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Offline software for the PANDA Luminosity Detector

Monday, 14 October 2013 15:00 (45 minutes)

Precise luminosity determination is crucial for absolute cross-section measurements and scanning experiments with the fixed target PANDA experiment at the planned antiproton accelerator HESR (FAIR, Germany). For the determination of the luminosity we will exploit the elastic antiproton-proton scattering. Unfortunately there are no or only a few data with large uncertainties available in the momentum range we need for PANDA. Therefore in order to minimize the large systematic uncertainty from theory and former experiments we will perform measurements at very small momentum transfer (and thus very small scattering angle), where the Coulomb part of the elastic cross section can be calculated very precisely.
To achieve the precision needed for the luminosity determination the detector should have full angular acceptance and good spatial resolution. The current design are four planes of sensors with distances of 10 or 20 cm in between. The sensors themselves are HV-MAPS (High Voltage Monolithic Active Pixel Sensor). The whole set-up is placed in vacuum to minimize multiple scattering. In parallel to the prototype construction this design is under study with Monte Carlo based simulation.
The luminosity detector is located outside of any magnetic field and will register hits of the straight tracks of the scattered antiprotons. Our reconstruction software includes hit reconstruction, track search, track fitting and software alignment. Moreover there are specific procedures like luminosity extraction or background treatment.
Nowadays tracking systems usually measure up to hundred hits per track, which demands quite complicated pattern recognition algorithms, but makes track reconstruction more robust against loosing of hits in a track. In our case we have only a little amount of hits per track and have to be sure of using most of them. Therefore we developed two different algorithms for track search and did a performance study for the comparison of the algorithms.
In order to achieve the best resolution of the scattering angle measurement even a misalignment of 50 um has to be avoided. The Millipede algorithm will adjust the alignment corrections for all sensors simultaneously. The limitation of the Millipede algorithm (originally developed for a large number of layers) is studied in detail.
In this presentation the basic concept will be introduced before focusing on Monte Carlo based performance studies of
each reconstruction step.

Summary

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