

## **ASD Quarterly Bulletin** **April – June 2014**

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During this quarter we finished Run 2014-1 with 98.7% Machine Availability and 150.6 hours of the Mean Time Between Faults (MTBF) having 934.3 hours longest period without faults. We orderly completed shutdown and began Run 2014-2. In this run the current statistics is 98.03% Machine Availability and 73.41 hours of MTBF that will hopefully improve. Several other developments and events took place in the second quarter of 2014 and are highlighted here.

**The Diagnostic Group** developed MBA diagnostics R&D plan and associated cost/schedule, developed MBA diagnostics production plan and cost/schedule, and contributed to MBA Conceptual Design Report. They continued development on prototype Mechanical Motion System that has been installed in Sector 27. Continued test and specification development for Libera Brilliance plus electronics for BPMs. Completed Microblaze and Zynq interface application to share Block RAM for Real Time Feed Back Double Sector Controller. Completed porting the Beam Signal Processor (BSP100) FPGA firmware to a new FPGA device for application to the Booster. Optimized the transition and feedthrough impedance of the new stripline kicker for Sector 31. Analyzed the microwave mode spectrum of a MBA baseline Aluminum extrusion chamber. Designed and optimized a NEG coated Copper testing co-axial tube to measure the impedance of MBA chamber from 0 ~ 40 GHz. Studied the beam based measurement of impedance and wake potential of coated beam pipe. Installed both Grid-X-ray BPMs in Sectors 35 and 27. Supported several Storage Ring (SR) studies periods, mostly X-ray BPM gap feed forward data collection for X-ray BPM alignment purposes. Took first data using new GRID XBPMs in Sector 27. (Data showed good diode signals as well as linearity when the x-ray beam was moved.) Supported Injector Test Stand (ITS) Laser Studies. Supported optical diagnostics installation for ITS photo-cathode electron gun (PCGun) commissioning and assisted with cable and hardware requirements. Organized beamline hardware integration/design and diagnostic systems development for PCGun linac installation. Performed an extensive investigation of Dynamic Compression Sector - ASD program initiatives and hardware options for the SR Sectors 35 and 31 diagnostics exchange. Supported for high charge injector studies. Continued working on temperature monitoring and regulation in SR tunnel, SR racks, SR mezzanine. Hosted video kickoff meeting and two day visit at APS with our collaborators THz radiation production experiment in the ITS.

**The Magnetic Devices Group** had three existing “Undulator A’s” prepared for installation, tuned and installed in April/May. U33#6 and U33#7 (for Sector 27) and U33#37 (for Sector 35) were installed to support shielding validation milestones for RIXS and Dynamic Compression Sector (DCS) beam line respectively. Assembly of the 2.7-cm period magnet structures for the revolver prototype was completed, along with the mechanical assembly of the new lower jaw. The device with 3.3 cm period and 2.7 cm period magnetic structures is undergoing controls testing. The plan is to install this device (2.7/3.3) in Sector 35 in December and then replace it with the DCS-funded revolver in the subsequent shutdown. During a machine studies access in June, the undulator in Sector 35 was swapped. This allowed the use of a U33 for beamline shielding validations and their milestone recognition, while providing a better-tailored source for the scientific activity during the remainder of the run. The magnet sort was completed for the two RIXS 1.72-cm period undulators. The plan is to complete assembly of these devices in July, magnetically tune them in August, and then install in September. The full set of SCU1 design

drawings has been completed, and all purchase orders for the remaining procurements have been placed. Three SCU1 magnetic cores have been wound. They are undergoing the epoxy impregnation and then will be tested in the LHe vertical cryostat. The design of the LCLS SCU prototype is proceeding as planned. Weekly meetings with partner labs, SLAC and LBNL, are taking place. The purchase orders for the cryostat fabrication have been awarded to the vendors. The completion of the fabrication and assembly of the HGVPU is planned for the end of June – beginning of July. The mechanical testing and magnetic tuning should be completed in July. The magnetic modeling of closely located magnet structures was started.

**The Power Systems Group** successfully conducted the conceptual design review for the MBA power supplies. The power supply R&D activities based on the conceptual designs are under way. The Booster kicker upgrade project is moving forward with the help of the RF Group. Eight high voltage cables have been terminated and ready for the partial discharge test. Thirteen power supplies and two power supply controllers have been prepared for the new PCGun solenoid assembly and the associated diagnostics.

**The Accelerator and Operations Group** have started commissioning of the PCGun in the ITS. The first photo-electron beam with 200 pC charge and 7 MeV energy was generated on April 10. The Booster ramp software was modified to allow for nonlinear ramp of quadrupole and sextupole magnets. With this modification, the extracted charge was increased to 6 nC in the low-emittance Booster lattice. Work on optimization and characterization of the APS-U MBA lattice is ongoing, tolerances to various errors are studied. A member of the group - Kathy Harkay - was awarded U.S. Patent on Low Work-Function Photocathodes Based on Acetylide Compounds (as Co-Inventor).

**The RF Group** completed the installation of the first Harmonic PAR amplifier with upgraded Programmatic Logic Controller (PLC) controls, completed studies of frequency shift versus temperature on the Fundamental PAR cavity, updated ACIS Interface boxes at Linac rf systems L2 and L3, and continued work on building spare envelope detector modules for the Linac low-level rf systems. Two klystrons were replaced in the 352-MHz RF systems, one to address a problem of unstable cathode emission with the Booster RF system, and one in RF3 to address instability issues. Also, two transformer-rectifier sets used to supply dc power to the 352-MHz rf systems were repaired during the maintenance shutdown. This work involved replacement of four bad capacitors at RF2, and replacement of a burned high-voltage connector at RF3. RF Group staff members have also been working on APS Upgrade MBA cost and effort estimates for both the 352-MHz RF and the bunch lengthening RF systems. Group started on a Work for Others (WFO) project to test WR284 waveguide windows using the linac L6 test stand.