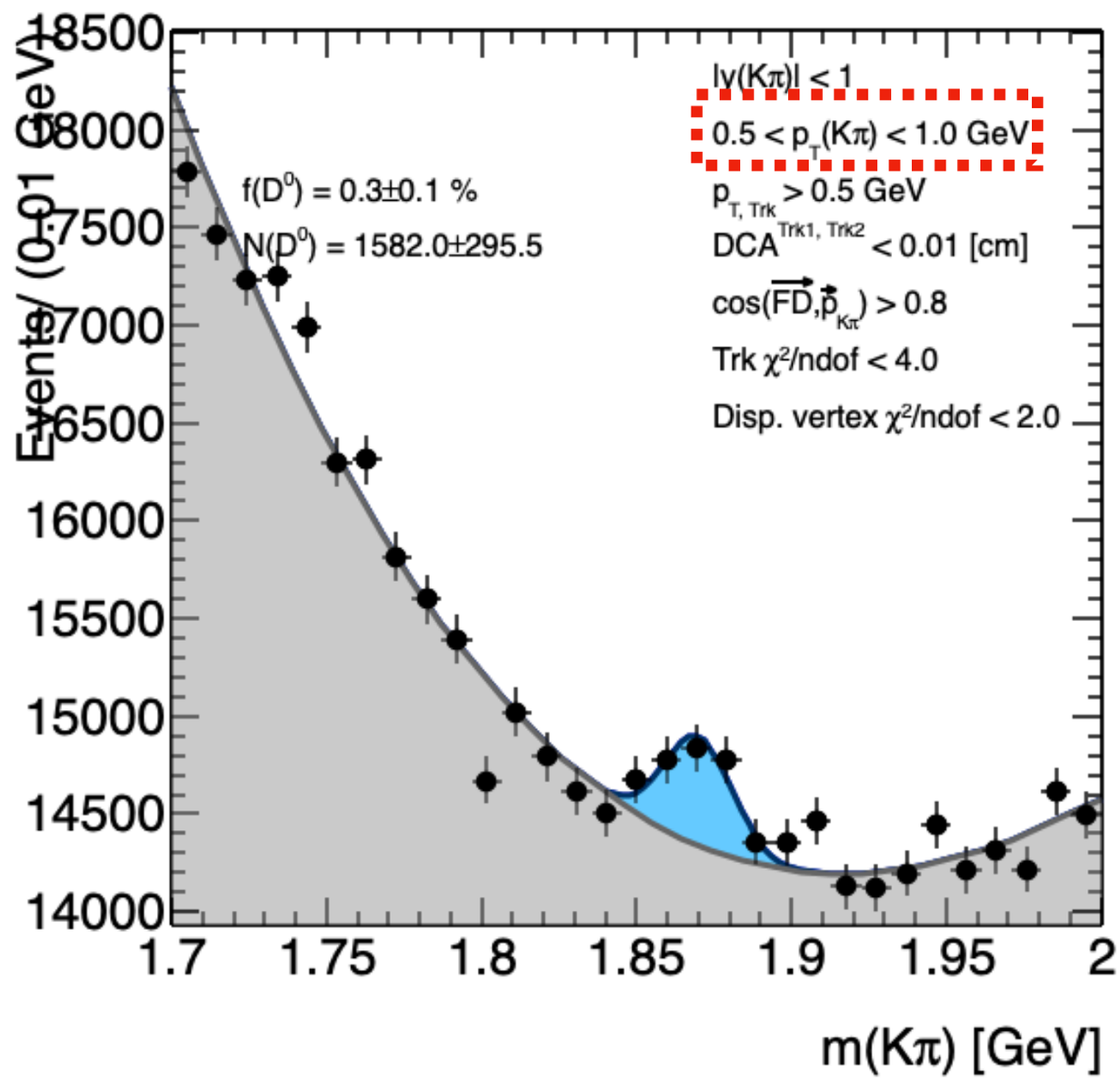
D-MESONS IN MOCK DATA

SEBASTIAN TAPIA, MAR 22, 2021, ISU

Outline

- Displaced vertex observables on latest release
- Intermediate state, $D^* \longrightarrow D^0(K\,\pi) + \pi$
- D^0 in full cc/bb sample (until last week)



Analysis code settings

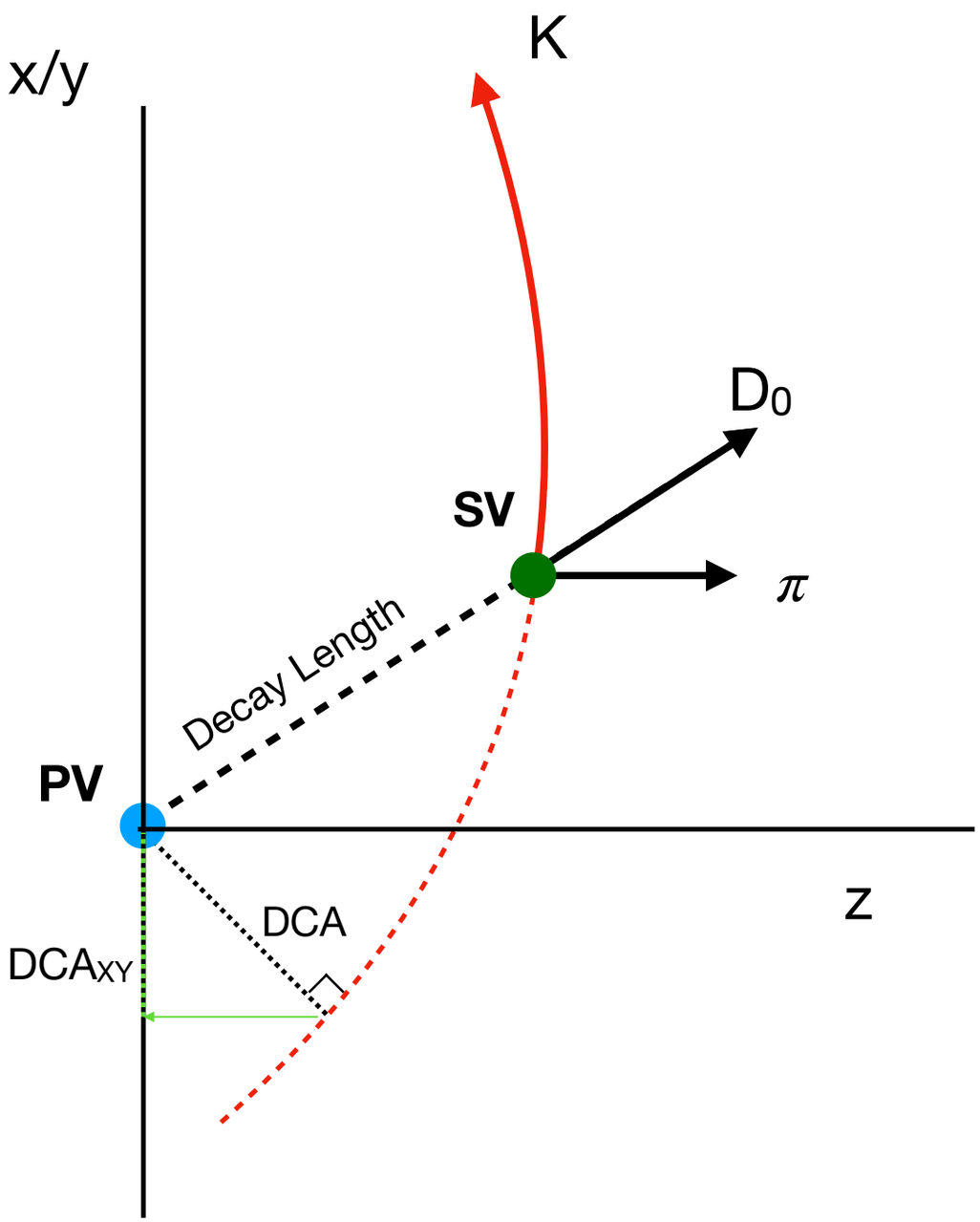
Soft selection use as baseline:

```
kfparticle->setMaximumTrackchi2nDOF(4);
kfparticle->setMaximumDaughterDCA(0.03);
kfparticle->setMinDIRA(0.8);

kfparticle->setMinimumTrackPT(0.1);
kfparticle->setMinimumTrackIPchi2(-1);
kfparticle->setMaximumVertexchi2nDOF(10000000);
kfparticle->setFlightDistancechi2(0);//minimum
kfparticle->setMotherPT(0);//minimum
kfparticle->setMotherIPchi2(10000000);/maximum
```

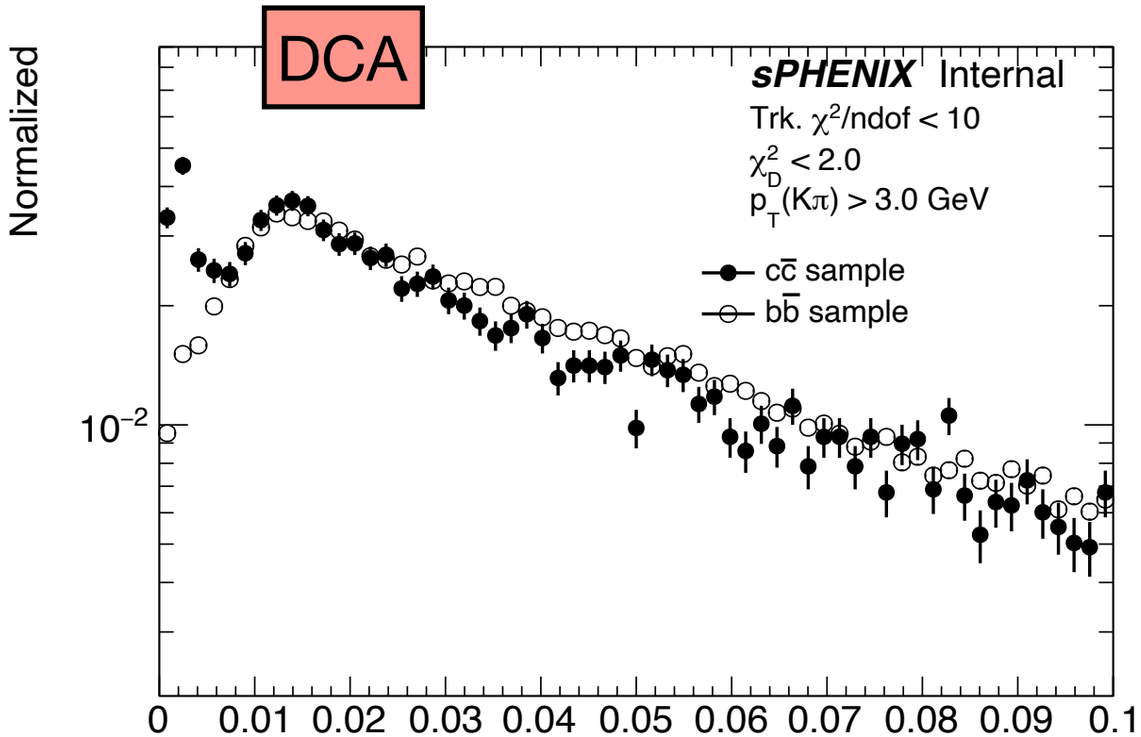
More cuts applied offline

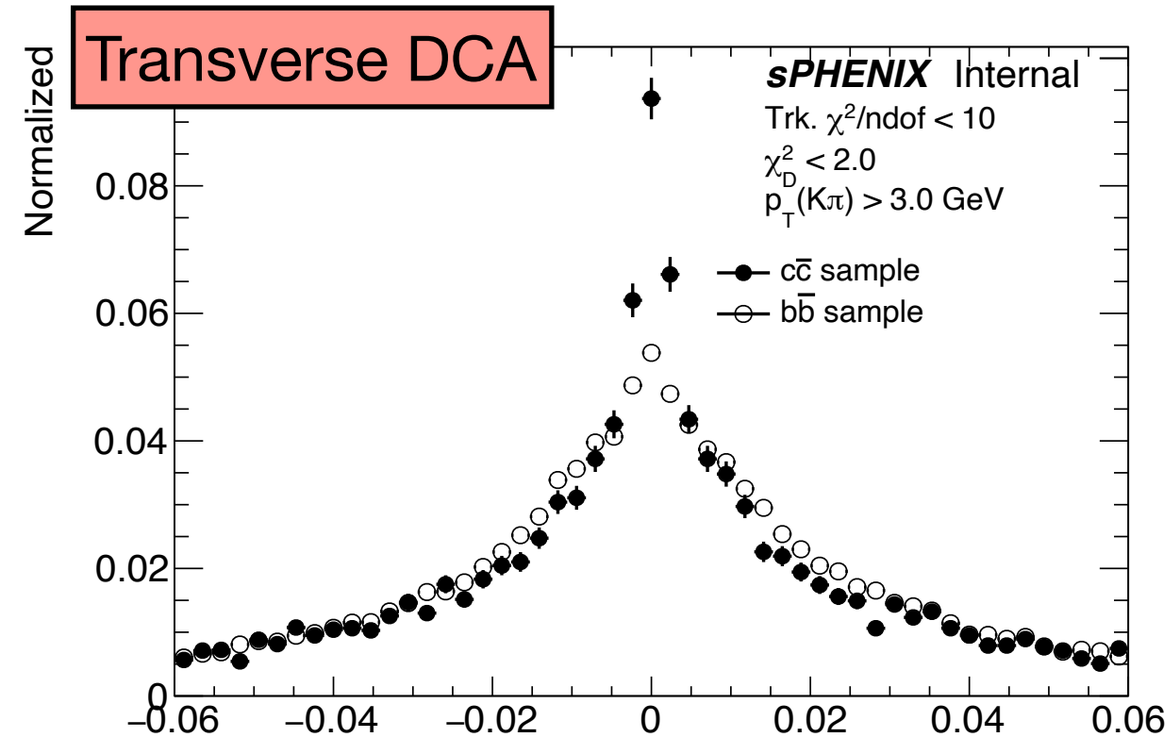
Secondary vertex observables

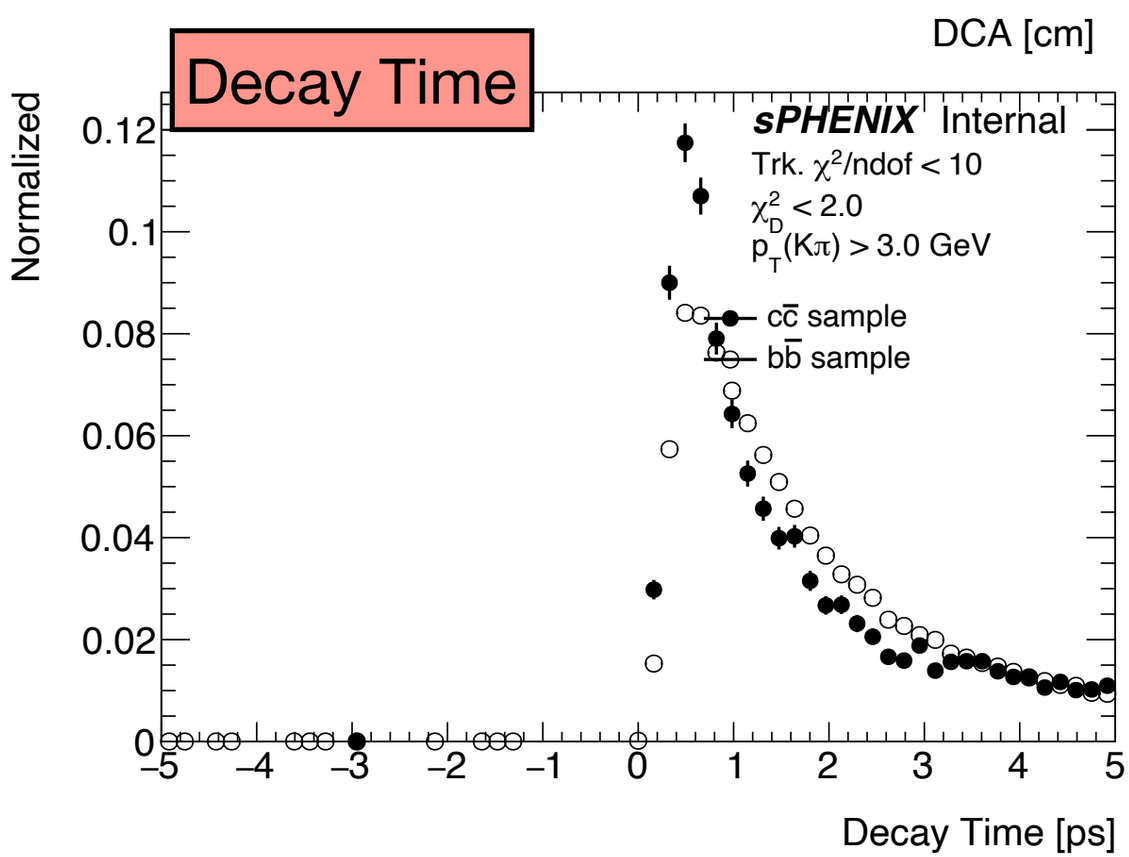


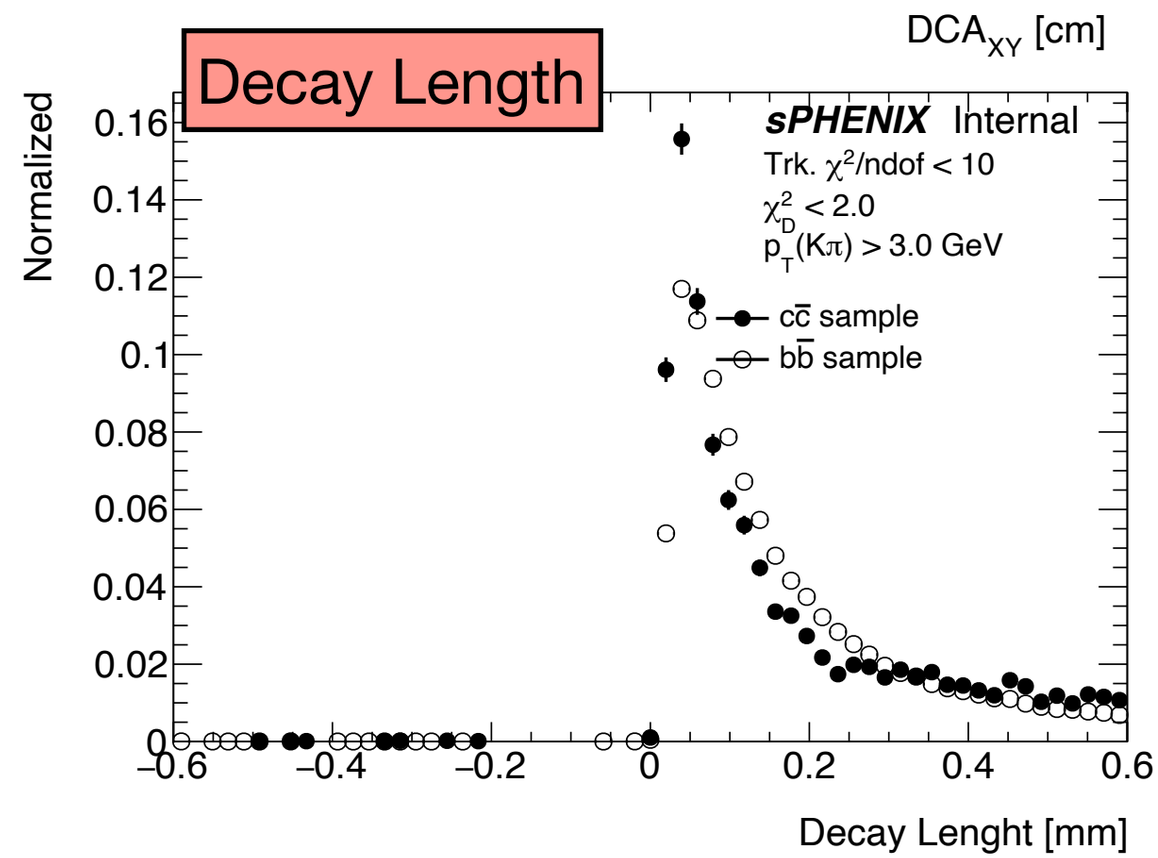
- DCA
- Transverse DCA
- Decay Length
- Decay Time

