



*... for a brighter future*

# ***BCDA Update***

## ***APS Monthly Operations Meeting***

### ***2007-06-27***

*Pete R. Jemian, AES/BCDA, Group Leader*  
*Beamline Controls and Data Acquisition*  
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U.S. Department  
of Energy

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# BCDA Staff

Name	Phone	Pager	Responsibilities	CAT contact
Marianne <b>Binetti</b>	2-5023	-	Group Secretary	-
Ken <b>Evans</b>	2-5110	-	Scientific Software Section	-
Peter <b>Fuesz</b>	2-5621	4-5621	Electronics Technician	-
Kurt <b>Goetze</b>	2-7959	4-7959	EPICS application development and support, hardware design	XOR-1, XOR-3, IXS(30)
John <b>Hammonds</b>	2-5317	630 417 8836	IPNS Controls and Computing, EPICS Extensions	All IPNS beamlines
Pete <b>Jemian</b>	2-3189	-	Group leader, paperwork, meetings	XOR-33, XOR-34
Xuesong <b>Jiao</b>	2-8644	-	SPEC application development, beam line support	XOR-11, XOR-12
David <b>Kline</b>	2-8639	4-8639	EPICS brick, EPICS application development and support, real time software engineering	IMCA(17), LS(21), Nano(26)
Tim <b>Mooney</b>	2-5417	4-5417	Software design, synApps code management, EPICS Application development and support	XOR-4, XOR-7
Ron <b>Sluiter</b>	2-7309	4-7309	EPICS motor record support, software integration	XOR-2, XOR-32
Joe <b>Sullivan</b>	2-8657	4-8657	EPICS Application development and support, real time software engineering	XOR-8, XOR-9, XOR-20
Brian <b>Tieman</b>	2-0141	4-0141	high-performance computing, image detector support, application software development and support	XOR-2BM-tomo

## Contact-collaborator relationship

- Contact person maintains relationship with beam line
- Collaborators called on (internally) within BCDA as needed

