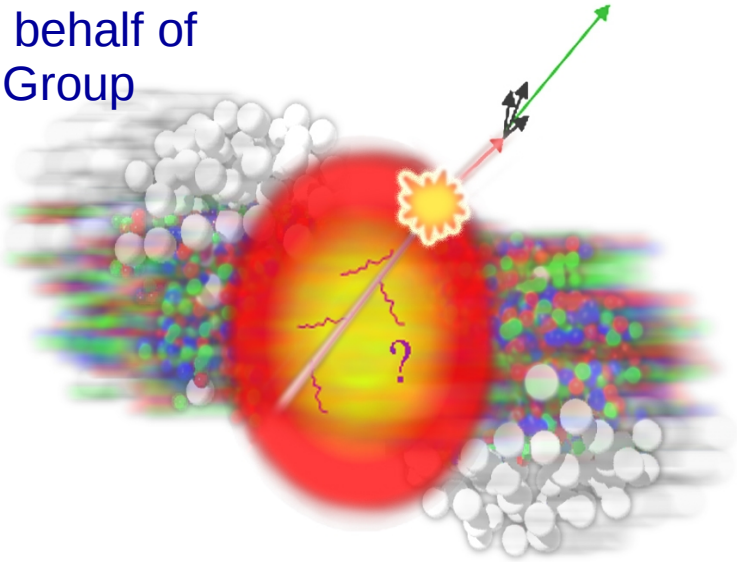
Jets in Pb+Pb Collisions Measured by ATLAS

Helena Santos, on behalf of
the ATLAS-LIP Group



- Motivation
- Jet reconstruction
- Physics analysis

Jornadas do LIP, 21-23 de Abril 2012

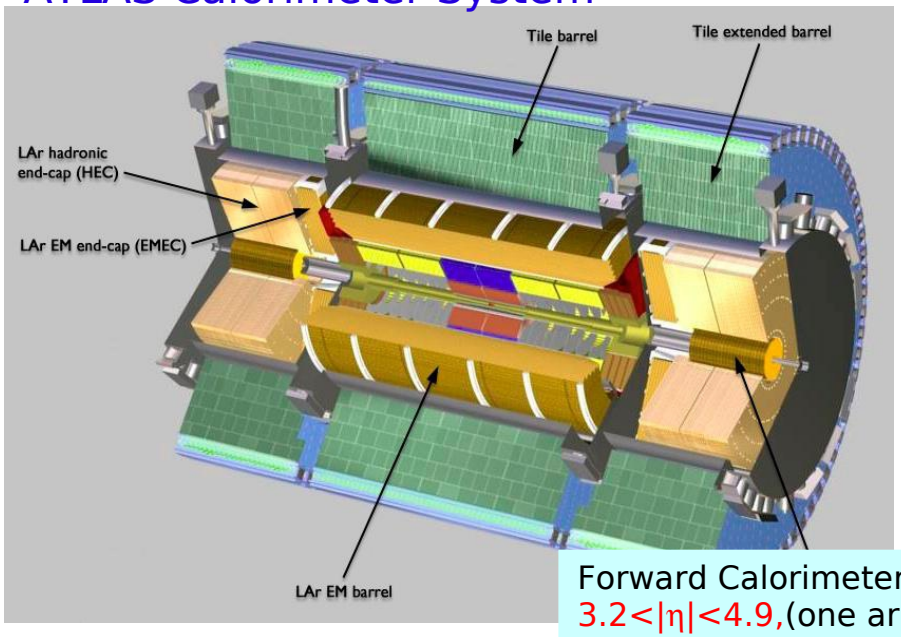
Jets in Heavy Ion Collisions

Unknowns:

- **How do parton showers in hot and dense medium differ from those in vacuum?**
  - **How much is the jet yield suppressed?**
  - **How does the suppression depend on jet radius?**
  - **Is the fragmentation function modified?**
  - **Is the hadron angular distribution broadened?**
- **What is the physics responsible for this modification?**

