$KK\pi$ update (my first look at DIRC)

PID with and without DIRC

- Using real data (2019-11) for this part of presentation

- Required
  - Incident photon in central beam bunch
  - Incident photon in coherent peak
  - Kinfit reaction : $\gamma\, p \rightarrow p\, K^{+}K^{-}\pi^{0}$
  - Best CL that is > 10e-4

Inclusion of DIRC

$\beta = 1/[n \cos(\theta)]$

so

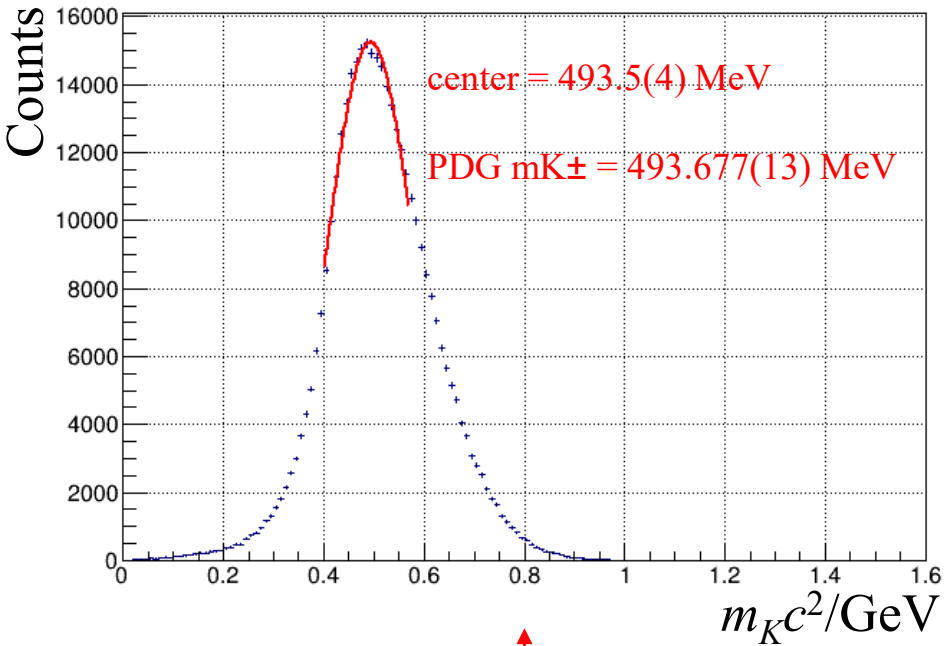
$(\gamma\beta)^2 = 1/[n^2\cos^2(\theta)-1]$

