

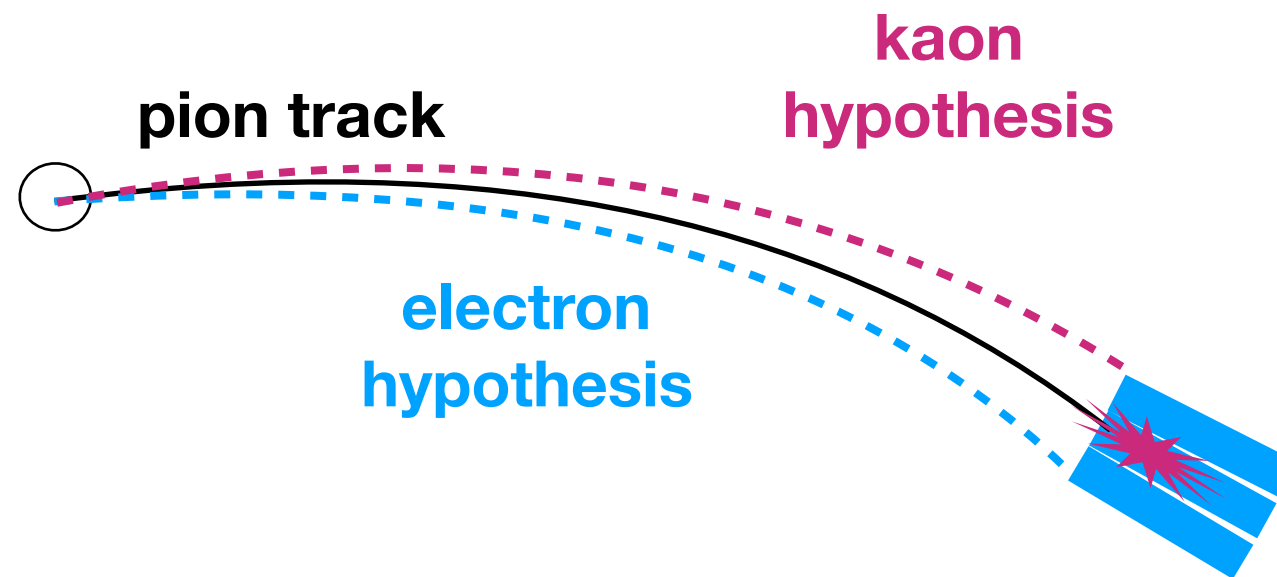
# Remarks on Tracking in PID

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PANDA PID Computing Workshop, May 3.-4. 2018



# Particle Hypothesis in Tracking



- No effect on pure helix fit
- Kalman Filter estimates while going along the track:
  - energy loss --> effect on curvature/momentum
  - scattering --> effect on covariance
- In principle there are different results for the hypotheses

# How to access in PandaRoot?

A. Run Kalman with custom hypothesis:

- `PndRecoKalmanTask::SetParticleHypo(int pdg)`

B. Run all 5 hypotheses together:

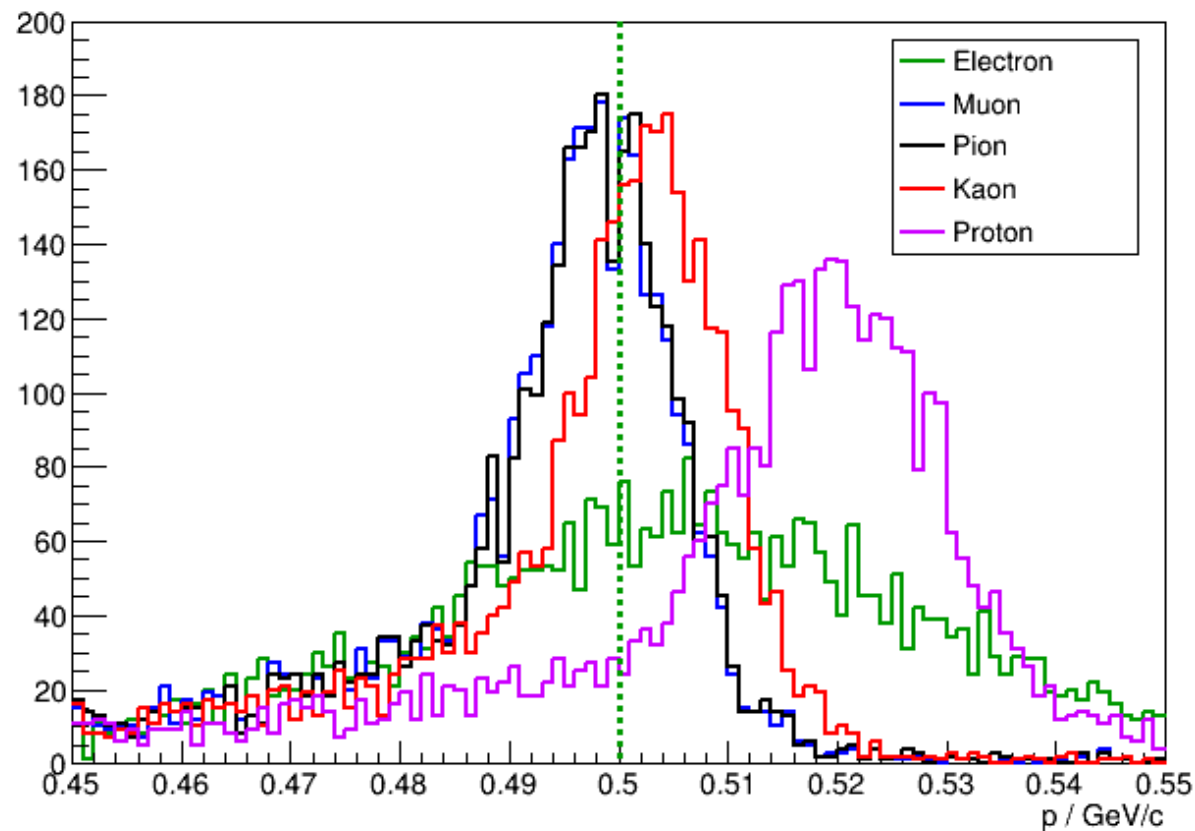
- `PndRecoMultiKalmanTask`
- 5 `TClonesArrays` available, usable in the PID stage



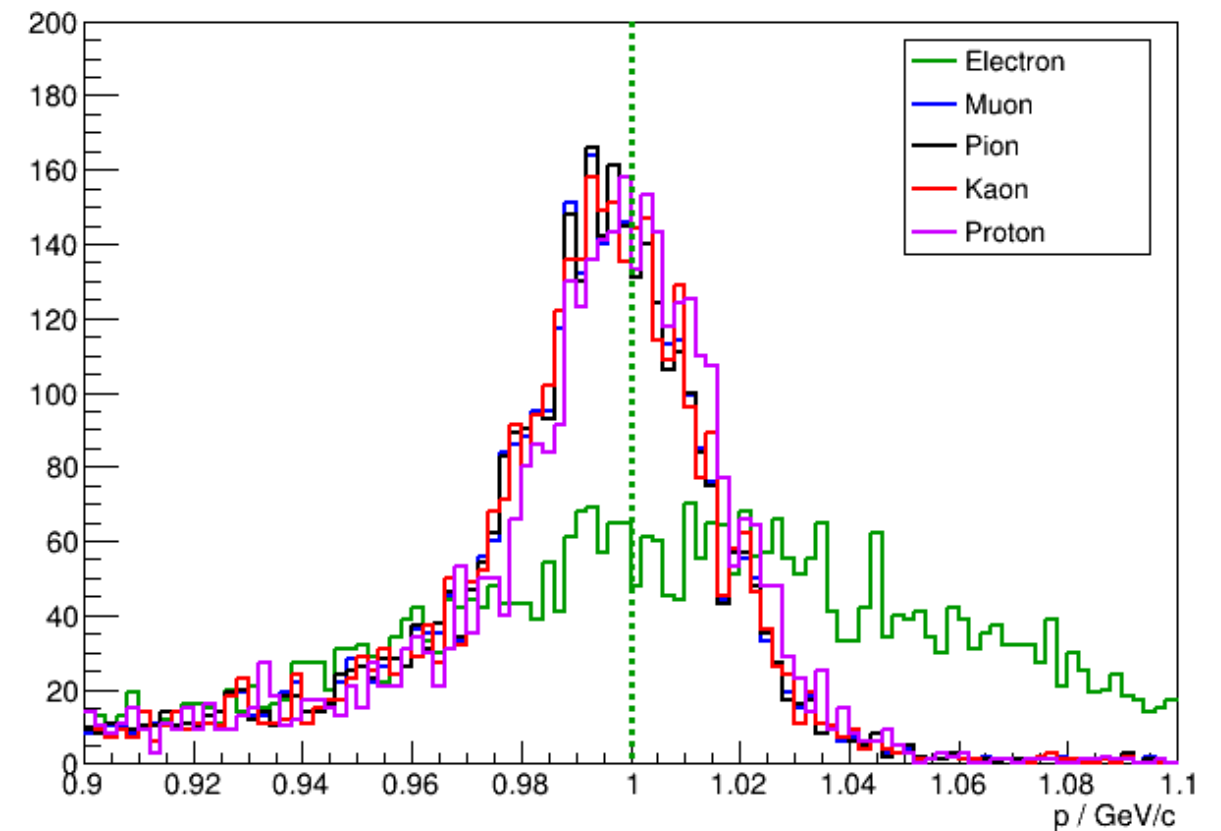
- PID accepts only one track array, so work still needed here

# Effect on Momentum Reconstruction

0.5 GeV/c Electrons



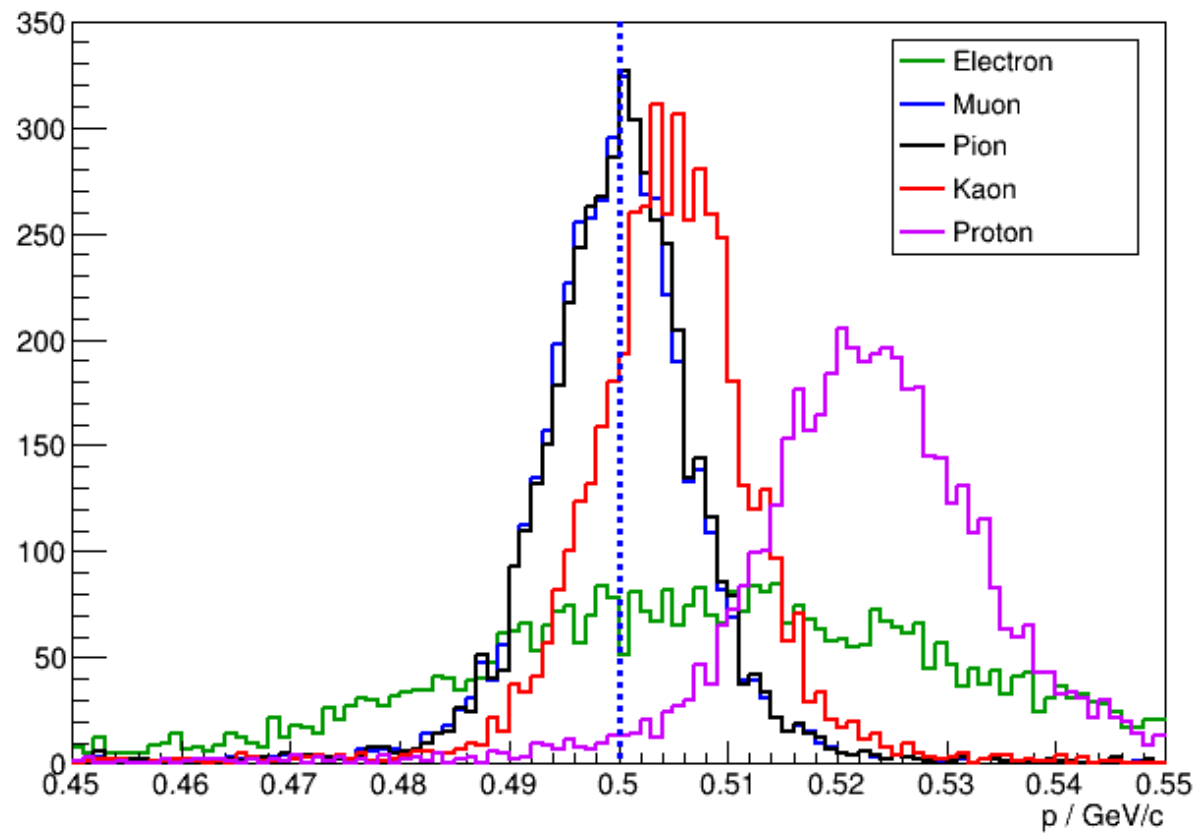
1 GeV/c Electrons



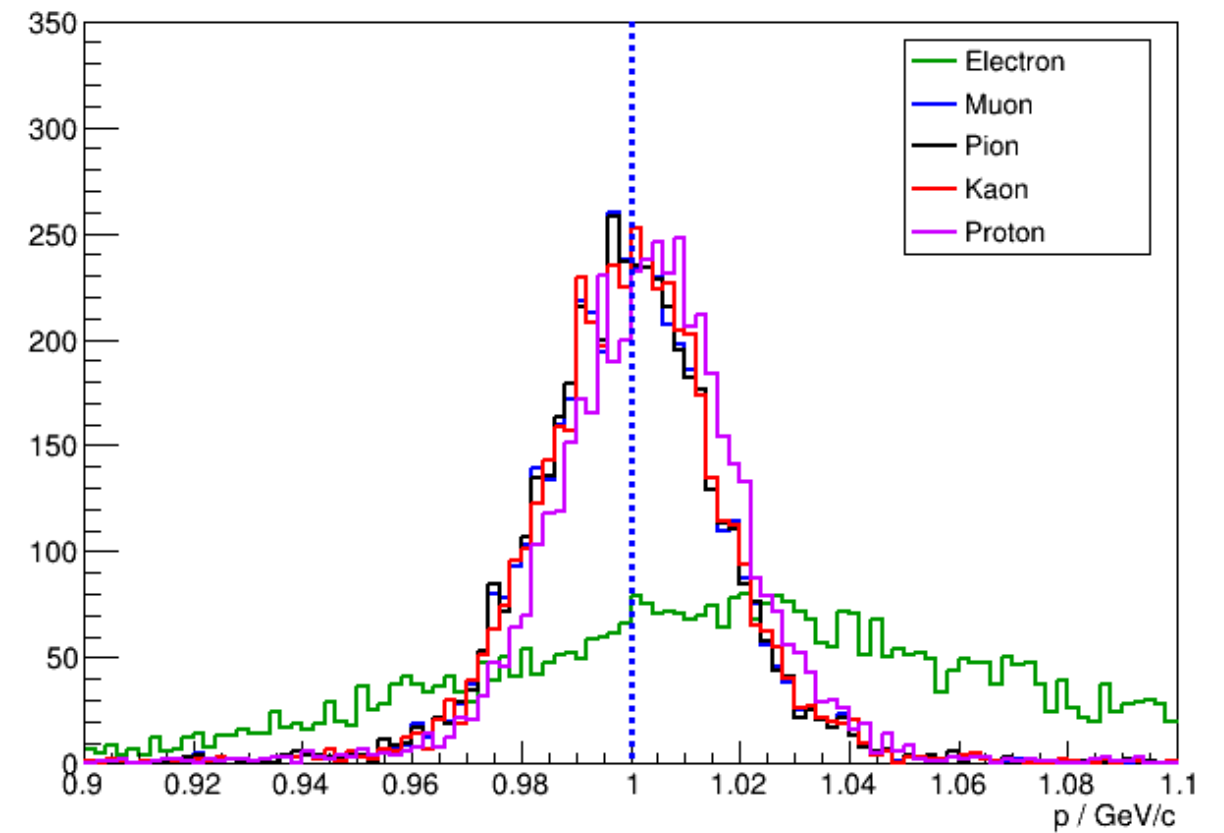
- Simulations: 5000 single tracks (e,mu,pi,K,p) in 40-120deg in theta, genfit1 & GEANE
- Bad electron reconstruction with electron hypothesis
- Maybe GEANE's electron treatment (straggeling) is wrong

