

Swiss Light Source

Status Report

June 2006

The Swiss Light Source at the Paul Scherrer Institut is a third-generation synchrotron light source. With an energy of 2.4 GeV, it provides photon beams of high brightness for research in materials science, biology and chemistry.



It is located in North East Switzerland, 40 kms from Zürich.



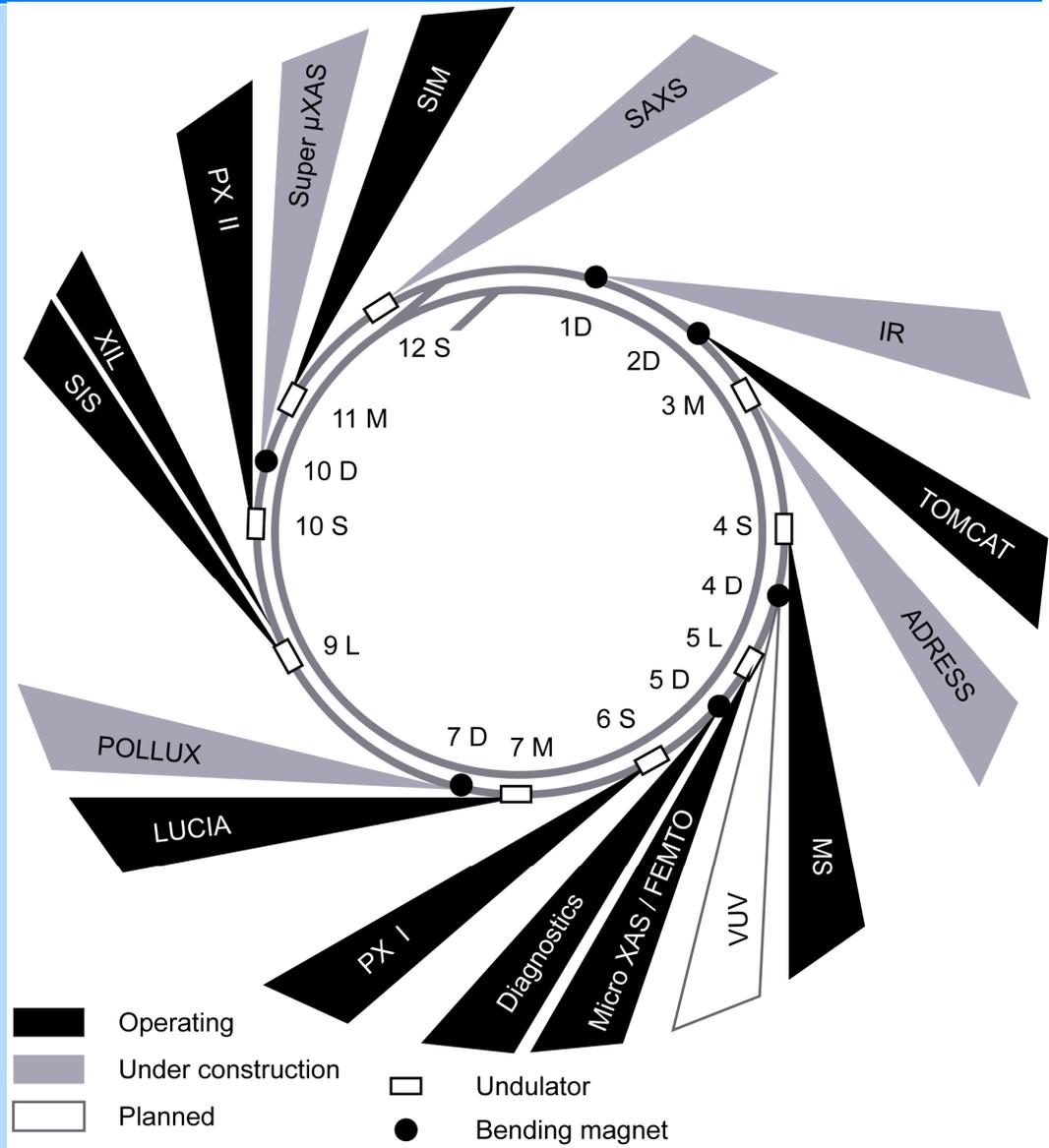
The Swiss Light Source came into operation in 2001, and has significantly strengthened PSI's role as a user laboratory and a unique center for research into structures.

