A “vector finder” approach to track reconstruction in the Inner Tracking System of MPD/NICA

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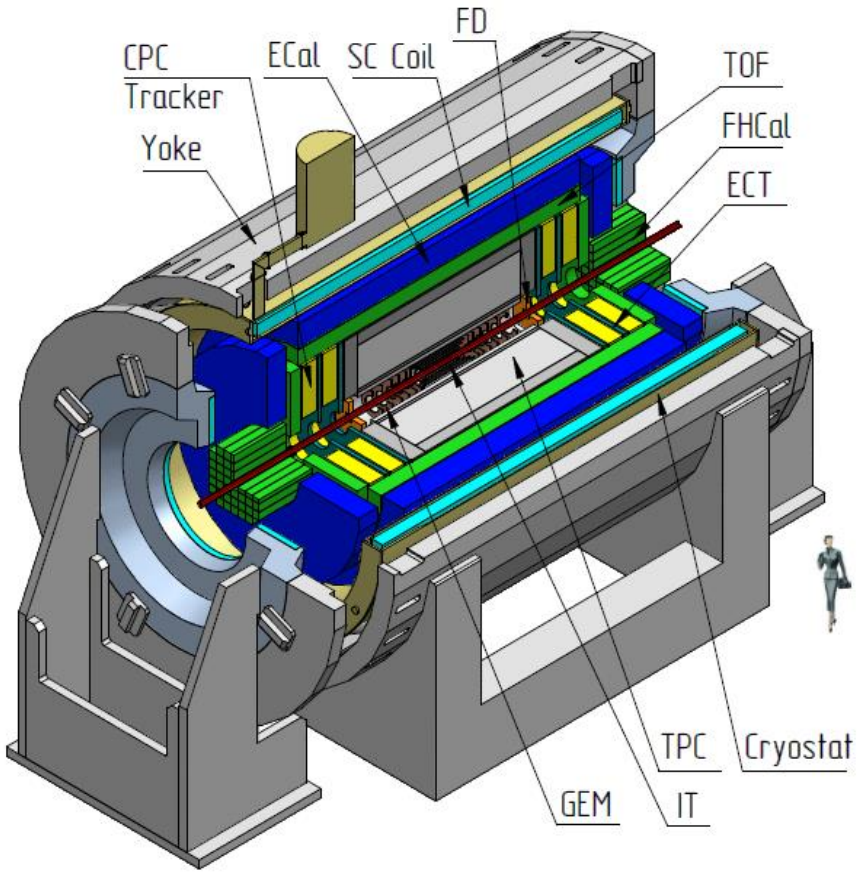
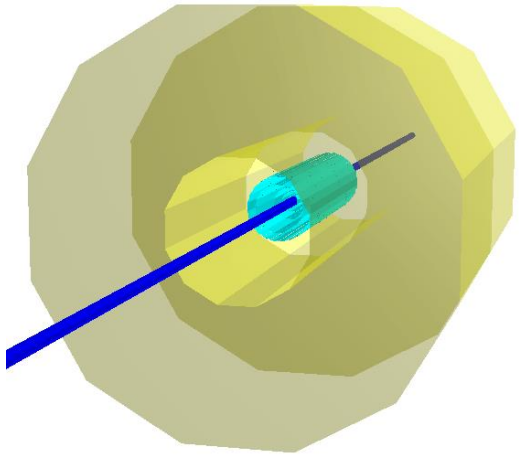
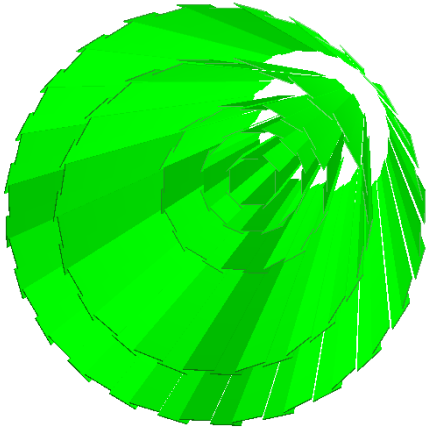
MPD, TPC&ITS geometry



