# High $p_T$ physics with identified particles

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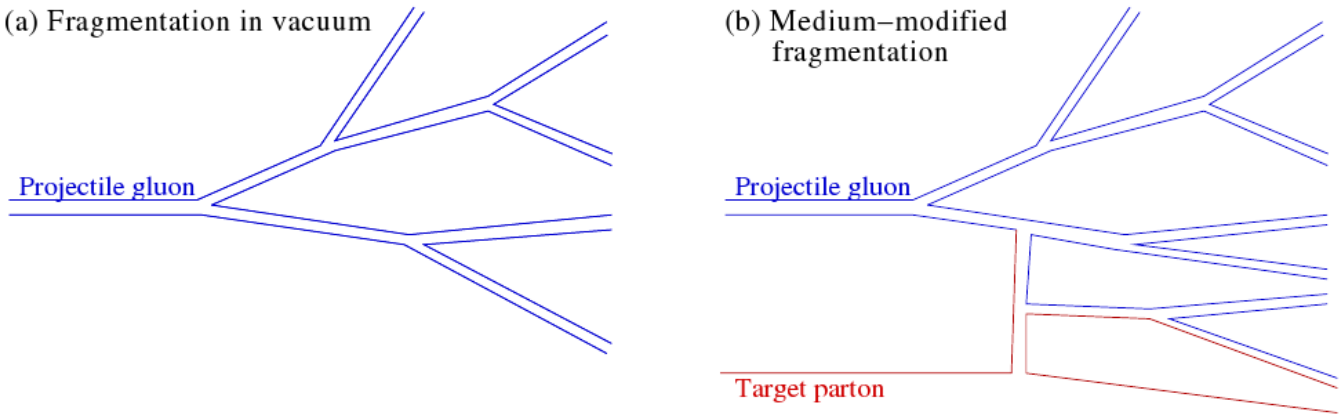
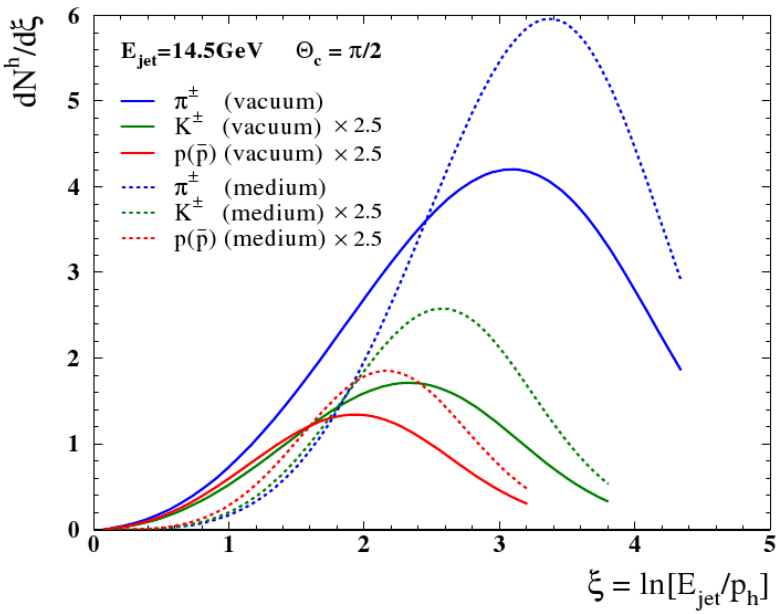
# Physics Motivations

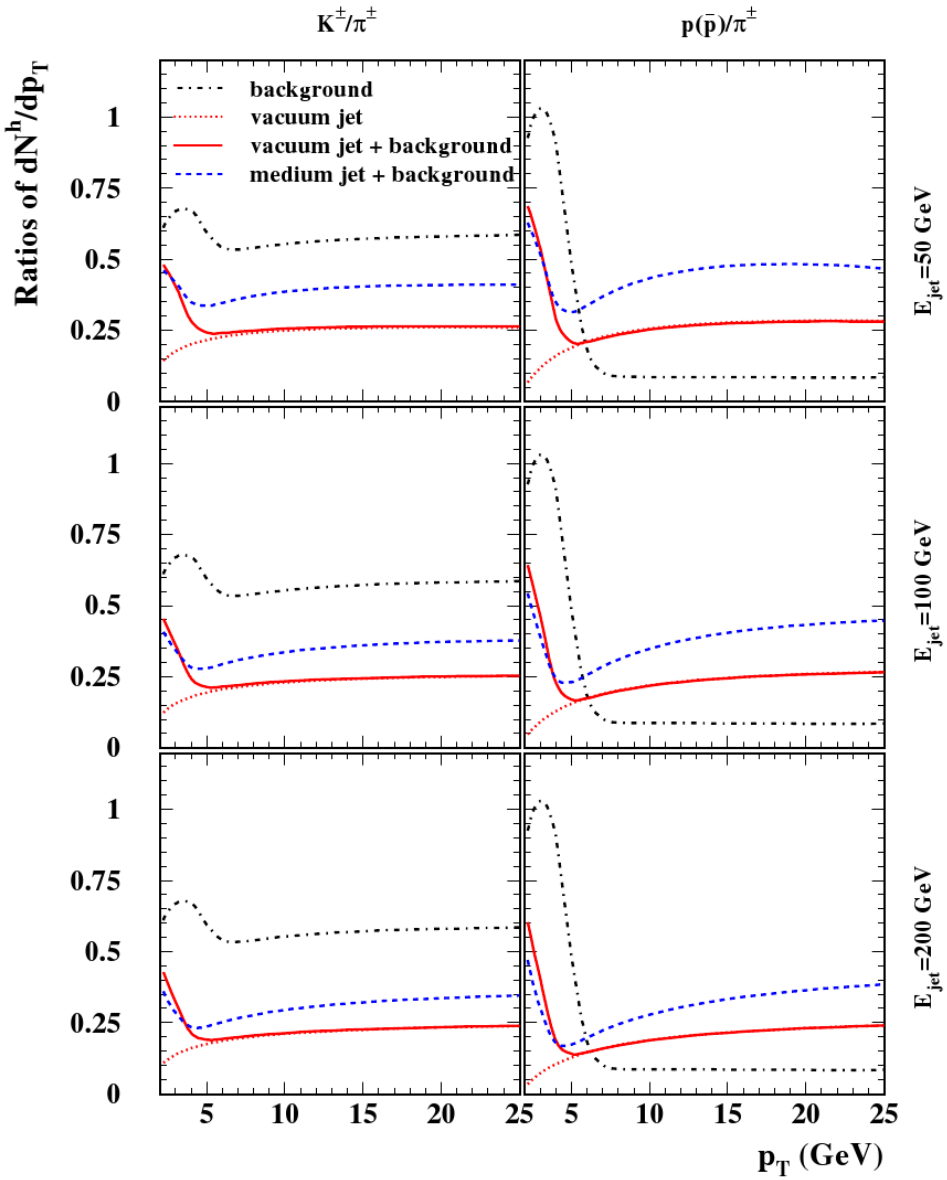
Jets produced in nucleus-nucleus collisions are expected to be strongly modified due to the interaction of the parton shower with the dense QCD matter. Jet quenching can leave signatures in the hadrochemical composition of the jet fragments. Several mechanisms may lead to such modification:

