RICH efficiency 2011

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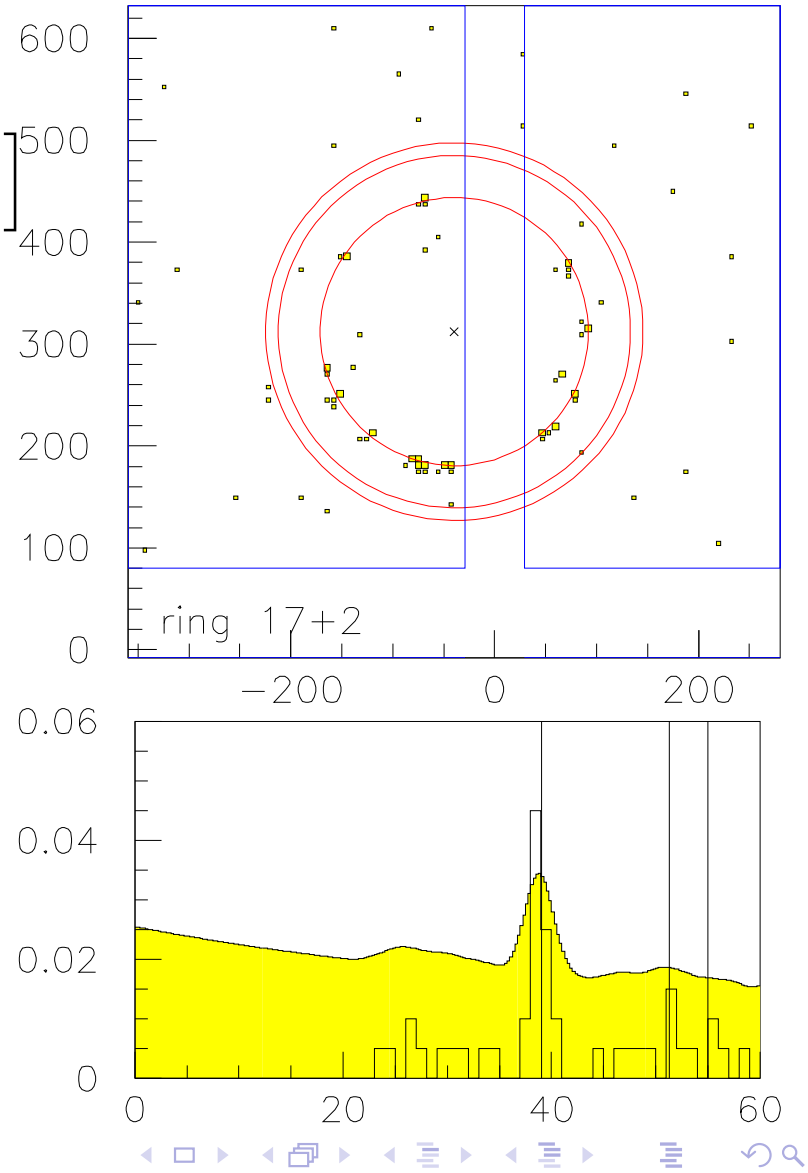
Aim

Determine the RICH efficiency for 2011

- Sample with:
  - $K_0 \rightarrow \pi\pi$
  - $\Phi \rightarrow KK$
  - $\Lambda \rightarrow \pi p$
- Determine the type of one of the particles
- Id of the second one fixed
- Get the answer from the rich for the second particle

LH calculation

- $L_N = \prod_{k=1}^{N^{ph}} \left[(1-\epsilon) G(\theta^{ph}_{rec,k}, \phi^{ph}_{rec,k}) + \epsilon B(\theta^{ph}_{rec,k}) \right]$
- $G(\theta, \phi) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(\theta - \Theta^{mass})^2}{2\sigma^2} \right) \frac{\theta}{\Theta^{mass}}$
- $B(\theta) = \frac{2}{\Theta_M^2}\theta$
- Normalised to number of photons: $L = \sqrt[N]{L_N}$
- $\Theta_M = 70 mrad$ upper limit of θ range
- Θ^{mass} Cherenkov angle for p, m



General Cuts

- Best primary vertex
- Incoming + scattered muon
- Vertex inside the target
- Extrapolated beam track crosses all cells
- $0.1 < y < 0.9$

K_0 / Λ selection

- Secondary vertex, 2 outgoing particles
- Opposite charge
- Particle $XX0 < 10$
- $p > 1$ GeV
- Particle has fit parameter
- $z_{Last} < 350$ cm
- Track not connected to any primary vertex
- $p_t^+ > 23$ MeV
- Distance vertices $> 2\sigma$
- Collinearity cut > 0.99995

- $m(\pi,\pi) - m(K_0) < 150$ MeV
- $|m(\pi,p) - m(\Lambda)| > 10$ MeV
- $m(\pi,p) - m(\Lambda) < 150$ MeV
- $|m(\pi,\pi) - m(K_0)| > 10$ MeV

Φ selection

- 2 additional outgoing particles (prim. vertex)
- opposite charge
- $2 < p < 70$ GeV
- $|E_{miss}| < 2.5$ GeV
- $z_{Last} > 350$ cm
- $p_t^+ > 23$ MeV
- $m(K, K) - m(\phi) < 150$ MeV

RICH cuts

- Remove RICH pipe
- Pions
  - $LH(\pi)/LH(K) > 1$ (1.02)
  - $LH(\pi)/LH(p) > 1$ (1.02)
  - $LH(\pi)/LH(bg) > 1$ (2.02)
- Kaons
  - $LH(K)/LH(\pi) > 1.02$ (1.08)
  - $LH(K)/LH(p) > 1$ (1.08)
  - $LH(K)/LH(bg) > 1.24$ (2.08)
- Protons above threshold
  - $LH(p)/LH(\pi) > 1$
  - $LH(p)/LH(K) > 1$
  - $LH(p)/LH(bg) > 1$
- Protons below threshold
  - $LH(bg)/LH(\pi) > 1$ (0.48)
  - $LH(bg)/LH(K) > 1$ (0.36)
  - **OR** all $LH = 0$

Cuts used in the multiplicity analysis, if different

Binning and fit function

- 2θ bins:

  $0.01, 0.04, 0.12$

- $13p$ bins:

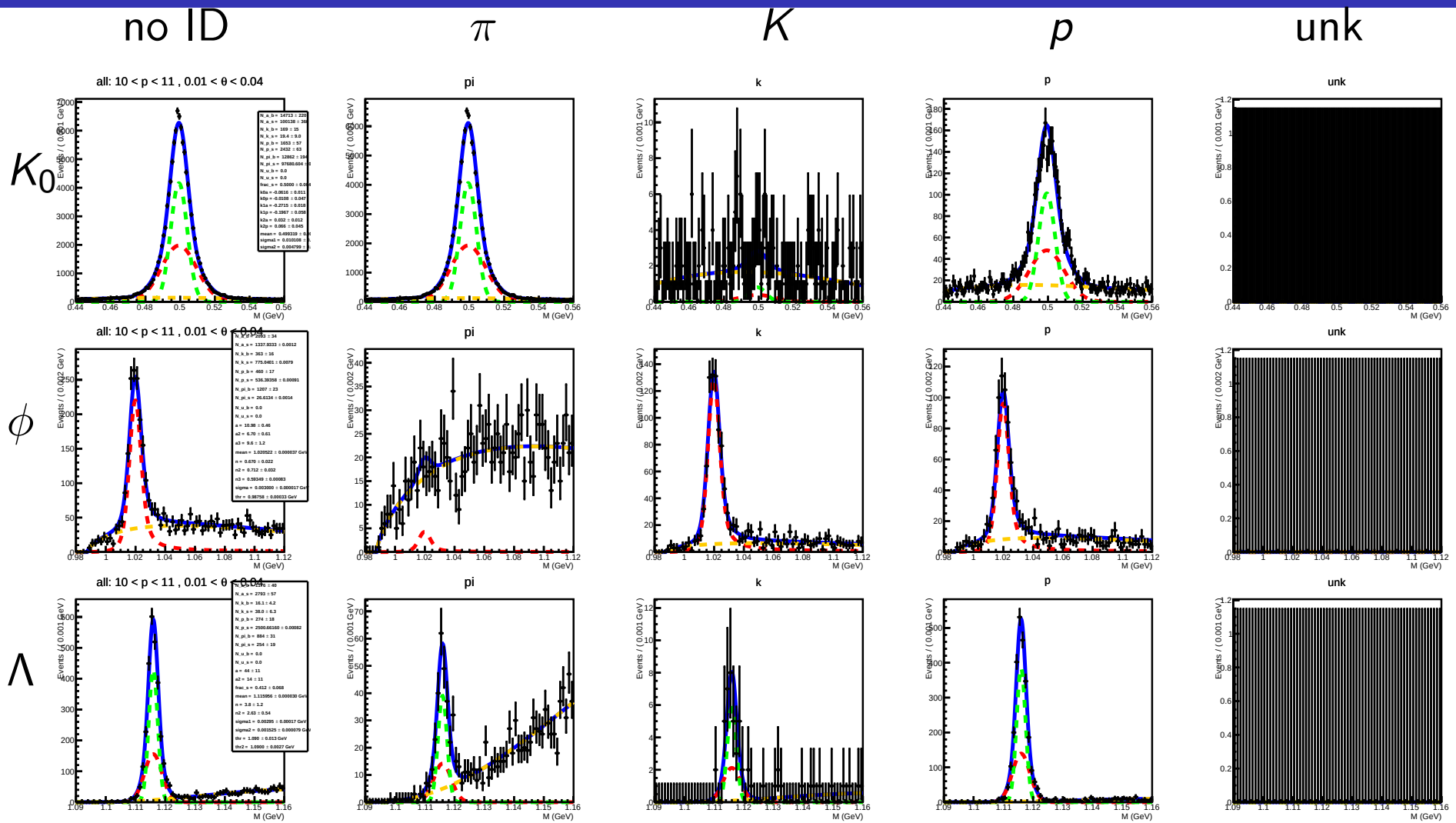
  $10., 11., 12., 13., 15., 17., 19., 22., 25., 27., 30., 35., 40., 50.$ GeV/c

- K_0: 2 Gaussian + Polynomial

- Λ: 2 Gaussian + $(x - thr)^n \exp(-a(x - thr))$

- ϕ: convolution rel. Breit-Wigner and Gaussian + $(x - thr)^n \exp(-a(x - thr))$

Fit

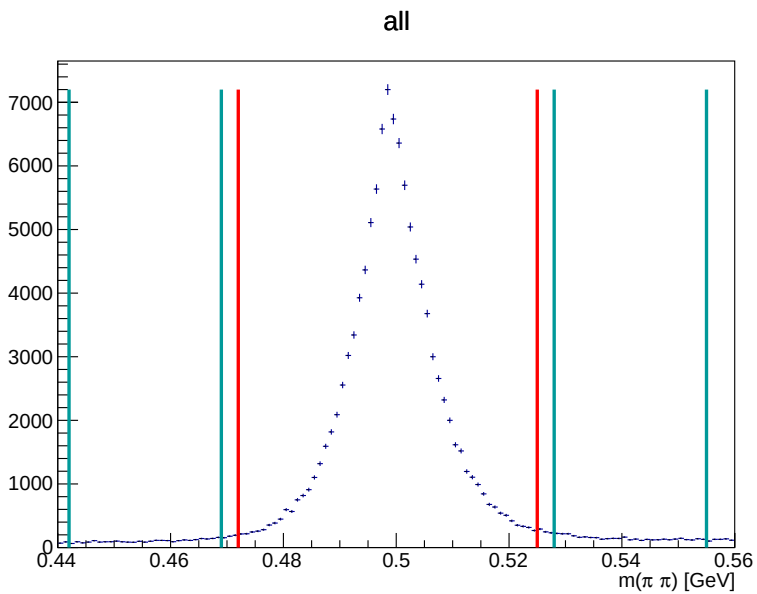


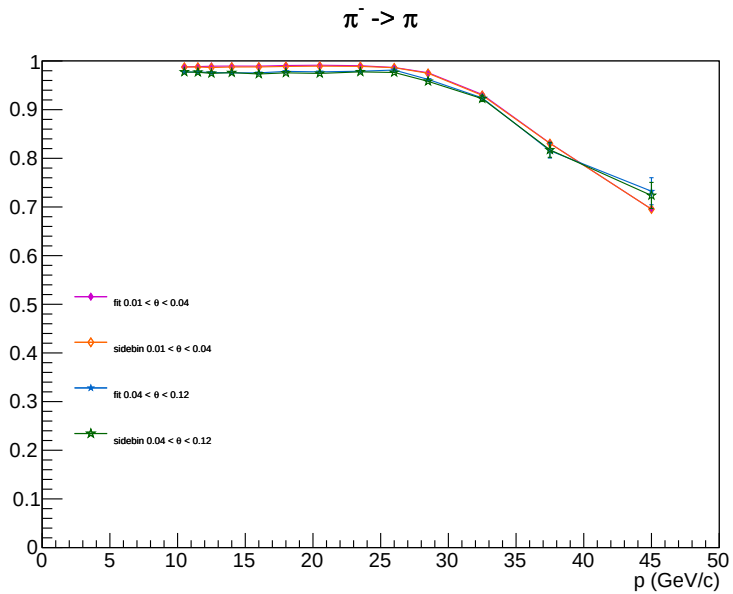
- One Particle correct identified
- Colors: Full model bgn signal signal

