

# Charge Asymmetry

Universität

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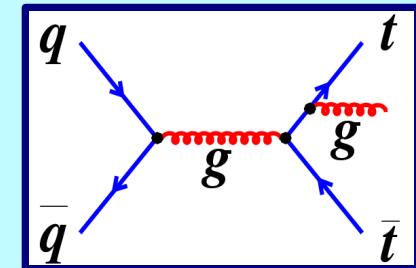
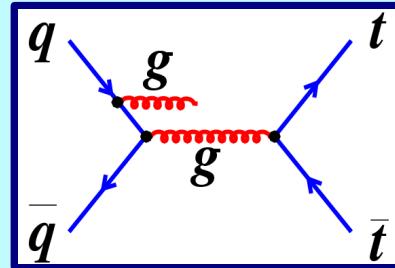
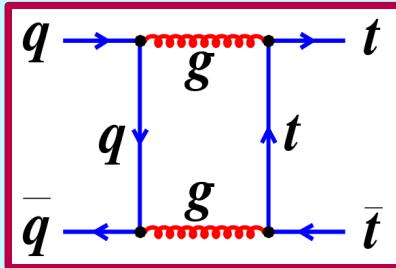
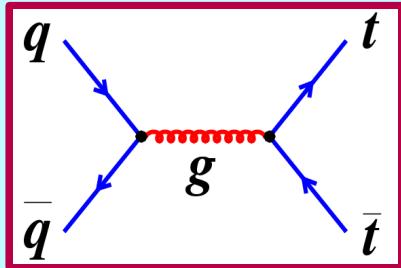
# In Top-Pair Production

Karlsruhe

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# Charge Asymmetry

**SM:** Asymmetry caused by interference of ME amplitudes for same FS



**Predictions:** *(in parton rest frame)*

$t\bar{t}$  (general):  $A_{\text{NLO}} = (4-7)\%$

*(J. Kühn et al.: arXiv:0709.1652)*

$A_{\text{LO}} = 0\%$

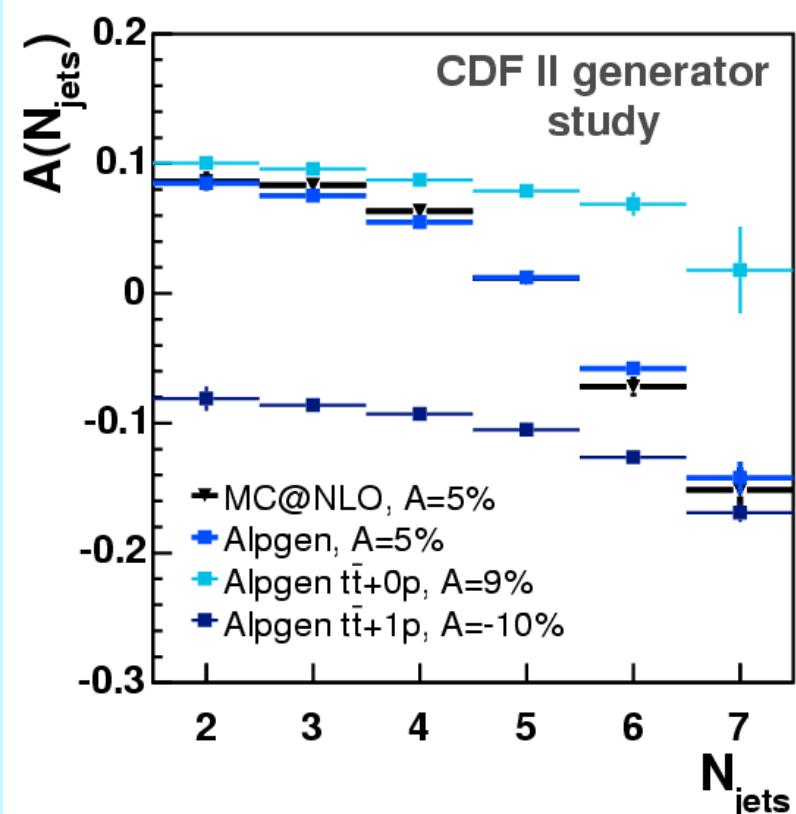
$t\bar{t} + g$ :

