

Study of Strangeness Production in Underlying Event at 7 TeV



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Data Sample and Selection

Data Sample:

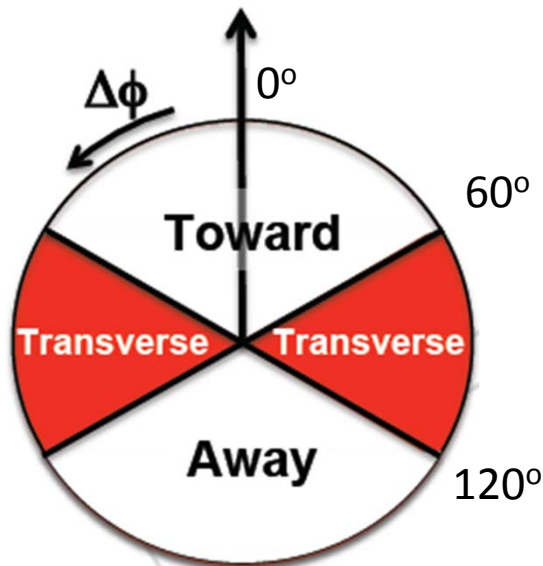
/MinimumBias/Commissioning10-
Jun14thReReco_v1/RECO

Runs: 132440-137436

+ JSON file

(CMSSW_3_6_1_patch4)

Leading Track Jet direction



Event & Track-Jet Selection:

- meant to be identical to UE QCD-10-010 analysis

Trigger:

HLT_MinBiasPixel_SingleTrack

BSC

Primary vertex:

single single vertex (offlinePrimaryVertices)

valid vertex (not fake, different from beam spot)

$dZ(\text{vtx}, \text{beamspot}) < 10\text{cm}$

$\text{ndof} > 4$

Leading Track-jet:

tracks with $p_T > 0.5 \text{ GeV}$, $|\eta| < 2.5$

V0 Selection (K_0s , Λ , $\Lambda\bar{\Lambda}$):

$|\eta \text{ daughters}| < 2.5$

$|\eta \text{ V0}| < 2.0$

$p_{T_K0s} > 0.5 \text{ GeV}$; $p_{T_}\Lambda, \Lambda\bar{\Lambda} > 1.0 \text{ GeV}$

Transverse flight distance $> 1 \text{ cm}$

+ kinematic fit

Kinematic Fit: Principle

V0s selected based on the χ^2 probability of the kinematic fit.

Kinematic fit: minimization of the χ^2 function with kinematic constraints:

3 constraints:

- vertexing (daughter tracks cross secondary vertex)
- fixed V0 mass to V0 PDG value
- pointing (V0 point to primary vertex)

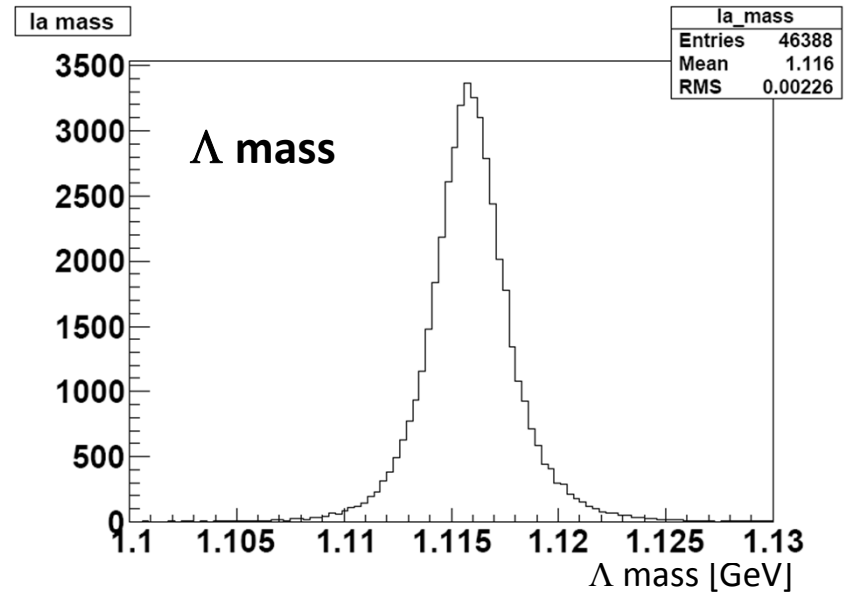
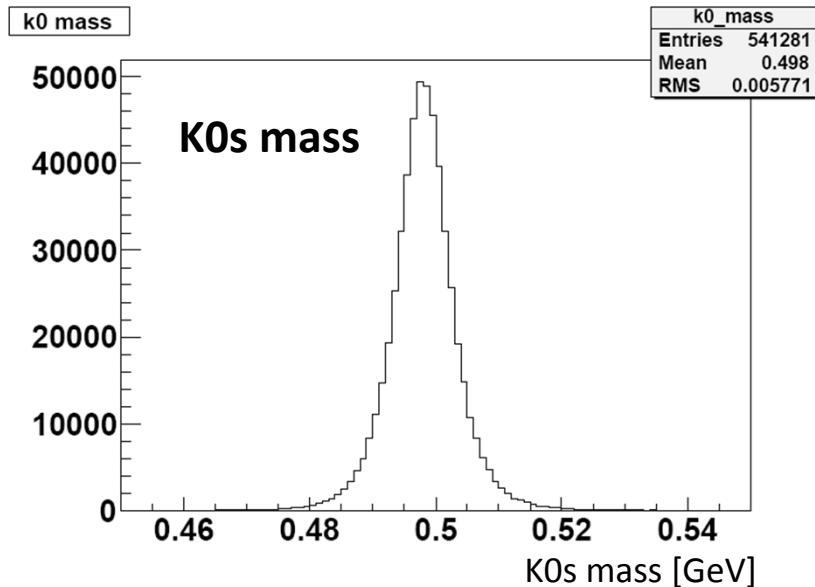
Talks on the fit presented at tracking PDG/POG and Alignment meetings

<https://indico.cern.ch/getFile.py/access?contribId=3&sessionId=2&resId=0&materialId=slides&confId=82610>



<https://indico.cern.ch/getFile.py/access?contribId=4&sessionId=2&resId=0&materialId=slides&confId=82616>

