Update
Inclusive Jet Cross Section
K_T Algorithm

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IFAE-Barcelona

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Outline

- Inclusive Jet Cross Section using K_T algorithm

  Central and Plug Region

  - → Trigger Efficiency Study
  - → Average P_T^{Jet} corrections
  - → Unfolding Procedure
  - → Hadronization corrections
  - → Comparison to NLO
  - → Plans

Review

Regis presented last week

New

Analysis

- Inclusive Jet Cross Section using K_T algorithm
  Central and Plug Region

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

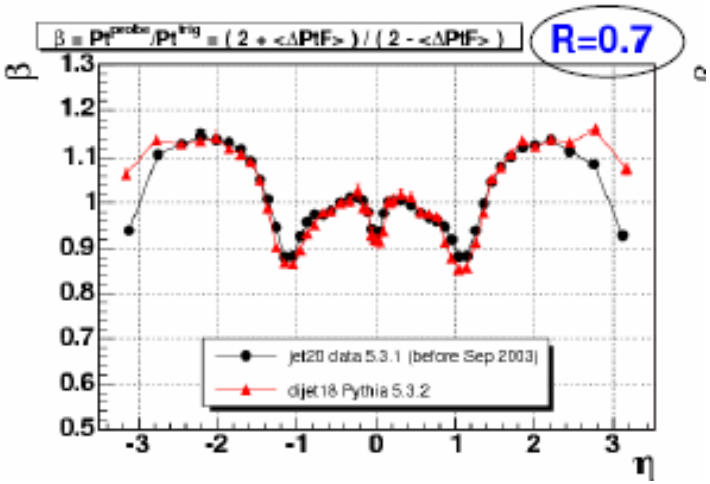
Data : Jet20, Jet50, Jet70 and Jet100 datasets-> **L=388 pb^{-1}**

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 η region**

- 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)

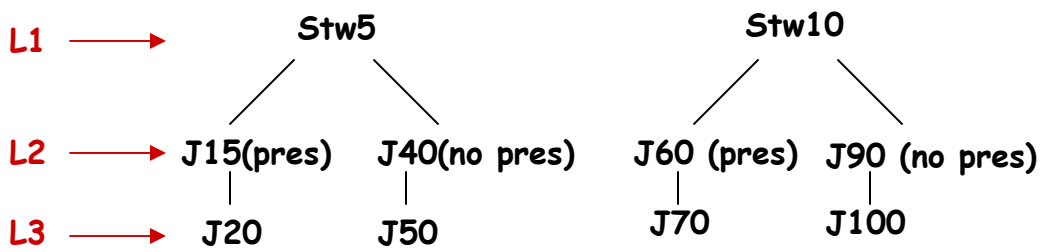


→ Event Selection

- Jets defined with K_T algorithm (D=0.7)
- Vertex position $|V_Z| <60$ cm
- E_T^{miss} significance $<F(P_T^{jet})$ where $F(P_T jet)=\min(2+0.018*P_T^{jet},11.5)$

Trigger Efficiency Studies

- Trigger Structure



Warning!!

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)

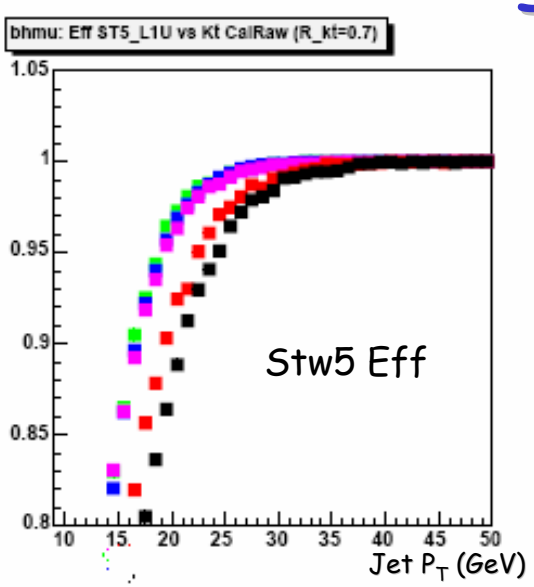
  → Jet50 data : Eff. J60(L2) and J70(L3)

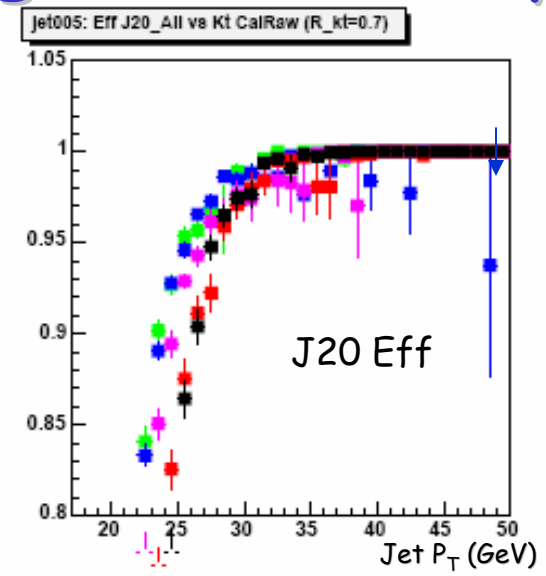
  → Jet70 data : Eff. J90(L2) and J100(L3)

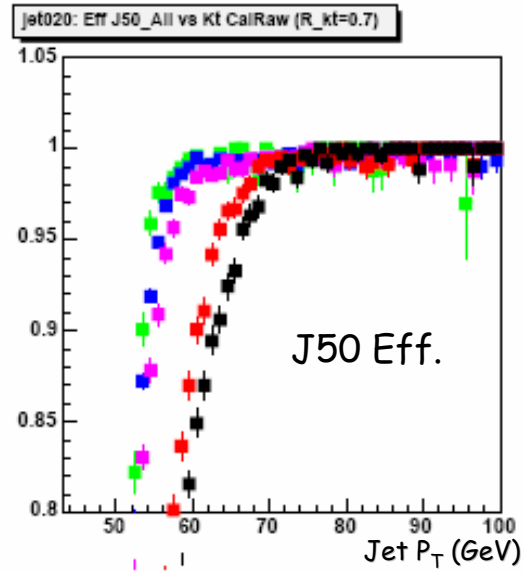
- Select Trigger Efficiency Threshold where the Efficiency is 99% (L1× L2 ×L3)

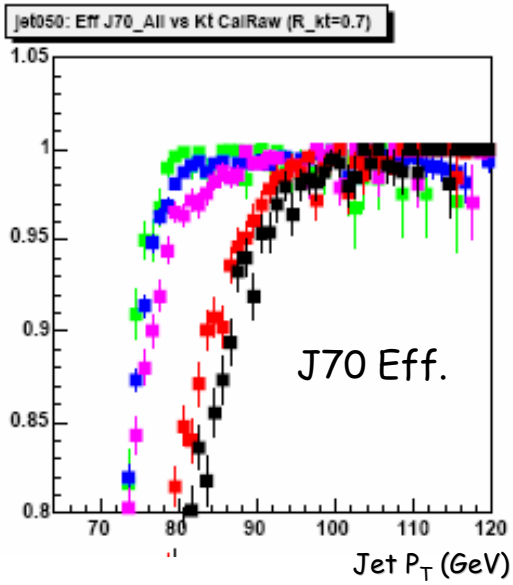
  → To avoid systematics due to energy scale uncertainties, the obtain thresholds are increased of 5%