- Color transfer between projectile and the medium
- Exchange of other quantum numbers (baryon number, strangeness)
- Recombination of partons from the jet with partons from the medium
- Exchange of momentum between the medium and the developing partonic cascade (S. Sapeta, U.A. Wiedemann, Eur. Phys. J. C55, 293 (2008), enhancement of parton splitting by a factor $1 + f_{med}$)



# Physics Motivations



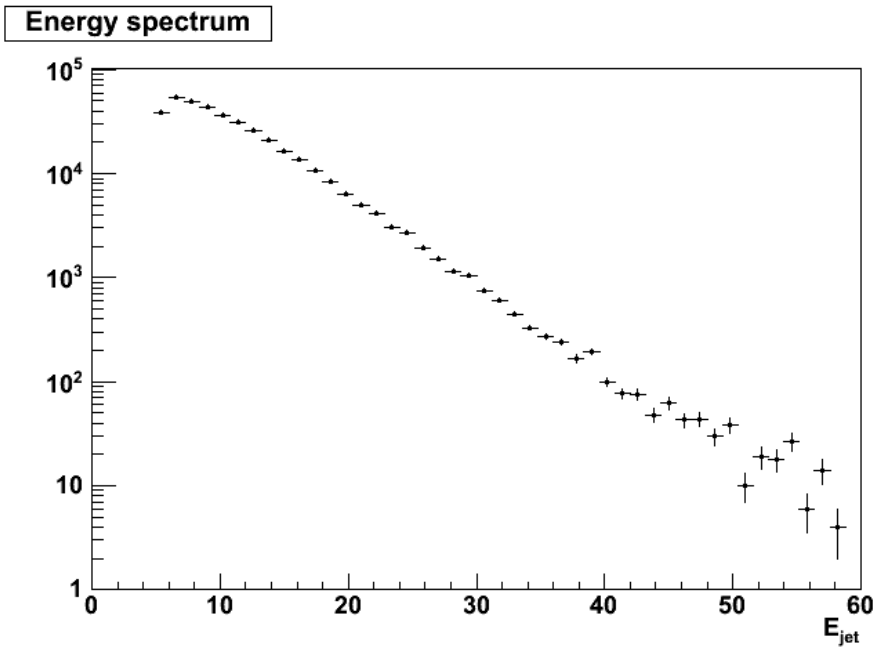

- Softening of the identified hadron spectra
- Kaon to pion ratio increases by a factor $\sim 50\%$, proton to pion ratio by a factor $\sim 100\%$
- Ratios depend weakly on $E_{\rm jet}$

# Some simulation results

**We need the TPC to identify hadrons at high $p_T$ (with rdE/dx)**

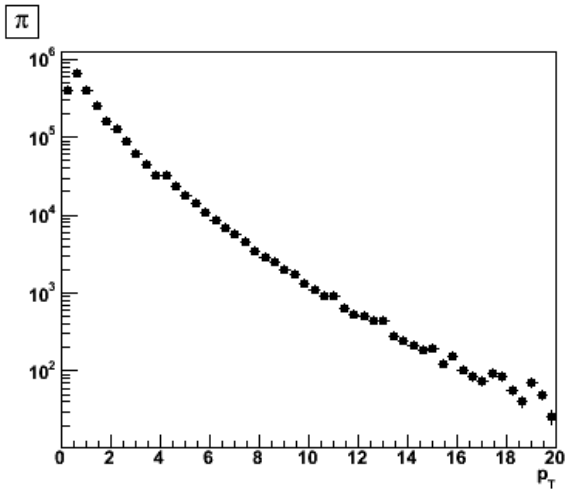
## A preliminary analysis:

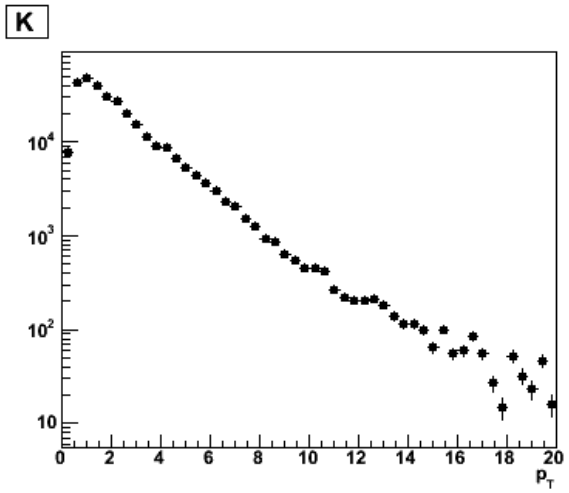
- ∼800k PYTHIA events on the grid, LHC09a1 production (v4-16-Rev-05)
- UA1 Jet Finder
- Evaluated the ratios from MC
- Hadrons identification with TPC

