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Model Enhanced IPM Based Emittance Measurements at the BNL Alternating Gradient Synchrotron

Tuesday 9 September 2025 16:00 (2 hours)

The Alternating Gradient Synchrotron (AGS) at Brookhaven National Lab is equipped with two types of Ionization Profile Monitors (IPMs): ion-collecting and electron-collecting. Ion-collecting IPMs are susceptible to significant distortions in the measured beam size due to the space charge of the passing beam. Conversely, electron-collecting IPMs are much less affected but can only be operated periodically to preserve sensor lifespan. In this work, WarpX simulations of IPM operation are used to characterize the measured beam size as a function of circulating beam parameters and IPM operating conditions. We then study the efficacy of integrating machine learning models into the beam size prediction algorithm to generate a better emittance measurement. We consider both supervised and unsupervised approaches. The former utilizes simulations to back out the contribution of space-charge when the ions drift from their point of origin to the collection rods. The latter case uses machine learning for noise reduction to get a better fit of the beam size data.

Footnotes

Funding Agency

I have read and accept the Conference Policies

Yes

Author: HALL, Christopher (RadiaSoft (United States))

Co-authors: HOFFSTAETTER, G. (Cornell University); EDELEN, Jonathan (RadiaSoft (United States)); BROWN, Kevin (Brookhaven National Laboratory); SCHOEFER, Vincent (Brookhaven National Laboratory)

Presenter: HALL, Christopher (RadiaSoft (United States))

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