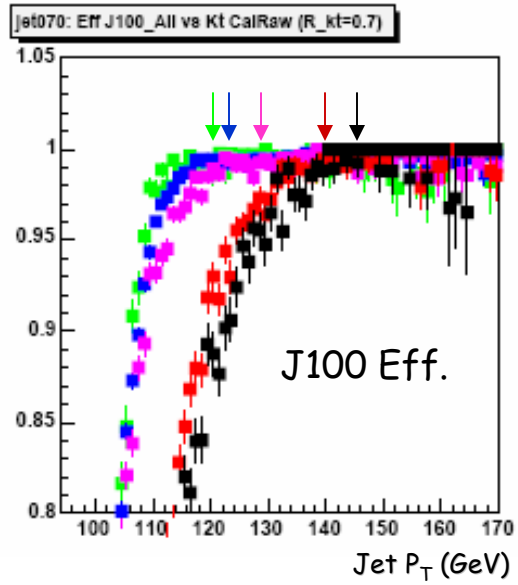
Trigger Efficiency Cuts











Rapidity Region 1 : $|Y| < 0.1$
Rapidity Region 3 : $0.7 < |Y| < 1.1$
Rapidity Region 2 : $0.1 < |Y| < 0.7$
Rapidity Region 4 : $1.1 < |Y| < 1.6$
Rapidity Region 5 : $1.6 < |Y| < 2.1$

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

	Rap1	Rap2	Rap3	Rap4	Rap5
Stw5	26	26	28	31	32
J20	33	35	33	34	33
J50	63	64	68	72	75
J70	86	86	93	99	104
J100	119	124	129	139	146

Average P_T^{Jet} Correction

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

→ Previous :Comparison (Data-MC) of some raw variables

The MC provides a reasonably good description of the data

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

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

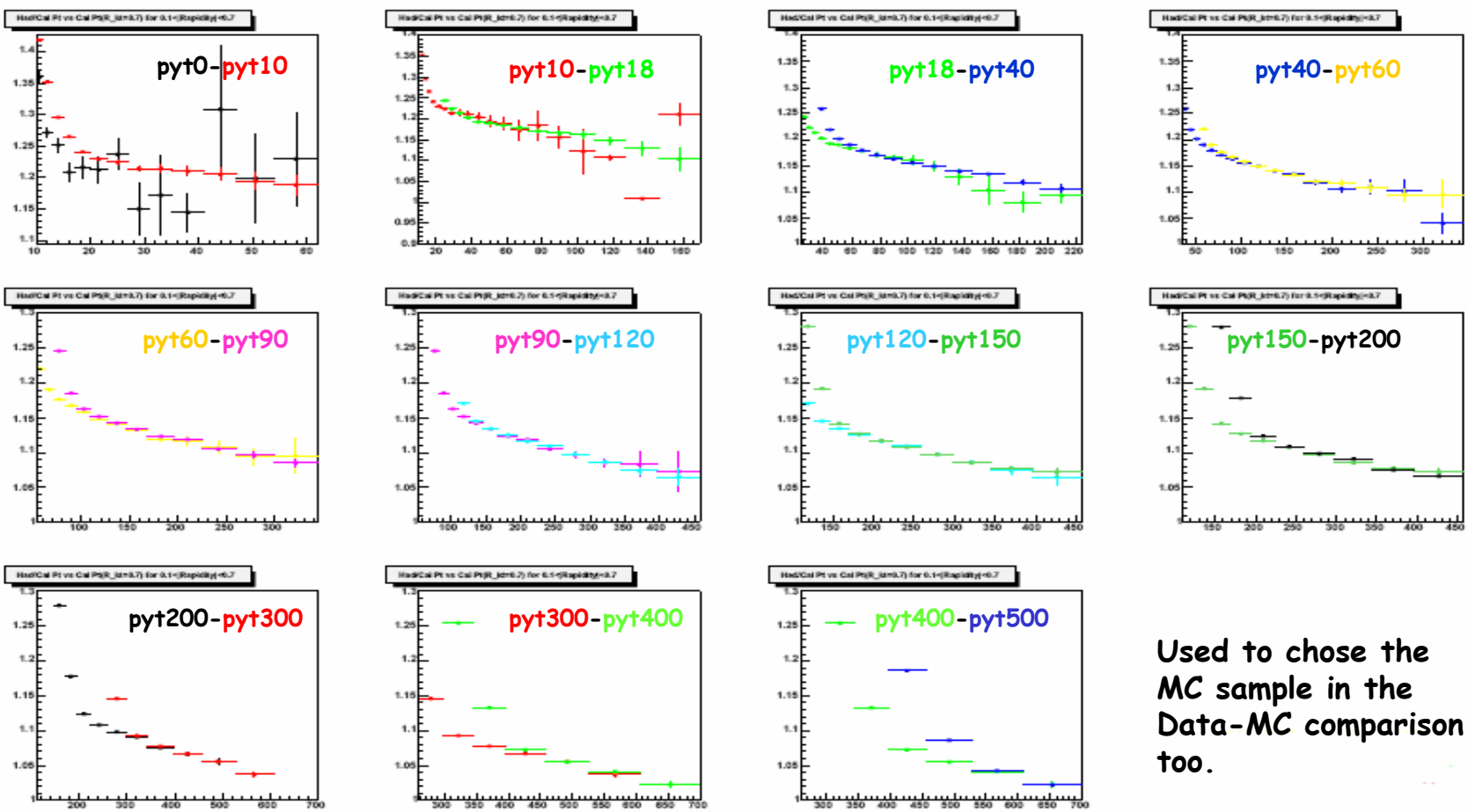
$$\Delta R = \sqrt{\Upsilon^2 + \phi^2}$$

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

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

Average P_T^{Jet} Correction

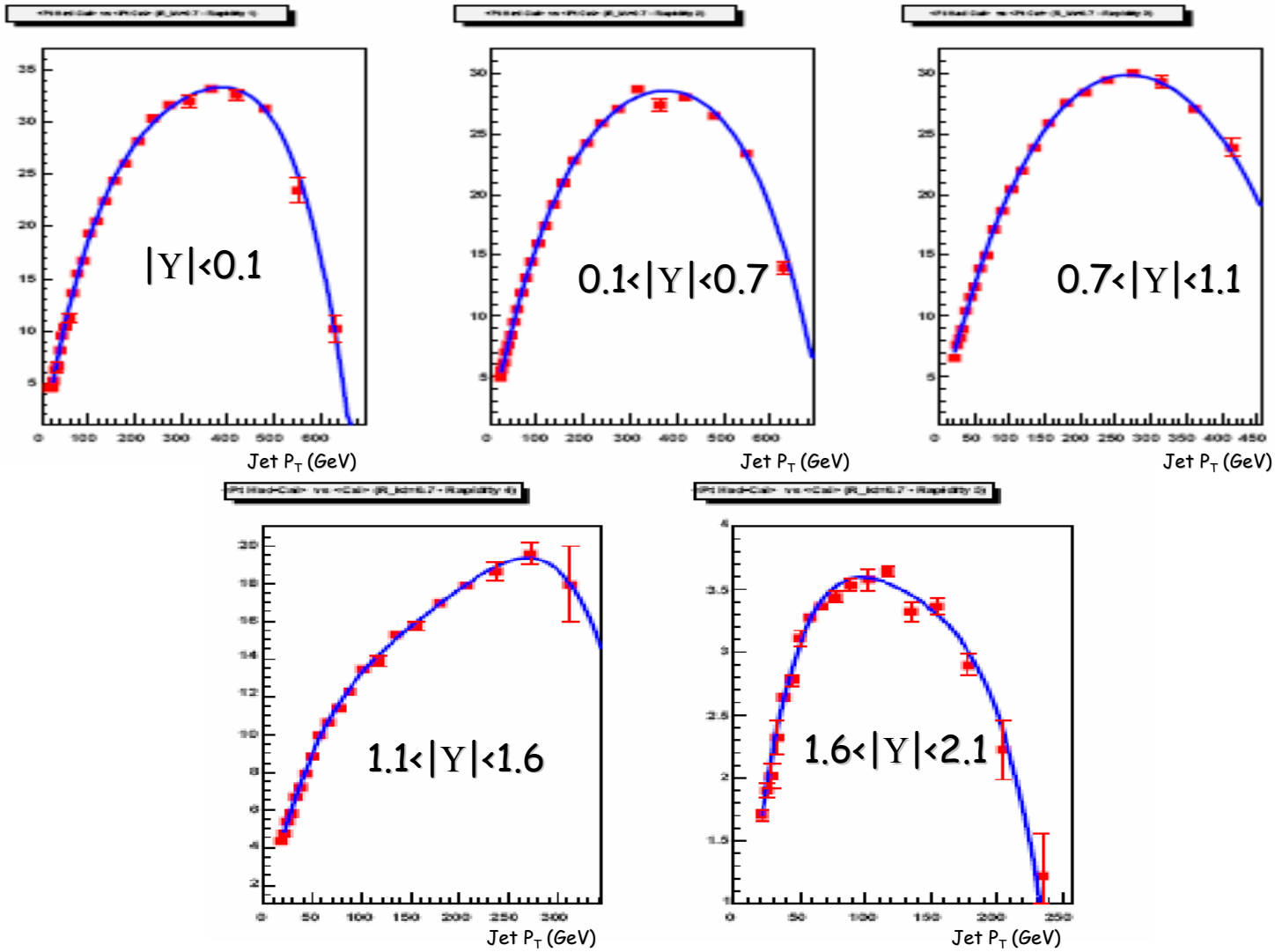
→ In order to chose the MC samples for each minimum P_t^{jet} (CAL) , we compare the distribution of P_T^{Jet}(HAD)/P_T^{Jet}(CAL) vs P_T^{Jet}(CAL) with the previous MC sample with lower p_t^{had} cut.
The minimum P_T^{jet} (CAL) is the point where both profiles are agreed.



