

Introducing CAML II

Thomas Pelaia II, ORNL*

Matthew Boyes, SLAC

ICALEPCS 2009

October 16, 2009



Participants listed alphabetically

- Matthew Boyes**
- Vidya Kumar**
- Thomas Pelaia II**
- David Purcell**
- Matej Sekoranja and his Cosylab team who developed CAML**

What is CAML?

- **XML specification and implementation for rendering rich controls in any modern, standards compliant web browser**
 - **Declarative Language** (no need for scripting unless you want to)
- **Namespace for embedding controls within XHTML documents**
- **Uses WebCA plugin (JavaScript interface to EPICS Channel Access client protocol)**

CAML Architecture

XHTML Document with CAML

```

<?xml version="1.0"?>
<?xml-stylesheet href="file:///Library/EPICS/CAML/xsl/webca.xsl" type="xsl" />
<!-- start html element and define caml namespace -->
<html xmlns:caml="http://webca.cosylab.com">
  <head>
    <title>Magnets Example</title>
    <caml:head webcaPath="file:///Library/EPICS/CAML/" />
  </head>
  <body>
    <h3>MEBT Orbit</h3>
    <table class="data">
      <caption>MEBT Orbit</caption>
      <tr>
        <th>Index</th>
        <th>Magnet</th>
        <th>Current</th>
        <th>BPM</th>
        <th>X (mm)</th>
        <th>Y (mm)</th>
      </tr>
      <caml:repetition name="RepMag">
        <caml:list>
          <caml:item>
            <caml:macroValuePair macroName="$($COIL)" />
            <caml:macroValuePair macroName="$($BPM)" />
          </caml:item>
        </caml:list>
      </caml:repetition>
    </table>
  </body>
</html>
  
```

Web Engine

Web Browser Display



XSL Processor



CAML Framework

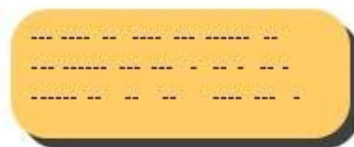


JavaScript Library

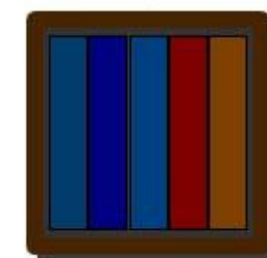
Style Sheet



XSL Transform



Web CA Plugin



Channel Access Library

IOC



CAML Goals

- Use the web browser as a modern display engine for controls**
- Integration with web pages**
- Leverage web technology**
 - HTML for layout structure**
 - Cascading Style Sheets for advanced style and layout**
 - JavaScript for scripting**
 - XSLT for transformations**
 - Rendering modern media (images, video, audio)**
 - Growing support for rich HTML 5 standards**
 - Large source of developers**

Sample CAML Page

Magnets Example

MEBT Orbit

Index	Magnet	Current	Current Set	Field	Field Set	BPM	X (mm)	Y (mm)
1	DCH01	-4.06 A	-0 0 3 8 8 5 Amp	-0.00414 T	-0 0 0 0 3 9 6 Tesla	BPM01	+0.01	+0.41
2	DCH04	3.09 A	+0 0 3 1 2 0 Amp	+0.00314 T	+0 0 0 0 3 1 8 Tesla	BPM04	+0.05	-0.21
3	DCH05	-2.56 A	-0 0 2 3 5 0 Amp	-0.00199 T	-0 0 0 0 1 8 3 Tesla	BPM05	+0.58	+0.30
4	DCH10	3.03 A	+0 0 2 8 3 6 Amp	+0.00235 T	+0 0 0 0 2 2 0 Tesla	BPM10	+0.37	-0.82
5	DCH11	4.74 A	+0 0 4 7 1 3 Amp	+0.00483 T	+0 0 0 0 4 8 0 Tesla	BPM11	-0.36	+0.61
6	DCH14	-1.37 A	-0 0 1 3 3 6 Amp	-0.00140 T	-0 0 0 0 1 3 6 Tesla	BPM14	-0.28	+0.19

