

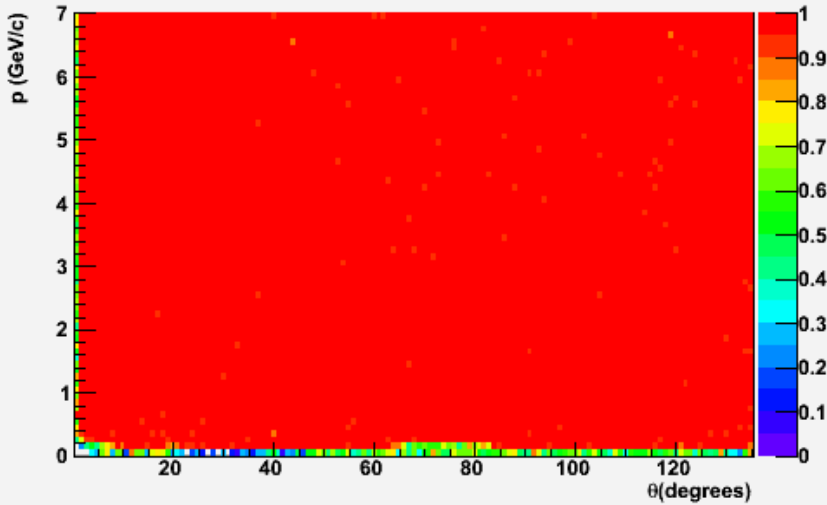
Kalman Filter Update

Simon Taylor/JLab

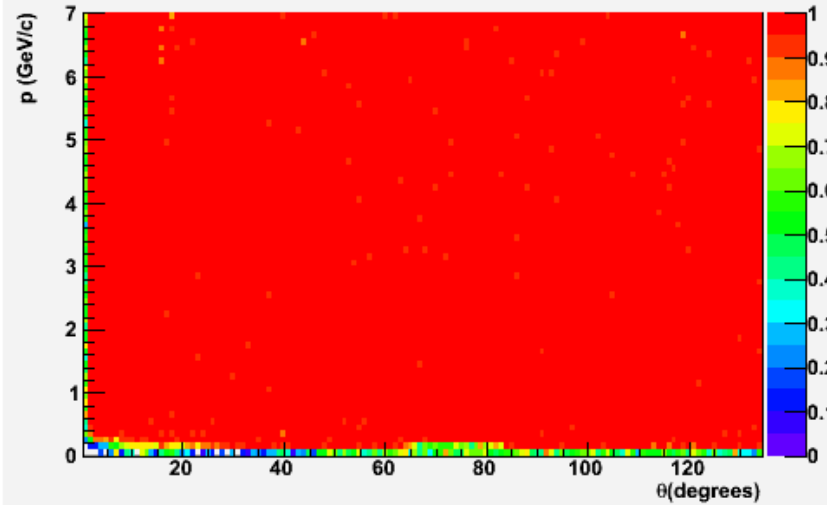
- Code no longer relies on scaling the measurement errors with an iteration-dependent schedule (asymptotically approaching no scaling)
- Variance in energy loss computed according to FWHM of Landau distribution (used to assume thick absorbers → Gaussian distribution)
 - This variance tends to be very small
- Use formula due to Lynch and Dahl for the RMS scattering angle for Multiple Scattering
 - The fraction of the full Moliere distribution considered is a parameter (choose $F=0.99$ for now)