Used to chose the MC sample in the Data-MC comparison too.

Average P_T^{Jet} Correction

$\langle P_T^{Jet}(HAD)-P_T^{Jet}(CAL)\rangle$ vs $P_T^{Jet}(CAL)$



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

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:

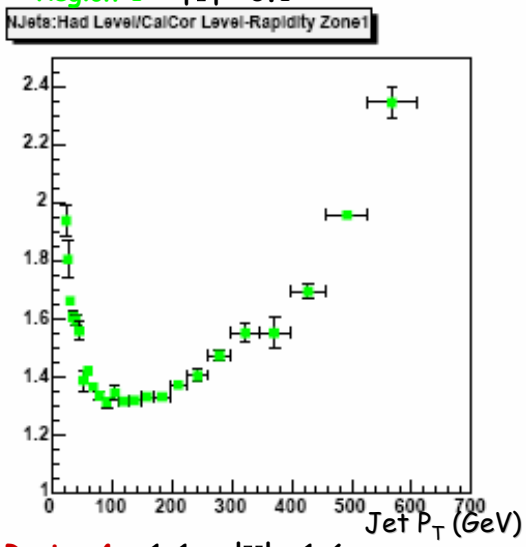
$$C_i = \frac{N_{Jet}\ \text{Hadron level}}{N_{Jet}\ \text{Calorimeter level}}\ (P_T^{jet}\ \text{bin i})$$

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

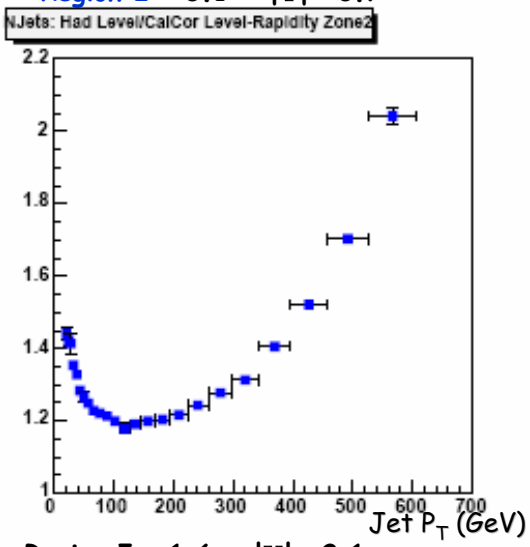
$$N_{jets\ (data\ unfolded)} = C_i * N_{jets\ (data\ corrected)}\ (P_T^{jet}\ \text{bin i})$$

