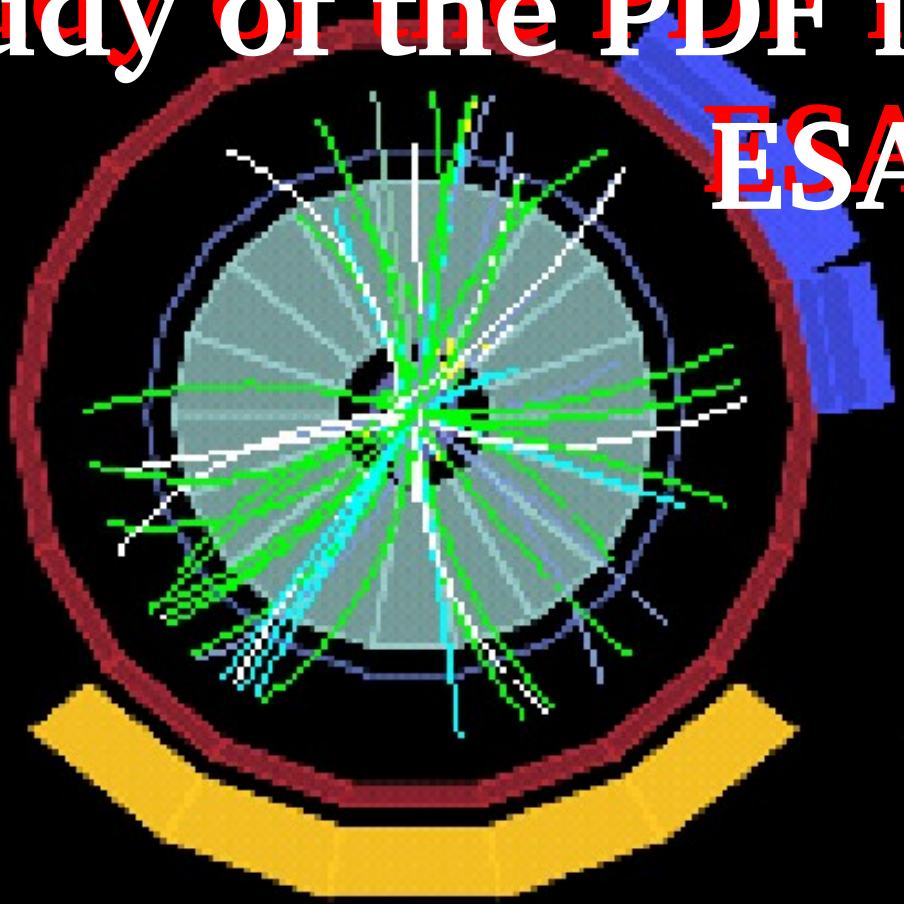
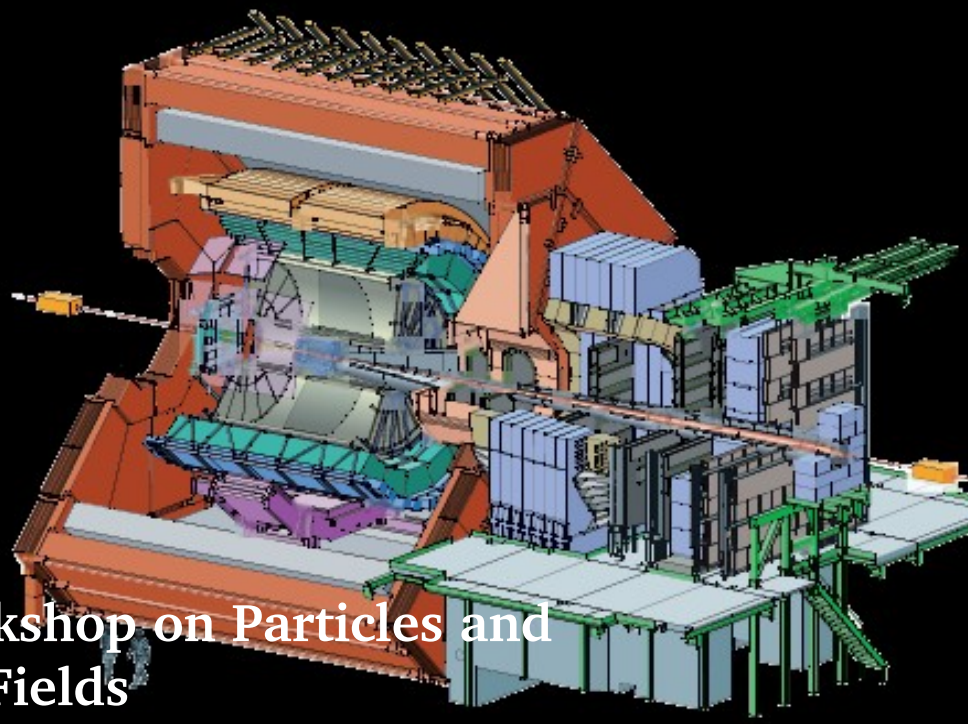
# Study of the PDF in the context of ESA.