Accelerator

Fully operational and working to agreed specifications.

Beamlines

- 10 are operational.
- 5 under construction.
- 1 in design phase.
- 2 proposed.



Operational Beamlines

X02DA-TOMCAT**X04SA-MS****X05DB-DIAG****X05LA-MicroXAS****X06SA-PX****X07MA-LUCIA****X09LA-SIS****X09LB-XIL****X10SA-PXII****X11MA-SIM****Tomographic Microscopy****Material Sciences****Diagnostics****Environmental / Material Sciences (FEMTO)****Protein Crystallography****Environmental / Material Sciences****Surfaces / Interfaces Spectroscopy****Interference Lithography (Extreme Ultraviolet)****Protein Crystallography****Surfaces / Interfaces Microscopy**

Under Construction

X01DC-IR**X03MA-ADRESS****X07DA-POLLUX****X10DB-Super μ XAS****X12SA-SAXS****Environmental / Material Sciences (Infrared)****Material Sciences****Material Sciences****Material Sciences****Material Sciences**

In Design/Planned

X04DB-VUV**X05DA-OPTICS****X06DA-PXIII****Environmental / Material Sciences (Ultraviolet)****Material Sciences****Protein Crystallography**

+ 6 additional bending ports – No specific plans yet

Operations

Excellent reliability and availability: in year 2005, downtime due to control system problems was accounted to be 2.4 hours (most of it due to booting a wrong IOC by mistake.)

Fast (and Slow) Orbit Feedback, Top-Up and Filling Pattern Feedback in routine operation. Integrating more X-Ray BPMs into the orbit feedback.

Scheduled Uptime	5063.4h
Delivered Uptime	4981.2h
beamlosses	67
Total Downtime	82.2h
Availability	98.4%

Downtime due to Control System problems 0.047%

Controls Issues

We are running EPICS 3.13.10 and vxWorks in 240 VME crates.

soft IOC's on standard PC's running LINUX and EPICS 3.14.8

Siemens PLC's for RF, ID's, machine and beamline safety interlock,
Vacuum System (new) interfaced to EPICS via ethernet (point to point)

Topics Presented

Source code and release management

Driver and library handling

Applications

Hardware Status

CVS - for source code control

- Command line - "cvs co FEMTO"
- GUI - tkcvs, eclipse and TortoiseCVS
- CVSweb - web interface

3 main domains

- Accelerator (A)
- Beamlines (X)
- General Applications (G)

statcvs - for repository statistics

statcvs + sls script + cron job =

Daily Status Report

A - Lines Of Code 839305

X - Lines Of Code 4734848

G - Lines Of Code 7574719

<http://statcvs.sourceforge.net/>

Development Statistics for X

Summary Period: 2000-12-19 to 2006-05-31

Generated: 2006-06-01

- [Authors](#)
- [Commit Log](#)
- [Lines of Code](#)
- [File Sizes and File Counts](#)
- [Directory Sizes](#)

Lines of Code



Total Lines Of Code: 4734848 (2006-05-31 16:58)

Software Reuse

The **sinstall** program installs project software into suitable working directories.

At install time links are made from the released application to the IOC boot directories corresponding to which version of EPICS is in use and which version of the operating system is being used in that IOC.

This allows different IOC's to be upgraded at different times.

