Jet Shapes and Energy Flows in Dijet Production

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QCD Meeting 7th February 2003

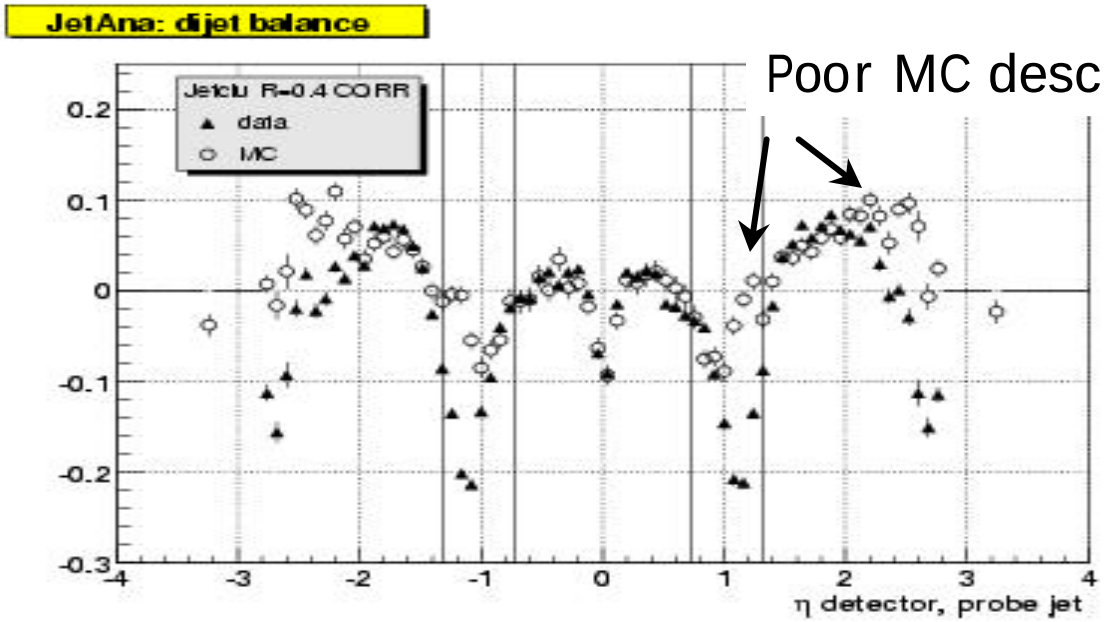
List of Updates w.r.t ICHEP'02

- Using whole Sample of Jet20 and Jet50
  - After QCD Good Run list is applied (~80 pb-1)
- Using latest Jet Corrections
  - Relative Corrections
  - Time dependence corrections
  - DO NOT APPLY ABSOLUTE CORRECTIONS
- Remove events with more than one primary VTX
- Latest Version of Data and PYTHIA (4.9.1htp1)

MC/Data Comparison

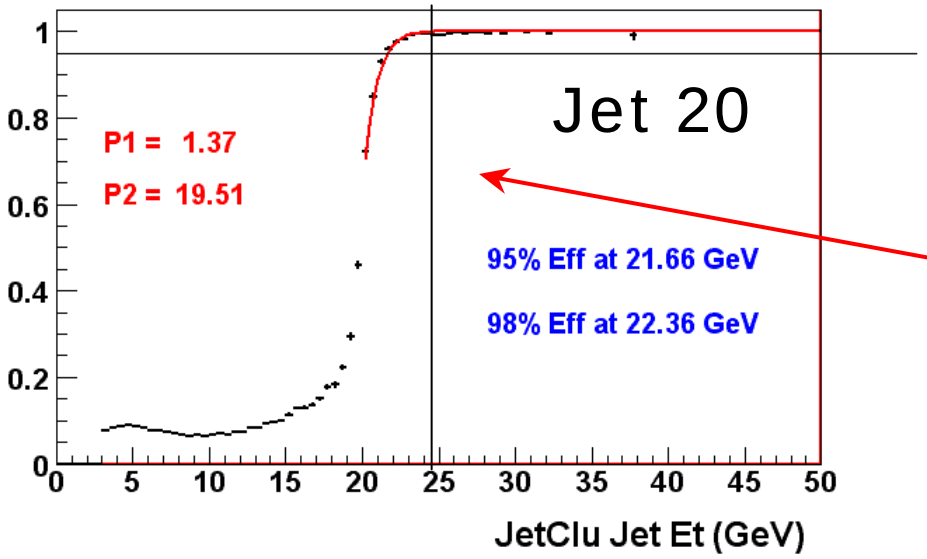
Dijet balance — data/MC comparison

Now with CdfSim v. 4.9.1 and 0.4 cone (JetClu), time correction applied



Maximum correction is ~20% at $|\eta|$~1.1

Selection Cuts for Jet20



Dijet Events selection:

$E_T^{jet} > 25\,\text{GeV}$ (uncorrected)

$|\eta^{jet}| < 2.3$

After corrections :

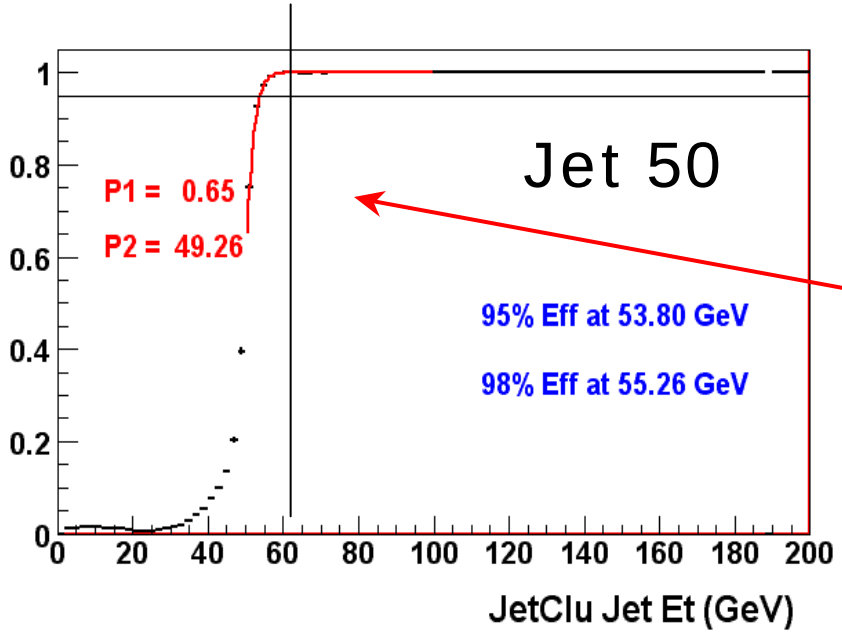
$E_T^{jet} > 30\,\text{GeV}$

Other cuts (same as ICHEP'02)

$$\frac{\text{Missing } E_T}{\sqrt{E_T}} < 2\,\text{GeV}^{1/2} \qquad |V_z| < 60\,\text{cm}$$

New Cut against MI : No more than 1 vertex

Selection Cuts for Jet50



Dijet Events selection:

$E_T^{jet} > 60\,GeV$ (uncorrected)

$|\eta^{jet}| < 2.3$

After corrections :

