D^* and Jets in Photoproduction

Zlatka Staykova

FH1

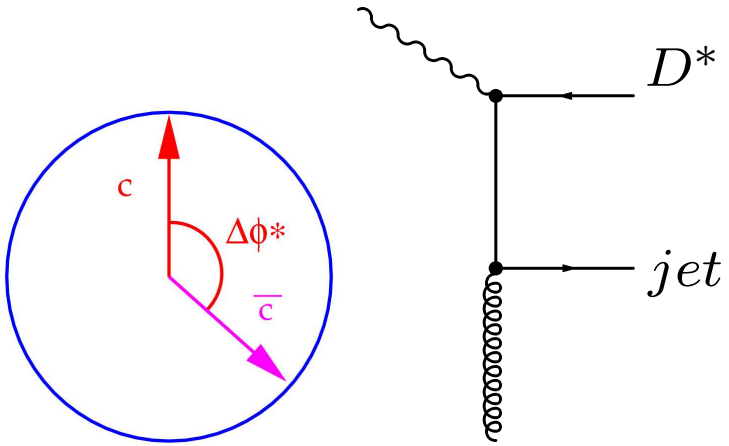
Smallx Lund-DESY meeting
25th January 2010
Lund

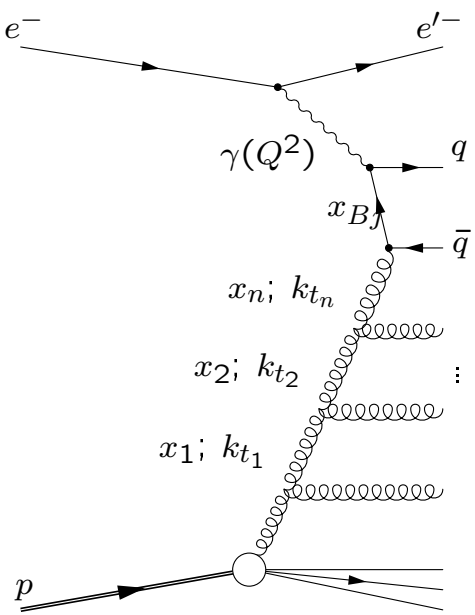
Outline

- Motivation
- Phase space definitions
- Measurement of Inclusive D^* cross sections and 2–jets in Photoproduction at HERA

Motivation and Goal of the Analysis

- Photoproduction of charm events– a good ground for testing pQCD and parton evolution models
- $\Delta\varphi$ in large $\Delta\eta \longrightarrow$ enough phase space for emissions
- $M_x^2 = (p + q - (p_{j1} + p_{j2}))^2$ the invariant mass of the remnant– large values, higher order emissions





Phase Space Definitions

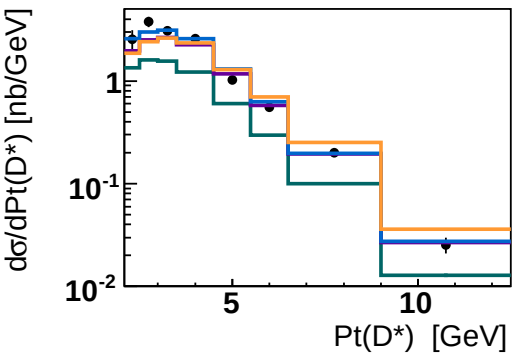
- Untagged photoproduction, $Q^2 < 2\,\mathrm{GeV}$ and $0.1 < y_h < 0.8$
- D^* selection:
  - D^* reconstructed in the golden decay channel $D^* \longrightarrow D^0\pi_{slow} \longrightarrow K\pi\pi_{slow}$
  - $p_t(D^*) > 2.1\,\mathrm{GeV}$ and $|\eta(D^*)| < 1.5$
- Jet selection:
  - D^* was treated as a leading particle
  - k_T clustering algorithm, FastJet package was used, $R = 1$, $p_t^{min} = 1.\,\mathrm{GeV}$
  - $p_t > 3.5\,\mathrm{GeV}$ and $|\eta(D^*_{jet})| < 1.5$ and $-1.5 < \eta_{other\ jet} < 2.9$
  - $M_{jj}^{inv} > 6\,\mathrm{GeV}$

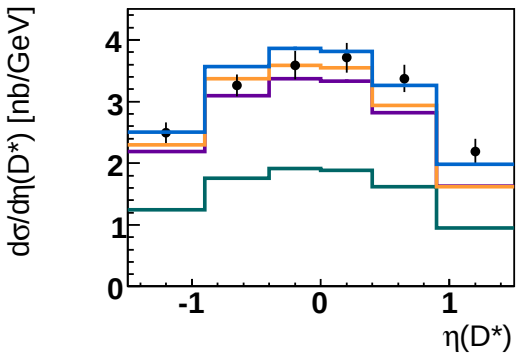
Cross Section Determination

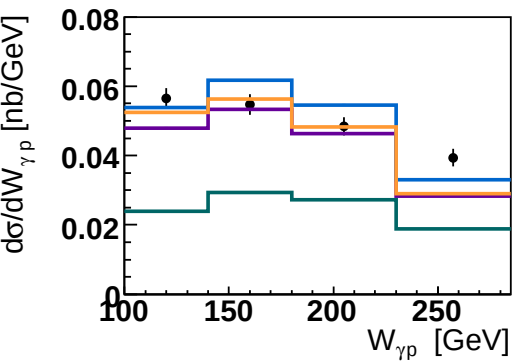
$$\sigma = \frac{\mathrm{N(D^*)}}{\mathcal{L} \cdot \varepsilon^{\mathrm{rec}}(\mathrm{TE})}$$

