Charm production at high ET

The top-charm frontier at the LHC

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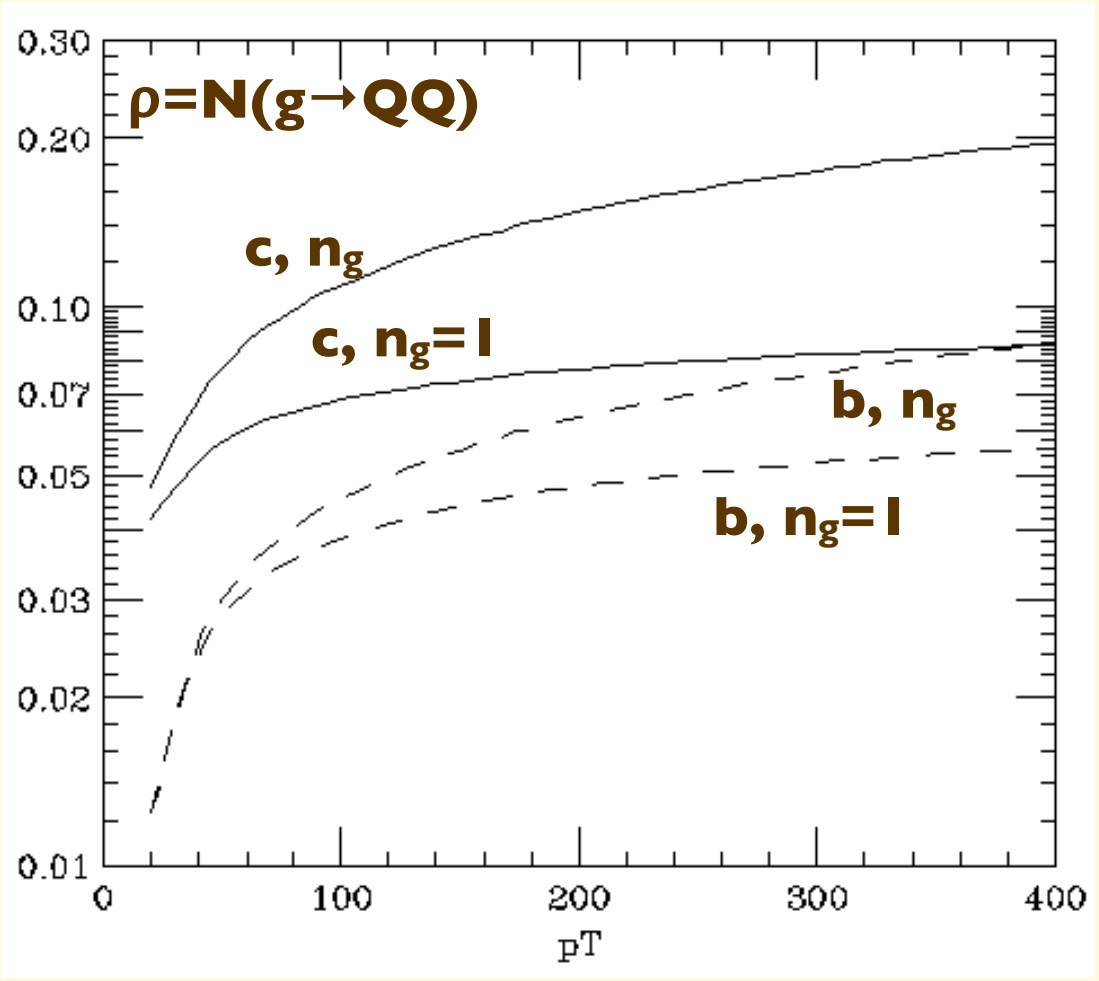
Heavy quark multiplicities in gluon jets,
Mangano, Nason, PLB285 (1992) 160-166

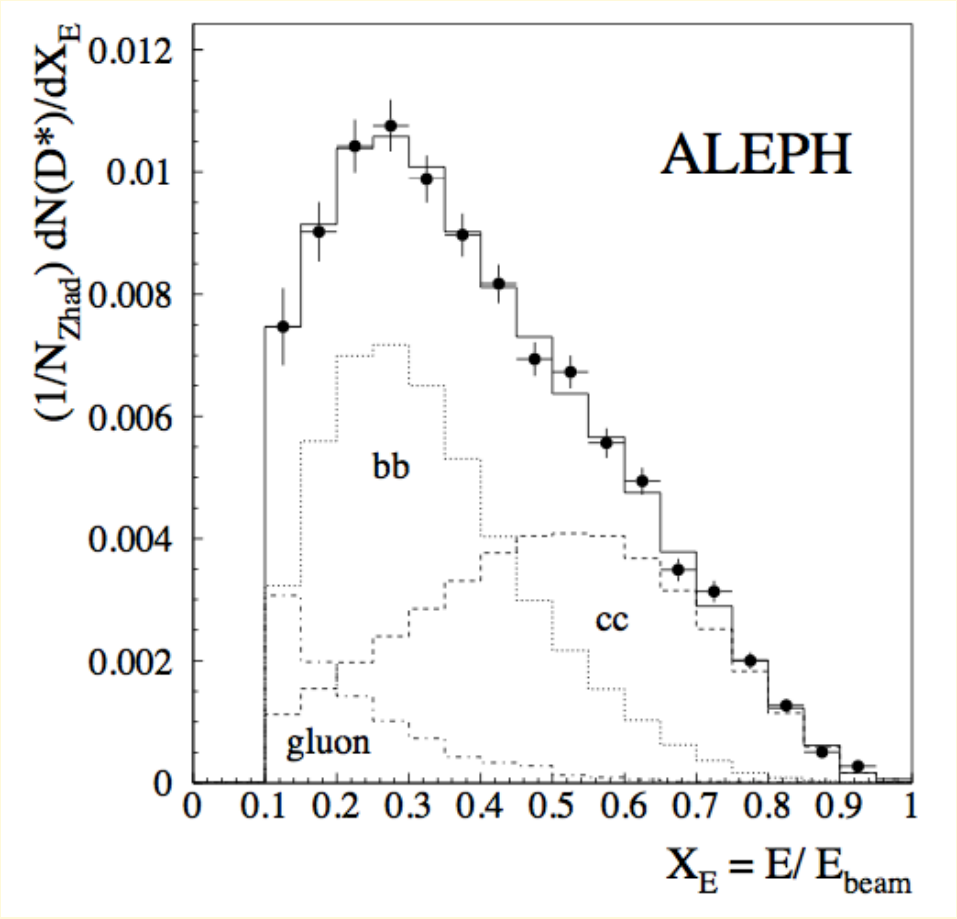
$$a = -\frac{1}{4}\left[1 + \frac{2C_A}{3\pi b}\left(1 - \frac{C_F}{C_A}\right)\right]$$

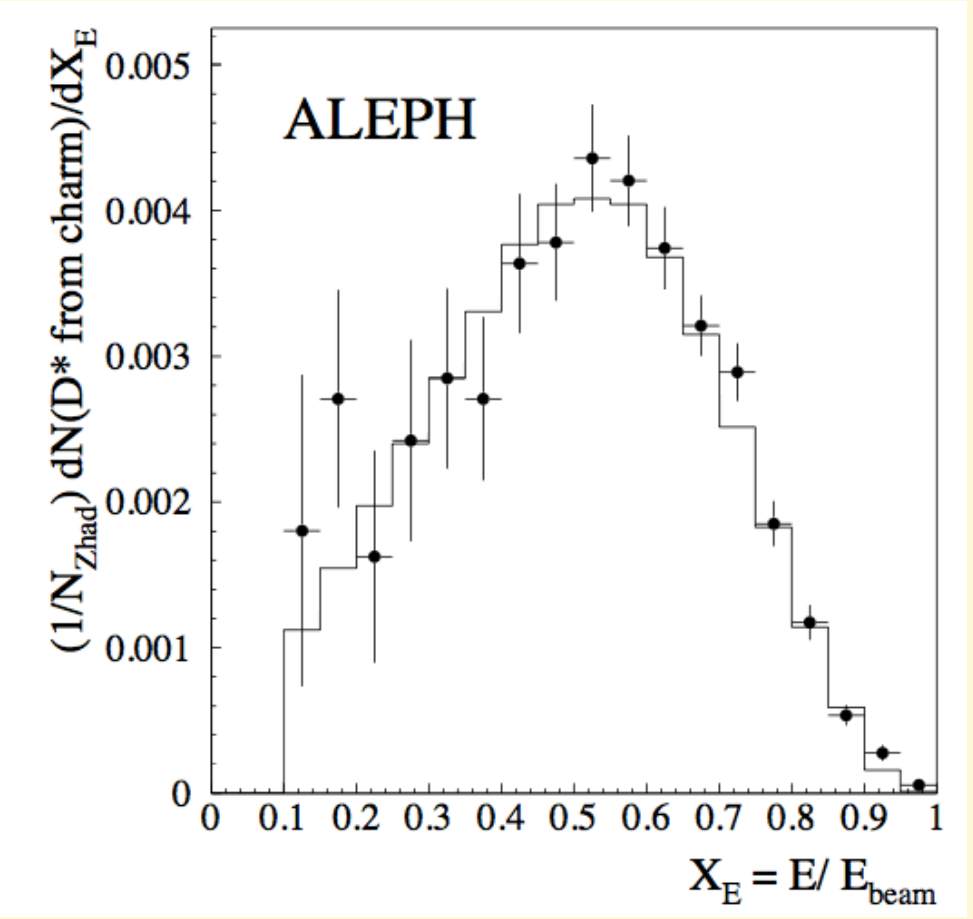
$$b = \frac{11C_A - 2N_F}{12\pi}.$$

$$\rho = \frac{1}{6\pi}\int_{4m^2}^{Q^2} \frac{dK^2}{K^2}\,\alpha_s(K^2)\left(1 + \frac{2m^2}{K^2}\right)\sqrt{1 - \frac{4m^2}{K^2}} \times n_g(Q^2, K^2)\,, \qquad (1.1)$$