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# Outline

- Review of the Event Shape Analysis.
- Main results.
- Sensitivity of the thrust with respect to the gluon PDF at low x.
- Results from simulations
- Conclusions.

# Introduction

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)

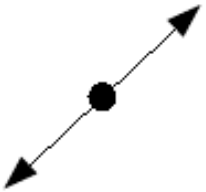
# Event Shape Analysis

## What are the shape variables?

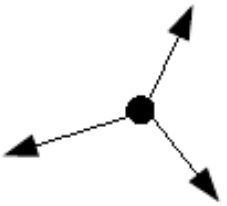
- ✓Similar to jet algorithms in that they describe the topology of an event.
- ✓Different in the sense that the information is encoded in a continuous fashion.

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

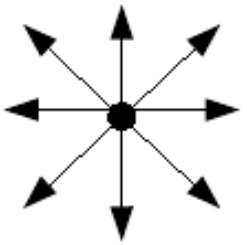
$\tau \equiv 1 - T$



**T = 1**



**T = 2/3**



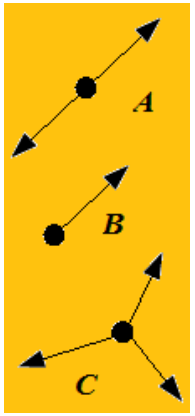
**T=2/π**

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

ESA combines this information for selecting specific jet topologies

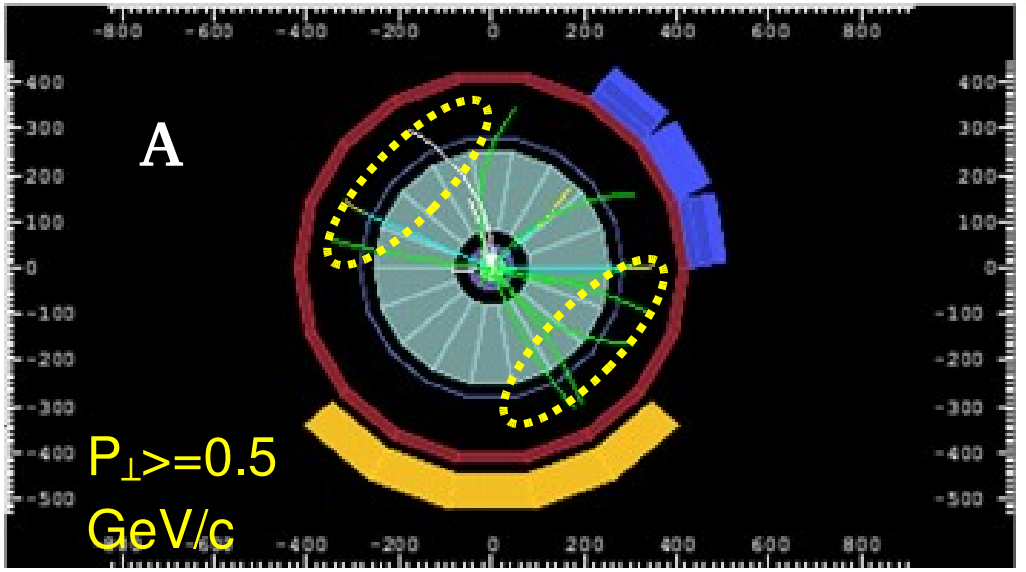
# Event Shape Analysis

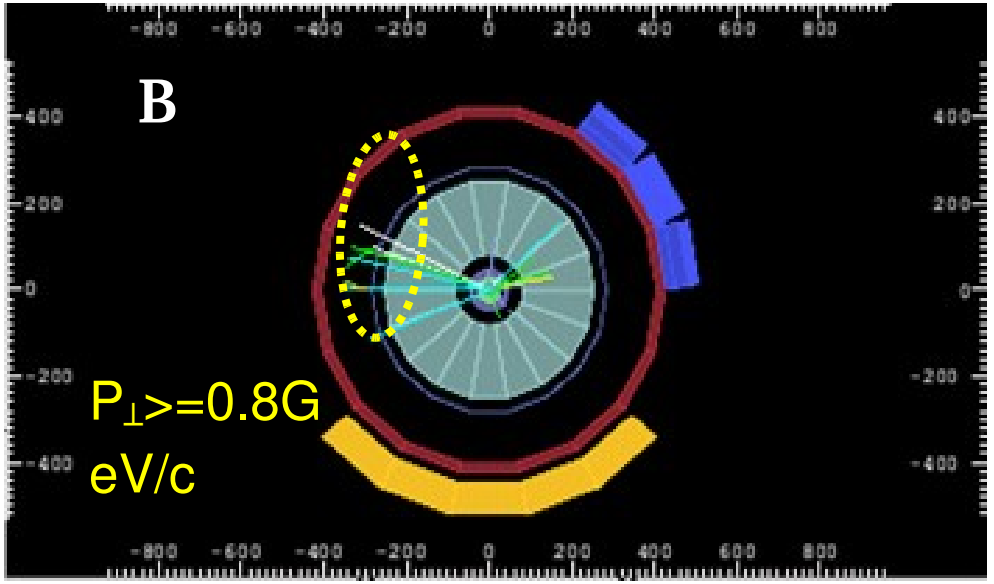
## Previous results for ALICE simulations

