Diffractive Dijets Photoproduction at HERA (Comparison with Pythia8)

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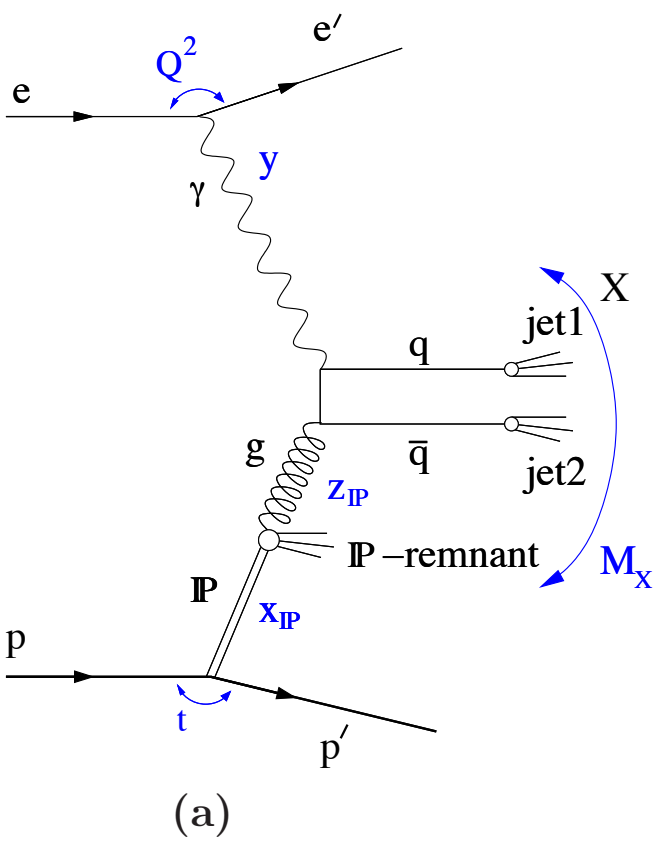
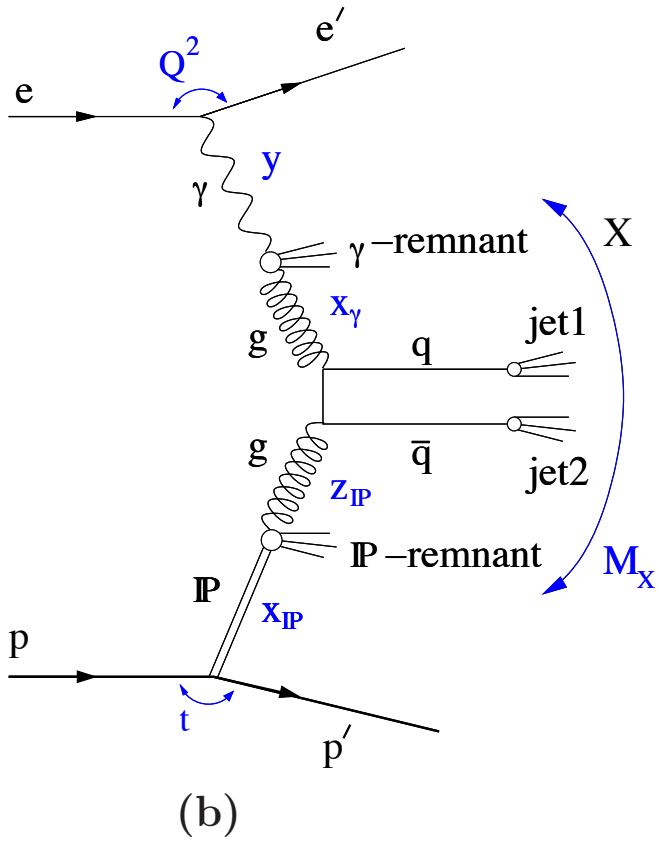
Diffractive Dijets in Photoproduction

- Comparison of Diffractive Dijets in Photoproduction at HERA (H1_2015_I1343110) 1502.01683 with Pythia8





Direct ($x_\gamma \approx 1$)

Resolved ($x_\gamma < 1$)

Common DIS Kinematics Observables

- Photon virtuality (negative of electron four-momentum transfer squared)

$$Q^2 = -q^2 = -(k - k')^2 = sxy \approx 4E_e E'_e \sin^2(\tfrac{\theta_e}{2})$$

- The energy transferred by the electron

$$\nu = \tfrac{p\cdot q}{m_p} = E'_e - E_e$$

- Inelasticity (fraction of the electron energy transferred to the proton)

$$y = \tfrac{p\cdot q}{p\cdot k} = \tfrac{\nu}{E_e} \approx 1 - \tfrac{E'_e}{E_e} \sin^2(\tfrac{\theta_e}{2})$$

