

WebScan (or Goodbye scanSee!)

Visualising sscan data in a web browser

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- 1 Displaying sscan data in a browser
 - Overview
 - The PV Archiver
 - Implementation
 - WebScan

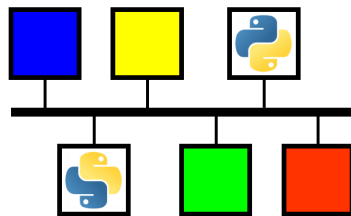
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Why put scans on the web?

- Cross platform (Mac, *nix, Windoze, SunOS)
- Location independent - beamline, guesthouse, home (via VPN)
- Single instance to maintain
- Searchable archive of scan data (currently 7 days stored)

What is it?

- Matt Newville's EPICS PV Archiver
 - Python + PyEpics
 - LAMP server
- WebScan
 - Javascript + Google Chart Tools + ASP



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The PV Archiver

s2pva.xray.aps.anl.gov/cgi-bin/pvarch/show.py

MIC Beamlines Status: Fri Aug 9 17:30:10 2013 [Settings/Admin Help](#)

[General](#) [APS](#) [2-ID](#) [8-BM](#) [28-ID](#) [34-ID](#) [Vacuum](#) [MOTORS](#) [2-ID-B](#) [2-ID-D](#) [2-ID-DF](#) [2-ID-E](#) [8-BM-E](#) [28-ID-C](#) [34-ID-C](#) [Status](#)

Storage Ring

SR Operating Status	Delivered Beam
SR Current [mA]	102.221
SR Lifetime [h]	8.263
Shutter Permit	PERMIT

Shutter Summary

2-ID: A, B, D, E	1. OFF, OFF, OFF
8-BM: A, B	ON, ON
26ID: A, B, C	OPEN, OPEN, OPEN
34-ID: A, B	1. open

Scan Summary

2-ID-B Scan	IDLE
2-ID-E Step Scan	IDLE
2-ID-E Fly Scan	IDLE
2-ID-D Scan	IDLE
2-ID-DF Scan	WAIT-DETECTRS
8-BM-B Scan	IDLE
34-ID-C Scan	WAIT-MOTORS

2ID: U3.3 Undulator

Energy [keV], Gap [mm], Harmonic	10.200, 21.901, 1
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2ID: U5.5 Undulator

Energy [keV], Gap [mm], Harmonic	2.187, 25.067, 1
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26ID: U3.3 Undulator

Energy [keV], Gap [mm], Harmonic	7.822, 18.206, 1
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26ID: U3.3 Undulator

Energy [keV], Gap [mm], Harmonic	7.854, 18.290, 1
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34ID: U3.3 Undulator

Energy [keV], Gap [mm], Harmonic	9.138, 16.016, 1
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[\[APS Storage Ring Status | APS Facility Page | APS OAG Data \]](#)

- The EPICS PV Archiver

cars9.uchicago.edu/~newville/Epics/PVArchiver/

The PV Archiver

MIC Beamlines Status:

Fri Aug 9 17:30:10 2013

[Settings/Admin Help](#)

[General](#) [APS](#) [2-ID](#) [8-BM](#) [26-ID](#) [34-ID](#) [Vacuum](#) [Utilities](#) [2-ID-B](#) [2-ID-D](#) [2-ID-DF](#) [2-ID-E](#) [8-BM-B](#) [26-ID-C](#) [34-ID-C](#) [Scans](#)

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34-ID: A, B

[1, OFF, OFF, OFF](#)

[ON, ON](#)

[OPEN, OPEN, OPEN](#)

[1, open](#)

Scan Summary

2-ID-B Scan

2-ID-E Step Scan

2-ID-E Fly Scan

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34-ID-C Scan

[IDLE](#)

[IDLE](#)

[IDLE](#)

[IDLE](#)

[WAIT:DETECTRS](#)

[IDLE](#)

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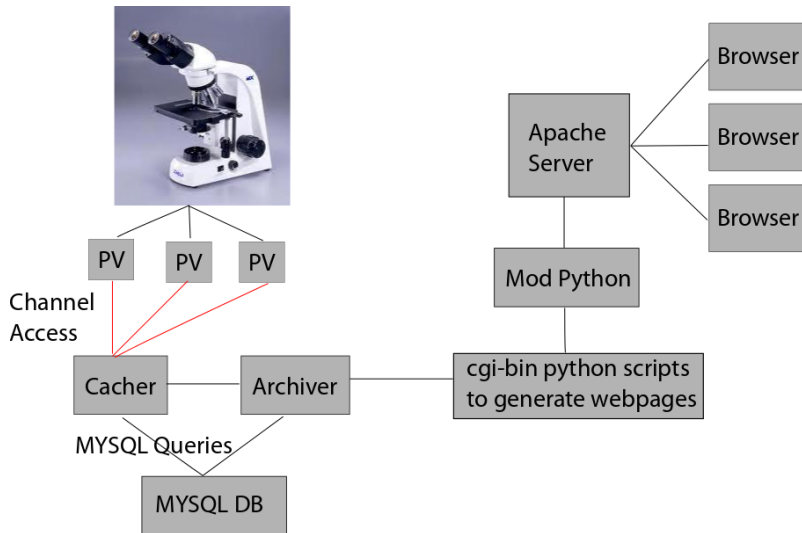
[9.138, 16.016, 1](#)

