

FAIR SIS100 design and operation goal: Conserve beam quality and minimize beam loss

Evolution of the beam quality and losses is dominated by space charge and magnet error resonances.

Simulation models (on GPUs or multi-core) are very demanding in terms of computing resources.

Fast models are required for optimization, including also counter measures, like correction schemes.

Project: Establish, fast and accurate surrogate models with machine learning, including (simplified) space charge models

Physics-based neural networks¹, requiring no or less training.

[1] A. Ivanov, A. Agapov, PRAB 2020

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19.0-

18.9

18.8

18.7

18.6

18.5

Q V -20

16

[%]

Beam losses [

18.5 18.6 18.7 18.8 18.9 19.0 Q_x Computation time: **s** 40 x 40 x 9 x 3 min = 30 day

SIS100, all field errors, 20'000 turns