Update
Inclusive Jet Cross Section in the Forward Region

K_T Algorithm

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IFAE-Barcelona

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Outline

- Inclusive Jet Cross Section using K_T algorithm
  Measurements Extended to the Forward Region

  → Trigger Efficiency

  → MC Studies
    - Dijet Balance
    - Bisector Method

  → Average P_T^{Jet} corrections

  → Unfolding Procedure

  → Hadronization corrections

  → Comparison to NLO

  → Plans

Analysis

- **Inclusive Jet Cross Section using K_T algorithm**
  Measurements Extended to the Forward Region

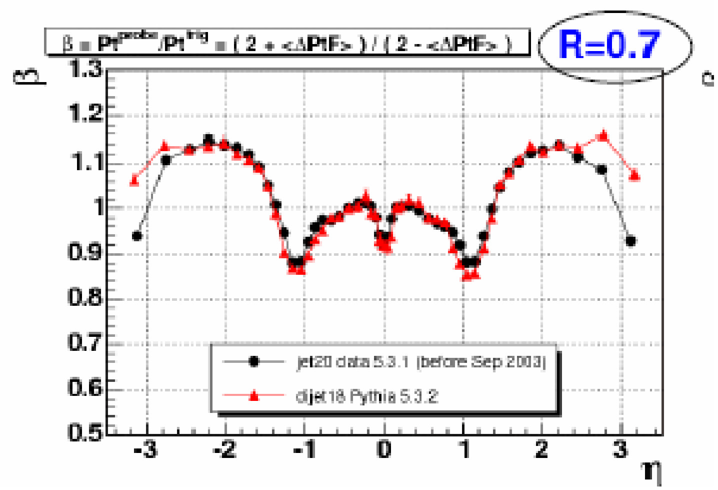
→ Using v5.3.1 Data (analyzed using v5.3.3) and v5.3.3 MC

Data : Jet20, Jet50, Jet70 and Jet100 datasets-> **L=385 pb^{-1}**
Good Run list version 7

MC : Di-Jet Pythia "TuneA" (Pt min:0,10,18,40,60,90,120,150,200,300,400 and 500)

→ **5 different Y regions**

- Region 1 : |Y|< 0.1 (Central crack)
- Region 2 : 0.1 < |Y|< 0.7 (Central Calorimeter)
- Region 3 : 0.7< |Y|< 1.1 (Central Cal. + crack)
- Region 4 : 1.1 < |Y|< 1.6 (Plug Cal. + crack)
- Region 5 : 1.6 < |Y|< 2.1 (Plug Calorimeter)

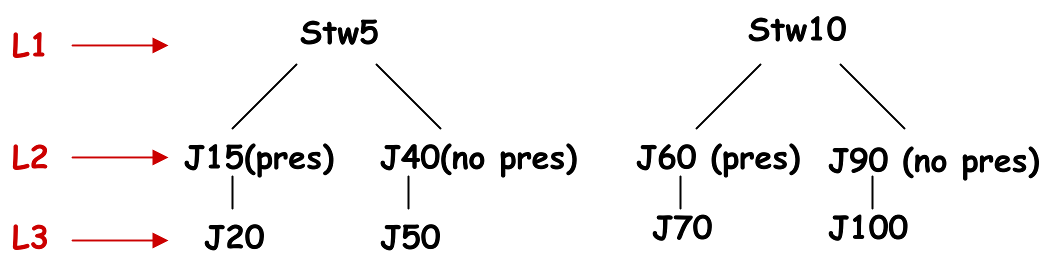


→ Event Selection

- Jets defined with K_T algorithm (D=0.7)
- Vertex position $|V_Z|$ <60 cm
- E_T^{miss} significance <$F(P_T^{jet})$ where $F(P_T jet)=\min(2+5/400*P_T^{jet}\ (\text{leading jet}),7)$

Trigger Efficiency Studies

- Trigger Structure



Note that

Prescale changed for:
(New trigger tables)

L1_Stw5 run>=184444 20 → 50

L2_Stw5 run>=184310 600 → 1000

↓ Stw5 J20 J50

- Study the L1, L2 and L3 Trigger Efficiency from data

  → High P_T muons: Eff. Stw5(L1)

  → Stw5 data : Eff. J15(L2) and J20(L3)

  → Jet20 data : Eff. Stw10(L1) ,J40(L2) and J50(L3)

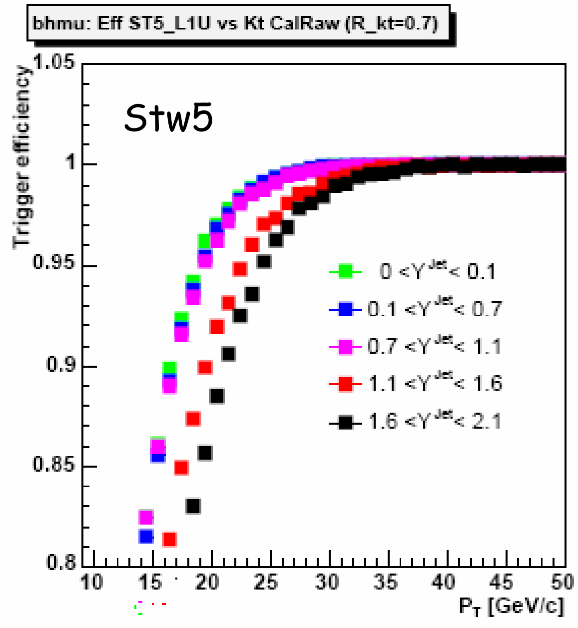
  → Jet50 data : Eff. J60(L2) and J70(L3)

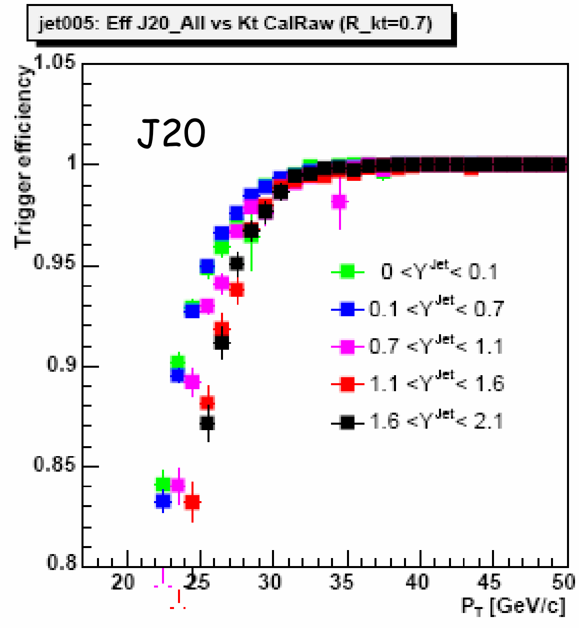
  → Jet70 data : Eff. J90(L2) and J100(L3)

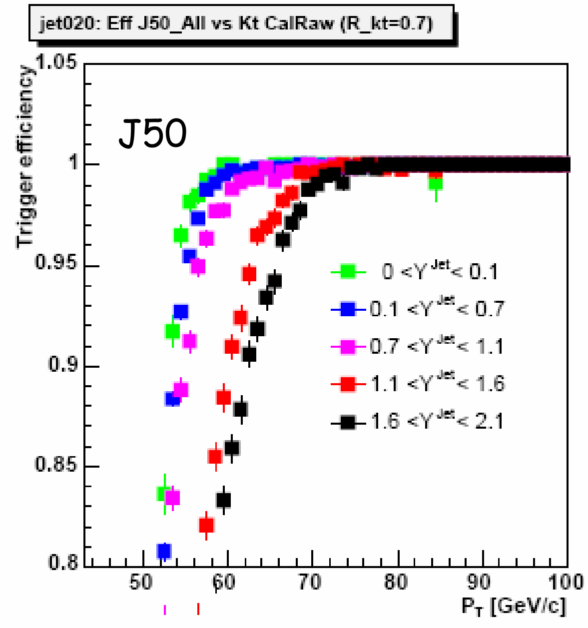
- Select Trigger Efficiency Threshold where the Efficiency is 99% ($L1 \times L2 \times L3$)

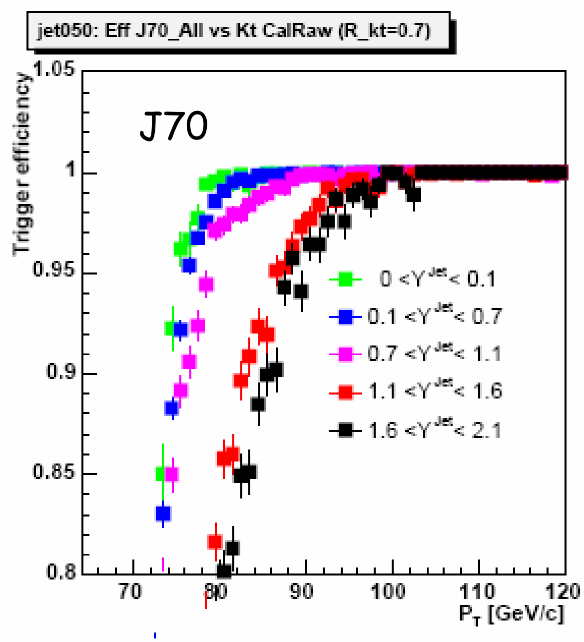
  → To avoid systematics due to energy scale uncertainties, the obtain thresholds are increased of 5%