Running on new KFParticle version — **MDC1.5**



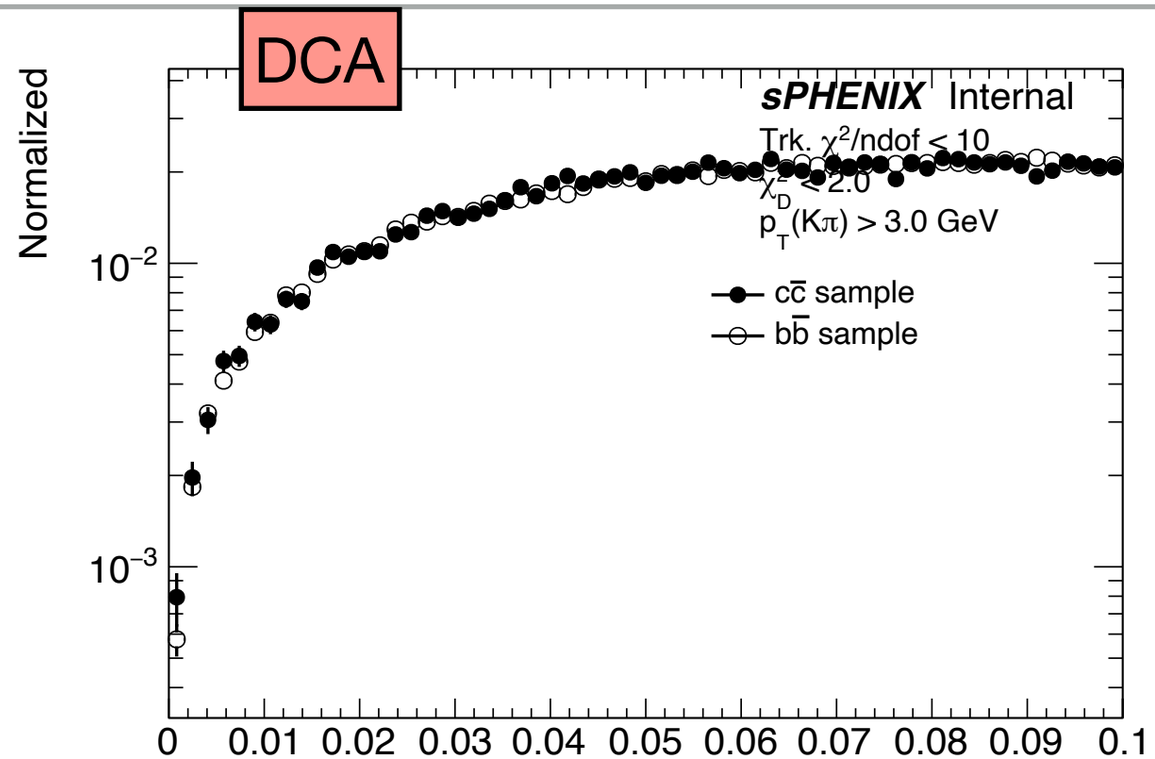


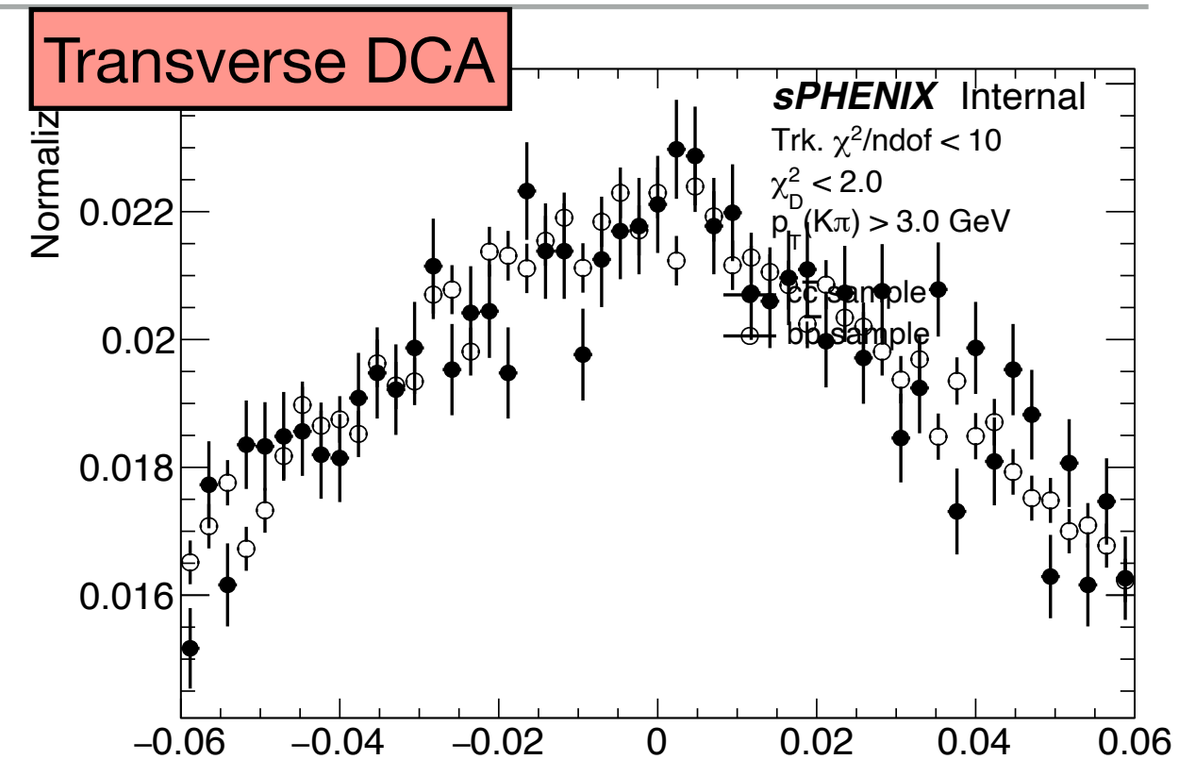


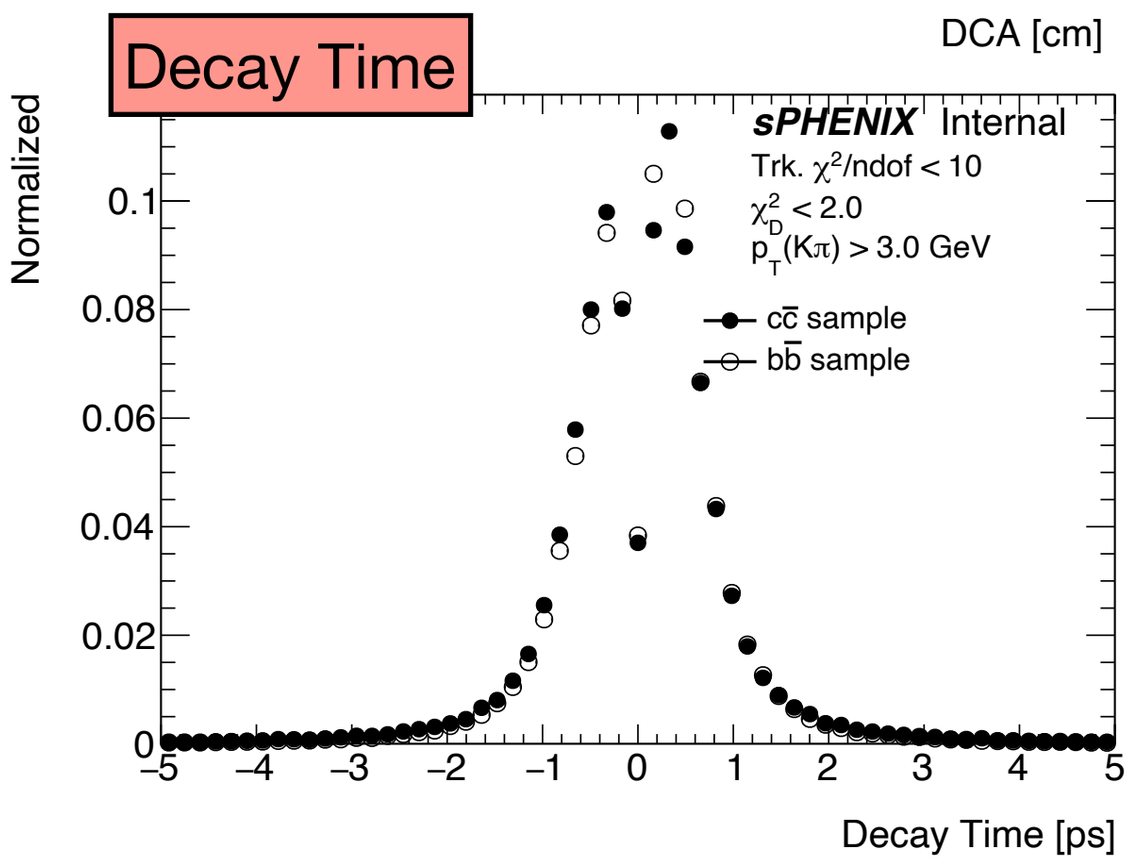


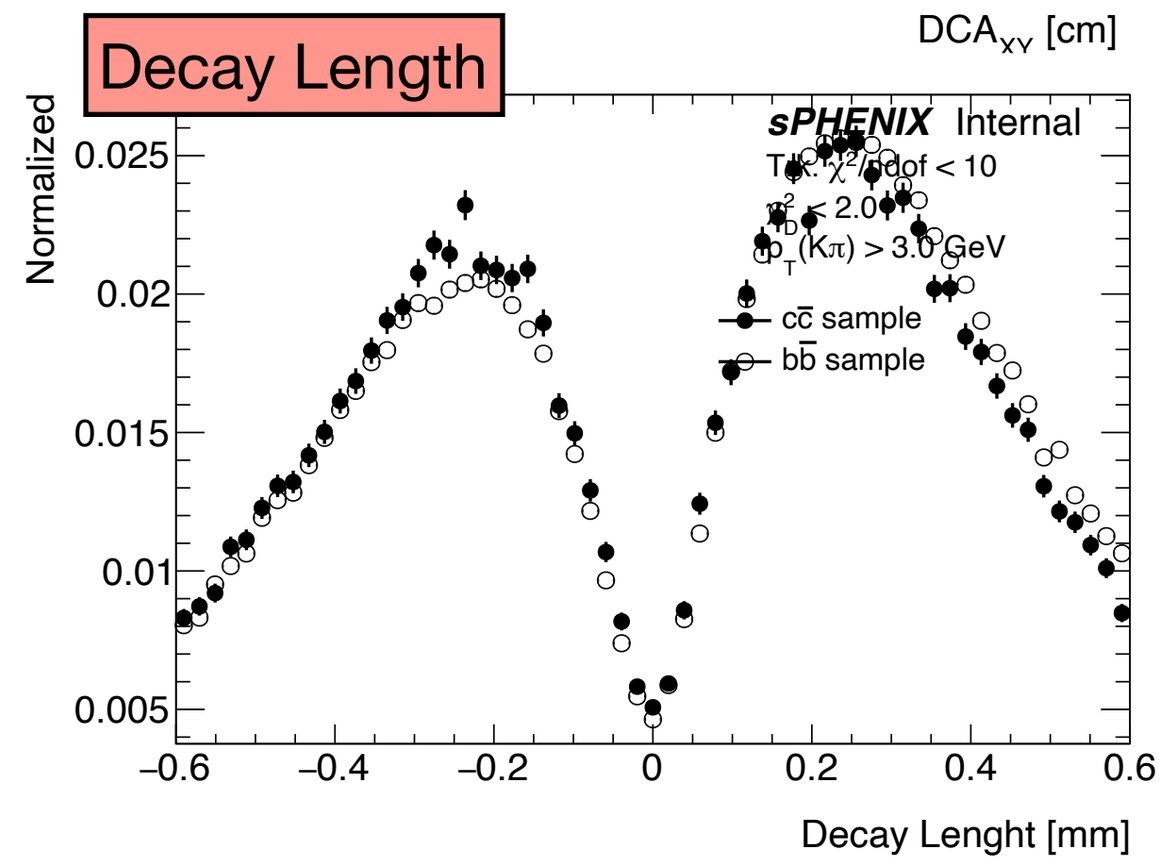
Same that show last meeting

Running on new KFParticle version — **new**





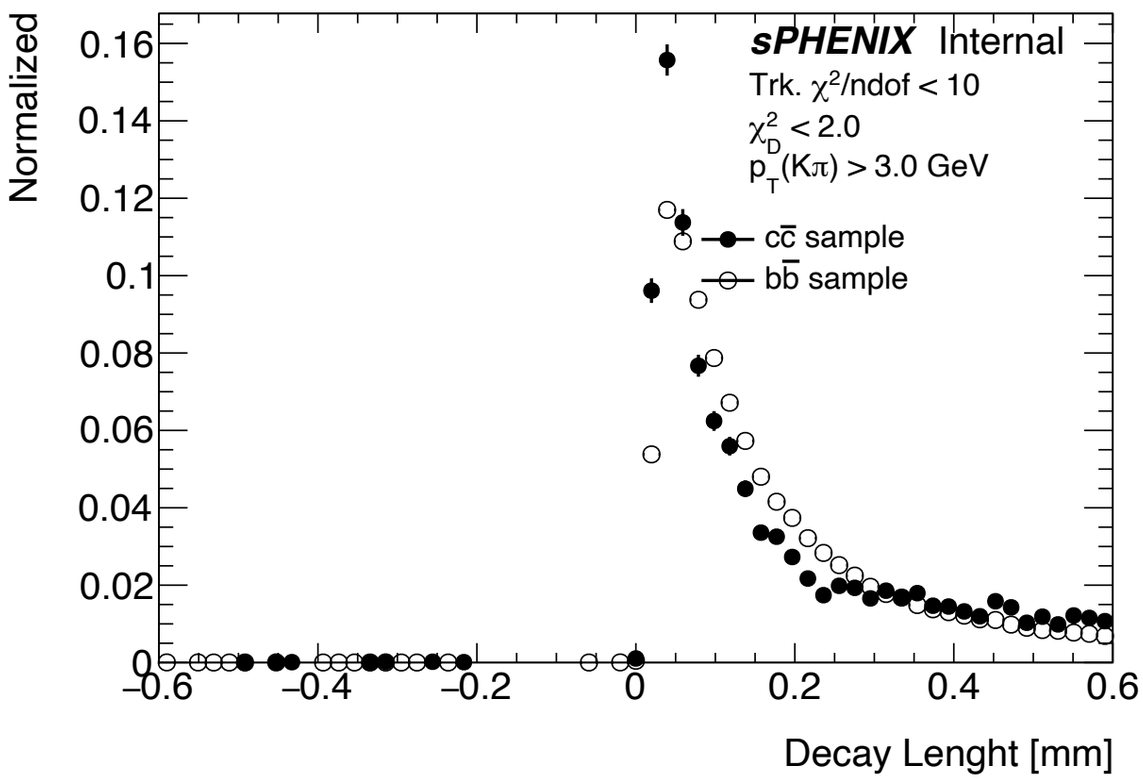




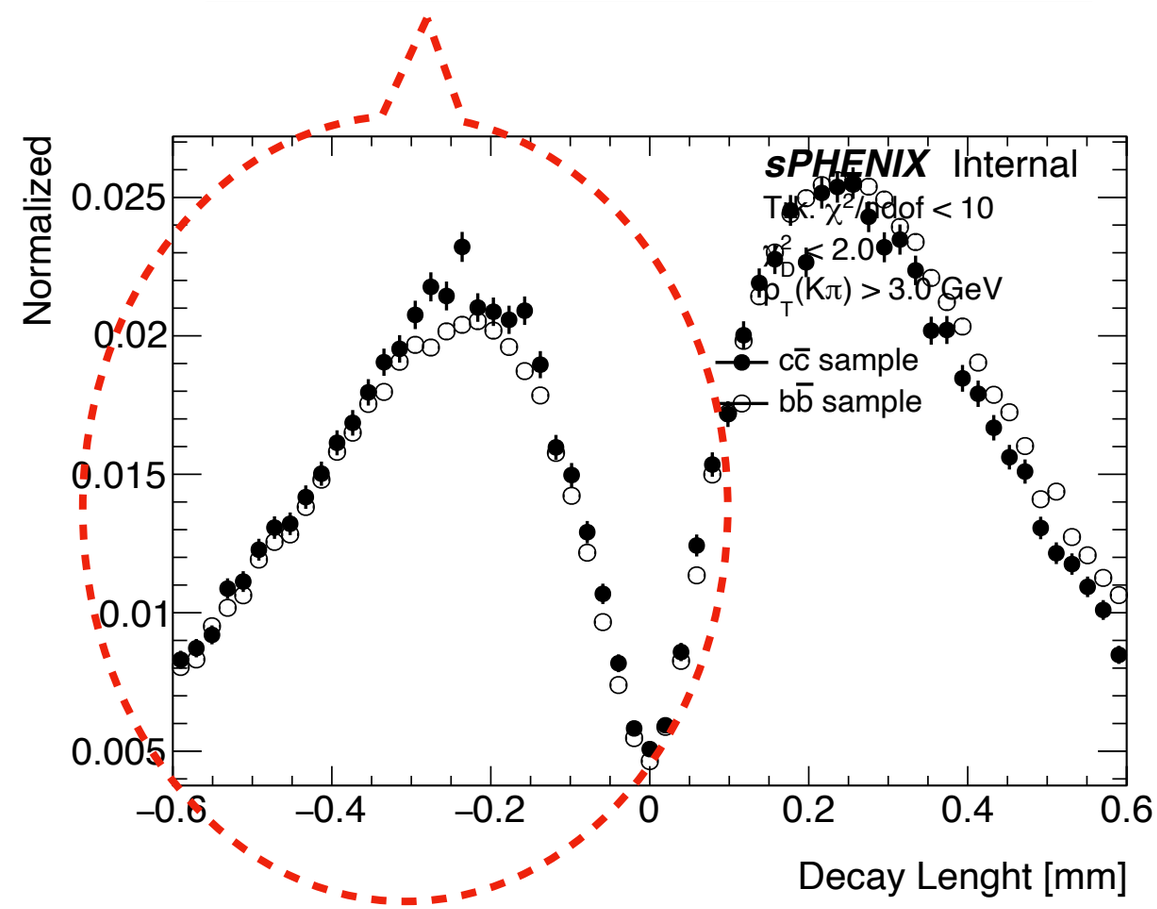
Displaced vertex observables are not consistent between both versions

What is different ??