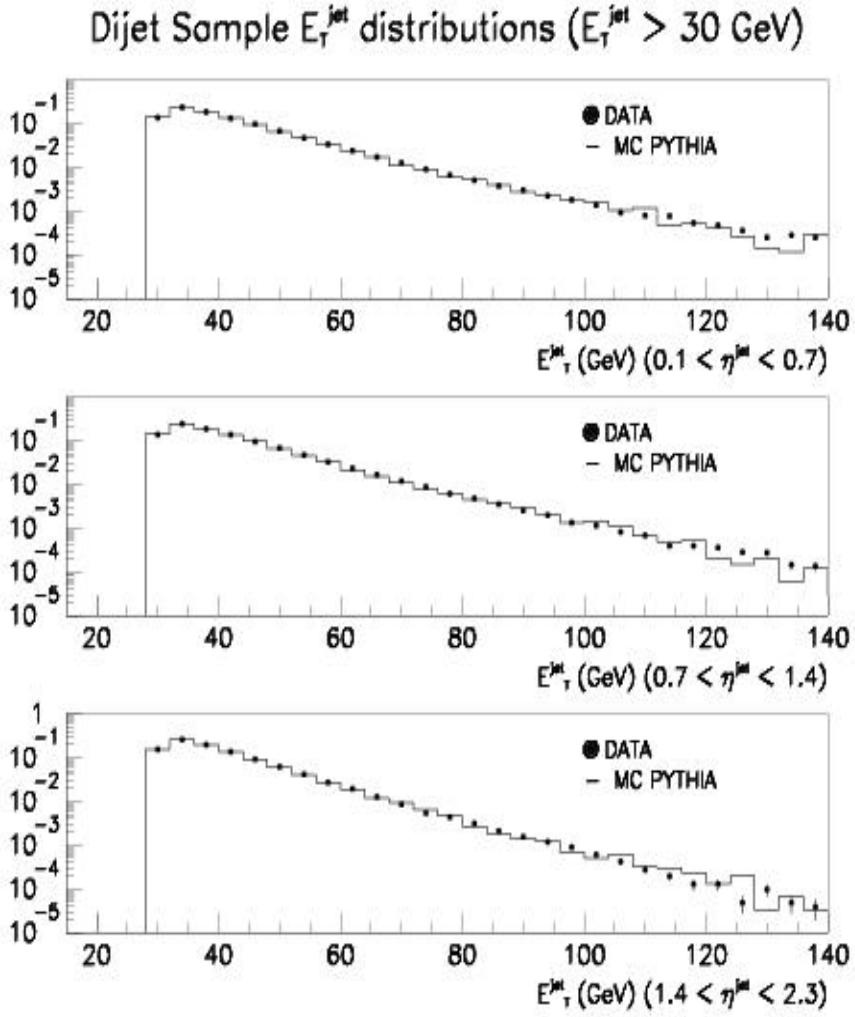
$E_T^{jet} > 75\,GeV$

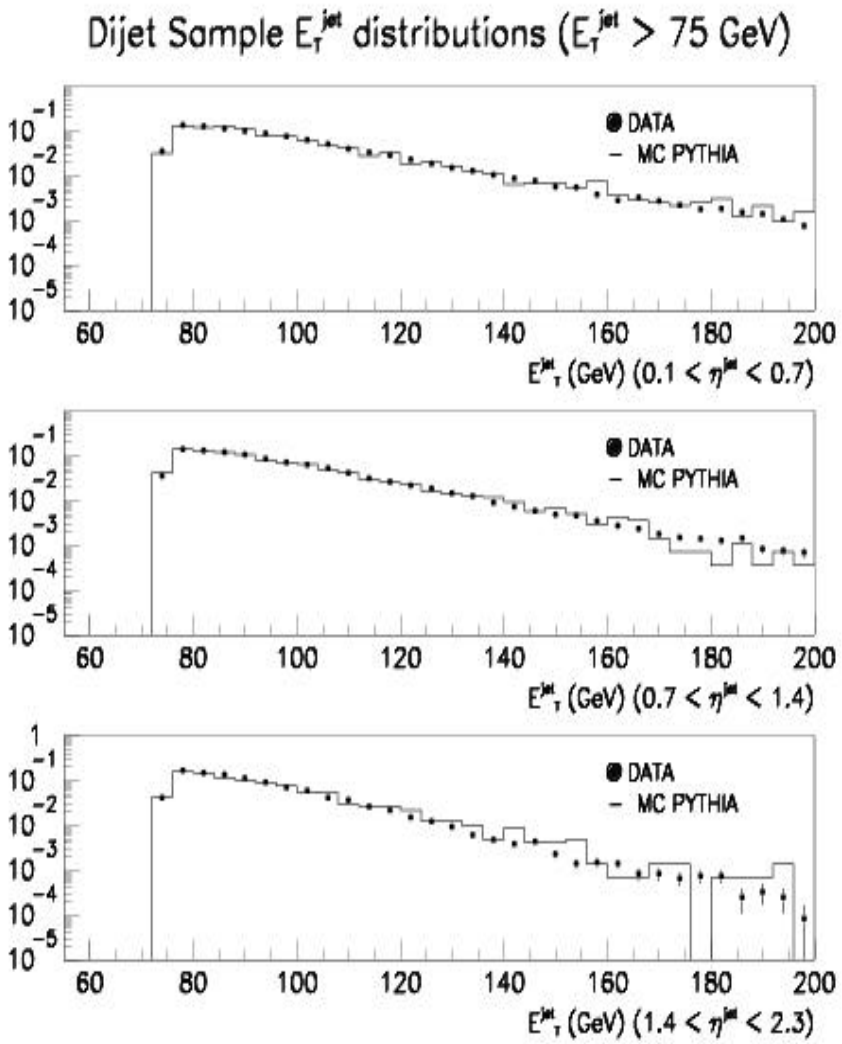
Other cuts (same as ICHEP'02)

