Remarks on Tracking in PID

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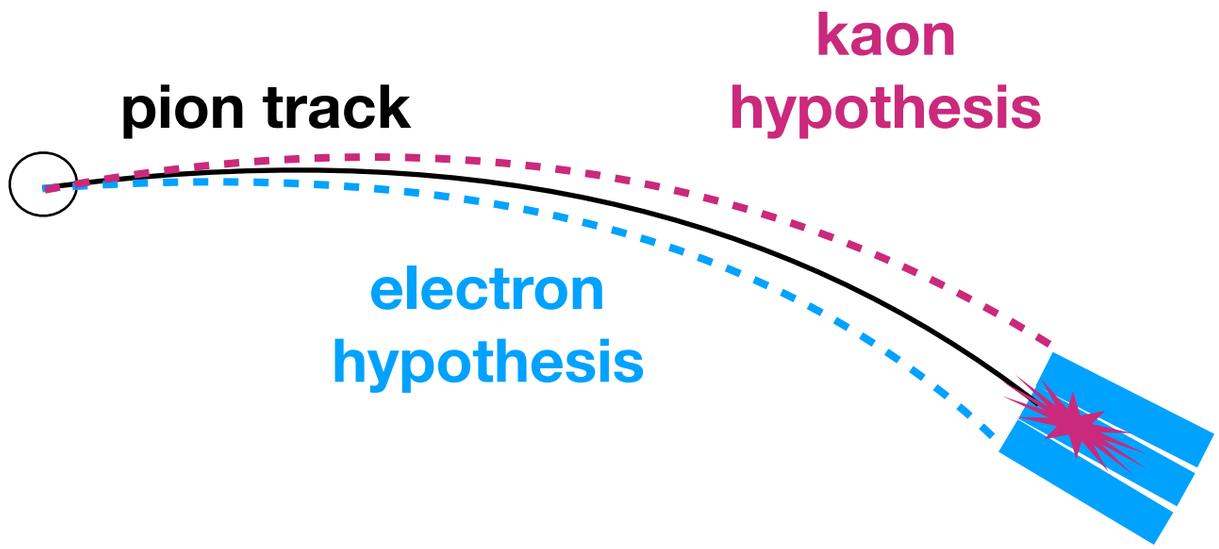
PANDA PID Computing Workshop, May 3.-4. 2018

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:

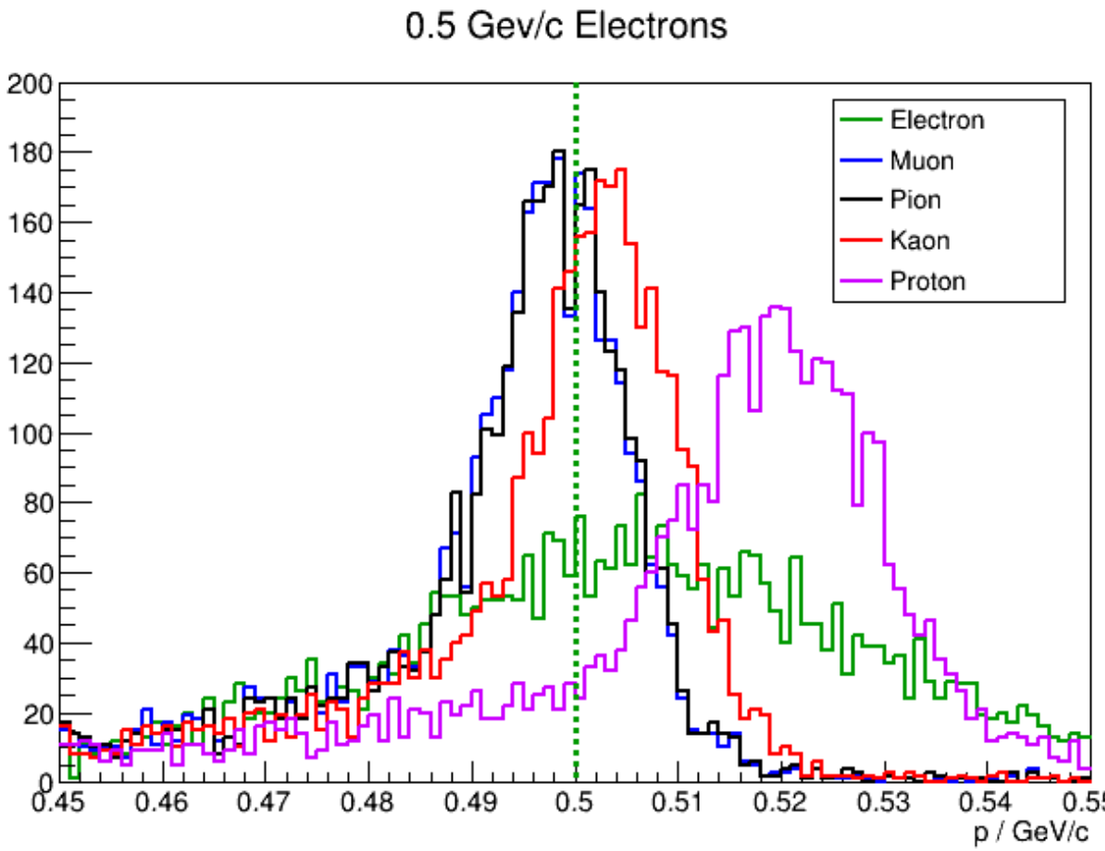
   - `PndRecoKalmanTask::SetParticleHypo(int pdg)`

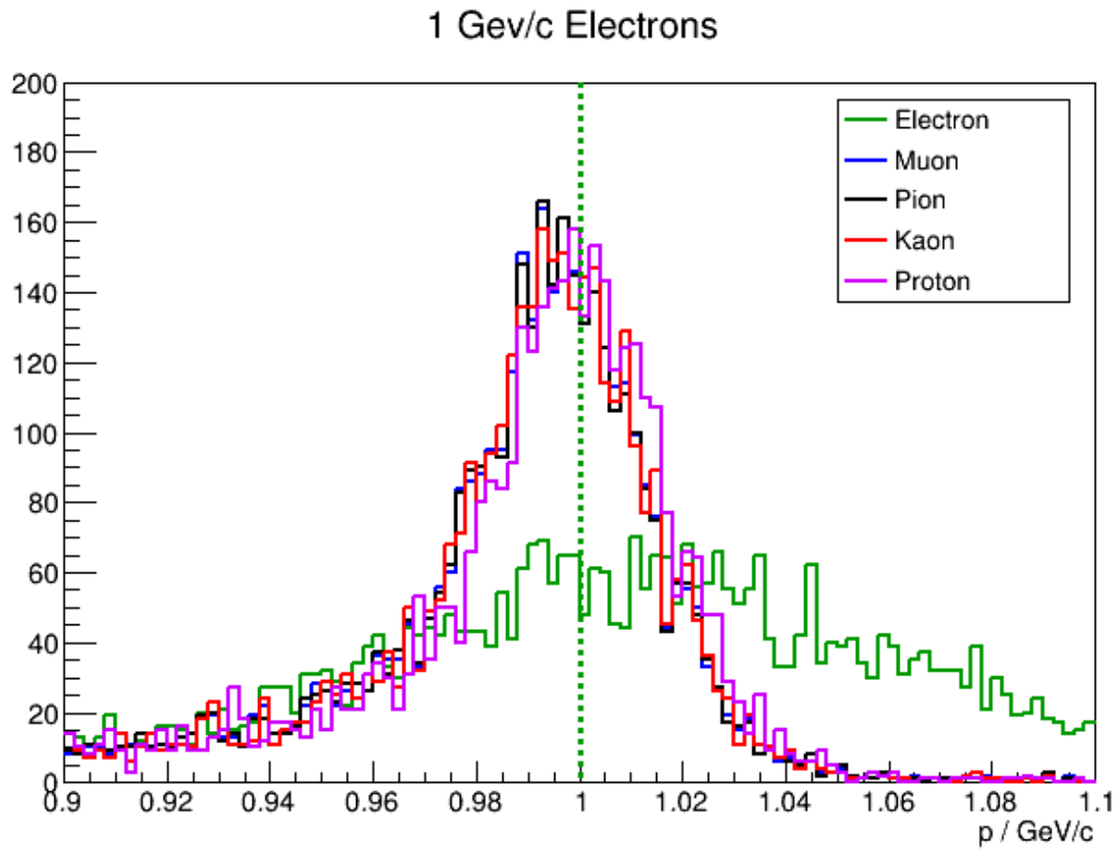
B. Run all 5 hypotheses togehter:

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

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

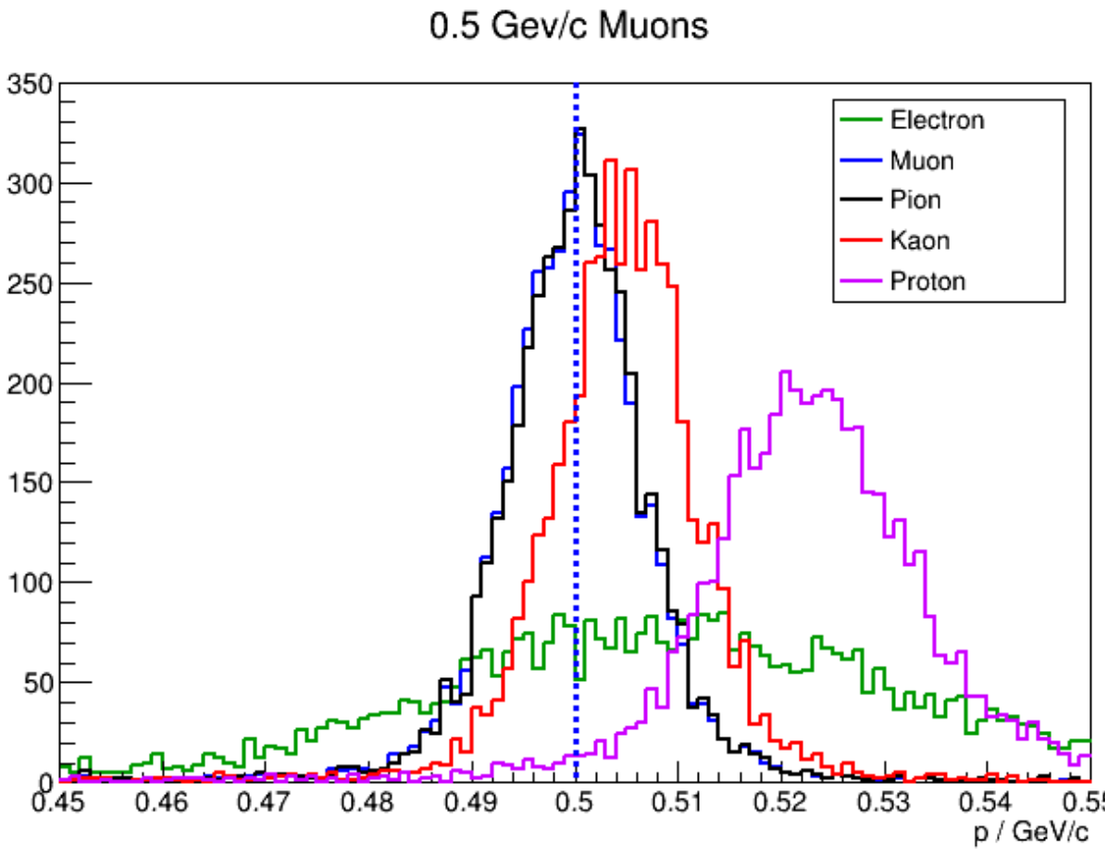
Effect on Momentum Reconstruction

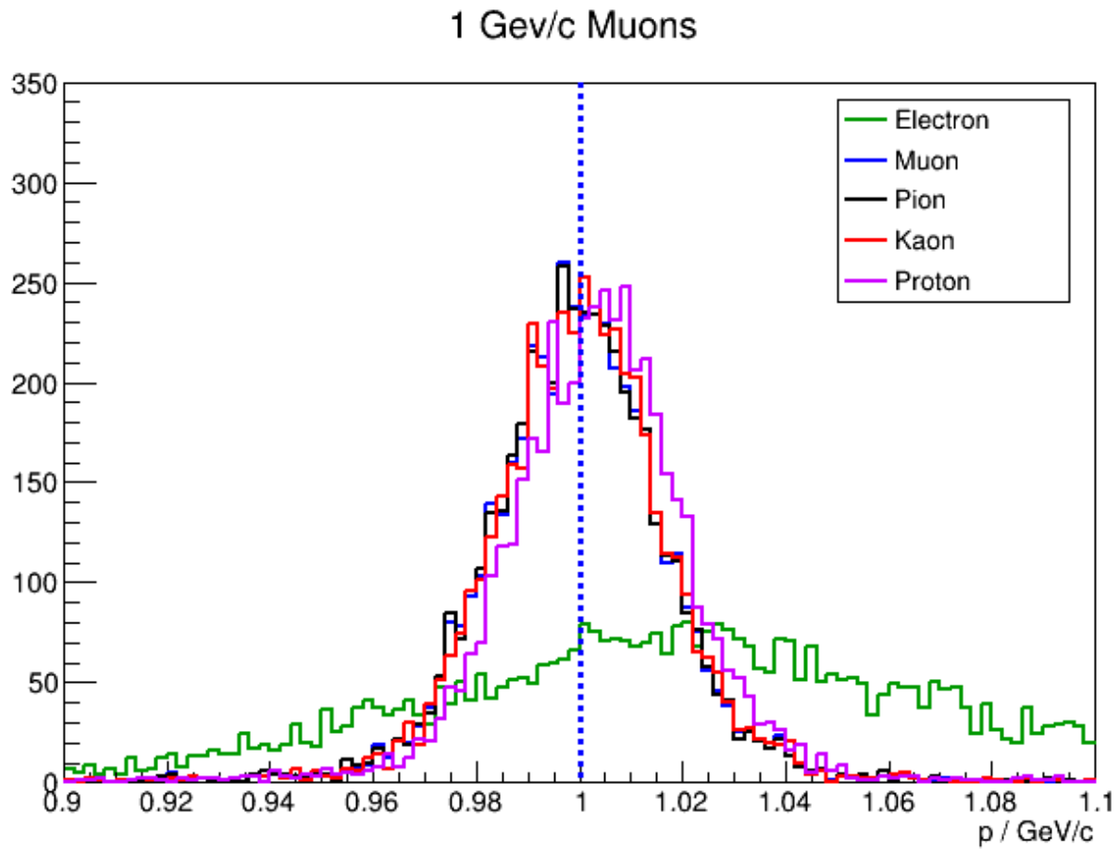


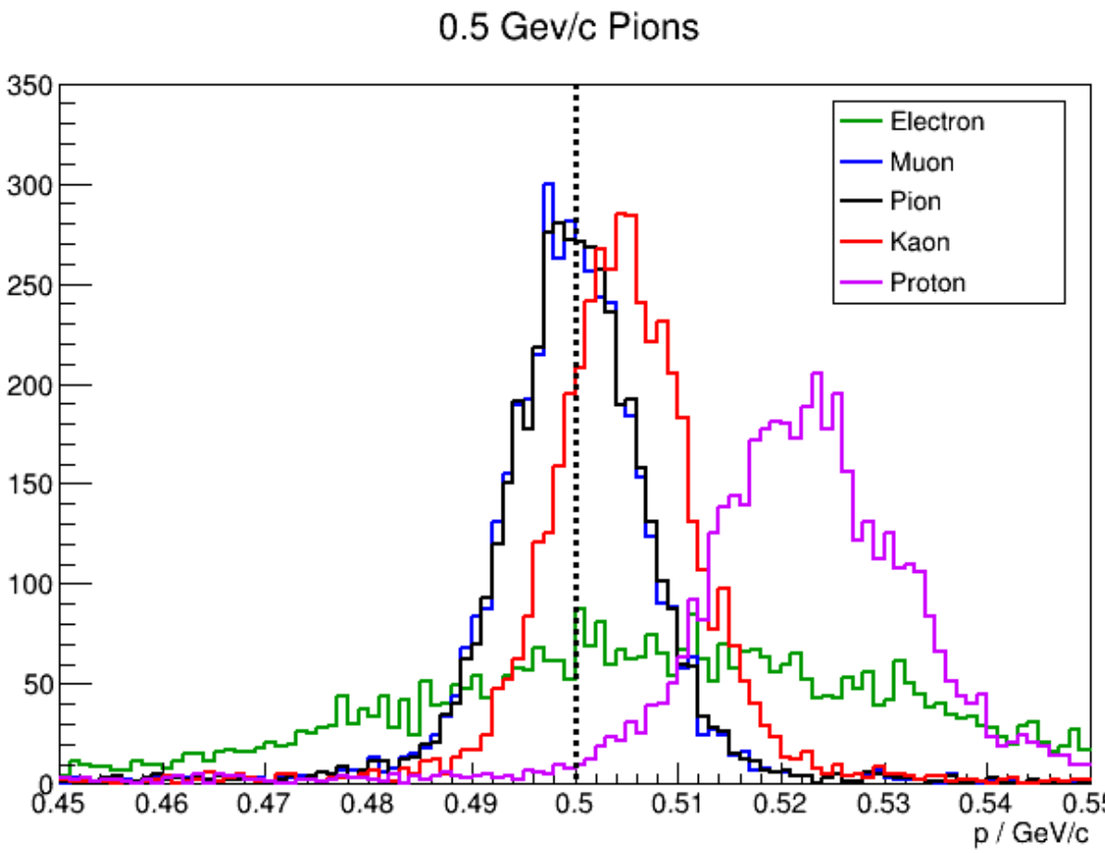


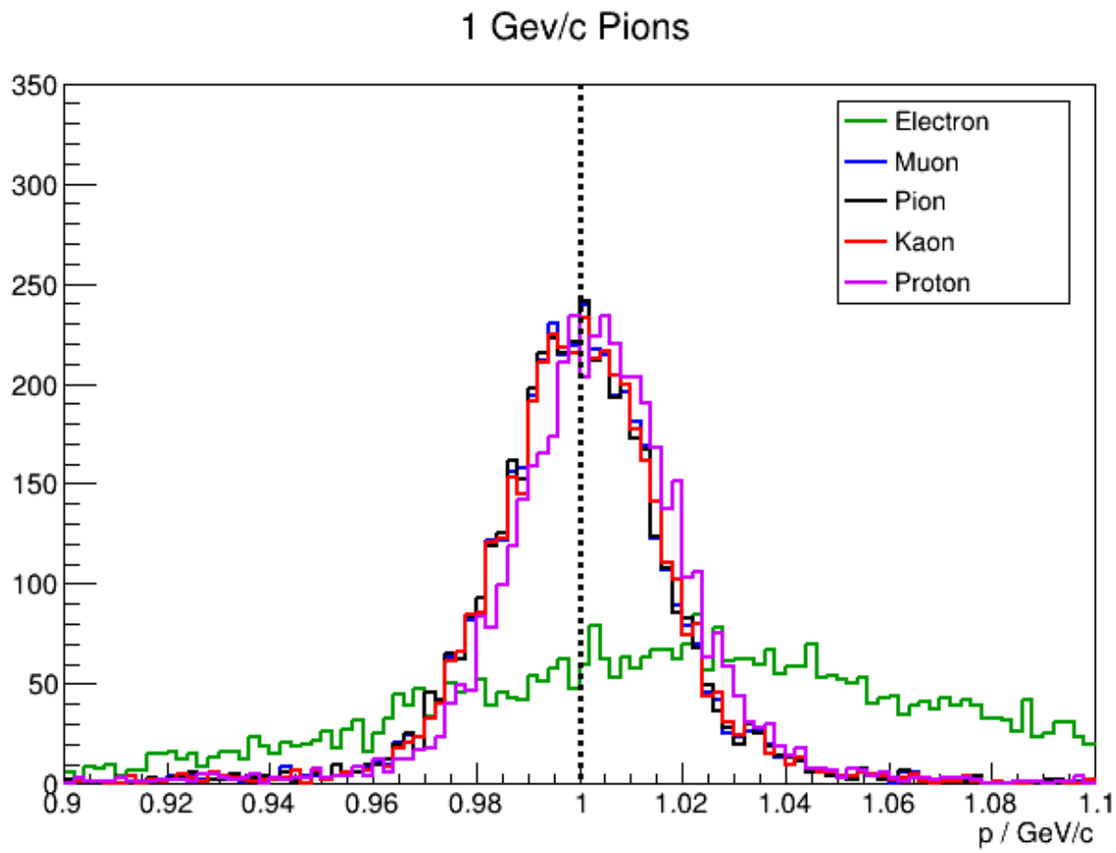
- Simulations: 5000 single tracks (e,mu,pi,K,p) in 40-120deg in theta, genfit1 & GEANE
- Bad electron reconstrunction with electron hypothesis
- Maybe GEANE's electron treatment (straggeling) is wrong

Effect on Momentum Reconstruction









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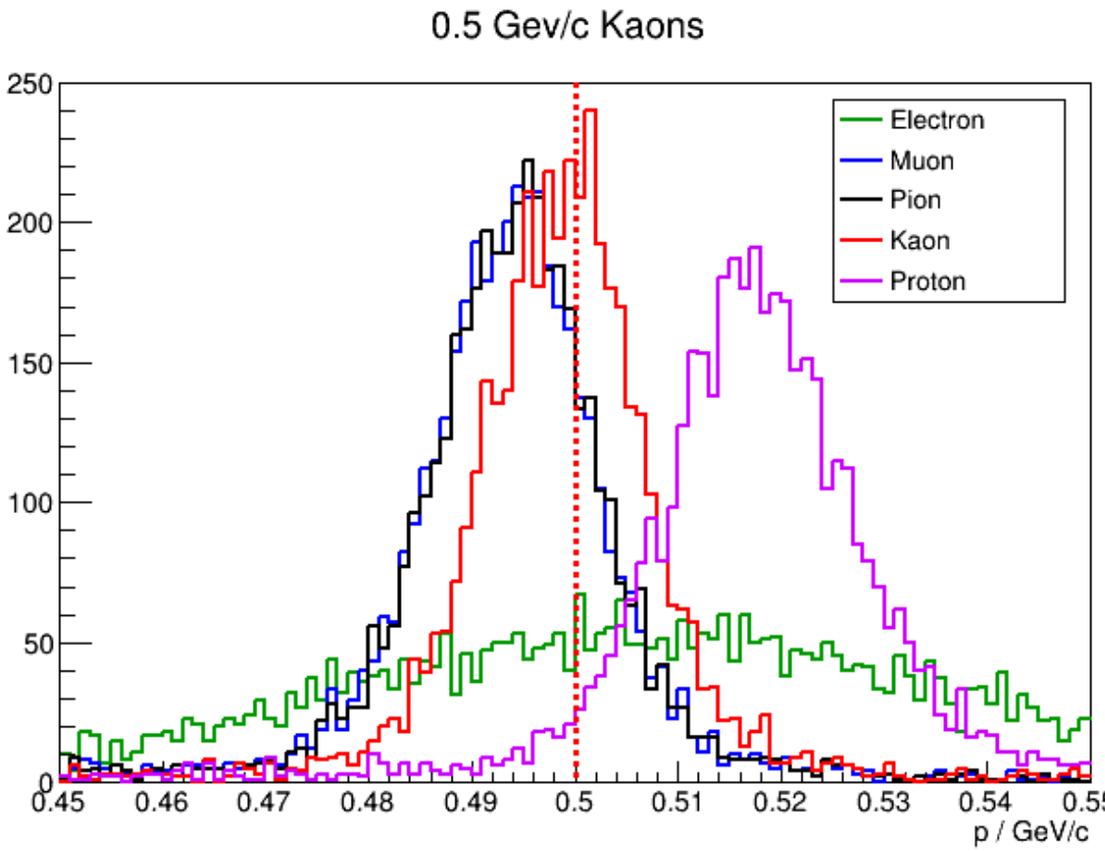
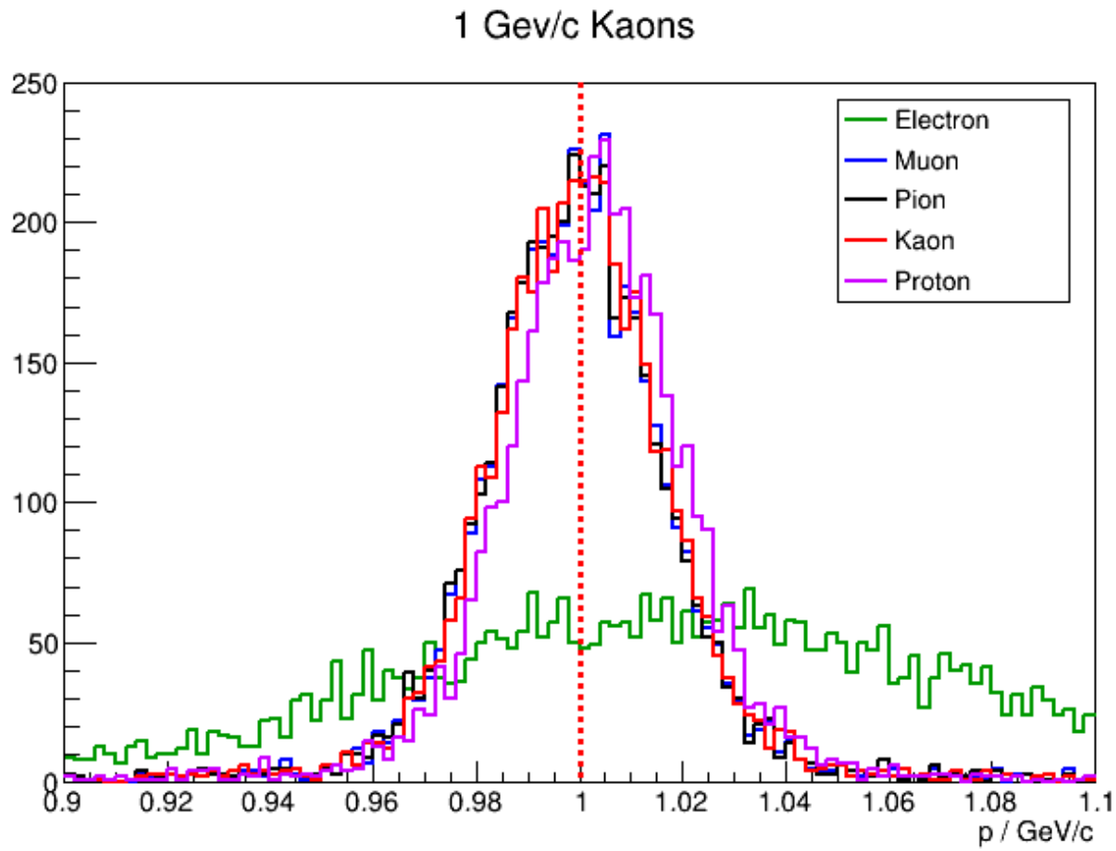
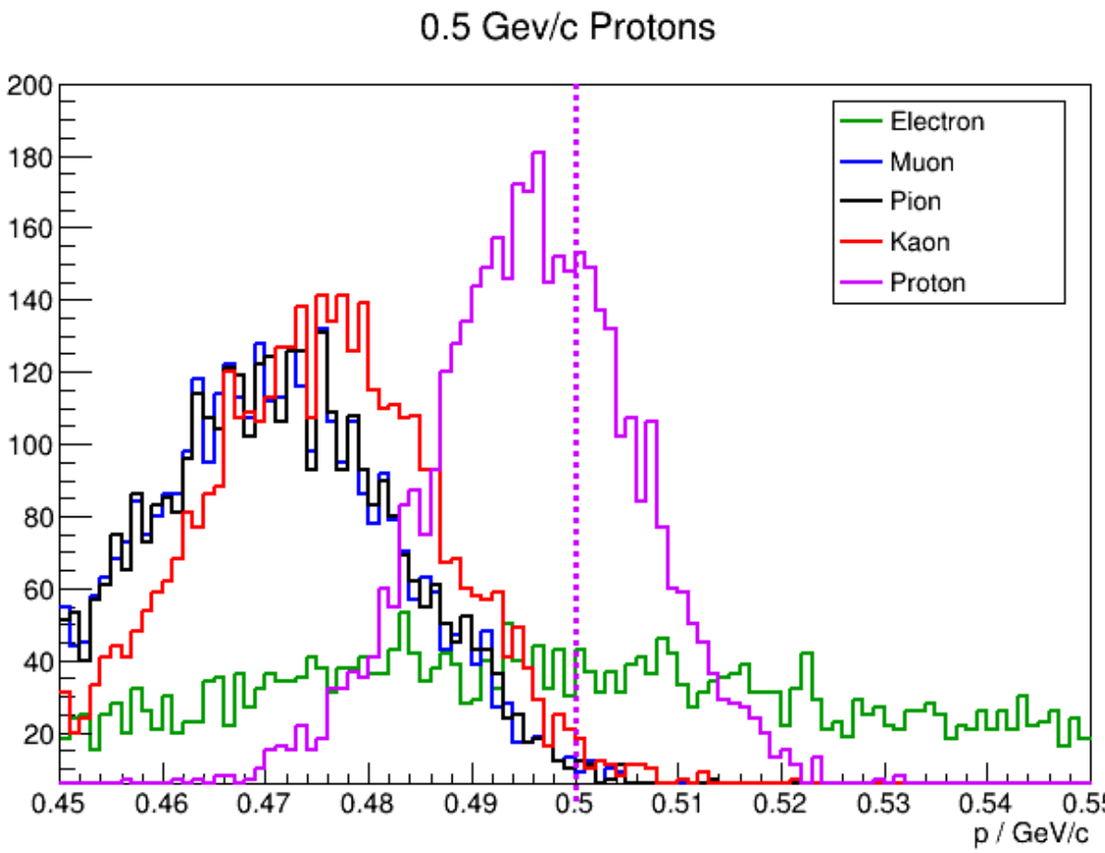
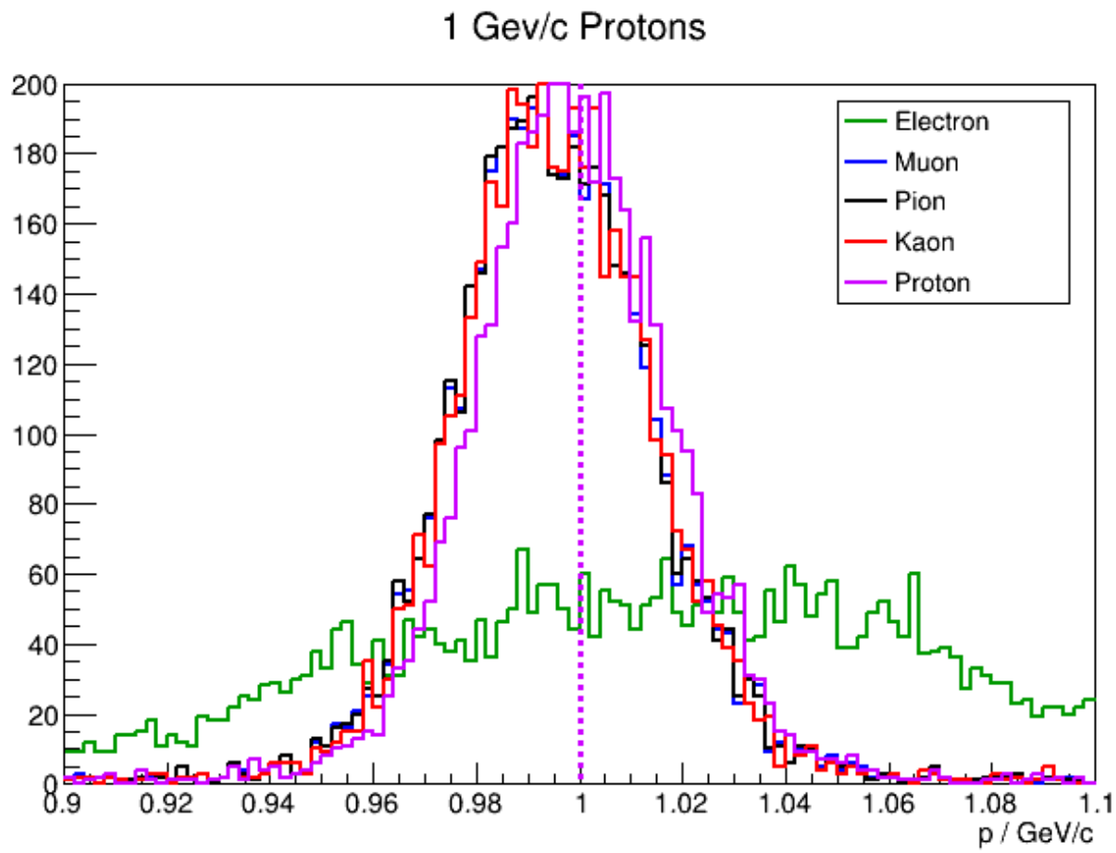


