Influence of PID on K+K+ correlation functions.

B. Batyunya (JINR), L. Malinina (SINP MSU-JINR), A.Fedunov (JINR)

Aliroot (with AliFemto) v4-16-Rev-02
AliEn analysis of 2 mln events
PDC2007: PYTHIA pp 14 TeV

1D and 3d $\pi\pi$ correlations
1D KK correlations

Standard AliFemto procedure

Gaussian distr.: $d^3N/d^3\mathbf{r}^* \sim \exp(-\mathbf{r}^{*2}/(4r_0^2))$

$\pi\pi$, KK r_0: 2 fm

KK Femtoscopy. Physical motivation.

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- KK suffer less from the resonance contributions then ππ -> more clear signal

-Absence of higher multi-particle effects, that may play role for pions, because kaon density is considerably smaller then the pions one (at RHIC,LHC energies).

- K+K- occurs due to FSI: Coulomb and strong. It is possible to determine the difference between emission times and positions of K+ and K- (R. Lednicky, V.I. Luboshitz et al., Phys. Lettre. B373 (1996) 30). The strangeness distillation mechanism (C.Grenier et al., Phys.Rev.Lett. 58, 1825 (1987), C.Spienles et al., Phys.Rev.Lett. 76, 1776 (1996)) could lead to strong temporal emission asymmetries between K+ and K- (S.Soff et al., J.Phys.G 23 2095 (1997), D.Ardouin et al. Phys.Lett.B446, 191 (1999)).

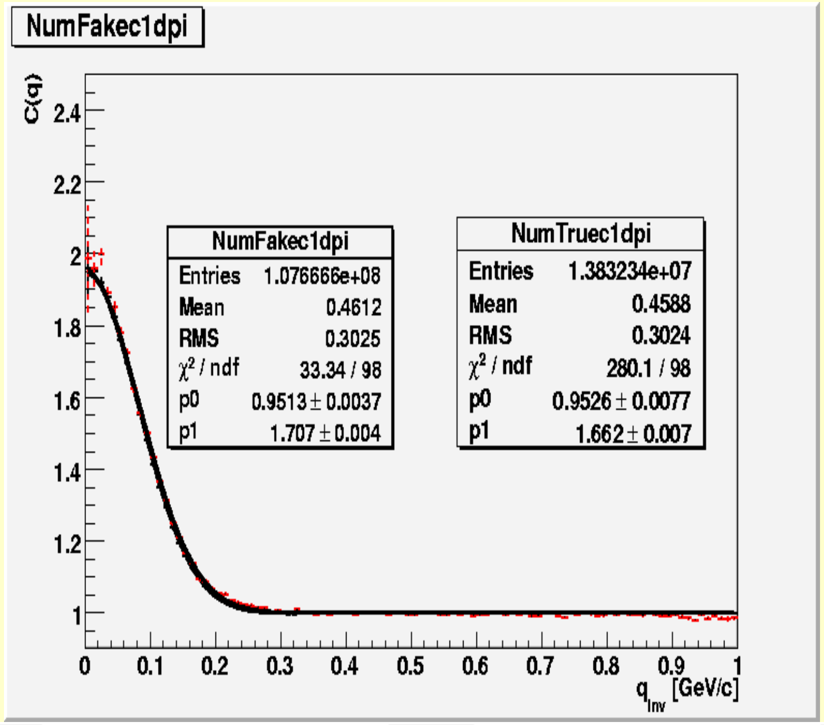
-strong FSI leads to coupling of K+K-→φ, peak of φ in CF(Qinv) near Qinv~ 250 MeV -> additional information about space-time source sizes and asymmetries.

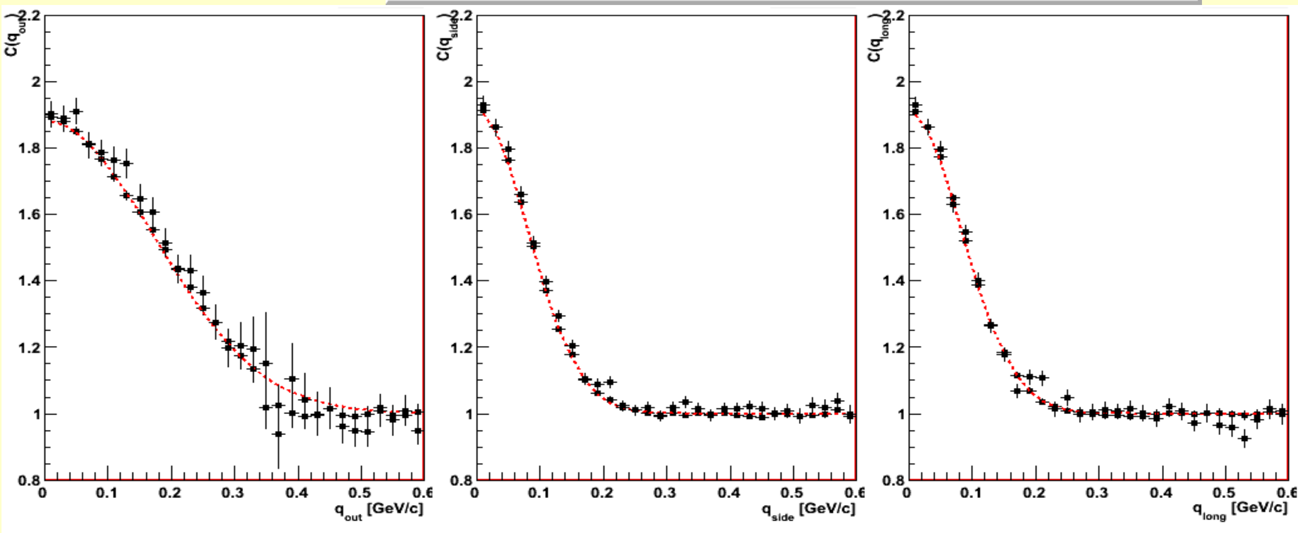
- residual correlations of φφ can be seen from KK correlation function

Simulated / reconstructed CFs ππ

Event selection cuts

Z-vertex: (-15.6 , 15.6) cm
18 mixing bins in z were used.
Pt: (0.15, 0.5)
GeV/c. number clusters TPC: >50
max Chi2/cluster TPC: <2.5
TPCrefit: kTRUE
ITSrefit: kFALSE
SigmaToVertex: 3.0;
SetPIDProbKaon: > 0.2
SetPIDProbPion: > 0.2
SetPIDProbProton: > 0.2
SetPIDProbMuon: > 0.2
“sharity": 0.02
"quality" : 0.0
TPC entrance separation: 2.0