which implies

$p^2c^2/(m^2c^4) = 1/[n^2\cos^2(\theta)-1]$

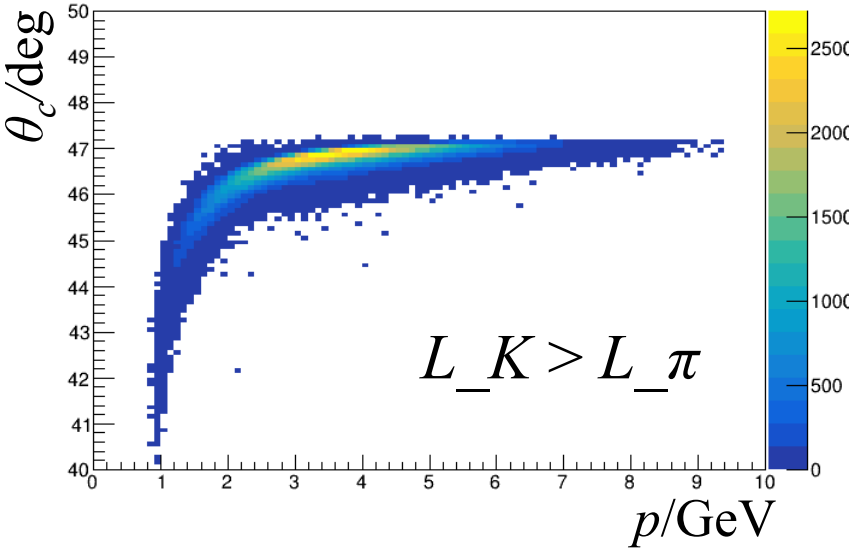
or

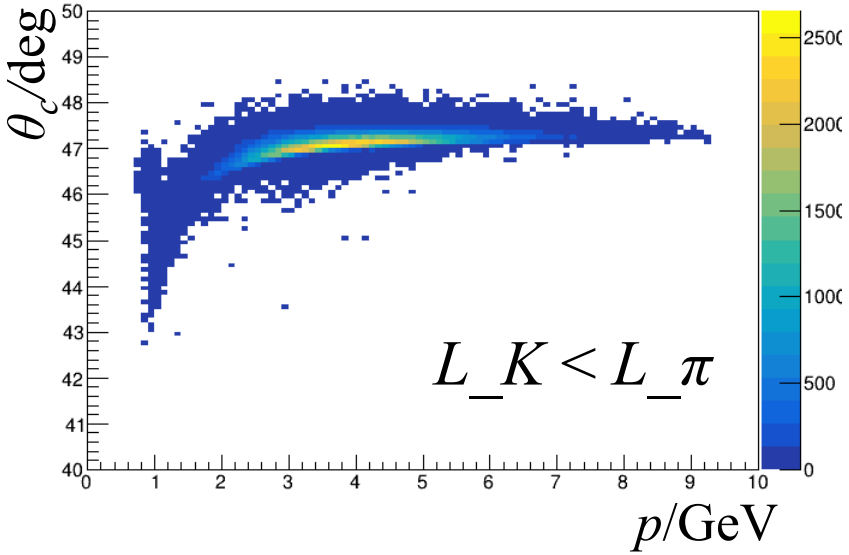
$mc^2 = pc[n^2\cos^2(\theta)-1]$

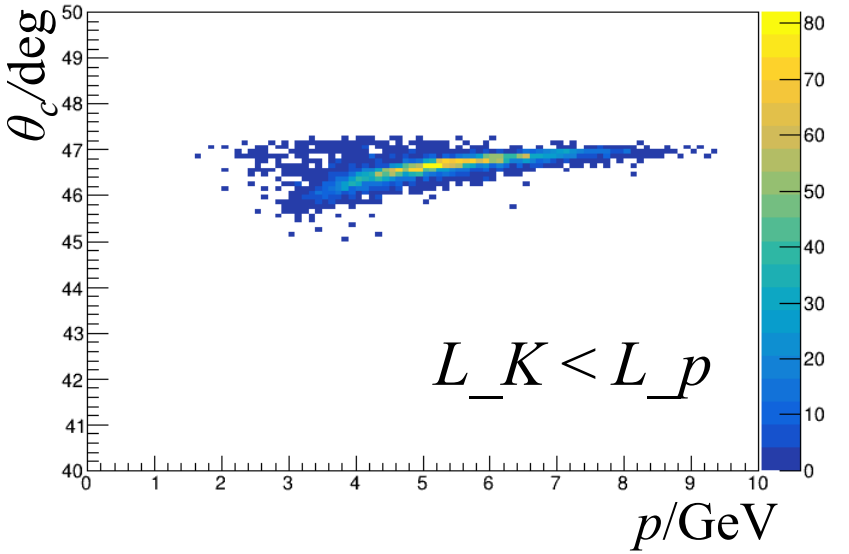


Set effective index of refraction
$n = 1.4805$ to get above plot

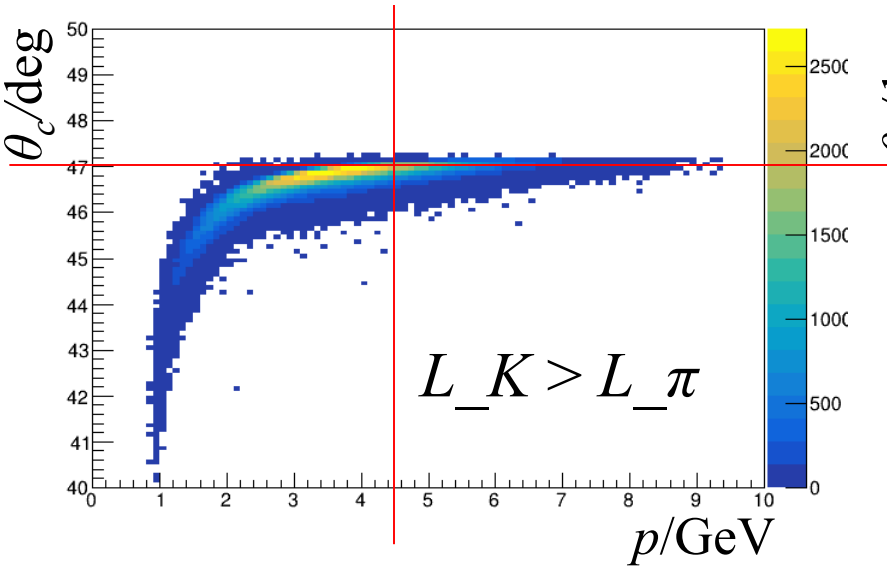
Cerenkov opening angle vs momentum for different likelihood scenarios

