B to D0 simulation for sPhenix update

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Xiaolong Chen, Gunannan Xie, Xin Dong

OverView

- Update
  — Consider signal double counts
  — Add ideal TOF match for Clean PID and hybrid PID
  — Update kaon Dca resolution (the same as pion)
  — Cross section: B meson~0.54μb (FONLL), D0~46μb (AuAu200 data), previous is D0~46μb, B~0.54*0.8

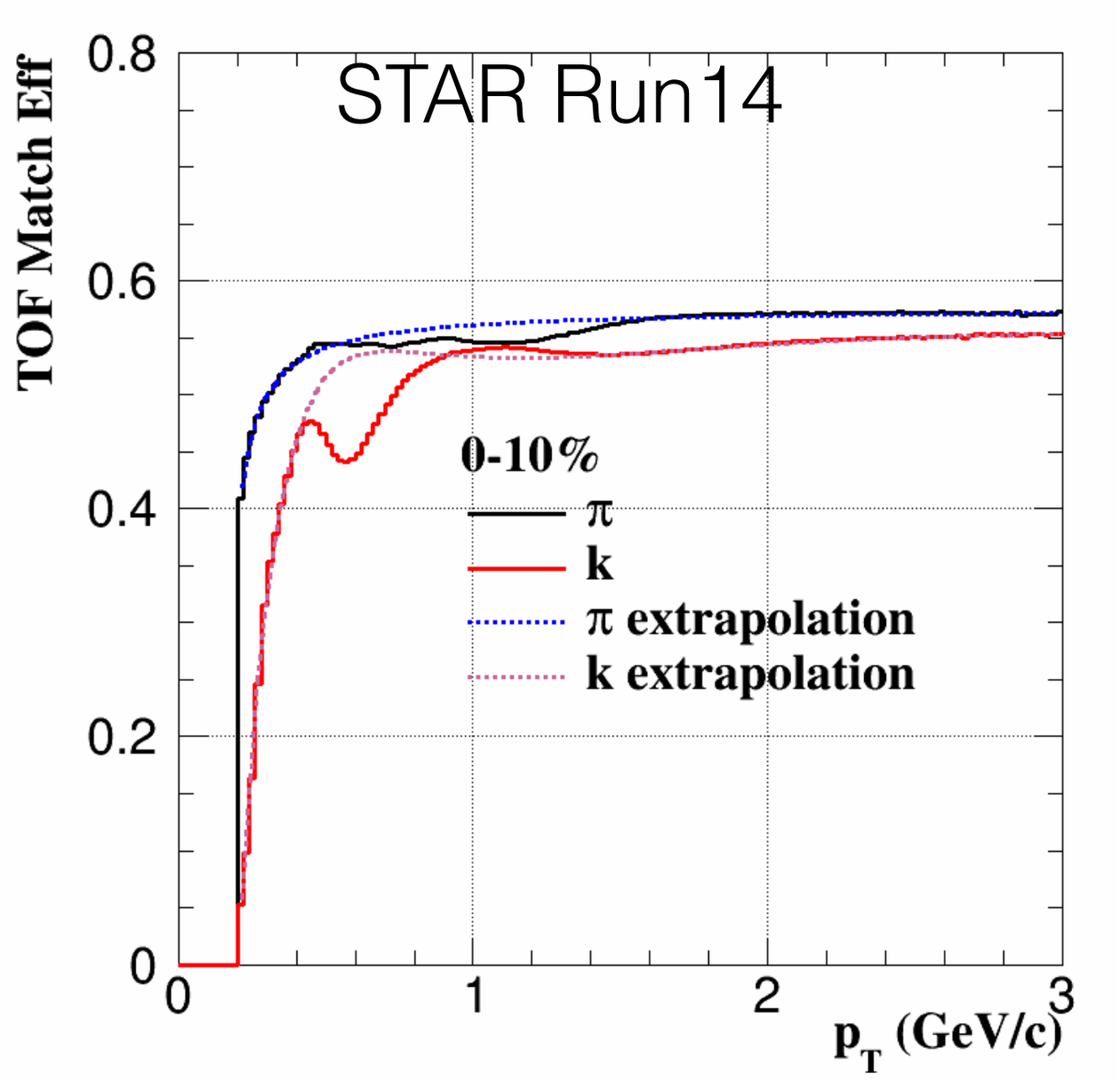
- Results
  — efficiency estimation
  — prompt and non-prompt D0 significance
  — the error of B to D0 ratio