MEBT Orbit Slider and Gauge

Index	Magnet	Field Set	BPM	X (mm)	Y (mm)
1	DCH01	-0.0039 Tesla	BPM01	+0.01	+0.41
2	DCH04	+0.0031 Tesla	BPM04	+0.05	-0.21
3	DCH05	-0.0018 Tesla	BPM05	+0.58	+0.30
4	DCH10	+0.0022 Tesla	BPM10	+0.37	-0.82
5	DCH11	+0.0048 Tesla	BPM11	-0.36	+0.61
6	DCH14	-0.0013 Tesla	BPM14	-0.28	+0.19

MEBT Quadrupoles

Index	Magnet	Field	Field Set	Current	Current Set
1	QH01	+35.41787 T	+3 4 4 3 2 1 4 T	+300.22472 A	+2 9 1 2 4 3 5 1 A
2	QV02	+37.65545 T	+3 7 3 3 4 5 0 T	+321.19924 A	+3 1 3 5 4 5 8 3 A
3	QH03	+28.89111 T	+2 8 6 0 4 2 8 T	+242.90164 A	+2 4 0 4 6 7 9 2 A

One error in opening the page. For more information, choose Window > Activity.

WebCA and CAML History

Available	Project
June 2006	Prototype WebCA plugin for Safari on Mac OS X
March 2007	Cosylab contracted to extend WebCA and port it to other browsers and platforms
February 2008	CAML as pure XML implementation using WebCA
February 2009	CAML II adds XML namespace for XHTML integration and many new controls...

CAML Controls

Type	Controls
Enumerated	Menu, Radio, Toggle Button, Bit/LED
Incremental	Slider, Wheel Switch
Text	Text Entry, Text Update
Plotting	2D Scatter, Line, Strip, Bar, Waterfall, Intensity
Meter	Gauge

CAML Features

- CAML namespace for easy integration with HTML/XHTML content**
- Virtual PVs for custom calculations**
- Repetition of arbitrary XHTML with substitution**
- Powerful formatting for text controls**
- Contextual menu for controls**
- Automatic plugin download and installation**
- EDL to CAML translator**

CAML XHTML Namespace

- **Mix CAML controls with HTML and other XHTML constructs**
- **caml namespace**

```
<body>  
  <h3>Horizontal Beam Position</h3>  
  <div>  
    <caml:xyChart flavor="advanced" xAxisLabel="Time" yAxisLabel="X Average Position"  
    xAxisStyle="time(HH:MM:ss)">  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM01:xAvg" name="BPM 1" />  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM04:xAvg" name="BPM 4" />  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM05:xAvg" name="BPM 5" />  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM10:xAvg" name="BPM 10" />  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM11:xAvg" name="BPM 11" />  
      <caml:xySeries Y-PVname="MEBT_Diag:BPM14:xAvg" name="BPM 14" />  
    </caml:xyChart>  
  </div>  
</body>
```

Virtual PVs

- Define virtual PVs
- Arbitrary JavaScript can operate on real PV values
- Custom control record configuration
- Scan rate (passive or fixed rate)

```
<caml:virtualPV name="bpmlxy" init="0" eval="(pvs.MEBT_Diag:BPM01:xAvg + pvs.MEBT_Diag:BPM01:yAvg)/2" />
<table class="data">
  <tr> <th>PV</th> <th>Value</th> </tr>
  <tr> <td>MEBT_Diag:BPM01:xAvg</td> <td><caml:textUpdate readbackPV="MEBT_Diag:BPM01:xAvg" /></td> </tr>
  <tr> <td>MEBT_Diag:BPM01:yAvg</td> <td><caml:textUpdate readbackPV="MEBT_Diag:BPM01:yAvg" /></td> </tr>
  <tr> <td>bpmlxy</td> <td><caml:textUpdate readbackPV="bpmlxy" /></td> </tr>
</table>
```