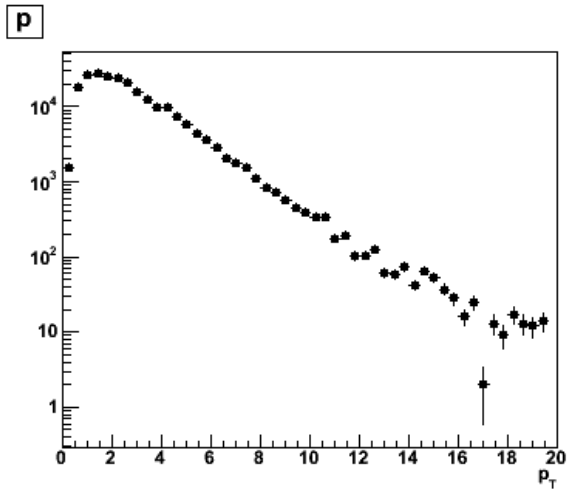


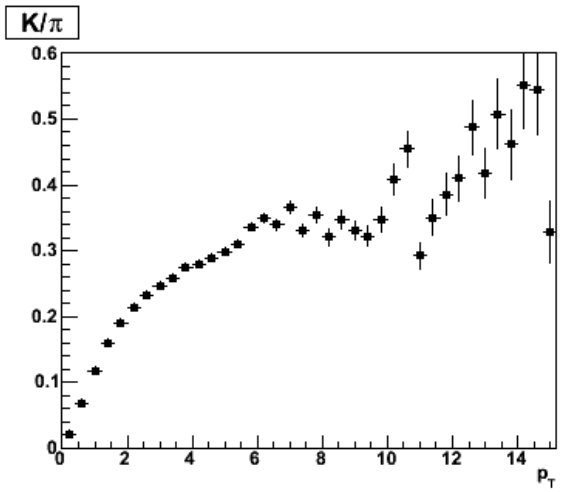

Not yet a full grid analysis. Run a Jet reconstruction task on the ESDs, creating AOD files (AliAODJet, AliAODTrack and AliAODMCParticle branches needed). Analysis code run locally on AODs. What about the creation of AODs in the coming production?