- B decayed D0
  — mean pT ~ 1.9GeV
  — > 1.0GeV, ~77%
  — > 2.0GeV, ~38%

Remove the red update

https://drupal.star.bnl.gov/STAR/system/files/Simu_sPhenix_update.pdf

STAR TOF and ideal TOF



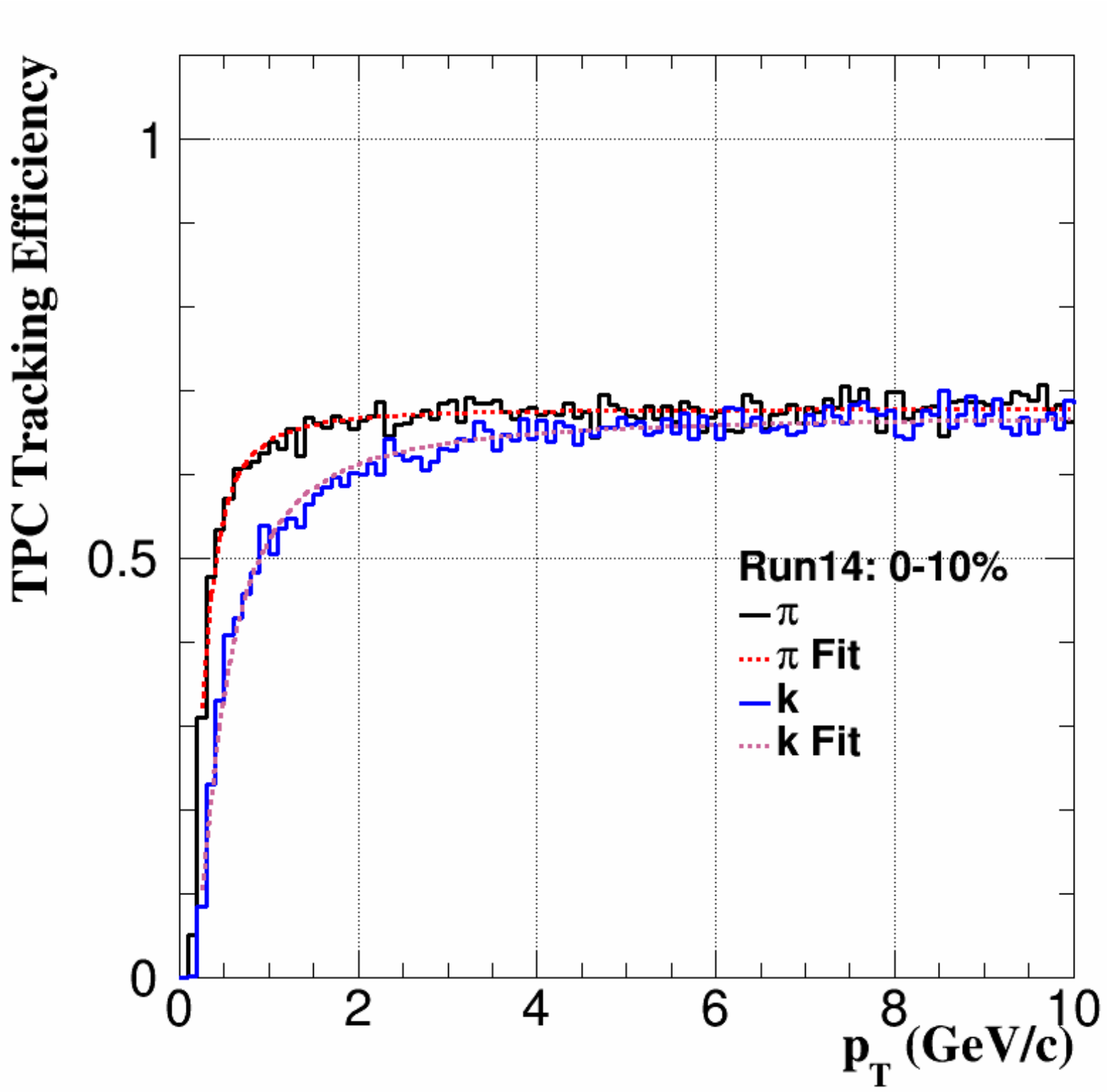
Ideal TOF

— shape from STAR

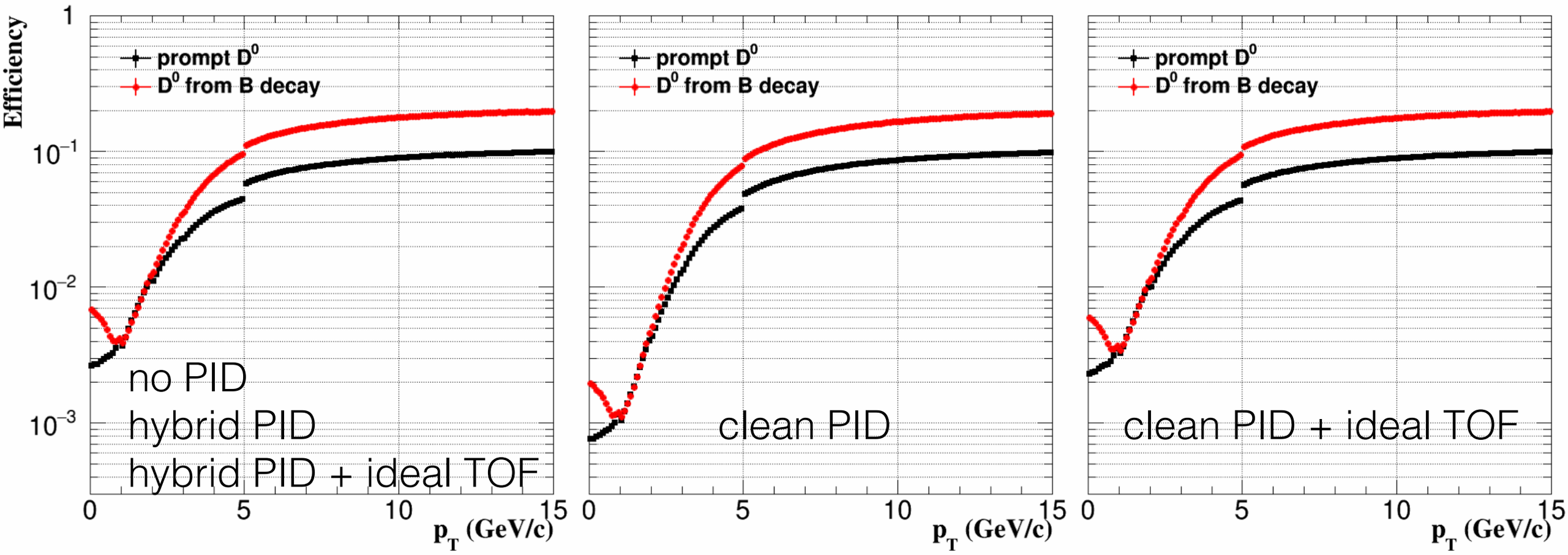
— scale factor

= 1.0 / fun_pi->Eval(3.0)

