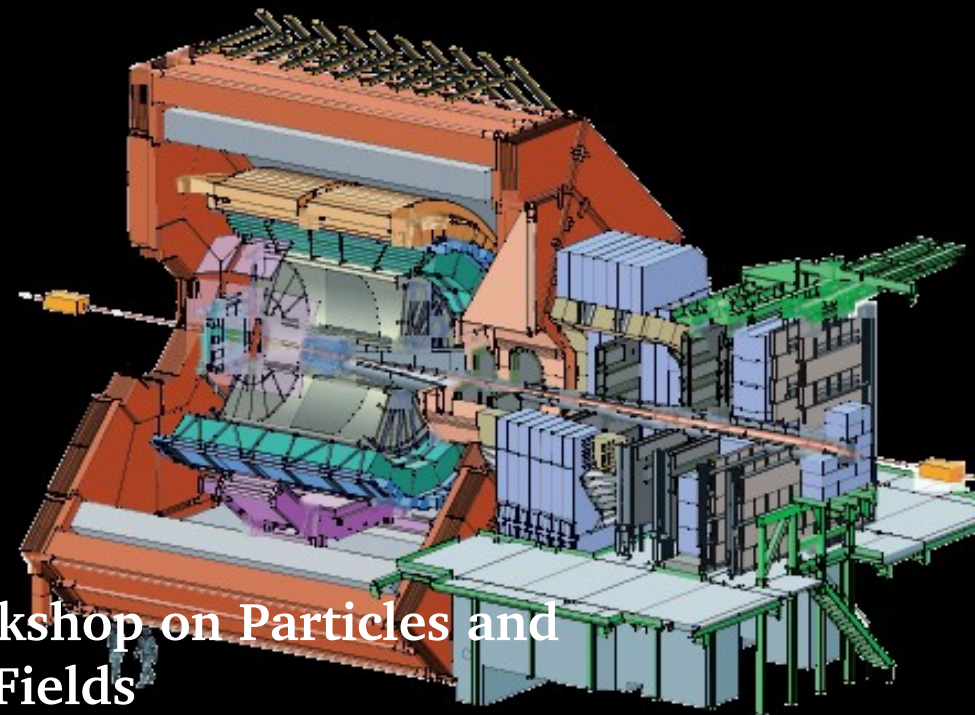
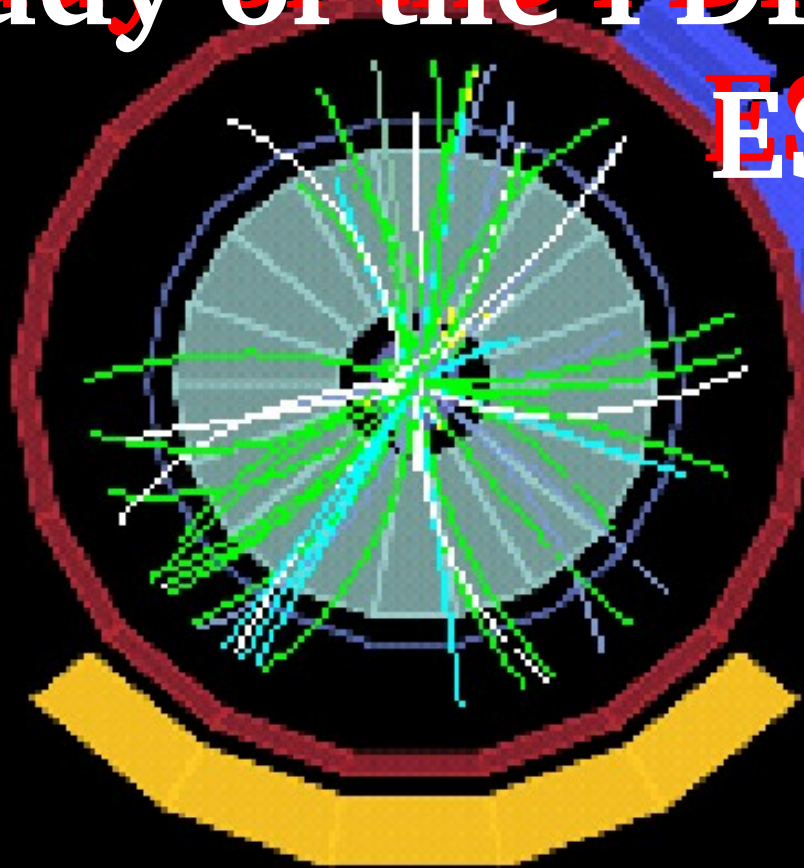


# Study of the PDF in the context of ESA.



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Guy Paic  
Eleazar Cuautle  
ICN-UNAM

XII Mexican Workshop on Particles and  
Fields  
November 2009.



In the present work we used the main results of the Event Shape Analysis applied to simulations of proton-proton collisions at LHC energies, for studying the possibility of using the first minimum bias data collected by ALICE in order to extract information about the gluon distribution function at low  $x$  Bjorken.

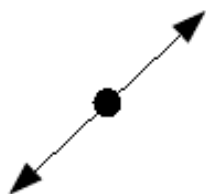
# Event Shape Analysis.

(ALICE-INT-2009-015, EDHS id: 1019980)

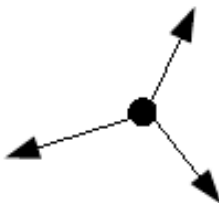
## What are the shape variables?

- ✓ Similar to jet algorithms in that they describe the topology of an event.
- ✓ Different in the sense that the information is encoded in a continuous fashion.

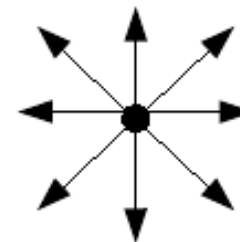
Thrust is defined as:  $T \equiv \max_{\vec{n}_t} \frac{\sum_i |\vec{p}_{t,i} \cdot \vec{n}_t|}{\sum_i |\vec{p}_{t,i}|}$  and we can catch different configurations like:



$T = 1$



$T = 2/3$



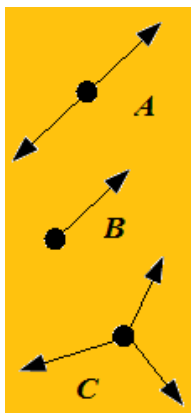
$T = 1/2$

$$\tau \equiv 1 - T$$

Recoil is defined as:  $R \equiv \frac{1}{\sum_i |\vec{p}_{t,i}|} \left| \sum_i \vec{p}_{t,i} \right|$ , it measures the balance of momenta of the event