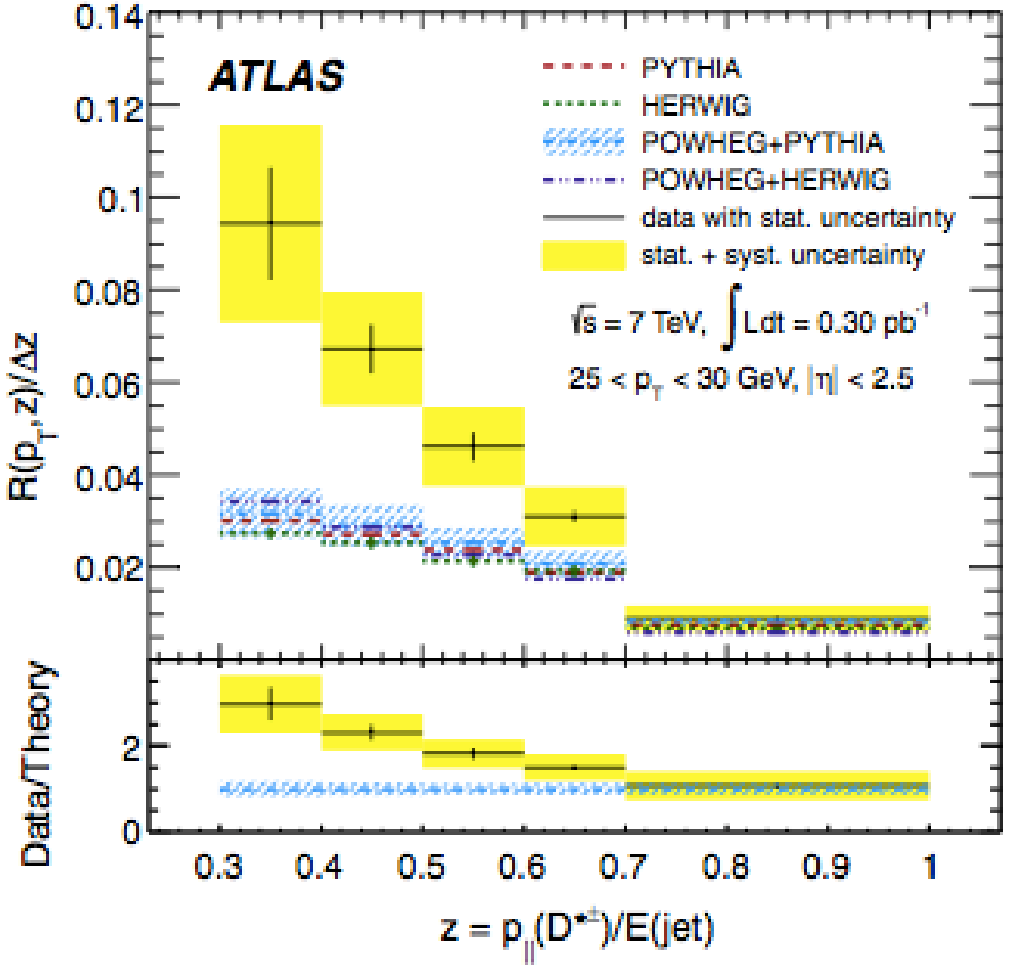
$$n_g(Q^2, K^2) = \left(\frac{\log(Q^2/\Lambda^2)}{\log(K^2/\Lambda^2)}\right)^a \times \cosh\left(\sqrt{\frac{2C_A}{\pi b}}\left(\sqrt{\log\frac{Q^2}{\Lambda^2}} - \sqrt{\log\frac{K^2}{\Lambda^2}}\right)\right)$$