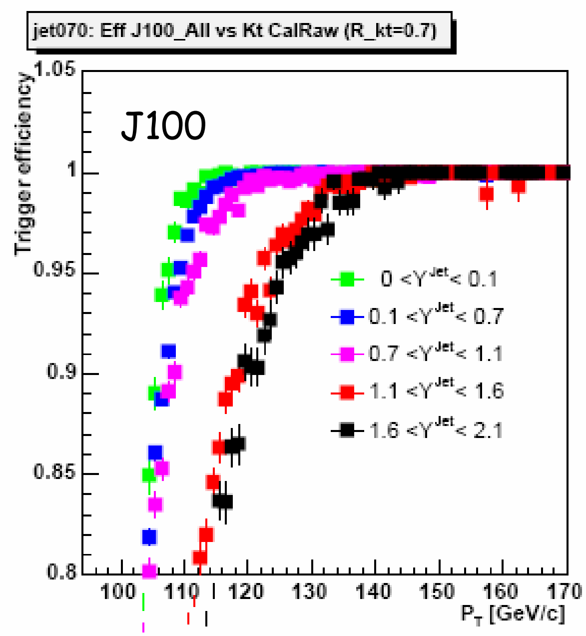
Trigger Efficiency Cuts







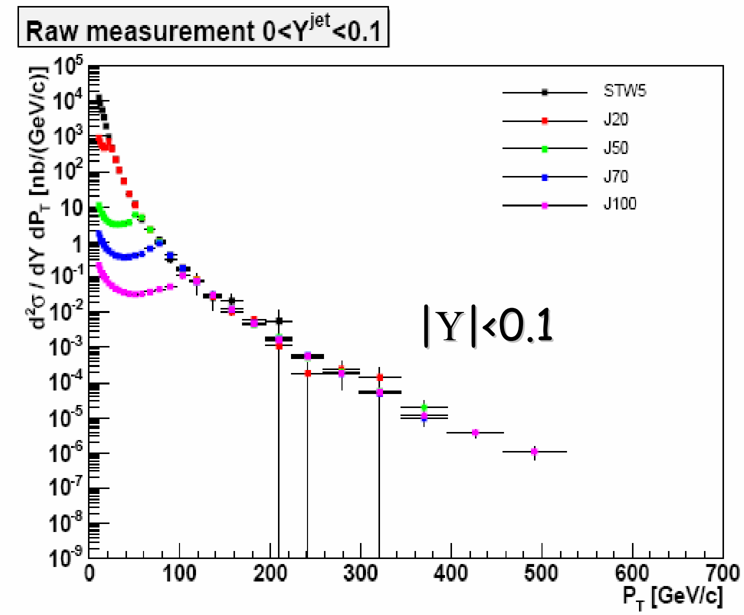


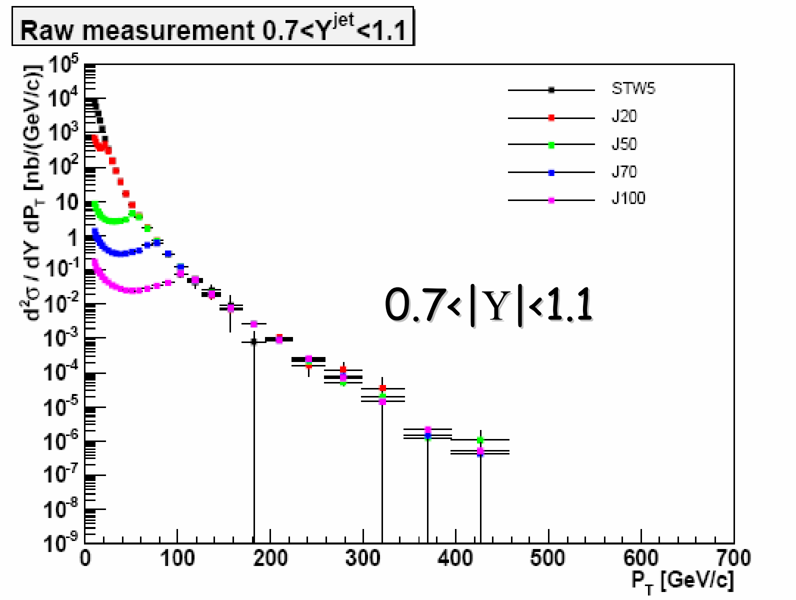


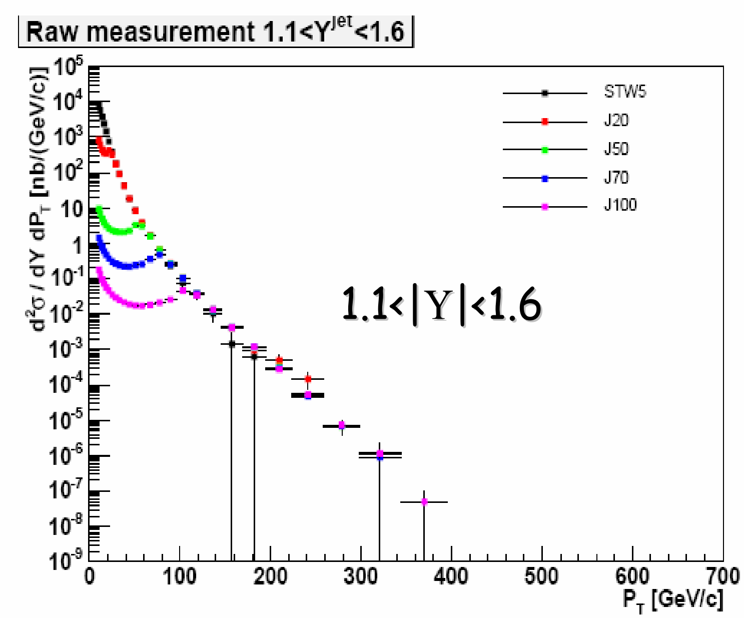
Minimum P_T^{Jet} Uncorrected (GeV/c) for each trigger

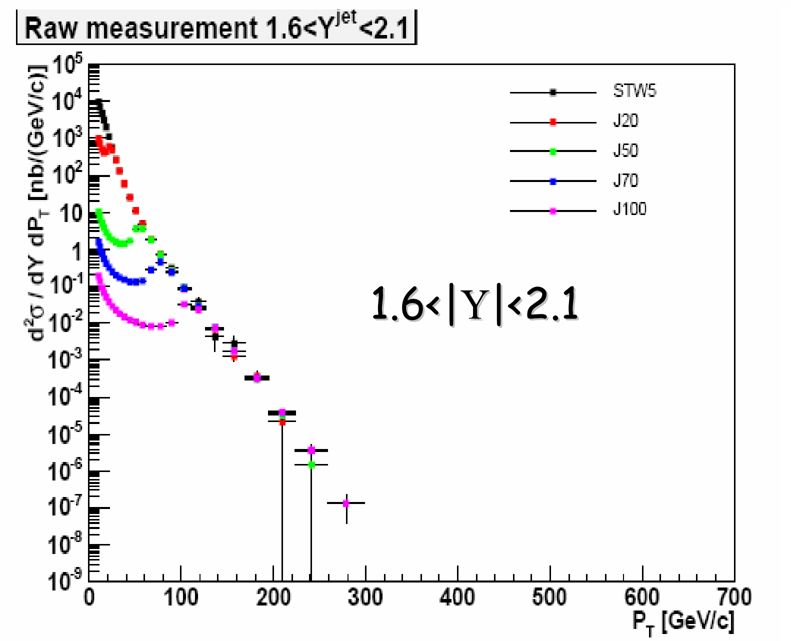
	Rap1	Rap2	Rap3	Rap4	Rap5
Stw5	26	26	27	32	33
J20	32	35	33	34	33
J50	60	61	65	72	74
J70	81	84	91	97	101
J100	117	120	124	138	140