Formatted Text Read Back

value, status, severity, time stamp, units



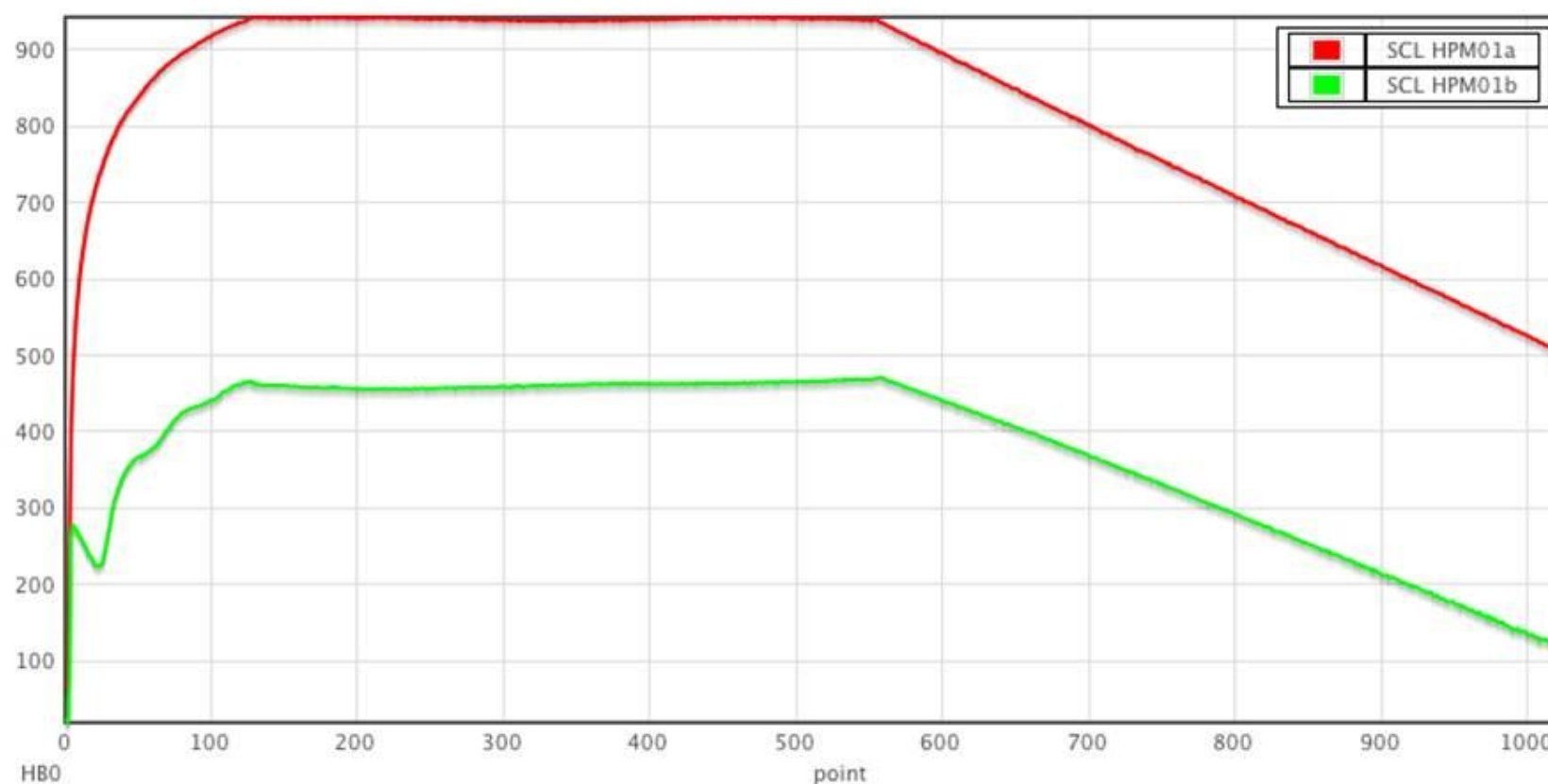
PV Read Back Display Formats

Description	Format	Rendering
Default		399.5 A
Simple Format	0.000	399.513 A
Formatted Value	v(0.0000)	399.5132
Exponential Value	v(0.000E0)	3.995E2
Formatted Value, Units, Alarm, Status	v(0.0000) uas	399.5132 A NO_ALARM NO_ALARM
Nothing but Alarm	a	NO_ALARM
Value, Units, Alarm, Status, Time	vuast	+399.51 A NO_ALARM NO_ALARM 2009-09-15T10:57:09:886
Format with label	'Magnet Current: ' vu	Magnet Current: +399.51 A
Default Time	v(0.000) u t	399.513 A 2009-09-15T10:57:09:886
Dashes	v(0.000) u t(mm-dd-yyyy HH:MM:ss)	399.513 A 09-15-2009 10:57:09
Forward Slashes	v(0.000) t(mm/dd/yyyy HH:MM:ss)	399.513 09/15/2009 10:57:09
Medium Date	v(0.000) t(mmm dd, yyyy HH:MM:ss)	399.513 Sep 15, 2009 10:57:09
Full Time	v(0.000) t(fullDate)	399.513 Tuesday, September 15, 2009
Long Time	v(0.000) t(longTime)	399.513 10:57:09 AM EDT
Nothing but Time	t(HH:MM:ss)	10:57:09