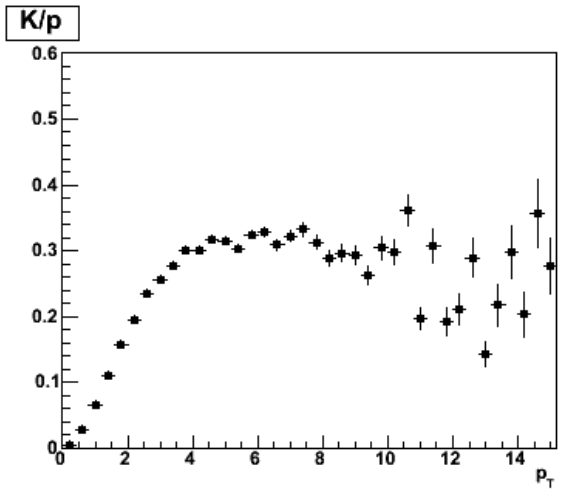
# Some simulation results



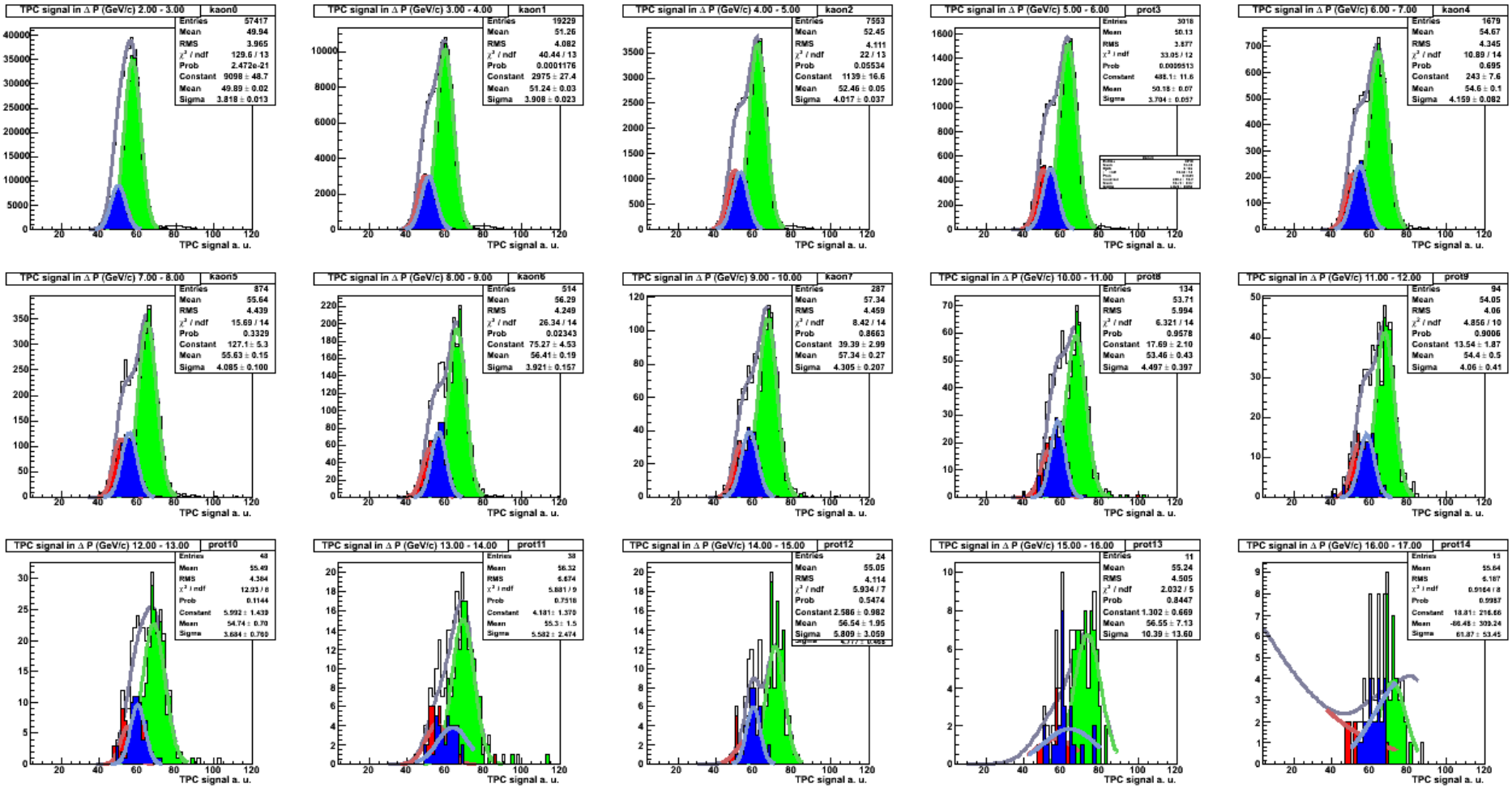




Monte Carlo ratios: Both slighly higher than Salgado-Wiedemann predictions

# TPC performances

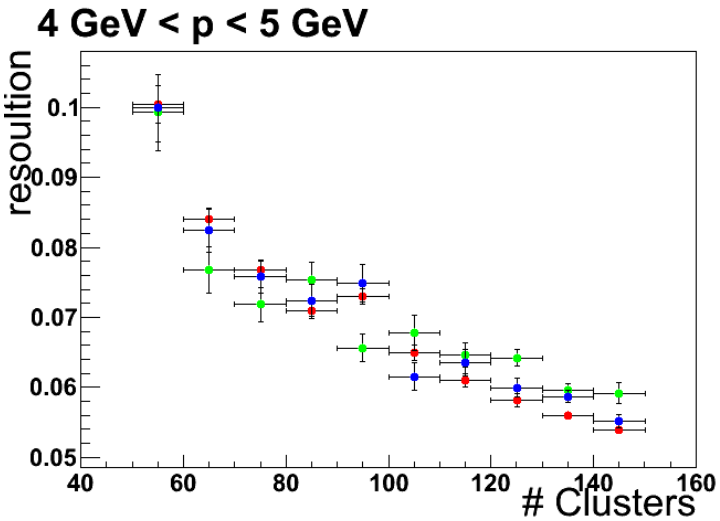
Pions Kaons Protons

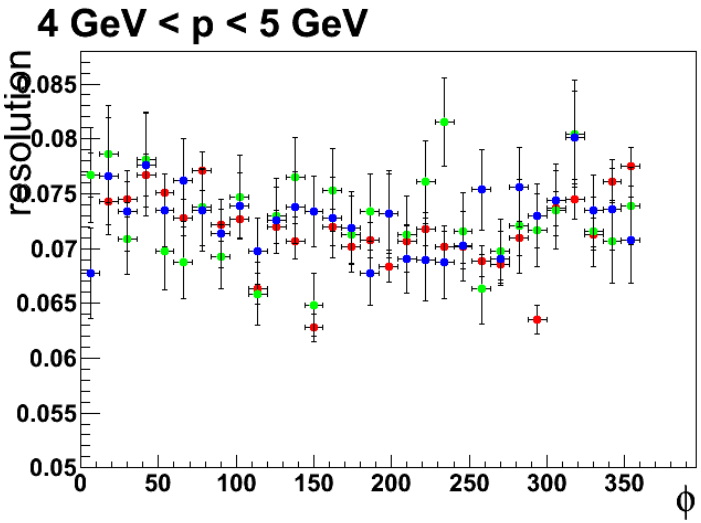


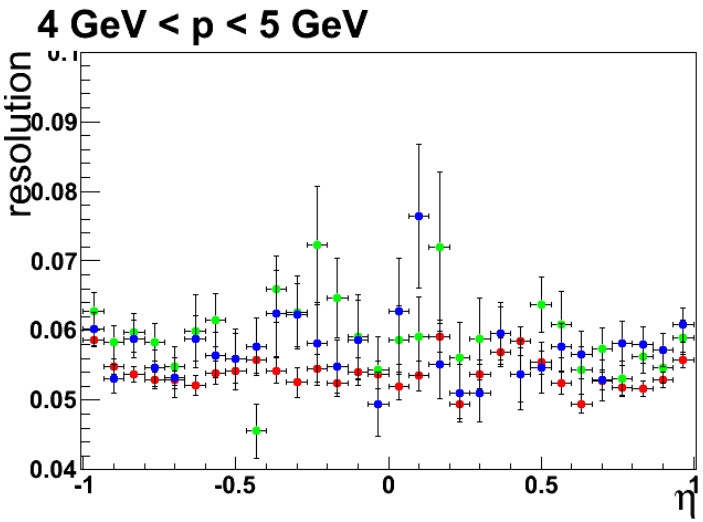

Resolutions in the order of ∼7–8% (optimal ∼5.5%)