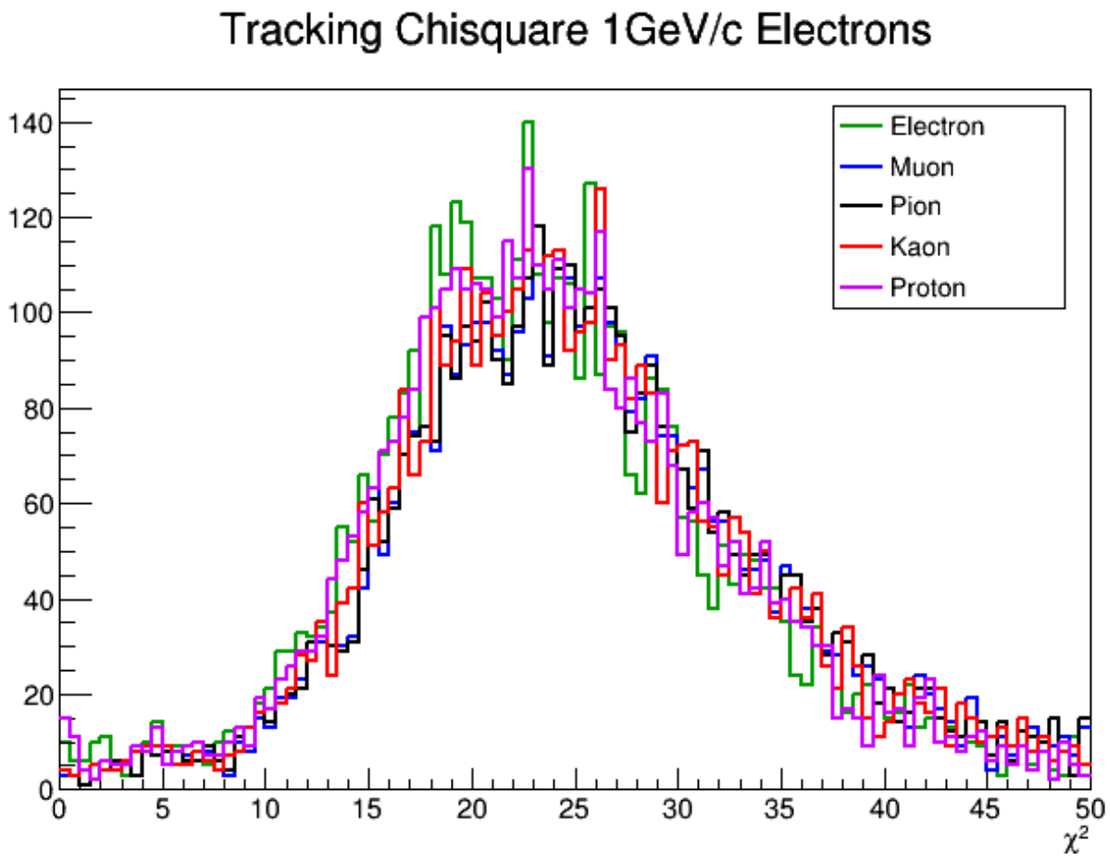


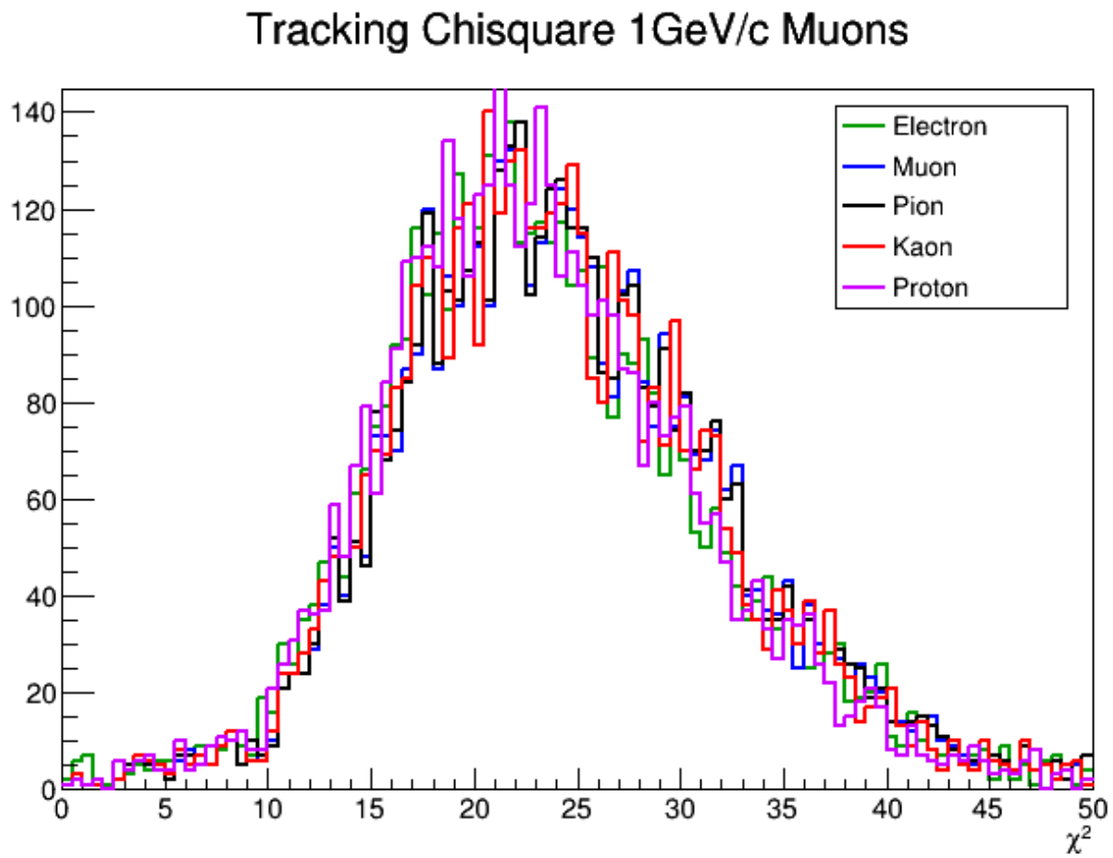


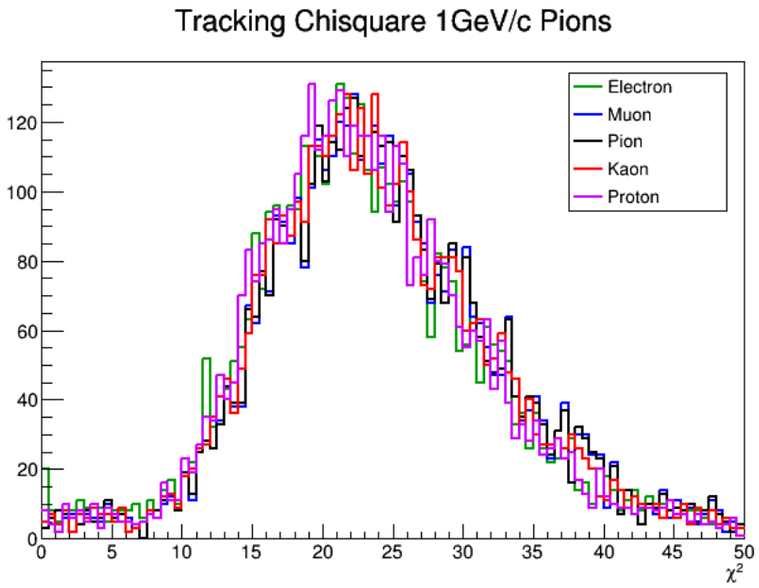


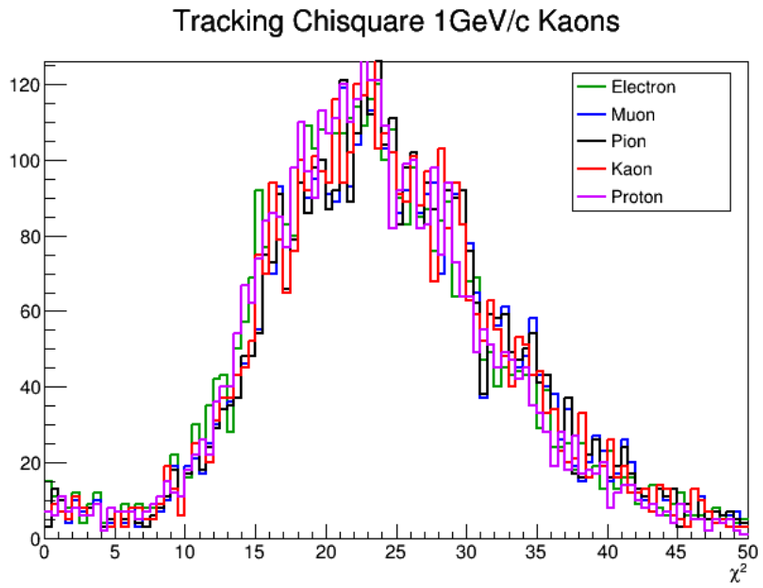
Tracking Quality useable for PID?

