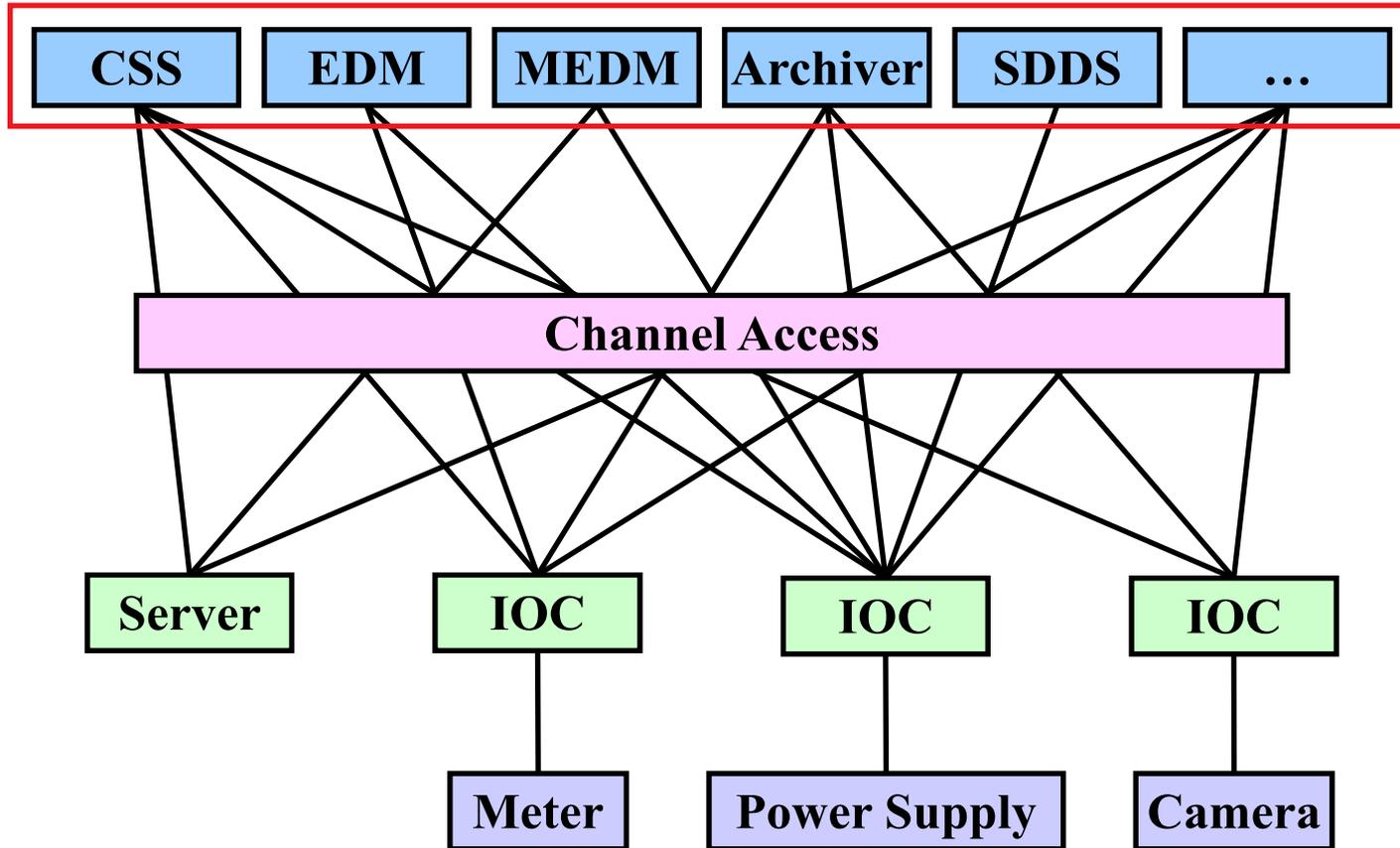


Channel Access and Client Tools

Author: Kenneth Evans, Jr. August 2004
Modified: Kay Kasemir October 2006
Andrew Johnson 2007 – 2014