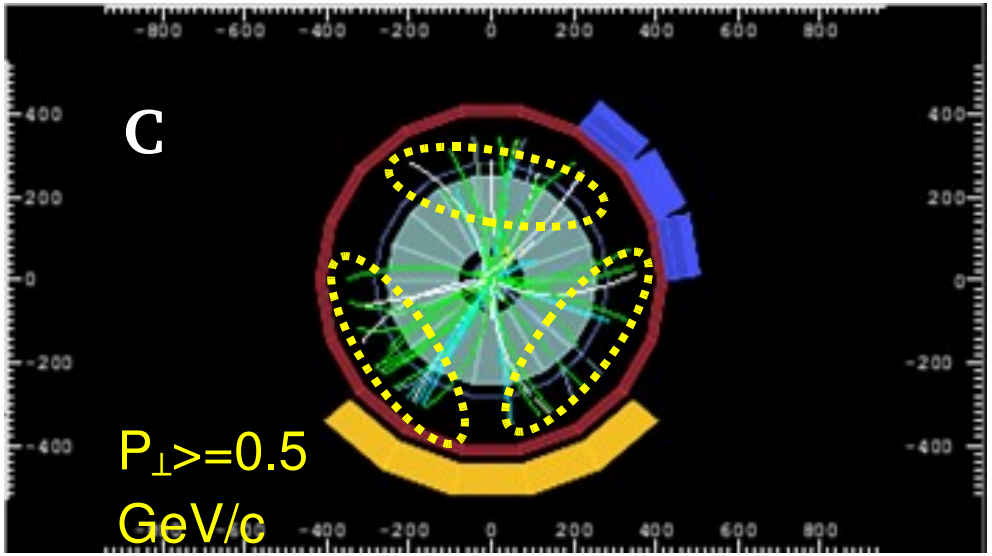



From a MB sample ESA extracts events of our interest.