- Bjorken - x (momentum fraction of proton carried by the struck quark)

$$x = \tfrac{Q^2}{2p\cdot q} = \tfrac{Q^2}{2m_p \nu}$$

- Squared centre-of-mass energy of the electron-proton collision system

$$s = (k + p)^2$$

- Squared centre-of-mass energy of the photon-proton collision system

$$W^2_{\gamma p} = (q + p)^2 = M^2_X = m^2_p - Q^2 + sy$$

Dijects Production Specific Observables

- Invariant Mass the hadronic final state excluding the leading proton

$$M_X^2 = P_X^2$$

- The longitudinal momentum fraction lost by the incoming proton

$$x_{\mathbb{P}} = \frac{q\cdot(p-p')}{q\cdot p}$$

- The four-momentum transfer squared at the proton vertex

$$t = (p - p')^2$$

- Longitudinal momentum fraction of photon (entering hard sub-process)

$$x_\gamma = \frac{p\cdot u}{p\cdot q}$$

- Longitudinal momentum fraction of Pomeron (entering hard sub-process)

$$z_{\mathbb{P}} = \frac{q\cdot v}{q\cdot(p-p')}$$

- Invariant mass of the dijet system M_{12}^2 (c.o.m of the hard sub-process)

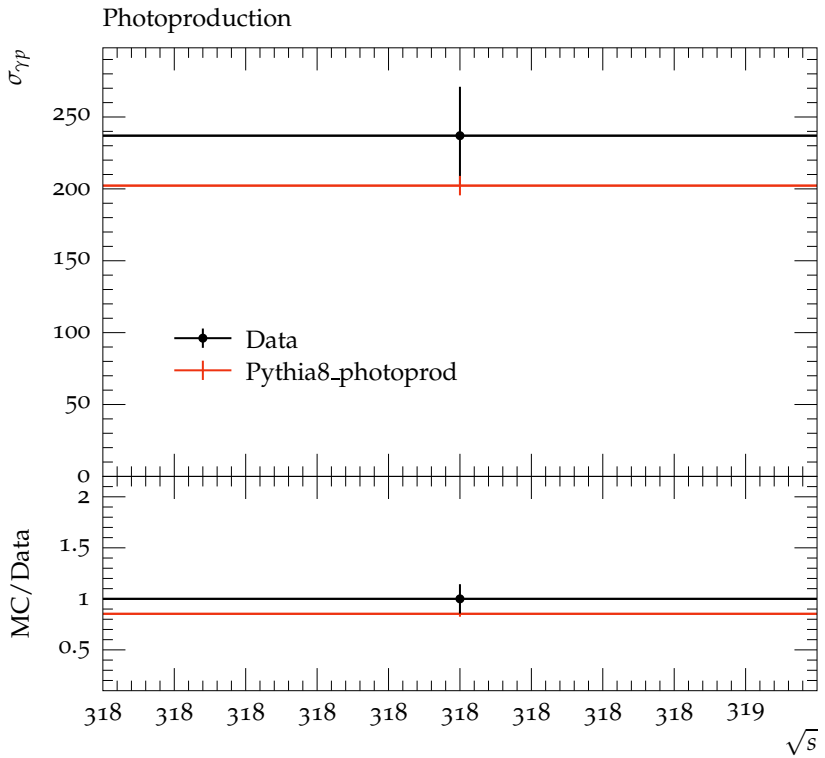
$$M_{12}^2 = (u + v)^2$$

Event Selection and MC Generator inputs

- Beam energies of the proton & positron are 920 GeV and 27.5 GeV resp.
- $Q^2 < 2$ GeV^2 and $0.2 < y < 0.7$
- $0.010 < x_{\mathbb{P}} < 0.024$, $z_{\mathbb{P}} < 0.8$ and $|t| < 0.6$ GeV^2
- $E_T^{jet1} > 5.5$ GeV, $E_T^{jet2} > 4.0$ GeV and $-1 < \eta^{jet} < 2.5$