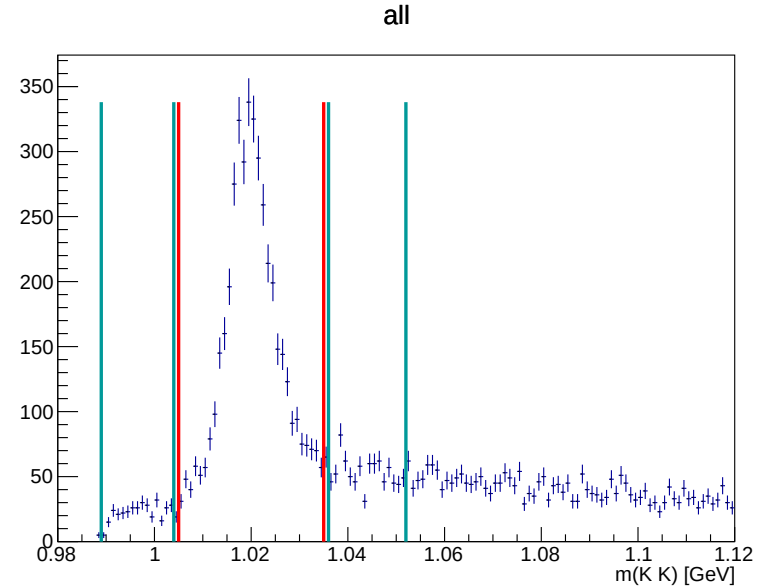
Checks and Results

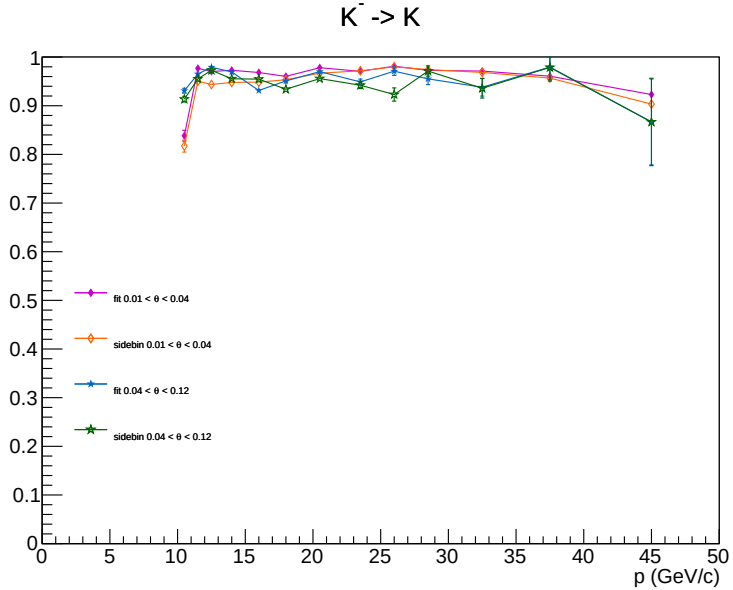
- Check the results from the fit with the one obtained with sidebins
- Compare the results from "my" LH cuts with the multiplicity ones
- Compare my and Quielas results

Sidebins

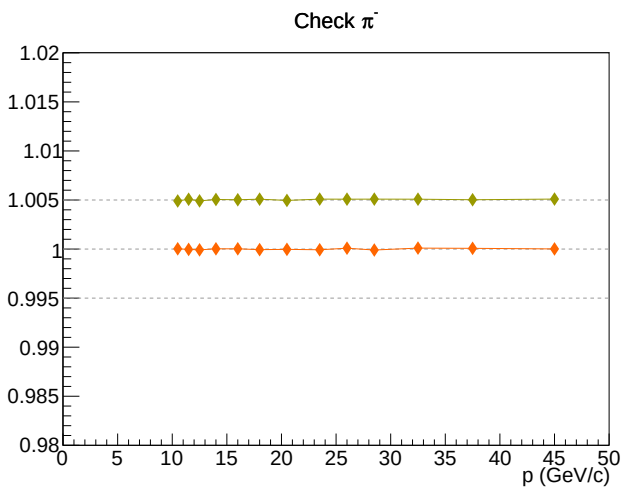

all
m(π π) [GeV]

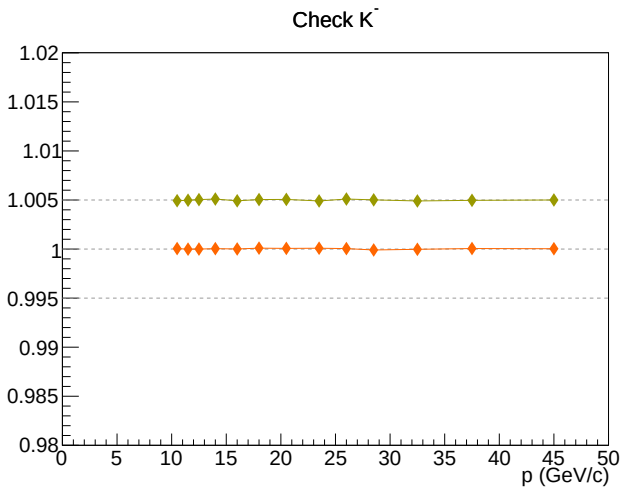

π⁻ -> π
p (GeV/c)
fit 0.01 < θ < 0.04
sidebin 0.01 < θ < 0.04
fit 0.04 < θ < 0.12
sidebin 0.04 < θ < 0.12

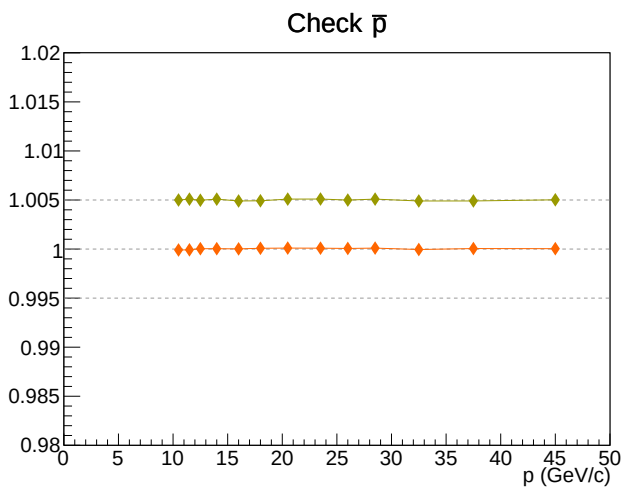

all
m(K K) [GeV]

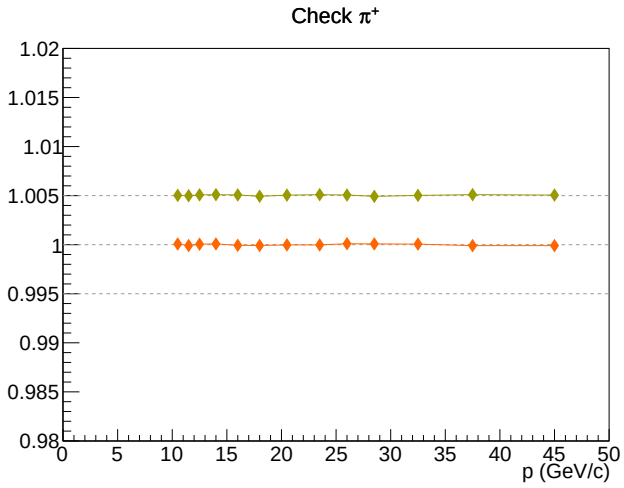

K⁻ -> K
p (GeV/c)
fit 0.01 < θ < 0.04
sidebin 0.01 < θ < 0.04
fit 0.04 < θ < 0.12
sidebin 0.04 < θ < 0.12

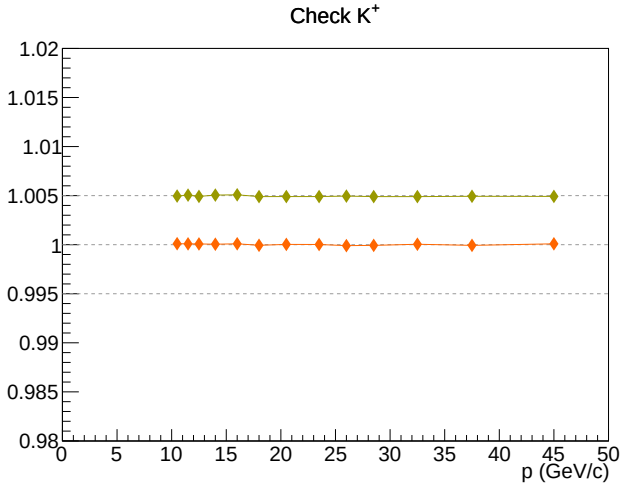
Sum of all efficiencies (my LH cuts)