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● Monitoring \approx 2500 PVs, 7 beamlines, 4 sectors

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System Model - PV Archiver



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Design philosophy

- Different paradigm to Archiver
 - not a replacement for mda files
- Store scan data in MYSQL DB
 - delete entries > 7 days old
- DB atomicity - scan rows
- Cache values to local variable
- Serialize and write arrays to DB
- Using callbacks:
 - no need for handshaking (AAWAIT, AWAIT)
 - sscan performance is not slowed
- Assumes that slow axis → fast axis goes Scan2 → Scan1 → ScanH

Features

Current:

- Realtime line-by-line scan updates
- Realtime images
- Select & deselect detectors at any time during scan
- Oblivious to IOC reboot & scan progress
- Monitor scans in multiple IOCs simultaneously

Planned:

- Click through scan history
- Interactive web pages

Collecting SScan Data

- **Scalar**

- *ioc:scan1.DnnCV*
- Less network overhead

- **Array**

- *ioc:scan1.DnnCA*
- Independent of IOC reboot
- Ensures all data collected

scan_full.adl

\$(N) djv:scan1 TMRF SCAN DIM: 0
llback while scan record is id OK #PTS 201 135

DATA STATE: POSTFD
SAVE DATA Active Wrote data to djv0057.mda

BeforeScan 1.00 BAD LINK Wait

Positioners ACTIVE POSITIONERS CHECK LIMITS
CLEAR POSITIONERS

Read 0.34000
Drive djv:m1.VAL 0.35000

START	CENTER	END	STEP SIZE	WIDTH
-1.00000	0.00000	1.00000	0.01000	2.00000

INITIS degrees SCAN MTRF LINEAR AFS/RFI RELATIVE AFTER SCAN PRTW PUS

POSITIONER SETTLING TIME 0.000 (S) REFERENCE DETECTOR 1

DetTriggers VAL SETTLING TIME 0.000 (S) VAL

1	djv:sim_det:trigger.P	1.000	2	1.000
3		1.000	4	1.000

CLIENT WAIT - + 0 AUTO WAIT FOR 0 CLIENTS

Detectors DIMENSION ACQ MODE SCAN

ID	NAME	DIMENSION	ACQ MODE
01	djv:sim_det:msmt.VAL		0.558
02	djv:sim_det:msmt2.VAL		0.832
03			0.000
04	djv:sim_det:msmt.VAL		0.558

GO
PAUSE
RESUME 1.000 DELAY
ABORT

PLOTS UPDATE EVERY 2.0 SECONDS
COPY LAST POINT THROUGH -1

ArrayTrig 1.00 BAD LINK Less ?
AfterScan 1.00 BAD LINK Wait

Collecting SScan Data

- **Scalar**

- *ioc:scan1.DnnCV*
- Less network overhead

- **Array**

- *ioc:scan1.DnnCA*
- Independent of IOC reboot
- Ensures all data collected

The screenshot shows the 'scan_full.adl' control panel. At the top, it displays the scan name 'djv:scan1' and the scan dimension '0'. Below this, the 'DATA STATE' is 'POSTED' and 'SAVE DATA' is 'Active'. The 'BeforeScan' section has a 'Wait' button. The 'Positioners' section shows 'ACTIVE POSITIONERS' and 'CHECK LIMITS' and 'CLEAR POSITIONERS' buttons. The 'Read' and 'Drive' fields are set to 'djv:in1.VAL'. The 'START', 'CENTER', 'END', 'STEP SIZE', and 'WIDTH' fields are set to -1.00000, 0.00000, 1.00000, 0.01000, and 2.00000 respectively. The 'UNITS' is 'degrees'. The 'POSITIONER SETTling TIME' is 0.000 (s) and the 'REFERENCE DETECTOR' is 1. The 'DetTriggers' section shows four triggers with 'VAL' and 'SETTLING TIME' fields. The 'CLIENT WAIT' is 0 and 'AUTO WAIT FOR' is 0 CLIENTS. The 'Detectors' table has columns for 'DIMENSION' and 'ACQ MODE'. The 'PLOTS' section has 'UPDATE EVERY' set to 2.0 SECONDS and 'COPY LAST PLOT' set to -1. The 'ArrayTrig' and 'AfterScan' sections have 'Wait' buttons. The 'SCAN' button is highlighted in blue. The 'GO', 'PAUSE', 'RESUME', and 'DELTA' buttons are yellow. The 'ABORT' button is red. The 'Less' and '?' buttons are green.