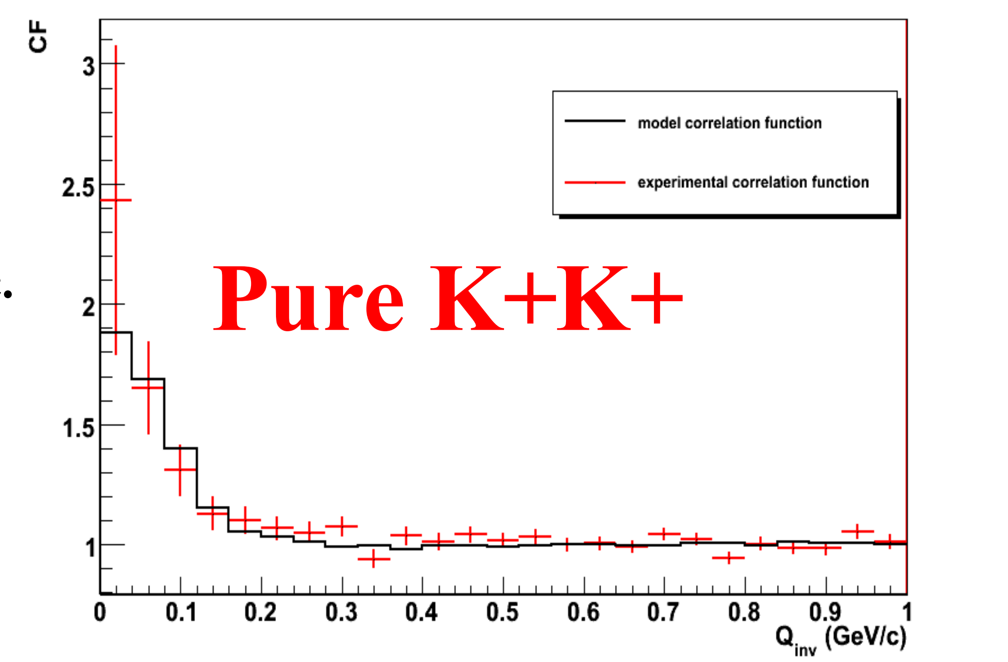




Simulated / reconstructed CF(qinv) K+K+

Event selection

Z-vertex: (-15.6 , 15.6) cm
18 mixing bins in z were used.
Pt: (0.15, 0.5) GeV/c.
number clusters TPC: >50
max Chi2/cluster TPC: <2.5
TPCrefit: kTRUE
ITSrefit: kFALSE
SigmaToVertex: 3.0;
SetMostProbableKaon: kTRUE
"sharity": 0.02
"quality": 0.0
TPC entrance separation: 2.0 cm.



Set of cuts 1 K+K+

SetPIDProbKaon: > 0.2
SetPIDProbPion: > 0.2
SetPIDProbProton: > 0.2
SetPIDProbMuon: > 0.2

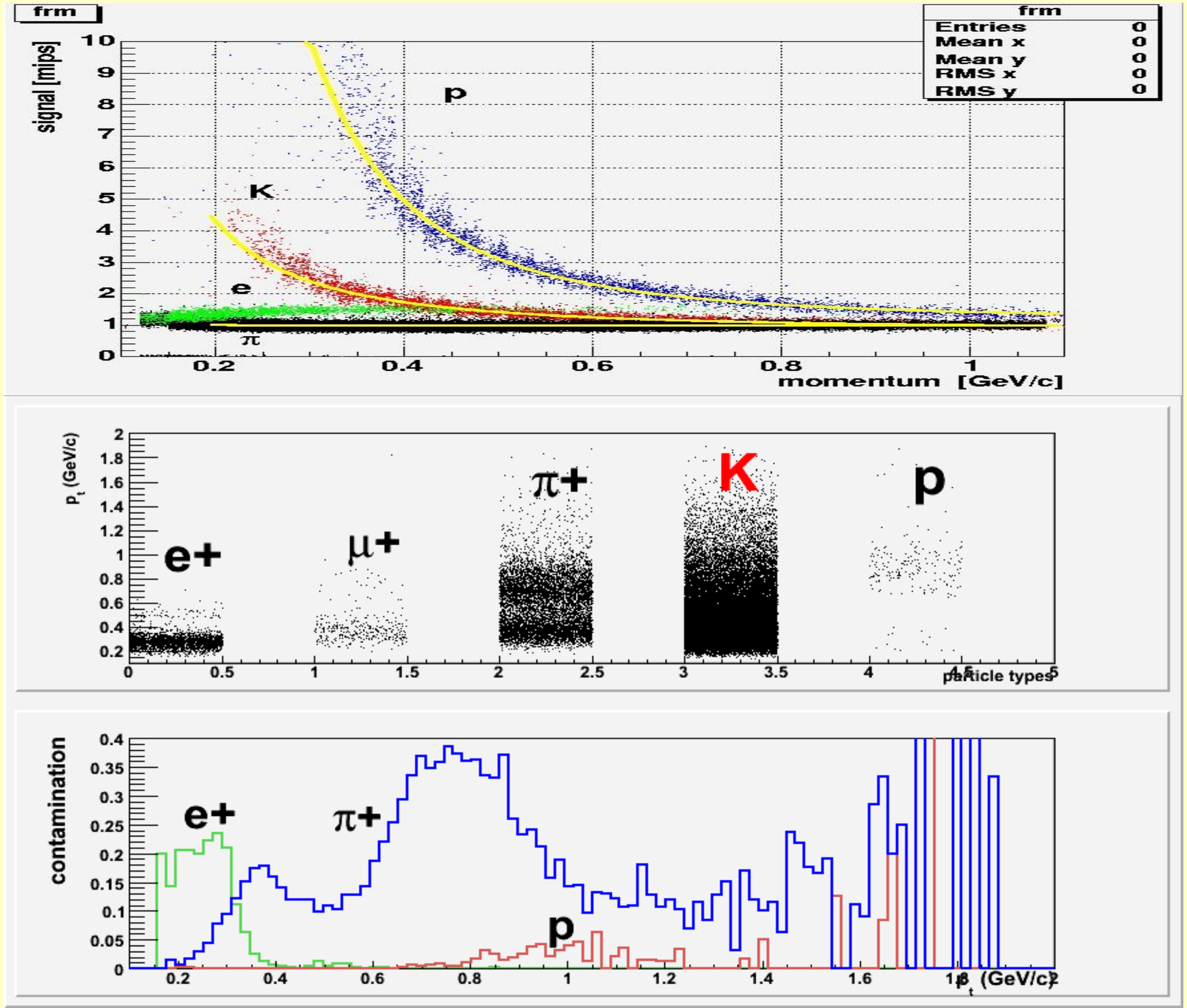
Set of cuts 2 K+K+

SetPIDKaon: > 0.7
SetPIDProbPion: < 0.5
SetPIDProbProton: < 0.5
SetPIDProbMuon: < 0.5