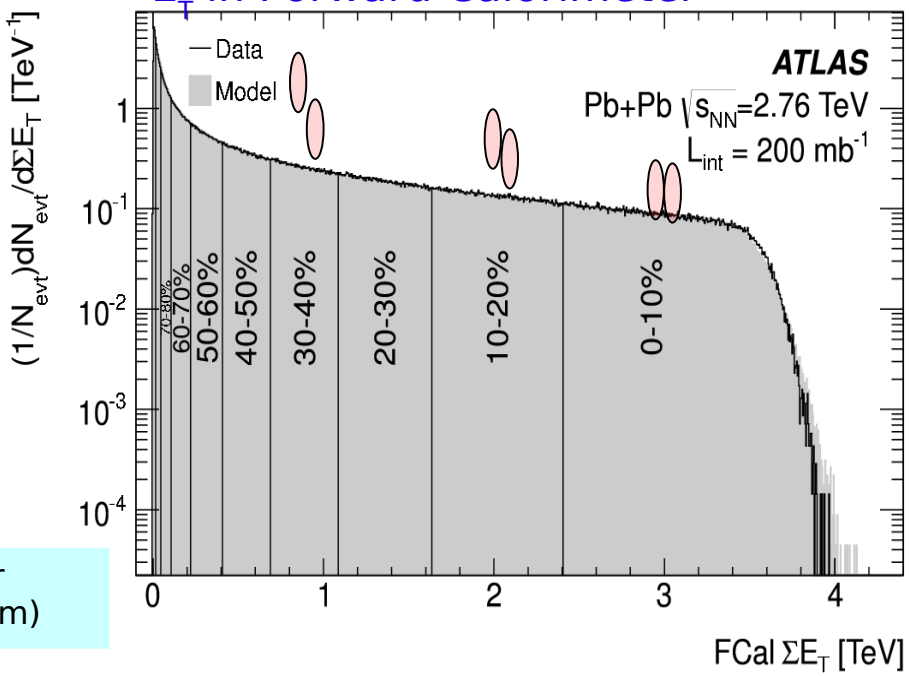
Collision's Centrality

ATLAS Calorimeter System



Forward Calorimeter
3.2<|η|<4.9,(one arm)

