EUROPEAN AI FOR FUNDAMENTAL PHYSICS CONFERENCE
EuCAIFCon 2024

Contribution ID: **50** Type: **Flashtalk with Poster**

Quantum Computing for Track Reconstruction at LHCb

Tuesday, 30 April 2024 14:50 (3 minutes)

The expected increase in the recorded dataset for future upgrades of the main experiments at the Large Hadron Collider (LHC) at CERN, including the LHCb detector, while having a limited bandwidth, comes with computational challenges that classic computing struggles to solve. Emerging technologies such as Quantum Computing (QC), which exploits the principles of superposition and interference, have great potential to play a major role in solving these issues.
Significant progress has been made in the field of QC applied for particle physics, laying the ground for applications closer to a realistic scenario, especially for track reconstruction of charged trajectories within experimental setups like the LHCb. This is one of the biggest computational challenges for such an experiment as it must be performed at a high rate of 1010 tracks per second while maintaining a very high reconstruction efficiency.
In this talk, the application of two of the most well-known QC algorithms will be presented to deal with track reconstruction at one of the main LHC experiments, LHCb: the Harrod-Hassidim-Lloyd (HHL) algorithm for solving linear systems of equations and the Quantum Approximate Optimization Algorithm (QAOA), specialized in combinatorial problems. Results running the algorithms using increasingly complex simulated events will be shown, including actual LHCb simulated samples. Finally, ongoing and future work to make the running of these algorithms efficient in QC hardware will be discussed.

Primary authors: NICOTRA, Davide; DE VRIES, Jacco; MERK, Marcel; LUCIO MARTINEZ, Miriam; CHIOTOPOULOS, Xenofon

Presenter: LUCIO MARTINEZ, Miriam

Session Classification: 2.1 Pattern recognition & Image analysis

Track Classification: Session A