

# Quantum algorithms for track reconstruction at high energy colliders

*Friday 19 July 2024 18:10 (17 minutes)*

Tracking is one of the most crucial components of reconstruction in collider experiments. It is known for high consumption of computing resources, and various investigations are ongoing to cope with this challenge. The track reconstruction can be considered as a quadratic unconstrained binary optimization (QUBO) problem. Recent progress with two complementary approaches will be presented: (1) the Quantum Approximate Optimization Algorithm (QAOA) implemented in the Origin Quantum hardware, (2) quantum annealing inspired algorithms, in particular the simulated bifurcation algorithms. Both approaches show promising performance on the track reconstruction, and the latter can particularly handle significantly large data at high speed; as much as four orders of magnitude faster than the simulated annealing.

[1] H. Okawa, Springer Communications in Computer and Information Science, 2036 (2024) 272–283, arXiv:2310.10255.

[2] H. Okawa, Q.-G. Zeng, X.-Z. Tao, M.-H. Yung, arXiv:2402.14718 (2024).

## Alternate track

### I read the instructions above

Yes

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**Session Classification:** Computing and Data handling

**Track Classification:** 14. Computing, AI and Data Handling