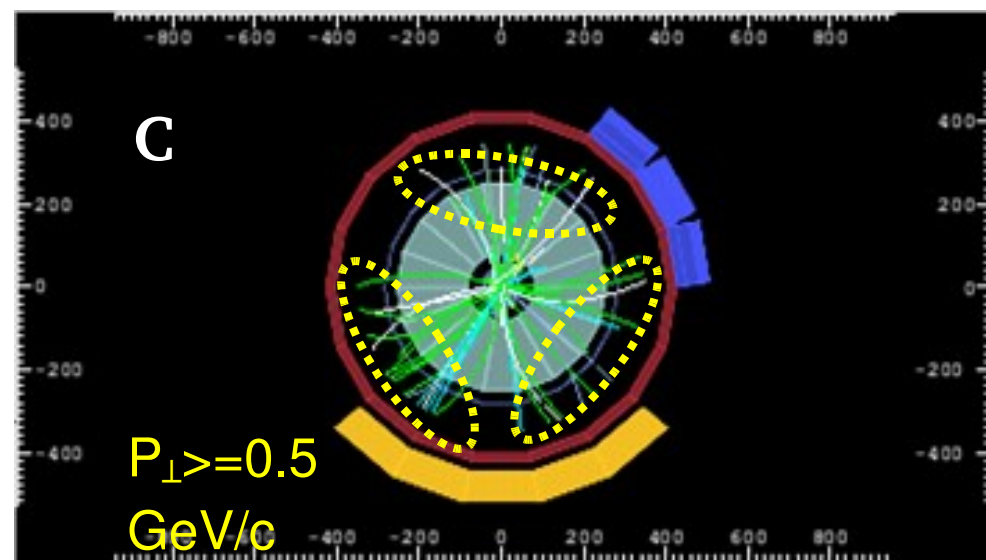
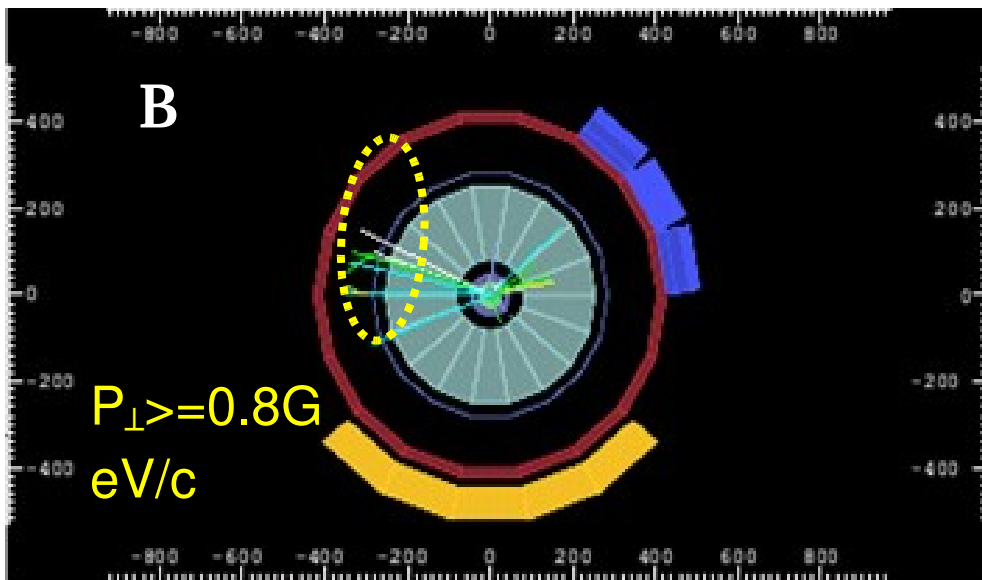
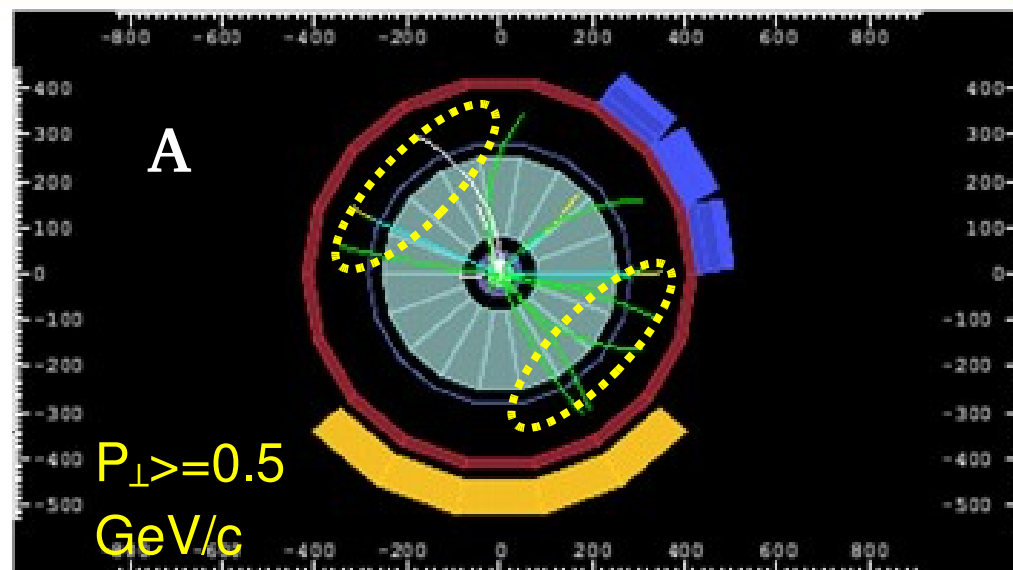
ESA combines this information for selecting specific jet topologies

## Previous results for ALICE simulations



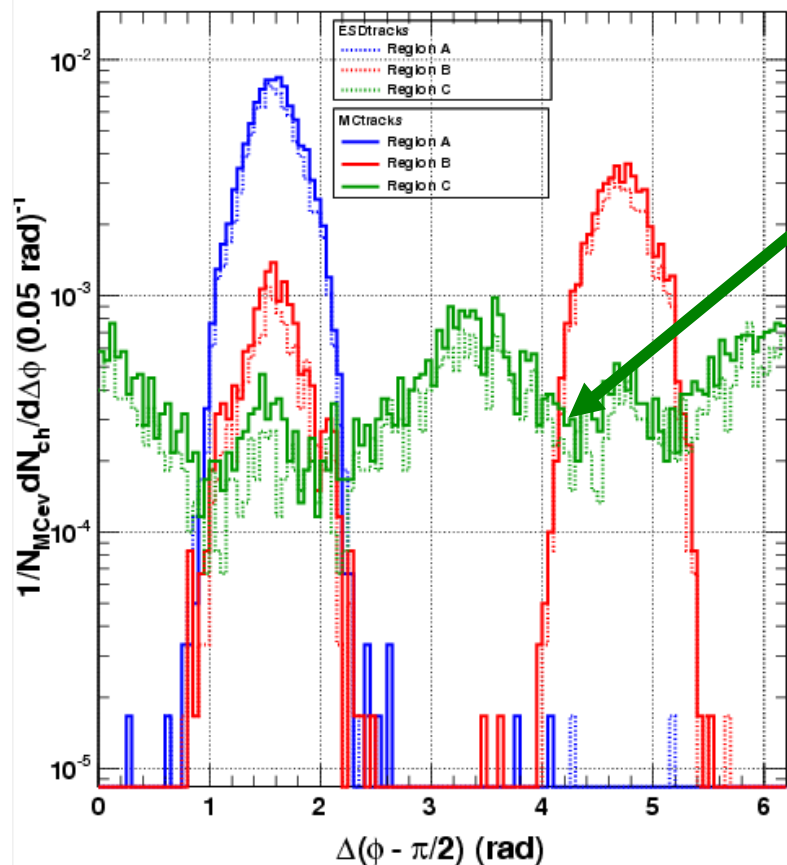
From a MB sample ESA extracts events of our interest.

