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Geoff developments in 2025

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The complexity of the CERN and GSI/FAIR accelerator facilities requires a high degree of automation to maximize beam time and performance for physics experiments. GeOFF, the Generic Optimization Framework & Frontend, is an open-source tool developed within the EURO-LABS project by CERN and GSI to streamline access to classical and AI-based optimization methods. It provides standardized interfaces for optimization problems and utility functions to speed up implementation. Plugins are independent packages with their own dependencies, allowing scaling from simple prototypes to complex state machines that communicate with devices in different timing domains. This contribution presents GeOFF's design, features, and current applications.

At GSI, multi-objective Bayesian optimization was applied to SIS18 multi-turn injection, building a Pareto front from experimental data. At CERN, GeOFF and ML/AI contributed to a record ion beam intensity for the LHC in 2024 through LEIR and SPS optimization. In addition, GeOFF underwent major updates in 2025, aligning it with the latest developments in Python-based numerical and machine-learning software.

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Footnotes

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