Single-track efficiencies

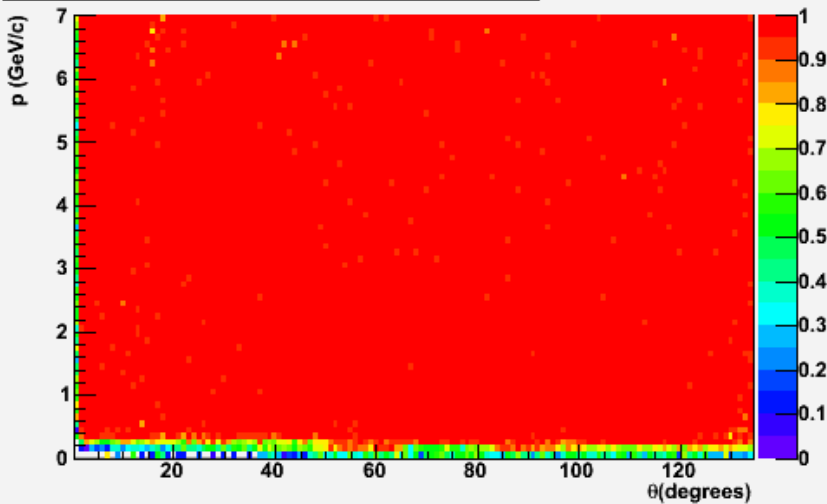
at least one candidate vs p vs theta



at least one wire-based fit vs p vs theta

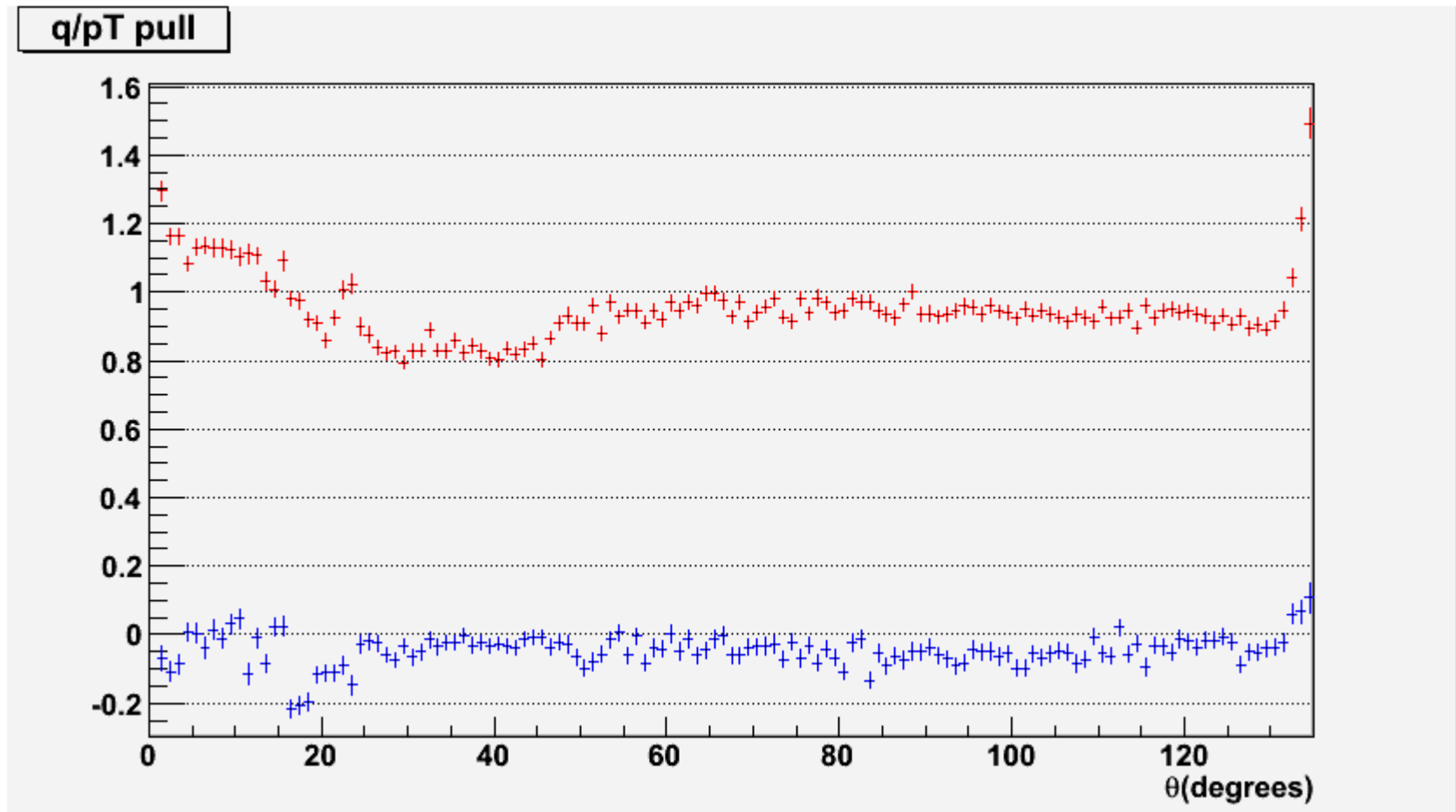


at least one time-based fit vs p vs theta



- Particle gun: generated 250000 π^+ tracks from center of target

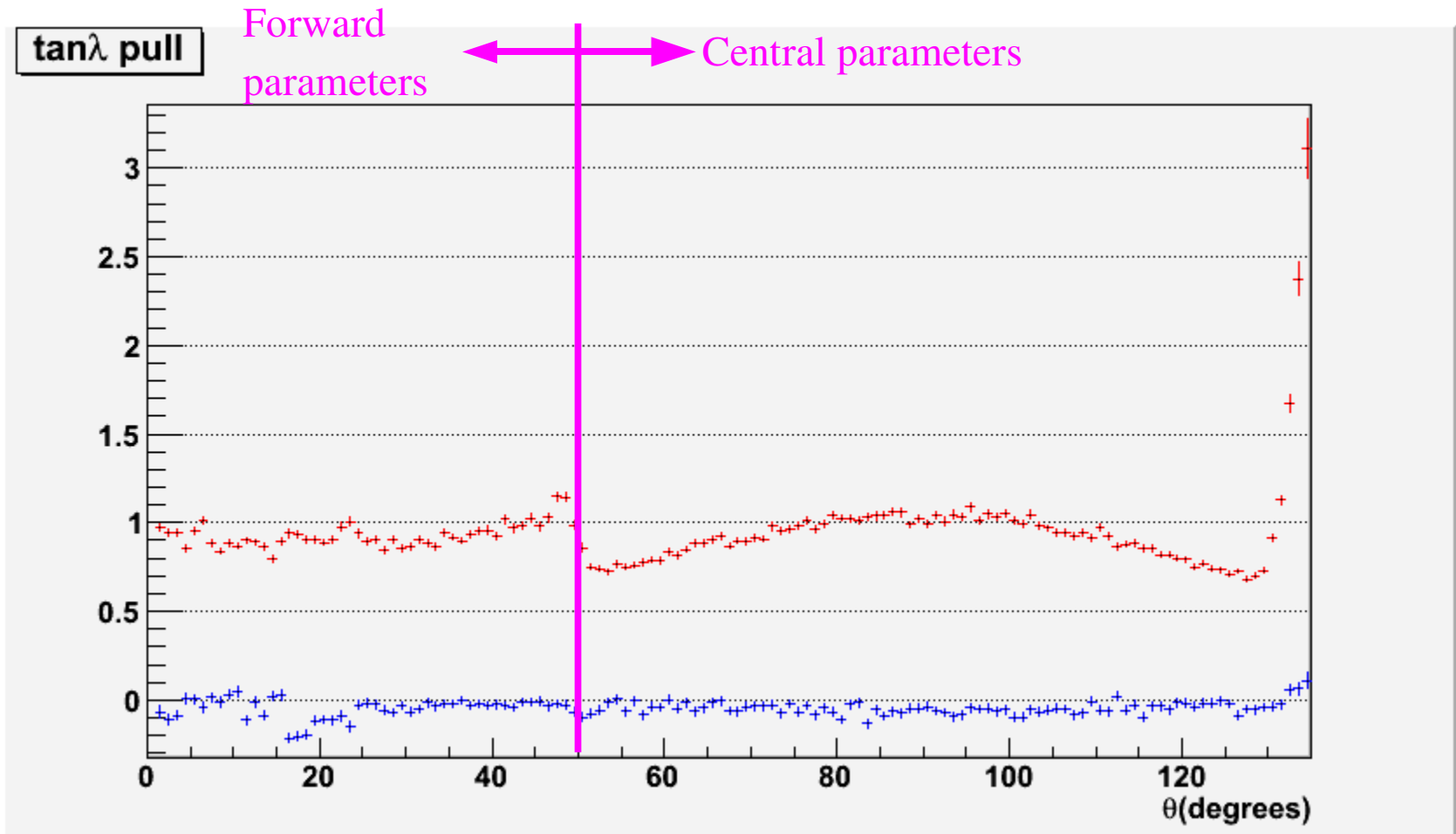
