VECTOR FINDER TOOLKIT FOR THE NICA/MPD INNER TRACKING SYSTEM

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MPD experiment and subdetectors

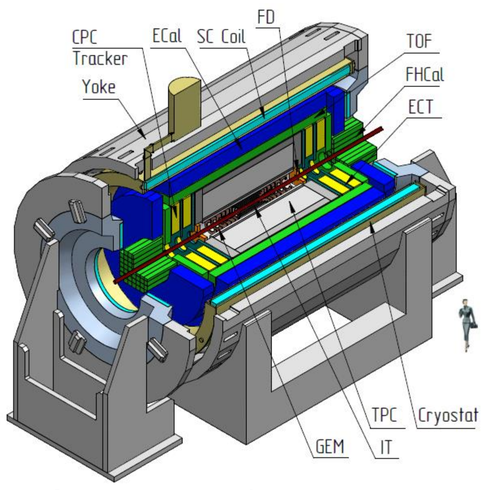

Fig. MPD experiment setup

The MPD experiment goal is to investigate hot and dense nuclear matter in beam-beam collisions from p to Au at NICA.

TPC is the main tracking detector of MPD/NICA.

ITS is planned to be installed at the later stage of the experiment

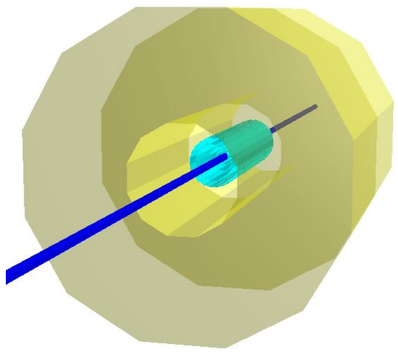

Fig. General view of ITS (blue) and TPC (brown)

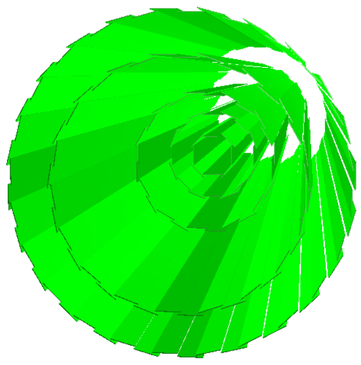

Fig. ITS structure

Track matching

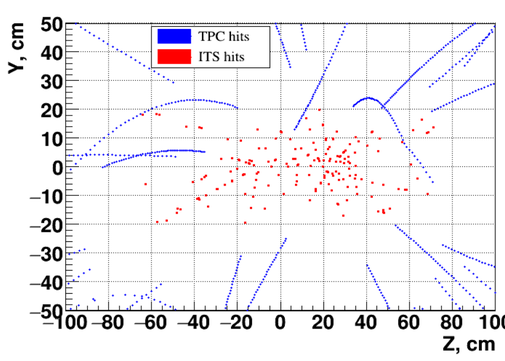

Fig. TPC(blue) and ITS(red) hits for 3 pp-interactions

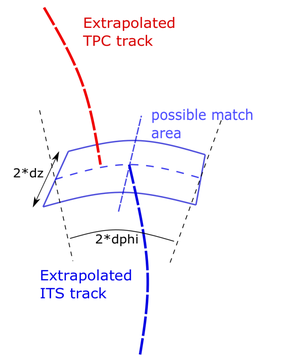

Fig. Track matching scheme

Separate track reconstruction procedures for TPC and ITS require a method to combine tracks from different detectors. Track matching procedure in the Vector Finder toolkit is based on propagating ITS and TPC tracks to a cylinder surface between the detectors and finding best possible TPC track match in close proximity of each ITS track.