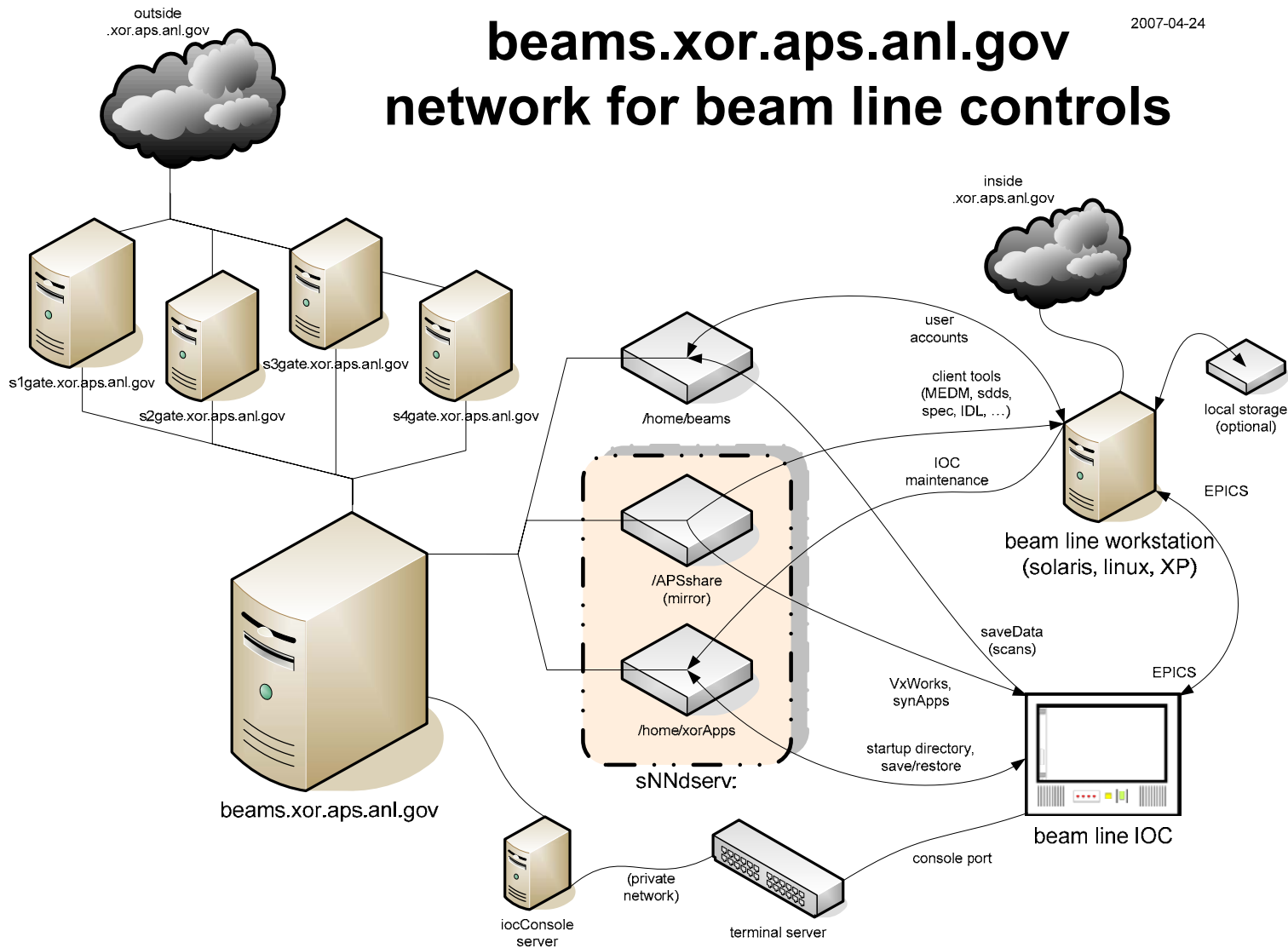
# NEWS

- synApps, current version 5.2.1 (built on EPICS R3.14.8.2)
- saveData software
  - Important bug fix (previously announced through beamline\_controls list)
  - IOC name length
- scanSee software – planning for replacement
- Various EPICS device support: Picomotors, more PI piezo controllers, ...
- Modbus support from Mark Rivers, CARS
  - includes Koyo/AutomationDirect PLCs
- Wind River (VxWorks) License
  - Enterprise license agreement is delayed
  - Will renew current perpetual license (so no upgrades yet)
- OS upgrades on every platform (except VxWorks)
- Transition from CVS to subversion
- Rebuilding EPICS extensions
- Environment variables for EPICS on UNIX/Linux systems in XOR
- Web service to support user-directed tomography processing
  - Initial implementation is within APS network

# *iocConsole*

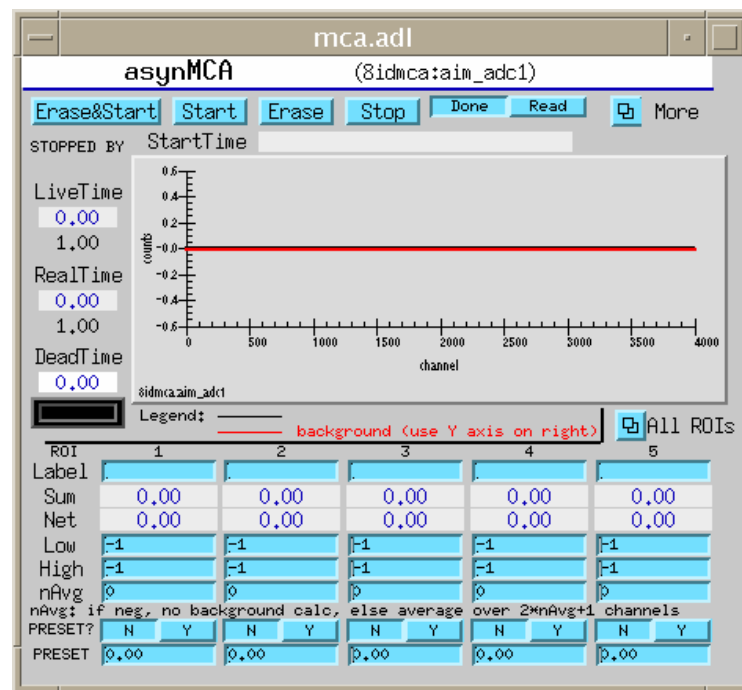
- Provided by Accelerator Controls group and IT group
  
- iocConsole
  - Software/hardware system to provide remote access to IOC console port
  - Simplifies EPICS system maintenance
  - Developed and used by accelerator controls group
  - AES/IT installed terminal servers are compatible with the BCDA supported 'screen' server system
  - IOC console port connections from any XOR computer (approved users)
  - Persistent serial connections (archive of IOC diagnostic messages)
  - Multiple connections to IOC debug port
  - VME IOCs only for now
  - Implementation for fixed-location E-brick IOCs is planned
  
- Running in Sector 7, 9, & 32
  - Will install with major IT upgrades from now on

