Argonne NATIONAL LABORATORY

Channel Access and Client Tools

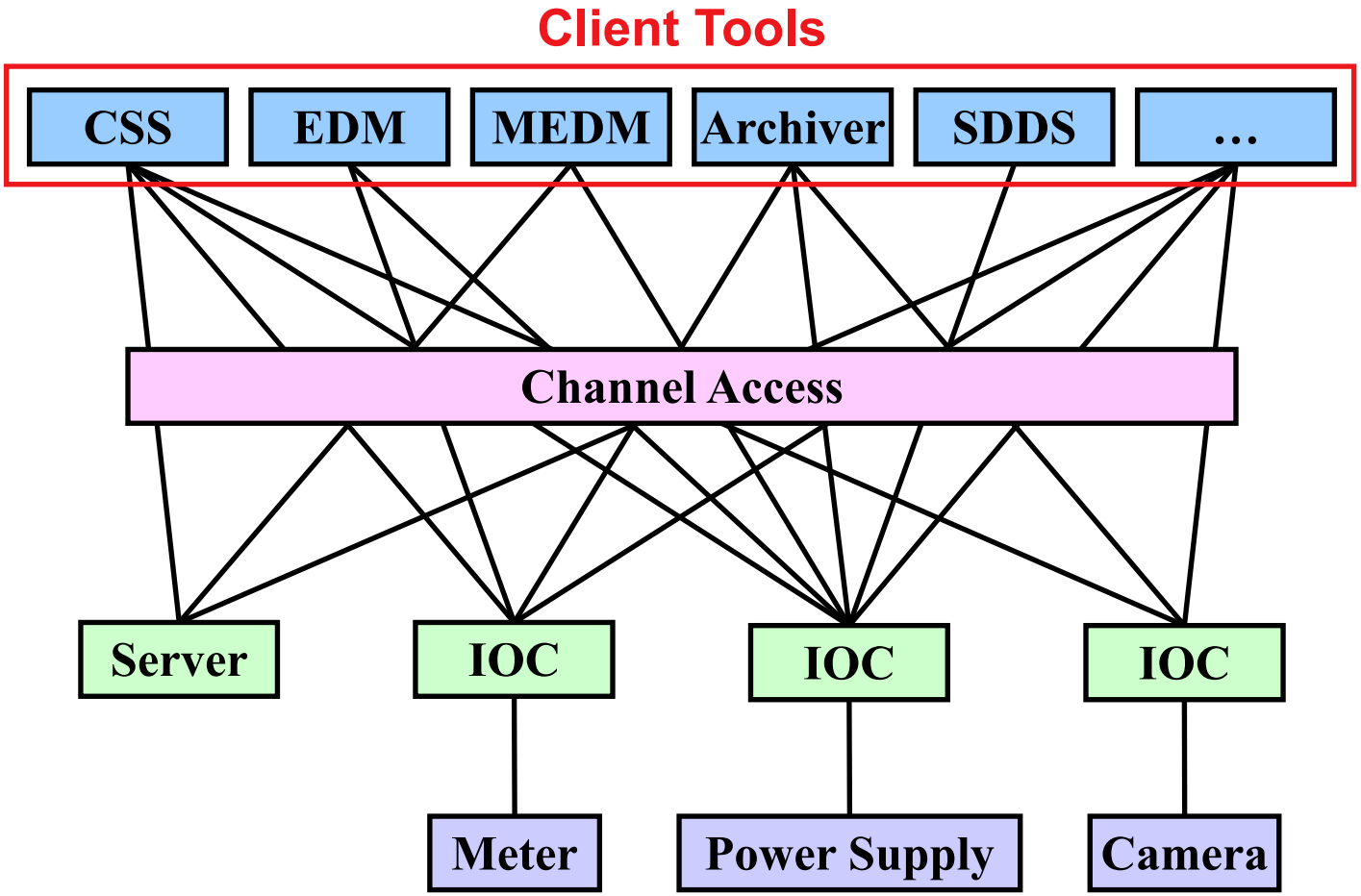
Author: Kenneth Evans, Jr. August 2004

Modified: Kay Kasemir October 2006

Andrew Johnson 2007 – 2014

U.S. DEPARTMENT OF ENERGY

EPICS Overview



