

Parallel Algorithms for Online Trackfinding at PANDA Using GPUs

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The PANDA experiment, one of the four scientific pillars of the FAIR facility currently in construction in Darmstadt, Germany, is a next-generation particle detector that will study collisions of antiprotons with beam momenta of 1.5–15 GeV/c on a fixed proton target.

Because of the broad physics scope and the similar signature of signal and background events in the energy region of interest, PANDA's strategy for data acquisition is to continuously record data from the whole detector, and use this global information to perform online event reconstruction and filtering. A real-time rejection factor of up to 1000 must be achieved to match the incoming data rate for offline storage, making all components of the data processing system computationally very challenging.

Online particle track identification and reconstruction is an essential step, since track information is used as input in all following phases. Online tracking algorithms must ensure a delicate balance between high tracking efficiency and quality, and minimal computational footprint. For this reason, a massively parallel solution with multiple Graphic Processing Units (GPUs) is under investigation.

The Locus Circle Hough algorithm is currently being developed by our group. Based on the Circle Hough algorithm (doi:10.1088/1742-6596/664/8/082006), it uses the information from the geometric properties of primary track candidates in the Hough space to extend the hit-level parallelism to later phases of the algorithm. Two different strategies, based on curve rasterization and analytical intersections, are considered.

The poster will present the core concepts of the Locus Circle Hough algorithm, details of its implementation on GPUs, and results of testing its physics and computational performance.

Tertiary Keyword (Optional)

Secondary Keyword (Optional)

Parallelization

Primary Keyword (Mandatory)

Algorithms

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