Line Chart



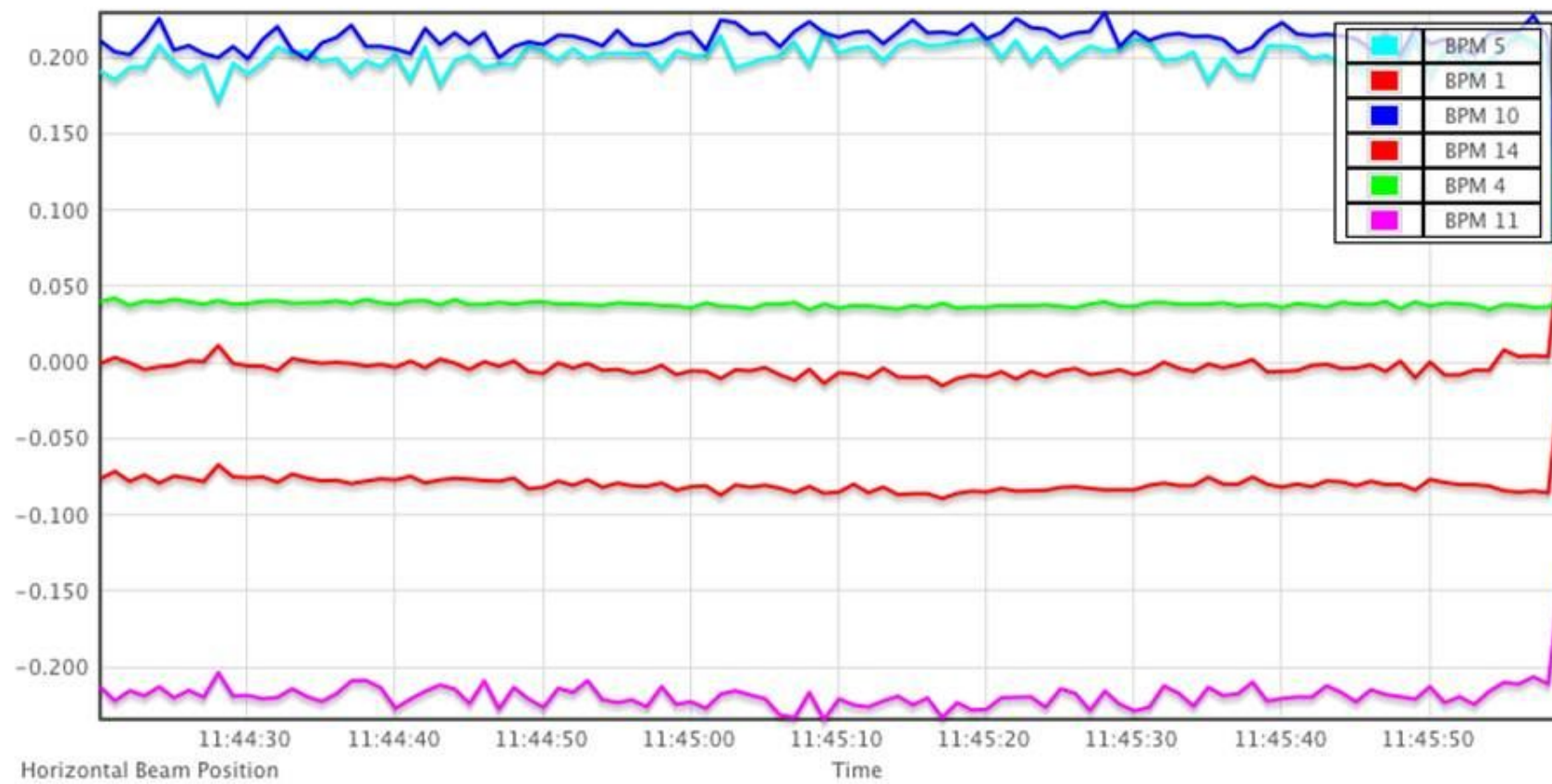
Line Chart Demo



Strip Chart



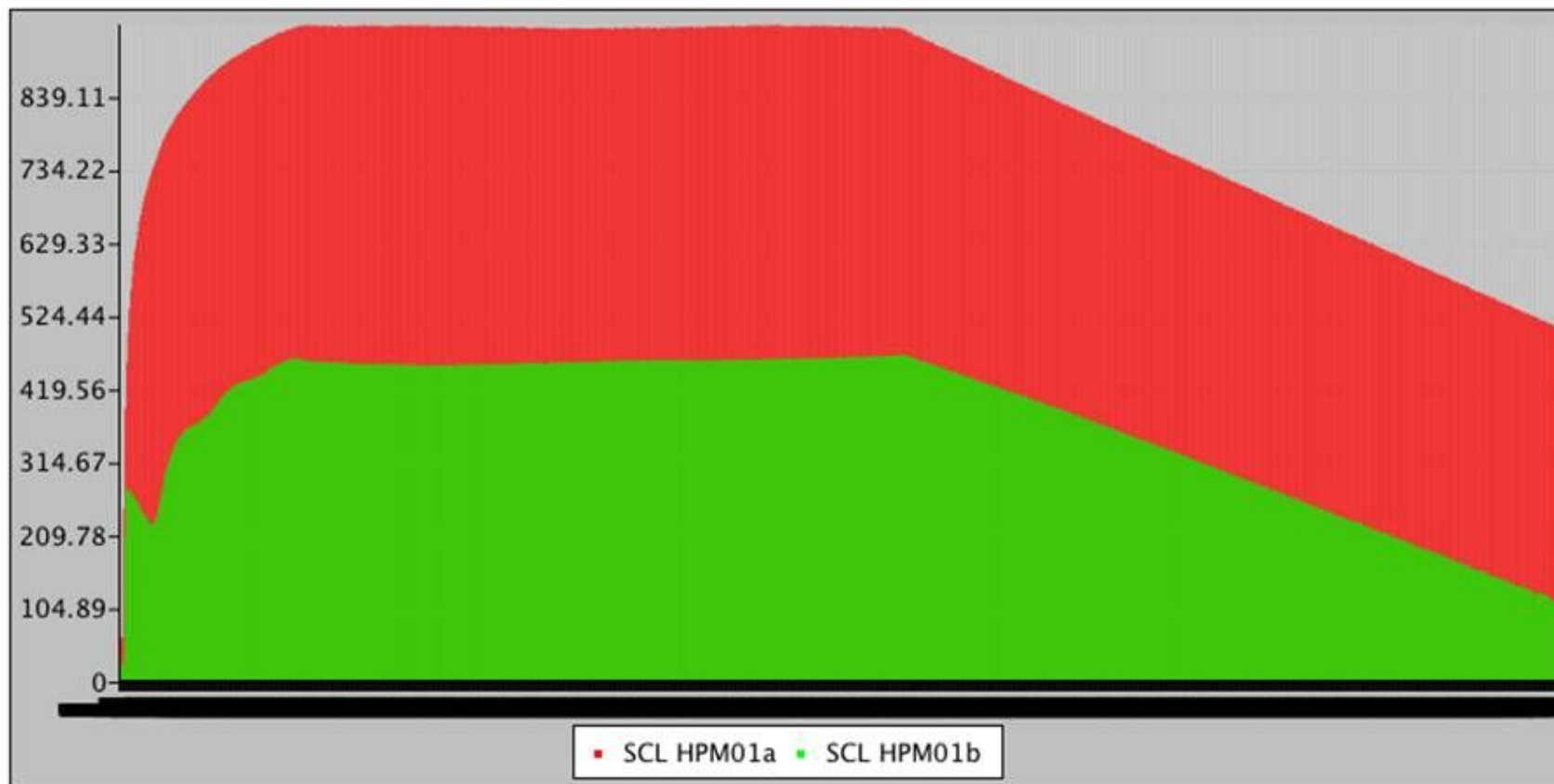
Horizontal Beam Position



Waveform Bar Chart



Bar chart with one bar per Waveform element.