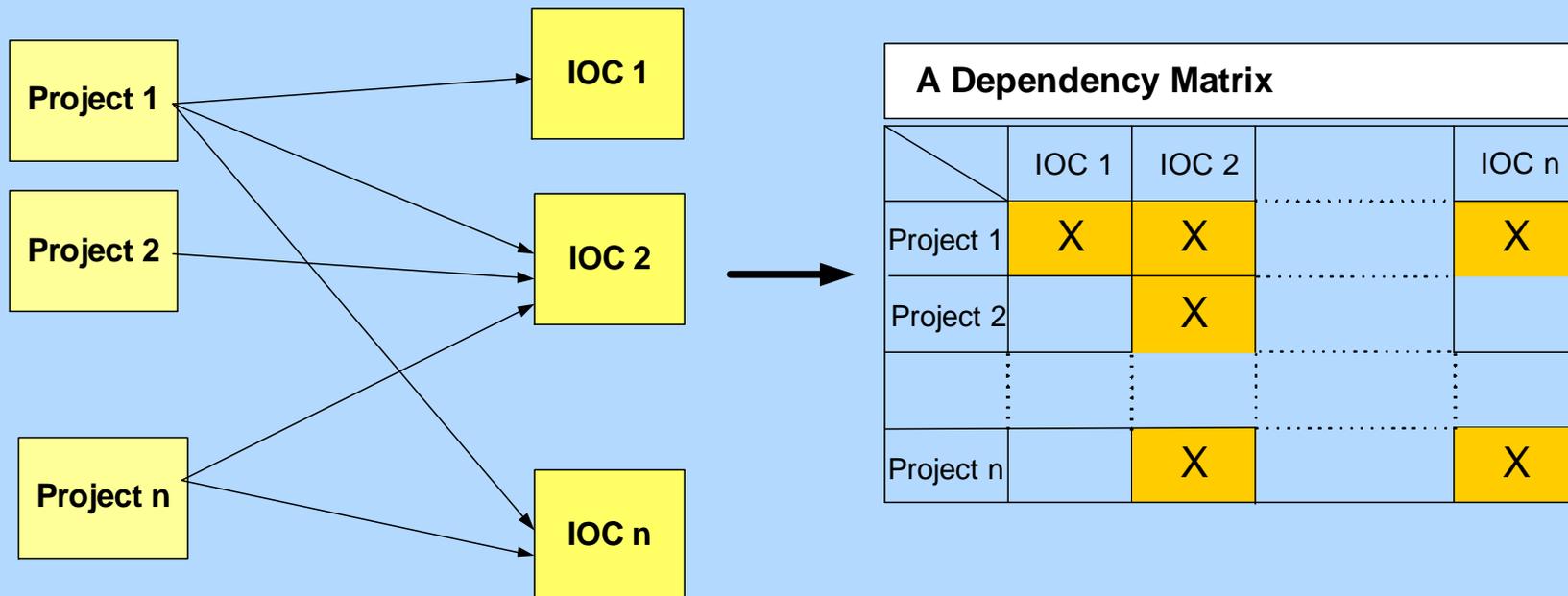
For the application a new version of EPICS only requires a change to the Oracle database and a re-install of the project.

Software Reuse

```
ls -G -g /prod/iocBoot/ioc/ARIAL-VME-1
lrwxrwxrwx    ARIAL-VME-1_ENCODER.subs -> ../../../../iocBoot/A/AL/ENCODER/ARIAL-VME-1_ENCODER.subs
lrwxrwxrwx    ARIAL-VME-1_HLS.subs -> ../../../../iocBoot/A/AL/HLS/ARIAL-VME-1_HLS.subs
drwxr-xr-x    dbd
lrwxrwxrwx    ENCODER_check.template -> ../../../../iocBoot/A/AL/ENCODER/ENCODER_check.template
lrwxrwxrwx    ENCODER.template -> ../../../../iocBoot/A/AL/ENCODER/ENCODER.template
lrwxrwxrwx    HLS.template -> ../../../../iocBoot/A/AL/HLS/HLS.template
lrwxrwxrwx    iocCore -> ../../R3.13.10/T2-ppc604/iocCore
lrwxrwxrwx    slsLib -> ../../R3.13.10/T2-ppc604/slsLib
lrwxrwxrwx    slsMain.dbd -> ../../R3.13.10/dbd/slsMain.dbd
-rw-r--r--    startup.script
-rw-r--r--    startup.script_ENCODER
-rw-r--r--    startup.script_HLS
lrwxrwxrwx    utilLib -> ../../R3.13.10/T2-ppc604/utilLib
lrwxrwxrwx    vxWorks -> ../../T2-mv2300/vxWorks
lrwxrwxrwx    vxWorks.sym -> ../../T2-mv2300/vxWorks.sym
```