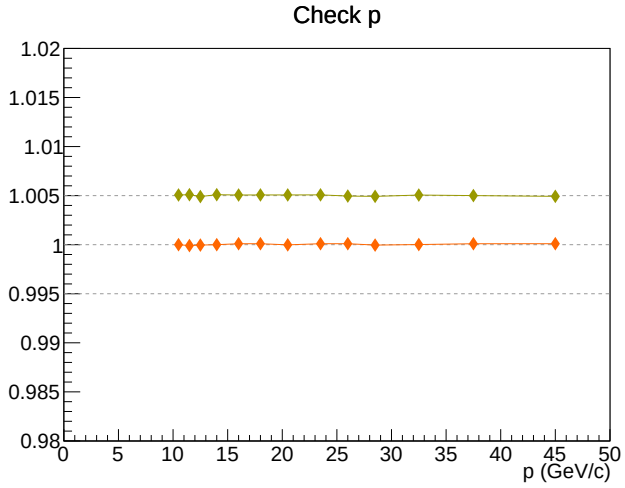






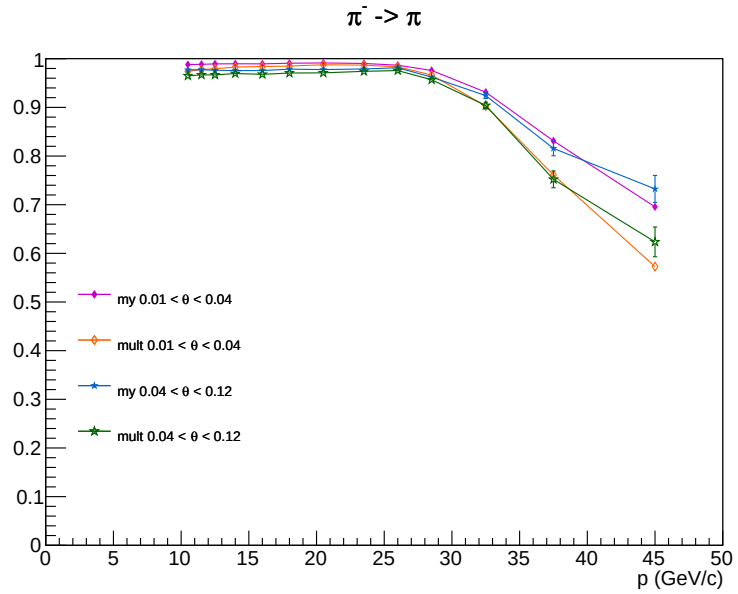


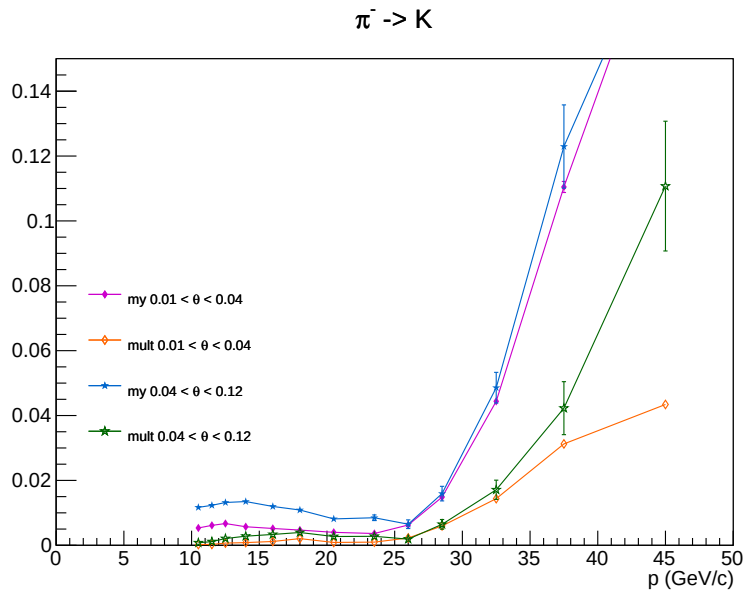


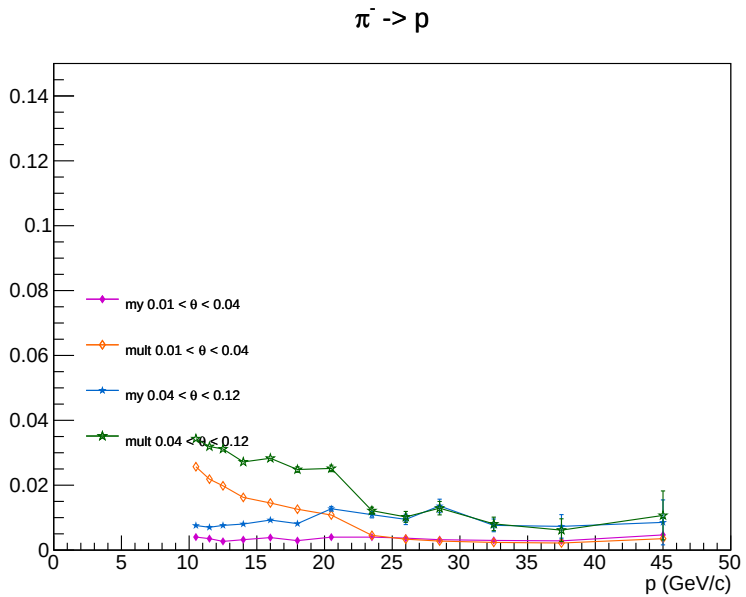


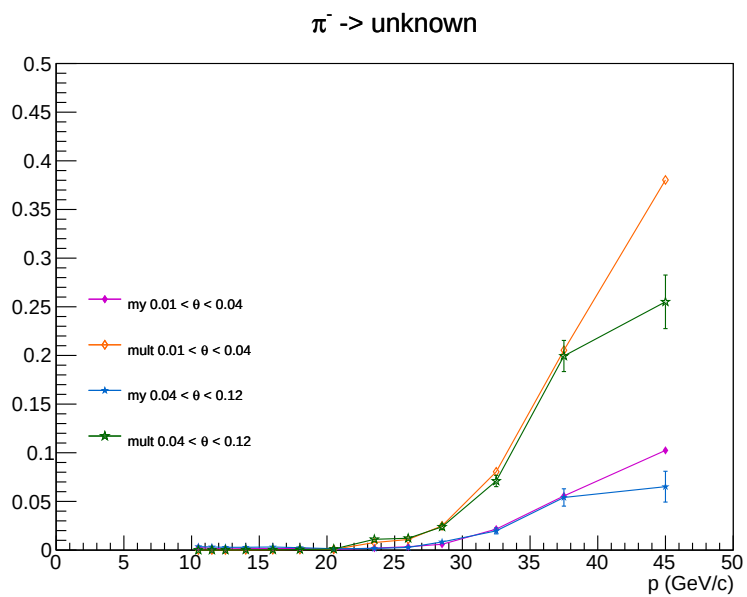
Good agreement with $\sum = 1$

RICH π^- comparison between diff LH cuts

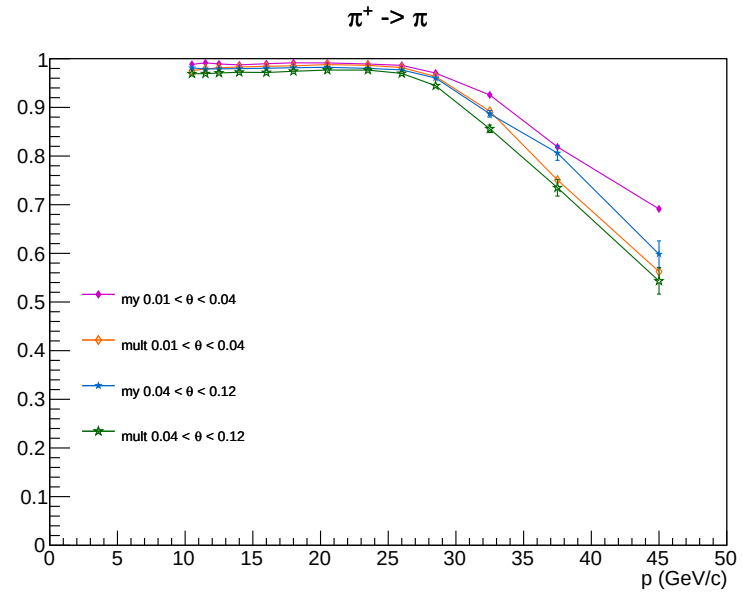


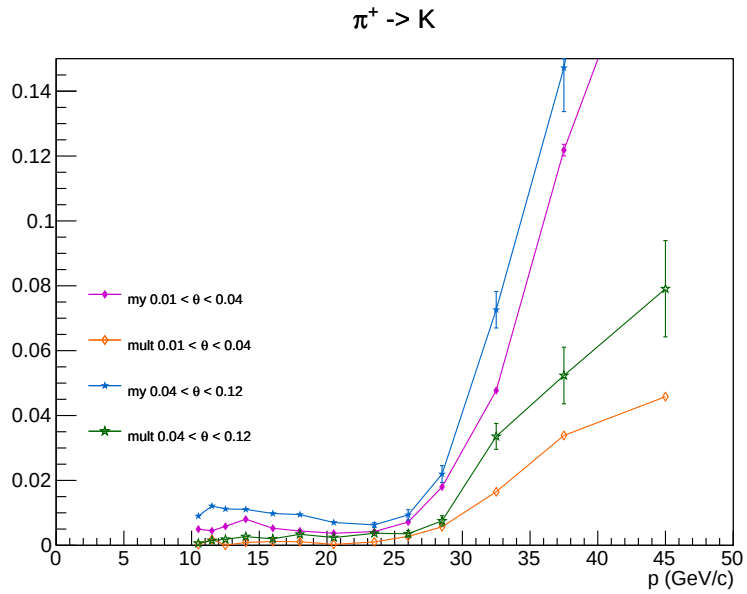


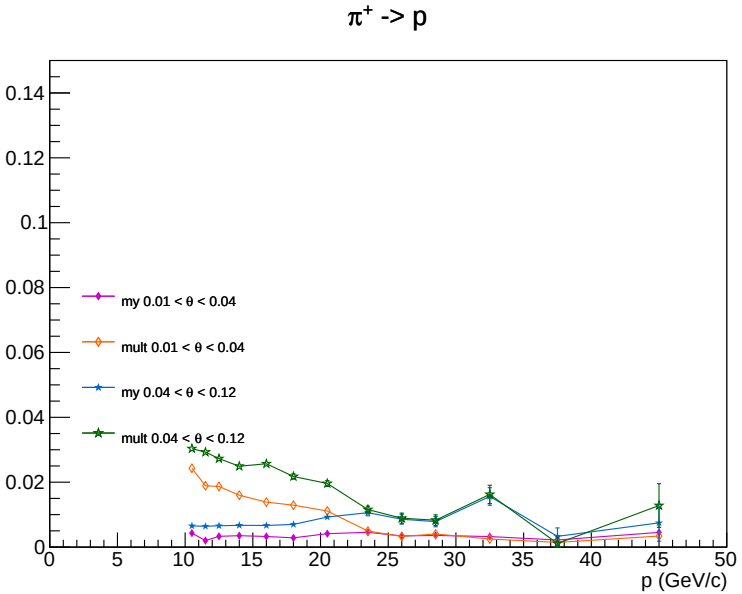


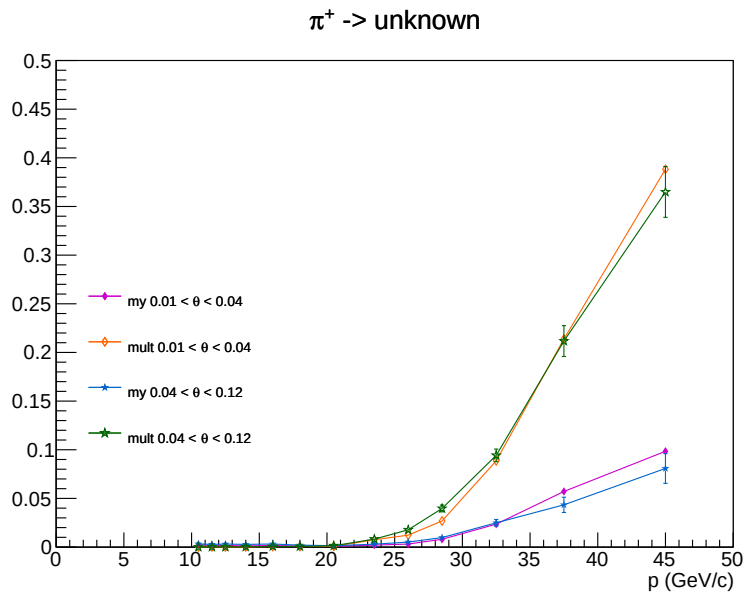


RICH π^+ comparison between diff LH cuts

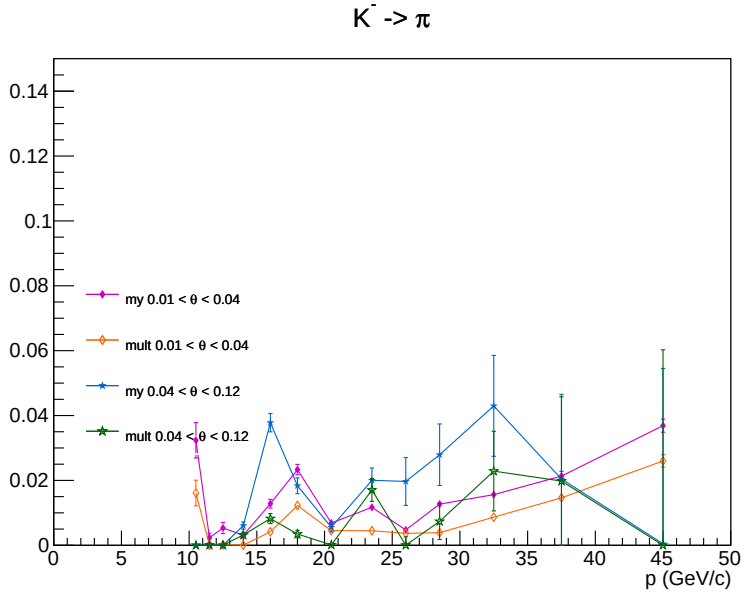


