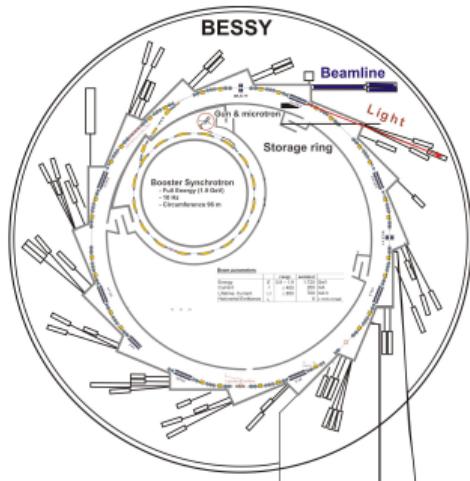


# ACCLAIM Kick-Off: HZB Introduction and Plans

Luis Vera Ramírez

Helmholtz-Zentrum Berlin  
[luis.vera.ramirez@helmholtz-berlin.de](mailto:luis.vera.ramirez@helmholtz-berlin.de)



Device	Injector Ring accelerator	Undulator	Beamline	Experiment
Data	<ul style="list-style-type: none"><li>Archive, Diagnostic</li><li>Simulations</li><li>Online optimization</li></ul>	<ul style="list-style-type: none"><li>Diagnostic</li><li>Raytracing</li><li>Scans/online data</li></ul>	<ul style="list-style-type: none"><li>Demands</li><li>Simulations</li><li>Beamtimes</li></ul>	
Methods	<ul style="list-style-type: none"><li>SVR-RFF</li><li>DNN</li><li>Deep-RL-Control</li><li>RNN, LSTM</li></ul>	<ul style="list-style-type: none"><li>Autoencoder</li><li>CNN, MLP, GBoost</li><li>Dataloader</li><li>Tensor product</li><li>kNN, auto-diff.</li></ul>	<ul style="list-style-type: none"><li>Reasonable random generator</li></ul>	
Agent	Operator	Beamline scientist	(Random-) User	

- ▶ **Accelerator Team:** Luis Vera Ramirez, Tom Mertens, Pierre Schnizer
- ▶ **Beamline/Experiment Team:** Gregor Hartmann, David Meier, Peter Feuer-Forson, Felix Möller

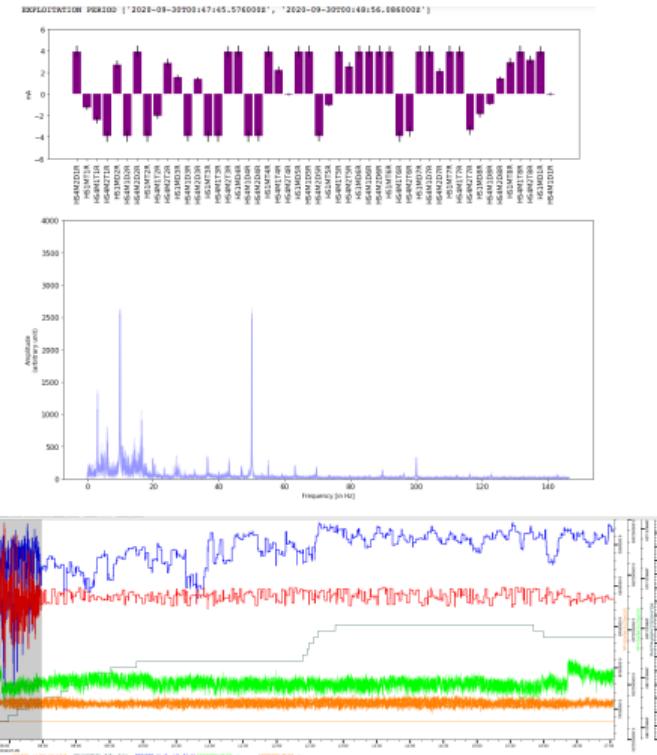


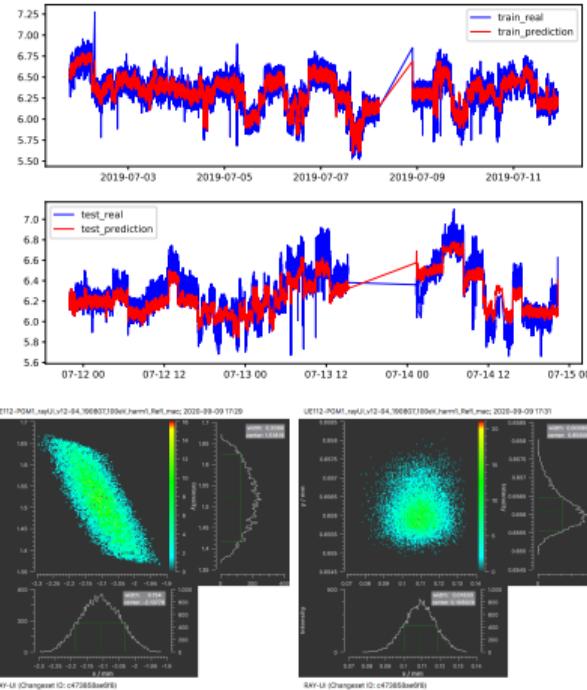
## Accelerator Optimization and Automation with (Deep) Reinforcement Learning:

- ▶ Injection Efficiency
- ▶ Booster Current Optimization
- ▶ Mitigation of Harmonic Orbit Perturbations
- ▶ ...

## Digital Twin

- ▶ Theoretical conception
- ▶ First use-cases (e.g. interfaces for the interaction with the RL-Agent for harmonic orbit correction)





## Measurement Prediction (**BESSY** Archiver data):

- ▶ First studies carried out on beam lifetime, size, position...
- ▶ Focus on feature importance analysis, anomaly detection and transferability.

## Further projects

- ▶ Beamline Raytracing
- ▶ bERLinPro Electron Gun Optimization
- ▶ Space-Charge-O-Meter with Disentangled Autoencoders
- ▶ ...



- ▶ **Digital Twin** development:  
ACCLAIM-funded Postdoc position  
(Computer Scientist) → currently in  
the selection process with > 15  
candidates.
- ▶ **Harmonic Orbit Perturbations -**  
Further tests and development to be  
carried out and reported
- ▶ First reports on new projects:
  - ▶ Roll-out of Anomaly Detection  
systems
  - ▶ RL for bERLinPro electron gun  
optimization
  - ▶ ...