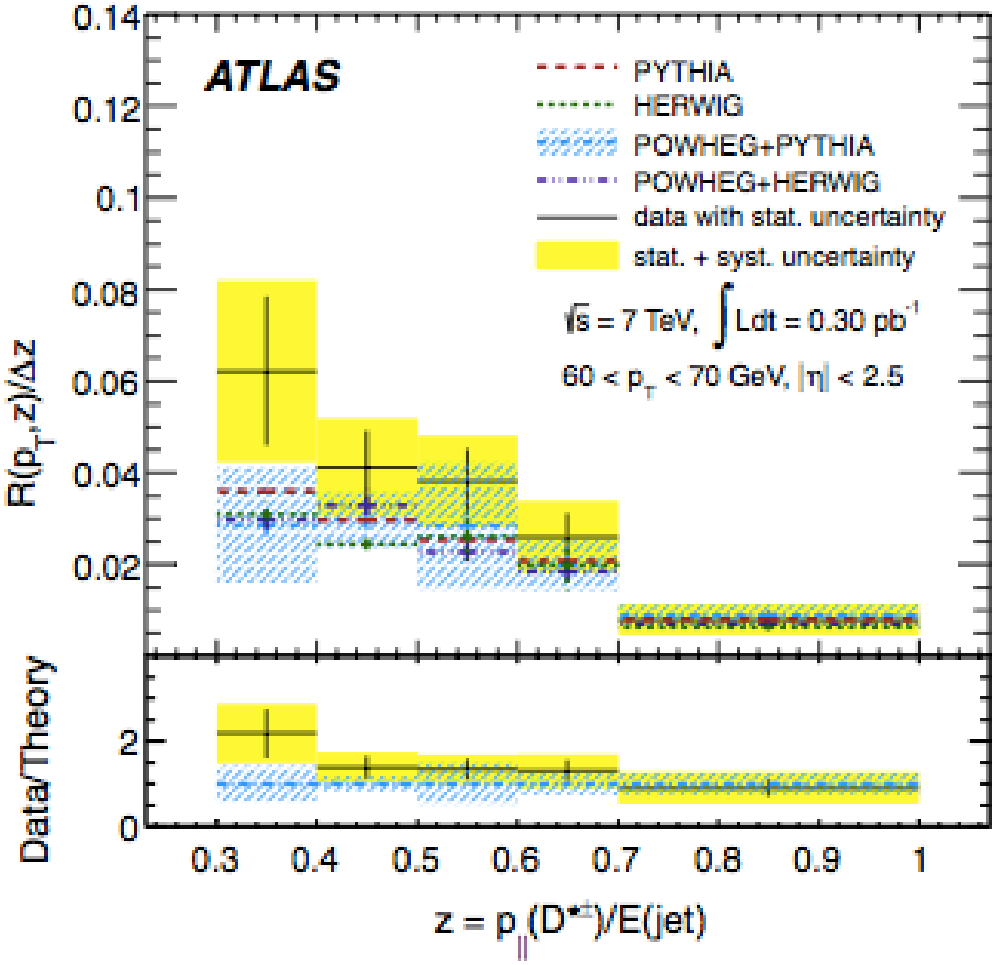






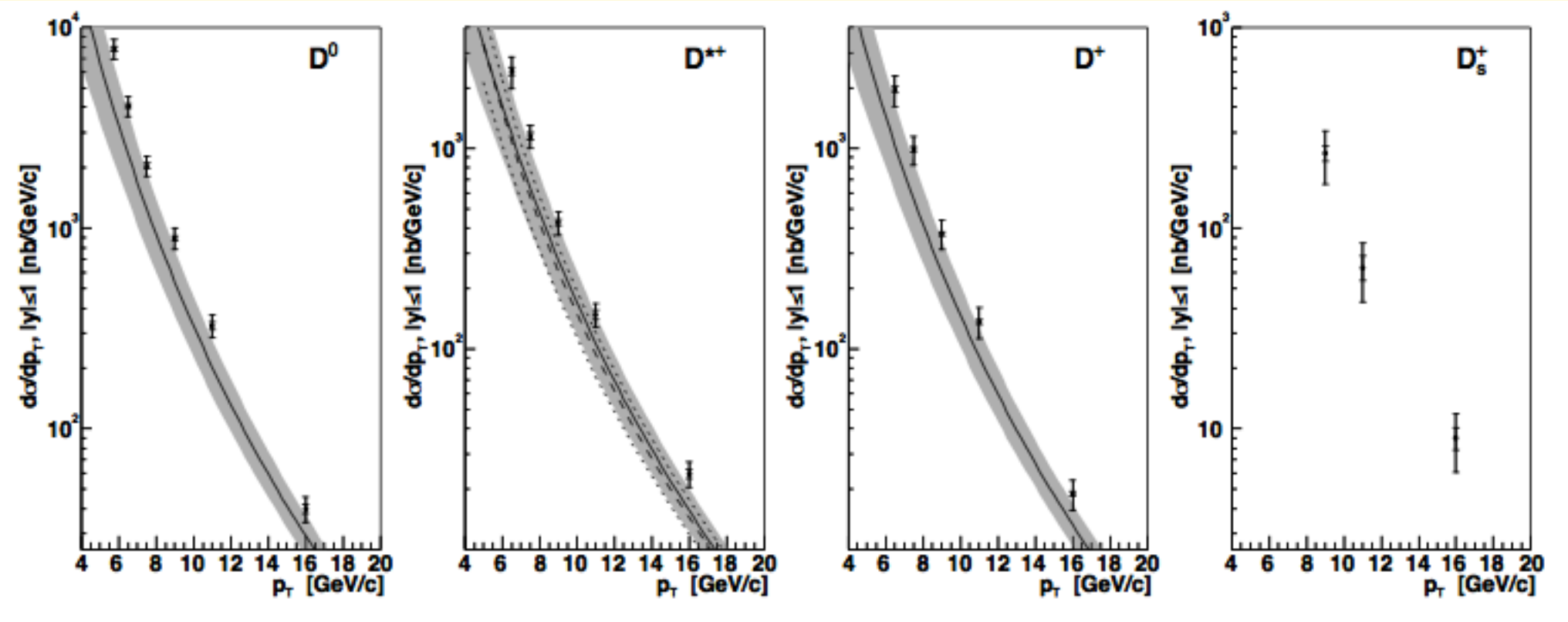
ALEPH, arXiv:hep-ex/9909032



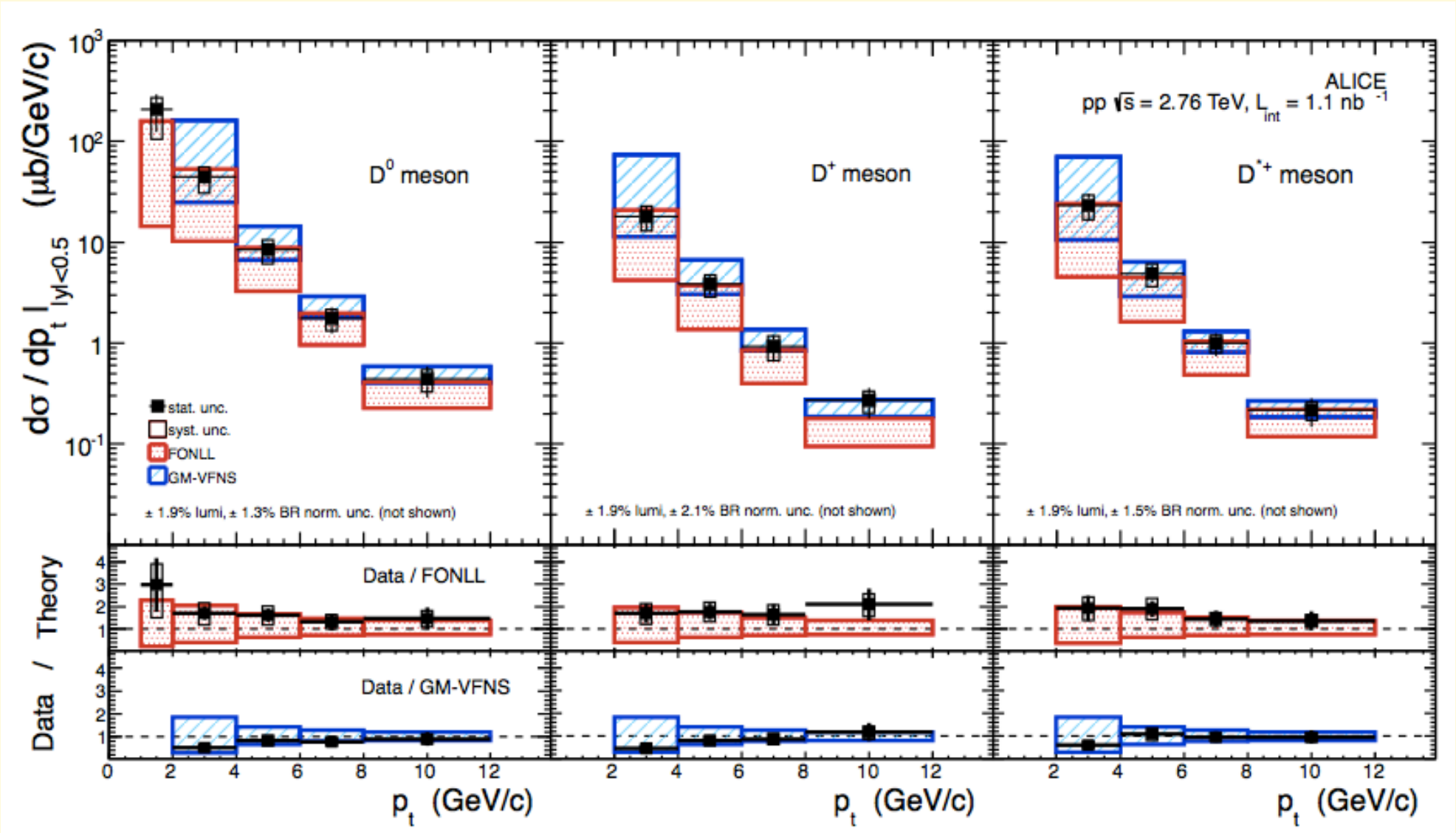


ATLAS, Phys. Rev. D85 (2012) 052005

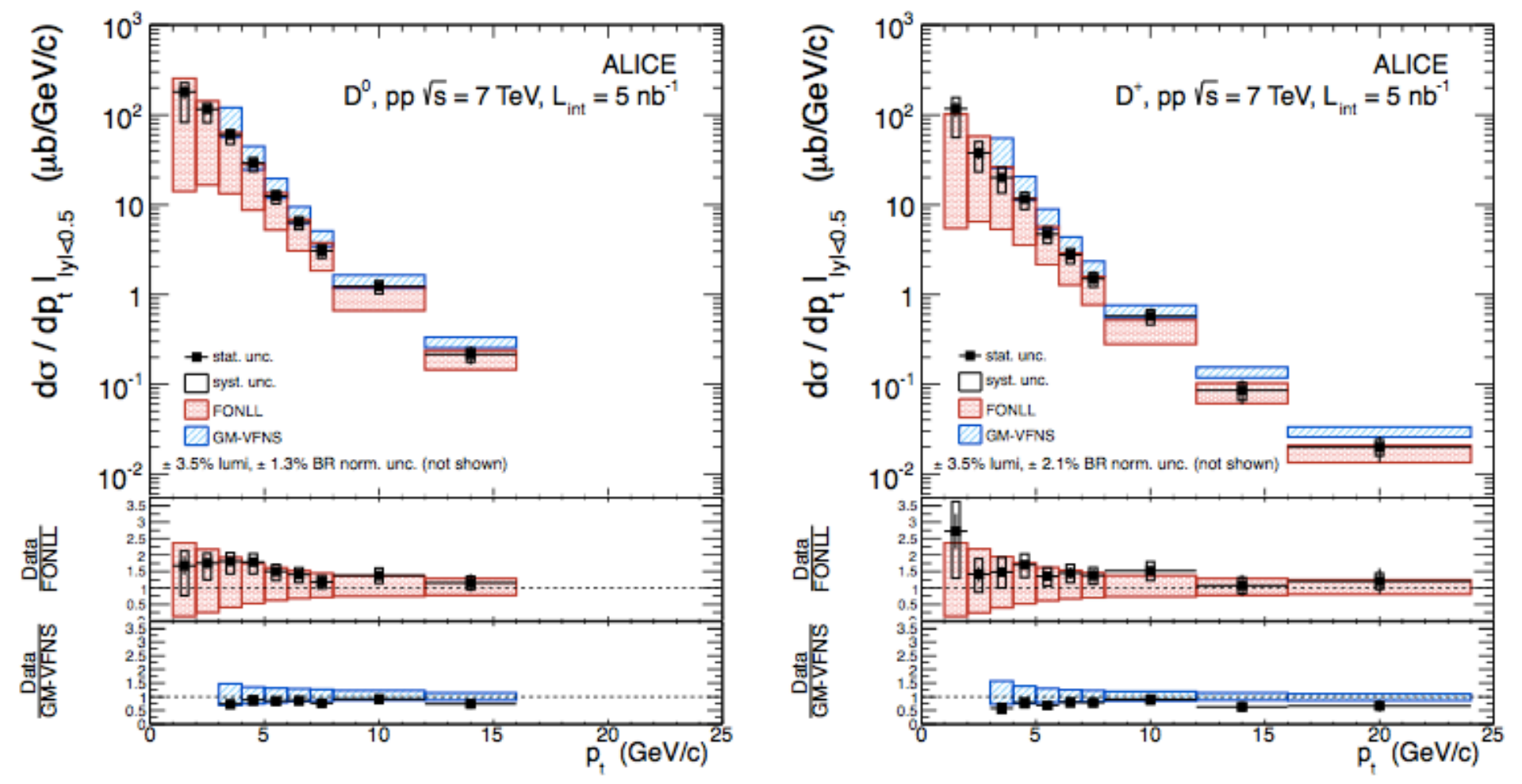