Diffractive Dijets in Photoproduction - Results 1

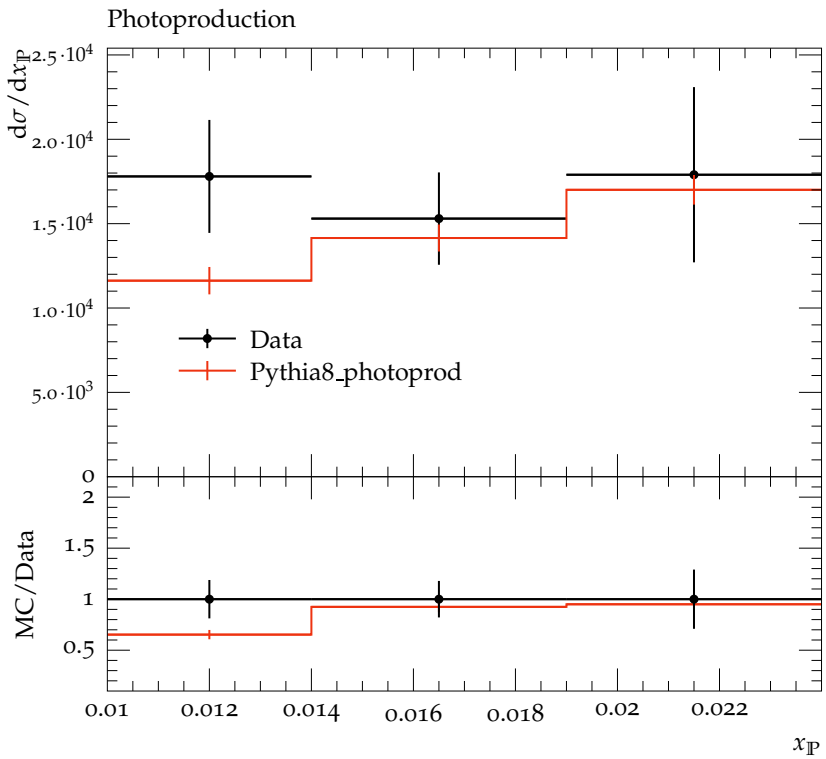
- Crossection of Photoproduction at 318 GeV

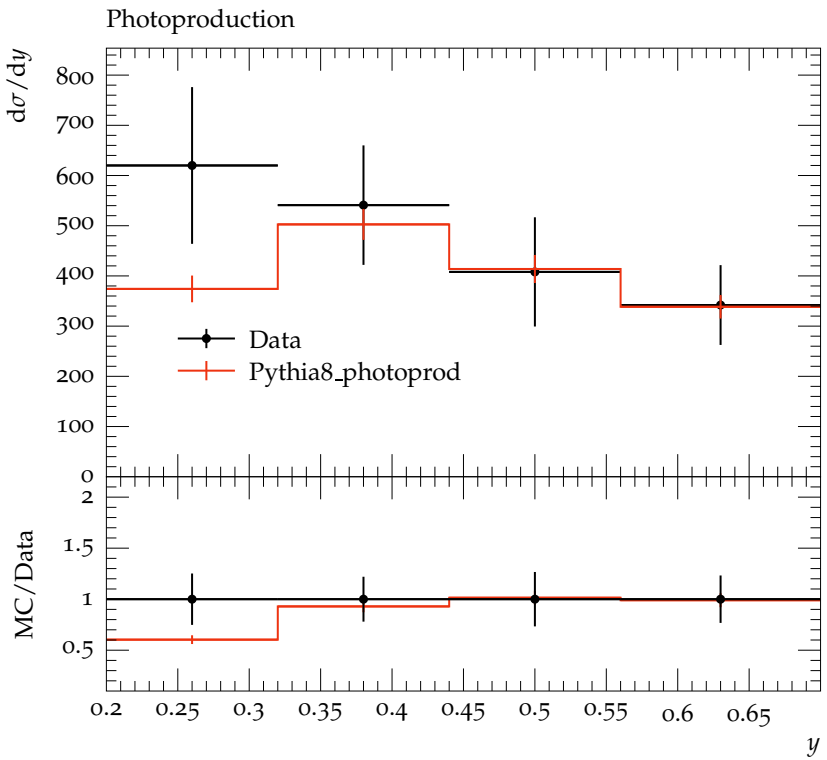


- Dijets cross-section is 237 pb (HERA) and Pythia $\approx$ 200 pb

Diffractive Dijets in Photoproduction - Results 2

- Fraction of the proton momentum carried by Pomeron ($x_{\mathbb{P}}$) & Inelasticity