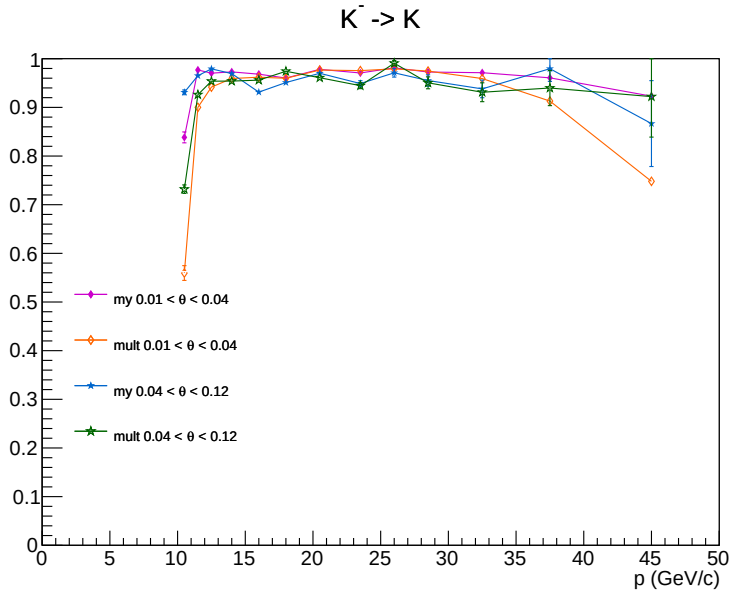


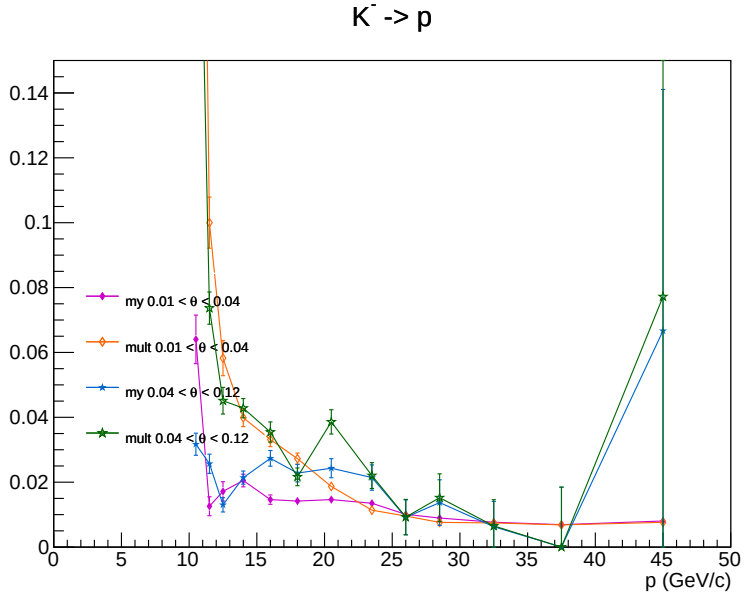


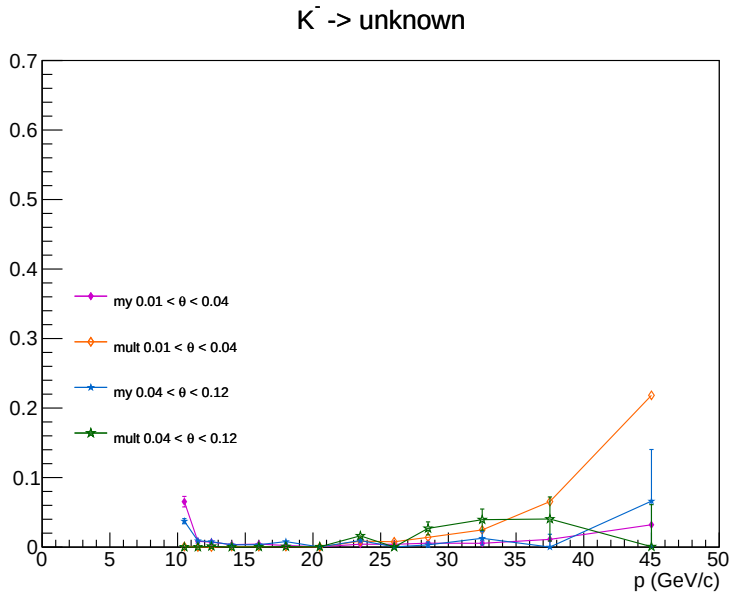


RICH K^- comparison between diff LH cuts

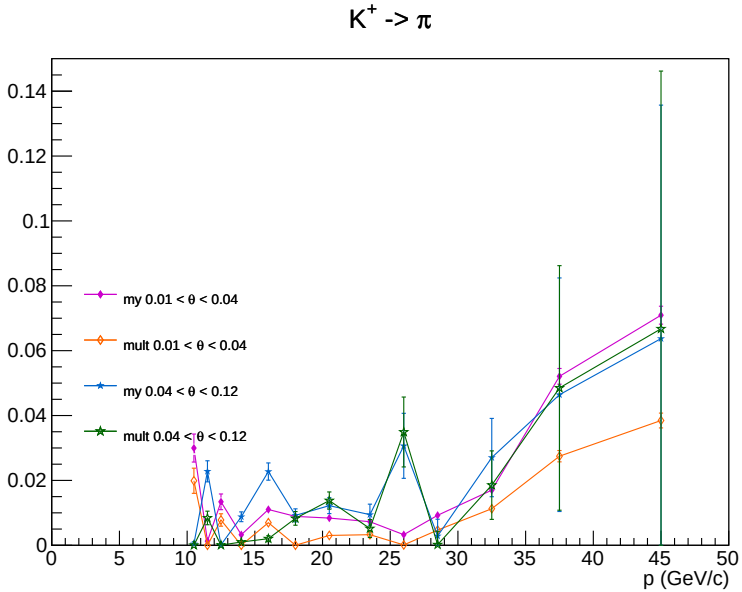


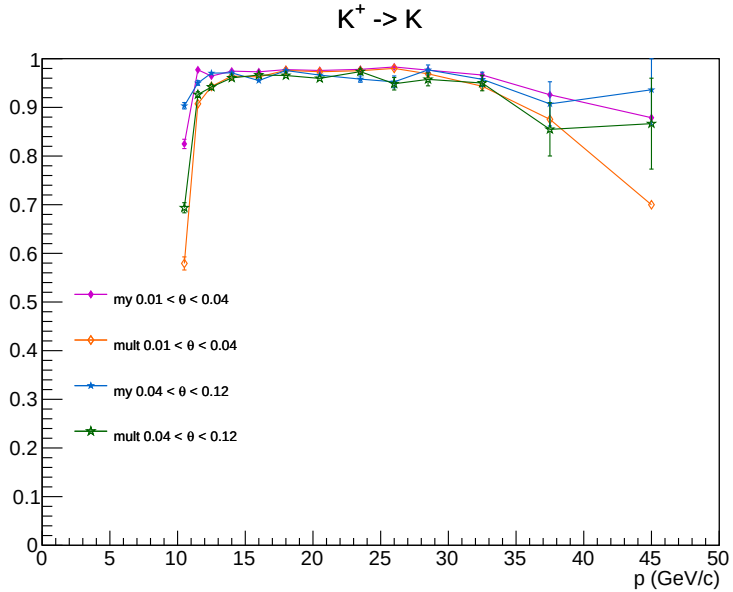


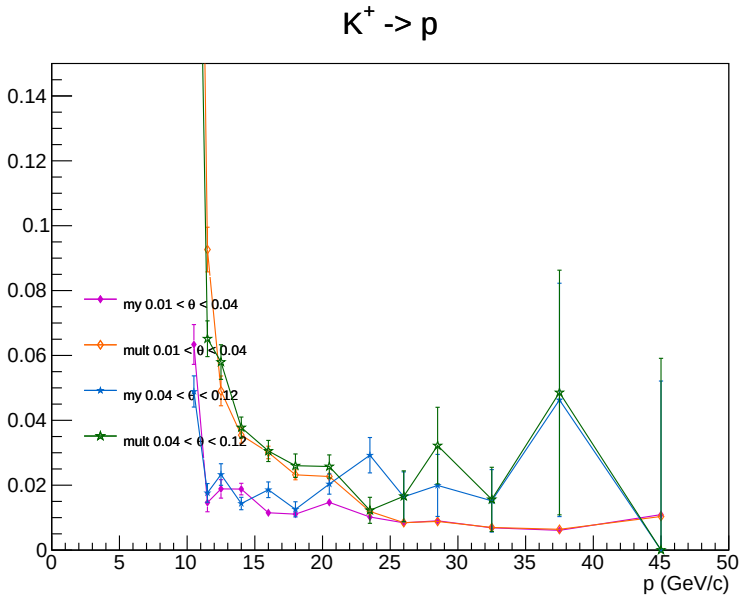


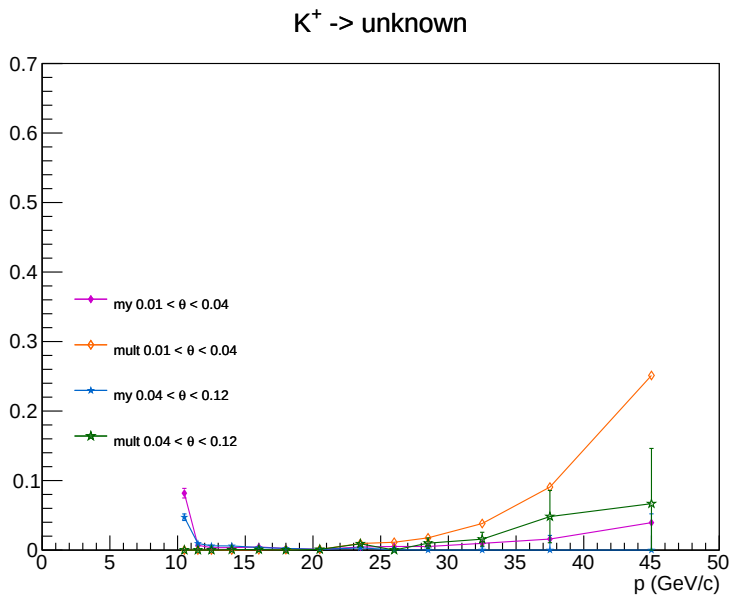


RICH K^+ comparison between diff LH cuts

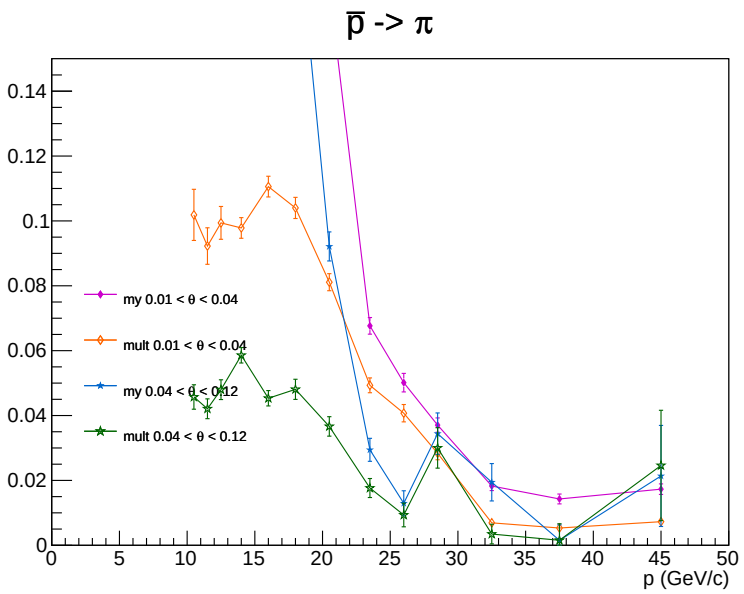


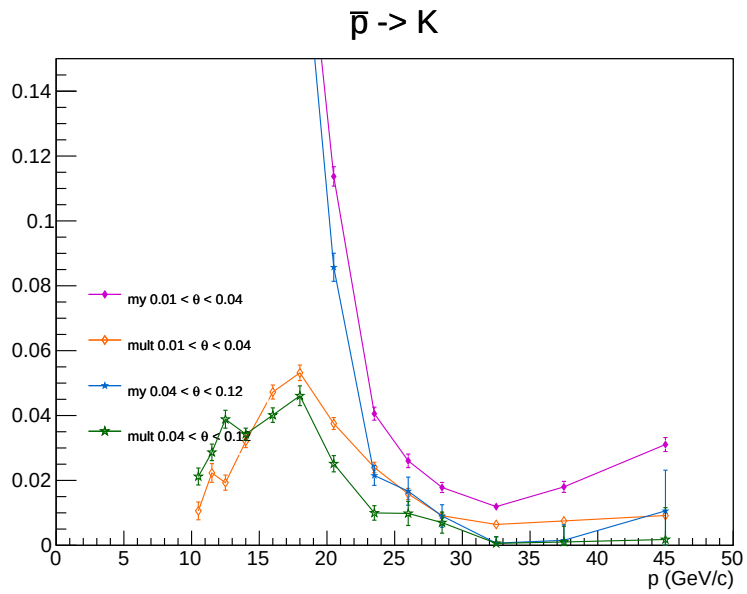


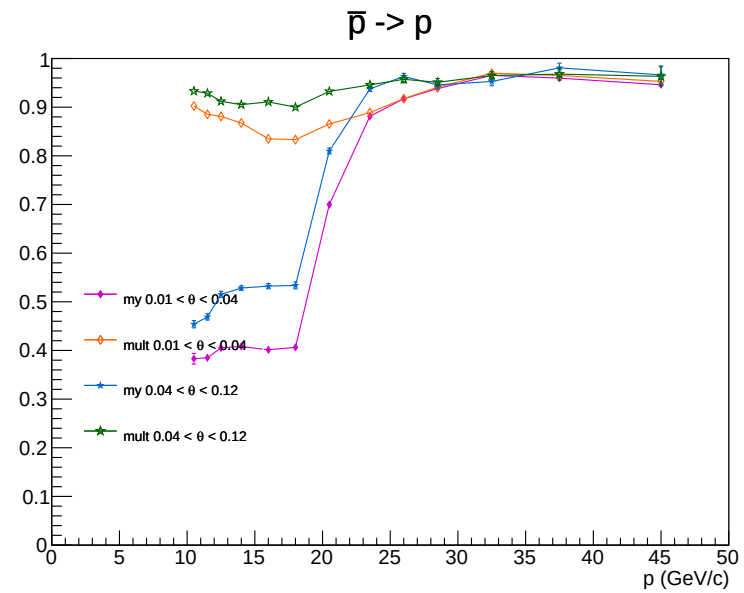


