Energy momentum conservation effects on the two particle Q_{inv} correlation function.
EMCICS

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Outline

1. Introduction

2. Energy-Momentum Conservation Induced Correlations

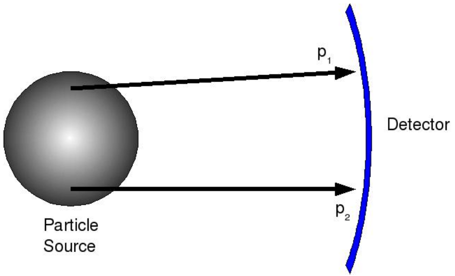
3. Analysis

4. Summary

Introduction

Motivation

- Use Bose Einstein effect for identical particles to measure source sizes.



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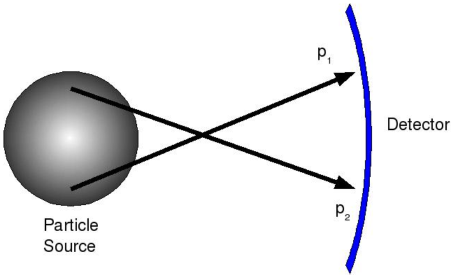

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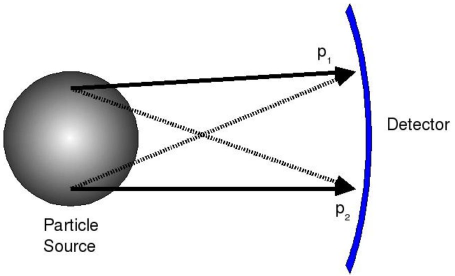

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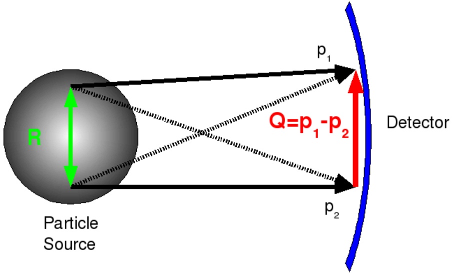

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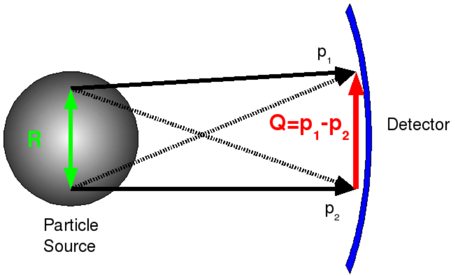
$$C_{th}(Q) = 1 + \lambda e^{-R^2 Q^2}$$



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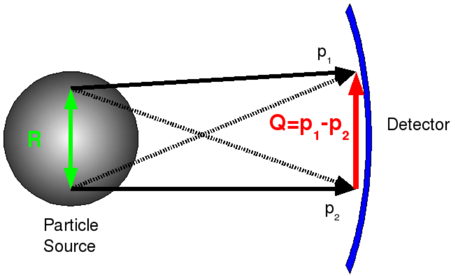

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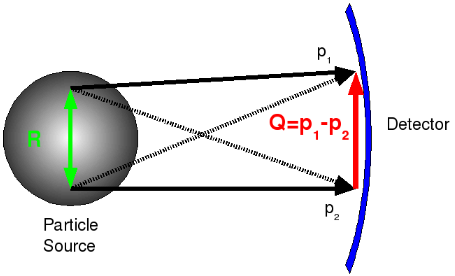
- Other correlations?



