# RICH Reconstruction working progress

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- Reconstruction Algorithm
- RICH Reconstruction Performance for p/K only

  MC p-C run: 10,000 events
- Summary & Next Step

# Reconstruction Algorithm

- Exact calculation of number of photoelectrons
- Likelihood calculation
- Fit ring with reconstructed particle ID radius
  - For all good fits, eliminate overlapping digits
- Redo likelihood calculation

# Reconstruction Algorithm

- Get Track Info

  momentum & ring center

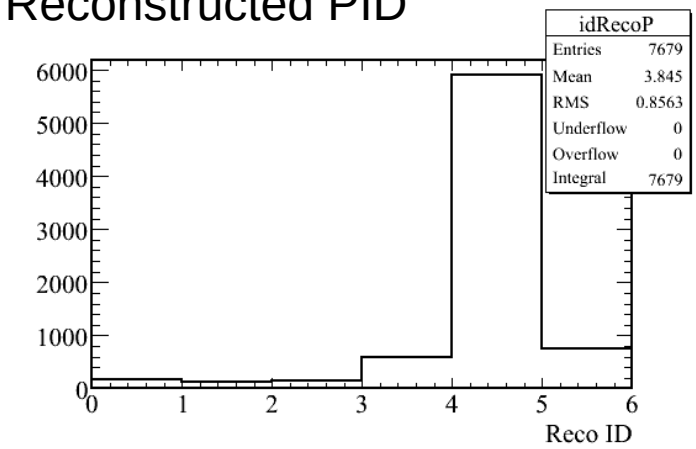
- Analysis
  - Given a momentum, define signal region: smallest $r_p$ to largest $r_e$
  - For each particle hypothesis $j$, compute the expected number of photoelectrons $n_i$ for every PMT $i$ in the signal region and calculate likelihood $L_j$
- In this study, use MCCRICHHit2 to find track information

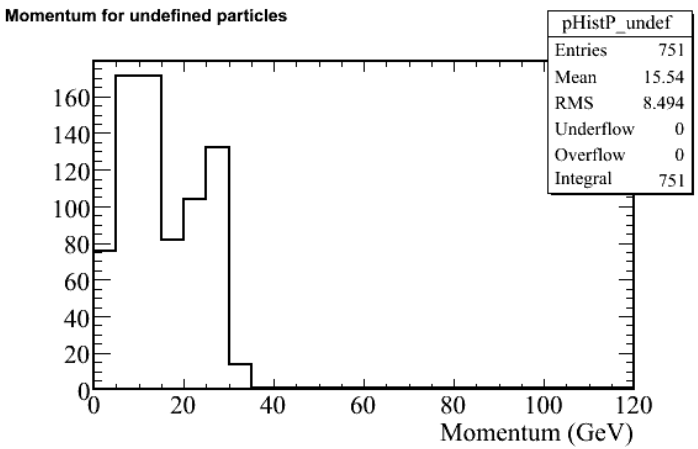
# True p Identification

RICH PID
- *0 Electron*
- *1 Muon*
- *2 Pion*
- *3 Kaon*
- *4 Proton*
- *5 Undefined*