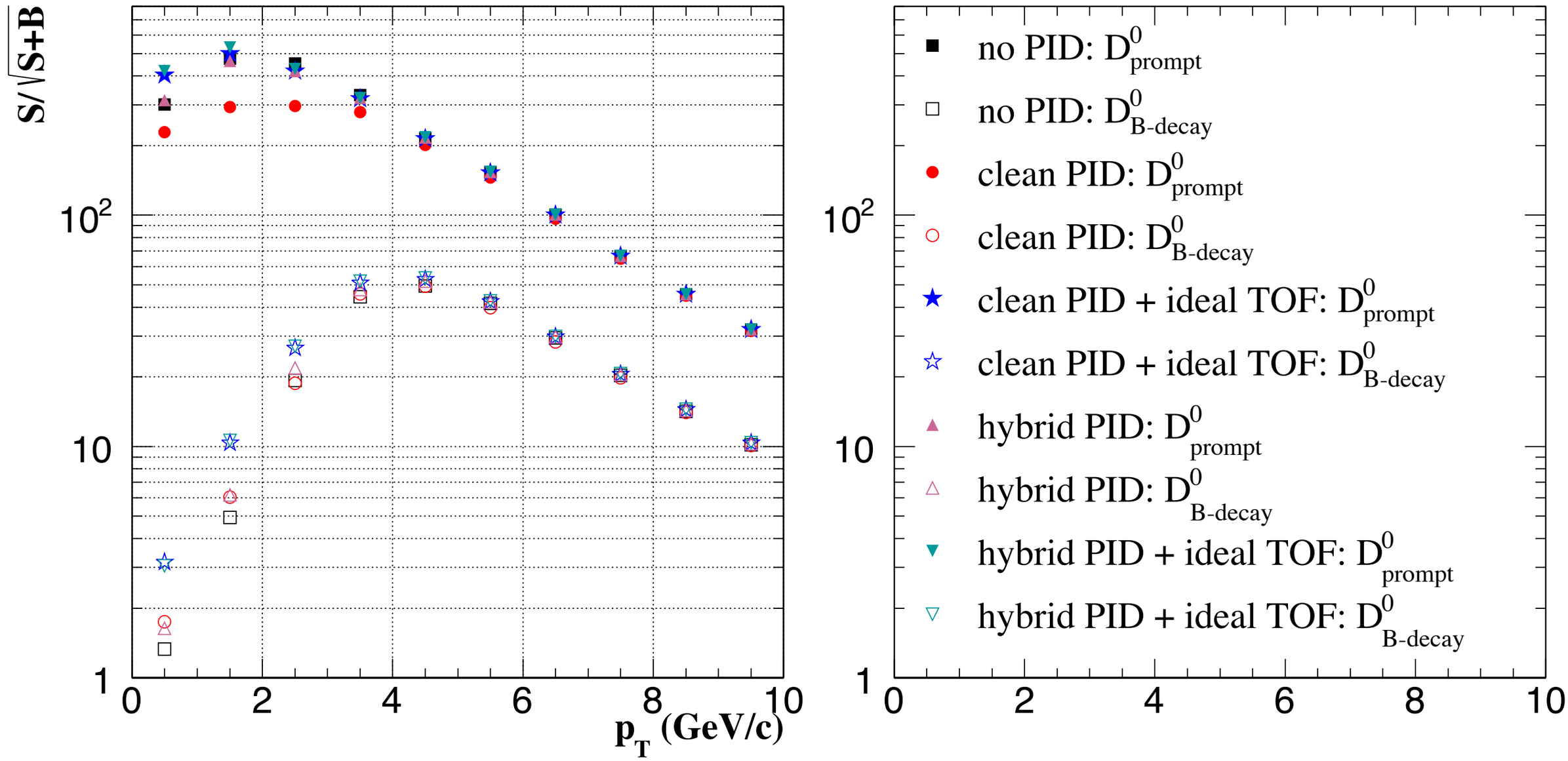
Used TPC track efficiency



Efficiency


Efficiency
1
10^{-1}
10^{-2}
10^{-3}
prompt D^0
D^0 from B decay
no PID
hybrid PID
hybrid PID + ideal TOF
clean PID
clean PID + ideal TOF
0
5
10
15