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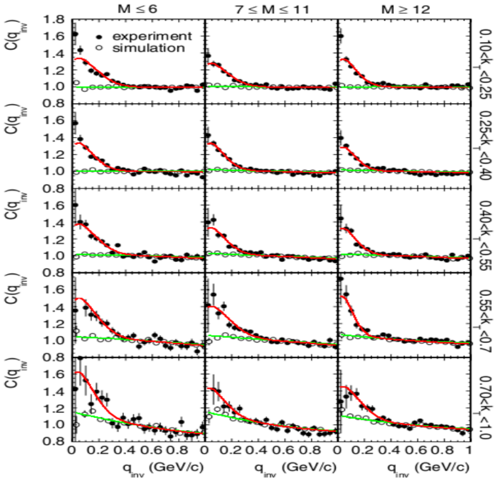

Figure: Alice: PhysRevD.82.052001

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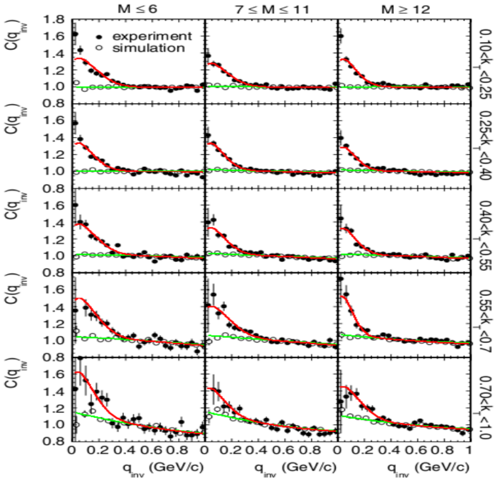
- The two particle correlation function binned in $\langle k_T \rangle$ and multiplicity.



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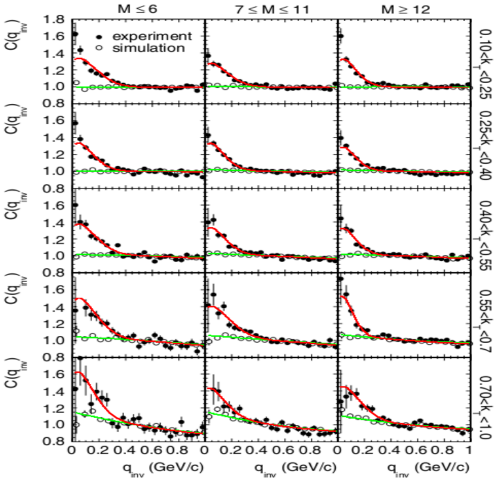

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- The source is not Gaussian.
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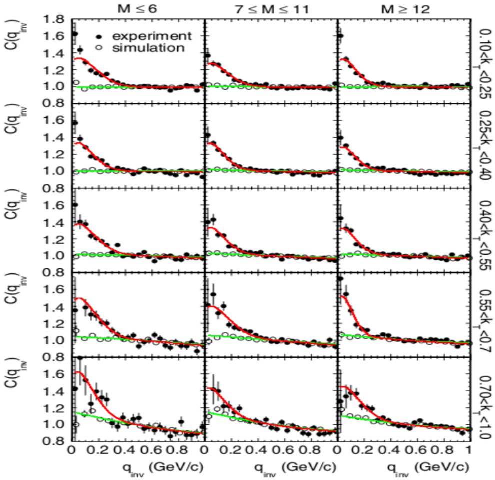

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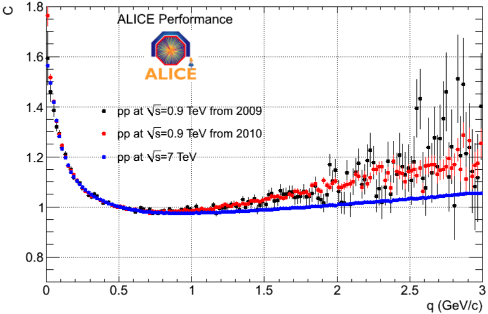

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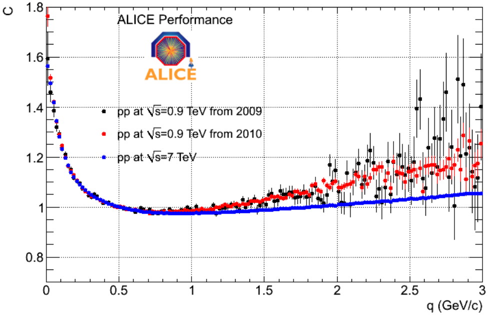