Combined PID in AliFemto

New class for analysis PID effects within AliFemto was created

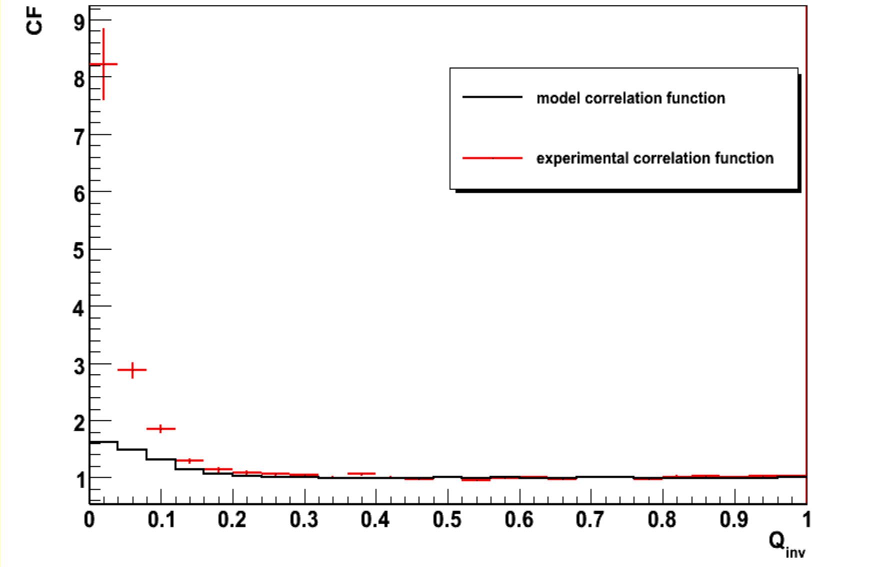
Cont = N(not K, K PID)/N(K PID)

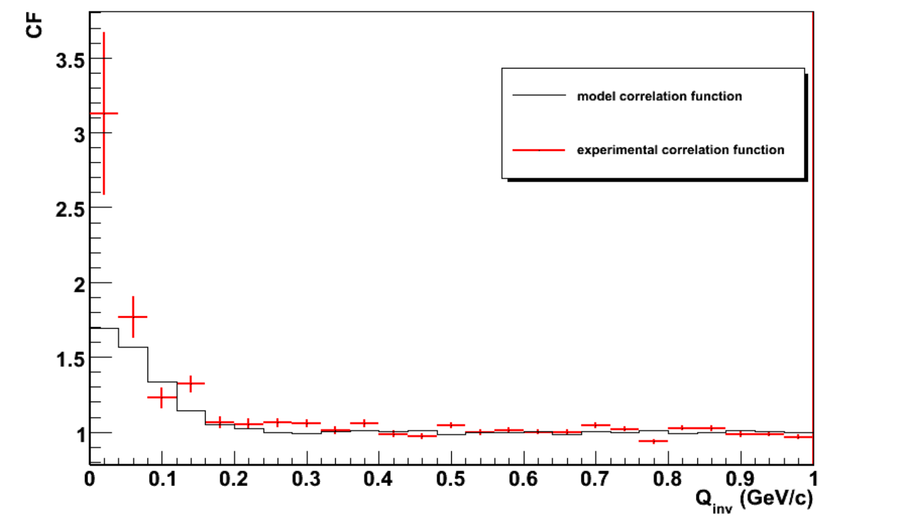


for set of cuts 2

e+ contamination is essential at small pt !

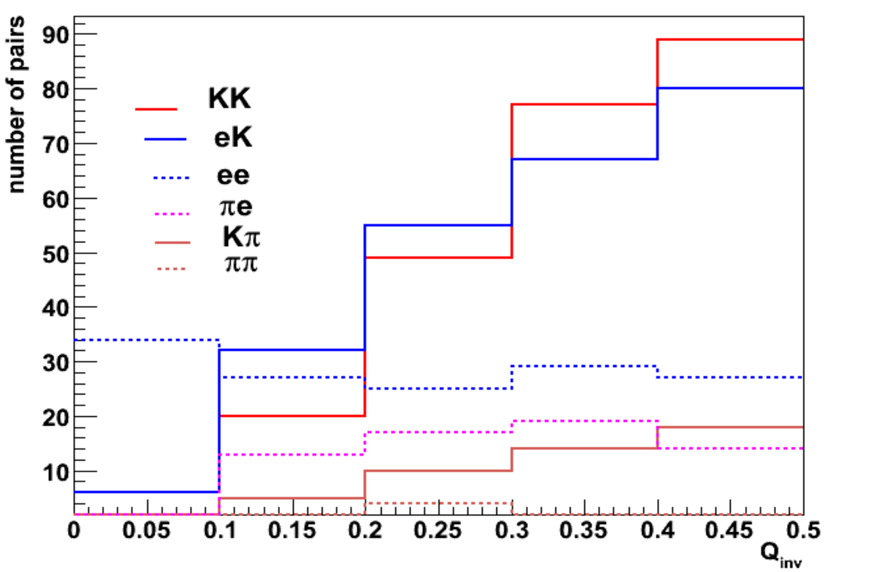
CF(qinv) K+K+. Standard combined PID.