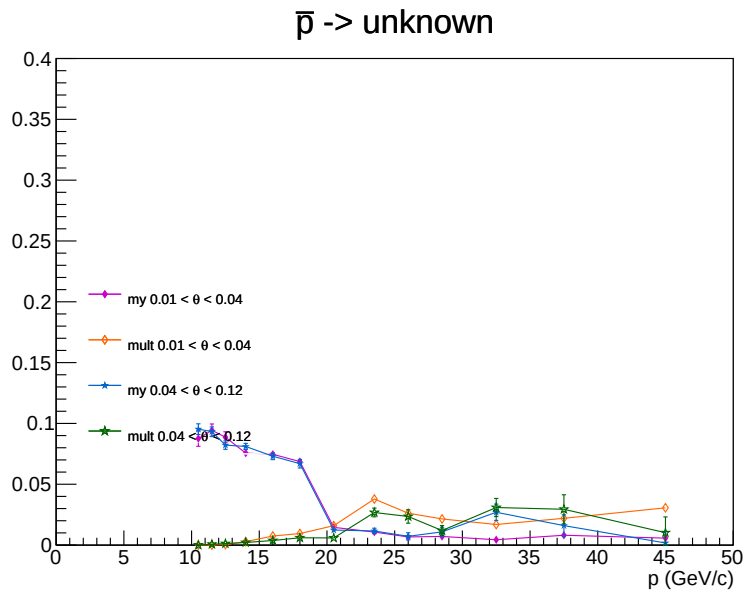


RICH $\bar{p}$ comparison between diff LH cuts

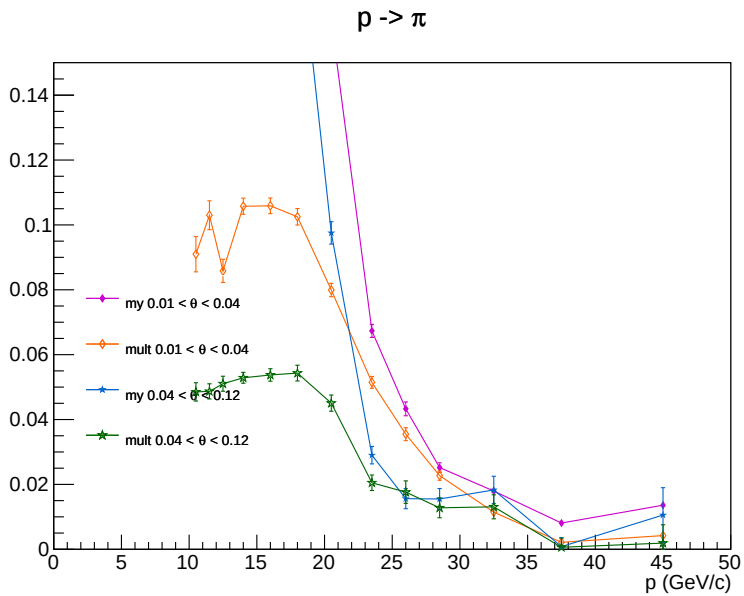


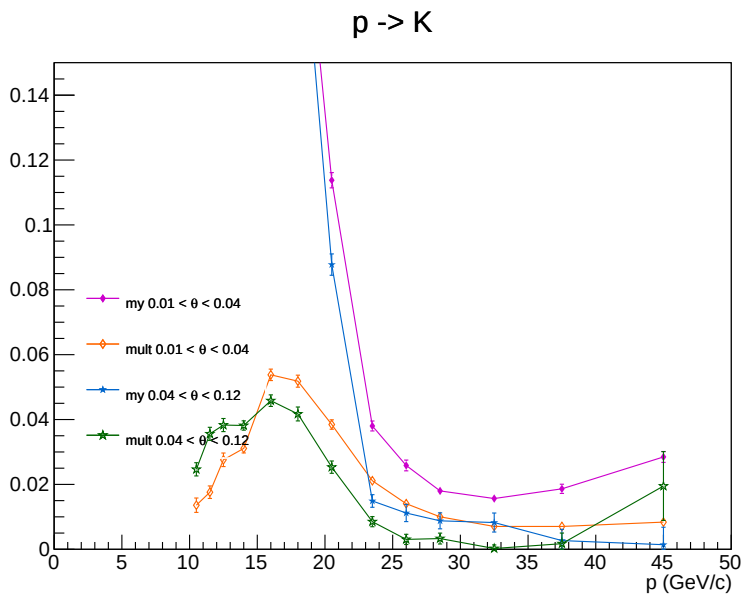


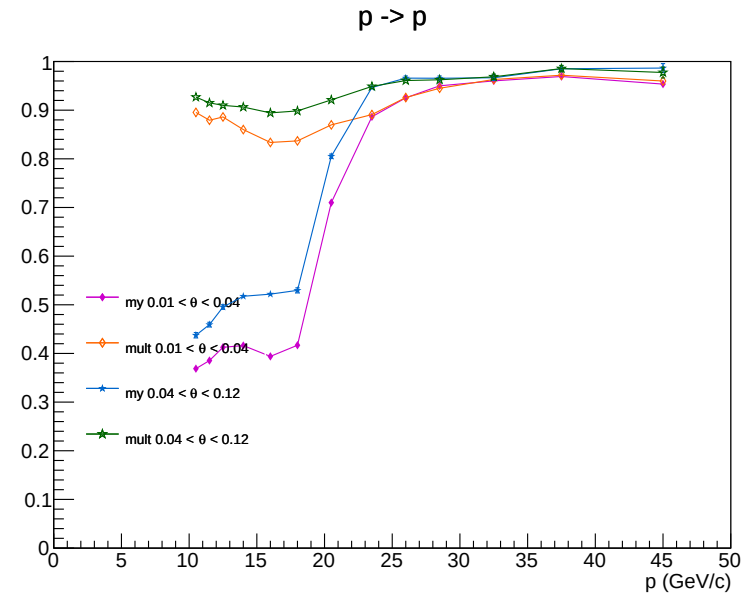


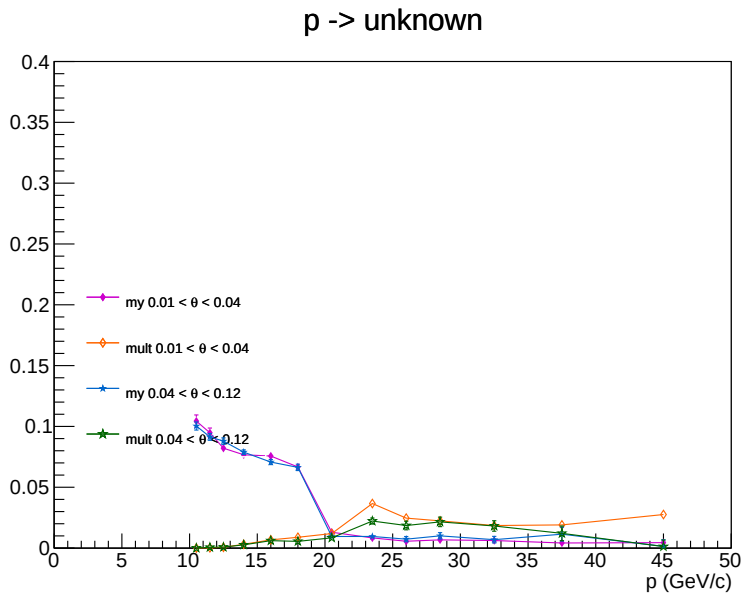


RICH p comparison between diff LH cuts

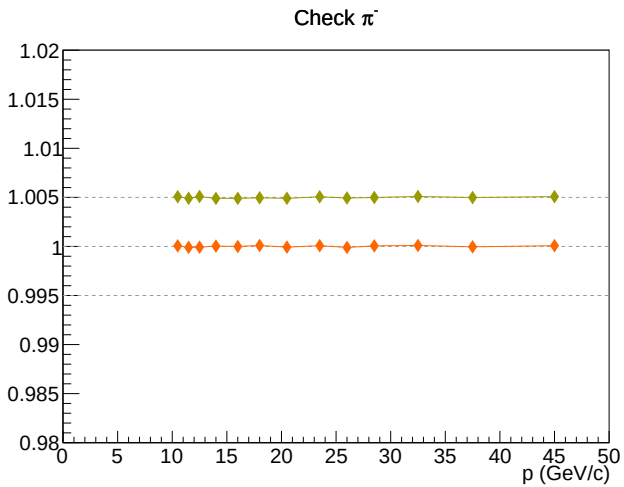


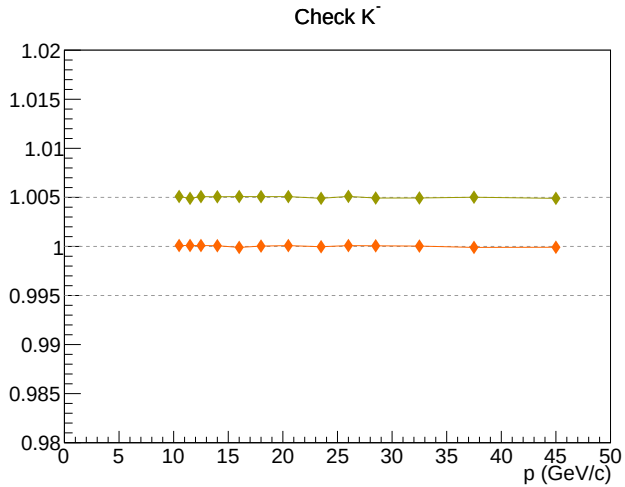


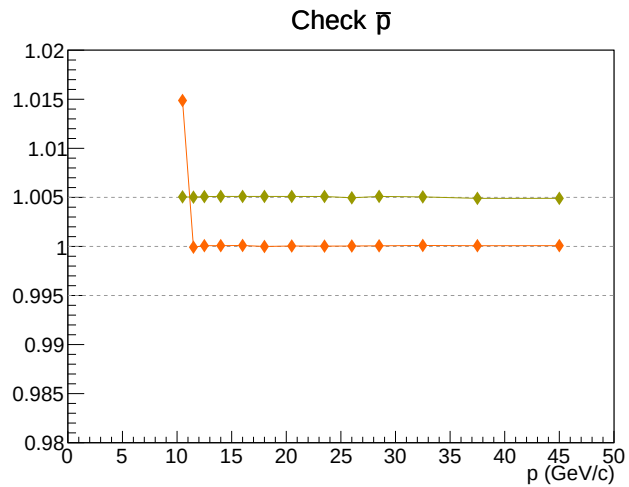


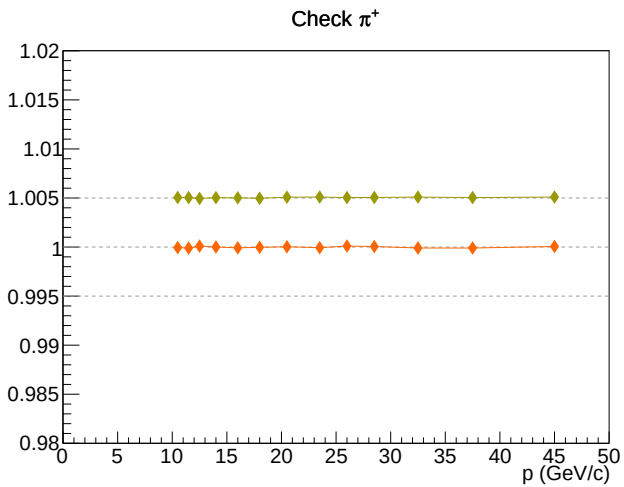


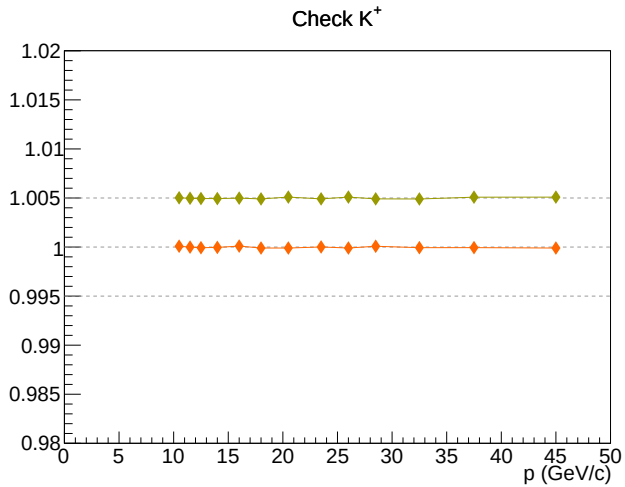
Sum of all efficiencies (my LH cuts)