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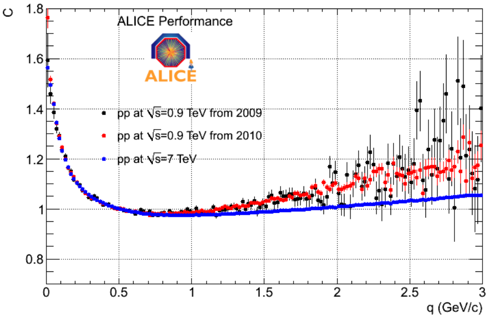
- Main source of long range correlations is energy momentum conservation.



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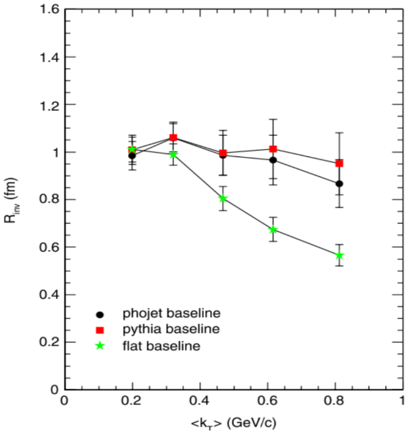

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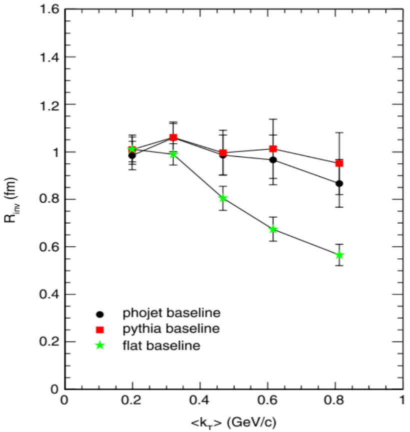

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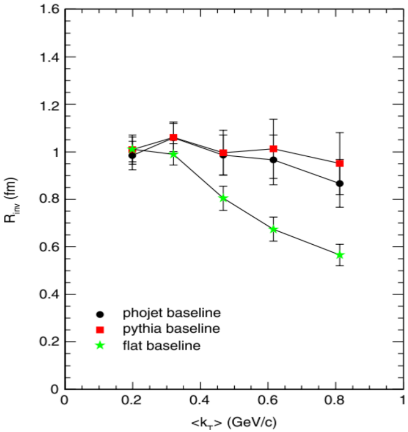
- **Understand the shape of the baseline from first principles.**



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Energy-Momentum Conservation Induced Correlations (EMCICs)

EMCICs

- Assuming particles are only correlated by energy-momentum conservation, one finds (Chajecki and Lisa Phys.Rev.C78:064903):

$$C(p_1, p_2) = 1 - \frac{1}{N}\left(2\frac{\vec{p}_{1,T} \cdot \vec{p}_{2,T}}{\langle p_T^2 \rangle} + \frac{p_{1,z} \cdot p_{2,z}}{\langle p_z^2 \rangle} + \frac{(E_1 - \langle E \rangle)(E_2 - \langle E \rangle)}{\langle E^2 \rangle - \langle E \rangle^2}\right)$$

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- This would characterize EMCICs, but we cannot measure N, $\langle p_T^2 \rangle$, $\langle p_z^2 \rangle$, $\langle E^2 \rangle$, $\langle E \rangle$.
- Instead,use this equation as a fit to the data.