$A_{\text{NLO}} = -(0-2)\%$

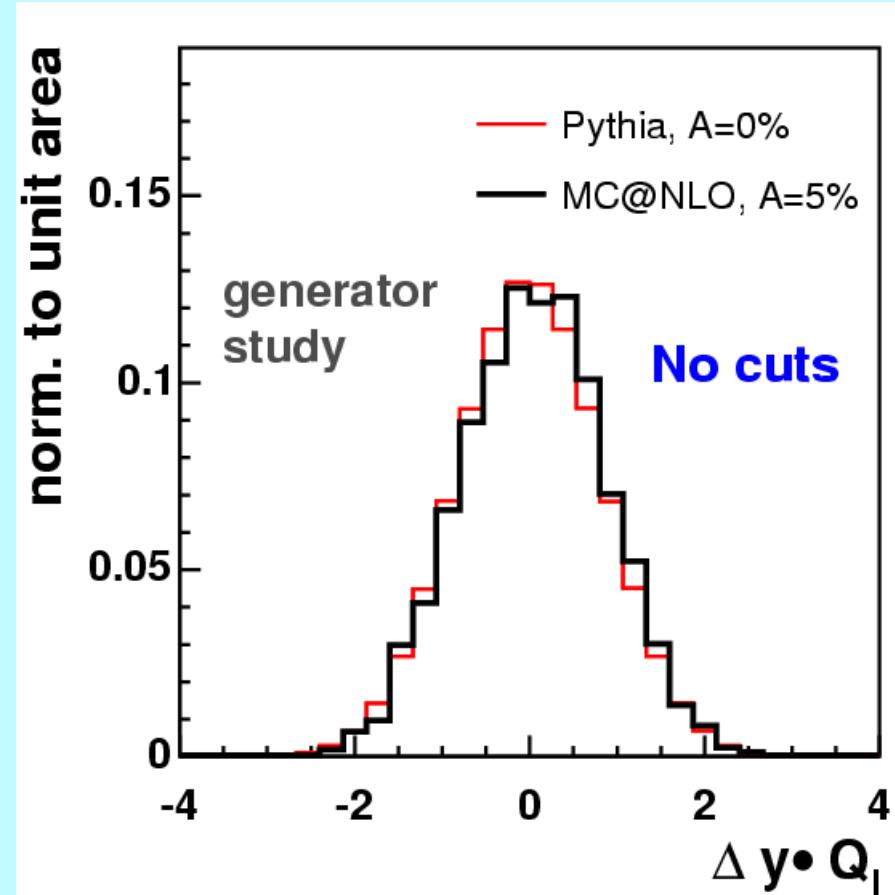