Reconstruction efficiency

Performance of implemented approach was tested on a sample of UrQMD generated events of Au+Au collisions at 9 GeV/c

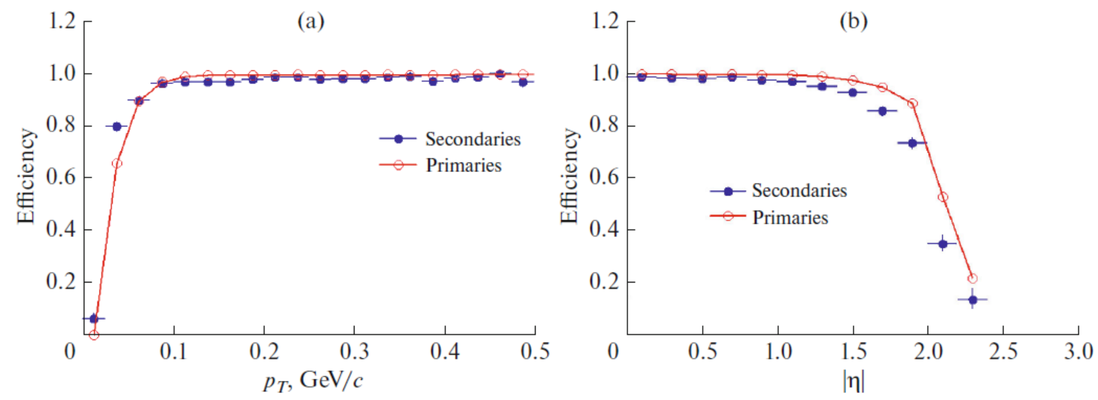

Fig. Reconstruction efficiency for primary and secondary tracks vs transverse momentum with |η| < 1.2 (a) and vs pseudorapidity with pt > 0.1 GeV/c (b)

Vector Finder general idea

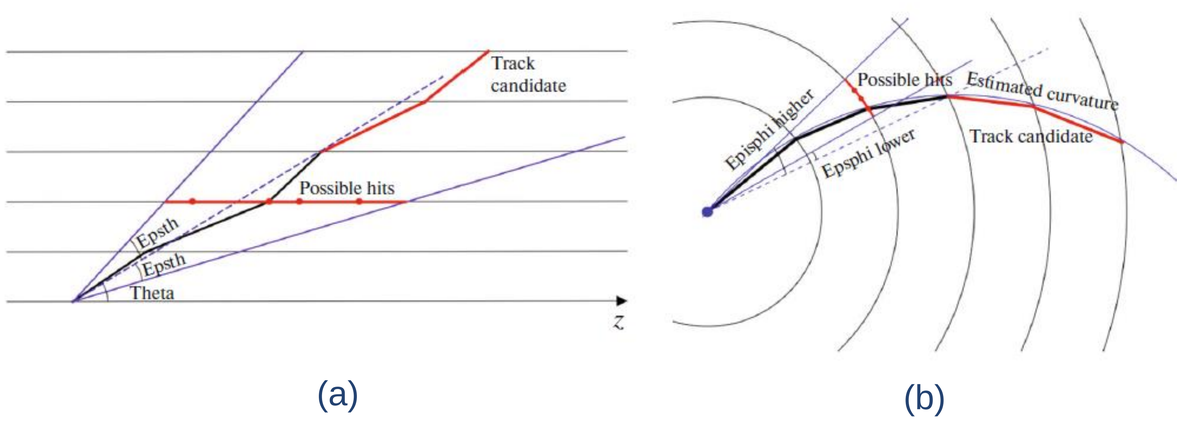

Fig. Longitudinal (a) and transverse (b) projection scheme of a primary track in ITS

Vector Finder approach for track finding in ITS is based on combinatorial search for hit combinations. Combinatorics is reduced by utilizing prior constraints of mutual hit positions for hits from the same track.