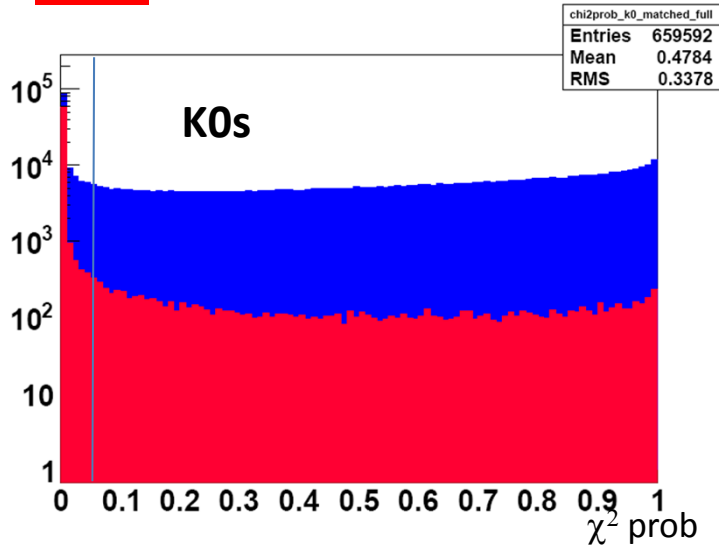
<https://indico.cern.ch/getFile.py/access?contribId=15&sessionId=1&resId=0&materialId=slides&confId=120130>

Fitting 9 measured parameters: $\rho = q / p_T$, θ , ϕ of two daughter tracks, sec. vertex (x,y,z), considering full 9x9 covariance matrix of measured parameters



Kinematic Fit: Chi2 Probability & Background

 matched to primary
 not matched to primary



Cut: χ^2 probability > 0.05

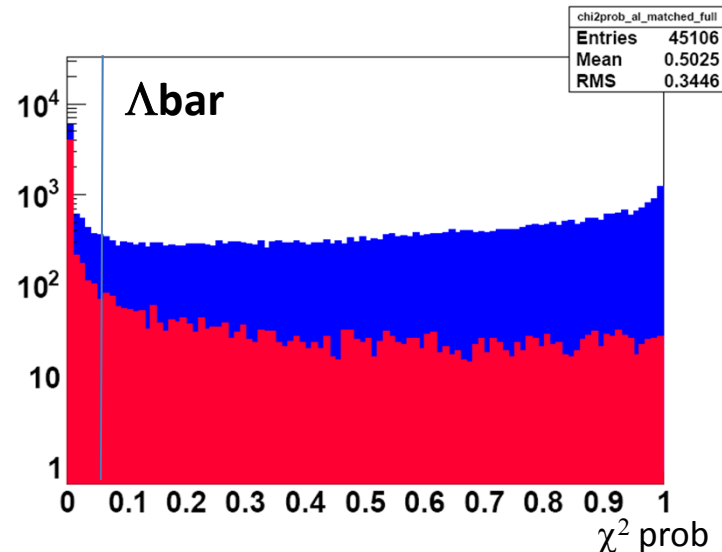
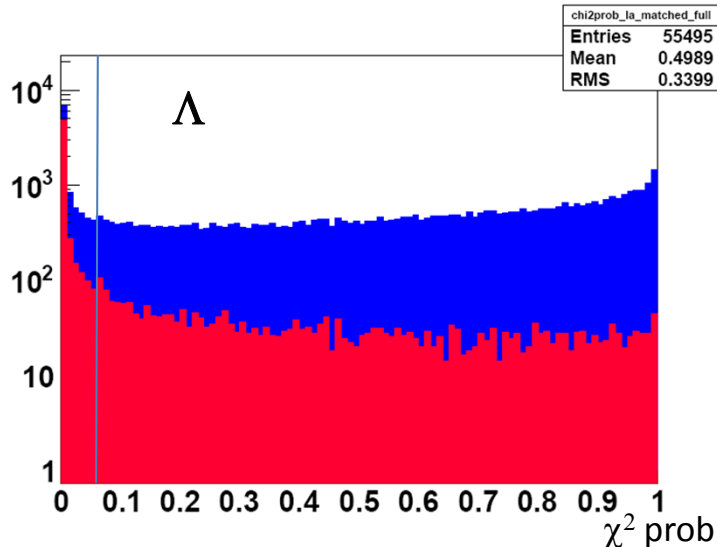
Background to V0 sample estimated from MC:

Background for K0s = 2.23 +/- 0.02%

Background for Λ = 6.64 +/- 0.12%

Background for Λ bar = 7.45 +/- 0.14%

Primary-matched within $R(\Delta\eta\Delta\phi) < 0.04$



V0 Correction

$$\text{V0 Correction} = 1 / (\text{acceptance} \times \text{efficiency})$$

acceptance is restricted to kinematic range of sufficient V0 selection efficiency

- small systematics expected

efficiency is estimated with detailed MC

MC Sample:

/MinBias_TuneD6T_7TeV-pythia6/Summer10-START36_V10_SP10-v1/GEN-SIM-RECODEBUG
(CMSSW_3_6_2)

K0s Correction: Acceptance

Acceptance definition: $N_{\text{acc}} / N_{\text{gen}}$

N_{gen} = K0s generated inside:

$p_T > 0.5 \text{ GeV}$

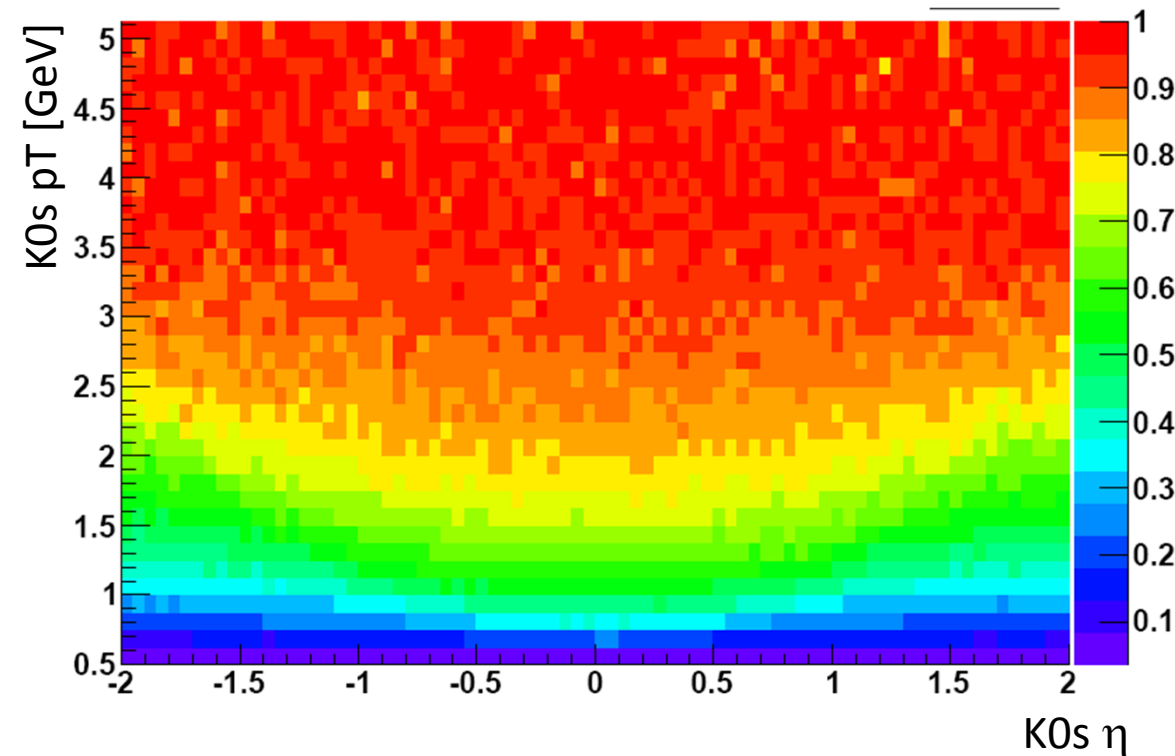
$|\eta| < 2.0$

N_{acc} = fraction of N_{gen} which passed the acceptance cuts:

$p_{T_daughters} > 0.3 \text{ GeV}$

$|\eta_{\text{daughters}}| < 2.5$

gen transv. flight dist. $> 1 \text{ cm}$



K0s Correction: Efficiency

Efficiency definition: $N_{\text{rec}} / N_{\text{acc}}$

N_{rec} = K0s passed all reco cuts:

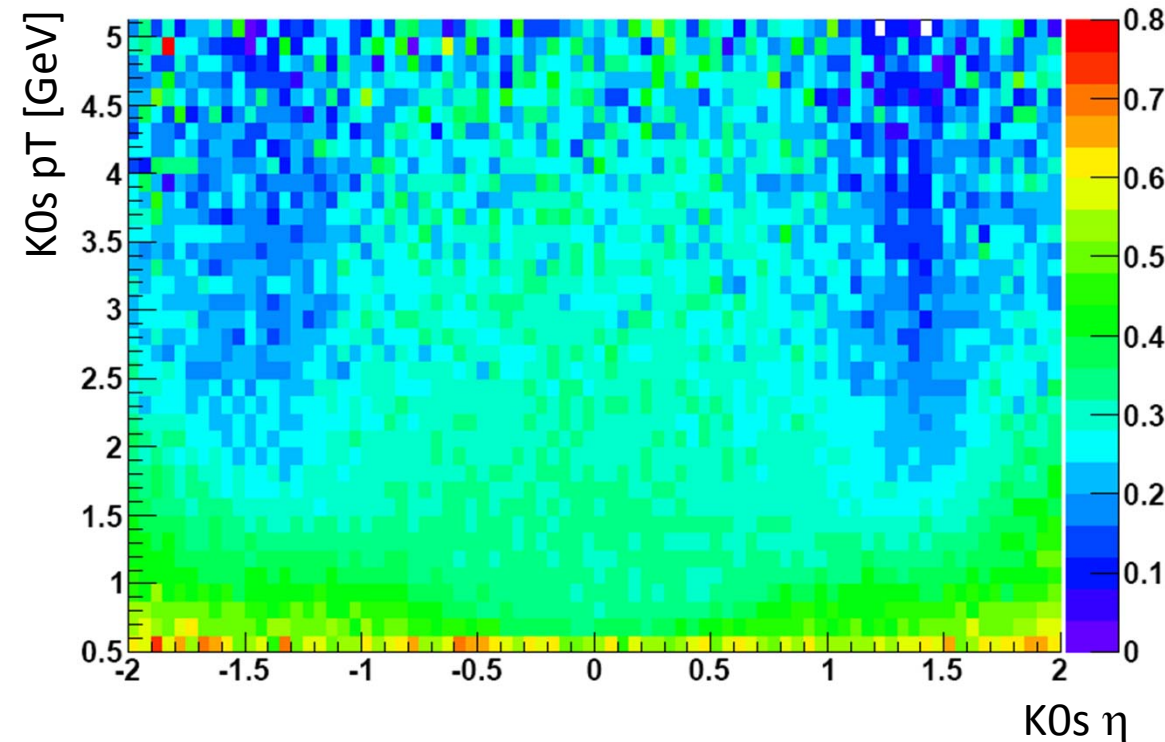
$|\eta \text{ daughters}| < 2.5$

$p_{\text{T}} \text{ daughters} > 0.3 \text{ GeV}$

$|\eta \text{ K0}| < 2.0$

$p_{\text{T}} \text{ K0s} > 0.5 \text{ GeV}$

Transverse flight distance $> 1 \text{ cm}$



Efficiency is relatively high

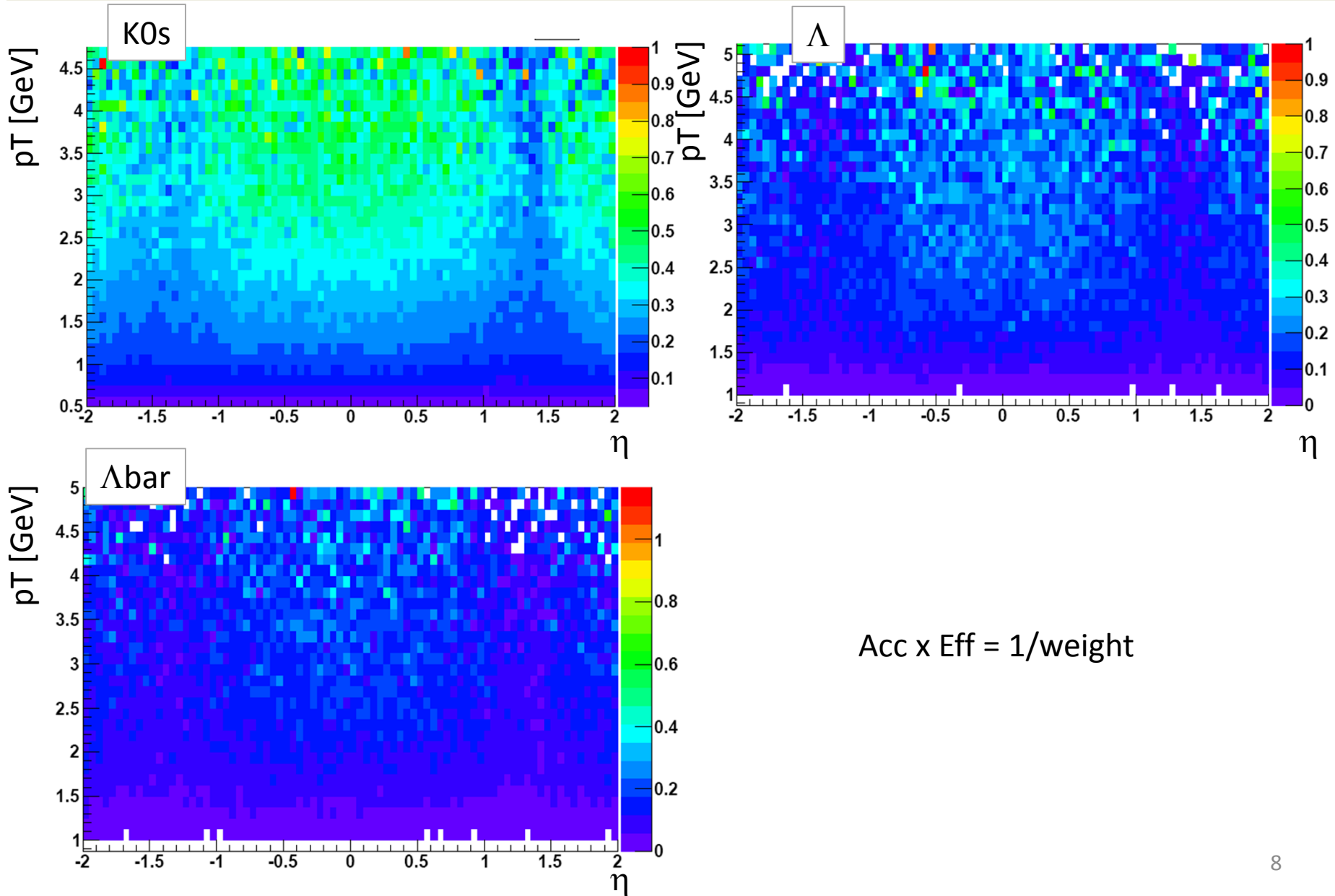
MC is describing efficiency correctly \rightarrow lifetime test

<https://indico.cern.ch/getFile.py/access?contribId=0&resId=0&materialId=slides&confId=115969>

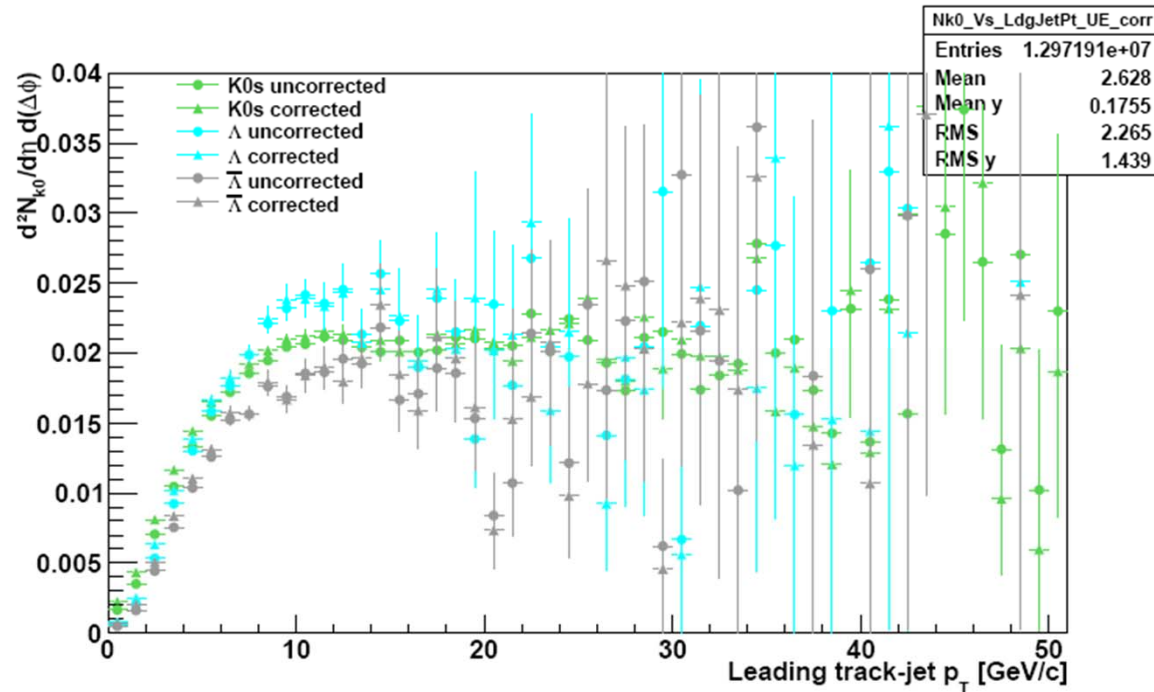
(QCD meeting)

\rightarrow small systematic uncertainties expected on the rates.

