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A fast method for particle tracking and triggering using small-radius silicon detectors

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We propose an algorithm, deployable on a highly-parallelized graph computing architecture, to perform rapid reconstruction of charged-particle trajectories in the high energy collisions at the Large Hadron Collider and future colliders. We use software emulation to show that the algorithm can achieve an efficiency in excess of 99.95% for reconstruction with good accuracy. The algorithm can be implemented on silicon-based integrated circuits using field-programmable gate array technology. Our approach can enable a fast trigger for massive charged particles that decay invisibly in the tracking volume, as in some new-physics scenarios related to partic- ulate dark matter. If production of dark matter or other new neutral particles is mediated by metastable charged particles and is not associated with other triggerable energy deposition in the detectors, our method would be useful for triggering on the charged mediators using the small-radius silicon detectors.

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