Region	Variables
A	$R \leq 0.35, \tau \leq 0.03$
B	$R \geq 0.9, \tau \leq 0.03$
C	$R \leq 0.4, \tau \geq 0.25$

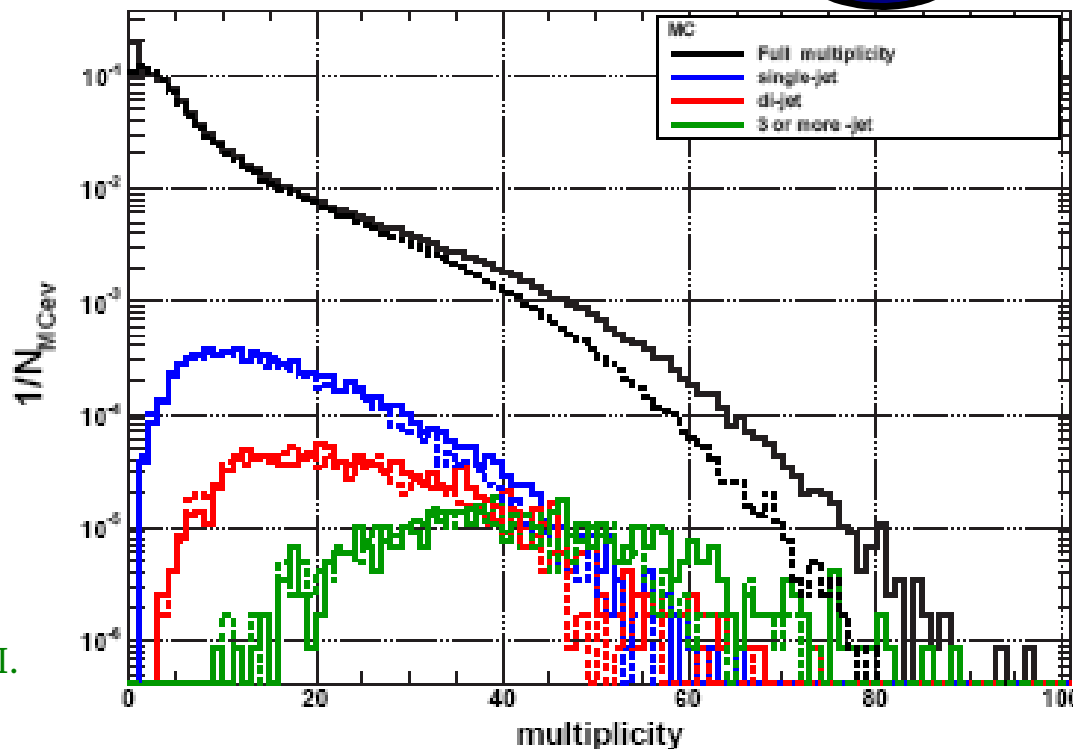
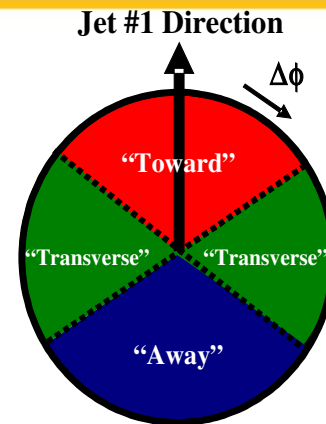


## Previous results for ALICE simulations

Signal of the three jet events, also presented at 200 GeV.



(Eur. Phys. J. C 62:535-540, 2009. A. Ayala, E. Cuautle, I. Domínguez, A. Ortiz, G. Paic)



# Sensitivity of the Thrust with respect to the gluon PDF

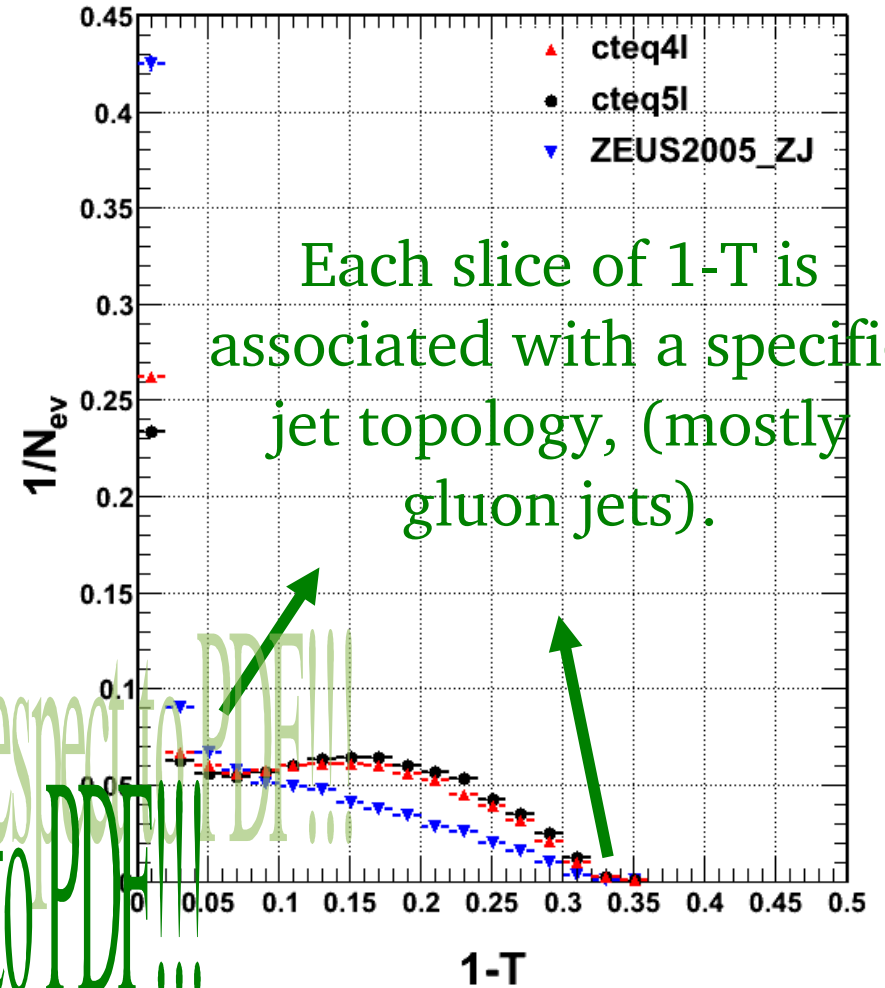
## Our first motivation...

