

June 27, 1996

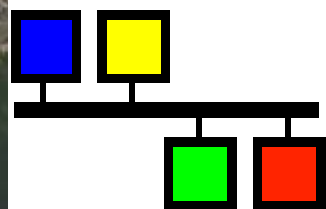
The EPICS Channel Archiver

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EPICS



User Residence Facility
Central Lab/Office Bldg
Conference Center
RF/Extraction Bldg.
Booster/Injector
Linac/Injection Bldg.
Lab/Office Modules
Experiment Hall/
Storage Ring
Lab/Office
Modules

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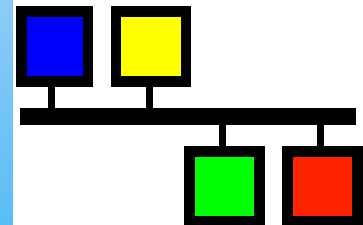
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Channel Archiver

- Channel Access Client.
- Stores Process Variable data in disk files.
- Can post channel access monitors.
- Archive data can be accessed over the web, providing “real-time” data from the beamline from any web browser.
- Additionally, users can look up experimental parameters over the Web from the time of their run.
- Very useful in debugging beamline problems.

Channel Archiver Version

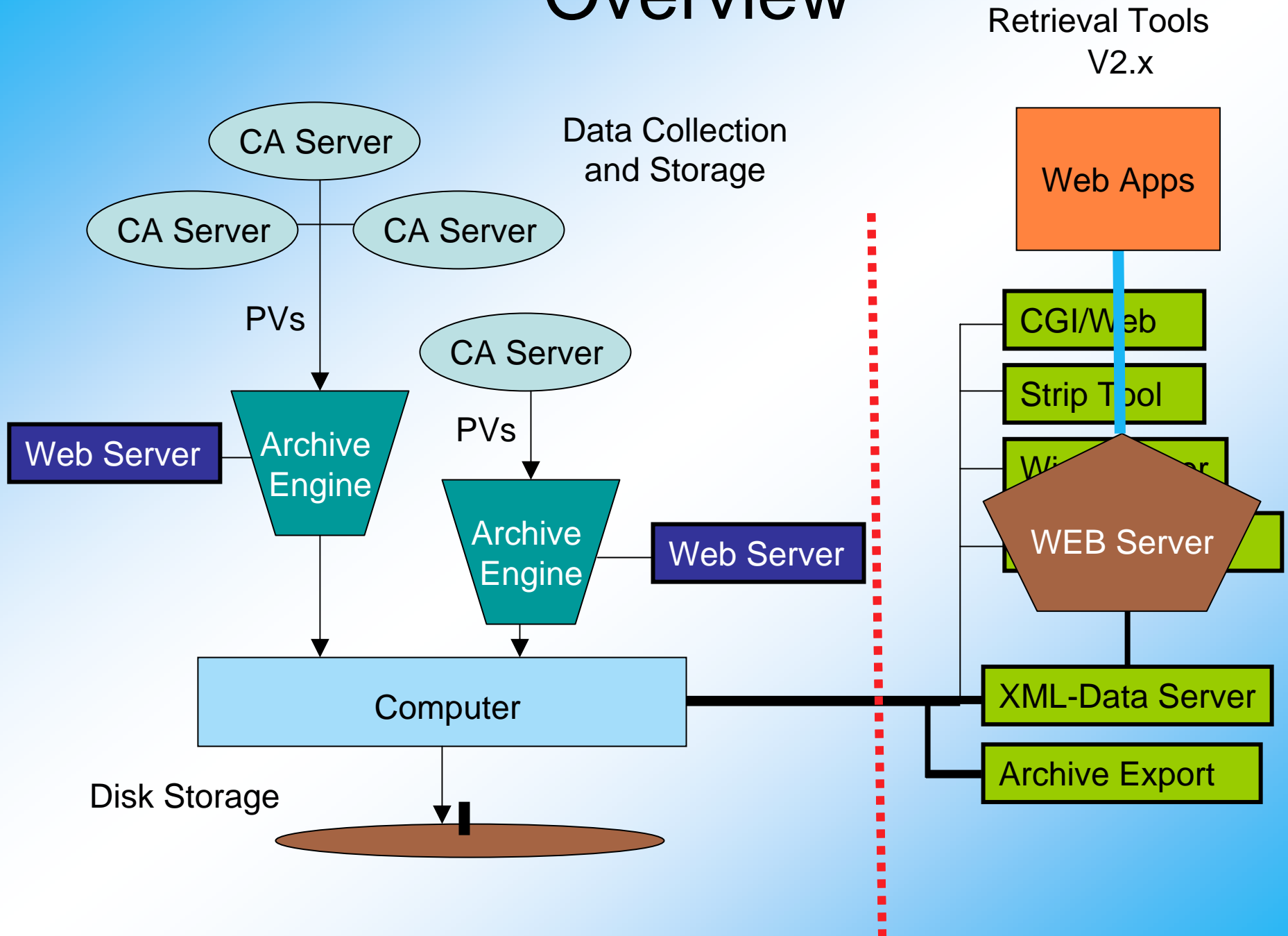
There are presently two versions of the Channel Archiver in use. The differences between the versions are significant and will be pointed out where appropriate during this presentation. Since many groups are still using EPICS R3.13.x the earlier version is still relevant.

<http://ics-web1.sns.ornl.gov/ARCHIVER/index.html>

1.x is for EPICS base R3.13.x. There is no active development going on. (1.10.2)

2.x is for EPICS base R3.14.x. These releases are new, they undergo testing at the SNS.

Overview



Tools

Archiving

ArchiveEngine

Command program, does actual archiving

ArchiveDaemon

Automatically checks ArchiveEngine and starts if necessary (web based)

Data Retrieval

Java Archive Client

Used to browse data, plot, and export data to spread sheets. Uses Archive Data Server

ArchiveExport

Command line tool, functionality similar to Java Client

Archive Data Server (Very Useful!)