$$\frac{\text{Missing } E_T}{\sqrt{E_T}} < 2\,GeV^{1/2} \qquad |V_z| < 60\,cm$$

New Cut against MI : No more than 1 vertex

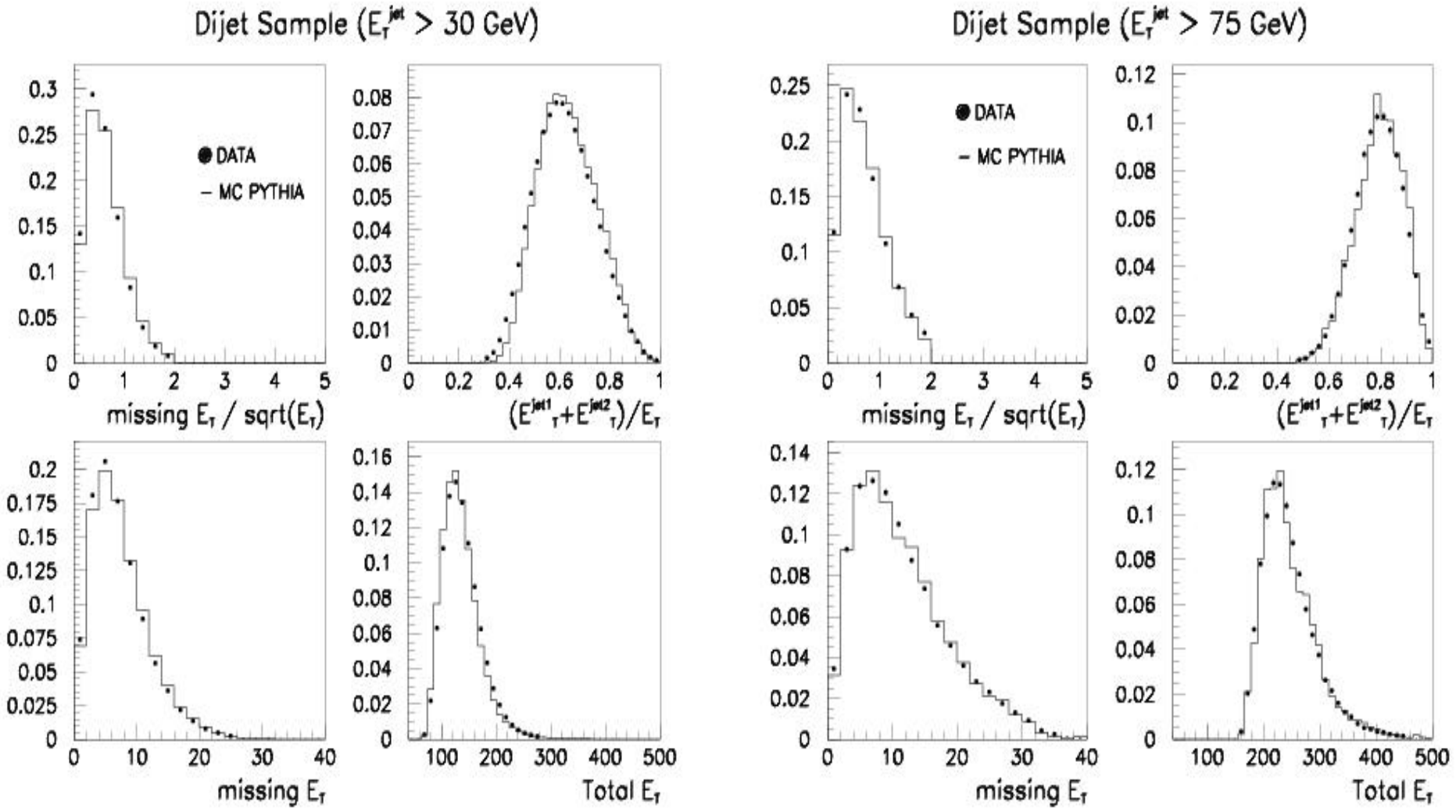
Some Control Plots (I)





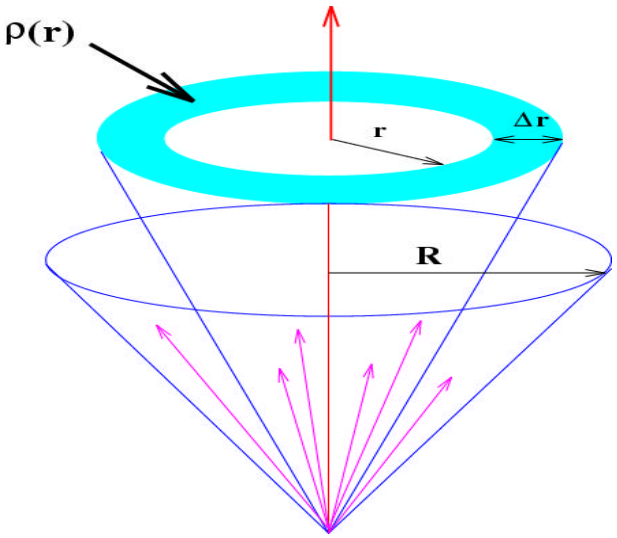
Comparison Data/MC is satisfactory

Some Control Plots (II)

