

Weekly Report for 10/19/2015

Highlights

- Made progress with abort kicker studies. Confirmed that the kicker pulse waveform is close to what was measured in the lab. Discovered that at least two bunches (in 24-bunch mode) are strongly lost at ID1 (with V. Sajaev, J. Dooling, L. Emery). (Kathy Harkay)
- Made progress with abort kicker simulations. Discovered and corrected an error (calibrated sextupoles) in the elegant file. After V. Sajaev discovered that the ID1 beam losses are due to the SCU1 photon absorber, I added the absorber and repeated the multibunch, multiparticle elegant simulations, and now there are ID1 losses, similar to the studies (and V. Sajaev's single-particle simulations). (Kathy Harkay)

APS Renewal and Upgrade

- MOGA optimization with high beta injection cell of APS?U 3PW?V6 lattice, also for 53pm lattices with reverse bends. (Yipeng Sun)
- Simulated the influence of 5mm gap chambers on the single bunch current limit. Reducing all ID gaps from 6mm to 5mm reduces the current limit by ~ 2 mA, so that operating at 4.2 mA is possible only if the chromaticity is increased beyond 5. Adding some small number of 5mm ID gaps appears feasible, (Ryan Lindberg)
- Attended MBA radiation and accelerator physics meetings. (Jeff Dooling)
- Presented progress on ion instability calculations and simulations with the FASTION code. Showed that shaking is much less effective at clearing ions than predicted by the SLAC ion code. (Joe Calvey)
- Began work on speeding up/parallelizing the FASTION code so that full simulations can be run in a reasonable amount of time. (Joe Calvey)
- Analyzed PTB beam size data, which indicates a somewhat larger emittance than we've been assuming. Running simulations with the larger emittance to see what effect this has on the PAR ions. (Joe Calvey)
- Convened an Injector WG meeting for Oct 26 (CY Yao and J. Calvey gave presentations). (Kathy Harkay)

MCR Operations

Storage Ring Operations

- Assisted MCR with turning beam over to Users. (Karen Schroeder)
- Assisted the MCR with instances of beam motion. (Karen Schroeder)
- Assisted Emery with performing single gap scan during User operations. (Karen Schroeder)
- Gave instructions to MCR so correct gains could be saved in the SBPM SCR Operator preferred file for S35 when gaps are fully opened. Updated the System Manager file with the same at Sereno's request. (Karen Schroeder)
- Measured the abort kicker current pulse waveform (8 kV and 10 kV) with J. Wang, which appears to be consistent with what was measured in the lab (he only gave me BdL measurements). (Kathy Harkay)
- Reviewed the first quench data written to a file that Marty Smith and Rich Diviero generated with the python script. Discussed improvements to the code with Marty. (Kathy Harkay)

Linac Operations

- Made access into linac Tuesday to correct alignment and re calibrate energy meters. (Jeff Dooling)
- Collected additional uv profile data in the laser room transport box. (Jeff Dooling)
- Ran additional shower/EGS simulations to better quantify the possible radiation levels in the LR with pc gun beam. (Jeff Dooling)
- Arranged radiation survey at the Injector Test Stand and the laser room while operating the photocathode RF gun spectrometer beam line. Run the PC gun at various RF operation conditions with the gate valve upstream of L1:AS1 closed, spectrometer magnet above +3 A for the radiation survey. Documented radiation survey results. (Yin-e Sun)

Procedures

- Reviewed two updated procedures and approved. (Karen Schroeder)

Training

- Completed another ACO requalification and began the requalification of another. (Karen Schroeder)

MCR Operations administrative/misc.

- Produced downtime report and either presented it myself or gave it to Flood to present to OPS Directorate. (Karen Schroeder)
- Reviewed and approved non-RSS SR work requests. (Karen Schroeder)
- Investigated multiple partial beam losses during studies. Determined the problem was RF4 and MCR contacted the appropriate personnel. (Karen Schroeder)
- Updated related PCGun medm displays to make them more useful for studies. Also incorporated additional alarms for machine protection and awareness. L1:PC1:BM1:PS magnet temperature (Stan Pasky)

