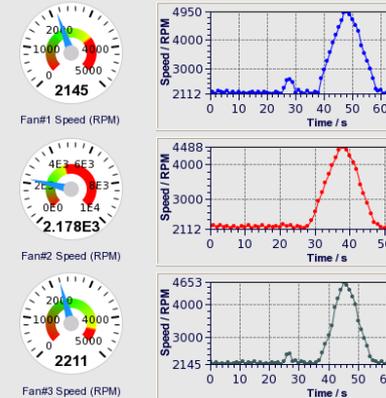
Free Memory:

Available Memory:

CENTELLIS TEMPERATURE MEASUREMENTS



Alarm Indicator LED CENTELLIS FANTRAY SPEEDS



CODAC SysSTATUS

- Not ready
- Ready
- Start of pulse sequence
- Wait for systems initialised
- Pre-pulse checks
- Final preparation
- Pulse
- After pulse checks

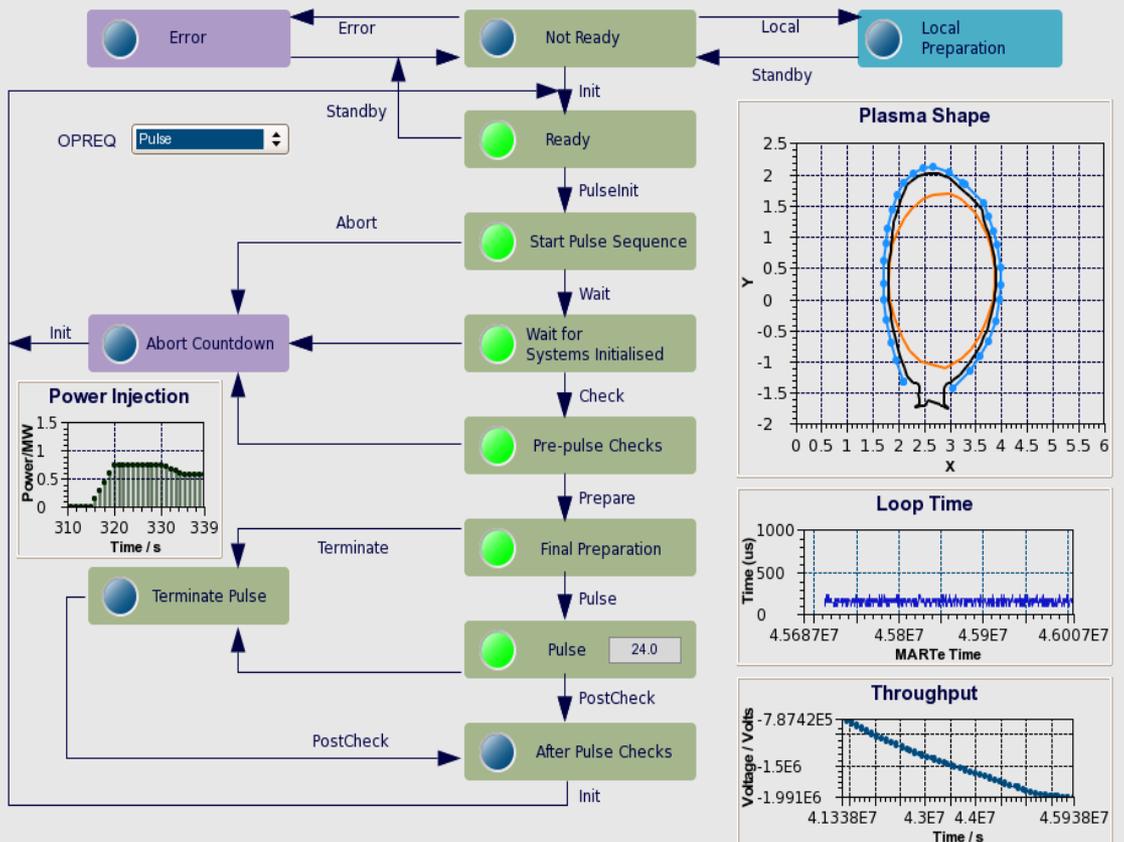
MARTE SysSTATUS

- Off
- Not ready
- Ready
- Initialising
- Initialised
- Executing
- Post pulse

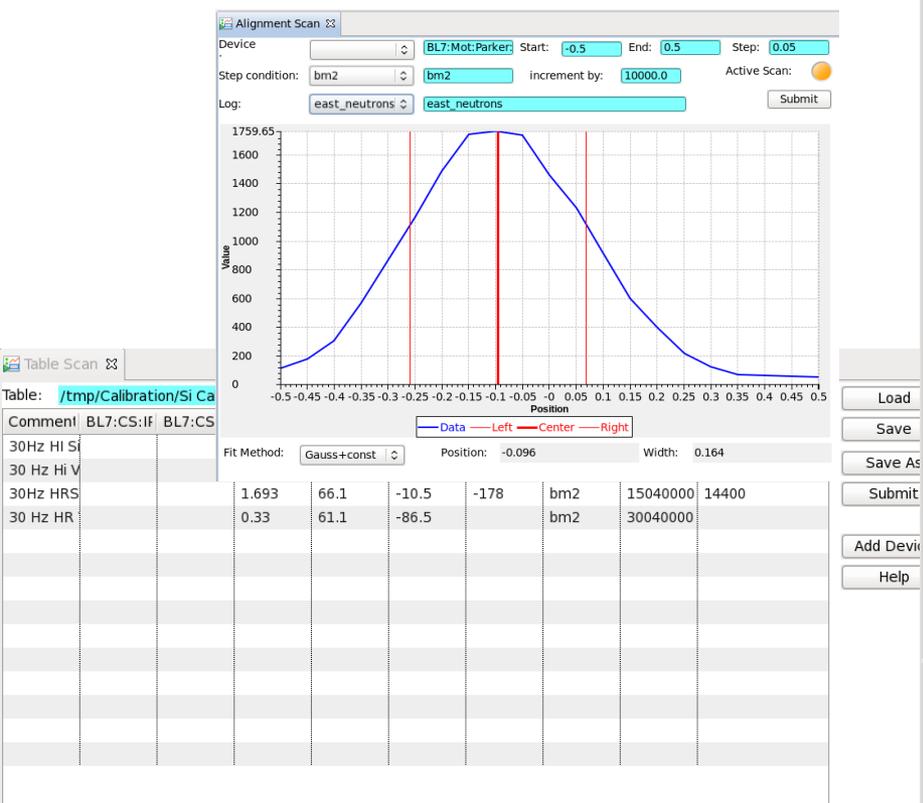
Pulse N.: Authorisation:

Countdown: PulseTime:

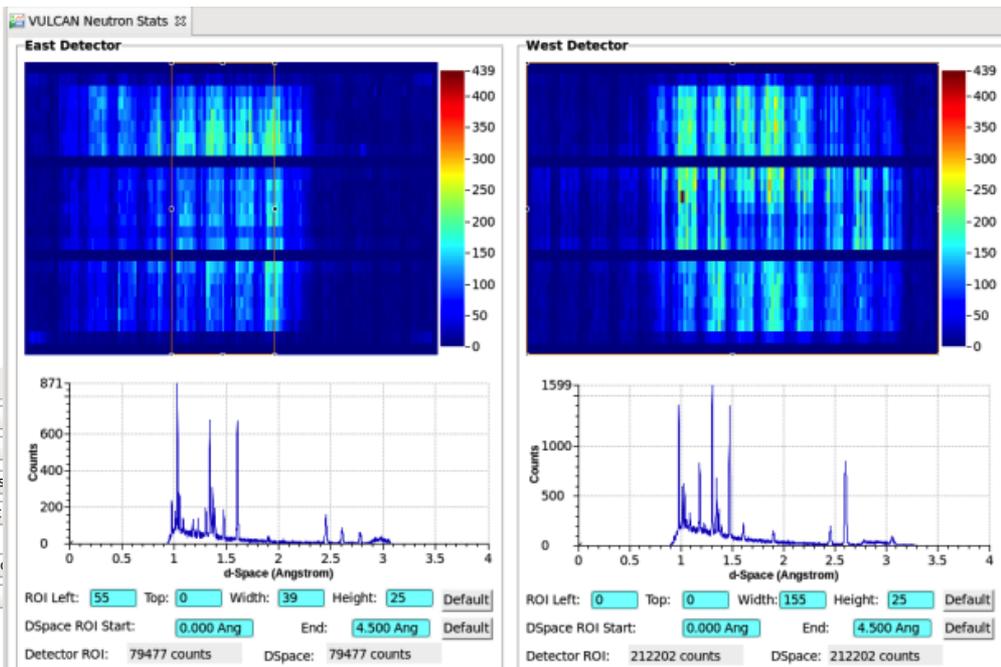
Plasma Operational SysStateMachine STATUS



ORNL SNS 'VULCAN' Beam Line



ID	Created	Name	State	%	Runtime	Fin
989	2014-03-31 15:45:56	/tmp/Calibration/Si Calibration 30 HZ.csv	Running		17:25:43	11
988	2014-03-31 13:45:53	/tmp/Calibration/Si Calibration for Al cover.csv	Finished - OK		01:45:21	15
987	2014-03-30 15:29:55	/tmp/Calibration/Si Calibration for Doug.csv	Finished - OK		11:54:55	03:24:54 - end -
986	2014-03-30 15:15:44	Gauss+slope Scan west_neutrons	Finished - OK		00:04:43	15:20:27 - end -
985	2014-03-30 15:09:28	Gauss+slope Scan west_neutrons	Finished - OK		00:04:43	15:14:11 - end -