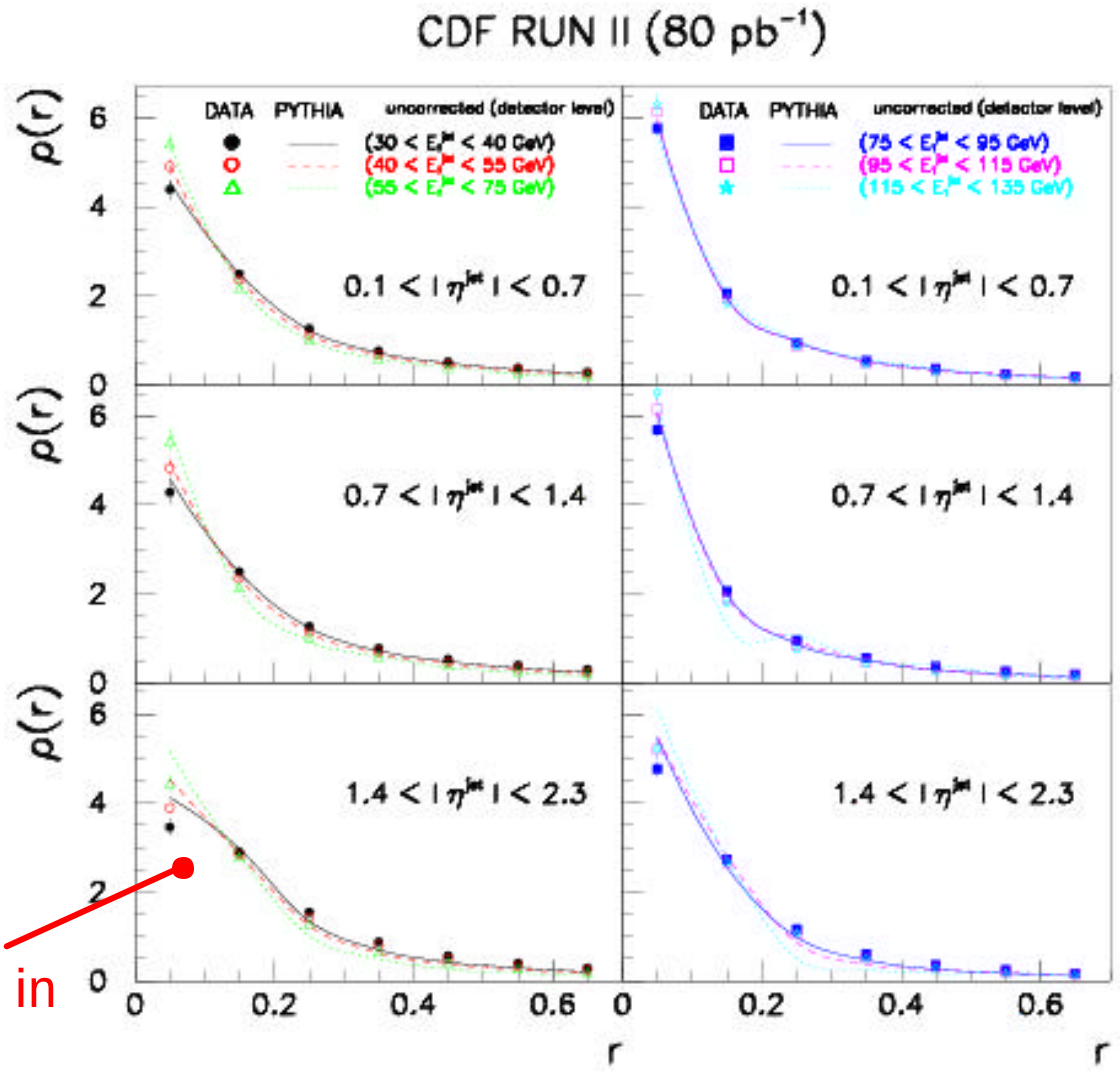


Comparison Data/MC is satisfactory

Differential Jet Shapes CAL



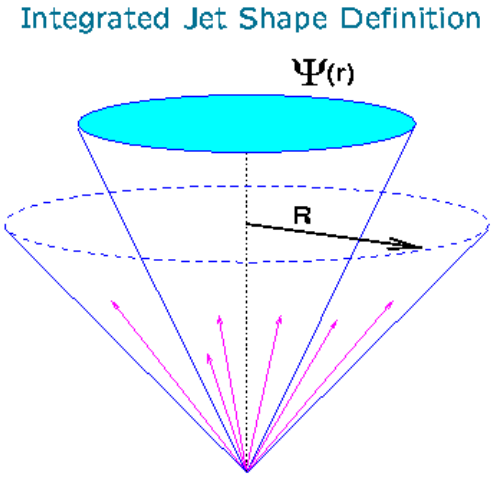
$$\rho(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum E_T(r \pm \Delta r/2)}{\sum E_T(0,R)}$$



MC is not describing DATA in The very forward region....

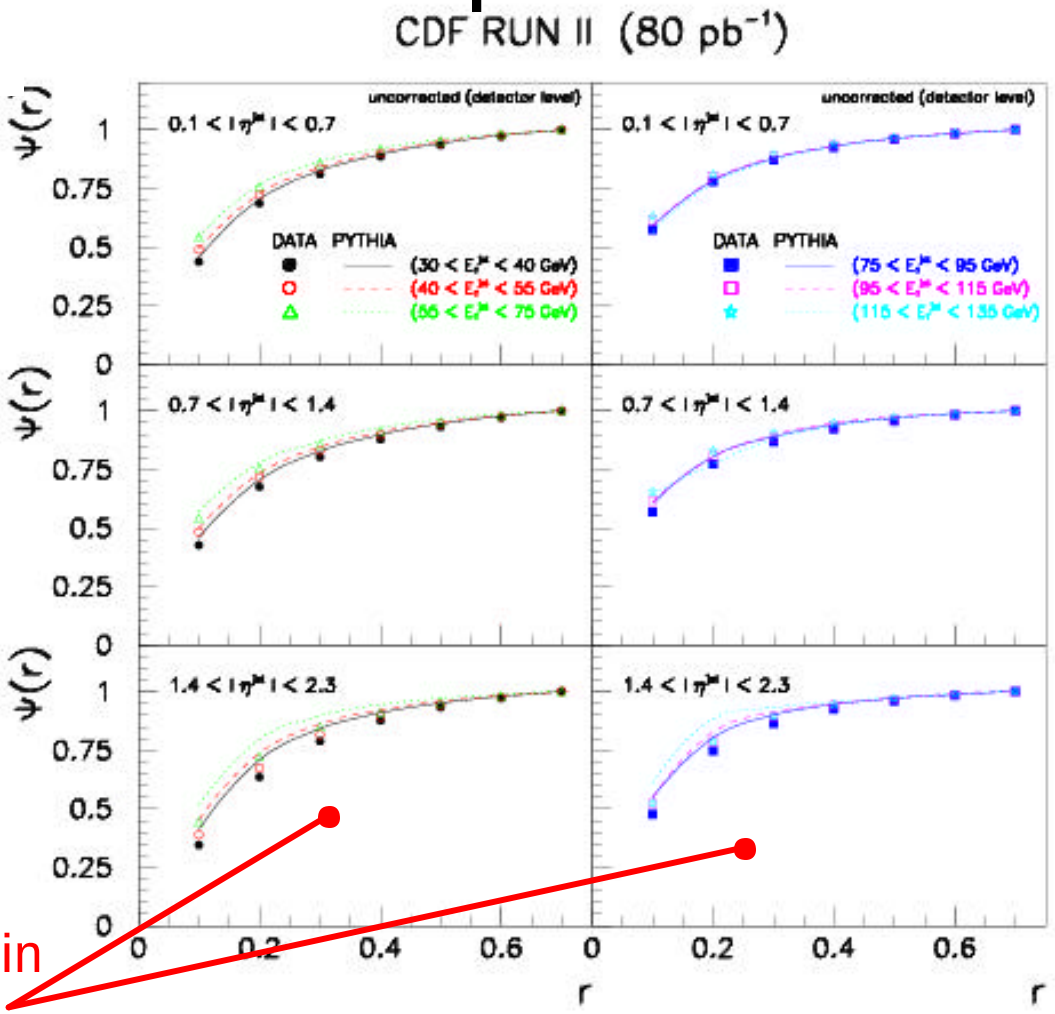
...will need improved shower simulation...

Integrated Jet Shapes CAL



$$\Psi(r) = \frac{1}{N_{\text{jets}}} \Sigma_{\text{jets}} \frac{E_T(0,r)}{E_T^{\text{jet}}(0,R)}$$