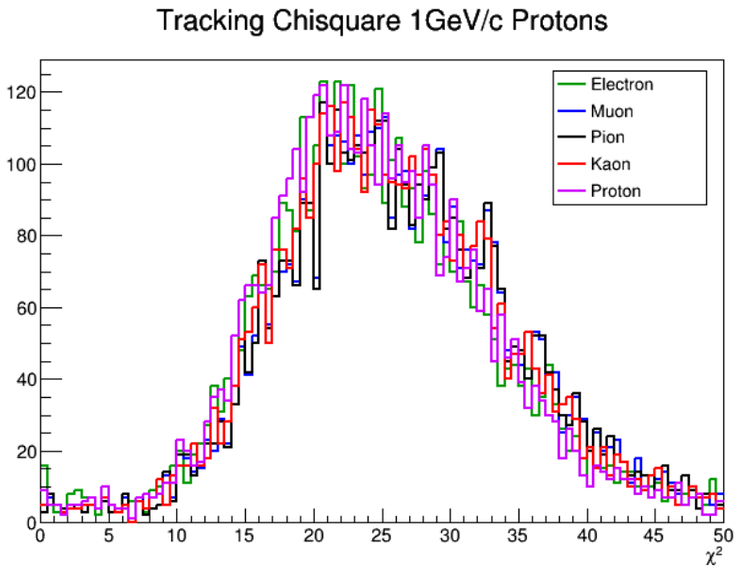
--> Does not look promising











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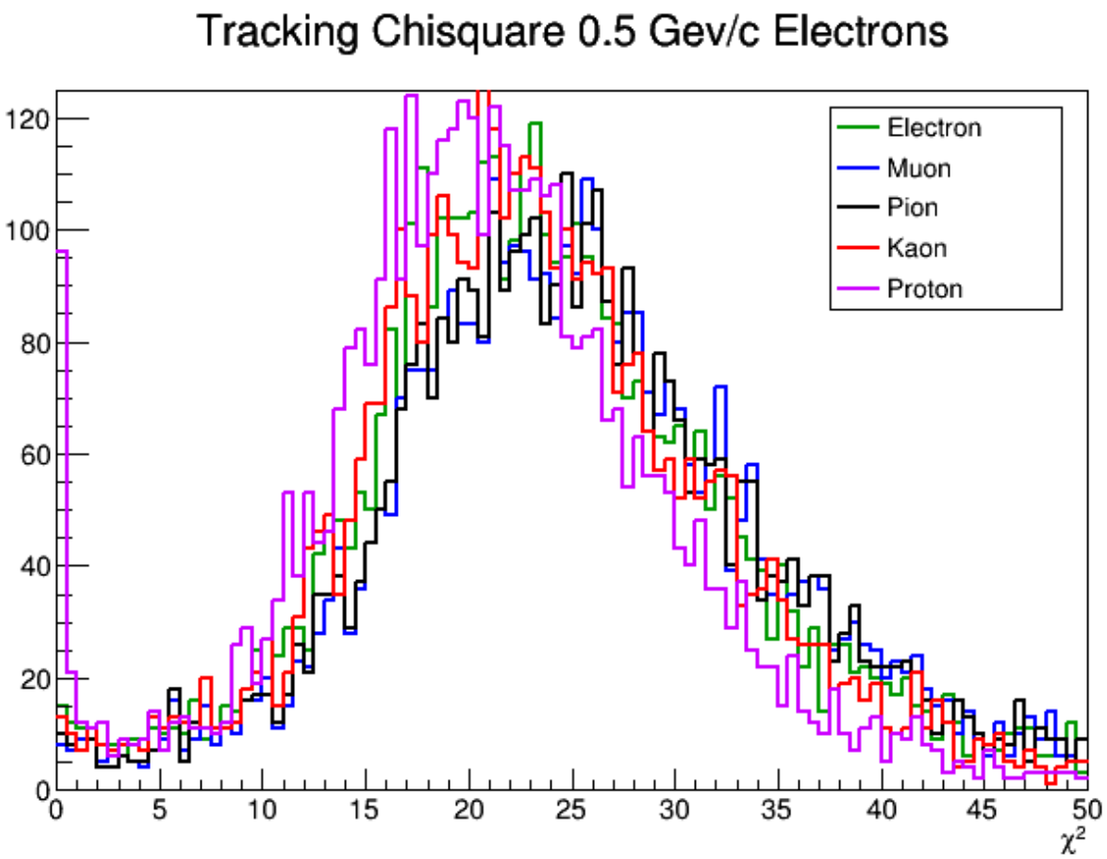
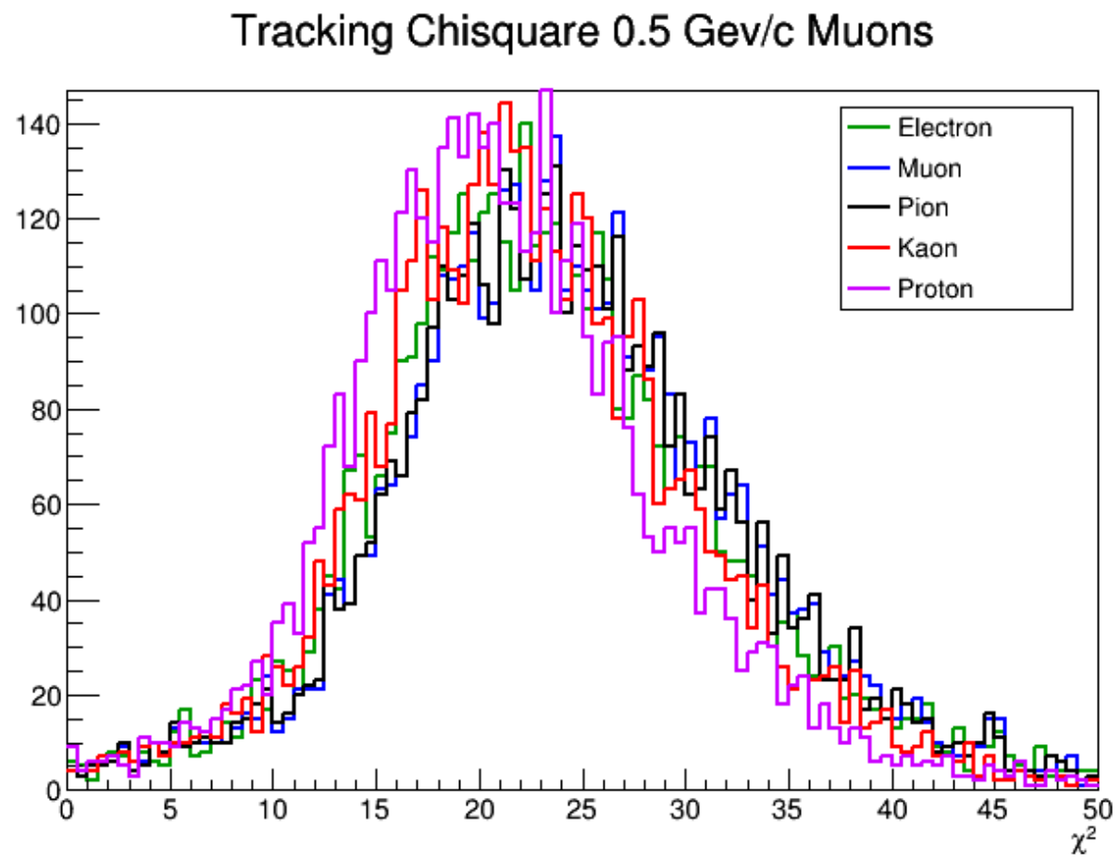
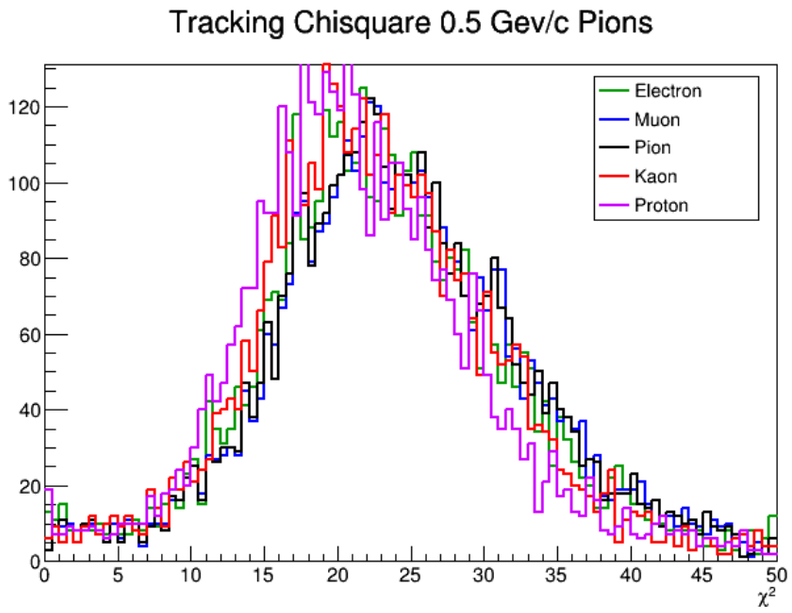
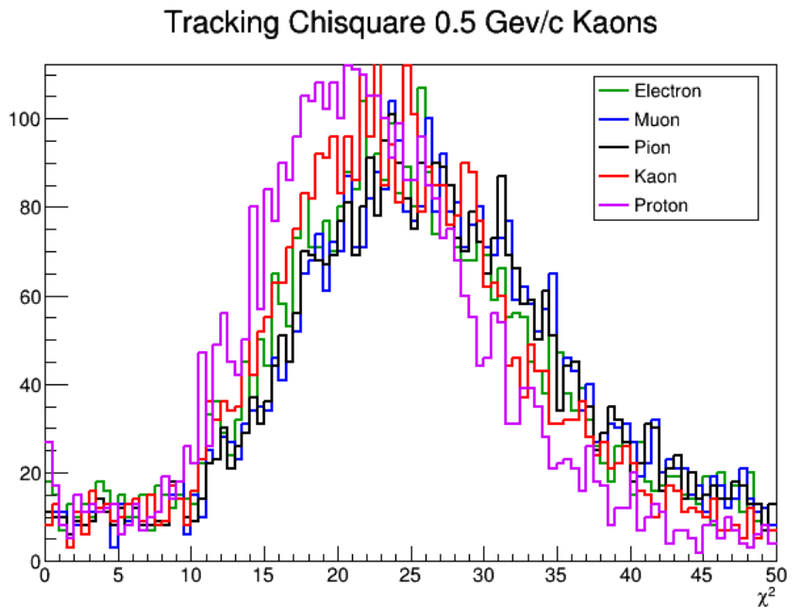
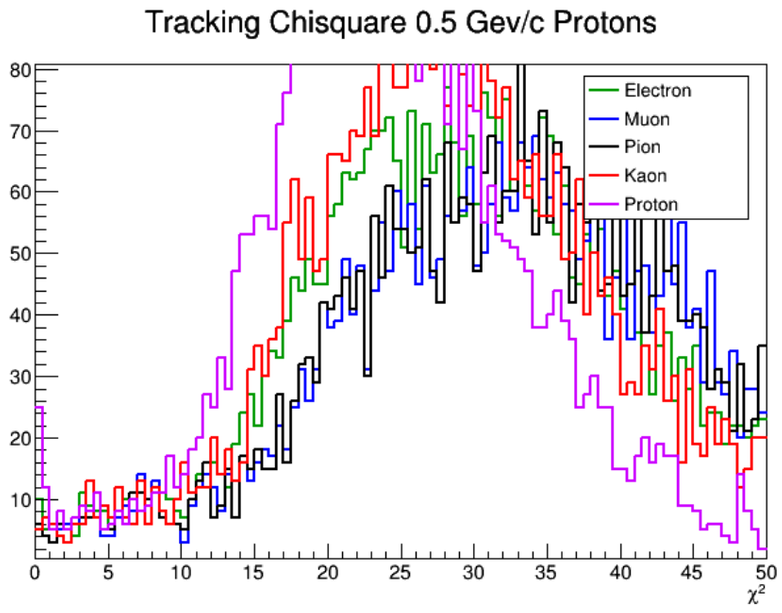