# Effect on Momentum Reconstruction

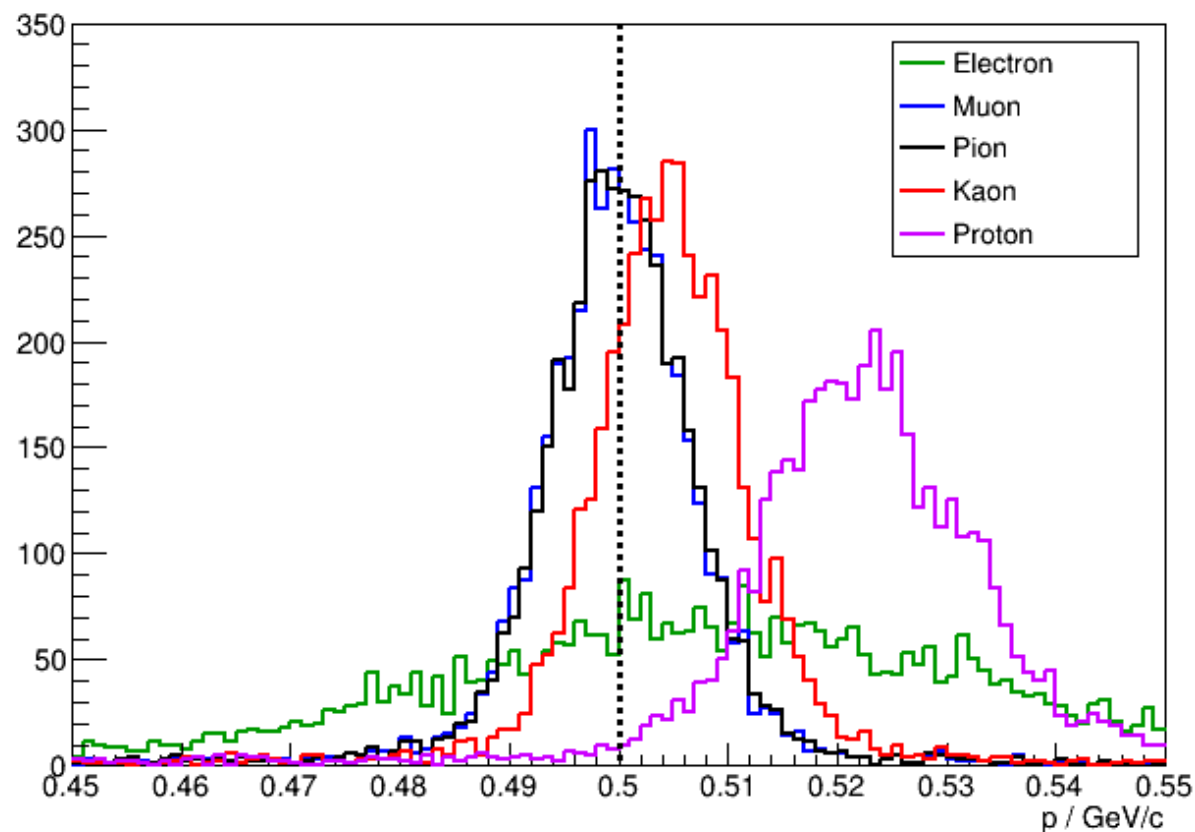
0.5 GeV/c Muons



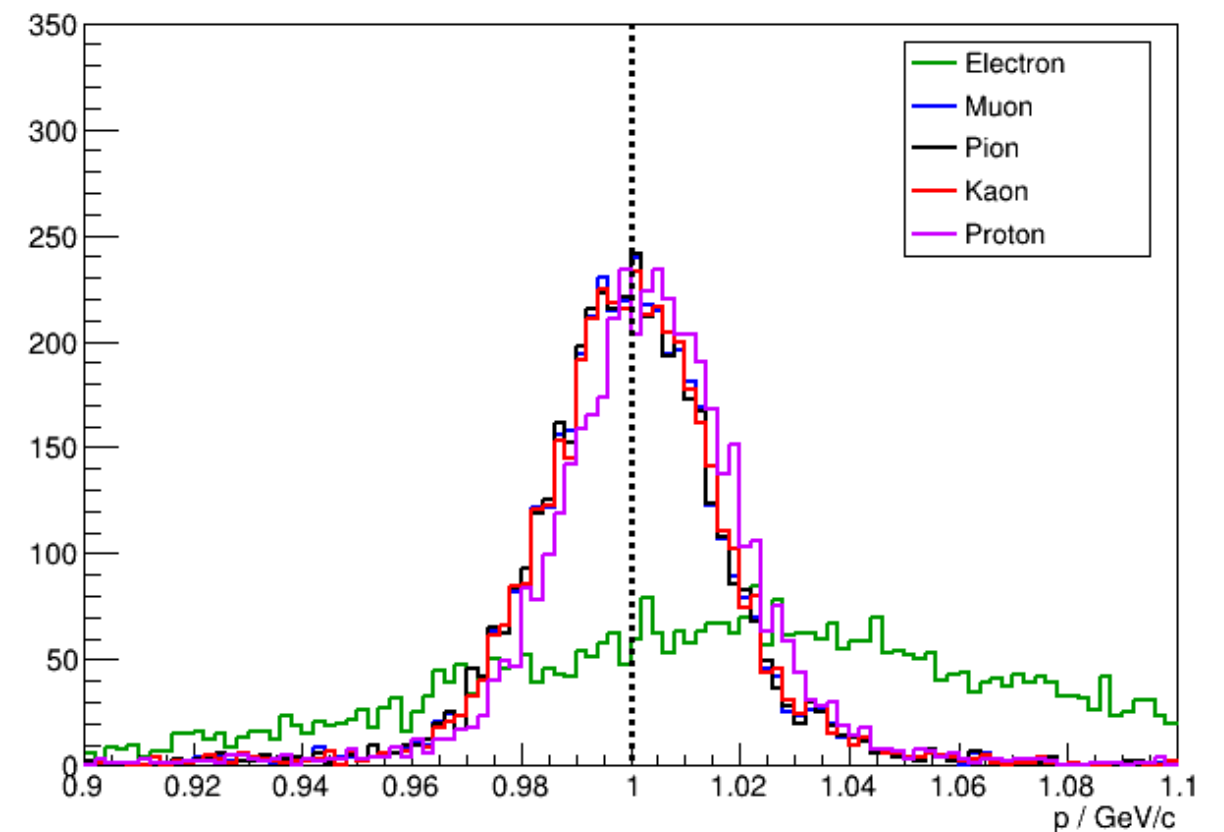
1 GeV/c Muons



0.5 GeV/c Pions

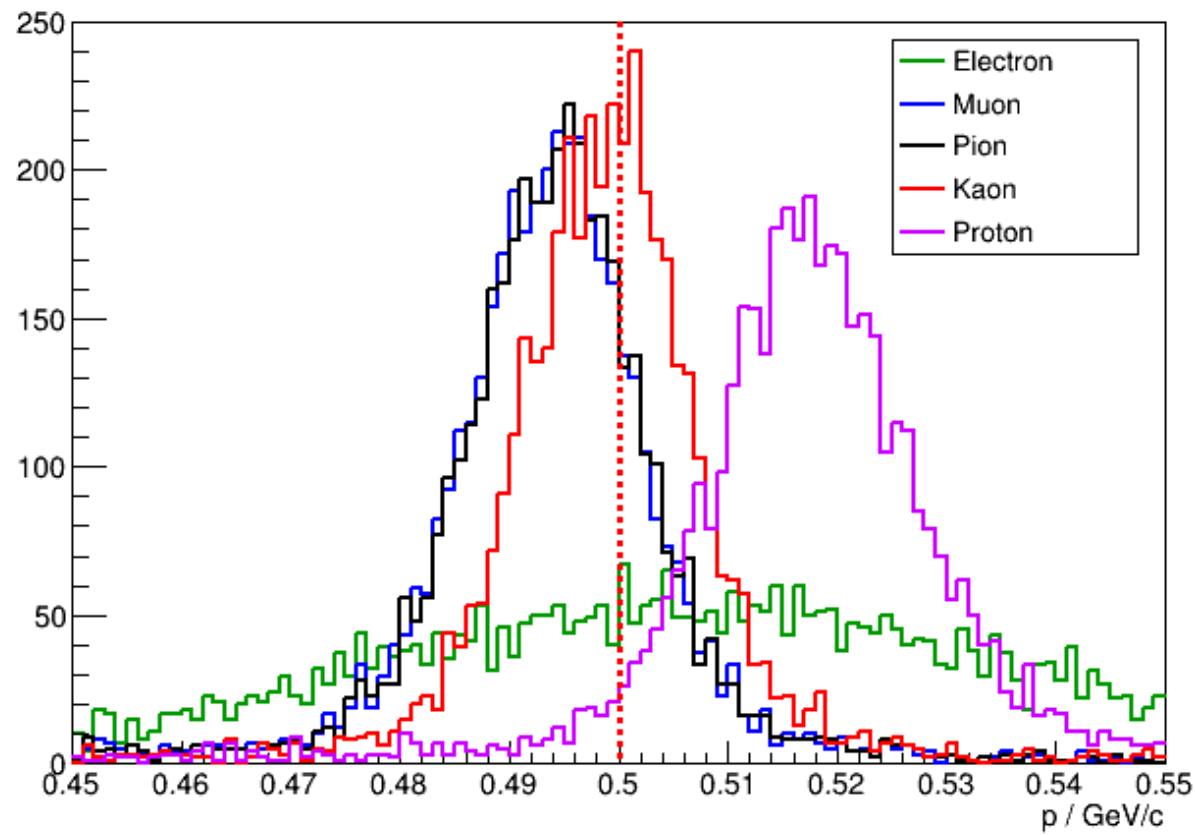


1 GeV/c Pions

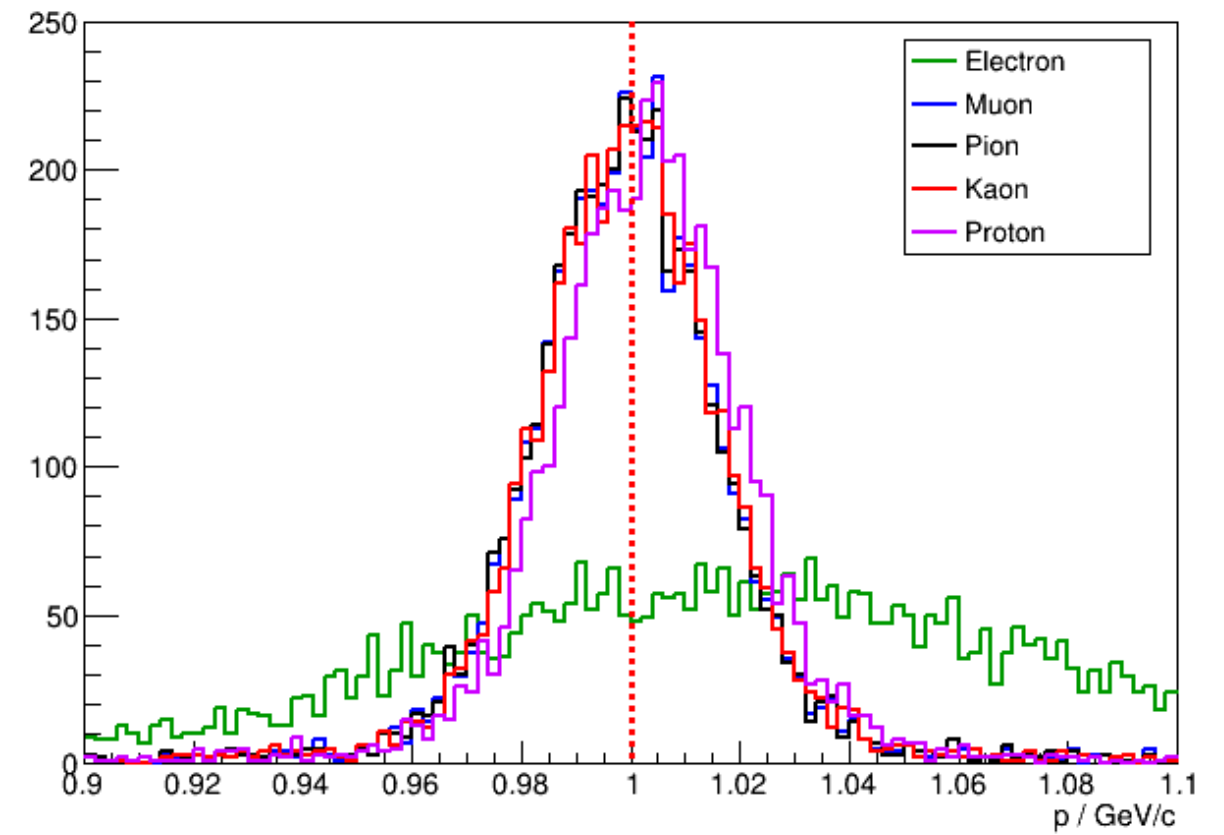


