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GPU-based Online Tracking for the PANDA experiment

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The PANDA experiment (antiProton ANnihilation at DArmstadt) is a new hadron physics experiment currently being built at FAIR, Darmstadt (Germany). PANDA will study fixed target collisions of phase space-cooled antiprotons of 1.5 to 15 GeV/c momentum with protons and nuclei at a rate of 20 million events per second.

To distinguish between background and signal events, PANDA will utilize a novel data acquisition mechanism. Instead of relying on fast hardware-level triggers initiating data recording, PANDA uses a sophisticated software-based event filtering scheme involving the reconstruction of the whole incoming data stream in realtime. A massive amount of computing power is needed in order to sufficiently reduce the incoming data rate of 200 GB/s to 3 PB/year for permanent storage and further offline analysis.

An important part of the experiment's online event filter is online tracking, giving the base for higher-level discrimination algorithms. To cope with PANDA's high data rate, we explore the feasibility of using GPUs for online tracking.

This talk presents the status of the three algorithms currently investigated for PANDA's GPU-based online tracking; a Hough transform, a track finder based on Riemann paraboloids, and a novel algorithm called the Triplet Finder. Their performances and different optimizations are shown. Currently having a processing time of 20 µs per event, the Triplet Finder in particular is a promising algorithm making online tracking on GPUs feasible for PANDA.

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