Looking at Decay length



Significant amount of negative values



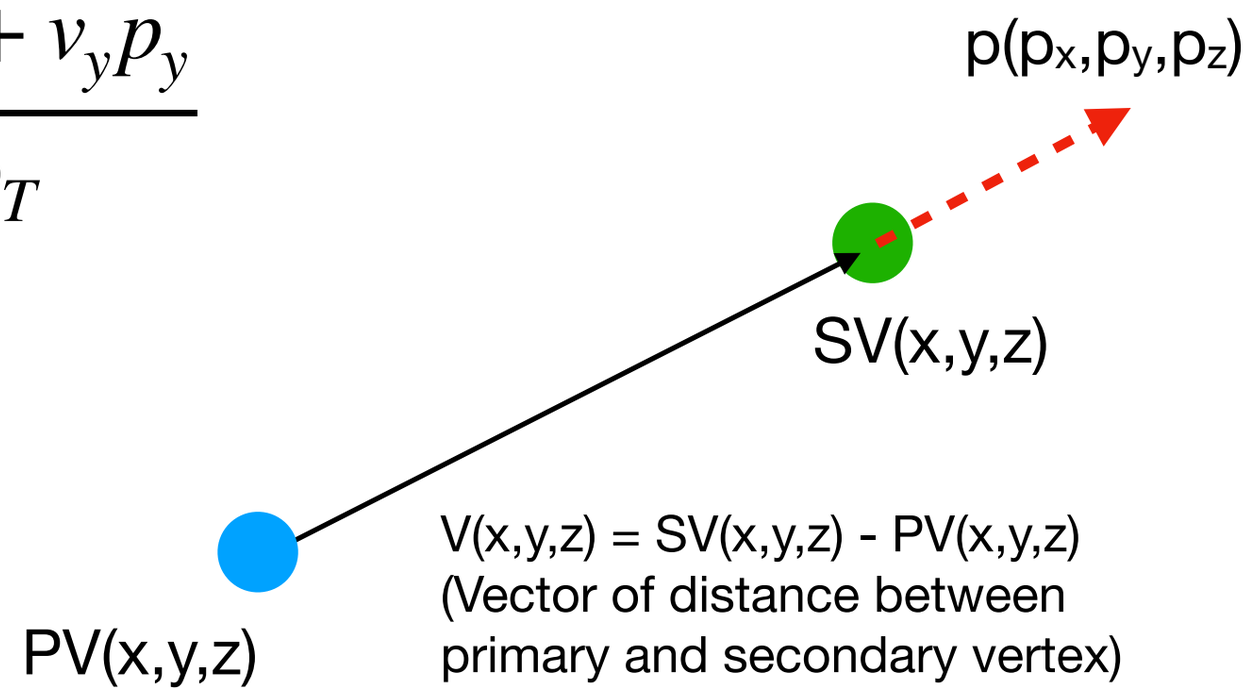
Displaced vertex observables are not consistent between both versions

What is different ??

Looking at Decay length

We can calculate decay length ourself as:

$$L_{2D} = \frac{v_x p_x + v_y p_y}{p_T}$$



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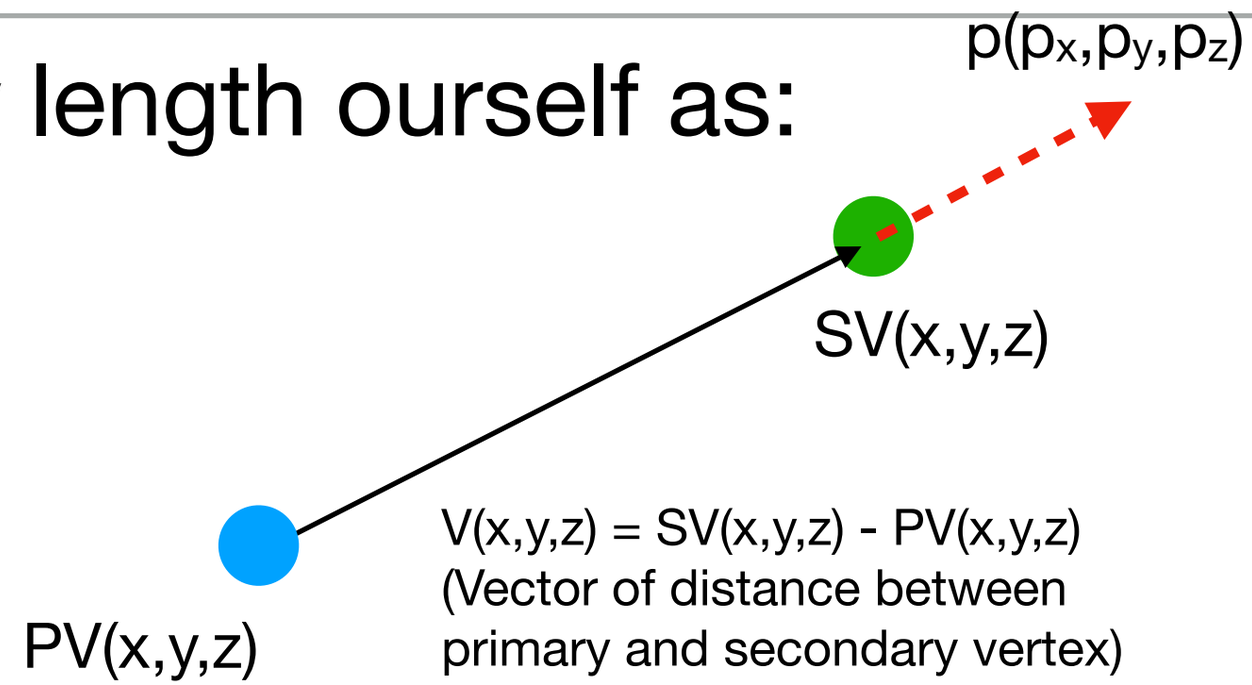
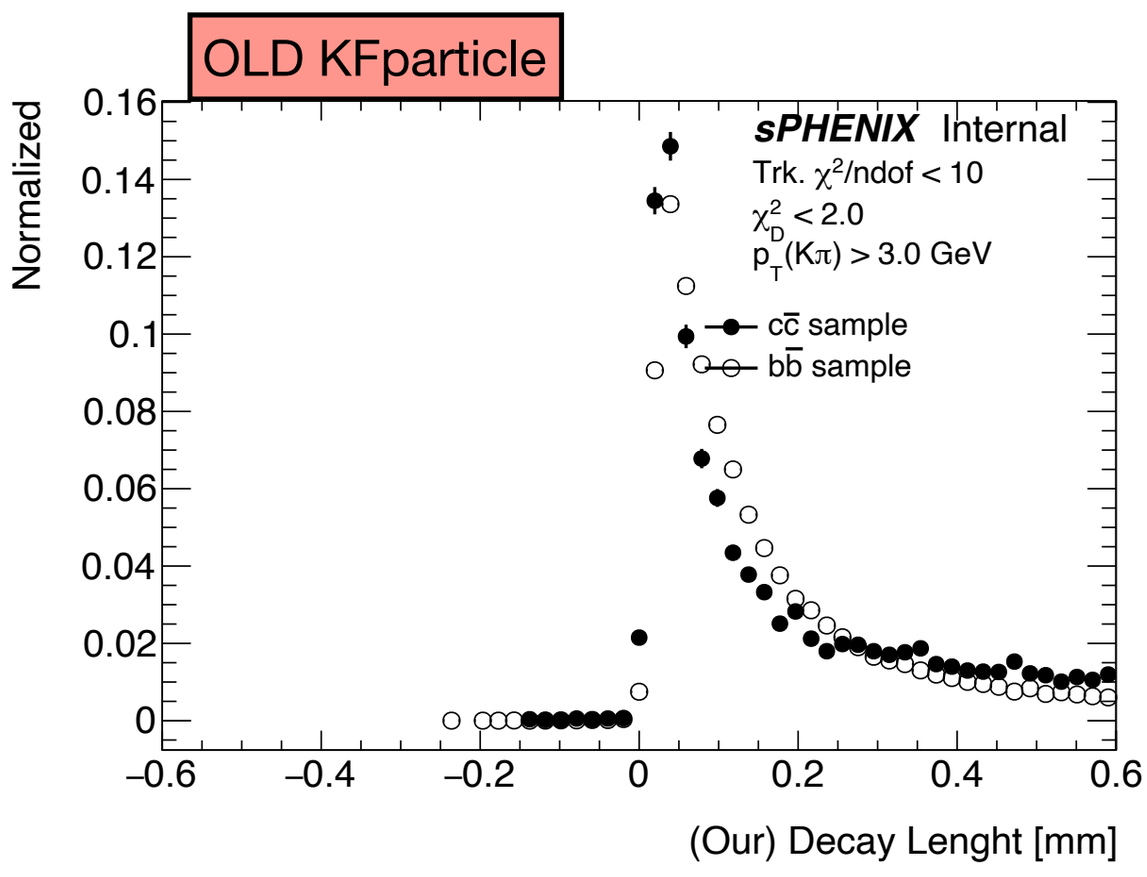
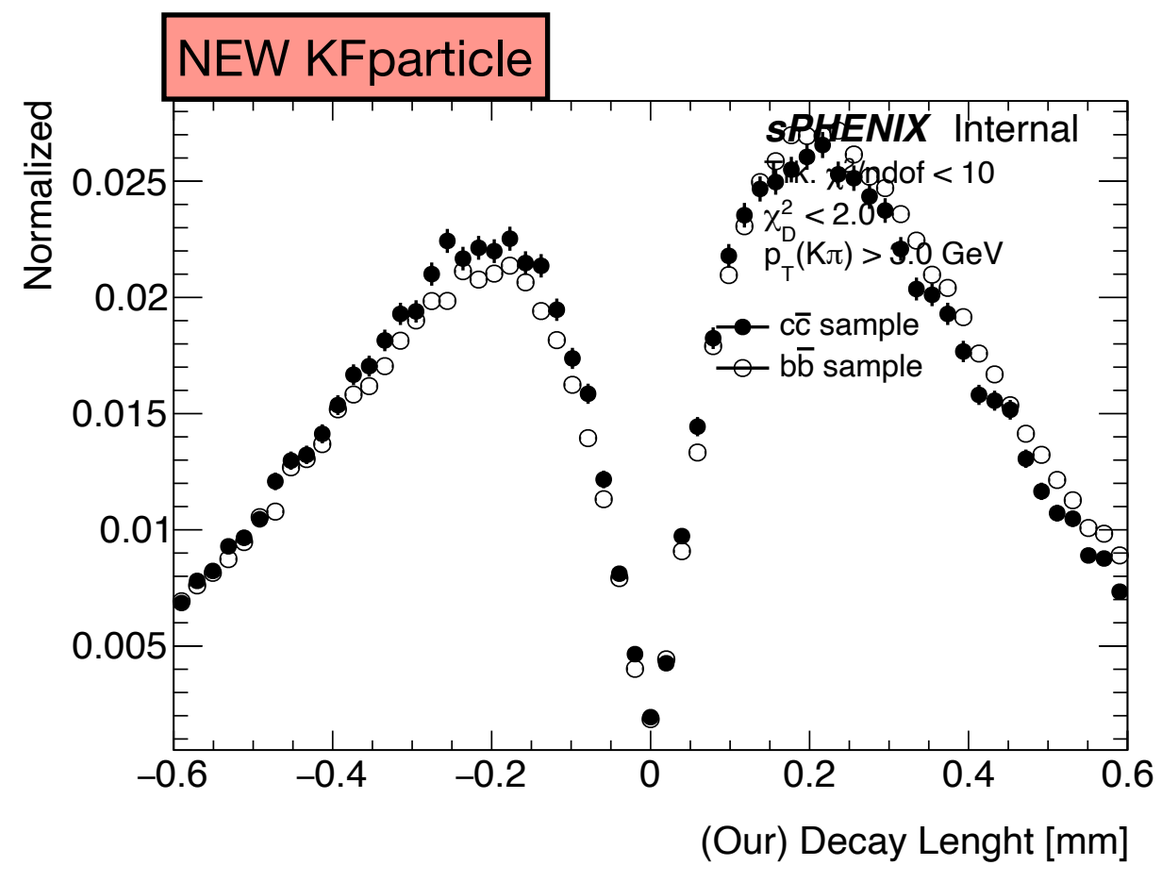


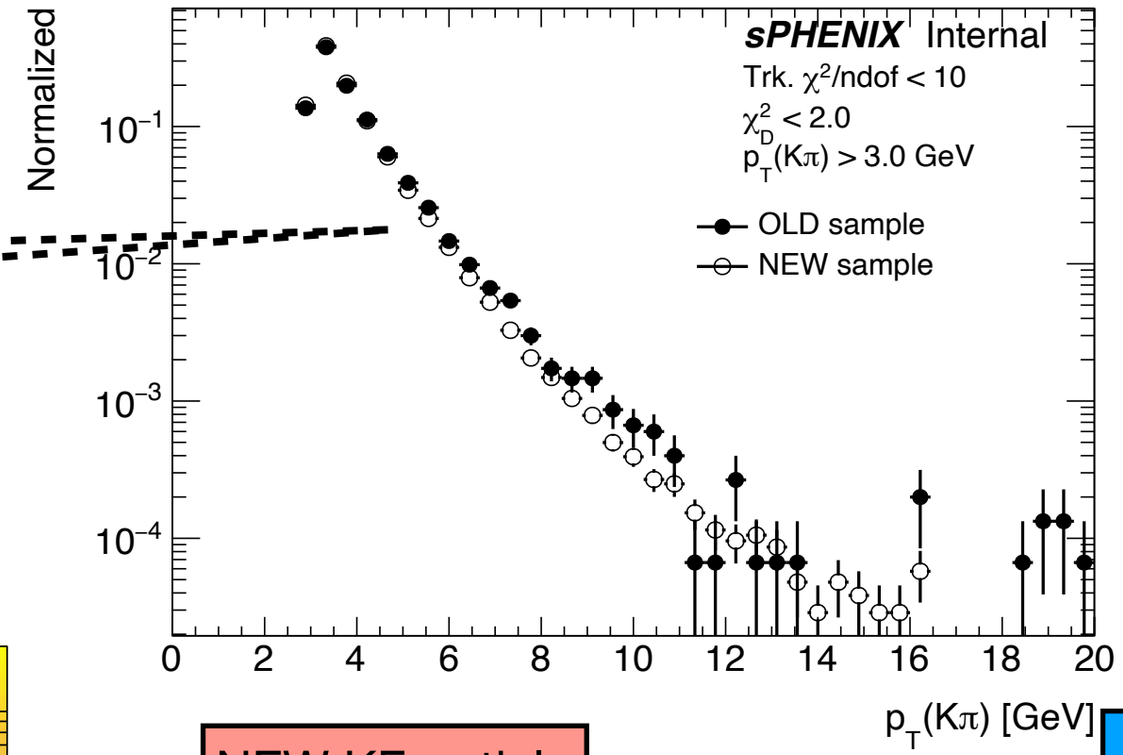




What is different ??