APS Machine Studies

Storage Ring Studies

- Performed gap scans to update ID gap feedforward tables. (Karen Schroeder)
- Made notification to appropriate people about scheduled studies (MPS validations needed, shutters open, etc.) (Karen Schroeder)
- Develop new APS optics for small round physical aperture at helical SCU at S32. Achieved 15mm to 10mm diameter in optics design. (Yipeng Sun)
- Performed machine studies for 15mm diameter in X, $\beta_{\min}=1.8\text{m}$. (Yipeng Sun)
- Participated in Abort Kicker studies with K. Harkay, L. Emery, and V. Sajaev, measuring the strength of the kicker on every other bunch in a 24-bunch fill pattern (12 of 24). (Jeff Dooling)
- Continued abort kicker studies, which focused on measuring the pulse waveform with a single bunch with a small kick (2 kV, does not kill the beam). Participating were V. Sajaev, L. Emery, and J. Dooling. (Kathy Harkay)
- Continued abort kicker studies using 10 kV (operating value), scanning the waveform with a single

bunch. Participating were V. Sajaev, L. Emery, and J. Dooling. The goal was to measure the loss location with the BPMs as well as the loss signals with the BLMs. The main result was that 2 bunches are strongly lost and 2 bunches partially lost at ID1. J. Dooling calculated the calibrated ID1 and ID6 BLM losses. I quantified the BPM loss at key locations using the sum signal (S39, ID1, ID6), and made a table comparing these to J. Dooling's results, and they agree rather well. (Kathy Harkay)

- Presented studies summaries at weekly machine studies meetings (10/22 and 10/29). (Kathy Harkay)

Linac Studies

- Corrected pixel to line calibration; reanalyzed PC Gun solenoid scan data from 10/12. (Jeff Dooling)
- Helped with the PC Gun drive laser alignment and energy calibration during a linac access. (Yin-e Sun)
- Run the PC spectrometer line. Observed beam on the spectrometer screen and Faraday cup. (Yin-e Sun)
- Run the PC Gun beam down to the end of APS linac. with ~320 pC measured at the PC Gun current monitor, we observed ~220 pC at the end of linac (L5 current monitor). Most of the beam loss occurred at L1 to L2. (Yin-e Sun)
- Observed PC Gun beam on the spectrometer screen at the end of the linac (FS10). (Yin-e Sun)
- Observed beam on the three screen at L3:FS3-FS5. (Yin-e Sun)

APS Machine Research and Development

Storage Ring Research and Development

- Began simulation of transverse feedback at the APS, trying to reproduce the experimentally measured accumulation limit. Found that the simulation predictions including feedback depend on the details at injection, which is different than those without feedback. (Ryan Lindberg)
- Carried out single-bunch, 2000 macroparticle elegant simulations for the abort kicker, 2 kV, and compared the centroid trajectory to the BPM turn-by-turn data from machine studies. Did a preliminary fit of the kick in each of the first three turns. The first turn fit appears to follow the expected kicker waveform (only had 8 & 10 kV data at the time), but the second and third turns appear to show oscillations. Discussed the results with J. Wang, and presented the results at the weekly machine studies meeting. (Kathy Harkay)
- Obtained measured BdL data for the abort kicker at 2 kV from J. Wang, digitized the plot and converted it into an sdds file including the computed kick. (Kathy Harkay)
- Dug into the elegant fits in more detail. When the first-turn kick was high, a large betatron phase shift was noted in the second and third turn. V. Sajaev also looked at fitting the same data and did not see such a big phase shift. After discussions with V. Sajaev and L. Emery, I discovered that I was not in fact using the correct sextupoles from the calibrated model. After I corrected the sextupoles, the agreement was improved, although some (smaller) betatron phase shift was still observed. Repeated the fits, and compared the results with the 2-kV bdL waveform, and now there is good agreement for the second turn. The third turn still shows a deviation, as V. Sajaev also observed. (Kathy Harkay)
- V. Sajaev discovered that the ID1 beam losses are on the SCU1 photon absorber, which had not yet been added to the official aps.lite elegant lattice file. V. Sajaev saw ID1 losses with single-particle simulations. Repeated the multibunch, multiparticle elegant simulations with the PA included and

now I also see ID1 beam losses (7.6 mA out of 102 mA). (Kathy Harkay)

Linac Research and Development

- discussed with diagnostics group about additional trigger for pc gun bpms. (Yin-e Sun)
- Submitted project proposals on interleaving and linac beam physics. (Yin-e Sun)

ITS Research and Development

- Coordinating a High Power Test of an Ultra-High Gradient Compact S-Band (HGS) Accelerating Structure in the Injector Test Stand. RadiaBeam Technologies reports on the RF design, fabrication and high-power tests of a ultra-high gradient S-Band accelerating structure operating in the pi-mode at 2.856 GHz. The compact HGS structure offers a drop-in replacement for conventional S-Band linacs in research and industrial applications such as drivers for compact light sources, medical and security systems. (Stan Pasky)