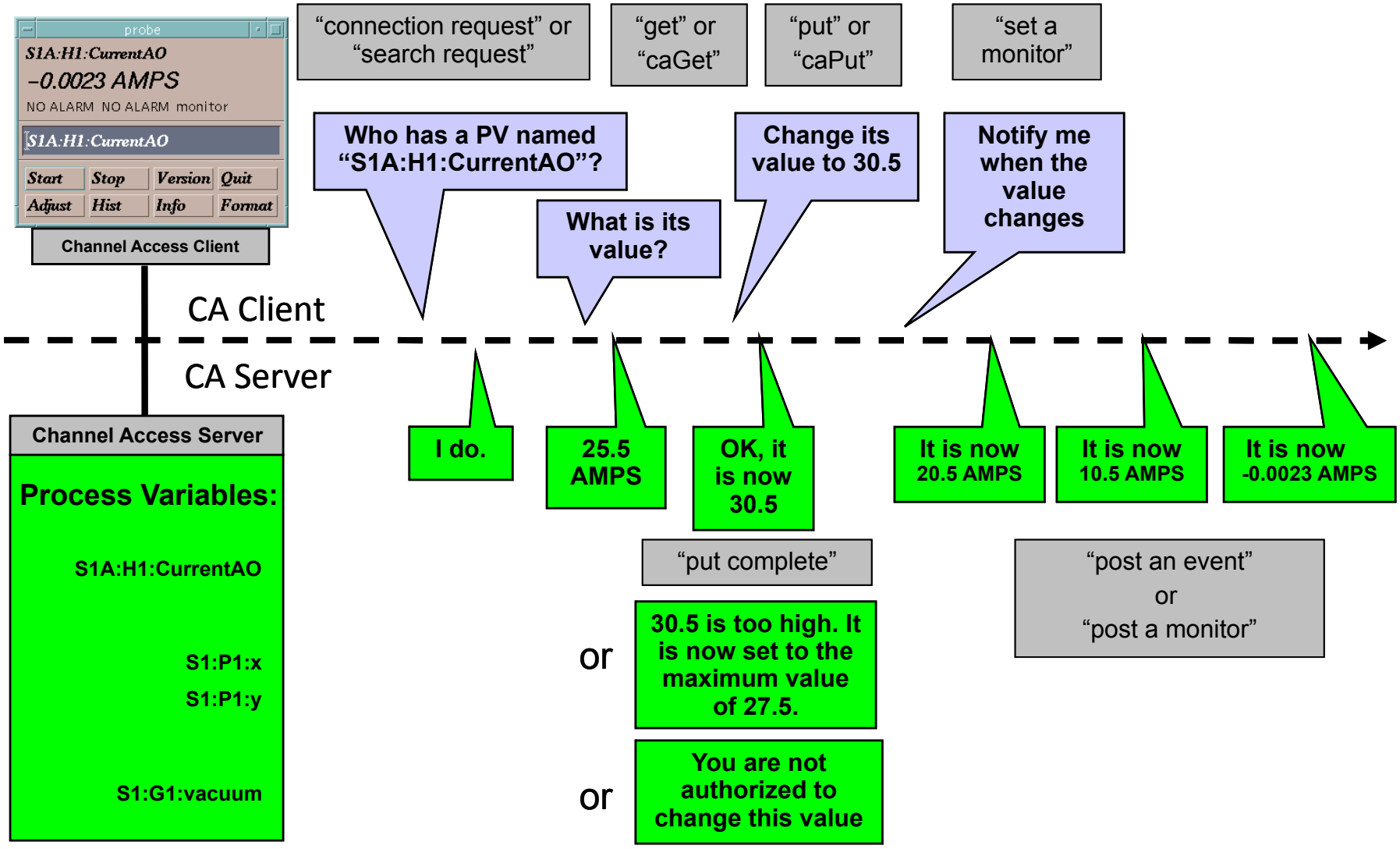
Channel Access

- 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

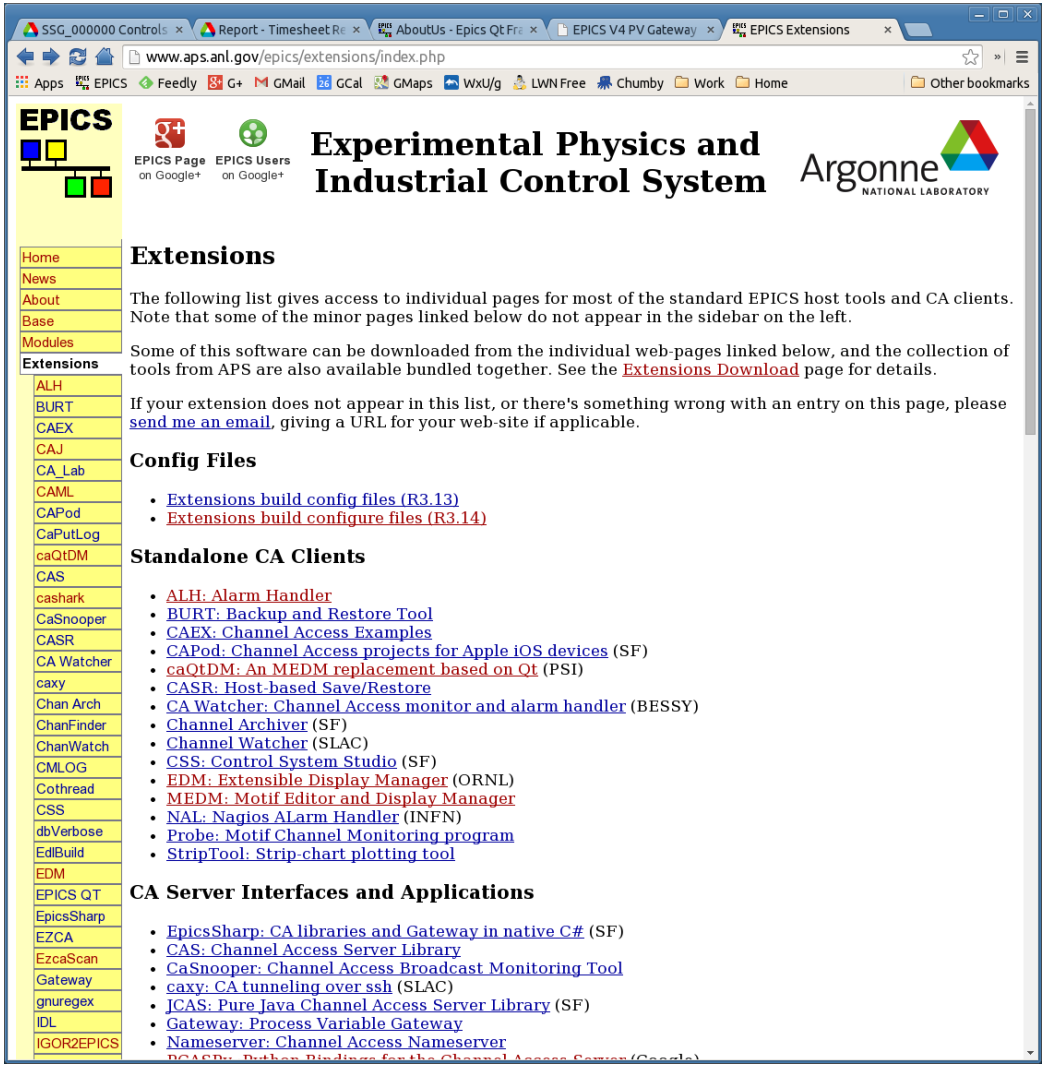
- Get information about a process variable

```
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
```