# Effect on Momentum Reconstruction

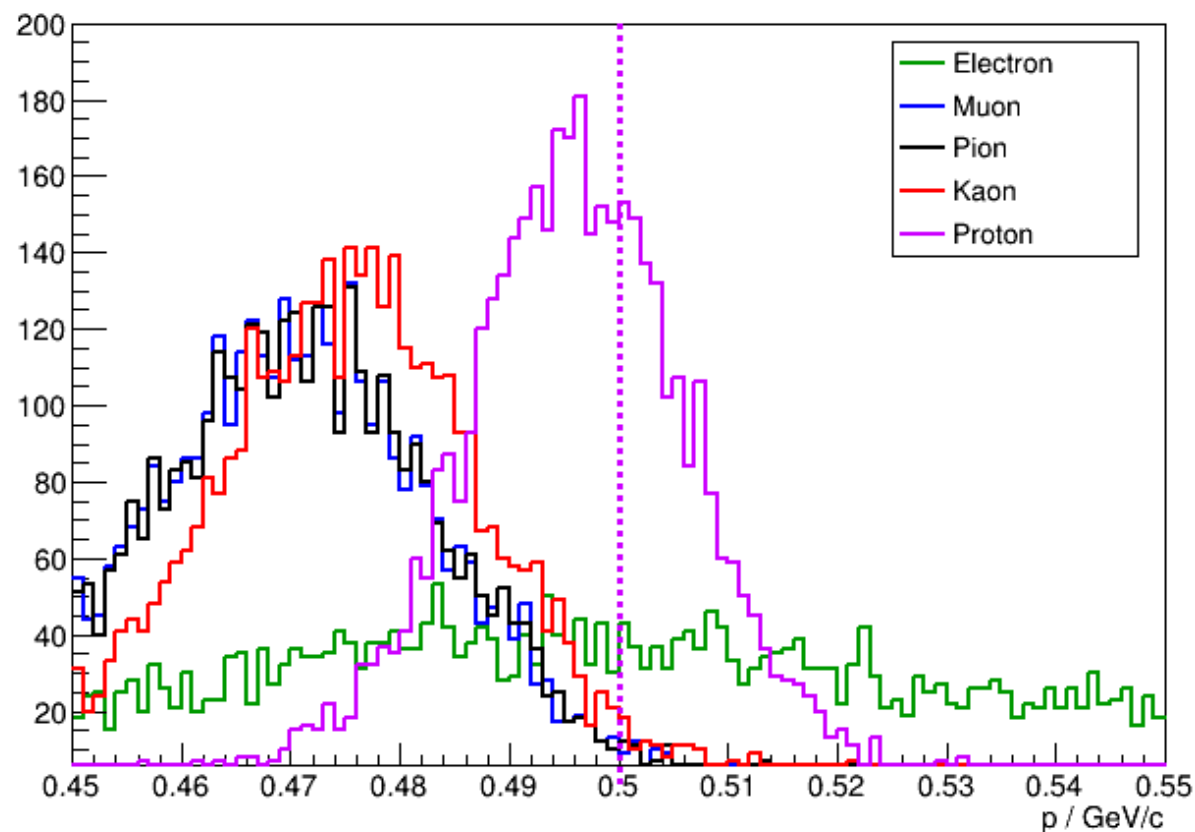
0.5 GeV/c Kaons



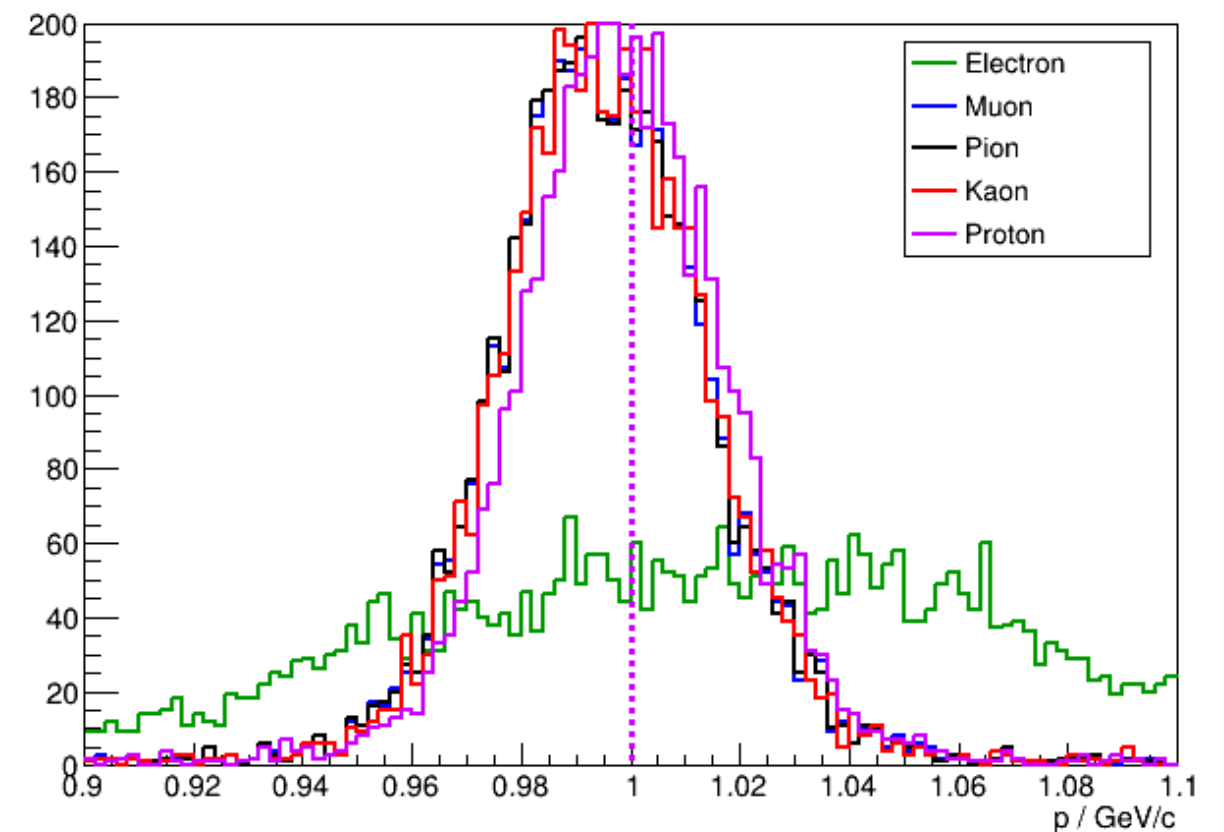
1 GeV/c Kaons



0.5 GeV/c Protons



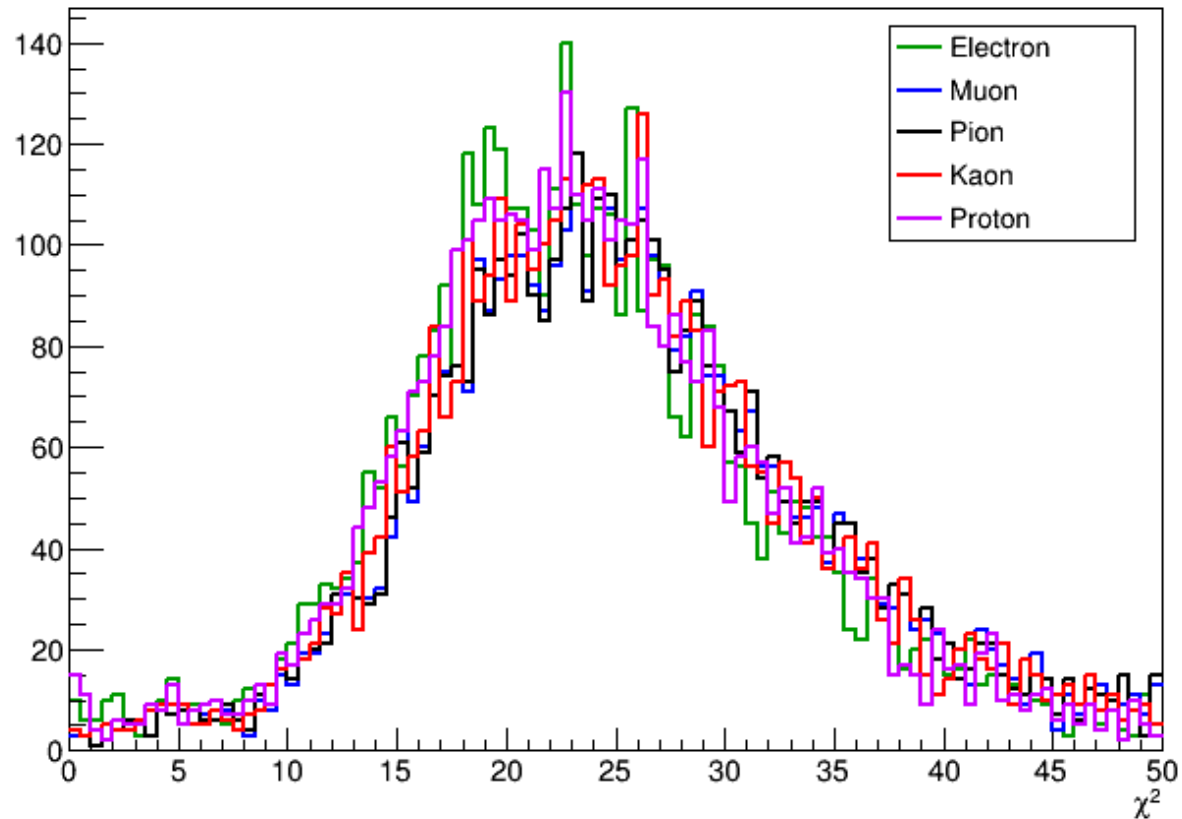
1 GeV/c Protons



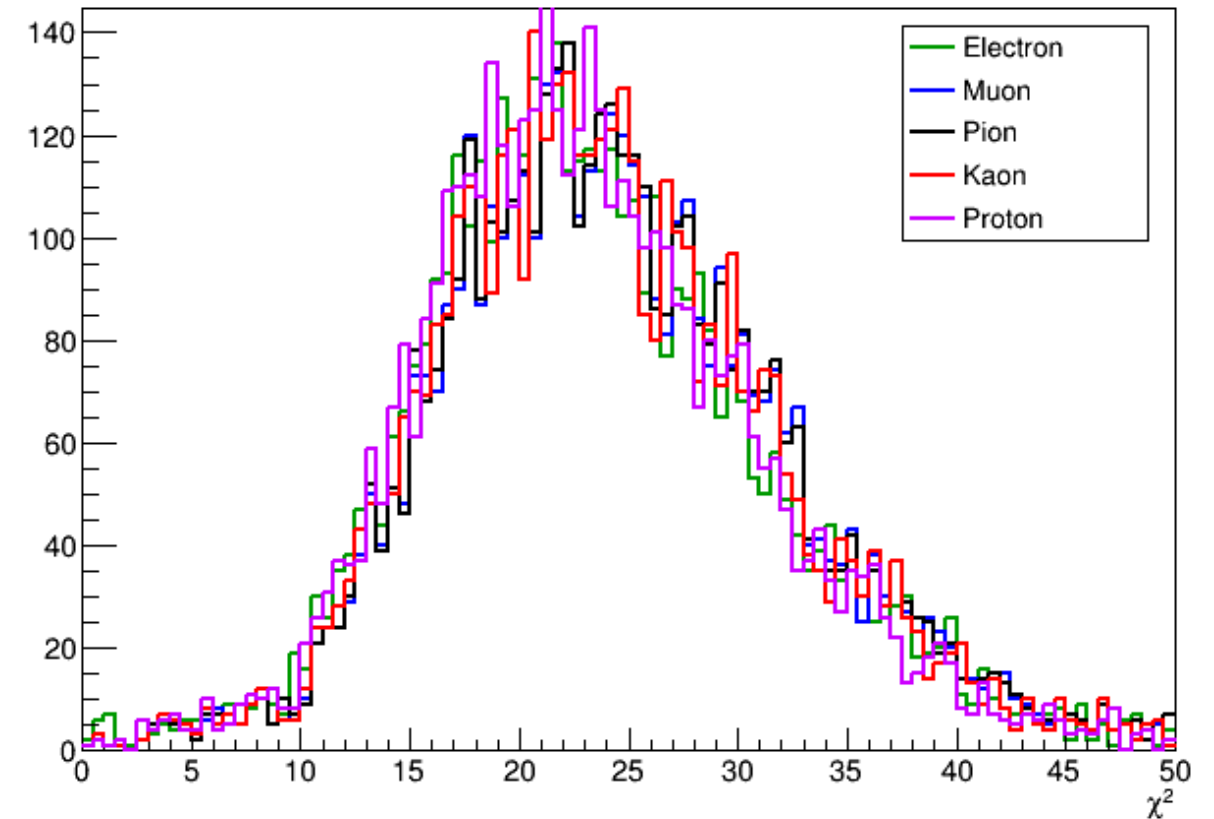
# Tracking Quality useable for PID?

