[2021.11.22]

OptunAPI

API to distribute hyperparameters optimization through HTTP requests

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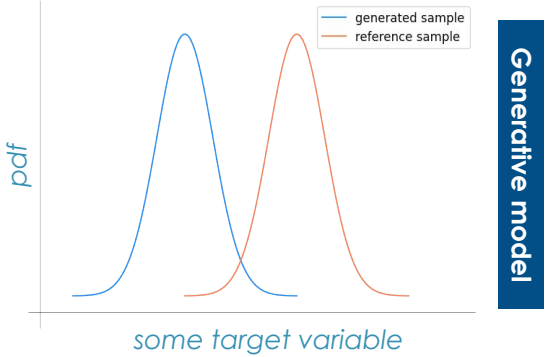
LPCC Fast Detector Simulation Workshop

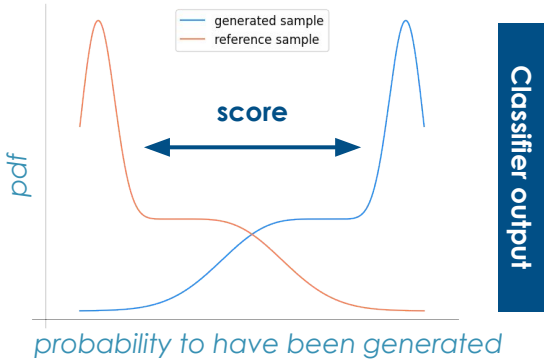
[22-23 Nov 2021]

Optimized models for Fast Simulation

- Deep **generative models** (GAN, VAE, NormFlow, ...) have proven to be able to replace Geant4-based simulations and to reduce significantly the computational cost for simulation production [arXiv:1712.10321, arXiv:1905.11825, arXiv:2106.05285].
- The **goodness** of trained models can be evaluated measuring the ability of a robust classifier (Random Forest, BDT, ...) to separate the reference samples from the generated ones [arXiv:1612.07186].
- Fast Simulation is up to **1000x faster** than Detailed Simulation in producing the whole simulation, paying the price of intense models training with lot of computational resources (including GPUs).

Model optimization and hyperparameters fine-tuning play a key role for Fast Simulation





Automating optimization studies

Cloud Computing services proliferation:

- easy access to resources for intense optimization studies
- need to coordinate multiple instances from different sources
- search of a safe exploration of the hyperparameters space

These point to OptunAPI, a simple API designed to distribute an automatic hyperparameters optimization **through HTTP request**.

OptunAPI defines a **client-server system** able to carry on the optimization studies **in parallel**.

`mbarbetti/optunapi`

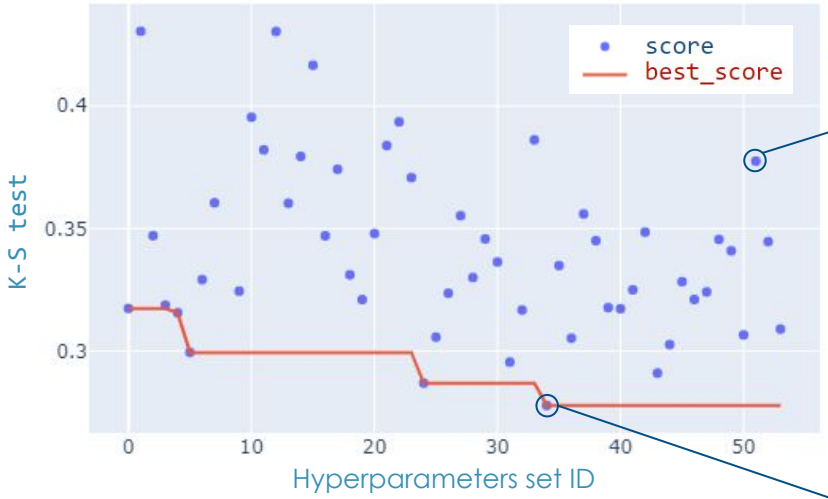
More user-friendly version in development!

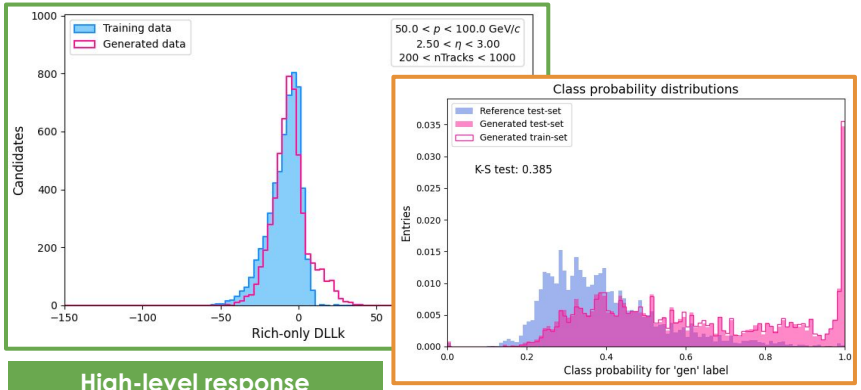
v0.2.0 release upcoming...