## beams.xor.aps.anl.gov network for beam line controls

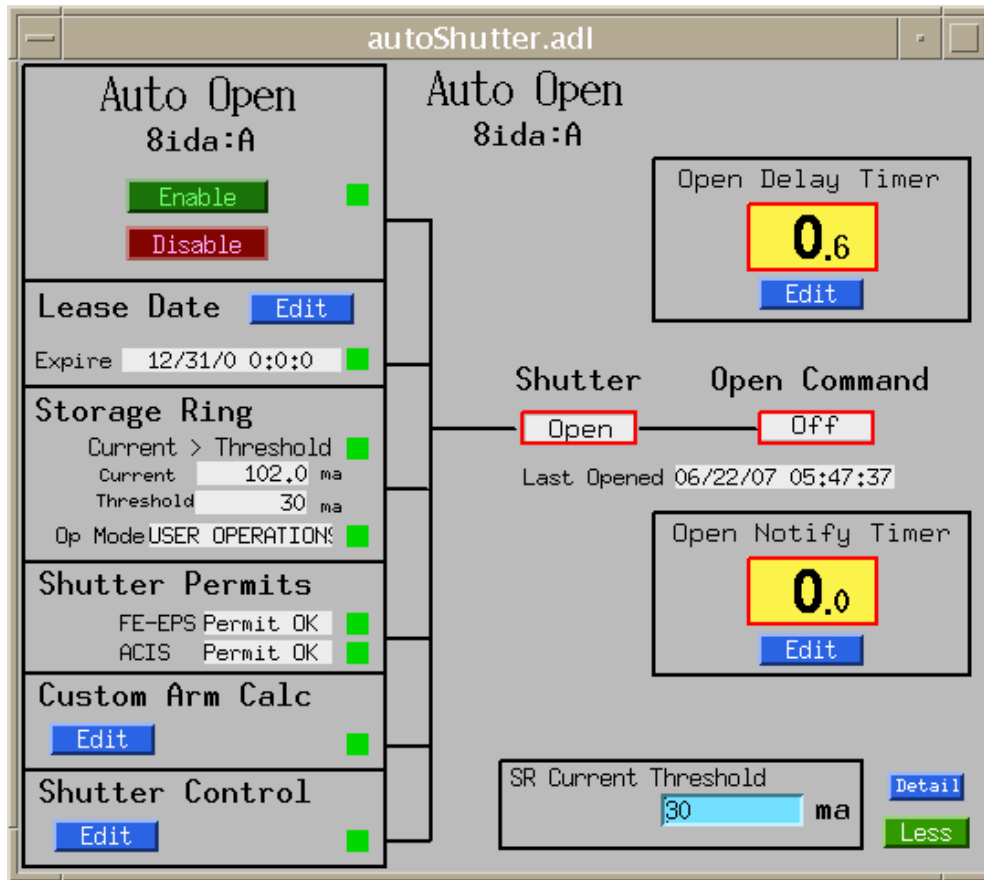


# Sector News

- Sector 3 control system EPICS / SynApps upgrade
  - Major software upgrade for all 4 beamline VME crates
  - Completed during the last shutdown
  - No beam time lost due to upgrade.
- Sector 8:
  - AIM MCA support (M. Rivers) was moved from 8-ID-E VME into Ebrick
  - AIM MCA and EPICS control system can move with the data acquisition hardware
  - XPCS 60 fps operation achieved with CCD Image Server
  - XPCS computation cluster code is not yet fully optimized, however, able to get analysis performance that very closely matches acquisition performance...we might have a shot at performing these sorts of experiments in true real-time!



# Auto Front-End Shutter Open Support



- Design review in 2006
- Requirements of several sectors incorporated
- Support standardized across XOR beamlines
- Remote Shutter interface support decoupled
- Can now run on beamlines without the 'Remote Shutter' device

## More Sector News

### ■ Sector 7:

- AES/IT has moved Sector 7 to the XOR network.
- Sector 7 beamline control systems now boot from XOR file servers and are directly supported by BCDA.
- IOC upgrades (hardware and software) are planned during the run

### ■ Sector 9:

- AES/IT has moved Sector 9 to the XOR network.
- Sector 9 beamline control systems now boot from XOR file servers and are directly supported by BCDA.
- IOC crate upgrades (hardware and software) are planned for the next shutdown.

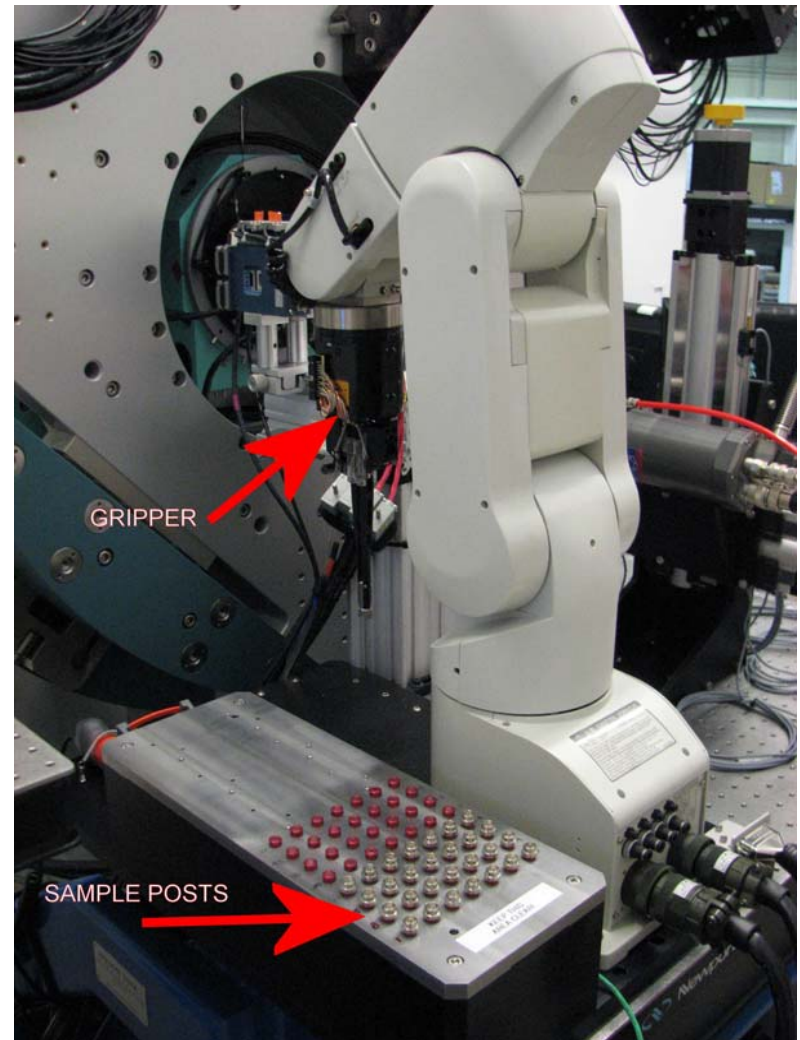
### ■ IMCA (Sector 17) remote shutter controls upgrade

- Replaced existing hardware and updated software
- New system is less complicated, more robust
- Solves a problem with VME resets causing unwanted open requests.