$$\Psi(r = R) = 1$$



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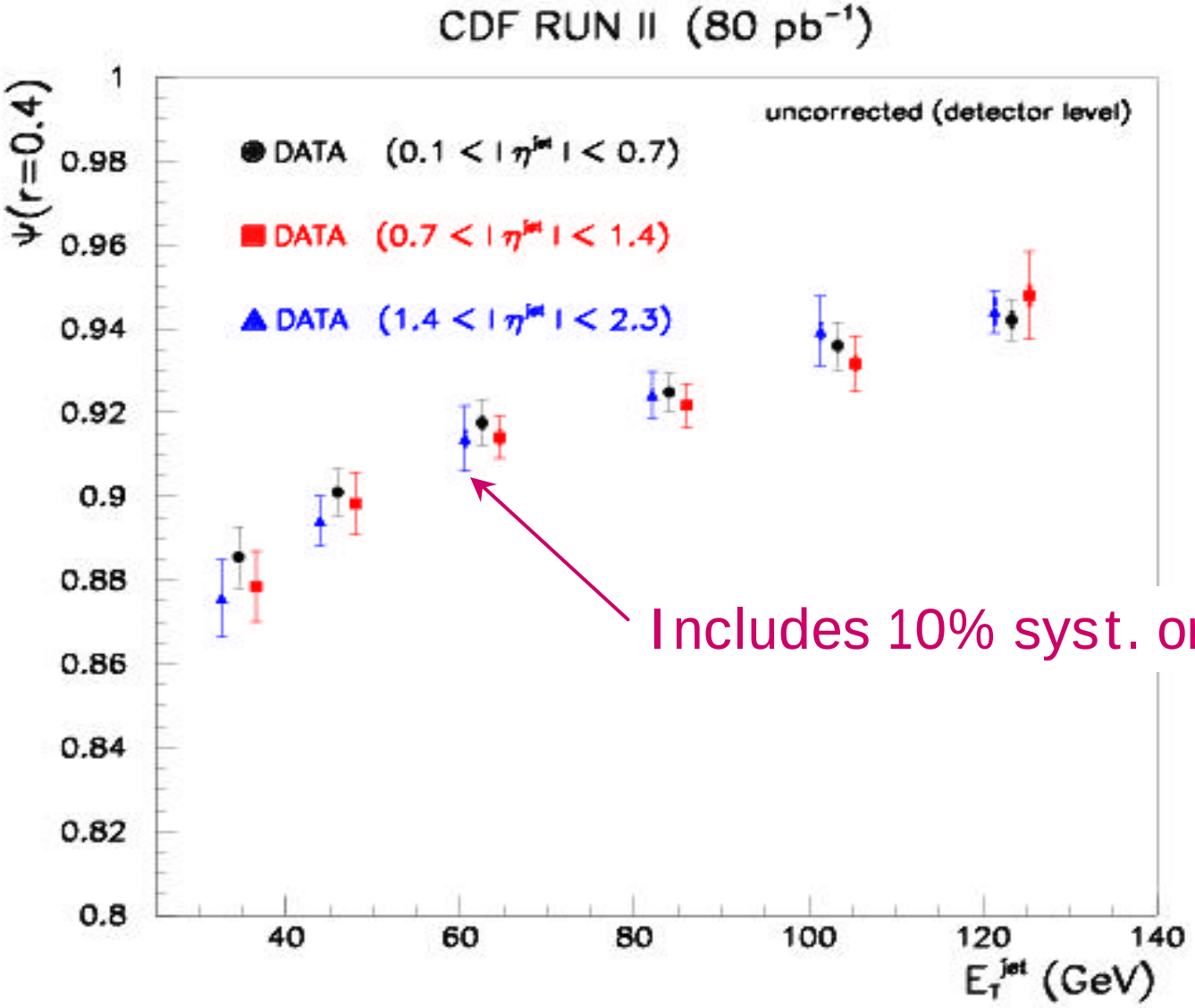
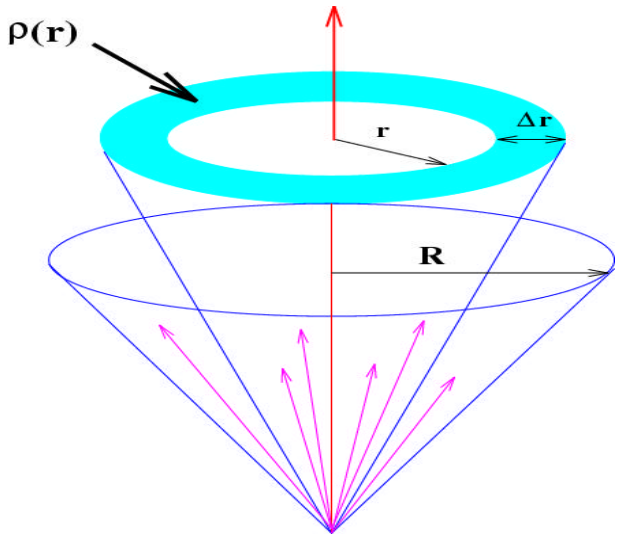


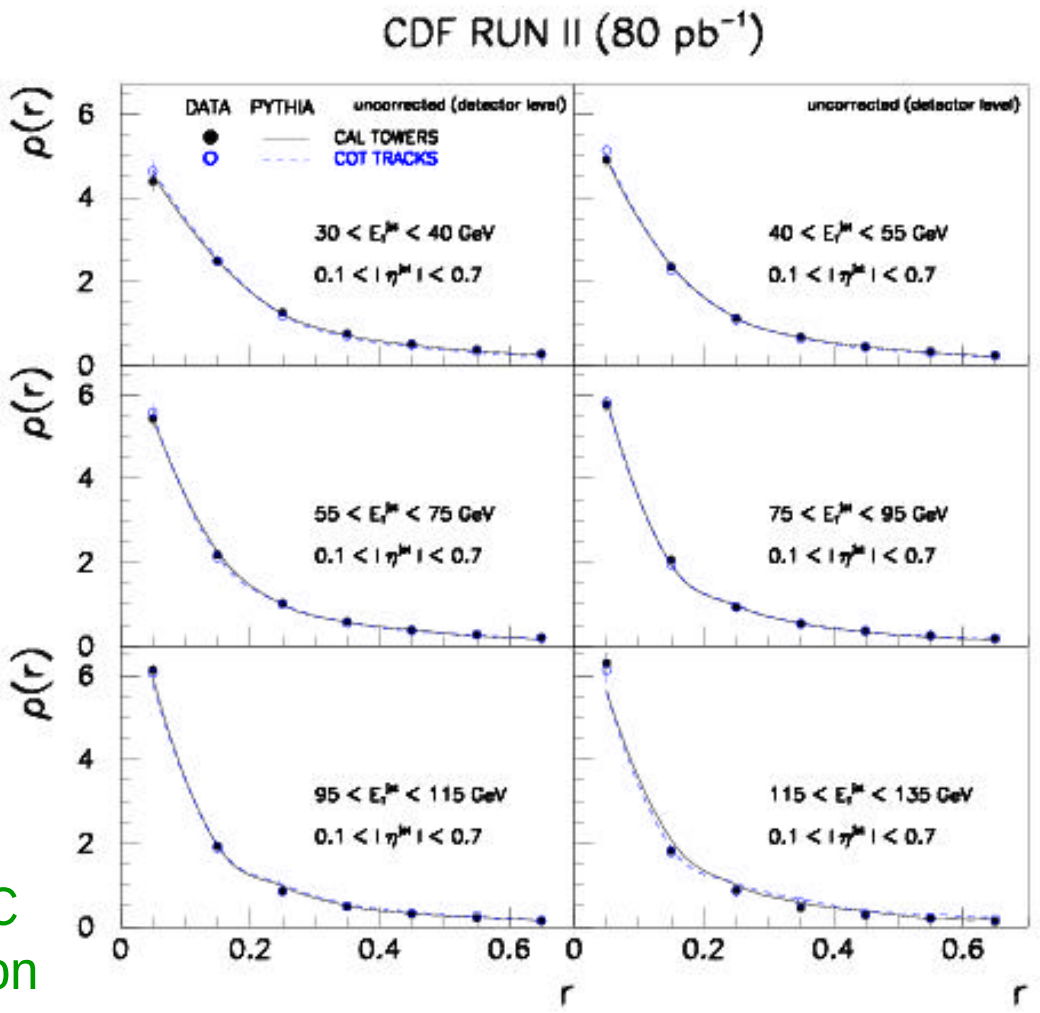
Includes 10% syst. on e-scale

Jet Shapes CAL/COT



$$\rho(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum P_T^{tracks}(r \pm \Delta r/2)}{\sum P_T^{tracks}(0,R)}$$