Transverse momentum pull distribution



Sigma

Mean

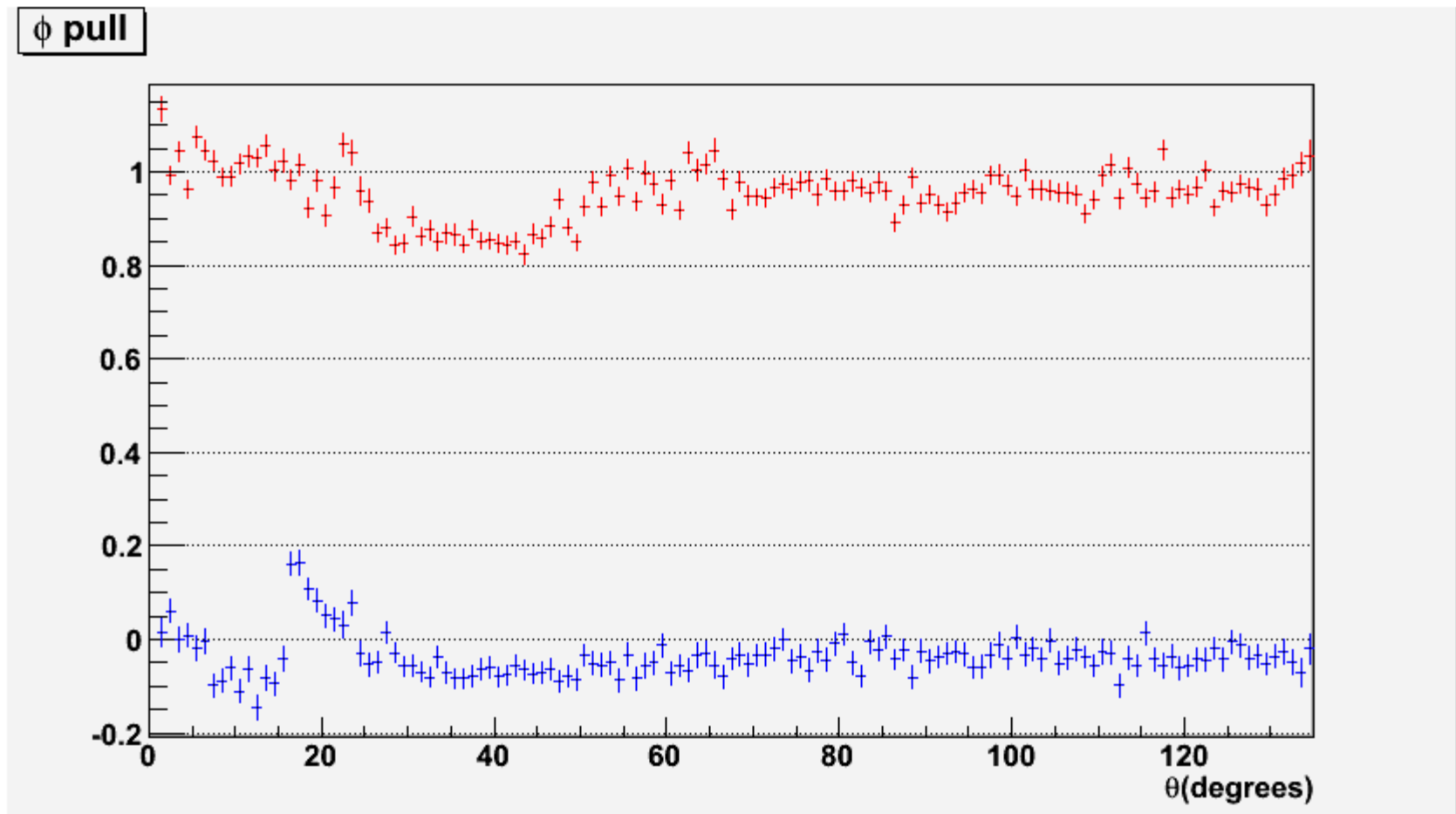
Tan λ pull distribution



Sigma

Mean

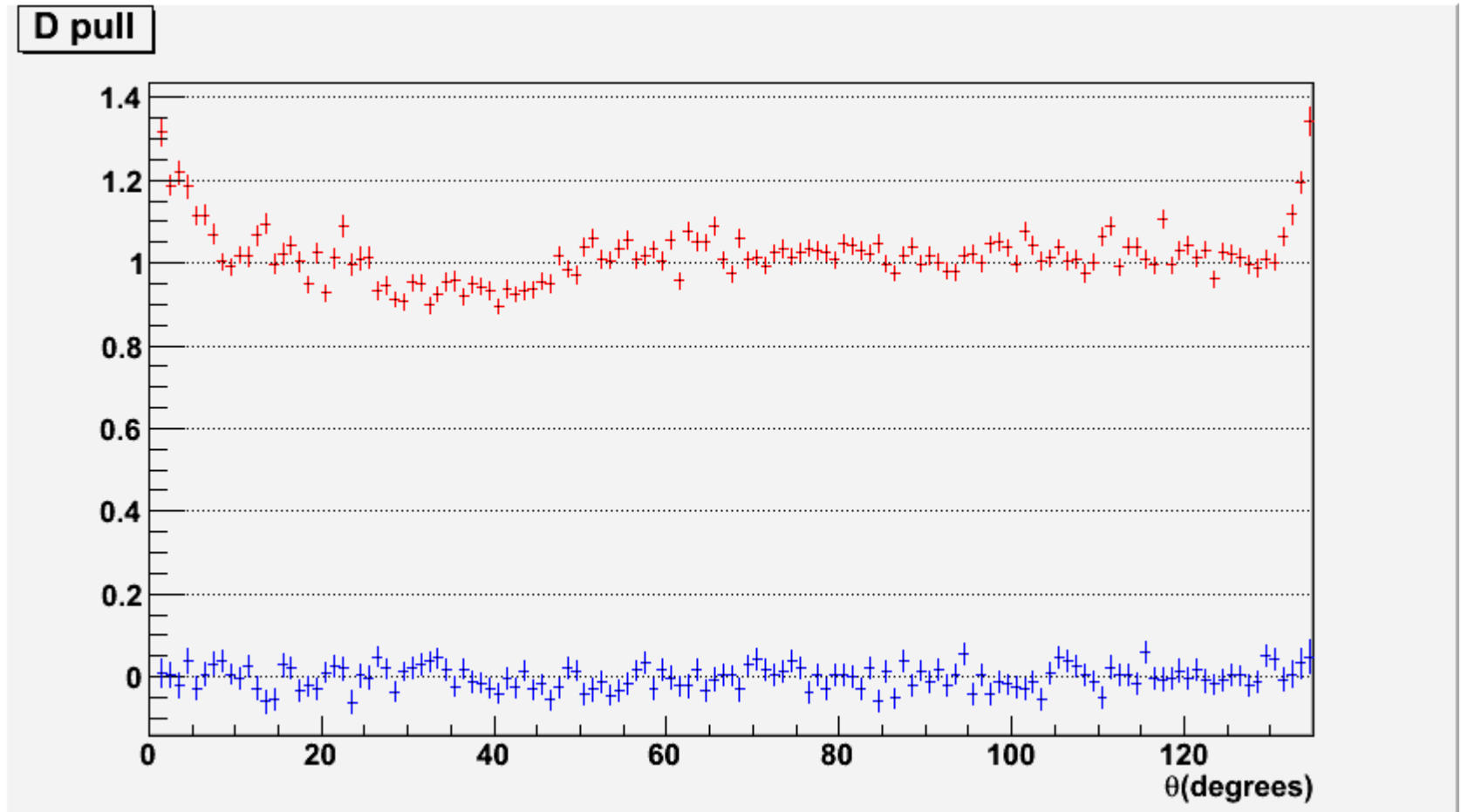
ϕ pull distribution



Sigma

Mean

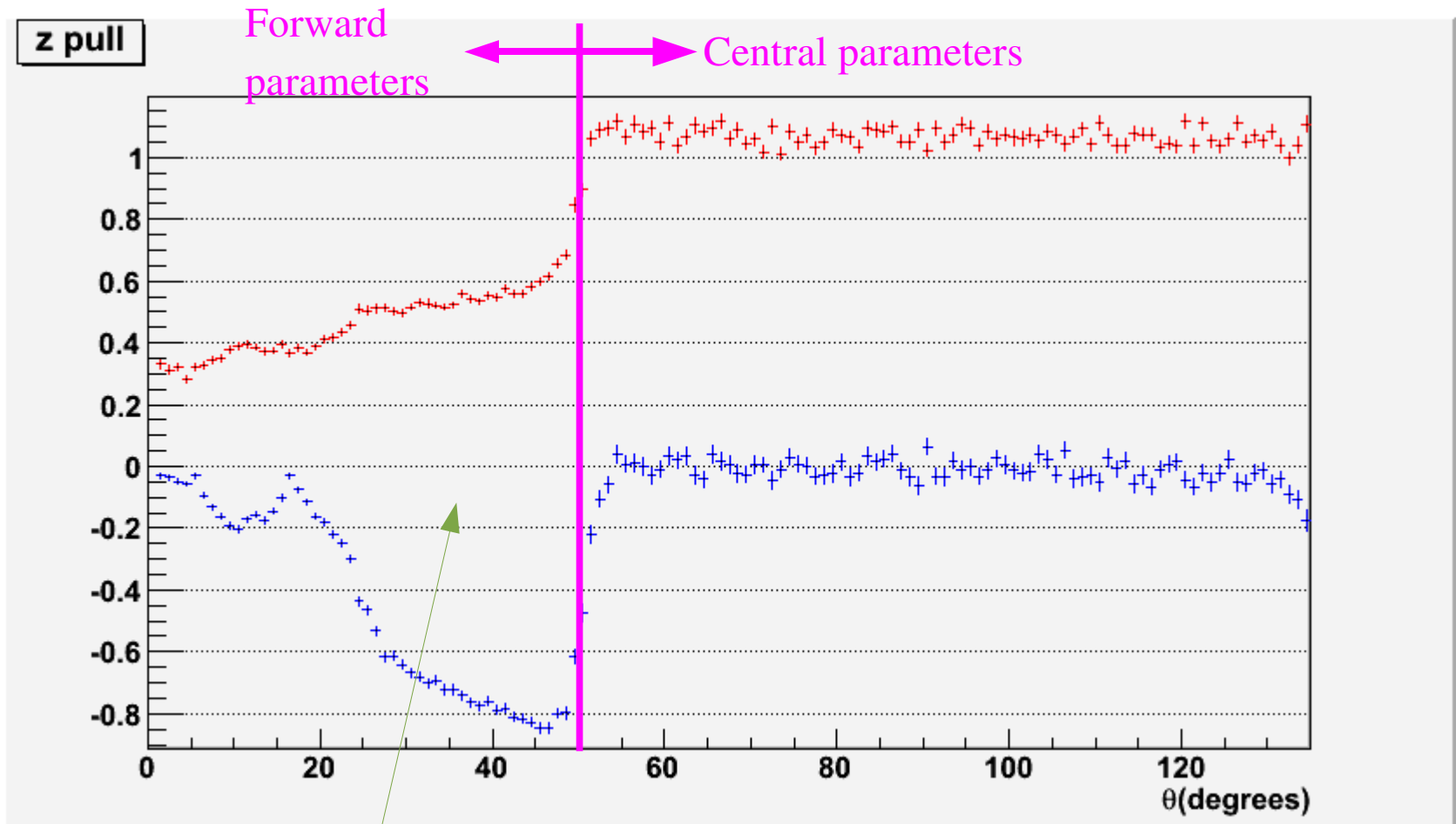
D pull distribution



Sigma

Mean