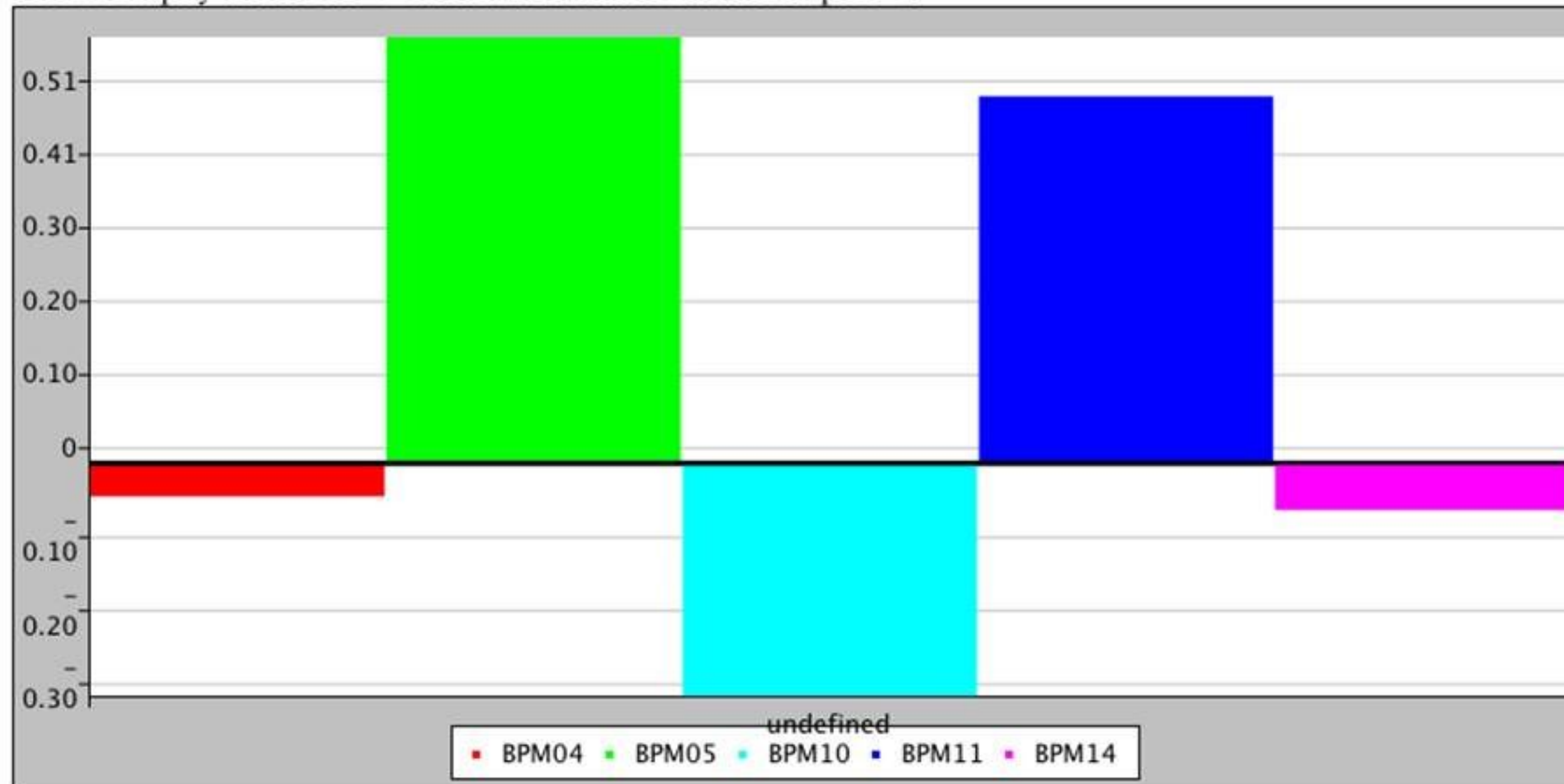
Bar Chart

One PV per Bar



Vertical Beam Positions