CDF, Phys.Rev.Lett. 91 (2003) 241804



ALICE, Phys.Rev.Lett. 91 (2003) 241804



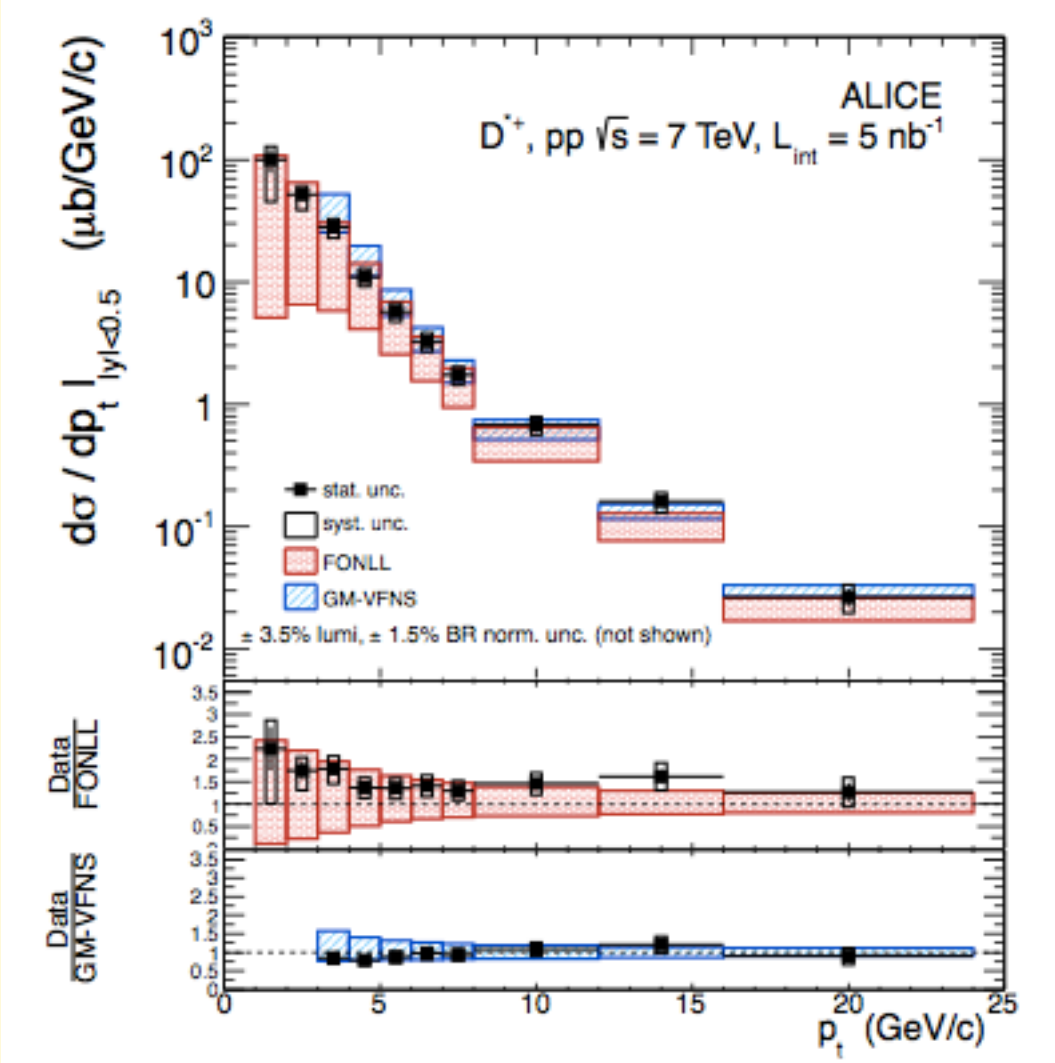
ALICE, JHEP 1201 (2012) 128



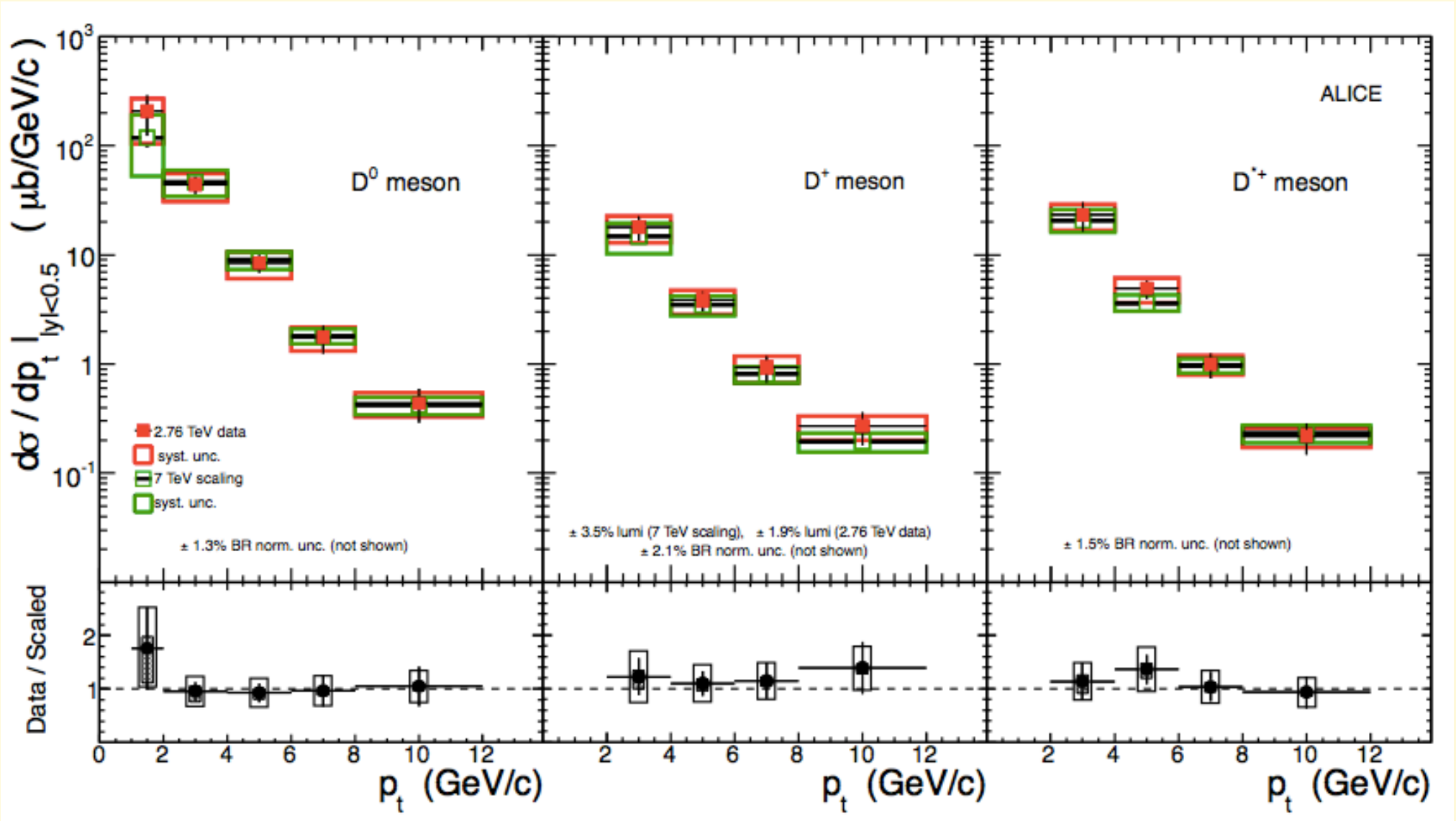
FONLL, Cacciari et al, JHEP 05 (1998) 007, JHEP 10 (2012) 137