Software Reuse

- one or more projects can be installed in one or more IOCs
- each project could require a different version of software
=> conflicts may arise



“require” keyword in startup.script

- **Standard method to load default libraries at startup of IOC.**
- **Flexible to allow test versions.**
- **Replaces need to explicitly define in each IOC startup script the library and dbd file locations.**
- **Guarantees all IOC's will get the latest version automatically when the library and dbd file is upgraded.**

```
require “motor”  
# OMS motor library and dbd files (Default Version)  
require “SSI”,“test”  
# SSI encoder library and dbd files (Test Version)  
require “SynApps”,“1.2.3”  
# Applications version 1.2.3
```

The last require will load (for example) :-

```
/prod/iocBoot/R3.13.10/dbd/SynApps-1.2.3.dbd  
/prod/iocBoot/R3.13.10/T2-ppc604/SynAppsLib-1.2.3
```

Information Collection

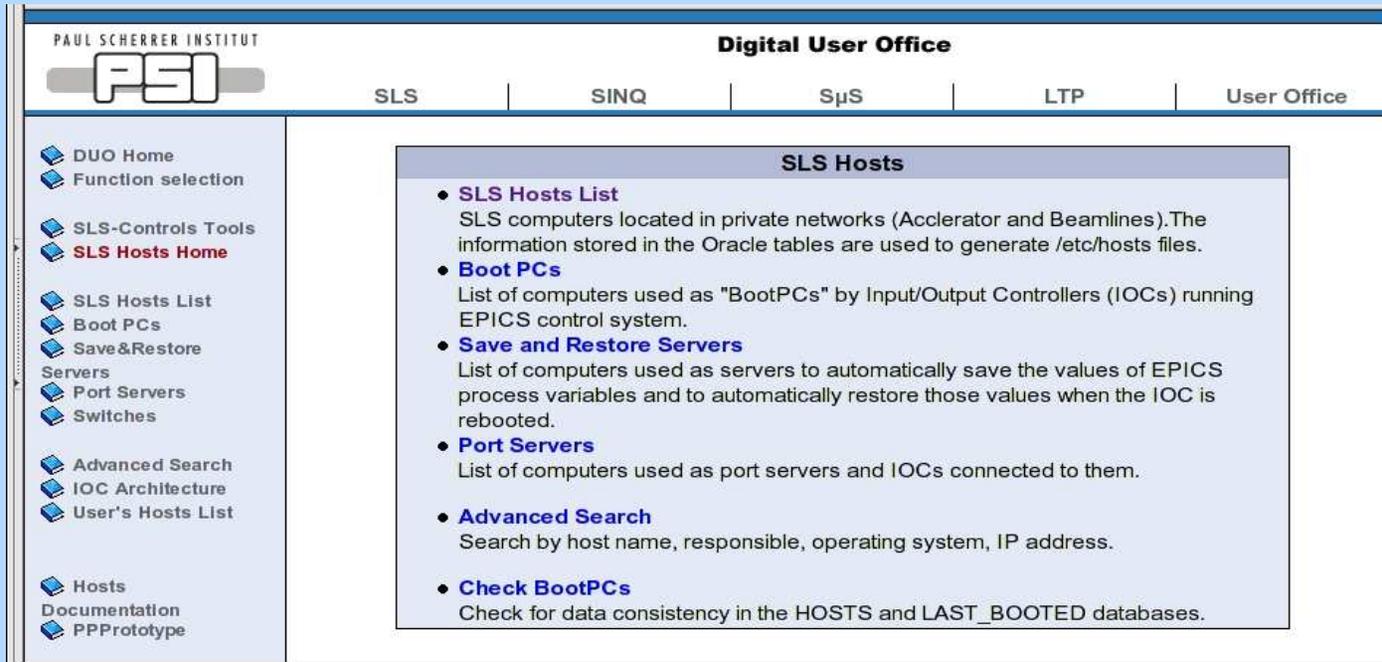
Extensive use of a relational database (Oracle)

