Λ_C reconstruction via $K^- + \pi^+ + p$ decays

The presented simulation analysis of Λ_C reconstruction in Au+Au collisions uses 20k simulated central (roughly 0-10% most central) HIJING collisions, with 18 Λ_C inserted in each event with flat p_T. All simulated Λ_C were forced to decay in the most interesting hadronic channel $\Lambda_C \to K^- + \pi^+ + p$ (B.R. 5.0%). The $c\tau$ for Λ_C is only 59.9 μm, which makes it a challenging measurement even with HFT. The simulation uses the most recent geometry of STAR with HFT (so-called upgr15).

The reconstructed signal was rescaled to the realistic scenario, which is the power-law with $\langle p_T \rangle = 1.0$ GeV/c and $n = 11$. The expect yield of Λ_C per binary collision is $dN/dy = 0.0004$, which is 20% of the D^0 yield measured by STAR. A scenario of Λ_C/D^0 enhancement similar to the one of Λ/K was also considered. We also made a simple rescaling for peripheral (60-80% most central) collisions, where signal was expected to follow R_{CP} of charged hadrons as measured by STAR and background tracks expected to scale with N_{part}.

Candidate triplets were constructed and several cuts were applied. The effort in cut tuning was to maximize signal signicance $S/\sqrt{S+B}$. Triplet invariant mass was cut at $2-\sigma$ to maximize the significance. The analysis assumed 90% efficiency of Time Of Flight (TOF) detector and its ability for $K-\pi$ separation for $p_T < 1.6$ GeV/c and $(K+\pi)-p$ separation for $p_T < 3.0$ GeV/c. For lower p_T bins of reconstructed Λ_C ($p_T < 4$ GeV/c, all daughter tracks were required to be identified, while for $p_T > 4$ GeV/c misidentified tracks were allowed into the analysis.

Distance of closest approach (DCA) of daughter tracks to reconstructed decay vertex was cut at 2σ, where σ is the track DCA resolution (a function of track PID and p_T). Two other cuts ($\cos\theta$ and track DCA to primary vertex) were automatically optimized to maximize significance. The cut optimization was performed separately for the cases of central collisions, enhanced central collisions and peripheral collisions in 3 p_T bins.

Figure 1 shows the ratio of R_{CP} for Λ_C and D^0 from 500M central and 500M peripheral events (which may be taken as 250M central-triggered and 2000M minimum-bias-triggered events). Note that the errors are statistical and errors coming from D^0 reconstruction can be neglected for it much bigger $c\tau$, 2-particle decay mode and higher yield.

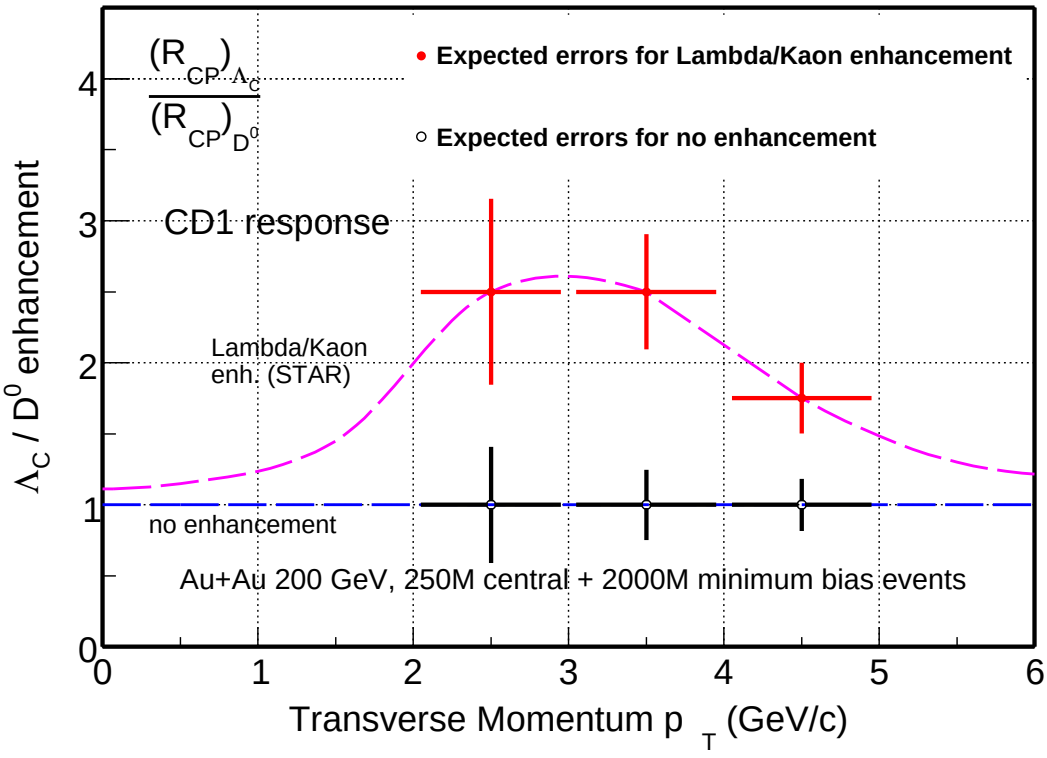

FIG. 1: Estimated performance of HFT detector demonstrated at its ability to measure a possible Λ_C/D^0 enhancement