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Some questions of correlation function modelling

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Outline

- Software and data sample used to modelling CF
- Different methods of correlation function modelling
- Summary

Data

- Epos 2.05 + hydro 7 @ TeV pp
- 8 M events
- 4 centrality classes in input file:

(0-50 50-100 100-150 150-200)

Analysis

- cuts similar to used in ALICE

$0.13<pt<0.7$ GeV/c $|\eta|<1.2$

- $\pi^+\pi^+$ only with quantum statistic effect
- $\pi^+\pi^+$ and $\pi^-\pi^-$ signals added to get better statistic
- Function used to fitting:

$C(q)=1.0+\lambda e^{-qr}+Aq+Bq^2$

Software

HaBeTy package

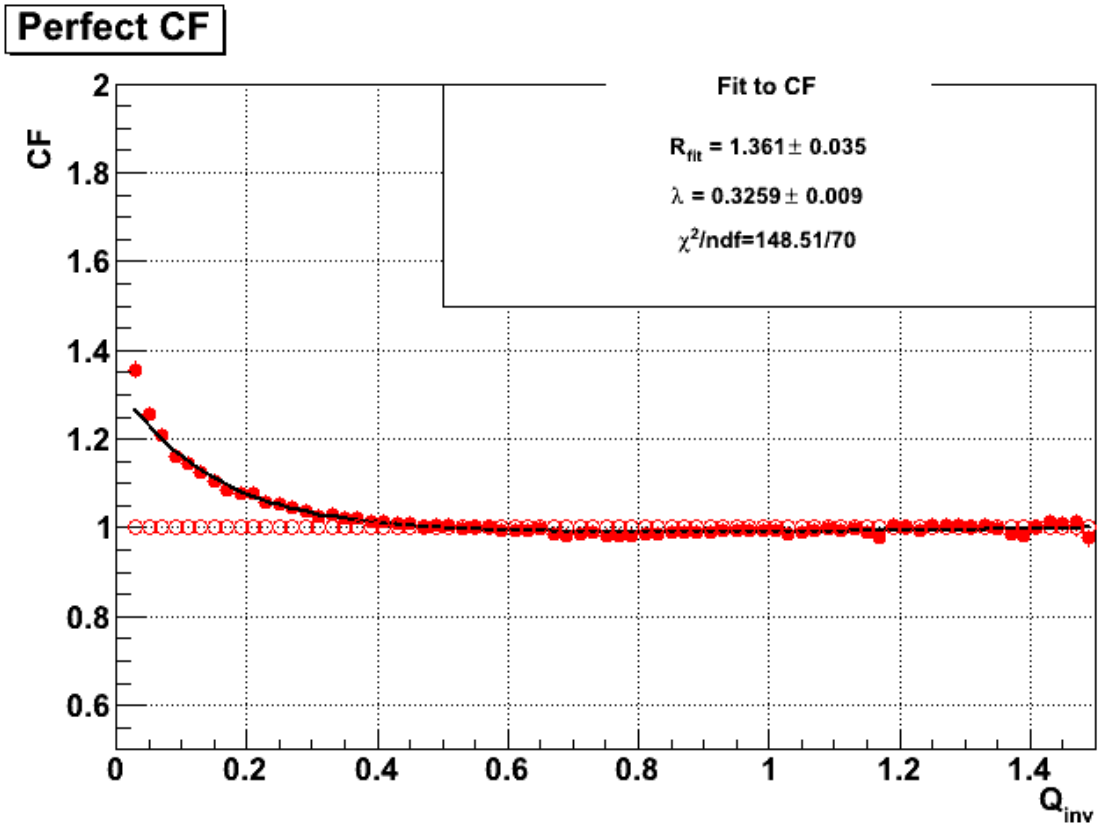
- C++ libraries allowing to calculate perfect correlation function
- User friendly – to change pair type or kinematics cuts you don’t have to modify source code but only input file
- Using Lednicky’s weight algorithm

Software

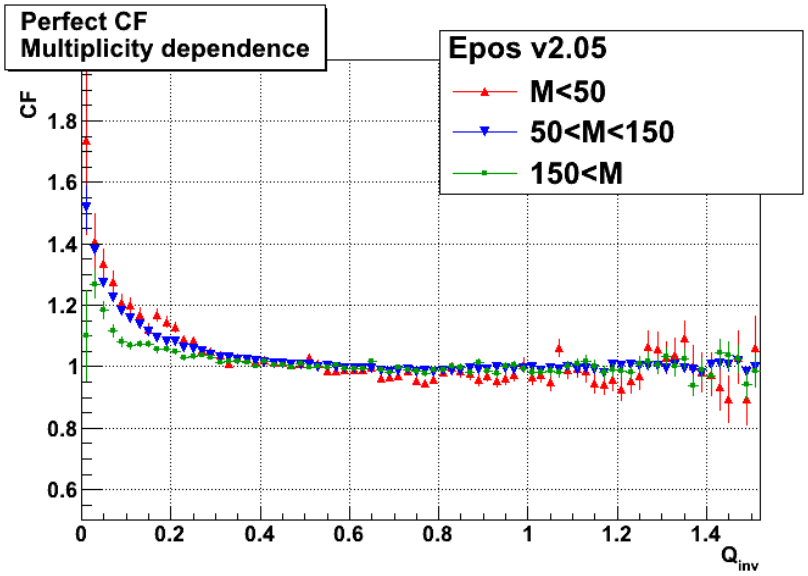
- Using UniGen format (format to save data from generator in the form of root trees - allowing to compare quickly results from different models)
- possibility of doing $\Delta\phi\Delta\eta$ and double ratio HBT analysis (early stage)

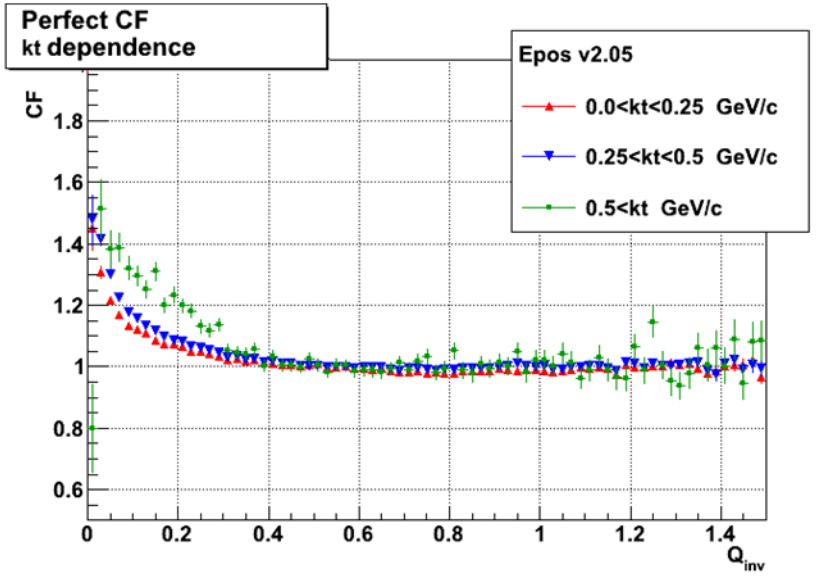
Perfect CF

- Distribution of pair with Lednicky's weights divided by distribution without them.



Perfect CF


Perfect CF
Multiplicity dependence
Epos v2.05
M<50
50<M<150
150<M
CF
1.8
1.6
1.4
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Q_inv

