

# Weekly Report for 03/30/2015

## APS Renewal and Upgrade

- Summarized Touschek beam loss simulation results. Gave a brief summary to MAB physics meeting. (Aimin Xiao)
- Start injection simulation with a longitudinal mismatched injection beam. (Aimin Xiao)
- Had discussion on MBA Lambertson magnet design with Melike, Vadim and Louis. Will continue working on this issue. (Aimin Xiao)
- Estimated SC tune shift of PAR. Results show the effect is negligible. (Aimin Xiao)
- Did some simulation of HOM instability with HHC. Saw that the instability follows the 700 Hz. the synchrotron oscillation frequency without HHC. More checks should be done. (Louis Emery)

## MCR Operations

### Storage Ring Operations

- Discussed with H. Shang the ID configuration changes in ID1. (Jan) (Louis Emery)
- Discussed with and concluded with A. Xiao on realignment of the CPU in ID4.(Jan) (Louis Emery)
- Solved a loop instability with orbit correction when someone inadvertently used "plain" correctors at short interval.(Jan) (Louis Emery)
- Met with IMCAT to discuss steering and what the PVs they see mean. (Jan) (Louis Emery)
- Discussed with Schroeder, the possible cause of the ID5 gap offset and 20% larger spectrum experienced by the users.(Jan) (Louis Emery)
- Discussed with J. Dooling his observations in ID4 bunch-by-bunch losses using Cerenkov signals during a beam dump.(Feb) (Louis Emery)
- Investigated a reported beam motion in ID19. Found a clear correlation of bpm readback variation and corrector effort with a temperature PV. (Feb) (Louis Emery)
- Helped G. Fystro confirm that the ID6 upstream device is changing the offset of the nearby bpm. The limit switch on ID6us is touching the chamber with enough force.(Feb) (Louis Emery)
- Examined a beam loss and determined from FPGA bpm that a S3A:V3 changed by about -12 A.(Feb) (Louis Emery)
- 1.8 kHz noise seen on beam history from the morning's beam dump. I determined that the orbit response was both a mixture of closed orbit and substantial path length change and energy oscillations, indicating that many dipole had currents errors imposed on them.(Mar) (Louis Emery)
- Assisted in Aimin's orbit switch that had to extend into user time.(Mar) (Louis Emery)
- Looked into low BTS charge and efficiency with CY.(Mar) (Louis Emery)
- Analyzed today's beam dump with others. We found the culprit S34A:V3 which had a set point close to zero. We set the setpoint to 2 A. Fixed undesirable situation with zero-setpoint A:V3 corrector using V-delta waveforms with the help of H. Shang.(Mar) (Louis Emery)
- Helped recovery beam from a partial beam loss. Needed to turn off P0 feedback and increase chromaticity. Live with a lower (Louis Emery)

- lifetime of 6.5 hours for the next week. Discovered adjusting the tunes a little bit to get from 5% efficiency to 70%. This was investigated the next studies period and determined that off-target bunches were being lost. Sextupole or too-high IK1 problem? (Mar) (Louis Emery)

## Linac Operations

- Tested laser in anticipation of pc gun studies next week. (Jeff Dooling)
- Worked on RG1 beam matching. In reference to a file saved in 2006, lower the RG1 power to .06MW, adjusted the RG1 beamline quadrupoles and linac beam steering to get electron beam spot on L3:FS3, FS4 and FS5. Then measuring beam sizes on L3:FS3, FS4 and FS5 using the beam size measurement script, and adjust RG1 quadrupoles to optimize the beam size on the two end screens (FS3 and FS5) to be twice the size as on FS4 (per Borland's linac lattice design). In the meanwhile, keeping the linac beam transportation efficiency as part of the optimization goal. Obtained new RG1 file, with gun charge 1.4 nC, we got 1.2nC at LTP. LTP ==> PTB is 100% transmission; and saved file LPL2015-083-0324-225736.gz for further trajectory straightening. (Yin-e Sun)
- Accessed linac to comparing brightness of RG1 and RG2 cathode (both at 15W). Noticed that RG1 cathode still glows less brighter than RG2. Indicating actually power dissipated by RG1 cathode might be still less than RG2 -- currently (4/13/2015) to generate 200 mA, the cathode heater power read out on the EPICS screen of RG1 heater is 25.5W. (with gun RF power at 2.06 MW. (Yin-e Sun)

