Progress towards Increasing Automation and Sample Capacity at the GM/CA Beamlines for the upgraded APS (APS-U)

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The Advanced Photon Source (APS) is rapidly approaching its yearlong shutdown for the upgrade to the APS-U starting in April of 2023. The GM/CA beamlines at Sector 23 have begun to prepare for the higher brightness of the new source. Installation of new optical focusing elements is underway.

One of the effects of the APS-U is the anticipated increase in the speed of data collection from crystal samples. Furthermore, users will certainly screen more samples at a greater rate. In response to this expectation, we are re-evaluating the capabilities of our current automounters. The possibilities include transitioning to a robotic arm, purchasing a commercial automounter, or upgrading the current automounter. This presentation will focus on upgrading our current automounters and cover other developments that will smooth the transition to the new source.

Our current automounters are a locally modified Berkeley Automounter (BAM). We converted the original model from limited discrete pneumatic positioning to continuous motor positioning for all motions except for the gripper on/off. The advantages of this conversion are:

1) Ability to stop at any position in the horizontal, vertical and gripper rotation
direction.
2) Flexibility to load samples onto either a vertically or horizontally mounted
goniometer.
3) In-house design, construction, maintenance and motion-control of the automounter.
4) Approximately 5 years of operational experience.
5) Tripling of the Dewar capacity from 6 to 18 ALS/Unipucks, for a total of 288 samples.
These improvements will bring us to the APS shutdown, however we expect the APS-U to accentuate the need to increase the robot capacity further. In order to accommodate this increase, a proposal under consideration is the addition of a second 18-puck Dewar, located adjacent to the existing Dewar, perpendicular to the direction of the incident X-rays.

The automounter is one component in the GM/CA automation pathway. A new GUI, PyBluice, will soon be released. It will combine existing and improved capabilities, i.e. loop-centering, screening, raster, and vector, which are necessary for data collection. It will also include the integrated automated data reduction and structure solution packages that are available in JBluIce. The new PyBluIce will balance the need to provide controls for teaching new users and the flexibility for expert users together with the demand for increasing automation.