- The **server** coordinates the studies providing instances with sets of hyperparameters taken from Bayesian optimization strategies.
- The **clients** test in parallel such hyperparameters providing a score measuring the difference between reference and generated samples.

LHCb use-case for OptunAPI

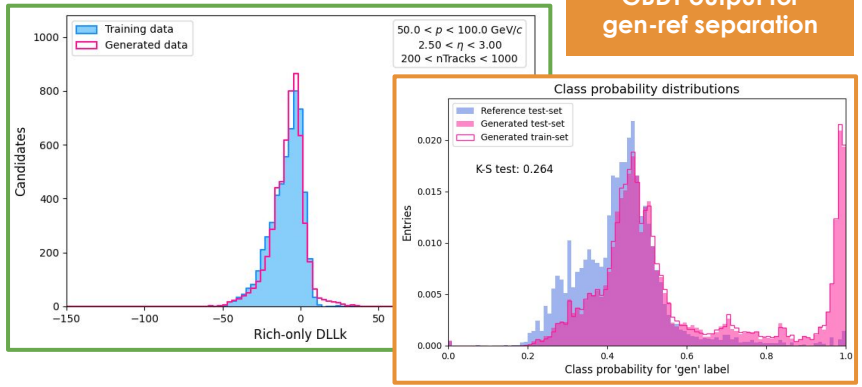
Optimization history



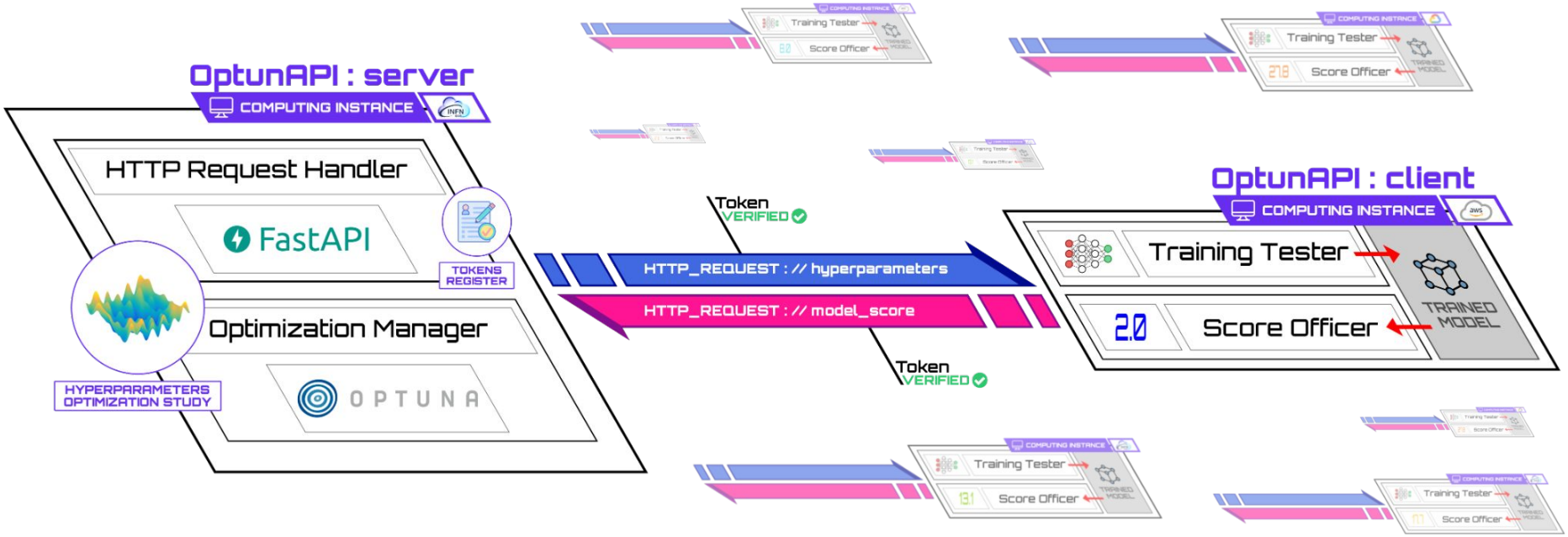


High-level response of RICH for muon tracks

GBDT output for gen-ref separation



- GAN models to parameterize the LHCb PID system
- hyperparameters tuning to push models performance
- optimization studies distributed across instances from different sources (AWS, INFN-Cloud, private nodes)

Backup

Sketch of the OptunAPI client-server system