



Contribution ID: 14

Type: **Plenary**

Track Clustering with a Quantum Annealer for Primary Vertexing

Monday 20 April 2020 19:30 (25 minutes)

Clustering of charged particle tracks along the beam axis is the first step in reconstructing the positions of hadronic interactions, also known as primary vertices, at hadron collider experiments. We demonstrate the use of a 2036 qubit D-Wave quantum annealer to perform track clustering in a limited capacity on artificial events where the positions of primary vertices and tracks resemble those measured by the CMS experiment at the LHC. The algorithm is not a classical-quantum hybrid but relies entirely on quantum annealing, thus allowing us to benchmark the performance of state-of-the-art quantum annealers against simulated annealing on a commercial classical processor. An intriguing quantum advantage is noted for low numbers of primary vertices. Accelerating the execution of the algorithm by modifying annealing schedules and setting inter-qubit entanglements by heuristic methods are discussed. We discuss extensions of this clustering algorithm to multi-dimensional problems commonly encountered in high energy physics and other fields. Implementations of the algorithm on the 5000+ qubit Advantage processor are anticipated.

Consider for young scientist forum (Student or postdoc speaker)

No

Second most appropriate track (if necessary)

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Session Classification: Recording sessions