Perfect agreement DATA/MC and COT/CAL in central region



Plan to include pythia jet60 sample

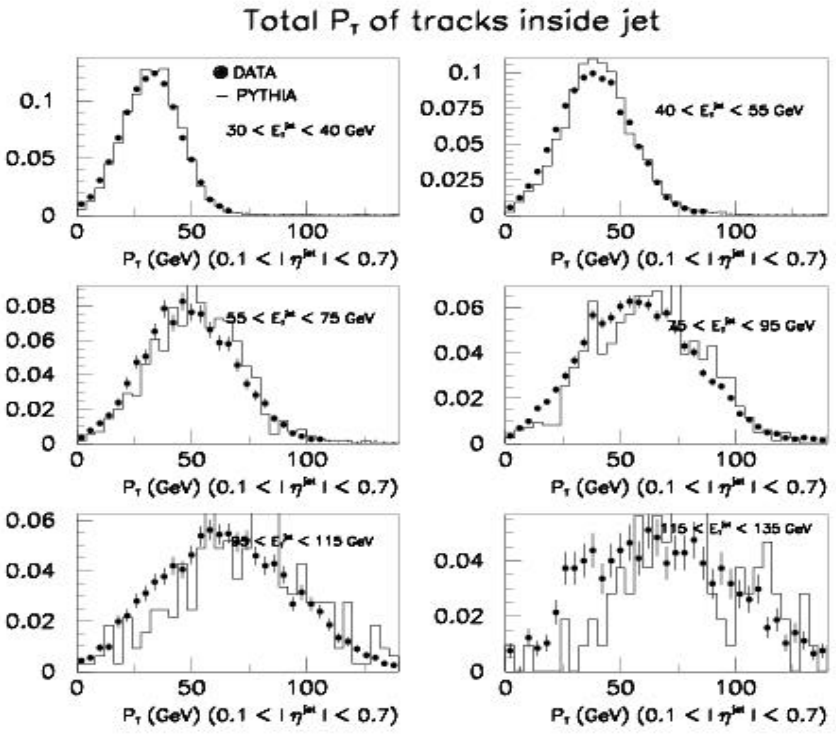
Tracks inside Jets

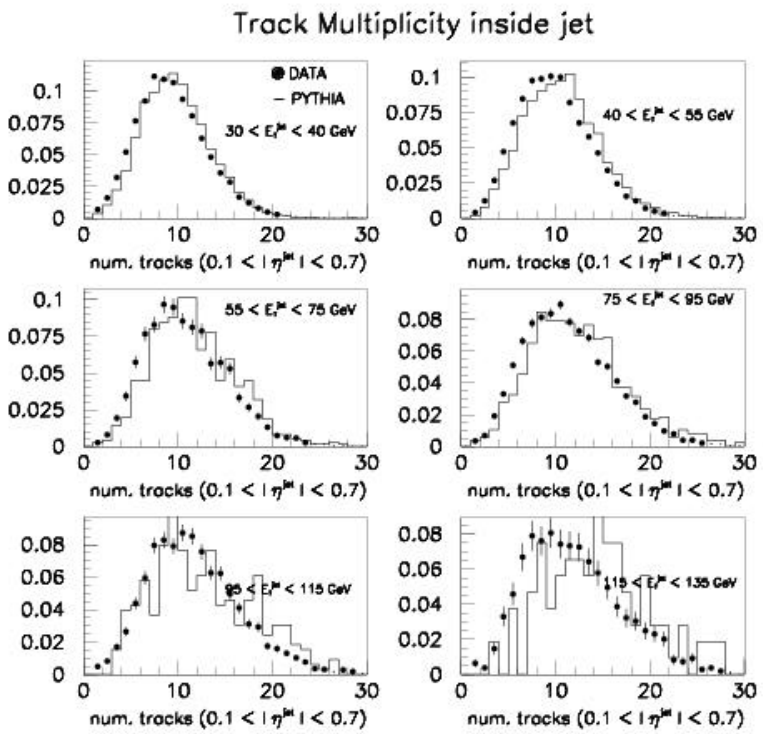
$500\ \text{MeV} < P_T^{\text{track}} < 100\ \text{GeV}$