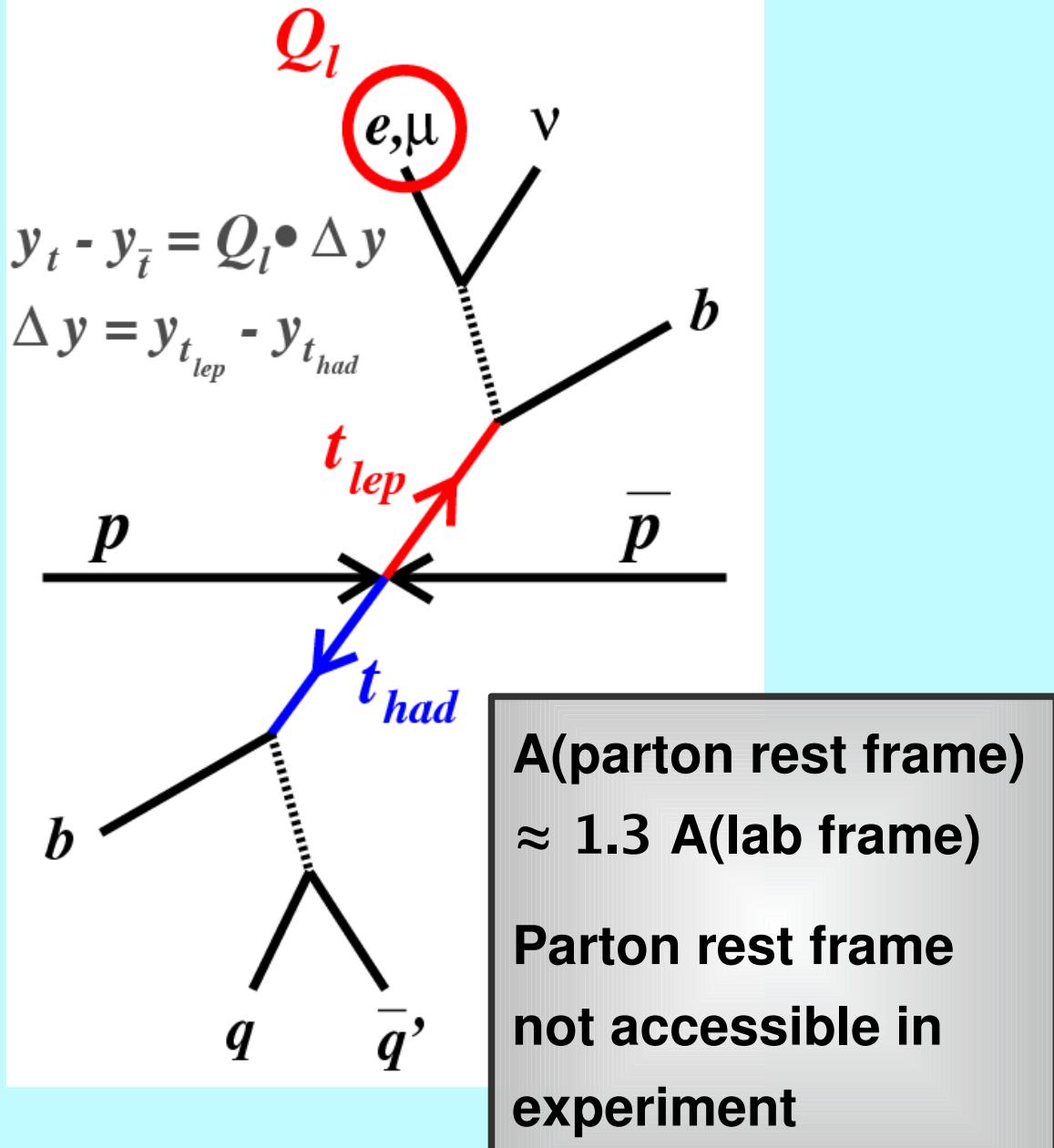
*(P. Uwer et al.: hep-ph/0703120)*