Raw Cross Section

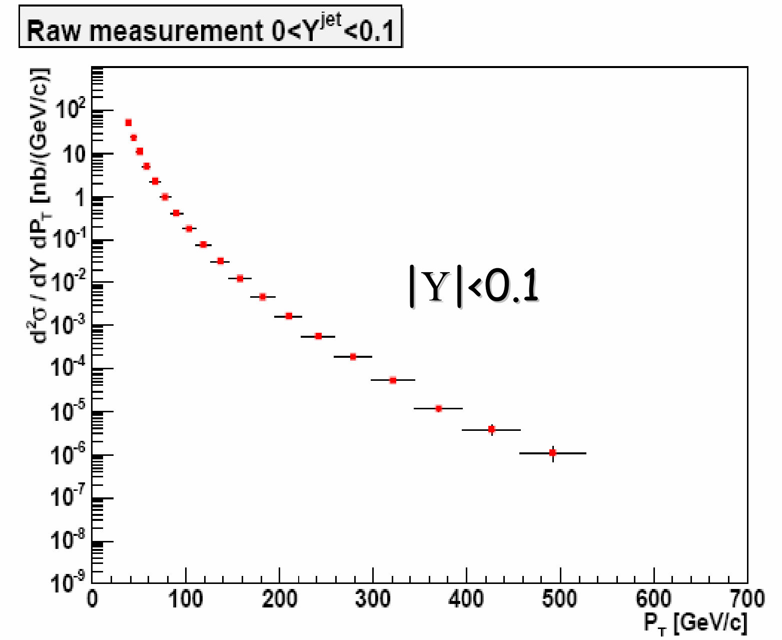


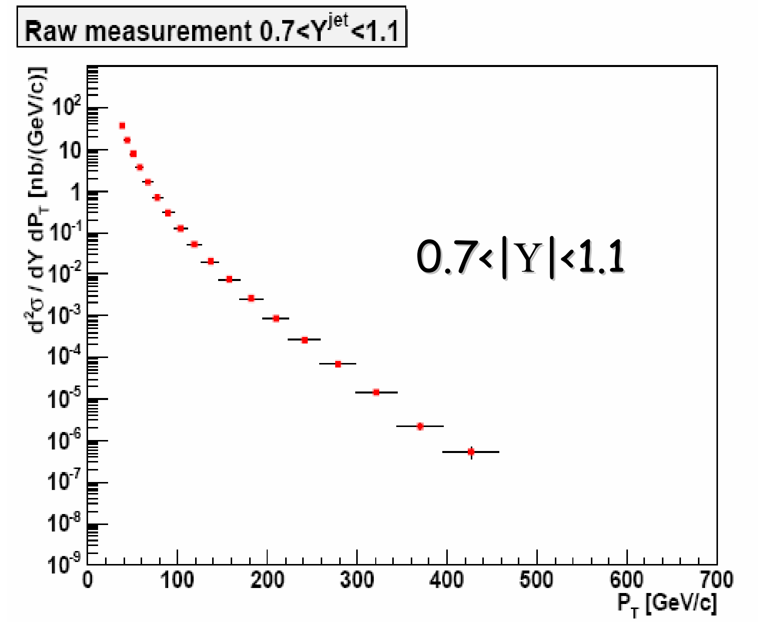


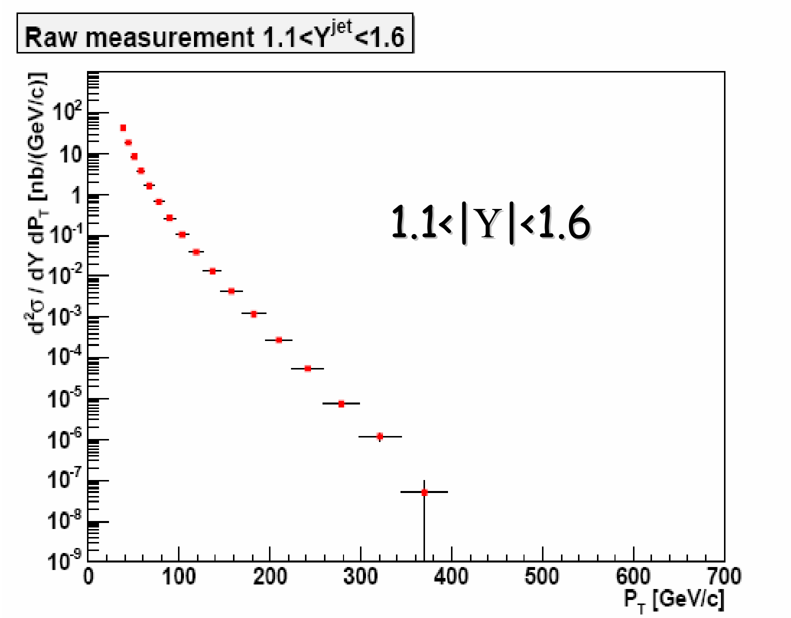


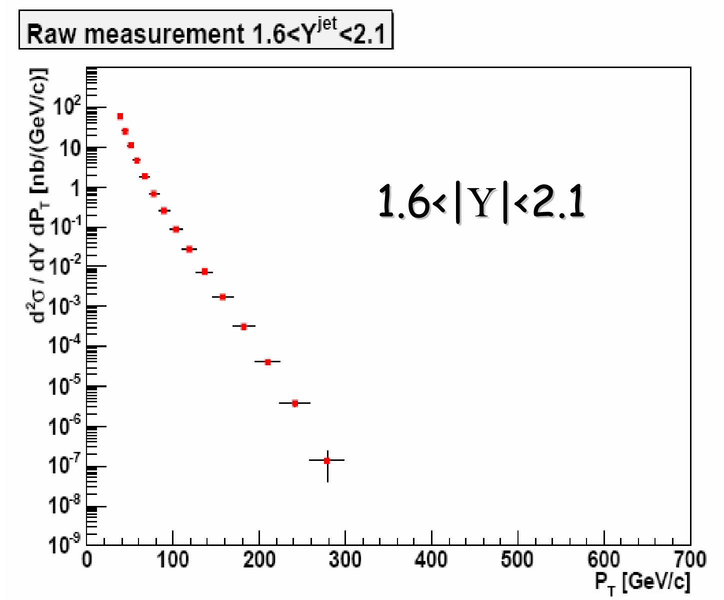


Raw Cross Section

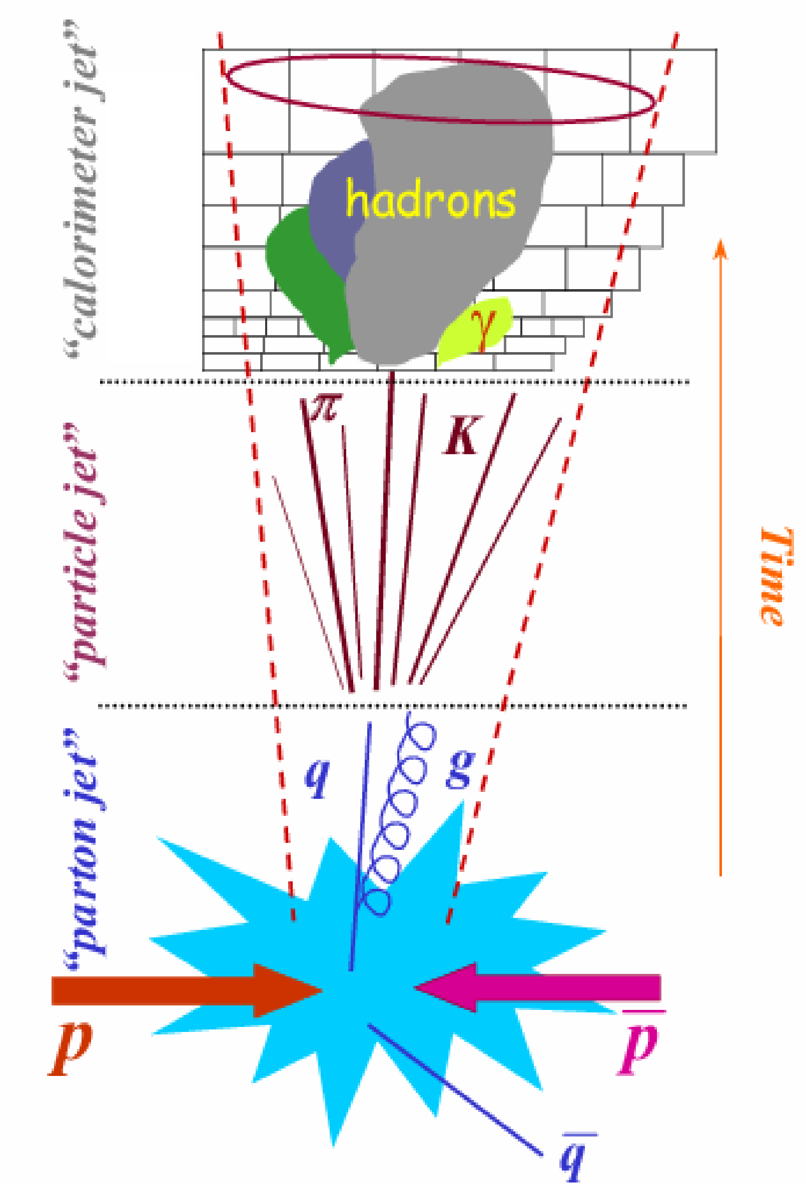








Corrections



We want that measurements are detector independence…

From calorimeter to hadron level

- Average p_T correction

  To correct the average Energy lost in the calorimeter

- Unfolding correction

  To take out the smearing/resolution effects

The MC simulation is good in the central part of the detector…what about the forward region?

MC Studies

- Compare Raw variables -> already showed in previous meetings

- Dijet Balance -> understand the energy scale
- Bisector Method -> study the resolution

- Event Selection

  - 2 and only 2 jets with $P_T^{Jet} \geq 10$ GeV/c
  - 1 and only 1 primary vertex ($|Vz|<60$cm)
  - Missing E_T significance cut applied in both jets

Dijet Balance: method

- Event Selection
  - One jet (Trigger Jet) with $0.2 < \eta_D < 0.6$
  - The other jet (Probe Jet) with

    $0 < Y^{Jet} < 0.1$; $0.1 < Y^{Jet} < 0.7$; $0.7 < Y^{Jet} < 1.1$; $1.1 < Y^{Jet} < 1.6$; $1.6 < Y^{Jet} < 2.1$

- Definitions

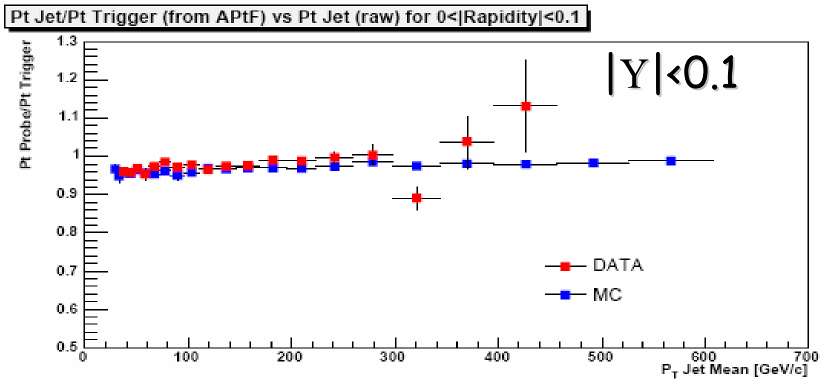
  -> $P_T^{Mean} = (P_T^{Trig} + P_T^{Prob})/2$

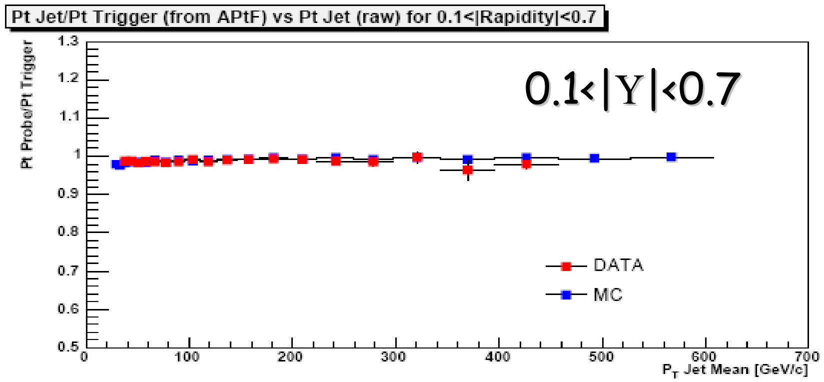
  -> $\Delta P_T^F = (P_T^{Prob} - P_T^{Trig})/P_T^{Mean}$

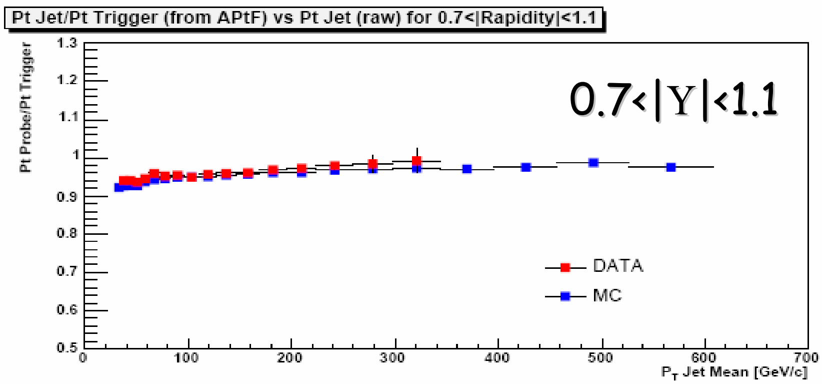
  -> In bin of P_T^{Mean} : $\beta = (2 + \langle \Delta P_T^F \rangle)/(2 - \langle \Delta P_T^F \rangle)$

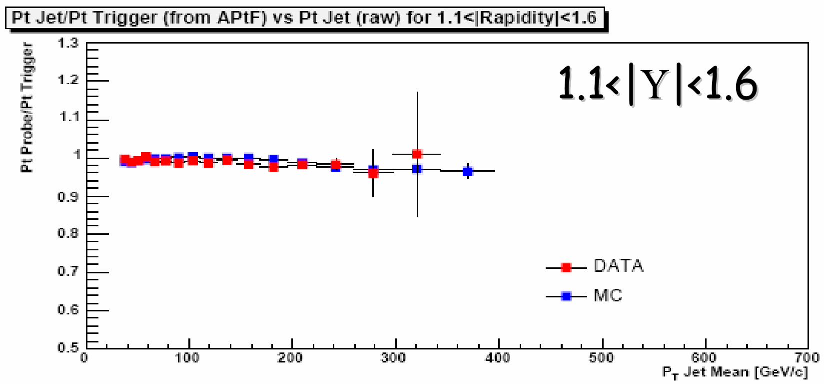
  event by event: $\beta = P_T^{Prob} / P_T^{Trig})$