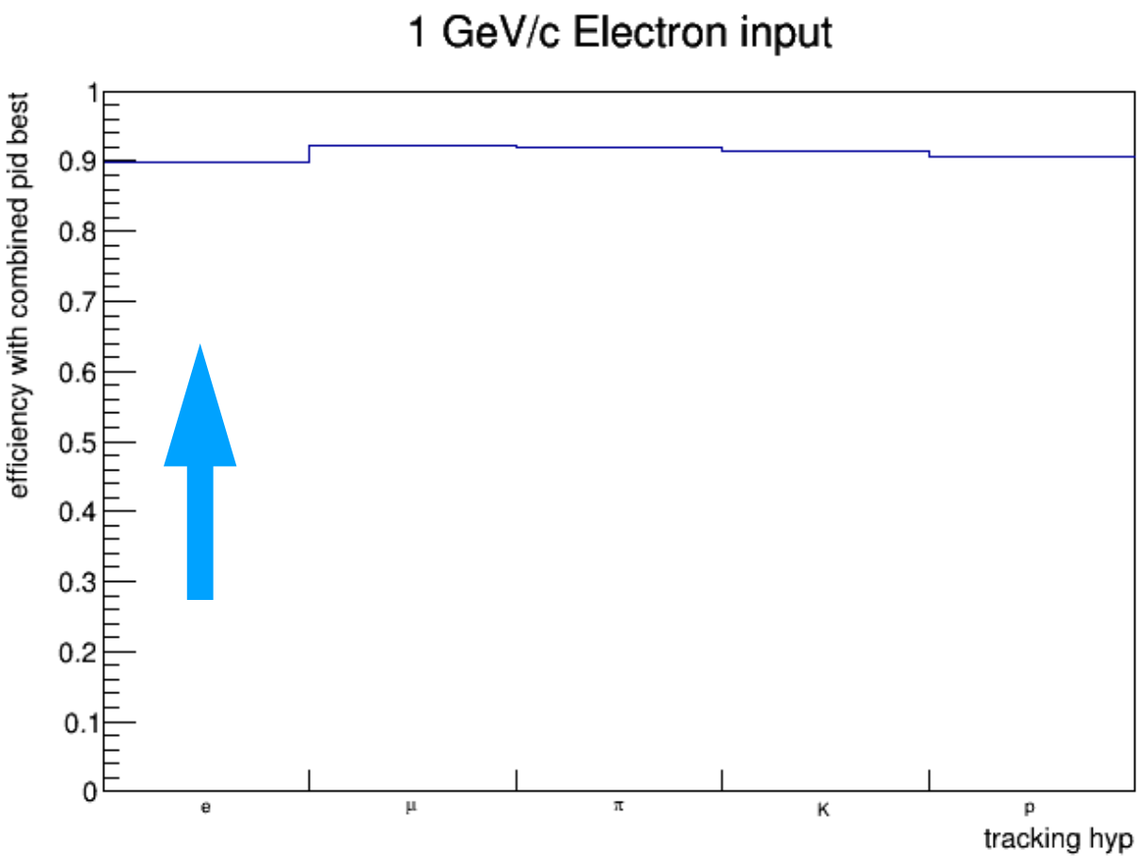


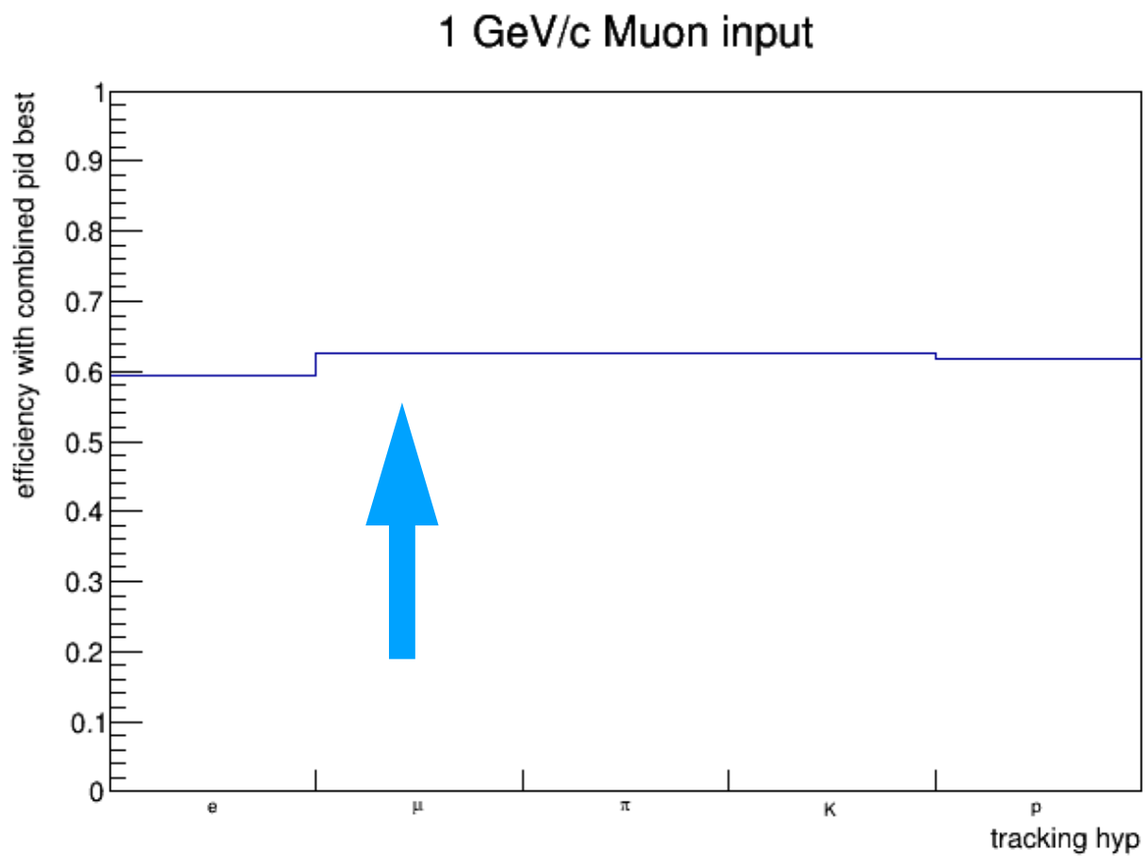


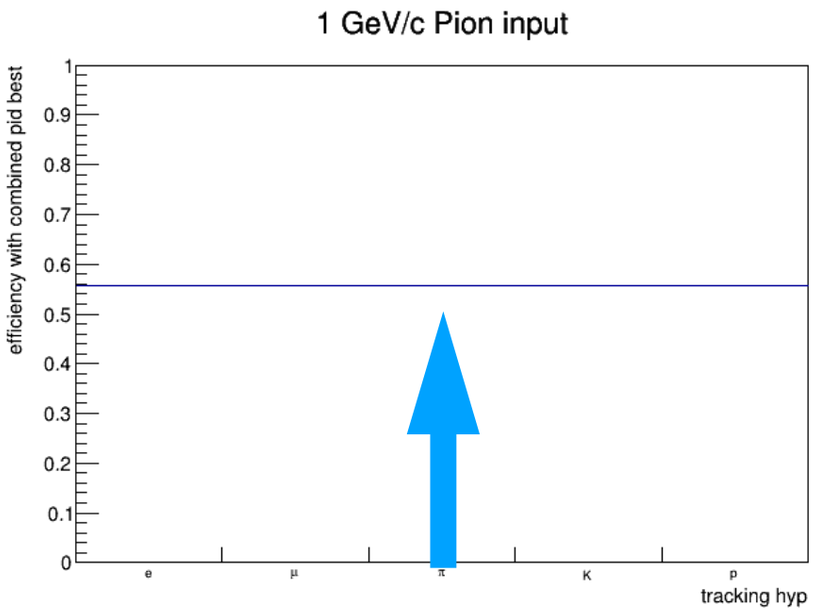


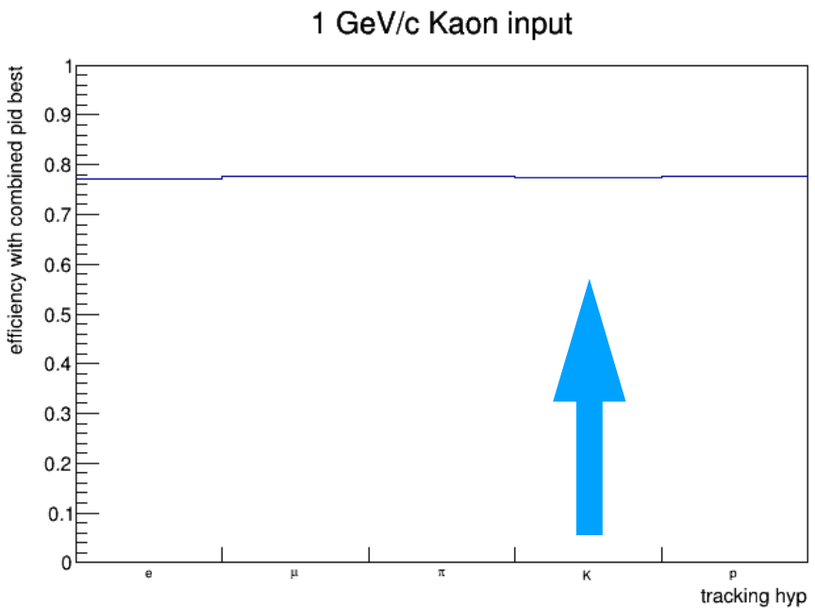
Best PID vs. Tracking Hyp.

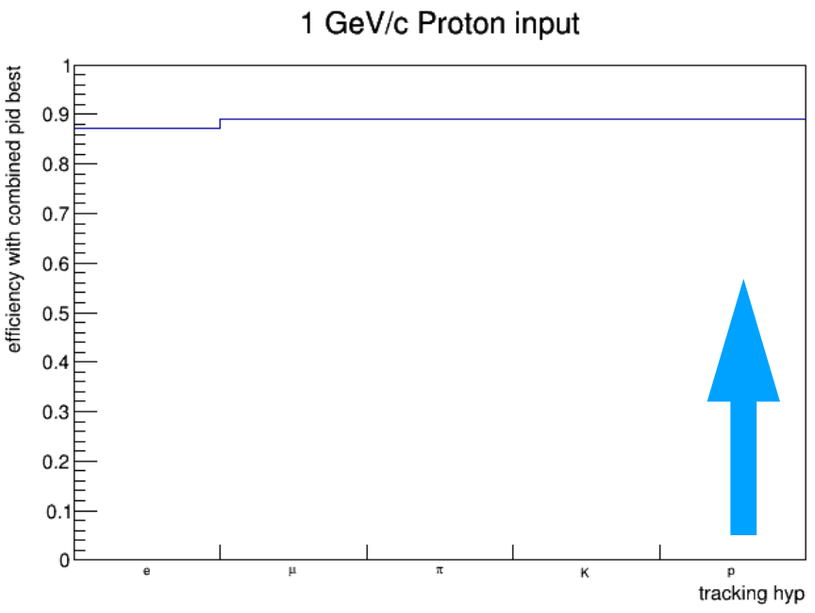
"PidAlgoMvd","PidAlgoStt","PidAlgoSciT","PidAlgoDrc","PidAlgoEmcBayes"











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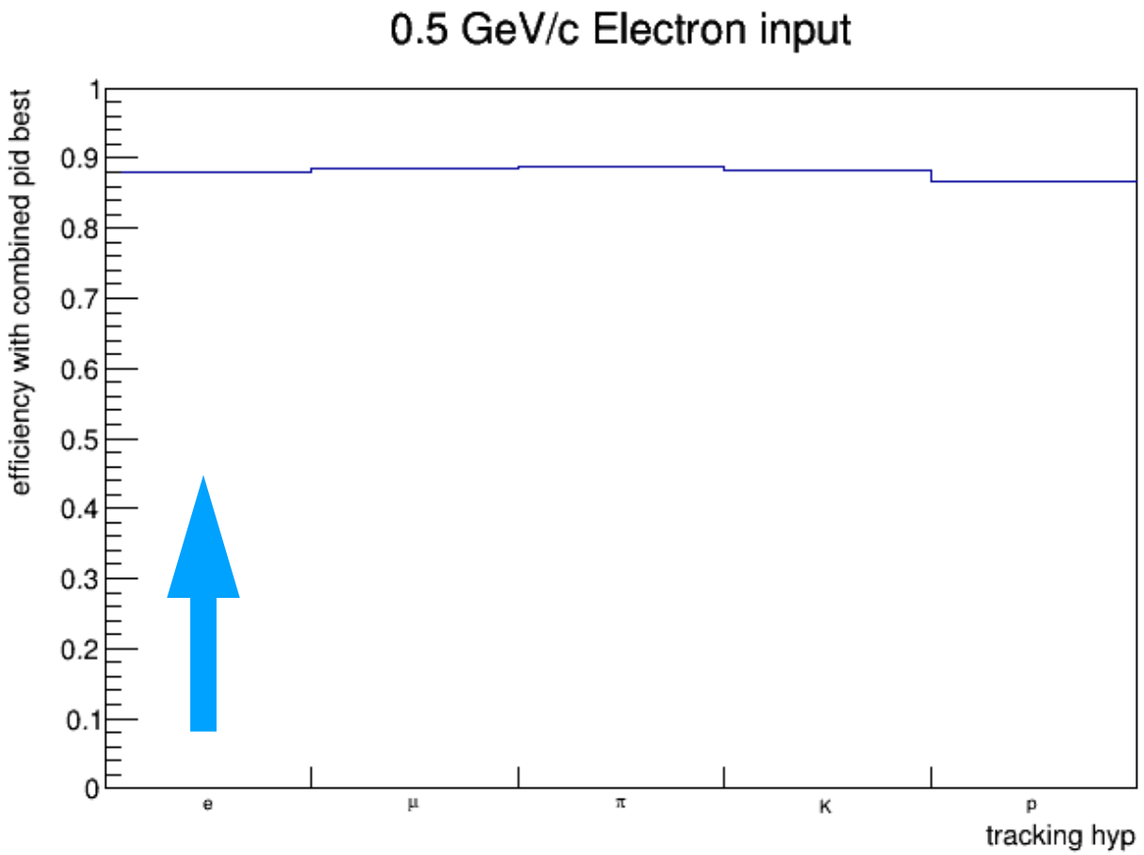

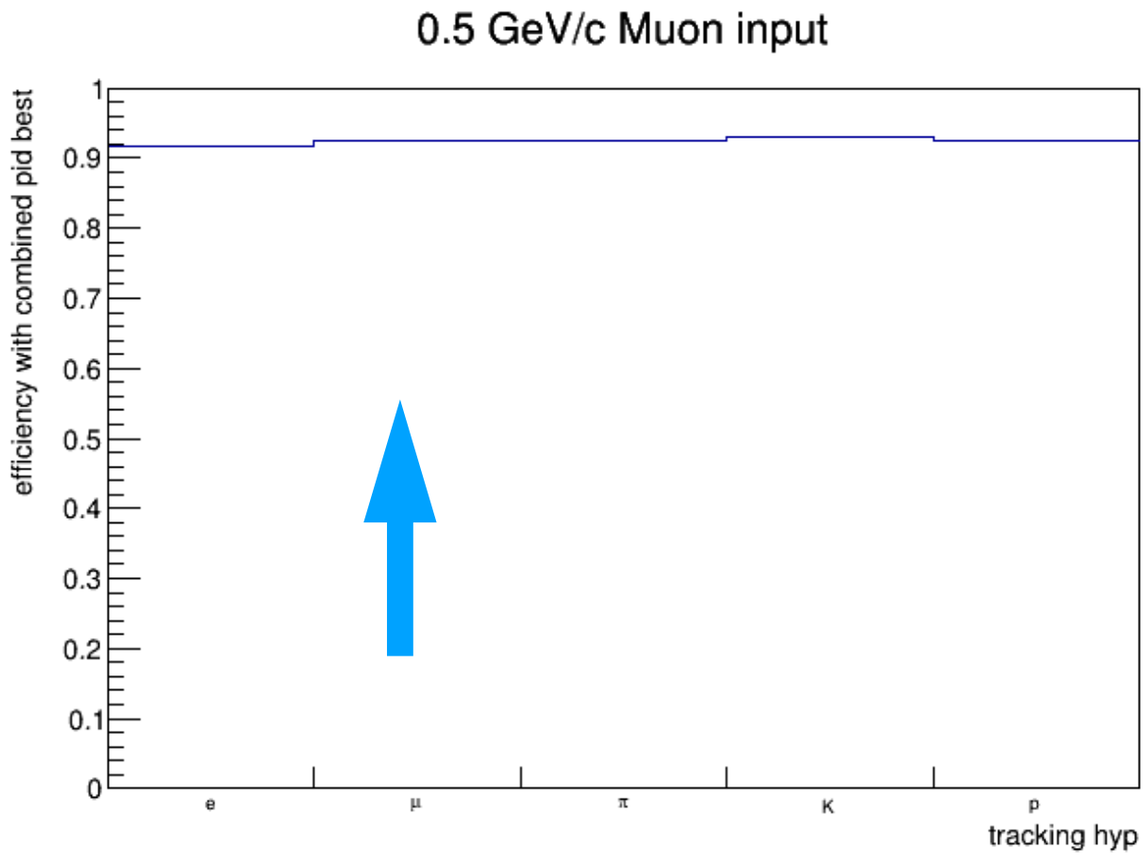

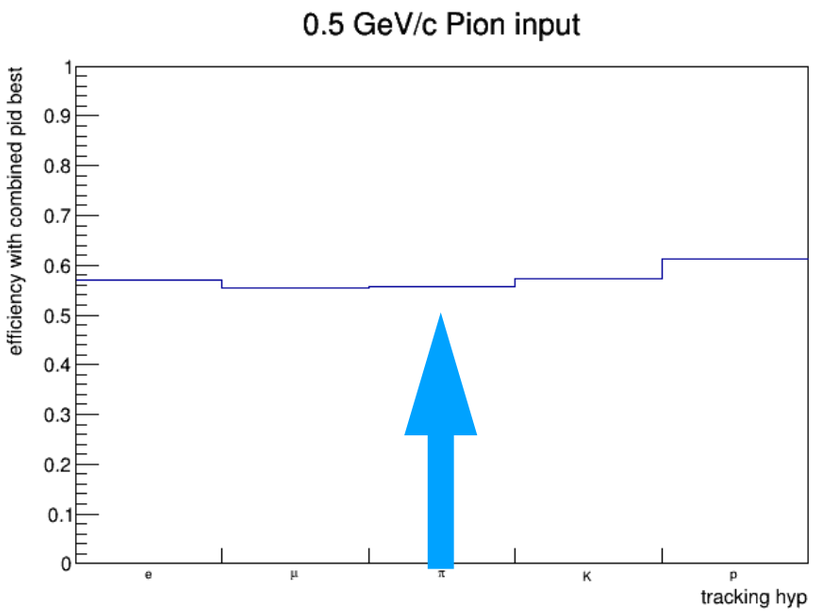

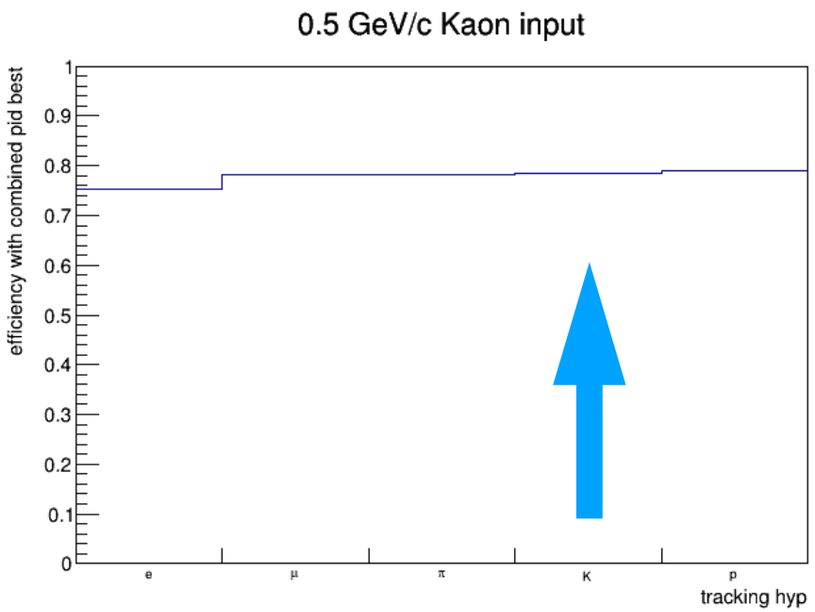

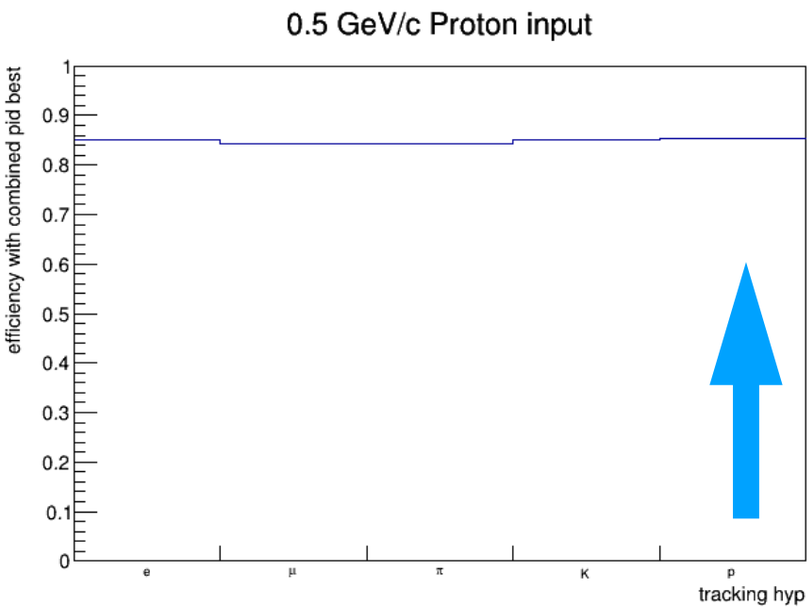

"Good" (p>0.5) PID vs. Tracking Hyp.