Using ESA, we demonstrated that we can select jets with mean transverse momentum  $\sim 5$  GeV/c, for events with leading particle:

$$P_{\perp} \geq 2 \text{ GeV/c}$$

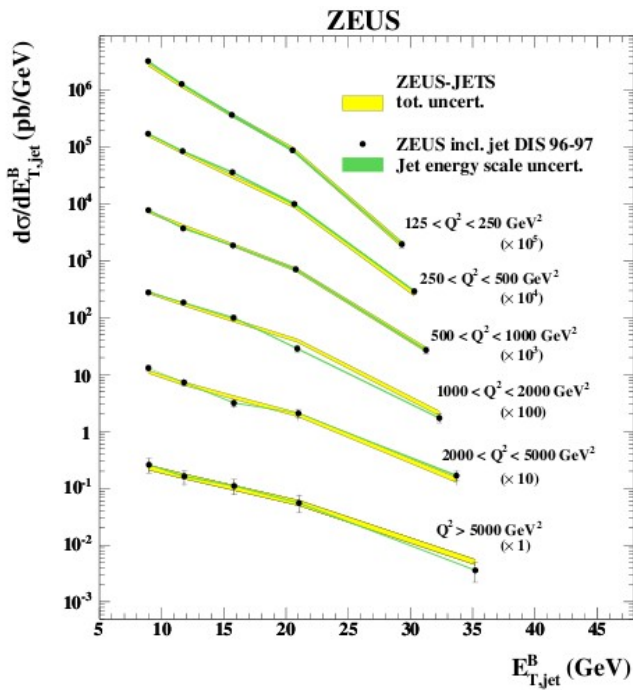
$$x_B \sim 2p_{\perp} / \sqrt{s} \sim 10^{-4}$$

(LHC energies  $s \sim 10$  TeV)



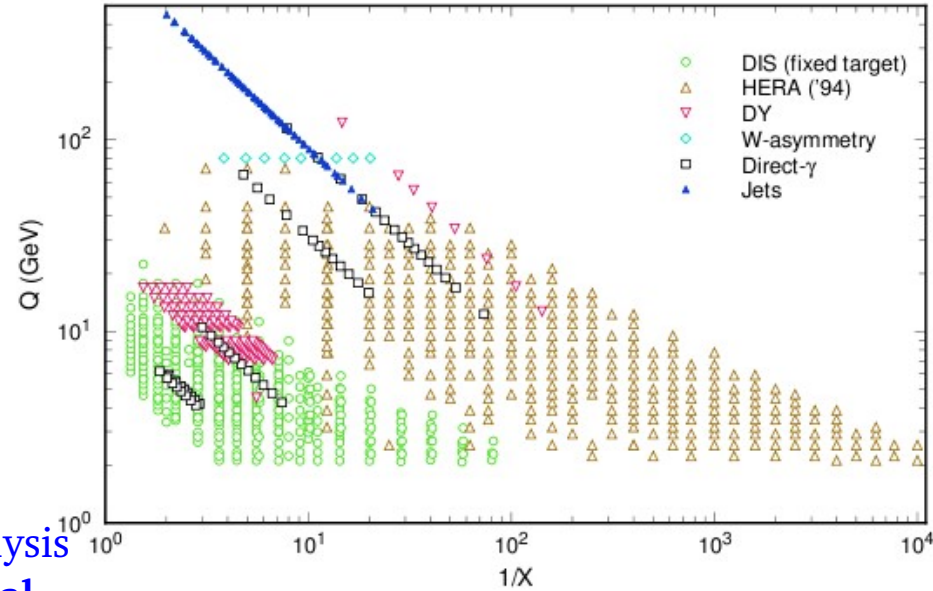
# Main characteristics between the PDF's: ZEUS2005-ZJ, CTEQ5L

**CTEQ5L**, Global analyses, using **DIS data** sets from BCDMS, NMC, H1, ZEUS, CCFR; **Drell-Yan data** from E605, E866; **W-lepton-asymmetry data** from CDF; and **inclusive jet data** from D0 and CDF.