$|\eta^{\text{track}}| < 1.0$

$|z^{\text{track}} - V_z| < 2\ \text{cm}$

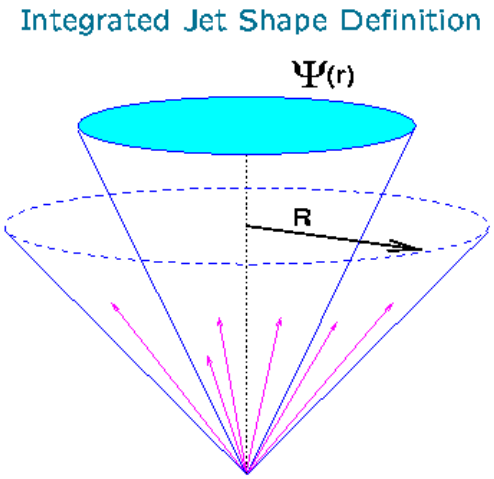
$\Delta R(\text{track - jet}) < 0.7$

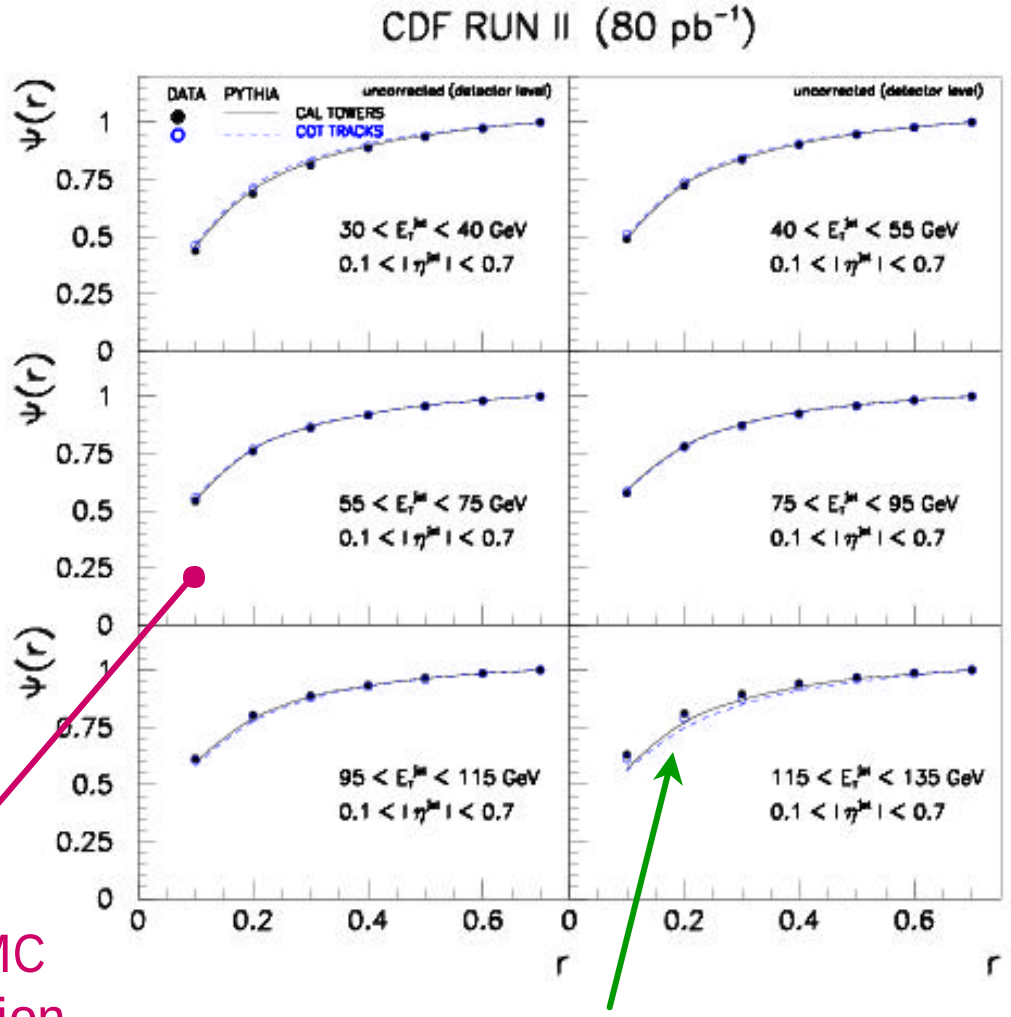




Needs more statistics in the MC at very high jet transverse energy

Jet Shapes CAL/COT





Perfect agreement DATA/MC and COT/CAL in central region

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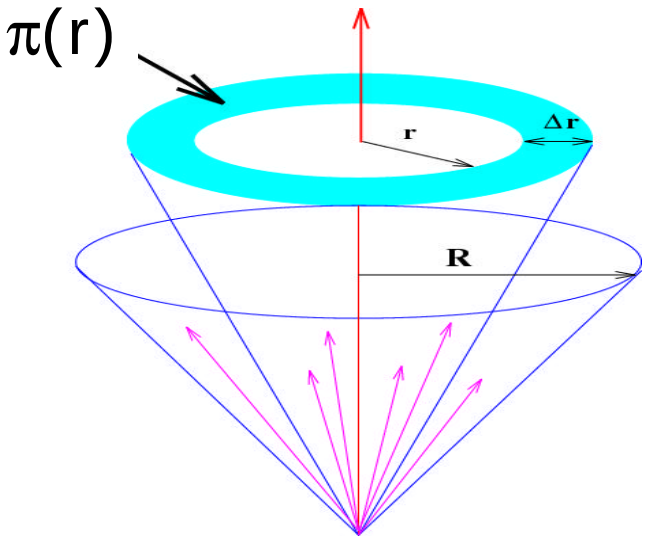
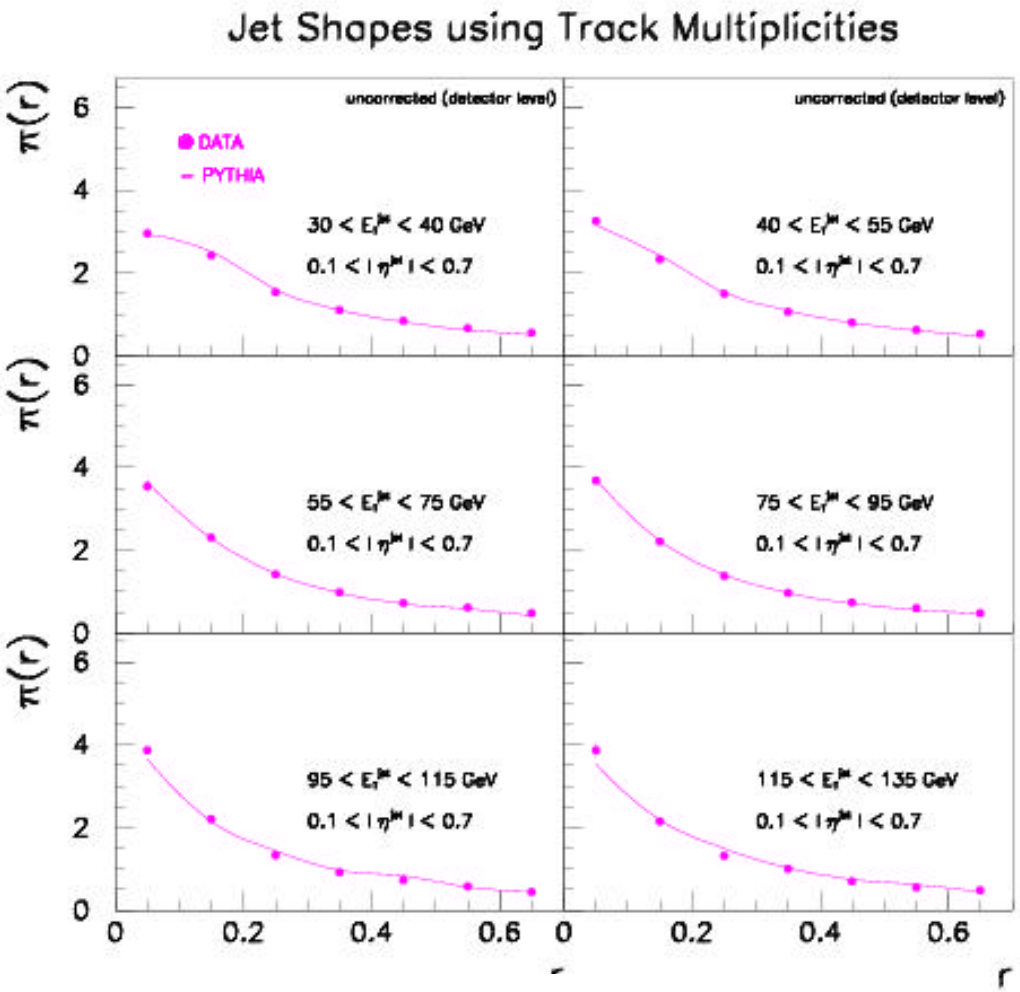
..Using Track Multiplicities

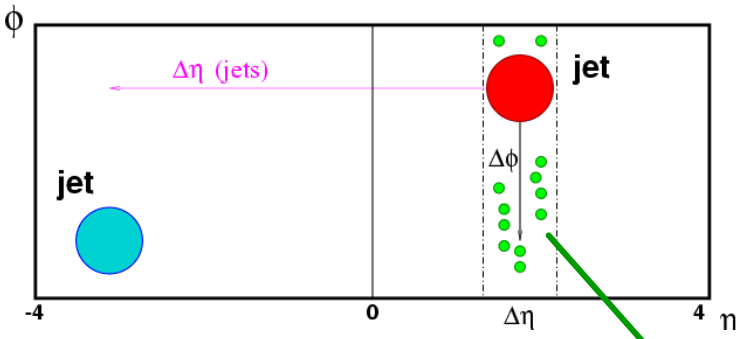


$$\pi(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum N_T^{tracks}(r \pm \Delta r/2)}{\sum N_T^{tracks}(0,R)}$$



