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Particle Tracking in a Solenoidal Field with an Adaptive Hough Transform

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An algorithm is presented which reconstructs helical tracks in a solenoidal magnetic field using a generalized Hough Transform. While the problem of reconstructing helical tracks from the primary vertex can be converted to the problem of reconstructing lines (with 3 parameters), reconstructing secondary tracks requires a full helix to be used (with 5 parameters). The Hough transform memory requirements typically grow exponentially with the number of parameters. To reduce the amount of memory used, this algorithm adapts the granularity of the accumulator array depending on the given distribution of detector hits. Furthermore, only a small portion of the accumulator array needs to be explicitly stored at a time. It will be shown that the time required for event reconstruction of the presented algorithm grows more slowly asymptotically as a function of the number of detector hits in the event than the time required for road-finding techniques. In addition, the algorithm is easliy implemented in a cache-oblivious manner. Thus, the presented adaptive Hough Transform is well-suited for reconstruction of the high-multiplicity events in heavy ion collisions.

Results of the algorithm will be shown for heavy ion collisions in various simulated detectors, as well as on data from the PHENIX Silicon Vertex Detector.

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