Gives access to archive data via a XML-RPC server. Simple functions can be incorporated into many popular programming languages (C, C++, Java, Perl)

Archiving

Archive Engine

- The Archive Engine is a Channel Access client that runs on the computer doing the Archiving.
- Loads a configuration file with a list of Process variables as well as monitor/scan information
 - File in 2.x version XML
 - File in 1.x version ASCII
- Has its own built in web server for additional configuration and stopping.
- Stores archive data to disk
- Needs an index file(2.x)/directory file(1.x) in the subdirectory in which the data is stored.

ArchiveEngine command-line program

Syntax:

```
ArchiveEngine [options] <config-file> <dir-file>
```

Options:

```
-d <description> : Web page description  
-p <port>       : port for web server  
-l <log>        : write log file  
-nocfg          : disable online configuration
```

Version 1.x uses a “directory” file

Version 2.x uses an “index” file

Configuration file

ASCII File V1.x

Configuration file lists channels to archive

```
# Example: <channel> <period [s]>
15IDB:vac1.VAL 1
15IDB:vac2.VAL 10
# Monitor: might change every 0.2 second
15IDB:vac3.VAL 0.2 Monitor
```

- **Scanned**

Periodically store most recent value

- **Monitor**

Store all incoming values – up to buffer limit

- **Original time stamps are stored!**

Configuration file XML File (V2.x)

Extensible Markup Language (XML) is a cross-platform, extensible, and text-based standard for representing data. It is also a key technology in the development of [Web services](#).

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<!DOCTYPE engineconfig (View Source for full doctype...)>
<engineconfig>
  <write_period>30</write_period>
  <get_threshold>20</get_threshold>
  <file_size>30</file_size>
  <ignored_future>1.0</ignored_future>
  <buffer_reserve>3</buffer_reserve>
  <max_repeat_count>120</max_repeat_count>
  <group>
    <name>Vacuum</name>
    <channel>
      <name>15IDB:vac1.VAL</name>
      <period>0.1</period>
      <monitor />
    </channel>
  </group>
</engineconfig>
```

Legacy issues between 1.x and 2.x

- **V2.x requires R3.14.4 or later**
- **V2.x requires index files rather directory files to keep track of data files**
- **All configuration files are based on XML. In V1.x, ASCII files were used.**

In the new release there is a perl script (ConvertEngineConfig.pl) that will convert the archive engine ASCII files to XML files .

The ArchiveDataTool (replaces the ArchiveManager) can be used to convert directory files to index files.

Note: Keep index & data files together, don't modify them.

Archive Engine Build Configuration

`\ChannelArchiver\LibIO\ArchiverConfig.h`

```
// Use password mechanism
// (for stopping the engine over the web)
#undef USE_PASSWD