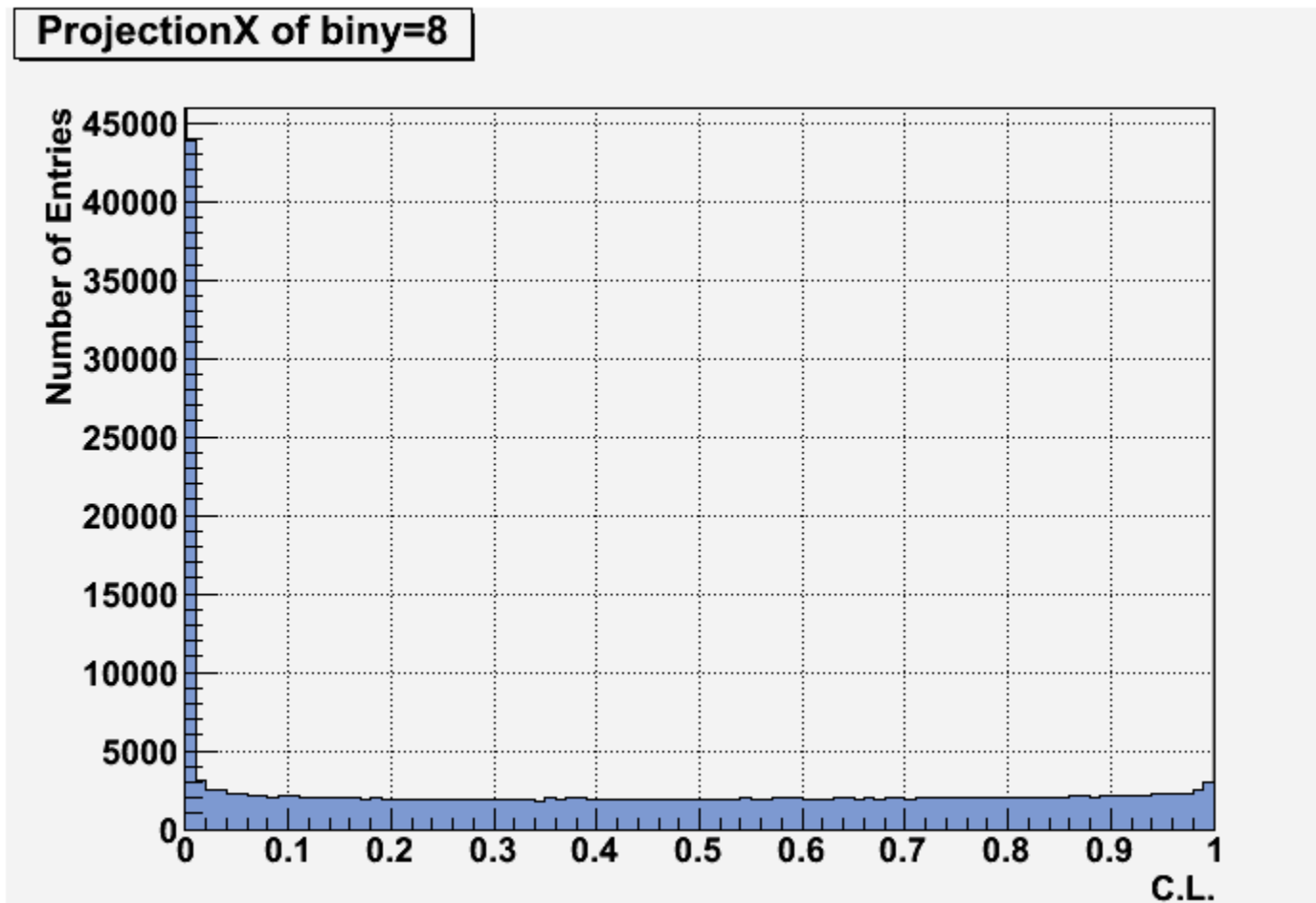
Z pull distribution



*Z is not a
parameter of the
fit in this region...*

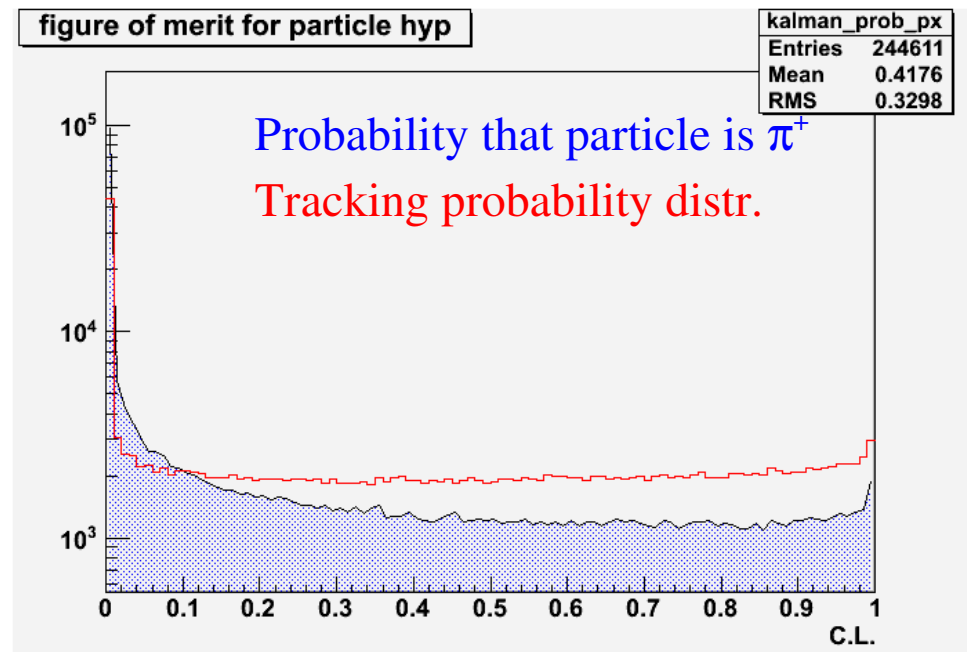
Sigma
Mean

Probability distribution



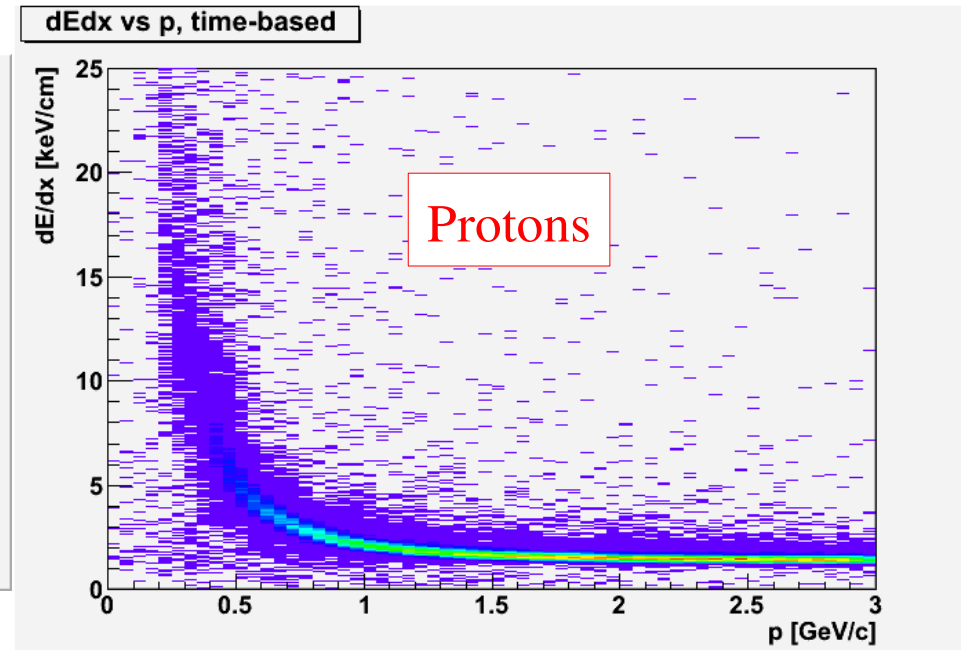
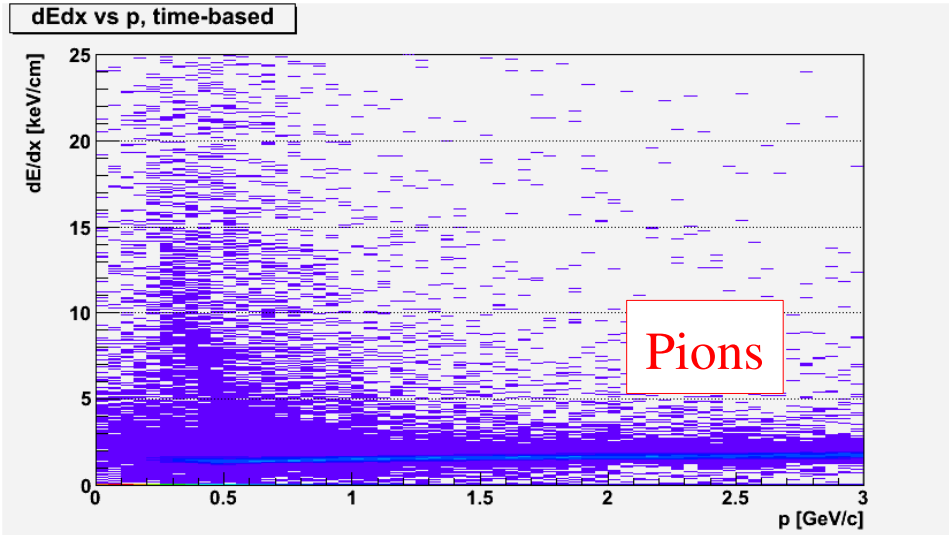
Particle Identification

- Order fitted tracks (several per candidate) according to Figure-of-Merit (FOM)
 - FOM \rightarrow likelihood that mass hypothesis is correct
 - Sum of χ^2 contributions converted to a confidence level with TMath::Prob
 - FOM based on:
 - Tracking χ^2
 - dE/dx in chambers
 - Time-of-flight to BCAL or ToF
 - dE/dx in Start Counter??
 - (not currently included)