## Procedures

- ACIS RF Area Tunnel Search (APS\_1192811) (Randy Flood)
- RF Test Stand ACIS Operation (APS\_1192560) (Randy Flood)
- Operation of the Linac/PAR ACIS (APS\_1192894) (Randy Flood)
- Operation of the Injector Test Stand ACIS (APS\_1191879) (Randy Flood)
- ACIS Controlled Access (APS\_1192895) (Randy Flood)

## Training

- Re-certified on CPR (Randy Flood)

## MCR Operations administrative/misc.

- Approved operators' time cards (Randy Flood)
- Approved vacation requests, set up coverage and updated the online schedule (Randy Flood)
- Approve CTLs, IT and Other work requests (Randy Flood)

## APS Machine Studies

### Storage Ring Studies

- Joined beam stability investigation study with Louis and Nick. (Aimin Xiao)
- Organized studies topics for present run (Jan). (Louis Emery)
- Made a aperture scan in 4ID (in x and y), which indicated an apparent reduction of full aperture from last run. Asked Alignment group and others to check out ID4 VC. Asked Diag. group about saturation of readbacks for ID4 P0s at around 1.0 mm, which could be helpful in understanding the problem. With N. Sereno test 4 ID P0 bpm's, but found that it was too complicated to change the

hardware and software configuration. (Jan-Feb) (Louis Emery)

- Helped Yipeng sun test his several tune and aperture scan scripts. Tutored him on fill patterns, sddspcas, time management of studies. (Jan-Mar) (Louis Emery)
- Set up working SR optics (coupling) and chromaticities for operation using Borland's solution of sextupoles for 24 singlets. We are stable with P0 feedback at slightly lower chromaticities. Helped Sajaev repeat the same for hybrid bunch pattern. (Jan-Feb). (Louis Emery)
- Taking routine beam motion for Reininger who was curious about various frequencies seen in SR photon beam.(Feb) (Louis Emery)
- Assisted on several of Sereno's shift of 4x4 libera feedback.(Mar) (Louis Emery)
- Gave an update on how pre-run studies agenda corresponded with this run's actual studies. (Mar) (Louis Emery)
- Assisted on GRID xray bpm shift in understanding why reflective memory gave different results from scalar PVs. The Dsp processing is dissimilar to the internal processing of the raw values.(Mar) (Louis Emery)
- Assisted on trigger and topup injection for Harkay's beam loss study.(Mar) (Louis Emery)
- Test P0 feedback with large AC beam motion. We were not able to disturb the P0 feedback waveforms with a high AC beam motion.(Mar) (Louis Emery)
- Analyzed 19ID steering recovery of 3/1/2015. We found that, though the software worked as expected, a 5 micron change was locked into the nearest P1 bpm during a short open-loop time window in steering procedure, and affected orbit by 1 microradian when global orbit restarted. With N. Sereno, verified ID steering with beam in general are not quite reproducible to some level; however this level is quite low (< 1 micron) (Mar) (Louis Emery)

## Linac Studies

- Participated in further RG1 studies with S. Pasky. Found beam was usable for top-up SR injection and continued to use RG1 gun for user operations. (Jeff Dooling)

# APS Machine Research and Development

## Storage Ring Research and Development

- Completed script for determining calibrated beam loss in ID6. Script can apply to other sectors when calibration data becomes available. (Jeff Dooling)
- Read some literature on plane ground waves effect on accelerator optics as follow up with Sajaev's calculation of possible ground motion for APS-U. Read the results of floor vibrations measurement in APS tunnel from BNL people. (Jan) (Louis Emery)
- Read windowing functions in relation to multiple frequency lock-in measurement of response matrix - I believe we will get the hoped-for S/N in response matrix from using multiple frequencies.(Jan) (Louis Emery)
- Discussed growth rate calculations from damped HOMs plus many additional other weaker HOMs for APS-U MBA lattice. The CDF are not that different from undamped HOM because the many additional other HOMs contribute quite a lot by themselves. (Feb) (Louis Emery)
- Discussed with Borland what could be done with putting EGS (or GEANT) into elegant.(Feb) (Louis Emery)