p_T (GeV/c)

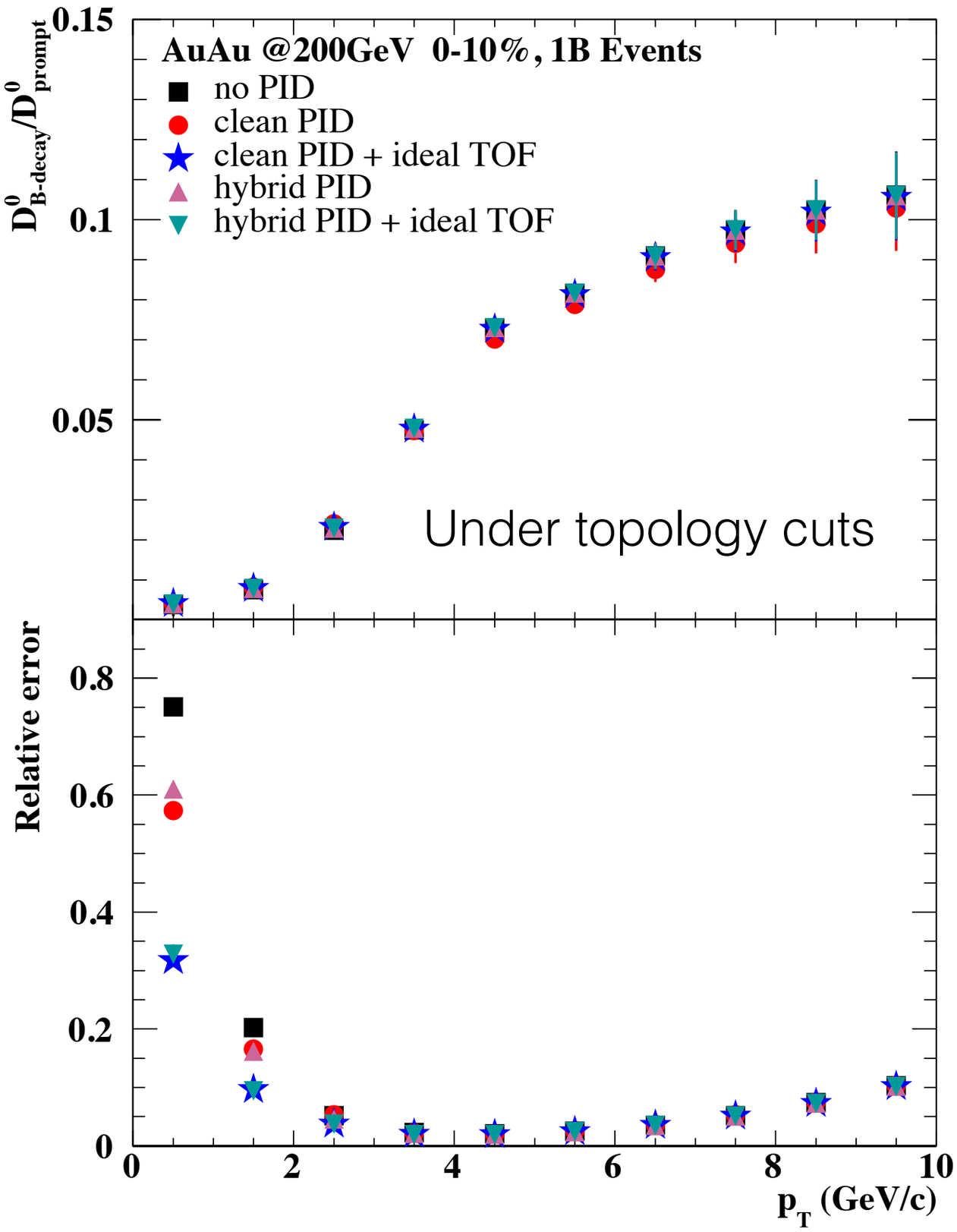
Significance — 1B central



See signal and background distribution at:

https://drupal.star.bnl.gov/STAR/blog/xlchen/signal-prompt-and-non-promt-and-background-distribution-sphenix-update