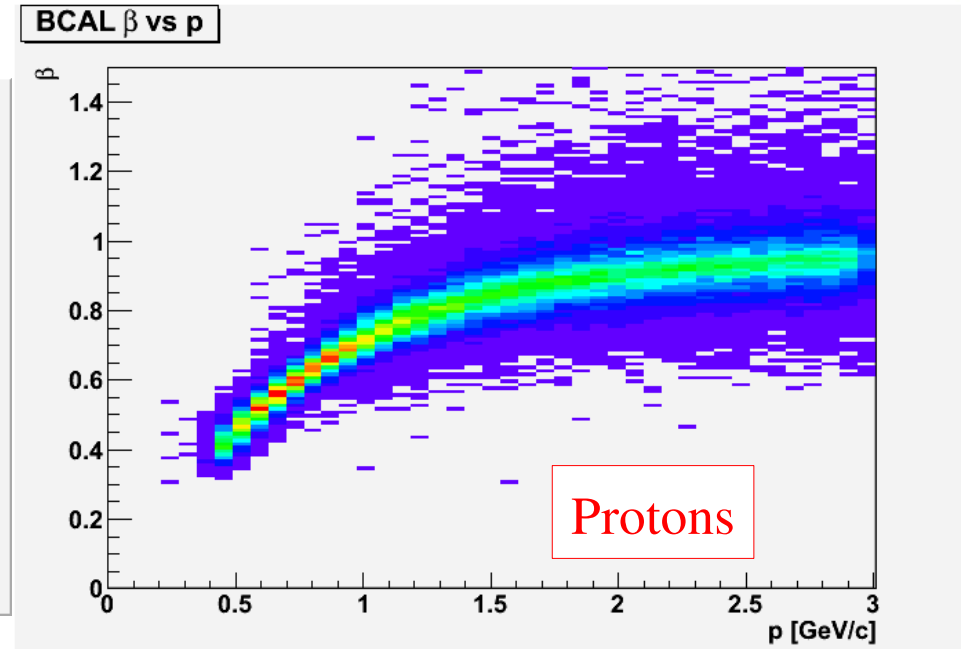
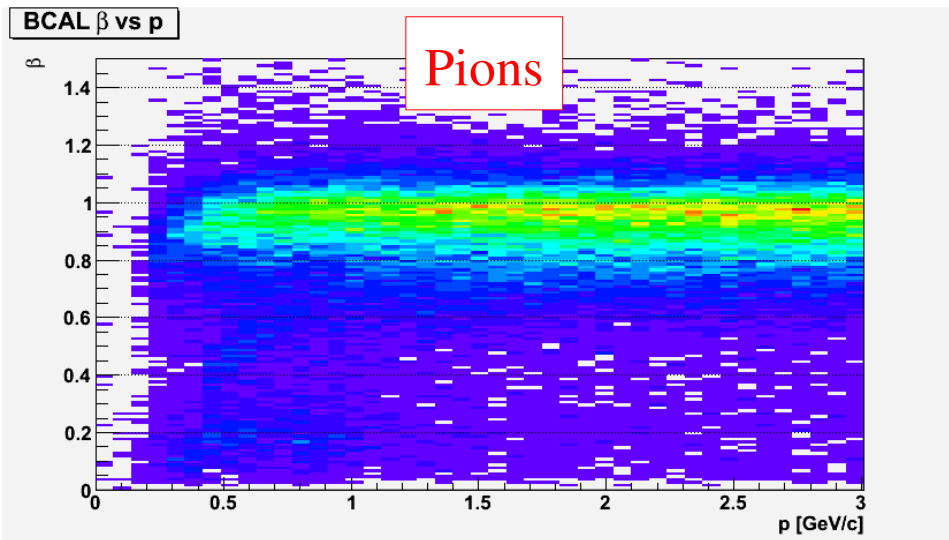
Example FOM for thrown π^+ 's

dE/dx in chambers

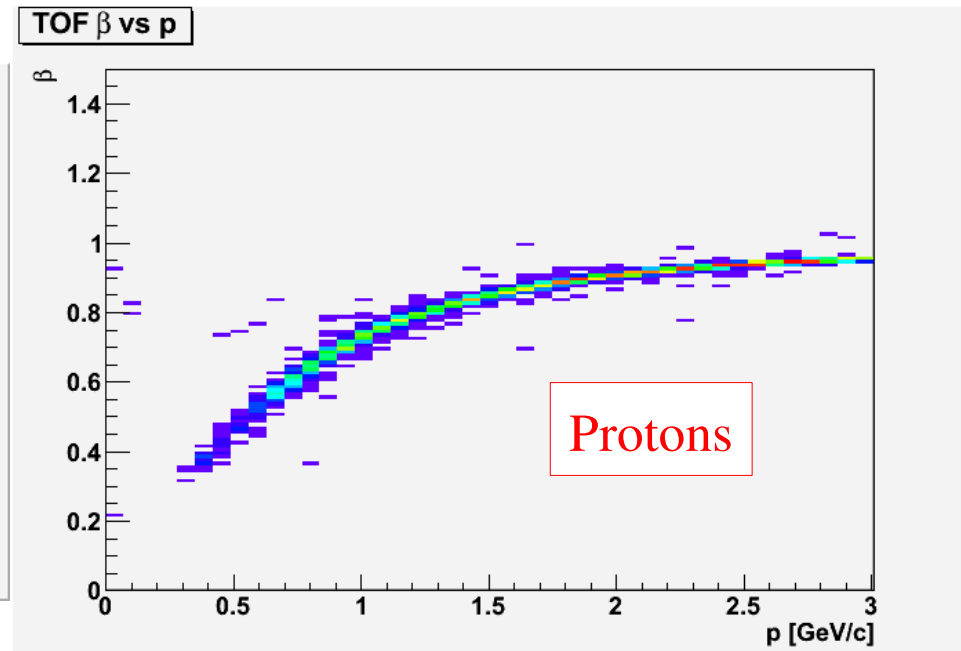
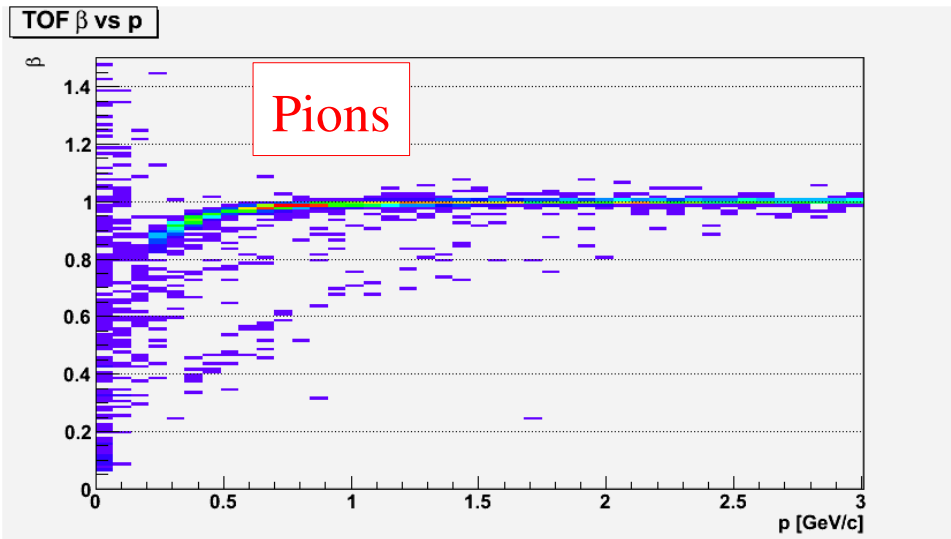