EPICS Overview

Client Tools



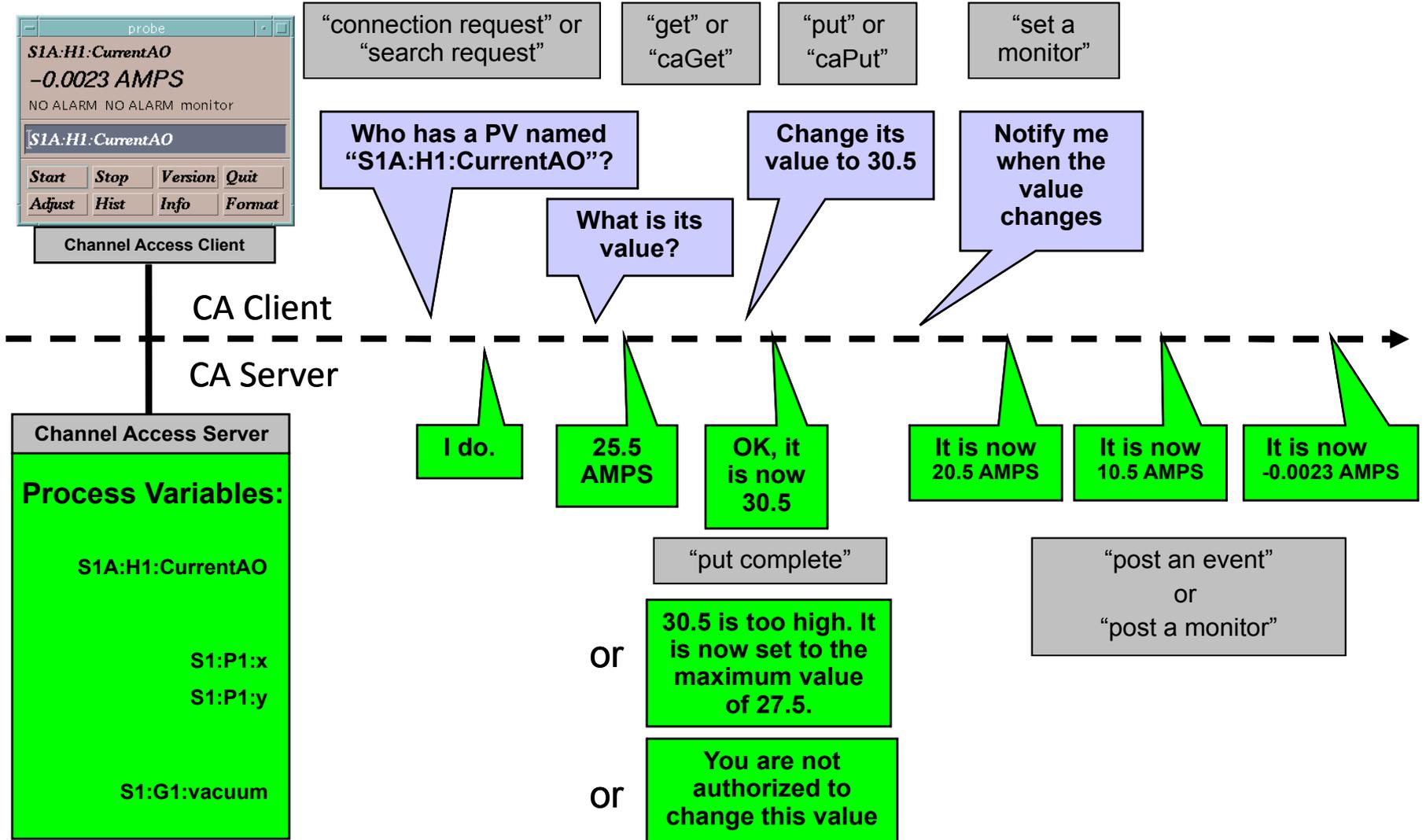
Channel Access

- The EPICS “software bus”
- Used to read and write values to/from Process Variables
- To many people, Channel Access *is* EPICS
 - Especially those that have no IOC experience
 - “Integrate X into EPICS” often means “Be able to control X via CA”
- CA is not defined by a protocol specification
 - EPICS Core Developers maintain CA client and server libraries in EPICS Base
 - Any client version can connect to and communicate with any server version
 - Other client and server implementations exist
 - These may not interoperate as well with other versions

What is a Process Variable (PV)

- “A named item of data, with associated optional attributes”
 - Data is an Integer, Floating point number, enumeration value or string, or an array of any of those types
 - Possible attributes include timestamp, alarm status/severity, precision, engineering units string, list of enumeration strings, operator/control/ alarm limits
 - The specific attributes you can fetch along with the data are restricted to some predefined subsets of those available

Channel Access in One Slide



Tools Described in This Presentation

- Command-line tools provided with EPICS Base
 - caget
 - caput
 - camonitor
 - cainfo
- Various clients provided as EPICS Extensions
 - MEDM
 - EDM
 - CSS-BOY
 - StripTool
 - ALH
 - CSS-BEAST



More Information & Tools

- The EPICS website provides a wealth of information
<http://www.aps.anl.gov/epics/>
- All EPICS Extensions programs here have a link or a page there
- There are many other tools described/linked there too

- Base command line tools are usually found at
 - ...epics/base-*<version>*/bin/*<platform>*/*<executable>*
 - /opt/epics/base-3.14.12.4/bin/linux-x86_64/...

- Extensions programs are usually installed in
 - ...epics/extensions/bin/*<platform>*/*<executable>*
 - /opt/epics/extensions/bin/linux-x86_64/...
 - Platforms are linux-x86_64, darwin-x86, win32-x86, etc.

Command-Line Tools

- There used to be several versions of these tools
