DAC

June 18, 2018

1 Recommendation

A.Mudrokh *presented selected results about MPD PID performance in Au+Au collisions with the set of Stage'1 detectors (TPC+TOF). The DAC notes the results and asks the speaker to demonstrate the overall MPD efficiency in hadron yield measurements.*

2 Response

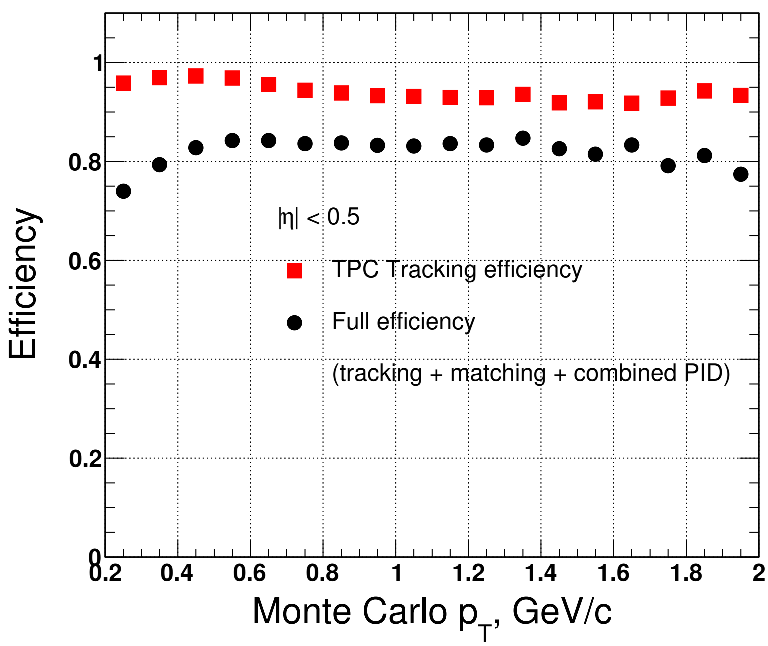

Figure 1: Overall MPD efficiency of pions.

The presented figure illustrates the overall MPD efficiency of the primary pions at midrapidity ($|\eta| < 0.5$) and within the transverse momentum range $0.2 < p_T < 2.0$.

Red squares represent the TPC tracking efficiency. It is defined as the ratio of all reconstructed tracks which passed the selection criteria ($N_{hits} > 20$ + TPC edge cut) to all simulated tracks reached TPC. Black circles illustrate the full efficiency defined as the ratio of reconstructed and identified particles (using combined TPC + TOF MPD PID) to all simulated ones.

3 Recommendation

A.Zinchenko *overviewed recent progress in MPD reconstruction including realistic TPC simulation. The results for the TPC tracking efficiency, momentum resolution, space resolution, two-hit resolution were shown together with selected results for invariant mass reconstruction of Lambda-hyperons. The DAC noted with satisfaction the achieved progress; however, it also noted the fact that not all possible effects were taken into account. For example, noise in the TPC FEE and distortions were not estimated. The PAC asked for an explanation of the rapid decrease of the track pointing accuracy at low transverse momenta (slide 18, right plot). Nu Xu noted surprisingly small difference between the results for ideal PID and realistic PID in the invariant mass spectra of Lambda candidates (slide 21), which is not fully understood.*

4 Response

The rapid increase of the track pointing uncertainty for low-p_T tracks (Fig. 2) is due to multiple scattering in the inner volumes of the TPC. It was checked by taking the innermost points of the primary particles in the TPC and extrapolating tracks back to the interaction point as helices with the exact track parameters (positions and momenta) from those points, i.e. excluding measurement errors. One can see in Fig. 3 that the earlier observed behavior is reproduced.

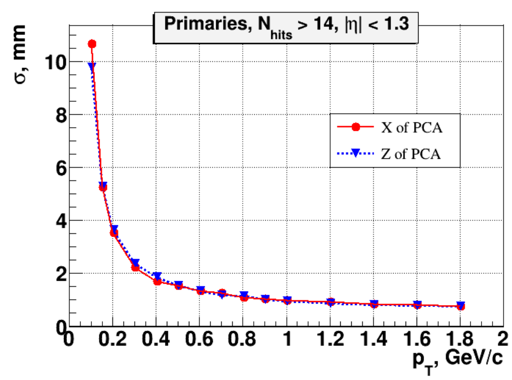

Figure 2: Transverse and longitudinal position errors in the point of the closest approach (PCA) to the interaction point for TPC reconstructed primary tracks with $|\eta| < 1.3$ versus particle transverse momentum.

The small difference between two plots in Fig. 4 was verified using the first half of the entries (invariant mass combinations) from these plots. As was found (see Fig. 5) the majority of entries are the same for both particle identification conditions (empty histograms). The number of different entries shown by dashed histograms is quite small and does not significantly modify the overall shape.