#define DEFAULT_USER      "engine"
#define DEFAULT_PASS     "password"
```

Location of gnuplot is also a configuration parameter.

Engine's HTTPD

- URL of engine's HTTPD: `http://<machine>:<port>`
- Status & Config., not data!
- Start/Stop Archiver

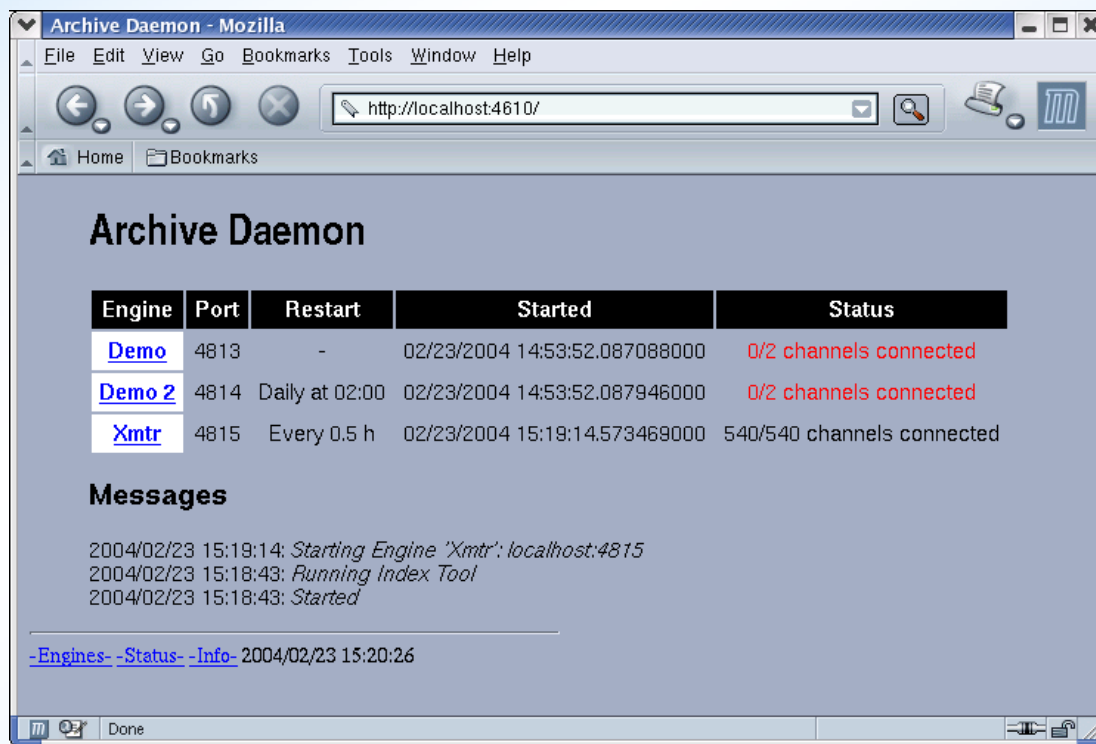
Name	Status	CA State	Period [s]	Buffer	Get Mechanism	Disabling
subsystem_off	monitored	NOT CONNECTED (00:00:00) <>	1	16		
fred	monitored	connected (05/03/2000 14:42:17.481556000) kingjohn.atdiv.lanl.gov:5064	1	256		
nothere	scanned	NOT CONNECTED (00:00:00) <>	5	16		

Name	ID	Enabled	Channels	Connected
main.cfg	0	Yes	4	4
subsystem	1	Yes	3	1

[-Main-](#) [-Groups-](#) [-Config.-](#)
(Use *Reload* from the Browser's menu for updates)

ArchiveDaemon

- Automatically starts, monitors and restarts ArchiveEngine on local host.
- Has a built-in web server
- Will check status of ArchiveEngine process and restart if necessary



The screenshot shows a Mozilla browser window titled "Archive Daemon - Mozilla" with the address bar set to "http://localhost:4610/". The main content area displays the "Archive Daemon" interface, which includes a table of engine configurations and a "Messages" section.

Engine	Port	Restart	Started	Status
Demo	4813	-	02/23/2004 14:53:52.087088000	0/2 channels connected
Demo 2	4814	Daily at 02:00	02/23/2004 14:53:52.087946000	0/2 channels connected
Xmtr	4815	Every 0,5 h	02/23/2004 15:19:14.573469000	540/540 channels connected

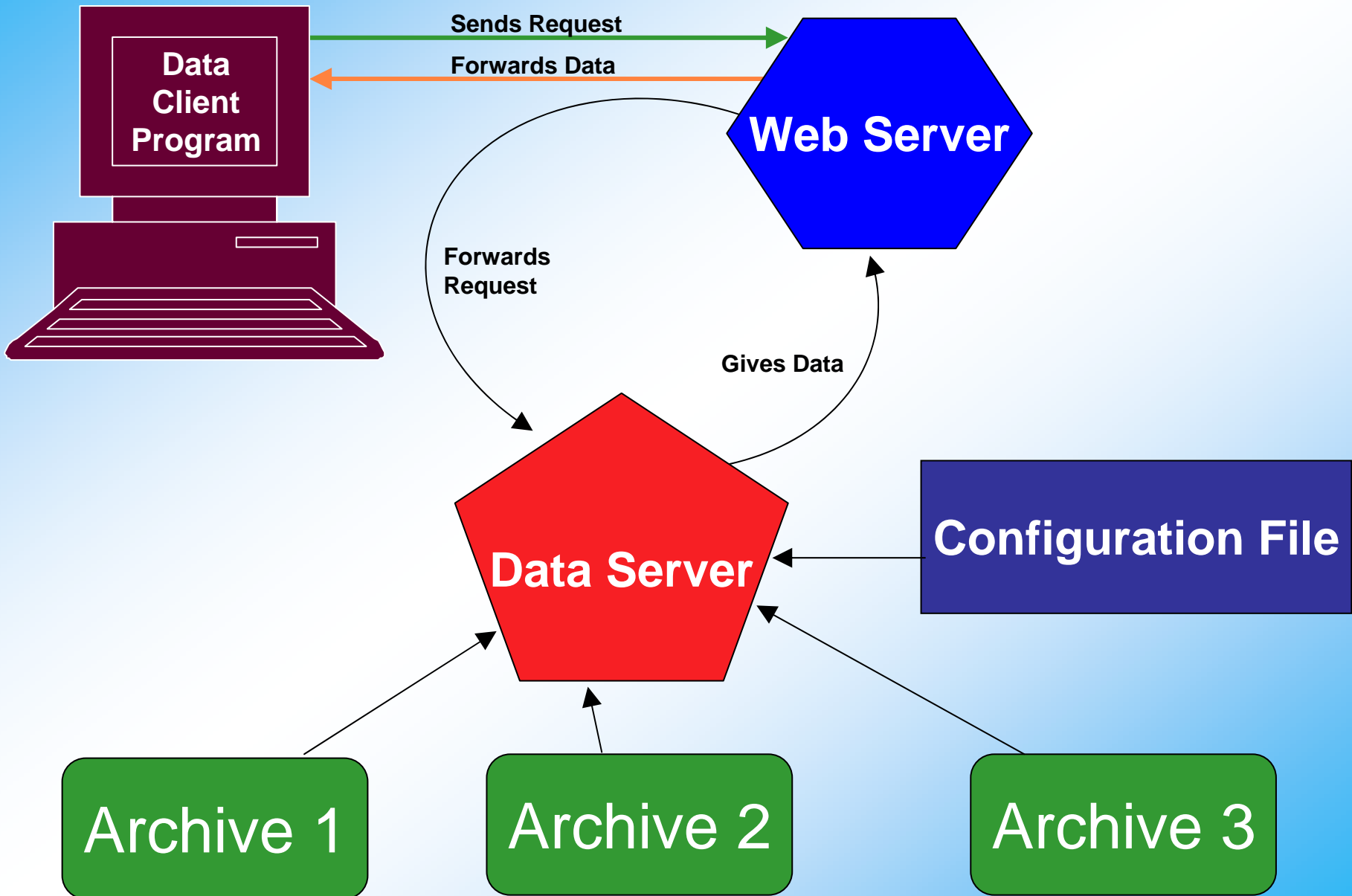
Messages

2004/02/23 15:19:14: Starting Engine 'Xmtr': localhost:4815
2004/02/23 15:18:43: Running Index Tool
2004/02/23 15:18:43: Started

[-Engines-](#) [-Status-](#) [-Info-](#) 2004/02/23 15:20:26

Data Retrieval

XML-RPC Data Server



XML-RPC Function Calls

- **archiver.info**
 - Returns version information
- **archiver.archives**
 - Returns archives that the data server can access
- **archiver.names**
 - Returns channel names and start and stop times
- **archiver.values**
 - Returne values from a particular archive for a given list of channel names

Calls can be used in C, C++, Perl

See: <http://www.xmlrpc.com>

ArchiveExport

- Command line tool
- Requires direct connection to local host disk

Syntax:

```
ArchiveExport [options] [index file] {channel}
```

Options:

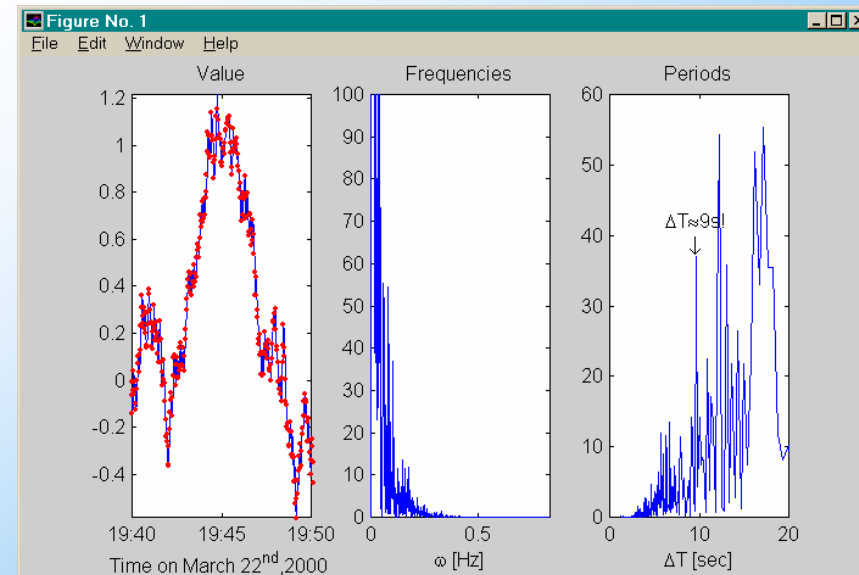
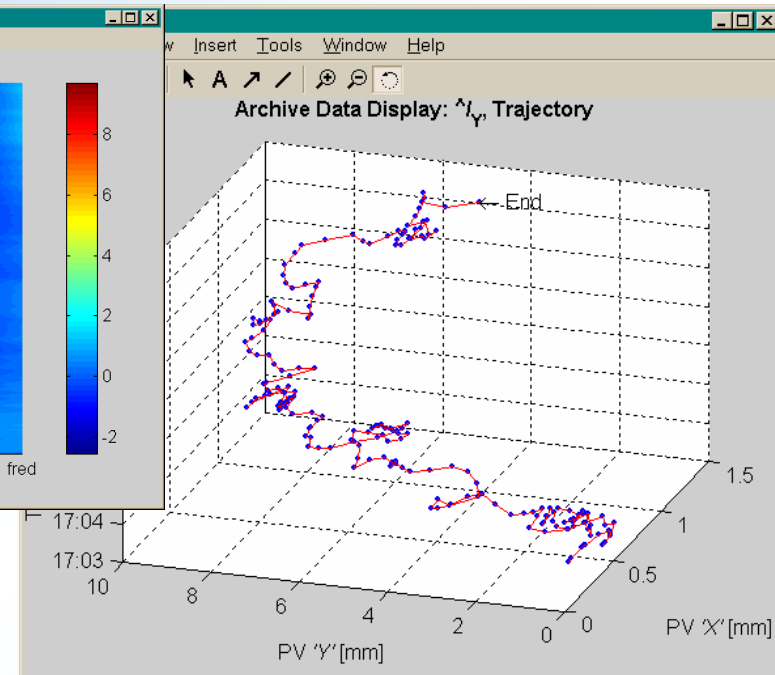
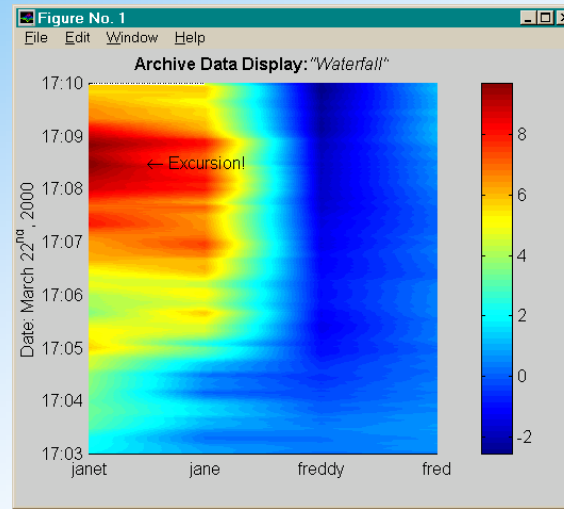
```
-verbose           : Verbose Mode
-list             : List all channels
-info            : Time -range info on channels
-start <time>    : Data start time
-end <time>      : Data end time
-text            : Status/Severity coulumn
-match           : Channel name pattern
-interpolate     : Interpolate Value
-output <file>  : Output data file name
-gnuplot         : Generate gnuplot command file
-Gnuplot        : Generate plot file
```

Java Archive Client

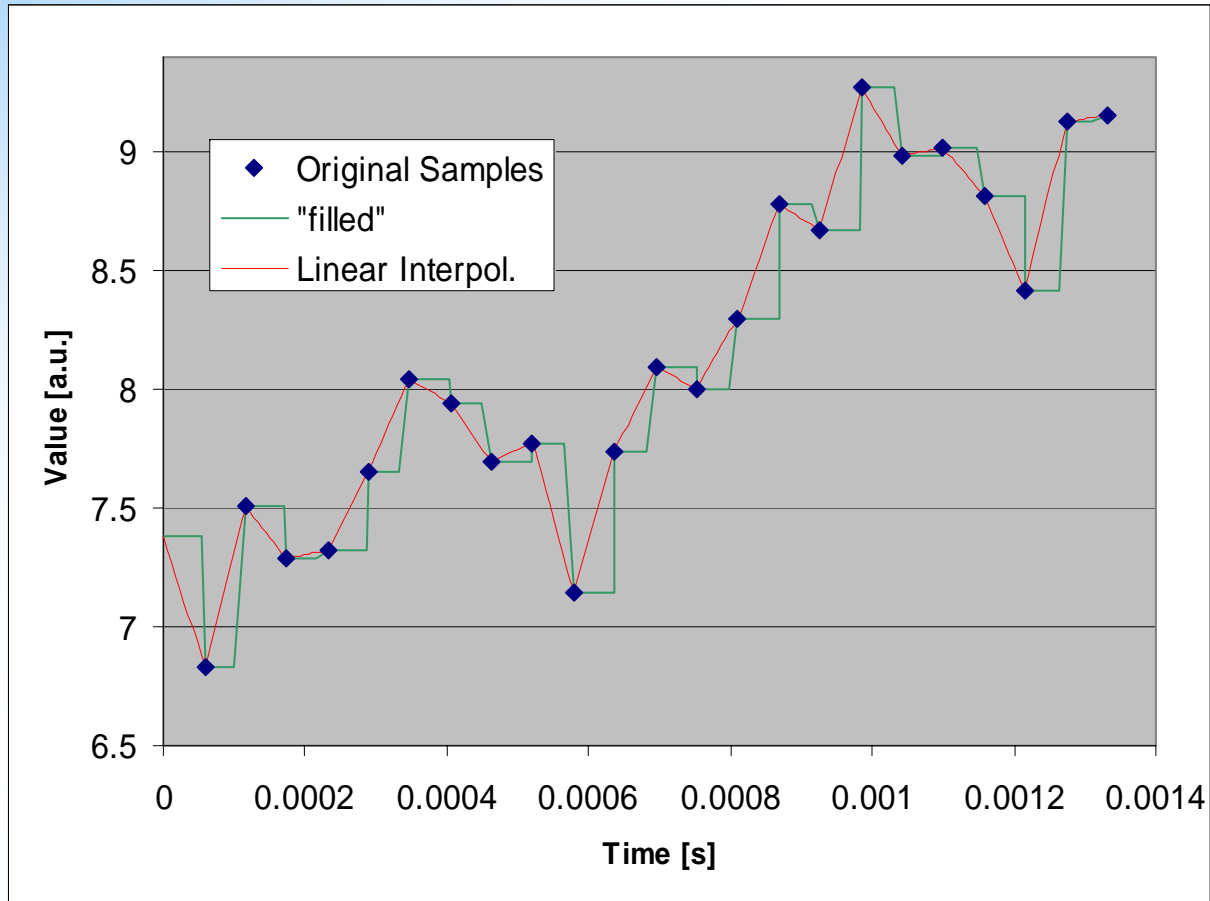