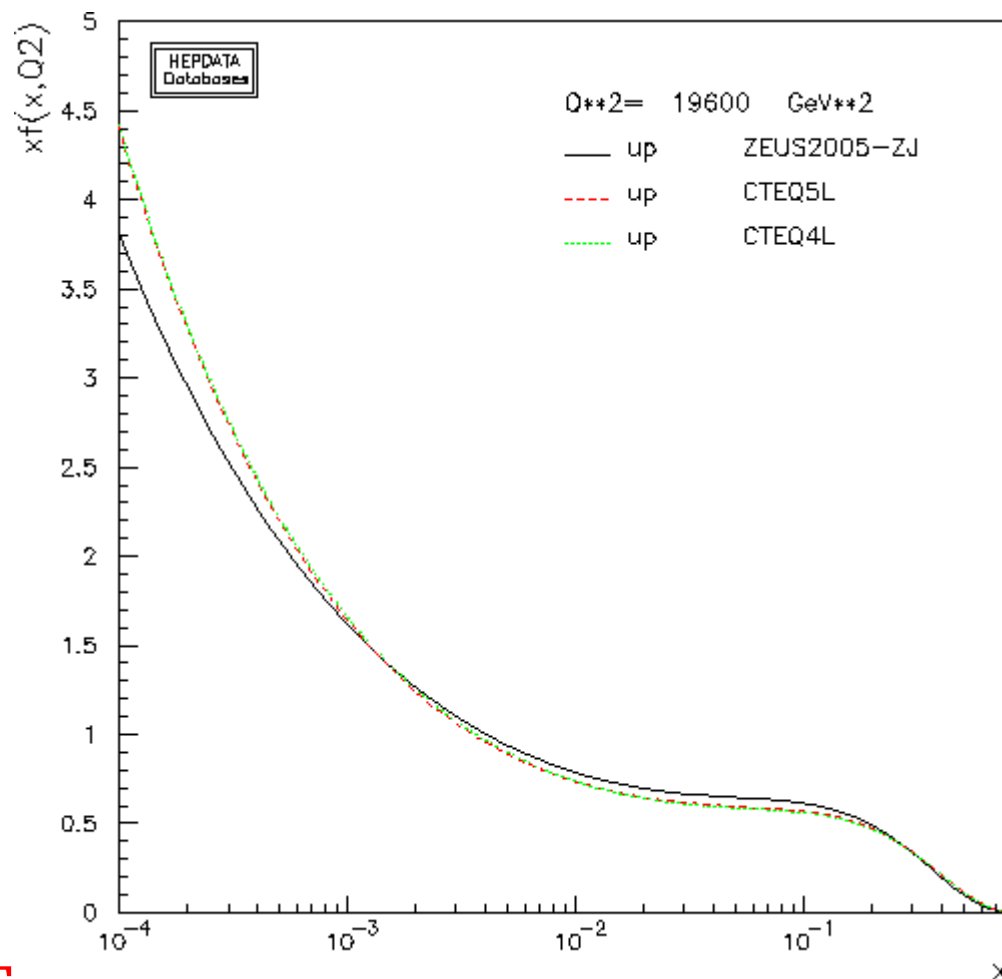
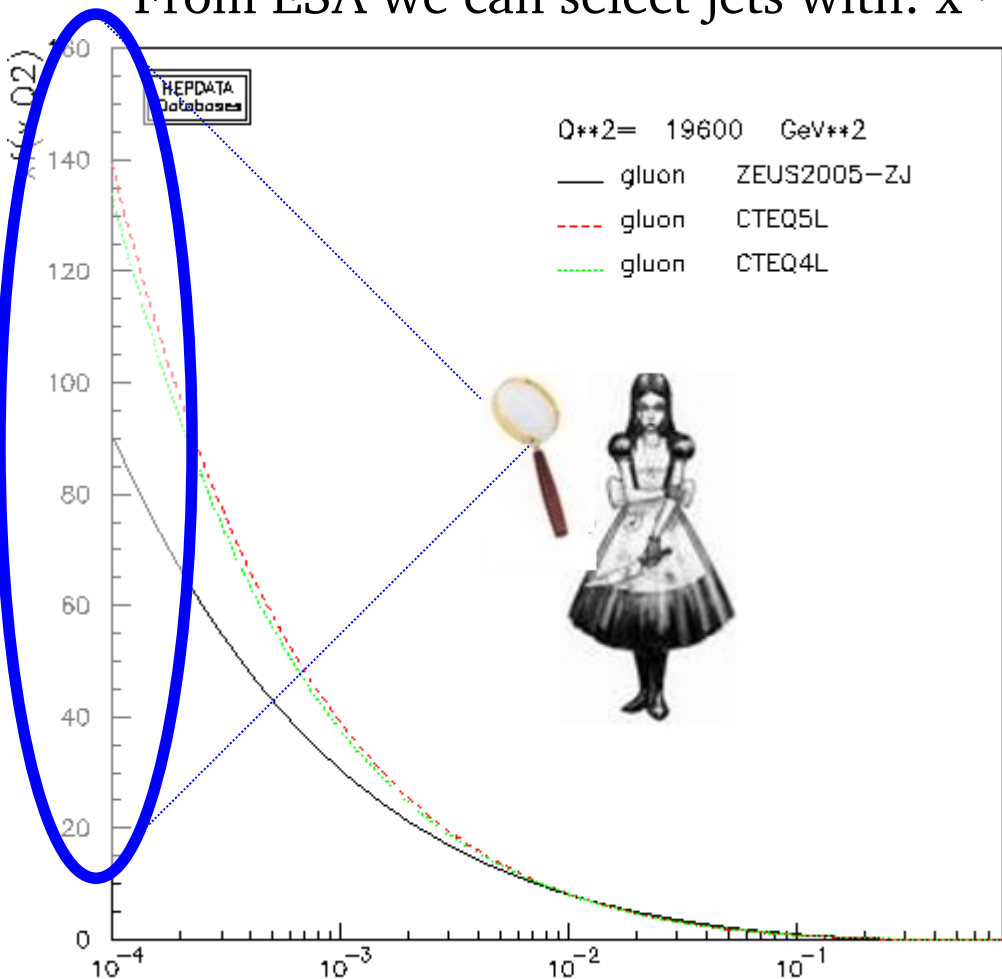
## ZEUS2005-ZJ

NLO QCD DGLAP analysis using ZEUS neutral current e+p DIS inclusive jet cross sections and direct dijet (in  $\gamma p$  scattering) cross sections + NC and CC e+p e-p DIS inclusive cross sections.



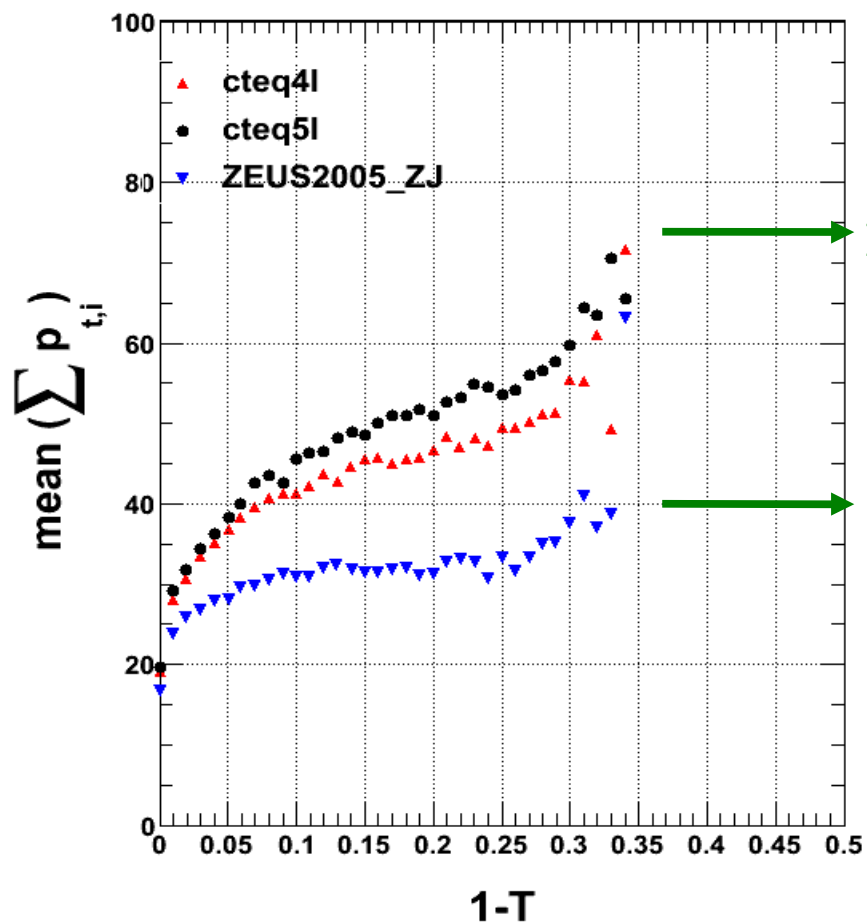
**Significant differences for constraining the gluon in the fits!**

From ESA we can select jets with:  $x \sim 2P_{\perp}/\sqrt{s} \ll 1$  (gluon jets) from MB data.