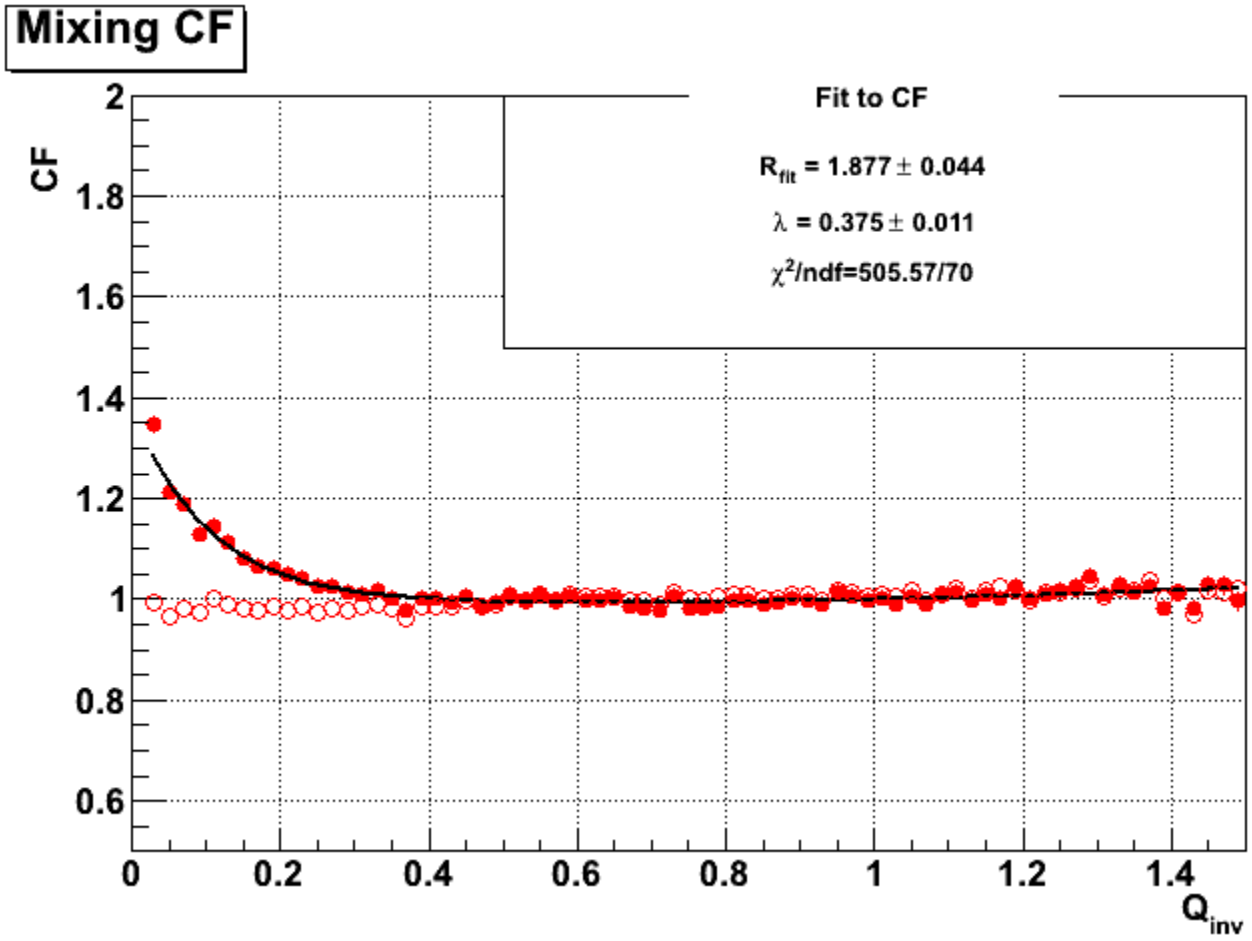

Perfect CF
kt dependence
Epos v2.05
0.0<kt<0.25 GeV/c
0.25<kt<0.5 GeV/c
0.5<kt GeV/c
CF
1.8
1.6
1.4
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Q_inv

Influence of background modelling effects on shape of the CF

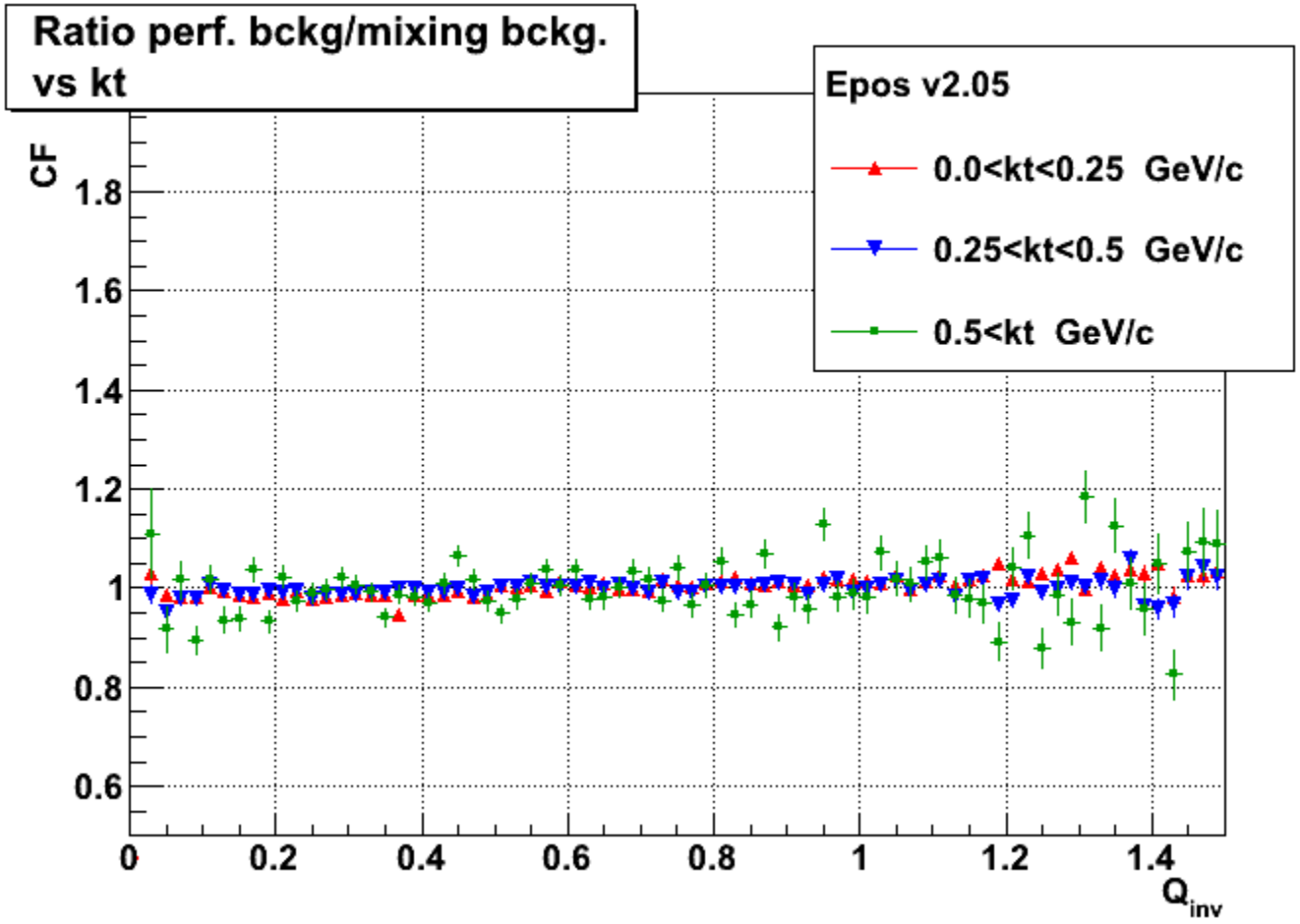
Background generating methods

Method	Description
Mixing	Mixing particles between events – in this analysis 5 events with the same number of particles
Rotation	Particles are from the same event but signs of px and py are reversed
Opposite	Second particle have different sings (for example $\pi+$ $\pi-$)
Opposite + rotation	It's combination of two methods above