--> Does not look promising

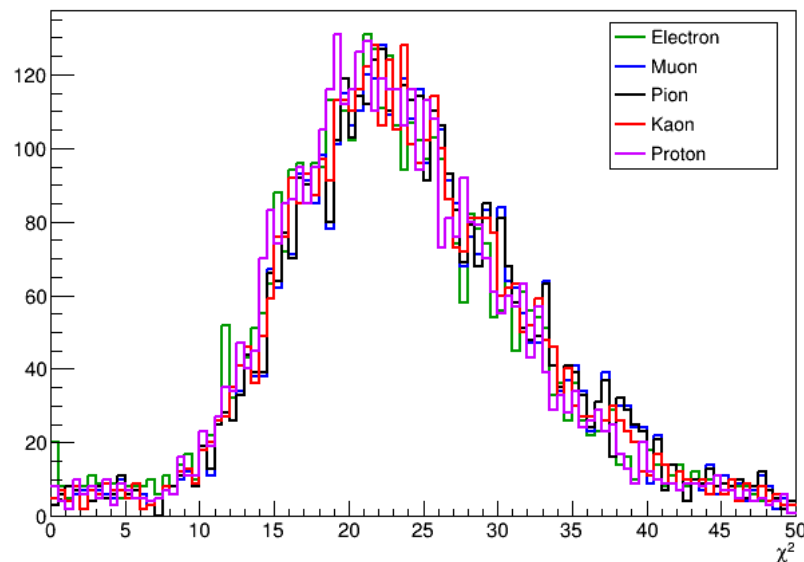
Tracking Chisquare 1GeV/c Electrons



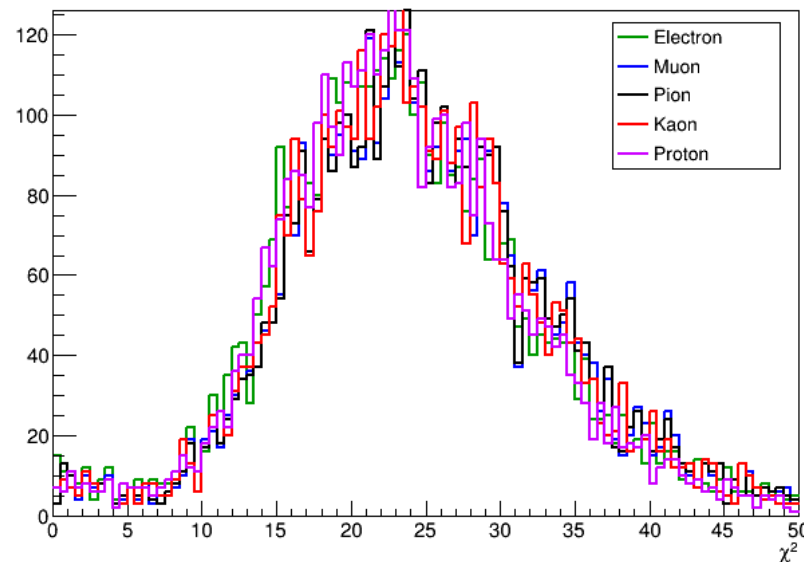
Tracking Chisquare 1GeV/c Muons



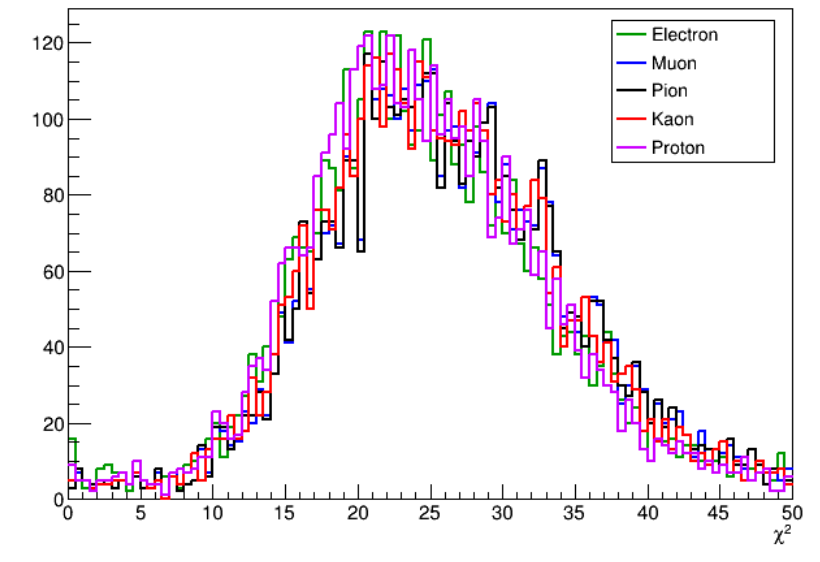
Tracking Chisquare 1GeV/c Pions



Tracking Chisquare 1GeV/c Kaons



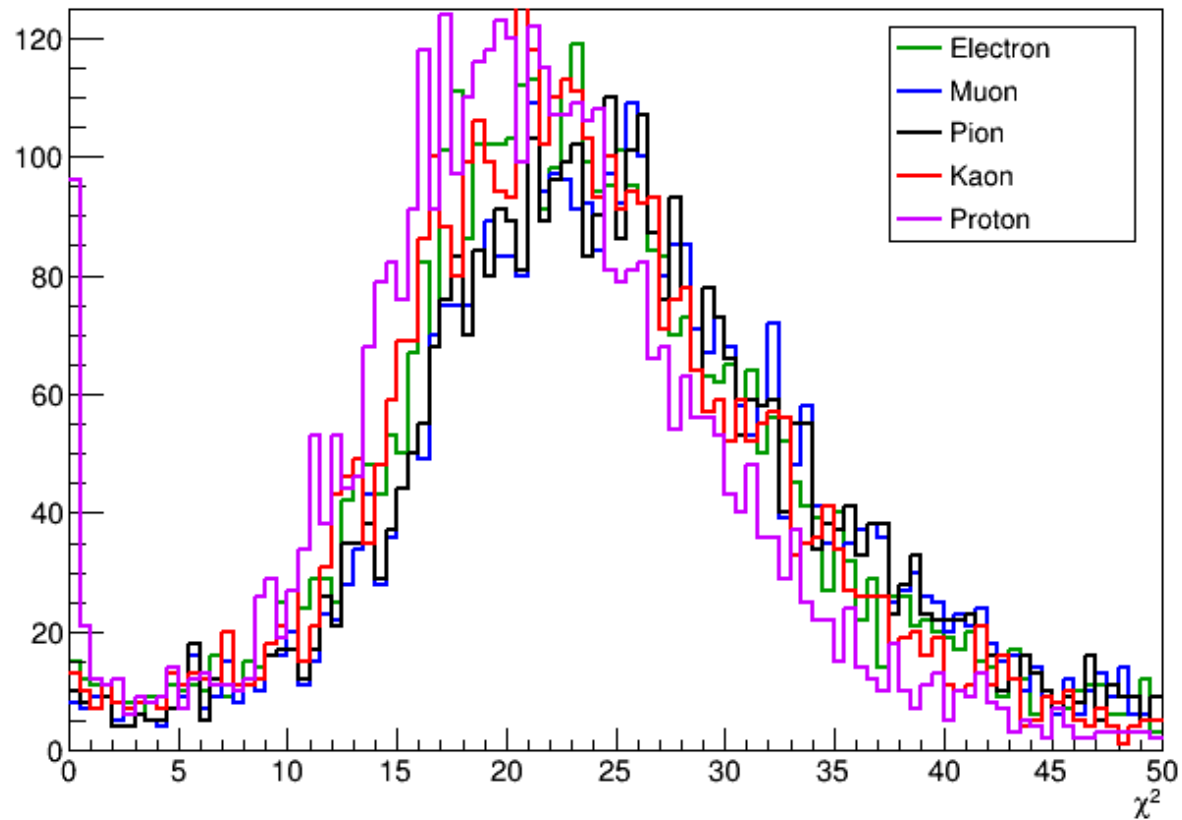
Tracking Chisquare 1GeV/c Protons



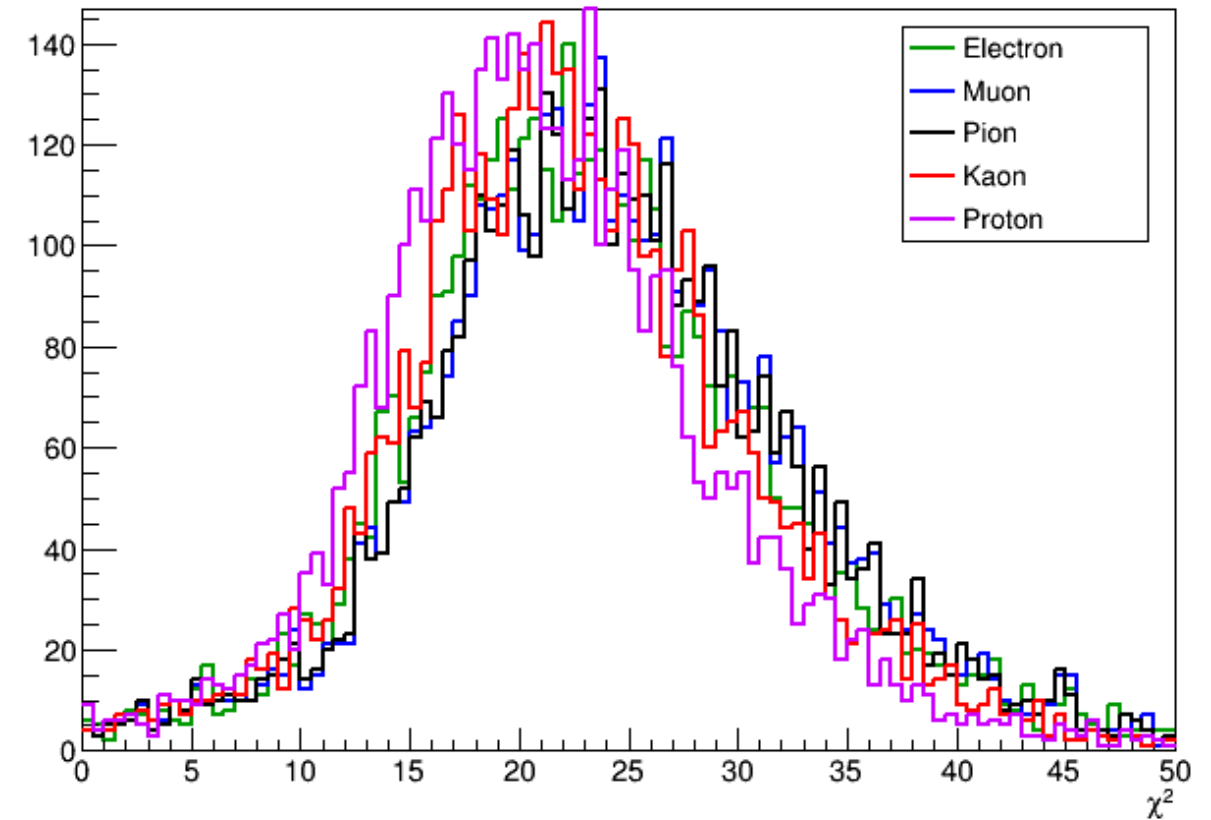
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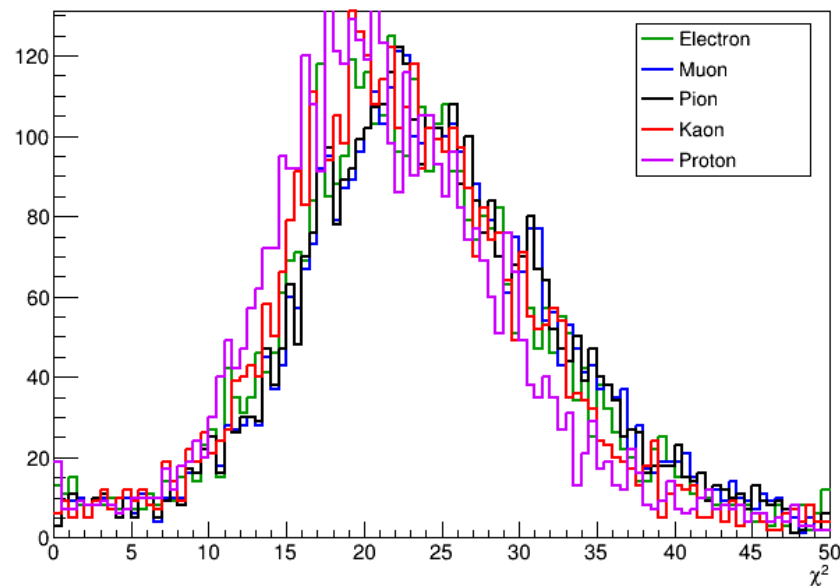
Tracking Chisquare 0.5 GeV/c Electrons



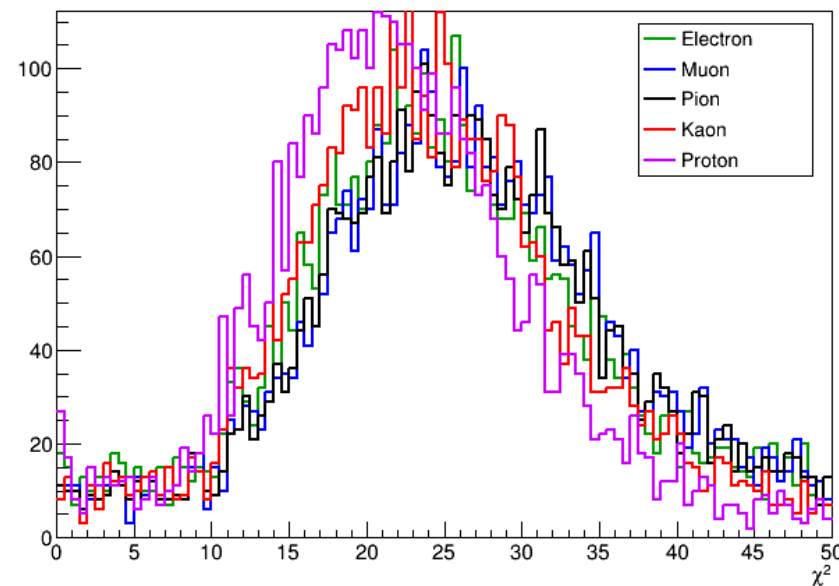
Tracking Chisquare 0.5 GeV/c Muons



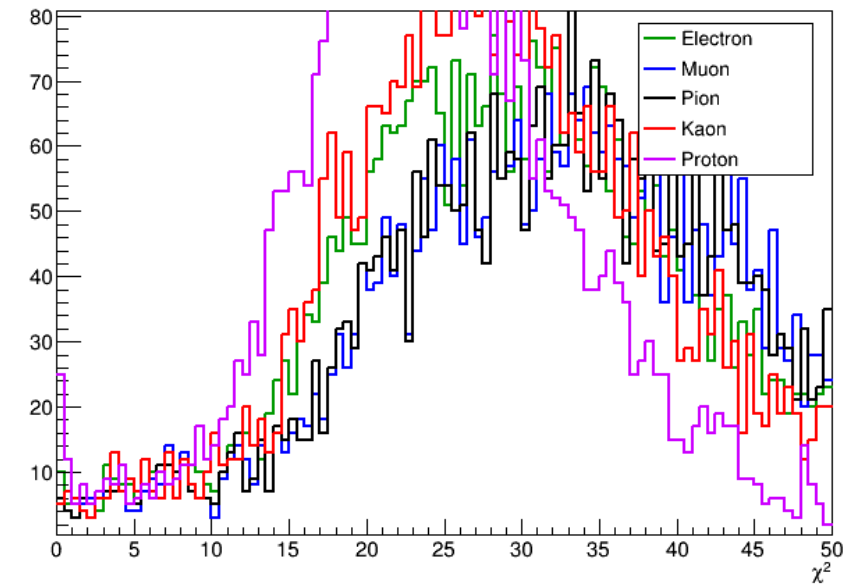
Tracking Chisquare 0.5 GeV/c Pions



Tracking Chisquare 0.5 GeV/c Kaons



Tracking Chisquare 0.5 GeV/c Protons

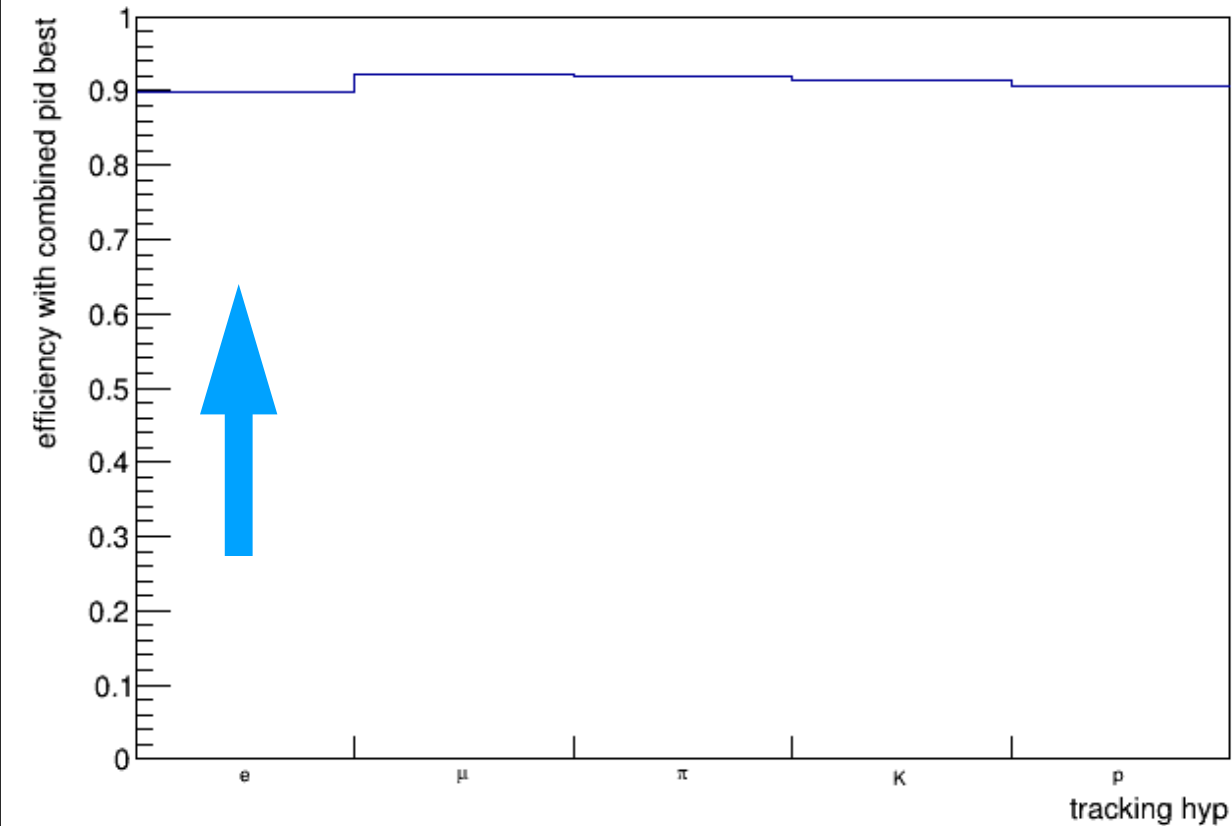




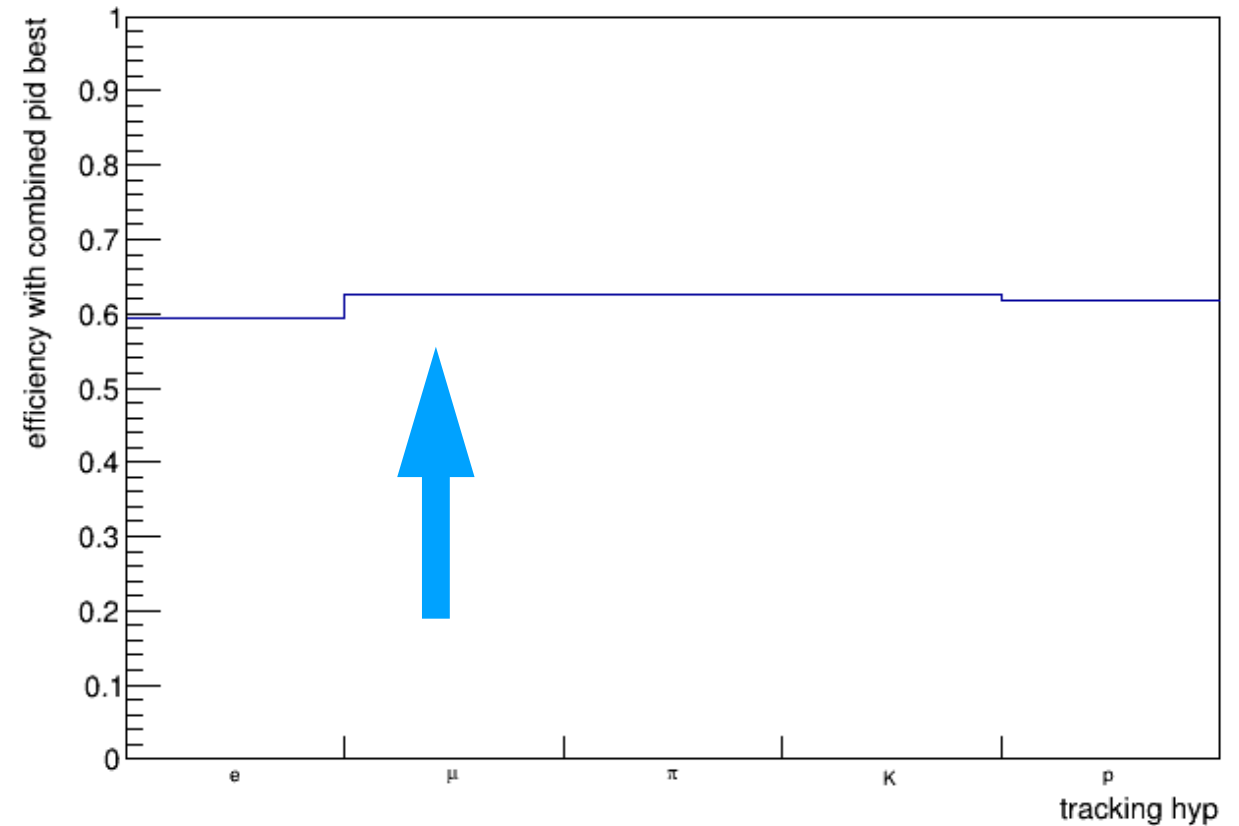
# Best PID vs. Tracking Hyp.