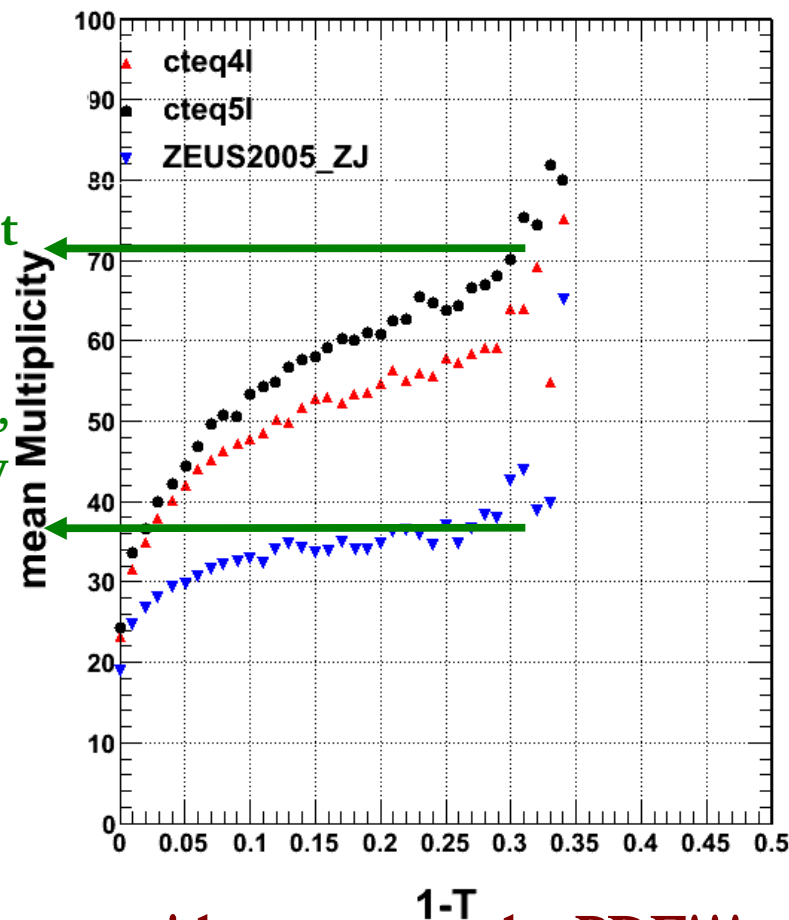


**Can we extract the low-x PDF information from first MB data of ALICE?**

Generation of MB events: pp at 10TeV, using the PDF's sets: ZEUS2005-JF, CTQ5L

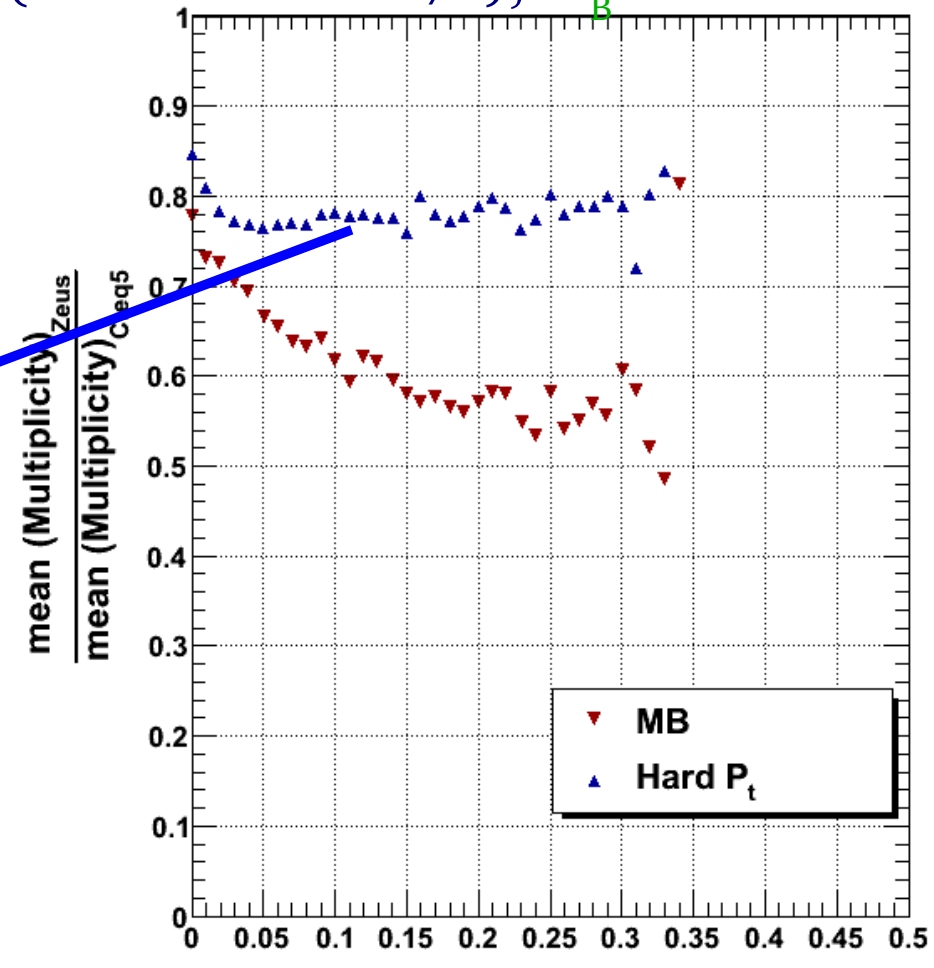
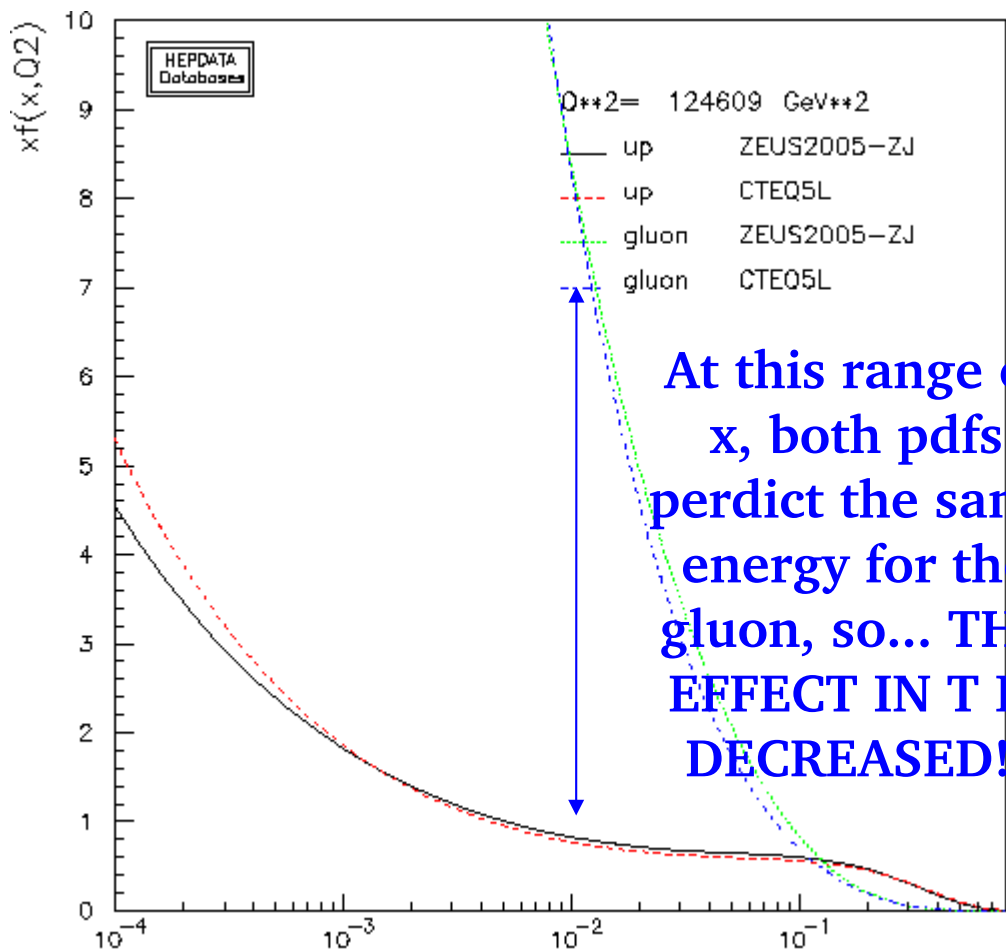