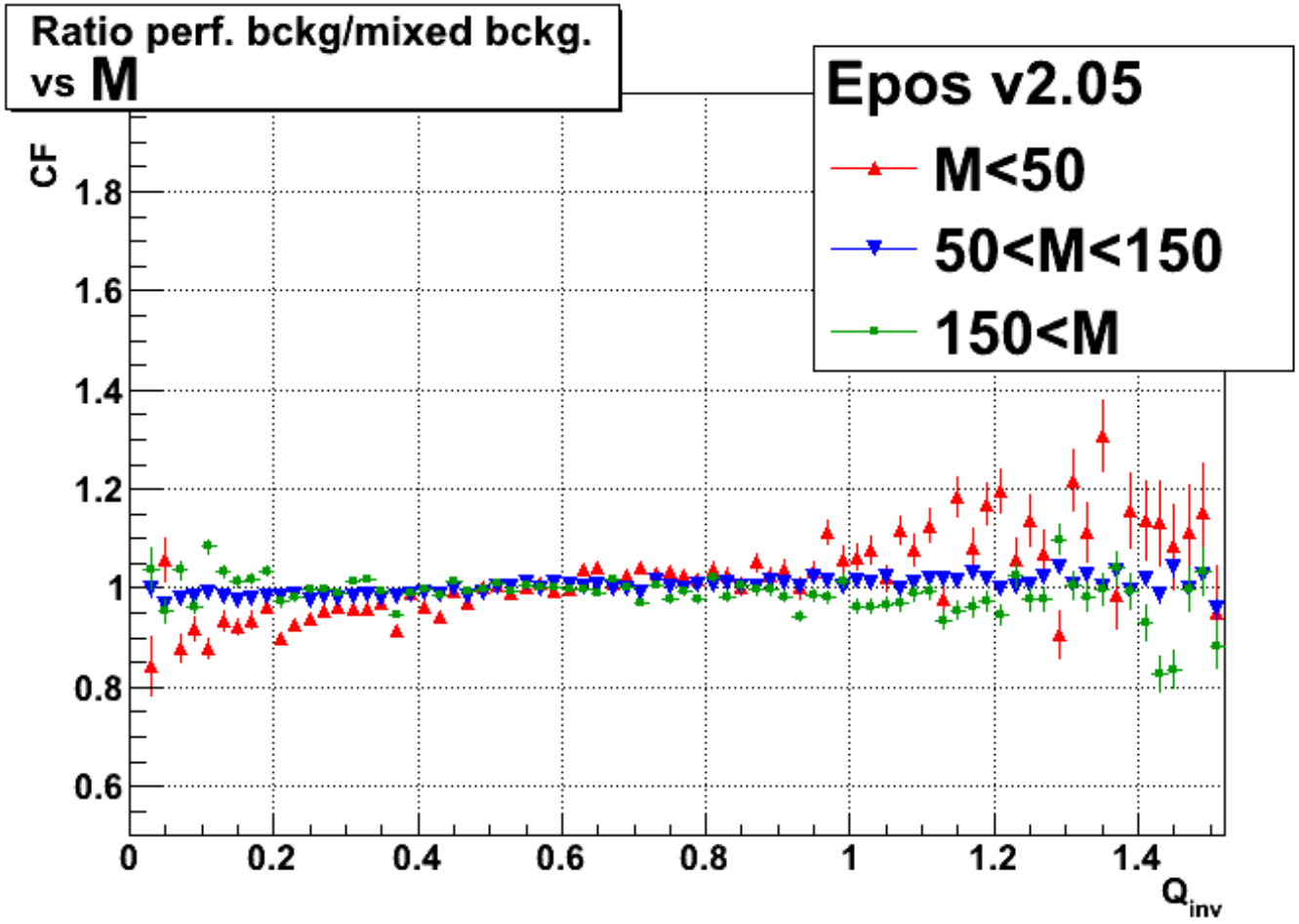
Mixing method -CF



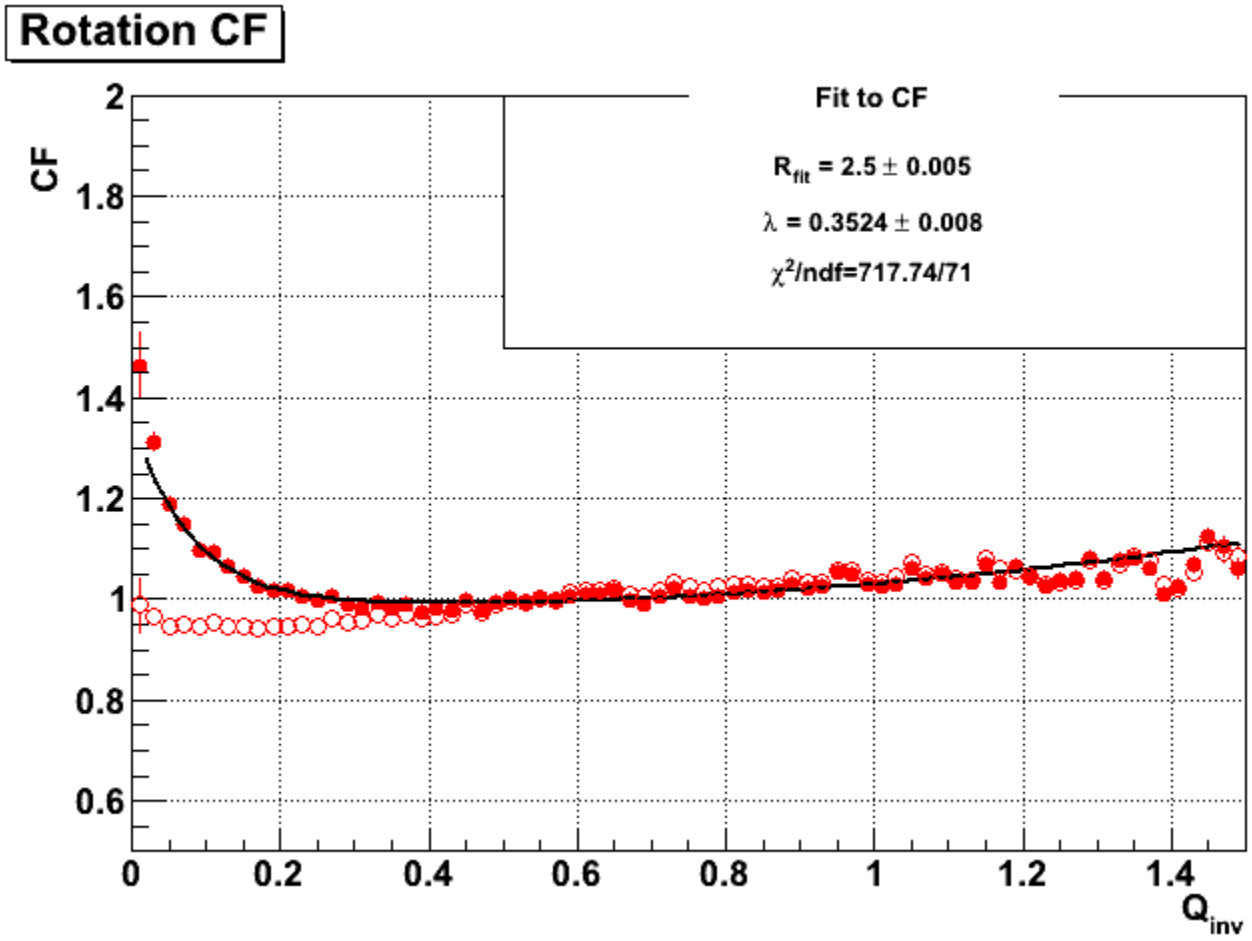
Mixing background vs. perfect background vs. kt



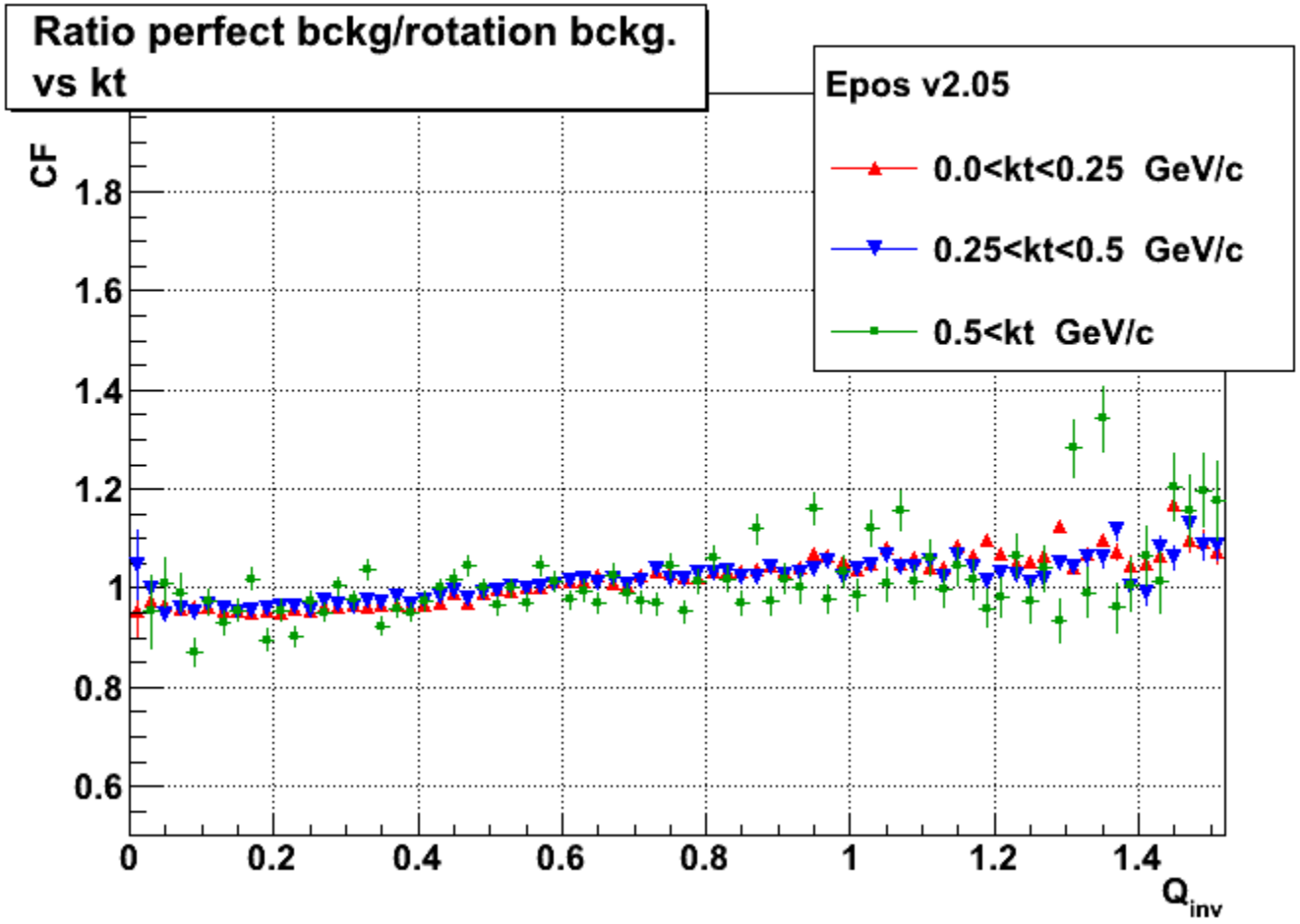
Mixing background vs. perfect background vs. multiplicity