Unfolding Factors

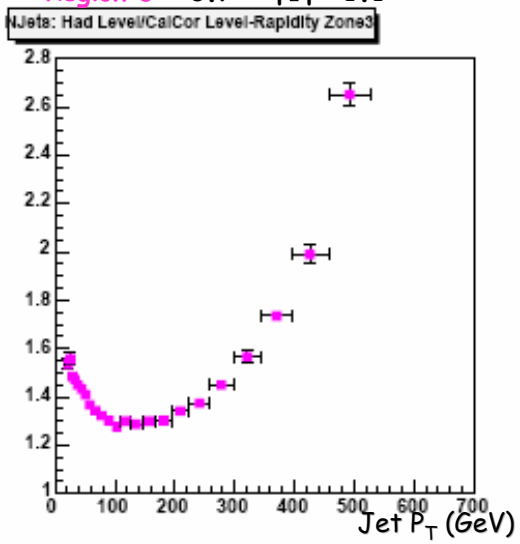
Region 1 : |Y|< 0.1



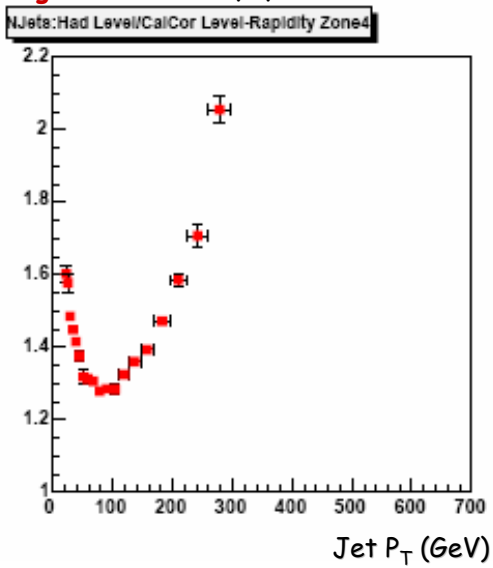
Region 2 : 0.1 < |Y|< 0.7



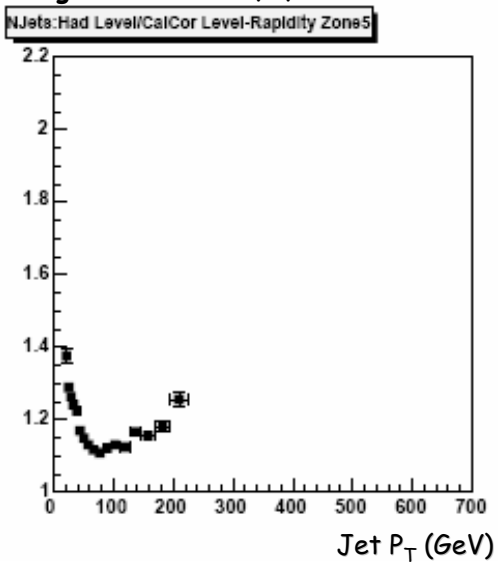
Region 3 : 0.7 < |Y|< 1.1



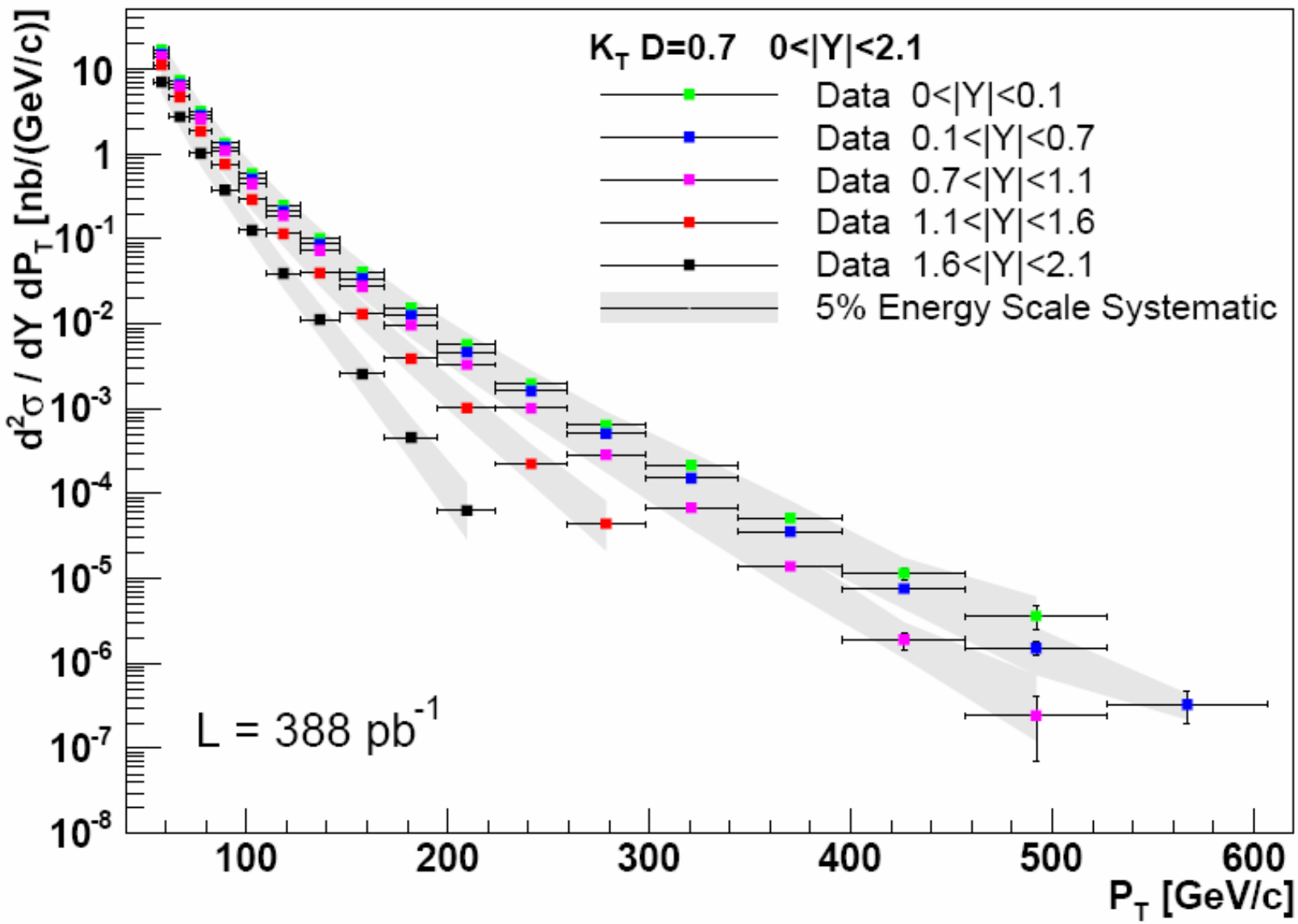
Region 4 : 1.1 < |Y|< 1.6



Region 5 : 1.6 < |Y|< 2.1

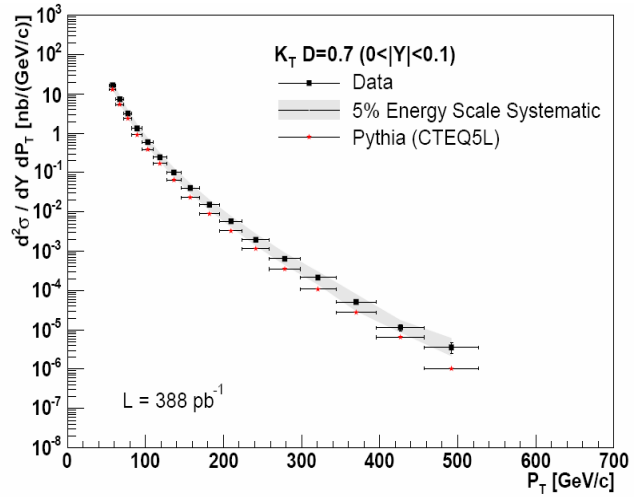


Cross Section

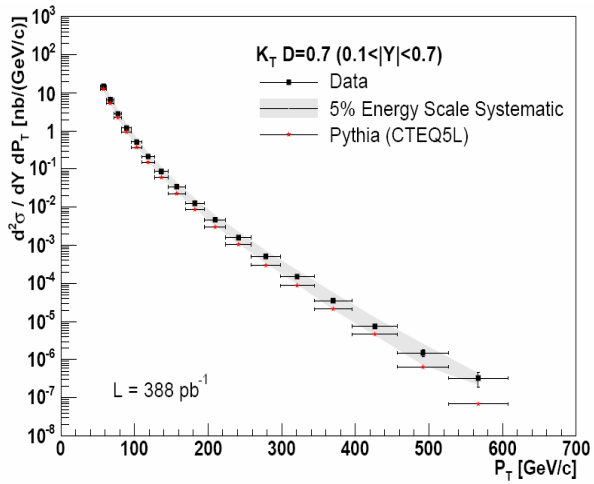


Cross Section Data-Pythia comparison

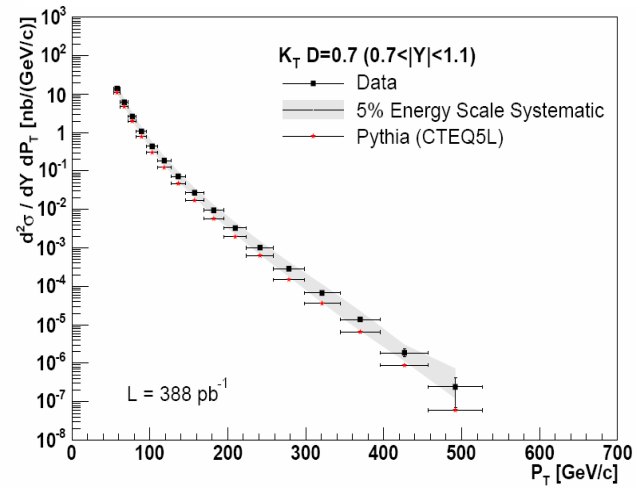
Rapidity Region 1 : |Y|< 0.1

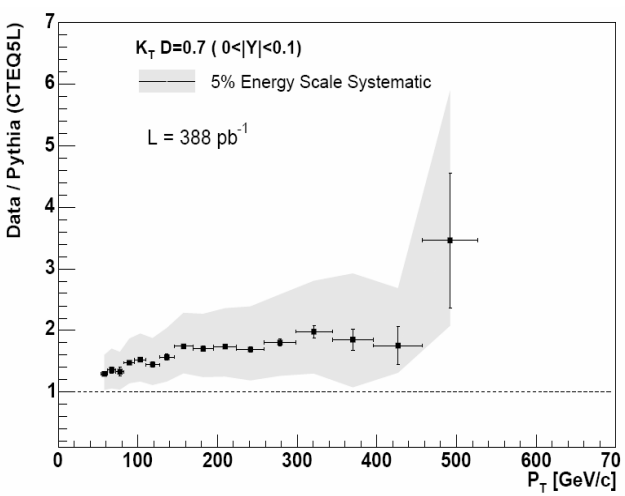


