

2010 July 9

FROM: Pete R. Jemian, Group Leader, AES Beam line Controls and Data Acquisition

SUBJECT: Responsibilities for support of beam line controls, data acquisition, and data analysis

ICMS Content ID: APS_1303193

Responsibilities for support of beam line controls, data acquisition, and data analysis

This document provides guidelines defining the responsibilities for the software and hardware support of controls, data acquisition, and data analysis at APS beam lines. It has been created in direct response to a specific question from one of the APS/XSD/XOR sectors but is generalized for all beam lines managed by APS/XSD/XOR. The following table lists the basic responsibilities. Brief descriptions of the activities are provided after the table.

Activity	Primary responsibility
Control system selection	APS division management
Control system design	AES/BCDA
Control system hardware purchases	Beam line
Control system physical construction	Beam line
Personnel Safety System	AES Safety & Interlocks Group
Beam Line Equipment Protection System	Beam line
Computer Network Infrastructure	AES/IT
Computer System Administration	AES/IT
Computer System hardware purchases	AES/IT
Computer System Operating Systems	AES/IT
EPICS IOC System Administration	AES/BCDA
Linux/UNIX Computer accounts, environment	Account holder (beam line staff for beam line accounts)
Control system software, detectors	AES/BCDA
Control system software, EPICS Extensions	AES
Control system software, EPICS Clients, Python support libraries	AES/BCDA
Control system software, EPICS Clients, other	Beam line
Control system software, SPEC	AES/BCDA
EPICS base	AES/SSG
BCDA EPICS synApps	AES/BCDA
Data analysis software	APS Users

Description of Activities

A brief description is provided for each of the activities in the above table.

Control system selection

The XSD and AES division management have the responsibility for the selection of the fundamental control system to be used on each beam line. The current directive is to treat all beam lines the same. With few exceptions, EPICS is used as the underlying control system on all beam lines managed by XSD. The software interface of all beam line hardware to be controlled is provided through EPICS process variables (PVs) hosted on EPICS Input/Output Controllers (IOCs). Exceptions to this are made on a case-by-case basis due to technical reasons.

Control system design

This is an example of a shared responsibility between the beam line and the support groups. Both beam line staff and AES/BCDA share responsibility for the software and hardware design of the control system, subject to management approval. Providers of components, such as detectors, have indirect influence over some important design considerations.

Control system hardware purchases

Beam lines will purchase all controls hardware. AES/BCDA will recommend supported components for procurement by the beam line. Hardware purchases such as detectors can have significant influence on IT and controls infrastructure requirements such as networking and file storage capacity. In some instances, it is convenient for AES/BCDA to purchase some controls components for beam lines. Ultimately, the materials cost for those components will be reimbursed by the beam line. For example, AES/BCDA maintains a supply of spare electronics and parts that are in common use on the various supported beam lines. IT oversees the purchase of all network infrastructures.

Control system physical construction

The beam line staff will arrange for the physical construction of the control system including the mounting of rack-mount electronics, the laying of cable, and the termination of electrical connectors. AES/BCDA often assists with beam line physical construction and maintenance.

It is expected that beam line staff will consult with the various support groups (AES/IT, AES/BCDA, AES/SI) responsible for maintenance prior to committing to the design of specific components.

Personnel Safety System (PSS)

The AES Safety and Interlocks Group (AES/SI) has responsibility for the PSS. This is documented elsewhere and is well-known.

Beam Line Equipment Protection System (BL-EPS)

XSD division management has allowed the XSD-managed beam lines to choose to design, construct, and maintain the BL-EPS or to have the AES Safety and Interlocks Group (AES/SI) group build and maintain the beam line BL-EPS. AES/BCDA has EPICS software for monitoring purposes to interface with some beam line BL-EPS components that use the Modbus TCP protocol such as certain Koyo PLCs.

Computer Network Infrastructure

The AES Information Technology (AES/IT) group has responsibility for the computer network infrastructure (such as switches, cabling, firewall, cyber security, HPC). This includes the switch specifications and network configuration on the XSD beam lines. Beam line staff has the responsibility to anticipate and communicate requirements and needs to AES/IT.

Computer System Administration

AES/IT has responsibility for all computer system administration and is responsible for following all DOE, Lab and APS Cyber Security policies. This includes the selection of hardware and operating systems based on APS configuration management as required by the Lab Cyber Security Program Plan (CSPP) and APS management. AES/IT has allowed beam lines to designate specific beam line staff access to limited administrative privileges in Microsoft Windows hosts and via SUDO access for Linux. ANL CSPP and Lab management requires AES/IT to restrict access to root accounts on all UNIX and Linux systems managed by the APS. AES/IT has delegated responsibility for specific EPICS system administration activities to AES/Controls, AES/BCDA, and XSD/ODG.

Computer System Hardware Purchases

Beam lines will purchase all computer system hardware for use at the beam lines. AES/IT will recommend supported computer hardware for procurement by the beam line based on APS configuration management as required by the CSPP. Standard hardware is currently from the Hewlett-Packard and Dell corporate line of desktops, workstations, and laptops for Windows and Linux. Sun hardware is supported for Solaris desktops and Apple Macintosh for OS X. Exceptions are based on technical requirements by vendor hardware and software.

