

# NSLS-II Beamline Controls Requirements

Wayne Lewis

NSLS-II, Brookhaven National Laboratory

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**ENERGY**

Office of  
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# Outline

- 1 NSLS-II beamlines overview
- 2 Beamline controls standards
- 3 Current status and future work

# Beamline scope

- Six project beamlines
- Twelve new beamlines in development
- Sixteen beamlines/programs to move from NSLS

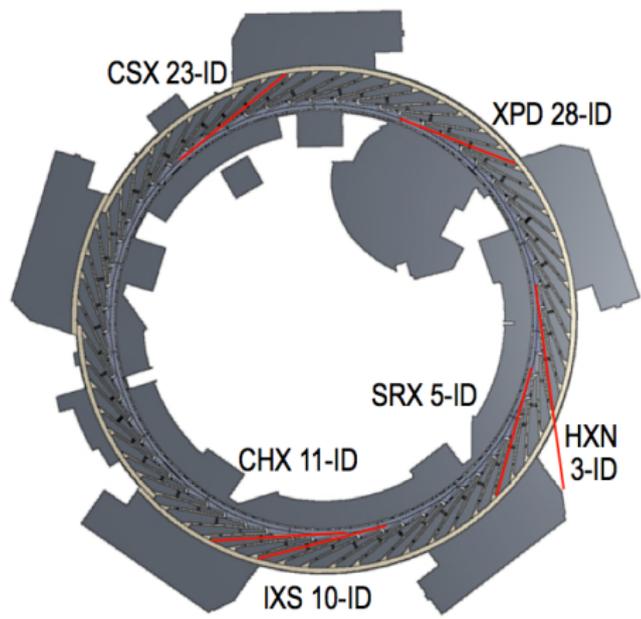


Figure: NSLS-II beamline layout

# Procurement methods

Most beamline components are being purchased in packages.

Control systems and motion control are typically not part of the procurement. The vendor provides the motors, encoders etc. with our defined interfaces.

Exceptions include more complex devices where performance criteria are dependent on motion controls. e.g. monochromators, hexapods.

# Required standards

- Control system software
- Data acquisition software
- Equipment standards
- Motion control standards
- Component naming standard
- Coordinate system standard
- Instrumentation interfacing standard
- Procurement standard

## Base control system software

EPICS chosen as base control system software for all beamlines

Extensive use of existing EPICS modules, including synApps package.

Linux and RTEMS operating systems.

CSS/BOY as base GUI system.

Consistent with technologies chosen for accelerator.

# Software for data acquisition and experiment control

Objective is to have a standard set of software solutions for data acquisition and experiment control.

GUI and command line based interfaces.

On-line data analysis.

# Selection of equipment for beamlines

Where possible, use the same equipment as the accelerator.

- Vacuum systems
- Equipment protection systems
- Controls hardware - VME crates, PCs

These standards are defined in the specifications given to beamline vendors.

# Standard motion controller

Based on Delta Tau GeoBrick LV

Similar to solution at Diamond

Standard product, repackaged to suit our wiring standards

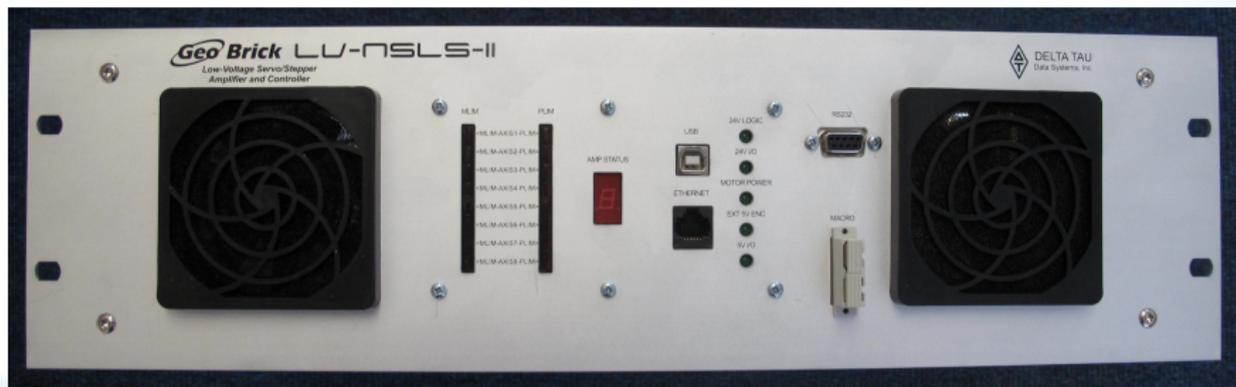


Figure: NSLS-II standard motion controller front panel

# Definition of naming standard

## Name structure

System{Device}Signal

## Sample name

SR:C23-ID:G1{EPU:1}T-I

System and device hierarchies allow flexibility in naming.

Instances for each name part allow easy duplication of components and signals.

Recognise that beamlines may need a shorter naming convention for routine use - use EPICS aliases.

# Objective of coordinate system document

Define coordinate systems for beamline optics and experimental endstations.

Provide a standard definition that will allow consistency within and between beamlines.

Allow sufficient flexibility for specific experimental requirements.