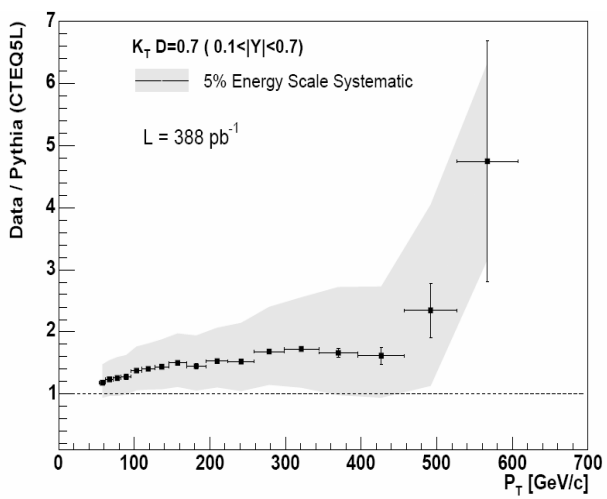
Rapidity Region 2 : 0.1 < |Y|< 0.7

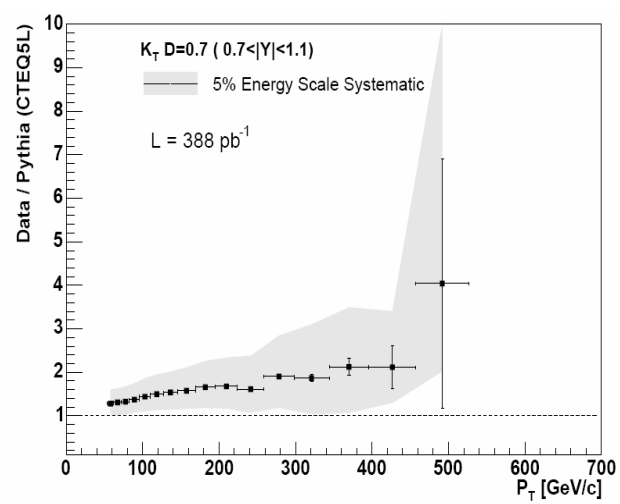


Rapidity Region 3 : 0.7 < |Y|< 1.1



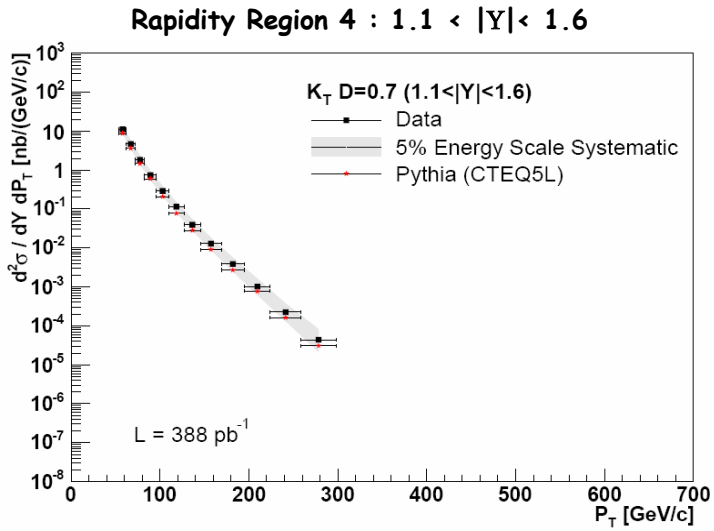


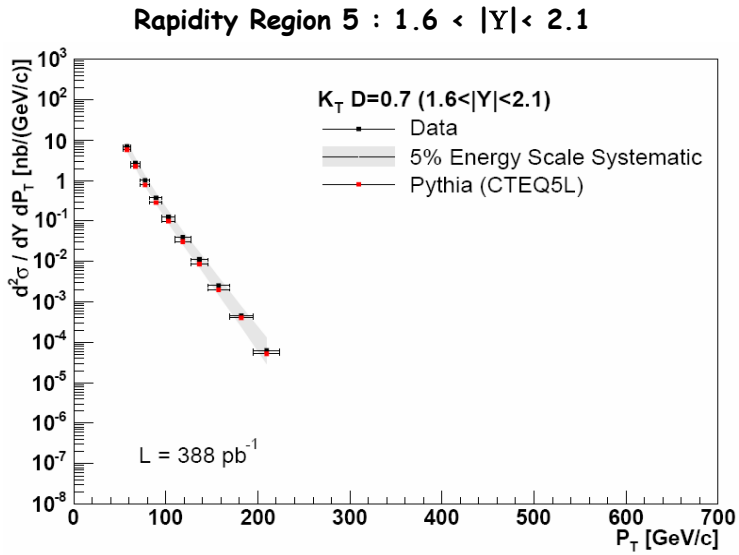


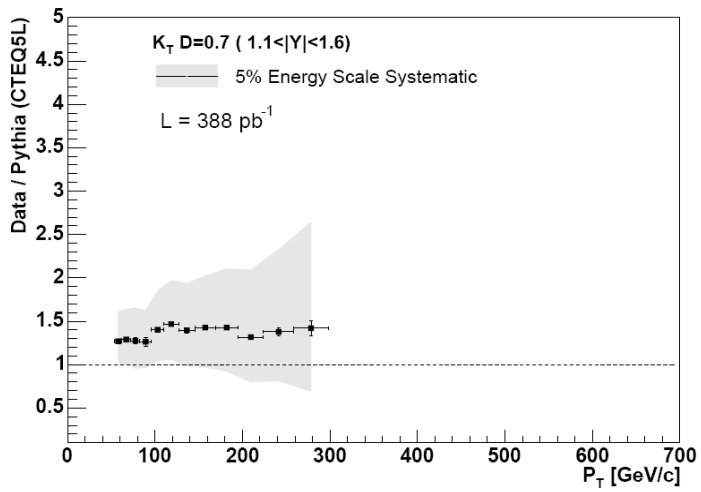


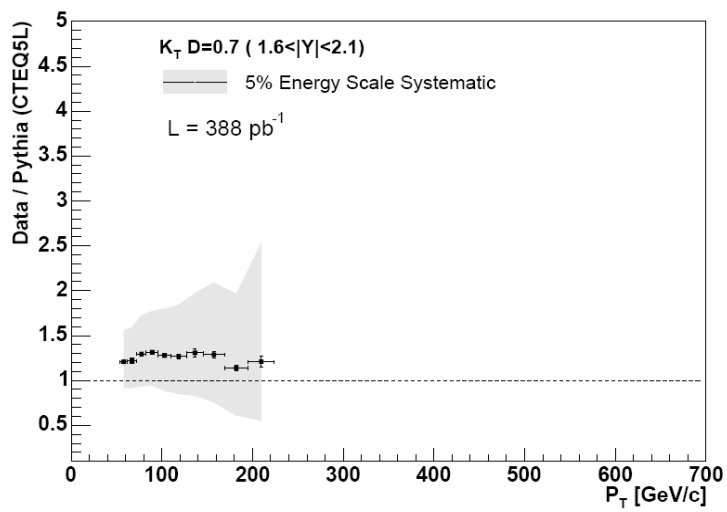
We should work on unfolding to remove the shape in the ratio

Cross Section Data-Pythia comparison









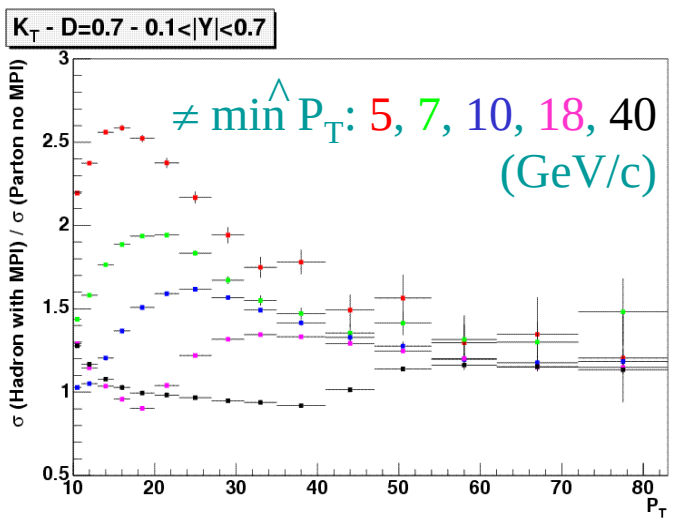
Hadronization Correction

- 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:

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

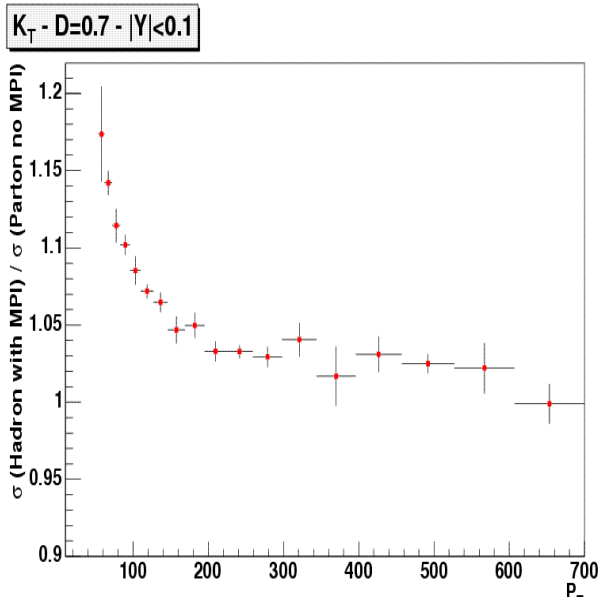


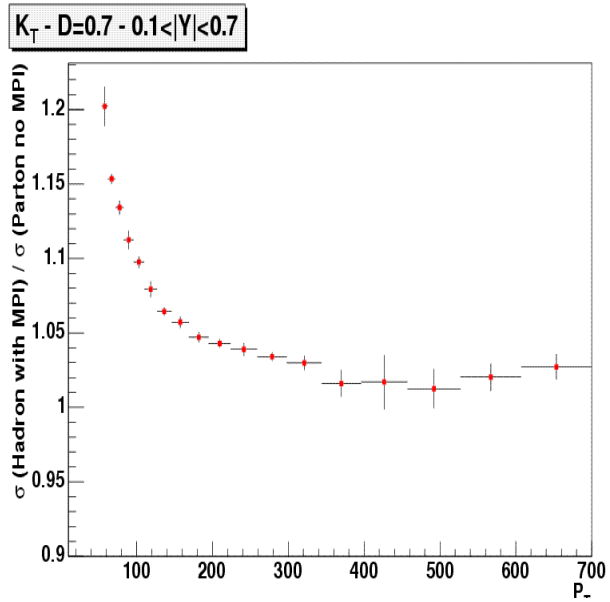
☹ Convergence only above ~ 50 GeV/c

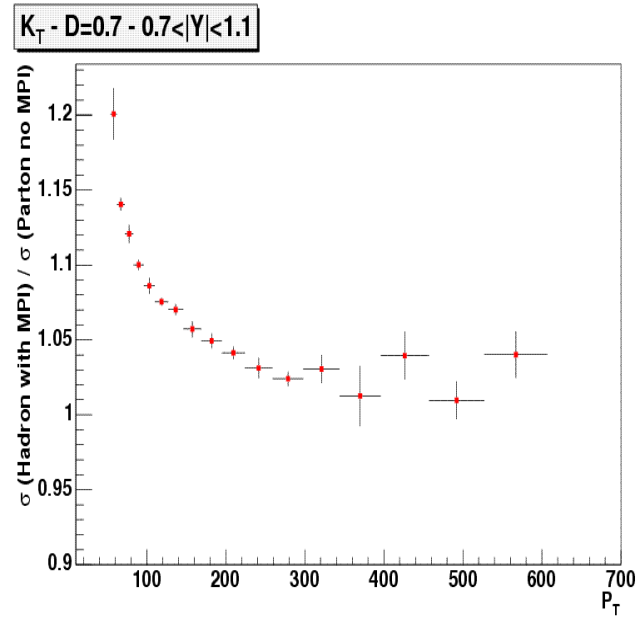
→ no correction provided here below

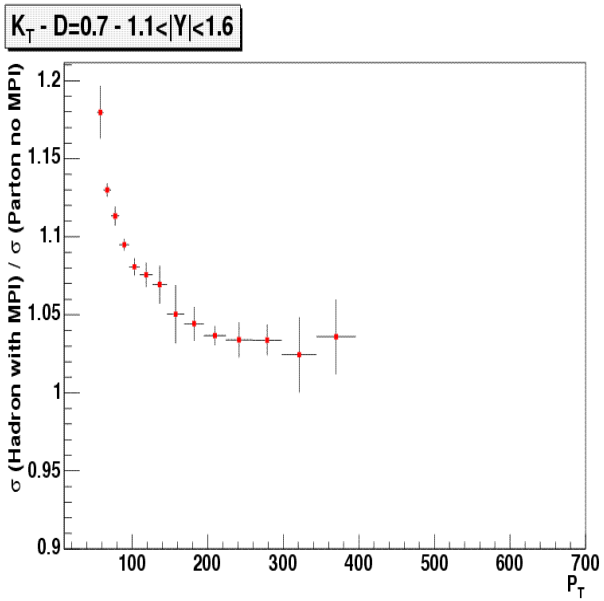
For more details -> See Regis's Talk @ 3rd QCD meeting