- We will discuss the ones that come with EPICS Base
- The tools we will cover are:
 - caget
 - *Gets the value of one or more process variables*
 - caput
 - *Sets the value of one process variable*
 - camonitor
 - *Monitors value changes of one or more process variables*
 - cainfo
 - *Gets information about one or more process variables*
- All accept –h to display usage and options
- NOTE: Some installations may have older versions of these programs in their default command search path.



Caget Example

- Get the values of two process variables

```
caget S35DCCT:currentCC S:SRlifeTimeHrsCC
```

- Returns

```
S35DCCT:currentCC      102.037
```

```
S:SRlifeTimeHrsCC     7.46514
```



Caput Example

- Set the value of a process variable

```
caput Xorbit:S1A:H1:CurrentAO 1.2
```

- Returns

```
Old : Xorbit:S1A:H1:CurrentAO      0
```

```
New : Xorbit:S1A:H1:CurrentAO     1.2
```

Camonitor Example

- Monitor two process variables

```
camonitor evans:calc evans:bo01
```

- Returns

```
evans:calc      2004-08-05 17:23:04.623245 1
evans:bo01     2004-08-05 17:23:04.623245 On
evans:calc      2004-08-05 17:23:05.123245 2
evans:bo01     2004-08-05 17:23:05.123245 Off
evans:calc      2004-08-05 17:23:05.623245 3
evans:calc      2004-08-05 17:23:06.123245 4
evans:calc      2004-08-05 17:23:06.623233 5
evans:calc      2004-08-05 17:23:07.123183 6
```

- Use Ctrl-C to stop monitoring

Cainfo Example

- Get information about a process variable

```
cainfo S35DCCT:currentCC
```

- Displays

```
State:                connected
```

```
Host:                 pvgatemain1.aps4.anl.gov:5064
```

```
Access:              read, no write
```

```
Native data type:   DBF_DOUBLE
```

```
Request type:       DBR_DOUBLE
```

```
Element count:     1
```

EPICS Extensions Web Page

EPICS Experimental Physics and Industrial Control System Argonne NATIONAL LABORATORY

Extensions

The following list gives access to individual pages for most of the standard EPICS host tools and CA clients. Note that some of the minor pages linked below do not appear in the sidebar on the left.