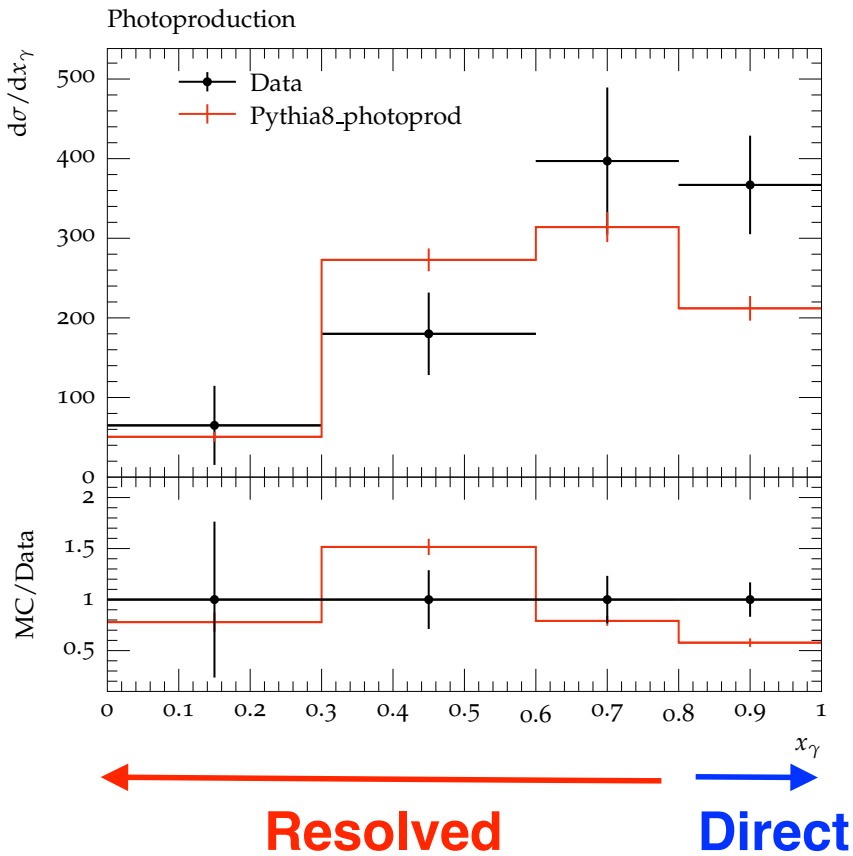


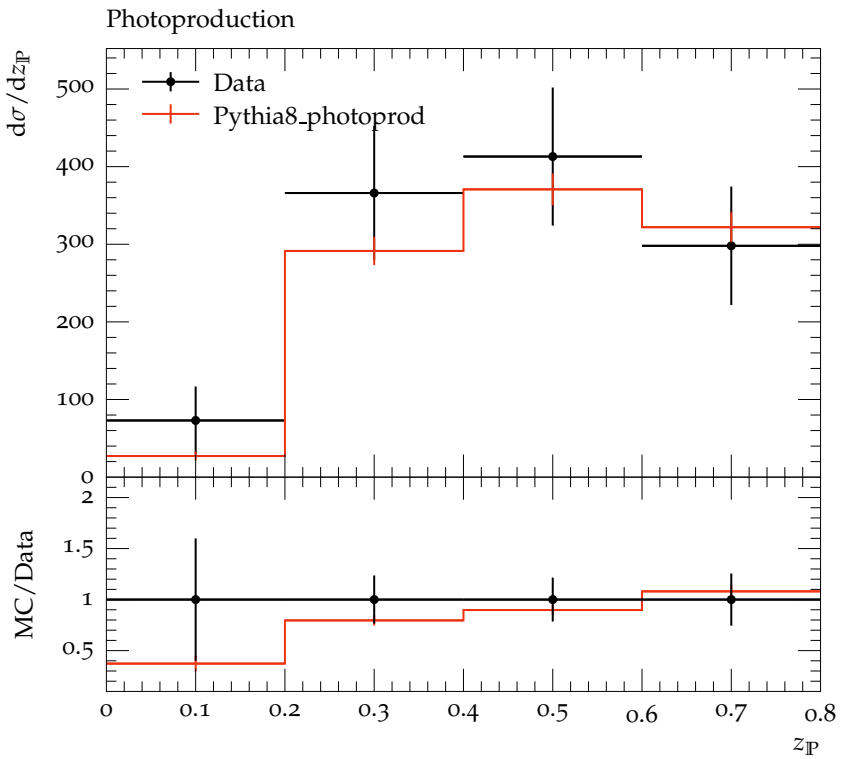


upto 50% differences in the low x_P and y regions

Diffractive Dijets in Photoproduction - Results 3

