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Track reconstruction in the LUXE experiment using quantum algorithms

Thursday 2 June 2022 09:30 (25 minutes)

LUXE (Laser Und XFEL Experiment) is a proposed experiment at DESY which will study Quantum Electrodynamics (QED) in the strong-field regime, where QED becomes non-perturbative. The measurement of the rate of electron-positron pair creation, an essential ingredient to study this regime, is enabled by the use of a silicon tracking detector. Precision tracking of positrons traversing the four layers of the tracking detector becomes very challenging at high laser intensities due to the high rates, which can be computationally expensive for classical computers. In this talk, a preliminary study of the potential of quantum computers to reconstruct positron tracks will be presented. The reconstruction problem is formulated in terms of a Quadratic Unconstrained Binary Optimisation (QUBO), allowing it to be solved using quantum computers and hybrid quantum-classical algorithms such as Variational Quantum Eigensolver (VQE) and Quantum Approximate Optimisation Algorithm (QAOA). Different ansatz circuits and optimisers are studied. The results are discussed and compared with classical track reconstruction algorithms using Graph Neural Network and Combinatorial Kalman Filter.

Consider for young scientist forum (Student or postdoc speaker)

Yes

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