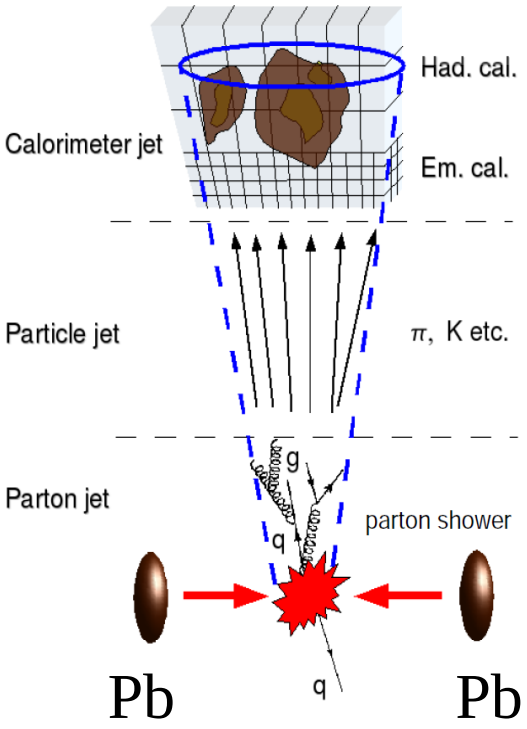
E_T in Forward Calorimeter

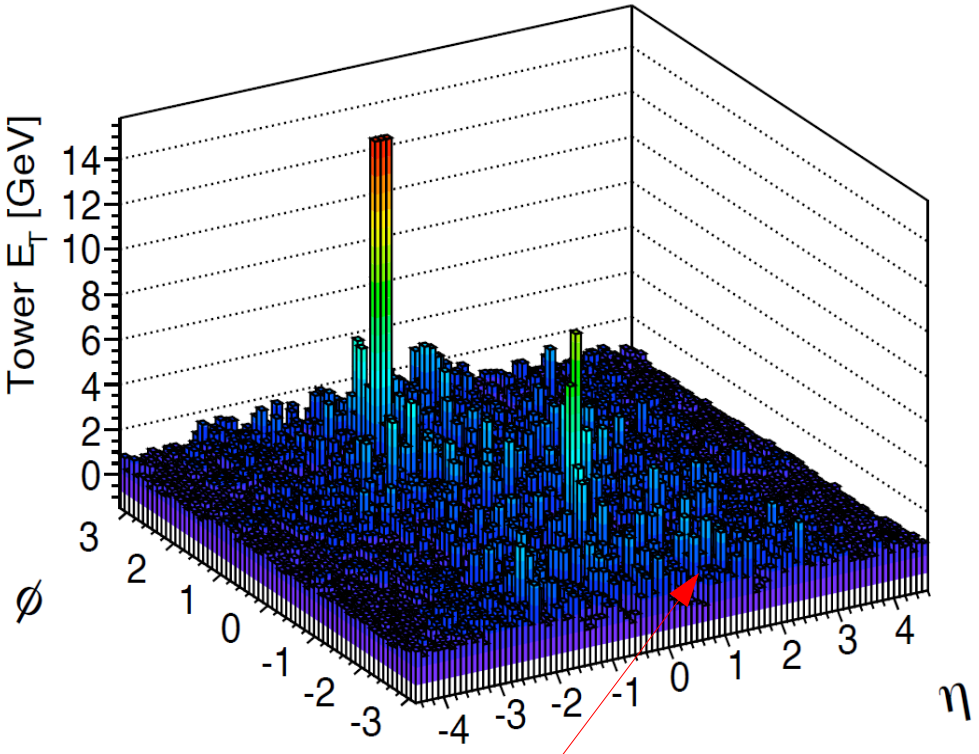


- Transverse energy in FCal compared to Glauber MC model ⊗ p+p data
- Sampling fraction of Pb+Pb collisions: f = 98 ± 2%, after all trigger and selection cuts

Event Seen by the Calorimeter

Main challenge: get rid off the huge underlying event produced in Pb+Pb collisions



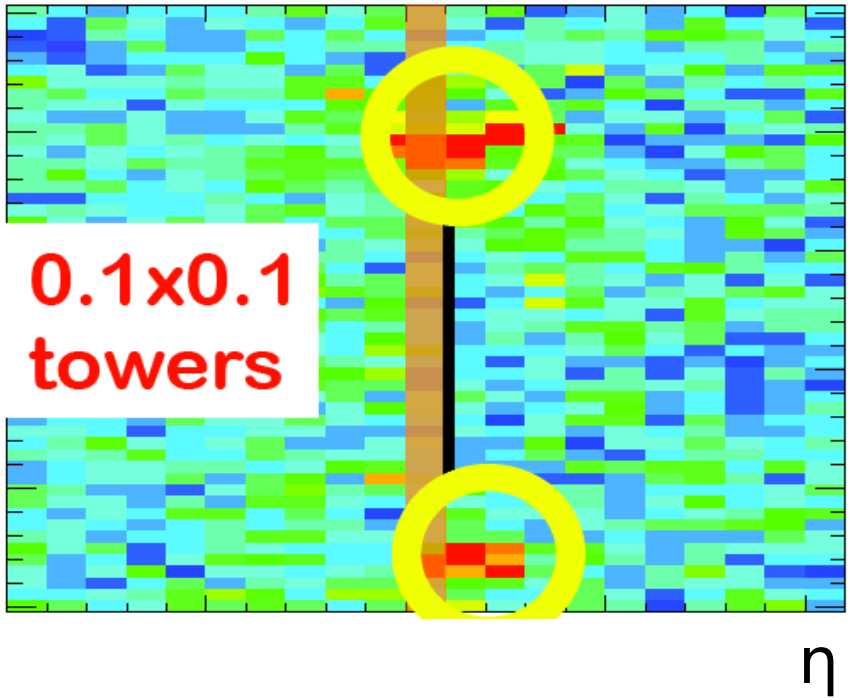


The “pedestal” must be subtracted.