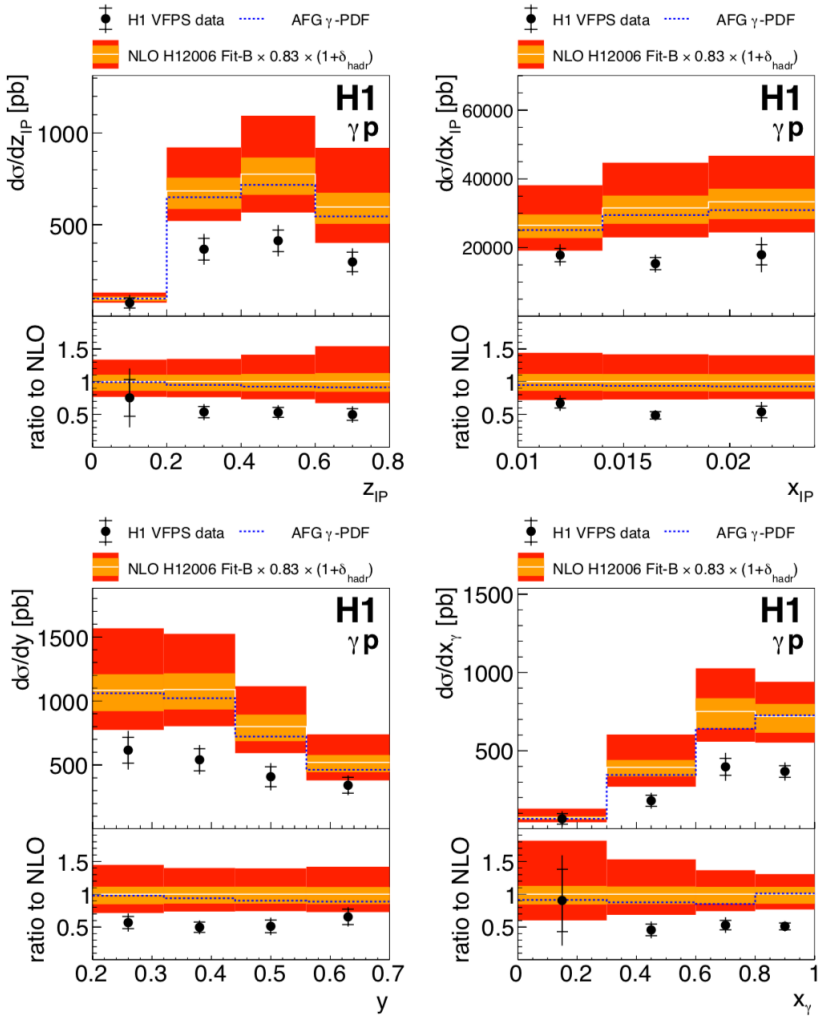
- Momentum fraction of photon and Pomeron entering hard sub-process





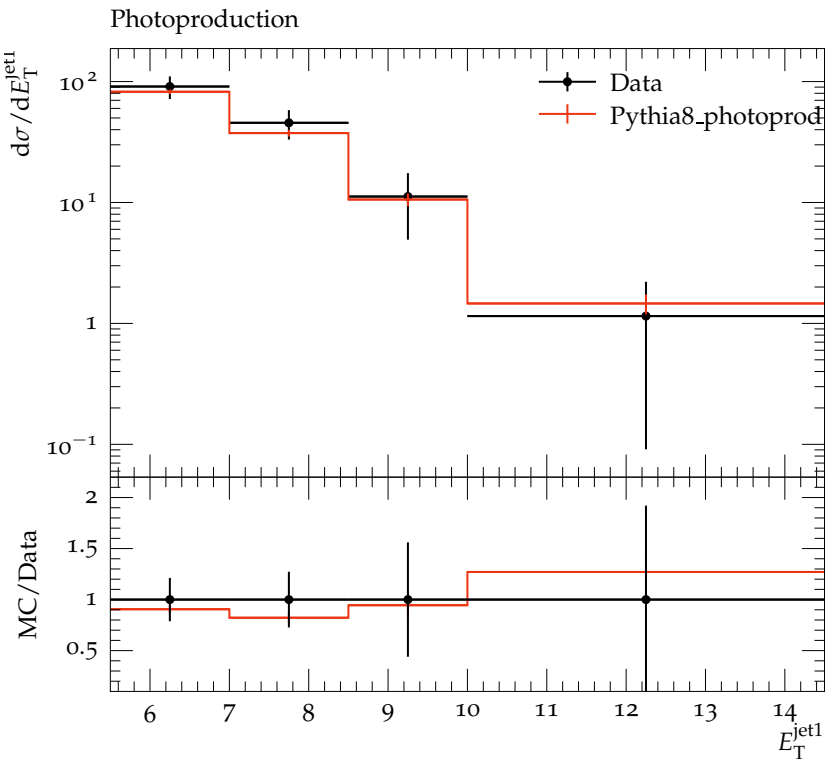
Diffractive Dijets in Photoproduction - NLO QCD