Software release – Tagged version – all project files listed in RDB

Host tables

Controls Inventory Database (CIDB)

Boot hosts



The screenshot shows the Digital User Office (DUO) web interface. At the top, it displays the PSI logo and the text "Digital User Office". Below this, there are navigation tabs for "SLS", "SINQ", "SpS", "LTP", and "User Office". The main content area is titled "SLS Hosts" and contains a list of links and descriptions:

- **SLS Hosts List**
SLS computers located in private networks (Accelerator and Beamlines). The information stored in the Oracle tables are used to generate /etc/hosts files.
- **Boot PCs**
List of computers used as "BootPCs" by Input/Output Controllers (IOCs) running EPICS control system.
- **Save and Restore Servers**
List of computers used as servers to automatically save the values of EPICS process variables and to automatically restore those values when the IOC is rebooted.
- **Port Servers**
List of computers used as port servers and IOCs connected to them.
- **Advanced Search**
Search by host name, responsible, operating system, IP address.
- **Check BootPCs**
Check for data consistency in the HOSTS and LAST_BOOTED databases.

On the left side of the interface, there is a sidebar menu with various options:

- DUO Home
- Function selection
- SLS-Controls Tools
- SLS Hosts Home**
- SLS Hosts List
- Boot PCs
- Save&Restore
- Servers
 - Port Servers
 - Switches
- Advanced Search
- IOC Architecture
- User's Hosts List
- Hosts
 - Documentation
 - PPPPrototype

Controls Inventory Database (CIDB)

This is a new application (in operation since February this year) which supplies users with information about the control system hardware using an Oracle database.

It's purpose is to keep track of what hardware modules are installed, what is in stock, the components in repair, on loan or otherwise not deployed. It supports the hardware purchasing, delivery to users, maintenance and quality management.

CIDB functionality is largely complementary to IRMIS. Integrating CIDB functionality into IRMIS would be beneficial.

System information +

System name: ARIAL-VME-6	Responsible: Dennis Armstrong	Facility/Group: SLS/Alignment System
SLS HostDB: ARIAL-VME-6 (Note: If there is no host in this system this link would point to an error page)		
Description: 		
History:		

Crate [CR148](#) located at WSLA.42.0.5

Additional hardware	
PSU 16878	empty

Front

01	IOC167	empty	empty
02	empty		
03	empty		
04	SSI008		
05	empty		
06	empty		
07	empty		
08	IPC635	empty	IPA238 IPA317
09	empty		
10	empty		
11	empty		
12	empty		
13	SSI043		
14	SSI054		
15	empty		
16	empty		
17	empty		
18	empty		
19	empty		
20	empty		
21	empty		

Back

01	empty		
02	empty		
03	empty		
04	empty		
05	empty		
06	empty		
07	empty		
08	TAP013	empty	empty
09	empty		
10	empty		
11	empty		
12	empty		
13	empty		
14	empty		
15	empty		
16	empty		
17	empty		
18	empty		
19	empty		
20	empty		
21	empty		