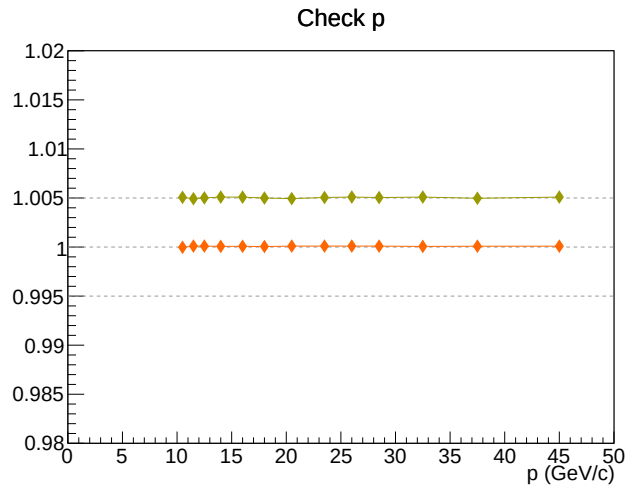






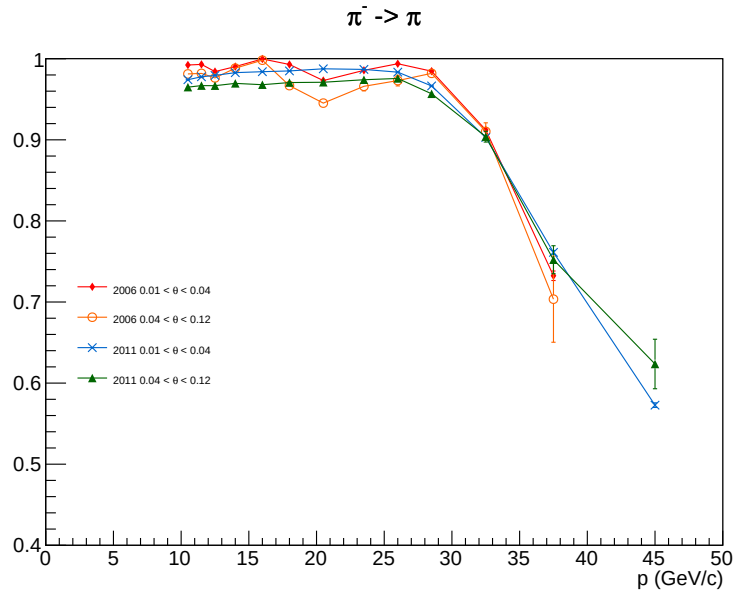


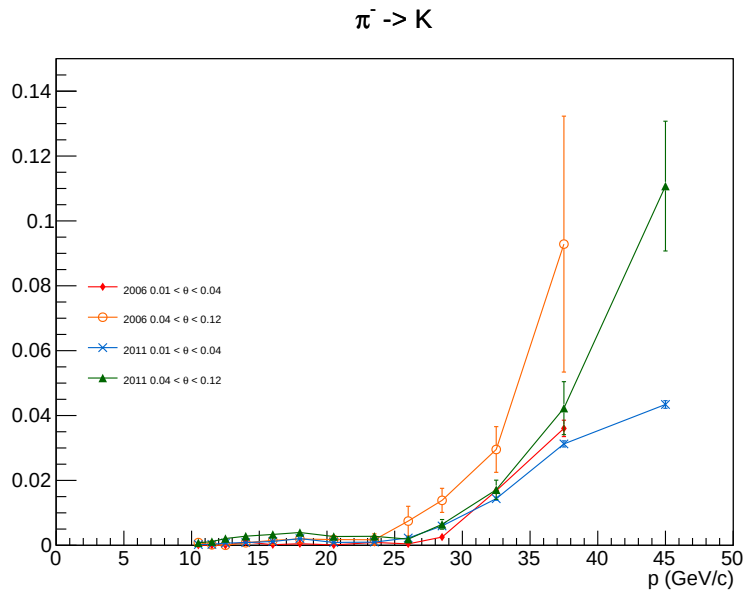


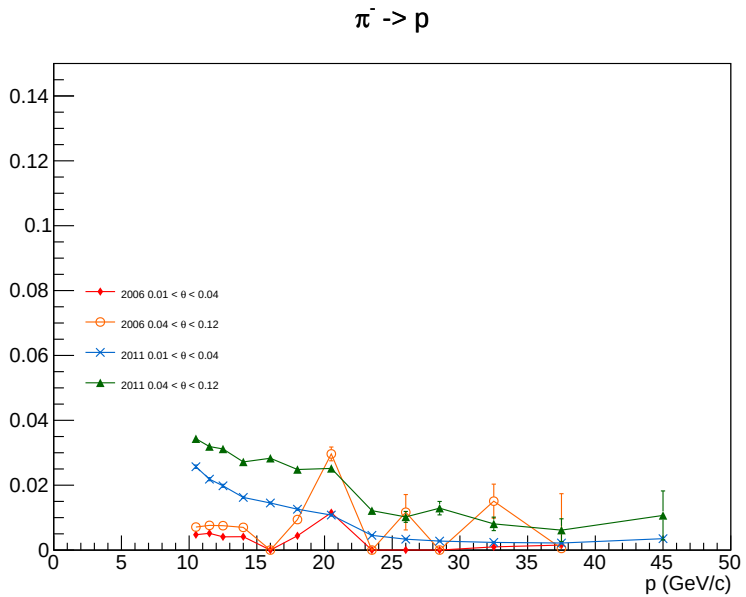


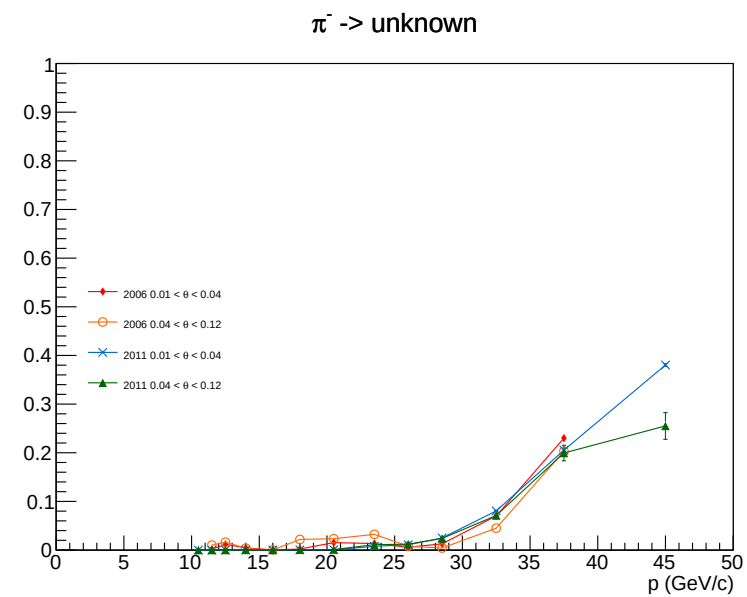
- Good agreement with $\sum = 1$
- Except for first $\bar{p}$ bin
- Next step: Compare with 2006 results

RICH π^- comparison with Quiela(2006)

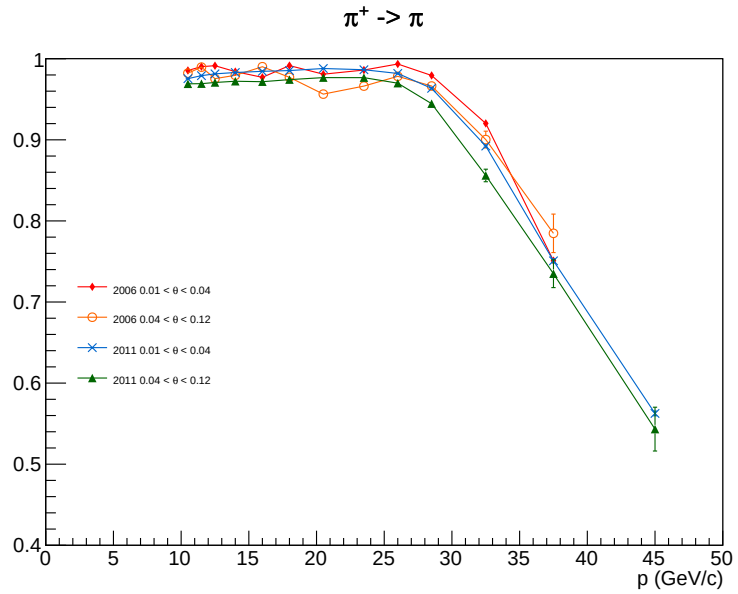


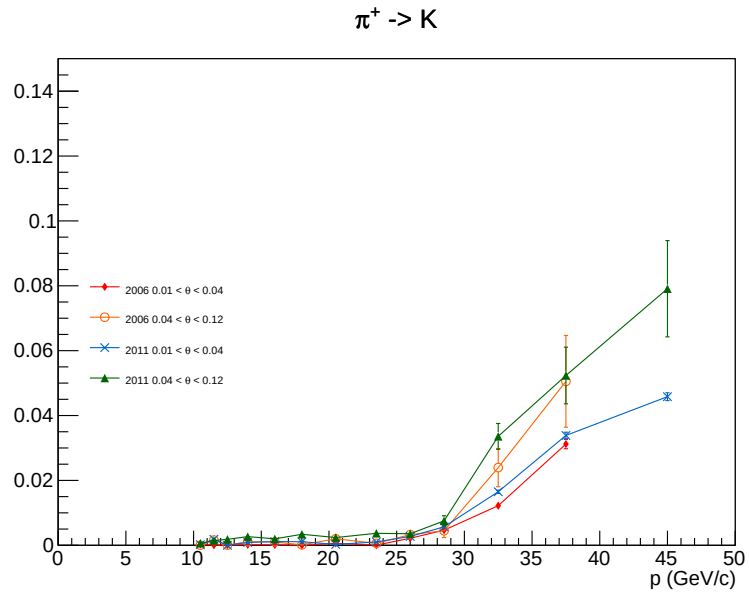


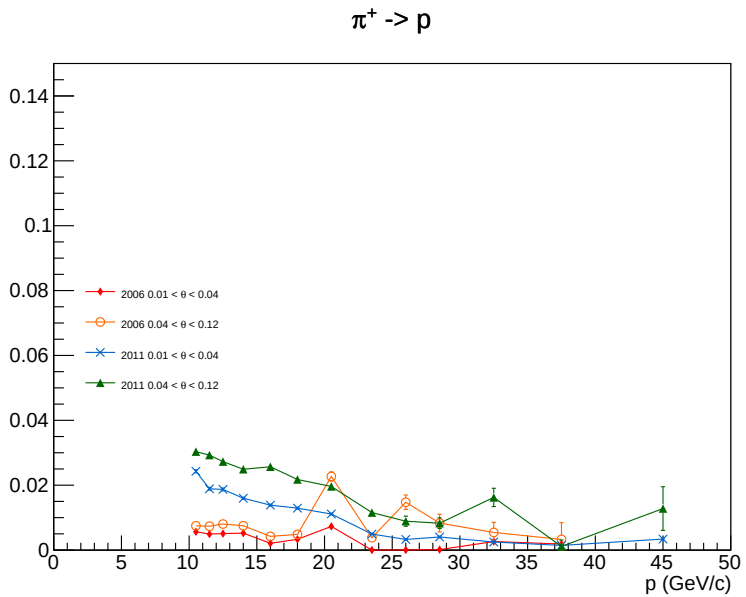


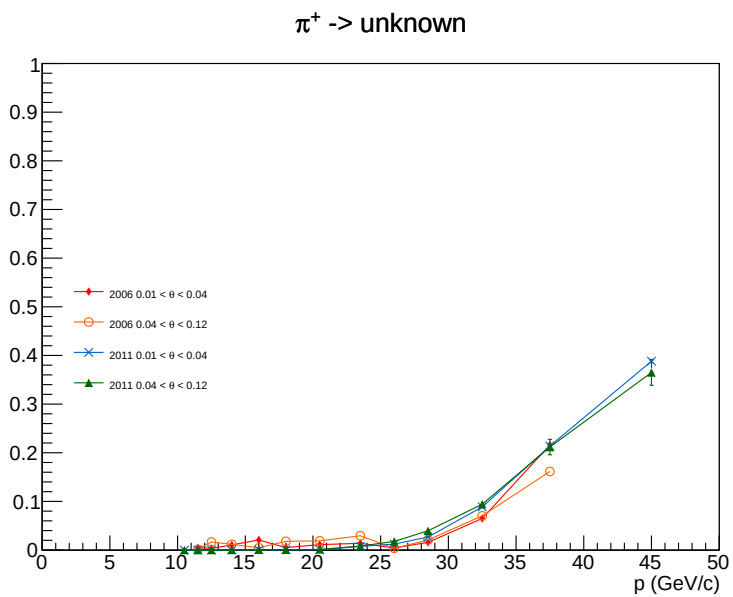


RICH π^+ comparison with Quiela(2006)