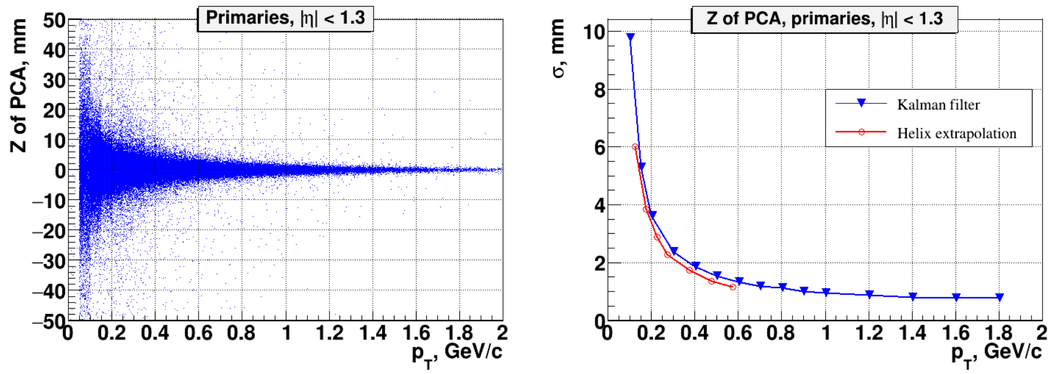

Figure 3: Left - Z-coordinate of the point of the closest approach to the interaction point versus transverse momentum for primary tracks with $|\eta| < 1.3$; right - longitudinal position error (sigma of the gaussian fit of vertical slices of the left plot) versus p_T: blue triangles are the same as in Fig. 2, red circles were obtained using helix extrapolation as explained above.

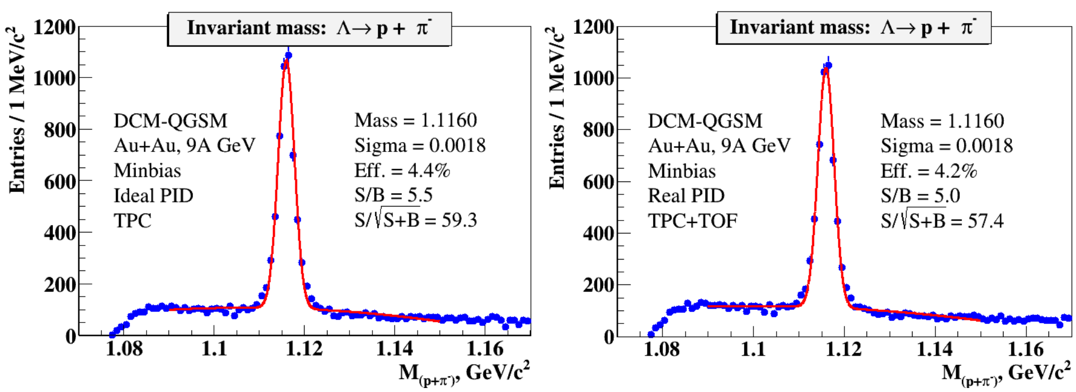

Figure 4: Invariant mass of a proton and a negative pion with different particle identification conditions: left - using Monte Carlo truth information, right - using particle ID method.

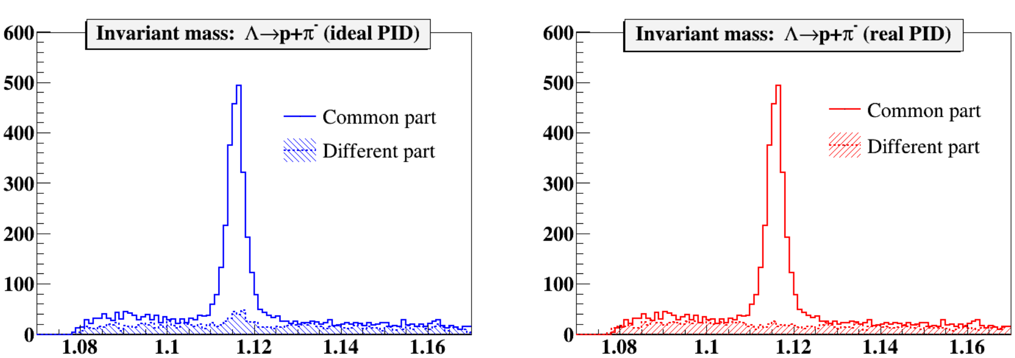

Figure 5: The same proton and negative pion invariant mass combinations as in Fig. 4 (only half statistics): empty histograms show the same combinations from the left and right samples, dashed histograms show different combinations.