VULCAN User Start Page

Proposal
 IPTS: 10076 Run: 42594 Run Detail

Neutrons
 Detectors: 291679 counts 68.5 cts/sec Detail
 BM1, 2: 827141 counts 4430023 counts Shutter: ●
 Frame Rate: 30 Hz Wavelength: 2.80 Ang

Equipment
 All OK: ● Status... Detail

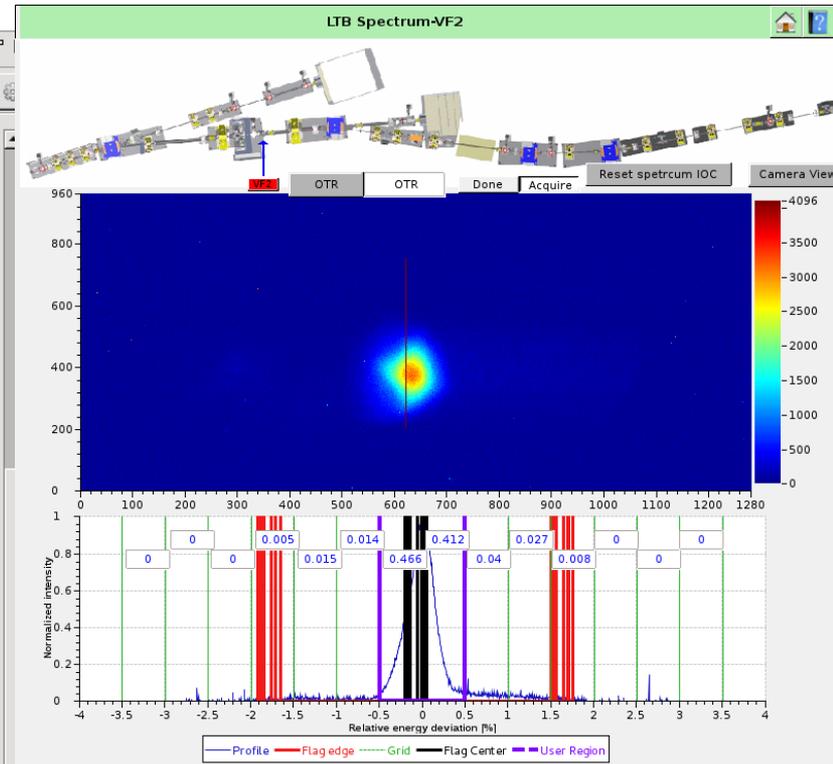
Experiment Control
 Scan: /tmp/10076-mapping_Mg-4-1mm.csv
 Progress: ●
 Finish: 17:01:09
Table Scan Range Scan
Alignment Scan

Engineering Diffractometer, EPICS/CSS since March 2014

BNL NSLS2

Date	Description	Owner	Logbooks	Tags	A.
5/12/14 7:40 AM modified at: 5/13/14 11:32 AM	Systems are now shut down for SR, BTS, Booster, LBT, and Linac. Klystrons 1 and 3 were left on and in standby.	zeitler modified by: zitvogel	Operations		0
5/12/14 7:32 AM modified at: 5/13/14 11:32 AM	Pendant 3 would not open using normal access request, RCT had to hit emergency access button. At the time the SR RF was set to AUX state, the main dipole was off, BTS B2 was off, and BTS shutter was closed.	zeitler modified by: zitvogel	Operations		0
5/12/14 7:21 AM modified at: 5/13/14 11:32 AM	Linac is Off. Cathode is off. klystrons in standby.	rfiller modified by: zitvogel	Operations		1
5/12/14 7:19 AM modified at: 5/13/14 11:32 AM	Vertical Emittance Measurement epsy: 85.6 +/-3.8 nm betax=14.2 +/-0.63 m alphax=-1.67 +/-0.07	rfiller modified by: zitvogel	Operations		1
5/12/14 7:09 AM modified at: 5/13/14 11:32 AM	Horizontal Emittance Scan: epsx: 81+/-5nm betax: 14.3+/-0.6m alphax:-1.81 +/-0.08	rfiller modified by: zitvogel	Operations		1
5/12/14 7:00 AM modified at: 5/13/14 11:32 AM	Linac Status Page.	rfiller modified by: zitvogel	Operations		1
5/12/14 7:00 AM modified at: 5/13/14 11:32 AM	Starting to shut down the Storage ring and booster while Ray finishes some measurements on the Linac.	zeitler modified by: zitvogel	Operations		0
5/12/14 7:00 AM modified at: 5/13/14 11:32 AM	There are the 72 bunches in all their glory. Saved the waveform to a text file.	rfiller modified by: zitvogel	Operations		1
5/12/14 6:55 AM modified at: 5/13/14 11:32 AM	72 bunches in the booster! That is what the linac is making. GREAT! We have established that the linac can inject its bunch train into the booster.	rfiller modified by: zitvogel	Operations		1
5/12/14 6:52 AM	successfully restore machine with the snapshot #1164 and Config LTB_BR_BTS_20140421	rfiller	Machine Physics Operations	MASAR	0
5/12/14 6:52 AM	Succeed to save a snapshot #1165 to MASAR database using Config LN-LTB-All-20131219 with description: 200 MeV, 9.0nC at ICT1, 150 ns 0.3% energy spread. Comment: Saving best Beam Loading Compensation with 9nC at ICT1, 150 ns	rfiller	Machine Physics Operations	MASAR	0
5/12/14 6:50 AM modified at: 5/13/14 11:32 AM	This is the best beam loading compensation to date with a 150 ns pulse. 9nC at ICT1. 7.4 nC at FCT1.	rfiller modified by: zitvogel	Operations		1
5/12/14 6:23 AM modified at: 5/13/14 11:32 AM	Booster extraction kicker 1 pulse is still erratic.	zeitler modified by: zitvogel	Operations		1

