Contribution ID: **73** Type: **not specified**

Application of deep learning method for insertion device orbit and coupling feedforward at the SSRF

Tuesday, March 18, 2025 11:25 AM (25 minutes)

The Shanghai Synchrotron Radiation Facility (SSRF), a third-generation synchrotron radiation source, demands exceptional beam stability for high-precision user experiments. However, manufacturing and installation inaccuracies in insertion devices (IDs) can lead to beam orbit and coupling distortions. To address this, we developed a data-driven predictive model leveraging deep learning to forecast the effects of ID gap variations. The model facilitates real-time feedback control by adjusting corrector and skew quadrupole currents, effectively mitigating ID-induced perturbations on beam orbit and coupling. Implementation at SSRF demonstrates a substantial reduction in these perturbations, resulting in enhanced experimental stability and reliability.

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Session Classification: Source position stability: part 2