
Contribution ID: **1236** Contribution code: **THPM018** Type: **Poster Presentation**

# Efficient accelerator operation with artificial intelligence based optimization methods

*Thursday 5 June 2025 15:30 (2 hours)*

Tuning injectors is a challenging task for the operation of accelerator facilities and synchrotron light sources, particularly during the commissioning phase. Efficient tuning of the transfer line is essential for ensuring optimal beam transport and injection efficiency. This process is further complicated by challenges such as beam misalignment in quadrupole magnets, which can degrade beam quality and disrupt operations. Traditional tuning methods are often time-consuming and insufficient for addressing the complexities of high-dimensional parameter spaces. In this work, we explore the use of advanced AI methods, including Bayesian optimization, to automate and improve the tuning process. Initial results, demonstrated on the transfer line of KARA (Karlsruhe Research Accelerator) at KIT (Karlsruhe Institute of Technology), show promising improvements in beam alignment and transport efficiency, representing first steps toward more efficient and reliable accelerator operation. This study is part of the RF2.0 project, funded by the Horizon Europe program of the European Commission, which focuses on advancing energy-efficient solutions for particle accelerators.

## Footnotes

## Paper preparation format

LaTeX

## Region represented

Europe

## Funding Agency

This work is part of the Research Facility 2.0 project that has received funding from the European Union's Horizon Europe research and innovation program under grant agreement No. 101131850.

**Author:** MATZOUKAS, Evangelos (Karlsruhe Institute of Technology)

**Co-authors:** XU, Chenran (Karlsruhe Institute of Technology); BLOMLEY, Edmund (Karlsruhe Institute of Technology); BRÜNDERMANN, Erik (Karlsruhe Institute of Technology); DE CARNE, Giovanni (Karlsruhe Institute of Technology); GETHMANN, Julian (Karlsruhe Institute of Technology)

**Presenter:** MATZOUKAS, Evangelos (Karlsruhe Institute of Technology)

**Session Classification:** Thursday Poster Session

**Track Classification:** MC6: Beam Instrumentation and Controls,Feedback and Operational Aspects: MC6.D13 Machine Learning