EMCICs

- The parameterization of the EMCICs becomes:

$$C_{EMCIC}(p_1, p_2) = \Bigg(1 - M_1 \cdot \overline{\{\vec{p}_{1,T} \cdot \vec{p}_{2,T}\}} - M_2 \cdot \overline{\{p_{1,z} \cdot p_{2,z}\}}$$

$$- M_3 \cdot \overline{\{E_1 \cdot E_2\}} + M_4 \cdot \overline{\{E_1 + E_2\}} - \frac{M_4^2}{M_3}\Bigg)$$

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- The M parameters are defined as:

$$M_1 = \frac{2}{N\langle p_T^2\rangle} \qquad M_2 = \frac{1}{N\langle p_z^2\rangle}$$

$$M_3 = \frac{1}{N(\langle E^2\rangle - \langle E\rangle^2)} \qquad M_4 = \frac{\langle E\rangle}{N(\langle E^2\rangle - \langle E\rangle^2)}$$

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- When femtoscopic effects are present, the total correlation function is:

$$C(Q) = \Phi_{femto}(Q) \times C_{EMCIC}(Q)$$

Fitting the baseline of the two particle correlation function with EMCICs

Monte Carlo simulation

- MC from ALICE production
- Pythia6 Perugia-0 tune
- Collision system : pp 900GeV
- Magnetic Field: 0.5T
- $\sim$ 10M events

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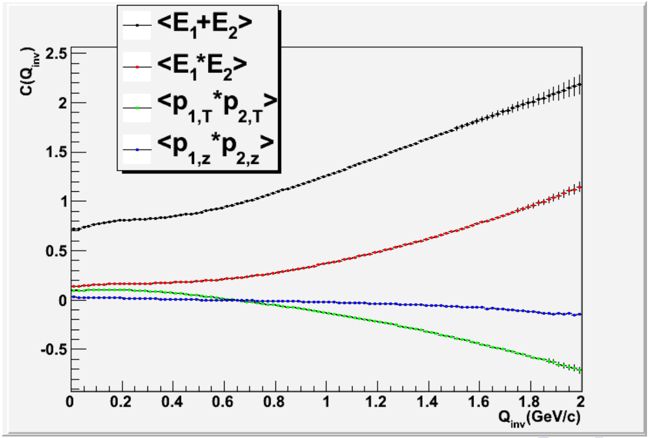
Data Analysis

- Two pion correlations obtained with ALICE's AliFemto code.
- Two track cuts applied.
- $0.1 < p_T < 1.2$ GeV.
- Four k_T bins (0.1,0.25,0.4,0.55,1.0).

The different EMCIC components



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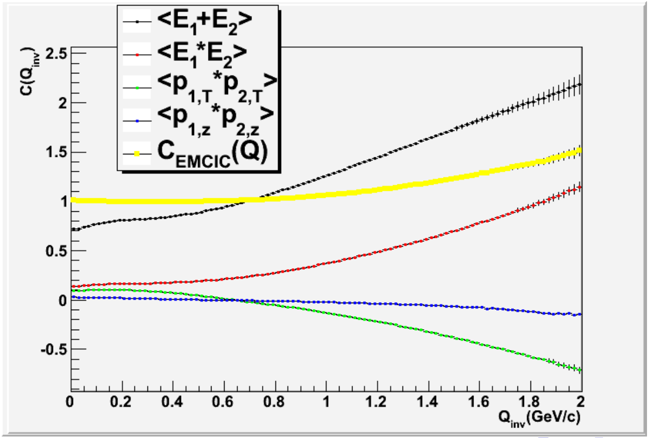

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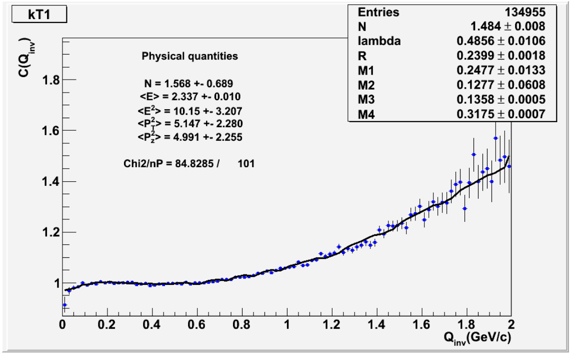