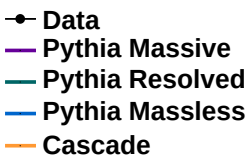
- N(D*) determined by a fit with an asymmetric function– Crystal Ball together with the Granet parametrization for the background.
- $\mathrm{N(D*)} = 3844 \pm 106$ total number of D* mesons
- Pythia Massless was used to correct the data for detector effects
- Only statistical uncertainties are shown in the histograms

Cross Sections– D* and event properties



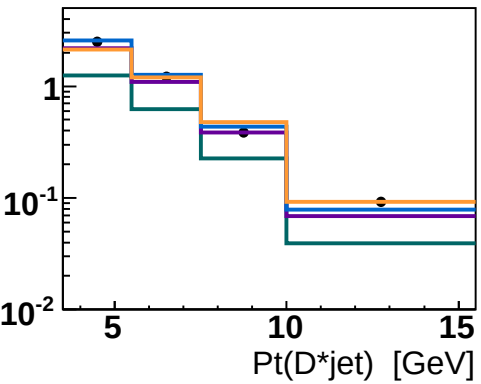


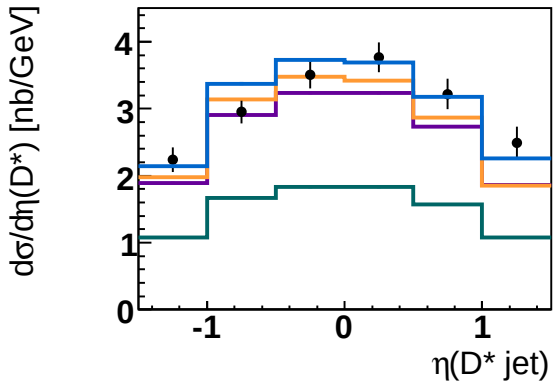




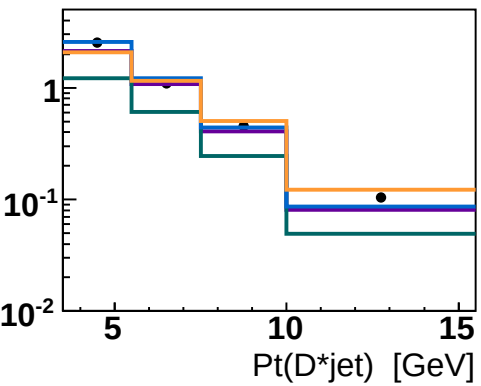
- $\sigma = 9.5 \pm 0.31^{\mathrm{stat}}$ nb
- Cascade underestimates the data at low p_t and overestimates the data at high p_t
- Pythia Massless describes $\eta(D^*)$ spectrum
- $W_{\gamma p}$ is not described by non of the Mc, Cascade does the best work

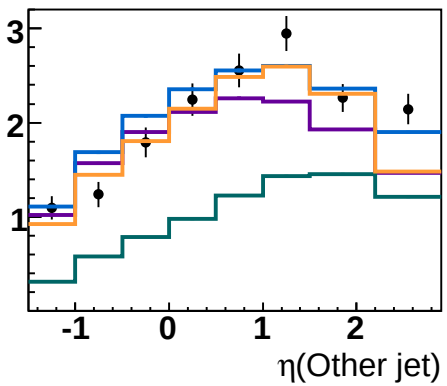
Cross Sections– Jet Quantities



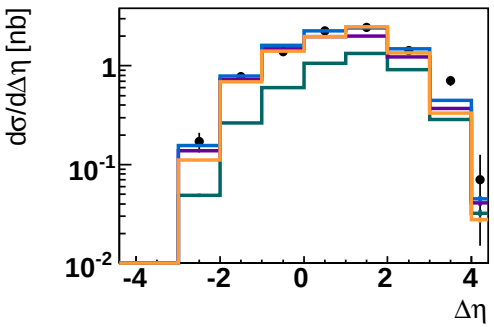


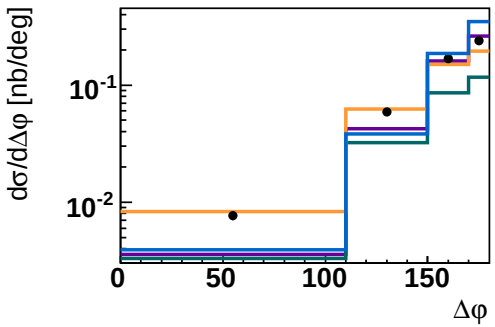
- No significant difference between Pythia massless and Cascade