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

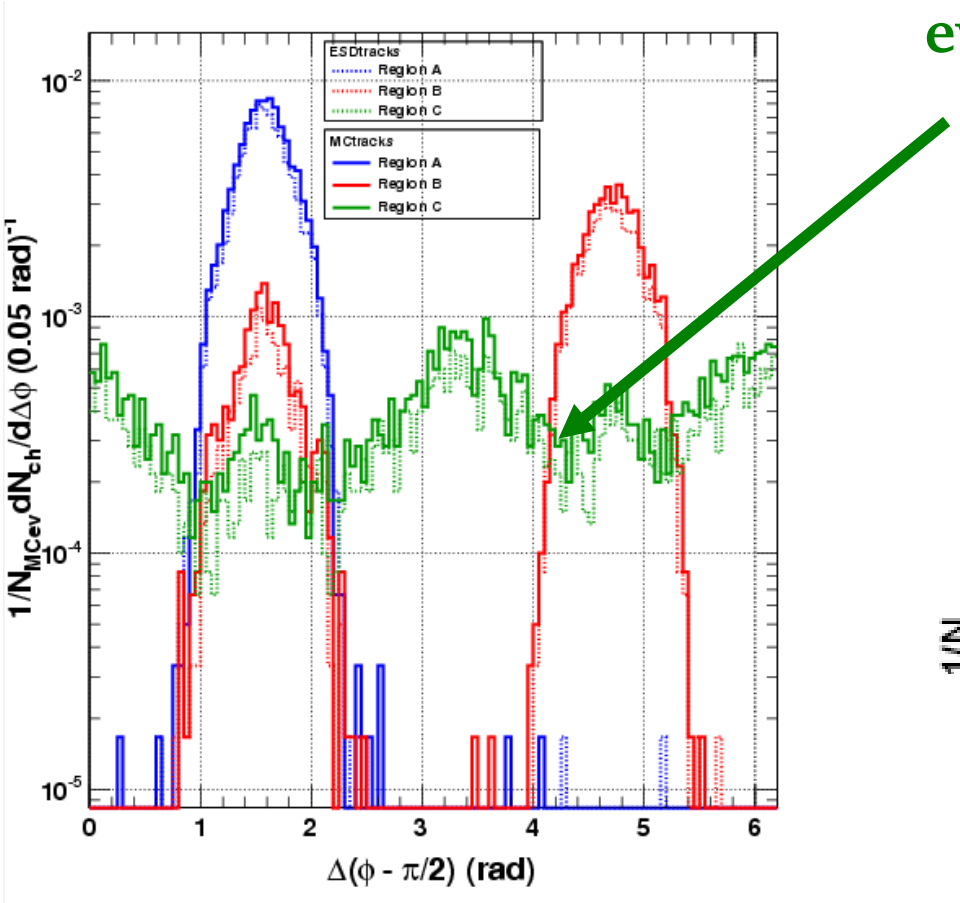


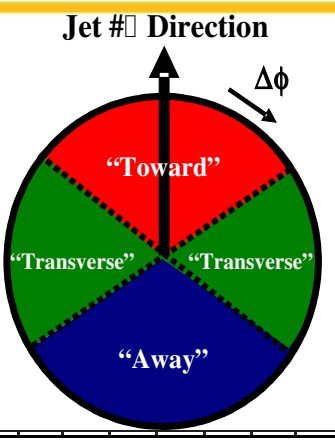
# Event Shape Analysis

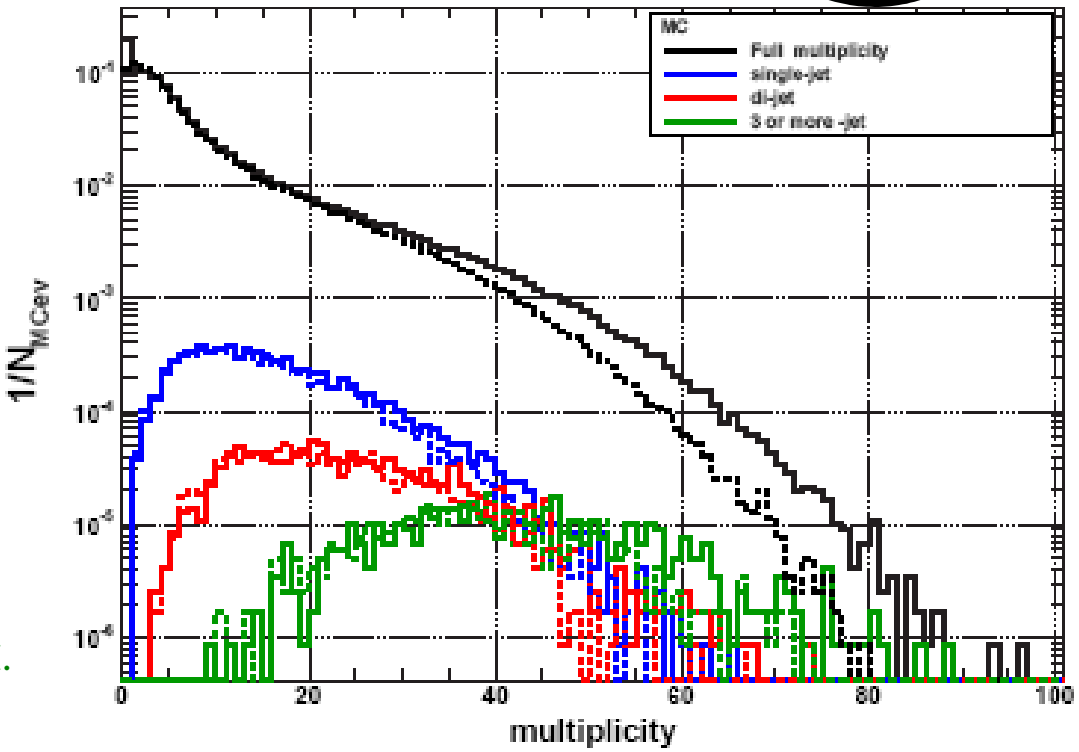
## Previous results for ALICE simulations