Emery)

- Realized that we missed another chance at making the bellows sections with smaller aperture for the SCU1 when it was taken out in Jan.(Feb) (Louis Emery)
- Read updates on work done for APS-U physics (Jan-Mar) (Louis Emery)
- Discussed with Bingxin his proposal for a large-beam size monitor.(Mar) (Louis Emery)
- Set up HOM tracking plus HHC with elegant with Borland's suggestions and initial runs of HHC. Determined the order to put ILMatrix and SR effects in elegant to get a net zero energy change (to avoid synchrotron oscillations). Saw that the expected spread of frequency of bunches from HHC is not there when the oscillations are high amplitude. More checking is needed. (Feb-Mar) (Louis Emery)
- Discussed with Xiang Sun rf heating in bpm's, as seen in slides from Beldnykh.(Mar) (Louis Emery)
- Contacted L. Wanfa to start collaborating in using his code for APS-U. Calvey is taking over at this point. (Feb) (Louis Emery)
- Provided magnet strength data for some APS magnet families for comparison with APS-U MBA magnets.(Mar) (Louis Emery)
- Had a discussion with Sajaev on how to take an global average of beta for the MBA lattice with errors.(Mar) (Louis Emery)
- Gave feedback about septum apertures to Harkay on her IK1 kicker beam loss study.(Mar) (Louis Emery)

## Linac Research and Development

- Generated Photo-electrons from the PC Gun. About 35 pC bunch charge was measured on the current monitor, at a QE of about  $1.7e-5$ . UV laser energy on cathode is about 11 uJ. (Yin-e Sun)
- Both the QE and the UV energy needs to be improved. In preparation for laser cathode cleaning, tested a laser raster scanning script on cathode. Unfortunately, the test caused the UV laser to run away from the imaging cameras. We learned that the coarse control of the picomotors should not be used when scripted is running, only the fine control with a fixed number of steps can be used. The ultimate solution will be purchasing closed-loop motors / controllers for the precise control position as required in laser-cathode cleaning (30um steps of a 30um rms laser beam spot), when funding becomes available. (Yin-e Sun)
- Did a walk-through of the LEUTL tunnel to check out functional equipment and beamline for planning PC gun beam in LEUTL in the future. Took pictures and notes. (Yin-e Sun)

## Other Research and Development

- visited AWA during their emittance exchange experiment. (Yin-e Sun)

## APS Machine Software

### AOP Applications Software

- Asked N. Schwarz to handle installing his PVPanelApplet for use with any account, including SR. (Soliday and H. Shang and IT contributed to the installation phase) (Jan) (Louis Emery)
- Helped T. Fors investigate a EPICS CA hang-up while using cavput.(Jan) (Louis Emery)

- Discussed with Schroeder how to ask Soliday to make a new dataset for archiving.(Mar) (Louis Emery)
- Discussed with H. Shang and Y. Sun the possible need of implementing the robust line optimizer from X. Huang into our own on-line optimizer.(Mar.) (Louis Emery)

## Storage Ring

- Discussed with H. Shang how to make launching SR orbit correction more robust against non-standard entries.(Jan) (Louis Emery)
- Explained the GUI on switching between pairs of P0 and P1s to Schroeder; changed the file permissions to allow asdops and sr, among other problems in steering and "polluting" bump bpms. (Mar) (Louis Emery)
- Generated new adt files for S27 Libera bpms.(Mar) (Louis Emery)
- Created AQS4 knob files for RHB lattice and symmetric lattice to be used in the future (Mar) (Louis Emery)
- Discussed with Sajaev on whether SRDynamciAperture should include the ID4 P2 bpms. ID4 now has a "deformed" phase space from the optimized sextupole.(Apr) (Louis Emery)

## General

- Verified T. Fors observations of sddsfft normalization, windowing and bugs. The normalization follow the convention physicists use rather that signal processing people. (Jan) (Louis Emery)