Some of this software can be downloaded from the individual web-pages linked below, and the collection of tools from APS are also available bundled together. See the [Extensions Download](#) page for details.

If your extension does not appear in this list, or there's something wrong with an entry on this page, please [send me an email](#), giving a URL for your web-site if applicable.

Config Files

- [Extensions build config files \(R3.13\)](#)
- [Extensions build configure files \(R3.14\)](#)

Standalone CA Clients

- [ALH: Alarm Handler](#)
- [BURT: Backup and Restore Tool](#)
- [CAEX: Channel Access Examples](#)
- [CAPod: Channel Access projects for Apple iOS devices](#) (SF)
- [caQtDM: An MEDM replacement based on Qt](#) (PSI)
- [CASR: Host-based Save/Restore](#)
- [CA Watcher: Channel Access monitor and alarm handler](#) (BESSY)
- [Channel Archiver](#) (SF)
- [Channel Watcher](#) (SLAC)
- [CSS: Control System Studio](#) (SF)
- [EDM: Extensible Display Manager](#) (ORNL)
- [MEDM: Motif Editor and Display Manager](#)
- [NAL: Nagios Alarm Handler](#) (INFN)
- [Probe: Motif Channel Monitoring program](#)
- [StripTool: Strip-chart plotting tool](#)

CA Server Interfaces and Applications

- [EpicsSharp: CA libraries and Gateway in native C#](#) (SF)
- [CAS: Channel Access Server Library](#)
- [CaSnooper: Channel Access Broadcast Monitoring Tool](#)
- [caxy: CA tunneling over ssh](#) (SLAC)
- [JCAS: Pure Java Channel Access Server Library](#) (SF)
- [Gateway: Process Variable Gateway](#)
- [Nameserver: Channel Access Nameserver](#)
- [PCASD: Python Bindings for the Channel Access Server](#) (Google)

MEDM

- Stands for Motif Editor and Display Manager
- Created in 1990, still used at many facilities worldwide
- Written in C, very hard to extend and modify
- The principal human interface to the APS control system



MEDM Screens

The image displays a collection of MEDM (Machine Execution and Data Monitoring) control screens for a particle accelerator. The screens are arranged in a collage:

