



TRAINABLE workshop

Data Generation WG
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Active Learning for Exploring Resonance Diagrams

Context:

- Facility for Antiproton and Ion Research (FAIR): wide variety of beam types
- synchrotrons: operate at space-charge limit
- **goal:** identify optimal settings for machine and predict maximum tolerable intensity
- **problem:** computationally costly simulations for 1 sec storage time (160'000 turns)
- ✓ 1st step: PIC space charge (\approx weeks) \implies effective models (\approx hours) for SIS100 [1]¹
- ⚠ 2nd step: smart parameter sampling
- ✗ 3rd step: predict for \approx 10 parameters

¹[1] Oeftiger et al. 2022, Phys.Rev.Accel.Beams 25, 054402 /

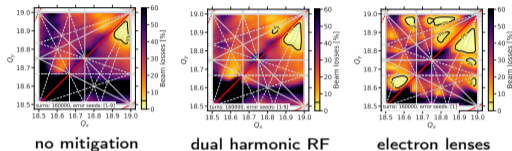
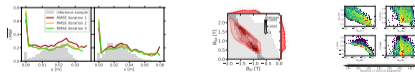


Figure: 2'500 simulations per resonance tune diagram

First results with **uncertainty-aware deep active learning** for exponentially nonlinear vertical FFA machines [2]²:



²[2] Oeftiger et al. 2023, IPAC'23 Proceedings /