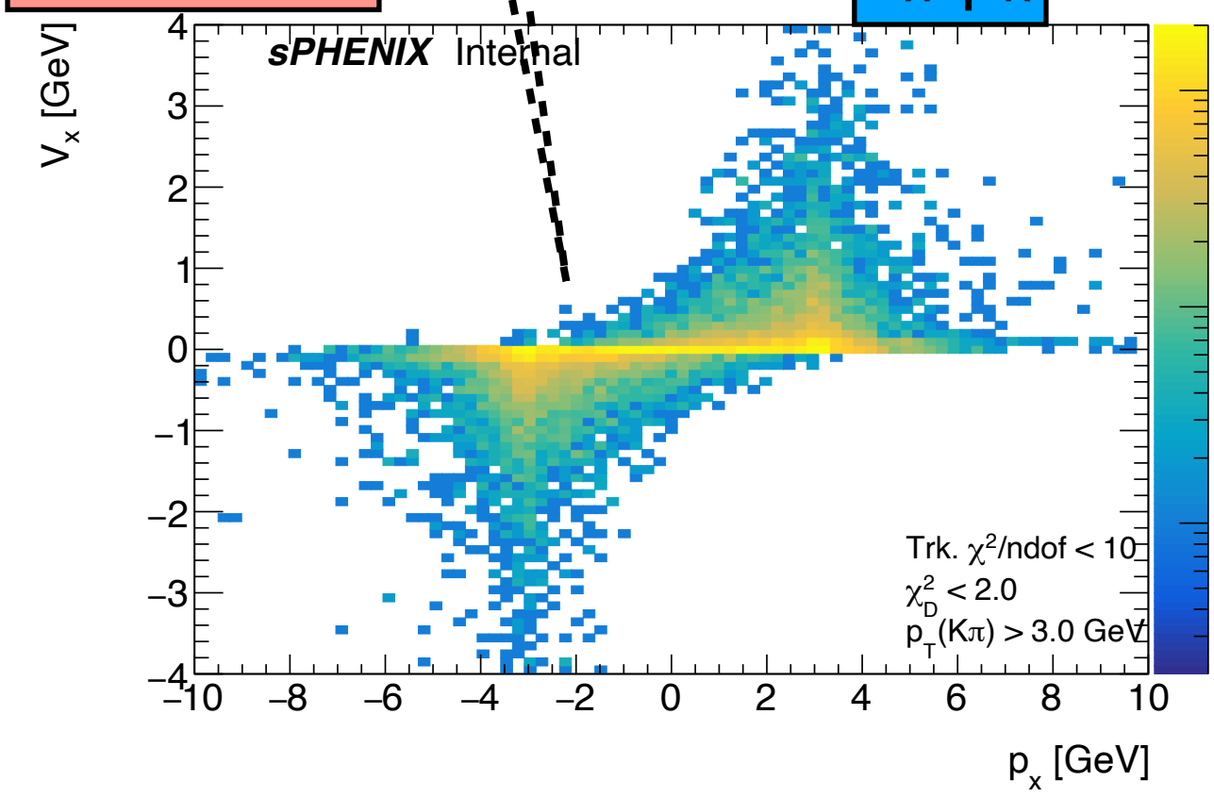
$$L_{2D} = \frac{v_x p_x + v_y p_y}{p_T}$$

Mother p_T



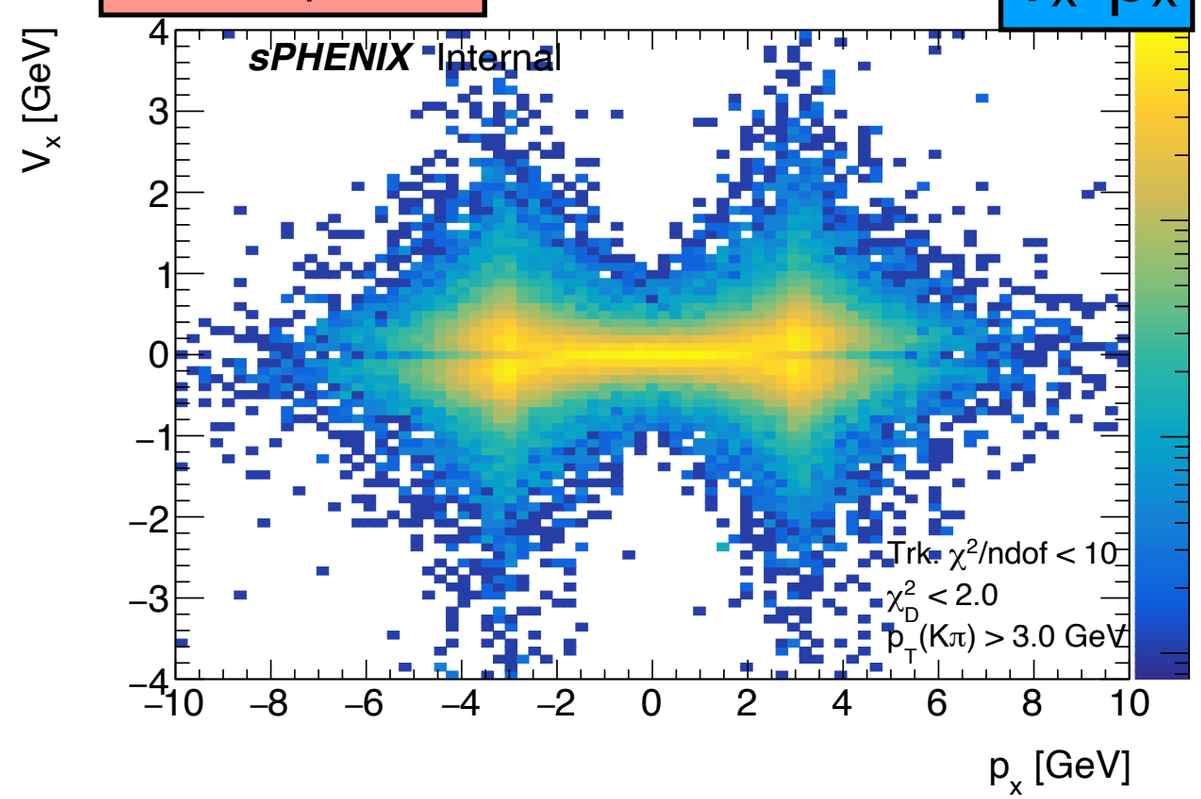
OLD KFparticle

v_x-p_x



NEW KFparticle

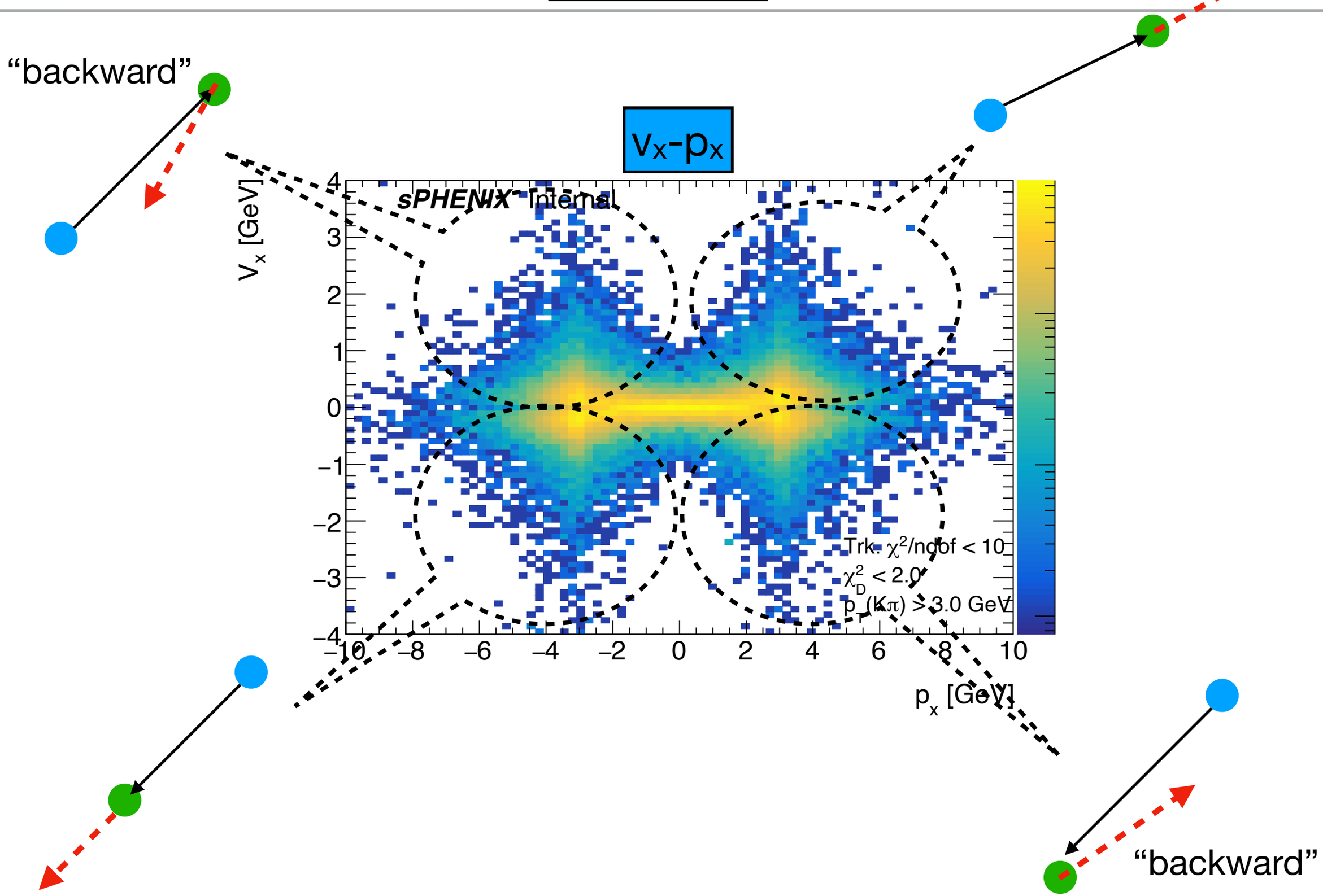
v_x-p_x



- Not change in pT
- Significant amount of secondary vertices which propagates “backwards”

What is different ??

NEW KFparticle



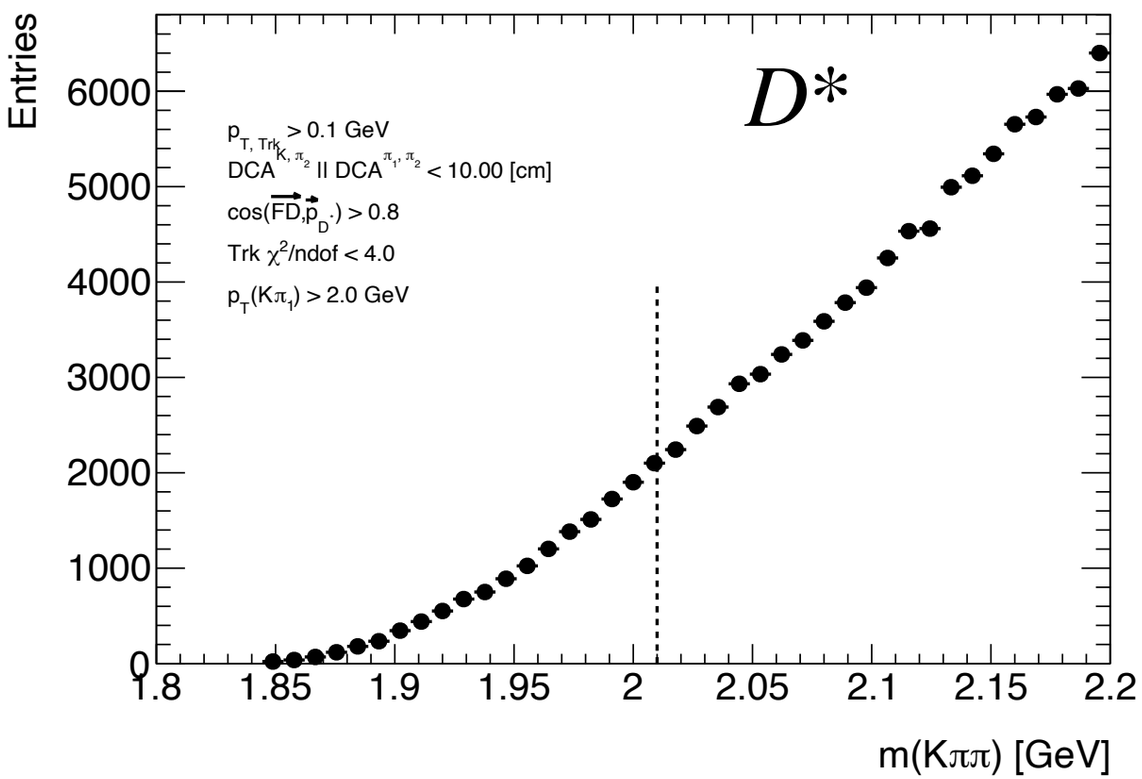
Intermediate state reconstruction

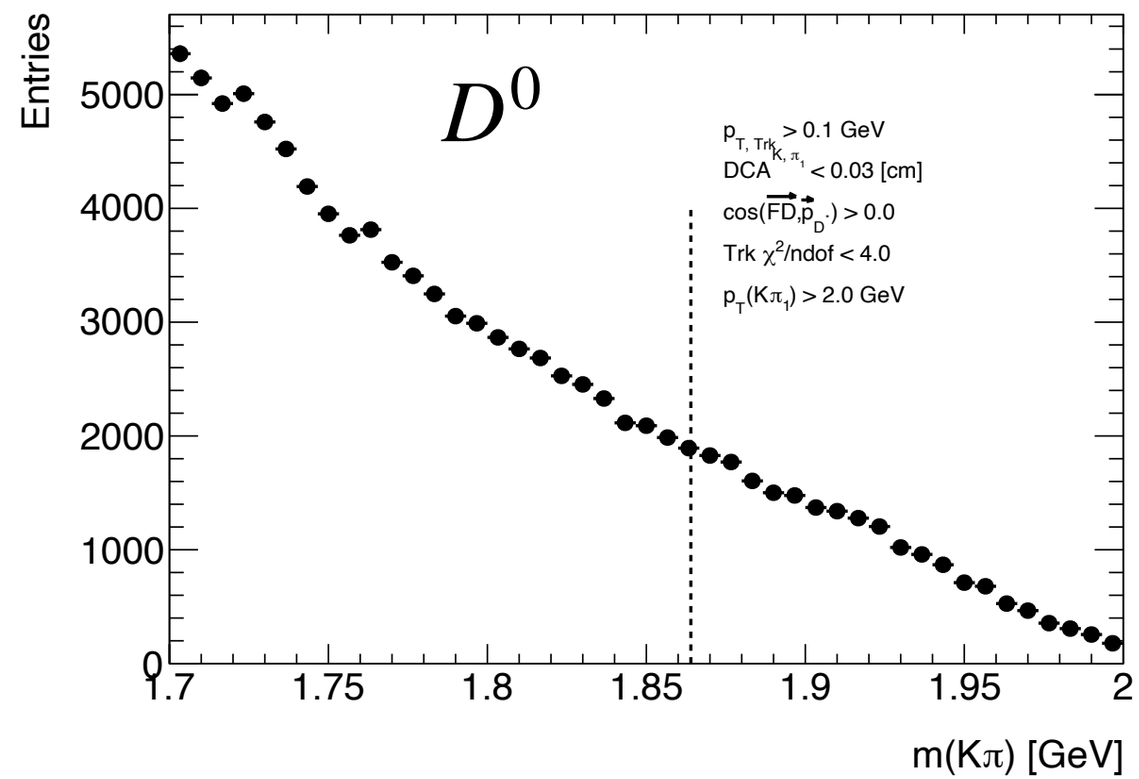
$$D^* \to D^0(K\pi) + \pi$$

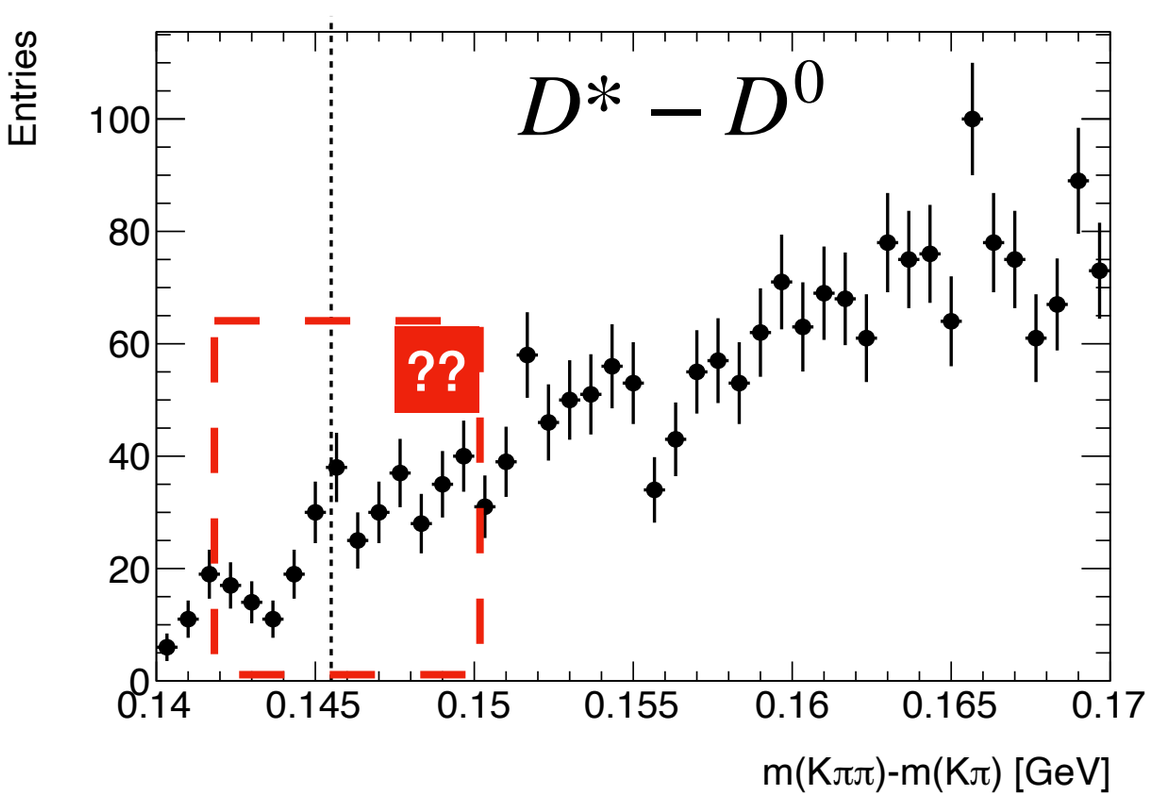
Intermediate state reconstruction

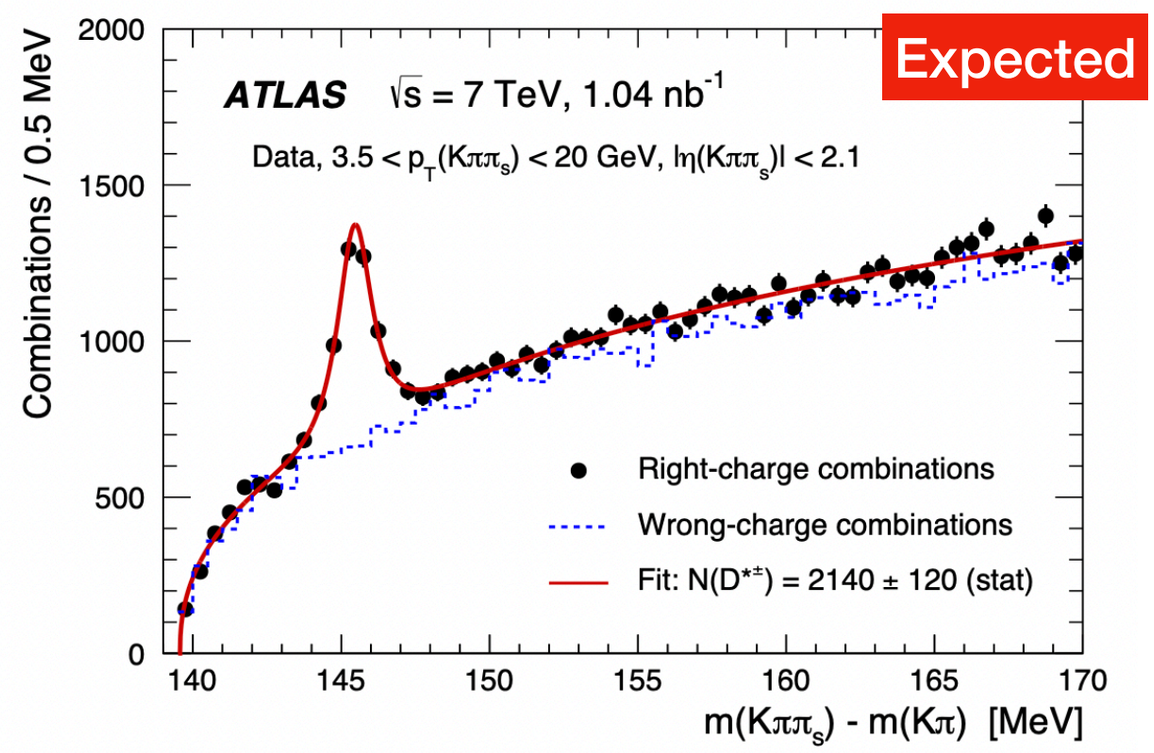
$D^* \to D^0(K\pi) + \pi$

No signal observed!



