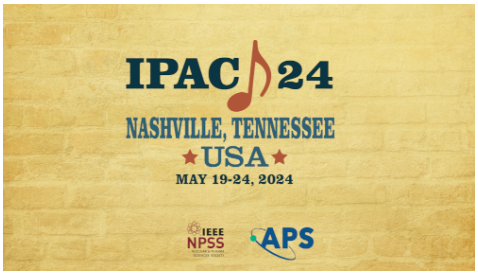

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Demonstrations of the 4D phase space reconstruction of flat and magnetized beams using neural-networks and differentiable simulations

Monday, 20 May 2024 16:00 (2 hours)

Phase space reconstruction using Neural-Networks and differentiable simulation* is a robust beam diagnostic method to obtain complete 4D phase space including the coupling terms such as (x-y') and (y-x'). In the first experimental demonstration, it was verified that the RMS beam envelope and normalized emittance from the reconstructed phase space are quantitatively similar to those from the conventional beam diagnostics such as quadrupole scan. In addition, here we show the demonstration of the phase space for the i) flat and ii) magnetized beam where the beam has i) very large ratio in between horizontal and vertical emittances (e.g., enx/eny »1) and ii) transverse coupling induced by non-zero solenoid magnetic field at the cathode (known-as canonical momentum-dominated beam). Through the demonstrations using the experimental data achieved at the Argonne Wakefield Accelerator Facility (AWA), we successfully obtained the information such that the measured flat beam indeed has the emittance ratio larger than 70 with minimized transverse coupling. In addition, we were able to obtain the magnetization from the reconstructed phase space. Moreover, we will compare the beam parameters obtained from the phase space reconstruction and conventional diagnostics and discuss the uncertainty of the parameters.

Footnotes

- R. Roussel et al., Phys. Rev. Lett. 130, 145001, 2023

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