Computer System Operating Systems

The standard operating systems are currently Solaris, Red Hat Enterprise Linux, Mac OS X, and Windows 7, XP and Vista.. Exceptions are based on technical need e.g. requirements by vendor hardware and software. All operating systems will be installed by the AES/IT group on all beam line desktops and workstations being used for data acquisition, control, and data analysis.

EPICS IOCs System Administration, (VxWorks, Linux, RTEMS, Windows)

AES/BCDA is responsible for the administration of all standalone EPICS Input/Output Controllers (IOCs). The configuration of all IOC software is under management using the subversion (also known as SVN) version control software. Beam line staff performing maintenance of IOC software will use SVN for configuration control to document any changes. For soft IOCs running on Linux and UNIX systems from user accounts, AES/IT has primary responsibility for the operating system. IOCs for detector support are covered later in this document in the section *Control system software, detectors*.

AES/BCDA will be responsible for the initial construction and maintenance of the software to operate the EPICS IOCs used by the beam line. Beam line staff experienced with the maintenance of EPICS IOCs will be able to make modifications as needed.

Some detectors distributed by the detector pool have EPICS IOCs managed by XSD/ODG. These computer systems are identified by stickers and the XSD/ODG group should be contacted for related maintenance issues.

Linux/UNIX Computer accounts, environment

AES/IT creates accounts on Linux or UNIX computers in response to specific requests. Those accounts are provisioned with a default environment (definition of the “path” and other variables) by AES/IT. The account owner (beam line staff for beam line accounts) has full responsibility for maintaining the environment variables. AES/BCDA provides some assistance with environment variables to access EPICS client software.

Control system software, detectors

Detectors are interfaced to the beam line controls through EPICS unless not feasible due to either time-constraints or technical limitations. Photon counting detectors such as scintillation counters and integrating detectors such as ionization chambers or photodiodes are interfaced through EPICS-supported scalers using intermediate electronics for signal conversion to a pulse train. EPICS drivers exist for certain multi-channel analyzers and multi-channel scalers. 2-D (area) detectors are now interfaced to EPICS through the areaDetector software for EPICS, usually using an EPICS IOC dedicated for the detector.

Some detectors distributed by the detector pool have EPICS IOCs managed by XSD/ODG. These computer systems are identified by stickers and the XSD/ODG group should be contacted for related maintenance issues. Other detectors are dedicated to each beam line. AES/BCDA is responsible for the maintenance of these systems.

Control system software, EPICS Extensions

EPICS extensions are created by the EPICS community worldwide. AES Software Services Group is responsible for building and maintaining various common EPICS extensions such as MEDM. Some other EPICS extensions have been built or are deployed by AES/BCDA. AES/BCDA distributes both source and compiled versions of EPICS clients to each sector on the APS floor through the dserv hosts from AES/IT. EPICS clients are compiled for Solaris and Linux operating systems.

Control system software, EPICS Clients, Python Support Libraries

BCDA has rebuilt the EPICS binding for Python so that it now compatible with the current version of EPICS base, and deployed it to each beam line on /APSshare. Beam lines can choose to use this binding to create client Python tools of their own design. AES/IT plans to deploy Python on all supported user operating systems, including ancillary packages but that deployment is not yet in place. There is no EPICS support for Python on Windows or Macintosh at this time.

Control system software, EPICS Clients, other

Beam line staff may choose to implement EPICS clients using software technologies such as C, C++, Perl, Tcl, Java, Eclipse, LabView, Matlab, IDL, Delphi, or many other possibilities. Some of the detector software support may be provided by AES/BCDA, AES/SSG, or others using Java or C++ to support a specific detector on a specific hardware host (usually Microsoft Windows using a software interface provided by the vendor).

Control system software, SPEC

AES/BCDA is responsible for installing SPEC and CPLOT on the XSD-managed beam lines and maintaining the software licenses for SPEC. The beam line will identify which instrument geometries are to be deployed. AES/BCDA is responsible for maintaining the

SPEC and CPLOT installations on the XSD-managed beam lines. Primary responsibility for maintenance of SPEC macros may be exchanged between AES/BCDA and beam line staff at some beam lines where there is beam line staff with strong understanding of SPEC macro programming

EPICS base software

EPICS base is created by the EPICS community worldwide and managed by the AES Software Services Group. AES/BCDA distributes both source and compiled versions of EPICS base to each sector on the APS floor through the dserv hosts from AES/IT. EPICS base is compiled for Solaris and Linux operating systems.

BCDA EPICS synApps

synApps is an open-source and collaborative suite of EPICS software tools created and maintained by AES/SSG for controlling instrumentation and acquiring data at synchrotron beam lines. Additional contributions are included from other contributors/users of synApps throughout the worldwide EPICS community. The capabilities of synApps are documented on the AES/BCDA WWW site. AES/BCDA uses synApps as the primary software to operate a control system on each beam line it supports.

Data analysis software

The users of the APS are responsible for the software for analyzing their data. Beam line staff members, notably instrument scientists, often assume a primary or secondary responsibility for data analysis. AES/BCDA and AES/SSG can advise on some aspects of data analysis, and in a few specific cases, has assumed primary responsibility for data analysis software.