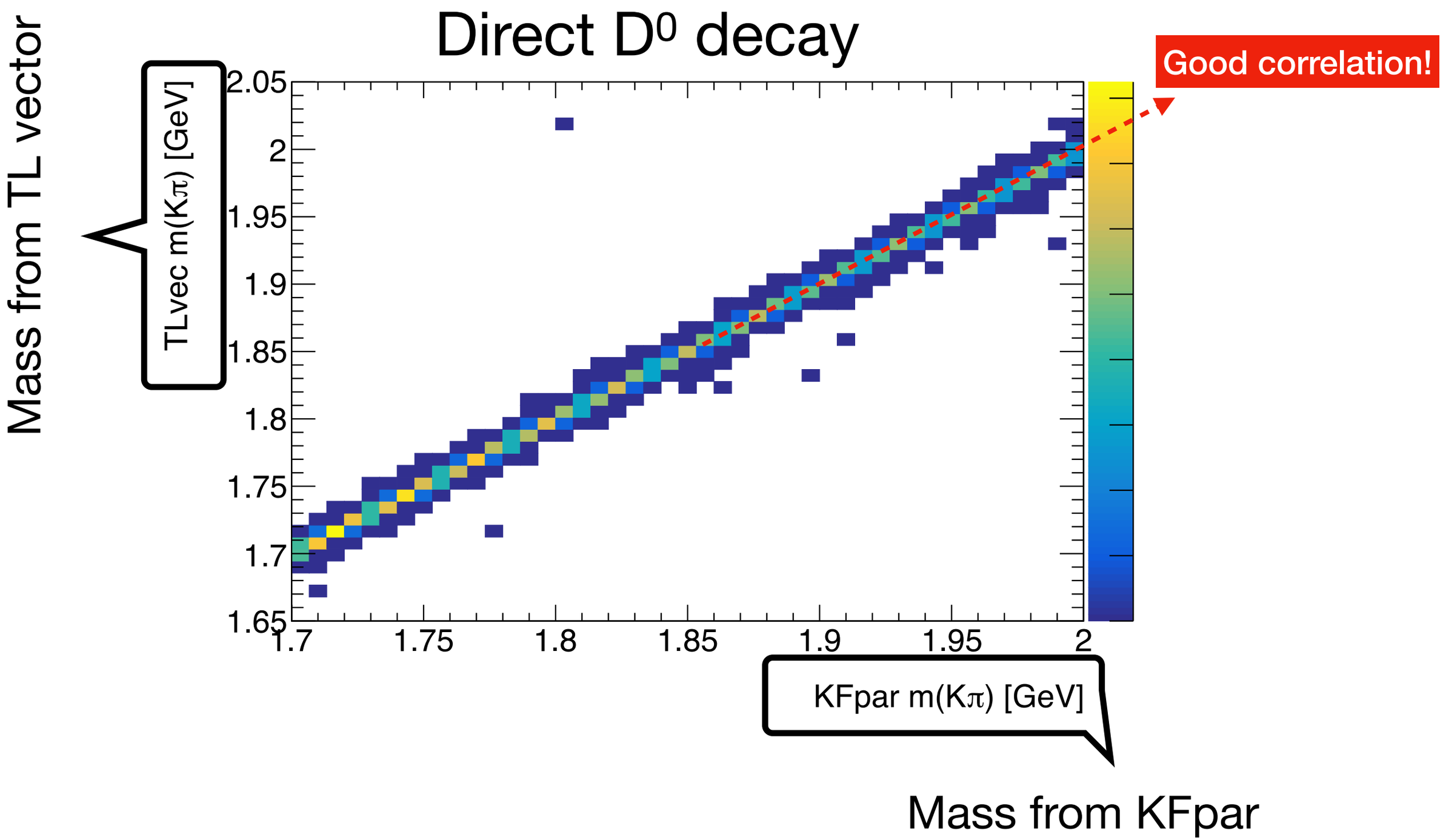






Where are the D*'s ?

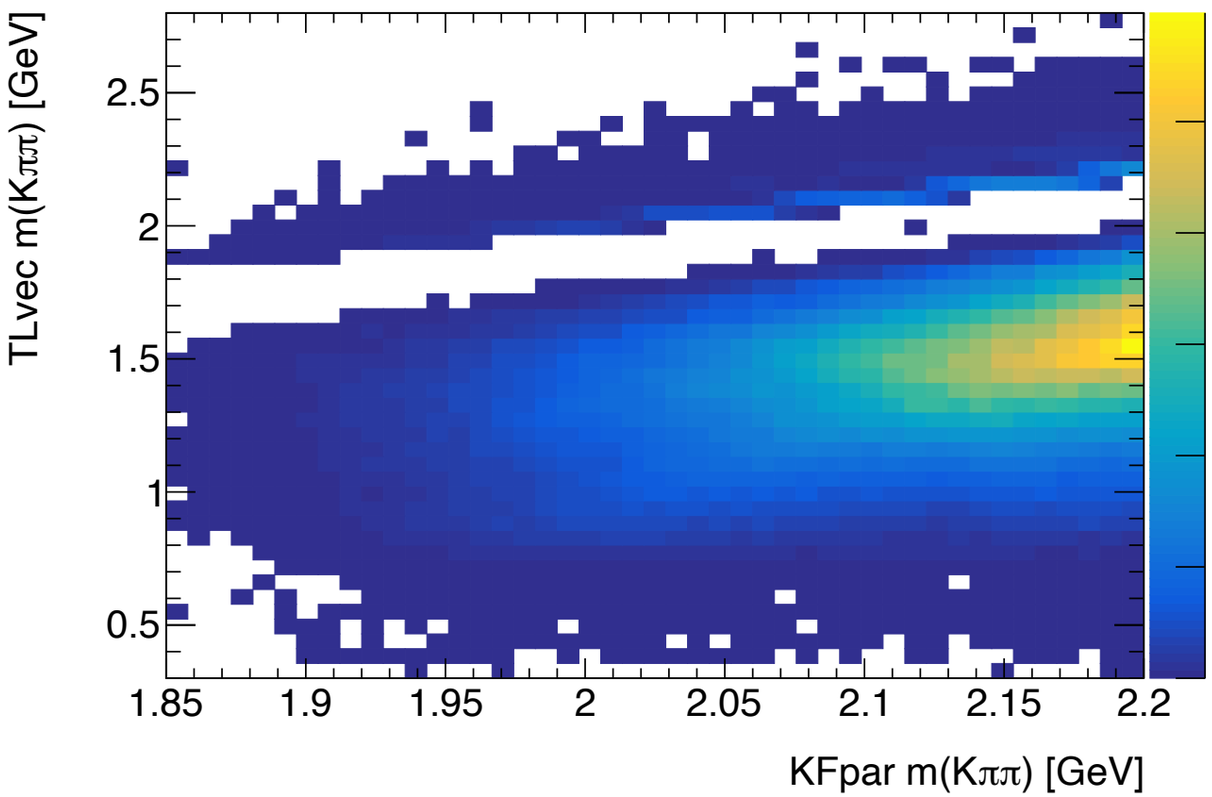
Checking parameters, by building TLorentz vectors with track information and comparing with KFparticle output



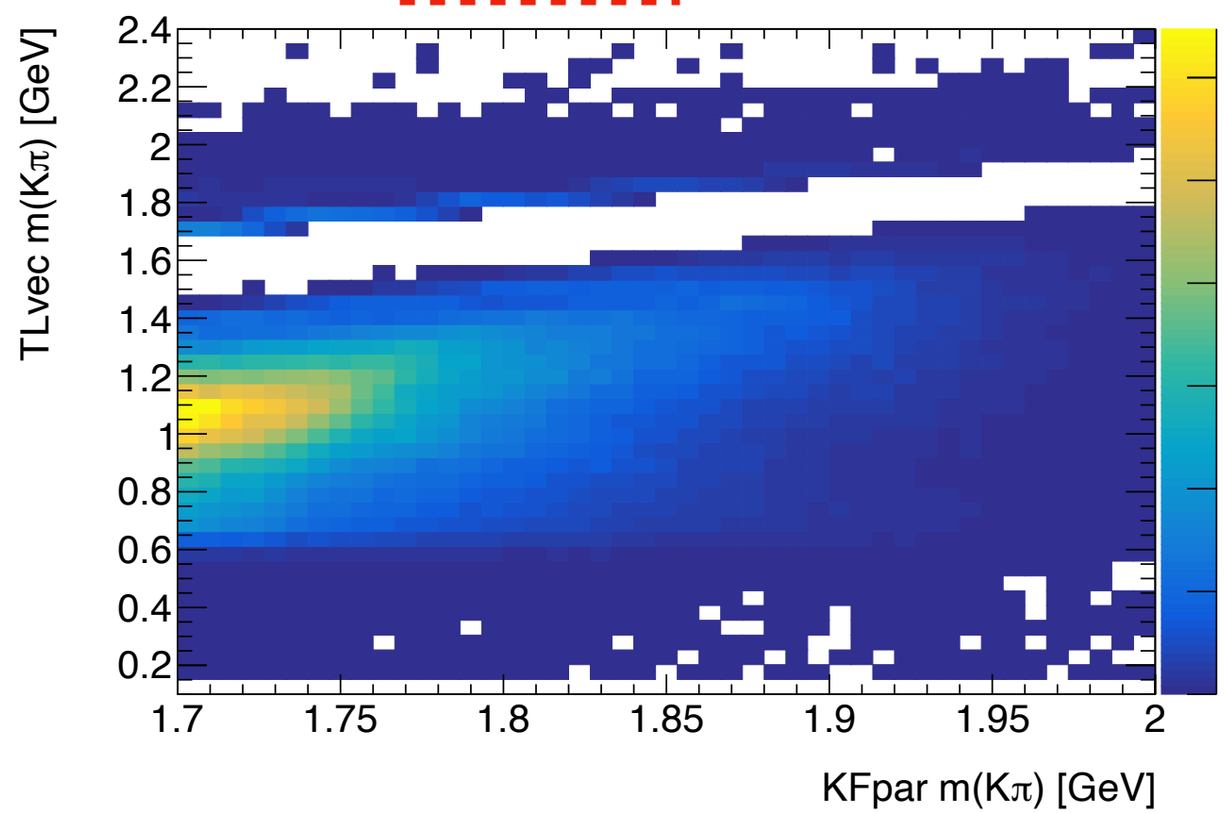
Where are the D*'s ?

Checking parameters, by building TLorentz vectors with track information and comparing with KFparticle output

$$D^* \rightarrow D^0(K\pi) + \pi$$



$$D^* \rightarrow D^0(K\pi) + \pi$$

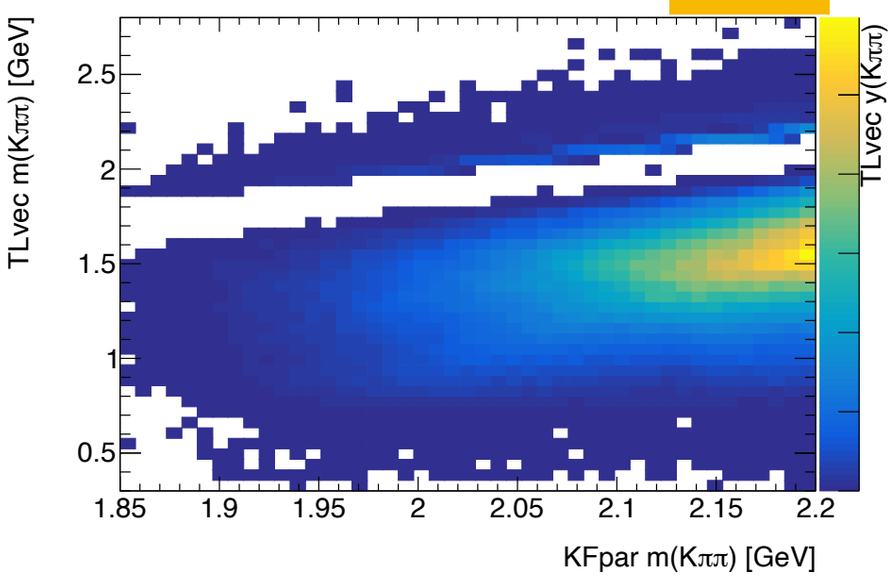


Almost **no correlation** between KFparticle and TLorentz vector mass for both D^* and D_0

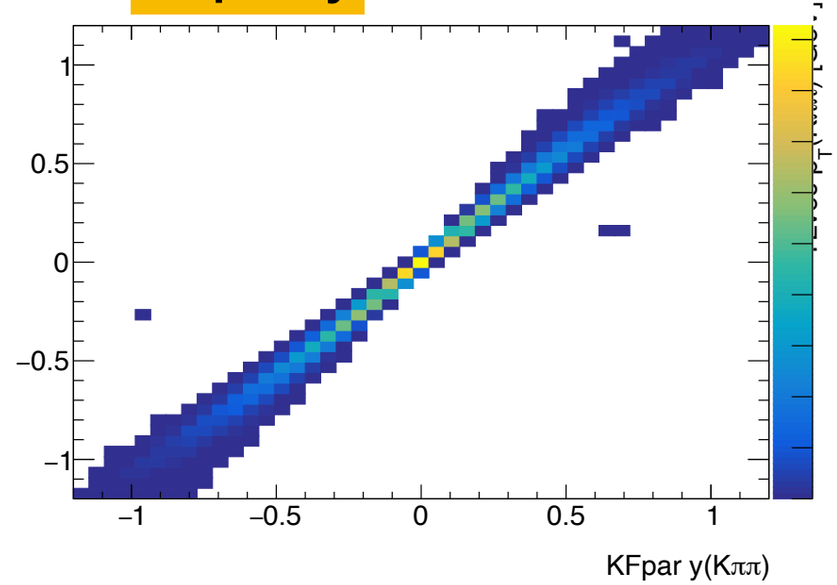
Where are the D*'s ?