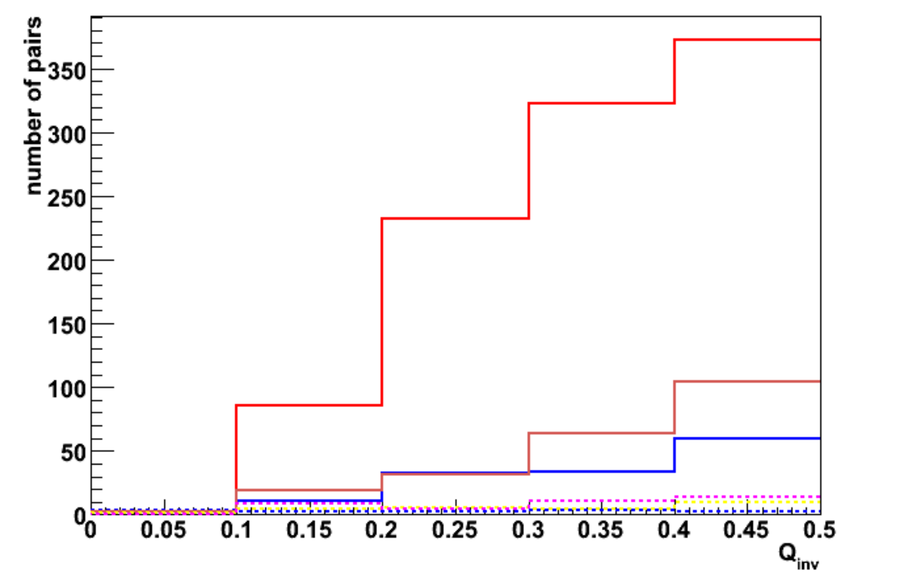




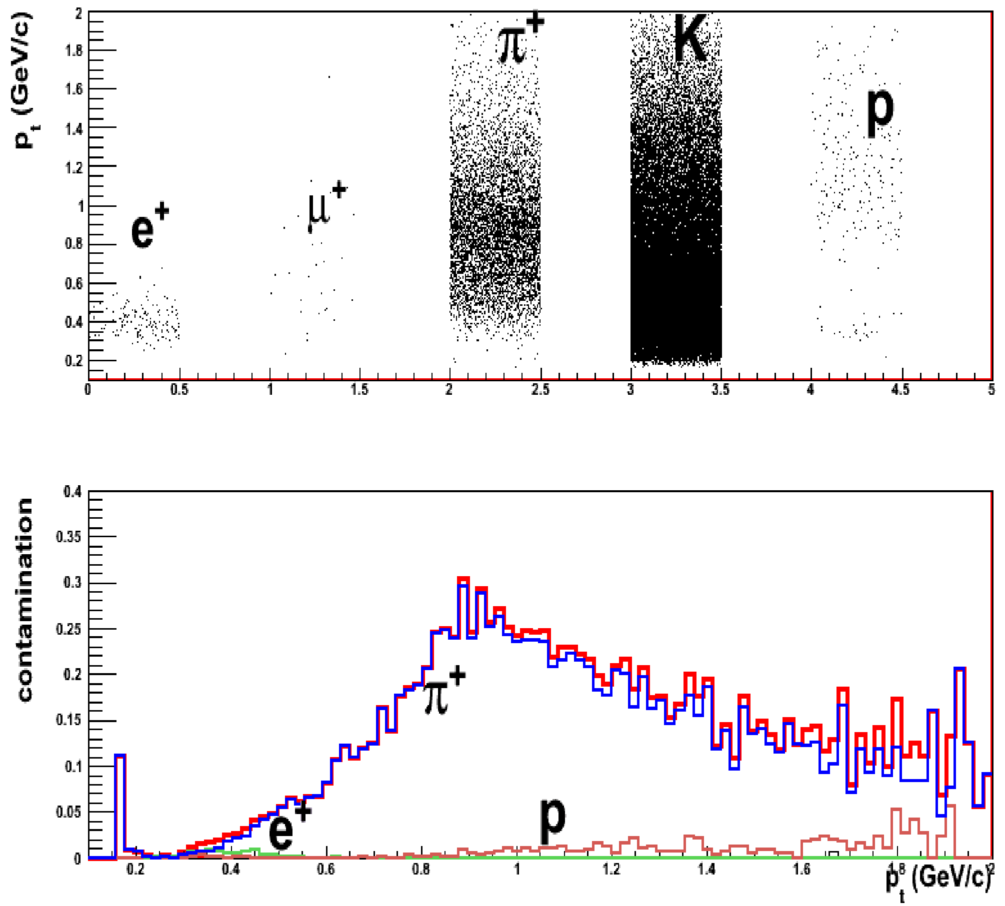
Set of cuts 1 K+K+

Set of cuts 2 K+K+

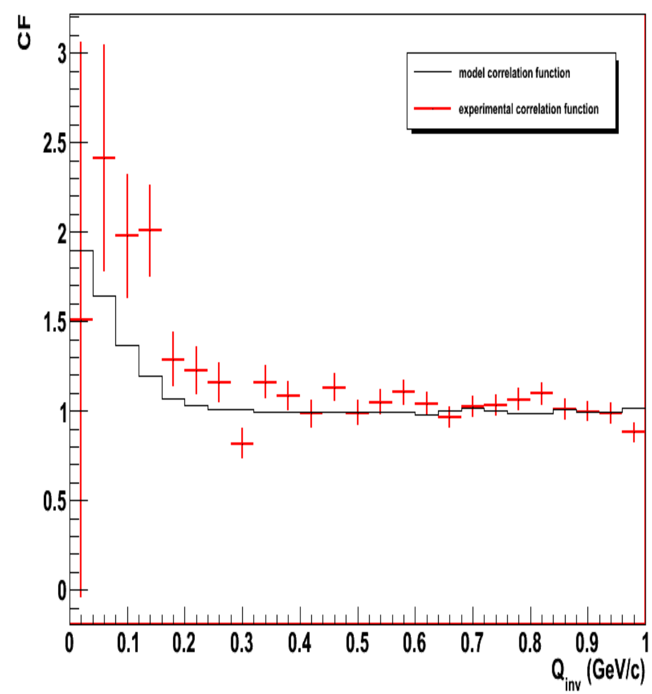




Results from Adam's run of the PWG2 train with Femto cars PDC09 Pythia production (LHC09a4, batch 8010x)



CF(Qinv):Small statistics !



In PDC09 e+ contamination is much less then in PDC07 !

What is the strange peak at small pt identified as pions ?!

CF(qinv) K+K+. Standard combined PID.

Strong influence of PID on CFs for kaons

How to improve standard combined PID ?

Standard PID: ITS */ifTPC */if TRD */if TOF

JINR PID:

At pt< 0.7 GeV/c: if no TOF ITS * TPC

if TOF ITS * TPC * TOF

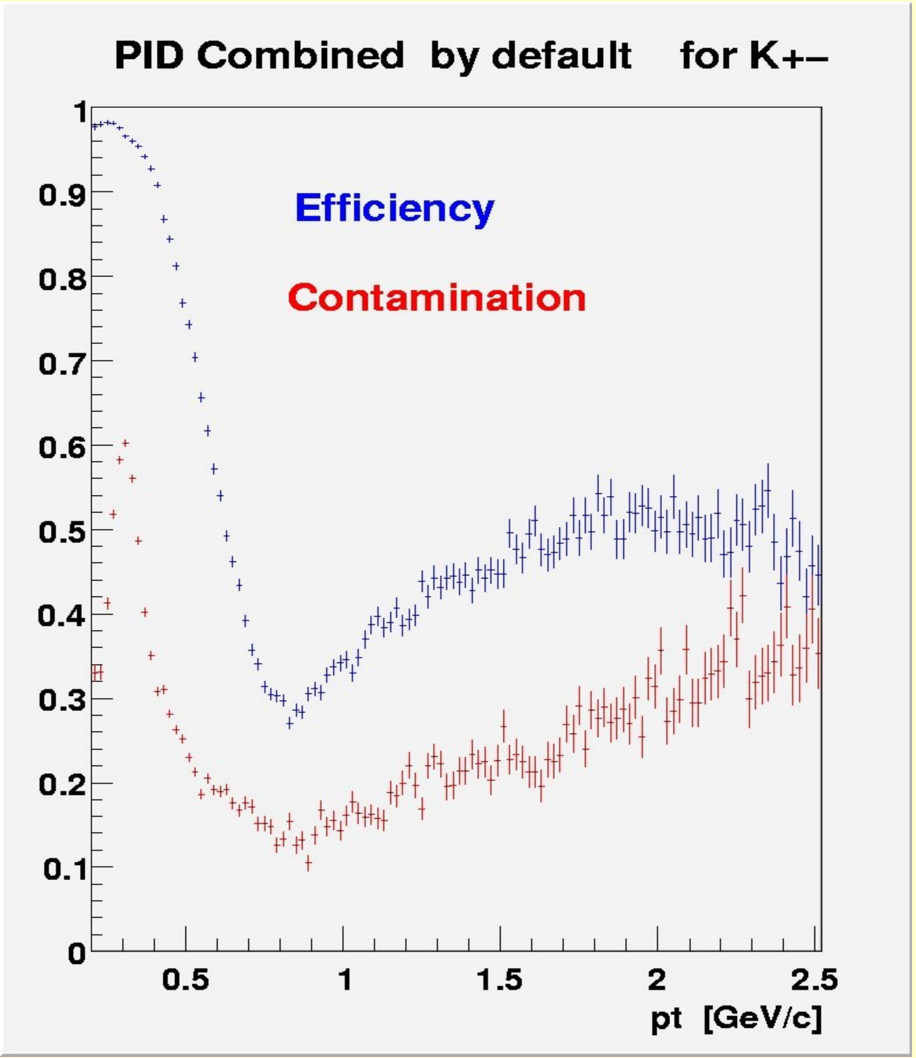
At pt>0.7 GeV/c: if TOF ITS * TPC * TOF

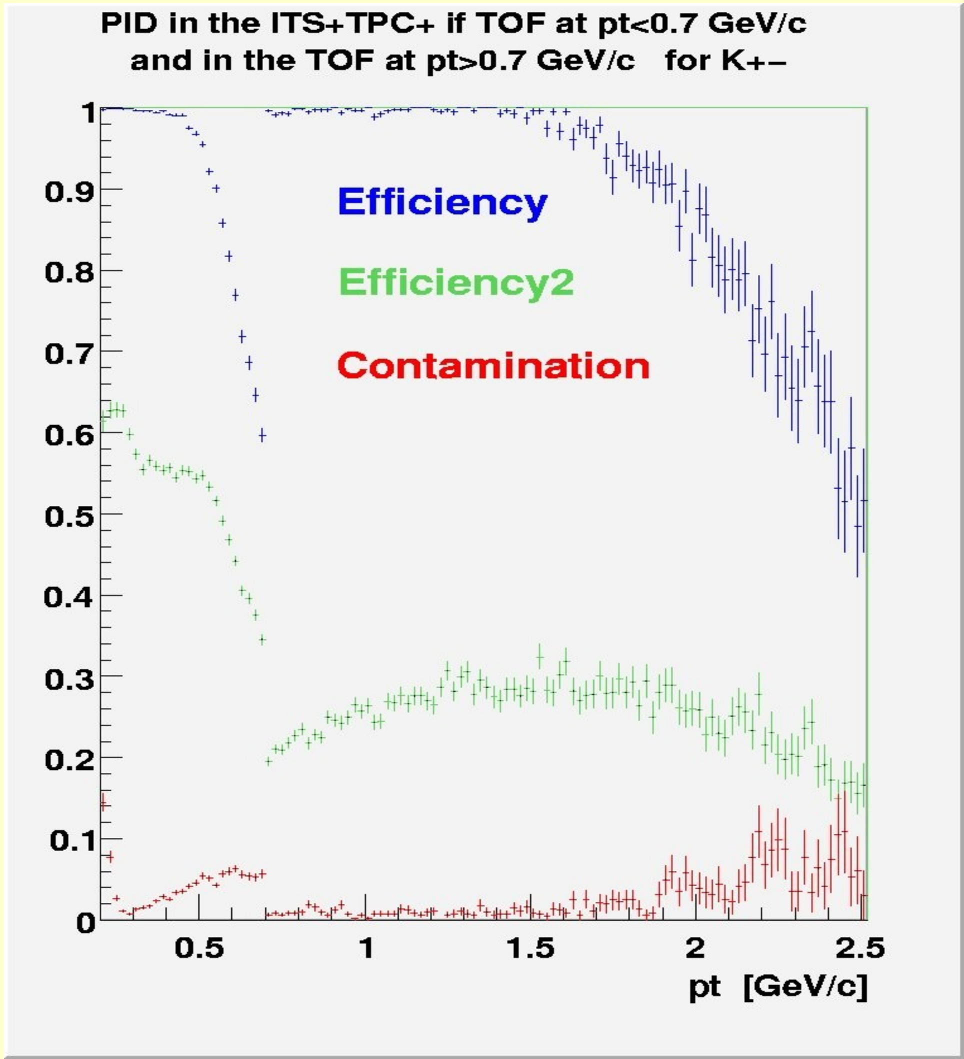
if no TOF: skip track

Standard PID JINR PID

Eff = N(K, K PID)/N(K) Eff2 = N(K, K PID)/N(K all)

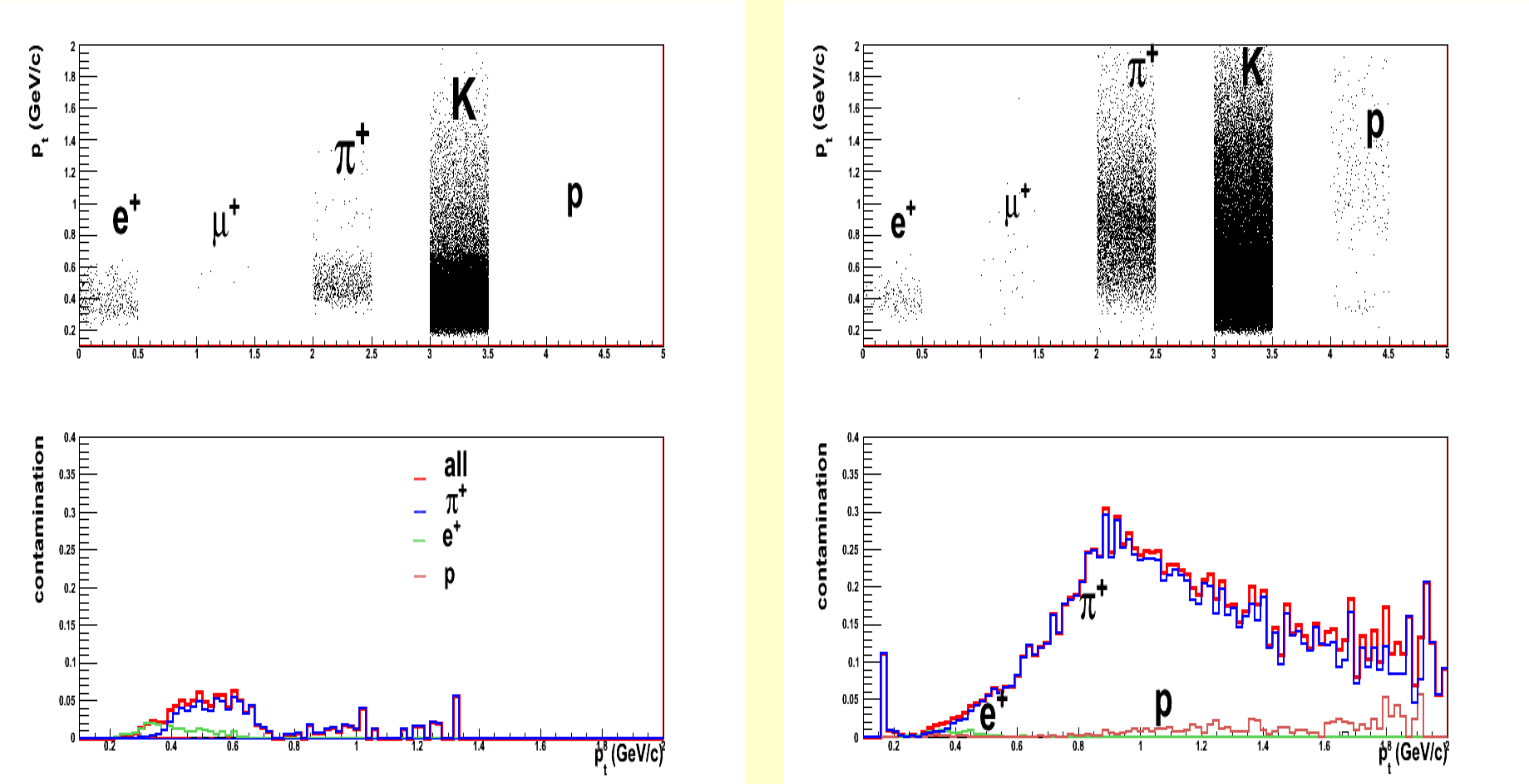
Cont = N(not K, K PID)/N(K)