MPD/NICA general design scheme



TPC and ITS geometry

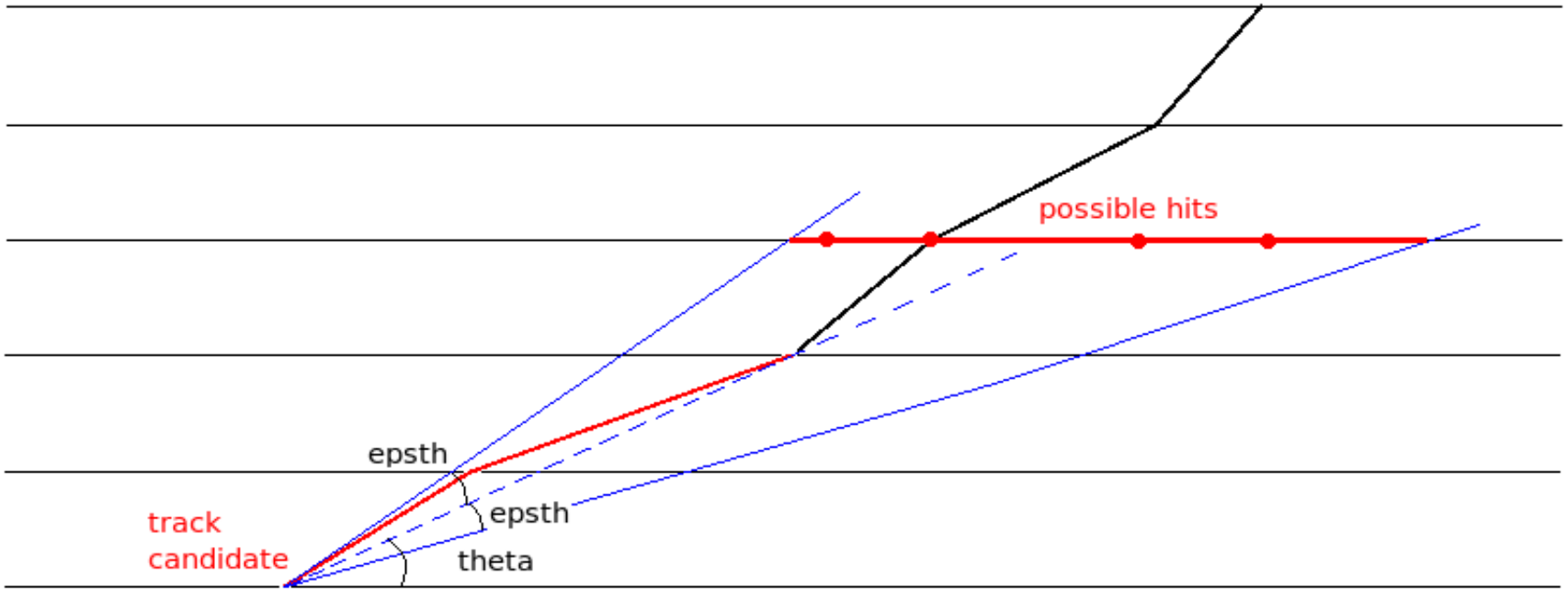


5-layer ITS geometry

Method

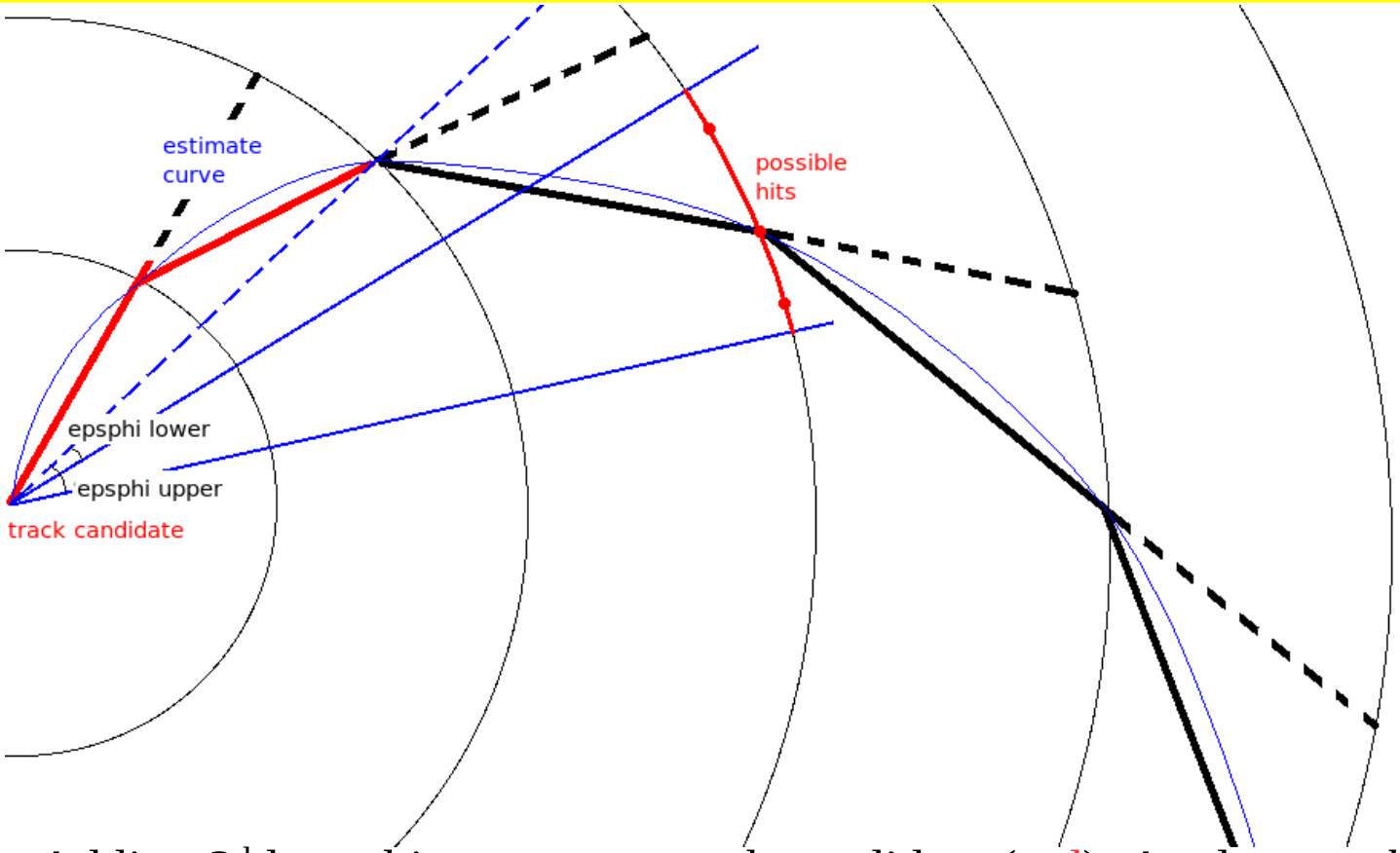
Vector Finder – a prior - constrained combinatorial search method (combines hits with angular positions which can exist in actual particle tracks)

Track scheme with angles (longitudinal)



Example: Adding 3^{d} layer hit to current track candidate (red). Angle delta *epsth* is preset. Area where possible hits are searched for, is highlighted with red and bordered with blue lines.