- Similar to Archive Export
- Uses XML-RPC Server
- Can be launched from a Web page
- Used to browse and plot data
- <http://lansce.lanl.gov/ArchiveViewer/>



- Export Tools generate MATLAB command file
 - ASCII, portable
 - No MATLAB binaries required
 - Full value info, time & status
 - Big & slow



“Fill”, “Interpol.”, ...



CGI Export

- Presently ChemMatCARS is running the 1.x version of the Archiver.
- Archive data is accessed over the internet via a CGI program using a web browser.
- Web pages are configured using an ASCII file.
- The program will be ported to the 2.x version of the Archiver.

Starting the Archive Engine

Command to start engine

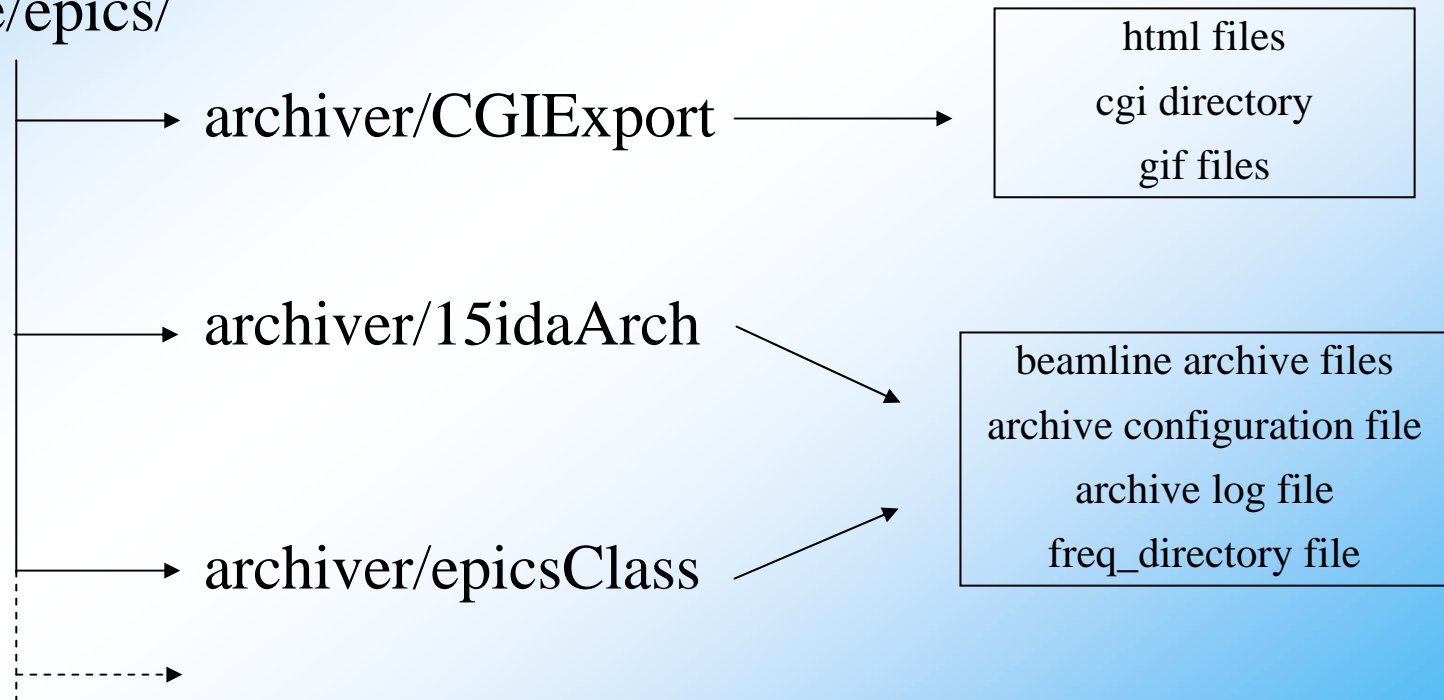
Version 1.8.2, built Jul 18 2001, 15:09:09

USAGE: ArchiveEngine [Options] <config-file> [<directory-file>]

Options: -port <port> WWW server's TCP port (default 4812)
 -description <text> description for HTTP display
 -log <filename> write logfile
 -nocfg disable online configuratio

Default directory-file: 'freq_directory'

/home/epics/



Storage Space

Below is a listing of the 15IDA archive directory. On a typical day an archive file is ~14Mb. Some PV's such as temperature are Archived every 10 seconds

$$365 * 14 \text{ Mb} = 5.1 \text{ Gb/y}$$

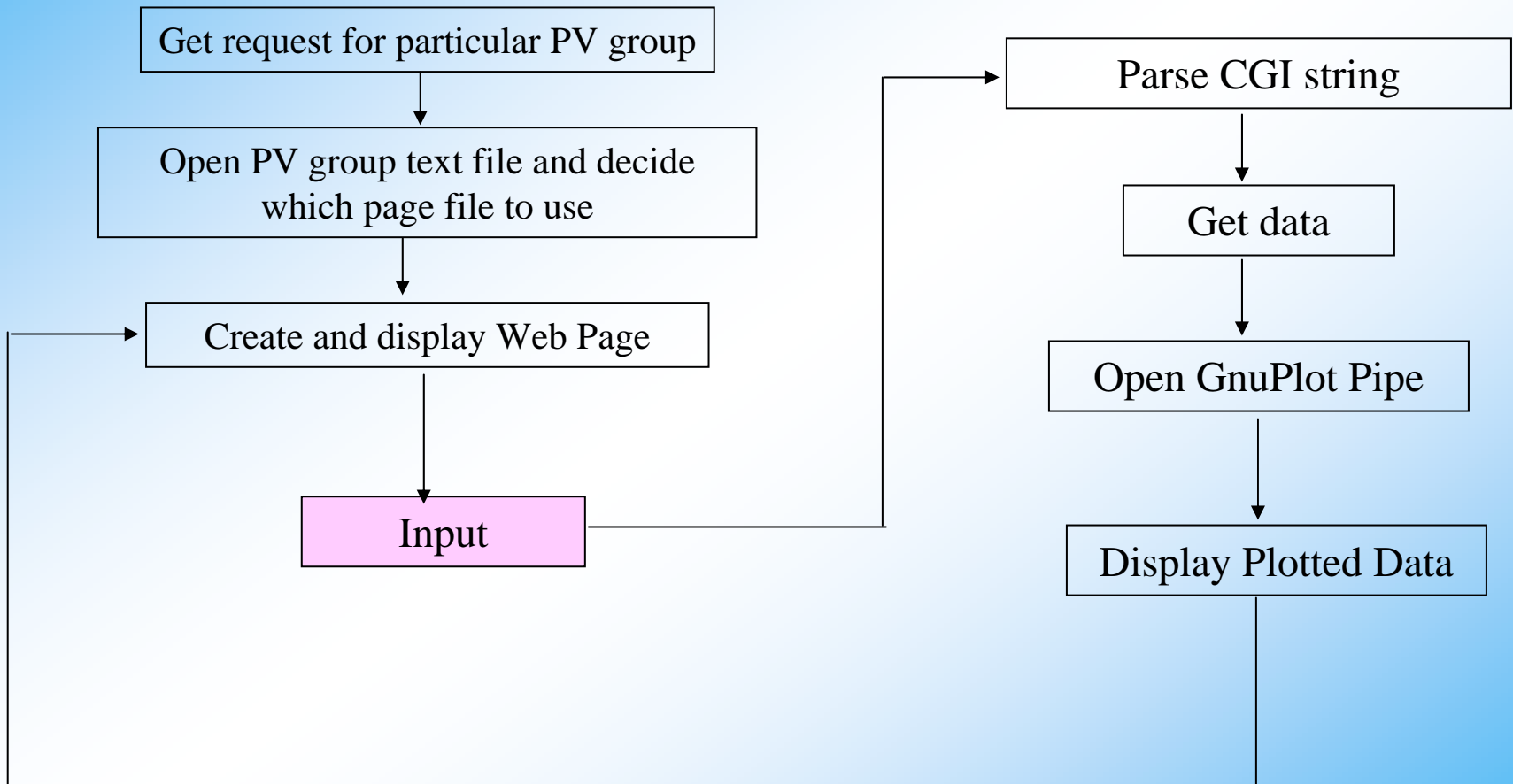
89 PV's are being monitored in the FOE at the present time.