## Before

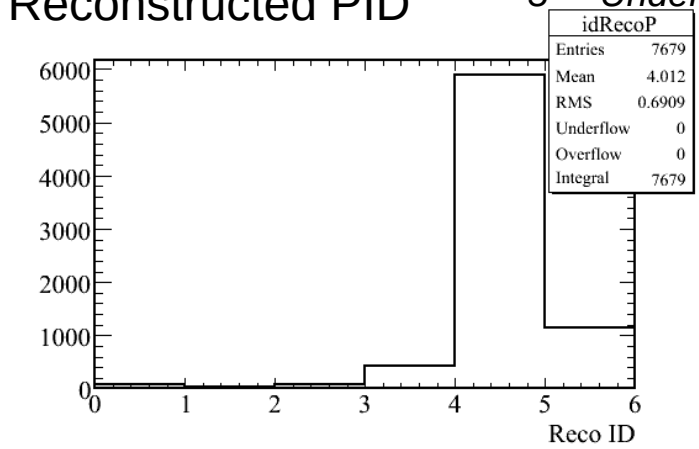
Reconstructed PID

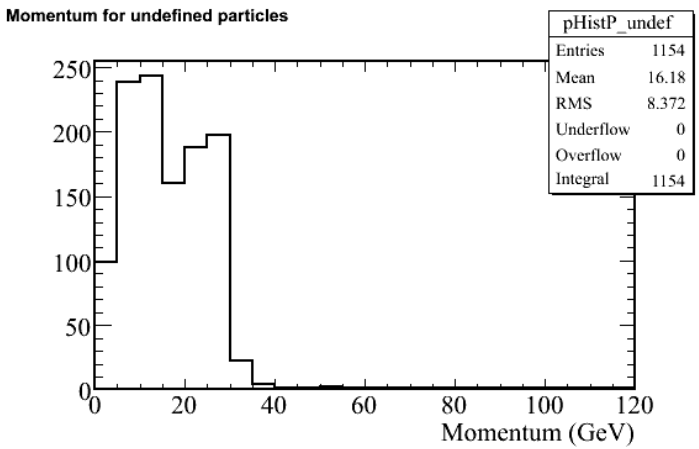



## After

Reconstructed PID



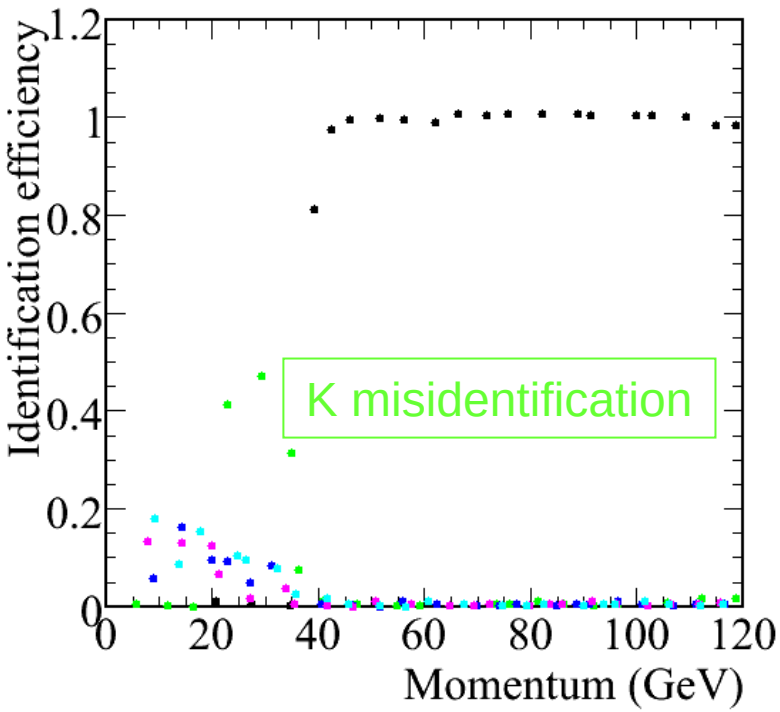

Almost all undefined particles are below p threshold ~33GeV