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

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

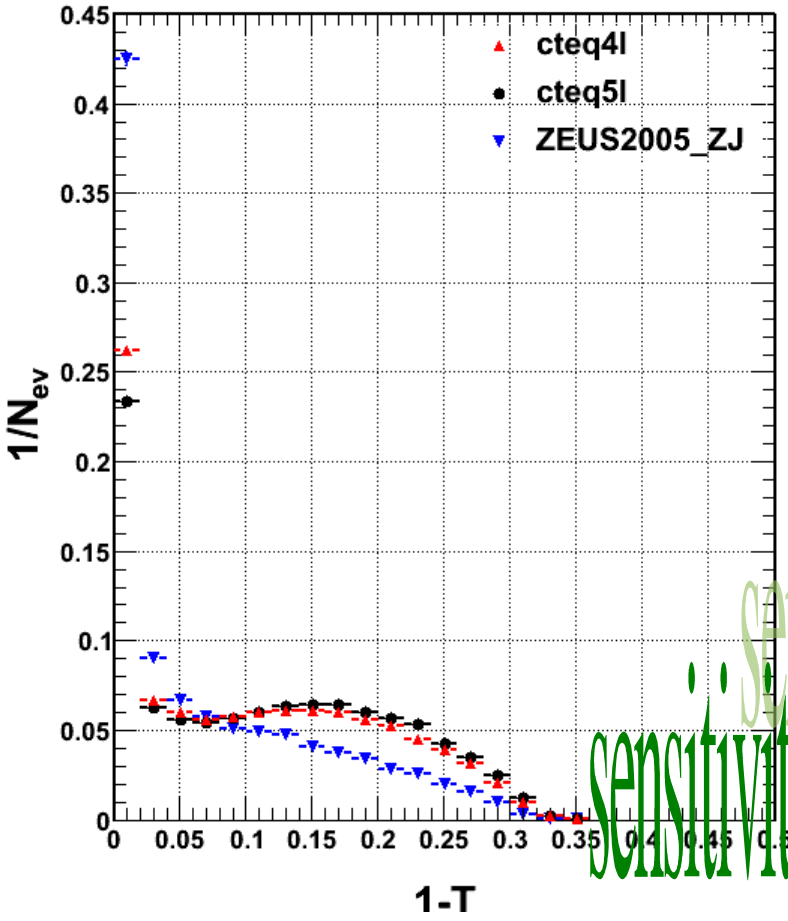


# Event Shapes and the PDF at low x.

# Our first motivation...

MB events mostly are dominated by gluons at 10 TeV.




We wanted to see the sensitivity of the bulk thrust distribution on PDF.

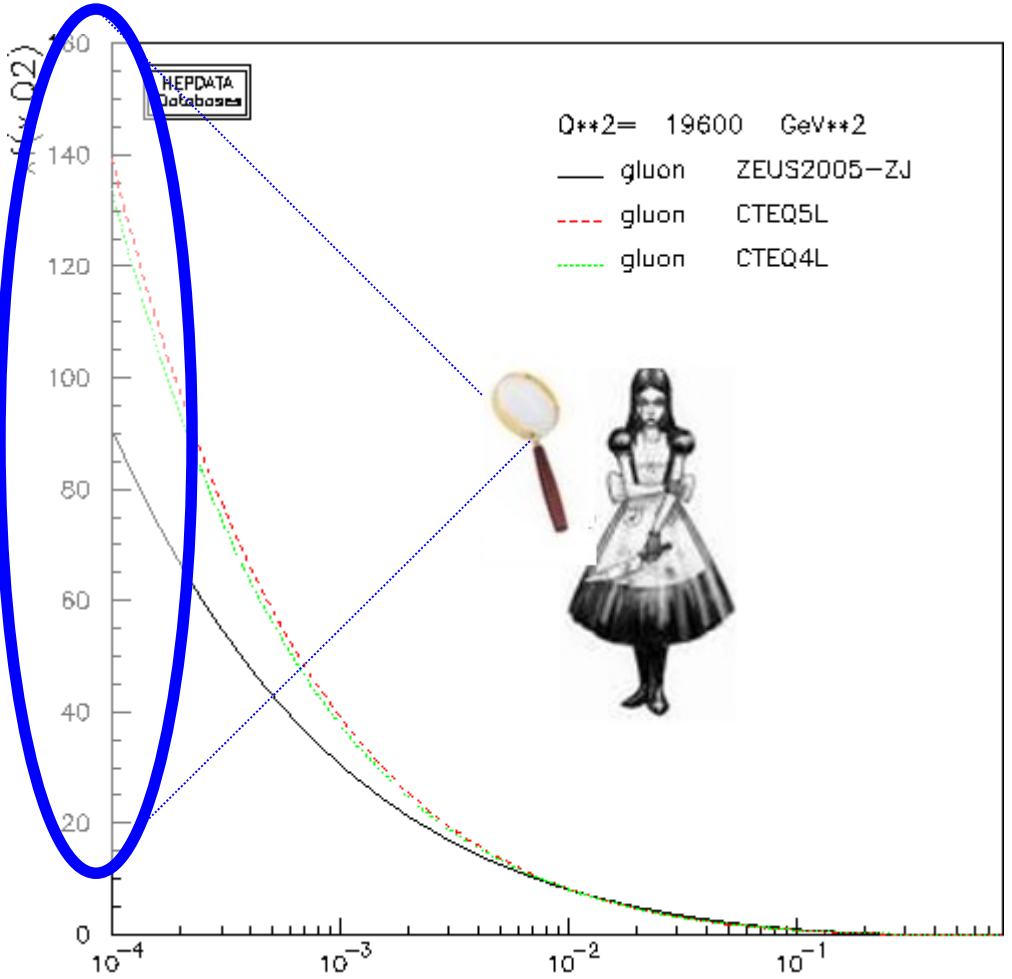
$$x_B \sim 2p_\perp/\sqrt{s} \sim 10^{-4}$$

