Reconstruction of 6D phase space using machine learning techniques at FLASH .

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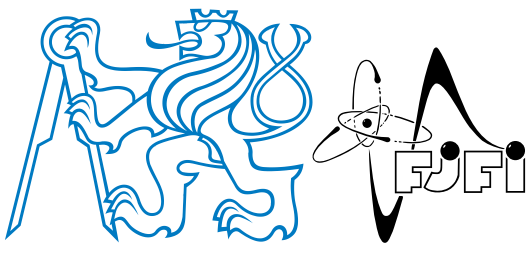
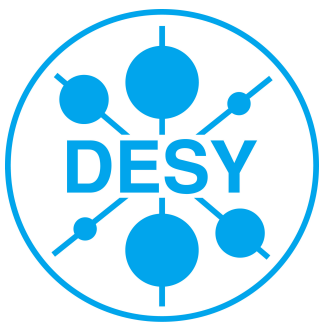
30.9.2025





Overview

- Introduction
- Generative Phase Space Reconstruction
- Implementation at FLASH
- Future plans

Generative phase space reconstruction (GPSR)

- R. Roussel et al. (2024), Efficient six-dimensional phase space reconstructions from experimental measurements using generative machine learning
- Argonne Wakefield Accelerator (AWA) - 20 two-dimensional measurements, few minutes [2]

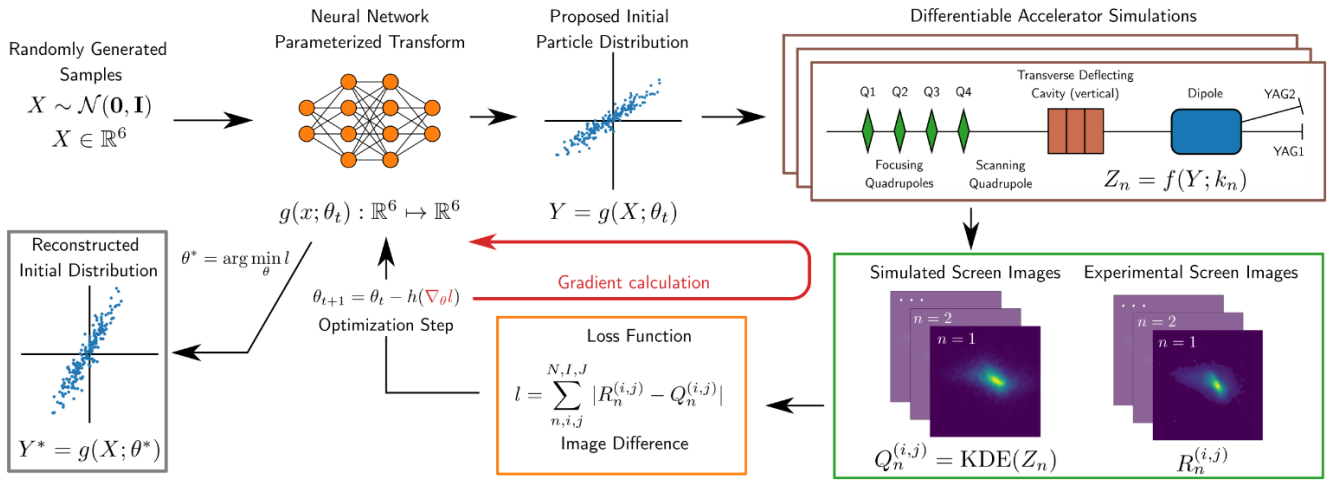


Figure: GPSR technique. *Source*: [2]

Implementation at FLASH

- Cheetah - Differentiable beam dynamics simulation engine
- J. Kaiser et al., Cheetah: Bridging the Gap Between Machine Learning and Particle Accelerator Physics with High-Speed, Differentiable Simulations [3]

Figure: FLASH PolarixTDS section with quadrupole magnets, dipole and OTR screen. *Source*: Adapted from [1].

Thank you!

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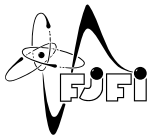
*Typeset by lua*LaTeX



References I

[1] F. Christie, J. Rönsch-Schulenburg, and M. Vogt, "A PolariX TDS for the FLASH2 Beamline", in Proc. FEL'19, Hamburg, Germany, Aug. 2019, pp. 328-331. doi:10.18429/JACoW-FEL2019-WEP006

[2] R. Roussel et al., "Efficient six-dimensional phase space reconstructions from experimental measurements using generative machine learning," Physical Review Accelerators and Beams, vol. 27, no. 9, Sep. 2024, doi: 10.1103/physrevaccelbeams.27.094601.

References II

[3] J. Kaiser, C. Xu, A. Eichler, and A. S. Garcia, "Cheetah: Bridging the Gap Between Machine Learning and Particle Accelerator Physics with High-Speed, Differentiable Simulations," arXiv (Cornell University), Jan. 2024, doi: 10.48550/arxiv.2401.05815.