## IOC/EPICS/Controls/Linux/Solaris/Linux Clusters/Data Loggers/Simulation software

- Started building EPICS 3.14.12.5 and associated libraries (Randy Flood)
- Administer the EPICS CVS repository to ensure current versions are installed and conflicts are tracked down and eliminated. (Randy Flood)

## Publications, papers and report

- worked on an IPAC paper with co-authors. (Yin-e Sun)

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

- User beam stability meeting (Randy Flood)
- Met with new Grainger account manager (Randy Flood)
- Presented stats and operational issues to Ops Directorate meeting (Randy Flood)
- presented Linac gun related study topics at the Injector Studies Planning meeting. (Yin-e Sun)
- Gave a presentation of Touschek simulation on the group physics meeting. (Aimin Xiao)
- Arranged for trips to Barcelona for the 1st Workshop on Low Emittance Ring Lattice Design and for the IPAC15. (Feb) (Louis Emery)
- Reviewed two SBIRs. (Mar) (Louis Emery)

## Education, Mentoring and outreach

- Worked on lecture for SDDS and EPICS. (Louis Emery)
- Gave a ASD talk on HHC beam dynamics with G. Waldschmidt and T. Berenc's input. (Louis Emery)

## Safety and Required Training

- Attended the Graded Approach training seminar given by Steve Gauthier, ESQ-QA. (Jeff Dooling)
- Did ESH training in lock-out.(Jan) (Louis Emery)
- Reviewed JHQ (Jan) (Louis Emery)
- Attended RSSC meeting.(Jan) (Louis Emery)
- Prepared for ISO9000 audit (beam studies workflow). (Mar) (Louis Emery)

## Miscellaneous

- looked through the NSLS-II decommissioning equipment list, discussed with PS, diagnostics and water group people to see if any equipment can be used by us. Generated a list of desired equipment to upper management. (Yin-e Sun)
- Made machine study list for next week. (Aimin Xiao)
- Gave a highlight report on work had been done between Jan. 2015 to March. 2015. (Aimin Xiao)
- Reviewed publication list for past years 2010-2014. (Aimin Xiao)
- Collected documentation on and design points for our ratchet doors for a NSLS-II physicist. (Jan) (Louis Emery)
- Continued formatting the APS-U CDR chapter for accelerators including a sophisticated TOC package to follow requirements from the APS-U project office to make the CDR chapter look like a typical Windows document. Had IT group fix some missing latex files (Jan) (Louis Emery)
- Gave a list of technical limitations on SR operations to management for MAC meeting (Jan). (Louis Emery)
- With Soliday fixed latex compiling of SDDS documentations.(Jan) (Louis Emery)
- Researched way to graph networks (visualization of multiple connections) with <http://www.biofabric.org/> There may be an accelerator application, say, graphing the constraints of APS-U MBA design.(Jan) (Louis Emery)
- Accepted to be SME for Research Technical Position at ANL. Met with HR and other divisional representatives on "research technical" type positions.(Jan-Mar) (Louis Emery)
- Spread the benefits of Borland's sddsplot3 to others in the group.(Jan-Mar) (Louis Emery)
- Gave Dejus a list of URLs for obtaining archived SR beam parameters. Gave information on tilted beam on photon beamlines.(Feb) (Louis Emery)
- Attended several shutdown planning to explain what we want to do with ID4 VC.(Mar) (Louis Emery)
- Eve of Pi day. Used abri pie voucher to get pie at cafeteria.(3.14.15) (Louis Emery)

- Discussed with Guimei Wang of BNL about how we set up post-mortems and analyze the data at APS.(Mar.) (Louis Emery)
- Helped Harkay with cvs version roll-back, which is useful for me to know (Mar) (Louis Emery)
- Attended "First Light" Gathering. Snacks were plain. I expected at least some crab cakes. (Mar) (Louis Emery)
- Gave talk on orbit stability and correction for high-level orbit correction meeting with beamline scientists and G. Srajer.(Mar.) (Louis Emery)
- Attended seminar by Hung-chung Chao on beam dynamics of Walkinshaw resonances.(Mar) (Louis Emery)
- AOP meeting lecture on instabilities (Apr.) (Louis Emery)