Comparison of Track Reconstruction Methods of the PANDA Experiment

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PANDA is one of the main experiments of the future FAIR accelerator facility at Darmstadt. It utilizes an anti-proton beam with a momentum up to 15 GeV/c on a fixed proton or nuclear target to investigate the features of strong QCD.

The reconstruction of charged particle tracks is one of the most challenging aspects in the online and offline reconstruction of the data taken by PANDA. Several features of the experiment make the reconstruction special in comparison to others:

- The anti-proton beam of PANDA is quasi continuous with a Poisson distribution of the time differences between two consecutive events with a mean time of 50 ns. This leads to a very high probability that events overlap and to an a-priori unknown event time.
- PANDA uses two different magnetic fields, a solenoidal one around the interaction point and a dipole field in the forward direction. Therefore, different track models have to be used and a connection between the different regions is necessary.
- The experiment is equipped with straw tubes trackers which measure the drift time inside a straw. This leads to an isochrone ring for each hit where the track has passed. The radius of the ring is dependent of the unknown start time of the track.
- PANDA reads out and reconstructs the complete detector data online. This imposes strong requirements onto the reconstruction speed of the online track finding and fitting algorithms.

Many different track reconstruction algorithms have been developed and tested both for online and offline reconstruction and on different hardware platforms such as CPUs, GPUs and FPGAs. In this presentation, an overview and a comparison of the different methods will be given.

Author: STOCKMANNS, Tobias (Forschungszentrum Jülich GmbH)

Presenter: STOCKMANNS, Tobias (Forschungszentrum Jülich GmbH)

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