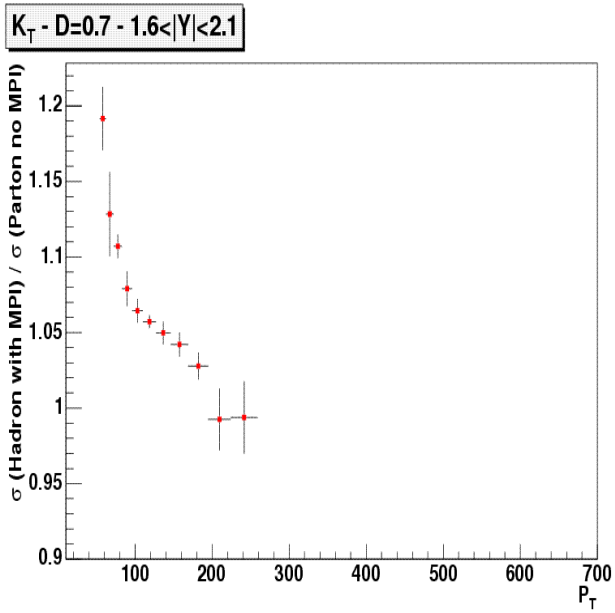
Hadronization Factors





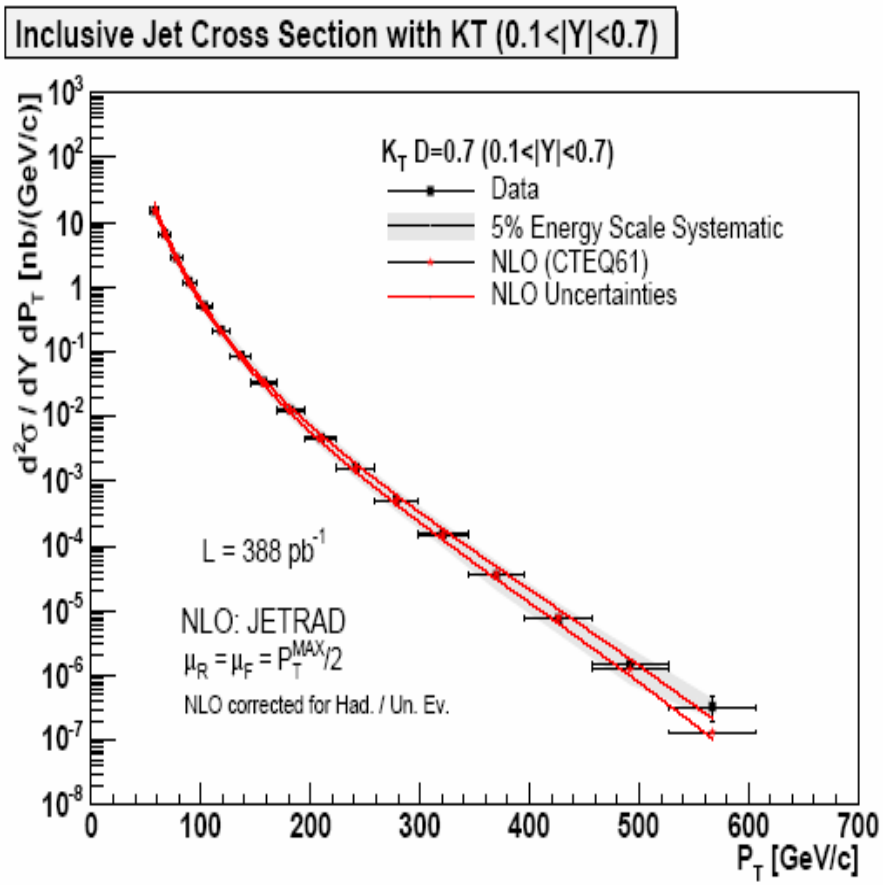


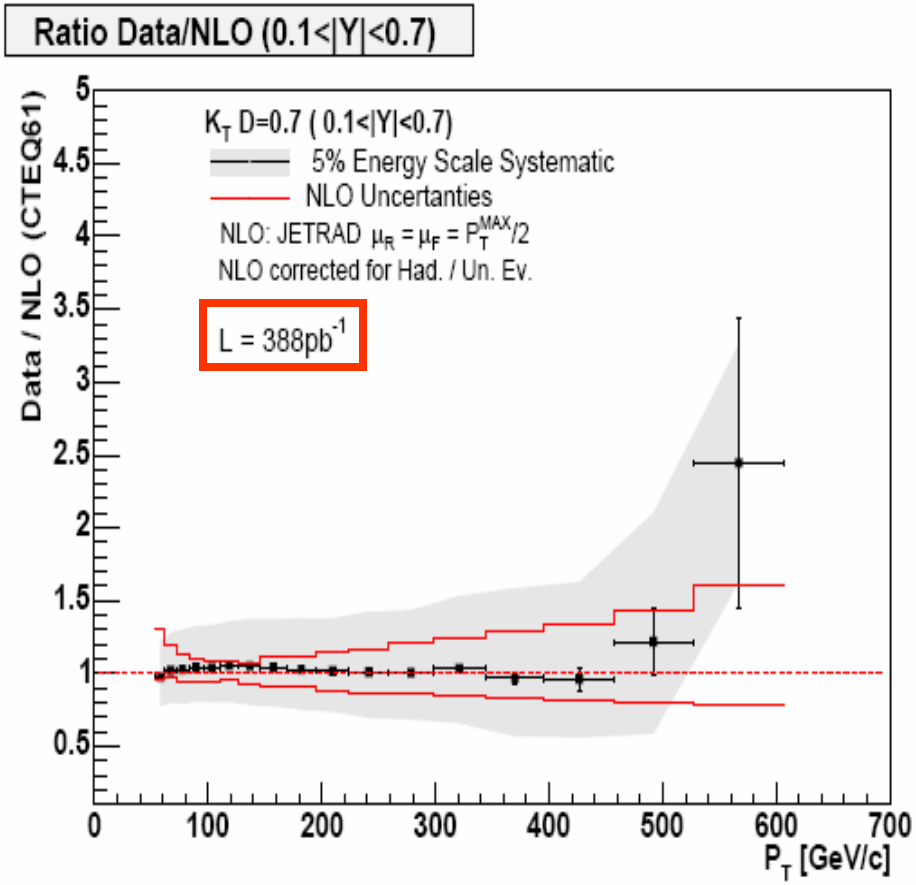




Small rapidity dependency

Cross Section Data-NLO comparison

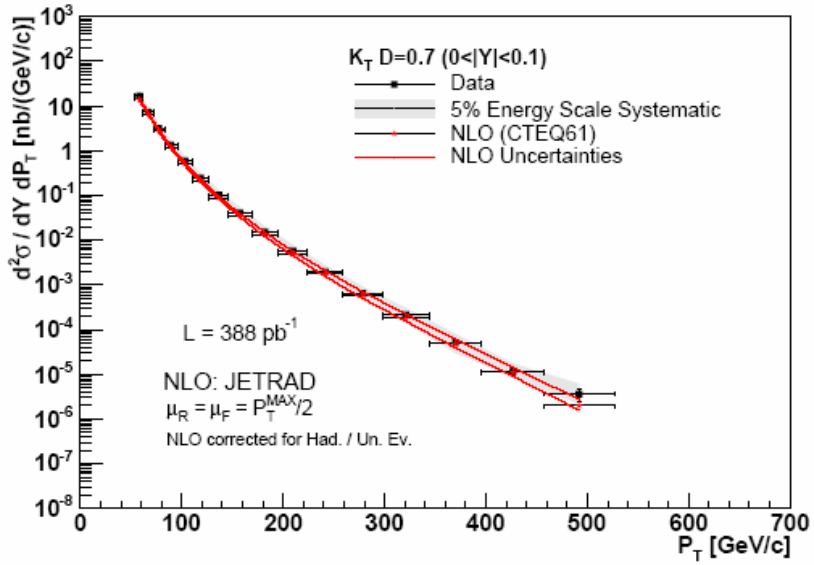




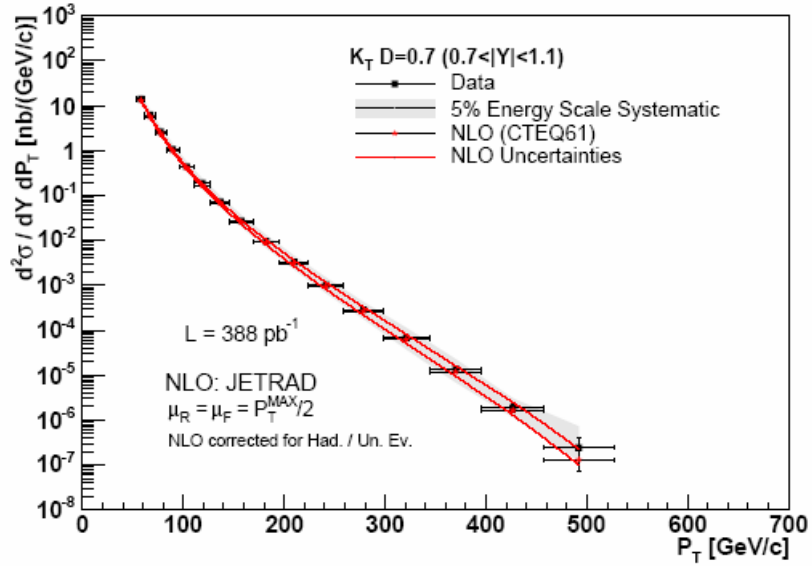
No Final Plots…still working on NLO generation

Cross Section Data-NLO comparison

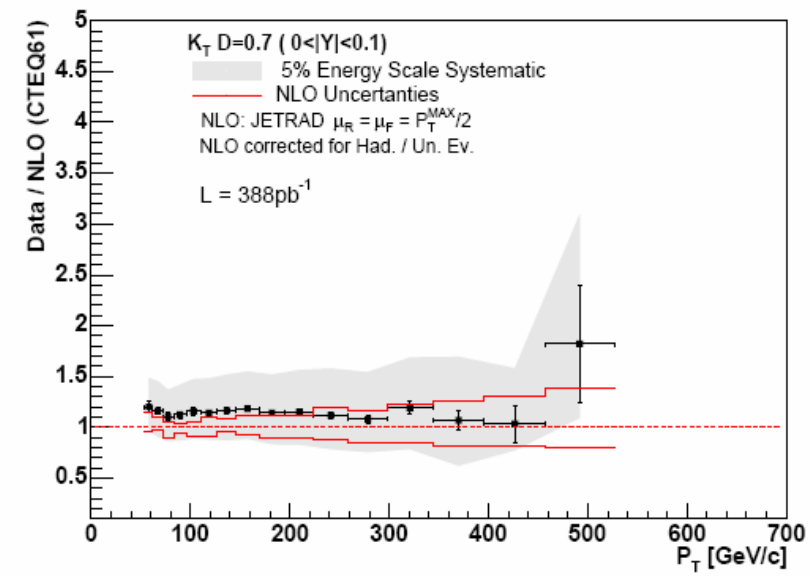
Inclusive Jet Cross Section with KT (0<|Y|<0.1)