Granularity of the ATLAS calorimeter:
Δηx Δφ=0.1x0.1 “towers” (piled calorimeter cells)

Jets Reconstruction

Jets are reconstructed using anti-k_T algorithm with two choices of R parameter (R=0.4 and R=0.2)



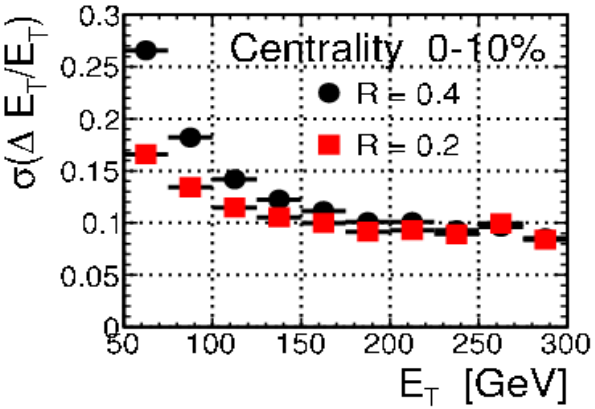
Average background estimated event-by-event per calorimeter sampling layer and per 0.1 η strip

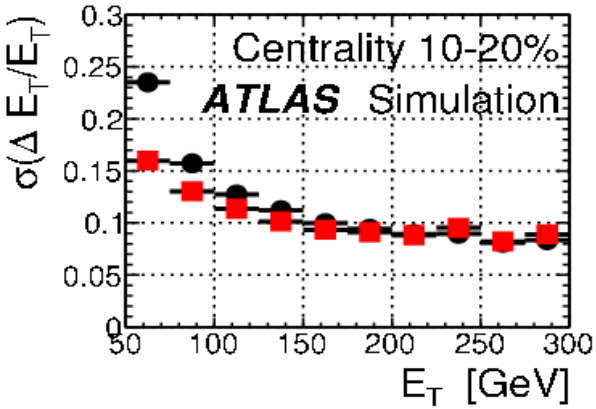
$$E_{T,subt}^{cell} = E_T^{cell} - \rho \, xA^{cell}$$

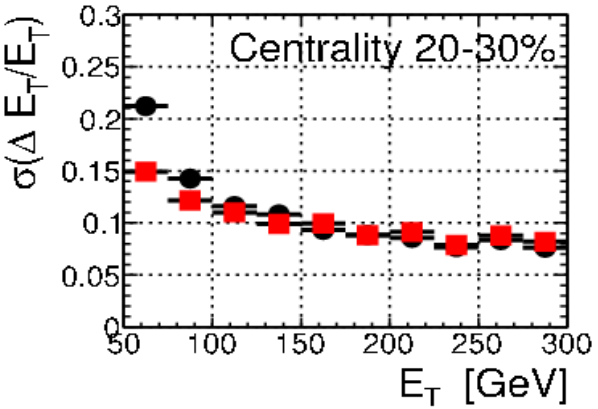
- To avoid biasing ρ due to jets:

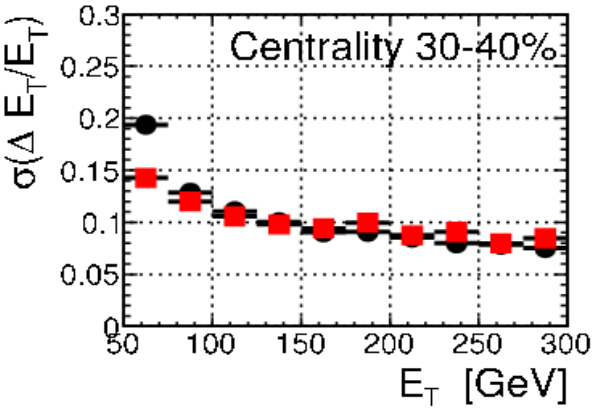
  Exclude cells satisfying $D = E_{T,max}^{tower} / \langle E_T^{tower} \rangle > 5$

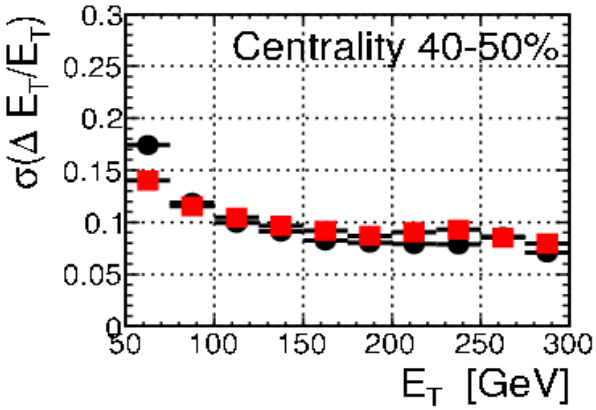
Jet Energy Resolution

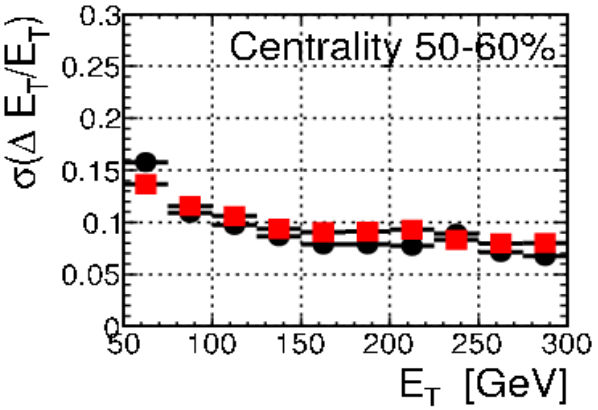


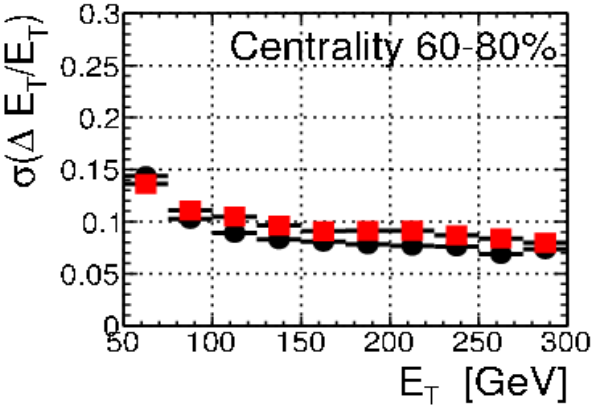












Jet energy resolution characterized for R=0.4 (red) and R=0.2 (black) jets for different centrality ranges