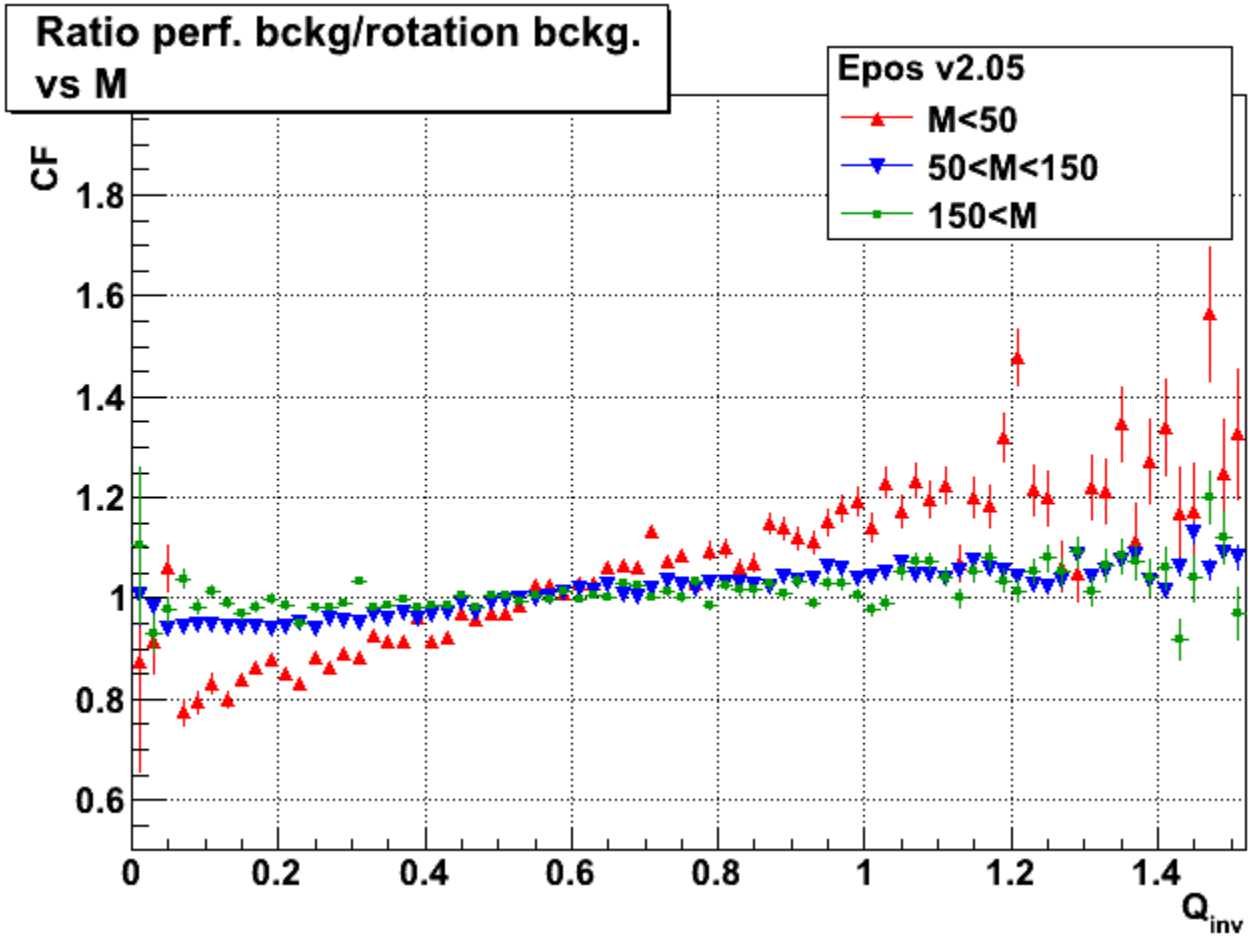
Rotation


Rotation CF
Fit to CF
R_{fit} = 2.5 ± 0.005
λ = 0.3524 ± 0.008
χ^2/ndf=717.74/71
CF
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Q_{inv}

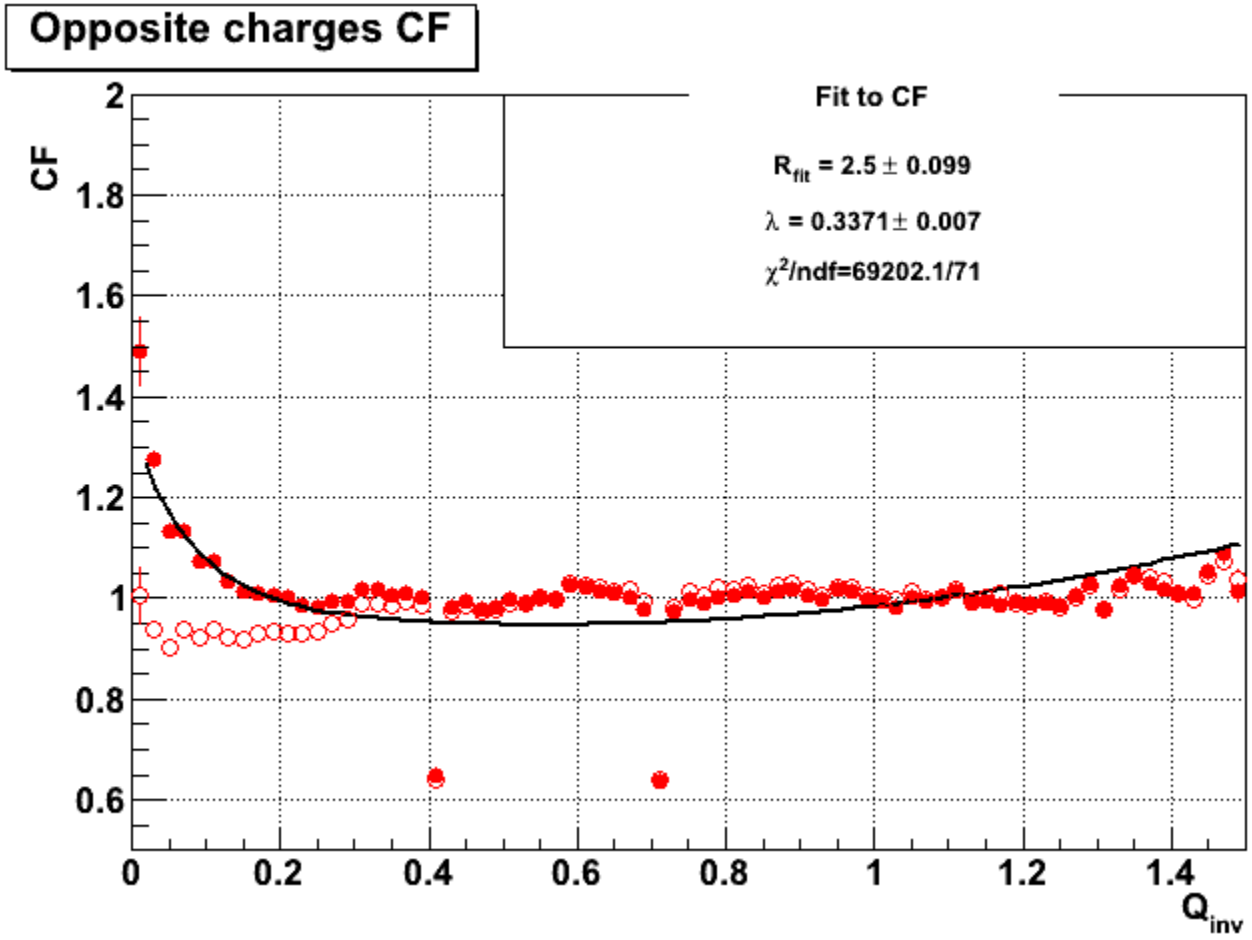
Rotation background vs. perfect background vs. kt



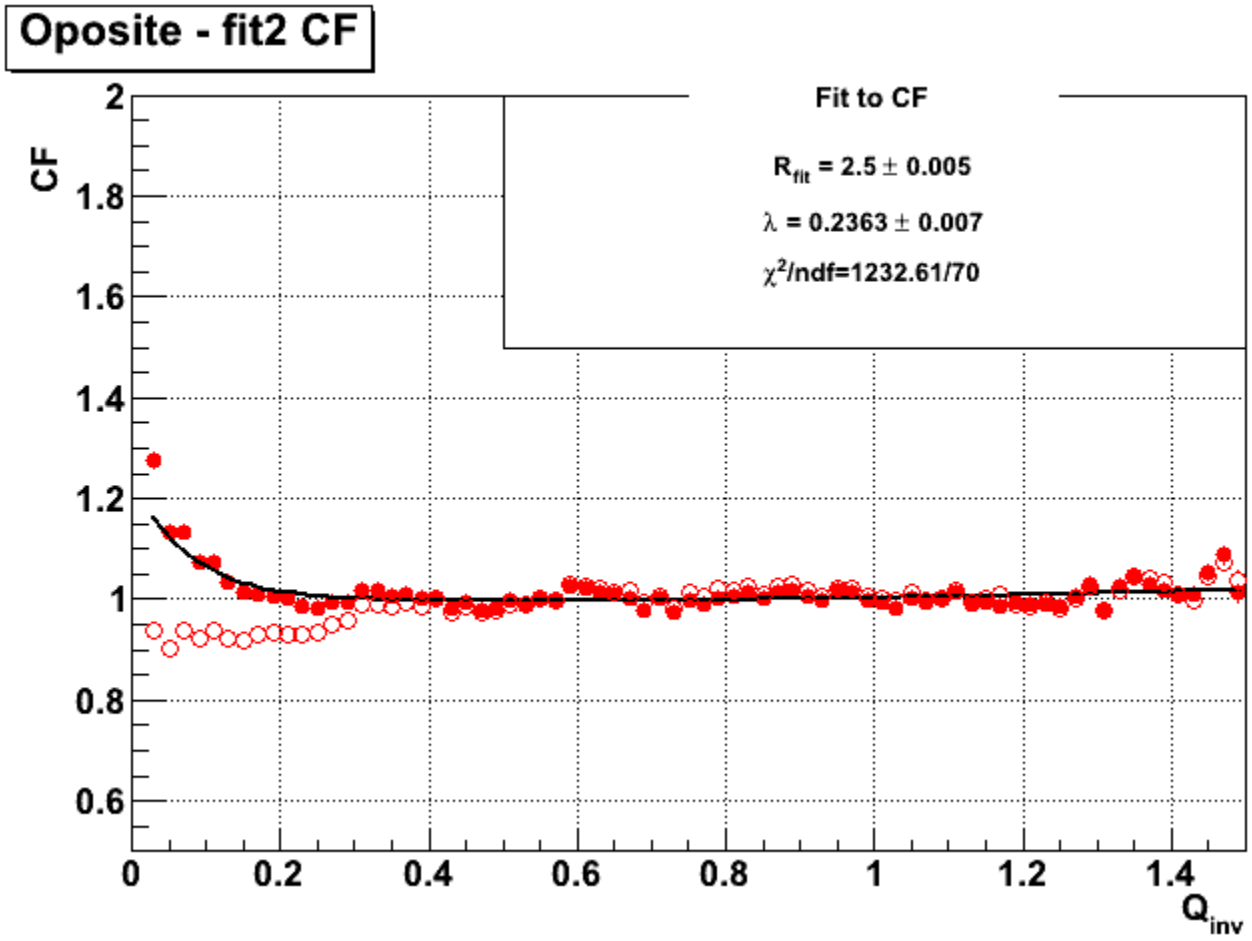
Rotation background vs. perfect background vs. multiplicity