```
-rw-r--r-- 1 epics epics 15659818 Sep 3 15:26 20040818-000000
-rw-r--r-- 1 epics epics 15754854 Aug 20 18:15 20040819-000000
-rw-r--r-- 1 epics epics 16467719 Sep 2 13:17 20040820-000000
-rw-r--r-- 1 epics epics 16685808 Aug 22 02:17 20040821-000000
-rw-r--r-- 1 epics epics 15870058 Aug 23 08:58 20040822-000000
-rw-r--r-- 1 epics epics 16620334 Aug 26 00:00 20040823-000000
-rw-r--r-- 1 epics epics 15861902 Aug 25 12:04 20040824-000000
-rw-r--r-- 1 epics epics 16999390 Sep 1 19:29 20040825-000000
-rw-r--r-- 1 epics epics 14303632 Sep 1 19:29 20040826-000000
-rw-r--r-- 1 epics epics 14159348 Sep 1 19:29 20040827-000000
-rw-r--r-- 1 epics epics 14130316 Aug 29 18:59 20040828-000000
-rw-r--r-- 1 epics epics 14864007 Aug 30 17:12 20040829-000000
-rw-r--r-- 1 epics epics 13824859 Sep 1 19:29 20040830-000000
-rw-r--r-- 1 epics epics 12142632 Sep 1 15:23 20040831-000000
-rw-r--r-- 1 epics epics 9472051 Sep 2 02:18 20040901-000000
-rw-r--r-- 1 epics epics 14071606 Sep 3 01:03 20040902-000000
-rw-r--r-- 1 epics epics 14203620 Sep 4 06:35 20040903-000000
-rw-r--r-- 1 epics epics 14071378 Sep 5 05:44 20040904-000000
-rw-r--r-- 1 epics epics 7444274 Sep 5 16:46 20040905-000000
-rw-r--r-- 1 epics epics 133 Aug 3 10:56
archive_active.lck
```

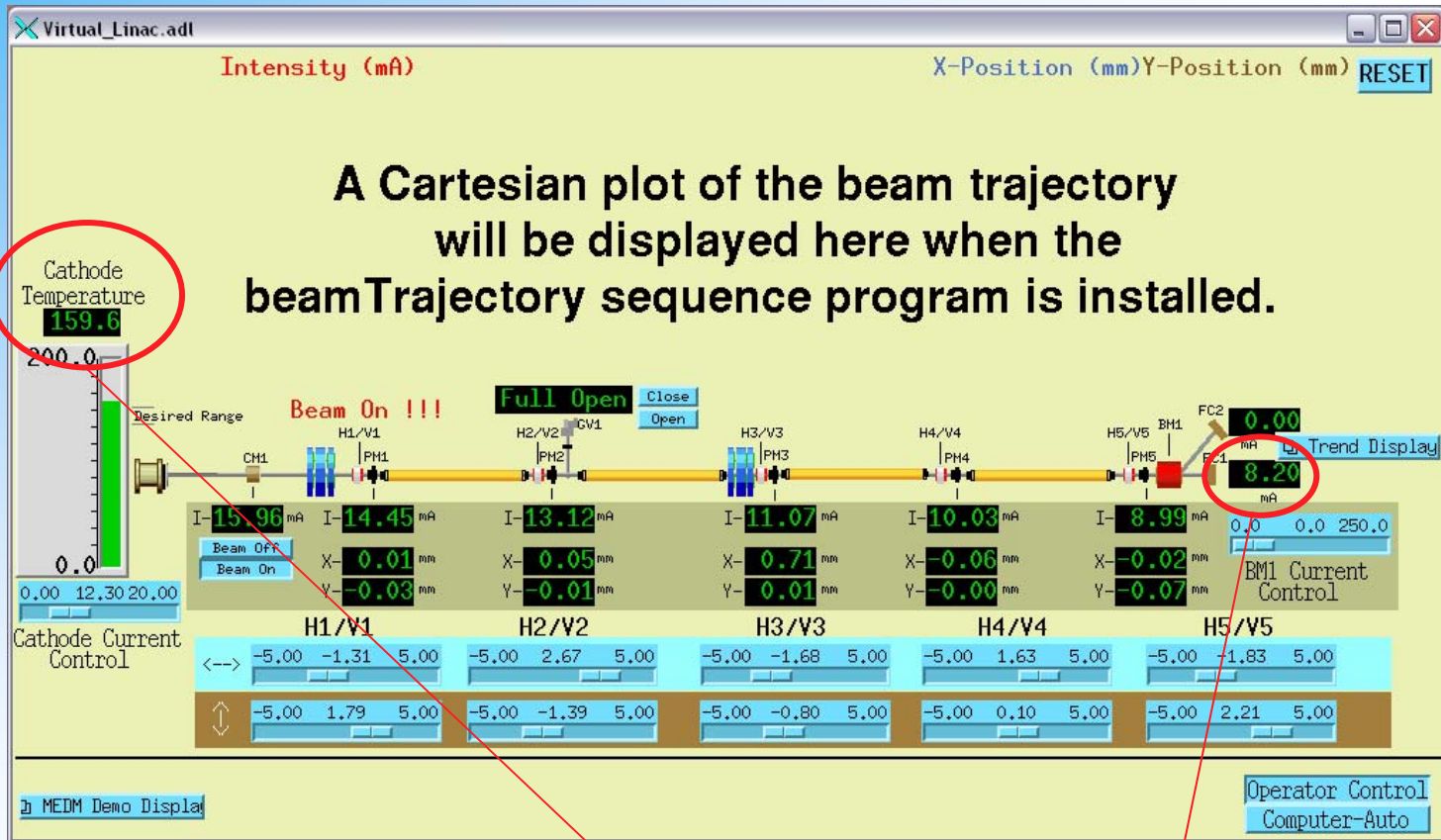
Modifications to CGI export

- Added the ability to describe PV on Page.
- Ability to display a small group of related PV's on a single web page.
- Manual scaling of each axis.
- Log plotting.
- Choice of left or right axis.
- Easy configuration of Web Page.

Flow Diagram for Modified CGIExport



Exercise with Virtual Linac



ArchiveEngine Config File