Comparison of contaminations from PDC09 with standard PID and PDC07 with JINR PID implemented in AliFemto

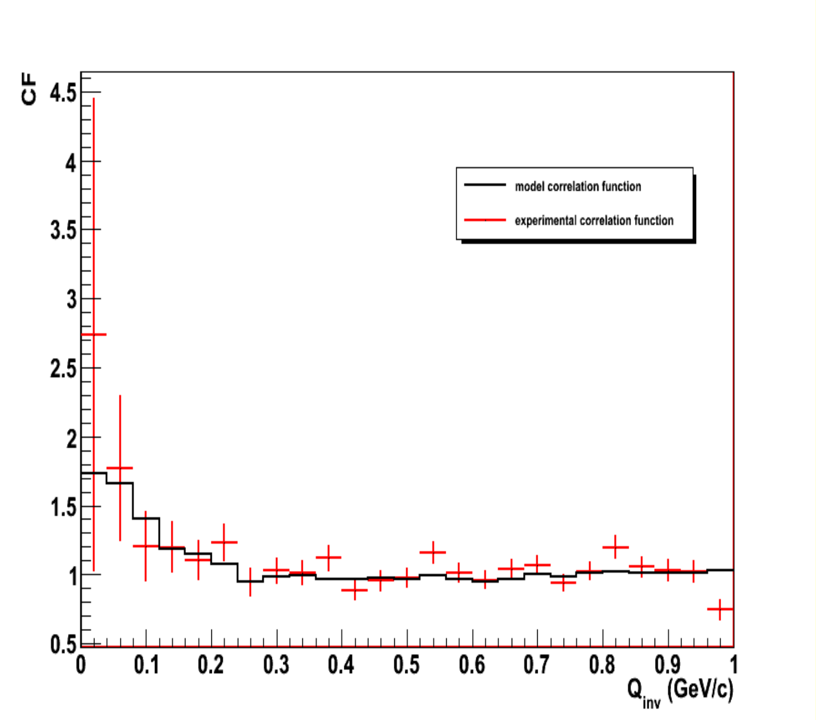
JINR PID **Standard PID**



All contaminations strongly decrease if we use the JINR PID approach in AliFemto.

K+K+   CF(Qinv) PDC07 with JINR PID

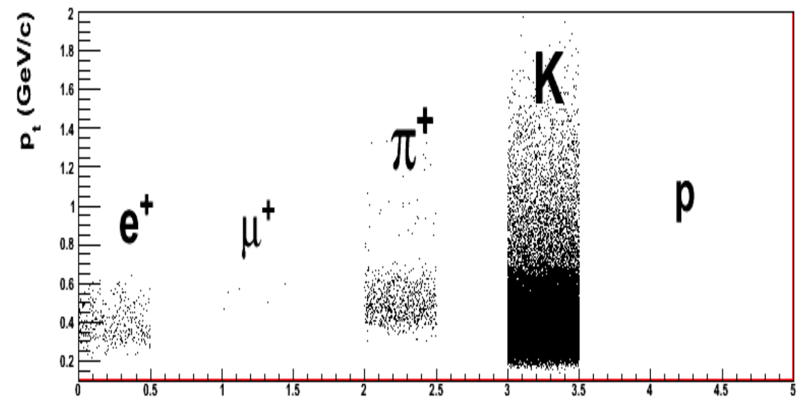
CF(Qinv) with JINR PID

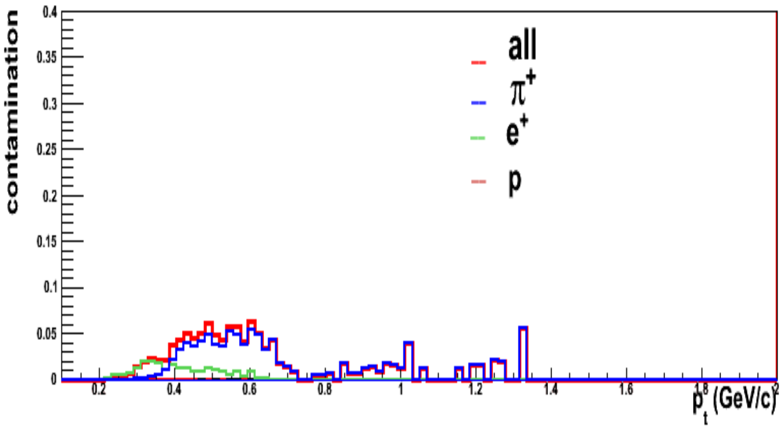


Set of cuts for K+K+

SetPIDKaon: > 0.7
SetPIDProbPion: < 0.5
SetPIDProbProton: < 0.5
SetPIDProbMuon: < 0.5