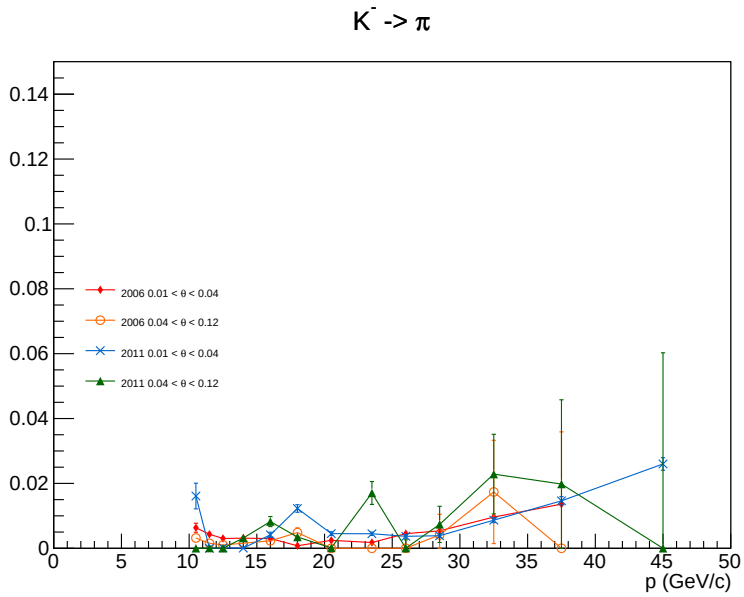


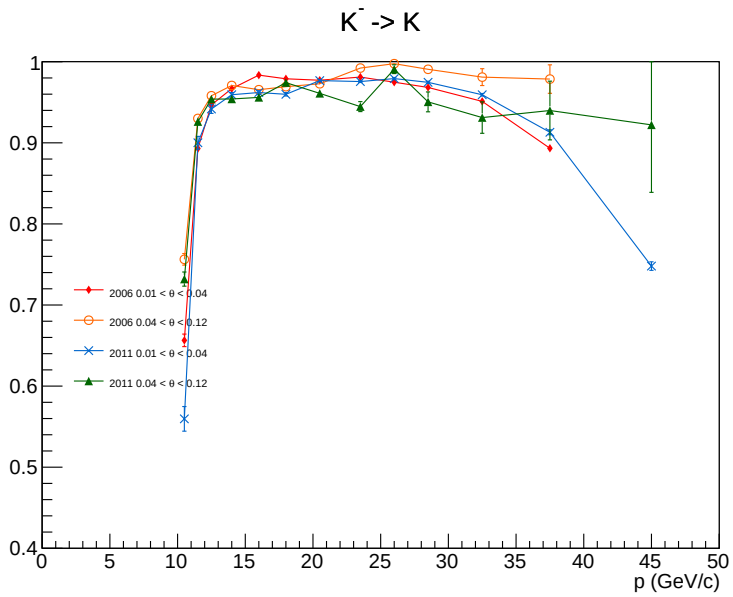


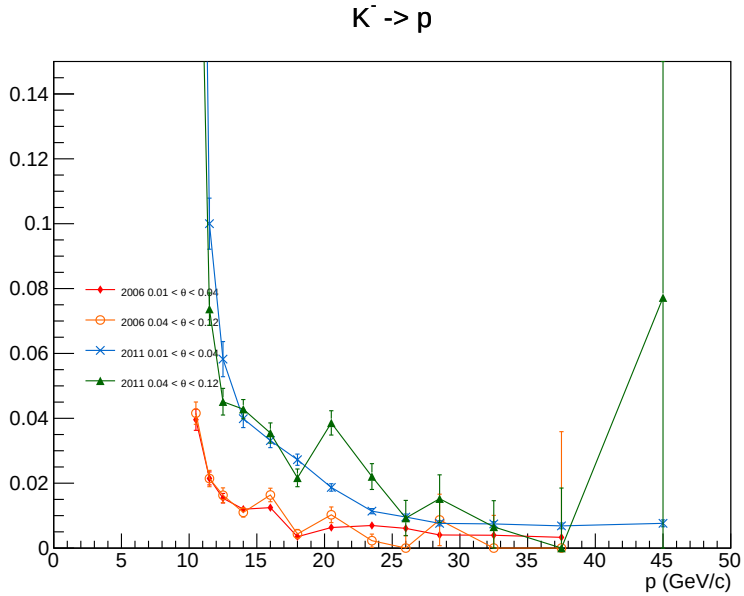


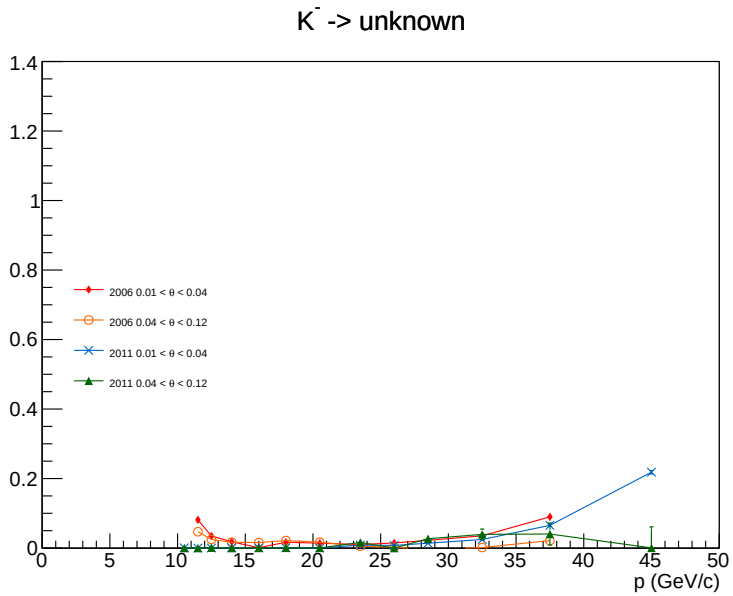


RICH K^- comparison with Quiela(2006)

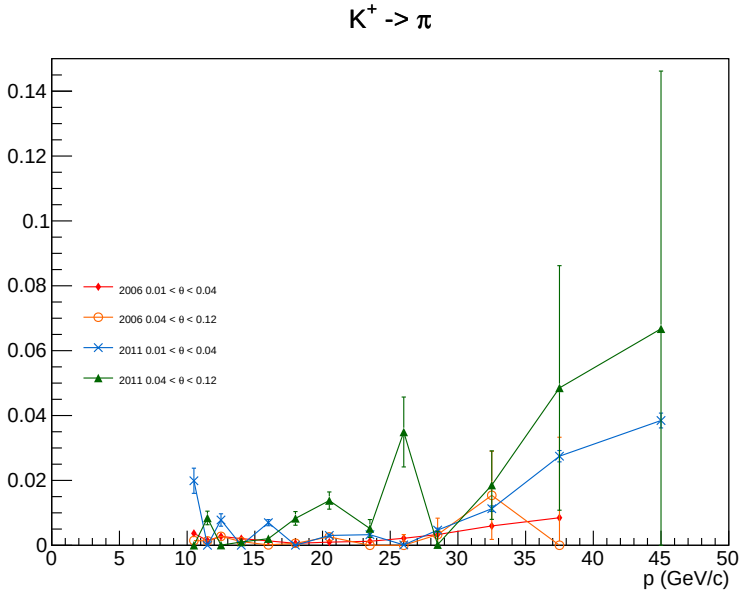


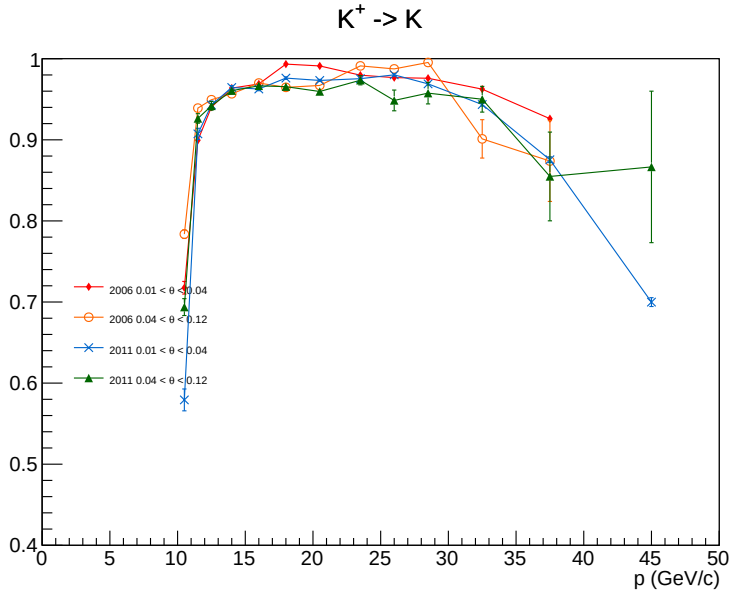


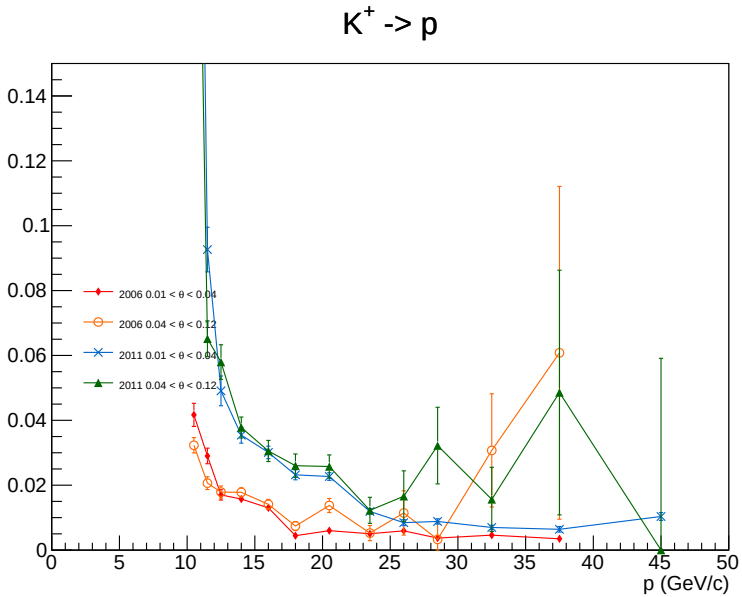


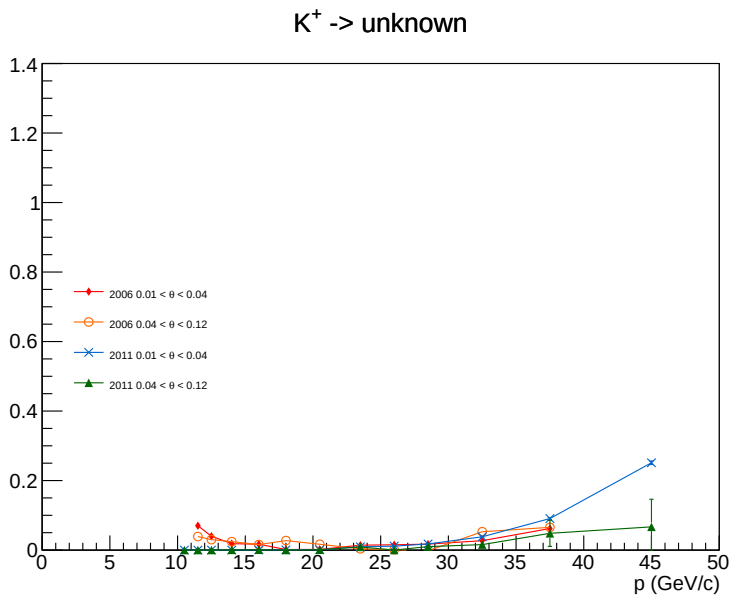


RICH K^+ comparison with Quiela(2006)