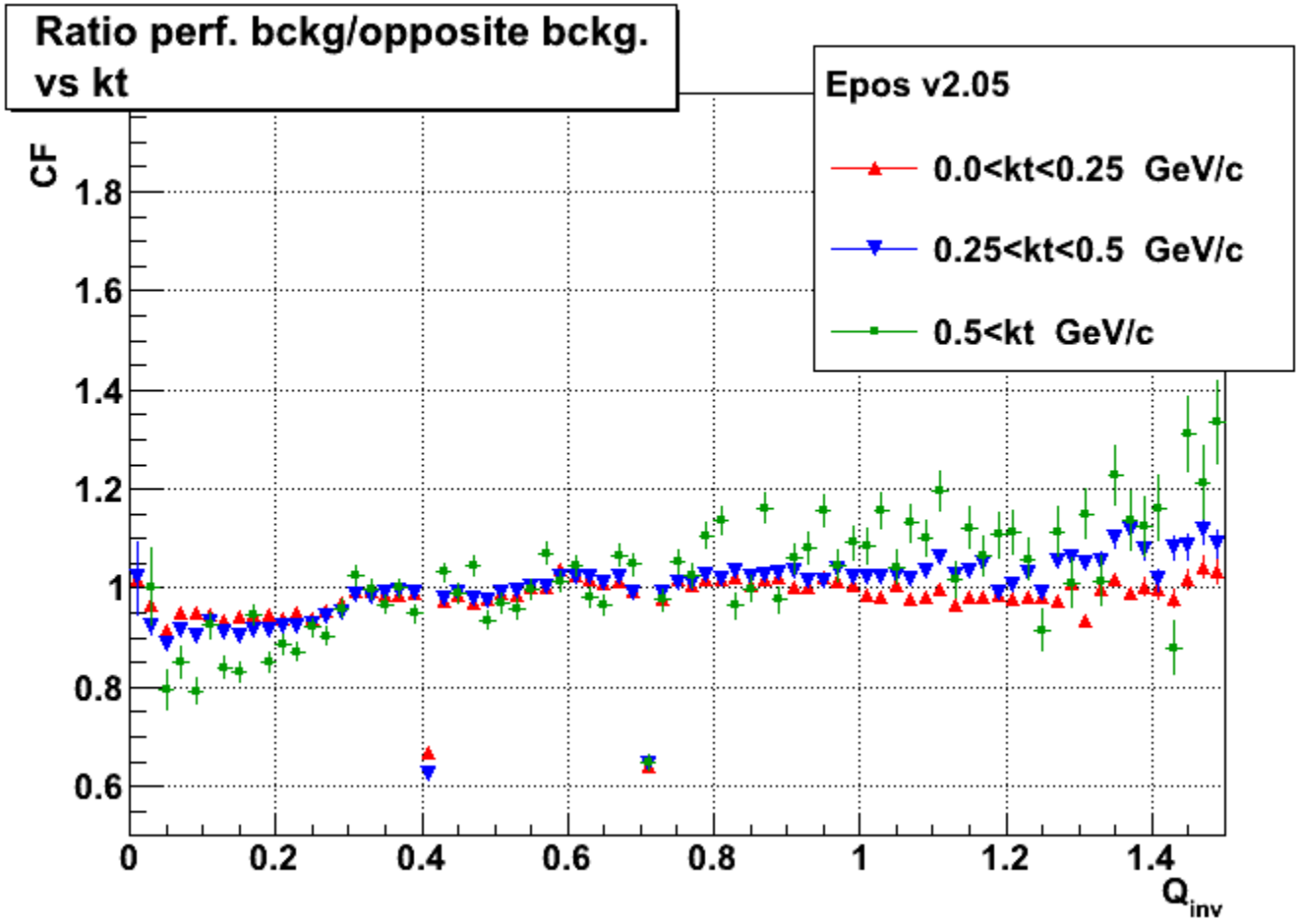
Opposite charges



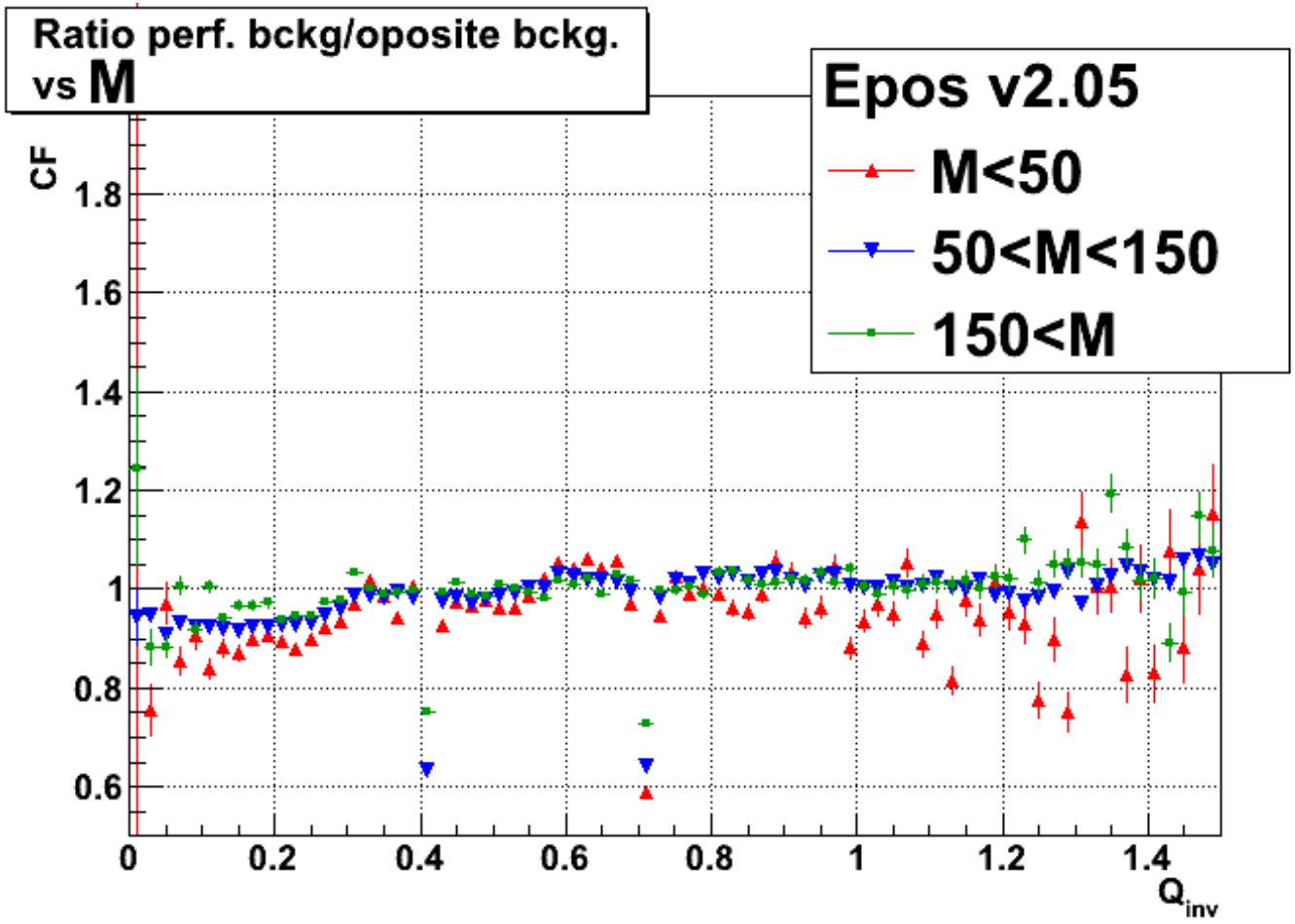
Opposite


Oposite - fit2 CF
Fit to CF
R_{fit} = 2.5 ± 0.005
λ = 0.2363 ± 0.007
χ^2/ndf=1232.61/70
CF
Q_{inv}
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4