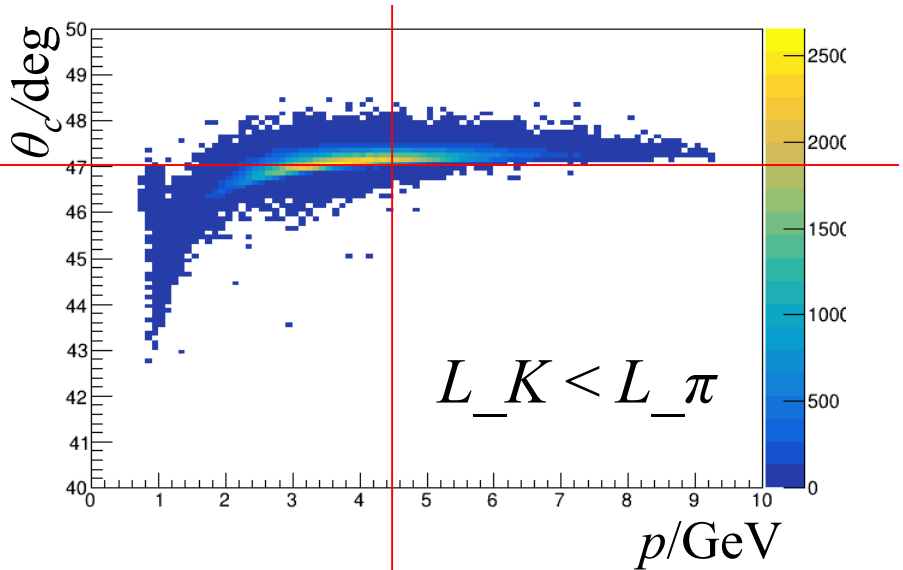


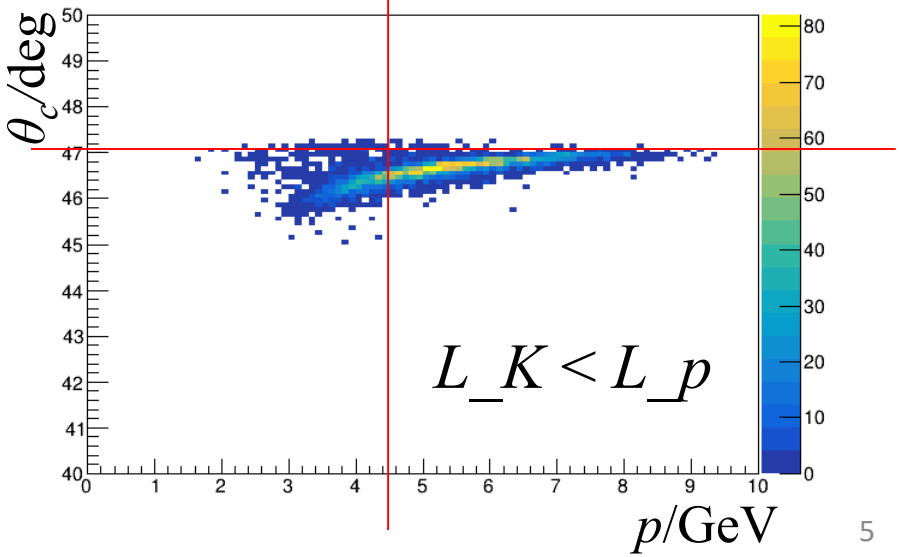




Cerenkov opening angle vs momentum for different likelihood scenarios





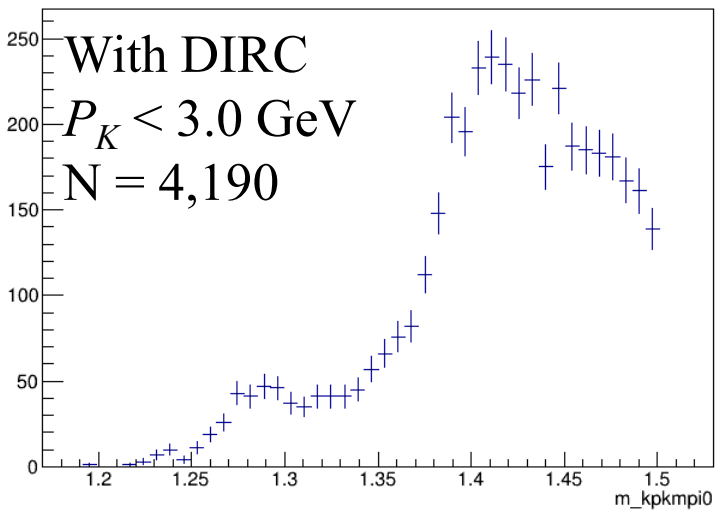


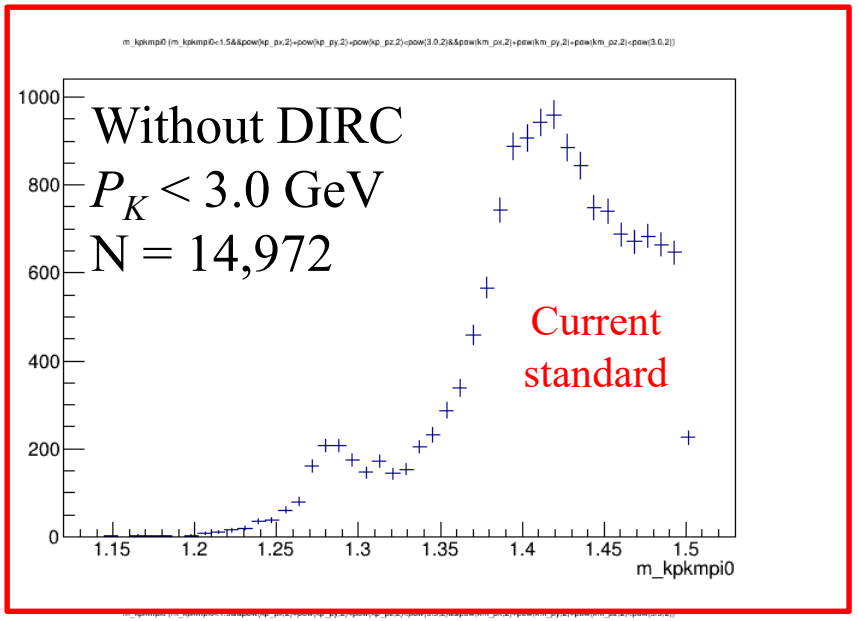
A momentum cutoff at 4.5 GeV is probably good ☺