FEMTO Installation

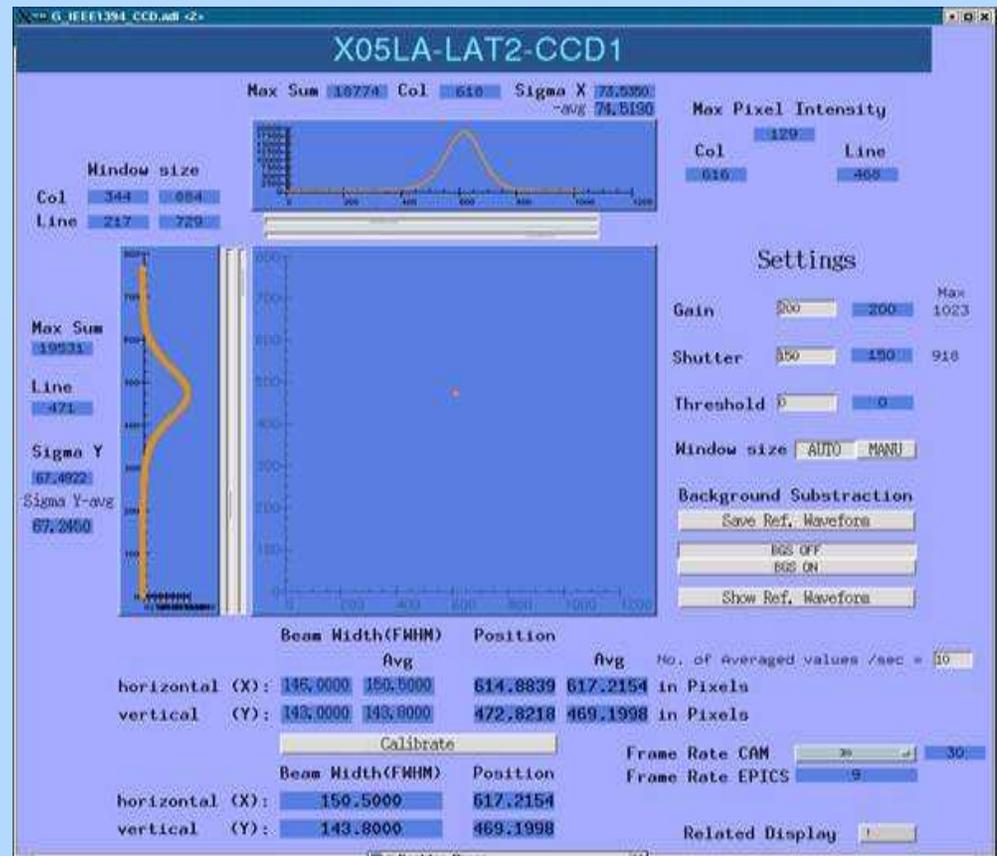
FEMTO Slicing Laser Stabilization Feedback

- **LeCroy oscilloscope application required an EPICS interface but only supports DCOM under Microsoft windows.**
- **Effort expended to use a DCOM to EPICS interface.**
- **Feedback to stabilise laser.**
- **Radiation effects on the firewire camera when the beam is not well stabilised or focused.**

Firewire Cameras

The CCD1394 project

- Standard application
- Able to handle any firewire camera that supports IIDC V1.3 (DCAM)
- Interfaces to a standard PC with a firewire port.
- EPICS control with video display on a PC running Linux Fedora Core 1 and EPICS 3.14
- 8 cameras in use – 10 more being installed/planned.
- Upgrading OS to Scientific Linux 3.
- Problems using EPICS CA gateway, a buffer size problem.
- Would like to use dynamic resizing with EPICS CA Protocol.