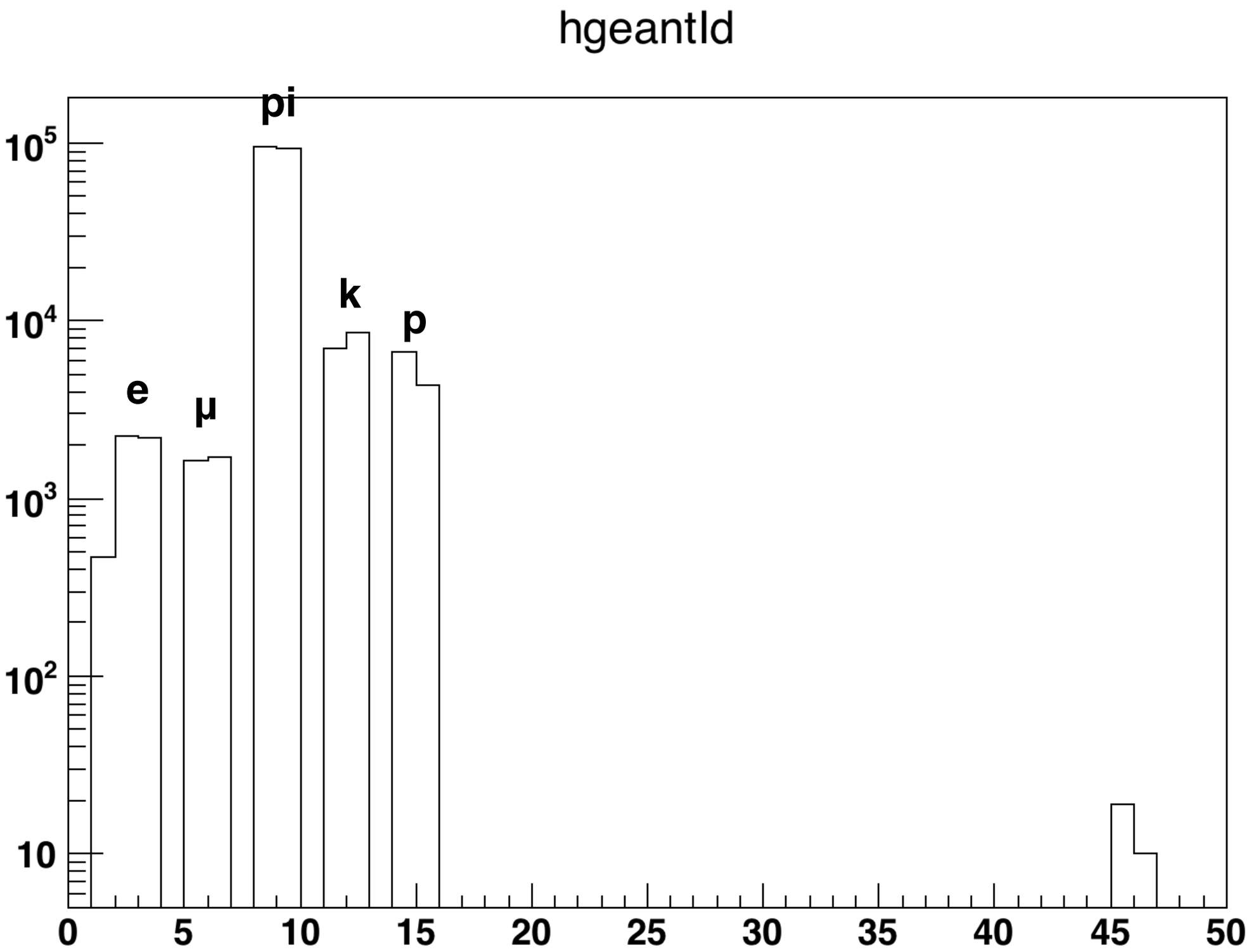
Error of B to D0 ratio — 1B central



Next to do

- 1. add other particle for mis-PID, this influence should be small (see. backup—geant id), pass
- 2. correlated background study (other hadron, or jet) ?? For low pT this influence is small, pass
- 3. pp200 GeV