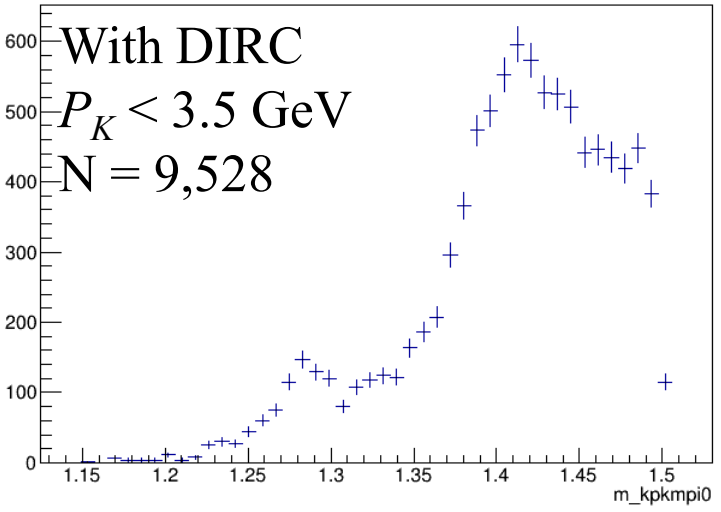
mass[$K^+K^-\pi^0$] With and Without DIRC

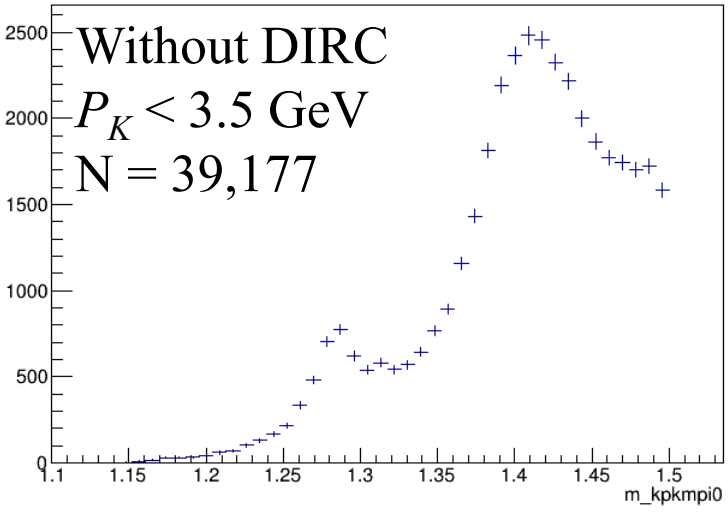
- Remaining slides require that $L\_K > L\_\pi$