## Controls for sample changer for 11-BM

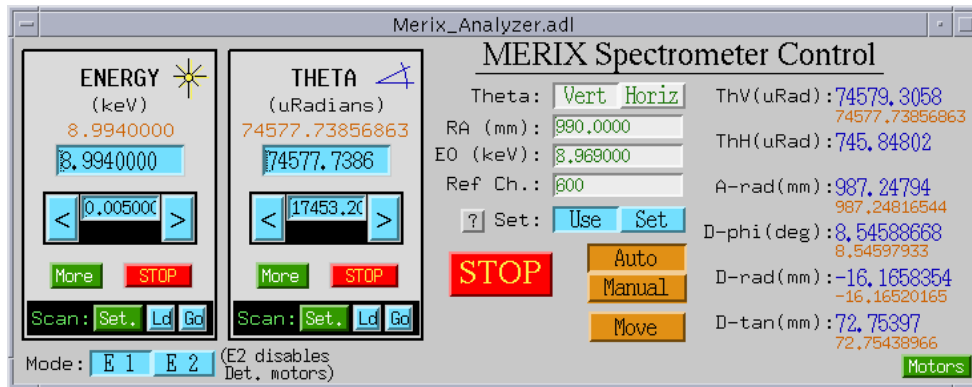
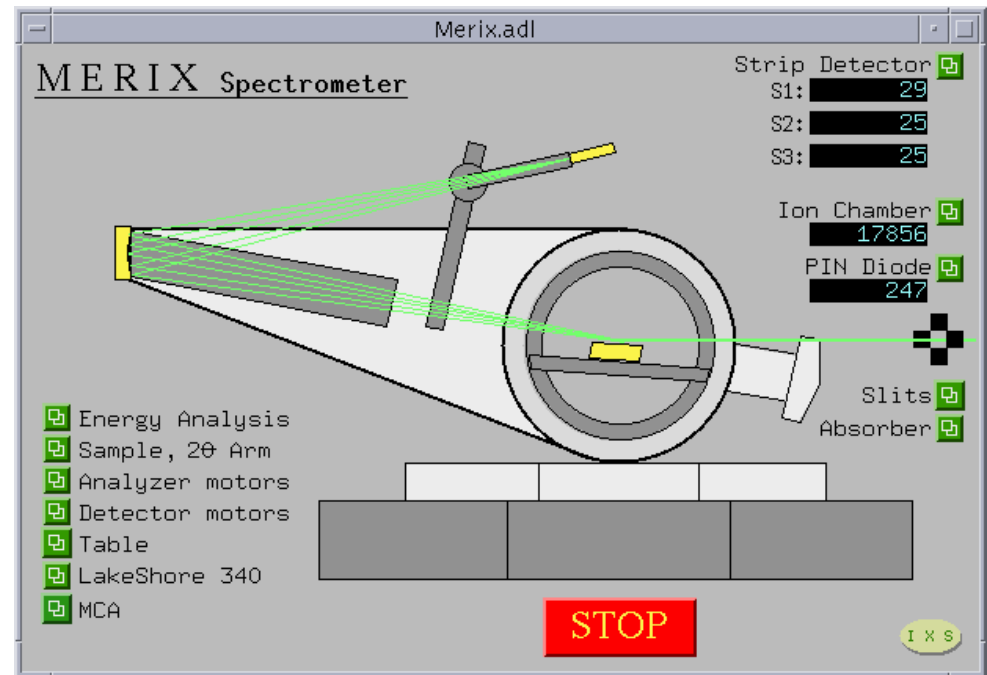
- Collaboration with Mechanical Engineering & Design Group
- Capacity: 56 samples (to be expanded with magazines)
- Small footprint and easy sample access
- Proven reliability of Mitsubishi industrial robot
- Robot human safety system ensures safe operation
- Integration into the data collection process through the use of a control script that coordinates sample mounting, diffractometer control, and data collection
- Strain gauge interface system for sample changer "hand". Designed, built to:
  - Detect and assert collision condition
  - Detect and assert *have sample* condition



## More Sector News: Sector 30

### Significant BCDA contributions provide solutions and support for

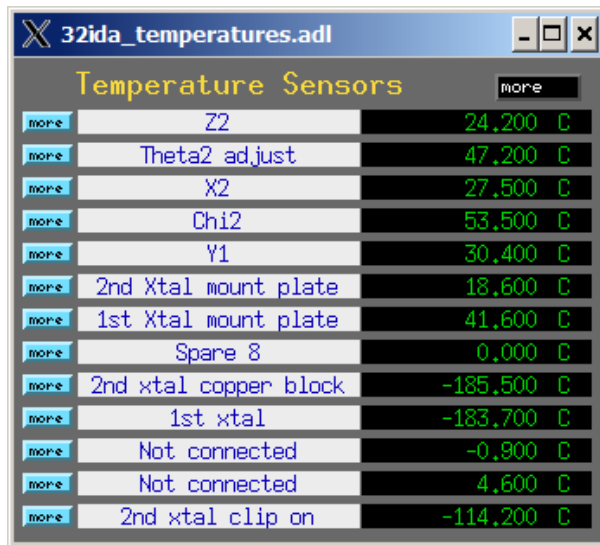
- Fundamental beamline controls hardware/software capability for entire beamline.
- EPICS support for high precision ceramic nanomotion system for the MERIX analyzer
- EPICS and SPEC support for MERIX 640-Channel microstrip detector.