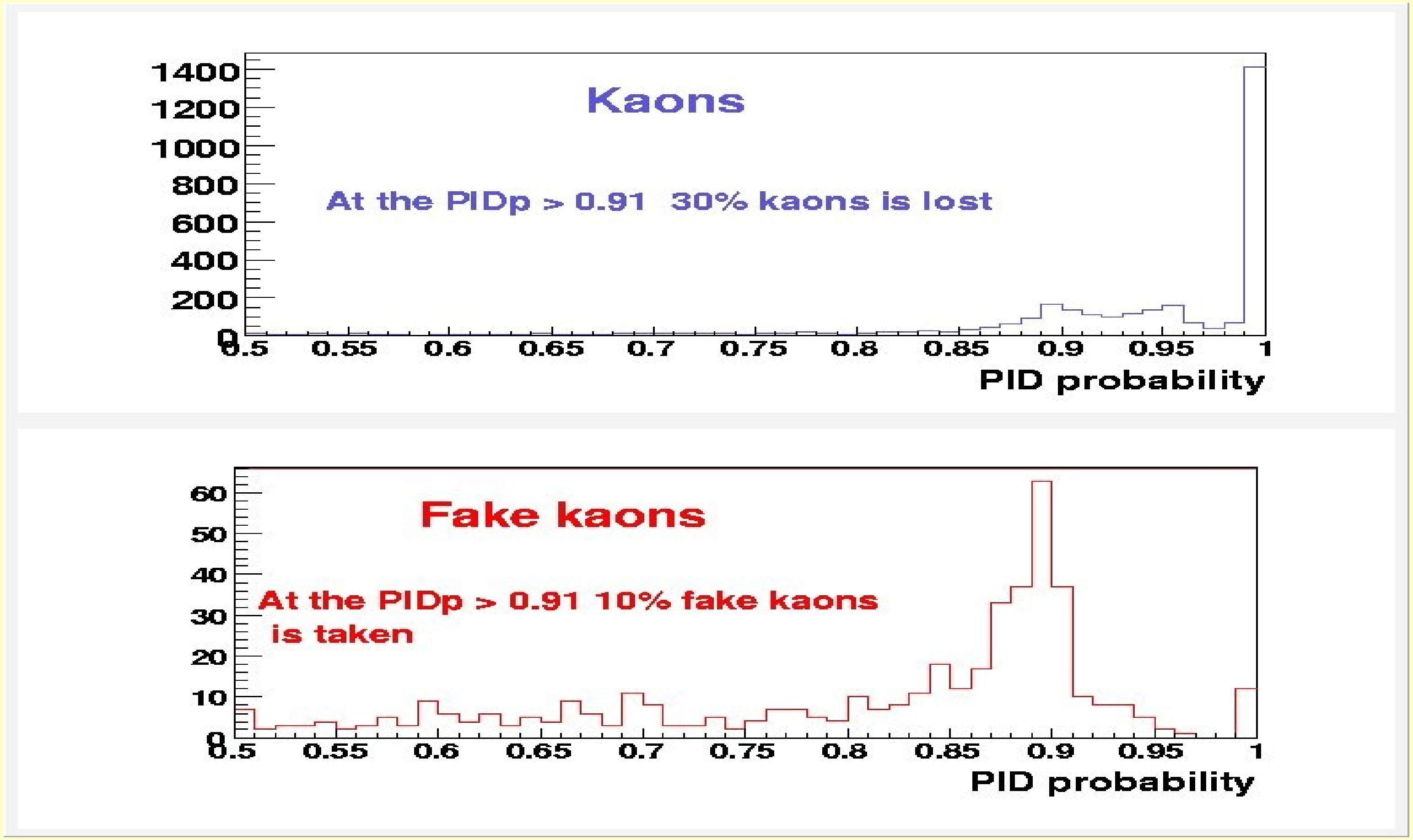
Contaminations with JINR PID





Can we decrease the contaminations more?

B. Batyunya study of PID probabiility distribution shape



The cut of the PID probability,
PIDp > 0.91 removes 90% of
the fake kaons but at 30% loss of the realistic kaons.

Conclusions. Plans. KK femtoscopy in pp.

K^+K^+, K^+K^- CFs reconstruction is under way.

JINR PID procedure essentially improves the purity of the sample

Additional slides

Conclusions UHKM & plans

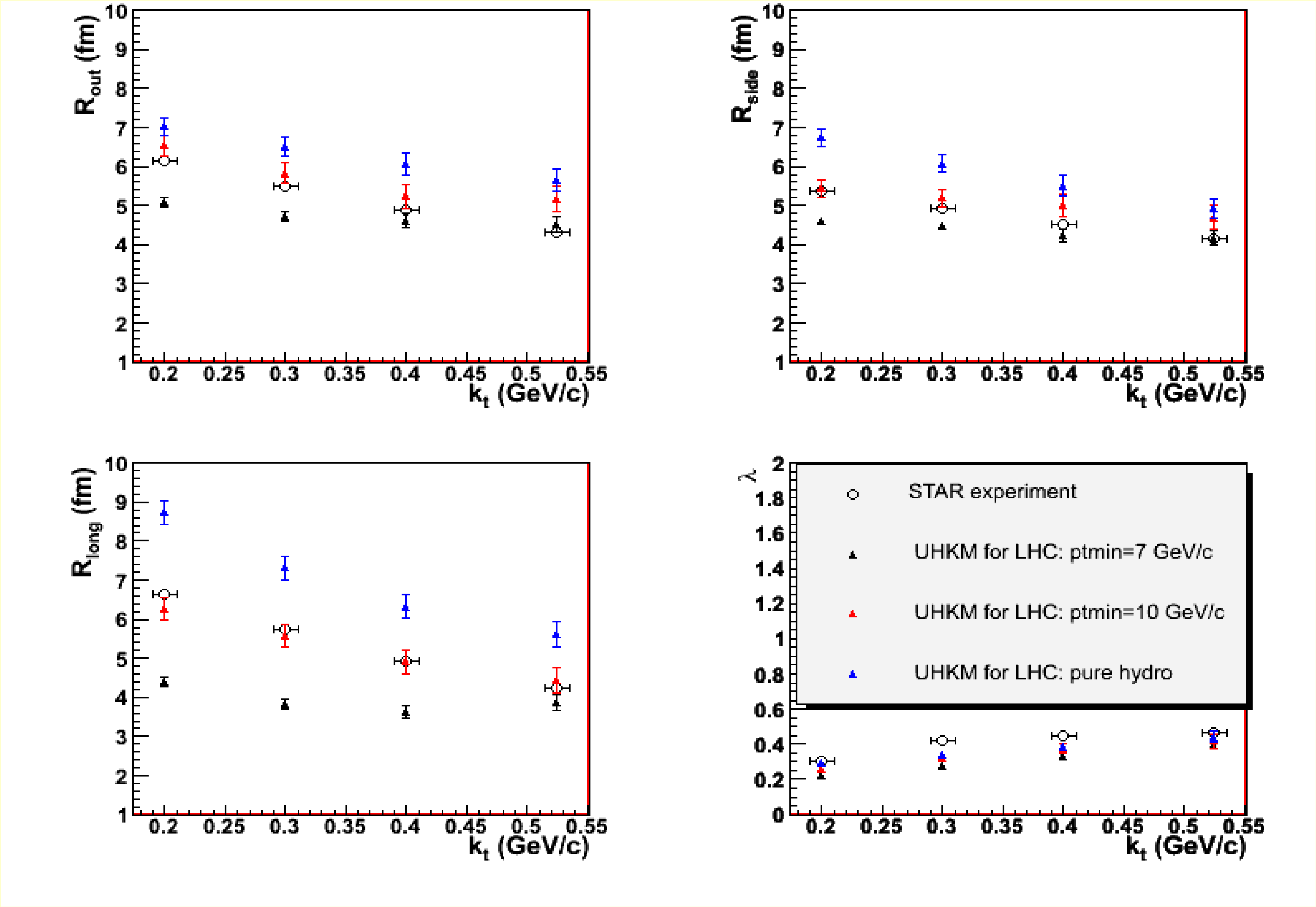
- We are prepearing the version of HYDJET++ (FASTMCj) including hydro part (FASTMC) and the part related with partonic states (PYTHIA+PYQUEN)

- We finished the work under implementation of the model in AliRoot

-We started to study the influence of hard processes (jet production, jet quenching, shadowing) on «soft» observables: correlation function and v_2

-More sophisticated method of taking into account the coordinate information from PYTHIA is needed
This method can be tested using pp data