# TPC performances

$\eta$, $\phi$ and $N_{clusters}$ dependencies of the resolution

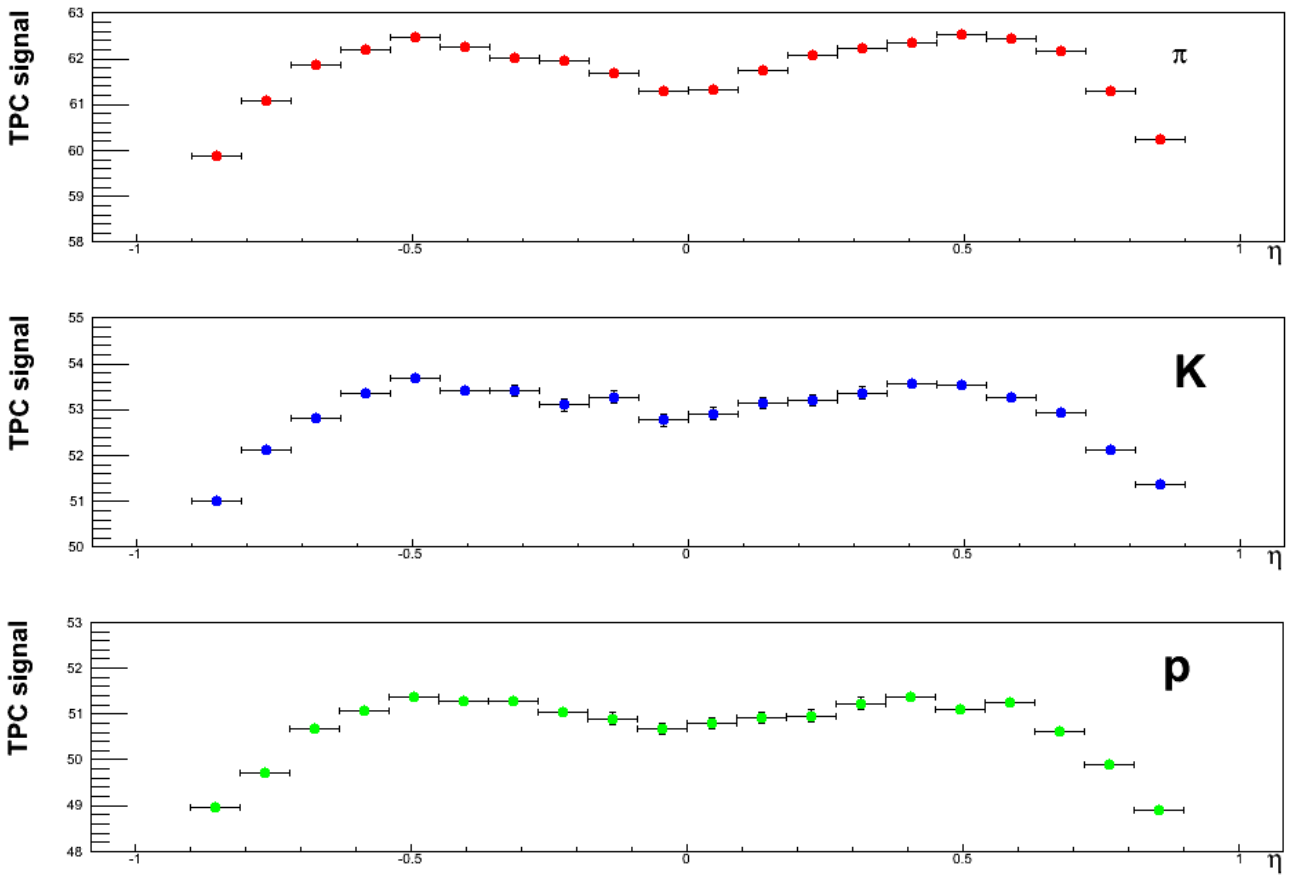


# TPC performances

$\eta$ modulation of in the TPC signal, issue not yet fixed

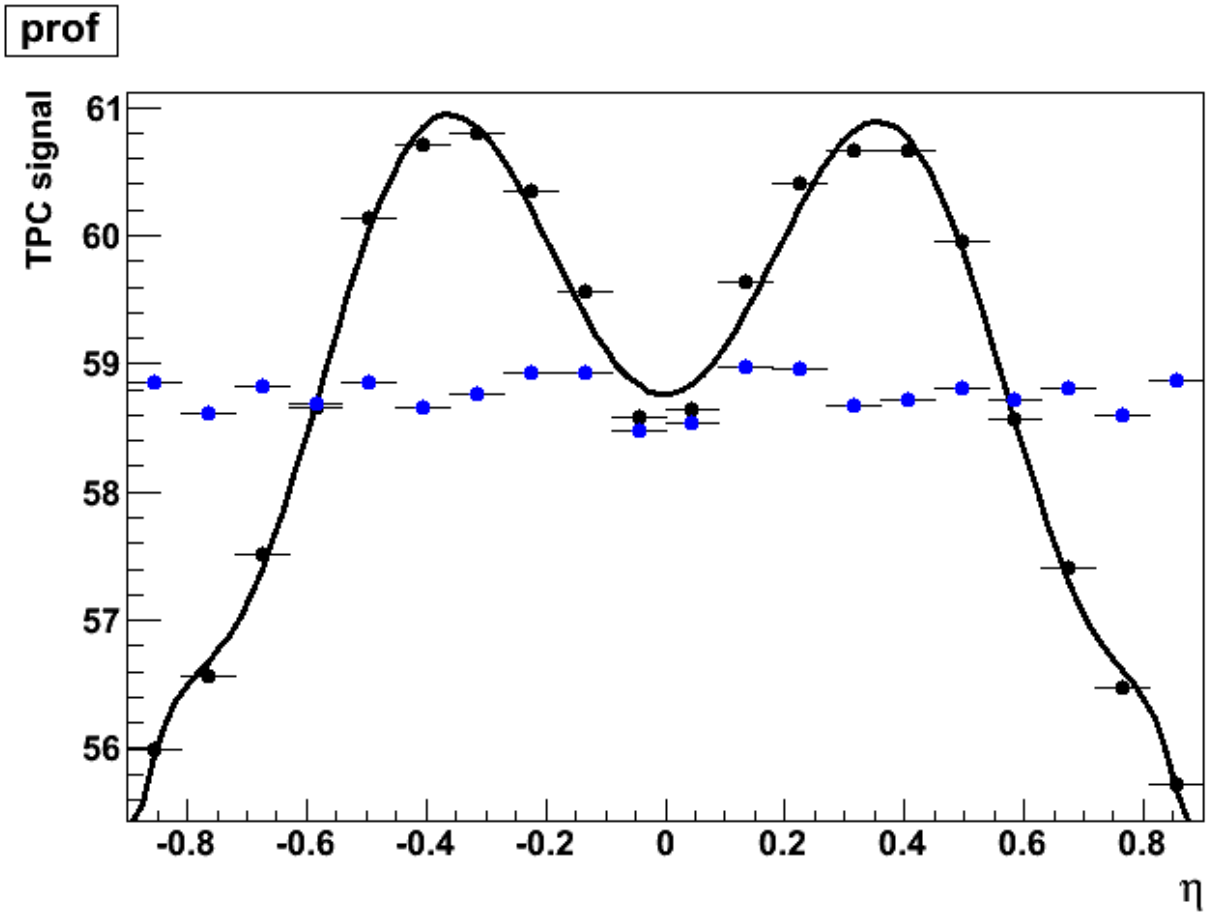



4 GeV/c $<$ p $<$ 5 GeV/c,
variations in the order of 5%