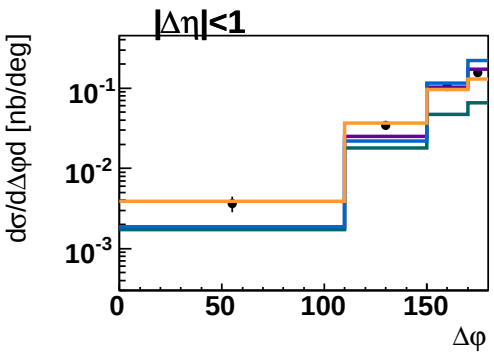


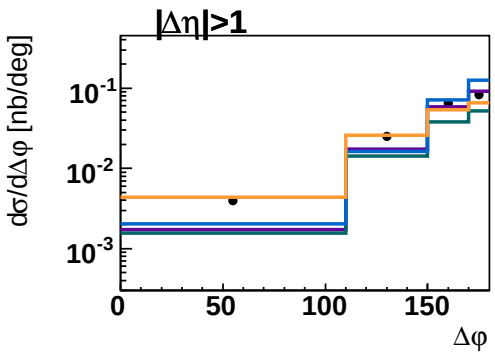


Cross Sections– Angular Correlations



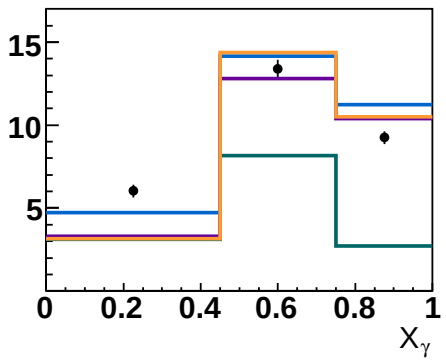


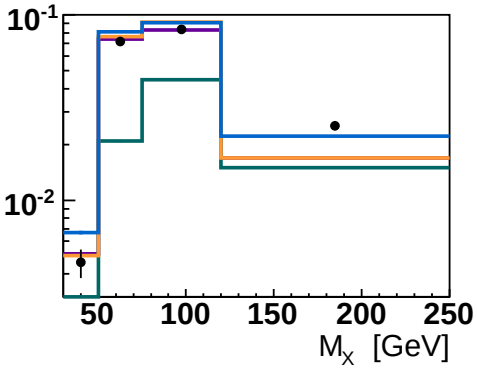




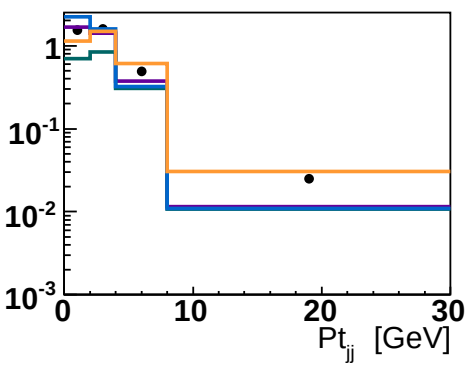
- No significant difference between Pythia massless and Cascade in the description of $\Delta\eta$ spectrum
- However the $\Delta\varphi$ spectrum is best described by Cascade.
- Even in the two $\Delta\eta$ the $\Delta\varphi$ spectrum is described by Cascade best

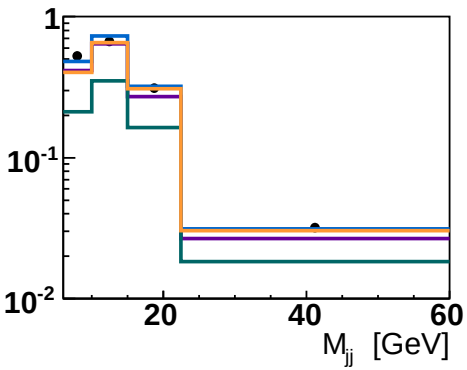
Cross Sections– Correlations





- $X_\gamma = \frac{\sum_{\text{jets}}(E-p_z)}{\sum_{\text{HFS}}(E-p_z)}$
- $M_x^2 = (p + \gamma - (D^*_{\text{jet}} + \text{Other jet}))^2$
- Non of the models describe X_γ





- p_t^{jj} is described best from Cascade
- No significant difference between the models in M_x

Summary

- Cross sections of photoproduction events containing D^* meson and 2–jets at HERA was measured and compared to different LO MC models
- Major technical problems are now solved, we can continue with "bread and butter"
- Next:
  - More differentials and double differentials (ideas are VERY WELCOME)
  - Systematic uncertainties (work in progress)
  - Compare with NLO models- FMNR and mainly MC@NLO
  - Most importantly– finish the thesis :)