START	CENTER	END	STEP SIZE	WIDTH
-1.00000	0.00000	1.00000	0.01000	2.00000

INITIALS	SCAN MODE	ARS/RFI	AFTER SCAN
degrees	LINEAR	RELATIVE	PRIM PLUS

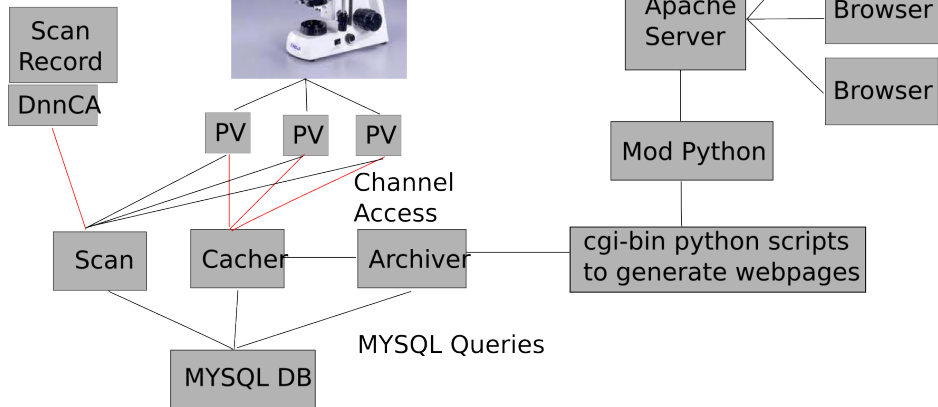
DetTriggers	VAL	SETTLING TIME	VAL
1 djv:sim_det:trigger.P	1.000	2	1.000
3	1.000	4	1.000

Detectors	DIMENSION	ACQ MODE
01 djv:sim_det:msmt.VAL		0.558
02 djv:sim_det:msmt2.VAL		0.832
03		0.000
04 djv:sim_det:msmt		0.558

PLOTS	UPDATE EVERY	SECONDS
	2.0	

ArrayTrig	AfterScan
	1.000

How does it work



Scan Process - Pseudocode

main loop

```
Connect to database  
  
Connect to PVs & add callback  
  
while True:  
    Process queue  
  
    Update scan database
```

on callback

```
Cache new value  
Append pv to queue
```

Process queue

```
while not queue == empty:  
    pvname, value = queue.pop()  
    If pvname ends with "2.EXSC":  
        if value == 1: # 2D Scan Begins  
            ...  
    else if pvname ends with "CA":  
        ...  
    add pvname to scan DB queue
```

Scan Database

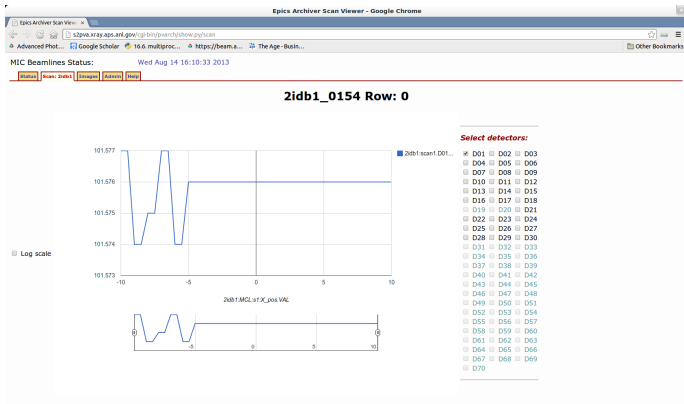
id	pvname	value	row	scan_id	ts
90439	djv:ScanDim.VAL	F2\n.	0	/home/david/data/mda/djv_0091	1376323793.51
82864	djv:scan1.EXSC	I0\n.	0	/home/david/data/mda/djv_0057	1376323952.78

Query for single row

MYSQL: `select value from scan where pvname="djv:scan1.D01CA" and row=0 and scan_id="xxx";`

Python: `self.scan.select('value', 'pvname="djv:scan.D01CA" and row=0 and scan_id="xxx")`

Browser Side Interaction



- Continuous updating with ASP and Google Chart Tools
- Chart tools requires connection to internet to Google JavaScript API (data NOT sent to Google)
- Page uses $\approx 100\%$ of 1 processor

- Add some more advanced features of scan see - derivative, FWHM
- More interactive pages with ASP
- Migrate to Django