$A_{\text{LO}} = -(9-10)\%$

Significant deviation would be an indication for new physics, e.g.  $Z'$  or axigluon



# Sensitive Variable: $\Delta y Q_l$



Asymmetry in parton rest frame is largely recovered by asymmetry in  $\Delta y Q_l$

J. Kühn et al., arXiv:0709.1652

# Selection and Reconstruction

- **Event selection:** Select Lepton+Jets events with  $N_{\text{jets}} \geq 4$ ,  
 $N_{\text{b-tags}} \geq 1$ , MET>20 GeV and exact one e or  $\mu$   
with  $p_T > 20$  GeV  
-> 484 top pair candidates
- **Background estimate:**  $86.7 \pm 22.6$  non-top events
- **Full reconstruction** of top fourvectors by choosing one reconstruction hypothesis using constraints on  $m_W$  and the top mass difference, transverse energy of tops and the b-likeness of assigned b-jets

# Correction Method

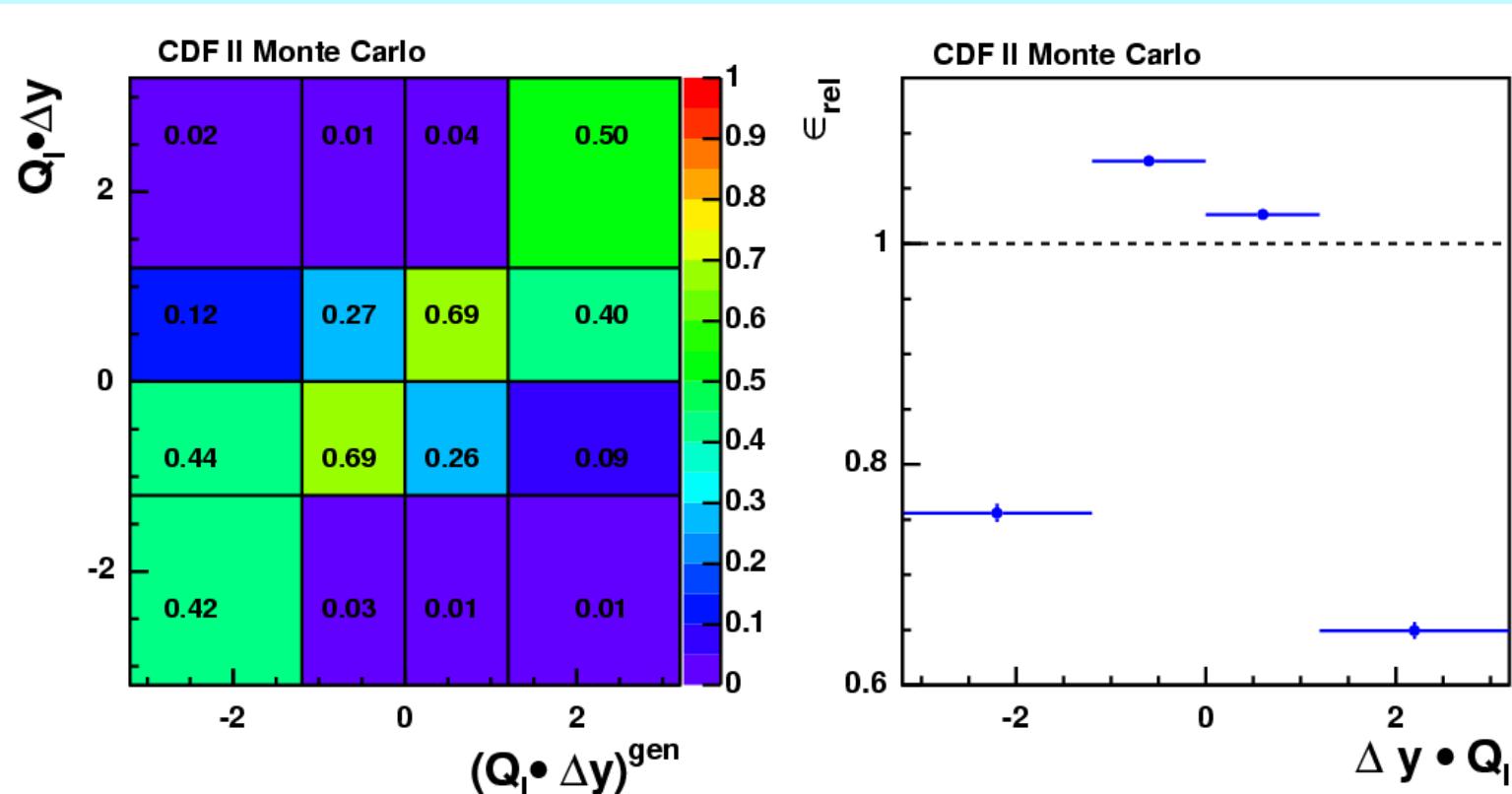
**Selection efficiency,  
 $t\bar{t}$  reconstruction and  
background**  
-> modification of  
true  $\Delta y Q_i$  and A

$$\begin{pmatrix} \hat{N}_1 \\ \hat{N}_2 \\ \hat{N}_3 \\ \hat{N}_4 \end{pmatrix} = \left[ \begin{pmatrix} S_{11} & S_{12} & S_{13} & S_{14} \\ S_{21} & S_{22} & S_{23} & S_{24} \\ S_{31} & S_{32} & S_{33} & S_{34} \\ S_{41} & S_{42} & S_{43} & S_{44} \end{pmatrix}, \begin{pmatrix} \epsilon_{11} & 0 & 0 & 0 \\ 0 & \epsilon_{22} & 0 & 0 \\ 0 & 0 & \epsilon_{33} & 0 \\ 0 & 0 & 0 & \epsilon_{44} \end{pmatrix} \right]^{-1} \begin{pmatrix} N_1^{bg\ sub} \\ N_2^{bg\ sub} \\ N_3^{bg\ sub} \\ N_4^{bg\ sub} \end{pmatrix}$$

