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Type: **Parallel session talk**

Track reconstruction of charged particles using a 4D quantum algorithm

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Particle track reconstruction plays a crucial role in the exploration of new physical phenomena, particularly when rare signal tracks are obscured by a significant background. In muon colliders where beam muons interacting with the detector produce secondary and tertiary background particles, track reconstruction can be computationally intensive due to the large number of detector hits. The formulation of the reconstruction task as Quadratic Unconstrained Binary Optimisation (QUBO) enables the use of quantum computers, which are believed to offer an advantage over classical computers in such optimisation scenarios.

Timing information provided by the tracker is a key element in suppressing the large background at muon colliders. The QUBO parameters are determined by combining spatial and temporal information from detector hits, resulting in a 4D quantum algorithm.

To demonstrate the effectiveness of this approach, the quantum algorithm is used to reconstruct signal tracks from samples consisting of Monte Carlo simulated charged particles overlaid with background hits. I will present the obtained reconstruction performance and discuss possible paths for further improvements.

Collaboration / Activity

Pattern Recognition

Primary author: SPATARO, David (FTX (FTX Fachgruppe SLB))

Presenter: SPATARO, David (FTX (FTX Fachgruppe SLB))

Session Classification: T12 Detector R&D and Data Handling

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