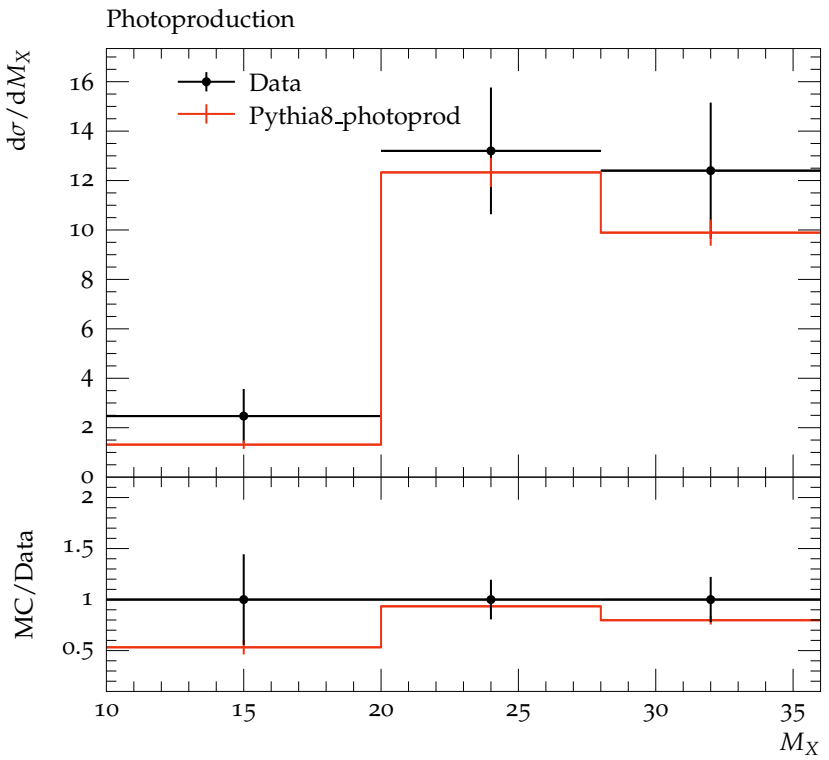
- NLO QCD calculations based on the H12006 Fit-B DPDF set overpredicts the data