mass[$K^+K^-\pi^0$] With and Without DIRC

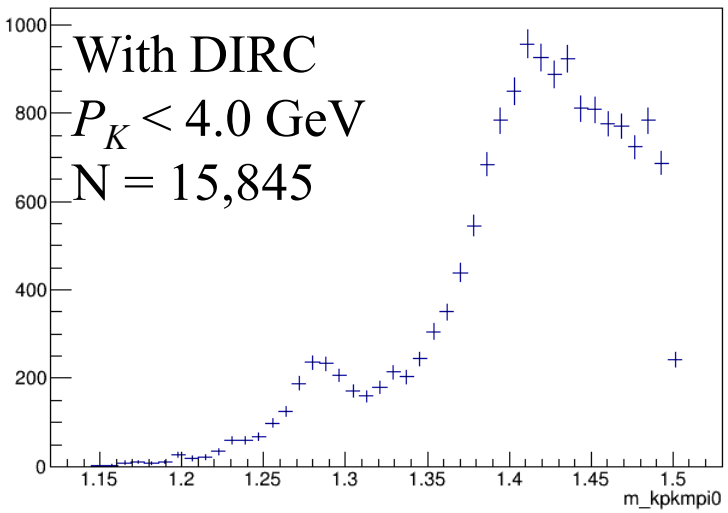


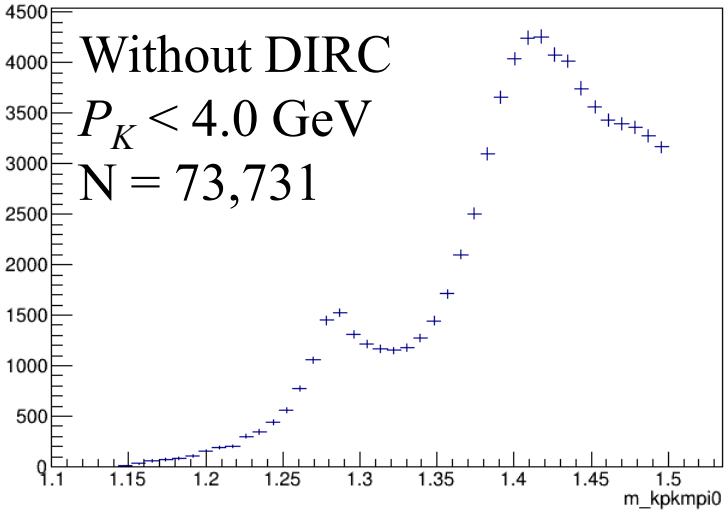


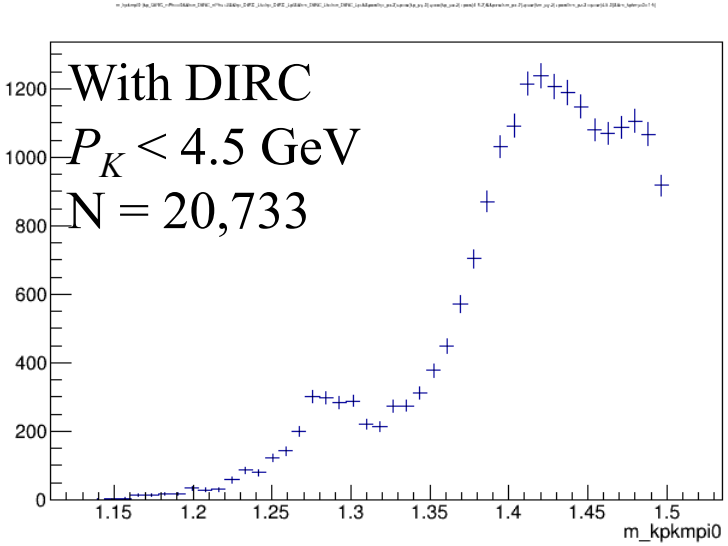


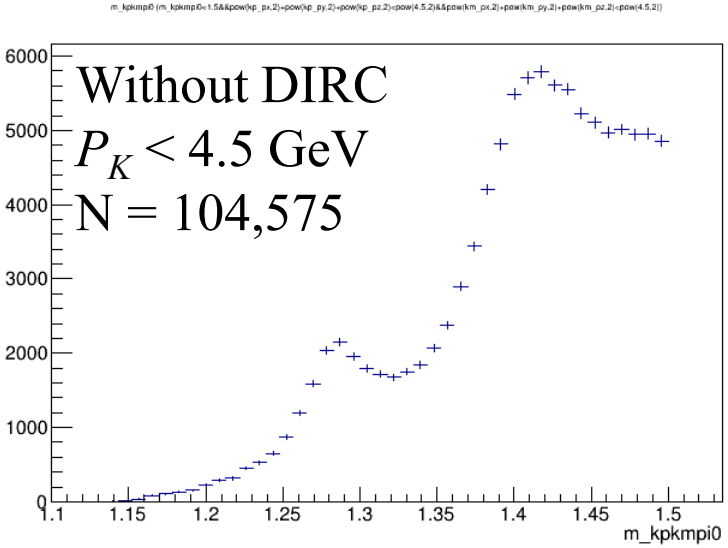


mass[$K^+K^-\pi^0$] With and Without DIRC

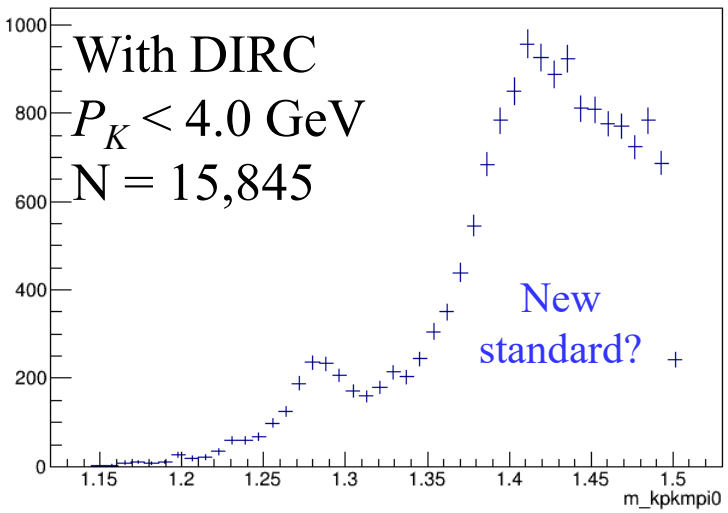


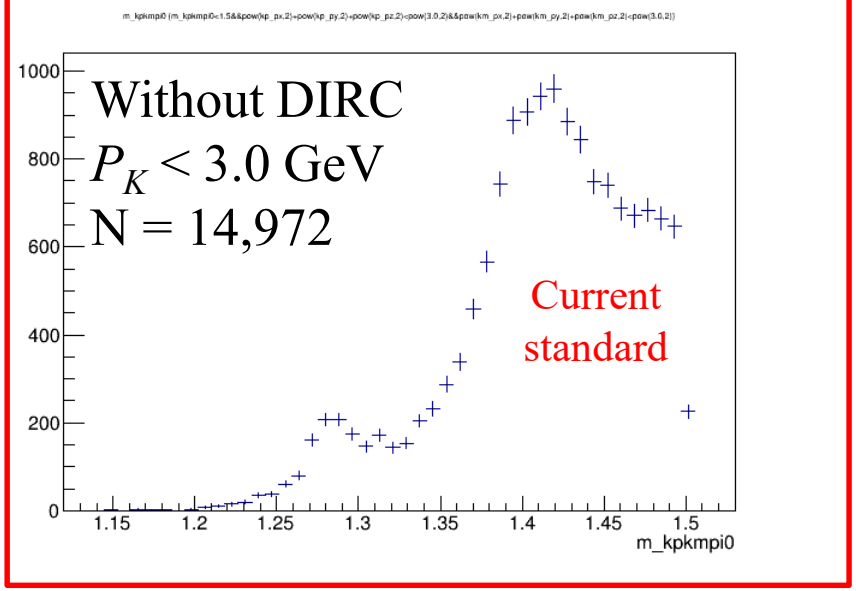


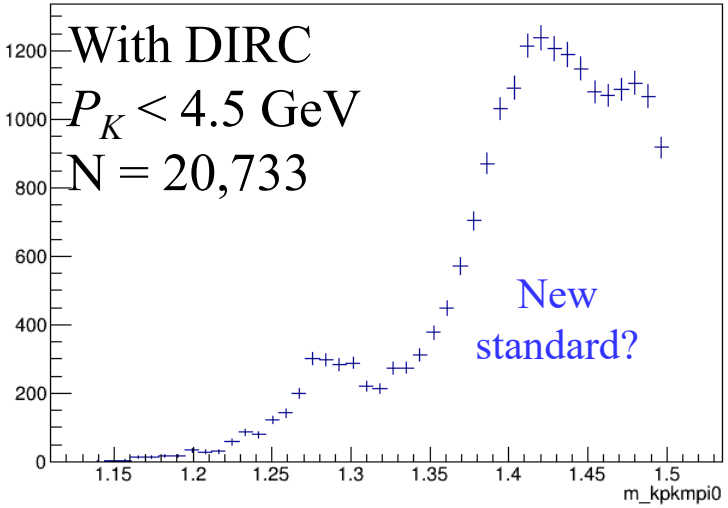




mass[$K^+K^-\pi^0$] With and Without DIRC







PID with and without DIRC