- Truncated mean: throw away top 40% of dE/dx measurements

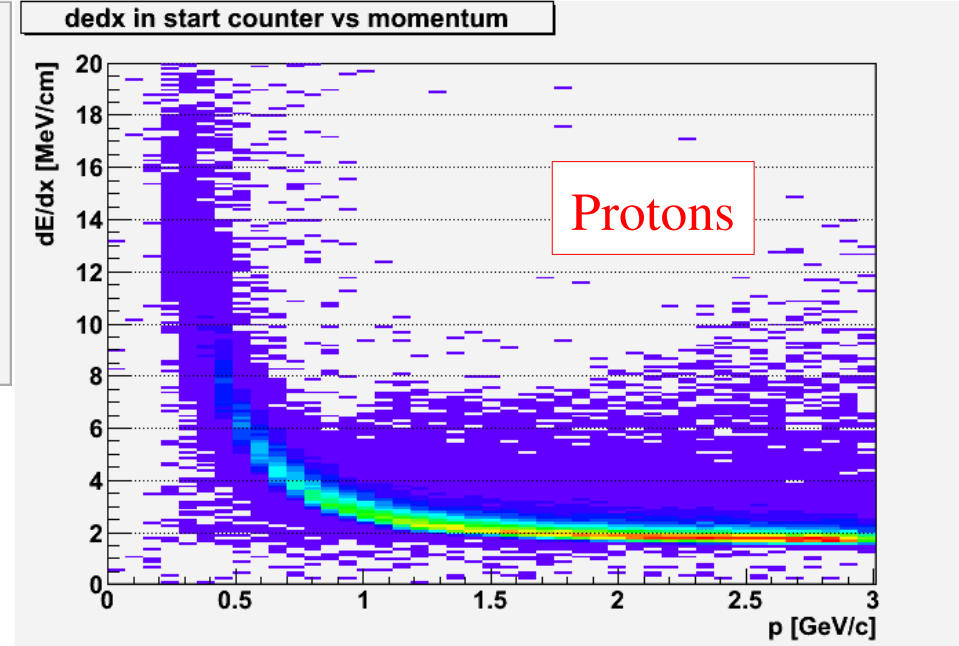
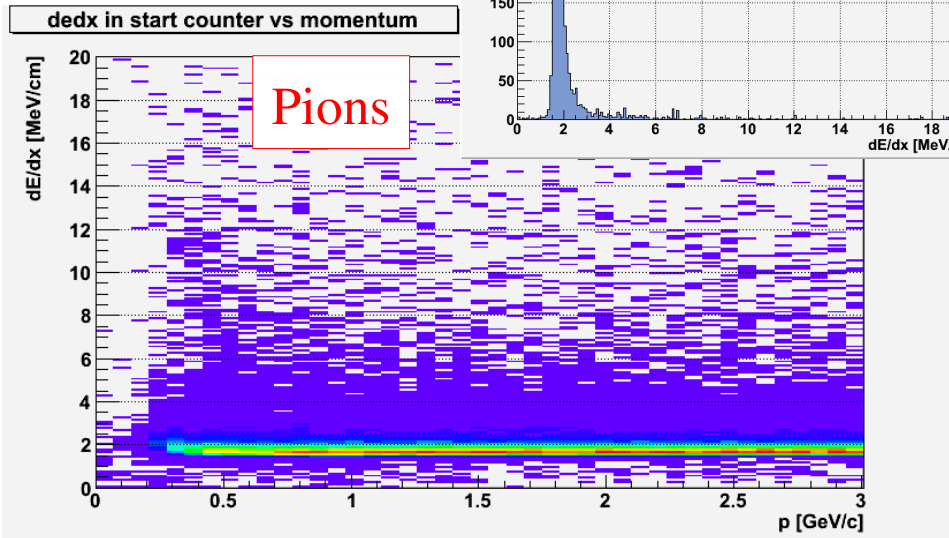
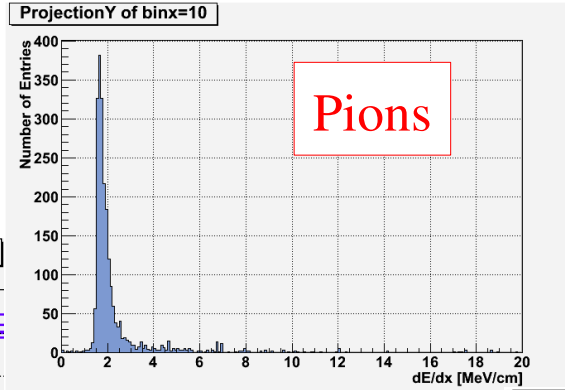
Time-of-flight to BCAL



Time-of-flight to ToF counters



dE/dx in Start Counter

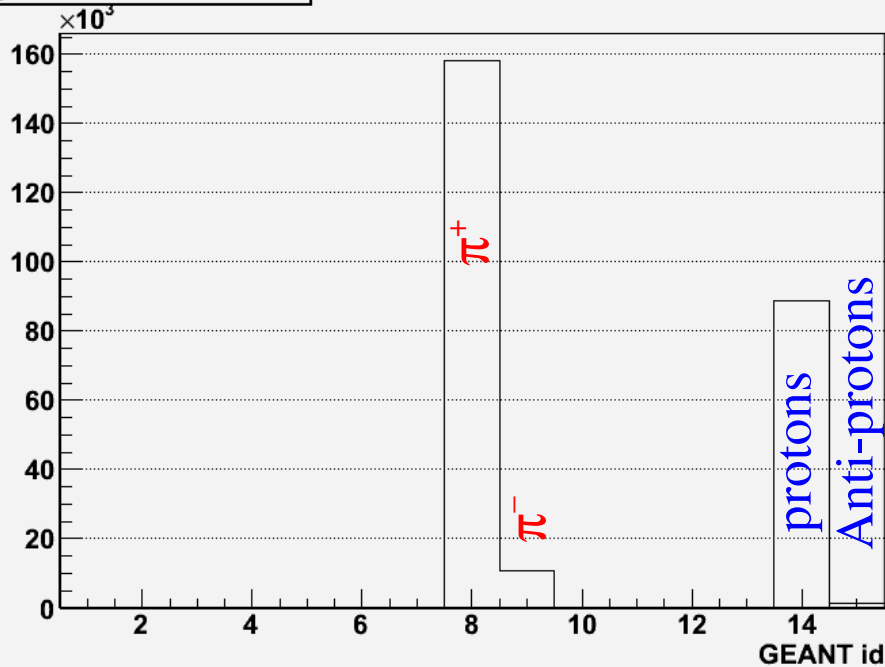


Not currently used in FOM...