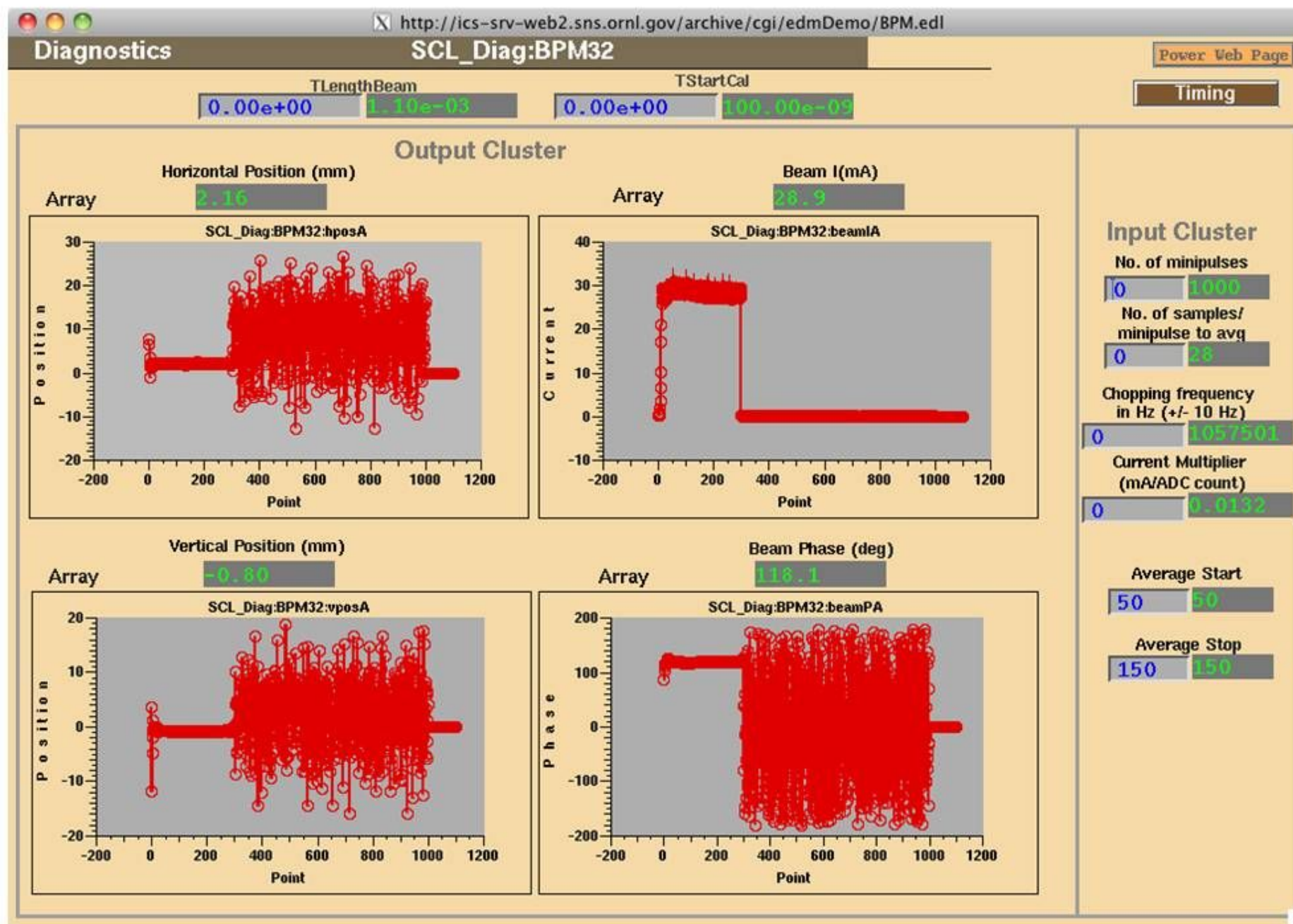
Here we display a series of PV values as a bar chart with one bar per PV.