Di-jet Asymmetry

Enhancement of asymmetric di-jets, relatively to p+p and PYTHIA+HIJING

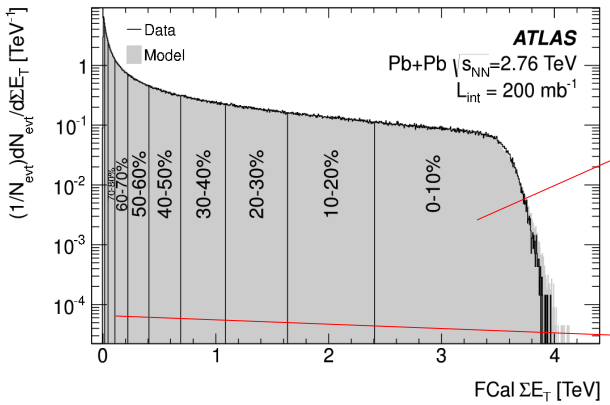
→ first indication of jet suppression

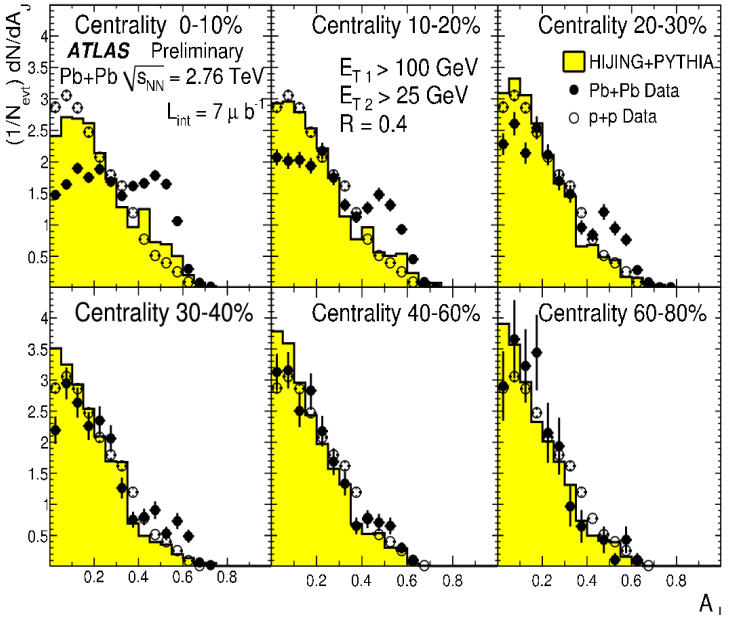
$$A_J = \frac{E_{T1} - E_{T2}}{E_{T1} + E_{T2}}$$