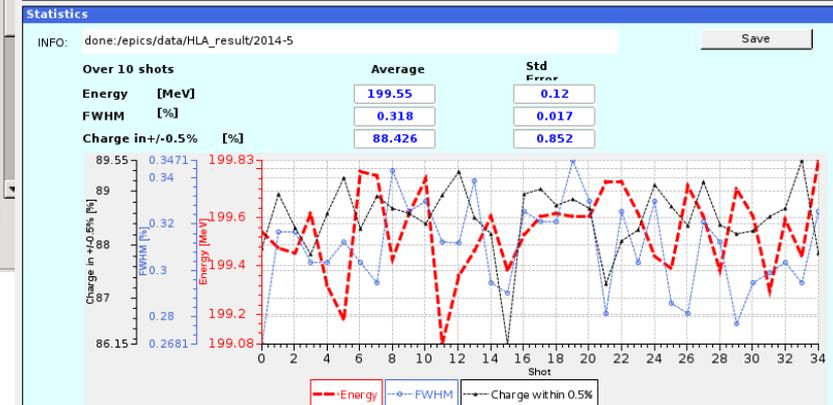
Previous page 1 Next page



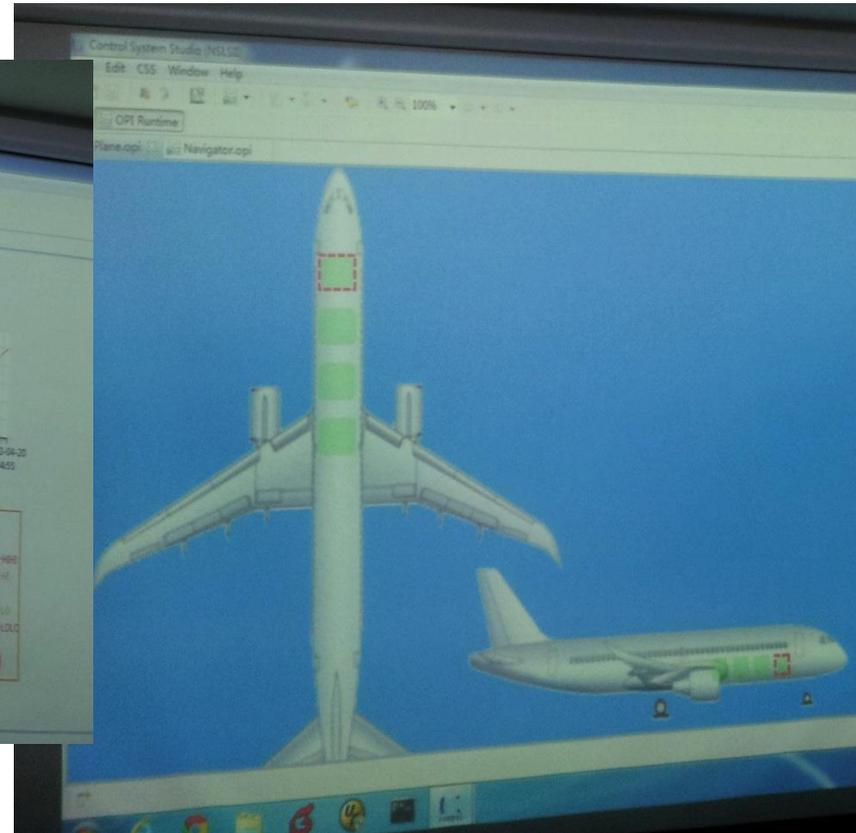
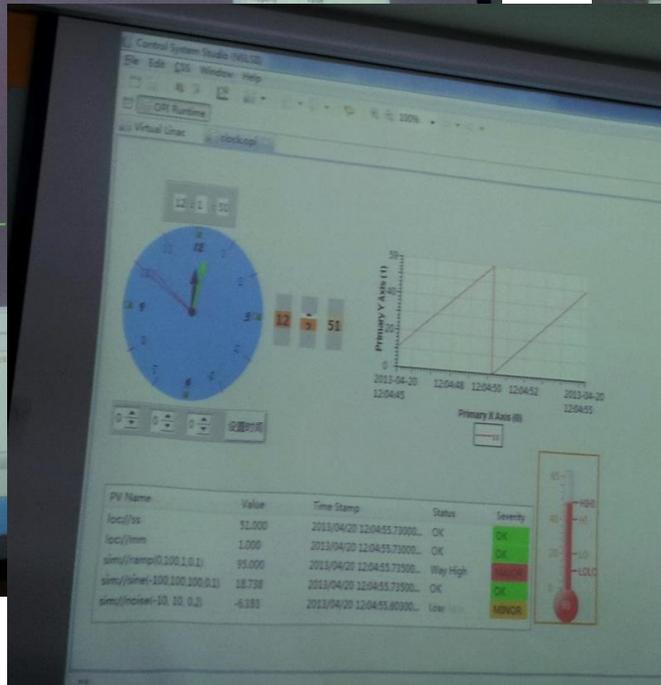
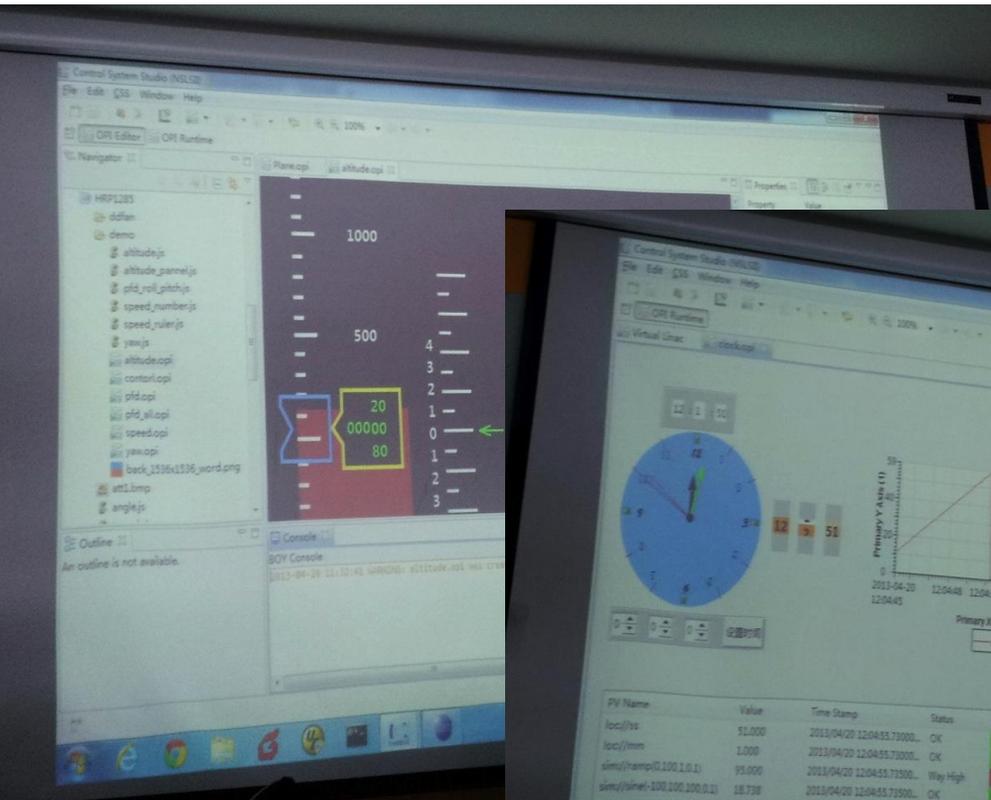
Statistics

INFO: done/epics/data/HLA_result/2014-5 Save

Over 10 shots	Average	Std Error
Energy [MeV]	199.55	0.12
FWHM [%]	0.318	0.017
Charge in +/-0.5% [%]	88.426	0.852



Airplane Simulator/Test



Somewhere in China ...

What is CS-Studio?

CS-Studio Components

Common Use

- BOY Display Builder
- Data Browser
- Probe
- PV Table
- EPICS PV Tree
- Channel Access
- PV Autocomplete from History

Selected Use

- Alarm System
- Channel Archiver, RDB Archiver, Archive Appliance
- ChannelFinder
- Olog, SNS ELog
- DDS, EPICS V4 PVA
- Autocomplete from Channel Finder, SNS PV database, Archive
- Scan Server
- SNS MPS Bypass Table
- Therapist, Clock, ...

Not all components are “visible”!

Technically...