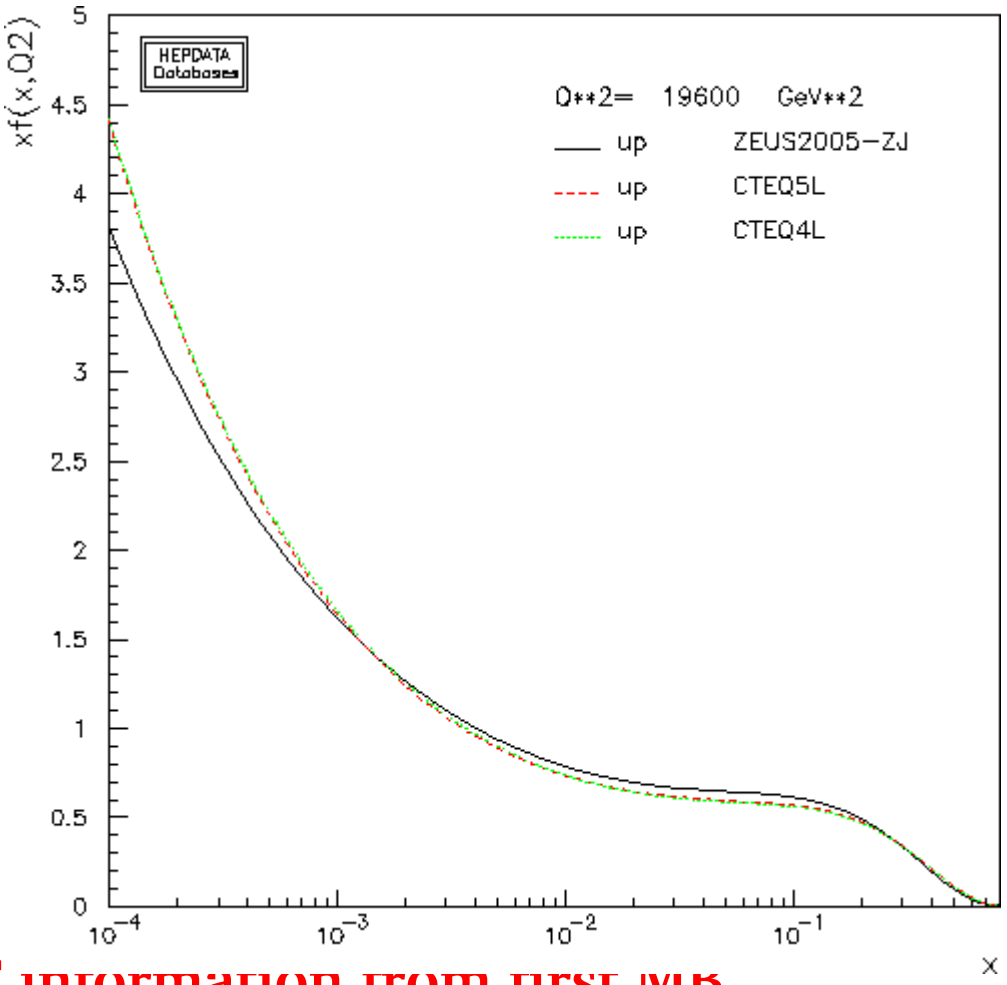
(LHC energies s~ 10 TeV, and η=0)

sensitivity of the thrust spectrum with respect to PDF!!!

sensitivity of the thrust spectrum with respect to PDF!!!