# TPC performances

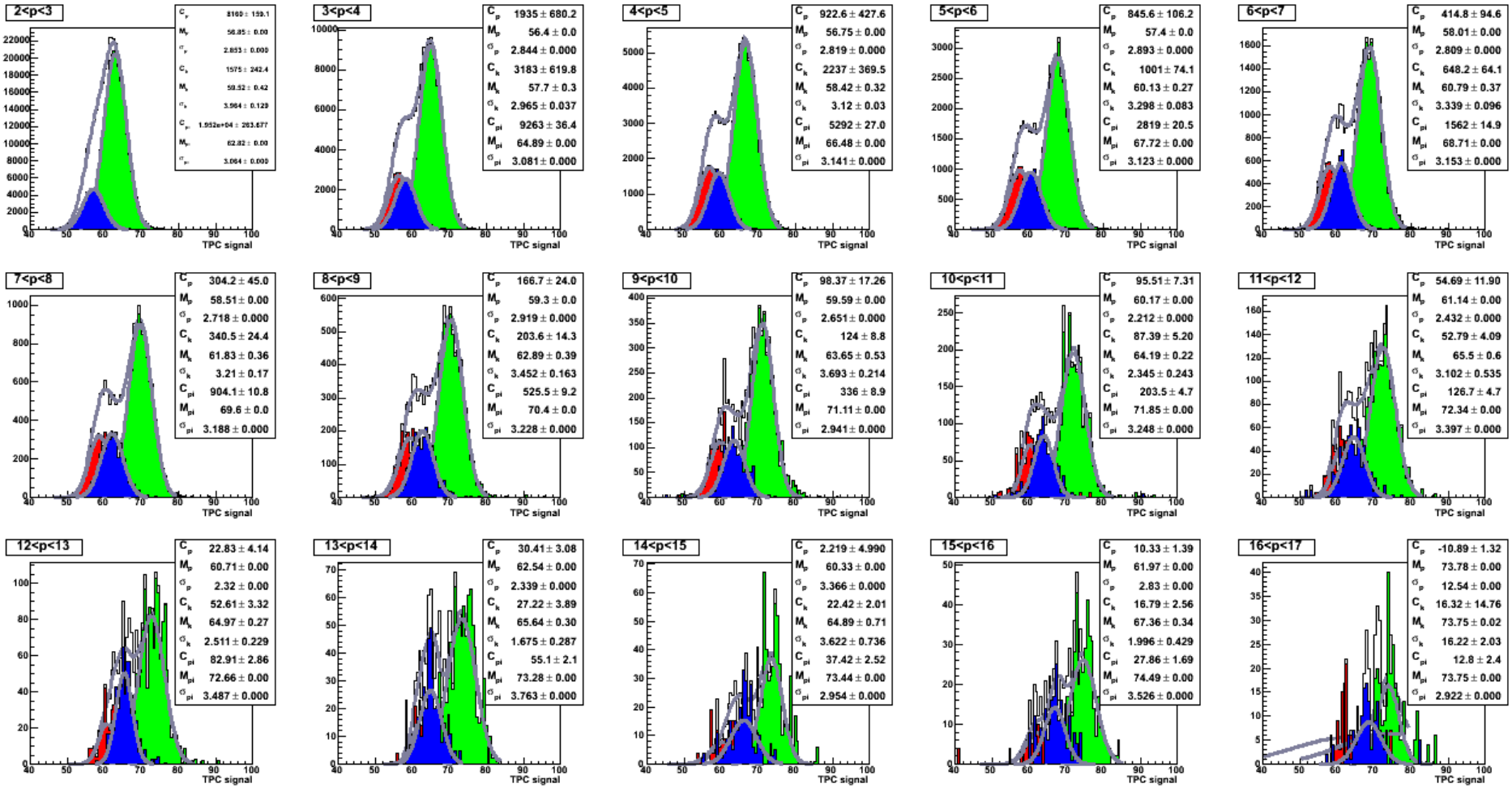
Temporary quick fix

fit with an $8^{th}$ order polynomial, then correct the distribution



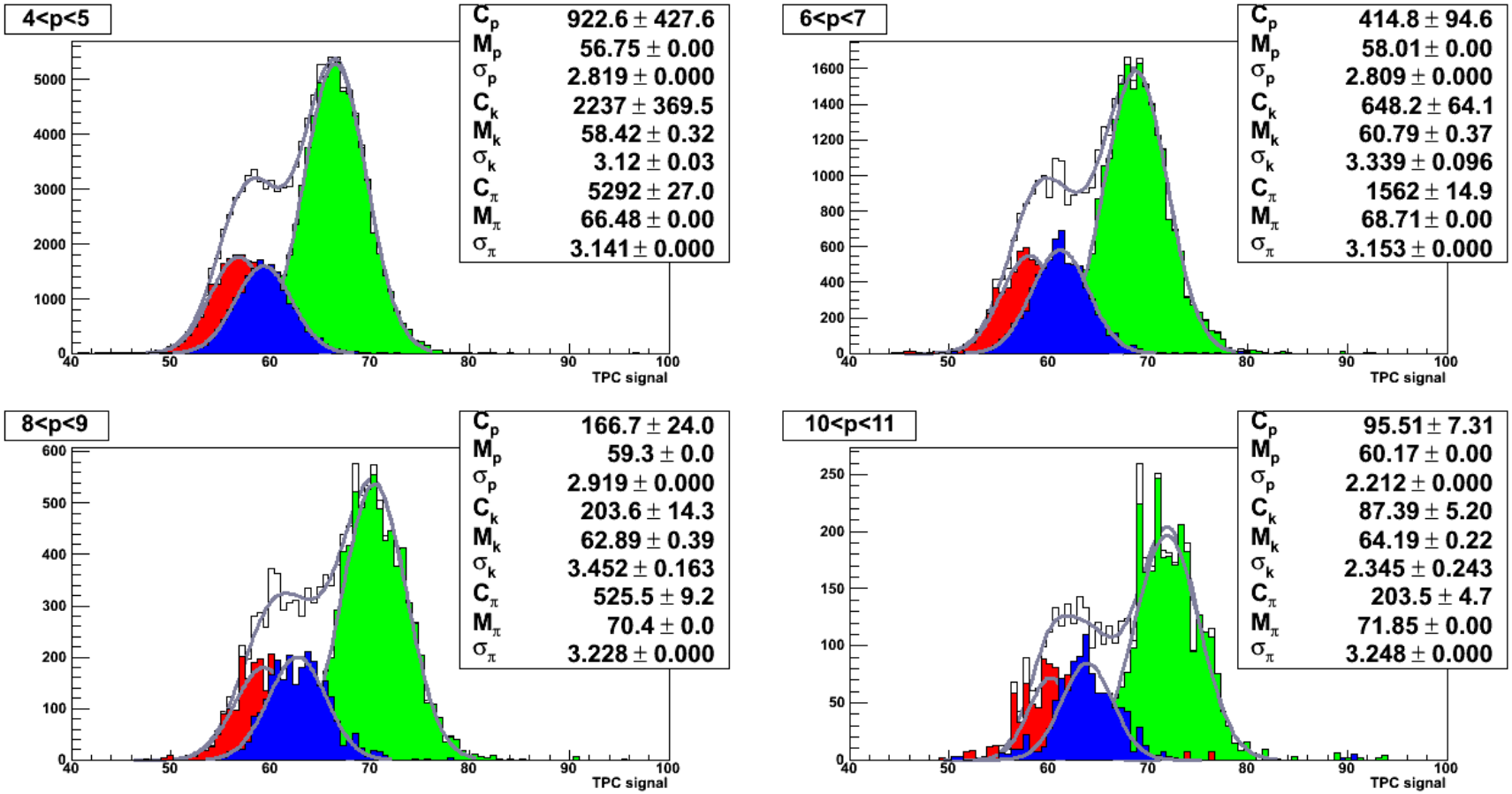
# TPC performances

Pions Kaons Protons




$N_{clusters} > 100$, $\eta$ fix $\Rightarrow$ resolutions in the order of $\sim$5%