- CS-Studio is an “Eclipse RCP” application
 - Rich Client Platform
- Eclipse RCP is based on Java
 - Windows, Linux, OS-X
- CS-Studio components are “Eclipse Plugins”
 - Fundamentally, supports install/uninstall

Integration: Alarm...

Context-Menu

The interface consists of several panels:

- Alarm Area Panel:** A grid of colored boxes representing different alarm areas. One box, 'BL-1B NOMAD', is highlighted in red. A context menu is open over it, listing options: 'Show in Alarm Tree', 'NOMAD Overview', 'Trigger automated email', and 'Alarm Perspective' (which is highlighted).
- Alarm Tree:** A hierarchical tree view showing the structure of alarm areas. The 'Area: BL-1B NOMAD (major-ack'ed)' is expanded, showing its sub-components.
- Alarm Table:** A table displaying current and acknowledged alarms. The 'Acknowledged Alarms' section contains one entry.

Complete Alarm Perspective:
Tree view, Table of current alarms

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Sev	Alarm Statu	Alarm Value
BL1B:Vac:VacOK	major-ack'ed alarm: Beam Line 1 B Vacuum	2014/03/06 07:40:376	MAJOR	LOLO_ALAR	major-ack'ed	LOLO_ALAR	0.0

Integration: Alarm...

Alarm Area Panel

IH

BL-1B NOMAD

BL-3 SNAP

BL-7 VULCAN

BL-11A POWGEN

BL-14B HYSPEC

BL16B VISION

IPPS

Alarm Tree

- IHC
- Area: IH
- Area: BL-1B NOMAD (major-ack)
- Area: BL-3 SNAP
- Area: BL-7 VULCAN
- PV: BL7:Det:All:Stat
- PV: BL7:CS:Stat:SkfChoppers
- Area: BL-11A POWGEN
- Area: BL-14B HYSPEC
- Area: BL16B VISION
- Area: IPPS

BL1B_Nomad Vacuum

Alarm Table

Current Alarms (0)

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Sev	Alarm Statu	Alarm Value
----	-------------	------------	-------------	-------------	-----------	-------------	-------------

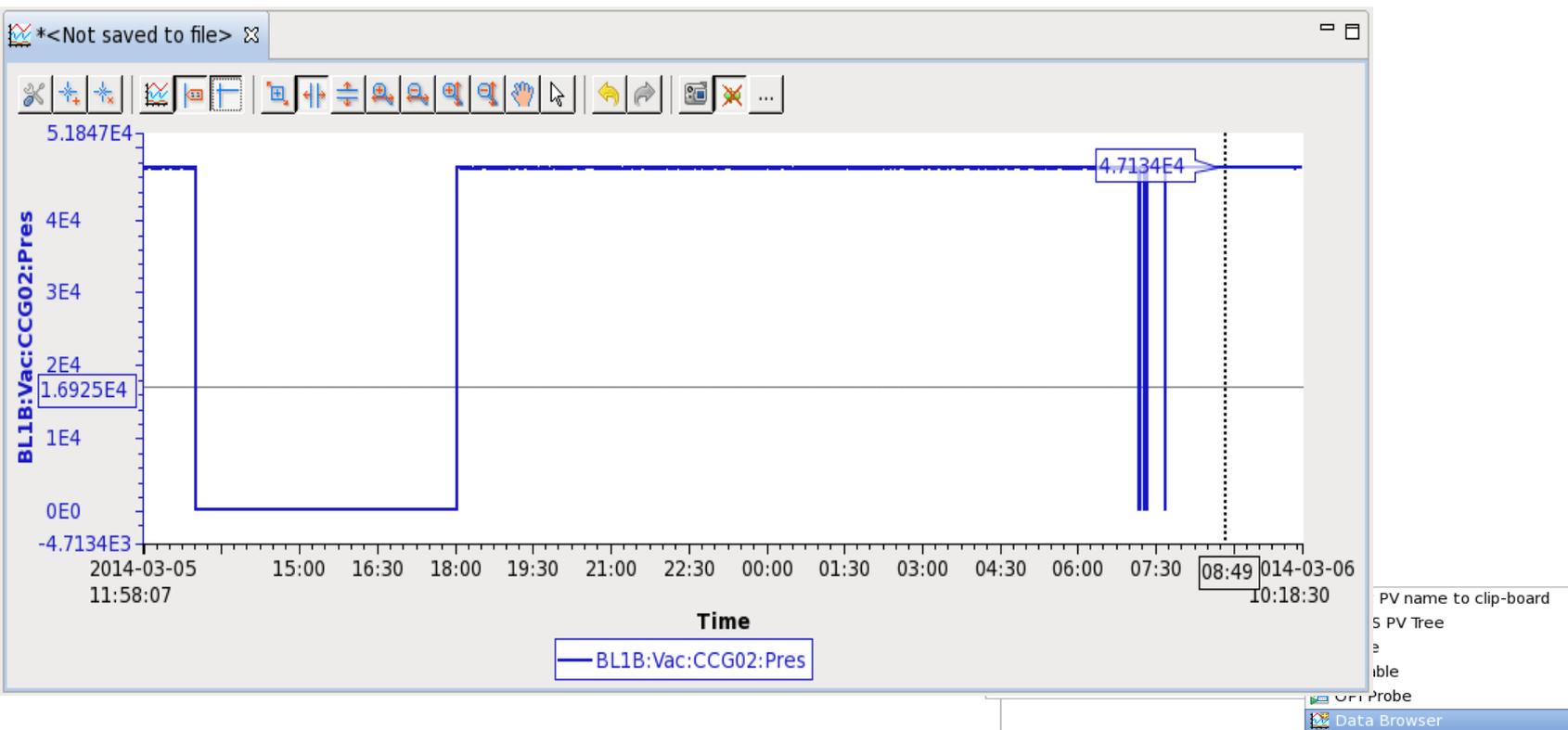
Acknowledged Alarms (1)