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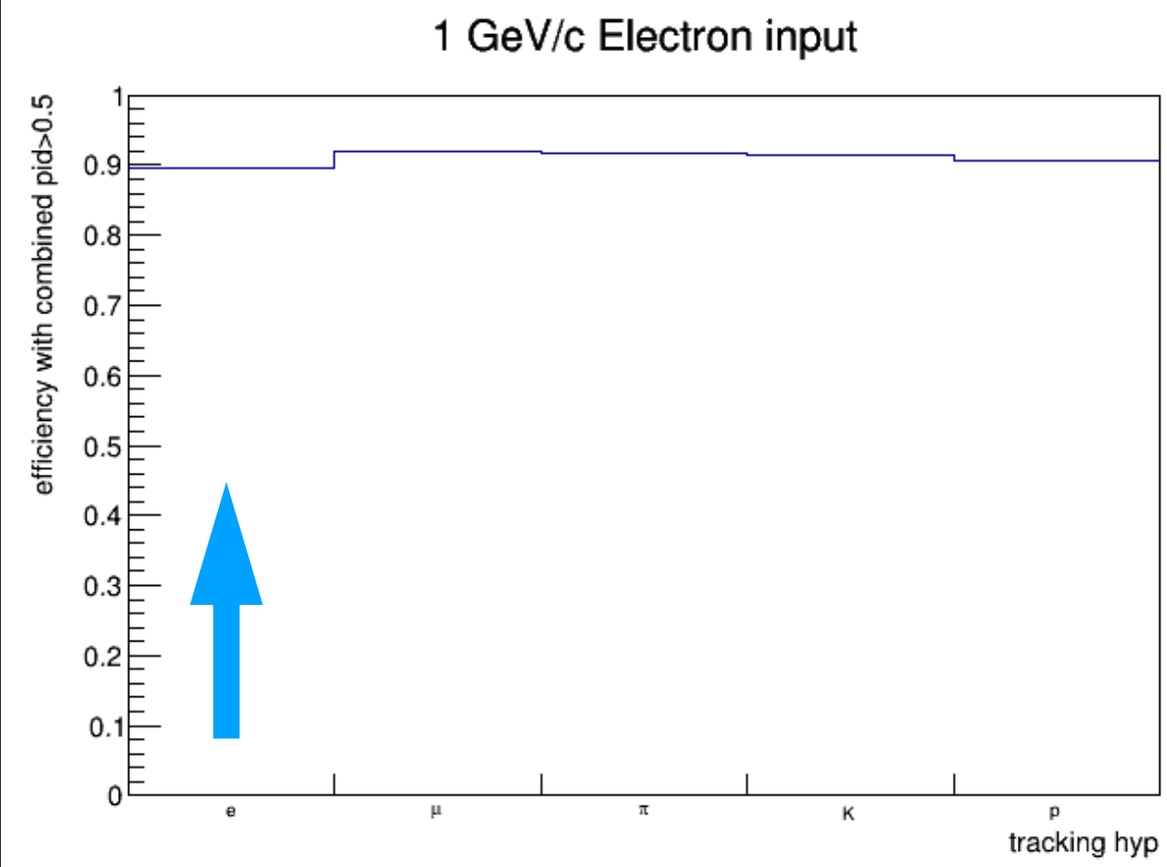

