First results with integrating
2nd generation Berkeley Cartesian automounters
into GM/CA CAT beamline controls

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OUTLINE

- Introduction
- Berkeley automounter of the second generation
- BAM2 software solution
- BAM2 integration into beamline control system
- Future plans
Introduction

- High-throughput macromolecular crystallography
  - Automated data collection
  - Automated sample changing
  - Automated data processing
Use of the automounter and remote operations

% user group visits

APS run cycle

- Automounter
- Remote Users
Berkeley automounter of the second generation

- Adept Python linear XYZ Cartesian module
  - Flexibility in motion
- Pneumatic gripper and rotation stage
  - Same as in the first robot generation
- Force sensor and touch probe
  - Automated alignment
- Stationary foam Dewar with heated lid
  - No maintenance
Berkeley automounter of the second generation

...installed at the 23BM-B experimental station
BAM2 software solution

- The Adept V+ real-time and multi-tasking operating system
  - Executes low-level commands
- Adept Desktop
  - Windows-based GUI
  - Connects over Modbus/TCP
- Java-based “CAM-commander” control program
  - Developed with Java NETBeans IDE
  - Connects to Adept controller over Modbus/TCP
  - Provides command line interface
BAM2 integration into beamline control system

- **EPICS robot server**
  - Receives commands via CA
  - Moves goniometer to mount position
  - Relays commands to BAM2 interface PVs

- **EPICS interface PVs:**
  - `<bl>:BAM2:cmd`
  - `<bl>:BAM2:ack`
  - `<bl>:BAM2:rsp`
  - `<bl>:BAM2:err`

- **“CAM-EPICS commander” control program**
  - Receives commands and provides responses through EPICS interface PVs

Diagram:
- Adept controller
  - Adept Python XYZ
  - Digital IO
  - Analog IO
  - Modbus/TCP
  - Ethernet LAN
  - EPICS IOC with robot server
  - Beamline computer with CAM-EPICS commander
  - Beamline computer with MEDM GUI
  - Windows computer with Adept Desktop GUI
  - Beamline computers with user JBLUICE
  - Beamline computers with user JBLUICE
BAM2 integration into beamline control system

- MEDM screens for BAM2
  - Dewar layout screen
  - BAM2 commands
  - Sample history
  - BAM2 interface PVs
Future plans

BAM2
- Optimize robot control program for faster operation
- Incorporate robot control program into the robot EPICS server
- Move robot to the 23ID-B beamline after integration with beamline controls and commissioning
- Add support for Rigaku packs

BAM1
- Update old robots with servo-motor driven linear stages and a force sensor
- Add a procedure for auto-alignment
The team

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