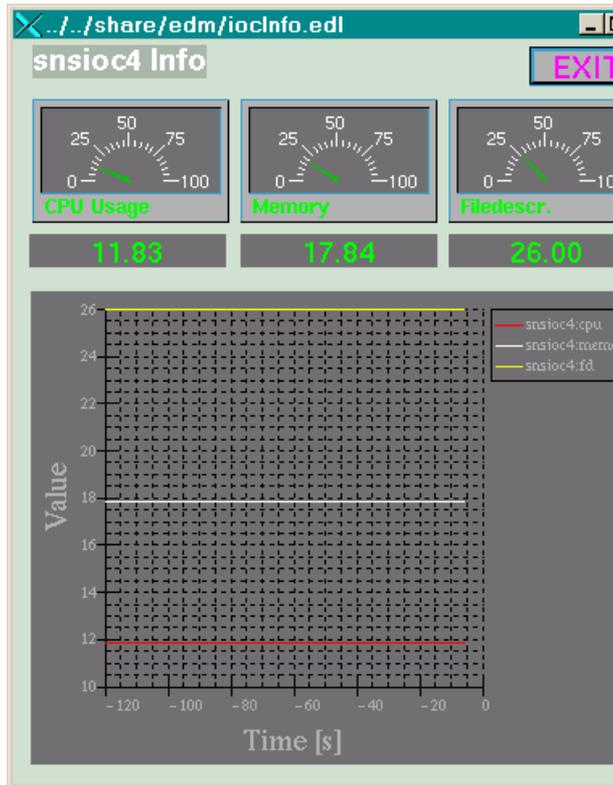
- Top Left:** A summary screen showing "Beam Current: 102.1 mA" and "Lifetime: 0.0 Hours". It includes a "Beam Current History" graph and a "Storage Ring" schematic diagram.
- Top Center:** A "WAVEGUIDE SWITCH MONITOR" screen showing a schematic of waveguide switches (S36, S37, S38, S40) and their relay switching status.
- Top Right:** "Booster RF Ramp Controls" screen with three graphs: "RF Ramp Signal", "Klystron Amp Output Signal", and "Cavity Gun Signal". It also includes an "Arbitrary Function Generator" and "Sun DAC" controls.
- Middle Right:** An "MPS Overview" screen displaying a grid of "SECTOR VALVES FLAGS" and "UNUSED CONTROLLERS" with status indicators.
- Bottom Left:** "LEUTL Beamline" control screen showing various parameters like "LEUTL Tuning" and "LEUTL Beam Power".
- Bottom Center:** "Booster Extraction Timing PreTrigger" screen with a timing diagram and control buttons.
- Bottom Right:** "Storage Ring Ramps" screen showing "Global Machine Controls" and "BPM Data Pool" controls.

- And thousands of others

EDM

- Extensible Display Manager (C++, still based on Motif)
- Created at SNS (Oak Ridge) in 2001, used at many EPICS sites
- All widgets are loaded from shared libraries and versioned
- Administrator can make additional widgets available without rebuilding EDM

EDM Screens



(SNS Linac test)

/export/home/epics/tmp/steiner/edm/CouplingLine.edl

Barney running...

