TPC dEdx reconstruction in the Hough Transfrom tracking

C.Cheshkov, P.Hristov

Outline

- Introduction
- Toy MC Study on several possible dEdx reconstruction approaches
- Implementation for Hough Transform tracker and some preliminary results
- Conclusions and To Do

Introduction

- The TPC dE/dx reconstruction in HLT can be useful mainly to separate e and π in the Pt region where we look for J/Ψ
- Due to its nature, the Hough Transform tracker need “special” dE/dx reconstruction

  $\Rightarrow$ so called “on-fly” reconstruction
- One has to take great care also about the timing performance of the algorithm

dEdx Reconstruction Methods

- “Truncated mean”
  - The good old method used in almost 100% of the cases
  - Caveat: practically impossible to implement in the online Hough tracker

    $\Rightarrow$ Need to keep ~160 amplitudes for each Hough bin

    $\Rightarrow$ Huge arrays and therefore extremely slow

dEdx Reconstruction Methods

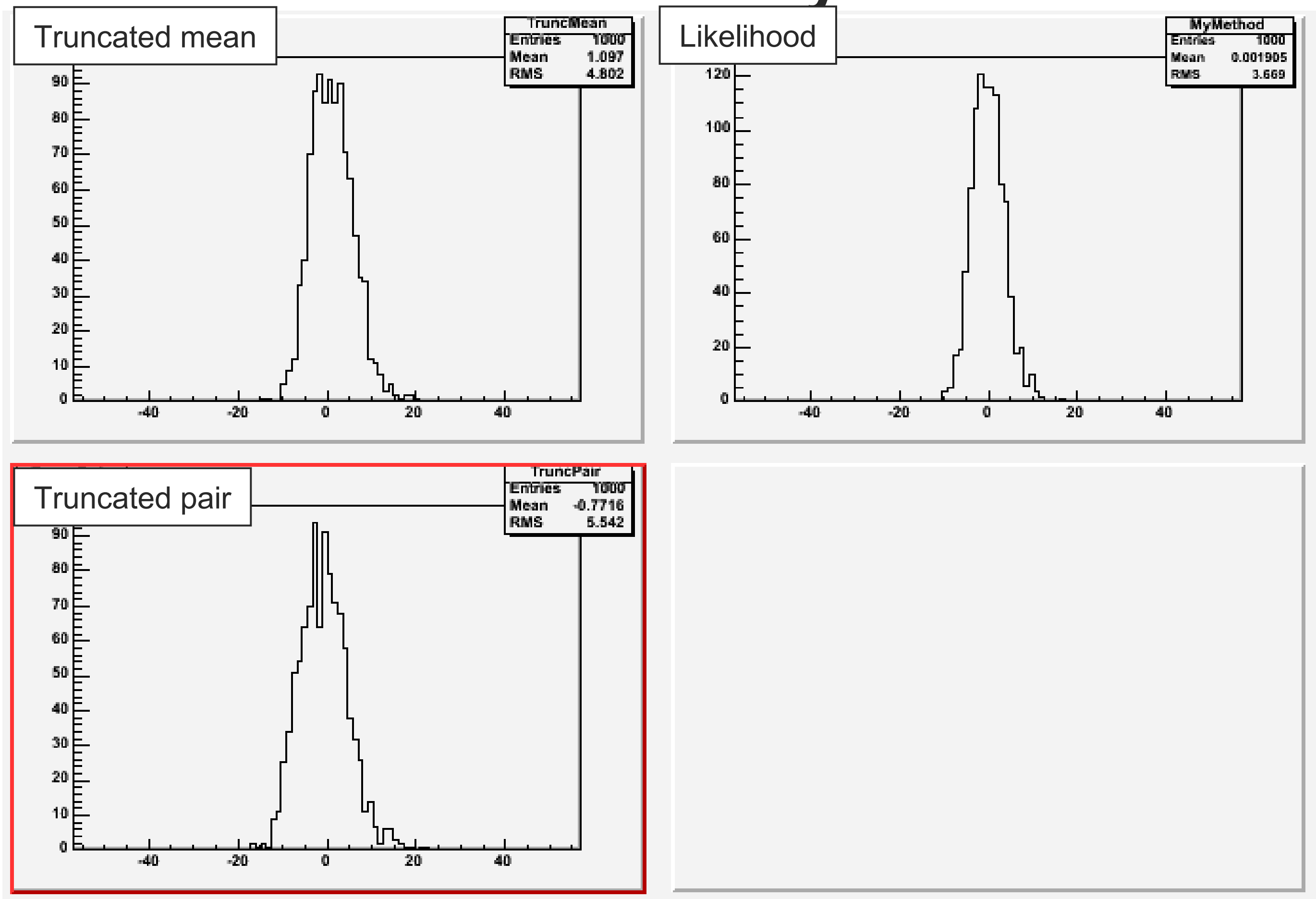
- "Max. Likelihood Method"
  - Fitting the Landau distribution by means of max.likelihood gives the "exact" solution for the mean
  - $\text{Mean}(A) = \sigma * \text{Log}(N / \Sigma\, \text{Exp}(-A_i/\sigma))$, where N - #samples and σ - width of the Landau distribution
  - Caveat: Need to know in advance the width σ ($\sigma \sim \beta^2$)

dEdx Reconstruction Methods

- "Truncated pairs"
  - The idea is to take 2 ADC amplitudes at once and fill only the smaller
  - In order to suppress further the divergences coming from the Landau distribution of the signal, compute geometrical mean instead of simple mean: $\Sigma A(i) \Rightarrow \Sigma \log[A(i)]$
  - Not as precise as two previous methods, but no obvious caveats for Hough tracker – small arrays needed, possibly fast computation and no need in additional input params