```
epics:cathodeTempM 5 Monitor
epics:PM1:intensityM 5 Monitor
epics:PM2:intensityM 5 Monitor
epics:PM3:intensityM 5 Monitor
epics:PM4:intensityM 5 Monitor
epics:PM5:intensityM 5 Monitor
epics:FC1:intensityM 5 Monitor
```

Populating the Web Page with PV's

```
<a href=" ../cgi/CGIExport.cgi?DIRECTORY=../epicsClass/freq_directory&PV GROUP=EPICS_CLASS">
Vlinac</a>
Vlinac parameters.
```

↓

```
15IDC_MOT
idc/idcMotData.txt
15IDC_PREAMP
idc/idcPreampData.txt
15IDC_SCAL1
idc/idcScal1Data.txt
15IDC_MM4005
idc/idcMM4005Data.txt
EPICS_CLASS
epicsClass/data.txt
```

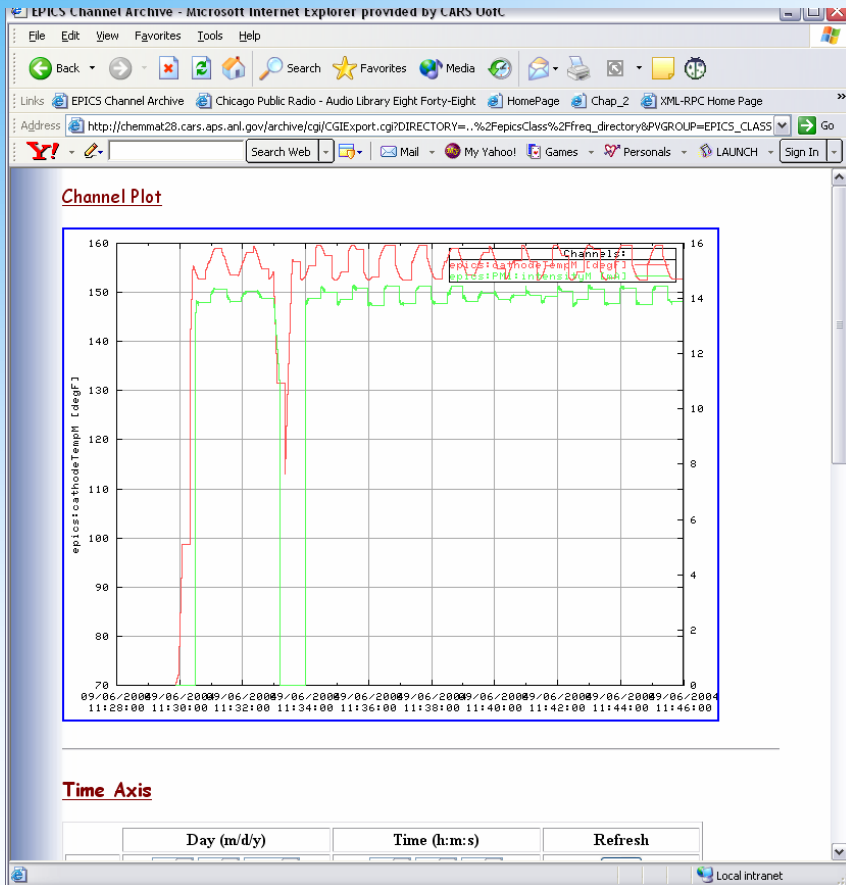
pvgroup.txt

→

```
Cathode Temperature
epics:cathodeTempM
Position Monitor 1
epics:PM1:intensityM
Position Monitor 2
epics:PM2:intensityM
Position Monitor 3
epics:PM3:intensityM
Position Monitor 4
epics:PM4:intensityM
Position Monitor 5
epics:PM5:intensityM
Faraday Cup 1
epics:FC1:intensityM
```

data.txt

Web Page Generated by CGIExport



EPICS Channel Archive - Microsoft Internet Explorer provided by CARS UoCL

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media

Links EPICS Channel Archive Chicago Public Radio - Audio Library Eight Forty-Eight HomePage Chap_2 XML-RPC Home Page

Address http://chemmat28.cars.aps.anl.gov/archive/cgi/CGIExport.cgi?DIRECTORY=..%2FepicsClass%2Ffreq_directory&PVGROUP=EPICS_CLASS Go

Search Web Mail My Yahoo! Games Personals LAUNCH Sign In

Time Axis

	Day (m/d/y)			Time (h:m:s)			Refresh
Start:	09	06	2004	11	28	00	GET
End:	09	06	2004	11	45	59	

Y Axis

Side	y-axis min:	y-axis max:	Use Manual Limits:	Log Scale:
Left axis:	0	100	<input type="checkbox"/>	<input type="checkbox"/>
Right axis:	0	100	<input type="checkbox"/>	<input type="checkbox"/>

Channel Description	Process Variable	Plot	Left Axis	Right Axis
Cathode Temperature	epics:cathodeTempM	<input checked="" type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>
Position Monitor 1	epics:PM1.intensityM	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="radio"/>
Position Monitor 2	epics:PM2.intensityM	<input type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>
Position Monitor 3	epics:PM3.intensityM	<input type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>
Position Monitor 4	epics:PM4.intensityM	<input type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>
Position Monitor 5	epics:PM5.intensityM	<input type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>
Faraday Cup 1	epics:FC1.intensityM	<input type="checkbox"/>	<input checked="" type="radio"/>	<input type="radio"/>

GET Plot All Data: (plot data is reduced otherwise)

Spreadsheet Status: (show channel status)

Excel-File Fill: (step-func. interpolation)

Matlab Interpolate: 0 secs (linear)

Local intranet

Demonstration of CGIExport

Summary

- The Channel Archiver is a Toolset for archiving any Channel Access data.
- Generic retrieval options, scripting, and Matlab allow further analysis.
- The XML-RPC Data Server will allow for relatively easy data retrieval over the web.
- The present CGI Program for data retrieval over the web will be updated to utilize the XML-RPC Data Server