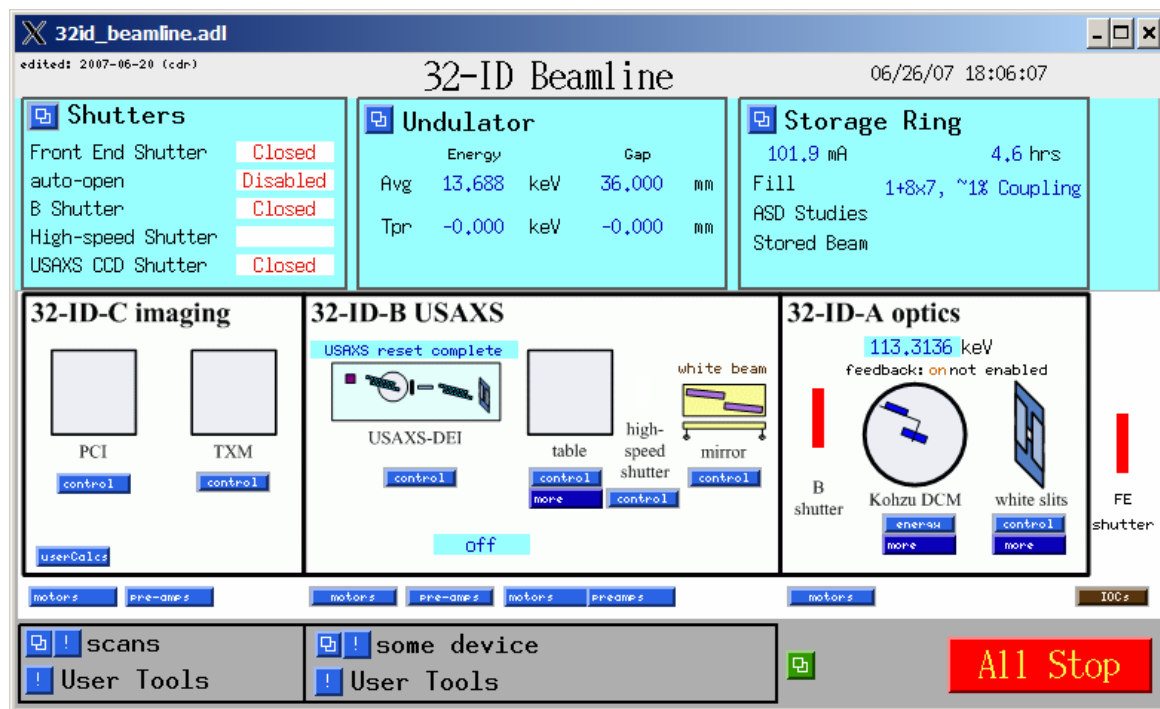
- Most commissioning is done
- now running with outside users as of early spring '07.

## More Sector News: Sector 32

- Added two IOCs to support the new 32-ID-C hutch.
- Additional temperature sensors supported by E-brick
- Example troubleshooting: IOC32IDA failed to boot
  - Initial assumption: network problems
  - problem found: noise on the RS-232 serial connection from an Oxford ILM202 (cryo pump LN2 level meter) to the IOC32IDA



Temperature Sensors		
more	Z2	24,200 C
more	Theta2 adjust	47,200 C
more	X2	27,500 C
more	Chi2	53,500 C
more	Y1	30,400 C
more	2nd Xtal mount plate	18,600 C
more	1st Xtal mount plate	41,600 C
more	Spare 8	0,000 C
more	2nd xtal copper block	-185,500 C
more	1st xtal	-183,700 C
more	Not connected	-0,900 C
more	Not connected	4,600 C
more	2nd xtal clip on	-114,200 C



32id\_beamline.adl  
edited: 2007-06-20 (cdr)  
32-ID Beamline  
06/26/07 18:06:07

**Shutters**  
Front End Shutter: Closed  
auto-open: Disabled  
B Shutter: Closed  
High-speed Shutter: Closed  
USAXS CCD Shutter: Closed

**Undulator**  
Energy: Avg 13,688 keV, Tpr -0.000 keV  
Gap: 36,000 mm, -0.000 mm

**Storage Ring**  
101.9 mA, 4.6 hrs  
Fill: 1+8x7, ~1% Coupling  
ASD Studies  
Stored Beam

**32-ID-C imaging**  
PCI, TXM, control buttons, UserCalcs

**32-ID-B USAXS**  
USAXS reset complete, USAXS-DEI, control button, off

**32-ID-A optics**  
113.3136 keV, feedback: on not enabled  
B shutter, Kohzu DCM, white slits, FE shutter, control buttons, more

motors, pre-amps, IOC's

scans, some device, User Tools

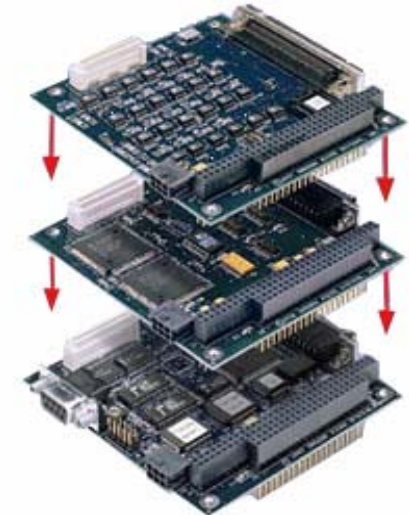
**All Stop**

## EPICS Brick (BC-043)

- Alternative EPICS IOC (server), ~\$1500+
- PC104 (Diamond Systems, Athena model)
- Vector Linux (linux-x86) on 40GB hard disk
- Soft EPICS IOC from /home/xorApps/...
- 4 serial ports
- 4 DAC (12-bit), 16 ADC (16-bit), 3 banks of 8-channel DIO
- Expandable
  - More analog/digital I/O
  - Pro-Dex (OMS) PC78 motor controllers
  - BCDA FPGA-based scaler
  - Serial ports
  - RTD, thermocouple, strain gauges, ...