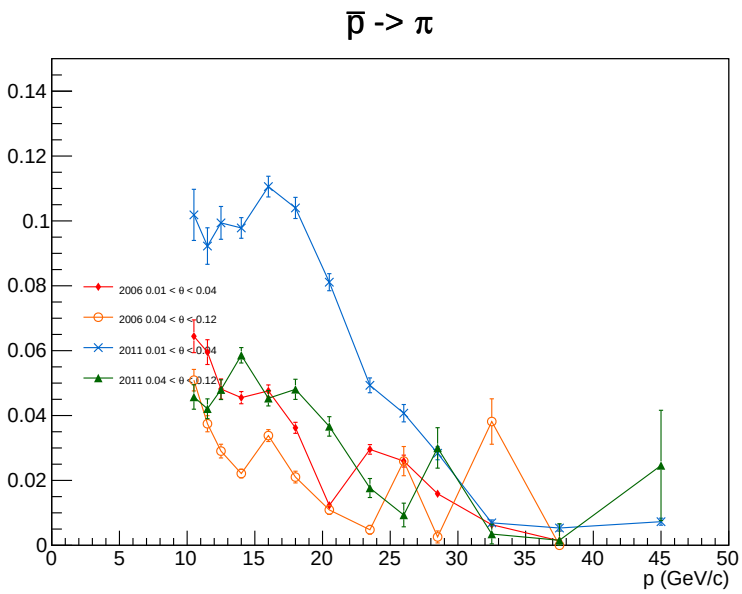


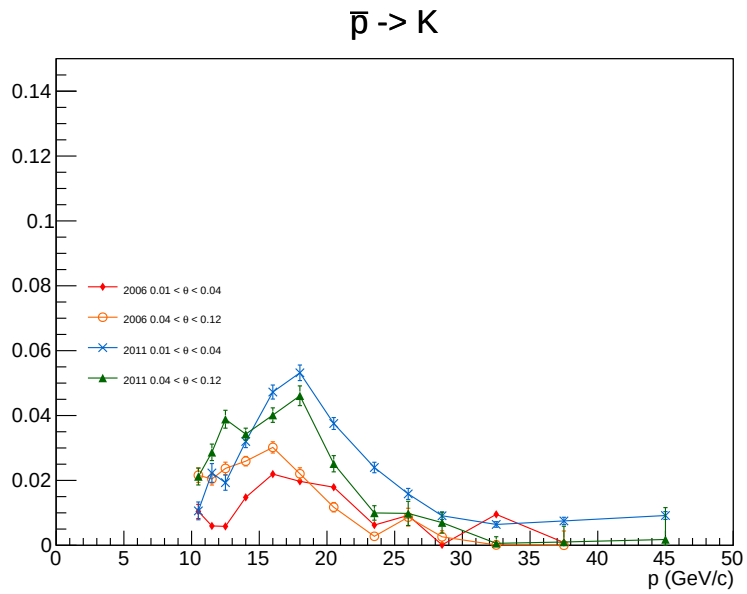


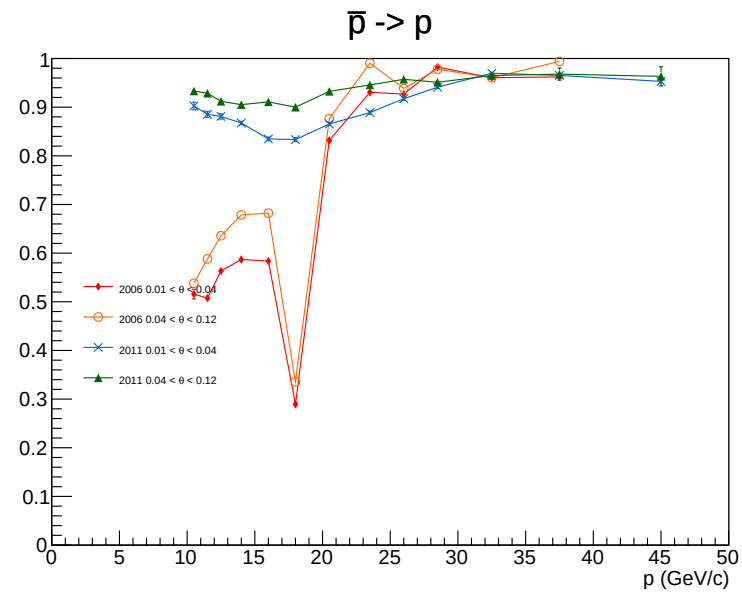


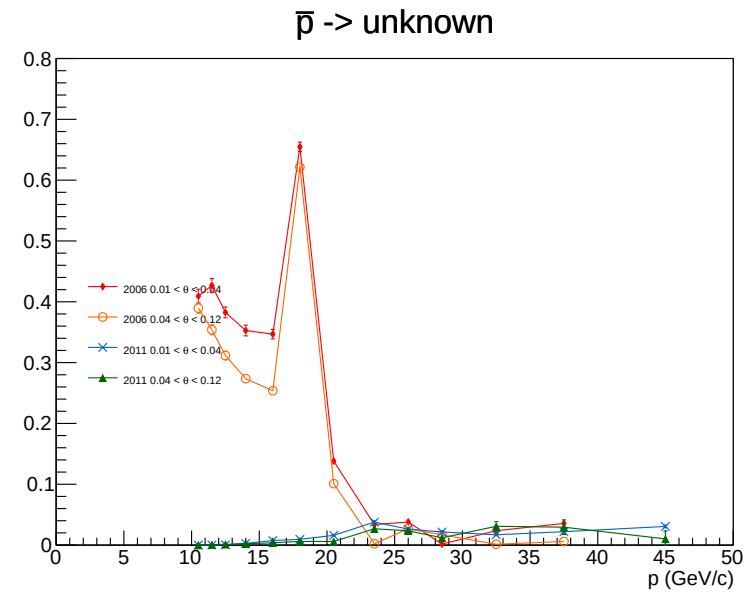


RICH $\bar{p}$ comparison with Quiela(2006)

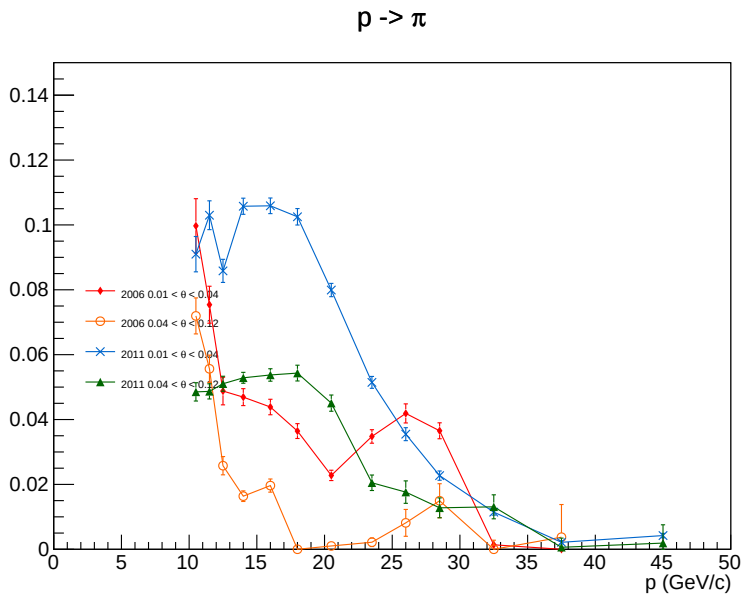


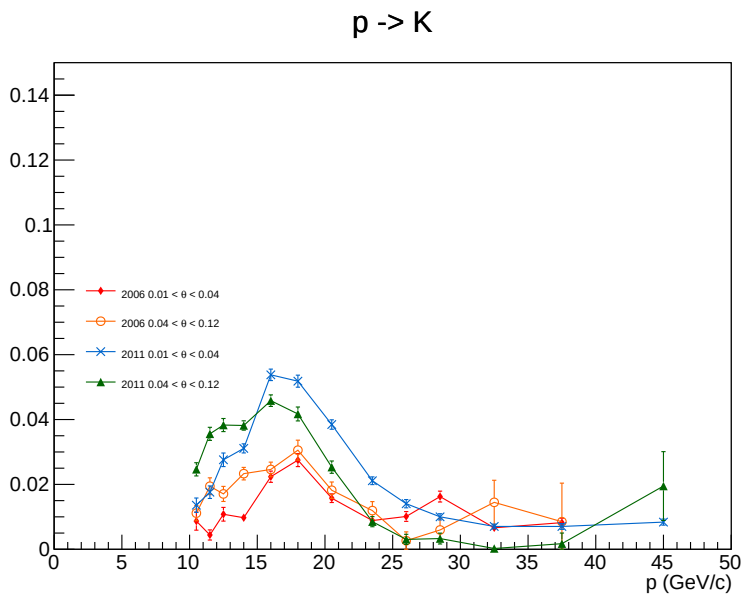


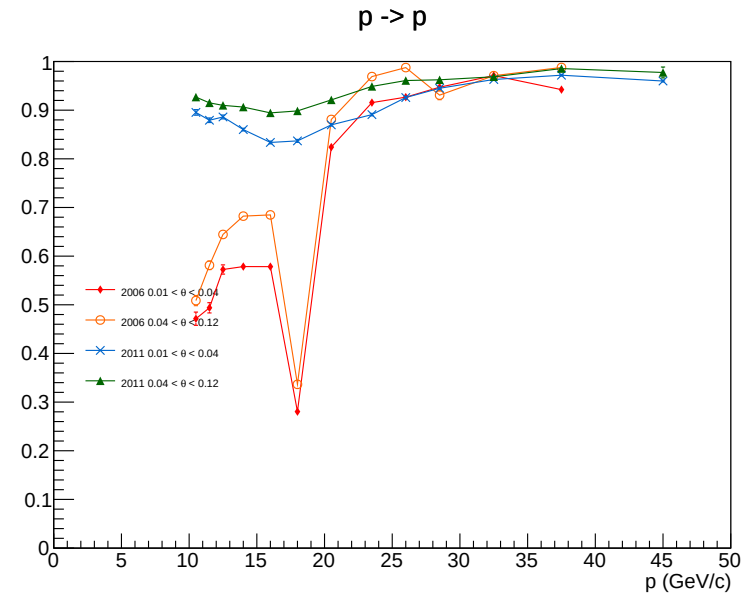


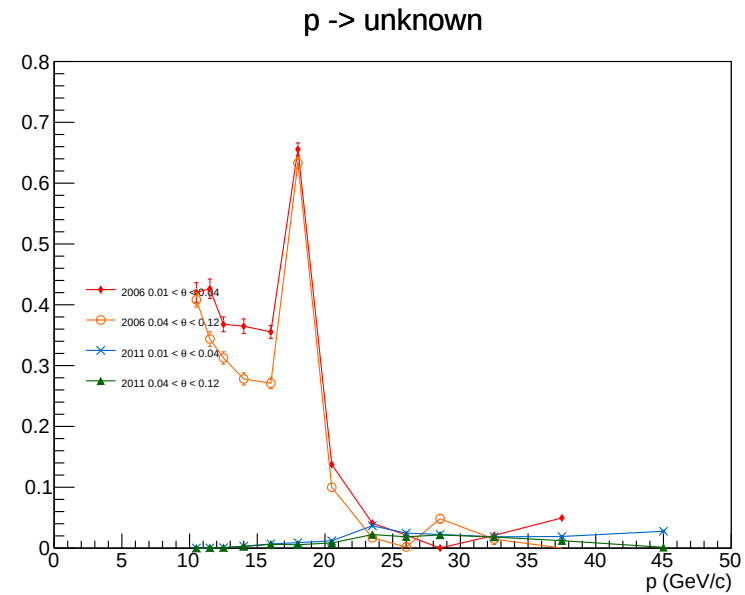


RICH p comparison with Quiela(2006)









Summary

- RICH efficiency table for 2011 created
- Two different sets of LH cuts
- Results compared with the 2006 tables