Coupling Line Beamline Controls

Beam: 40 Ar^{7+}

New BRho: 2.5368 Tm **2.5368 Tm**

New vs. Now 0.0 %

Store	Rcl	2.5622
Store	Rcl	2.5368
Recall Line	Last	2.5368

Energy: 9.4600 MeV/nuc
Rigidity: 2.5368 Tm

Optics: K5t1.data
Magnetic Rigidity: 3.3000 Tm

1 172 1710 % Set: Apply BRho

MagDetails Detectors Attenuators

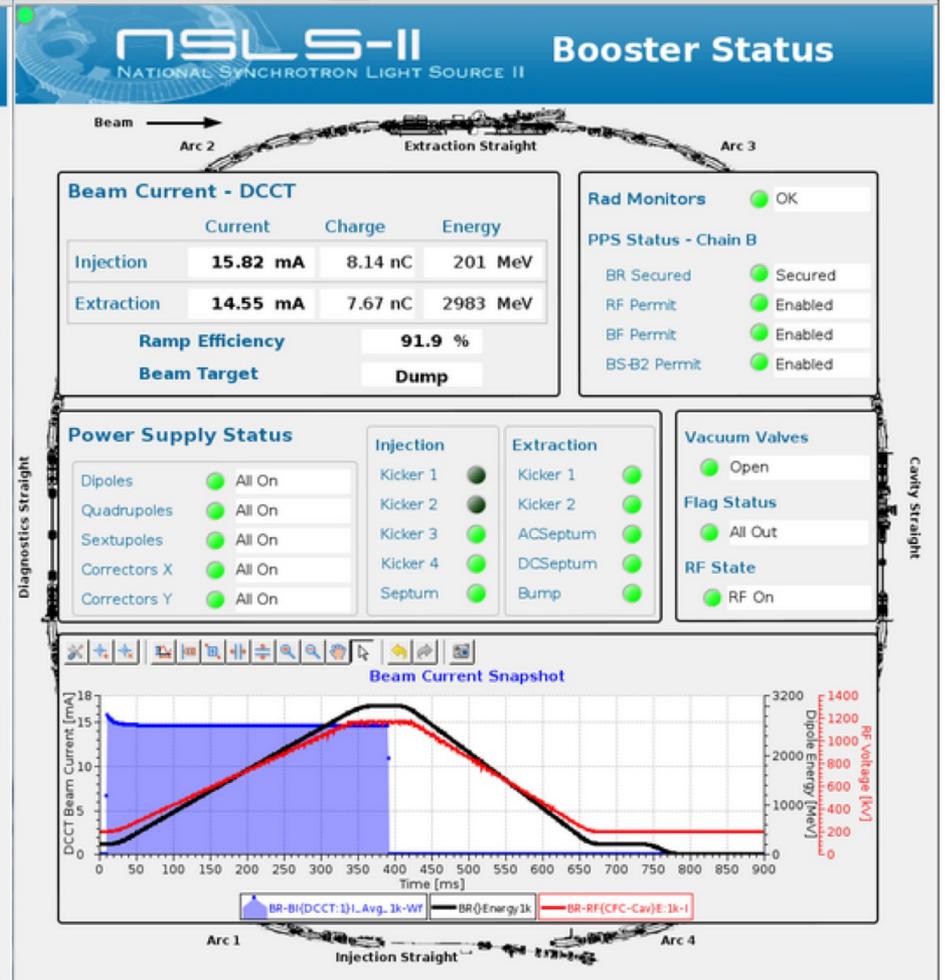
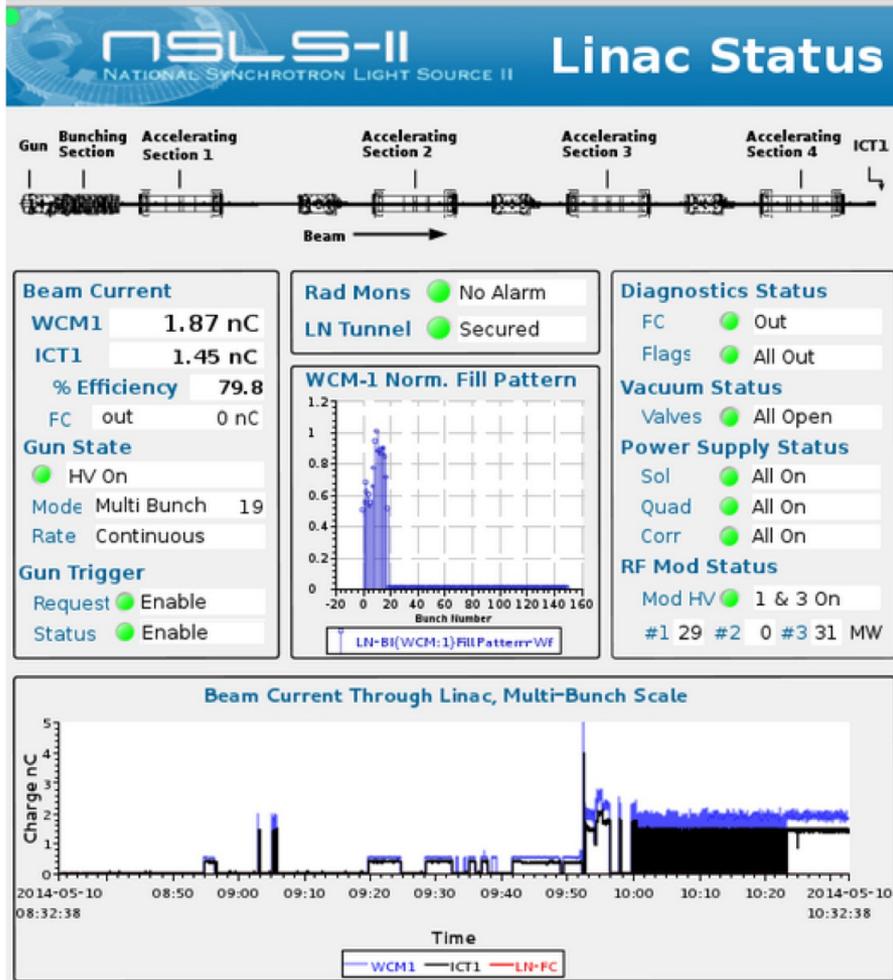
Do Stuff