Backup 1—Geant id in hijing, RcTrack



Backup 2—Cross section

The statistic and systematic errors are from the fit, the normalization errors are from the normalization factor for extrapolation from mid-rapidity to full rapidity $f = 4.7 \pm 0.7$ and the $R \equiv N_{D^0}/N_c = 0.56 \pm 0.04$. The measured D^0 yield is non-singly diffractive, it is scaled by a factor of $R_\sigma \equiv \sigma_{ine}/\sigma_{NSD} = 1.4$. The final charm cross section at mid-rapidity is calculated as:

$$\sigma_{D^0}^{NN} = \frac{1}{N_{ev}} \frac{dN}{dy}\bigg|_{y=0} \times \sigma_{inelastic}^{pp} \times \frac{1}{N_{bin}}$$

$$\frac{d\sigma_{c\bar{c}}^{NN}}{dy}\bigg|_{y=0} = \frac{dN_{D^0}}{dy}|_{y=0} \;/\; R \;/\; R_\sigma \times \sigma_{inel}^{pp}. \qquad \sigma_{inelastic}^{pp} = 42mb \qquad (4)$$

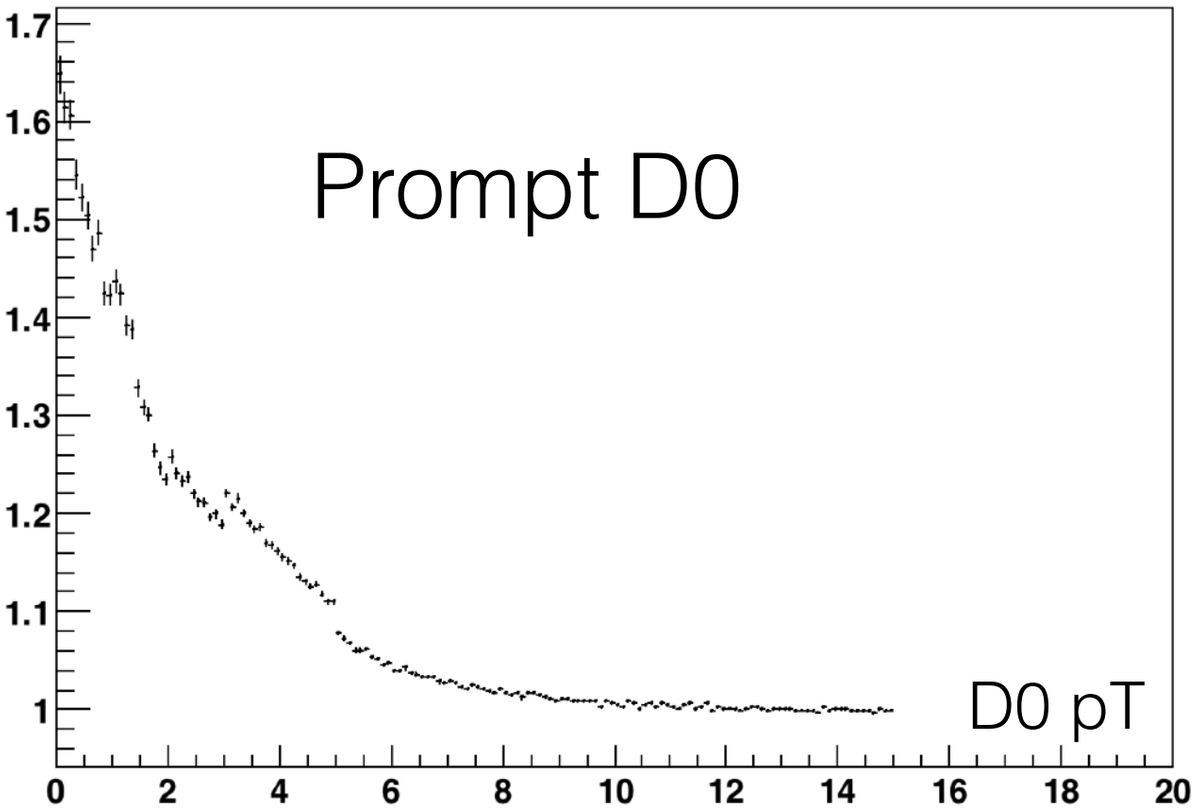
(D0+D0bar)/2 , σ|y=0 (/2)