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Sev	Alarm Statu	Alarm Value
BL1B:Vac:VacOK	major-ack'd alarm: Beam Line 1 B Vacuum				major-ack'd	LOLO_ALAR	0.0

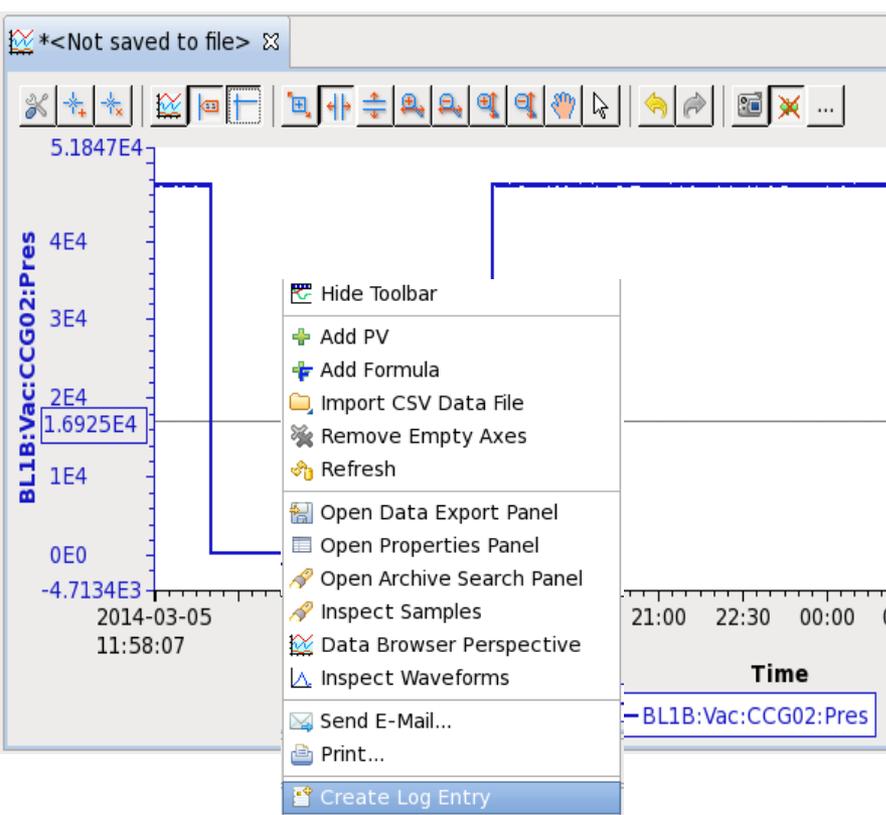
What to do

- NOMAD Overview
- Vacuum Display

Integration: Alarm...



Integration: Alarm...



Create Log Entry

User Name: Password:

Date: Level:

Received vacuum alarm on beam line.
Looks like the reading dropped to zero.
The same happened a few times before.
We assumed that just as before the sensor was disconnected, so we checked the XY123 controller box.
Upon inspection, we noticed that ...

Logbooks:

Tags:

Hide details

Images | Files | Properties

Images:

Integration: Channel Finder

Control System Studio (NLSII)