In agreement with the momentum of the gluon, predicted by the PDF's



Strong sensitivity of the thrust spectra with respect to the PDF!!!

Comparison with hard Pt events Hard Pt (300 to 500 GeV/c),  $x_B \sim 10^{-2}$



So, for ALICE MB data, ESA provides observables for extracting the PDF at low-x!

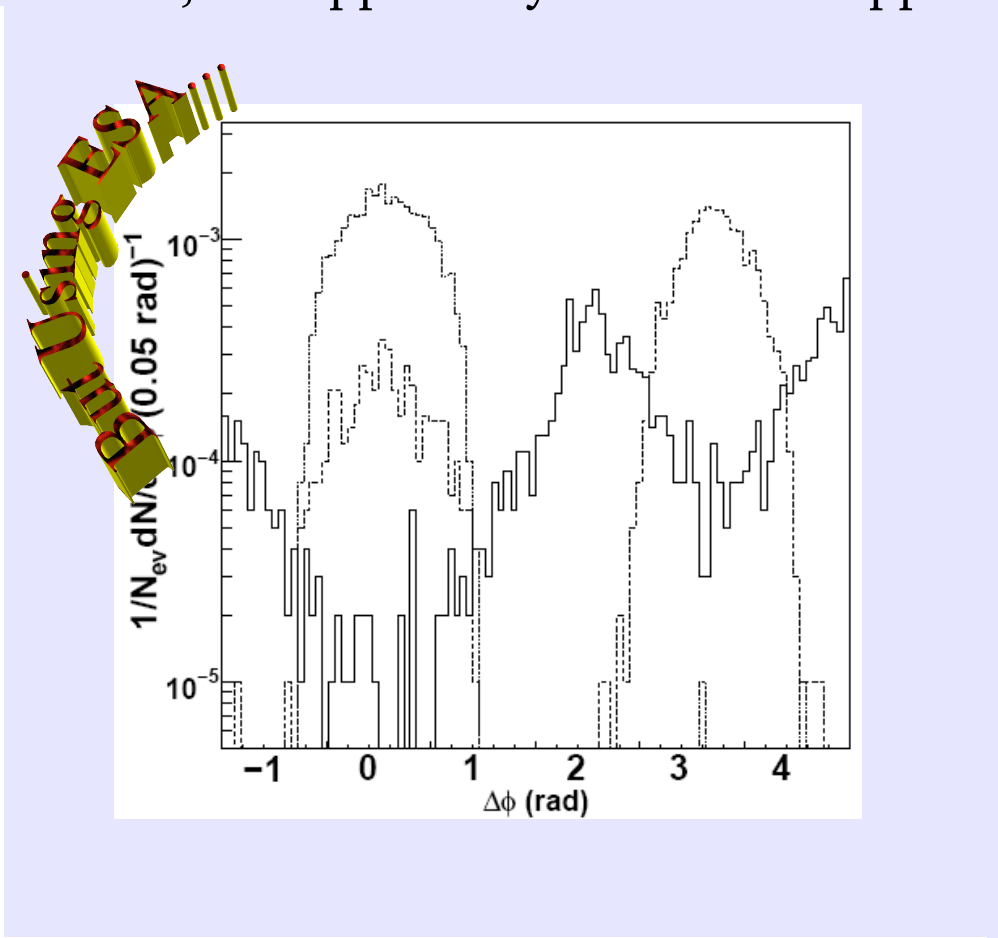
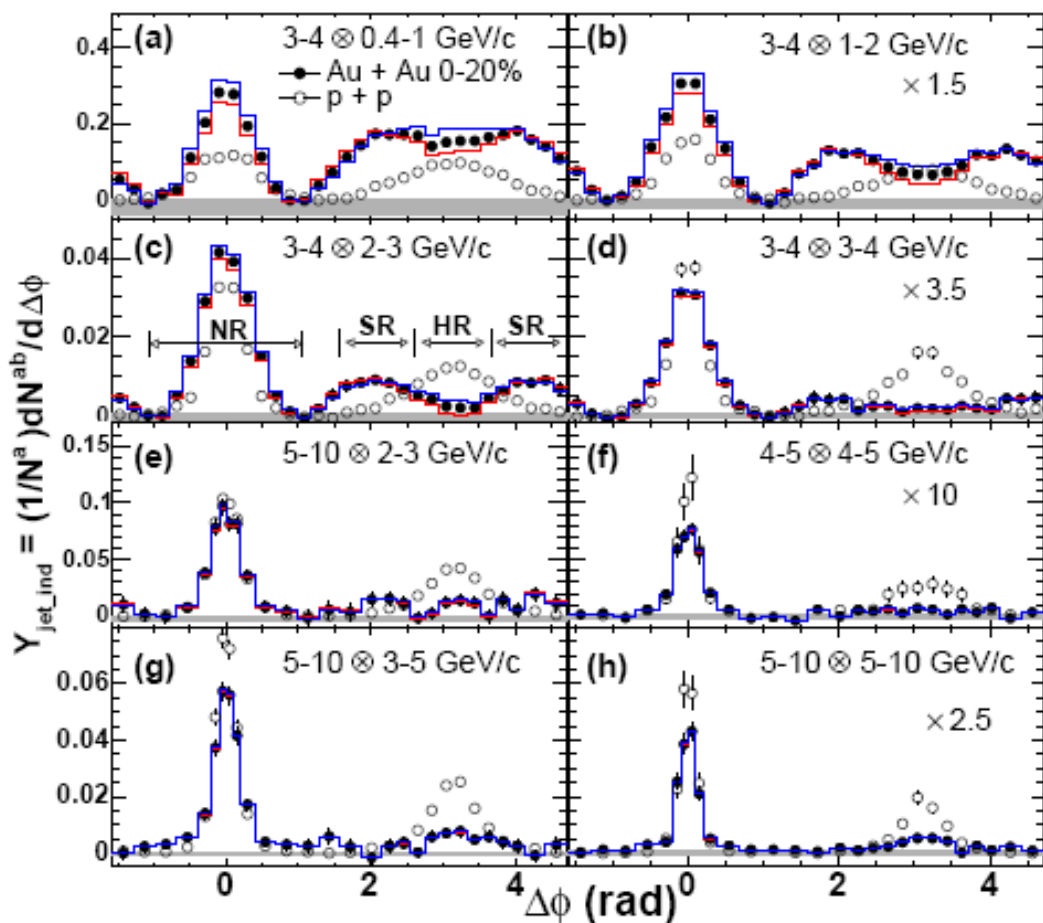
# Conclusions