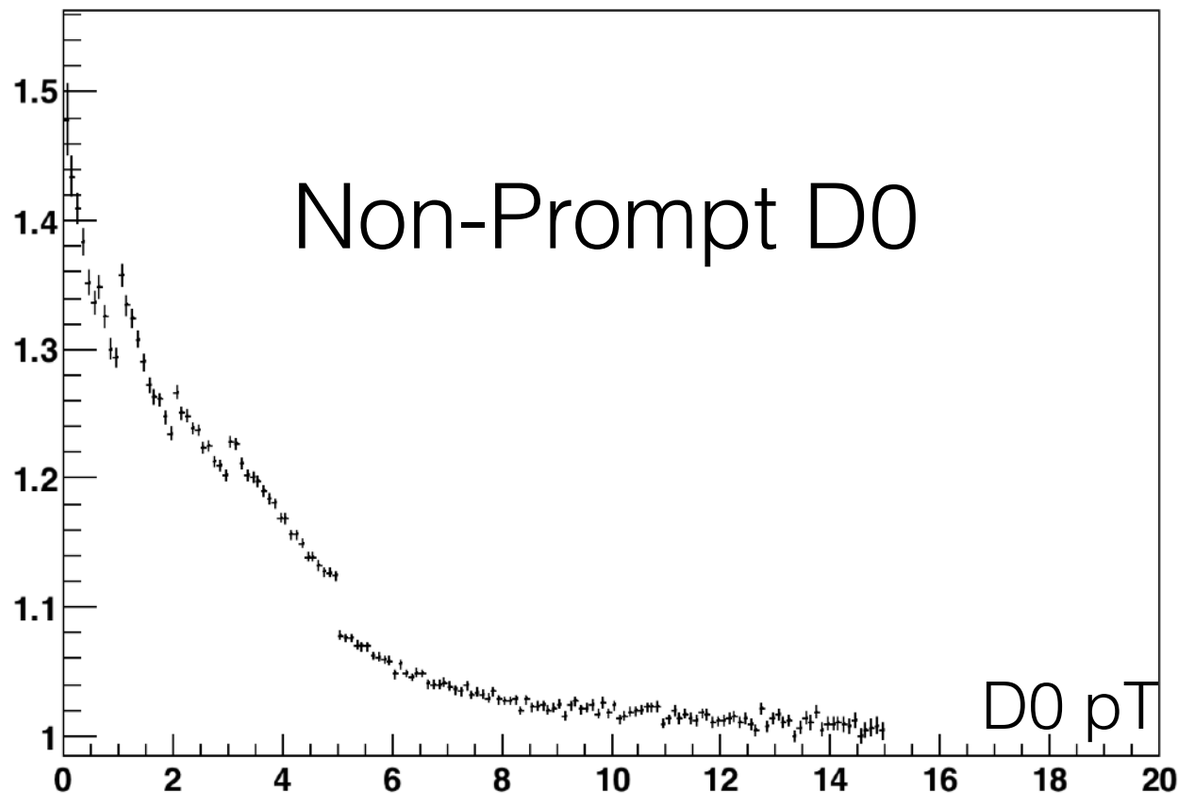
cross section	D^0	B
FonII	56.8μb	0.54μb
AuAu200 0-10%	HFT:46μb (N_{bin}=959) Pub:86μb (N_{bin}=941)	
pp200	95μb (*Rσ=133μb)	

ccbar—check Cross section	AuAu200	pp200
Run14 HFT	0-80%: 81.6μb 0-10%: 81.3μb	
Publish	0-80%: 173μb 0-10%: 153μb	170μb

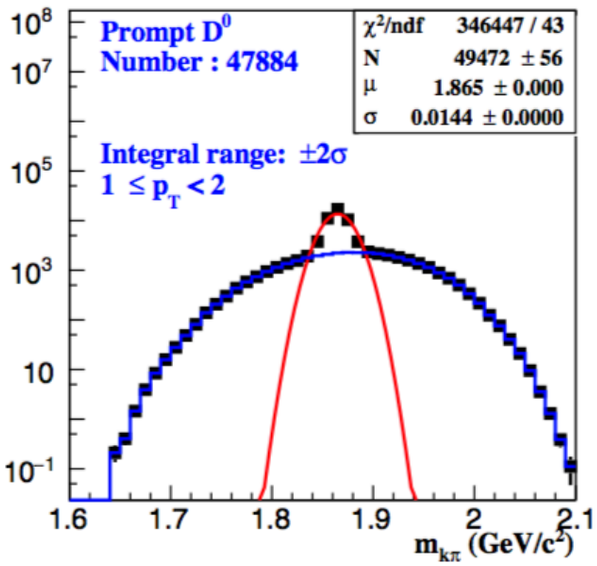
Backup 3—efficiency improve with new kaon Dca resolution

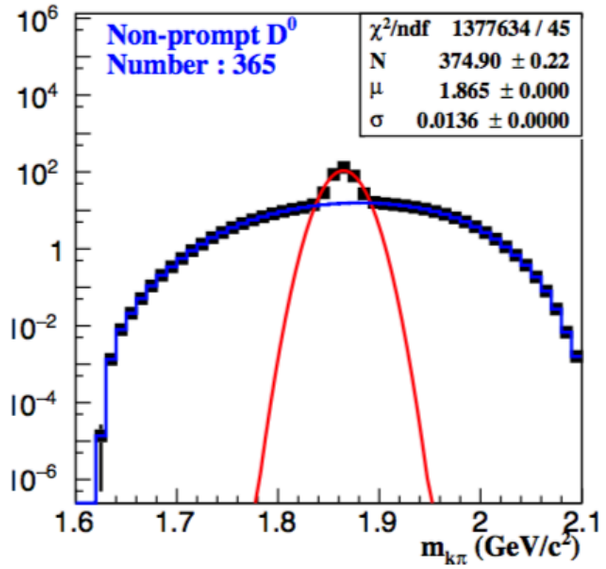
The ratio of new efficiency over old efficiency