GM-VFNS, Kniehl et al, Phys. Rev. D71 (2005) 014018, EPJC72 (2012) 2082

ALICE, JHEP 1201 (2012) 128

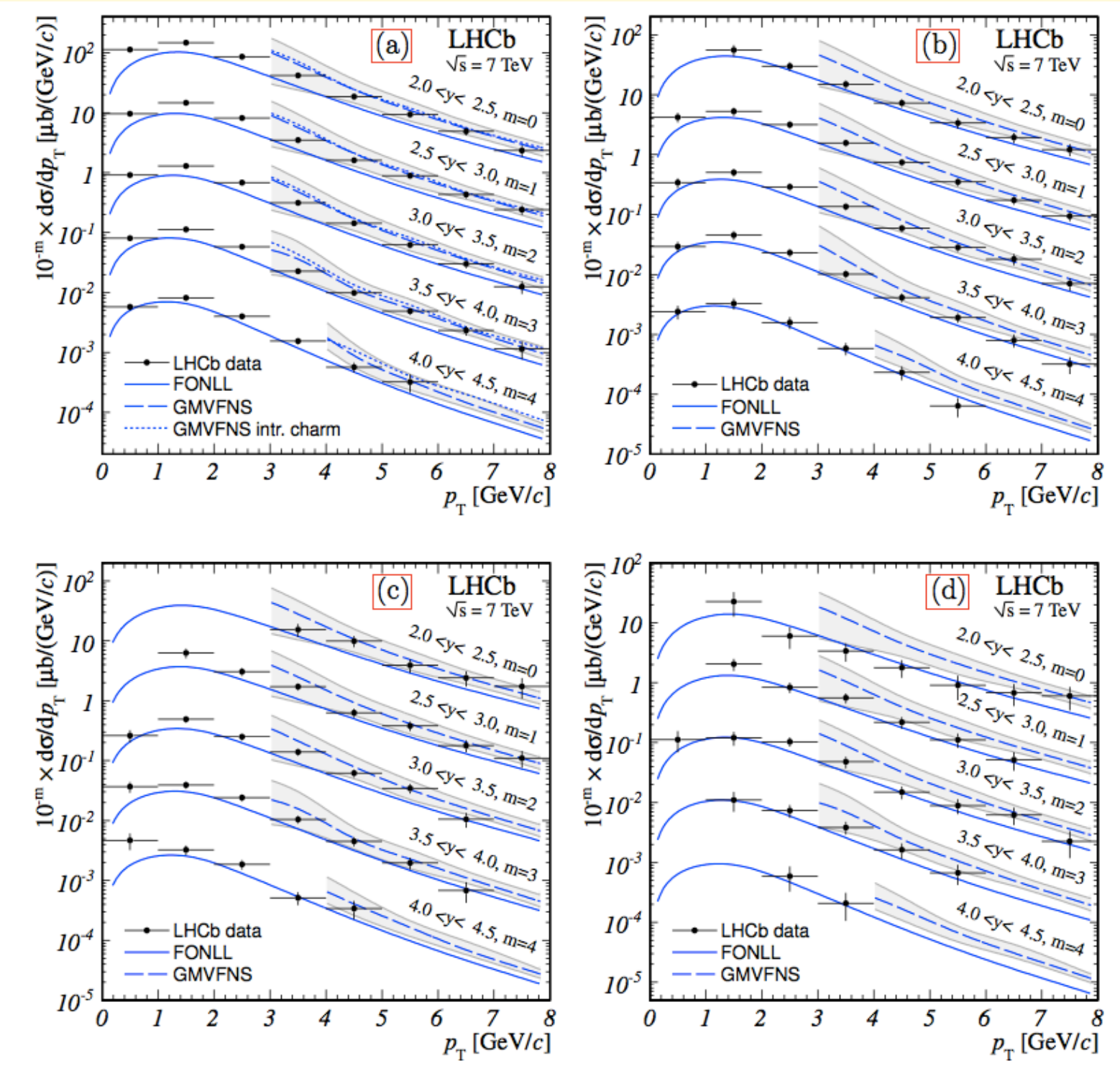


ALICE, JHEP 1207 (2012) 191

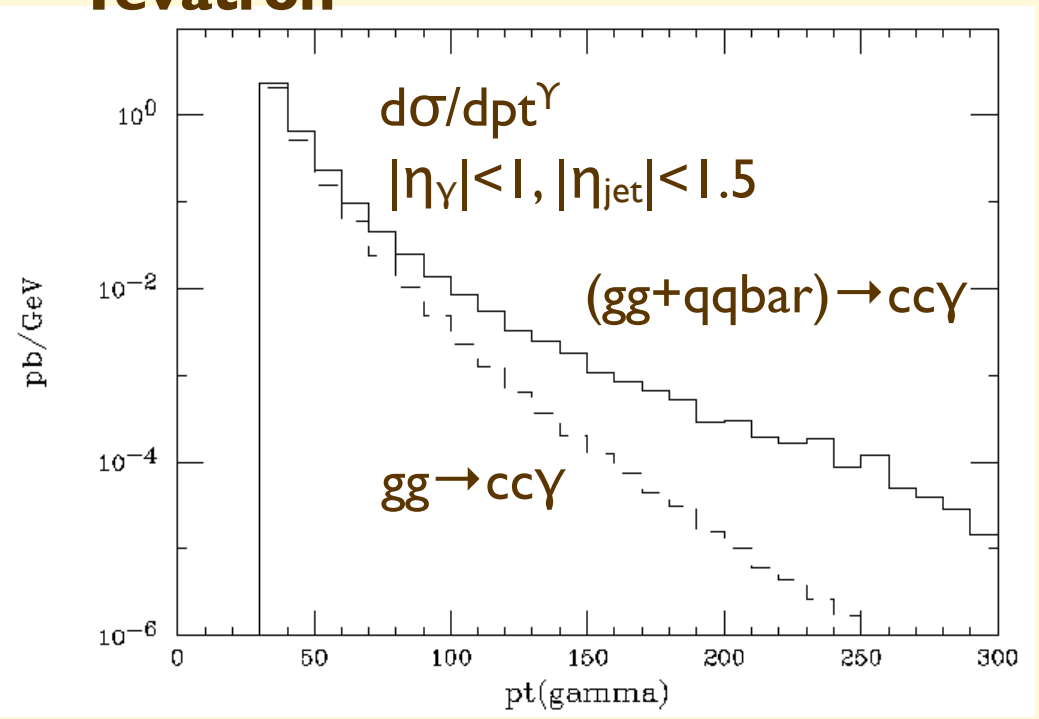


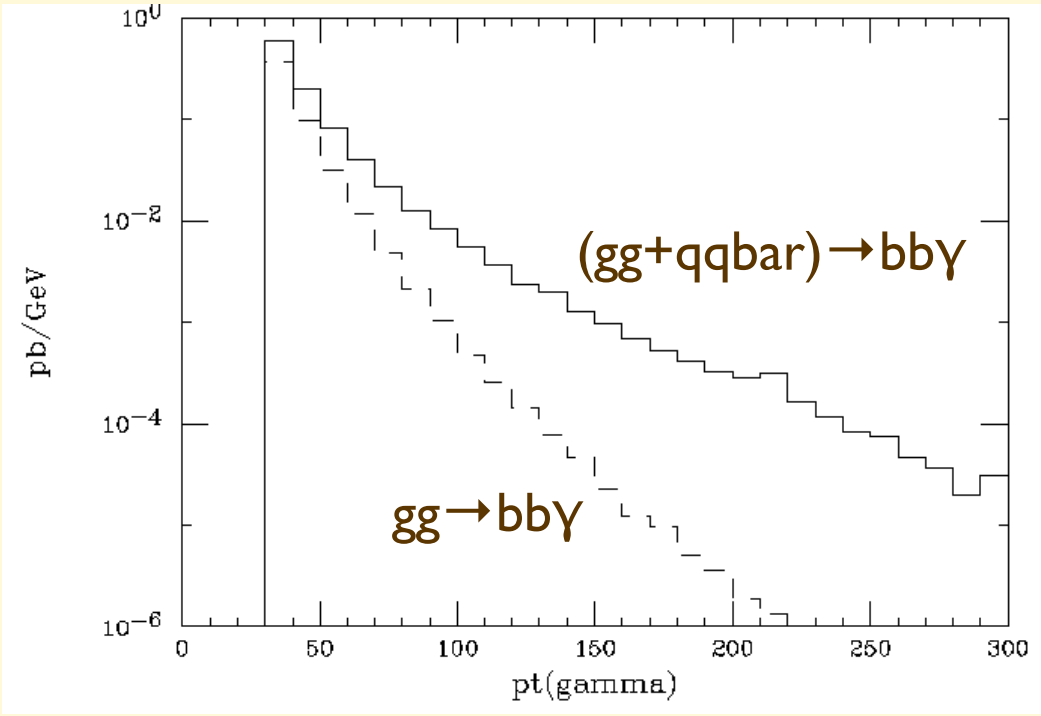
2.76 TeV data vs rescaling of 7 TeV data using FONLL 7 TeV/2.76 TeV ratio