Track scheme with angles (transverse)



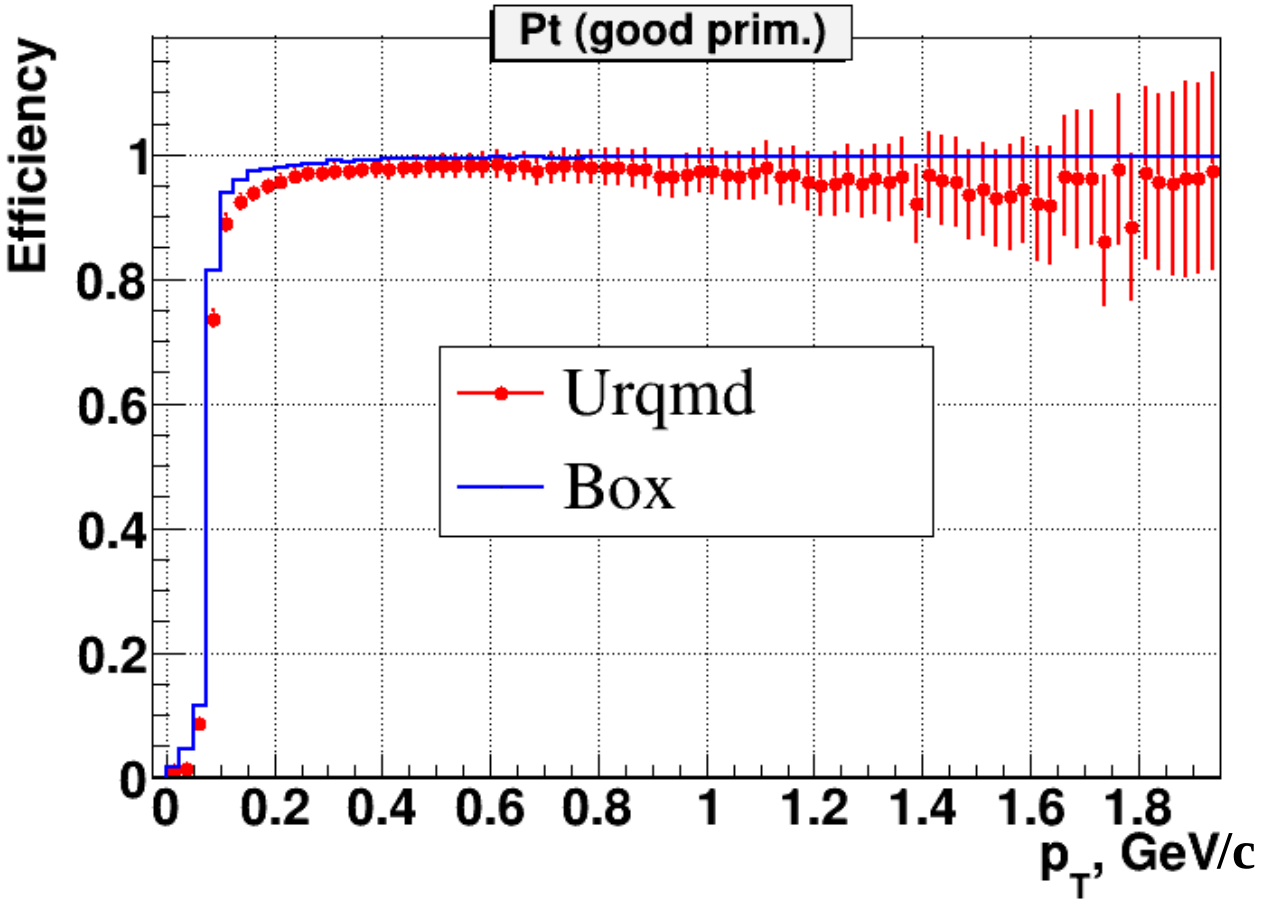
Example: Adding 3^{d} layer hit to current track candidate (red). Angles *epsphi*, lower and upper, depend on momentum, which is estimated based on track curvature for track candidate. Area where possible hits are searched for, is highlighted with red and bordered with blue lines.