$D^* \rightarrow D^0(K\pi) + \pi$

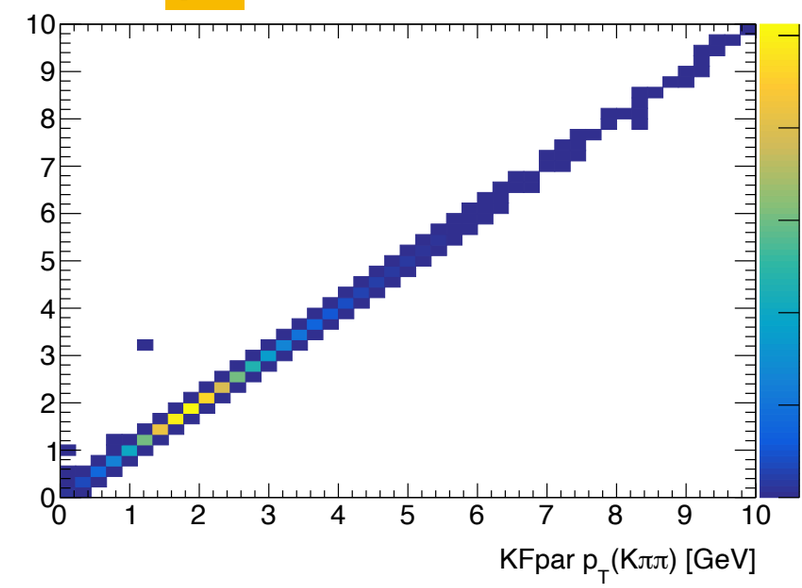
Mass



Rapidity

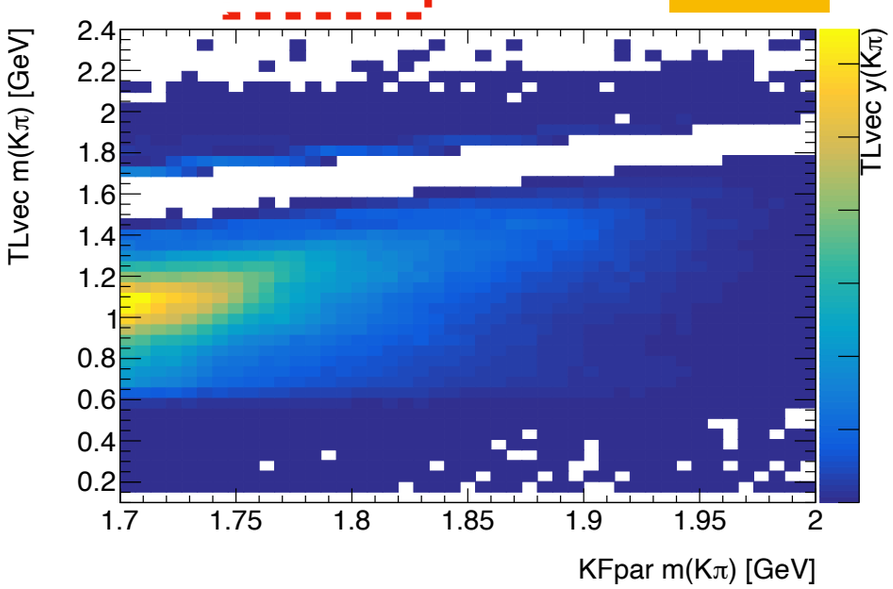


pT

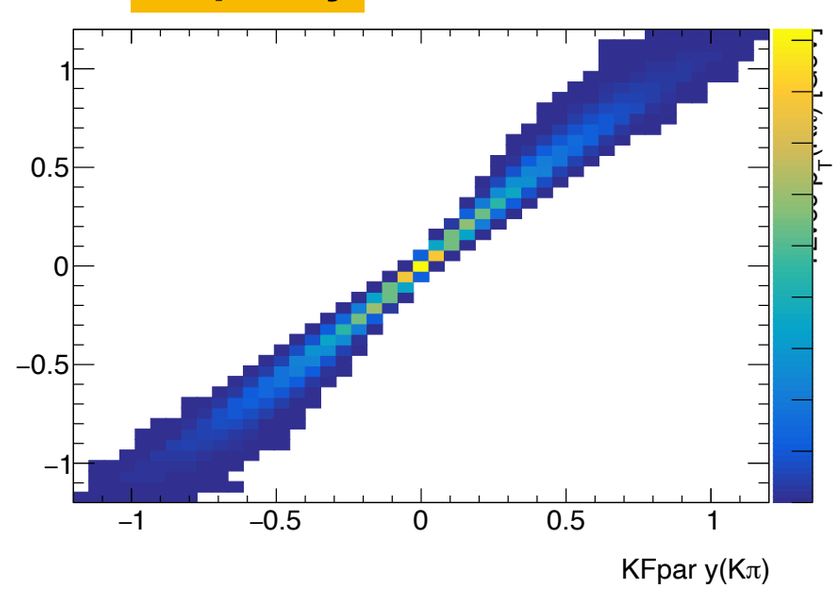


$D^* \rightarrow D^0(K\pi) + \pi$

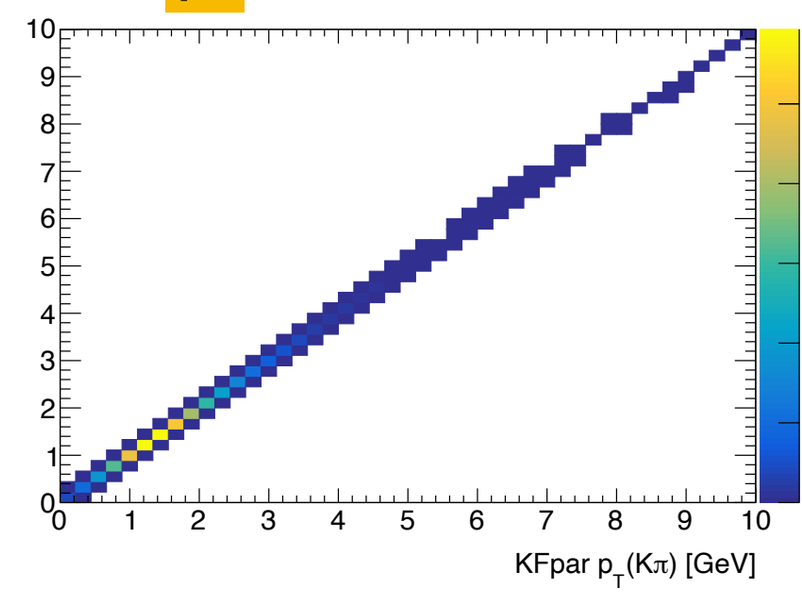
Mass



Rapidity



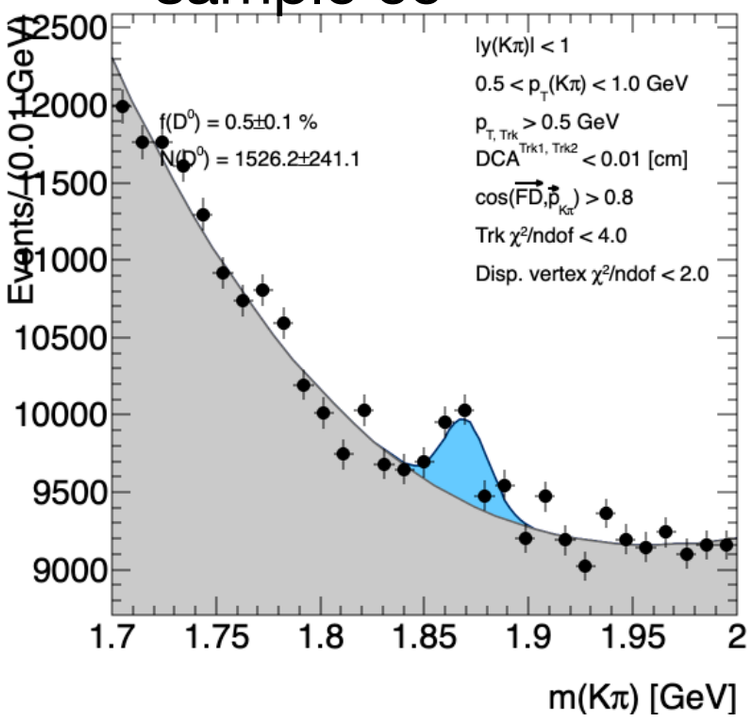
pT



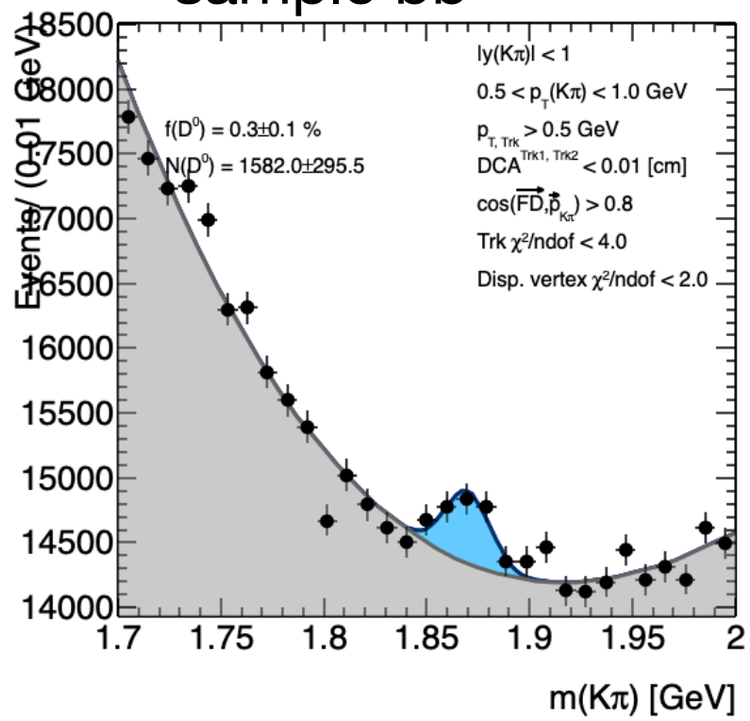
- Strong disagreement in mass and rapidity
- Good correlation in p_T

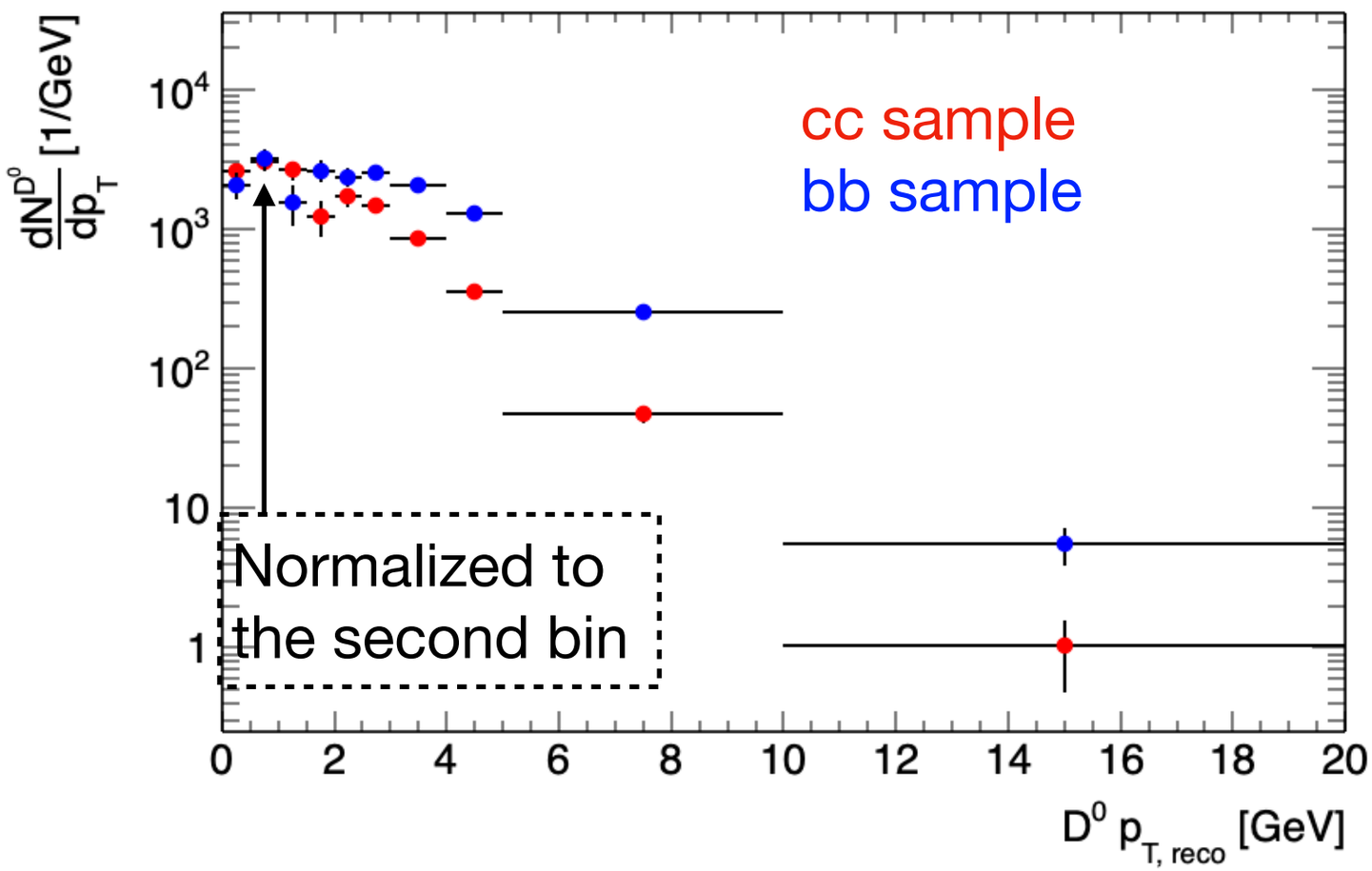
MDC1 — D^0

sample cc



sample bb





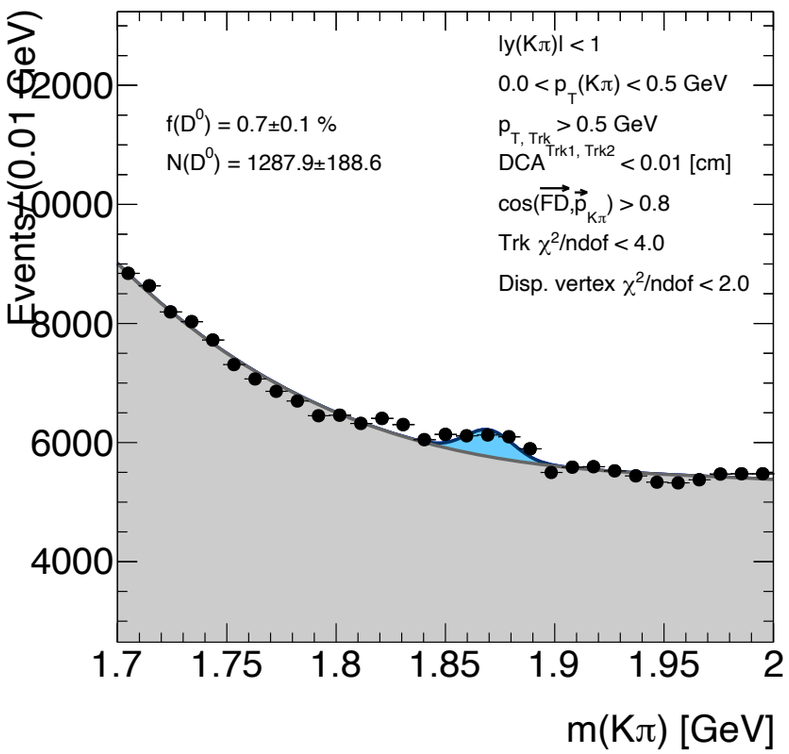
- D^0 visible down to ~0.5 p_T
- Harder D^0 distribution from bb sample or better reconstruction performance for non-prompt D^0's