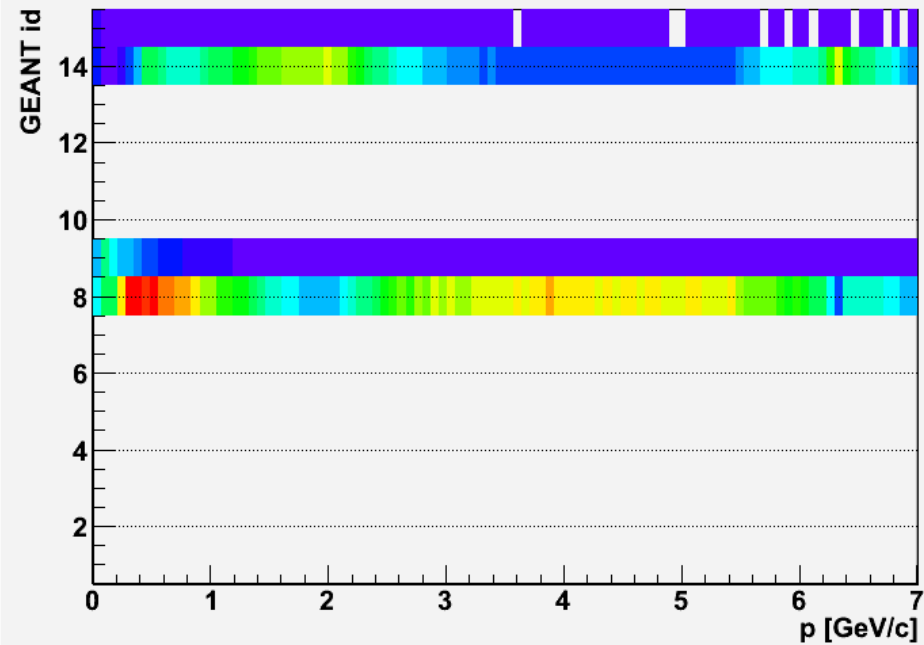
PID purity

- Event sample: π^+ from center of target
- Mass hypotheses: M_{proton} , M_{π}

particle id statistics

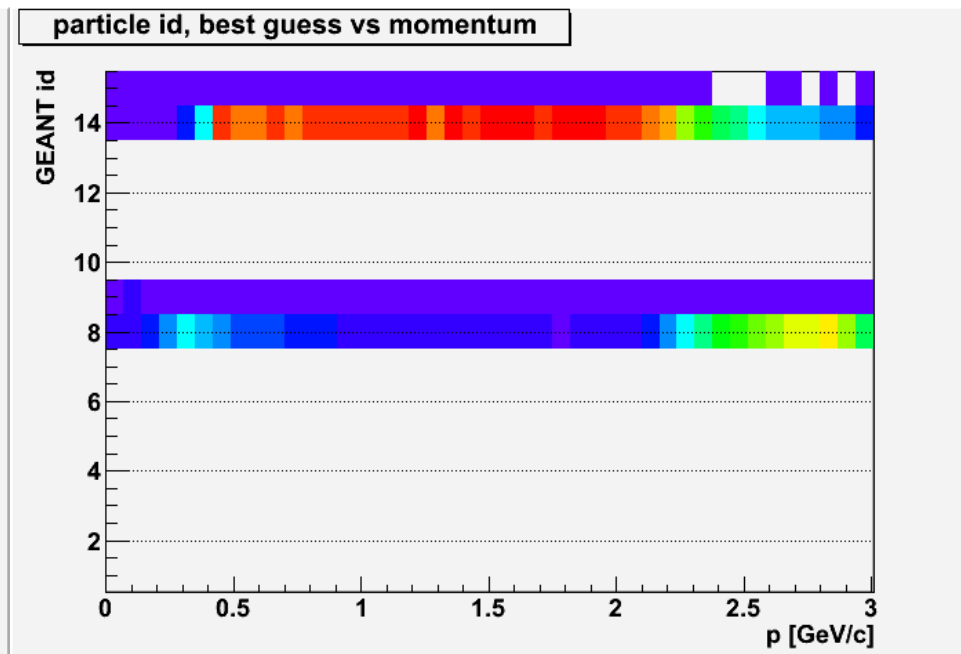
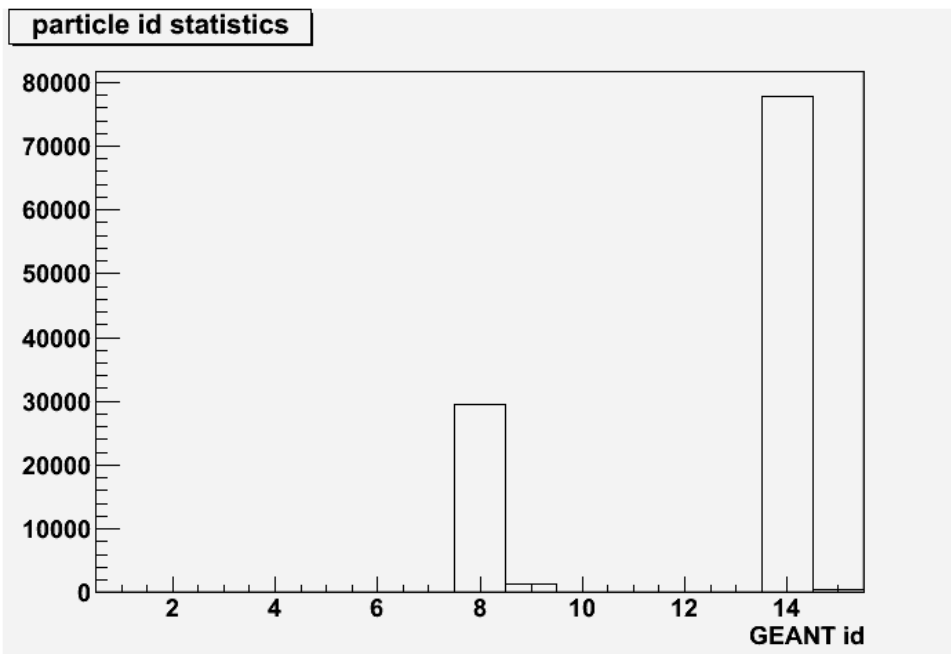


particle id, best guess vs momentum



PID purity

- Event sample: proton from center of target
- Mass hypotheses: M_{proton} , M_{π}



Summary

- Starting to understand errors in Kalman Filter better, but:
 - Some interesting features in σ of pull distributions for z and $\tan\lambda$
 - Systematic errors in z for $\theta < 50^\circ$
- Developing PID scheme using FOM based on TOF, dE/dx , and tracking χ^2
 - Scheme works better for protons than pions for $p < 2 \text{ GeV}/c$
 - BCAL timing resolution appears to be much worse for pions than for protons