# Event Shape Analysis

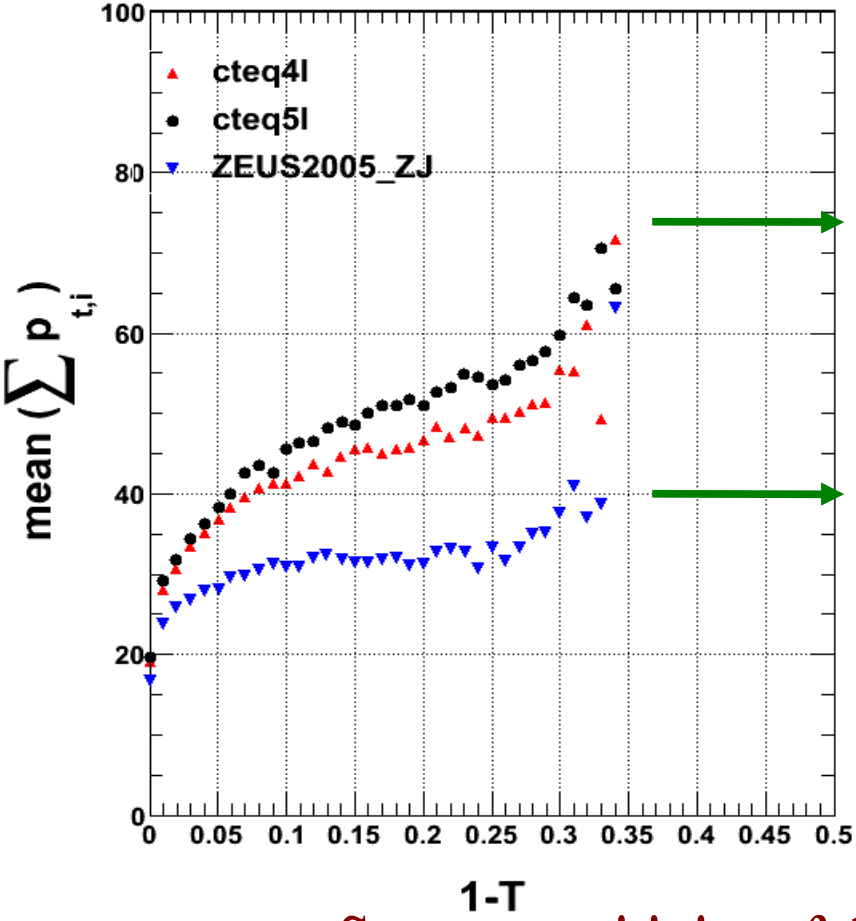


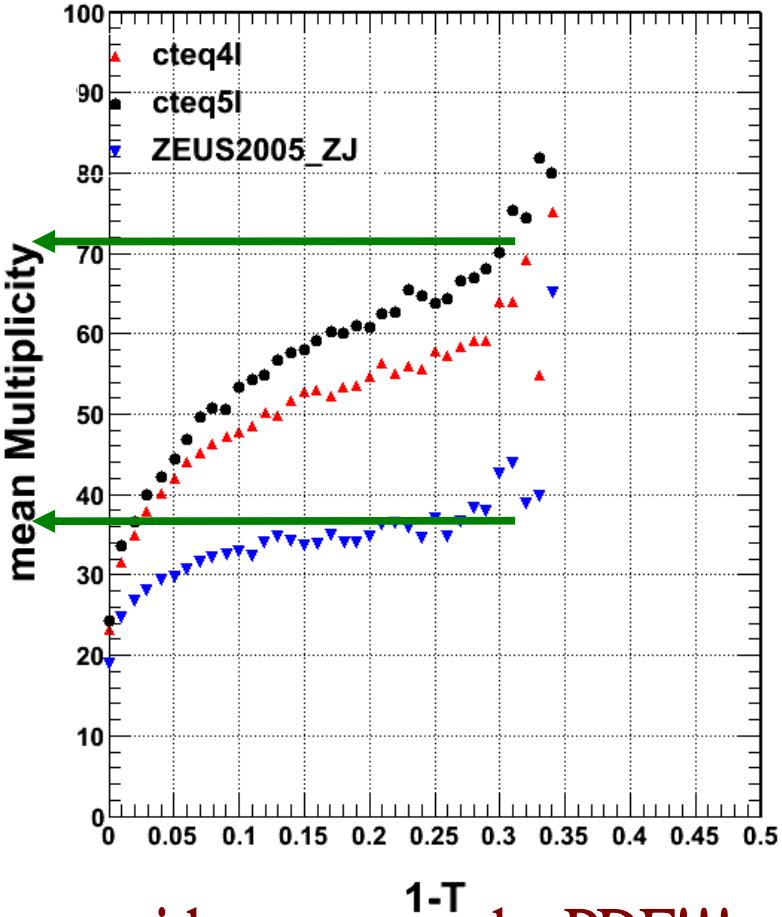




**Can we extract the low-x PDF information from first MB data of ALICE?**

# Event Shape Analysis

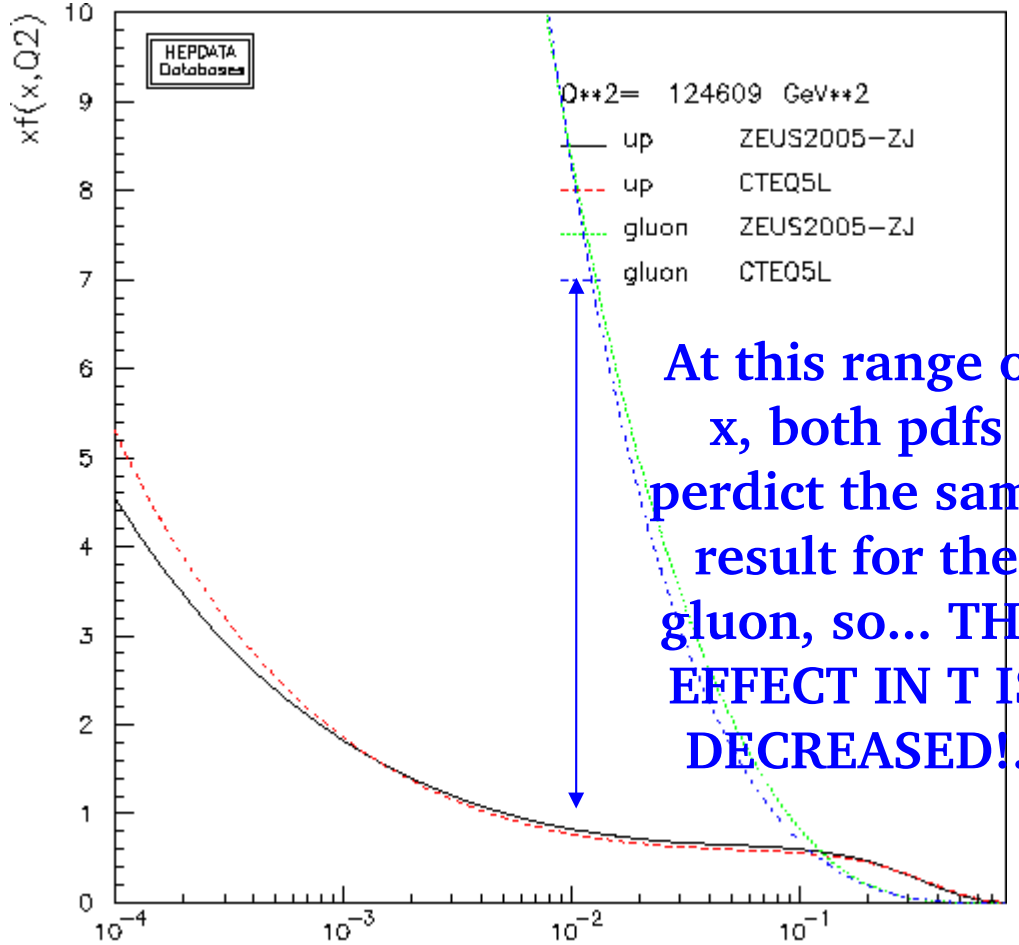
Generation of MB events: pp at 10TeV, using the PDF's sets: ZEUZ2005-JF, CTQ5L