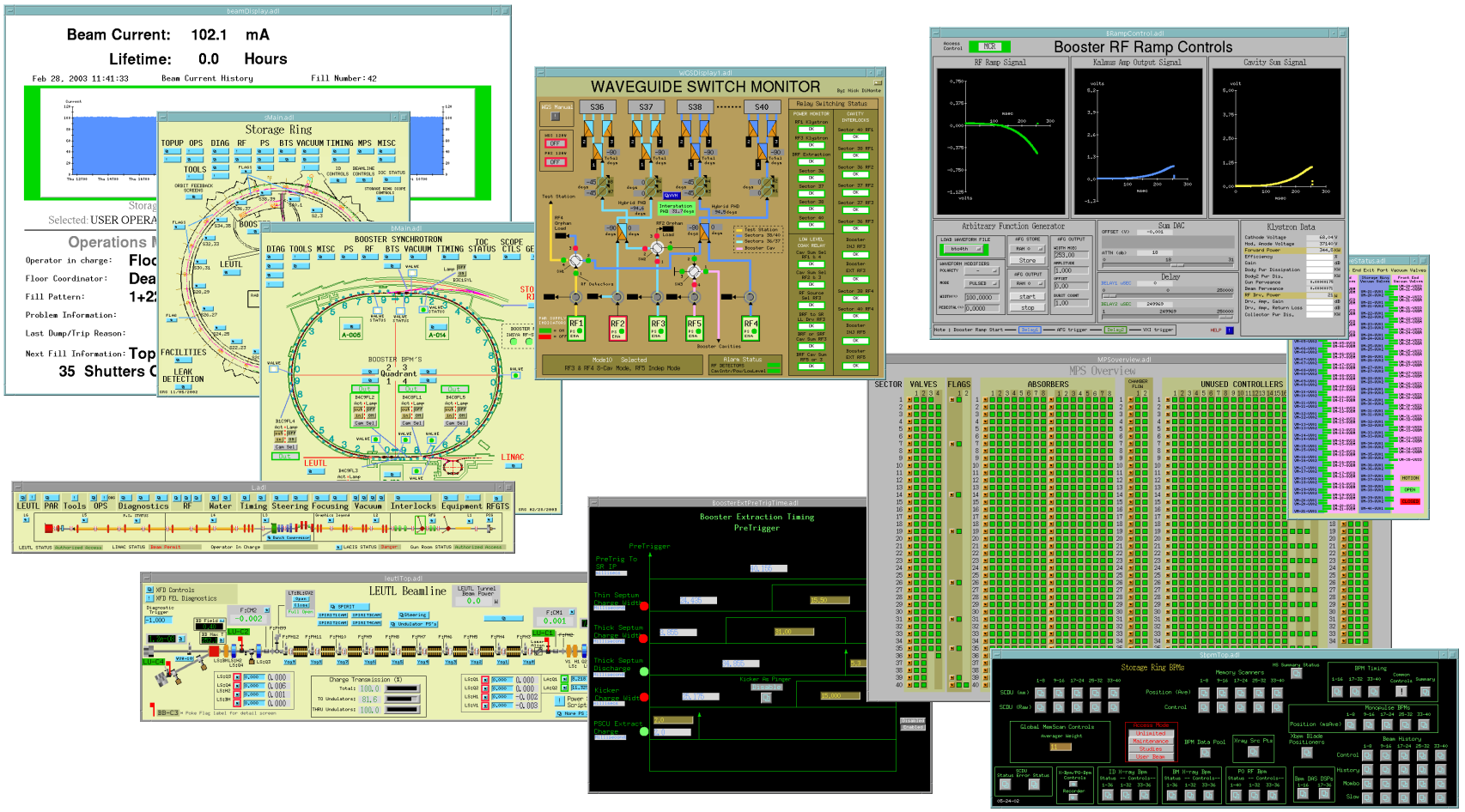
EPICS Extensions Web Page



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