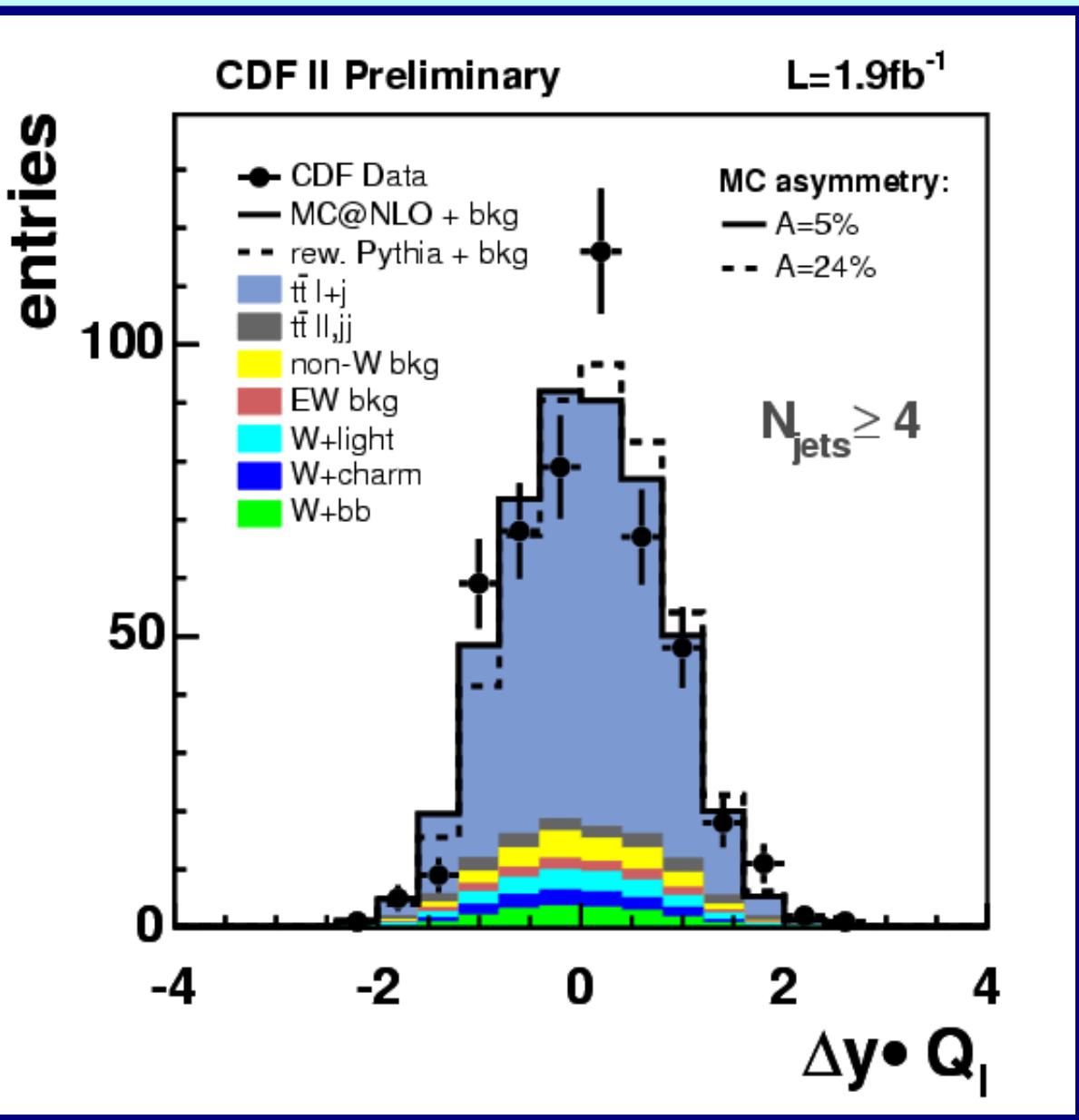
Smearing matrix      efficiencies      = C



