Tracking in the TRD

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Kalman filter technique [1] is used for track fitting. Two track extrapolation methods: straight line and Runge-Kutta are available depending on magnetic field presence. Two tracking approaches for the TRD were developed:

- The first one is based on the information from the vertex detector STS, i.e. initially we reconstruct STS tracks, then propagate them through RICH detector to the first TRD layer and extract necessary information for initializing TRD tracks from STS tracks. In this case, we can estimate the initial direction of the particle and particle momentum, which is needed to take into account the multiple scattering effect.

- In the second, standalone tracking the only TRD information is available.

  In this case the problem is more complicated, since the momentum and particle directions are unknown. In order to initiate the search we have to create track-candidates and to estimate rough track parameters by well-organized search through all admissible combinations.

Additional tracking routine is developed for an alternative detectors setup (STS → MUCH → TRD). MUCH is a MUon CHamber [3]. In this case TRD tracks are initiated with MUCH tracks.

There is no magnetic field in TRD, therefore, we can consider tracks as straight lines, although the influence of the stray magnetic field should be taken into account while track propagating from STS. TRD track finders takes into account also disadvantages of the detector such as noise, inefficiencies, measurement errors, as well as the amount of detector material. Different parameters are to be specified on each tracking iteration (sigma coefficient, which determines a prediction corridor, initial and final stations of the track search and maximum number of missing hits in each station).

Software, implementing the proposed algorithms, was imbedded into CBM framework and tested with the following simulation parameters: 100 central Au-Au collisions at 25 GeV; CbmRoot version July 07.

Two TRD geometries used, which appeared to be the most optimal: with 10 (4-3-3) and 12 layers (4-4-4).

The efficiency of the STS based track finding is on the level of 95.7% for all tracks, and it drops down on 1%, if we normalize to the tracks that have only a half of the points from the number of TRD layers. For this case, we can conclude that 10 layers design looks more optimal from the cost and performance considerations because it has the higher number of found tracks (434 tracks for 12 layers and 440 tracks for 10 layers layout). Efficiency plot is shown below in Fig.1.

The standalone track finder is tested with the same simulation parameters. Its efficiency is 88.9% for 12 layer setup and 89.3% for 10 layer setup, i.e. one can see that 10 layer design also looks more optimal.

CBM internal note [2] is prepared and will be published in October 2007.

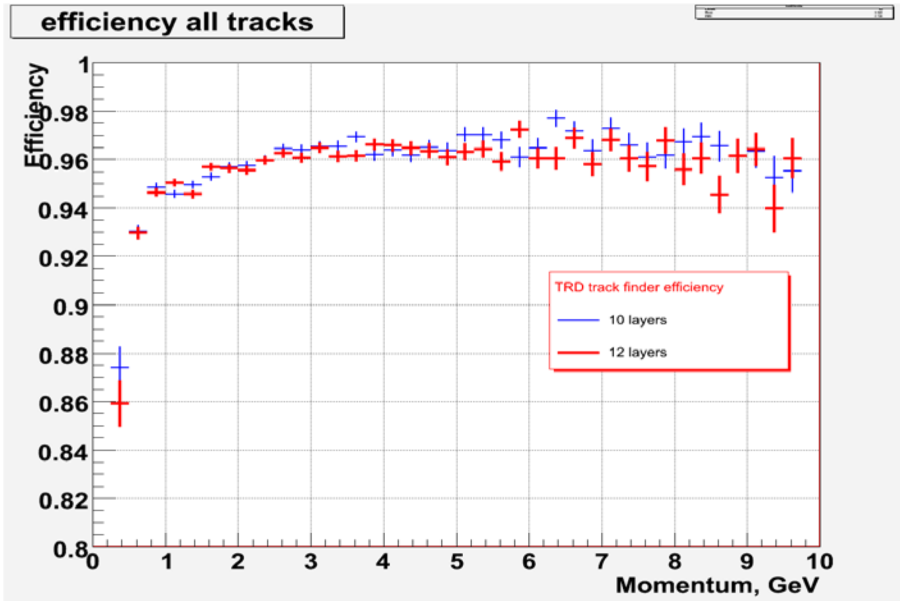

Fig. 1: Efficiency for STS → TRD tracking

References

[1] R. Fruehwirth, Application of Kalman filtering to track and vertex fitting, Nucl.Instrum. Meth. A262 (1987) 444.

[2] A.Lebedev, G.Ososkov, Event Reconstruction in the TRD, CBM-SOFT-note-2007-00, to be published.

[3] CBM Collaboration, Compressed Baryonic Matter Experiment. Technical Status Report, GSI, Darmstadt, 2006.