Diffractive Dijets in Photoproduction - Results 4

- Transverse energy of the leading jet and invariant mass of remanants

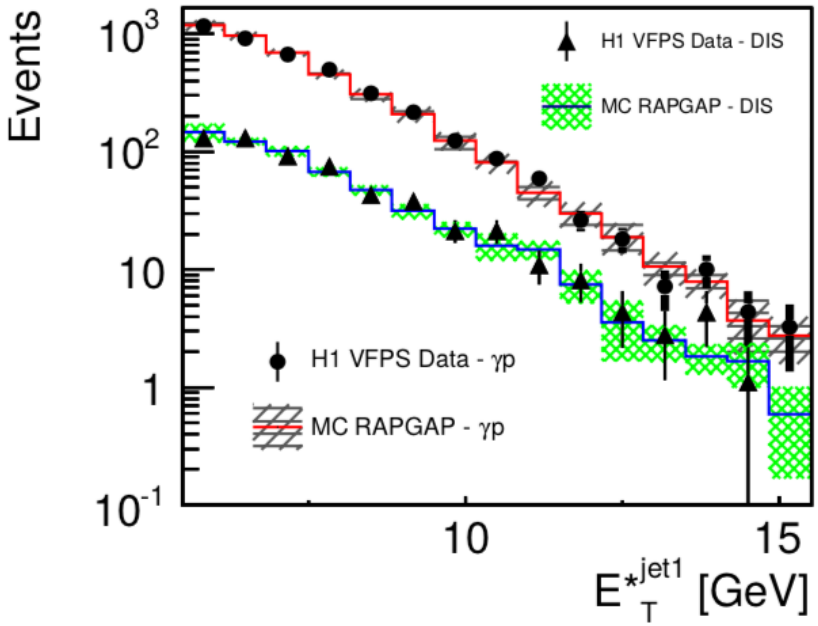


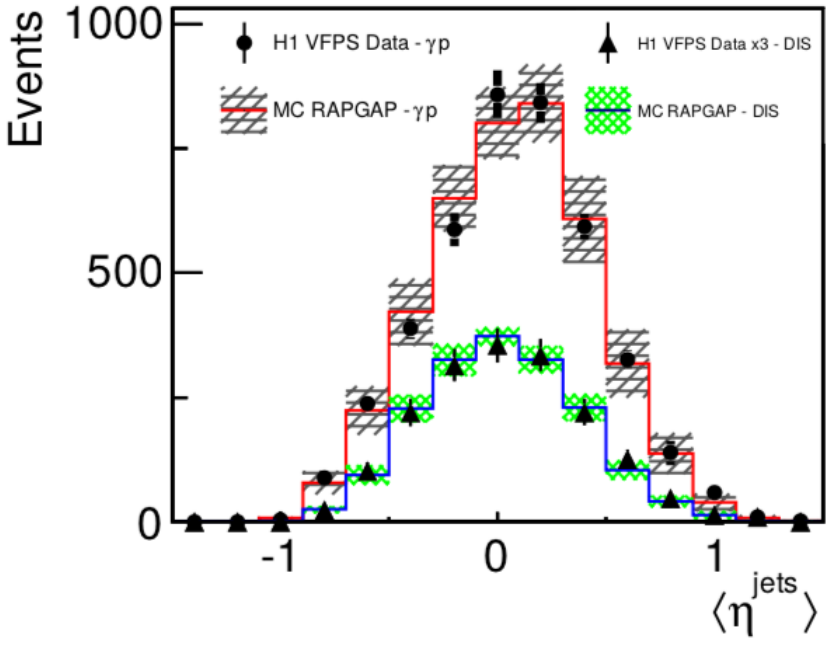


Fairly good agreement

Diffractive Dijets in Photoproduction - RAPGAP

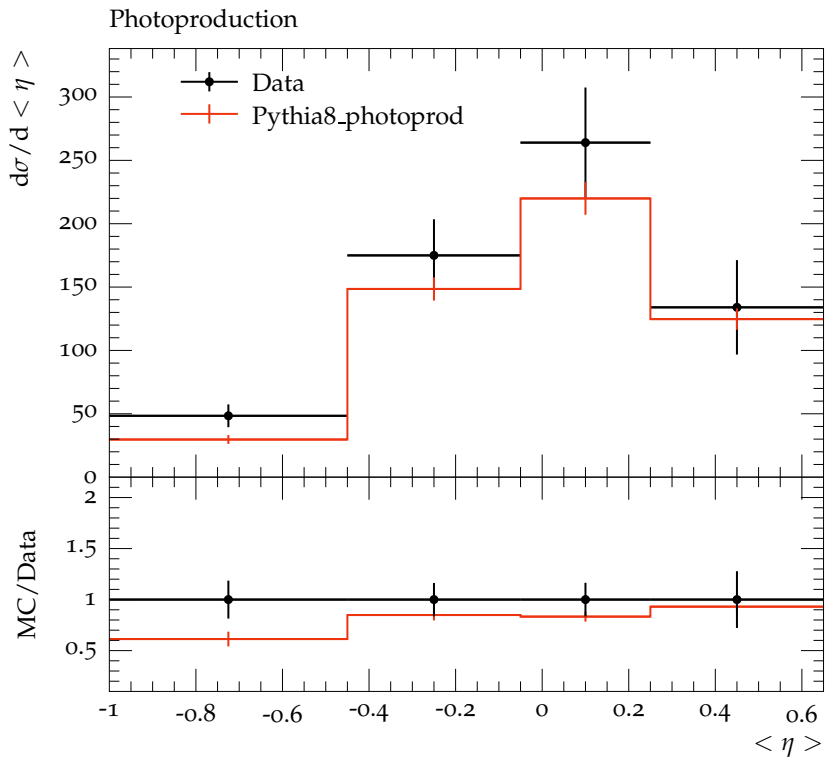
- RAPGAP generator results compared with the data