$E_{T1} > 100\,GeV$

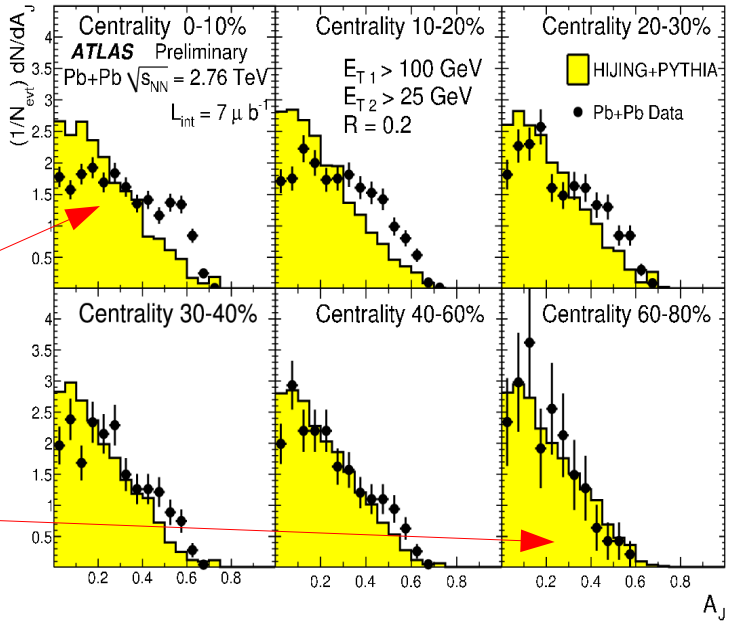
$E_{T2} > 25\,GeV$

$|\eta| < 2.8$





R=0.4



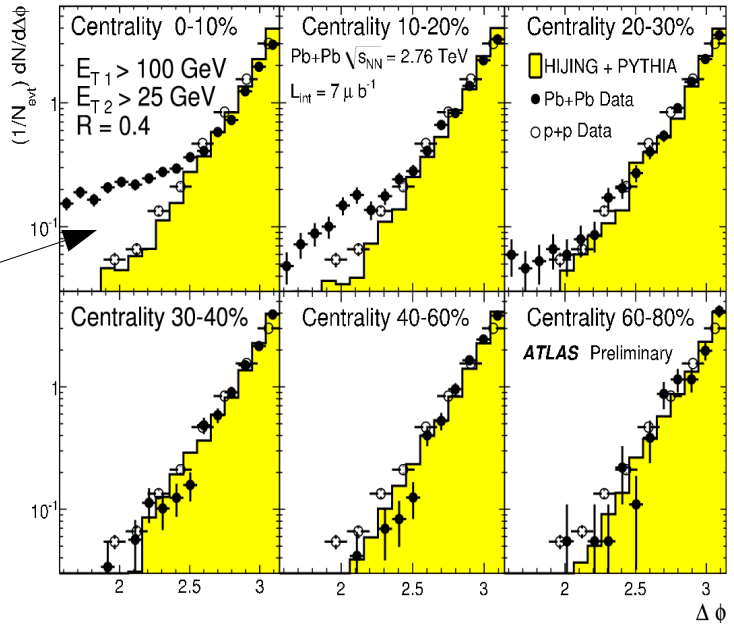
R=0.2

Di-jet Azimuthal Correlation

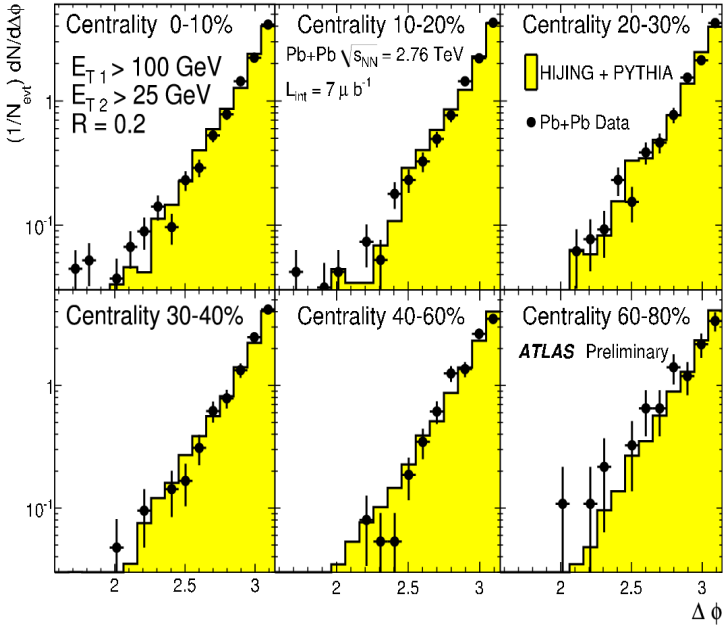
Δφ=π acoplanarity remains, while A_J is changing

Consistent with combinatoric contribution to R=0.4 di-jet Δφ distribution

– 2nd jet "missing" and uncorrelated jet used



R=0.4



R=0.2

- But, combinatoric contribution much smaller for R=0.2

  – Yet, equally strong asymmetry modification

Conclusions

1 - Jet reconstruction has reached very good performance;

Still room for improvements...

2 - Di-jet balance in peripheral collisions well compatible with p+p collisions and non-quenching based MC;

Di-jet asymmetry increases with increasing centrality.

3 - No broadening of $\Delta\varphi$.

Ongoing:

- Analysis of 2011 data
- Trigger studies on Heavy Flavour jets

Acknowledgements

To the ATLAS-LIP Group: Thank You All!!

And to:

QUADRO DE REFERÊNCIA ESTRATÉGICO NACIONAL
PORTUGAL 2007.2013

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