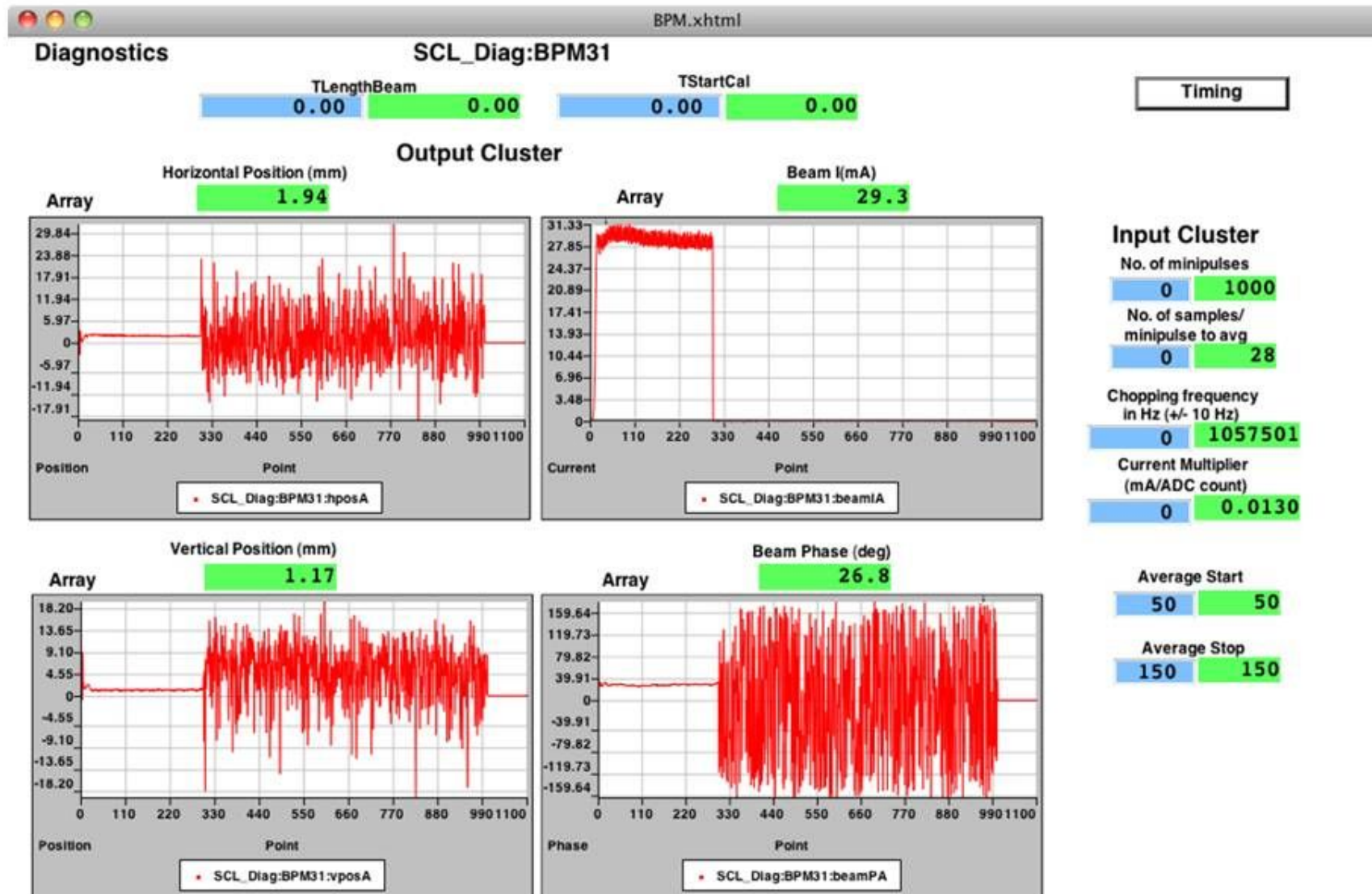
EDL to CAML Translator

- Translates EDL files in a specified folder to CAML files**
- Supports plots, text read backs, links**
- Doesn't support images, background colors**
- Java tool**

Sample EDM Page



Translated CAML Page



CAML Availability

- Runs on Linux, Mac OS X and Windows**
- Targets modern, standards compliant web browsers such as Firefox and Safari**
- Included in latest Channel Access client installer for Mac OS X**
- Further information:**
<http://www.ornl.gov/~t6p/Main/CAML.html>

CAML Windows Channel Access Installer



- Extension of bat script created by David Purcell
- Based on Nullsoft's Scriptable Install System
 - Installs/Configures:
 - Installs plugin for Firefox and Safari
 - Installs CA Repeater
 - Configures Channel Access Environment variables
- Soon to be available

Known Issues

- Contextual Menus are awkward**
- EPICS Channel Access client installation not easy or appropriate for all end users**
- Plots are too slow and all plots need advanced features**
- EDL to CAML translator is too limited and should be implemented as a script instead of Java**
- Mixing an “advanced” chart with a slider causes Safari to crash**
- Other bugs**

Future Features and Tasks

- Abstracted Channel Access source (CA native plugin and fallback CA web service)**
- Channel Access configuration in CAML**
- All plots should be faster and “advanced”**
- Contextual menus replaced with an inspector**
- Enhanced EDL to CAML translator script**
- Support external data input for repetitions**
- Add support for Internet Explorer**