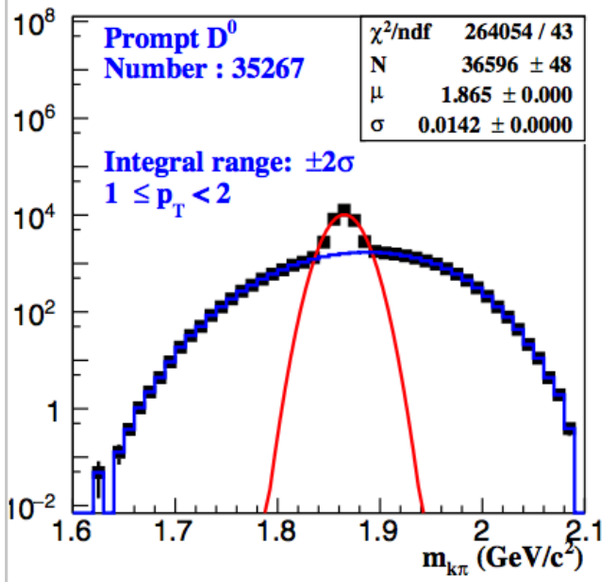


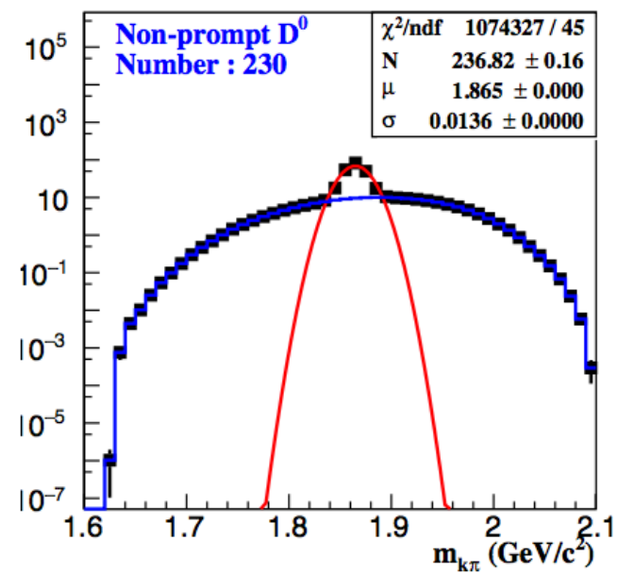


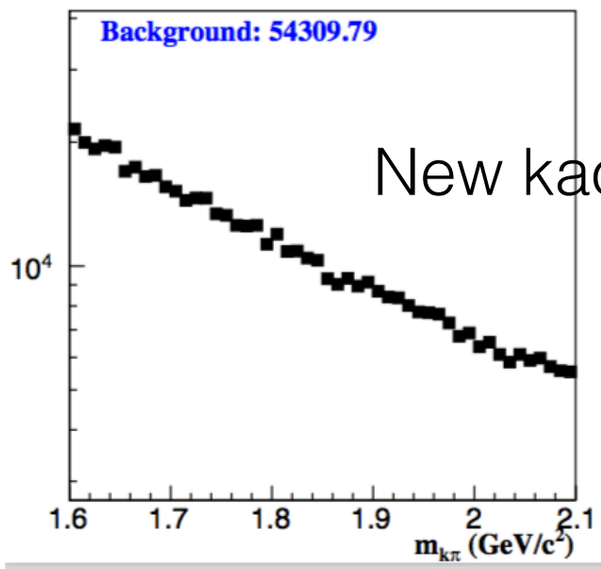
Backup 4—background improve



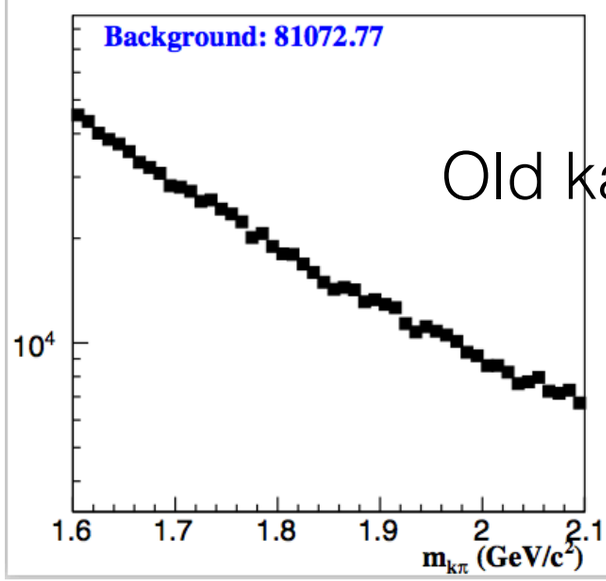








New kaon Dca resolution



Old kaon Dca resolution