LHCb, Nucl.Phys. B871 (2013) 1

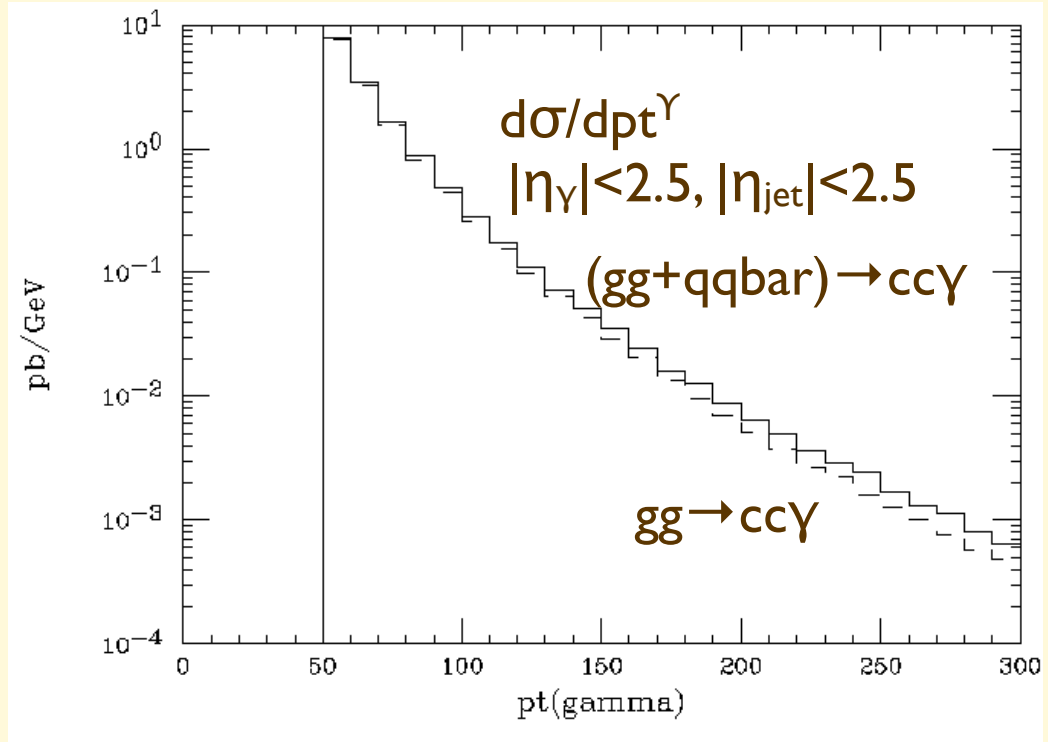


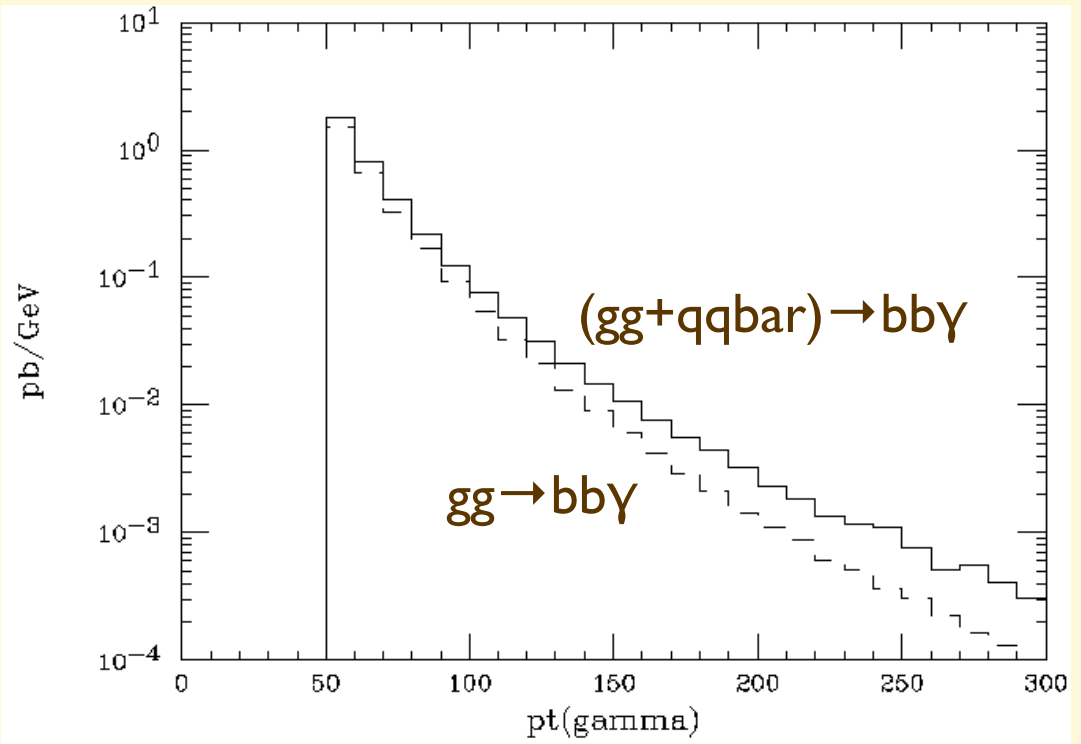
Tevatron





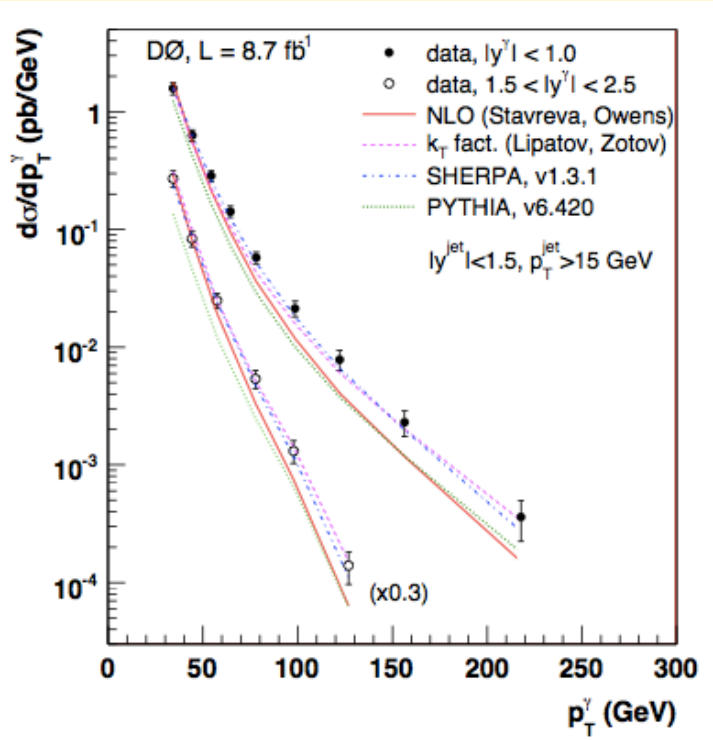
LHC

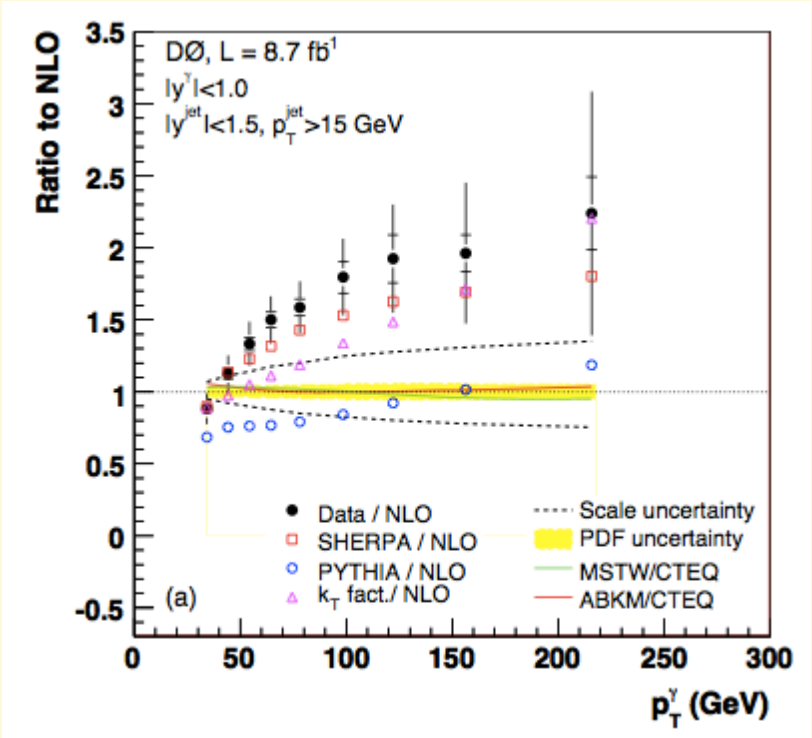




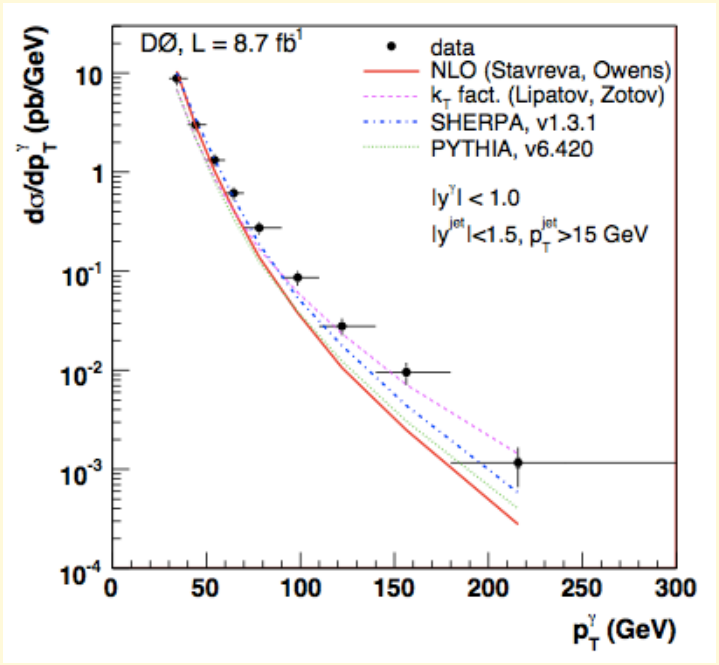
D0 results

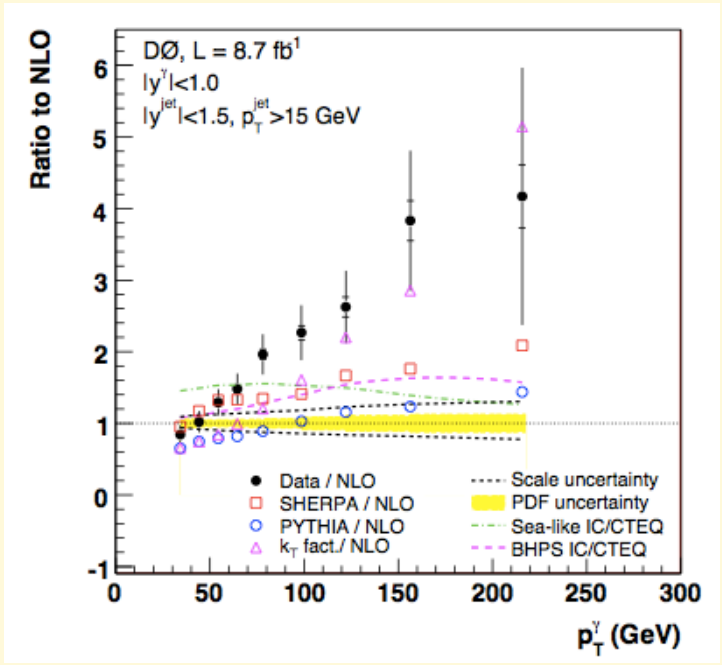