V0 Correction: Acc x Eff



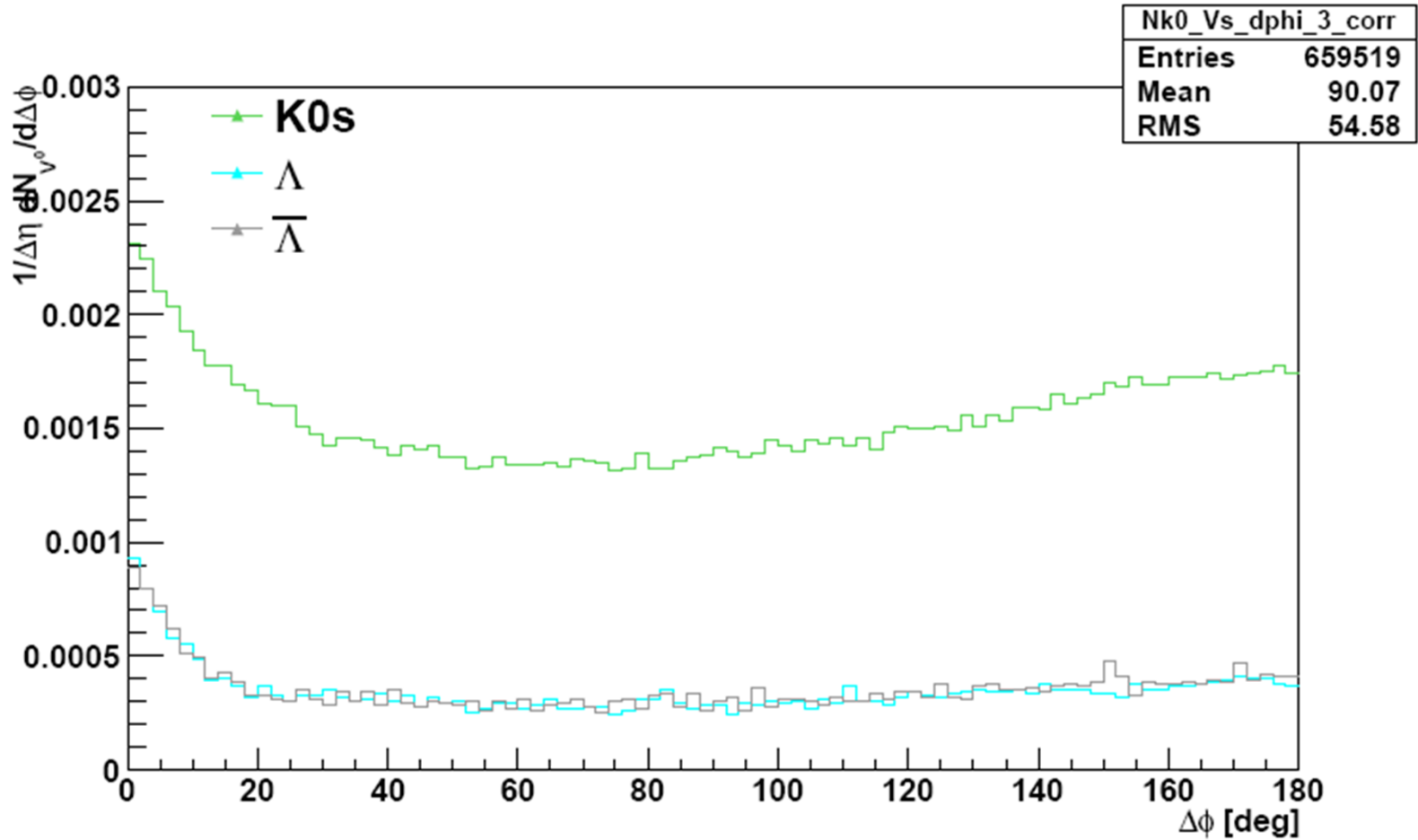
Cross-check: uncorr./corrected rates



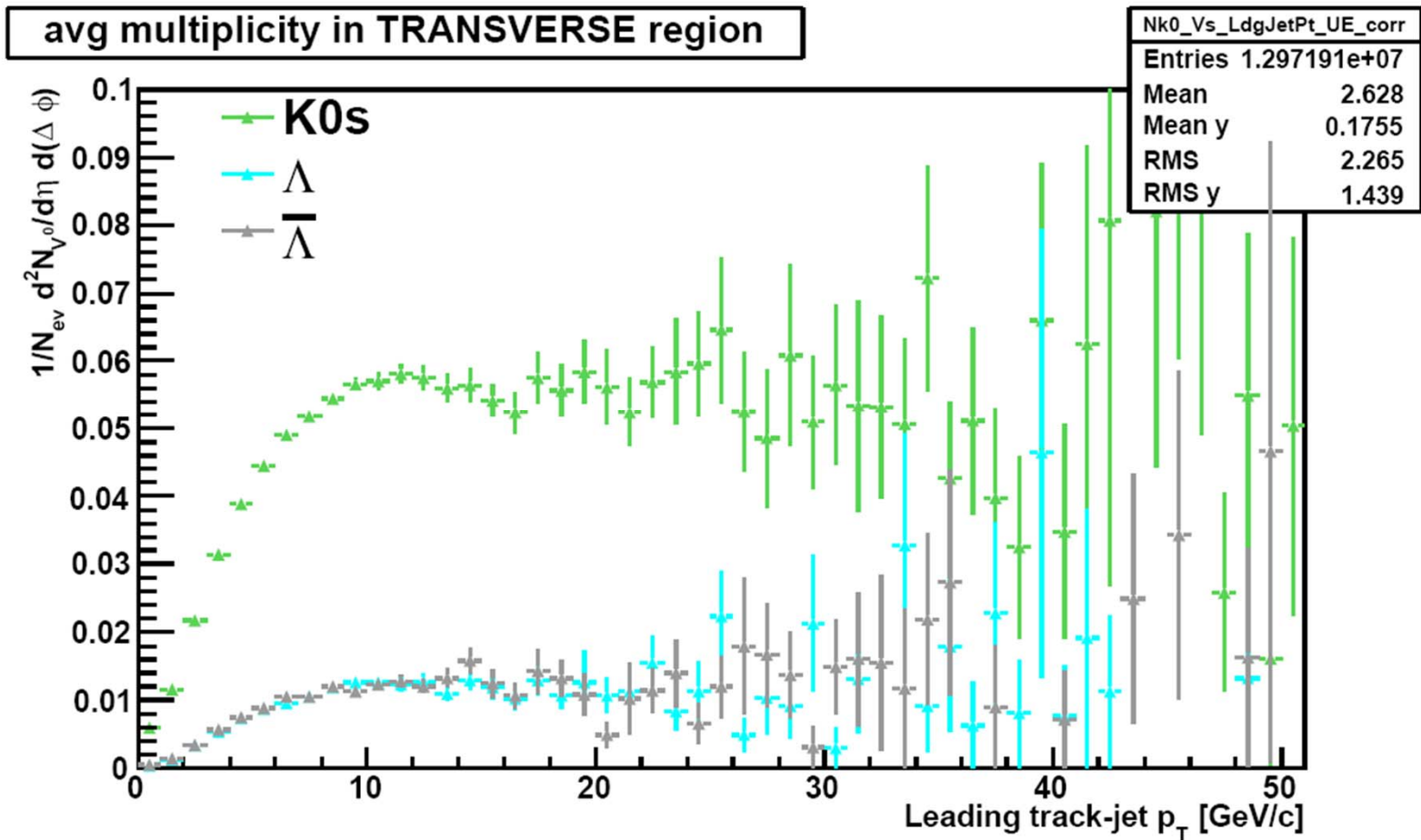
Shapes normalised to 1

Observed trend is not a feature of the correction

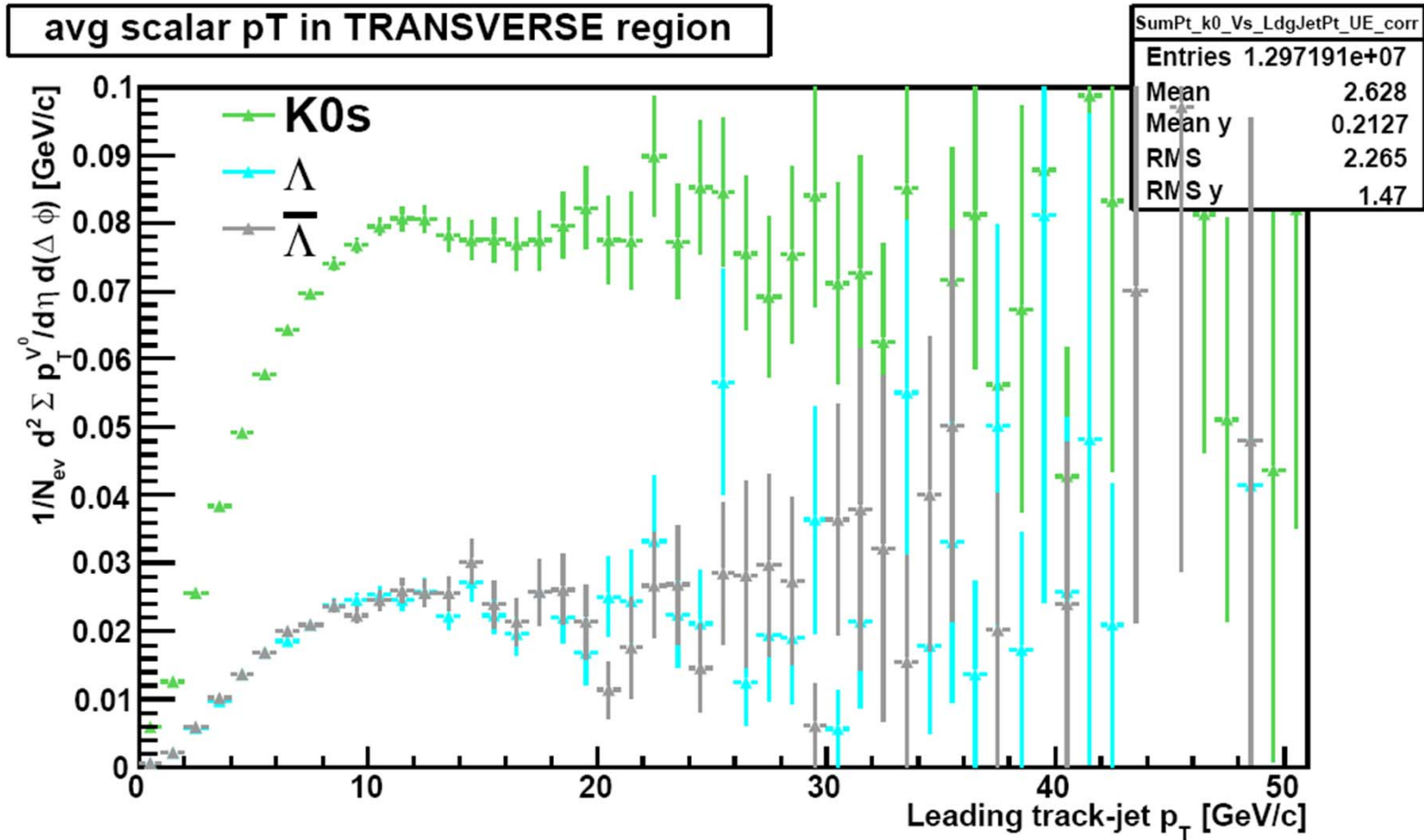
$1/\Delta\eta \, dN/d\Delta\phi$