MC describes how tracks are distributed inside the jet

Study of Energy Flows

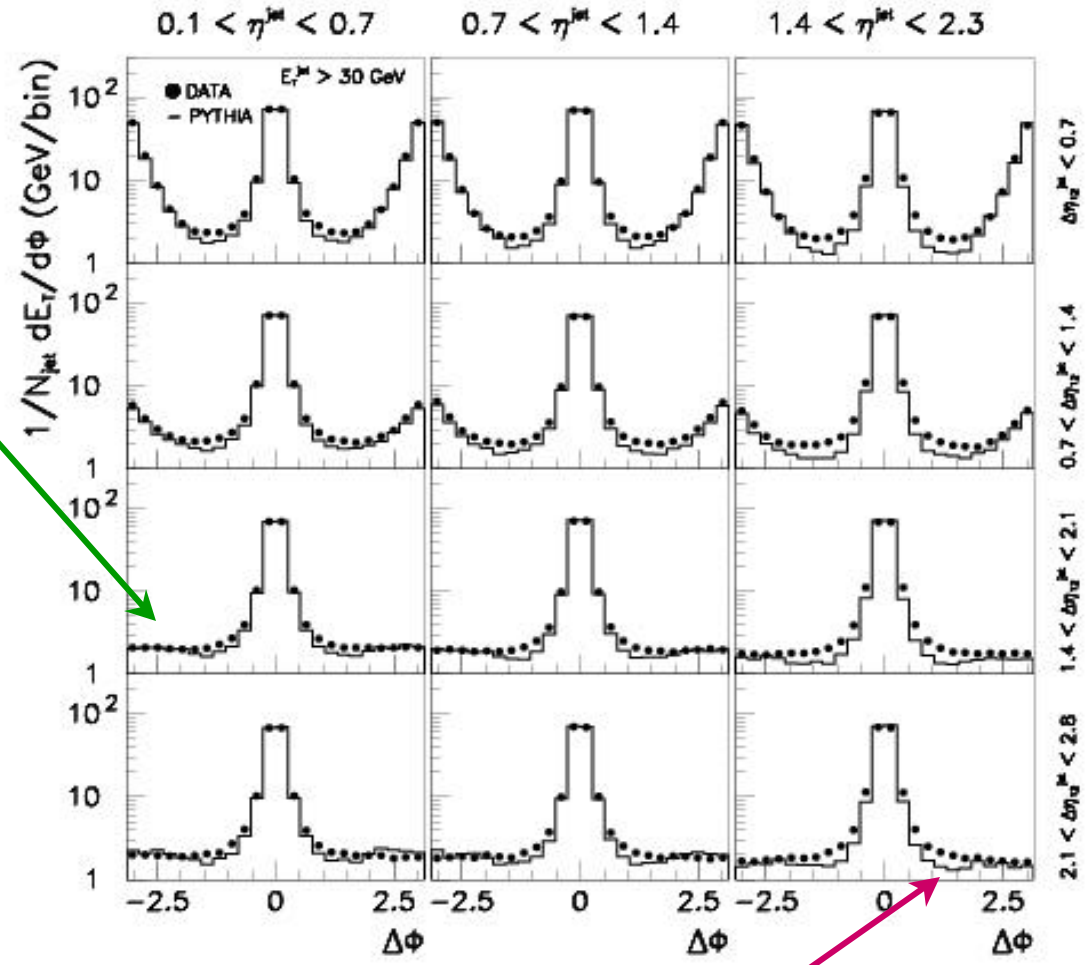


Dijets ($E_T^{jet} > 30$ GeV)

(no corrected for the moment)

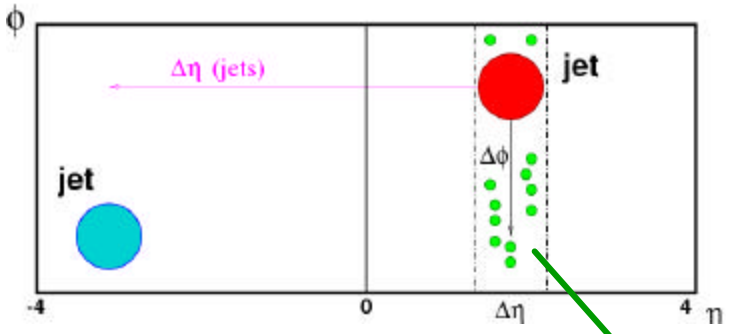
Selecting events with only one primary vertex

Energy Flows around jets sensitive to Underlying Event and soft gluon radiation



Forward region affected by MC simulation …

Study of Energy Flows (II)

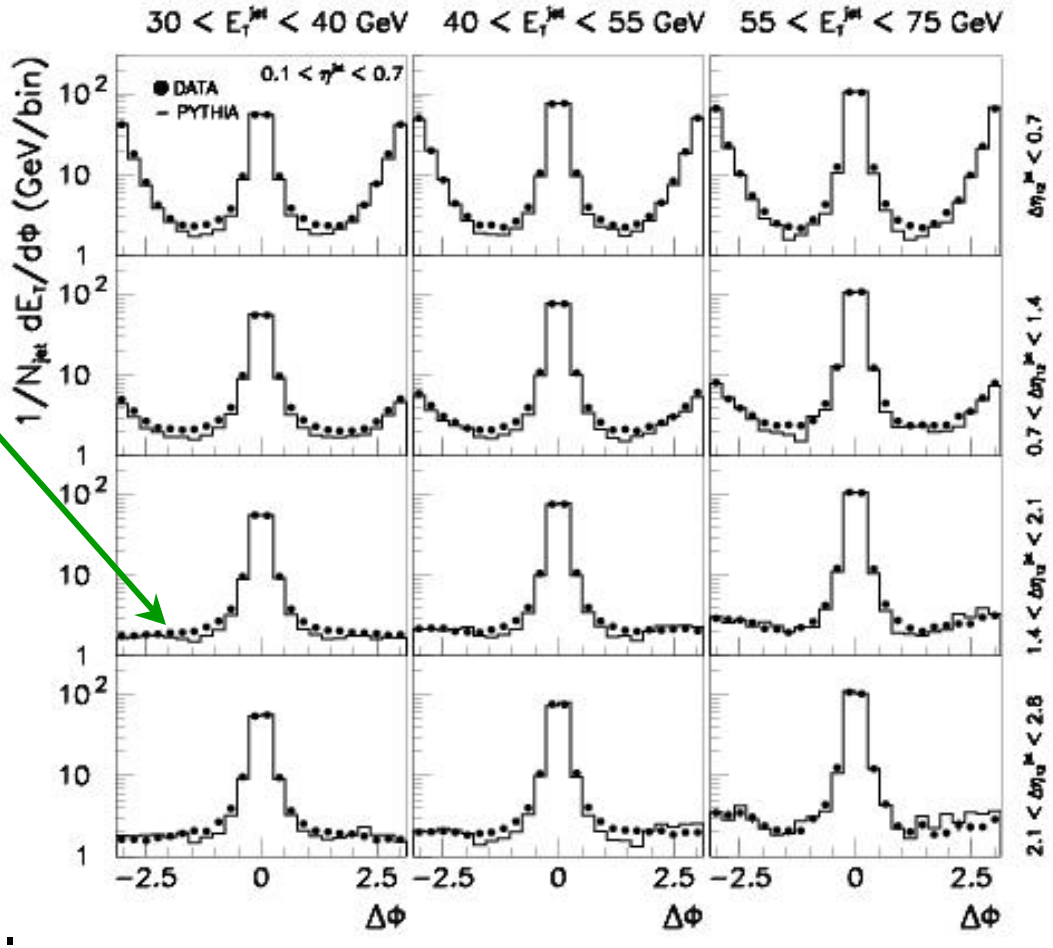


Just for central jets

$0.1 < |\eta| < 0.7$

PYTHIA with Set (A) tuning of underlying event provides a reasonable description

Repeat this with tracks..



Comparison with HERWIG on the way…

Summary and Conclusions

- **Results updated with latest version of MC and DATA**
- **Very good agreement in the central region**
- **Absolute corrections not applied until MC is understood**
- **Forward Region affected my MC simulation**
- **PYTHIA describes both the jet (shape and hardness) and the underlying event structure**
- **….Include HERWIG in the picture as soon as we can**