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AI-assisted Design of the Tracking System at the Electron Ion Collider

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The Electron-Ion Collider (EIC) is a cutting-edge accelerator experiment proposed to study the origin of mass and the nature of the ''glue" that binds the building blocks of the visible matter in the universe. The proposed experiment will be realized at Brookhaven National Laboratory approximately 10 years from now, with the detector design and R&D currently ongoing. Notably, EIC can be one of the first facilities to leverage on Artificial Intelligence (AI) during the design phase. Optimizing the design of its tracker is of crucial importance for the EIC Comprehensive Chromodynamics Experiment (ECCE), a consortium that is proposing a detector design based on a 1.5T solenoid. The optimization is an essential part of the R&D process and ECCE includes in its structure a working group dedicated to AI-based applications for the EIC detector. In this talk, we describe an unprecedented study in AI-assisted detector design using full simulations based on Geant4. Our approach deals with a complex optimization in a multidimensional design space driven by multiple objectives that encode the detector performance while satisfying several mechanical constraints. We describe our strategy and show the results of the AI-assisted tracking system in ECCE.

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Instrumentation

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