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Quantum Machine learning frameworks for charged particle tracking

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With the advent of the High Luminosity LHC era, which is expected to significantly increase the amount of data collected by the detectors, the computational complexity of the particle tracking problem is expected to increase.

Conventional algorithms suffer from scaling problems. In our work, we represent charged particle tracks as a graph data structure and we are investigating the use of quantum machine learning techniques to see if we can gain a quantum advantage in the reconstruction of tracks.

Finding the optimal combination of classical machine learning tools and quantum libraries is challenging, especially since most quantum tools are still in the developing phase and they are not stable.

We report on our experience in testing quantum machine learning frameworks, such as Jax, Pennylane, and IBM Qiskit, eventually using GPUs as accelerators. Finally, we give an outlook on the expected performance in terms of scalability of accuracy and efficiency of the particle tracking problem.

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