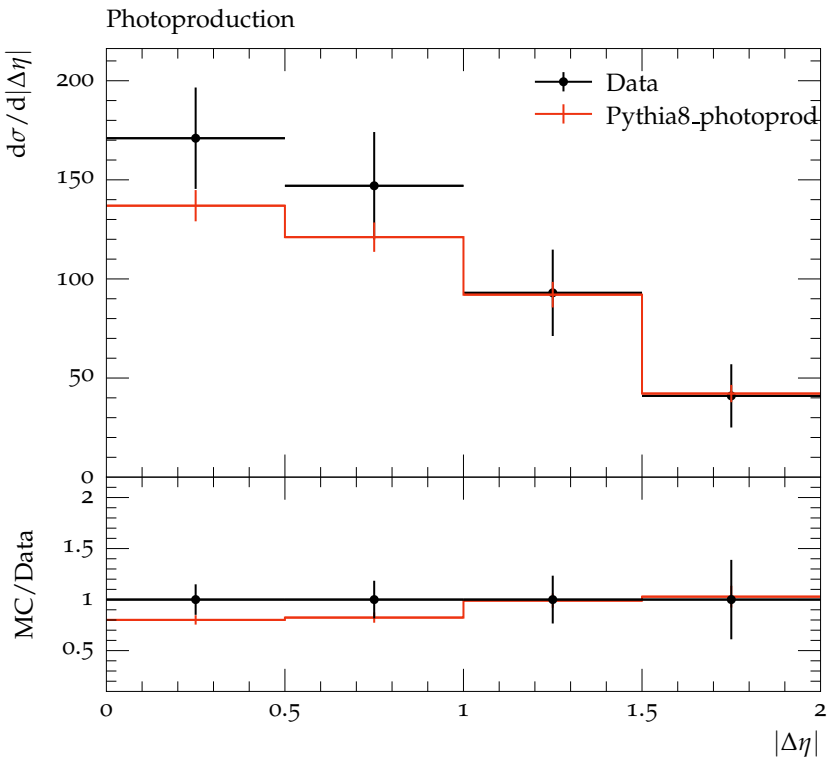




Diffractive Dijets in Photoproduction - Results 5

- Average and difference of the pseudorapidities of the dijets





Summary

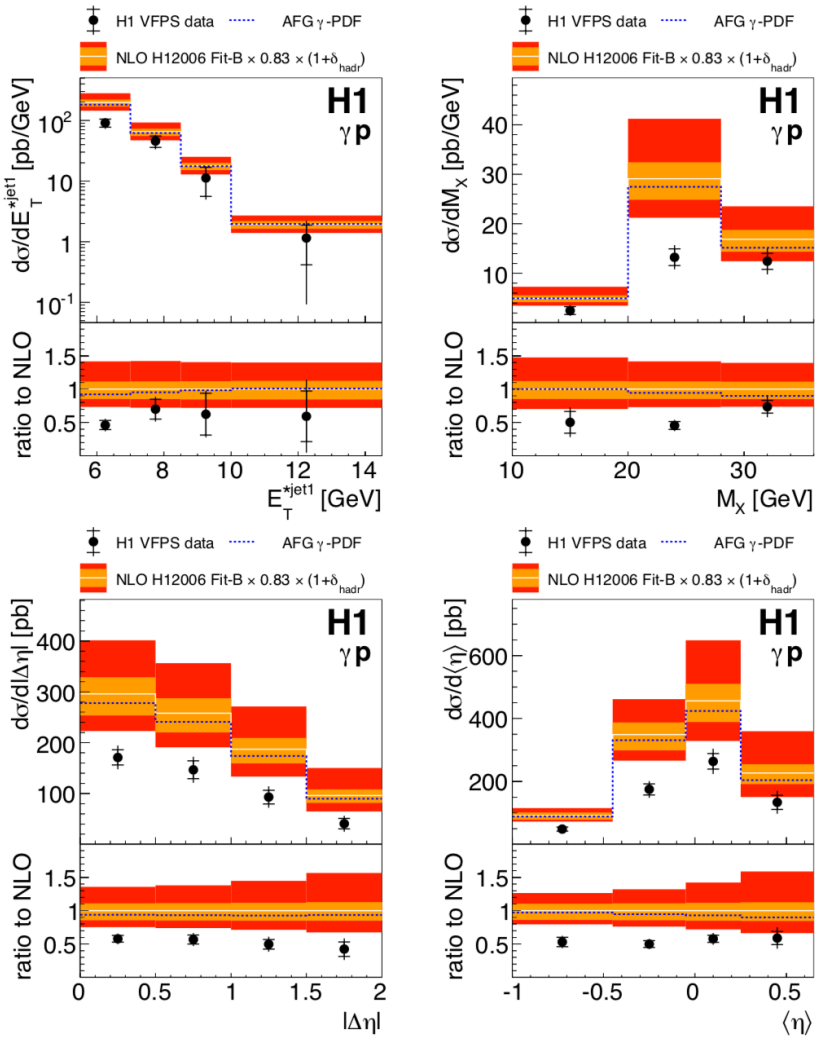
- Interestingly some of the dijets production observables have been reproduced well by Pythia8
- Compare the Dijets production via DIS with Pythia8
- Compare the Zeus results of dijets photoproduction with Pythia8
- Introduce RAPGAP generator and compare results?

Additional Material

BACKUP

Diffractive Dijets in Photoproduction - NLO QCD

- NLO QCD calculations based on the H12006 Fit-B DPDF set overpredicts the data



Diffractive Dijets in Photoproduction - RAPGAP

- RAPGAP generator results compared with the data