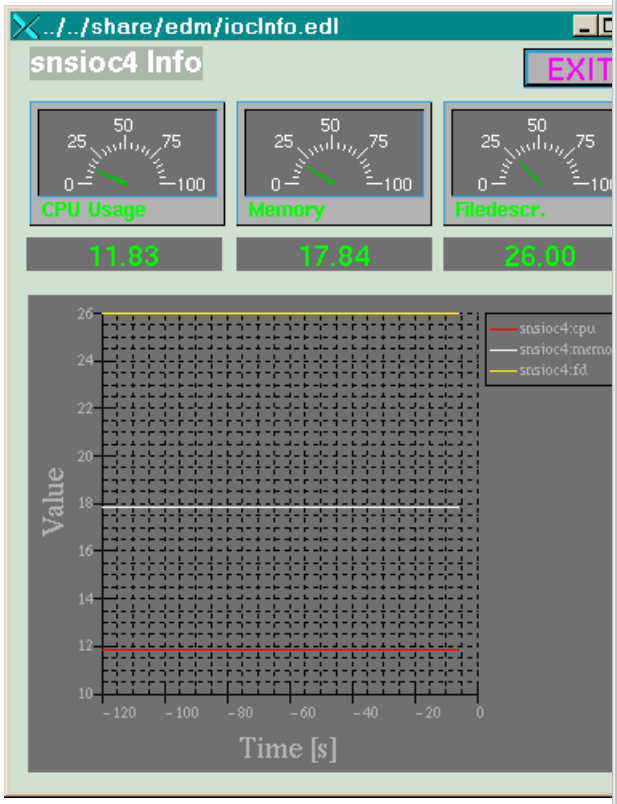


- And thousands of others

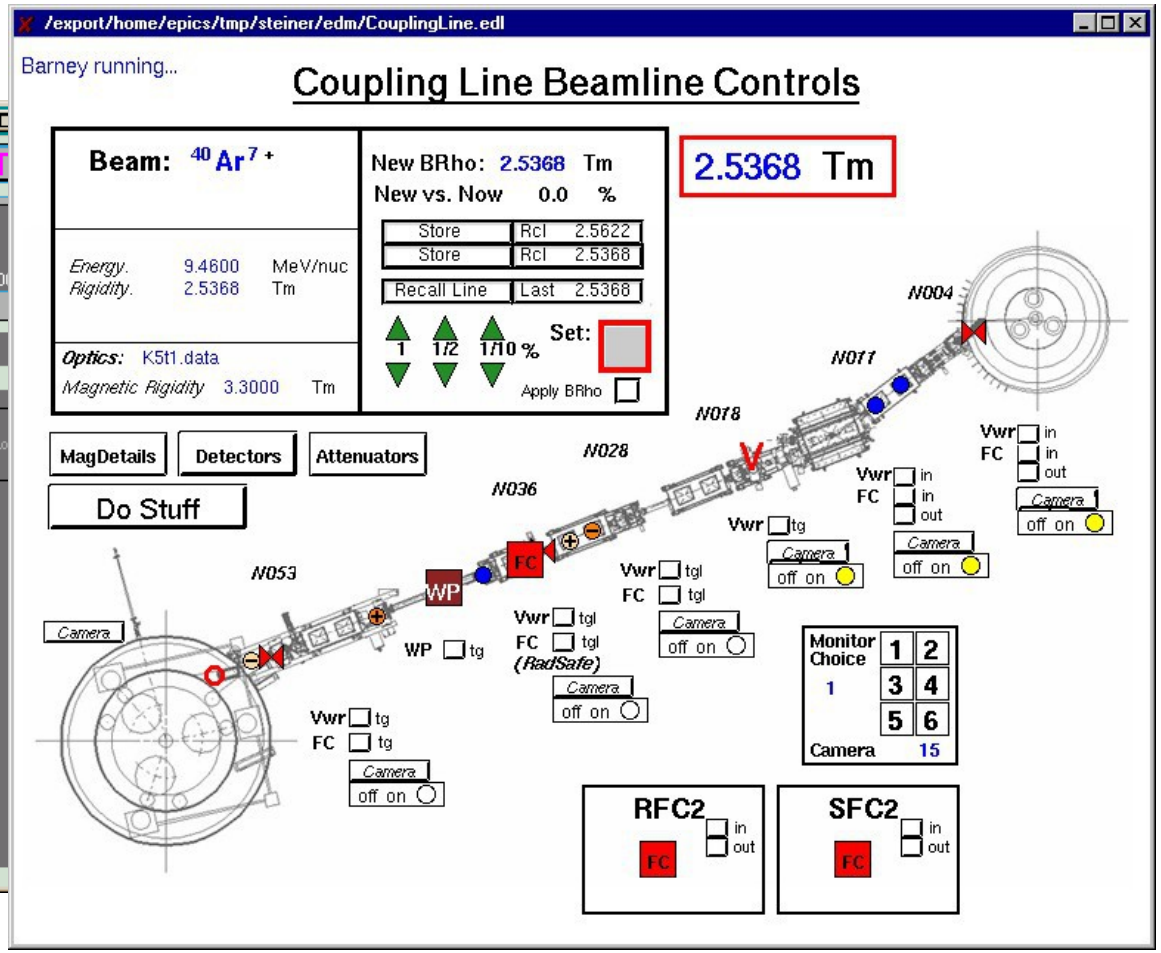
EDM

- 