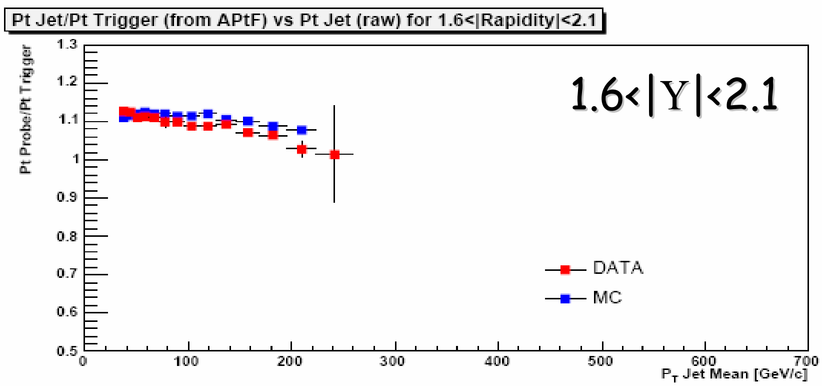
Dijet Balance: results



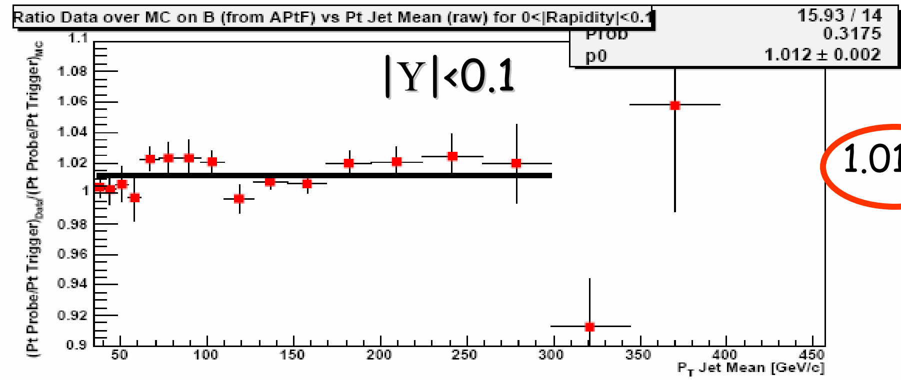




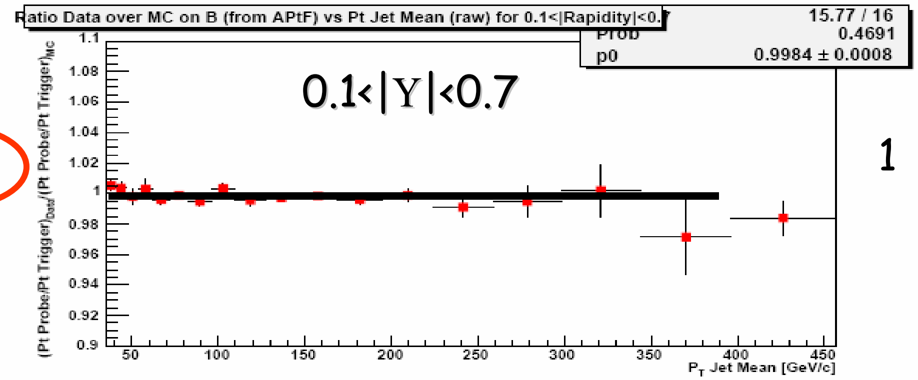




Dijet Balance: Data/MC



1.012



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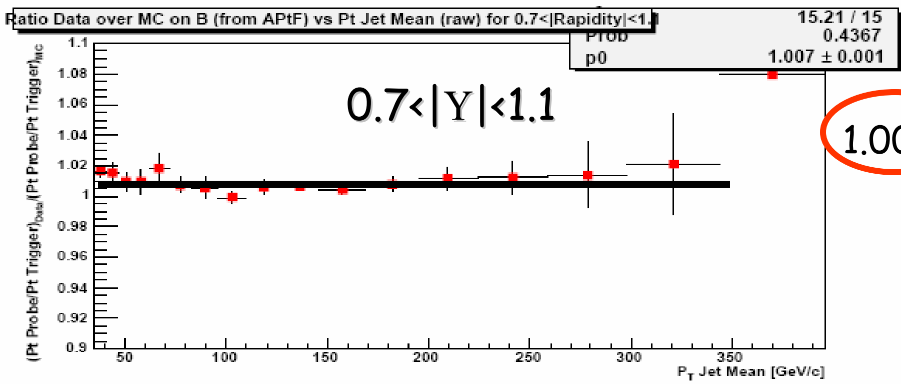
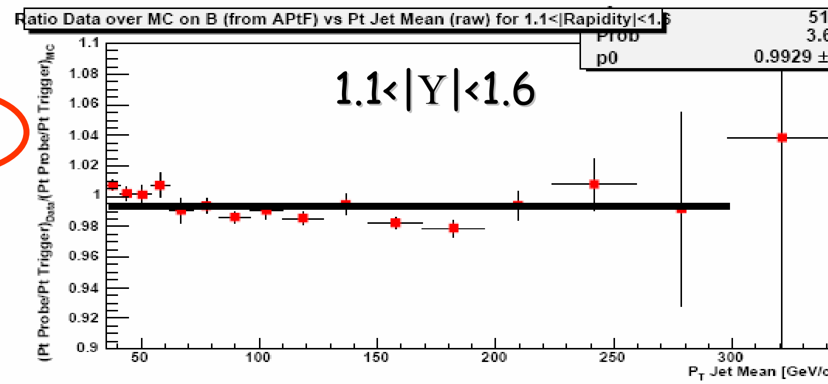
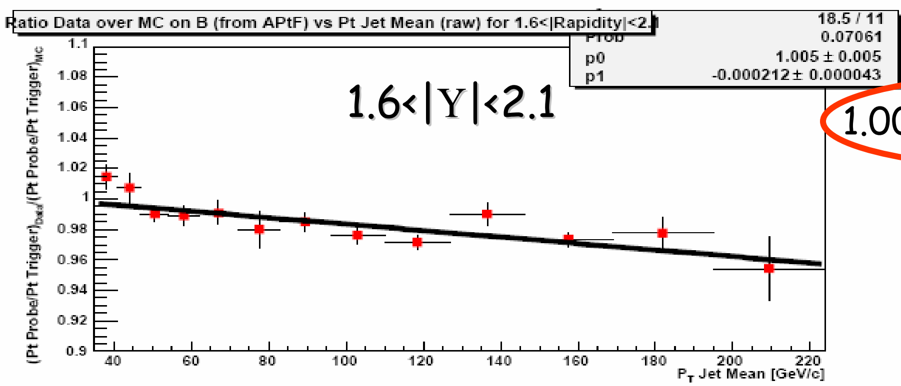


1.007



0.993



$1.005*(-0.0021 *P_T^{Jet})$

We apply these correction in the P_T^{Jet} at Calorimeter Level in the MC

Bisector Method

- Event Selection
  - One jet (Jet 1) with $0.1 < Y^{Jet} < 0.7$
  - The other jet (Jet 2) with

    $0 < Y^{Jet} < 0.1$; $0.1 < Y^{Jet} < 0.7$; $0.7 < Y^{Jet} < 1.1$; $1.1 < Y^{Jet} < 1.6$; $1.6 < Y^{Jet} < 2.1$

- Definitions

  -> $P_T^{Mean} = (P_T^{Jet1} + P_T^{Jet2})/2$

  -> $\gamma = |(\phi^{Jet1} - \phi^{Jet2})/2|$

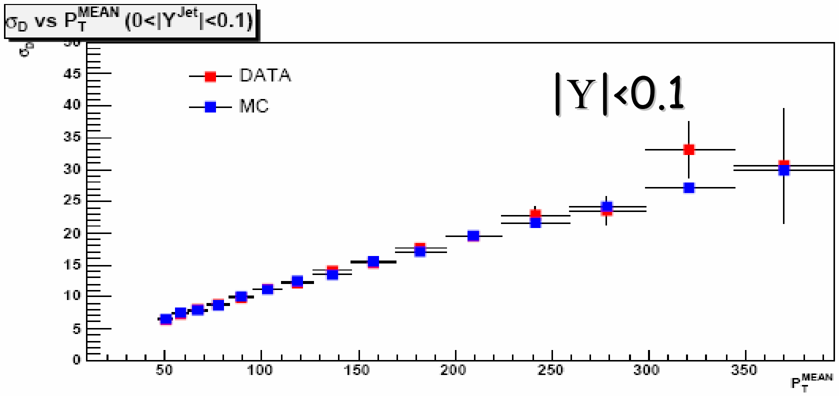
  -> $\Delta P_T^{//} = \pm (P_T^{Jet1} + P_T^{Jet2}) \cos(\gamma)$

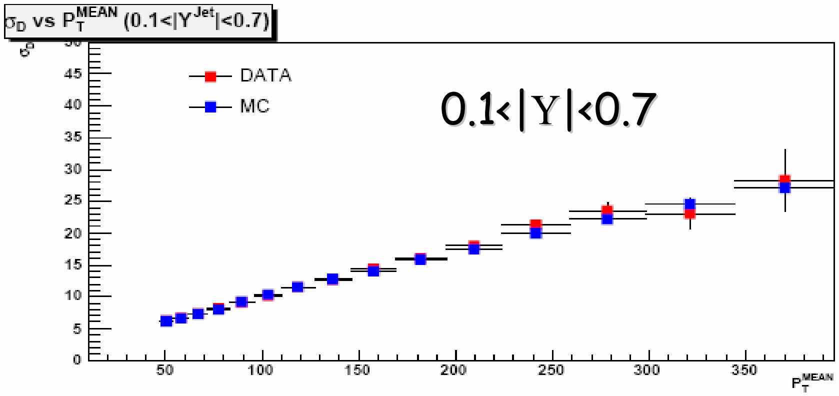
  -> $\Delta P_T^{PERP} = \pm (P_T^{Jet1} - P_T^{Jet2}) \sin(\gamma)$

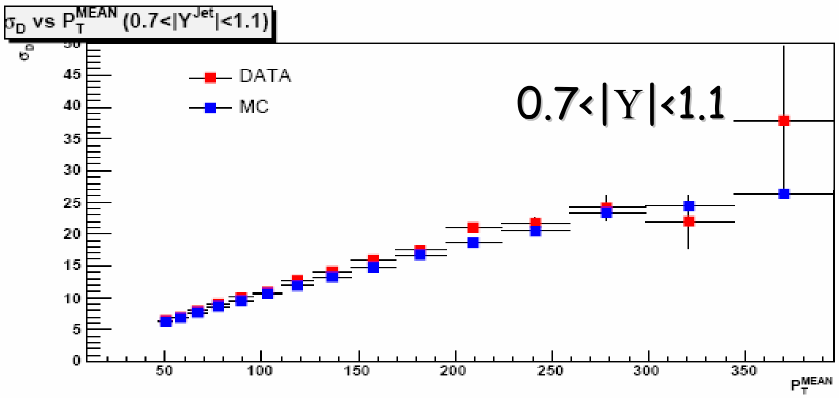
  -> In bin of P_T^{Mean} :

