

# Weekly Report for 06/16/2014

## Highlights

- Awarded U.S. Patent on Low Work-Function Photocathodes Based on Acetylide Compounds (K. Harkay Co-Inventor). (Kathy Harkay)
- Reviewed two NSF proposals submitted under the Accelerator Science initiative. (Kathy Harkay)
- Gave talk on "Coupled Bunch Instabilities with Landau Cavities" to AOP group. (Louis Emery)

## APS Renewal and Upgrade

- Improved the dynamic aperture area of 90pm-alternate-lattice by 50%, using MOGA. (Yipeng Sun)
- Continue MOGA optimization of APS upgrade lattice. (Yipeng Sun)
- Attended weekly Upgrade physics meeting. Read papers on beam-ion instabilities based on work at SLAC/SSRL. (Kathy Harkay)

## MCR Operations

### Storage Ring Operations

- Observed SCU0 LHe pressure for 24 bunches at 445 A and hybrid mode at 649 A and made a prediction for the SCU0 User, as to when the pressure will reach a certain value. This serves as advance information that the User requested, so he can reduce the main coil current to avoid loss of SCU0 control if the LHe pressure exceeds the pressure minor alarm level (during normal ops) or the return pressure (after a quench). (Kathy Harkay)
- Recorded ID6 and ID33 BLM scope waveforms after three beam dumps. Had a preliminary discussion with Nick Dimonte on automating the scope waveform saves. (Kathy Harkay)

### ITS Operations

- Received training on photo-cathode drive-laser system turning on/off. Utilized the training to operate the laser on a daily basis, and escorted diagnostics and control group colleagues to access the laser room. (Yin-e Sun)

## APS Machine Studies

### Storage Ring Studies

- SCU0 BLM studies with J. Dooling; tested longer IK5 pinger pulse. Compared BLM signals with pulse length data supplied by PS group, and agreement is good, as expected. Presented results at weekly machine studies meeting (6/18). (Kathy Harkay)
- Discussed further IK5 tests with M. Borland. (Kathy Harkay)
- Investigated a problem with the change of tune after standardization after a shut-down of power supplies. After recovery, the tune changed by -0.4 in x and 0.03 in y. An attempt was made to determine whether there was a specific quadrupole that went bad. I wasn't able to get convergence from the response matrix fitting. Re-standardizing with no change in tune suggests that possibly the previous existing conditions were wrong. So I kept the quadrupole settings for UBOP. (Louis Emery)
- Another problem: With Sajaev investigated a change in bpm readback (large, e.g. 0.7 mm in worst case) in two sectors that occurs after a beam dump and refill. We tested the usual causes but none fit. Note that both narrow band bps and bps-100 bps changed at the same time. they have no electronics or timing in common. Perhaps the original readbacks and saved offsets were done under incorrect conditions that existed for several weeks. Discussed with Xiao and Sereno what to do with the narrow band bps offsets in the sector where many bpm readbacks changed. (Louis Emery)

## ITS Studies

- continued photo-cathode rf gun electron beam parameter studies. Extensive measurement of beam emittances as solenoid, RF phase and gradient, drive-laser size are varied. Entries logged in the machine e-log [https://logbook.aps.anl.gov/elogs/MS/Machine\\_Studies/](https://logbook.aps.anl.gov/elogs/MS/Machine_Studies/) (Yin-e Sun)

## APS Machine Research and Development

### Storage Ring Research and Development

- Discussed with J. Dooling a presentation on the SCU0 BLM data, which will serve to justify purchasing a similar system for SCU1. Analyzed selected FPGA data to correlate with BLM data and quench data. (Kathy Harkay)
- At Y. Ivanyushenkov's suggestion, read IPAC14 paper on beam-loss induced quenches in SC wiggler at Canadian Light Source. Discussed the paper also with V. Sajaev, and discussed with him further his idea to use the injection kickers to control beam loss location. He set up a simple trajectory analysis in elegant, which I used to analyze various cases of kicker vs. amplitude. (Kathy Harkay)
- Forwarded SCU0 BBA technical note to C. Doose, who forwarded it to P. Emma and Soren at LCLS. (Kathy Harkay)
- Orbit motion: Provided to Sajaev some plots of MATLAB single-variable calculation of correction effectiveness for datapool and RTFB. The various filter coefficients explain the "flat" gain area for V plane but not for H plane. There is an interplay between the Kp and the two frequency filter preventing a flat top for the Kp part. We could revisit the setting of the filters and Kp in studies. (Louis Emery)
- Gave an explanation for the PSD peaks at 100 seconds in the large spd data sets. I believe it is rf controllaw running (with low gain) together with datapool without feedforward. Calculated the amplitude of this peak to be 60 nm, which is small. (Louis Emery)
- Discussed possible explanation for apparent effect of orbit correction from PSD at low frequencies. Suggest to do SVD on complex fourier components of each bpm to find a correlation. Interpretation of possible result is not clear at this point, but asked Shang to make a new version of sddspseudoinverse with complex matrices. (Louis Emery)
- Researched random matrices to find an explanation for the usual resulting singular value spectrum of noise. This may be useful for distinguishing from data real orbit motion from bpm noise. (Louis Emery)

