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Extracting critical beamline element misalignments from data using a beam simulation model

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Successful implementation of AI/ML models for online tuning of accelerators highlights the need for accurate simulation of beamline elements. Deployment of such models requires the inclusion of realistic element misalignments during the simulation process. This paper presents an original method to determine misalignments across entire beamlines and apply them to the previously developed TRACK simulation model. Validation and sensitivity analysis has been performed in this study for a newly commissioned section of ATLAS called the Argonne Material Irradiation Station (AMIS) using experimental data. A preliminary study shows the average difference in beam transmission between experiment and simulation for 28 tuning cases has dropped from ˜46% without steering to ˜17% after applying steering and further down to ˜8% after accounting for 4 quadrupole misalignments in the simulation. Given these values and the well-established accuracy of the TRACK model, major deviations in element positions could be narrowed down enabling engineers to perform the necessary alignment corrections, and possibly eliminating the need for some steering elements. Predictability of the TRACK code has been shown to significantly improve after applying realistic alignment and steering corrections

Footnotes

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