Monitor Choice: 1 2, 3 4, 5 6, Camera 15

RFC2 SFC2

(Matthias Steiner, Nat'l Superconducting Cyclotron Lab., Michigan State University)

CSS-BOY



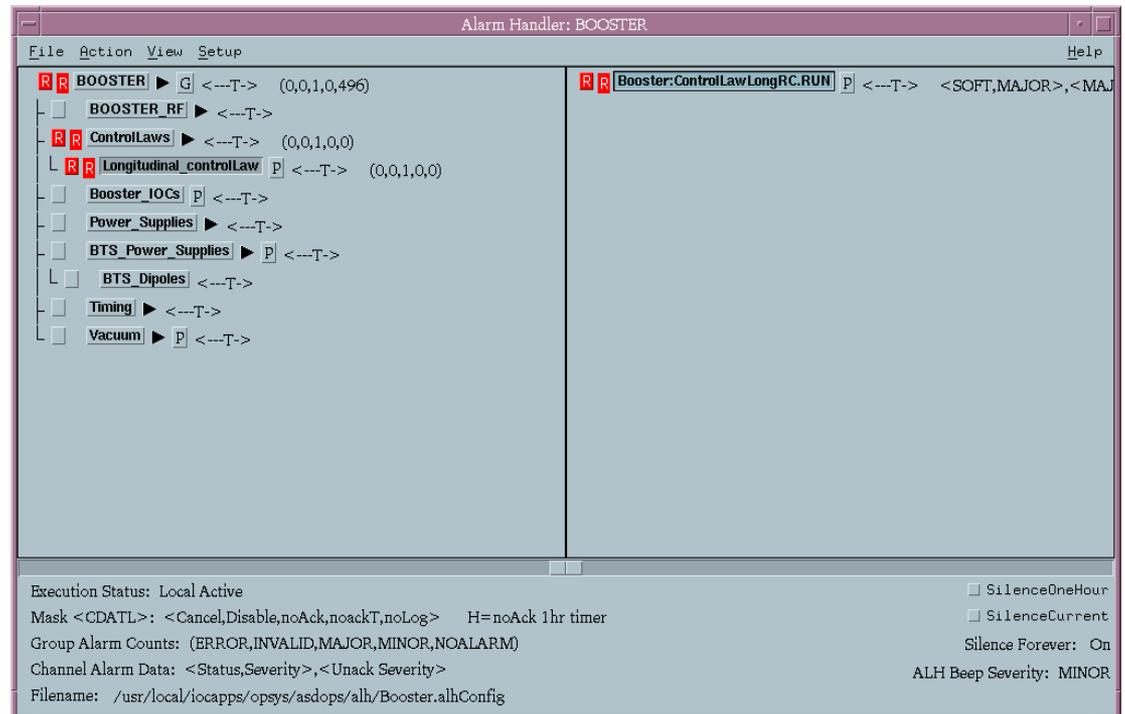
StripTool

- Plots process variables in real time on a strip chart
- Heavily used at APS and older sites



ALH (Alarm Handler)

- Monitors the operation of the machine
- Notifies control-room operators when abnormal conditions arise
- Provides guidance, logs operator acknowledgements and other actions



CSS-BEAST

The screenshot displays the CS-Studio interface for the 'RadMon Inj Plan'. The main window shows a plan view of radiation monitors (BRM-05 to BRM-11) with status indicators (Normal, Alarm, etc.). A legend on the right defines 'PPS Interlocking' and 'Not PPS Interlocking' location markers. The left sidebar shows the 'Alarm Area Panel' with categories like 'Common environment', 'Linac', and 'Booster', and an 'Alarm Tree' listing various process variables (PVs) and their associated systems (e.g., CCG, TCG, IP, RF, LNRFPWR, LNLRF, Magnet Systems, Diagnostics, Radiation Monitoring).