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

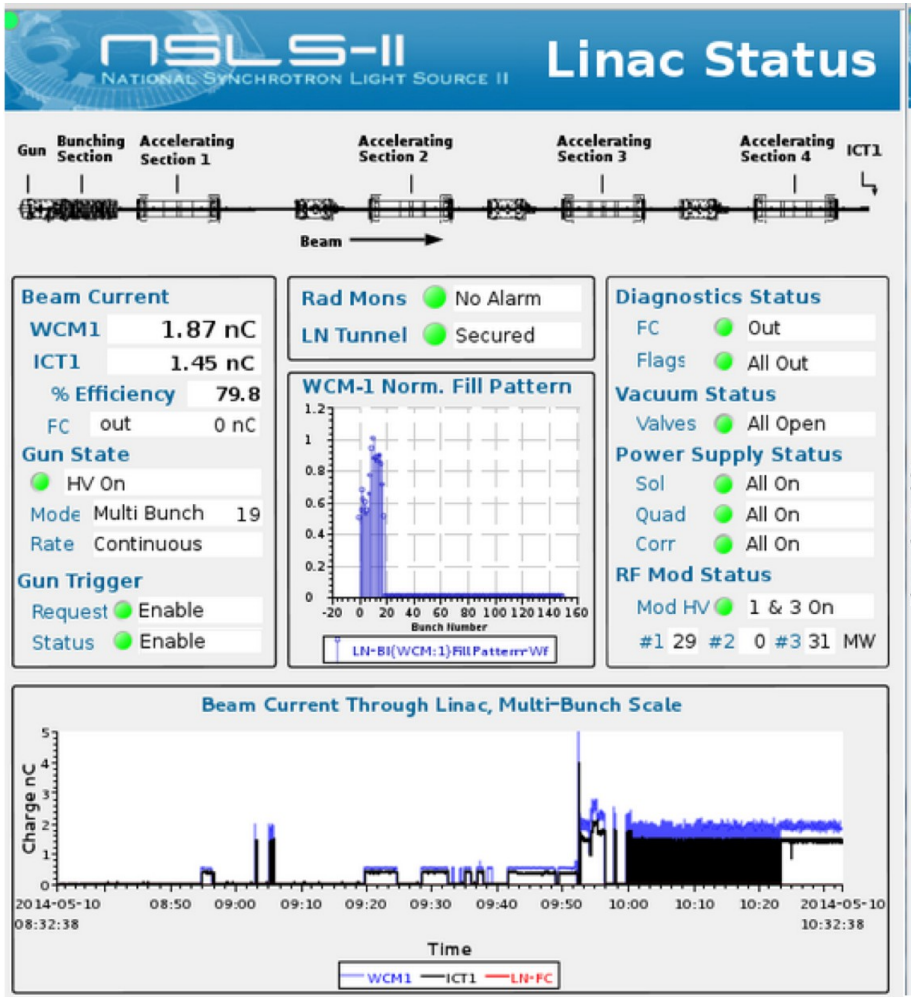


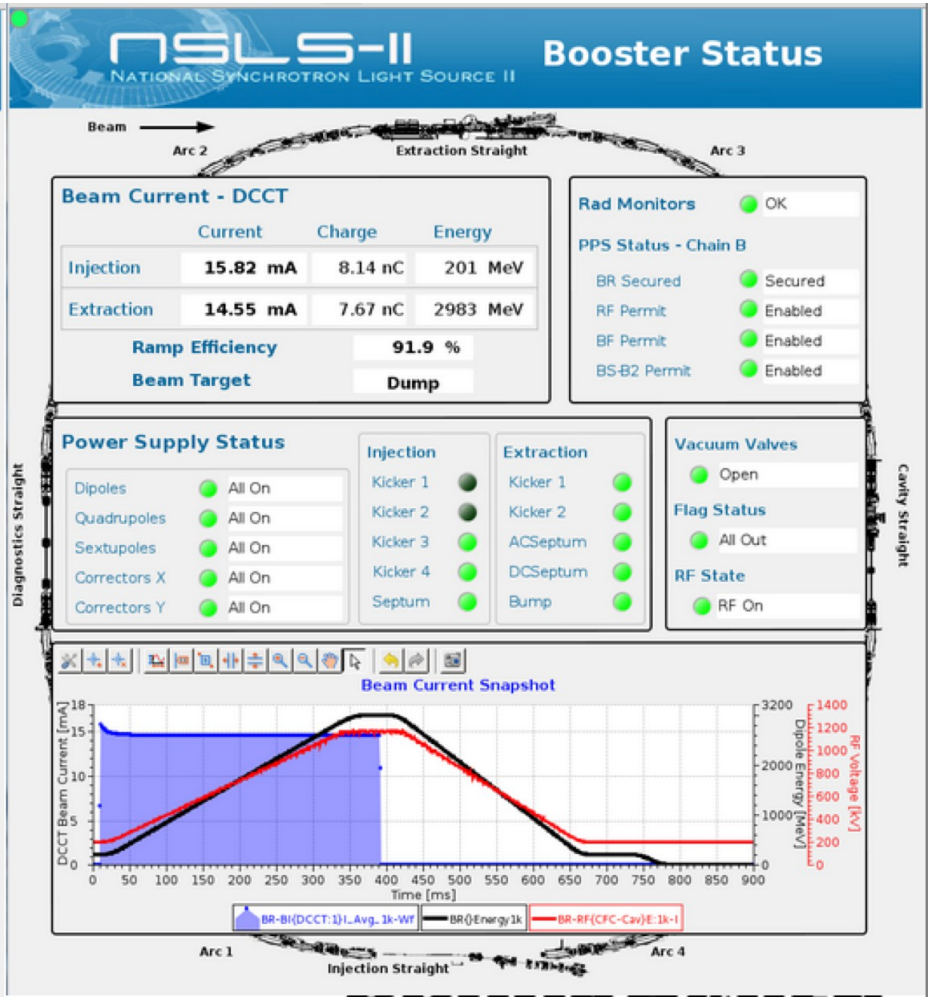
(SNS Linac test)