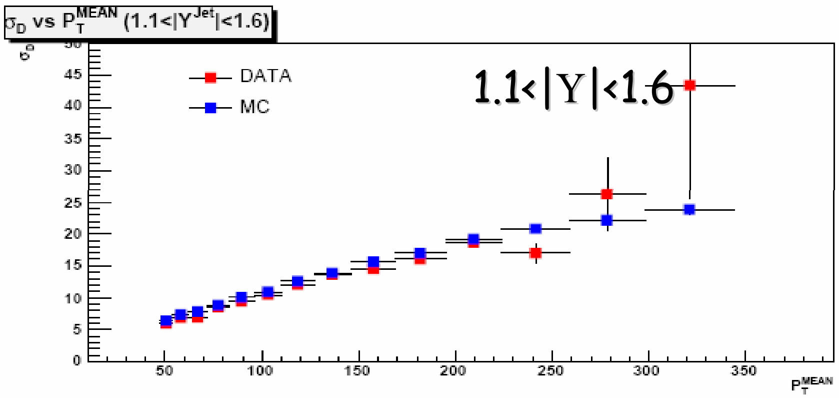
  - $\sigma_{//}$ = rms of $\Delta P_T^{//}$ distribution
  - σ_{PERP} = rms of ΔP_T^{PERP} distribution
  - $\sigma_D = \sqrt{(\sigma^2_{PERP} - \sigma^2_{//})} / \sqrt{2}$

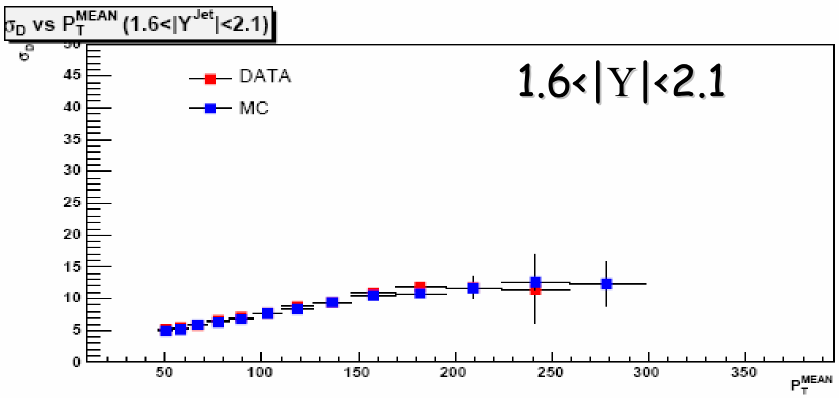
Bisector Method: results



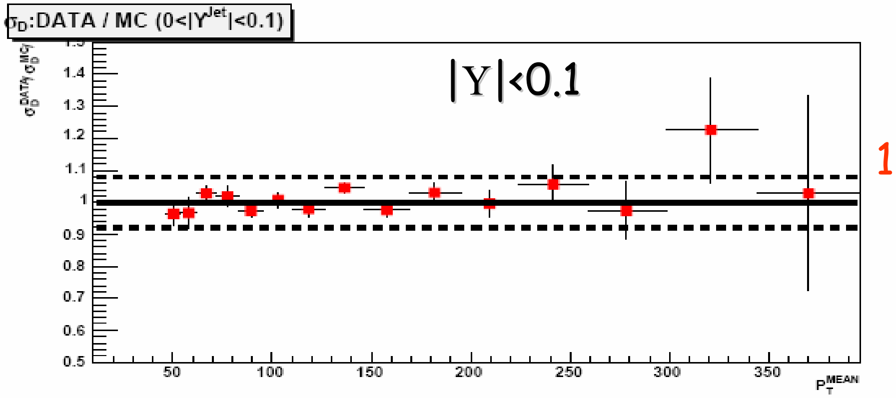


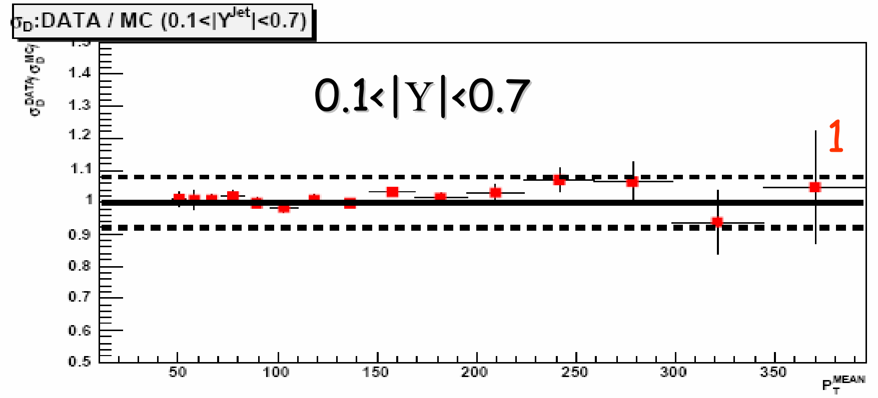


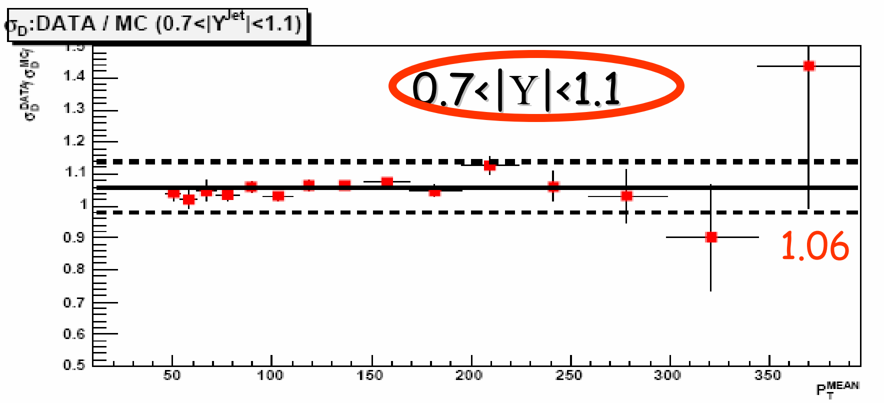


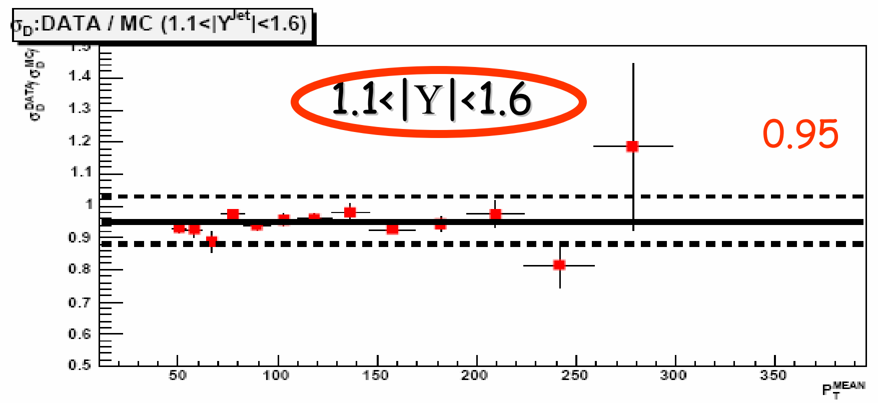


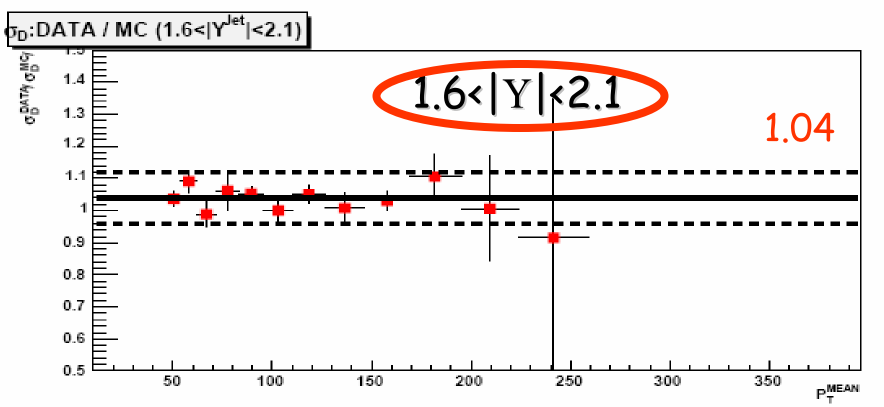
Bisector Method: Data/MC











We should apply correction in the P_T^{Jet} at Calorimeter Level in the MC.

We are working on it...

Average P_T^{Jet} Correction

- Use Pythia MC to make the average P_T^{Jet} Corrections

→ Reconstructed the Jets at Calorimeter(CAL) and Hadron (HAD) level

→ Pair CAL-HAD jets are matched in Y - ϕ space $\Delta R < 0.7$

$$\Delta R = \sqrt{Y^2 + \phi^2}$$

→ After apply corrections from Dijet Balance studies in the MC
(pending to apply correction from Bisector Method in the resolution)