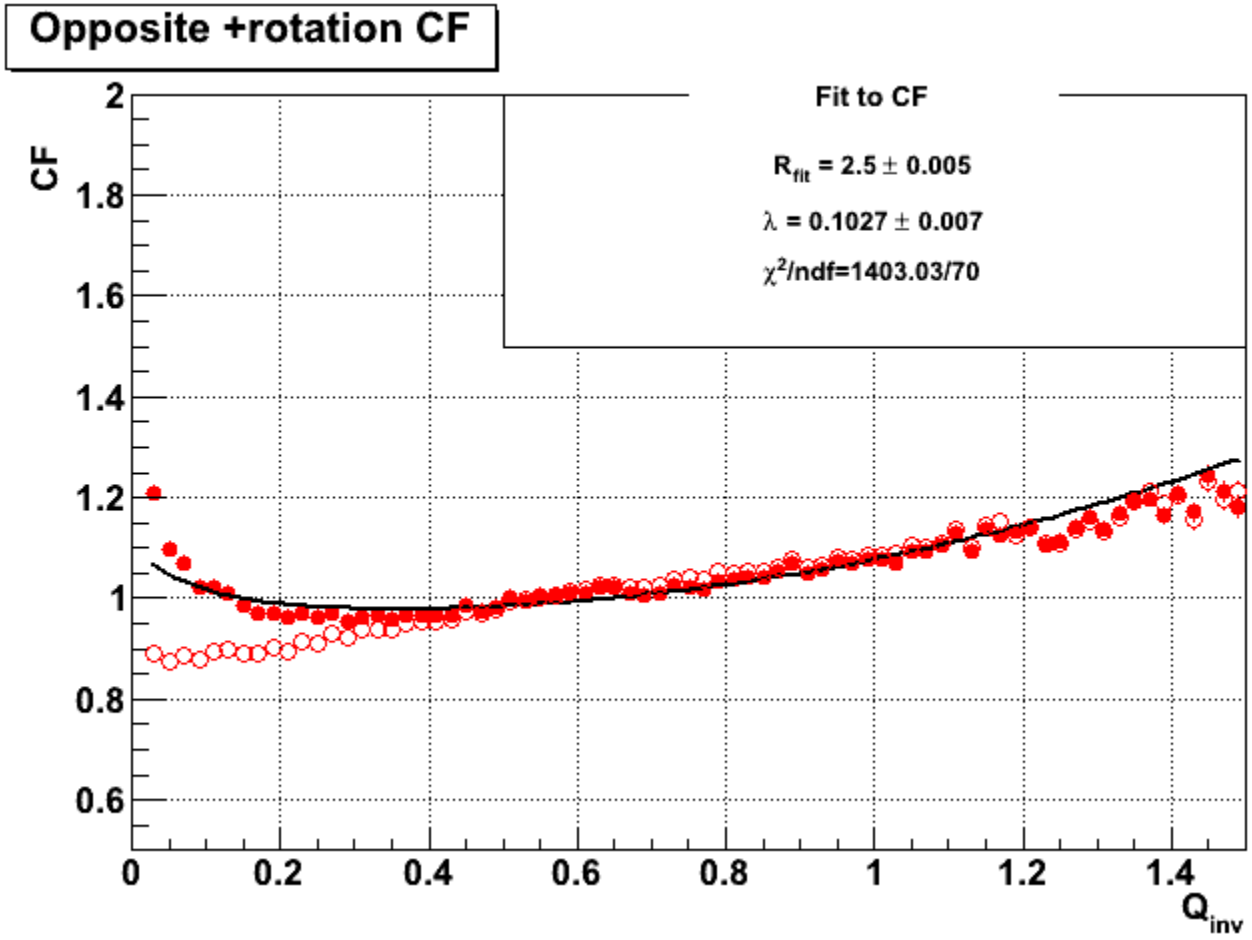
Opposite background vs. perfect background vs. kt



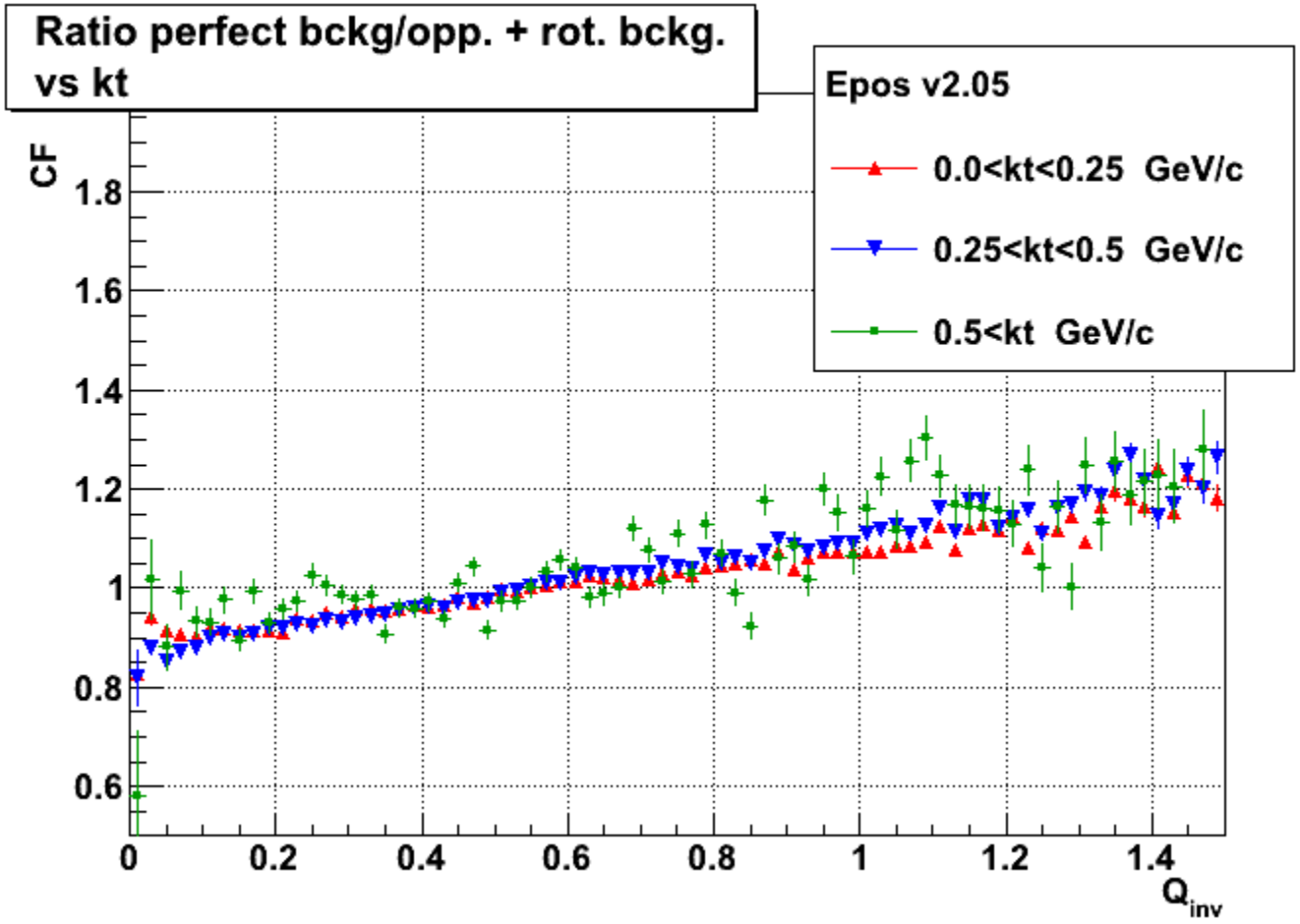
Opposite background vs. perfect background vs. multiplicity