**BC-043**



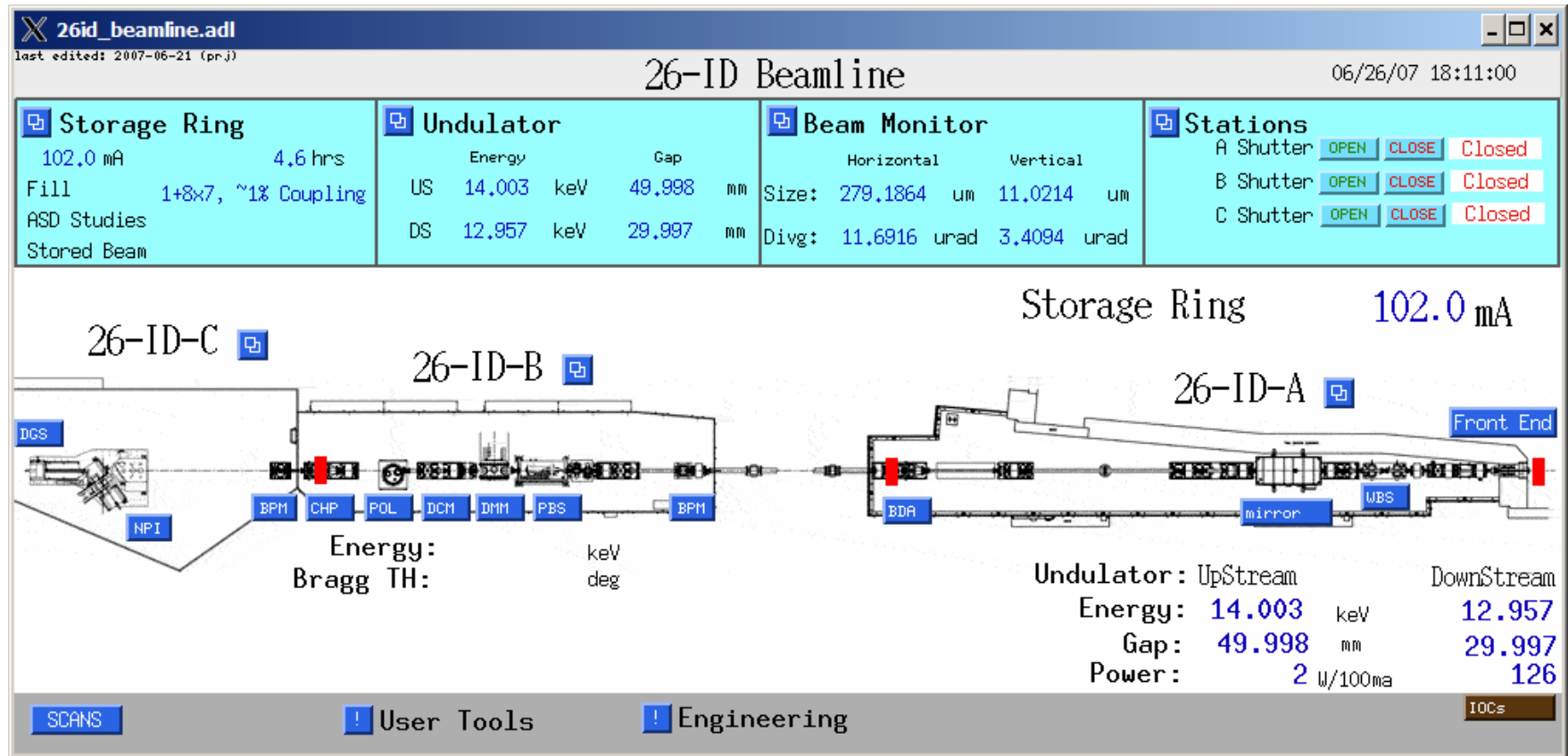
**PC104 stack**

### *Who is using?*

- 26ID (whole beamline)
- 11BM sample changer
- 32ID USAXS and mirror
- 8ID MCA
- ... a few others

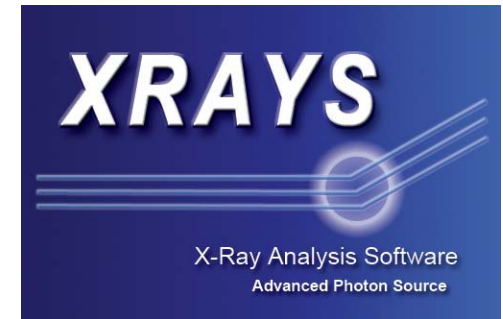
## More Sector News: 26-ID (nanoprobe)

- Beam in 26ID-C on 2007-06-15!
- 2 more IOCs need to be completed and installed (all boot from XOR servers)
- DCM & DMM CosyLab's MicroIOC (yet another PC104-based EPICS server)
- Added AIM MCA support (after implementation at 8-ID)