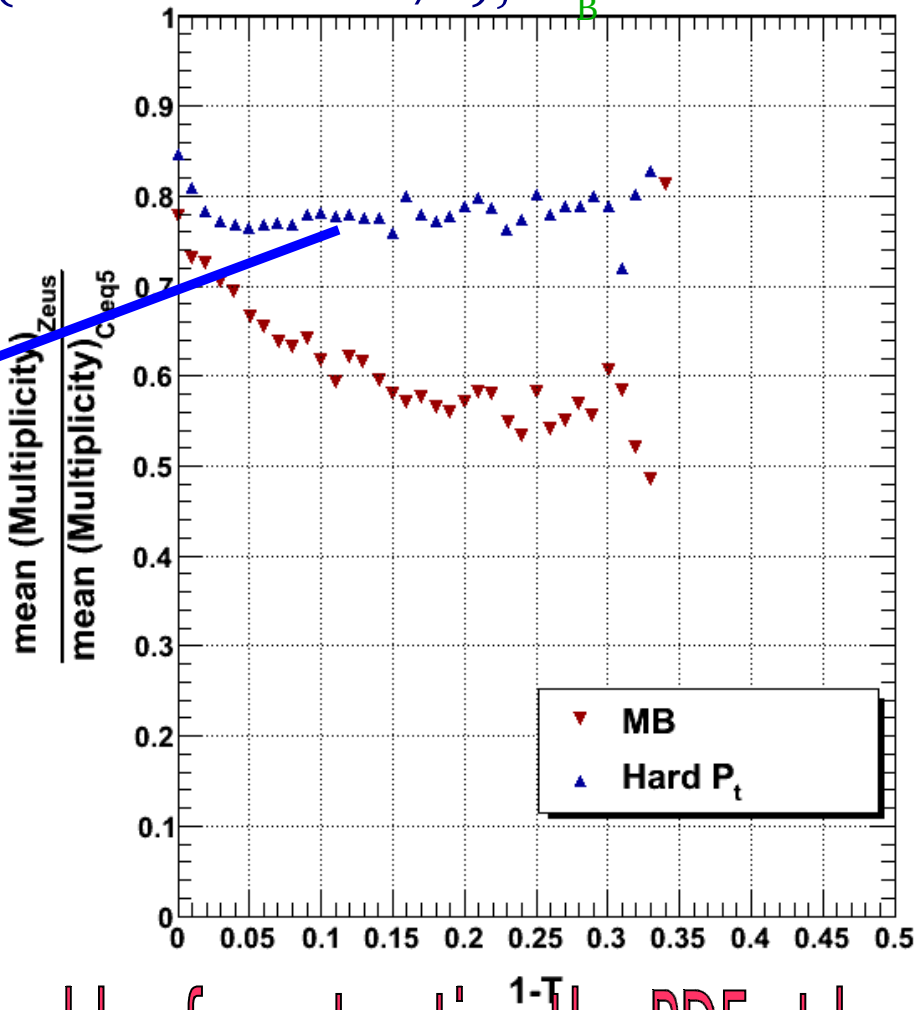




Strong sensitivity of the thrust spectra with respect to the PDF!!!

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




**At this range of x, both pdfs perdict the same result for the gluon, so... THE EFFECT IN T IS DECREASED!.**




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

# Conclusions

# Conclusions

- ESA is a powerful method to identify specific jet topologies in experiments with restricted acceptance.
- A very simple analysis (without jet identification) guides handle on the gluon distribution in low x.
- The sensitivity of thrust to gluon PDF is the best for MB events.