APS Machine Software

Storage Ring

- the brief gap scan table was re-created during startup, which had improper values for SCU1 and caused the gap scan pem stuck because SCU1 could not reach the desired setpoint. Updated gap brief scan table for SCU1 (should not exceed 34mm) and modified makeGapScanMonitorFile script for SCU1. (Hairong Shang)
- wrote script to update HOM.searchResults in SR daily directory for search and compare feature in CollectRFSpectrum. And made the data rootname to be consistent with selected preset. (Hairong Shang)
- Improved ScopeSaveRestore: recomputed the deltaT of HP9000 waveform data for interpolation mode, because the waveform data has more points due to interpolation. (Hairong Shang)
- fixed the problem in sddsgencontrolbits when the turn marker offset is greater than the turn marker interval. And created 6 bunches per turn presets FPGA bpm timing control for machine studies. (Hairong Shang)
- updated the xray bpm status PV names in SRXrayBPMStatusUpdate, SROrbitControllaw, and APSMpSRCorrectionConfiguration.tcl (Hairong Shang)

Injectors

- added "Get Lattice" button per operator's request to BoosterCorrectorControlNew (Hairong Shang)
- changed to use "pv umon" in BRampSwapSync to reduce the channel access traffic, tested and fixed the swap/sync errors which caused by sending the swap/sync command at the same time. Split swap/sync into two commands, and fixed the problem. (Hairong Shang)
- modified APSMpBoosterSwitchLattice.tcl to link the BOOSTER controllaw directly to IRamp or VRamp BOOSTER controllaw. (Hairong Shang)

General

- study Xiaobiao Huang's RCDS optimizaiton algorithm and started writing it in C. (Hairong Shang)
- modified DataLoggerViewer to be able to plot histogram. (Hairong Shang)
- Improved SaveCompareRestore: added option of continue (ignore the difference) or abort altering

snapshot if the replacement data has different columns as the original snapshot, (Hairong Shang)

Publications, papers and report

- Made an RM&D review on all the injectors, made the necessary corrections and updates. (Stan Pasky)

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

- Attended emergency OPS directorate meeting for steam plant shutdown. Passed that info on to the MCR and requested that they do walkthroughs of experimental floor to check for leaks. (Karen Schroeder)
- Reviewed a paper on bending magnet radiation properties for PRSTAB. (Ryan Lindberg)
- Took part in the triennial ASRC review of the APS Tuesday morning. (Jeff Dooling)
- hosted a photoinjector physics meeting. presented PC gun beam line related work during last shut down, beam measurements; reported the visit to LCLS-I drive laser. (Yin-e Sun)
- Presented report to COOL15 on a AOP group meeting. (Yin-e Sun)
- Prepared slides on linac past and future three years for management ASRC meeting. (Yin-e Sun)
- attended high gradient structure testing at ITS planning meeting. (Yin-e Sun)
- Participated in search committee work for TRIUMF ALD for Accelerators, including a telephone conference with the committee. (Kathy Harkay)

Education, Mentoring and outreach

- I am helping Medani Sangroula prepare his research proposal for his comprehensive exam at the beginning of December. (Ryan Lindberg)
- participated the emittance exchange experiment at AWA/ANL. (Yin-e Sun)
- Continued collaboration with SLAC on 5-dipole compressor. Generated 100k particle files at the entrance of the compressor and sent initial input files to slac collaborators for CSR studies. (Yin-e Sun)
- Communicated with Fermilab collaborator on the thermionic cathode rf gun studies. (Yin-e Sun)
- Chose an official postdoc mentor (K. Harkay). (Joe Calvey)

Safety and Required Training

- Finished one training course. (Yipeng Sun)
- Attended a two-day Cryogenics Training Class, provided by Cryoco LLC The class had technical content relevant to day-to-day oversight and maintenance of the liquid nitrogen distribution system at the APS. The intent of the class was to increase general cryogenic safety awareness and provide information at an introductory level for operations and maintenance of these systems. (Stan Pasky)
- Completed LMSPROC137 REQUIRED READING - Release of Materials and Equipment. (Stan Pasky)
- Completed safety training for ASD102, ASD115, ASD125, ESH114, and reviewed LMSPROC137. (Kathy Harkay)

Miscellaneous

- attended group LOTO refresher (Yin-e Sun)