"PidAlgoMvd", "PidAlgoStt", "PidAlgoSciT", "PidAlgoDrc", "PidAlgoEmcBayes"

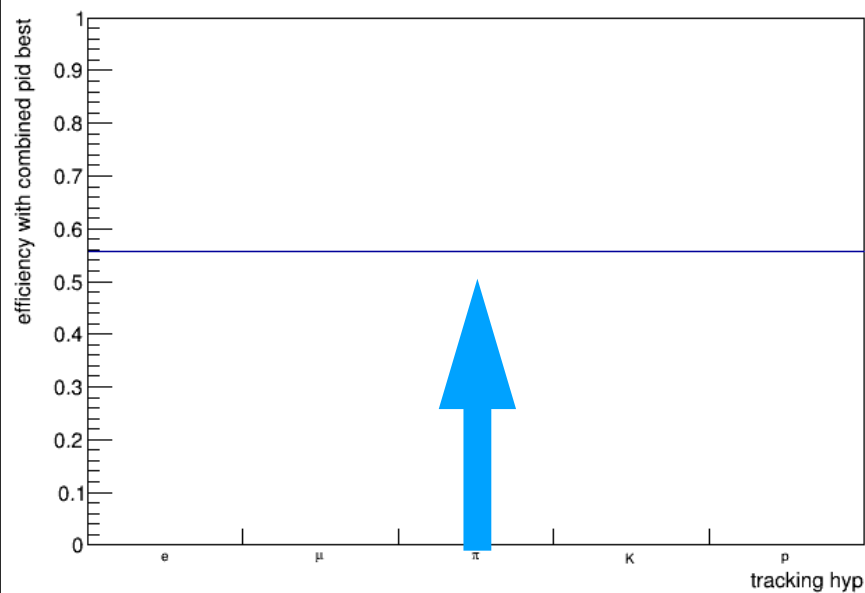
1 GeV/c Electron input



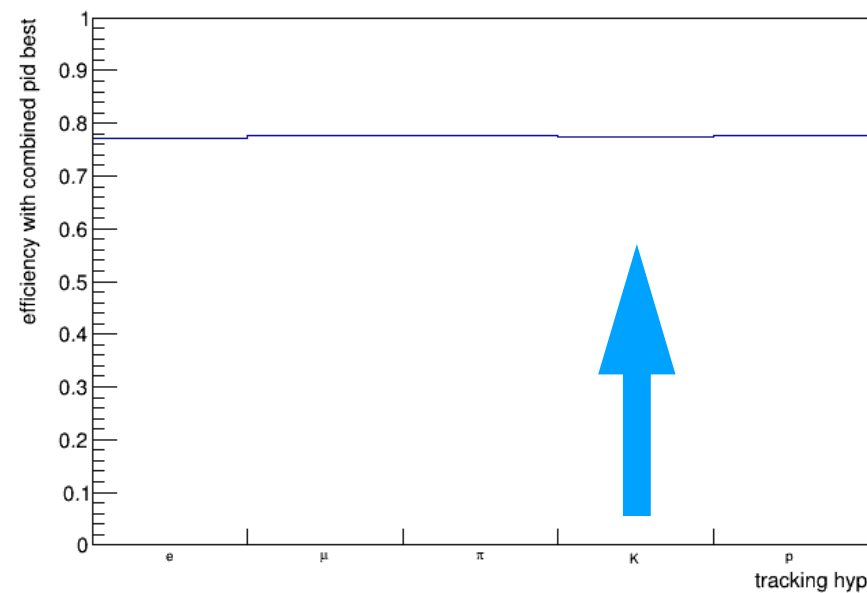
1 GeV/c Muon input



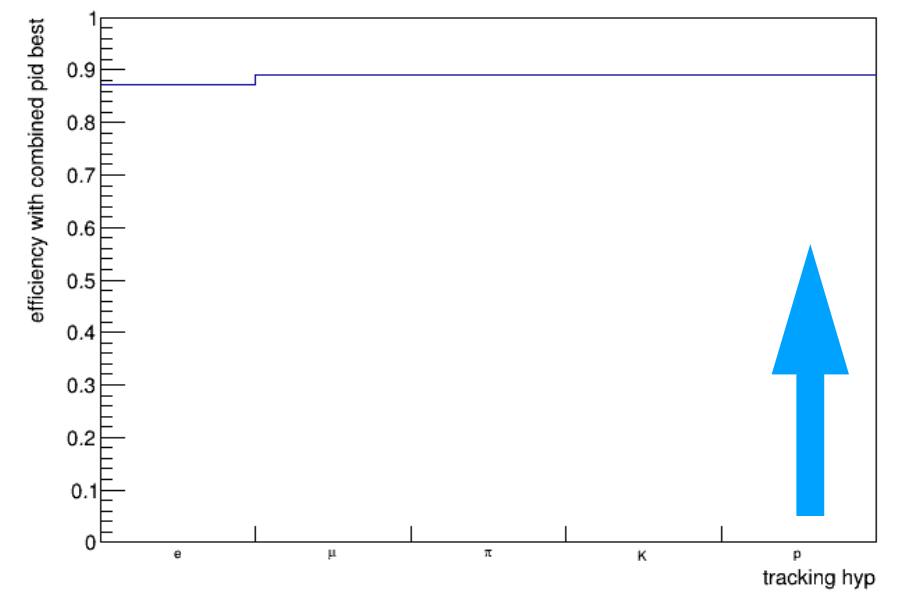
1 GeV/c Pion input



1 GeV/c Kaon input



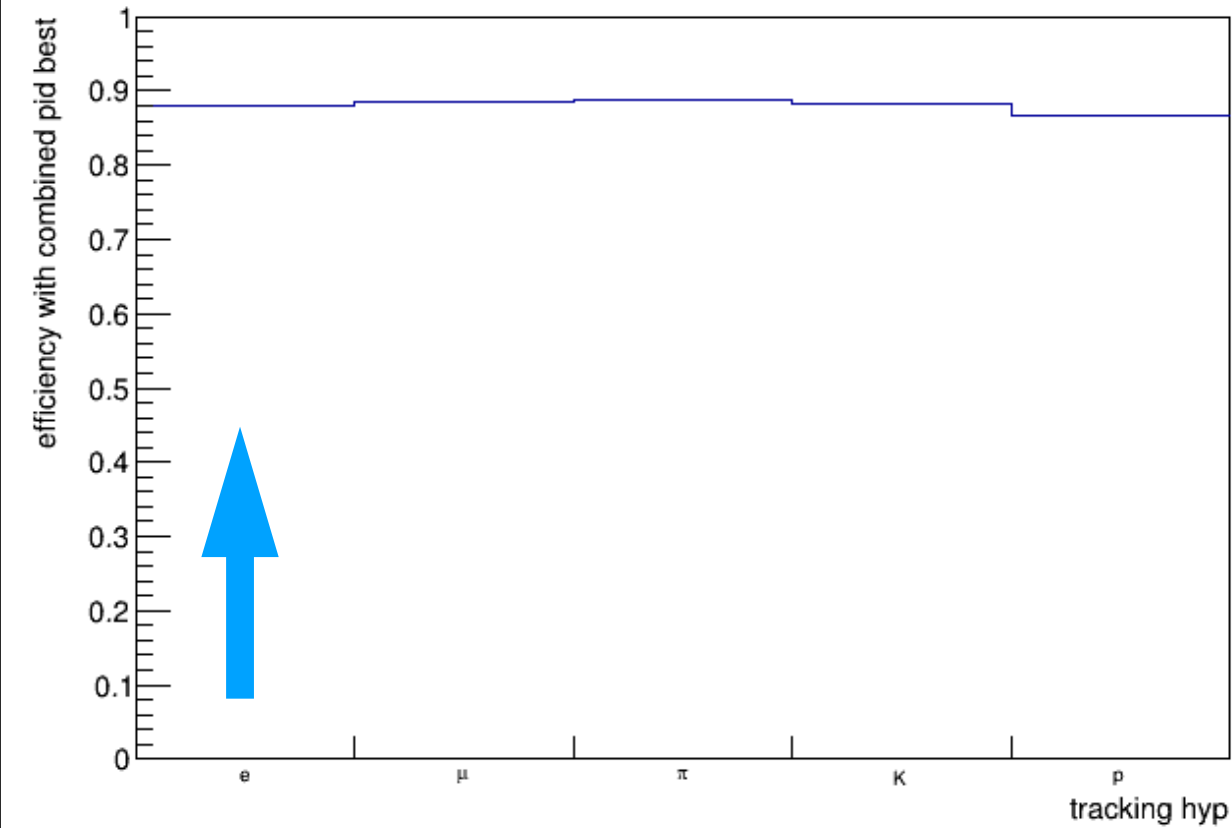
1 GeV/c Proton input



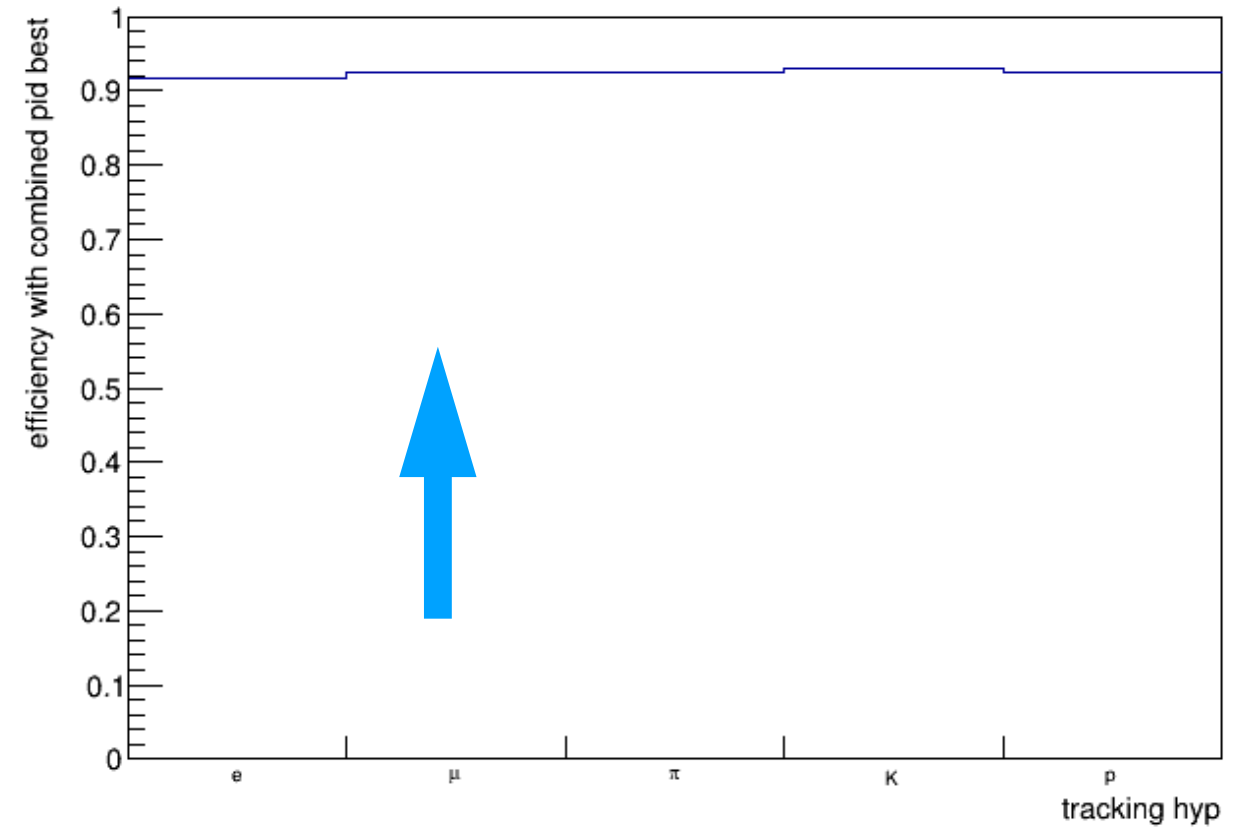
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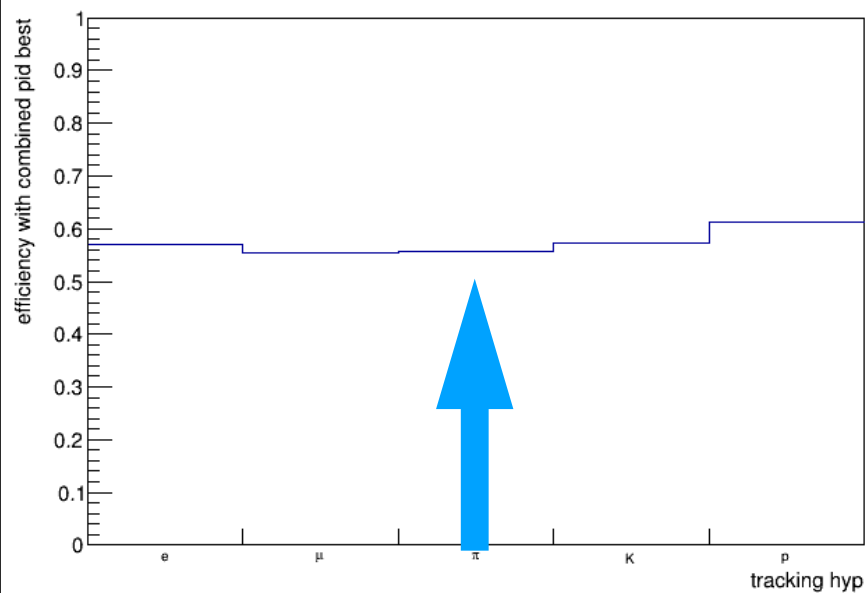
0.5 GeV/c Electron input



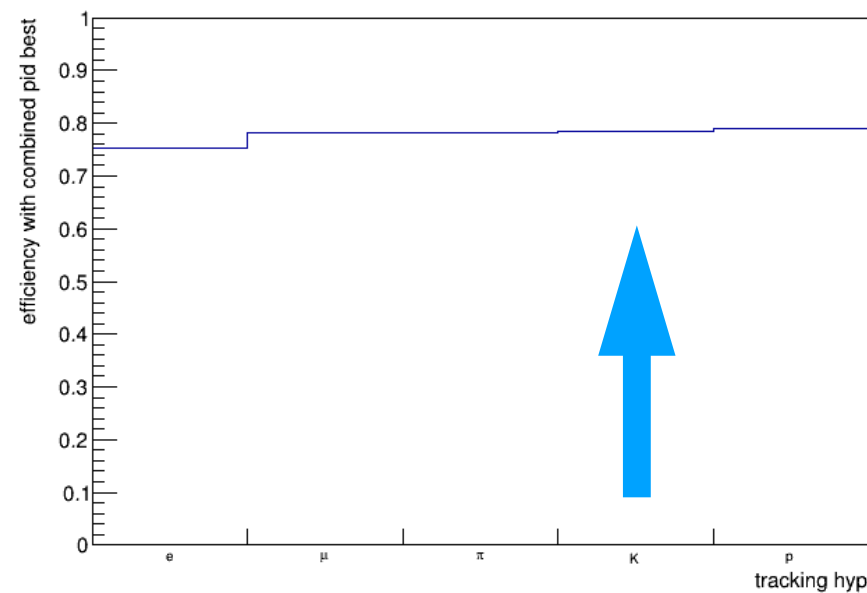
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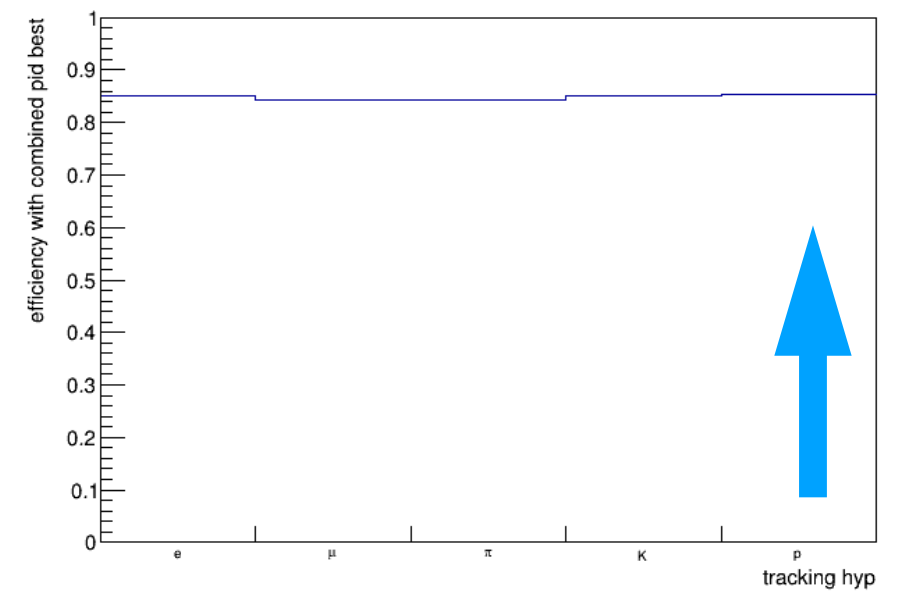
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0.5 GeV/c Kaon input



