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ADVANCING NON-LINEAR SPACE CHARGE SIMULATIONS

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This study explores various neural network approaches for simulating beam dynamics, with a particular focus on non-linear space charge effects. We introduce a convolutional encoder-decoder architecture that incorporates skip connections to predict transversal but also coupled 3D electric self-fields. The model demonstrates robust performance, achieving a Mean Absolute Percentage Error (MAPE) of 0.5% within just a few minutes of training. Our findings indicate that these advancements could provide a more efficient alternative to numerical non-linear space-charge methods in beam dynamics simulations, where the speed up is significant.

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