

Facility improvements on beamline 12.2.2 at the ALS: A COMPRES facility update

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In the past year, beamline 12.2.2 at the Advanced Light Source scheduled 376 user shifts for a total of 84 individual experiments, ~40% of which were COMPRES experiments including single crystal (~ 10%) and powder diffraction experiments under high P-T conditions on end-station 2 equipped with various detectors and a single-axis diffractometer. The annual productivity continued to be robust in terms of publication output: 35 publications in peer reviewed journals contained 12.2.2 data, 16 of which were (co-)authored by COMPRES members.

While no major projects were started, extensive incremental improvements were made that contributed to increased stability and user friendliness of the experimental systems, thus making user experiments more efficient. On the laser heating set-up (which has had both complete software and hardware redesigns in the last 18 months), we deployed and tested a Pi-shaper on the upstream side with very encouraging results and are in the process of installing its downstream counterpart in order to reduce thermal gradients around the X-ray spot; the tradeoff is mildly reduced peak temperatures. The double-sided laser heating setup for the radial diamond anvil cell diffraction geometry, which includes full temperature mapping is now fully commissioned and works as a stable user facility. The resistive heating project is focused on making band/ring heaters, while band heater is a low maintenance/support user facilities, designed for various diamond anvil cells, and it is full LabView temperature and temperature ramp control up to 900K. The ring heater can heat the samples up to 1700K, but only for BX90 cells. The ambient pressure/controlled atmosphere lamp heater set up has been further refined and is in full user operation mode, and has already ramping up its publication output.

Although the 4-circle single crystal diffractometer project on end-station 1 was impacted by staff changes at 12.2.2, work planning, controls development, and equipment installation for this facility have been fully reinitiated, and we plan to end its commissioning in first half of 2020. The commissioning of the new RDI CMOS-8 detector to replace our PE detector was complicated by calibration and control communication issues. These issues have been largely resolved, and we expect the new detector to come online on end station 2 after the summer shutdown. The ALS, and the 12.2.2 facility, are ramping up preparations for the ultimate storage ring upgrade (ALS-U). Current projections foresee a 1 year dark period starting in about 4 to 5 years. The portion of the upgrade that will affect the COMPRES program the most will be the replacement of the superbends (which serve as a source to 12.2.2). Currently, 3.2 Tesla warm bend and 4.7 Tesla superbend magnets are being evaluated. A decision is expected in the middle of 2019.

The latest progress and particular science highlights enabled by 12.2.2 will be showcased.