- KFparticle reconstruction performance needed to confirm

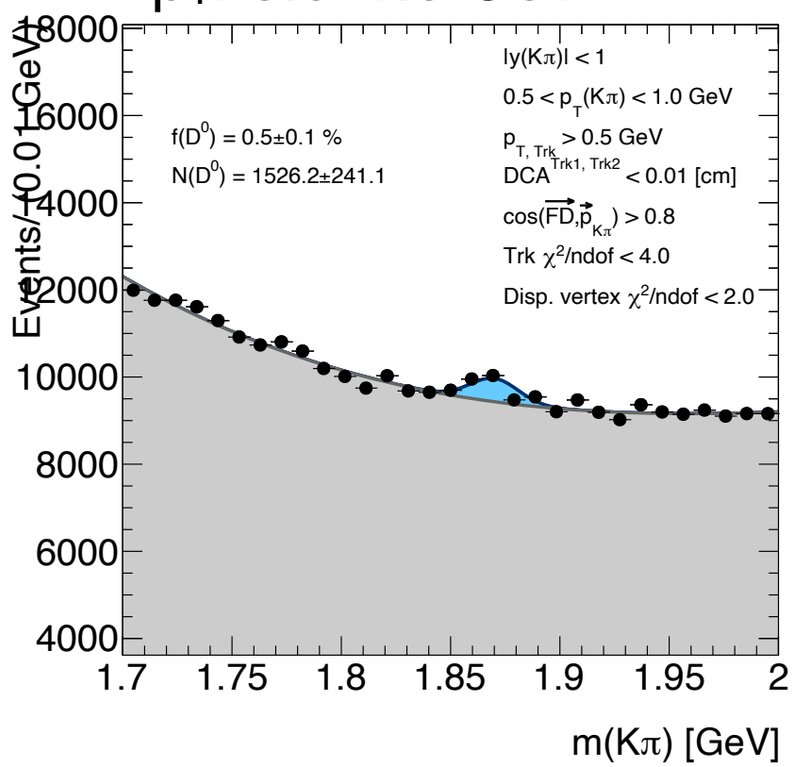
Additional slides

Fitting cc —> D^0

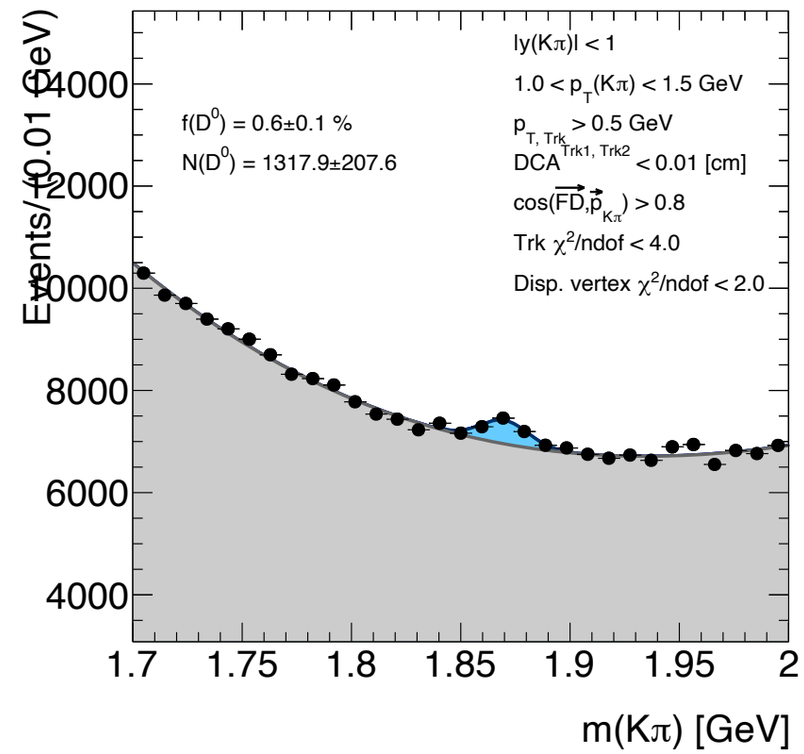
p_T: 0-0.5 GeV



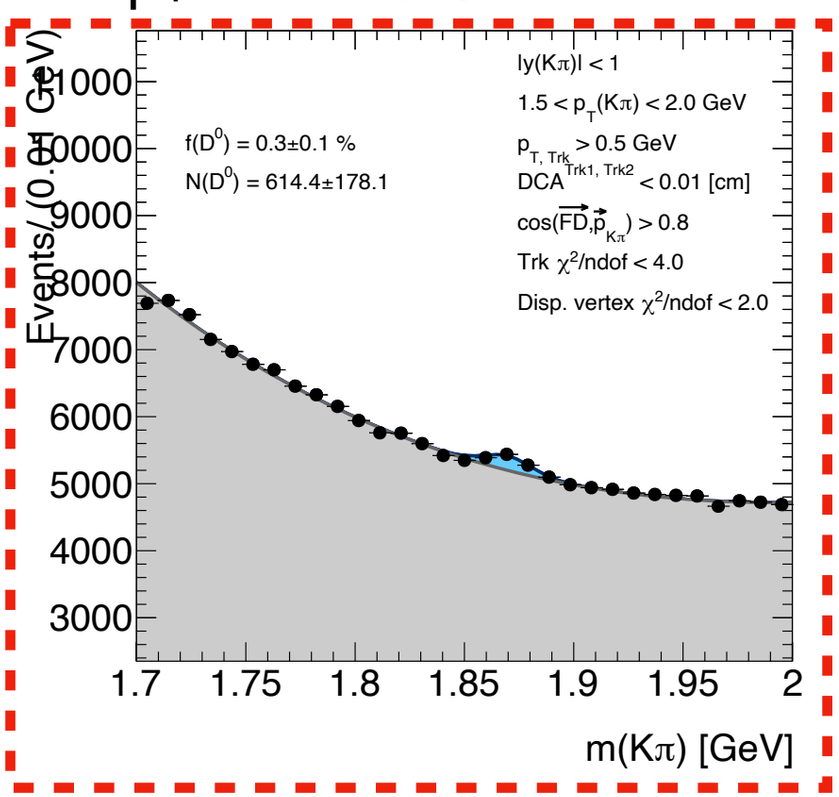
p_T: 0.5-1.0 GeV



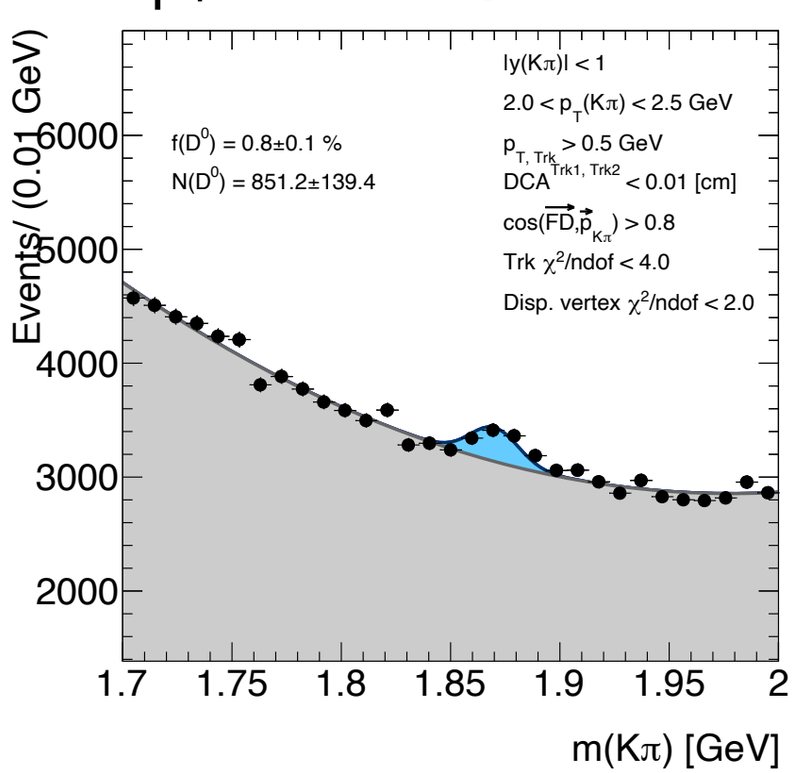
p_T: 1.0-1.5 GeV



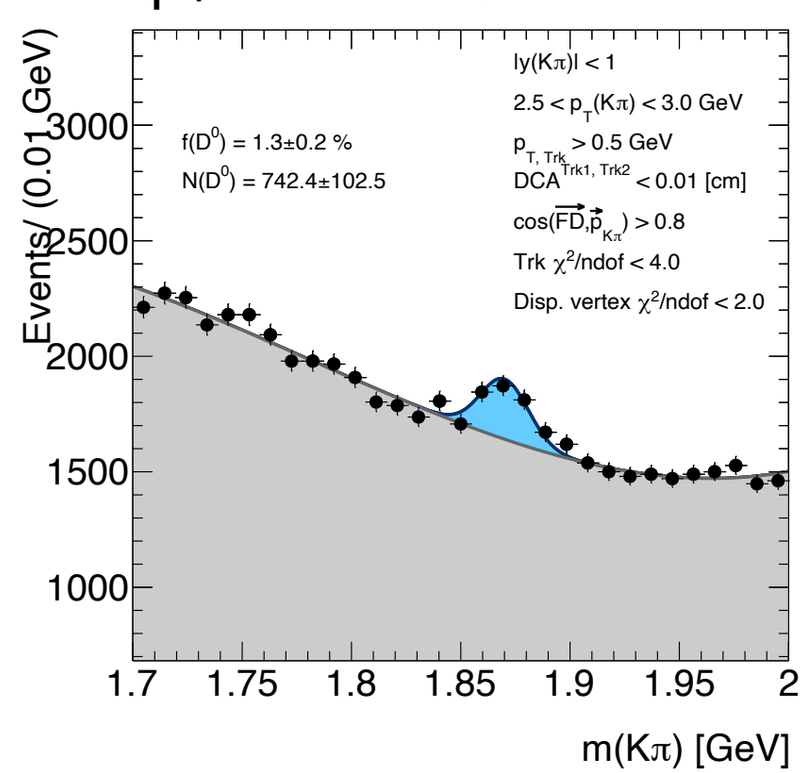
p_T: 1.5-2.0 GeV



p_T: 2.0-2.5 GeV

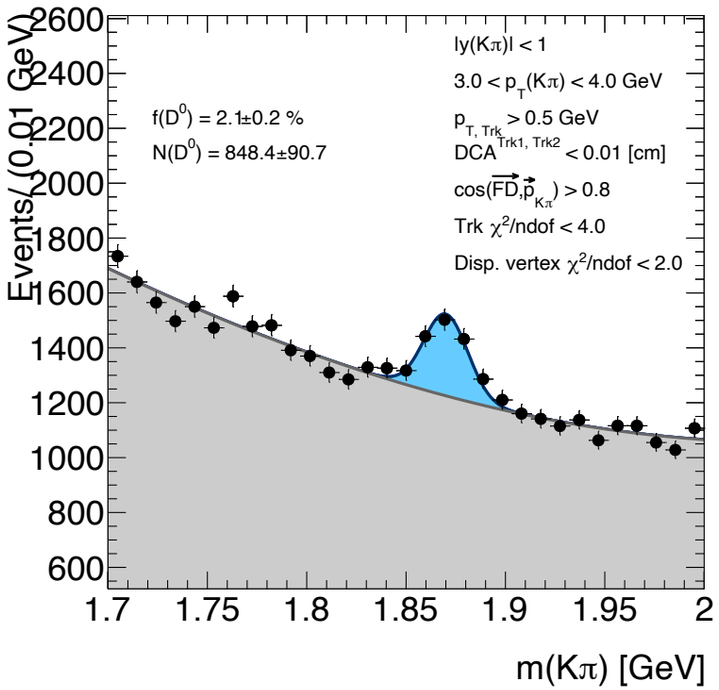


p_T: 2.5-3.0 GeV

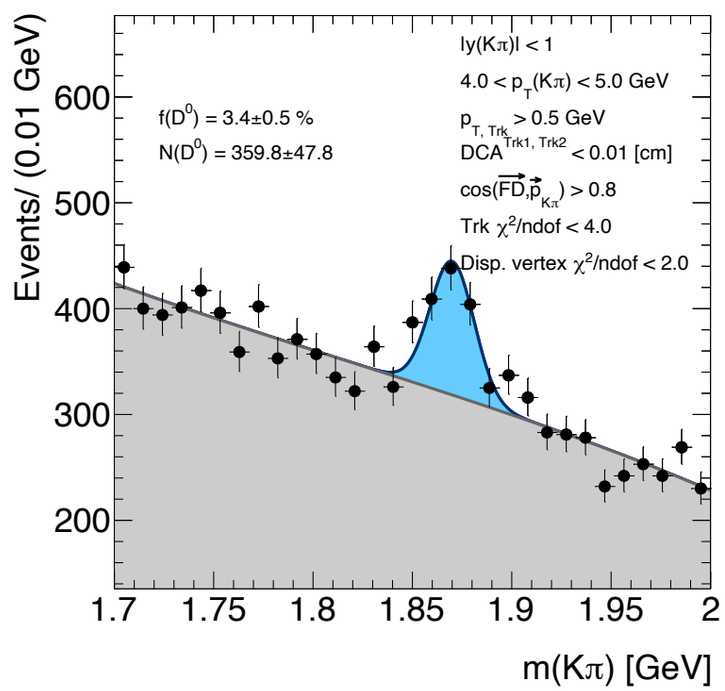


Fitting cc —> D^0

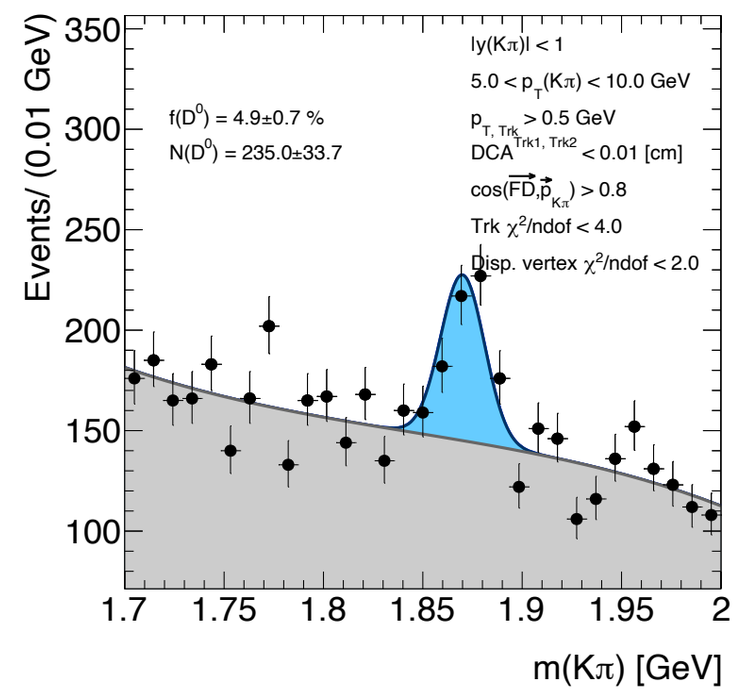
p_T: 3.0-4.0 GeV



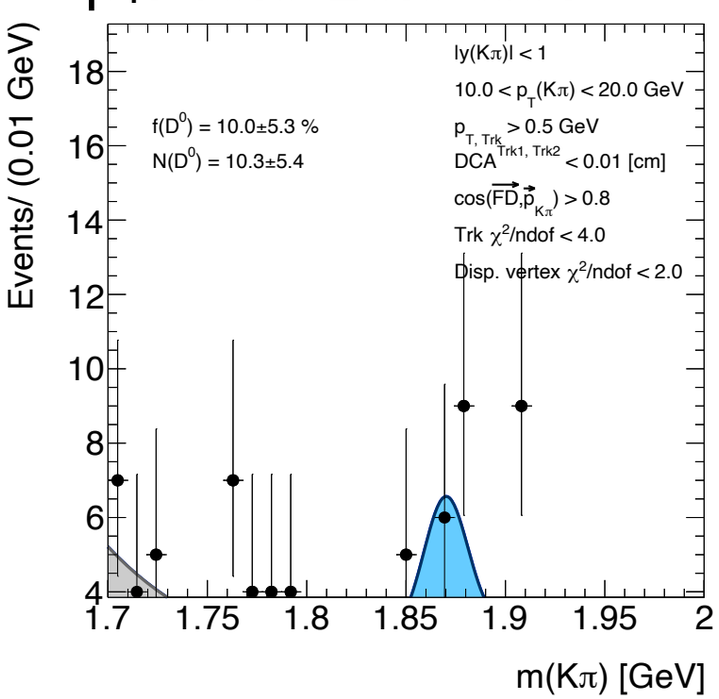