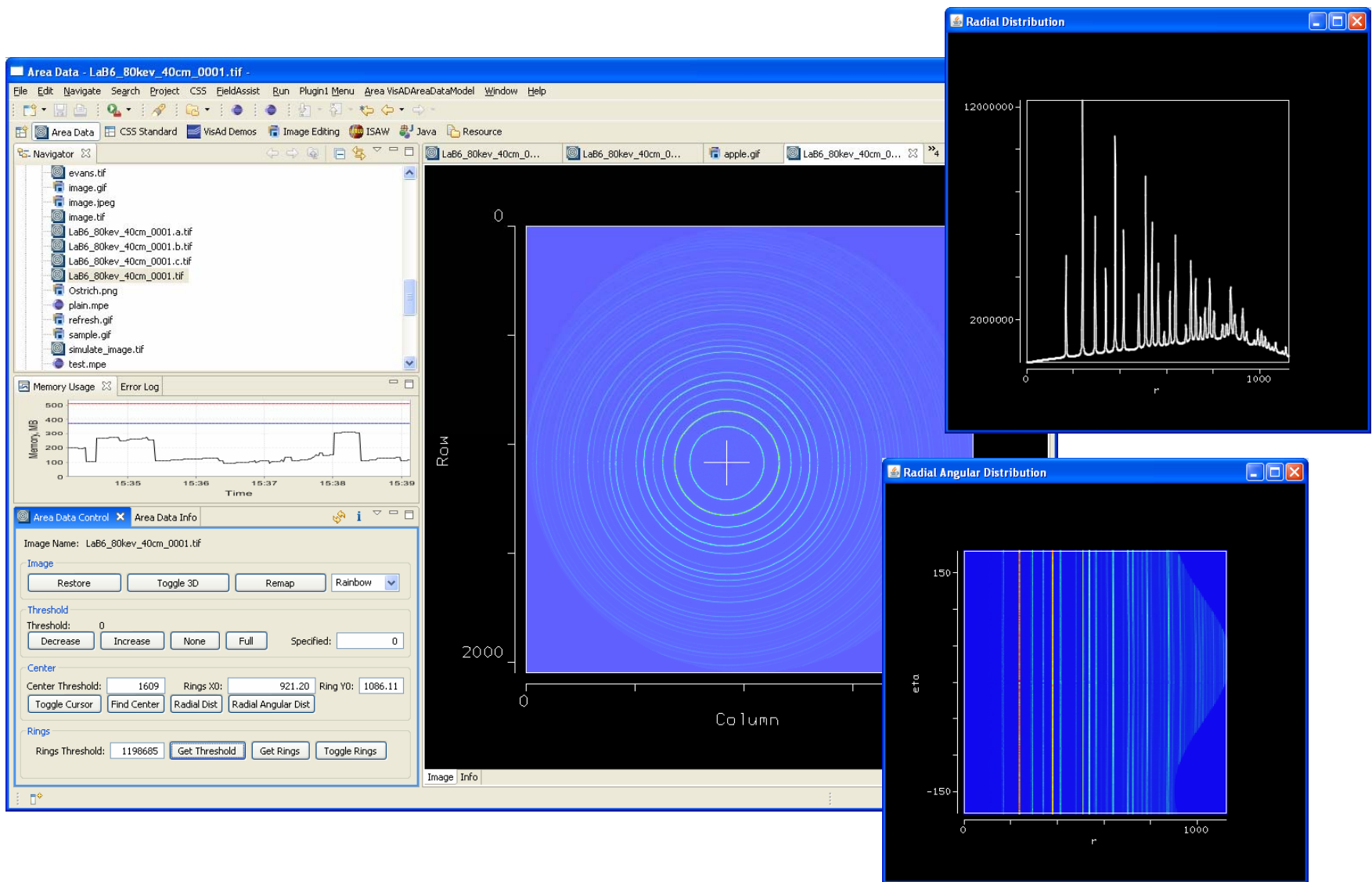


# Scientific Software Section

- The Scientific Software Section is in place
  - We are currently interviewing for a second person
  - Pursuing licensing and other necessary legal structure
  - Establishing a code repository and tracking system
- XRAYs (X-Ray Analysis Software)
  - Expected to grow into a large suite of analysis and visualization applications
    - *Scientific workbench program*
    - *New analysis and visualization applications*
    - *Updating and coordination of existing analysis and visualization applications*
    - *A framework of software routines that developers can use to write applications*
- Present work consists mostly of exploration and prototype applications
  - This is the groundwork for what we really want to do
  - More than 1200 Java source files in 60 projects



# Area Data Editor - First Scientific Application



## Longer Term

- The objective is to fulfill the recommendations of the 2006 XSD Scientific Software Workshop
- Eclipse and Java applications is where we are starting
  - These are client-based applications
  - Partly driven by the fact that x-ray data is localized
- We expect to incorporate high-performance computing
  - Typically means servers, clusters, and grid computing
  - Data on centralized servers is more typical of other communities
- We will not limit ourselves to Java
  - There are many other languages, in particular
    - *Legacy FORTRAN codes*
    - *Python is heavily used in scientific communities*
    - *C and C++ will continue to be important*
- See the web page for more information

[http://www.aps.anl.gov/APS\\_Engineering\\_Support\\_Division/Scientific\\_Software/](http://www.aps.anl.gov/APS_Engineering_Support_Division/Scientific_Software/)



*Thanks ...*

- ... for your attention

# What we do

## ■ Software

- synApps (EPICS IOC & client software)
- spec support
- EPICS client extensions
- CCD image server
- High-Performance Computing applications

## ■ Hardware

- VME boards (e.g., OMS VME58 motor transition)
- Patch panels
- Electronics packaging
- EPICS brick packages