# True p Identification

RICH Reco PID
*Electron*
*Muon*
*Pion*
*Kaon*
*Proton*

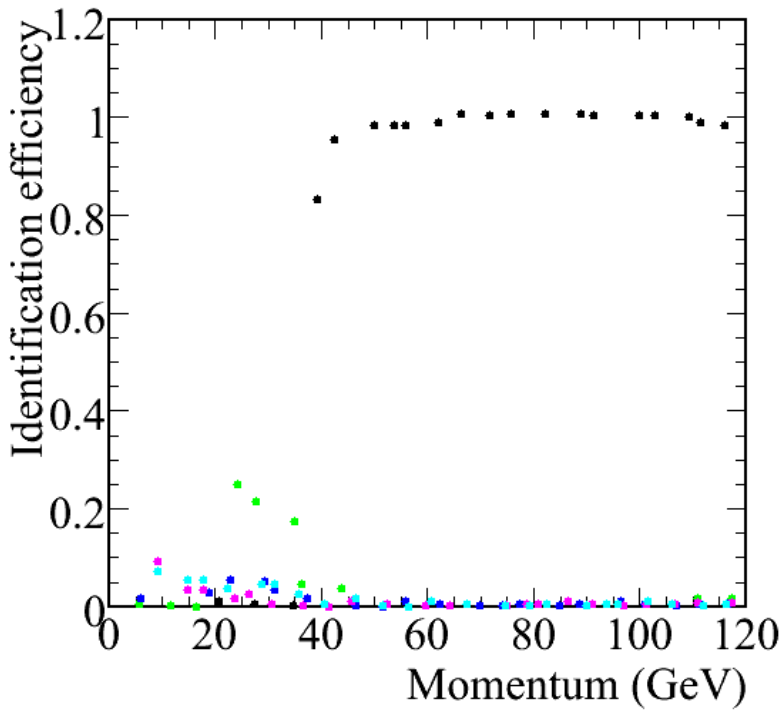
Before

Efficiency of p identification vs momentum




After

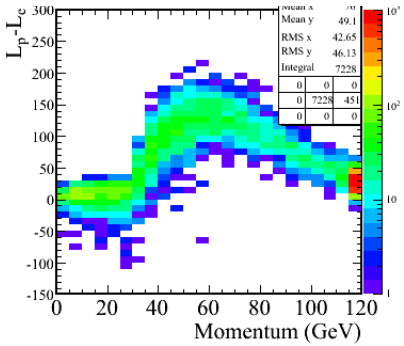
Efficiency of p identification vs momentum