Standard definitions of cartesian and rotation axes.

Need axes for beamline, beam and optic.

# Reflective optic coordinate system

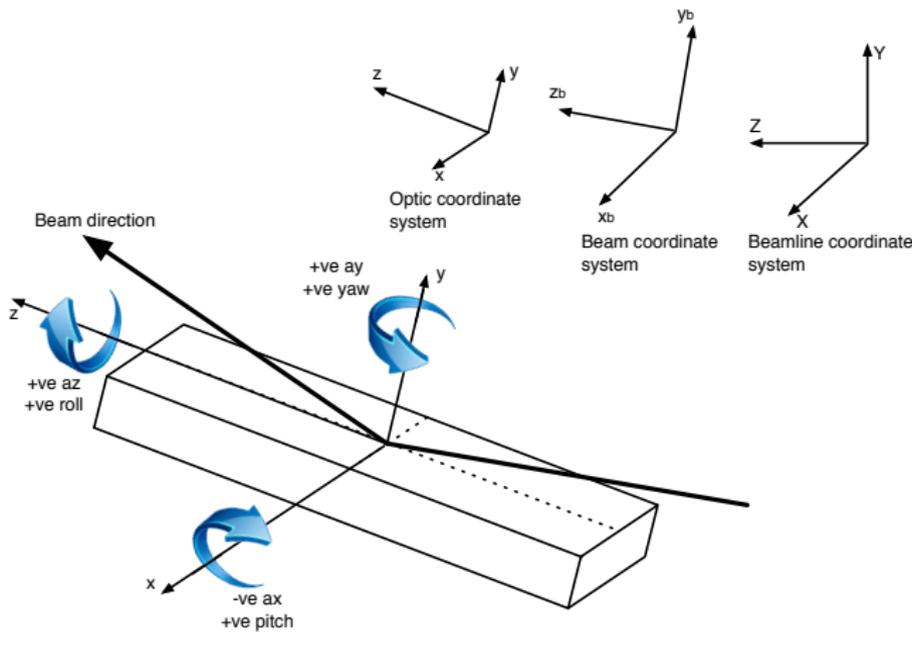


Figure: Mirror coordinate system

# Transmission optic coordinate system

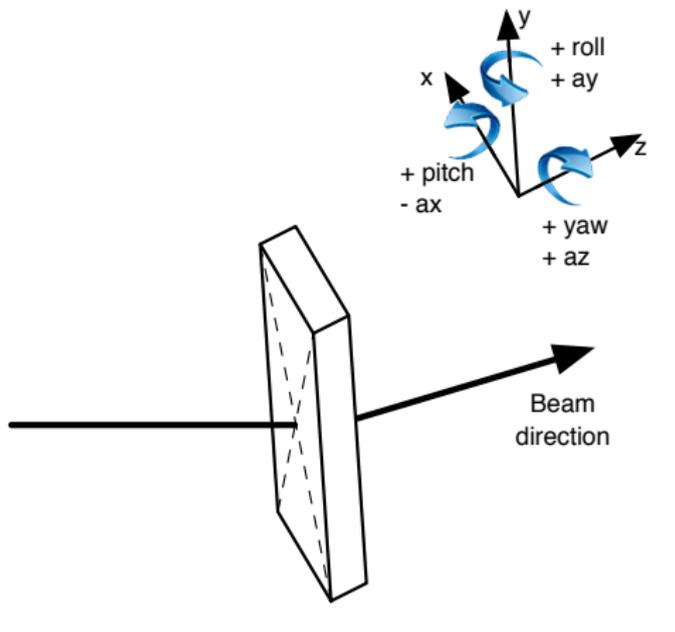


Figure: Transmission optic coordinate system

# Objective of instrumentation standards

Define electrical connectivity and physical interfaces for motion controls, vacuum, equipment protection and other beamline equipment.

Defines standard equipment to be used in beamline control systems.

Provide part numbers for standard connectors.

Define standard cable types

# Motor connectors

Motor connectors using Souriau circular connectors.

Limits and motor signals in same connector and cable. Using same pinout as Australian Synchrotron, Soleil, Swiss Light Source.

Encoder connector via DSub15.



Figure: NSLS-II motion controller rear panel

# Motor component standards

## Standard motor definition

- 2 phase stepper
- $< 5$  A, 50 VDC

## Standard limit switch definition

## Standard encoder definition

- Incremental, quadrature

# Procurement standards

Developed standard set of procurement specifications related to controls.

Define standard software, hardware and interfaces we expect the vendors to use.

Same specifications used for all beamline packages.

Review by controls group of all individual procurement packages for specific controls requirements.

Expect that these standards will continue to be developed and used for future beamlines.

## Current status

- Procurements are underway. Most specifications done and issued.
- Preliminary work on standard data acquisition system.
- Prototyping of beamline data acquisition equipment.
- Standard motion controller procurement underway.
- Support for accelerator motion systems development.

## Future work

Beamline design reviews coming up later in 2011.

Development of detailed controls requirements for each individual beamline.

Final selection of standard beamline instrumentation and equipment.

Development of motion control standards.

Support for accelerator motion systems installation and commissioning.

# Questions