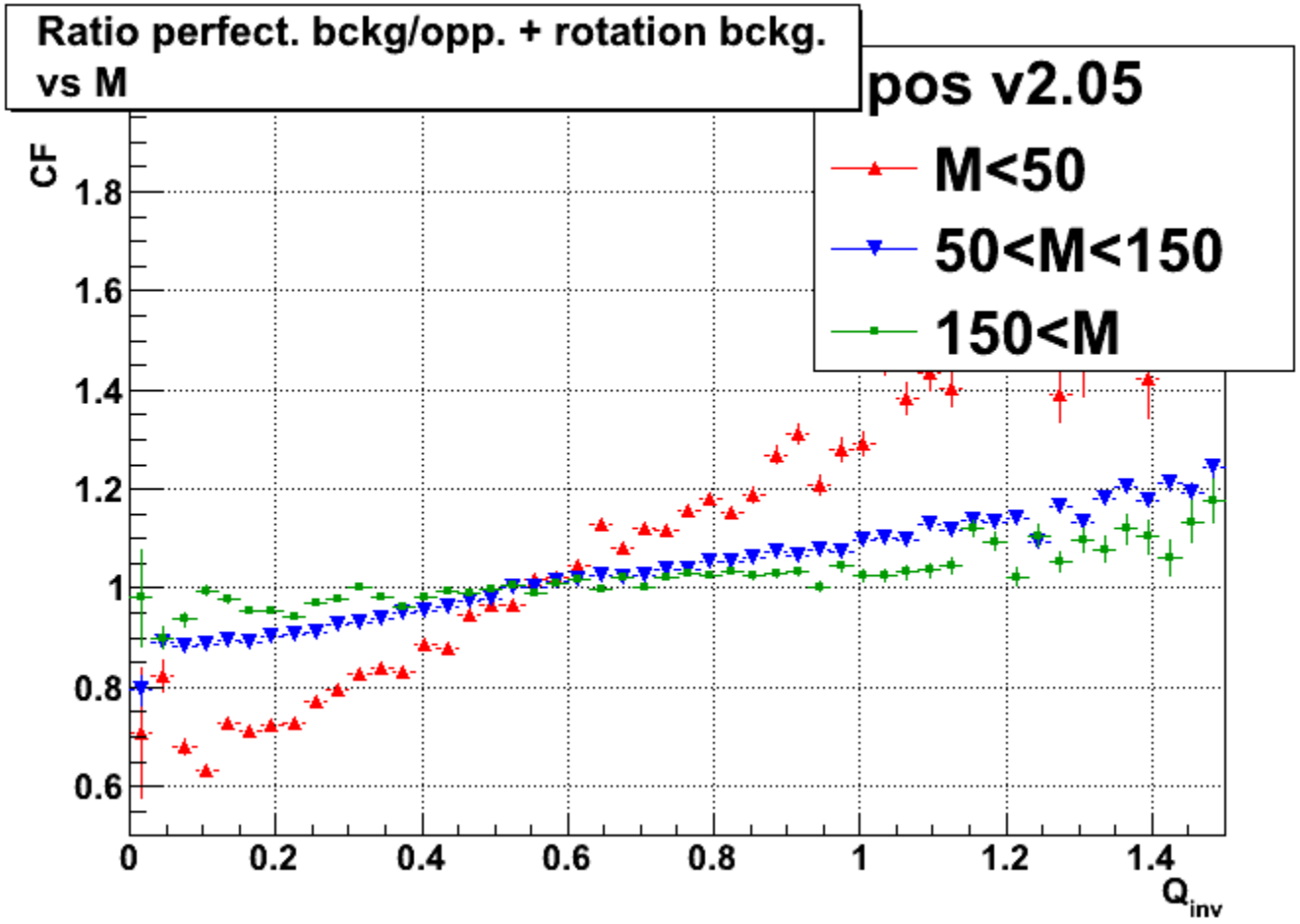
Opposite + rotation



Opposite+ rotation background vs. perfect background vs. kt



Opposite+ rotation background vs. perfect background vs. M



Comparison

Method	Rinv	Lambda
Perfect	1.361+/-0.04	0.326+/-0.03
Mixing	1.887+/-0.04	0.375+/-0.011
Rotation	2.5 +/-0.05	0.354+/-0.008
Opposite	2.5+/-0.1	0.237+/-0.007
Opposite+rotation	2.5 +/-0.05	0.103+/-0.07

Summary

- There is strong dependency between shape of the background and multiplicity, lack of this dependency with kt
- Mixing seems to be the best method for calculating background
- Rotation, opposite, opposite + rotation give similar results of the measured radii

Plans for future

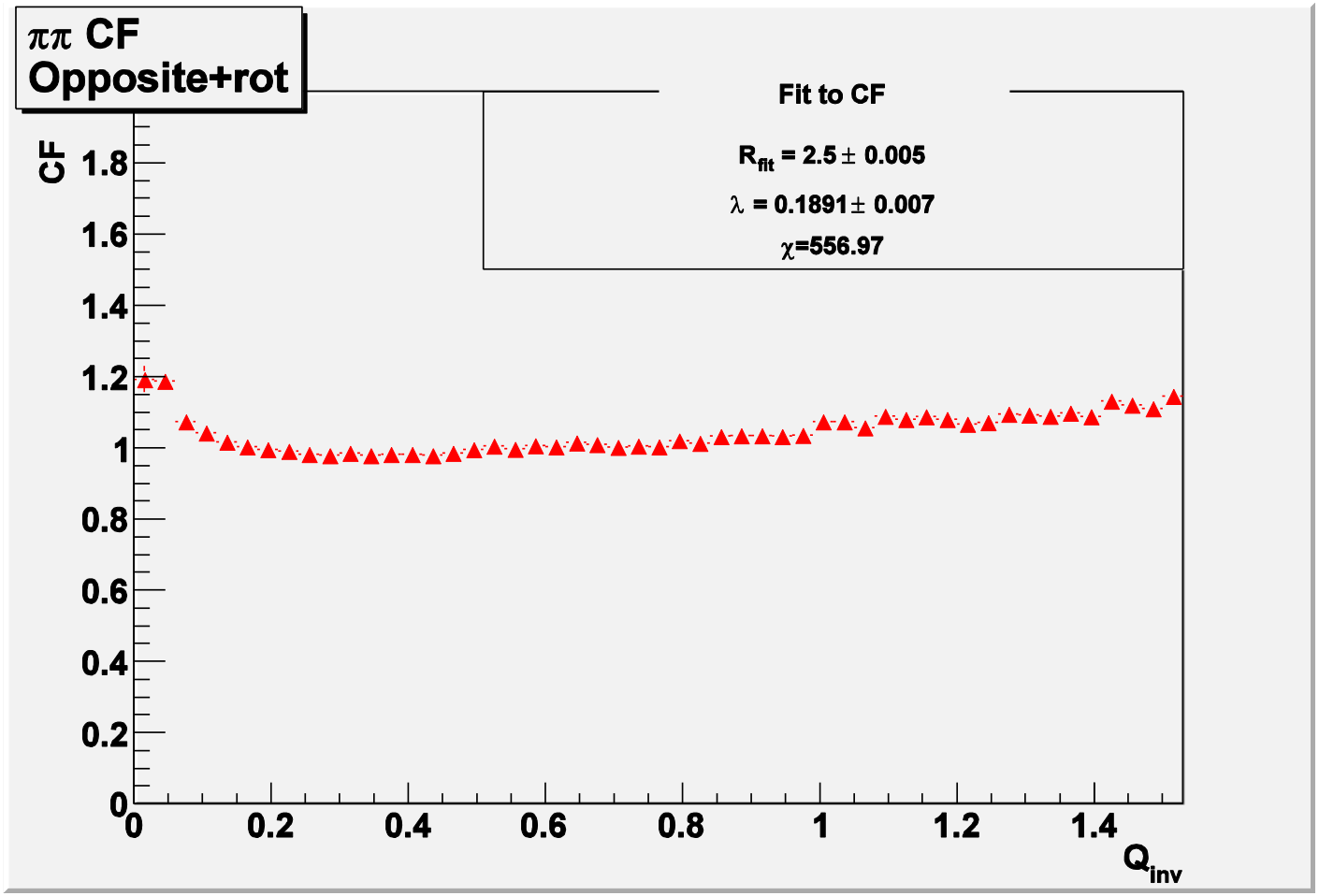
- More analysis with mixing method (different options of selecting events to mix together)
- Analysis with different cuts
- Analysis of background for spherical harmonics CF
- Azimuthally sensitive correlation functions
- Similar analysis of background for $\Delta\phi\Delta\eta$ correlation functions, studying influence of jets and mini-jets on the shape of this function
- Development of HaBeTy project – adding not only HBT stuff

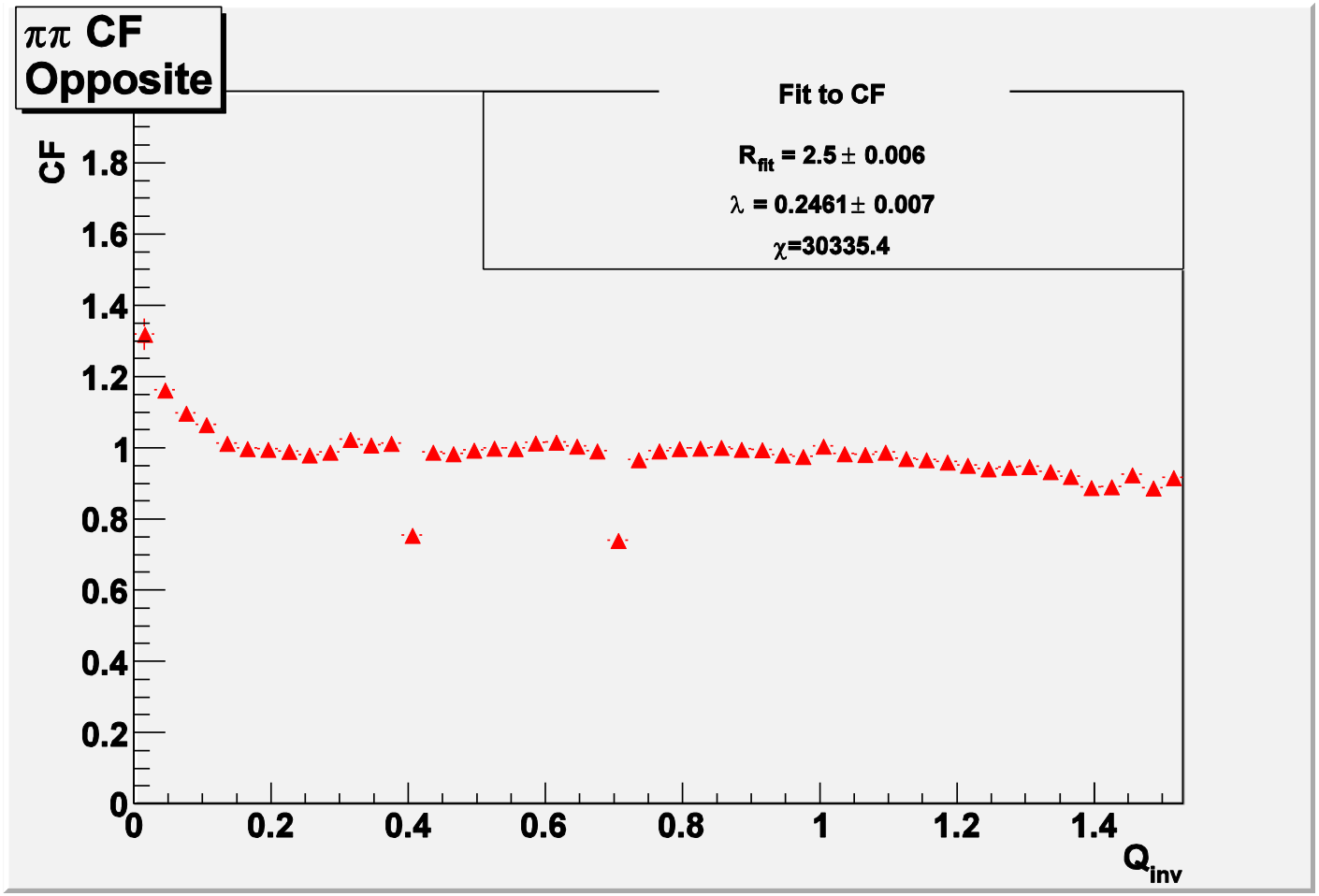
Backup slides – some analysis with Epos 2.05 data