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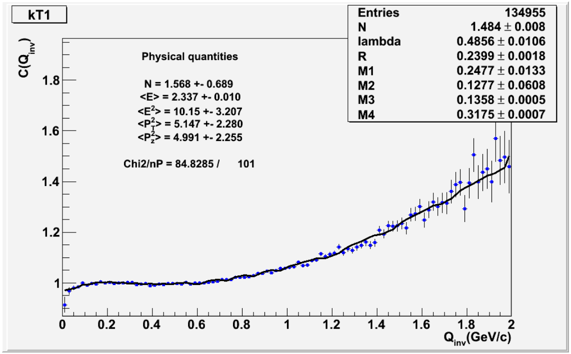

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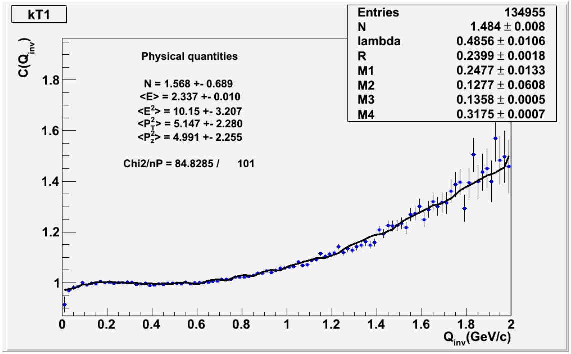
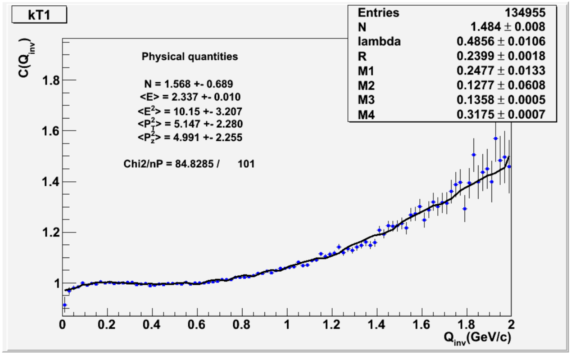
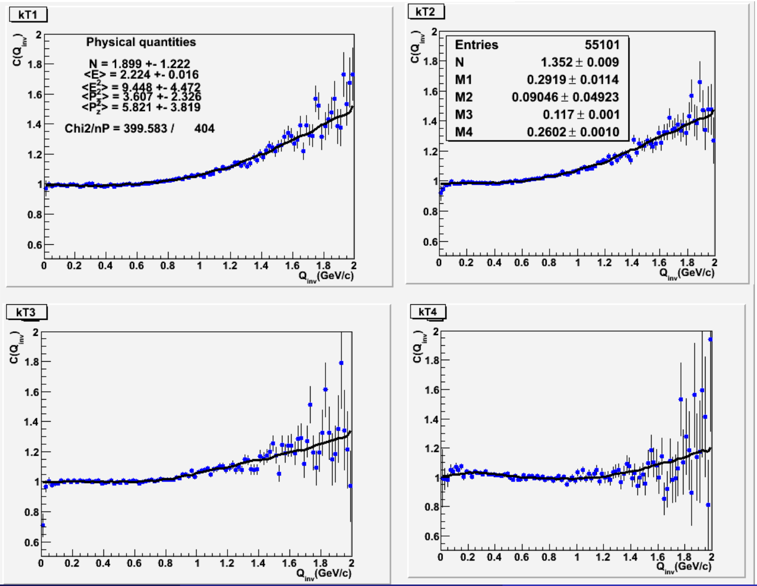


Fitting the baseline of the Q_{inv} CF with EMCICs

- There are several local minima.
- Starting values are important.
- Obtained from typical values of $N, < E >$, $< E^2 >, < p_T^2 >, < p_z^2 >$



Fitting the baseline with EMCICs in 4 k_T bins



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