# TPC performances



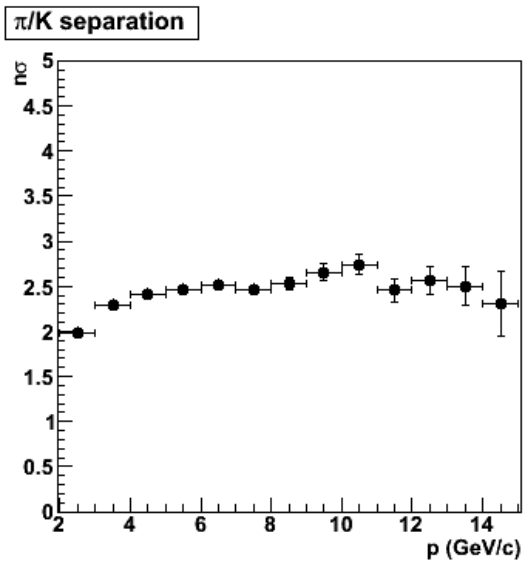

Total fit: sum of 3 Gaussians.

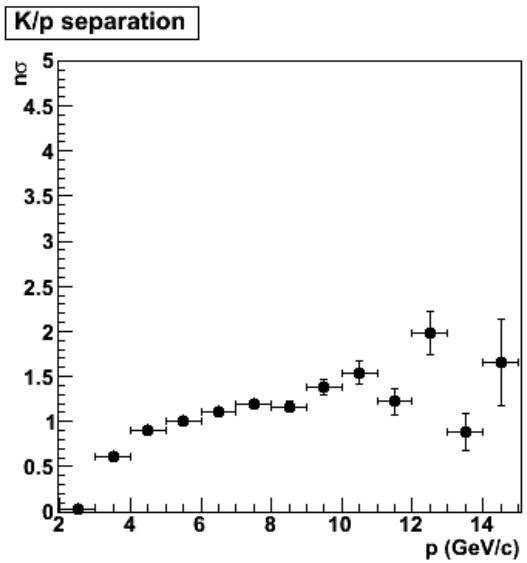
Fixed parameters: $M_p$, $\sigma_p$, $M_\pi$, $\sigma_\pi$

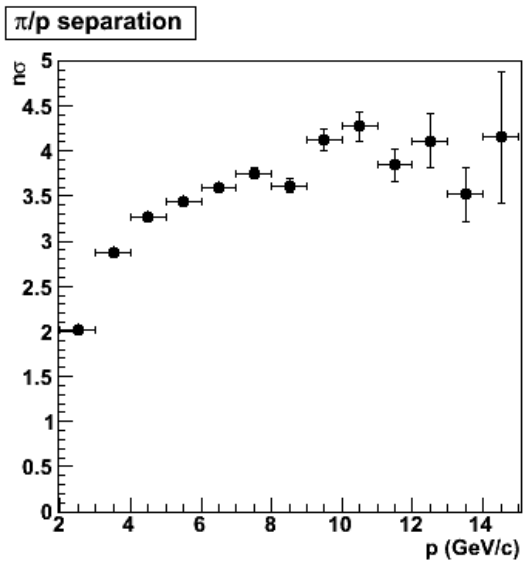
Constraints on kaons parameters: $M_K \in [M_p, M_{pi}]$, $\sigma_K \in [0.5\sigma_{pi}, 1.5\sigma_{pi}]$, $C_K \in [0, C_{pi}]$

# TPC performances

## Separation power



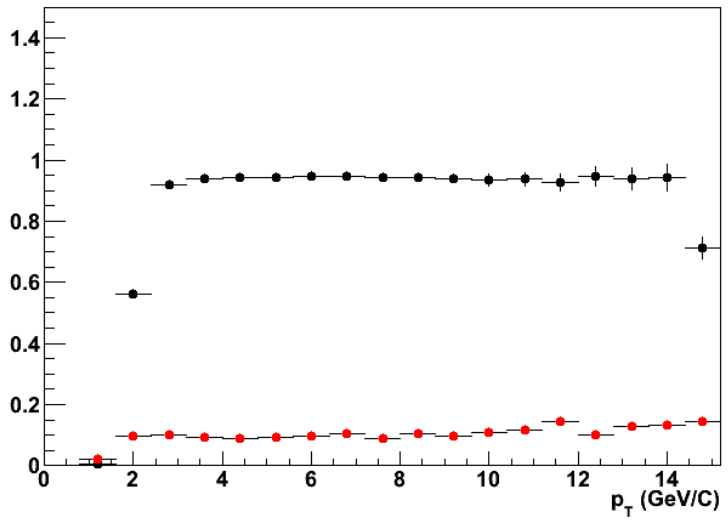



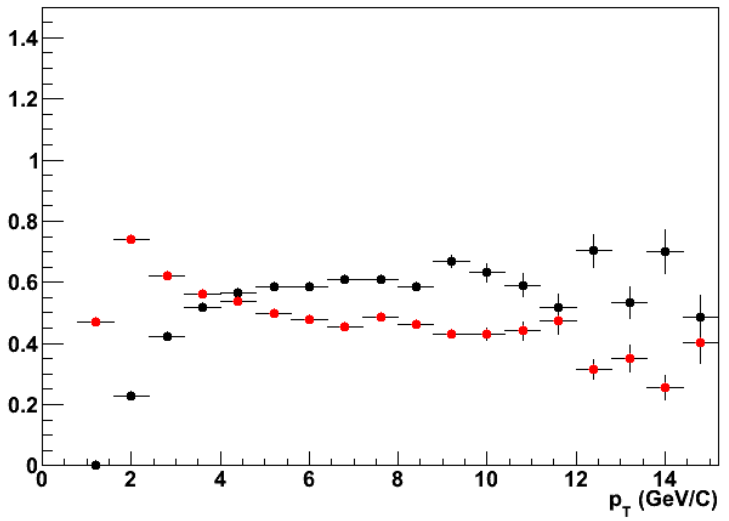

Even if good resolution is reached, it is still difficult to separate kaons from protons

