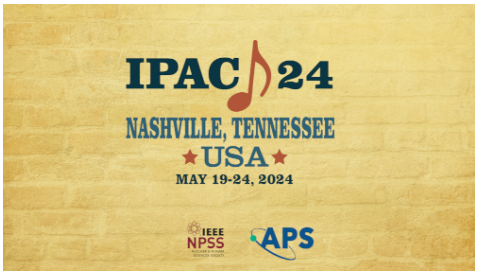

Contribution ID: **1890** Contribution code: **TUPS58** Type: **Poster Presentation**

Virtual diagnostics and ML-based longitudinal stability corrections at the Fermilab linac

Tuesday, 21 May 2024 16:00 (2 hours)

The Fermilab Linac delivers 400 MeV H- beam to the Booster rapid cycling synchrotron. A major source of Booster losses at injection, especially in an injection painting scheme as will be employed at PIP-II, is Linac centroid energy (momentum) drift and energy spread. Factors like ambient temperature and humidity variations affect cavity resonant frequencies. This, combined with fluctuations in the energy and phase of particles emerging from the Front End causes perturbations in the longitudinal motion of beam in the Linac, resulting in longitudinal emittance blowup and central momentum drift. To improve longitudinal stability, we have developed several machine learning (ML)-based correction schemes using beam position monitor (BPM) and beam shape monitor (BSM) data. The BSM is a longitudinal profile monitor and is particularly useful in the drift tube section of the Linac where BPMs are sparse. However the BSM is a destructive diagnostic thus taking data is expensive. To mitigate these limitations, work is on-going on developing ML-based modeling of the beam longitudinal phase space, to be used as virtual BSM for tuning.

Footnotes

Funding Agency

Paper preparation format

LaTeX

Region represented

North America

Primary author: SHARANKOVA, Ralitsa (Fermi National Accelerator Laboratory)

Presenter: SHARANKOVA, Ralitsa (Fermi National Accelerator Laboratory)

Session Classification: Tuesday Poster Session

Track Classification: MC6: Beam Instrumentation, Controls, Feedback, and Operational Aspects: MC6.D13 Machine Learning