### Other Research and Development

- Electron cloud R&D: Followed up with L. Boon regarding progress on her paper and her thesis. We discussed the secondary electron mean free path length in Aluminum. (Kathy Harkay)
- Cathode R&D: Connected IIT team with T. Rao at BNL for testing their SC photocathodes in BNL's SCRF gun. (Kathy Harkay)

## APS Machine Software

### AOP Applications Software

- Verified the working of Shangs new MXA method. (Louis Emery)
- Followed up on warning messages on new magnet QS4 in standardization procedure. Soliday fixed the problem. (Louis Emery)

## Storage Ring

- wrote RTFBDaqAcquire script per Nick's request to acquire, process and plot daq data for triggered and non-triggered acquisition. (Hairong Shang)
- modified tune measurement script to use HP loaner EXG signal generator and MXA, tested getxytunes and SRDispChromMeas with CY, both worked successfully and more efficient than MXA-VSA combination. (Hairong Shang)
- fixed mobo gap scan software problem which did not work after ID 1m 27 and 35 being upgraded, updated APSSRSetXrayBlades to obtain the ID sectors from config file so that it automatically removes the non-existent IDs and added special process for setting ID1 blade rates, instead of setting to ID1 normal blade rates, it sets to the ds or us blade rates depending on current gap state because ID1 normal blades are linked to ds or us blades based on their gap status. (Hairong Shang)

## Injectors

- added IRamp RMS, gain and delay to booster energy save logger and booster ramp save review tool. (Hairong Shang)
- developed ITSQEMeasurement for measuring ITS quantum efficiency, tested and installed, and added OAGapps application and gnome menu. (Hairong Shang)

## General

- fixed the segmentation error when calling urgent\_ subroutine because of not enough memory allocated and increased the array size of energy to 50001 (was 5001). (an important bug fix and improvement, so that one can have fine energy steps). (Hairong Shang)
- wrote script for copying local file into EXG (agilent signal generator) WAVEFORM to generate signal and drive the beam for tune measurement. (Hairong Shang)
- helped Jeff Dooling with plotting his 3-d data with contour plot, first use sdds2dinterplot to create contour plot needed data format and then use sddscontour to plot. (Hairong Shang)

## Publications, papers and report

- Yipeng Sun, MOGA optimization and evaluations of 90 pm Alternate H7BA Lattice, AOP-TN-2014-031 (Yipeng Sun)
- Awarded U.S. Patent on Low Work-Function Photocathodes Based on Acetylide Compounds (K. Harkay Co-Inventor). (Kathy Harkay)

## Web Site

- Maintain Next-Generation Storage Ring Meetings wiki web site. (Yipeng Sun)

## Meetings, workshops, conferences, committees, LMS related, and reviews

- attended PC gun/ Tcav meetings. (Yin-e Sun)
- Attended ASTA user meeting at Fermilab. (Yin-e Sun)
- Attended activities of the DOE review. (Yin-e Sun)
- Reviewed one paper for PRST-AB. (Yipeng Sun)
- Participated in preliminary discussions of attendees and speakers for the P3 workshop, as member

of the scientific organizing committee. ,Collected titles and abstracts from IIT team. Submitted attendee list for ANL and IIT. (Kathy Harkay)

- Reviewed two NSF proposals submitted under the Accelerator Science initiative. Submitted detailed reports. (Kathy Harkay)

## Safety and Required Training

- participated in ICMS day activities. (Yin-e Sun)

## Miscellaneous

- Met with DOE Triennial Review team. (Kathy Harkay)
- Submitted a notes that I had written in Feb on orbit correction producing a time-slope of the external perturbation. (Louis Emery)
- Refereed a PRSTAB article. (Louis Emery)
- Attended a break-out meeting with DOE reviewers. (Louis Emery)
- Gave talk on "Coupled Bunch Instabilities with Landau Cavities" to AOP group. (Louis Emery)
- Starting to attend MBA tolerance meeting regularly. (Louis Emery)
- Researched top-up running history from old emails and notes. (Louis Emery)