**Subtraction  
of background  
correct for other  
effects using  
a 4x4 matrix**



# Inclusive Asymmetry



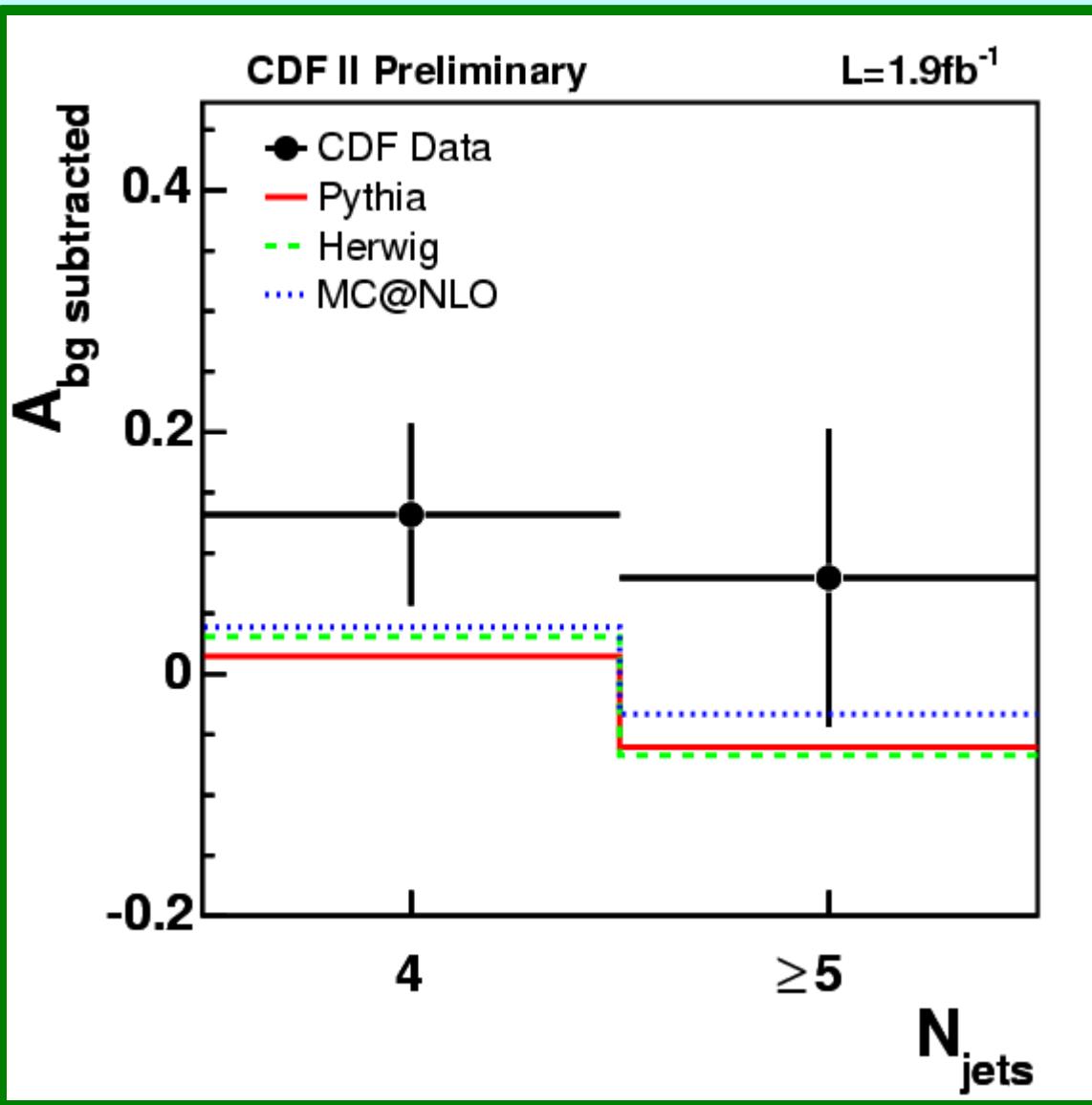
$$A_{\text{rec}} = (8.7 \pm 4.5) \%$$

$$A_{\text{bg-sub}} = (11.9 \pm 6.4) \%$$

Correction with  
4x4 matrix:  
 $A = (24 \pm 13 \pm 4) \%$

NLO: (4-7)% in  $\Delta y Q_1$

# Exclusive Measurement – $A^{\text{bg sub}}(N_{\text{jets}})$



4 jets:

$$A^{\text{bg sub}} = (13.2 \pm 7.5)\%$$

$\geq 5$  jets:

$$A^{\text{bg sub}} = (7.9 \pm 12.3)\%$$

Measured asymmetry in both bins above NLO prediction but consistent with NLO prediction within errors.