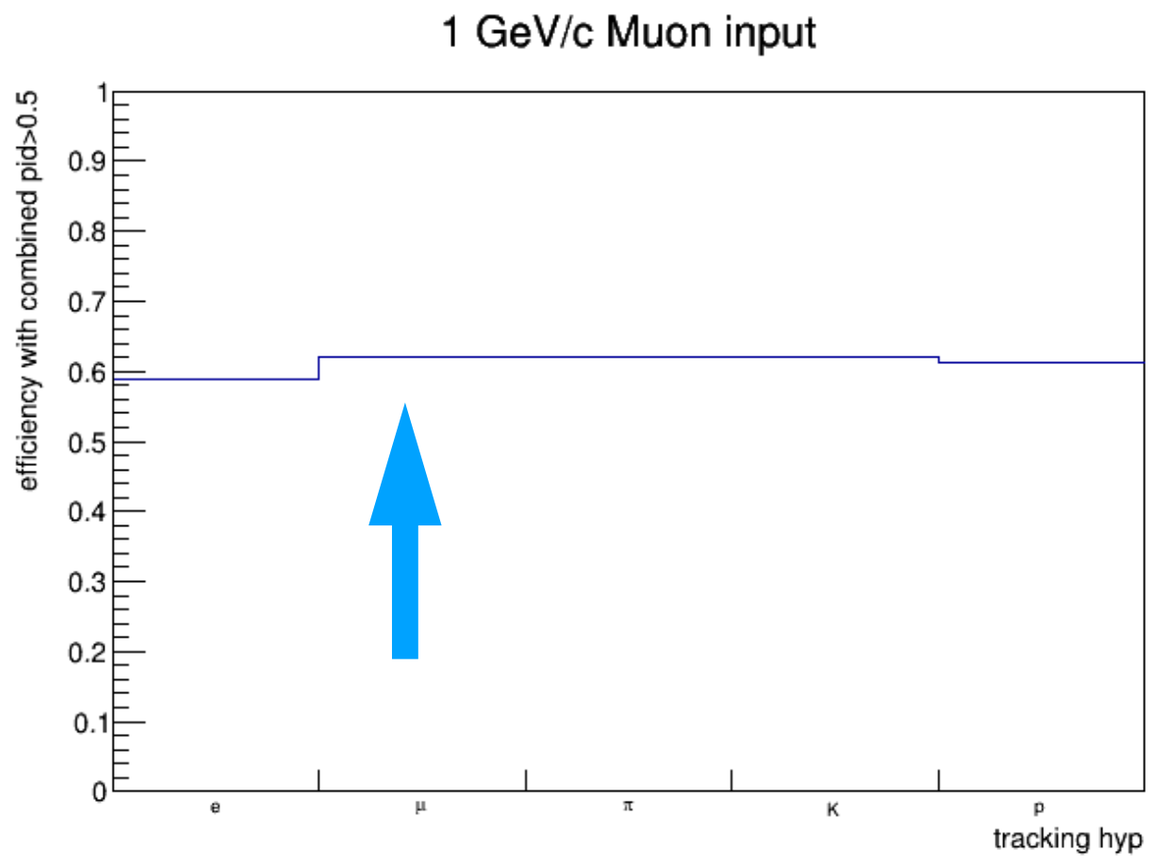

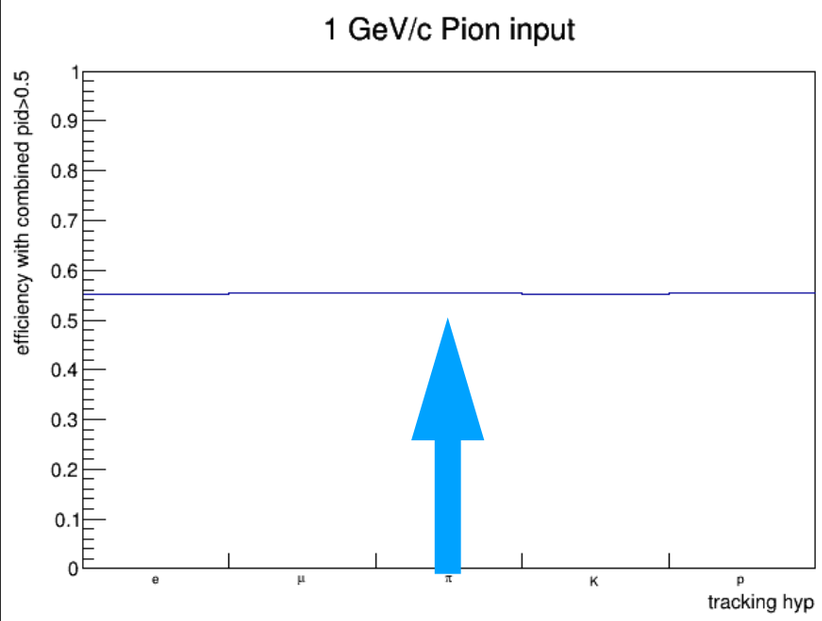

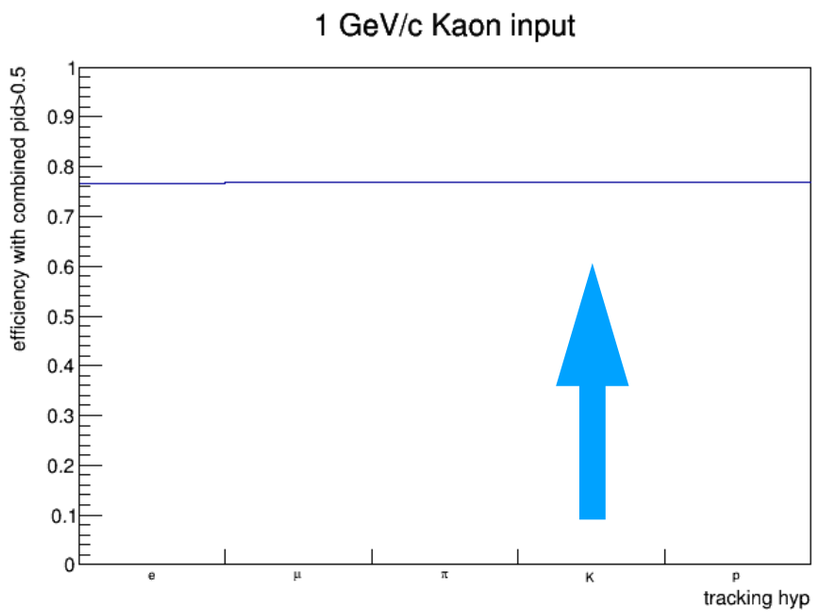

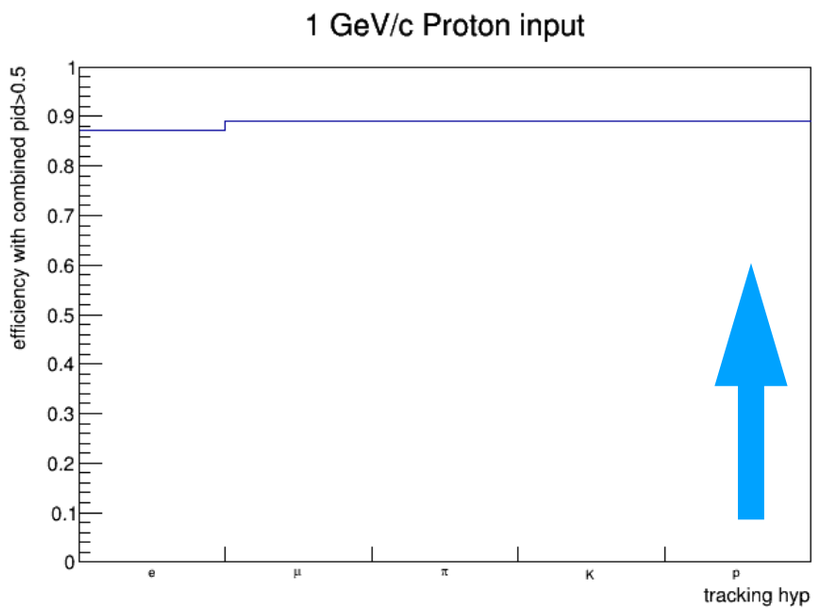

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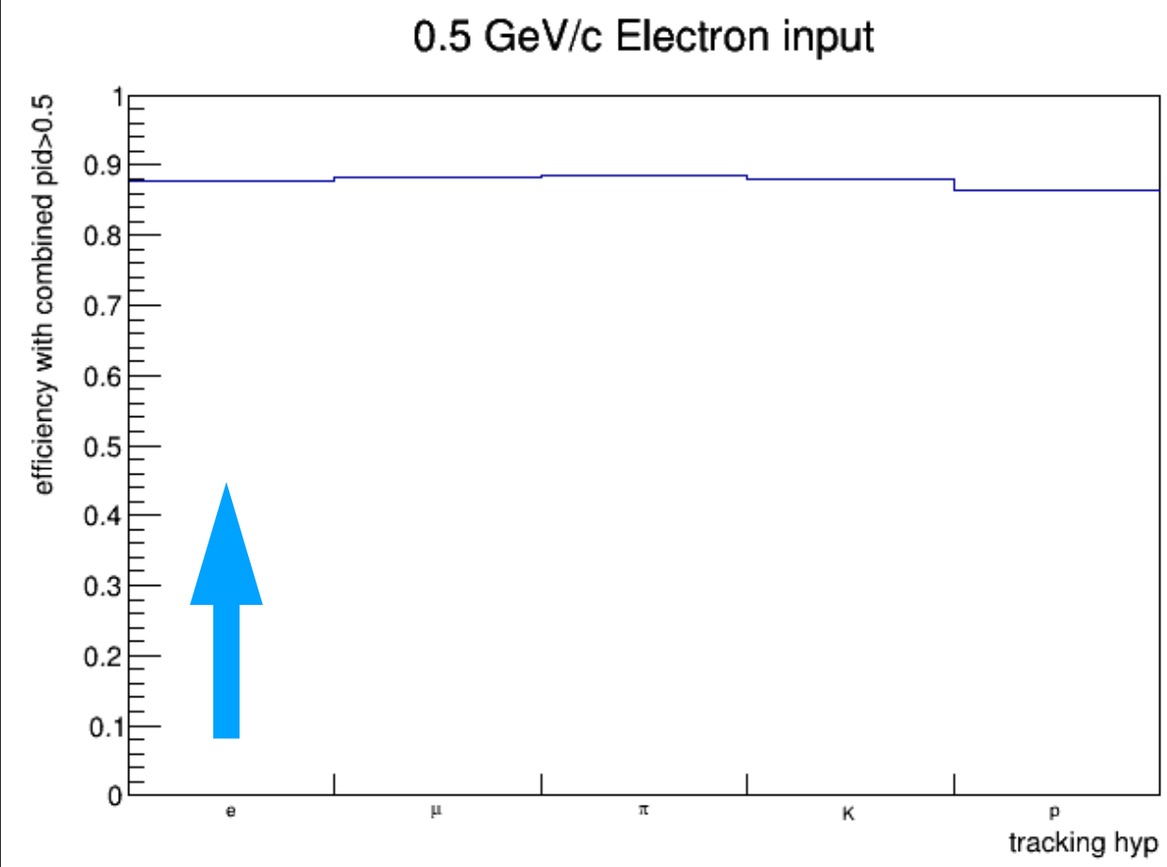
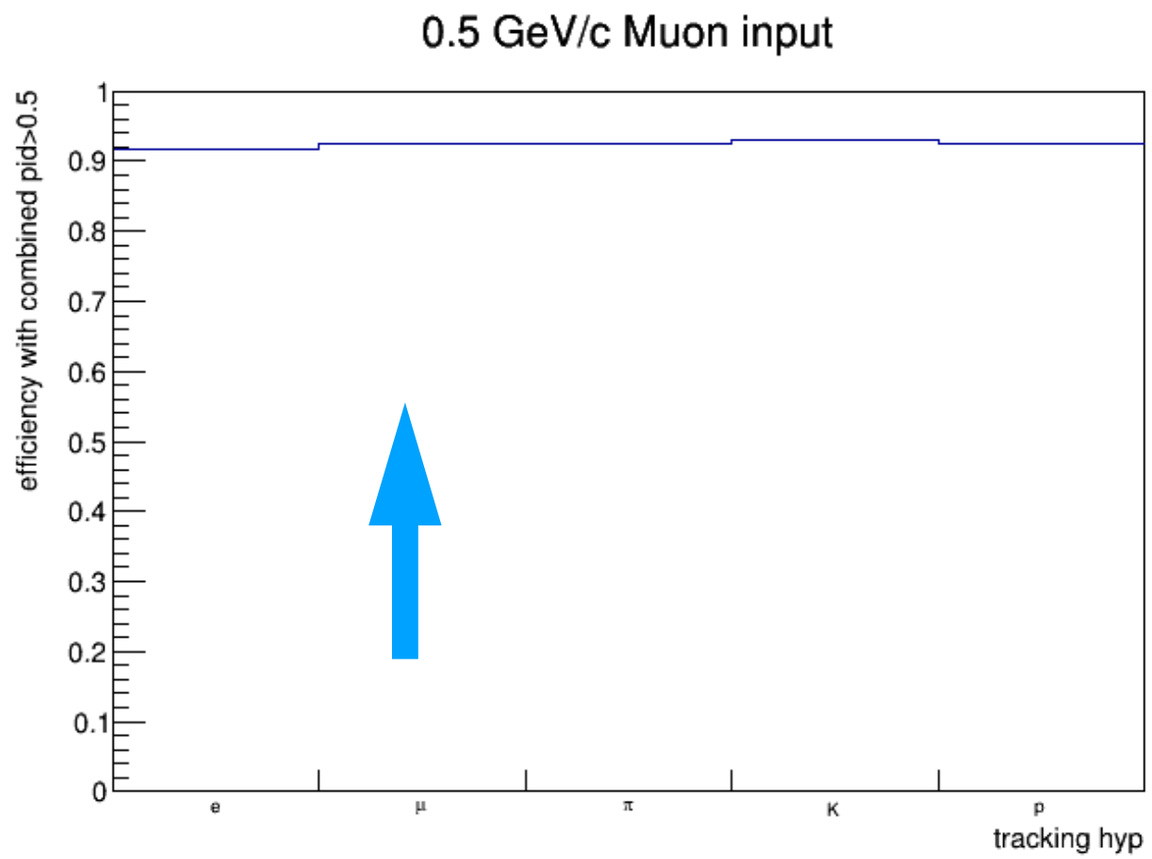
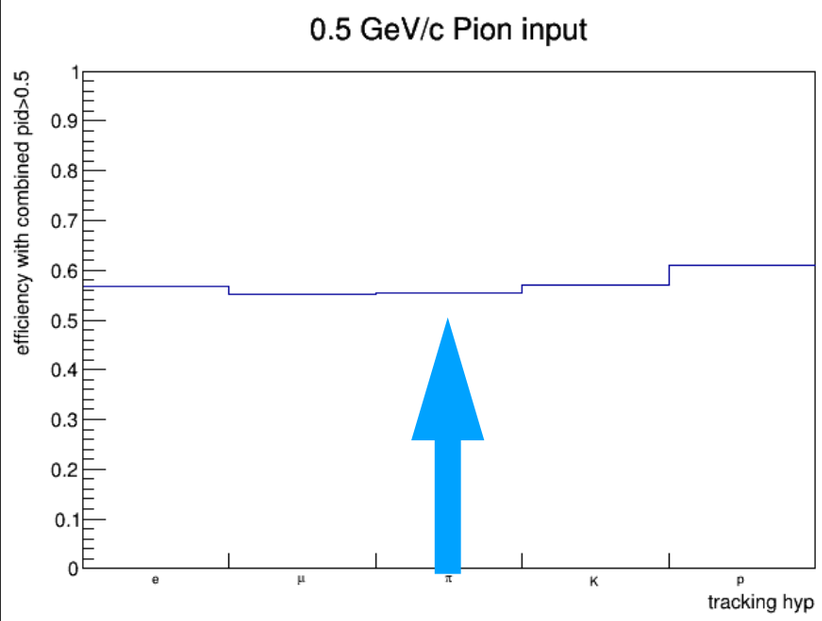
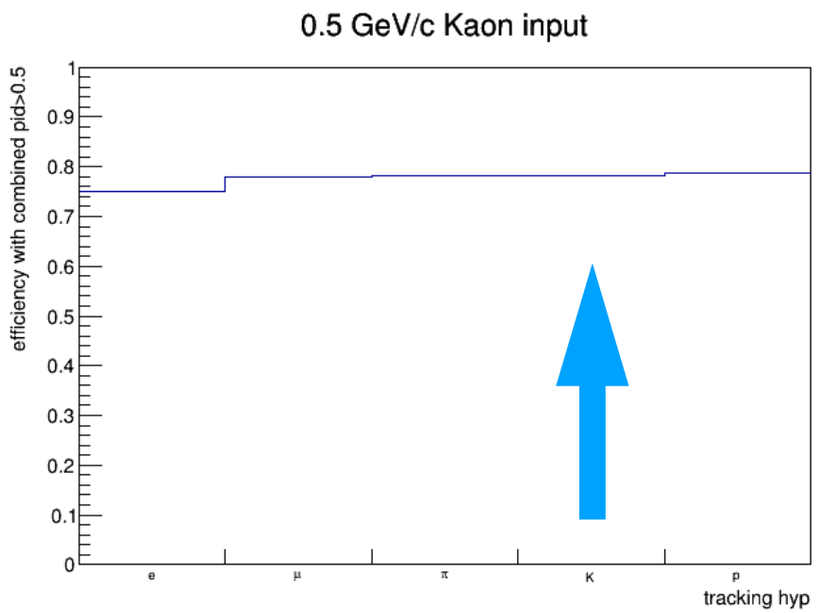
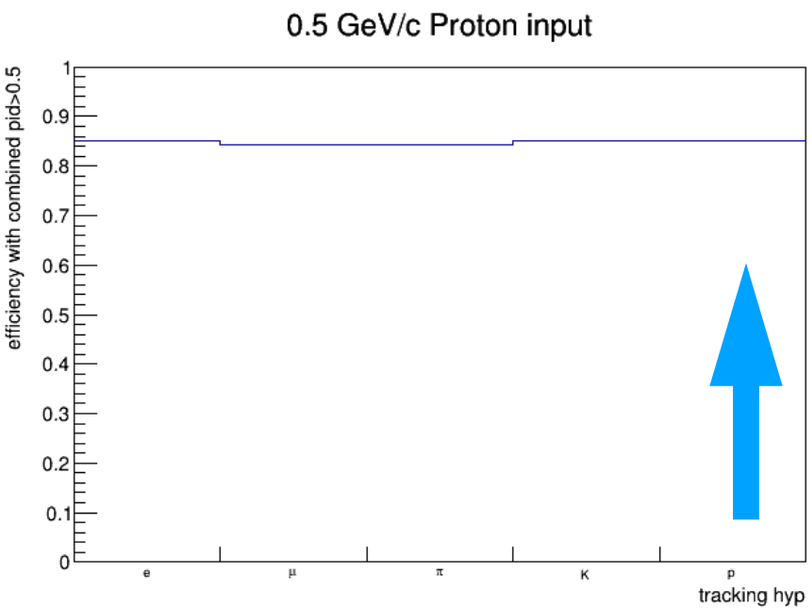