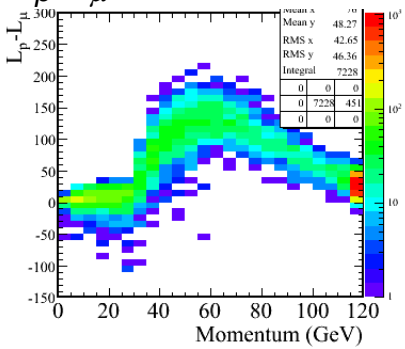
# True p Identification

## Before

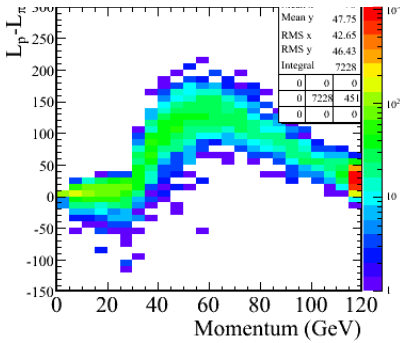
$L_p$-$L_e$ vs momentum



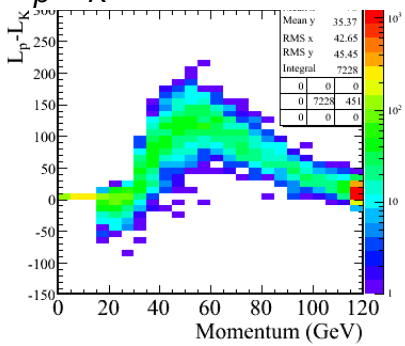

$L_p$-$L_\mu$ vs momentum




$L_p$-$L_\pi$ vs momentum

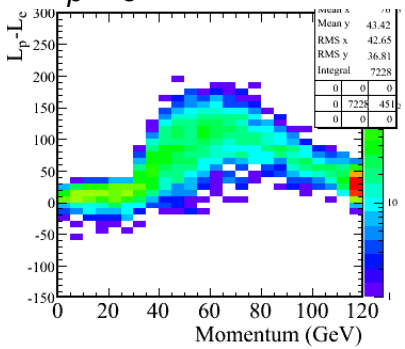



$L_p$-$L_K$ vs momentum

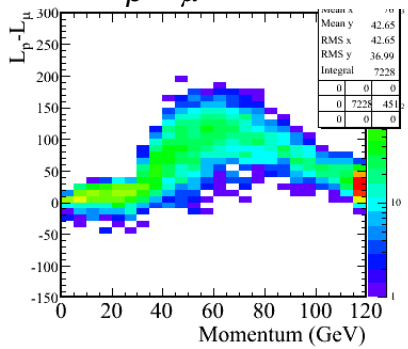



## After

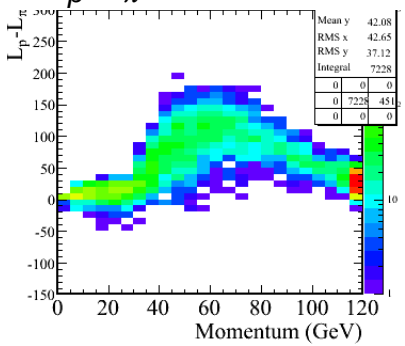
$L_p$-$L_e$ vs momentum



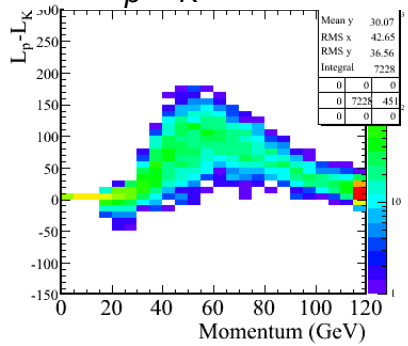

$L_p$-$L_\mu$ vs momentum




$L_p$-$L_\pi$ vs momentum




$L_p$-$L_K$ vs momentum

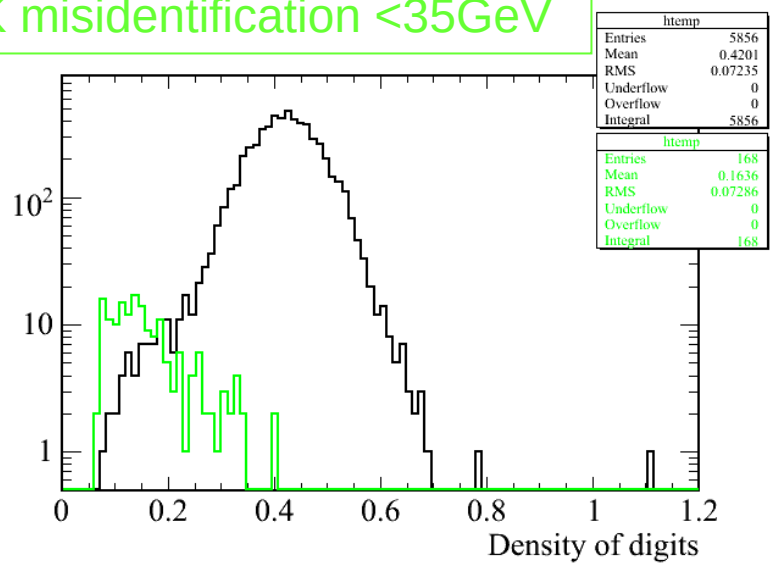



Cut on likelihood difference < 50?