# TPC performances

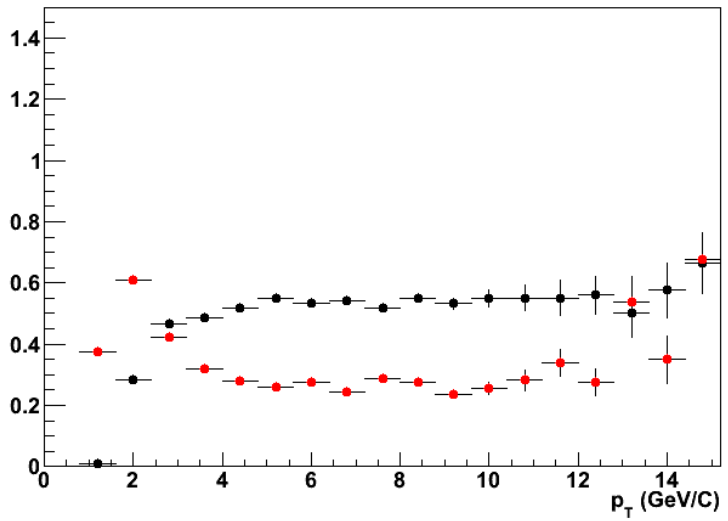
**pions**




**kaons**



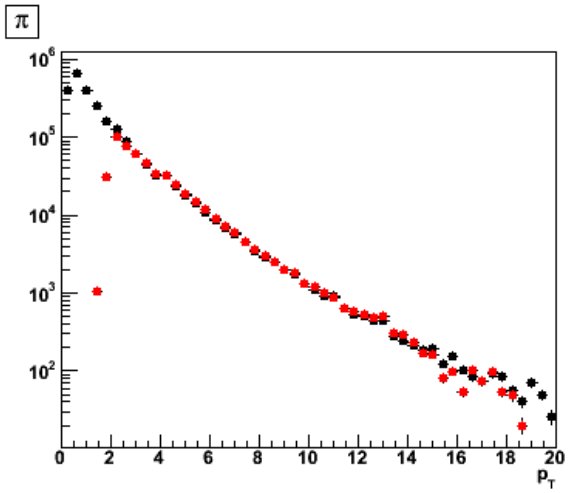

**protons**

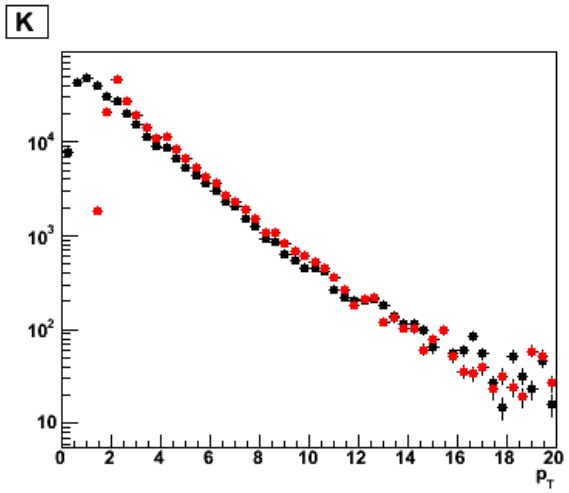


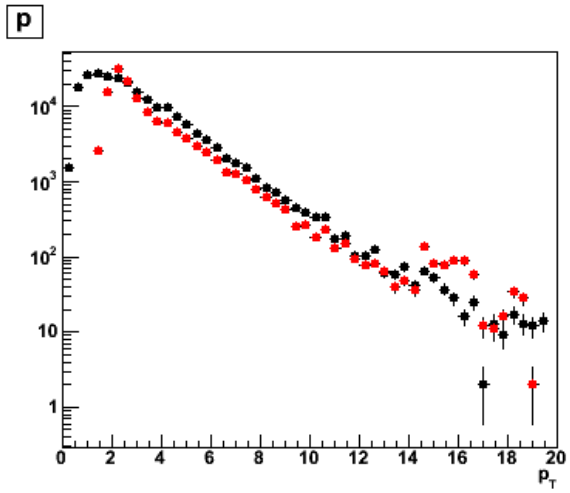

Efficiency and Contamination

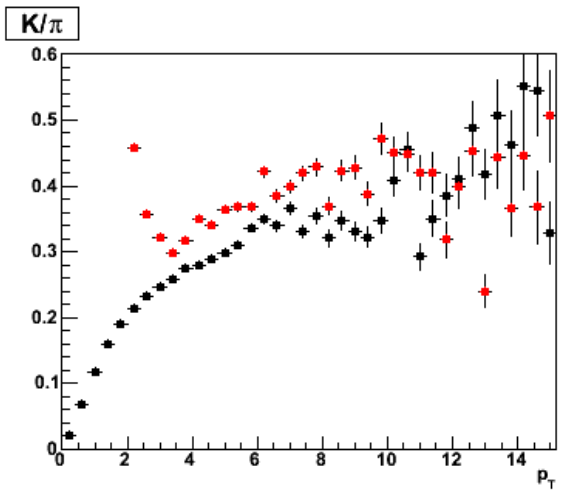
Contamination is very high for proton and kaons

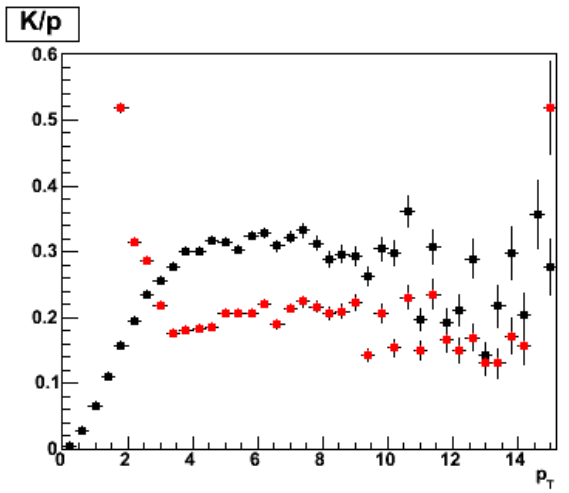
# Some simulation results




Monte Carlo ratios and Reconstructed ratios

$K/\pi$ overestimated, $p/\pi$ underestimated

# Conclusions

- Still work to do (bug fixes) for the high-$p_T$ particles identification in the TPC
- Try to understand how to improve $K/p$ separation
- PYTHIA-MLLA calculations comparison