Event generators

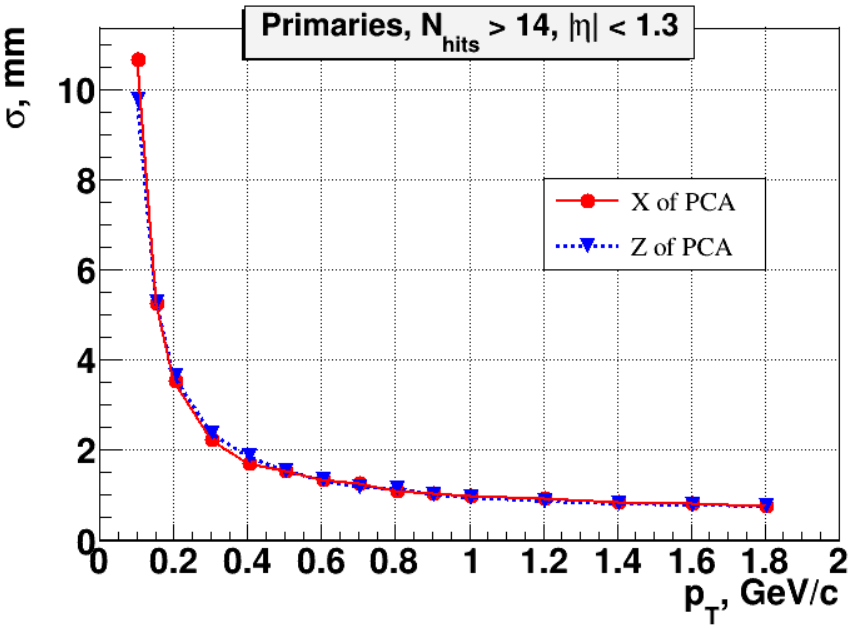
Box – FairBoxGenerator of muons – μ^- and μ^+
500 μ^-, 500 μ^+ per event, Pt range from 0.02 to 2.0 GeV/c, polar angle from 40 to 140°

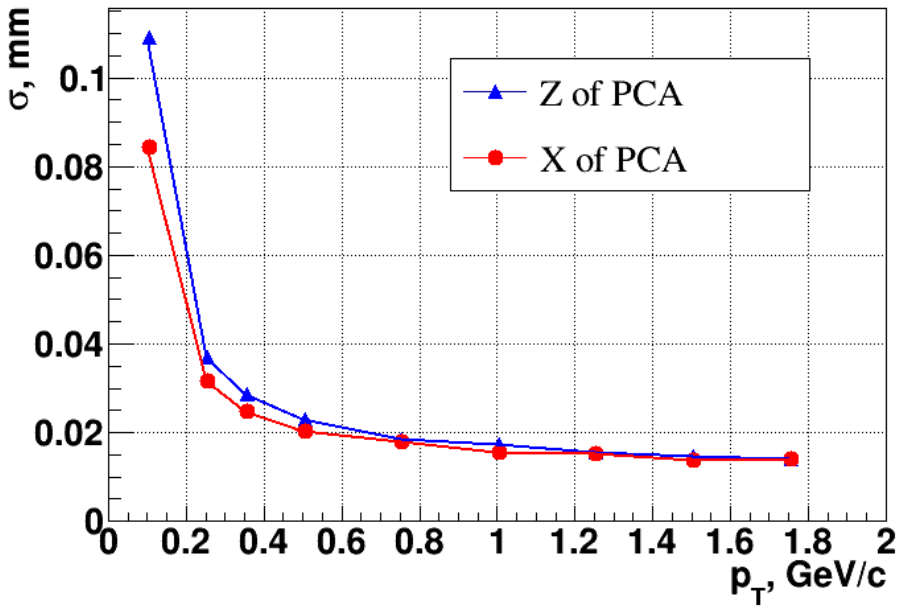
UrQMD – central Au+Au collisions at sqrt(s) = 9 GeV