# Study of the three jet production at RHIC energy

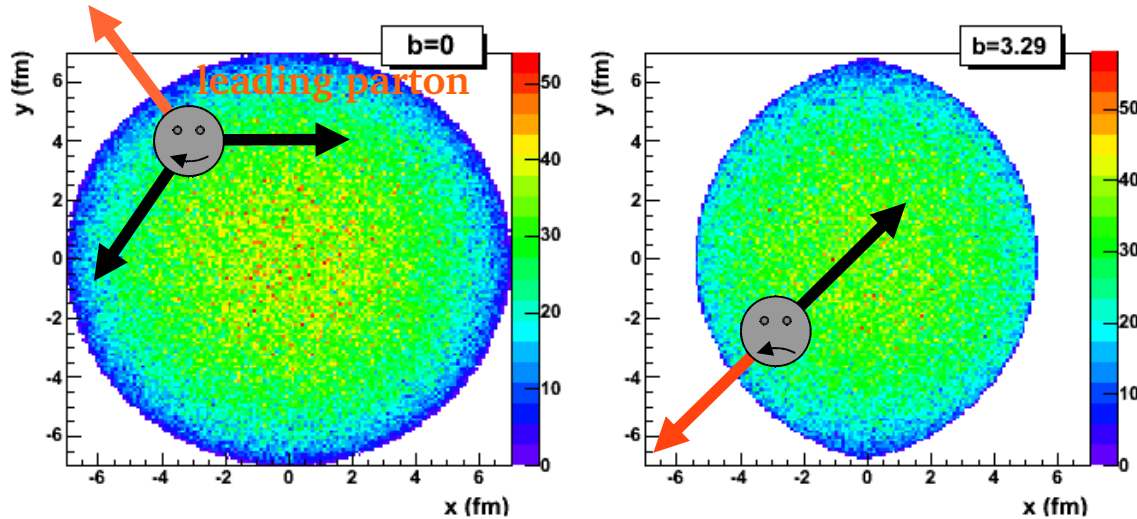
A. Adare *et al.*, (PHENIX Collaboration), Phys. Rev. C **78**, 014901 (2008).

Wang F. *et al.*, (STAR Collaboration), Nucl. Phys. A **774**, 129 (2006).

Double hump structure observed in AuAu collisions, but apparently inexistent in pp.



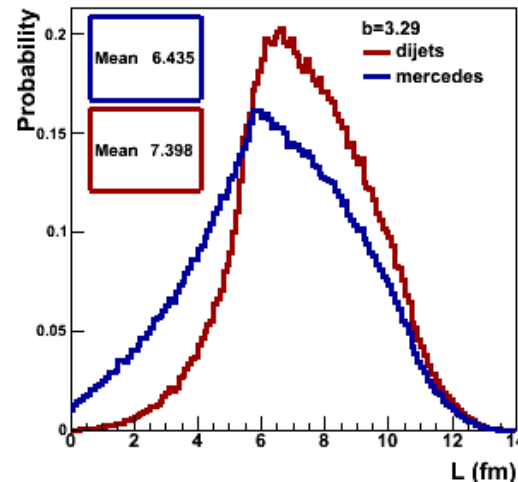
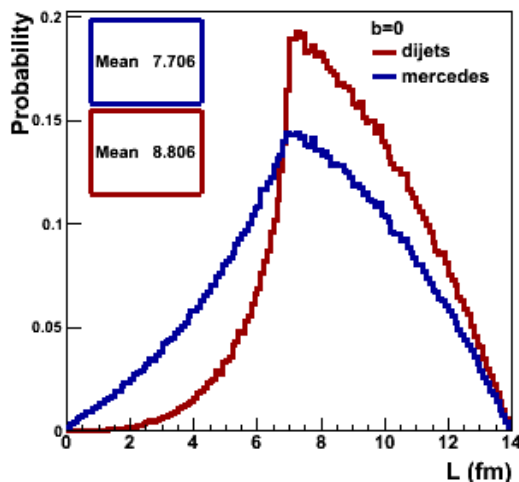
Pointing in the direction of explaining the observed phenomena...



(A. Ayala, J. Jalilian, J. Magnin, G. Paic, A. Ortiz, E. Tejada)

Excluding the **leading parton!!**

By geometrical arguments the away parton of a back-to-back jet travel more distance in the medium than the mercedes parton ones.



Does this mechanism amplify hadron production from 2->3 with respect to 2->2 parton processes in AuAu?

For answer the last question...

1. Comparison between the processes 2->2 in pp and AuAu.

$$D_{h/i}(z_i, \Delta E_i, \mu^2) = (1 - e^{-\langle \frac{L}{\lambda} \rangle}) \left[ \frac{z'_i}{z_i} D_{h/i}^0(z'_i, \mu^2) + \langle \frac{L}{\lambda} \rangle \frac{z'_g}{z_i} D_{h/g}^0(z'_g, \mu^2) \right] + e^{-\langle \frac{L}{\lambda} \rangle} D_{h/i}^0(z_i, \mu^2)$$

$$z'_i = \frac{h_i}{(b_{ti} - \Delta E_i)}$$

$$z'_g = \langle \frac{L}{\lambda} \rangle \frac{b_t}{\Delta E_i}$$

Next steps.

Repeat the analysis for the case 2->3, we expect that in AuAu the processes 2->3 will be amplified with respect to 2->2 in comparison with the pp case.