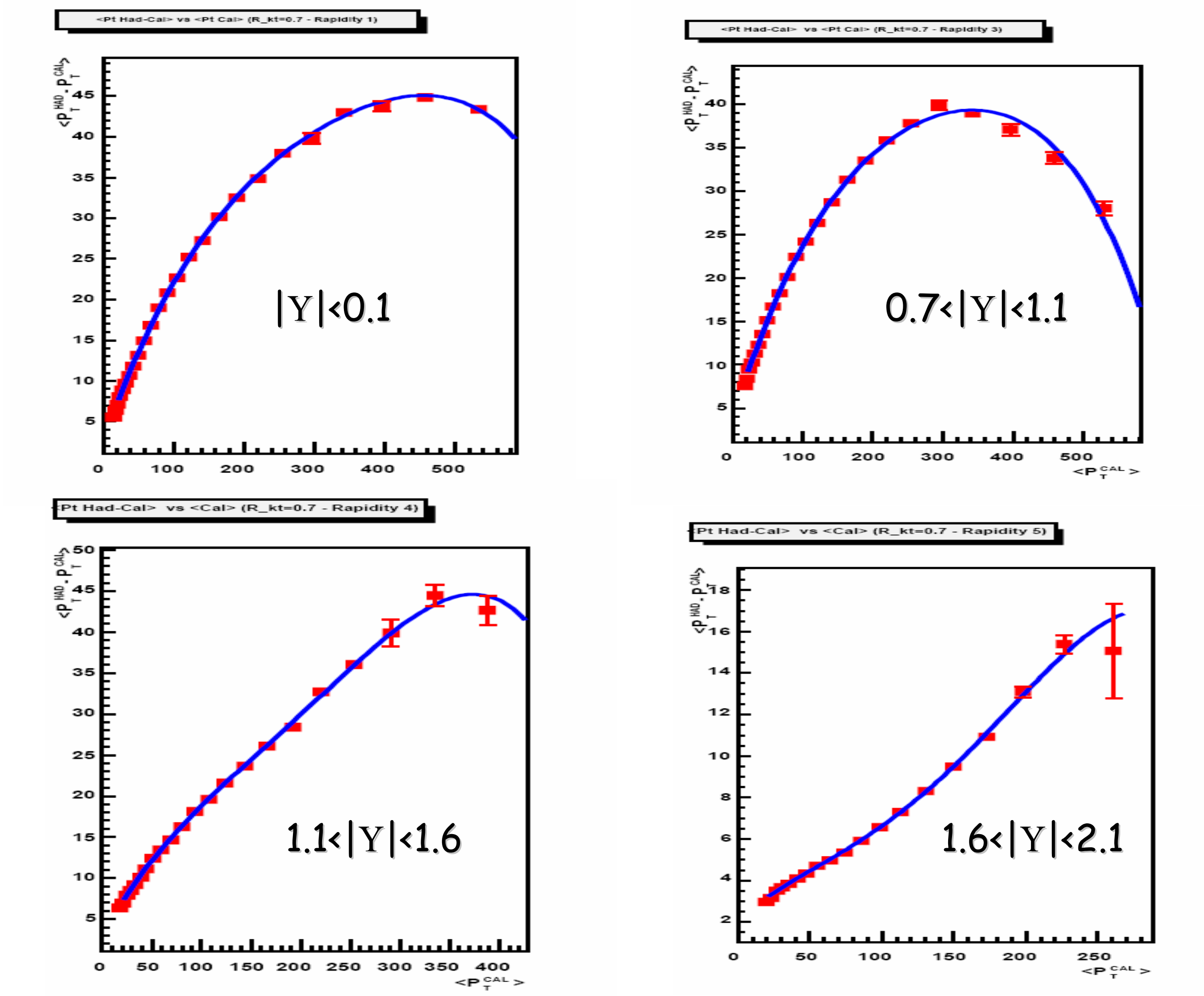
→ The correlation $\langle P_T^{Jet}(HAD) - P_T^{Jet}(CAL) \rangle$ versus $\langle P_T^{Jet}(CAL) \rangle$ for matched jets is reconstructed and fitted to a function form:

$$P_0 + P_1 * P_T^{jet}(CAL) + P_2 * P_T^{jet}(CAL)^2 + P_3 * P_T^{jet}(CAL)^3 + P_4 * P_T^{jet}(CAL)^4$$

P_T Average Corrections

$< P_T^{Jet}(HAD) - P_T^{Jet}(CAL) >$ vs $< P_T^{Jet}(CAL) >$

$(P_T^{HAD} + P_T^{CAL}) / 2$
bins



$P_0 + P_1 * P_T^{jet}(CAL) + P_2 * P_T^{jet}(CAL)^2 + P_3 * P_T^{jet}(CAL)^3 + P_4 * P_T^{jet}(CAL)^4$

Unfolding Procedure

- Use Pythia MC to correct back the jet spectrum to the hadron level

→ Count: the N_{Jet} Calorimeter level (all cuts)
N_{Jet} Hadron (no cuts)

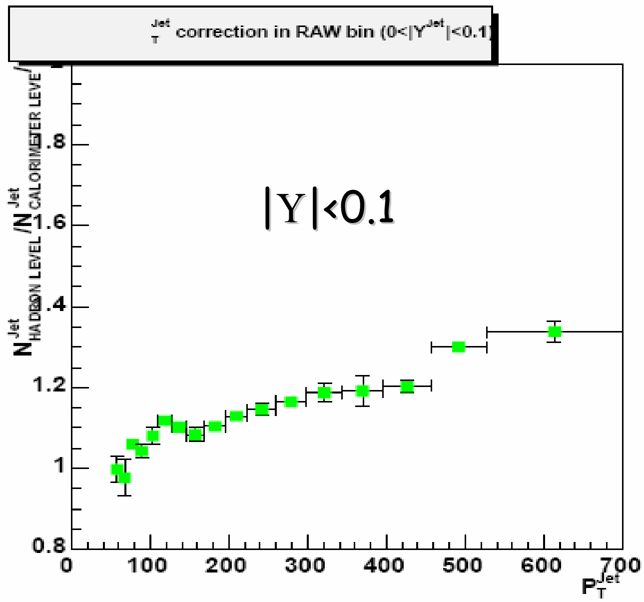
→ Bin-by-bin Corrections factors:

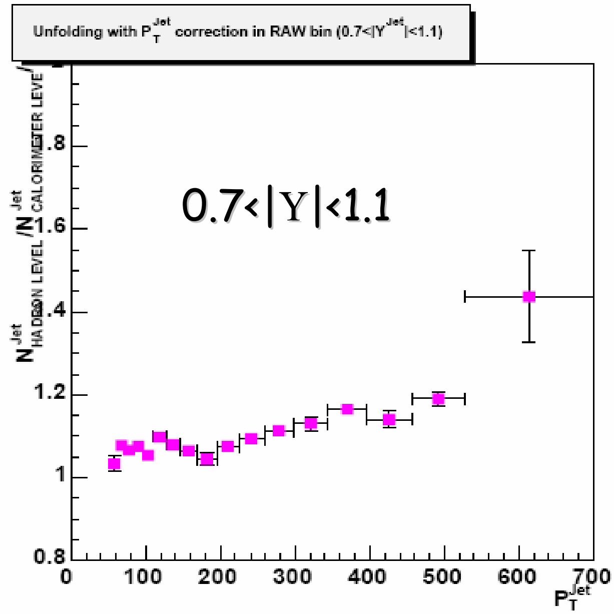
$$C_i = \frac{N_{Jet}\ \text{Hadron level}}{N_{Jet}\ \text{Calorimeter level}} \quad (P_T^{Jet}\ \text{bin } i)$$

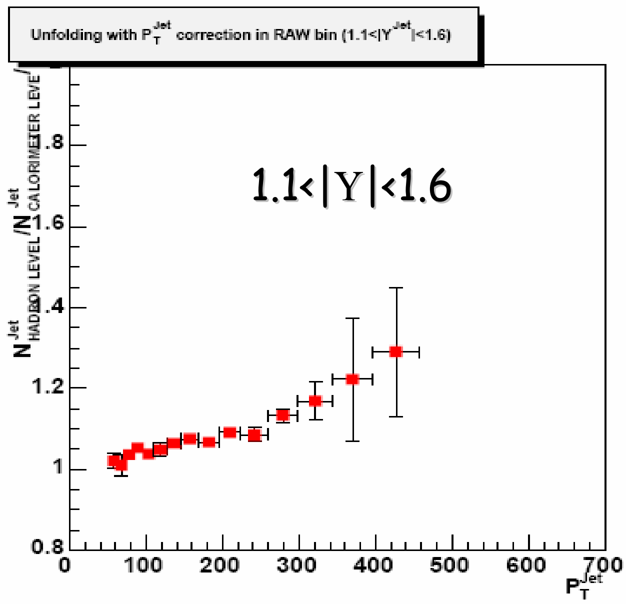
- Apply this bin-by-bin Corrections factors to the measured corrected P_T spectrum to unfold it to the hadron level.

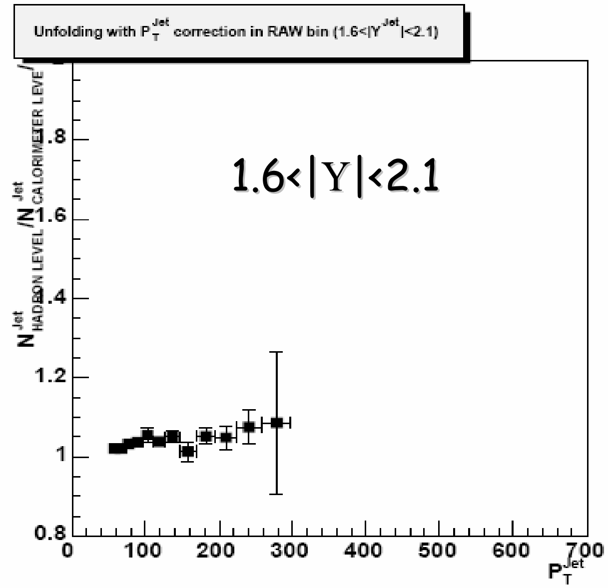
$$N_{jets}\ _{(\text{data unfolded})} = C_i * N_{jets}\ _{(\text{data corrected})}\ (P_T^{jet}\ \text{bin } i)$$

Unfolding Factors









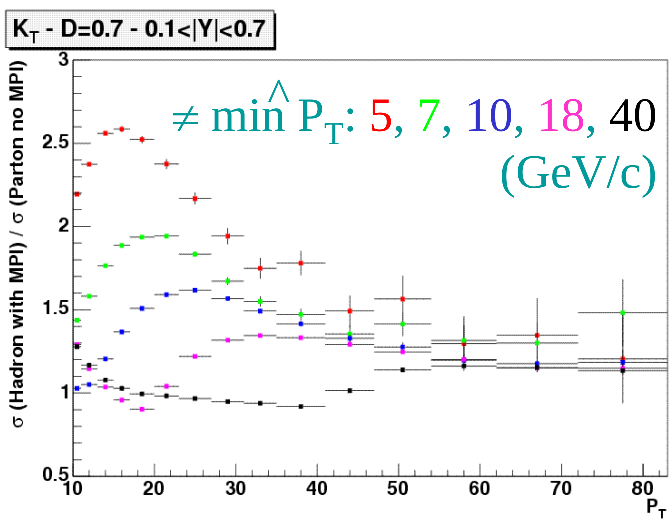
Hadronization Correction

➢ Correct the NLO for Underlying Event and Fragmentation in order to compare to data

→ Using Pythia MC (162.5 millions events: Dijet Samples + additional samples especially generated…)

→ Hadronization Correction factors:

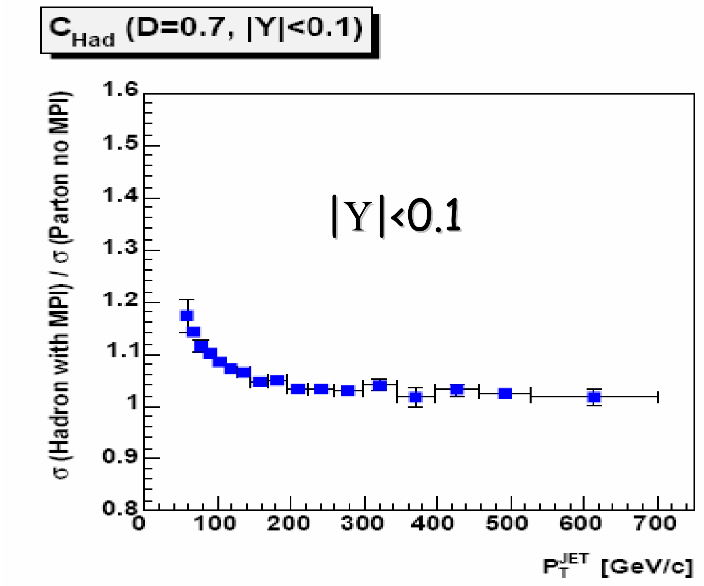
$$C_i = \frac{\sigma\text{ (Hadron Level - Pythia Tune A with MPI)}}{\sigma\text{ (Parton Level - Pythia Tune A no MPI)}} \quad (P_T^{jet}\text{ bin i})$$

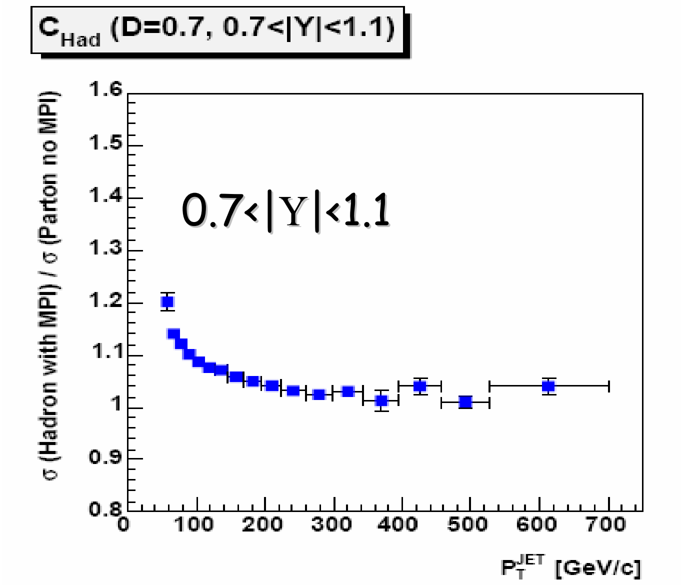


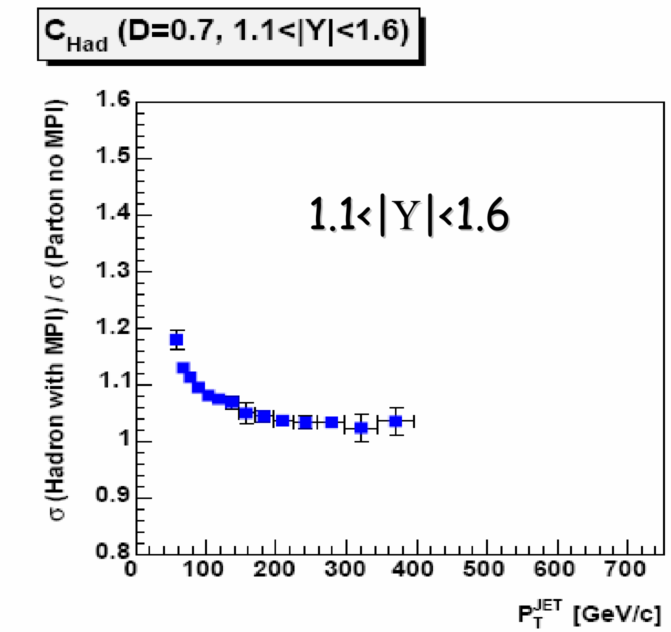
☹ Convergence only above ~ 50 GeV/c
→ no correction provided here below

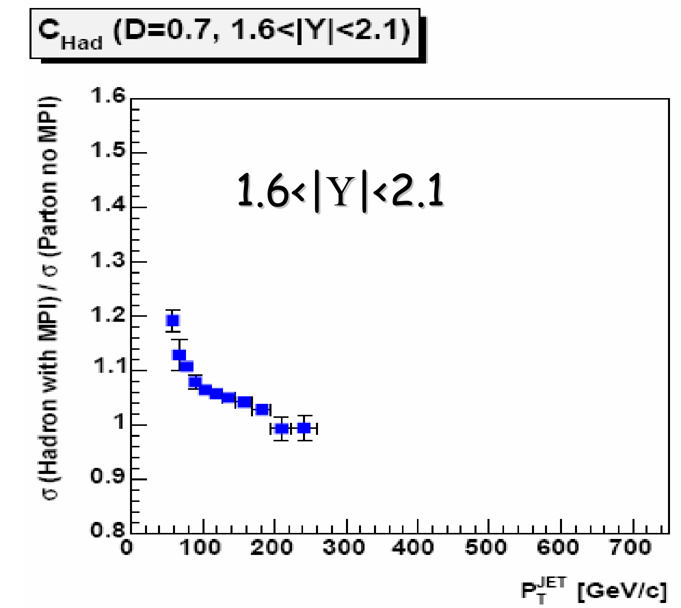
For more details -> See Regis's Talk @ 3rd QCD meeting