Efficiency dependence on Pt



Coordinates of PCA versus Pt

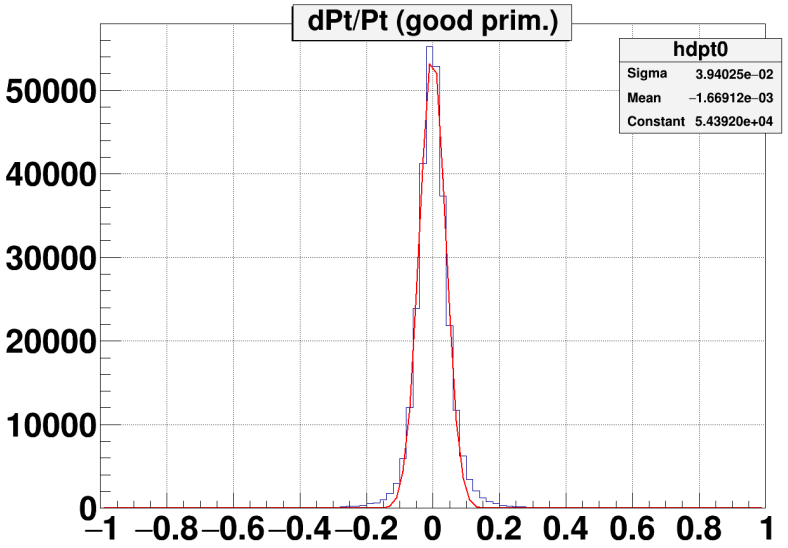


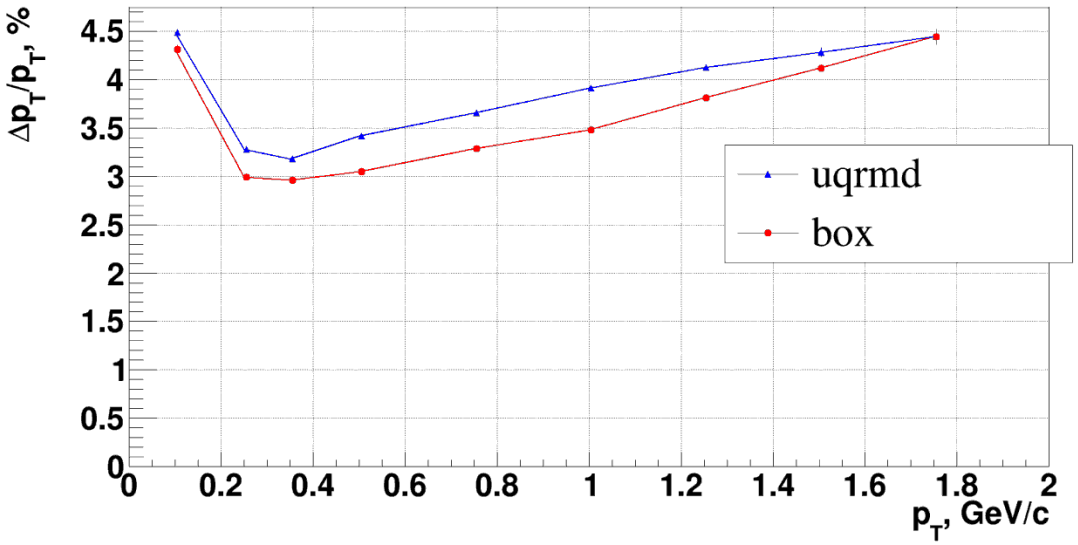


Left – TPC (Kalman filter based approach)
Right – ITS (Vector Finder approach)