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

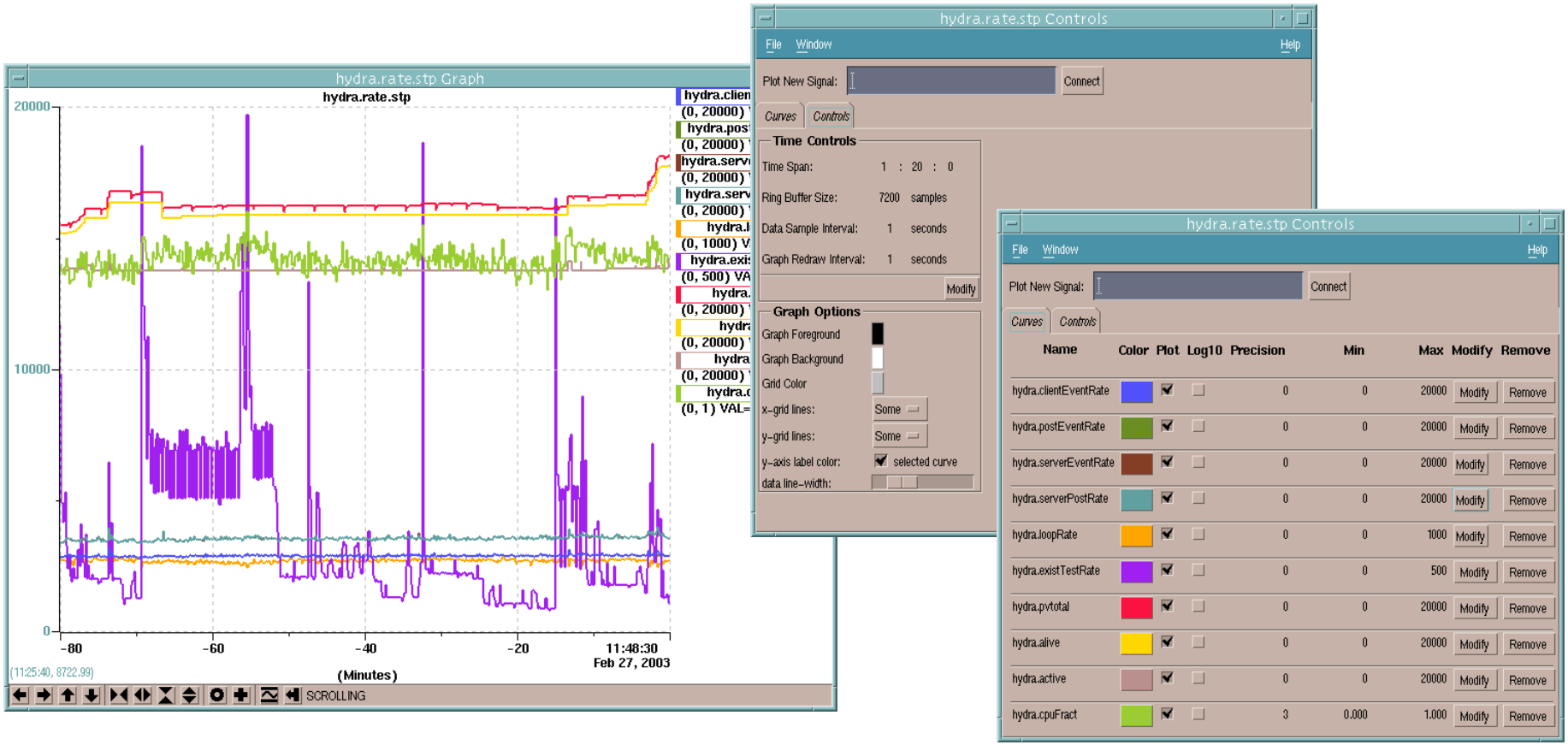
CSS-BOY


NSLS-II
NATIONAL SYNCHROTRON LIGHT SOURCE II
Linac Status
Gun
Bunching Section
Accelerating Section 1
Accelerating Section 2
Accelerating Section 3
Accelerating Section 4
ICT1
Beam
Beam Current
WCM1 1.87 nC
ICT1 1.45 nC
% Efficiency 79.8
FC out 0 nC
Gun State
HV On
Mode Multi Bunch 19
Rate Continuous
Gun Trigger
Request Enable
Status Enable
Rad Mons No Alarm
LN Tunnel Secured
WCM-1 Norm. Fill Pattern
Bunch Number
LN-BI{WCM:1}FillPattern-Wf
Diagnostics Status
FC Out
Flags All Out
Vacuum Status
Valves All Open
Power Supply Status
Sol All On
Quad All On
Corr All On
RF Mod Status
Mod HV 1 & 3 On
#1 29 #2 0 #3 31 MW
Beam Current Through Linac, Multi-Bunch Scale
Charge nC
2014-05-10 08:32:38
2014-05-10 10:32:38
Time
WCM1
ICT1
LN-FC


NSLS-II
NATIONAL SYNCHROTRON LIGHT SOURCE II
Booster Status
Beam
Arc 2
Extraction Straight
Arc 3
Beam Current - DCCT
Current Charge Energy
Injection 15.82 mA 8.14 nC 201 MeV
Extraction 14.55 mA 7.67 nC 2983 MeV
Ramp Efficiency 91.9 %
Beam Target Dump
Rad Monitors OK
PPS Status - Chain B
BR Secured Secured
RF Permit Enabled
BF Permit Enabled
BS-B2 Permit Enabled
Power Supply Status
Dipoles All On
Quadrupoles All On
Sextupoles All On
Correctors X All On
Correctors Y All On
Injection
Kicker 1
Kicker 2
Kicker 3
Kicker 4
Septum
Extraction
Kicker 1
Kicker 2
ACSeptum
DCSeptum
Bump
Vacuum Valves
Open
Flag Status
All Out
RF State
RF On
Diagnostics Straight
Cavity Straight
Beam Current Snapshot
DCCT Beam Current [mA]
Dipole Energy [MeV]
RF Voltage [kV]
Time [ms]
Arc 1
Injection Straight
Arc 4