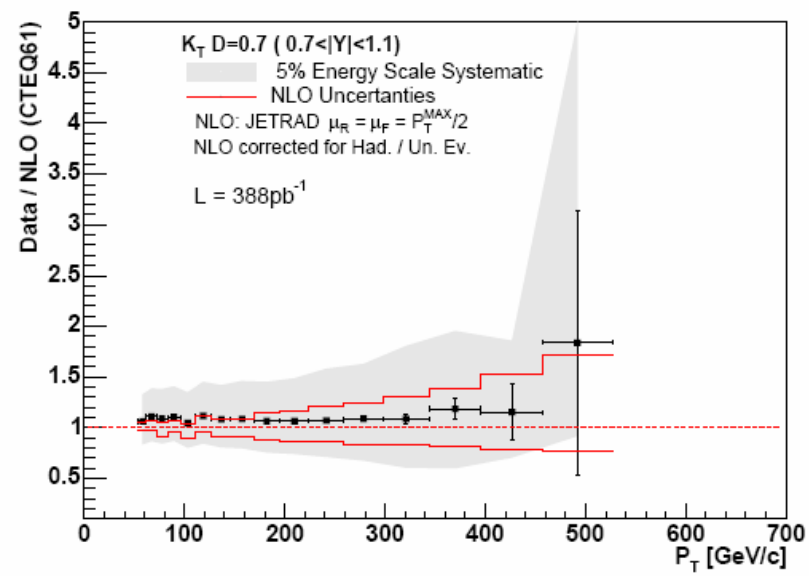
Inclusive Jet Cross Section with KT (0.7<|Y|<1.1)



Ratio Data/NLO (0<|Y|<0.1)



Ratio Data/NLO (0.7<|Y|<1.1)



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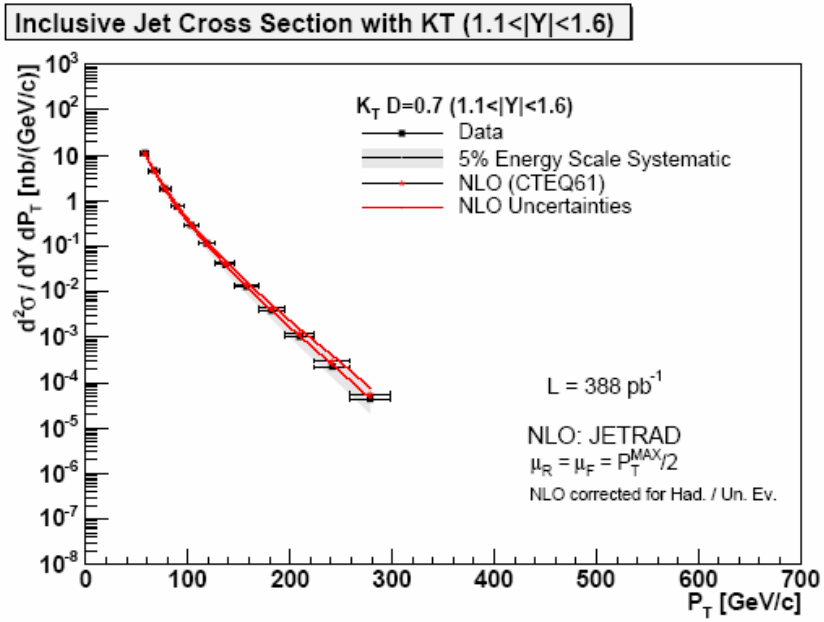
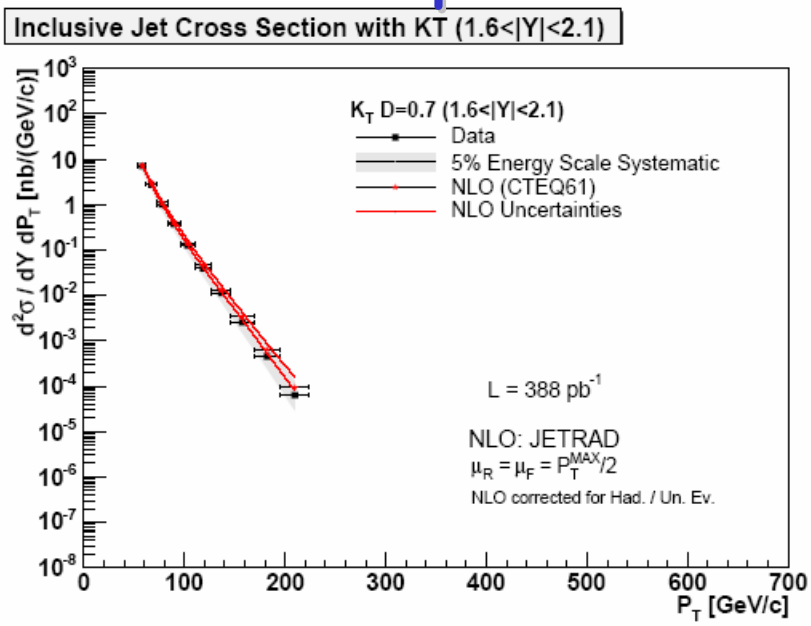
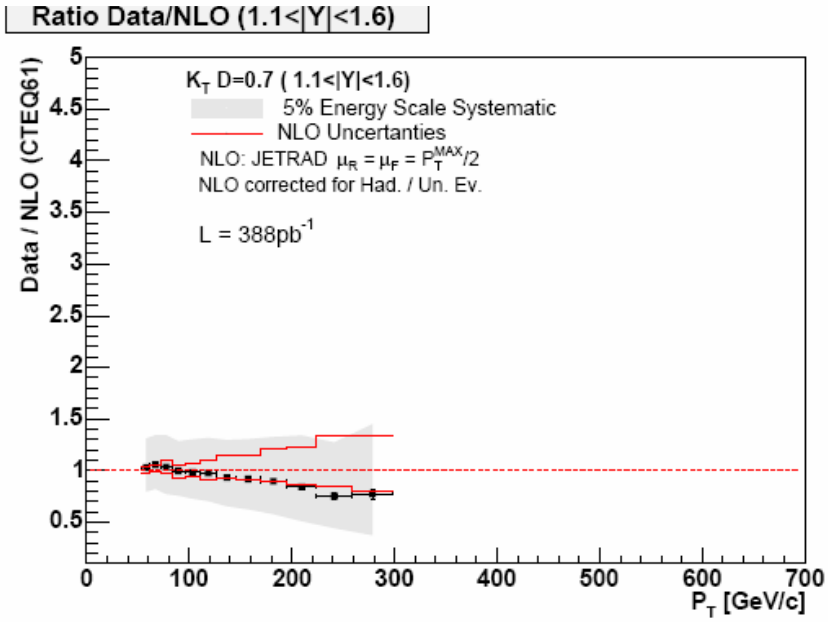
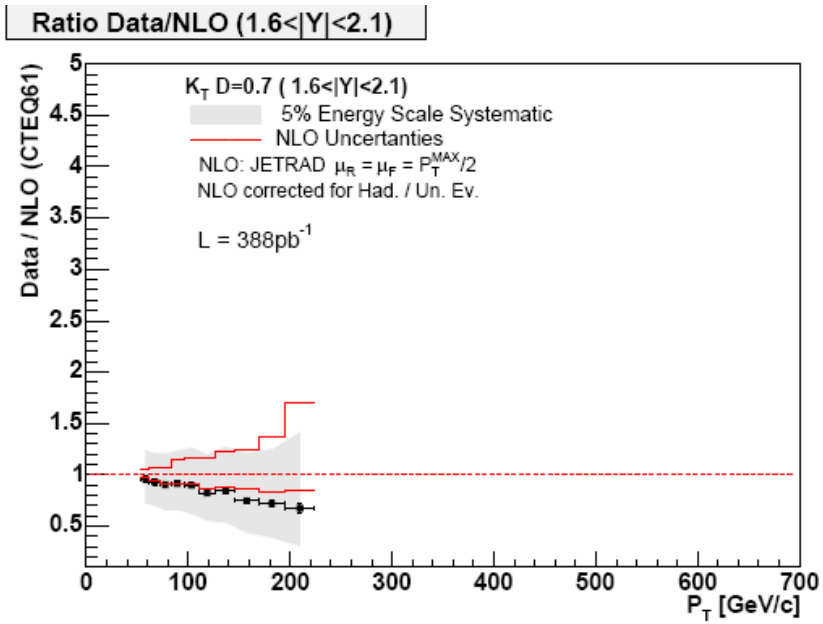
Cross Section Data-NLO comparison









Plans

- Work on :
  - → Systematics
    - Cuts (vertex, E_T^{miss} significance)
    - Jet Energy Scale: Dijet balance using the COT for the central jet and CAL for the second jet
    - Unfolding : Use Herwig instead of Pythia
  - →Pileup Corrections

Results blessed by Winter Conferences