

Meet & greet talk

Alexander Schütt

Helmholtz-Zentrum Berlin

RL4AA'23

- Task: Predict the vertical beam size of the electron beam
- Why?
 - Derive vertical beam size from device settings
 - Long term: Adjust noise generator for constant beamsize
⇒ minimize impact from one user to another
 - Preparation for BESSY III: round beam

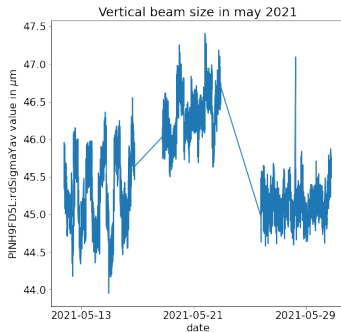
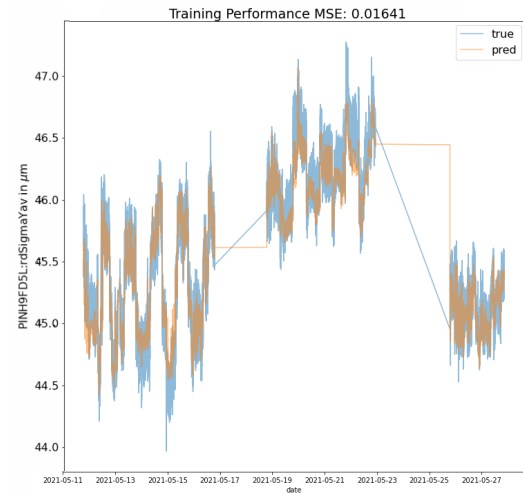
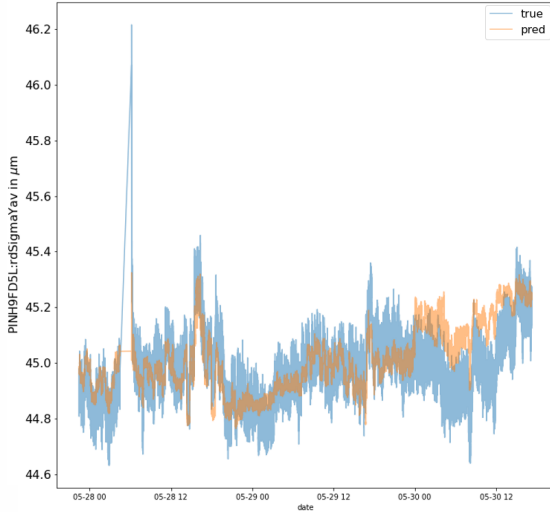


Figure 1: Vertical beam size of electron beam, measured using a pinhole camera.

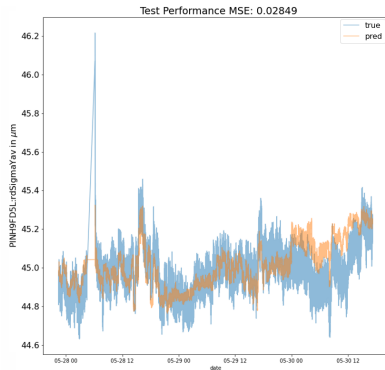
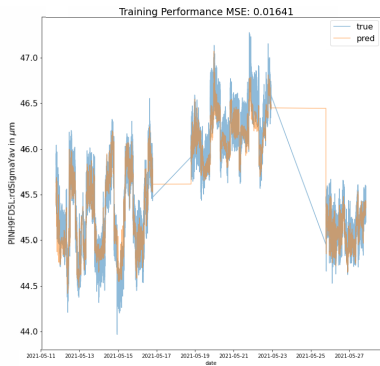
Recurrent neural network regression



Test Performance MSE: 0.02849



Performance Analysis



Idea for Master thesis (With RL)

- Task: Optimize steerer control
- Currently: Beam controlled via Least squared method

$$\Delta s_{t_i} = (R^T R + \lambda \text{Id}_{64})^{-1} R^T (-b_{t_i}),$$

- **Problem:** Response matrix R might change in time
- Easy solution: Update response matrix via

$$R_{\text{new}} = R_{\text{old}} - 2\alpha (R_{\text{old}} s_{t_i} - b_{t_{i+1}}) s_{t_i}^T$$

- Better solution: With RL?

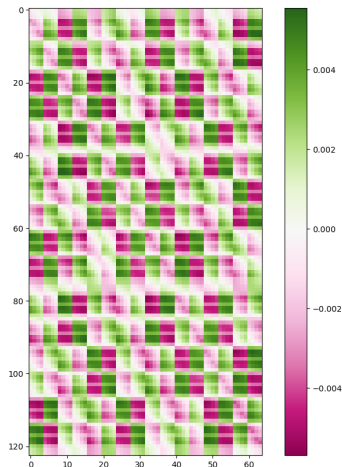


Figure 2: BESSY II response matrix

Better Solution with RL?

- Car driving analogy: „If I can drive 1000 cars, then small changes in the cars will not bother me.“
- Idea: Train the RL-agent to pick optimal steerer settings, after observing the BPMs, on multiple response matrices

$$R_{\text{new}} = R + \varepsilon,$$

where $\varepsilon \in \mathbb{R}^{123,64}$ random

- To debate: Can it perform better than the easy solution?