Hadronization Factors

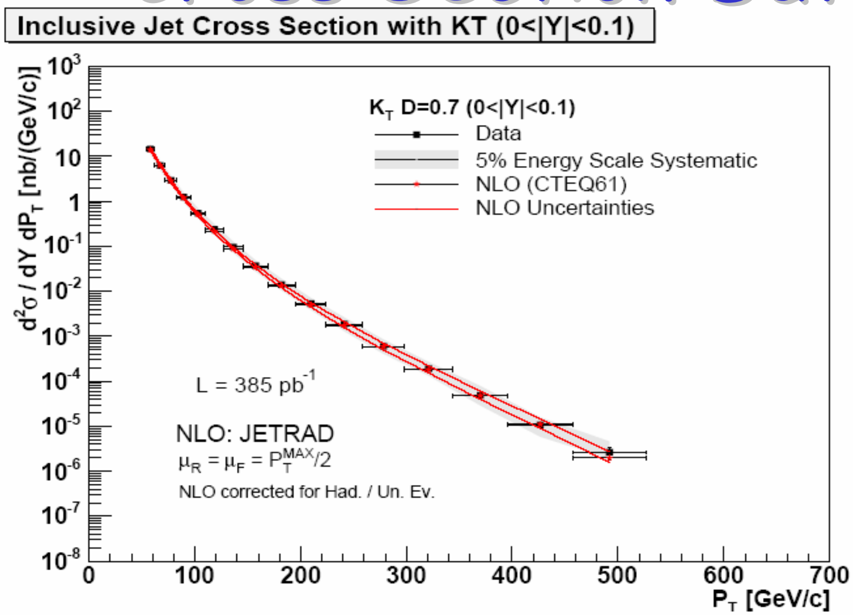


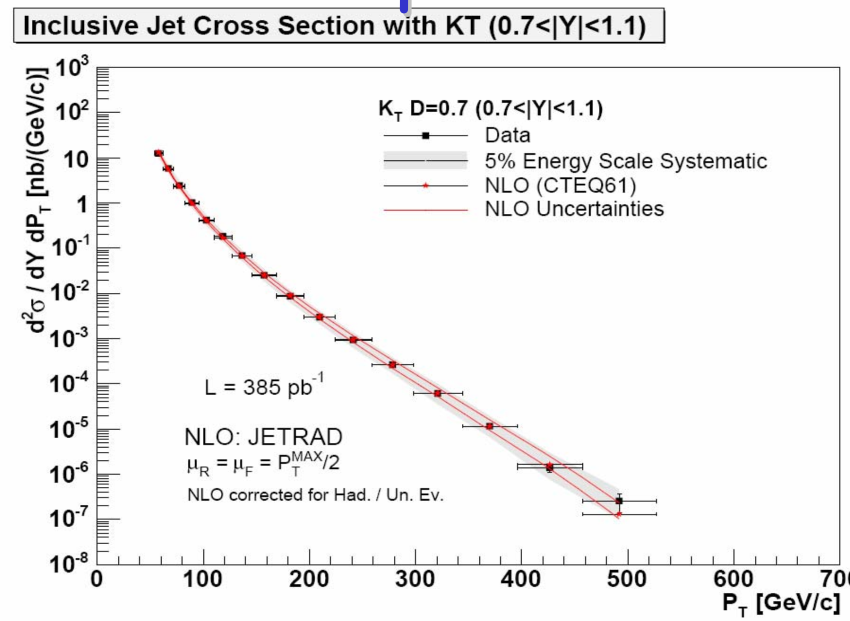


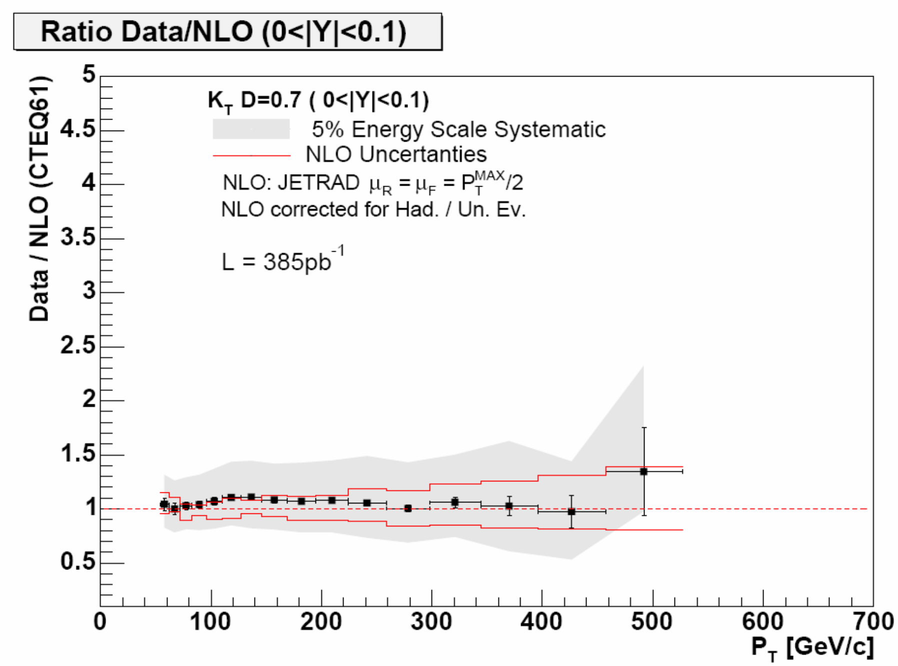


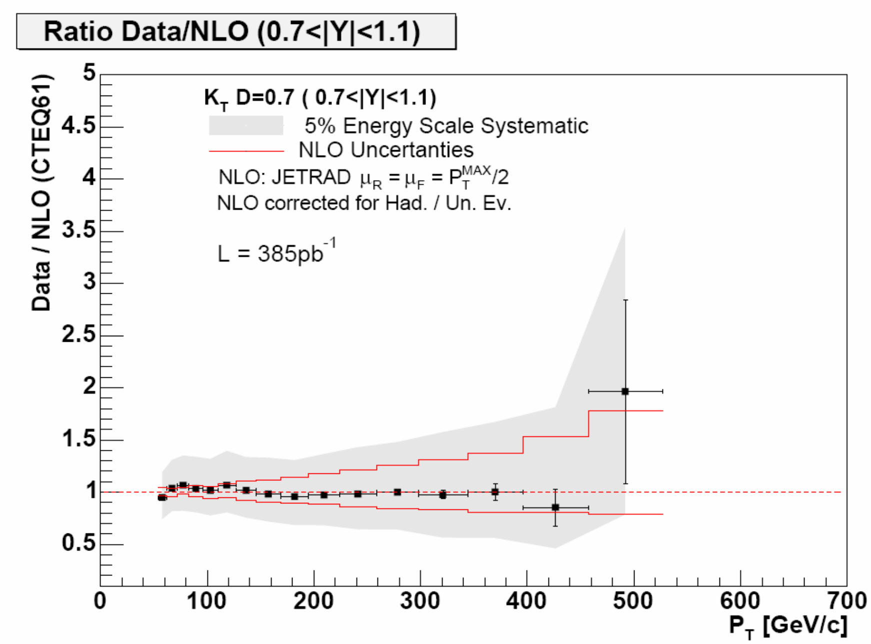


Cross Section Data-NLO comparison



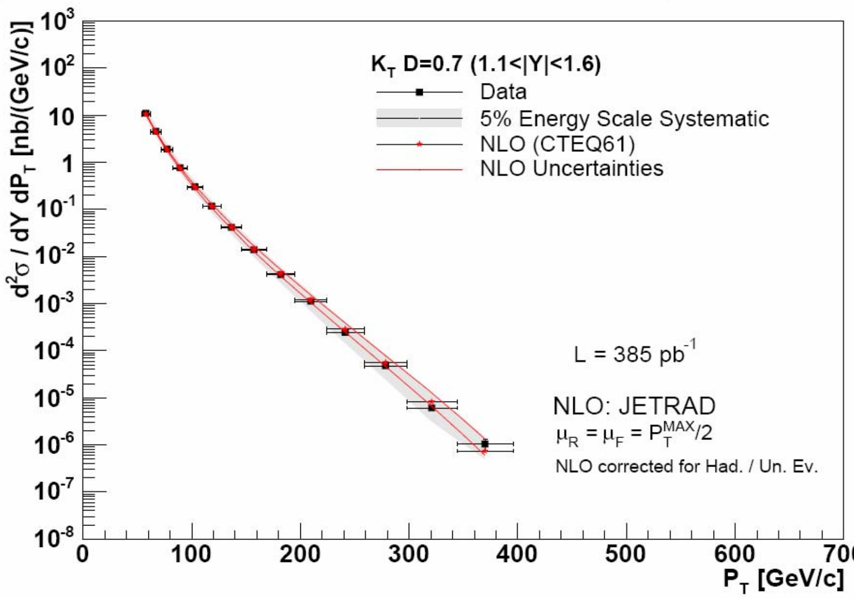




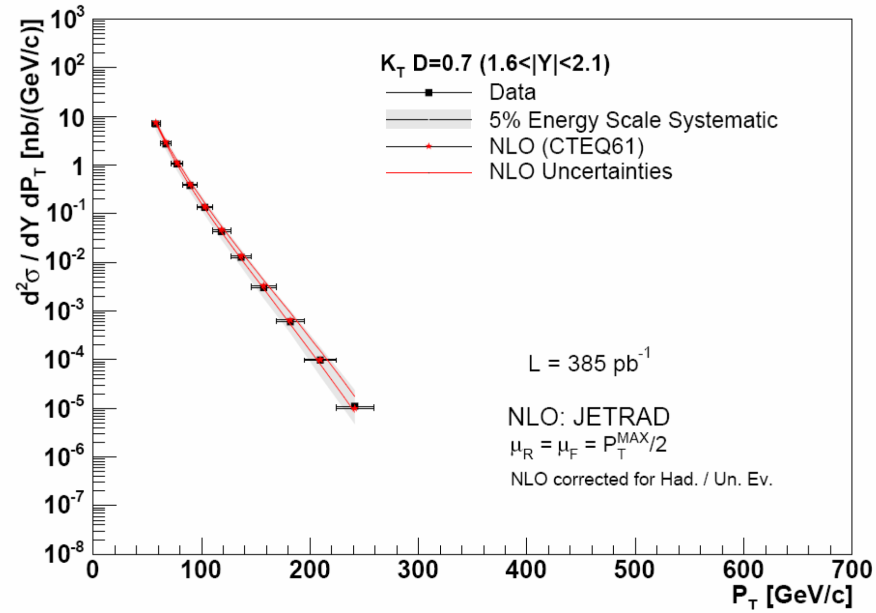


Cross Section Data-NLO comparison

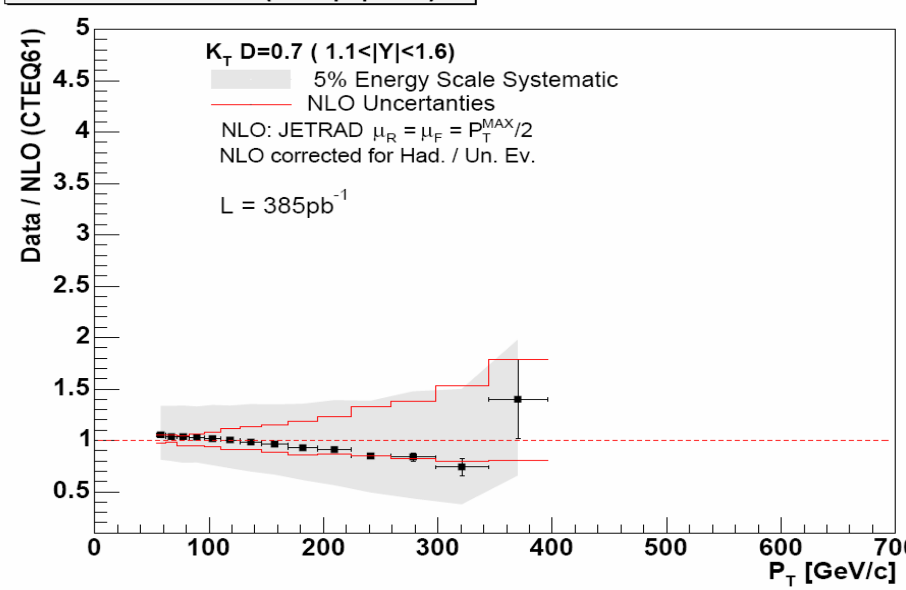
Inclusive Jet Cross Section with KT (1.1<|Y|<1.6)



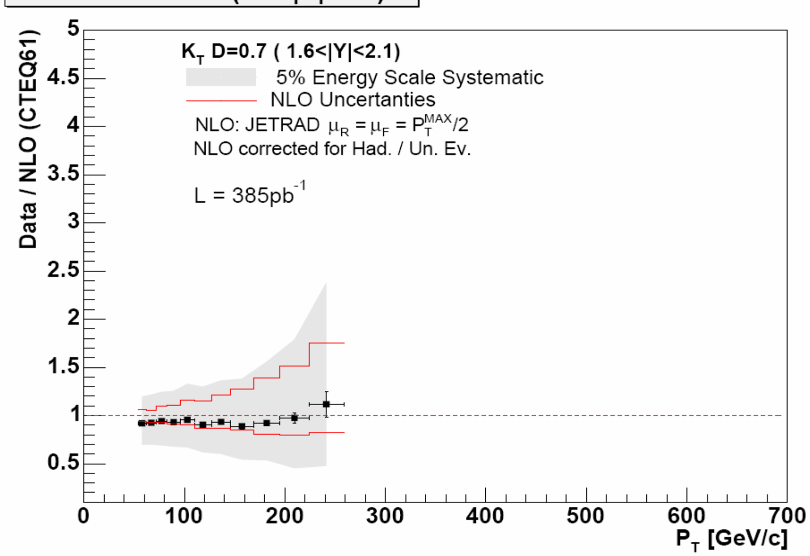
Inclusive Jet Cross Section with KT (1.6<|Y|<2.1)



Ratio Data/NLO (1.1<|Y|<1.6)



Ratio Data/NLO (1.6<|Y|<2.1)



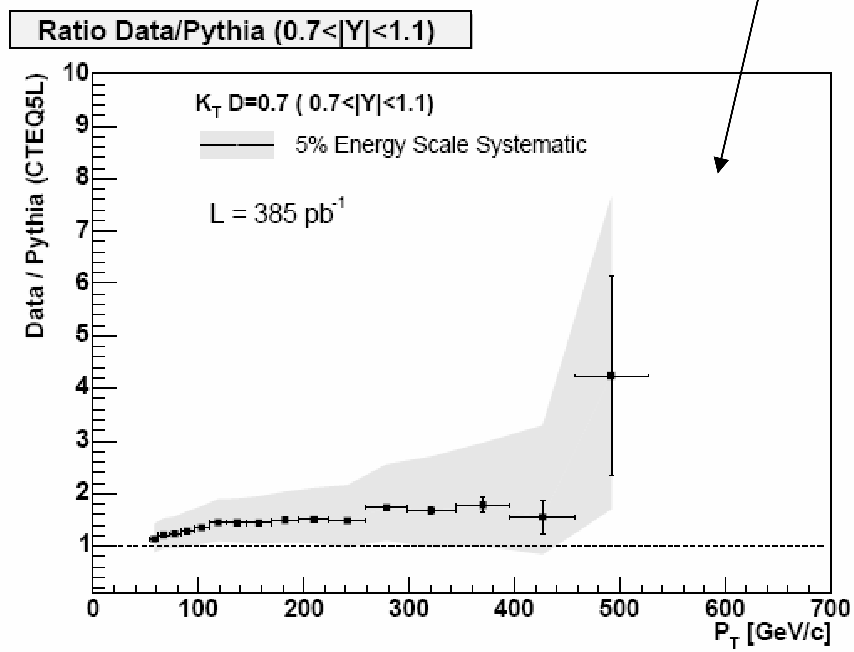
Plans

- Work on :

  →Pileup Corrections (for the moment we applied extra *1.75 correction)

  →Apply corrections from Bisector method studies

  →Reweigh the MC to remove dependencies on PDF's



  → Systematics

Results ready by The Collaboration meeting