## Scan support

- sscan record
- dataCatcher (obsolete)
  - UNIX IDL client to capture sscans and save/read .mda files
  - Obsolete (might miss capturing data in some cases)
- saveData
  - IOC-based method to save scans in .mda files
- scanSee
  - UNIX IDL client to save/read .mda files
  - No longer developed – planning for replacement
  
- ***From the APS community***
- EPICS\_SSCAN\_DISPLAY (M. Rivers, CARS-CAT)
  - UNIX IDL client to save/read .mda files
- HpJedi (A. Bommanavar, HP-CAT)
  - Java client to display active sscan record data

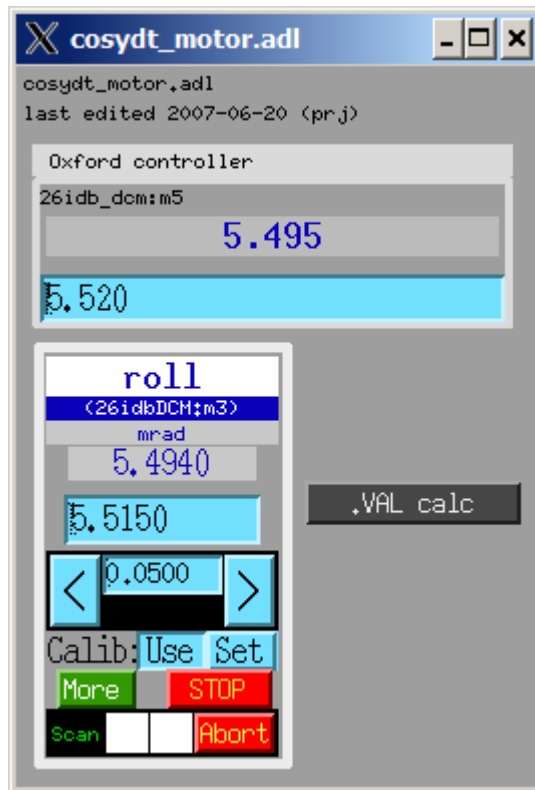
# New Hardware: Physik Instrumente (PI) E-516 Piezo Controller



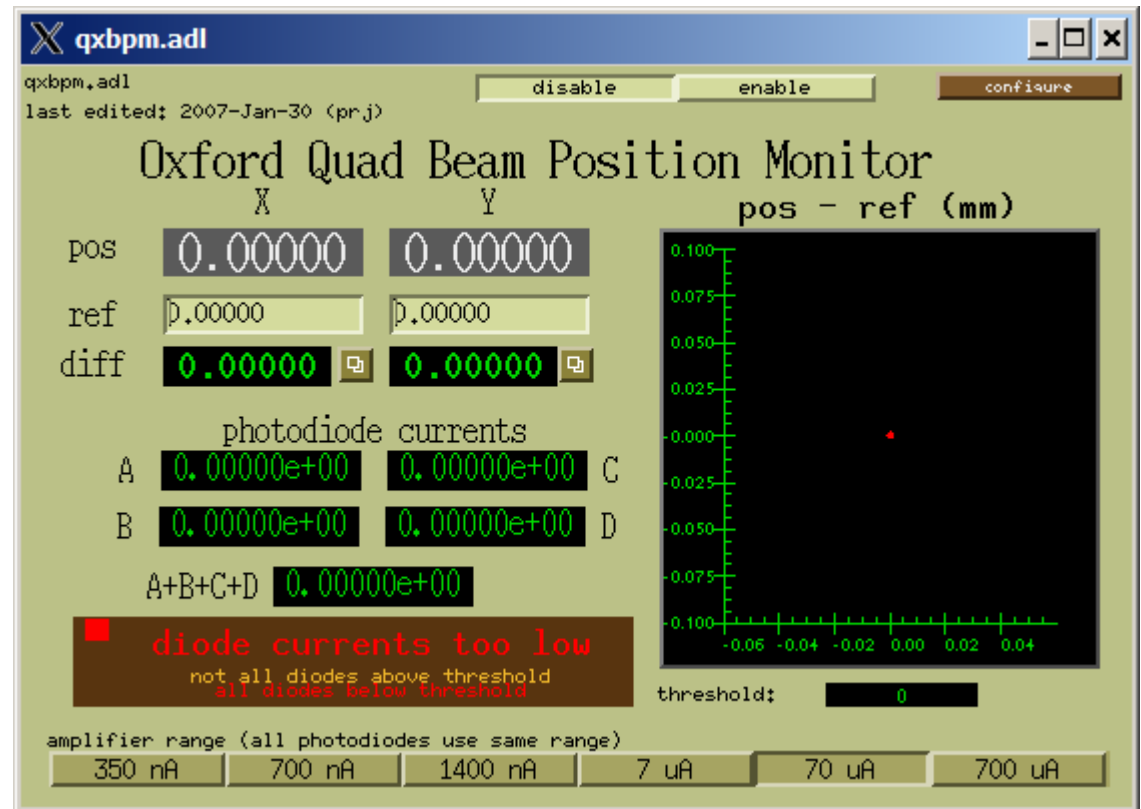
*So why does PI provide a completely different control protocol for every controller they make?  
So it seems...*

## 26ID device support – some old, some new

- Provide EPICS motor support for Cosylab motor interface to Delta Tau motor controller while preserving Cosylab interface



- Serial support for Oxford X-ray BPM



## 32ID DCM PZT feedback software

- epid-based feedback software to keep 32ID-A DCM tuned up
- Switches itself off based on user criteria (calculation record)
- Maximizes intensity in detector by adjusting DCM piezo