For standard HBT analysis

Cuts : $|\eta|<0.9$ $0.0<pt<1.0$ GeV/c

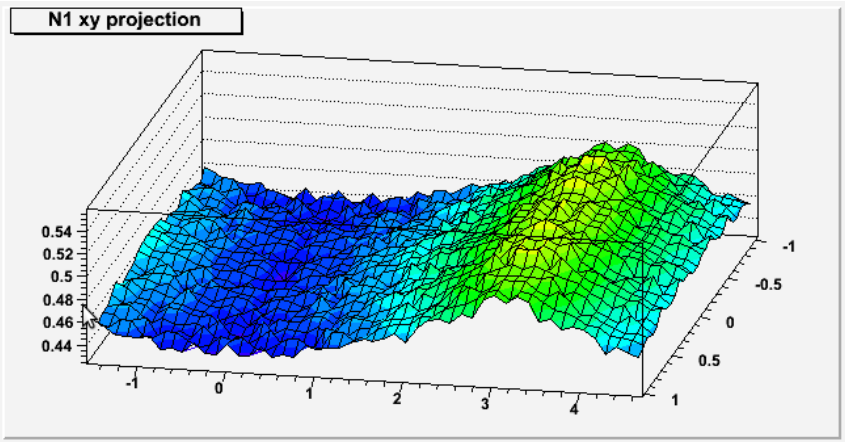
These results are very preliminary…

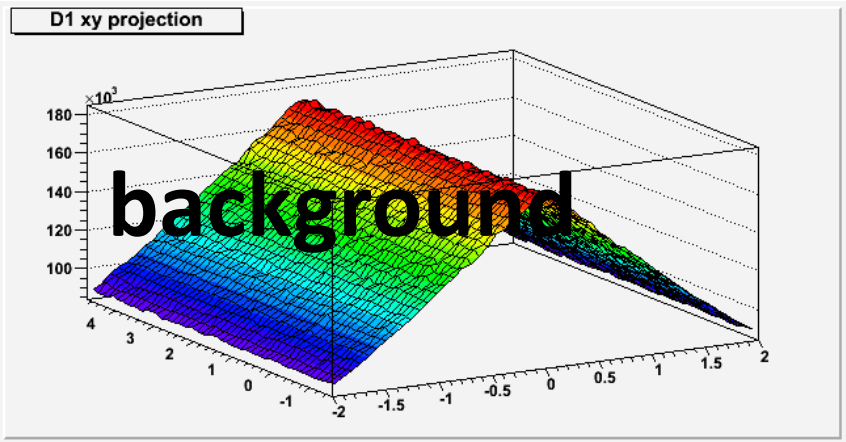

ππ CF
Opposite+rot
Fit to CF
R_fit = 2.5 ± 0.005
λ = 0.1891 ± 0.007
χ=556.97
CF
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Q_inv

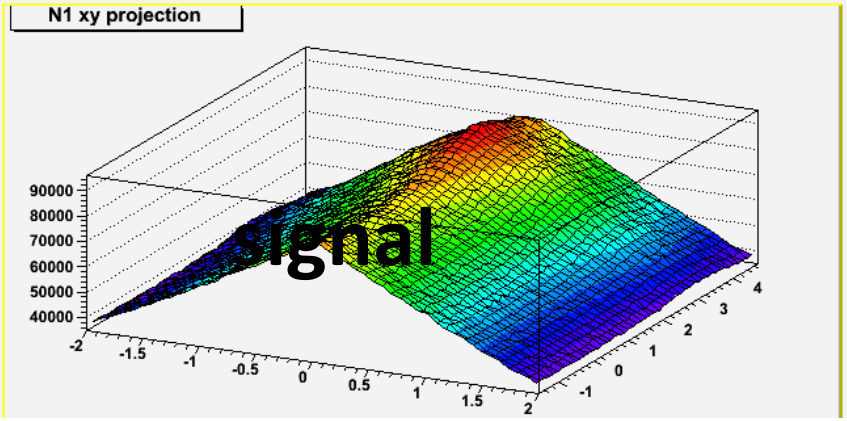

ππ CF
Opposite
Fit to CF
R_fit = 2.5 ± 0.006
λ = 0.2461 ± 0.007
χ=30335.4
CF
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Q_inv

- And some aspects of $\Delta\phi\Delta\eta$
- This analysis are very very preliminary…

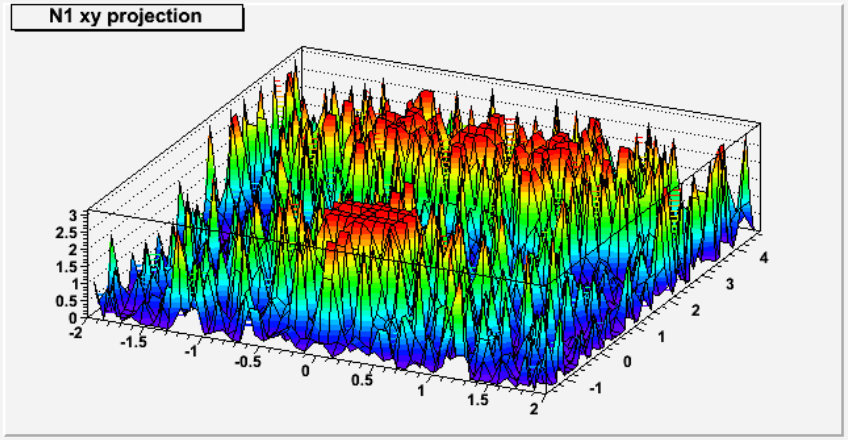
Low pt π^+,no BEC

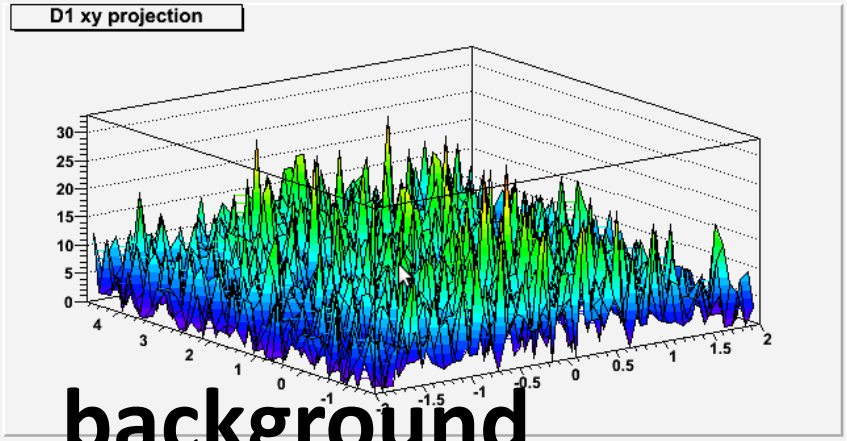




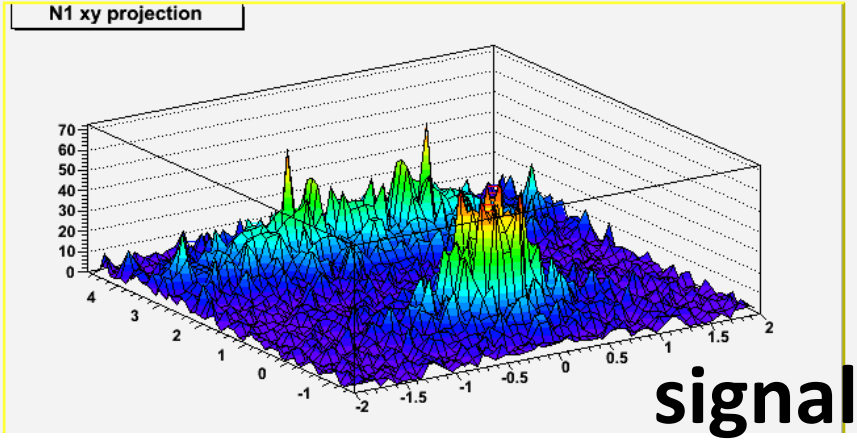


High pt π^+, no BEC





background



signal