p_T: 4.0-5.0 GeV

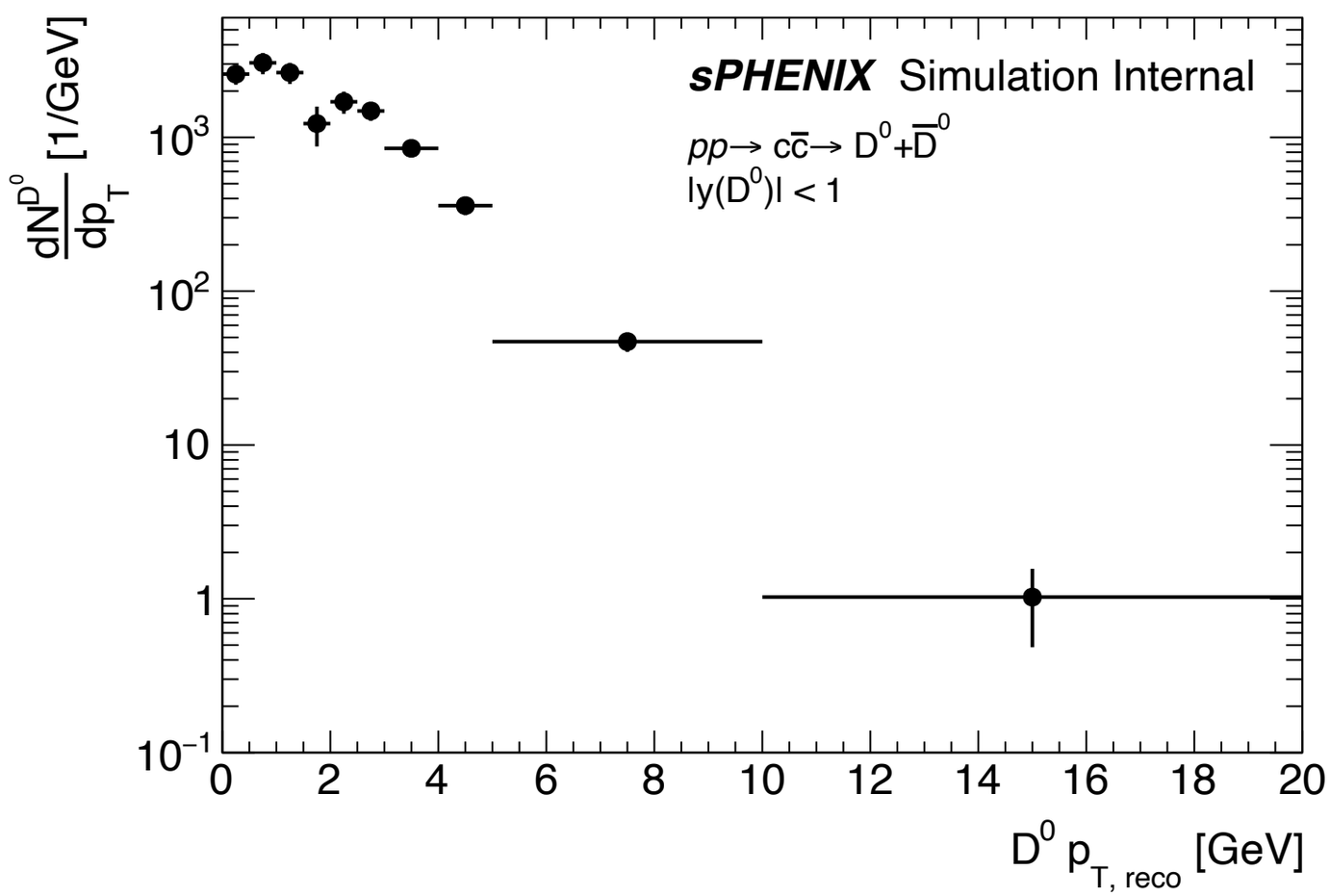


p_T: 5.0-10.0 GeV



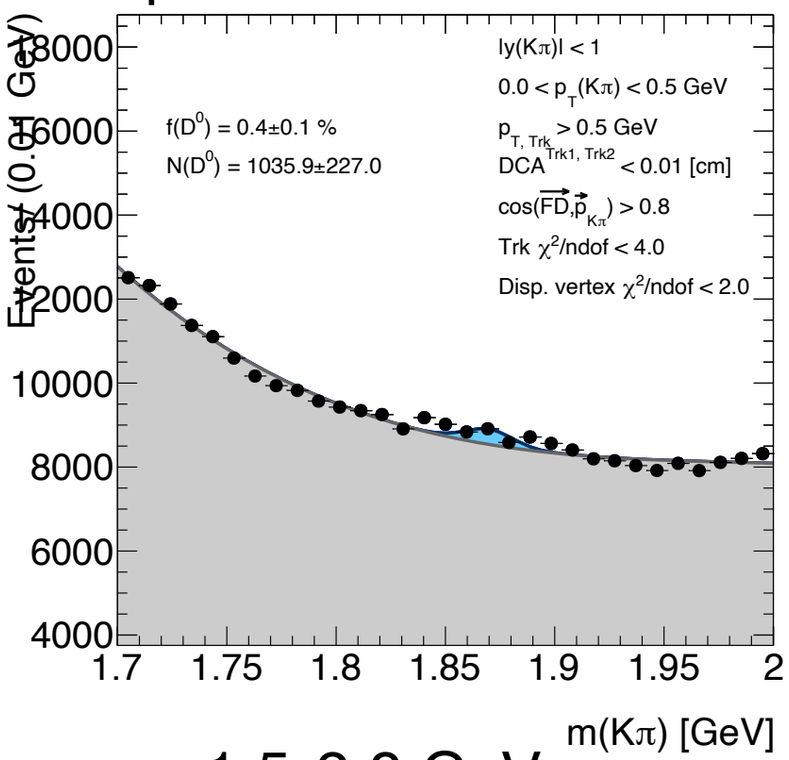
p_T: 10.0-20.0 GeV



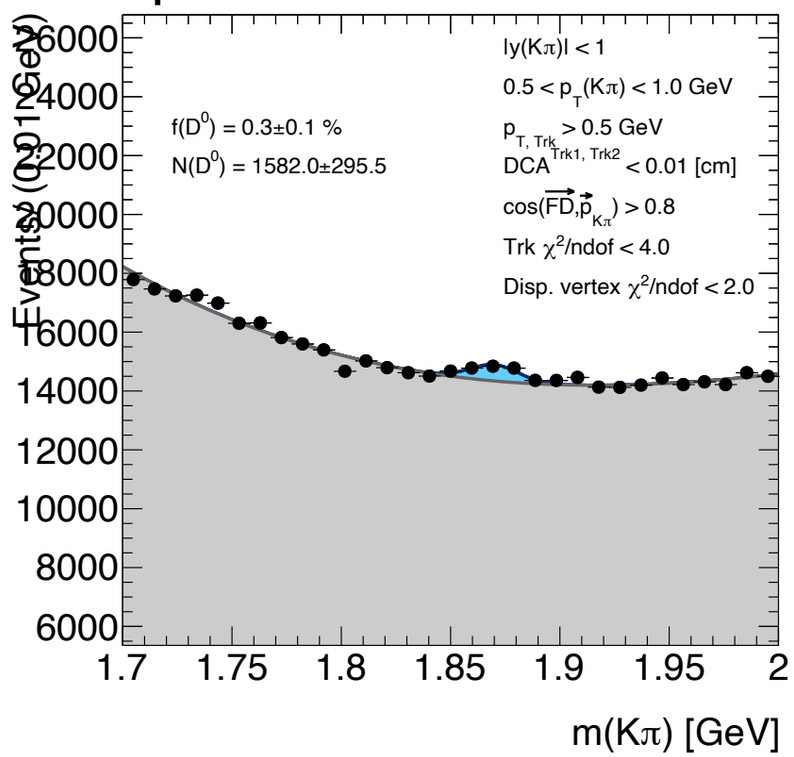


Fitting bb —> D^0

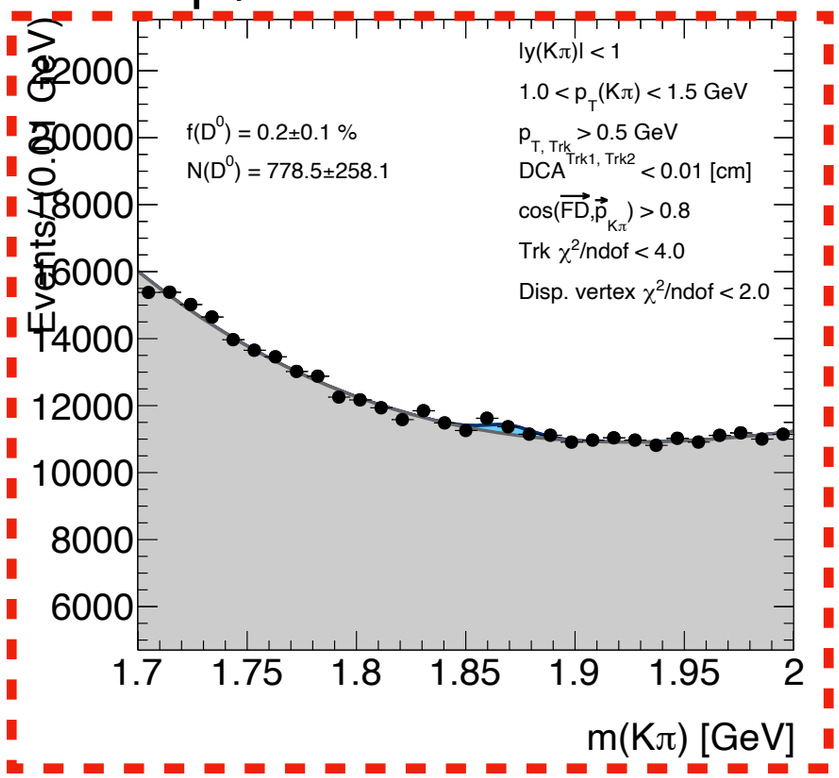
p_T: 0-0.5 GeV



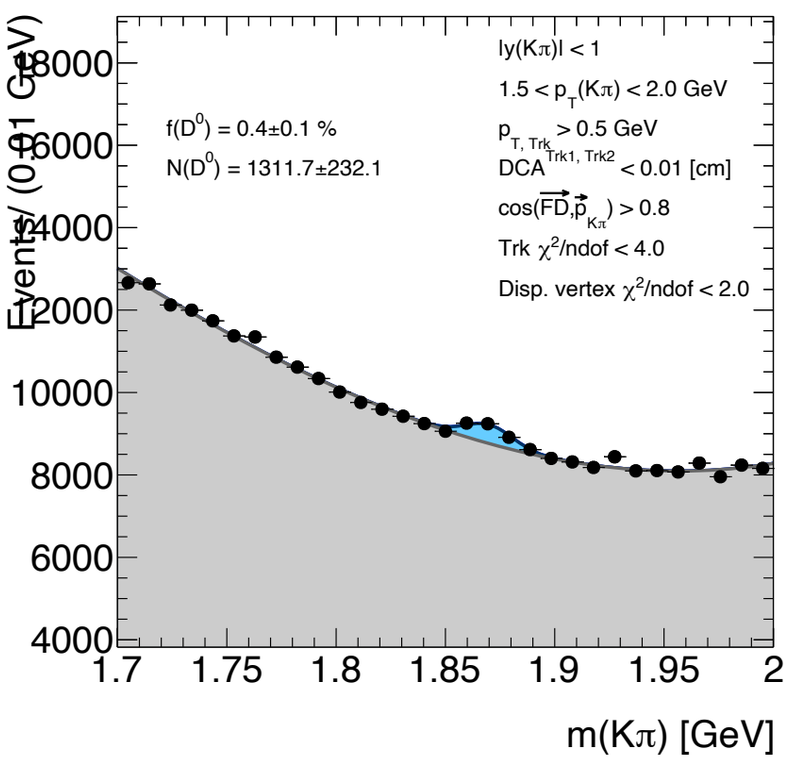
p_T: 0.5-1.0 GeV



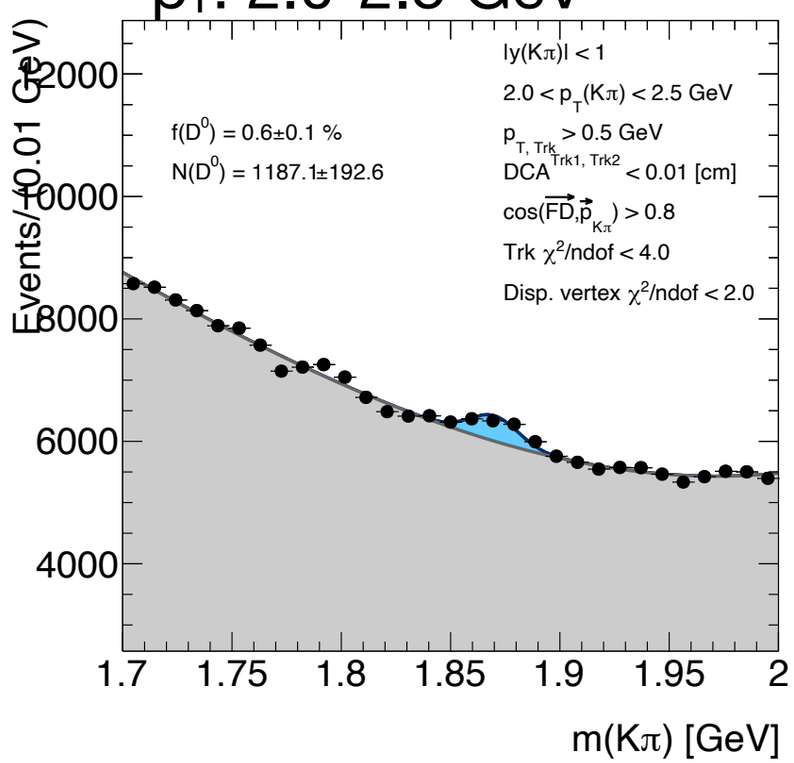
p_T: 1.0-1.5 GeV



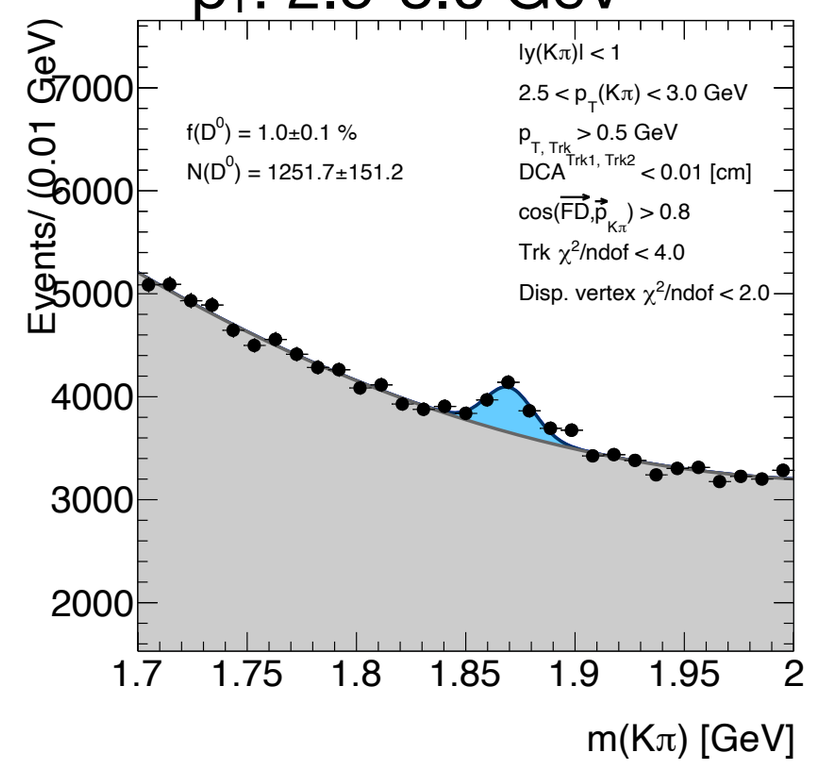
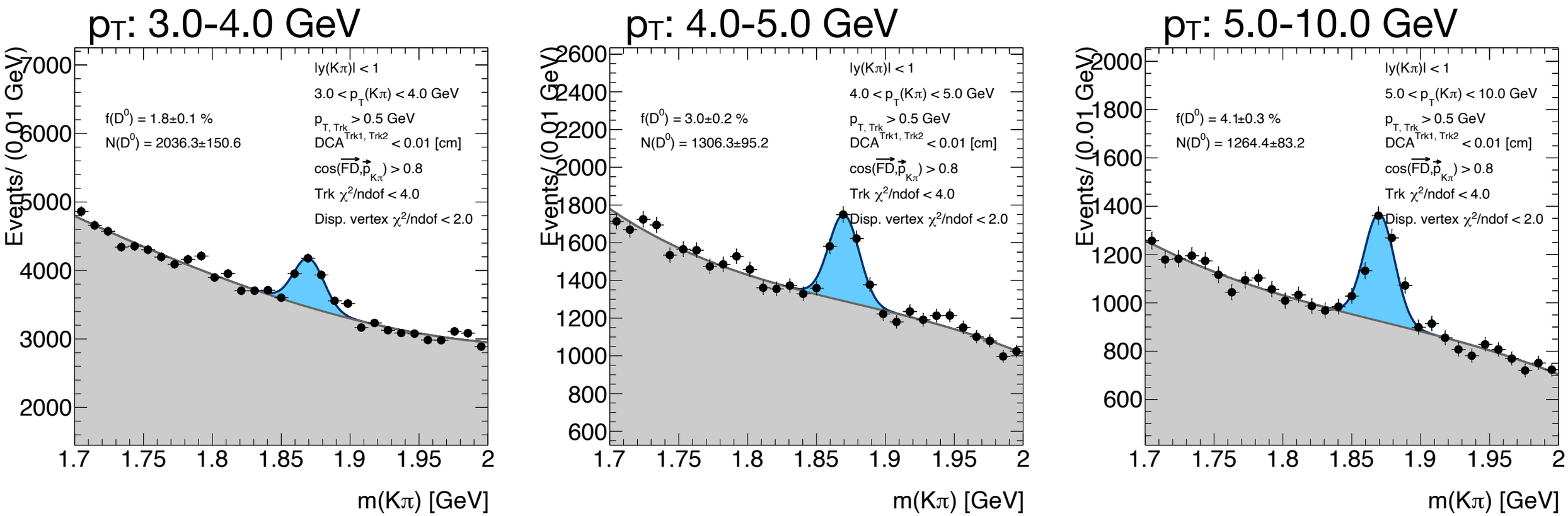
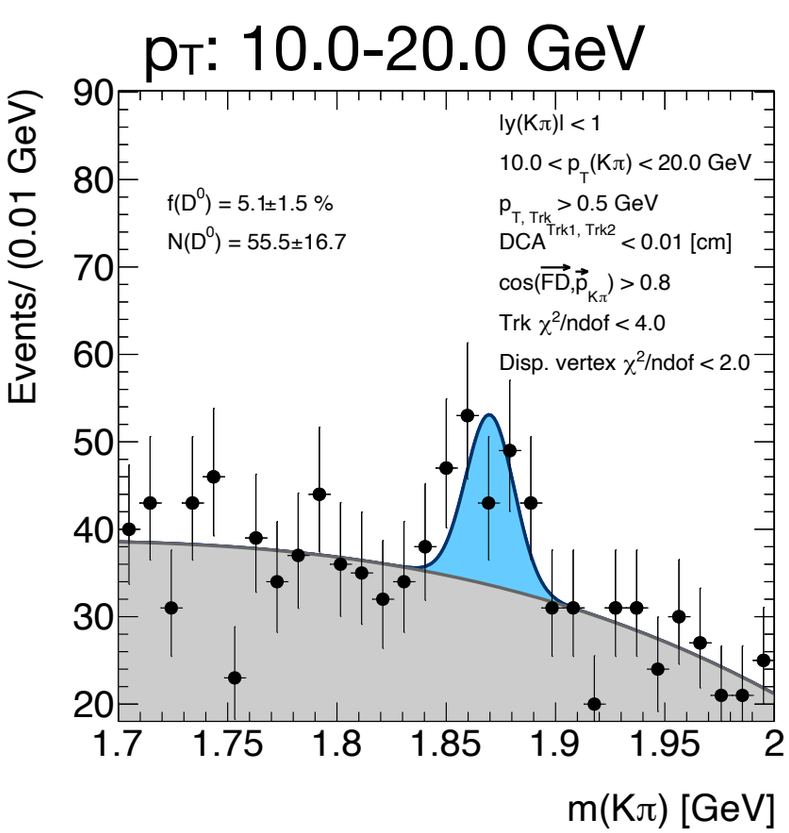
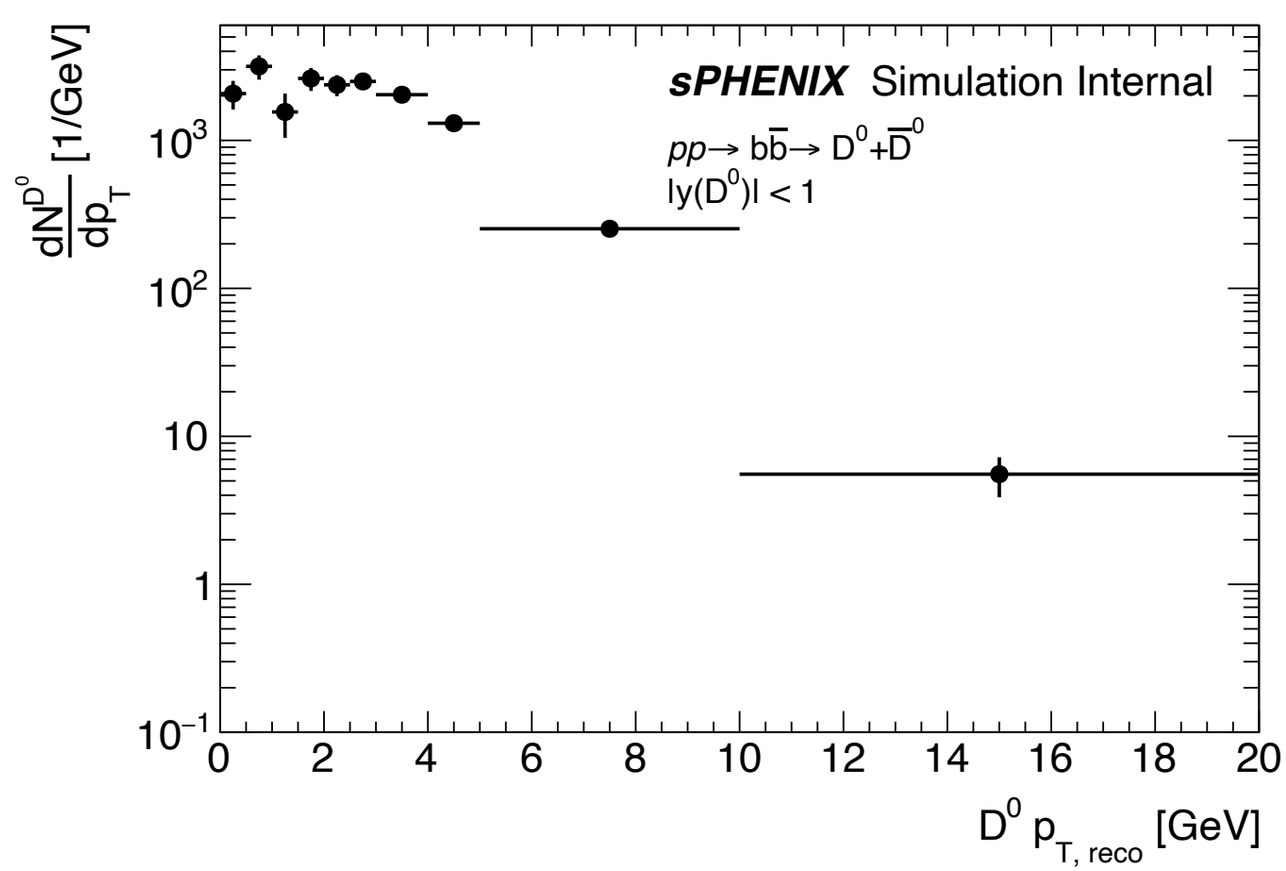
p_T: 1.5-2.0 GeV



p_T: 2.0-2.5 GeV



p_T: 2.5-3.0 GeV



Fitting bb —> D^0