Rates



Scalar pT Sum



Conclusion & Plans

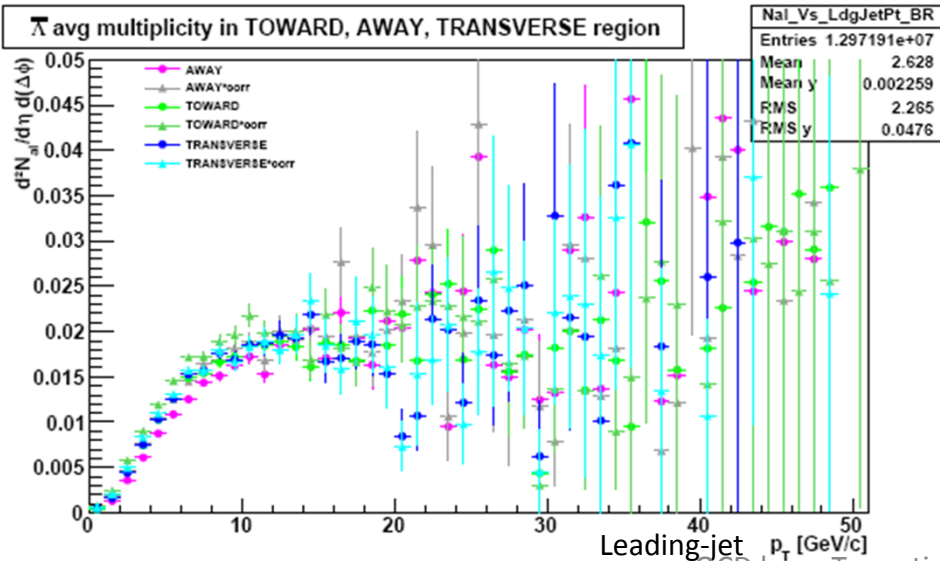
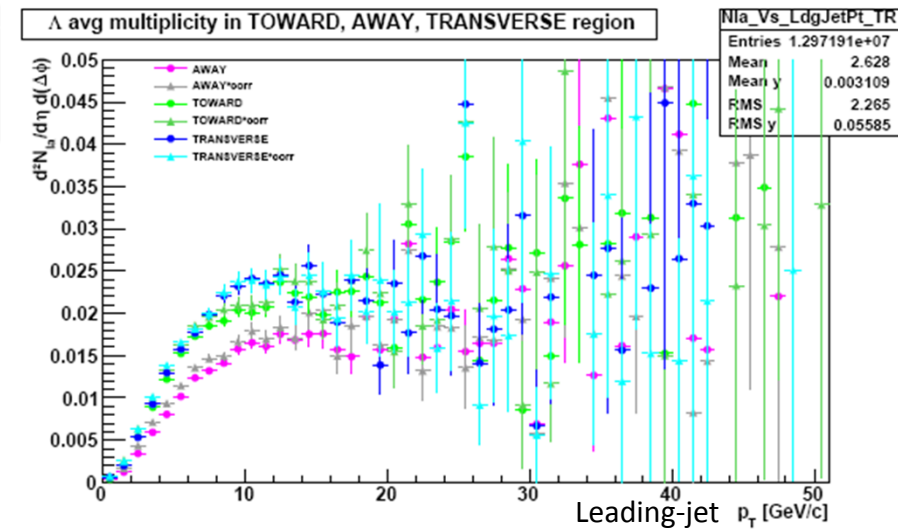
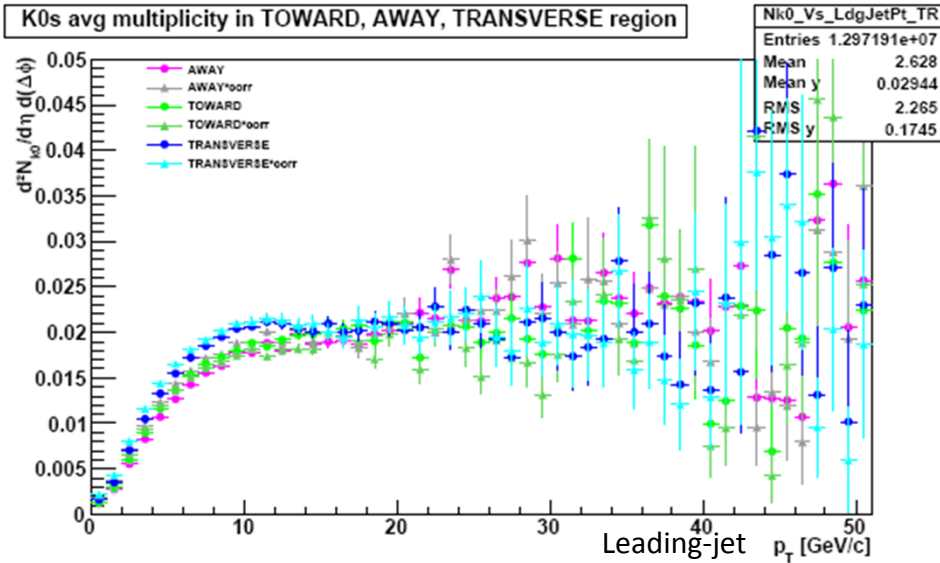
- very first look on the rates of the strange particles (K_0 s, Λ , Λ bar) in the underlying event
- using kinematic fit to select relatively clean V0 sample
- Similar trend with track-jet pT as for primary charged particles

Plans

- produce rates corrected for background
- evaluate systematic uncertainties
 - V0 selection efficiency
 - V0 acceptance (different PYTHIA tunes)
 - background subtraction
 - trigger and event selection