- Previous data was real (2019-11 data)
- Data shown in the rest of the presentation is simulated

PID with and without DIRC

Let:

- $\varepsilon_{\text{Good}}$: Efficiency for correctly identifying $K^+K^-\pi^0$

PID with and without DIRC

Let:

- $\varepsilon_{\text{Good}}$: Efficiency for correctly identifying $K^+K^-\pi^0$
- ε_{Bad} : Efficiency for identifying $K^+\pi^-\pi^0$ as $K^+K^-\pi^0$

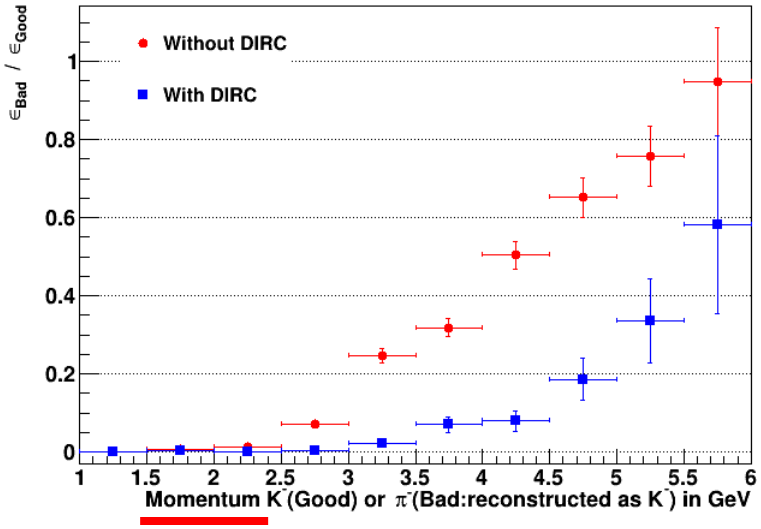
PID with and without DIRC

Let:

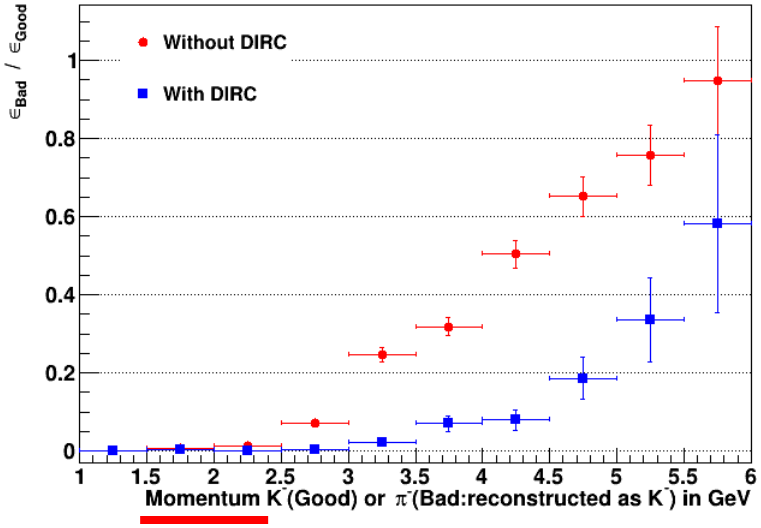
- ε_{Good} : Efficiency for correctly identifying $K^+K^-\pi^0$
- ε_{Bad} : Efficiency for identifying $K^+\pi^-\pi^0$ as $K^+K^-\pi^0$

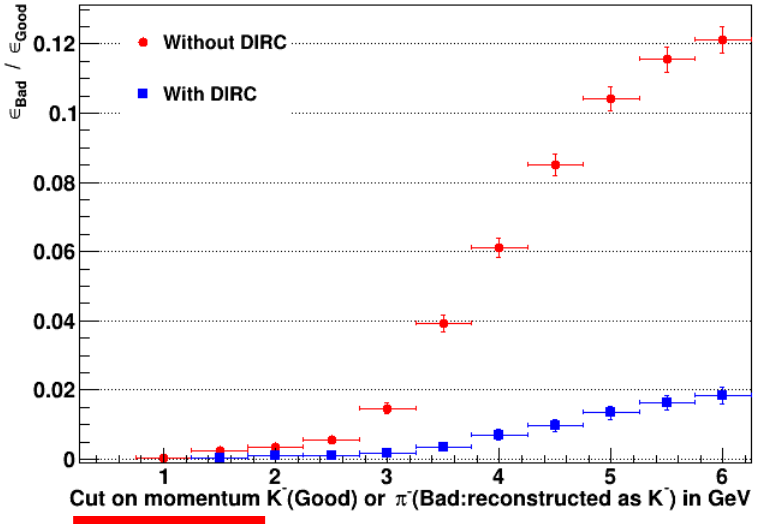
We want the ratio $\varepsilon_{Bad}/\varepsilon_{Good}$ to be small

PID with and without DIRC

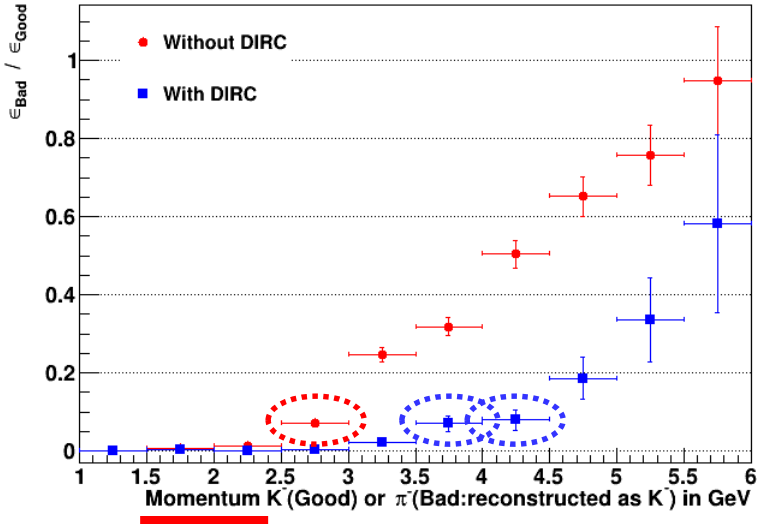


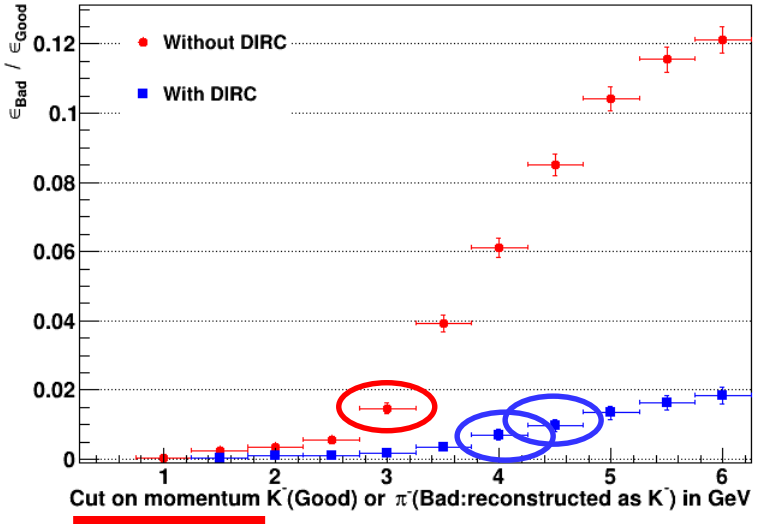
PID with and without DIRC





PID with and without DIRC





- What is currently used = Red solid circle
- To use when including DIRC? = Blue solid circles