γ+b



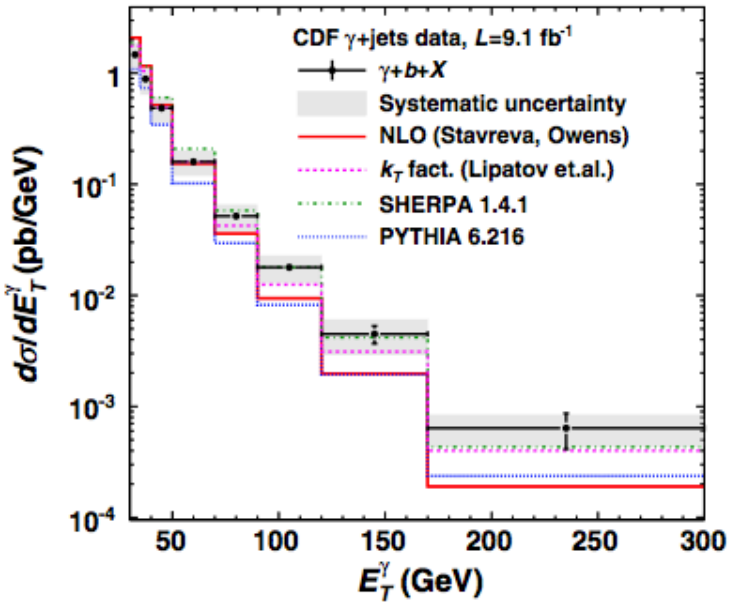


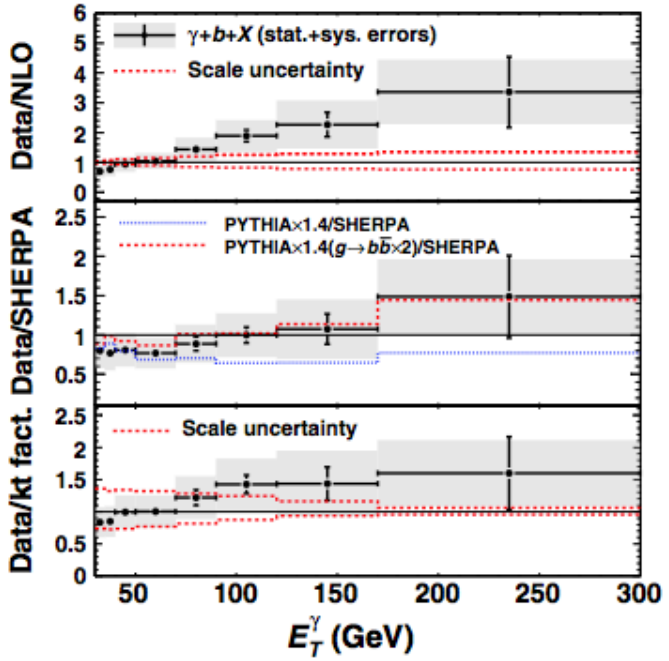
γ+c

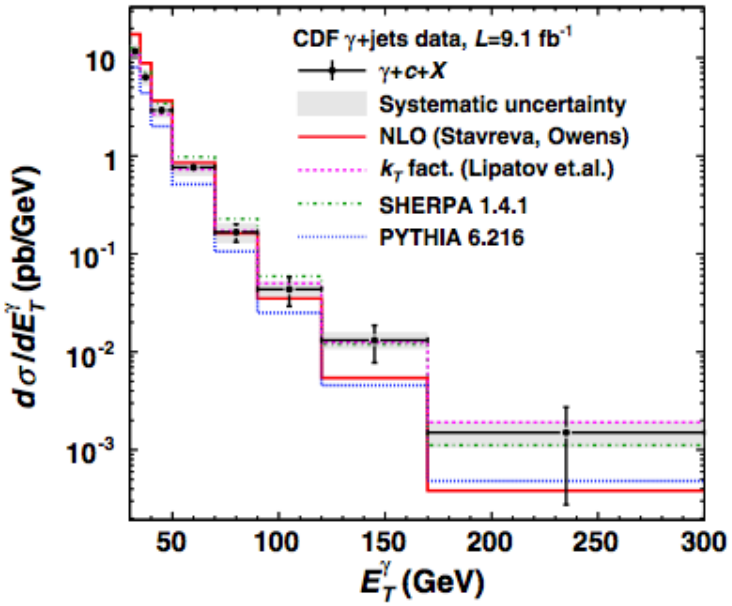




CDF results


CDF γ+jets data, L=9.1 fb-1
γ+b+X
Systematic uncertainty
NLO (Stavreva, Owens)
kT fact. (Lipatov et.al.)
SHERPA 1.4.1
PYTHIA 6.216
dσ/dE_T^γ (pb/GeV)
E_T^γ (GeV)