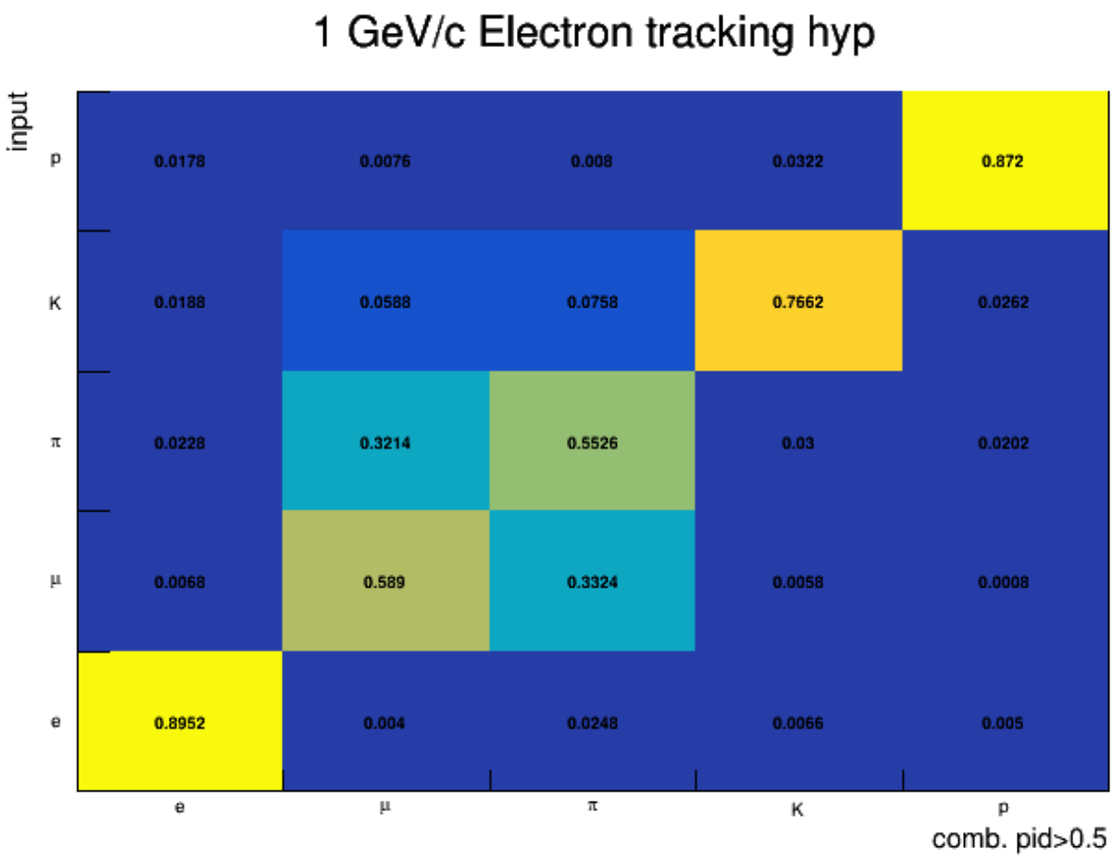


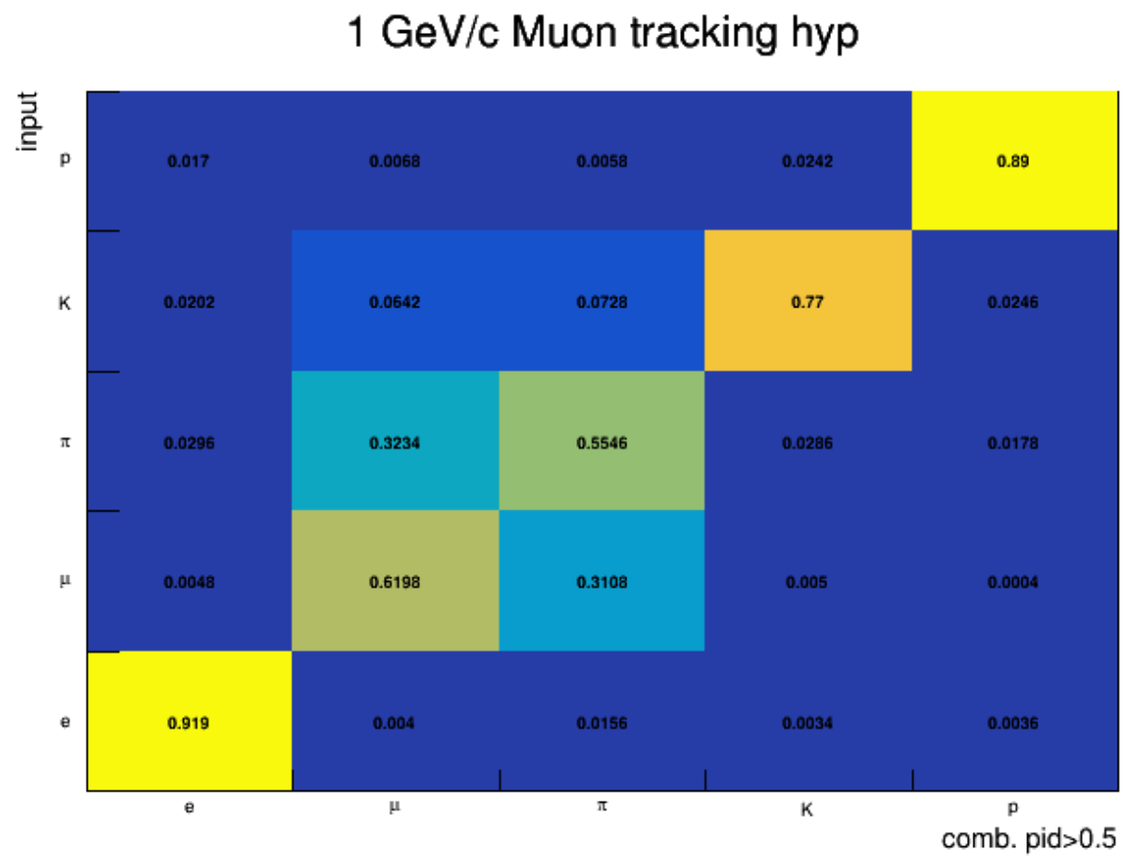


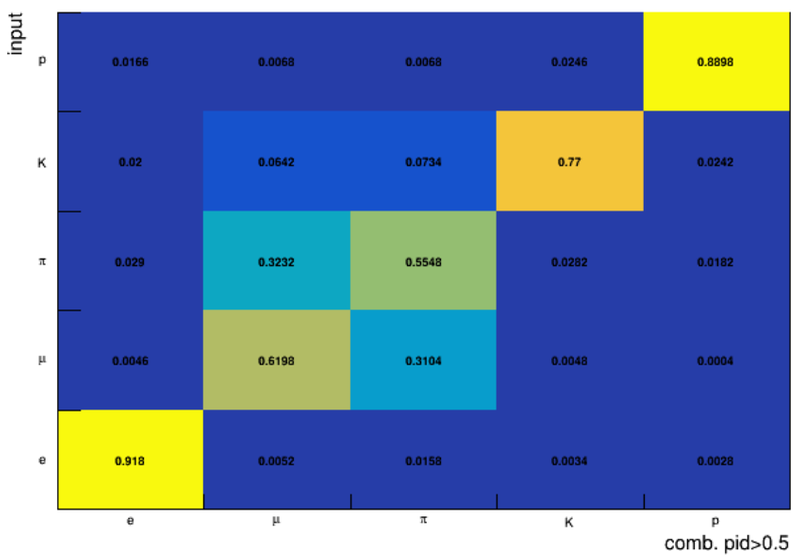


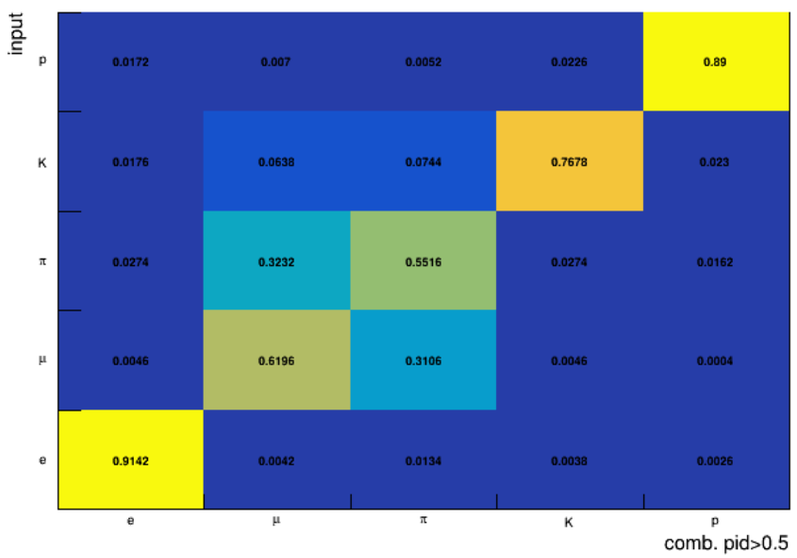


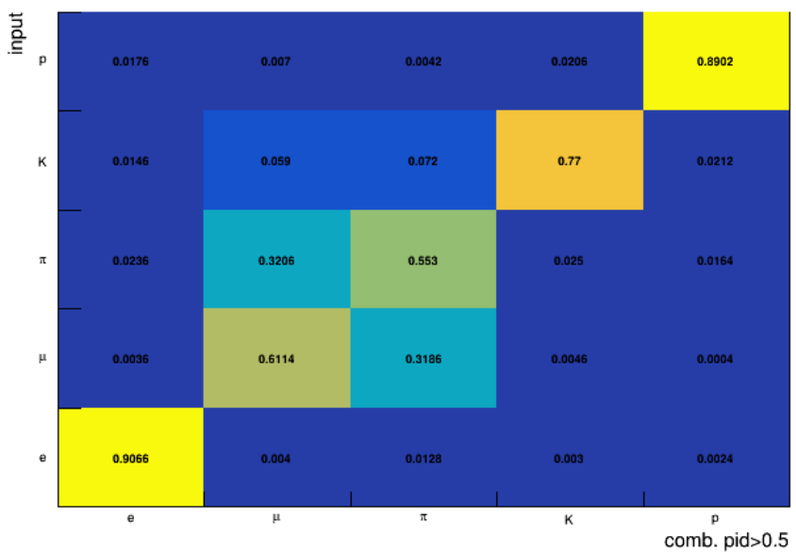
Input-Output Matrices











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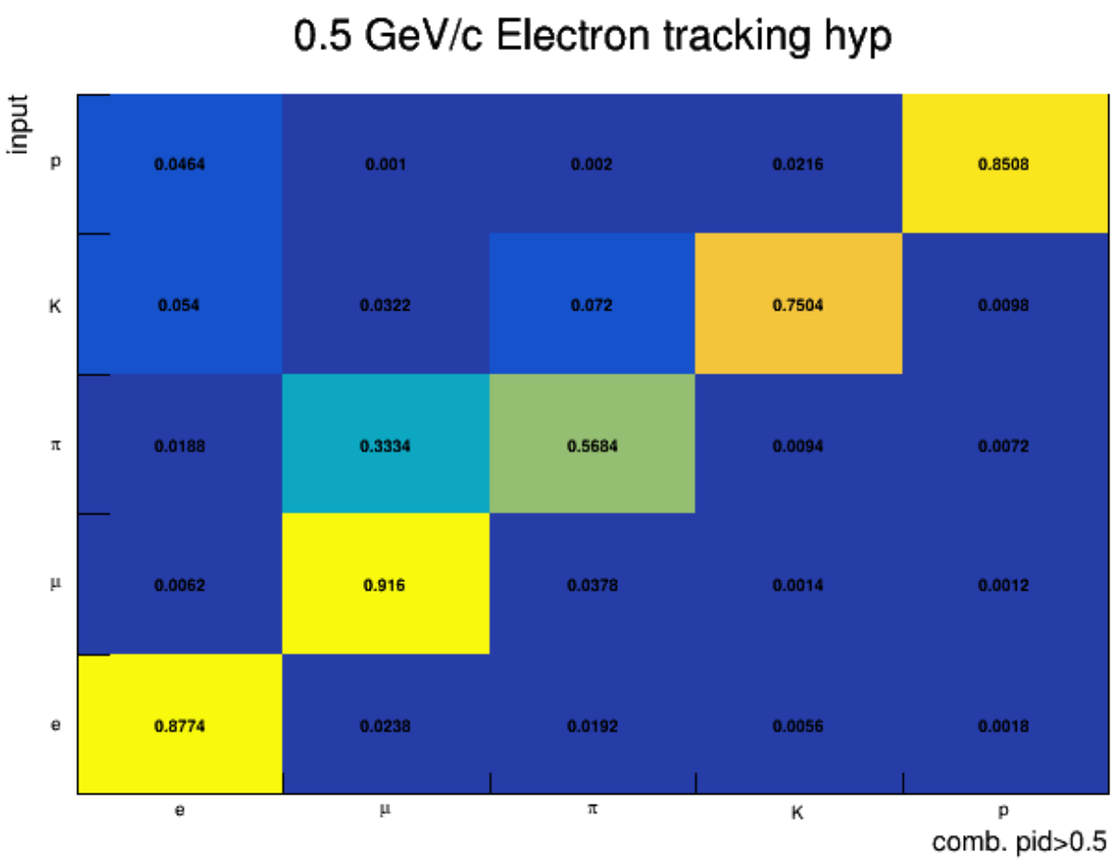

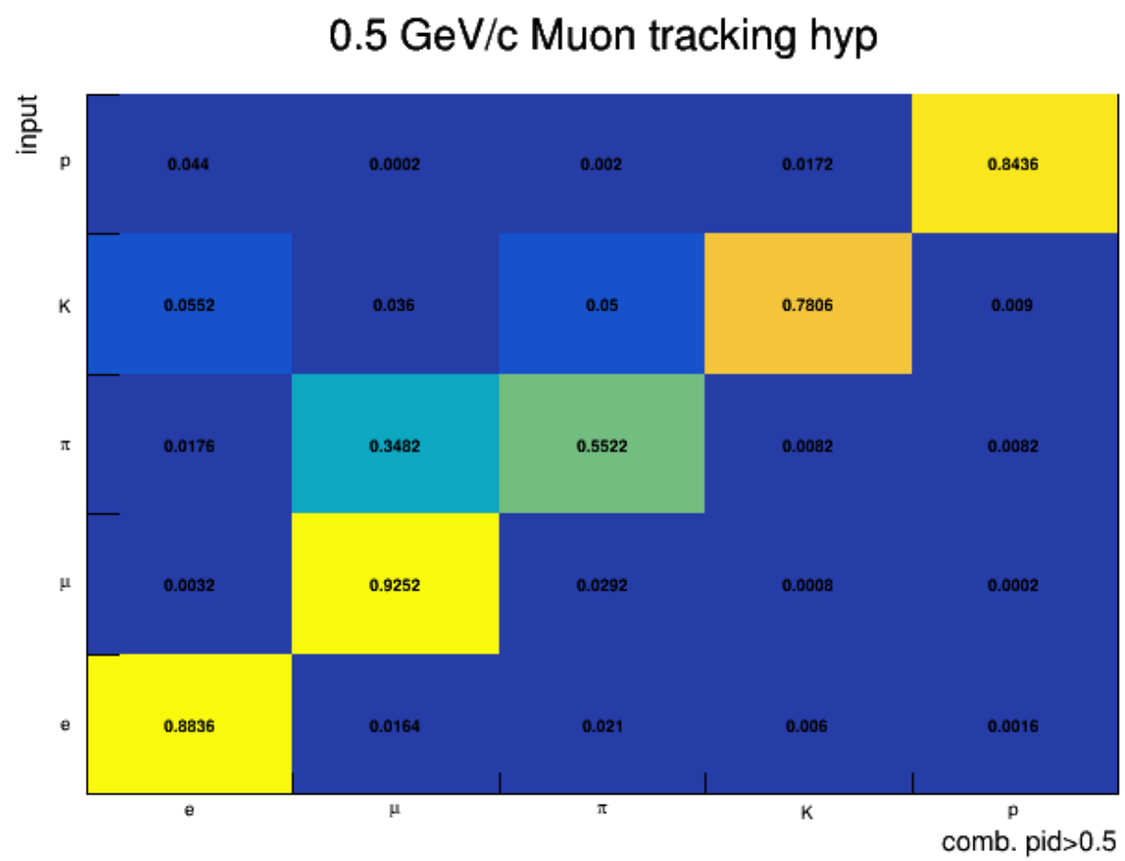

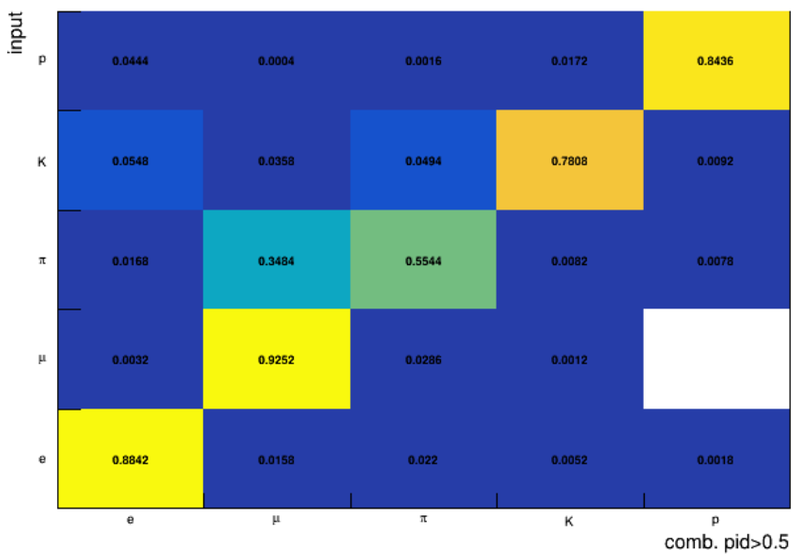

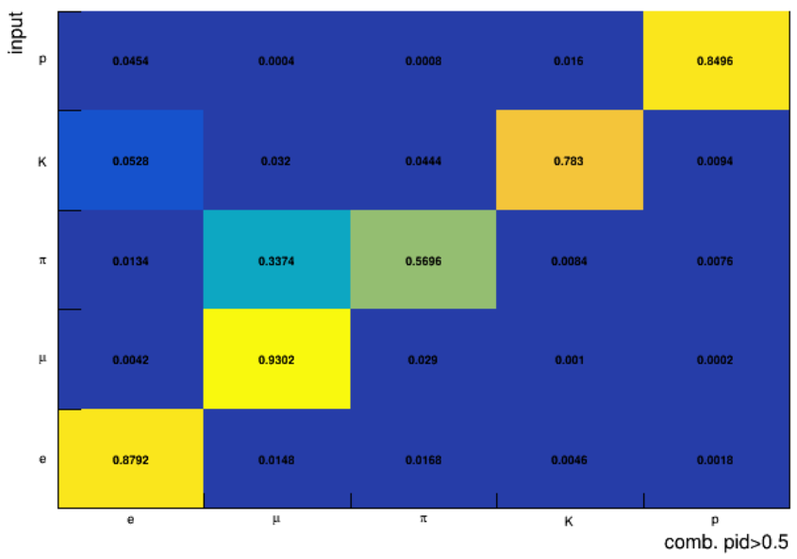

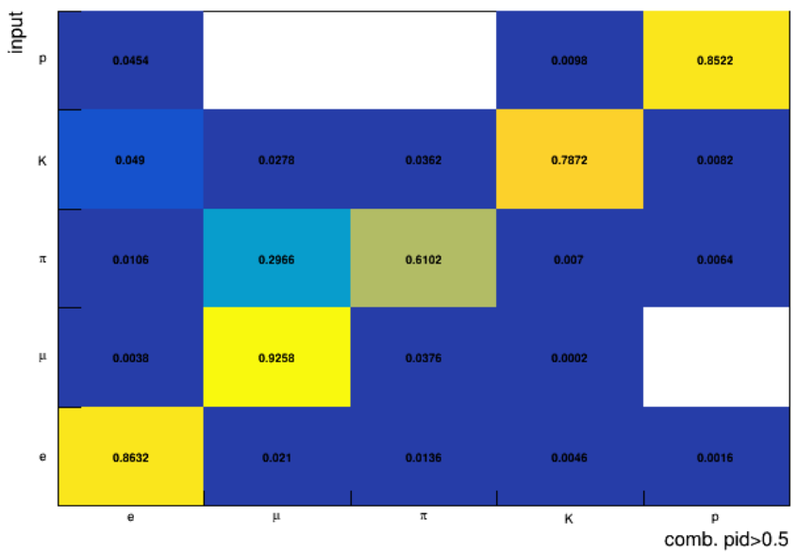

Summary/Outlook

- 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.