Backup Slides

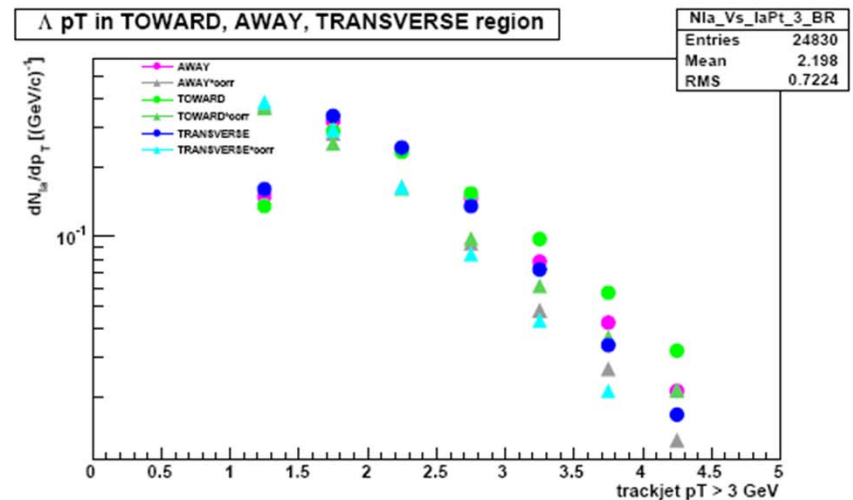
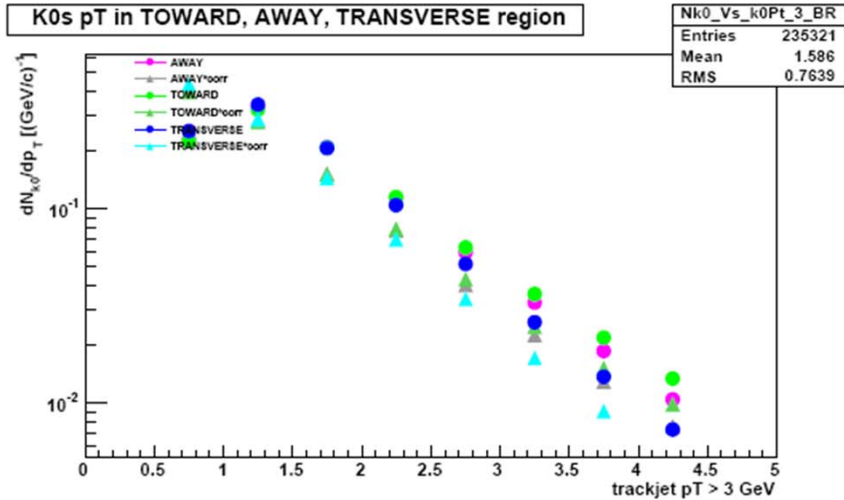
Cross-check: uncorr./corrected rates



Shapes normalised to 1

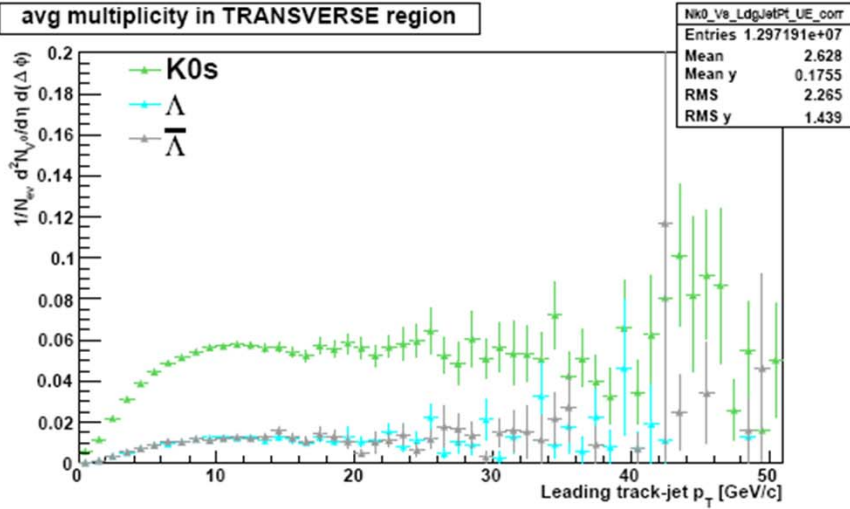
Observed trend is not a feature of the correction

pT Spectra (shape comparison)

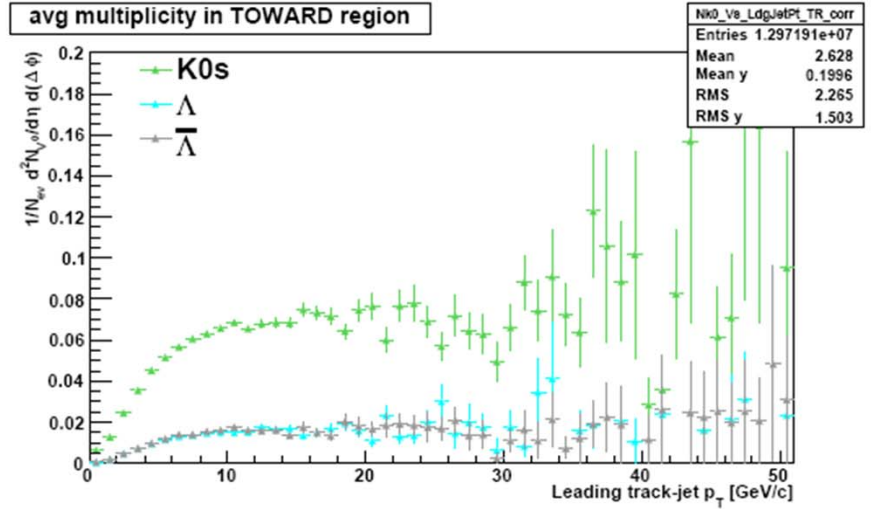


Rates

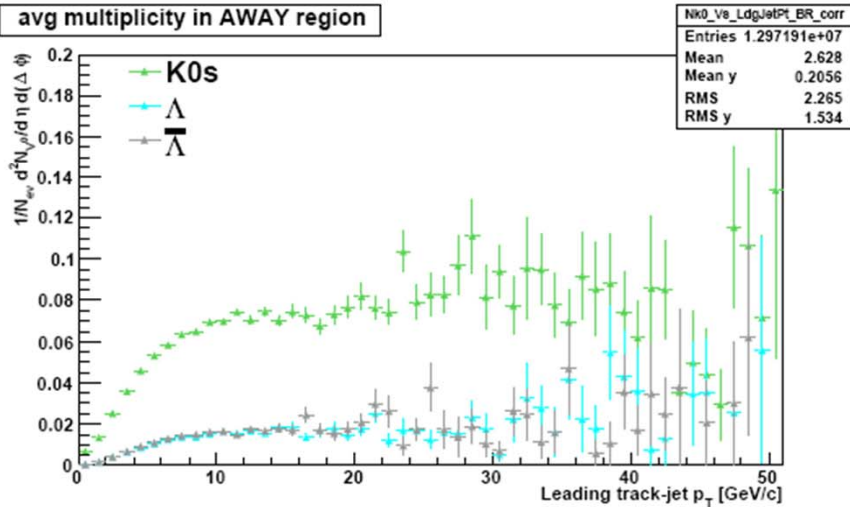
avg multiplicity in TRANSVERSE region



avg multiplicity in TOWARD region



avg multiplicity in AWAY region



More V0 activity in the toward region

Scalar pT Sum