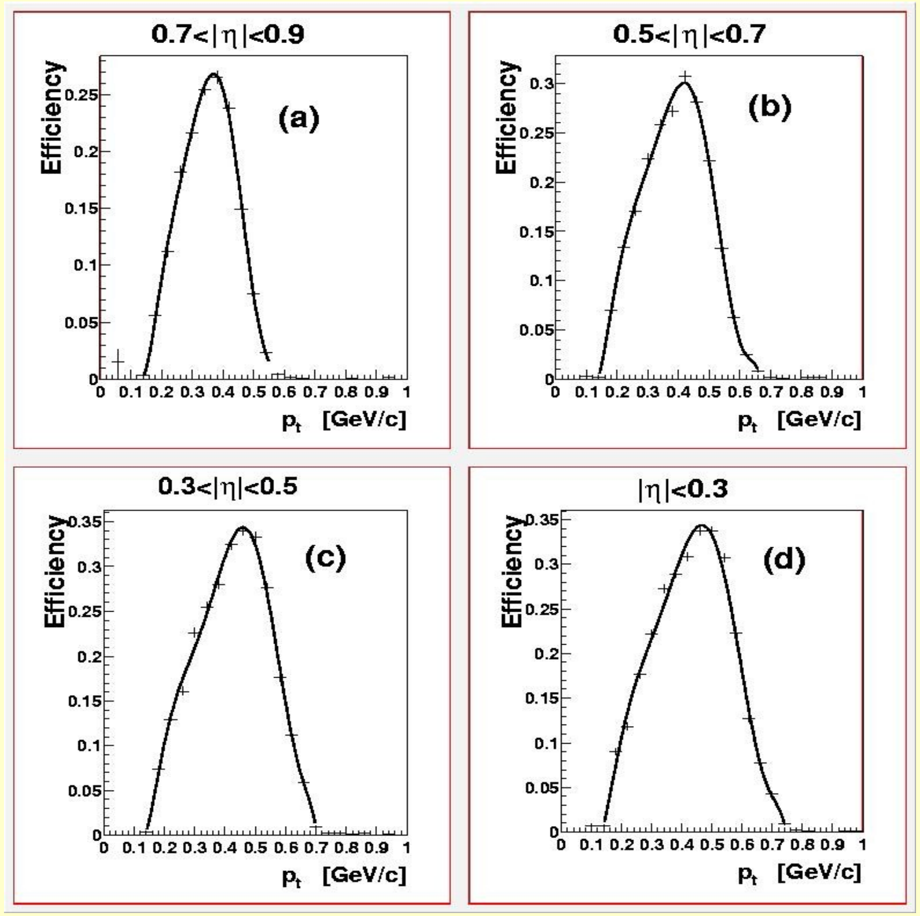
UHKM for LHC very preliminary



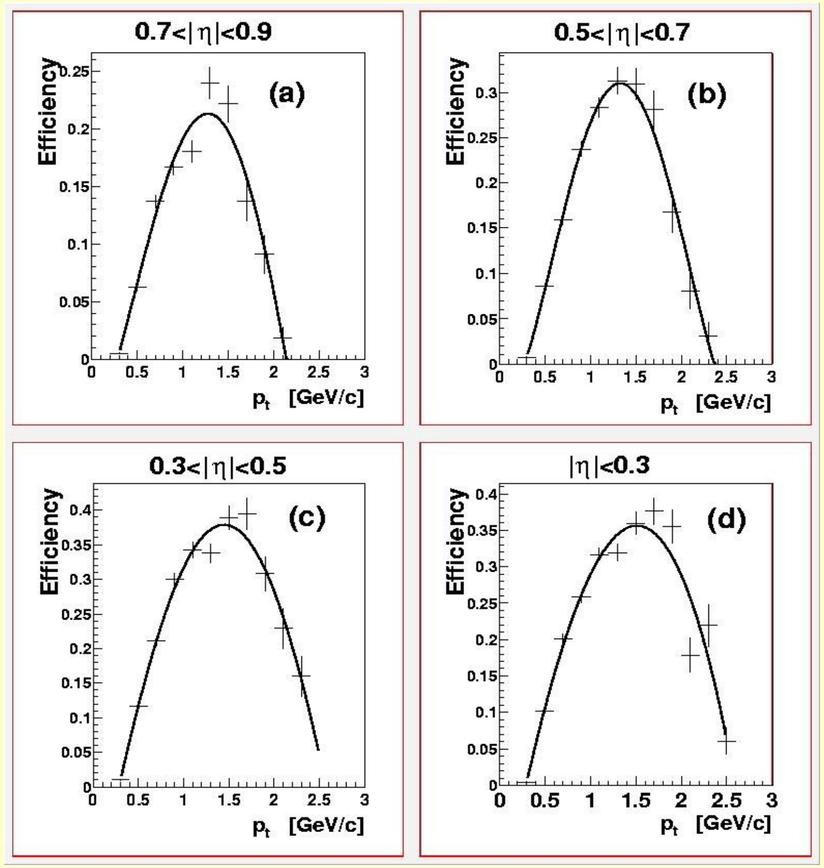
100% hydro: a small increase of the correlation radii;
Ptmin=10 GeV/c : correlation radii as at RHIC energies;
Ptmin=7 GeV/c : decrease of the correlation radii, especially Rlong

Efficiency of K detection:

in the TPC



in the TOF



HYDJET++: hydro + part related to the partonic states

The soft part of HYDJET++ event represents the "thermal" hadronic state FASTMC: Part I: N.S. Amelin, R. Lednisky, T.A. Pocheptsov, I.P. Lokhtin, L.V. Malinina, A.M. Snigirev, Yu.A. Karpenko, Yu.M. Sinyukov, Phys. Rev. C 74 (2006) 064901; Part II: N.S. Amelin, R. Lednisky, I.P. Lokhtin, L.V. Malinina, A.M. Snigirev, Yu.A. Karpenko, Yu.M. Sinyukov, I.C. Arsene, L. Bravina, Phys. Rev. C 77 (2008) 014903
http://uhkm.jinr.ru

The hard, multi-partonic part of HYDJET++ event is identical to the hard part of Fortran-written HYDJET (PYTHIA6.4xx + PYQUEN1.5) : I.P.Lokhtin and A.M.Snigirev, Eur. Phys. J. C 45, 211 (2006), http://cern.ch/lokhtin/pyquen,
http://cern.ch/lokhtin/hydro/hydjet.html

First "official" version of HYDJET++ code and web-page with the documentation has been just completed (16 September, 2008): http://cern.ch/lokhtin/hydjet++

The complete manual: I.Lokhtin, L.Malinina, S.Petrushanko, A.Snigirev, I.Arsene, K.Tywoniuk, e-print arXiv:0809.2708, submitted to Computer Physics Communications

Two-tracks effect cuts:

"sharity" cut 0.02: two tracks shared less than a given number of clusters, and had a large fraction of TPC padrows where both of them had distinct clusters.

TPC entrance separation: To address the "merging", a cut on the particle separation at the entrance to the TPC was set to 2.0 cm.

"quality" cut : 0.0