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# Machine learning-based orbit correction in the RCS of CSNS

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The rapid cycling synchrotron (RCS) of The China Spallation Neutron Source (CSNS) accumulates and accelerates the injection beam from 80 MeV/300 MeV to the energy of 1.6 GeV and then extracts the high energy beam to the target. During each cycle of the RCS ring, beam positions at the same BPM vary over time due to energy and mode transitions. Traditional orbit correction averages turn-by-turn (TBT) data over 512 turns, producing 20 points over 20 ms, and applies the response matrix method to correct each orbit independently. However, this approach overlooks temporal orbit variations and inter-orbit correlations, limiting correction accuracy. To address these limitations, we implemented a machine learning-based orbit correction system. Using raw BPM orbit data as inputs and corrector changes as outputs, the model learns the relationship between orbit deviations and correction actions. Results demonstrate that this method effectively corrects time-varying orbits, achieving significantly improved performance. This paper presents a detailed overview of the machine learning-based approach.

## Footnotes

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