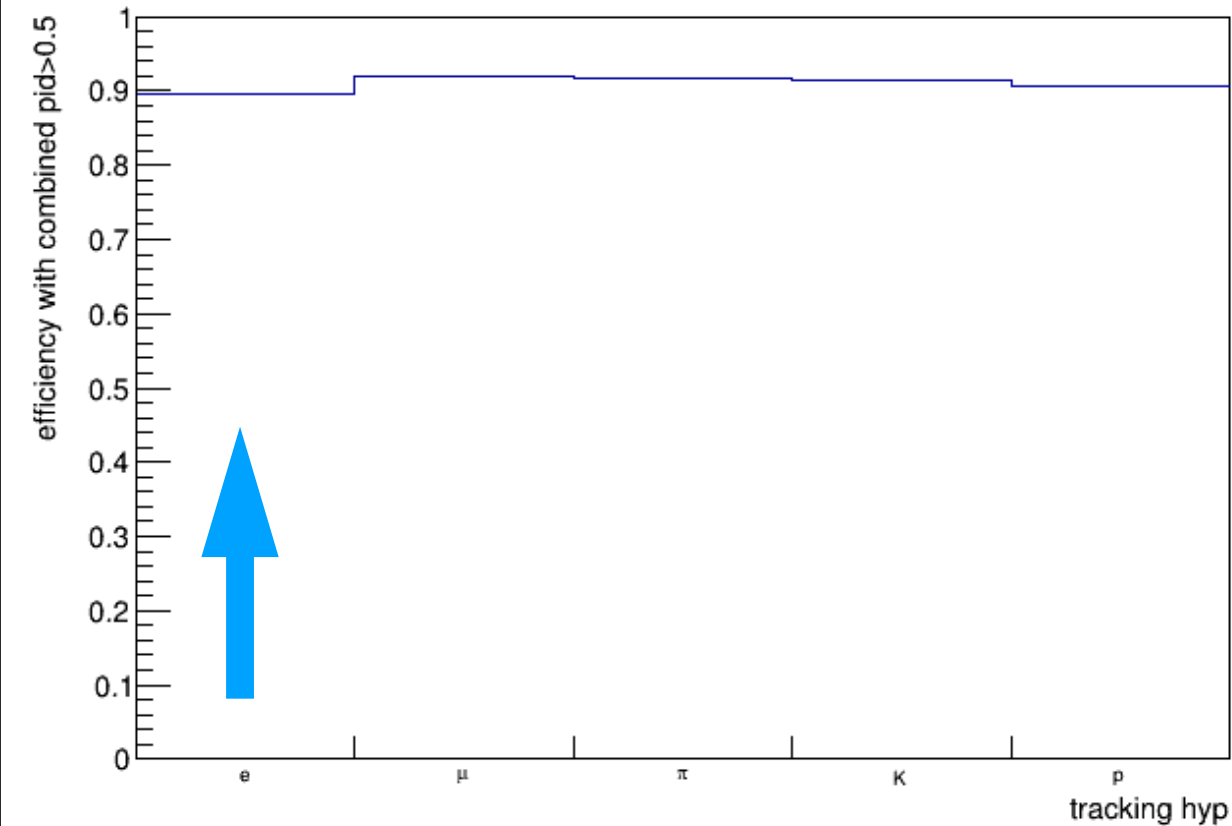
0.5 GeV/c Proton input



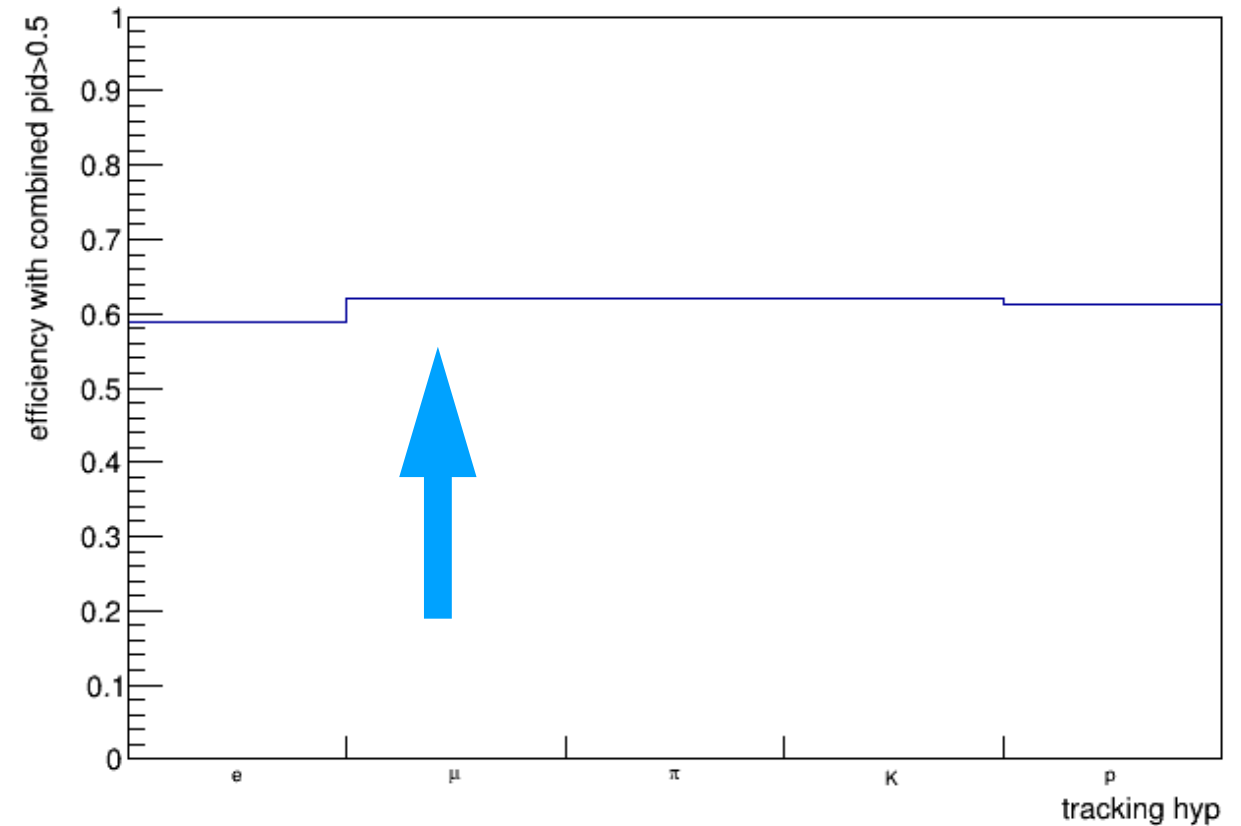
# "Good" ( $p > 0.5$ ) PID vs. Tracking Hyp.

"PidAlgoMvd", "PidAlgoStt", "PidAlgoSciT", "PidAlgoDrc", "PidAlgoEmcBayes"

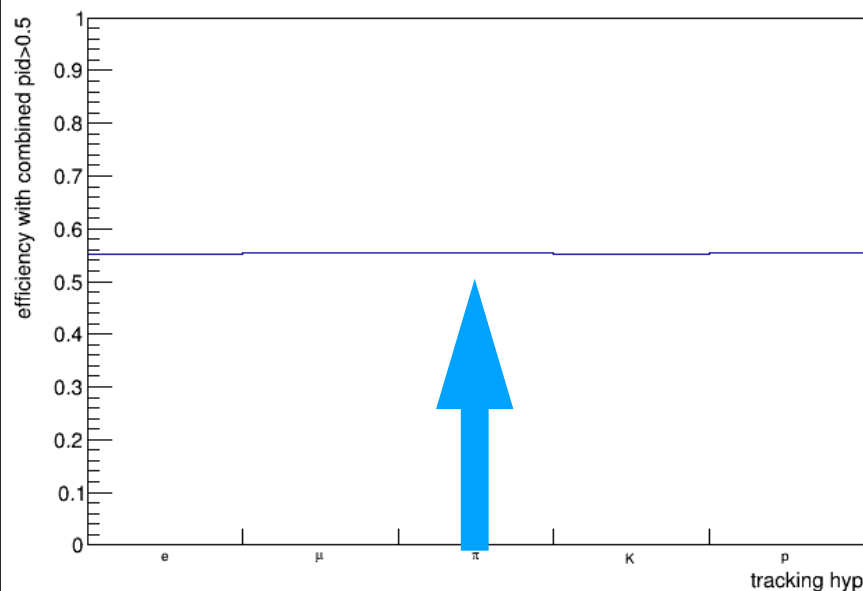
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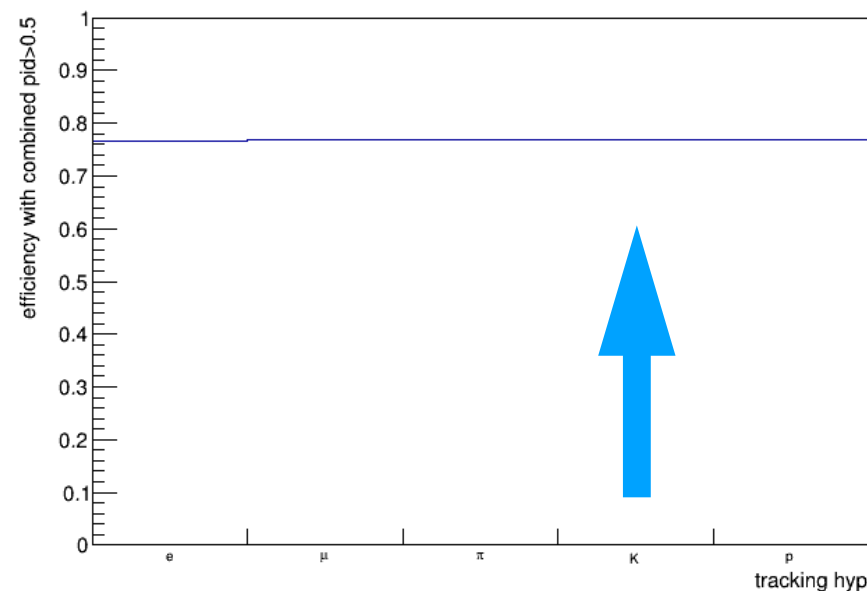
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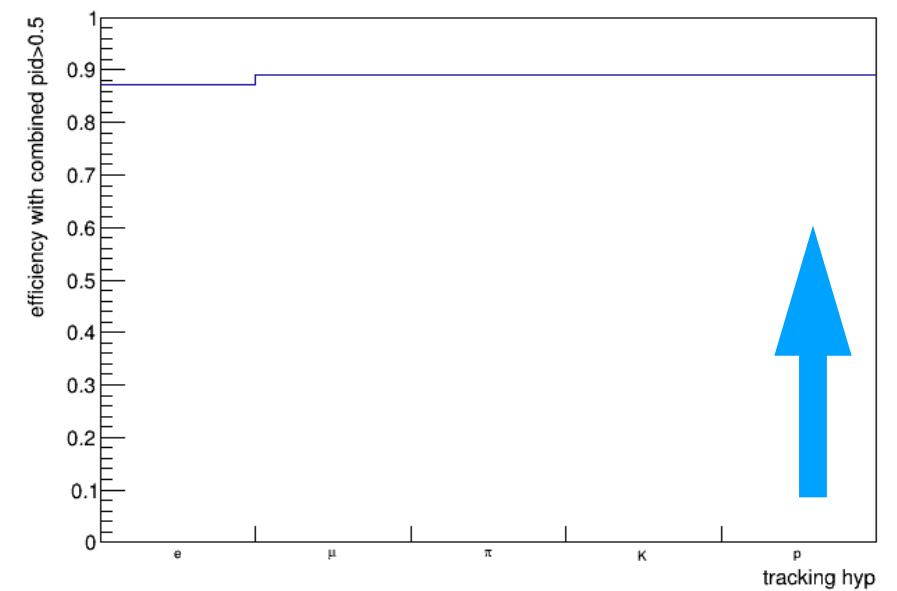
1 GeV/c Pion input