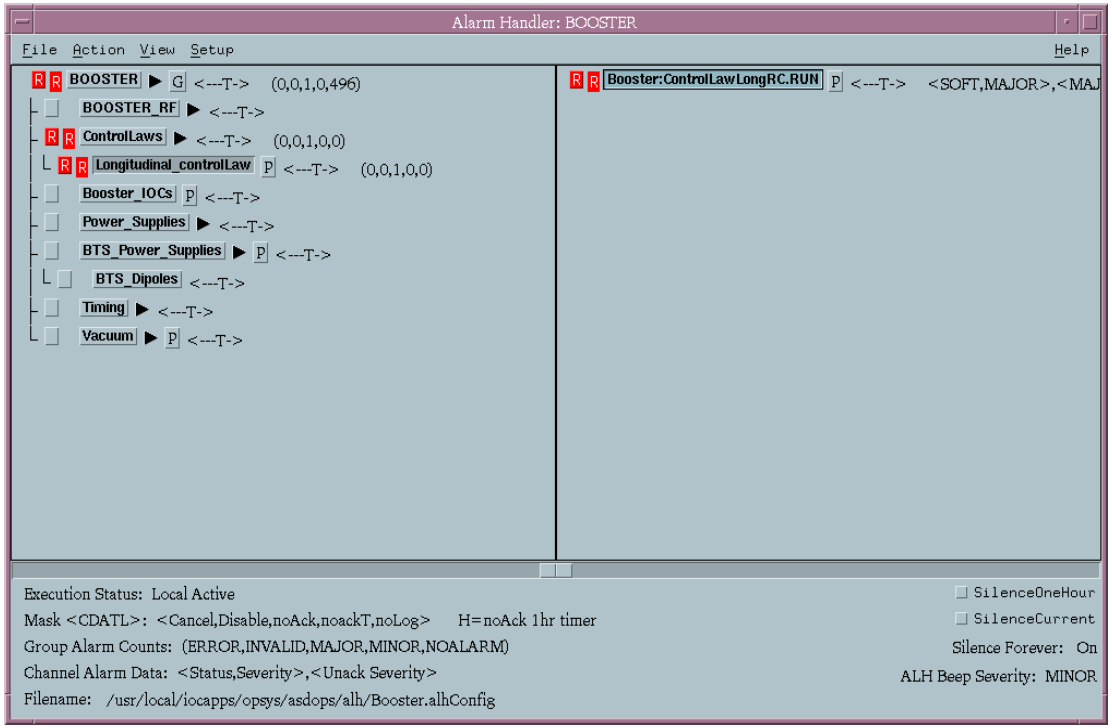
StripTool

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

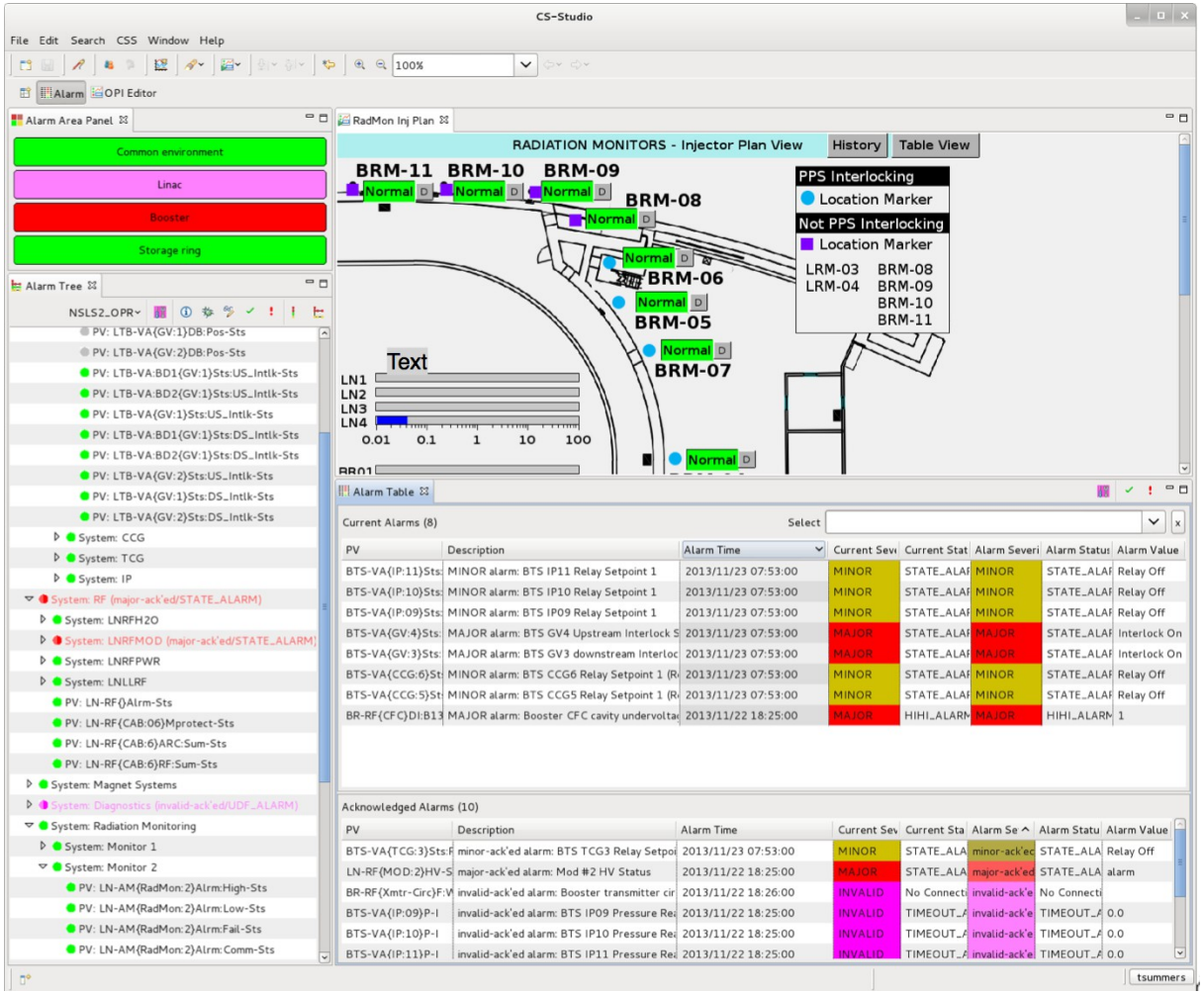


ALH (Alarm Handler)

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



CSS-BEAST


CS-Studio
File Edit Search CSS Window Help
Alarm
OPI Editor
Alarm Area Panel
Common environment
Linac
Booster
Storage ring
Alarm Tree
RadMon Inj Plan
RADIATION MONITORS - Injector Plan View
History
Table View
BRM-11
BRM-10
BRM-09
BRM-08
BRM-06
BRM-05
BRM-07
Normal
PPS Interlocking
Location Marker
Not PPS Interlocking
Location Marker
LRM-03 BRM-08
LRM-04 BRM-09
BRM-10
BRM-11
Text
LN1
LN2
LN3
LN4
0.01 0.1 1 10 100
Alarm Table
Current Alarms (8)
Select
PV
Description
Alarm Time
Current Sev
Current Stat
Alarm Severi
Alarm Statu
Alarm Value
Acknowledged Alarms (10)
tsummers