

# A scalable and distributed AI-assisted Detector Design for the EIC



A collaborative project (DE-FOA-0002875) by:

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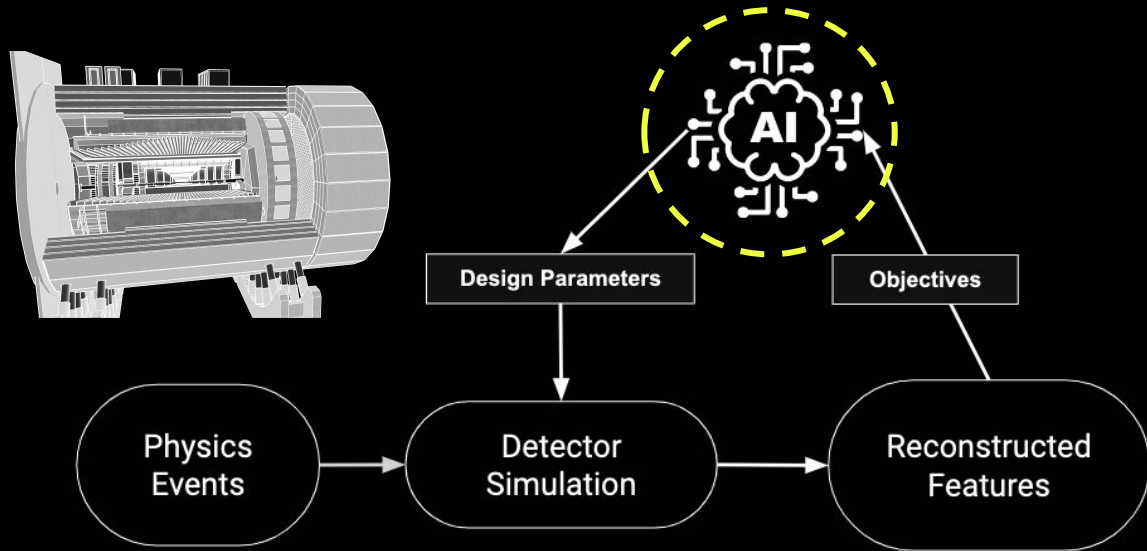


Cristiano Fanelli, on behalf of AIDE

ePIC AI Town Hall Meeting, Aug 30, 2023

# Project Scope

The AI-assisted design embraces all the main steps of the sim/reco/analysis pipeline...



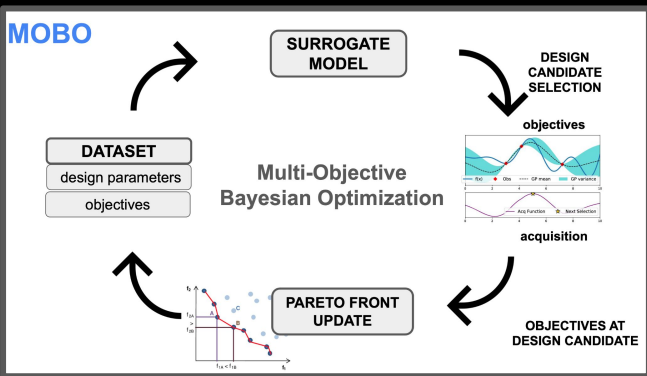
- Benefits from rapid turnaround time from simulations to analysis of high-level reconstructed observables
- The ePIC SW stack offers multiple features that facilitate AI-assisted design (e.g., modularity of simulation, reconstruction, analysis, easy access to design parameters, automated checks, etc.)
- Leverages heterogeneous computing

Provide a framework for an holistic optimization of the ePIC integrated detector — A complex problem with (i) **multiple design parameters**, driven by (ii) **multiple objectives** (e.g., detector response, physics-driven, costs) subject to (iii) **constraints**

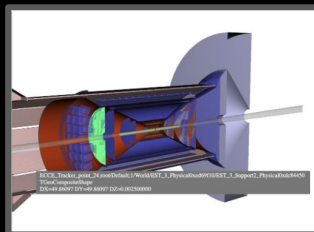
The ePIC detector could be the first large-scale detector ever realized with the assistance of AI

# Future Work Prospects

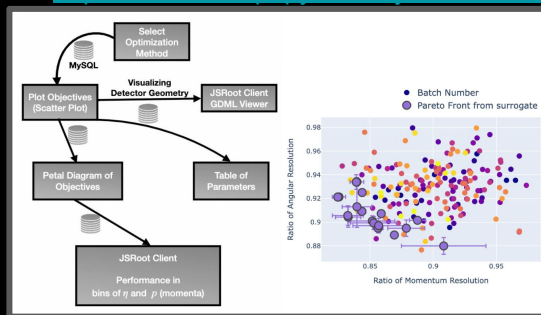
CF, Z. Papandreou, K. Suresh, et al. "AI-assisted optimization of the ECCE tracking system at the Electron Ion Collider." NIMA: 1047 (2023): 167748.  
 CF "Design of detectors at the electron ion collider with artificial intelligence." JINST 17.04 (2022): C04038.



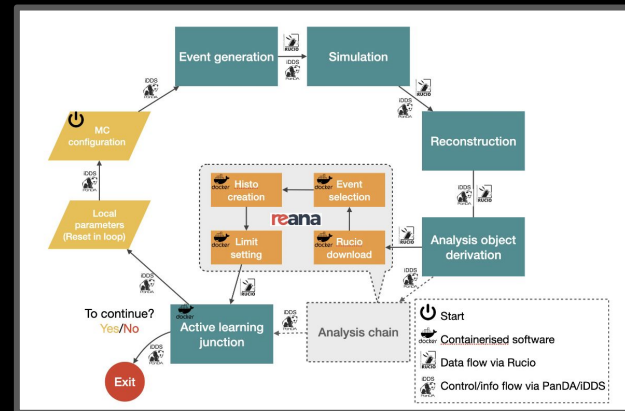
(i) Will contribute to advance the boundaries of MOBO complexity to accommodate a large number of objectives and will explore usage of physics-inspired approaches



<https://ai4eicdetopt.pythonanywhere.com/>



(ii) Development of suite of data science tools for interactive navigation of Pareto front (multi-dim design with multiple objectives)



(iii) Will leverage cutting-edge workload management systems capable of operating at massive data and handle complex workflows

Examining solutions on the Pareto front of ePIC at different values of the budget can have great cost benefits

A fractional improvement in the objectives translates to a more efficient use of beam time which will make up a majority of the cost of the EIC over its lifetime