1 GeV/c Kaon input



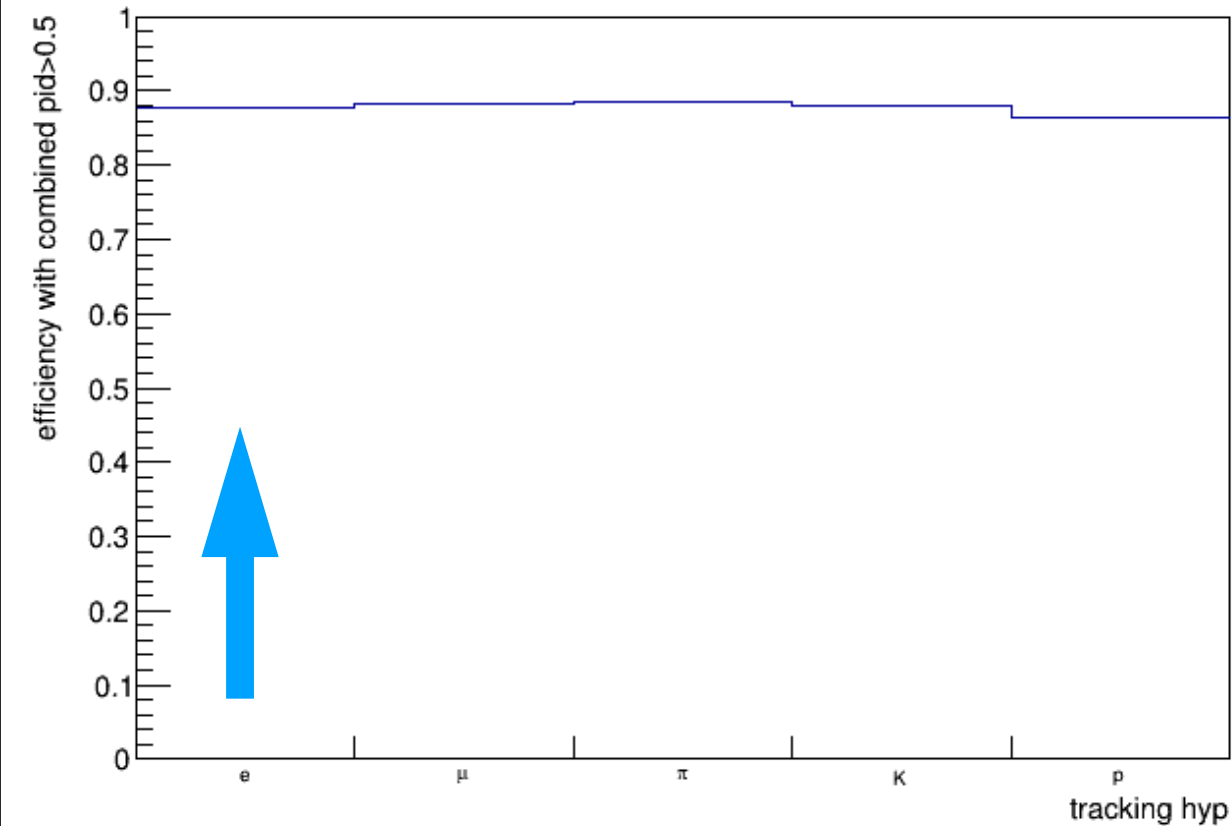
1 GeV/c Proton input



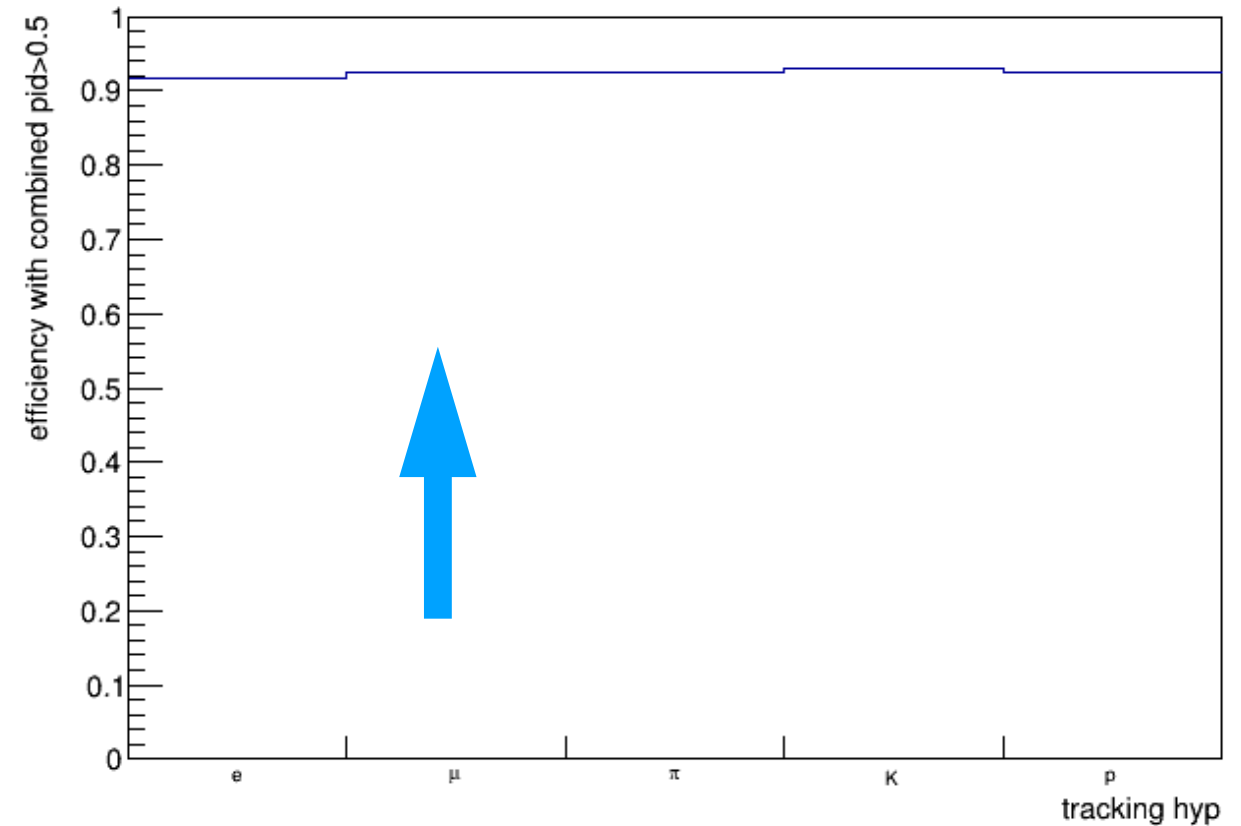
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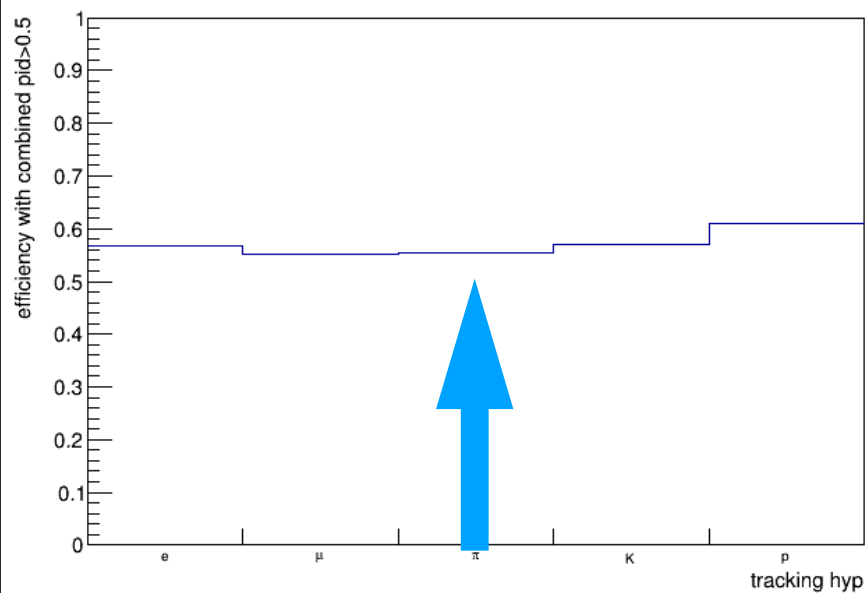
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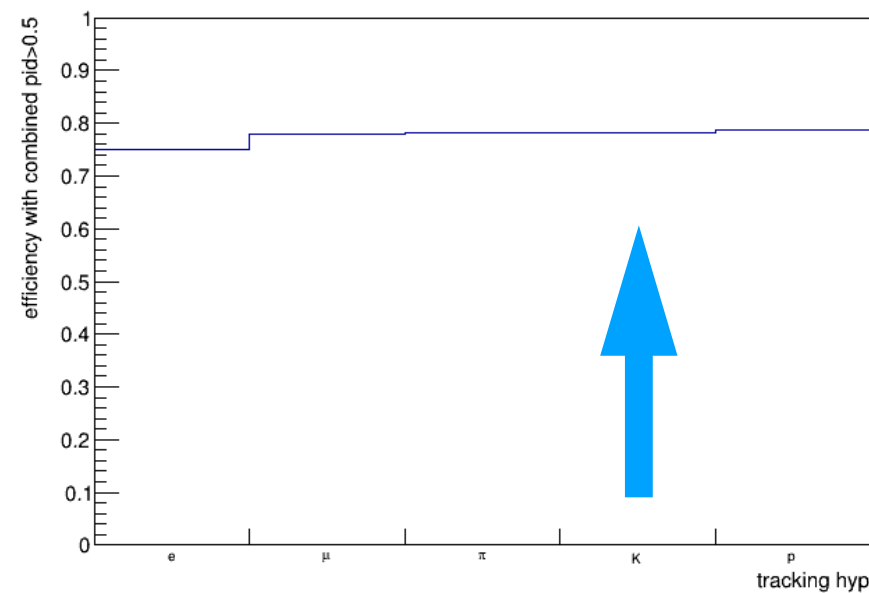
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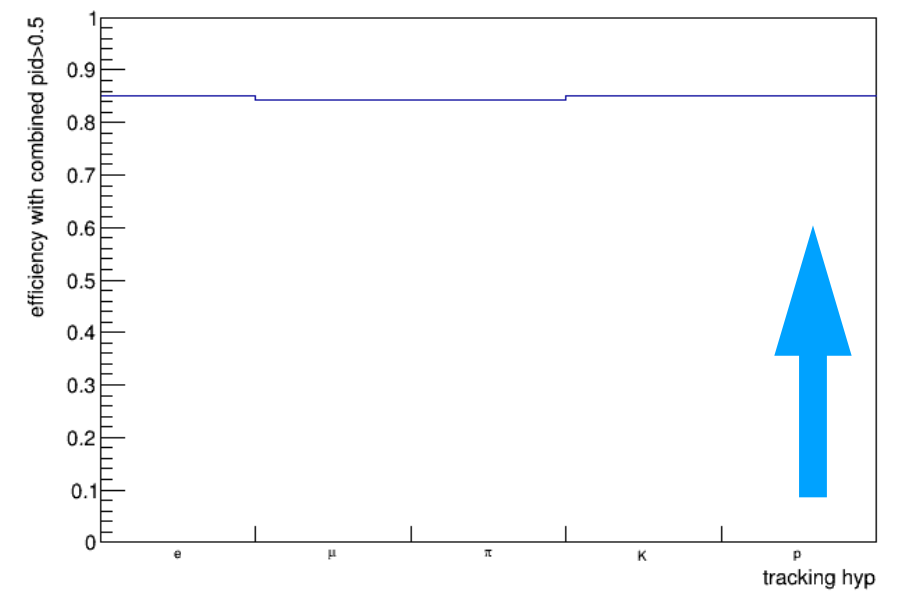
0.5 GeV/c Pion input



0.5 GeV/c Kaon input

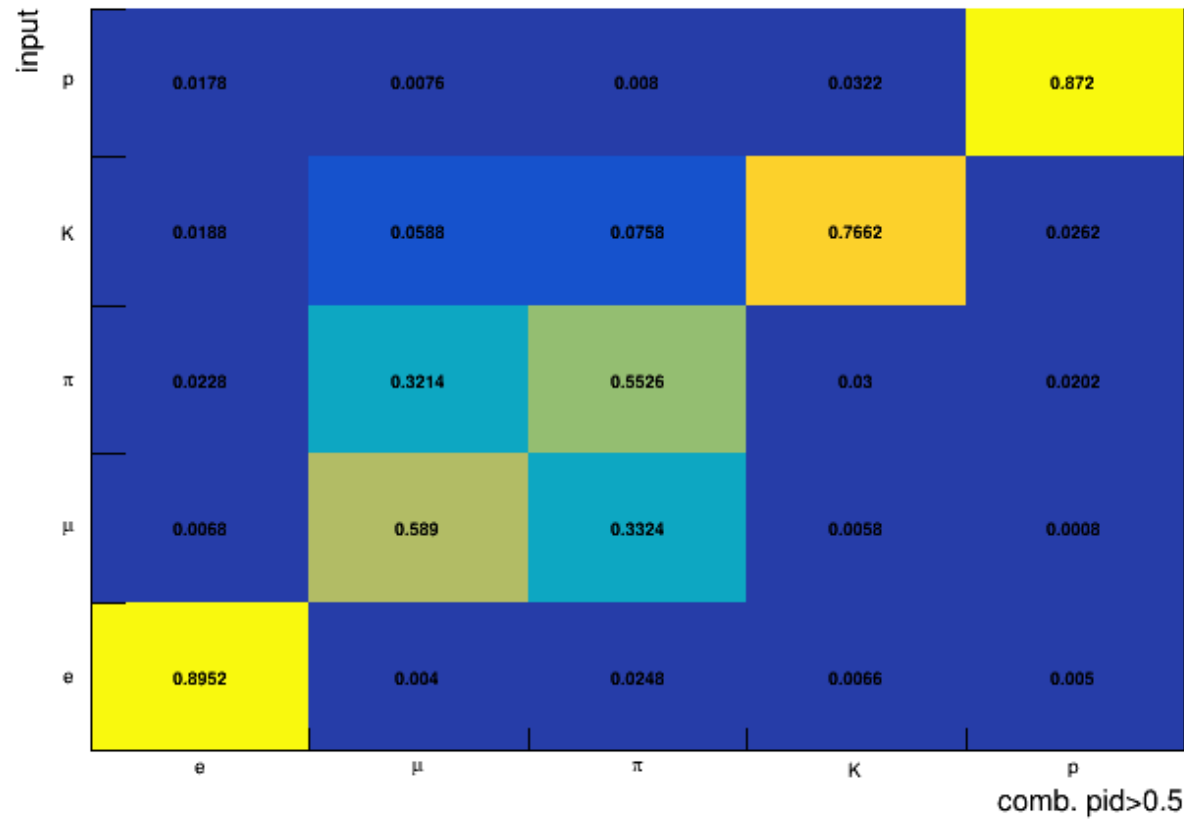


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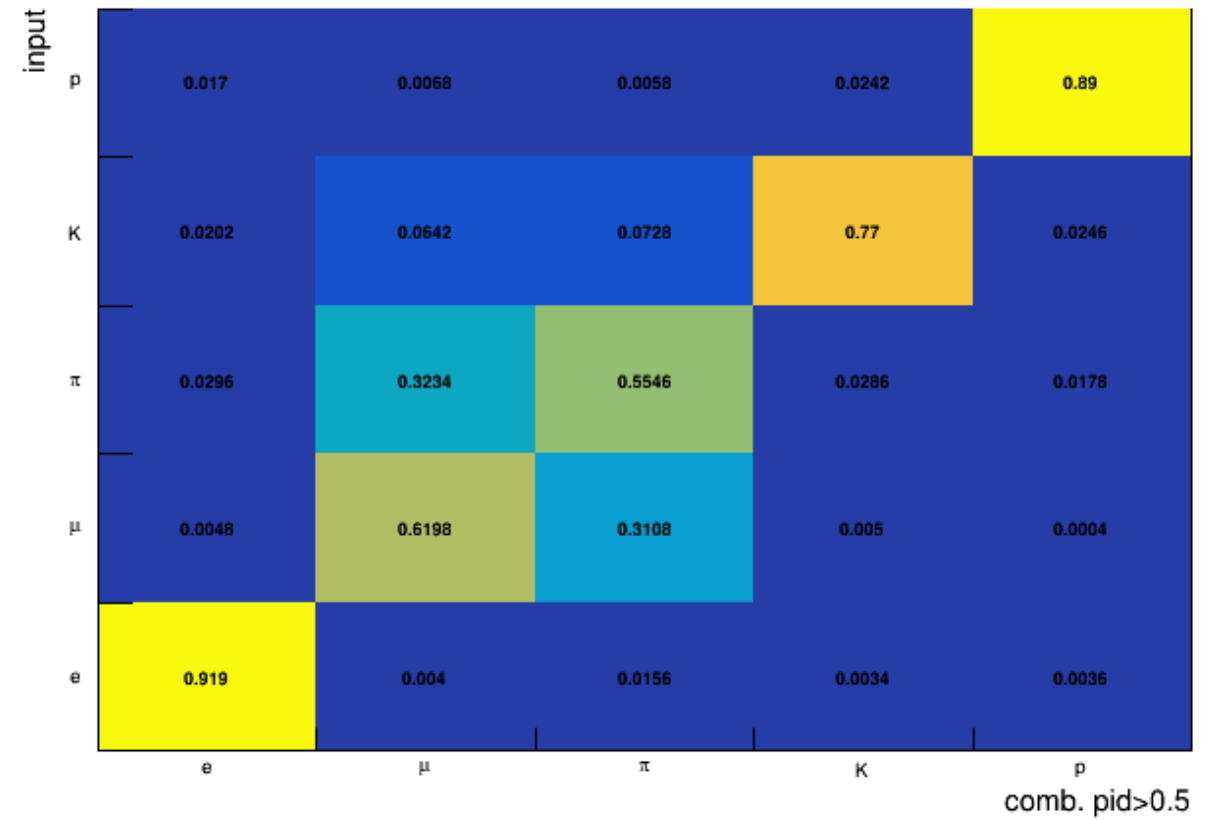