PCA – point of the closest approach to the interaction point

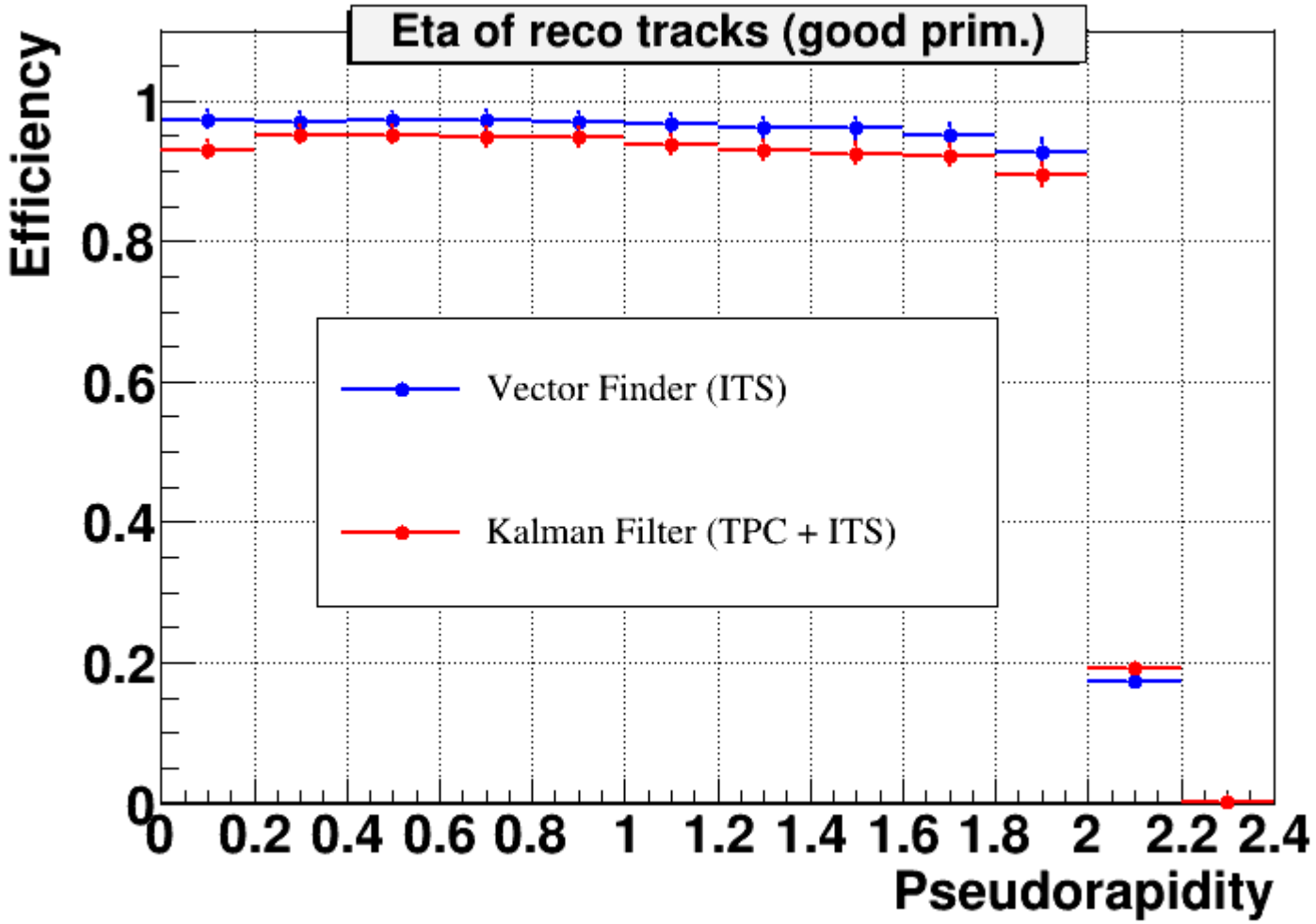
dPt/Pt (gauss fit) and dependence on Pt





dPt/Pt — relative transverse momentum resolution (momentum reconstruction accuracy)

Efficiency dependency on Pseudorapidity



Summary and next steps

Stand-alone ITS track reconstruction using Vector Finder approach has been developed and implemented

It improves track reconstruction efficiency as compared with the TPC-based tracking

ITS significantly improves track position uncertainty near the interaction point

Combined ITS + TPC track reconstruction using Vector Finder approach is the next step.