MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: **165** Type: **Presentation**

Beam Based RF Voltage Measurements at the Fermilab Booster (RCS) for Intensity Upgrade

Thursday, 3 August 2017 14:45 (25 minutes)

Fermilab Booster is the second oldest rapid cycling synchrotron (RCS) in the world. In the intensity frontier (IF) program of Fermilab, the Booster plays a critical role. Currently, (PIP-era) the Booster receives proton beam from the 400 MeV normal conducting LINAC and accelerates the beam to 8 GeV using its twenty RF stations that are distributed around the ring. The main dipole magnets of the Booster cycle at 15 Hz and follow a sinusoidal magnetic ramp. During the PIP-II era, this cycle rate will be increased to 20 Hz and a higher intensity beam (>1.5 times higher than the PIP intensity) will be injected from a superconducting LINAC. The required accelerating RF voltage during PIP-II era will need to be about 30% more than during the PIP era. Therefore, it is extremely important to find out the current RF voltage by carrying out beam-based measurements to specify the needed upgrades to the Booster RF system. During the beam cycle the magnetic field is changing all the time. Due to this, 1) measuring/calibrating the RF voltage used for beam capture and acceleration, 2) longitudinal beam tomography, are not trivial tasks. Here we present a method to accomplish both tasks near injection and extraction energies of the Booster. Python/Matlab programs* have been developed which use wall current monitor data to measure synchrotron frequencies and extract the RF voltage with an accuracy of 13% at injection and 7% at extraction. We have also attempted to obtain the beam tomography in the longitudinal phase space using these data. The method developed here is applicable to any similar RCSs in the world.

*The author would like to thank Shreyas Bhat from the Fermilab Computing Division for his involvement in developing a necessary Python program for the data analyses.

Work supported by Fermi Research Alliance, LLC under Contract No. De-AC02 07CH11359 with the United States Department of Energy

Primary author: Dr BHAT, Chandra (Fermilab)

Presenter: Dr BHAT, Chandra (Fermilab)

Session Classification: Accelerators

Track Classification: Accelerators