# Density of PMTs in a given ring

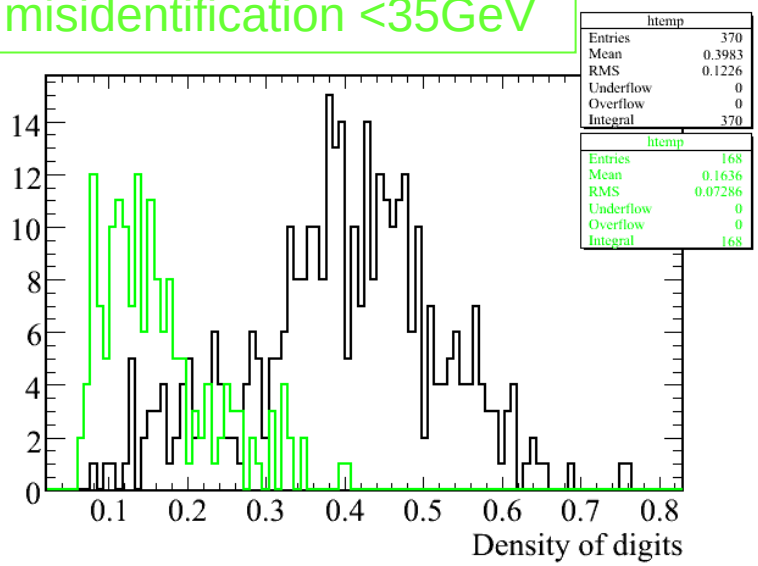
True P identification

K misidentification <35GeV




True K identification

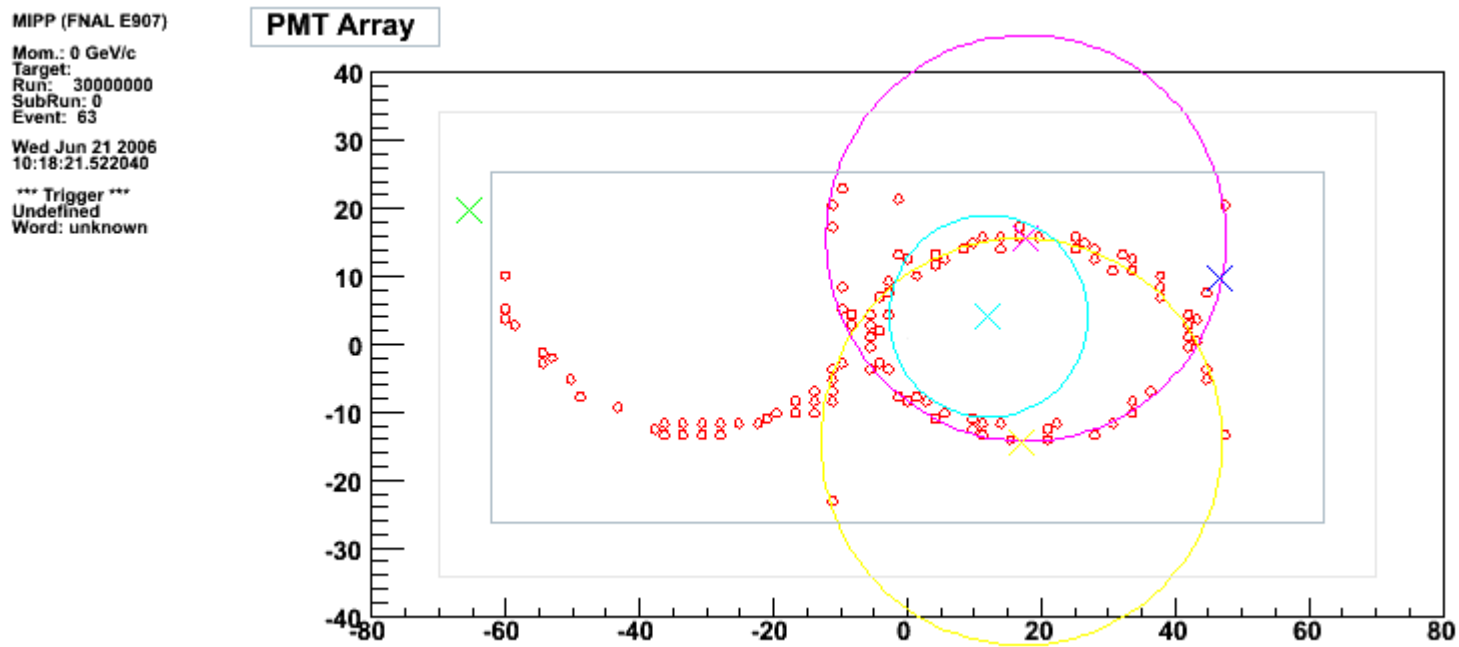
K misidentification <35GeV




Density of digits =

(observed PMTs)/(expected PMTs)/(ring area)/(2πR)

# Event Display 63




*Two particles correctly identified.*

*However, p is misidentified as K!*

*Divide density calculation into segments……*

# Summary & Next Step

- Timing: 10,000 events took ~75 mins
- Problems with reconstruction
  - Misidentify tracks have no rings (improved, but still need some more work)
  - Rings with no track?
- Next step
  - More careful study on misidentification events
  - Divide PMT density calculation into segments