The main steps of the algorithm are:

1) Create track candidates from 2-hit combinations on the two outermost layers of ITS
2) Expand track candidates inwards by layer hits closer to interaction point, using prior knowledge of event topology in transverse and longitudinal projections
3) Fit collected hit combinations, using Kalman Filter
4) Track candidates with best quality (using χ^2 metrics for quality measurement) with no common hits are considered to be real tracks. Corresponding hits can are excluded before the next iteration

Matching efficiency

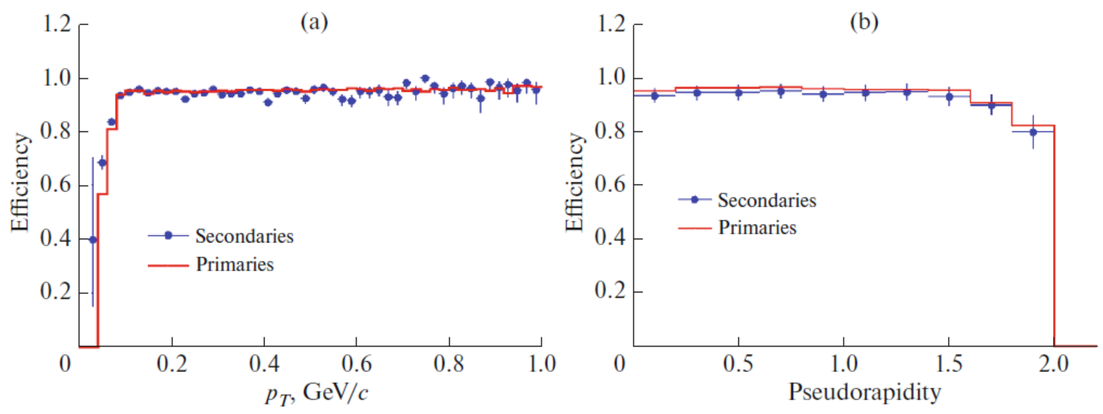

Fig. Matching efficiency for primary and secondary tracks vs transverse momentum with |η| < 1.2 (a) and vs pseudorapidity with pt > 0.1 GeV/c (b)

Vector Finder adaptation for secondary tracks

Unlike primary tracks, secondary tracks do not pass through primary vertex, so it cannot be used to define constraints. Instead of longitudinal and transverse angles theta and phi, and an alternative solution is used, calculating linear extrapolation and circle arc propagation for track candidate continuation in longitudinal and transverse projections respectively.

Adaptation for BM@N

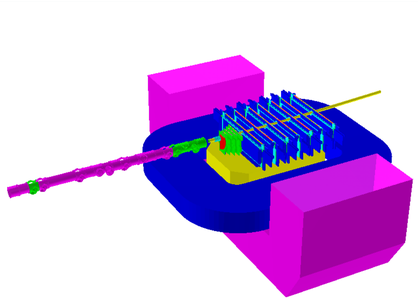

Fig. BM@N experiment model

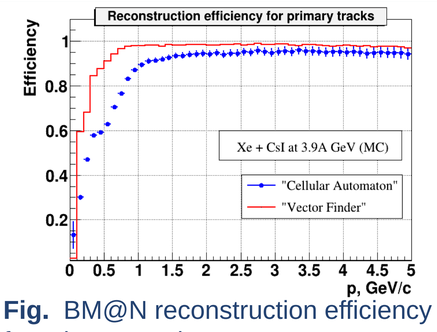

Fig. BM@N reconstruction efficiency for primary tracks

The approach developed was successfully adapted for the fixed target experiment BM@N, improving results as compared to the previously used algorithm. Currently it is being tested and tuned for real data and applied for data quality checking.

Conclusion & Acknowledgements

Vector Finder approach was successfully implemented for the Inner Tracking System of NICA/MPD, showing efficiency improvement for primary and secondary tracks. The proposed algorithm was adapted for NICA/BM@N and is now being tested and used for real data.

We would like to thank Yu.A.Murin (VBLHEP, JINR) and V.P.Kondrat'ev (St. Petersburg State University) for providing us with ITS design information.