# Input-Output Matrices

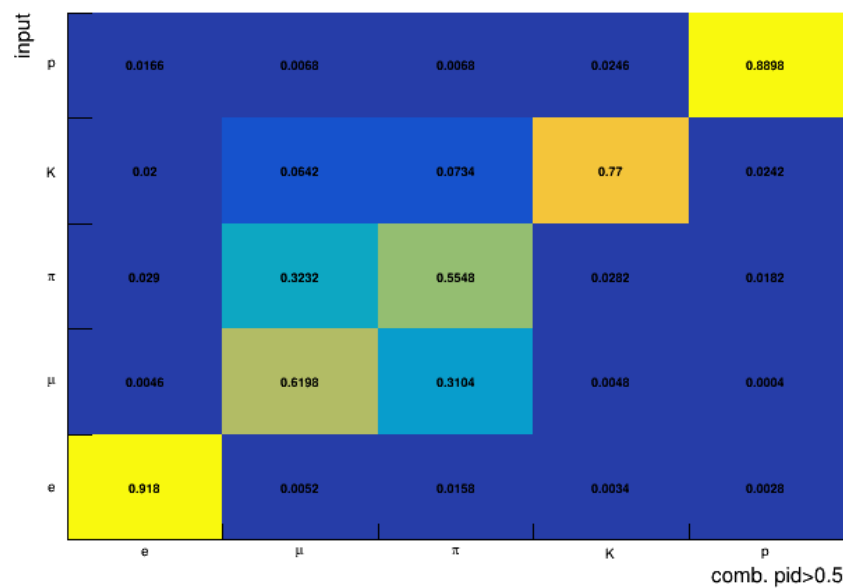
1 GeV/c Electron tracking hyp



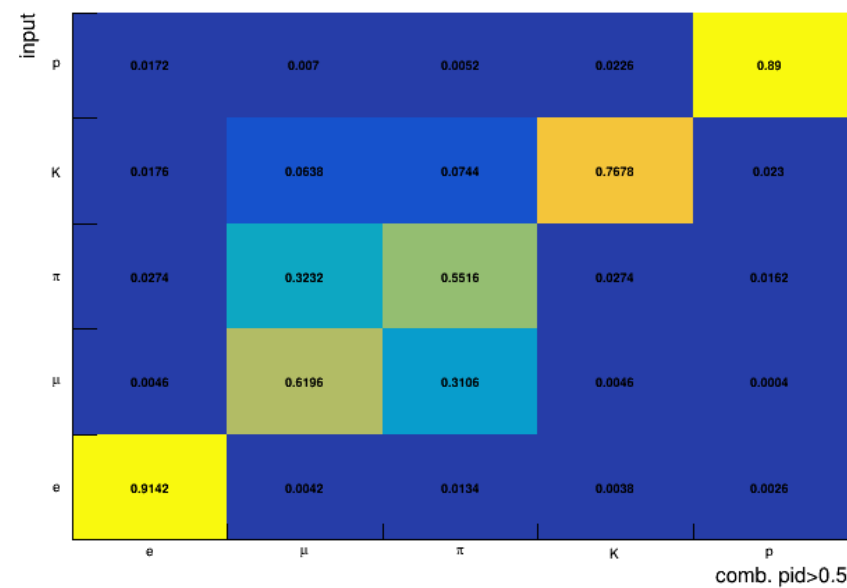
1 GeV/c Muon tracking hyp



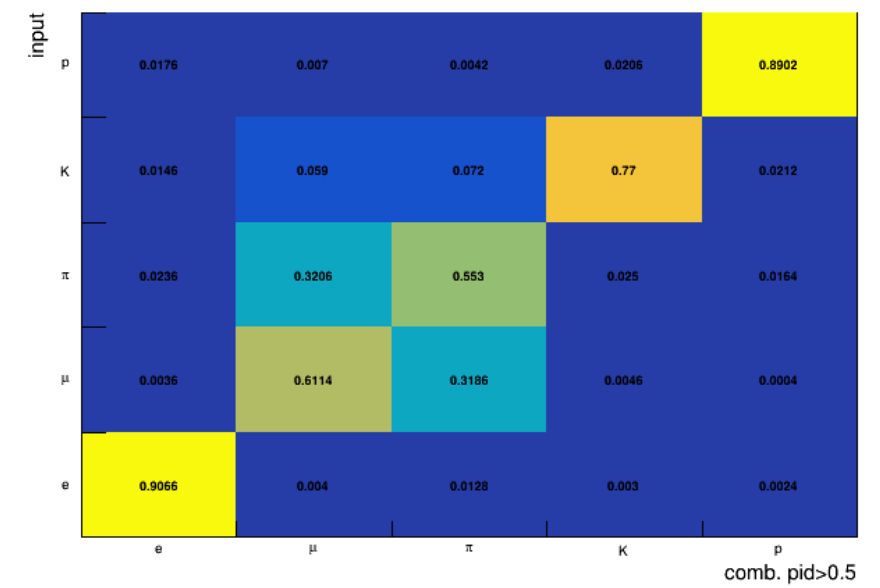
1 GeV/c Pion tracking hyp



1 GeV/c Kaon tracking hyp

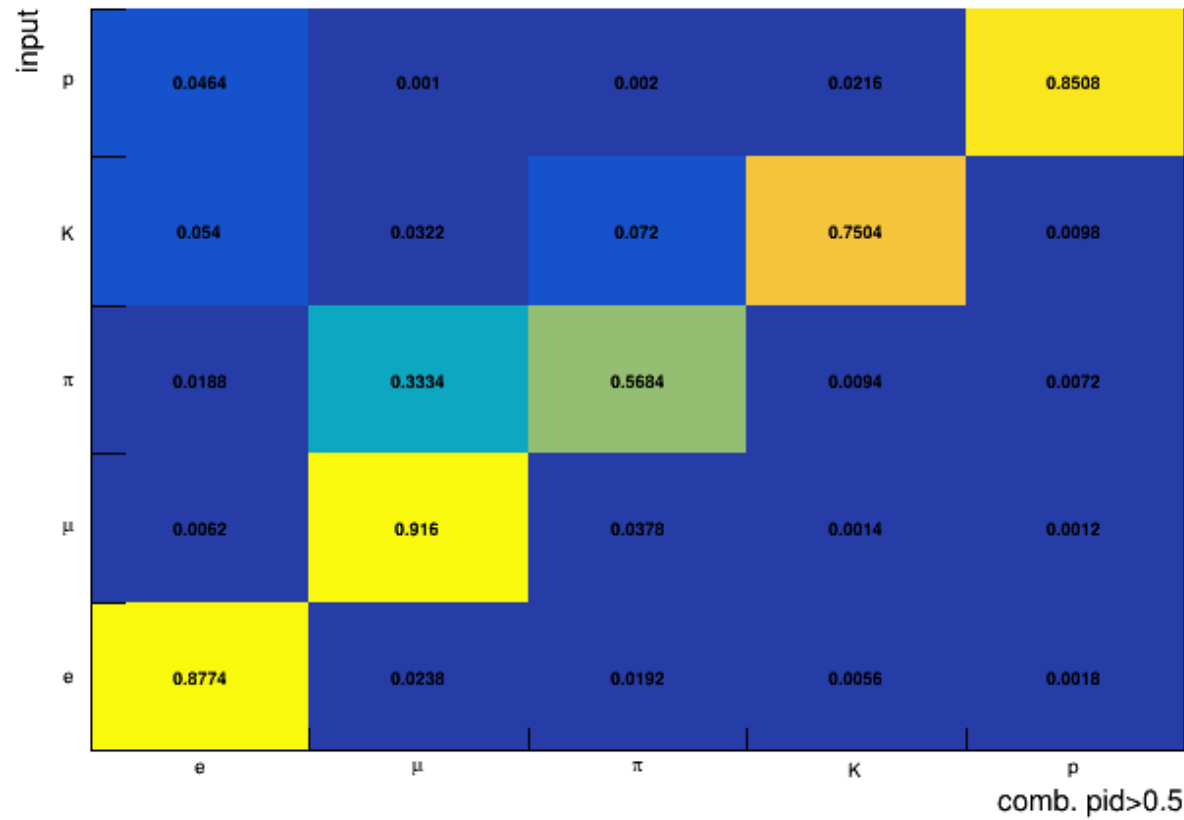


1 GeV/c Proton tracking hyp

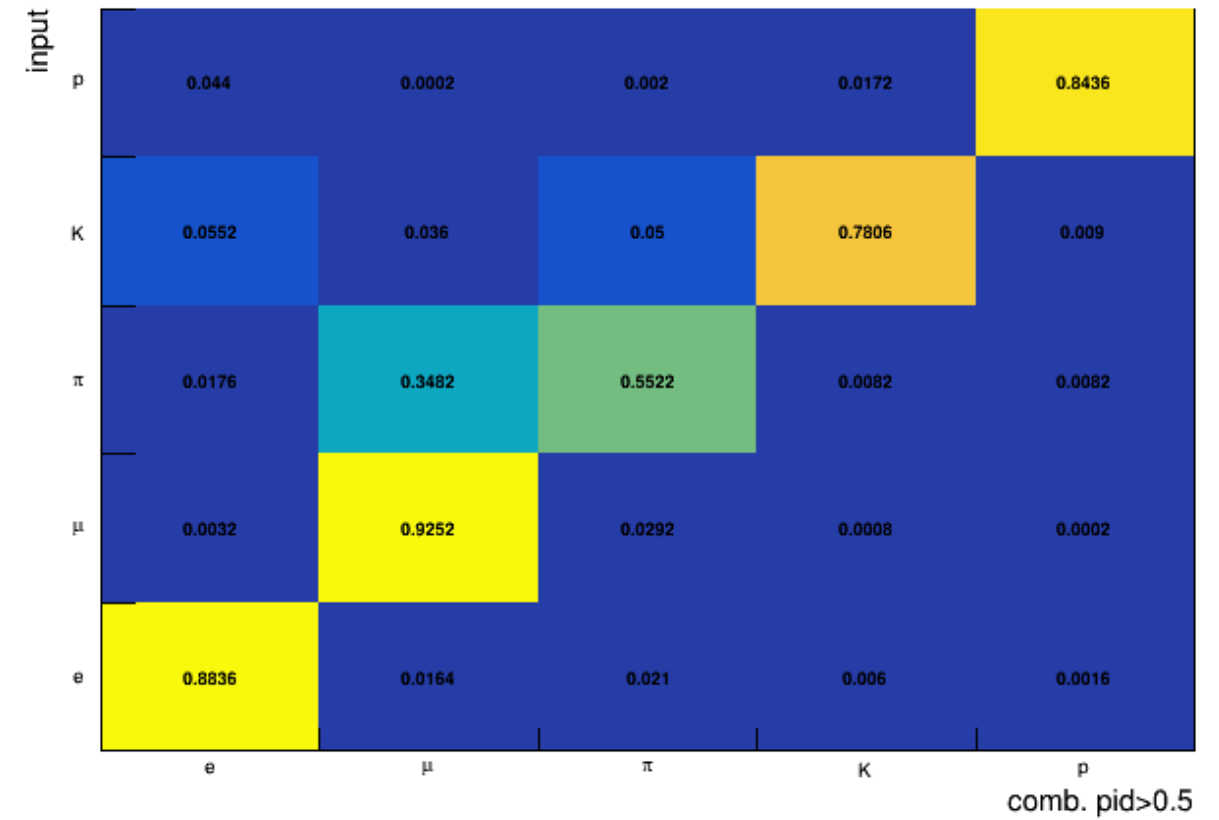


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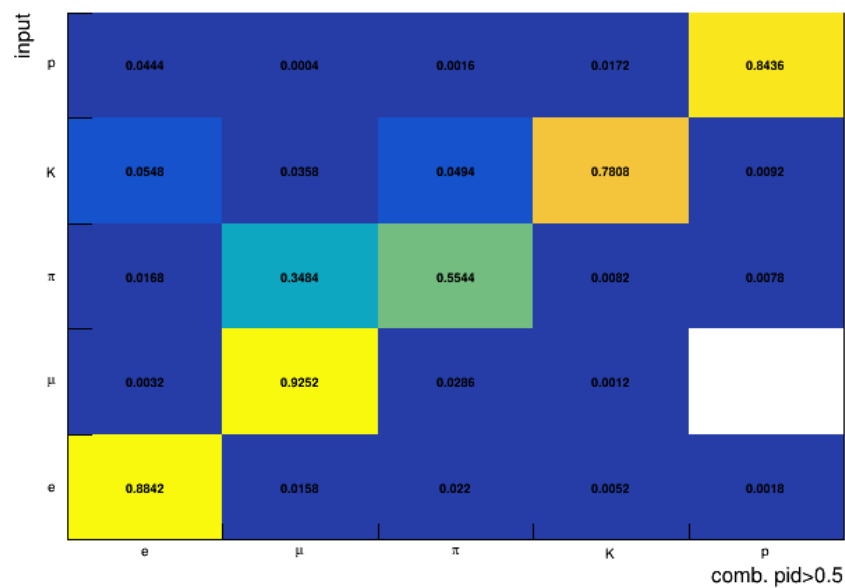
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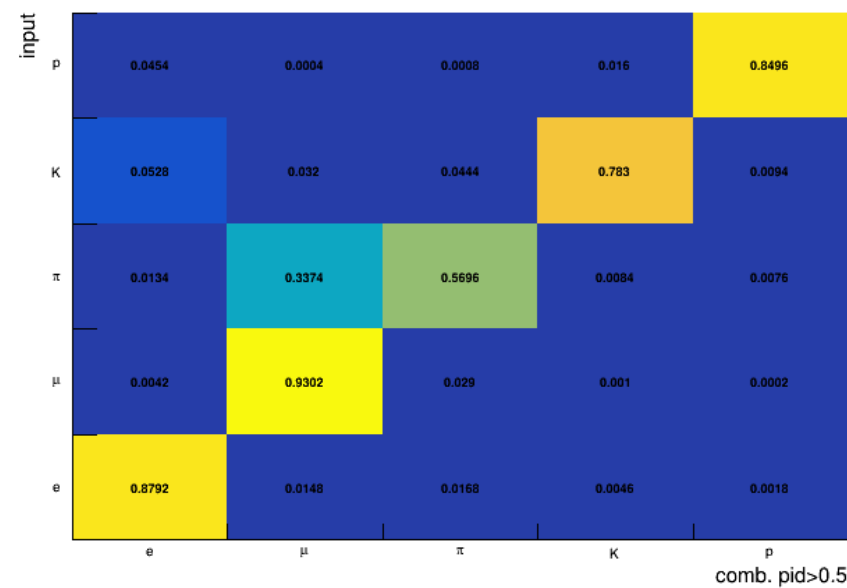
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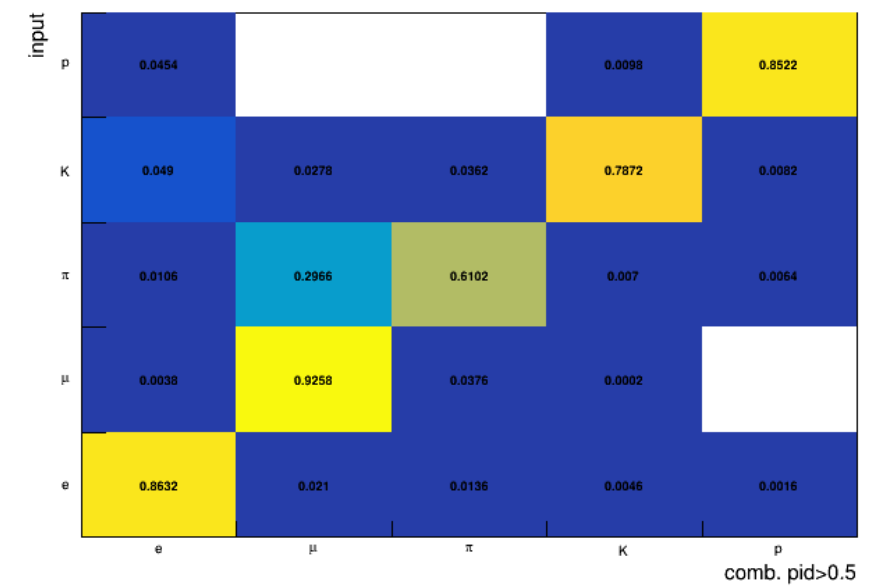
0.5 GeV/c Pion tracking hyp



0.5 GeV/c Kaon tracking hyp



0.5 GeV/c Proton tracking hyp



# Summary/Outlook

- 5-fold Kalman procedure available
- Momentum reconstruction effected below 1GeV
- Electrons seem to benefit from pion hyp (bug in scattering implementation?)
- Study of best PID algorithms combination necessary
- TODO:
  - 5-fold PID
  - Propagation down to Analysis level
  - --> scheduled to be done, soon.