γ+b+X (stat.+sys. errors)
Scale uncertainty
Data/NLO
PYTHIA×1.4/SHERPA
PYTHIA×1.4(g→bb̄×2)/SHERPA
Data/SHERPA
Scale uncertainty
Data/kt fact.
E_T^γ (GeV)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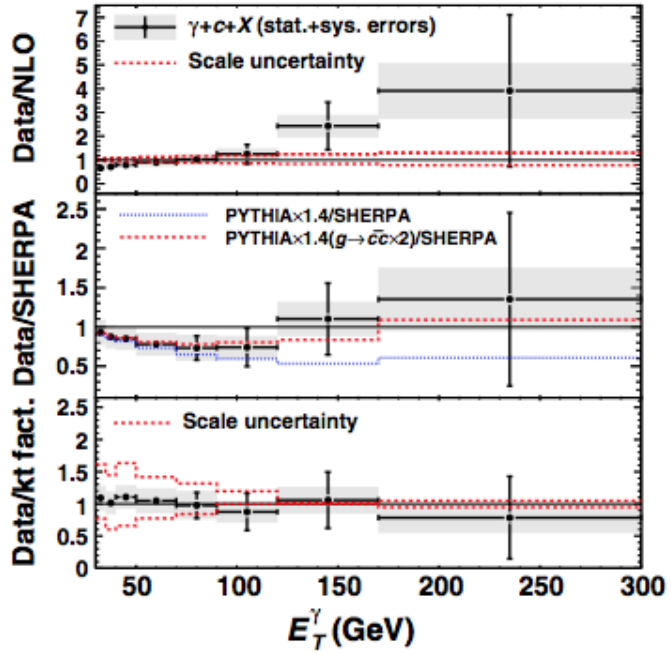
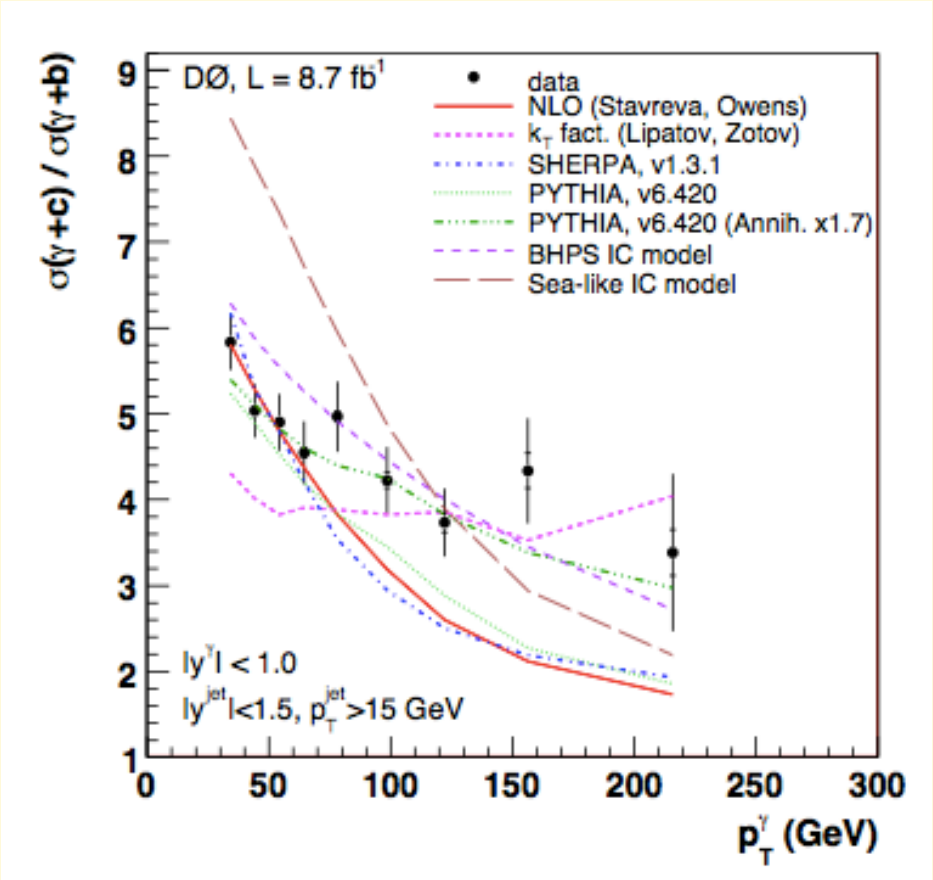
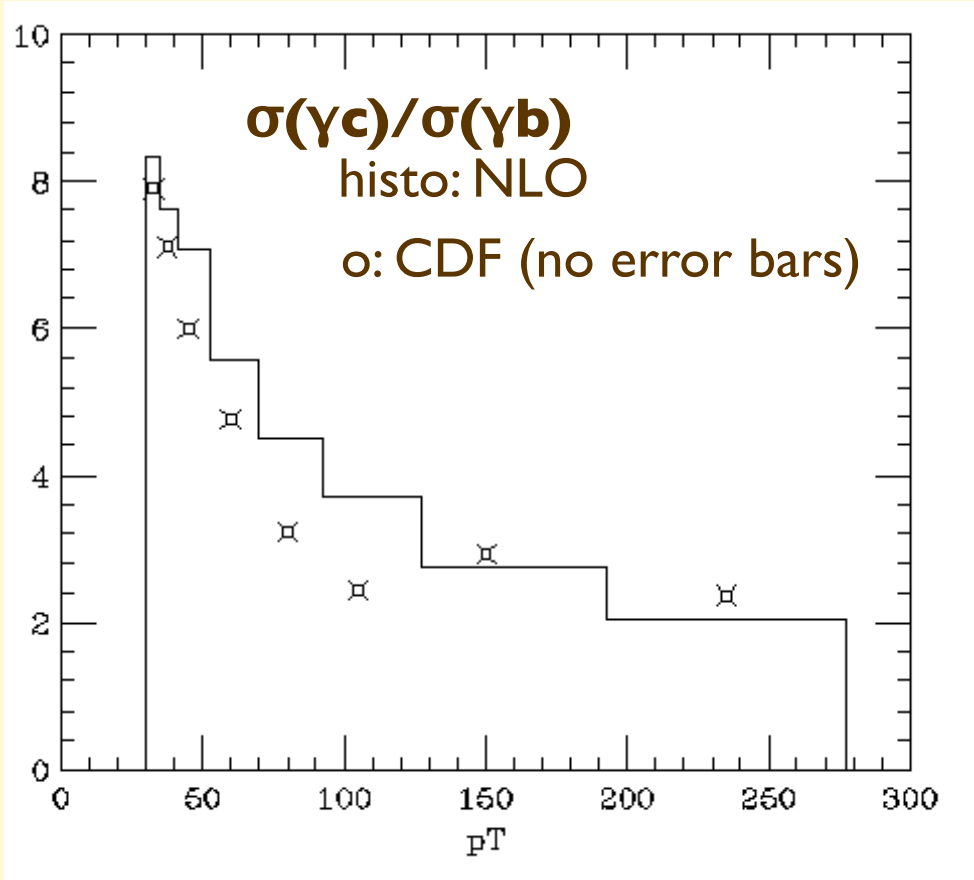

γ+c+X (stat.+sys. errors)
Scale uncertainty
Data/NLO
PYTHIA×1.4/SHERPA
PYTHIA×1.4(g→cc̄×2)/SHERPA
Data/SHERPA
Scale uncertainty
Data/kt fact.
E_T^γ (GeV)

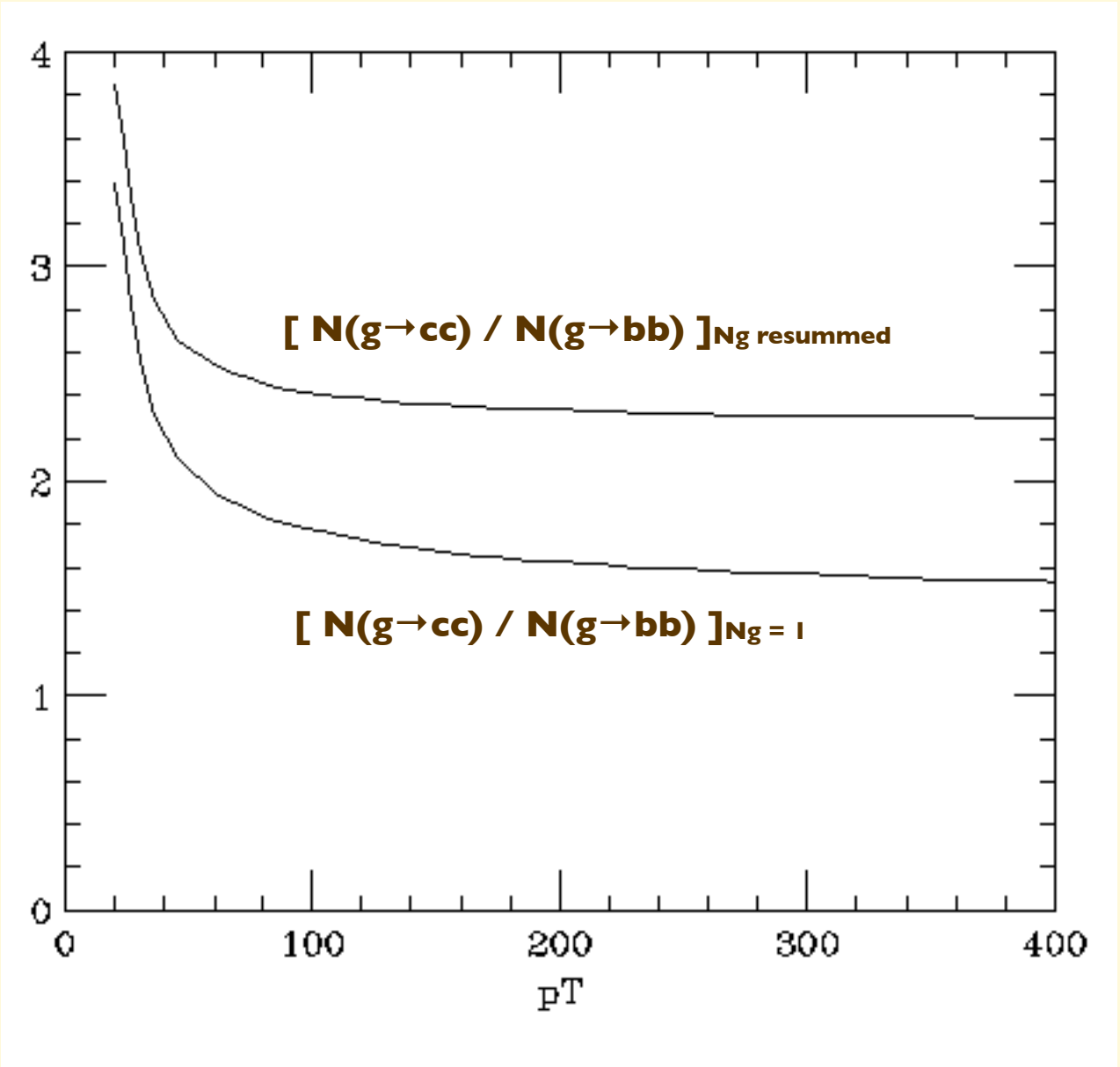
Similar trend in cdf and D0: an excess in both c and b.

However, if we look at the ratios c/b:





Are the CDF and D0 results consistent with each other?


4
3
2
1
0
0
100
200
300
400
pT
[N(g→cc) / N(g→bb)]Ng resummed
[N(g→cc) / N(g→bb)]Ng = 1

Thus γc production at large pt at the LHC is more sensitive to the charm PDF than at the Tevatron, where gluon splitting has a major role at large pt.