The 'Alarm Table' at the bottom shows the following data:

PV	Description	Alarm Time	Current Sevi	Current Stat	Alarm Severi	Alarm Status	Alarm Value
BTS-VA(P-11)Sts	MINOR alarm: BTS IP11 Relay Setpoint 1	2013/11/23 07:53:00	MINOR	STATE_ALAF	MINOR	STATE_ALAF	Relay Off
BTS-VA(IP-10)Sts	MINOR alarm: BTS IP10 Relay Setpoint 1	2013/11/23 07:53:00	MINOR	STATE_ALAF	MINOR	STATE_ALAF	Relay Off
BTS-VA(IP-09)Sts	MINOR alarm: BTS IP09 Relay Setpoint 1	2013/11/23 07:53:00	MINOR	STATE_ALAF	MINOR	STATE_ALAF	Relay Off
BTS-VA(GV-4)Sts	MAJOR alarm: BTS GV4 Upstream Interlock S	2013/11/23 07:53:00	MAJOR	STATE_ALAF	MAJOR	STATE_ALAF	Interlock On
BTS-VA(GV-3)Sts	MAJOR alarm: BTS GV3 downstream Interloc	2013/11/23 07:53:00	MAJOR	STATE_ALAF	MAJOR	STATE_ALAF	Interlock On
BTS-VA(CCG-6)Sts	MINOR alarm: BTS CCG6 Relay Setpoint 1 (R	2013/11/23 07:53:00	MINOR	STATE_ALAF	MINOR	STATE_ALAF	Relay Off
BTS-VA(CCG-5)Sts	MINOR alarm: BTS CCG5 Relay Setpoint 1 (R	2013/11/23 07:53:00	MINOR	STATE_ALAF	MINOR	STATE_ALAF	Relay Off
BR-RF(CFC)DI:BI3	MAJOR alarm: Booster: CFC cavity undervolta	2013/11/22 18:25:00	MAJOR	HIHI_ALARM	MAJOR	HIHI_ALARM	1

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Se	Alarm Statu	Alarm Value
BTS-VA(TCG-3)Sts	minor-ack'd alarm: BTS TCG3 Relay Setpoi	2013/11/23 07:53:00	MINOR	STATE_ALA	minor-ack'ed	STATE_ALA	Relay Off
LN-RF(MOD-2)HV-S	major-ack'd alarm: Mod #2 HV Status	2013/11/22 18:25:00	MAJOR	STATE_ALA	major-ack'ed	STATE_ALA	alarm
BR-RF(Xmtr-Crc)F:	invalid-ack'd alarm: Booster transmitter cir	2013/11/22 18:26:00	INVALID	No Connect	invalid-ack'e	No Connect	
BTS-VA(IP-09)P-I	invalid-ack'd alarm: BTS IP09 Pressure Res	2013/11/22 18:25:00	INVALID	TIMEOUT_A	invalid-ack'e	TIMEOUT_A	0.0
BTS-VA(P-10)P-I	invalid-ack'd alarm: BTS IP10 Pressure Res	2013/11/22 18:25:00	INVALID	TIMEOUT_A	invalid-ack'e	TIMEOUT_A	0.0
BTS-VA(IP-11)P-I	invalid-ack'd alarm: BTS IP11 Pressure Res	2013/11/22 18:25:00	INVALID	TIMEOUT_A	invalid-ack'e	TIMEOUT_A	0.0