THE DEVELOPMENT OF THE UNDULATOR CONTROLS MODULE AT THE LINAC COHERENT LIGHT SOURCE*

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Abstract

The Linac Coherent Light Source, LCLS, at the SLAC National Accelerator Laboratory, SNAL, is the first hard x-ray Free Electron Laser [1]. The Undulator Controls Module, UCM, controls five cams and two translation stages that regulate the position of each of the 33 permanent undulator magnet segments within 10 microns. The UCM package, hardware and software, was designed and built by the Advanced Photon Source at Argonne. Important lessons were learned throughout the collaborative design, installation, testing, and commissioning periods that could be invaluable to future similar controls projects.

INSTALLATION AND CHECKOUT

The complex installation of the UCM hardware went smoothly. Cables were well labeled, and the cable distribution system, EIA, proved extremely useful at managing the almost 40 devices that needed control cables. Checkout was hindered by the lack of a proper and tested procedure. Interlock checks and motion calibration procedures had to be learned during valuable checkout time within the tunnel. Mechanical problems in the mover system also presented challenges during the checkout phase.

COMMISSIONING

The commissioning of the UCM can be summarized in one major milestone, LCLS is now the first hard x-ray laser in the world. Repeatable and accurate motion control of the 33 undulators has contributed to a very successful commissioning. Not all physicists desired software functions were available during commissioning because of poor requirements tracking, but most of them have now been added.

CONCLUSION

The Undulator Controls Module has proven itself by the great success of the LCLS. Many easily identified factors can be attributed to this success. Some of them are the quality of the hardware developed by Argonne and its proper and timely delivery, and the swift installation and trouble shooting of the SLAC team. Despite such great success, future similar project can take some advice from hardships experienced during the development of the UCM. A single controls requirement document, summarizing requirements from the mechanical interface to high level functions, can be an invaluable single source to develop the whole control system. The lack of such document delayed the development of some UCM software functions. A timely drafted handout plan that would include drawings, installation and tested checkout procedures must be a requirement during any collaboration.

REFERENCES


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Status Report
Figure 1: Undulator controls equipment, aisle side.

Figure 2: Undulator controls equipment, wall side.