Minutes

PSP/AD Taskforce Meeting
Date: 20190912
Time: 10:00 am
Place: Huddel

Dave Capista: Presented one page spread sheet with various topics of interests
- 20 Hz upgrade of the Booster and rest of the complex is going to be a real challenge.
- He listed several items of concerns
1) Gradient magnets PS
2) GMPS has to run at higher voltage. Dave stated that according to Criss Jenson no tests have been made.
3) Controls- upgrades? Many application programs currently being used today may have to be looked into.
4) HLRF, Booster, MI and RR. One has to test operational feasibility of all Booster RF stations. Who is going to do it? and when and on what time scale? -should be ready and fully functional by PIP-II LINAC comes online.
5) LLRF: Right now, Booster LLRF uses old technology. When, how, what time scale and who should take responsibility of 20 Hz upgrades to these. Also, Hand shaking between accelerators.
6) Dave wants to start testing the 20Hz capability during next shutdown on various devices.

In order to discuss these subjects in detail he wants to have another meeting. Currently we have planned to have a meeting on next **Thursday Sept 19, 2019 at 1:30 pm** (tentative).

Valeri Lebedev: Presented on "Characterization of Transverse Beam Motion in Booster"
Beams Doc- 7625; http://beamdocs.fnal.gov/AD/DocDB/0076/007625/001/BeamMotionInBooster-VL.pdf

Studied longitudinal beam dynamics of Booster beam on operational cycles using Nathen's transverse damper pickup.
1) H and V damper pickups signals are digitized with 0.4 ns sampling time for about 10 ms of Booster cycle around transition crossing. Data for V and H motions were acquired at different cycles. He presented analyzed data on turn by turn for each bunch, bunch position averaged over one turn, spectra of beam motion and dependence of longitudinal modes of relative motion on time.
2) In his data he could see transition crossing clearly. Beam position measured with an RMS deviation due to noise ~3um.
3) Divides the data into 6 regions and FFT was done
4) Horizontal plane: by studying the horizontal motion of separate bunches, one could see oscillatory motion of the bunch before as well as after TX.
5) the frequency of oscillation is about twice the synchrotron oscillation frequency.
6) Modes 2 and 29 dominate at around 1600 turns before transition crossing (near to 1st point of data) and at TX. Both of them are unstable.
7) Vertical plane: the oscillations are much smaller.
8) We have to apply longitudinal damping even before TX

Comments:
IK: Study on head-tail instability in the Booster beam will be interesting. Coupled mode oscillations in the Booster beam will be detrimental to the slip tacking in RR.
CB: Beam longitudinal motion before transition very much depends on how beam is captured. In the past we have used synchrotron motion of the clumps of beam (produced due to non-adiabatic beam capture) in a bucket from capture to about 200 us to calibrate RF voltage. At that time the bunches were ~20 ns (buckets were almost full) and we have looked at other modes.

Chandra Bhat: "Beam Energy Spread in Booster at Injection"
Beams Doc- 7622; http://beamdocs.fnal.gov/AD-public/DocDB/ShowDocument?docid=7622
Presented a method to measure the beam energy spread of LINAC beam bunches in Booster.
1) used the data from 2017-2019 (before shutdown). Data include data with 400 MeV transfer line debuncher RF cavity ON/OFF and Booster RF cavity OFF. Also, data taken on acceleration mode and DC mode.
2) Beam with a single bunch in LINAC notch: three Gaussian fits and 5-Gaussian fits analysis are presented.
2) Multi-bunch analysis
3) Results from Booster notch method is also presented.
4) Comparison with data taken prior to installation of Marx modulator in LINAC
5) We find that
   a. energy spread of LINAC beam dE(95%) ~1.9+/-0.1 MeV (currently)
   b. "Single Bunch in LINAC Notch" method can be used to measure beam energy spread distribution along a long LINAC beam pulse by leaving one or two bunches in the middle of every 2nd or 3rd notch. This method may become a valuable tool during PIP-II era to characterize the SC LINAC beam.
   c. Prior to 2018 the dE of the LINAC beam at injection in Booster appeared to be ~40% smaller than now. This needs further investigation.

Comments:
VL: The WCM data on the LINAC beam need cable dispersion corrections. Probably the bunches are much narrower than what is presented.
DEJ: Chandra has taken difference in the measured bunch lengths between 1st and 2nd turn WCM data. So, results may not be still OK.
WP: It is very straight forward measure to cable dispersion.
KT: We can make cable dispersion measurements tomorrow if possible.