<http://epics.web.psi.ch/software/firewire>

Girder Control for Beamlines

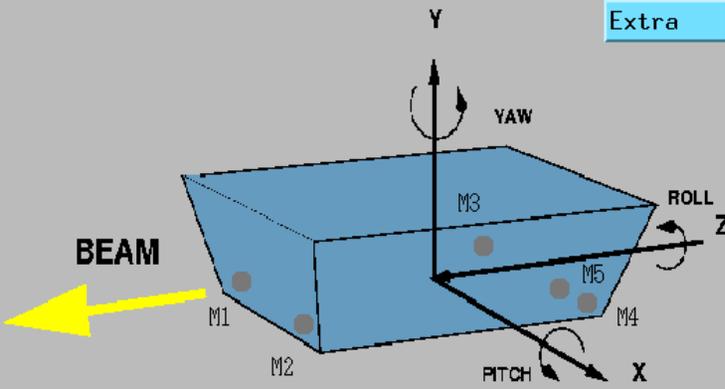
The HEXGIR project

X G_HEXGIR_X07DA.adl

5D GIRDER MOVER: X07DA-HG

MOVING: ●

Out of range:
 M1 ●
 M2 ●
 M3 ●
 M4 ●
 M5 ●
 V L H S R



AXIS	REARBACK	SETPPOINT	TWEAK	SAVED
X [mm]:	-0.000	0.000	< 0.01000 >	0.000
Y [mm]:	0.000	0.000	< 0.01000 >	0.000
Z [mm]:	0.000			0.000
PITCH [mrad]:	-0.001	0.000	< 0.01000 >	0.000
YAW [mrad]:	-0.001	0.000	< 0.01000 >	0.000
ROLL [mrad]:	0.000	0.000	< 0.01000 >	0.000

STOP LOAD POSITION SAVE POSITION

- 5 or 6 Degrees Of Freedom girder controller (X,Y,Z,Roll,Yaw,Pitch).

- Fully Parameterised for different girder dimensions.

- Standard application.
- Operational in X11MA beamline.

- Being installed in X03DA and X07DA beamlines.

- Very responsive control system scans and setup 6x faster than the old system.

Motors

We have been using the Oregon Micro Systems OMS58 VME cards for motor control.

The OMS card is becoming obsolete. We are currently looking for a replacement for this card. It should be as widely usable as possible (all or most applications at PSI: SLS machine & beamlines, proton accelerators, future projects).

We are looking at OMS MAXv: known architecture, good performance, supports stepper and servo motors with (almost) the same API.

However some requirements are difficult to fulfill:

- Synchronising data acquisition with movements
- OMS (Pro-Dex) support is sub-optimal

vxWorks Upgrade

- **All operational IOC's are now running Tornado 2 and EPICS V3.13.10.**
- **We have gained valuable experience which will ease the upgrade path to run EPICS 3.14 on vxWorks V5.5. We moved from vxWorks 5.3.1 and Tornado 1.**
- **Information flow – 20 people involved.**
- **Bootstrap Loader – Reprogrammed Boot ROM in over 200 IOC's.**
- **saveData application now runs in soft IOC – ported from VME due to problems running under T2.**
- **Network problems with vxWorks V5.5 code - merged the V5.5.1 network code.**

Outsourcing Beamlines

We have outsourced one beamline but this has not yet been fully installed. We still have an open mind about this process.

Integration with the existing EPICS control systems take time (safety issues etc.)

This may not have much benefit for the controls group.

Future Plans

- Upgrade to EPICS 3.14 on VME IOC's aim for a December 2006 prototype with all drivers working and tested.
- Deploy the new version in 2007.
- Upgrade to Scientific Linux 3 completed for all PC's on beamlines.
- Planning for Scientific Linux 4 upgrade.
- Investigate use of microIOC's.
- ECLIPSE for Application Development Environment.
- IRMIS integration.
- More applications on VME cards, extend the use of DSP's.
- We are looking at the Motorola mvme3100 CPU card as our possible new standard platform (price!). We will probably support also mvme6100 cards in case more CPU power is needed. However the 6100 is for many applications too powerful. It also generates a lot of heat, a problem in non airconditioned areas during summer.

Thanks to the EPICS Community