ψ angle for determination of Σ (ρ^0 decay)

- Last meeting I had a difficult time describing the ψ angle I was trying to talk about ☹
- Next slide gives definition of ψ

ψ angle for determination of Σ (ρ^0 decay)

Here, P_γ is the degree of linear polarization of the photon; Φ is the angle of the photon electric polarization vector with respect to the production plane measured in the over-all (γp) c.m. system; θ and ϕ are the polar and azimuthal angles of the π^+ in the ρ^0 rest frame. (See Fig. 12 and Ref. 36.)

- J. Ballam, et. al., Phys. Rev. D **5** 545 (1972)

Note: The angle Φ is the same as in our typical intensity expressions (sometimes called big phi) and if z-axis is taken along direction of γ, then φ given here is the azimuthal angle in the Gottfried-Jackson frame.

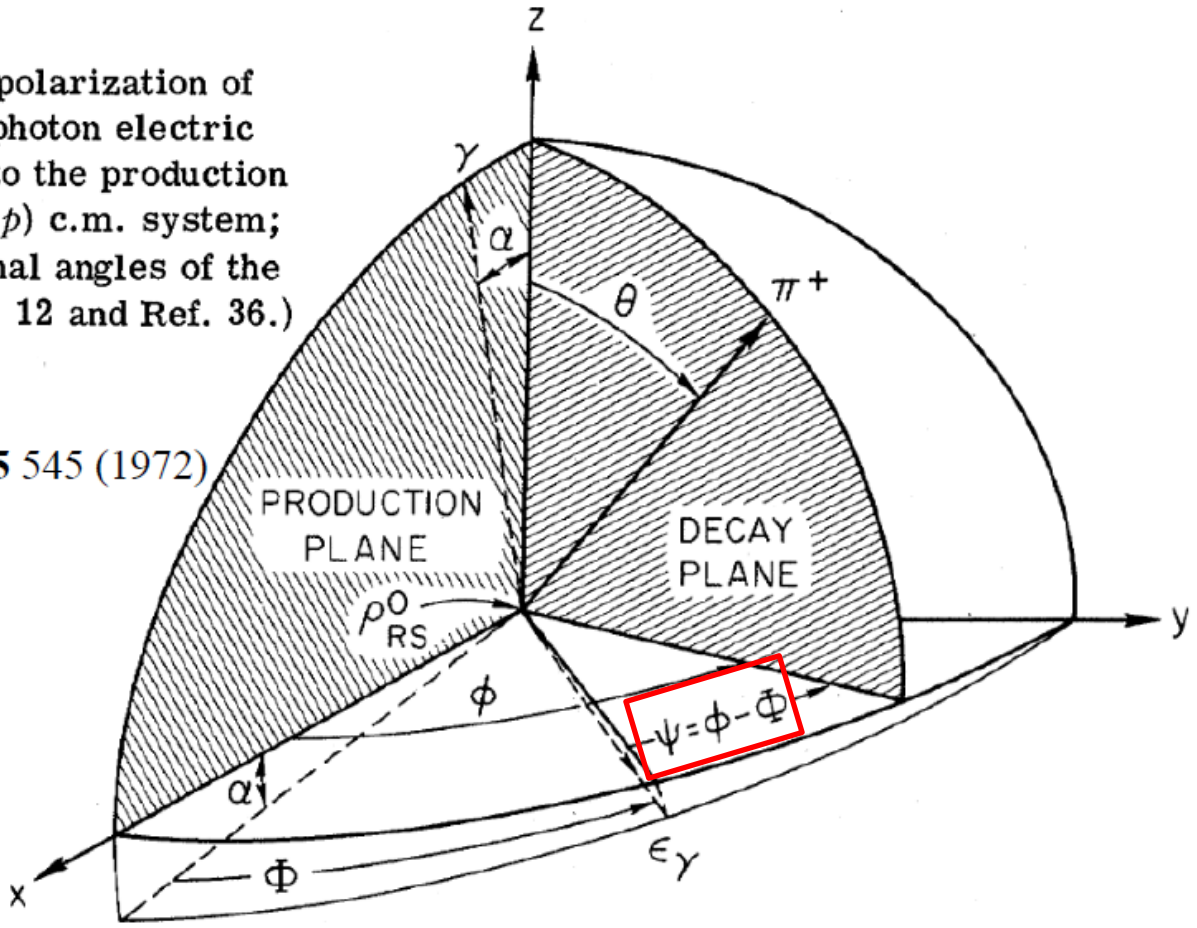


FIG. 12. Angles used in the study of ρ^0 decay. The angle α is zero in the Gottfried–Jackson system.

Title

Title