dEdx Reconstruction Methods

Results from toy MC

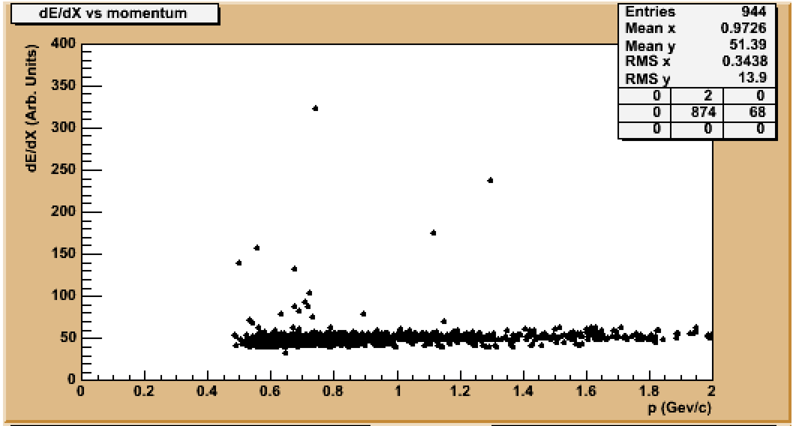


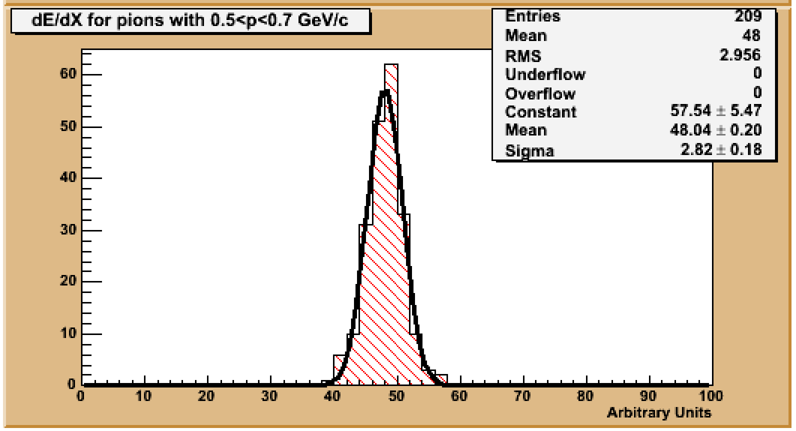
Implementation in HT

- “Truncated pairs” method has been chosen and implemented recently into the HT
- Since we don’t have clustering in HT, identified local maxima in pad and timebin directions are simply taken as dE/dx samples
- Using pre-calculated LUTs, the amplitudes are corrected for track-pad crossing angles
- Still some work to be done in order to reject further possible overlapping clusters

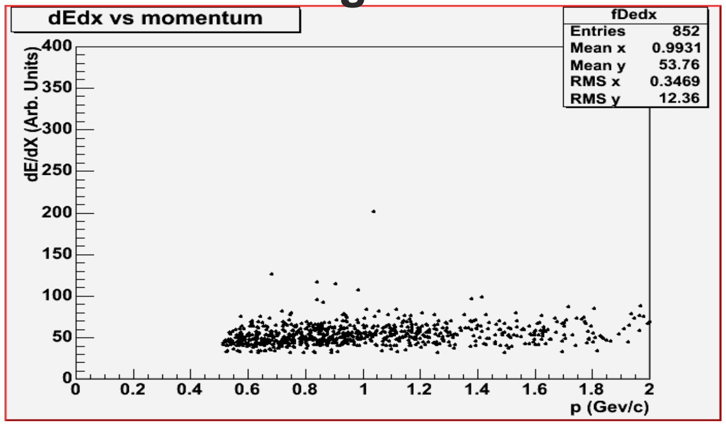
Preliminary results

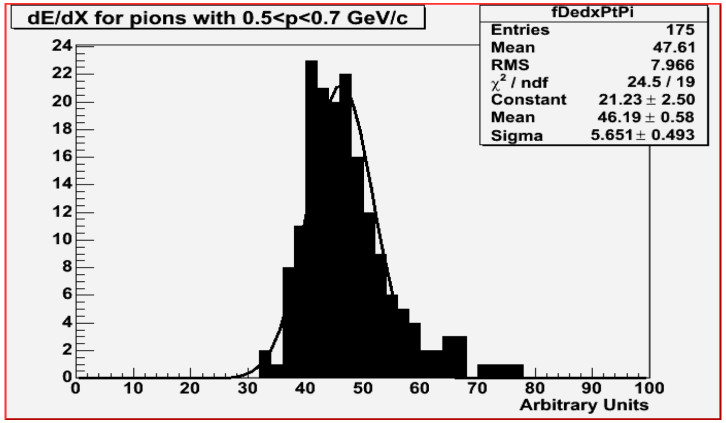
Off-line





Hough tracker





dN/dy=2000, 0.5T

Conclusions & To Do

- It seems that the predictions from the toy MC are qualitively confirmed
- However, slightly bigger than expected right tail
- Need to check carefully again all the corrections to the amplitudes
- Further rejection (or correction for) of possible overlapping clusters
- Try the “Max.Likelihood” method at least in the region of >1GeV/c, where the width of the landau distribution should be constant
- Optimize the code and check the timings