Panda GEM Tracker software status

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PANDA experiment's forward tracking will be achieved using 3 stations of the GEM tracker. The stations in the form of circular planes perpendicular to and centered around the Z axis are placed 117, 153 and 188 cm in the downstream direction away from the interaction vertex. The detector covers polar angles from 3° to 20°. The detector geometry, simulation and reconstruction software are part of the PandaRoot framework [1].

Status

The GEM Tracker geometry description in PandaRoot consists of 3 stations. Several planes for each station simulate detector windows, cathodes, GEM foils and sensitive pad planes. The total thickness of one station is 5.255cm, including 5.212cm of gas, 0.0378cm of kapton, 0.0004cm of aluminium and 0.0048cm of copper. The material simulating readout electronics or support structure is not yet implemented.

Each of the pad planes, located in the centers of all GEM stations, will be double-sided coated with readout pads, grouped on each side in two perpendicular views. Thus, each station provides strip information about crossing particles in four directions: radial and circular (stations' front), horizontal and vertical (stations' back).

The digitization of the GEM Tracker has recently been updated to describe the detector response in more realistic way. In comparison to the first implementation, now the charge spread (of about 1mm) over several strips is taken into account, as seen in Figure 1. As a spin-off effect of this work also proper time information is attached to stimulated strips.

The first step in the data reconstruction is the cluster finder, which groups close lying strips and calculates mean strip value. These mean strips are subsequently input to the hit finder, which reconstructs the positions of tracks crossing the station.

The track reconstruction, performed by the GEM standalone track finder (described in [2]) has been only slightly modified as its performance was satisfactory.

Time based simulation

Since PANDA experiment is going to be read off continuously and all the data analysis like clusterization, hit finding, track reconstruction and event recognition are to be done online in order to select interesting events, PandaRoot packages are quickly being reorganized to adapt to this scenario [3].

In order to check the effect of this change on the GEM reconstruction, simple analysis has been performed, as seen in Figure 2. Digis belonging to different events are usually well separated and are coming at very similar times. One can observe (see times around 1790ns in Fig. 2) that for very close events they will be indistinguishable using the time information. The only solution is to separate them using vertex position. One can also see (see times around 1870ns in Fig. 2) signals from slow secondary particles coming even after few events. Detailed tracking is crucial in assigning them to proper events.

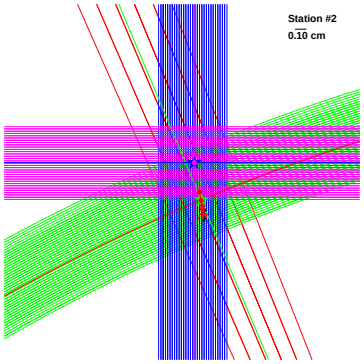

Figure 1: Fired strips on pad plane. Front (red and green) and back (pink and blue) views are plotted. The reconstructed clusters' mean values are also plotted, as green, red, blue and pink lines respectively. The star markers show the reconstructed hits. Red (pink) groups of 3 points and a line mark the particle trajectory in the detectors' front (back) drift volumes.

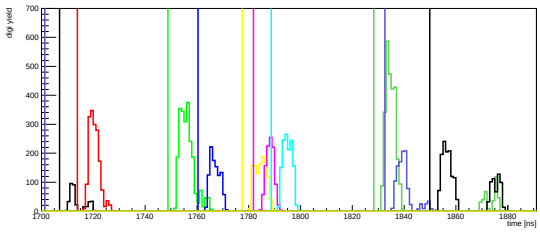

Figure 2: Digis time stamps. Different colors represent different events. The vertical lines mark the corresponding event time. Particularly event crowded time interval was chosen.

References

[1] Status of the FairRoot framework, M. Al-Turany *et al*, this report.

[2] Standalone track finding for the GEM-Tracker of the PANDA Experiment, R. Karabowicz *et al*, GSI Scientific Report 2010.

[3] FairRoot: Time-based simulation and reconstruction, M. Al-Turany, T. Stockmanns, GSI Scientific Report 2011.