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}Fld:SP	C01	G2	QUAD	ql2g2c01a	31.6966	k1	134	V:1-SR	0.448
V:1-SR:C01-MG:G2{QL3:145}Fld:I	C01	G2	QUAD	ql3g2c01a	32.8997	k1	145	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL2:134}Fld:I	C01	G2	QUAD	ql2g2c01a	31.6966	k1	134	V:1-SR	0.448
V:1-SR:C01-MG:G2{QL3:145}Fld:SP	C01	G2	QUAD	ql3g2c01a	32.8997	k1	145	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL1:125}Fld:SP	C01	G2	QUAD	ql1g2c01a	30.5301	k1	125	V:1-SR	0.275
V:1-SR:C01-MG:G2{QL1:125}Fld:I	C01	G2	QUAD	ql1g2c01a	30.5301	k1	125	V:1-SR	0.275
V:1-SR:C01-MG:G2{SL3:141}Fld:SP	C01	G2	SEXT	sl3g2c01a	32.4622	k2	141	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL1:121}Fld:SP	C01	G2	SEXT	sl1g2c01a	29.8986	k2	121	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL3:141}Fld:I	C01	G2	SEXT	sl3g2c01a	32.4622	k2	141	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL2:132}Fld:I	C01	G2	SEXT	sl2g2c01a	30.9986	k2	132	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL2:132}Fld:SP	C01	G2	SEXT	sl2g2c01a	30.9986	k2	132	V:1-SR	0.2
V:1-SR:C01-MG:G2{SL1:121}Fld:I	C01	G2	SEXT	sl1g2c01a	29.8986	k2	121	V:1-SR	0.2

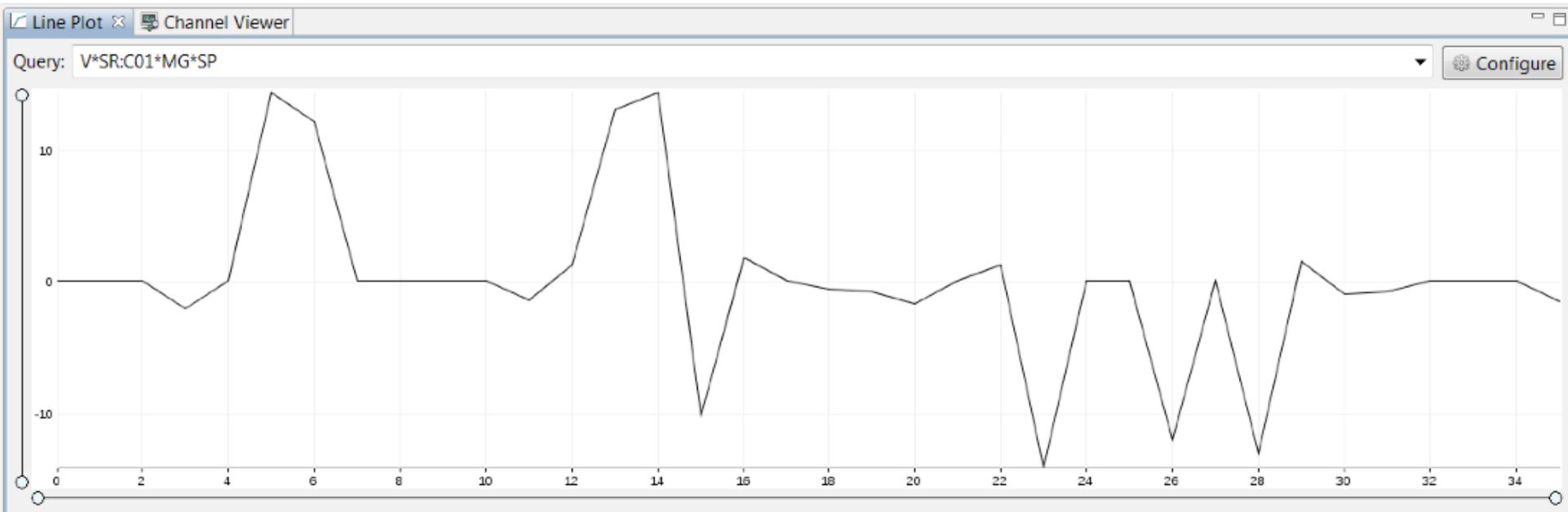
Channel

- Process Variable
- Configure...

- Copy PV name to clip-board
- EPICS PV Tree
- Probe
- PV Table
- OPI Probe
- Data Browser

“All 6- and 4- pole magnets in cell 1..”

Integration: Plot for Channel Finder Query



“All PVs that match ‘V*..’”

CS-Studio

is a collection of components.

Many of them. Confusing to get started as a developer/integrator.

To end user:

One tool, integrated Workflow

- Alarm display
- BOY Displays (Channel Access)
- Data Browser (with RDB Archive)
- Logbook (SNS Elog)

Result:

Operations 2014-04-03 10:40	<p>The instrument returned to normal automatic operation as of 09:00.</p> <p>RFQ Recovery from SCL 19a Trip</p> <p>During the 30-second beam recovery from SCL 19a, the RFQ resonance error decreased quickly. In order to save the RFQ from opening loop, I dropped the field down by one click. After the resonance error became stable, I restored the field back to .340.</p> <p>Note: The BEAST alarm for RFQ resonance error came in and this is what alerted us that there was a problem. The alarm annunciated in time for us to do something instead of it being too late.</p> <p>- 2014_04_03_103941.jpg -</p>
Operations	<p>LEPT changes channel C dropping out Charles Peters</p>