Forward Jets in Charm Photoproduction

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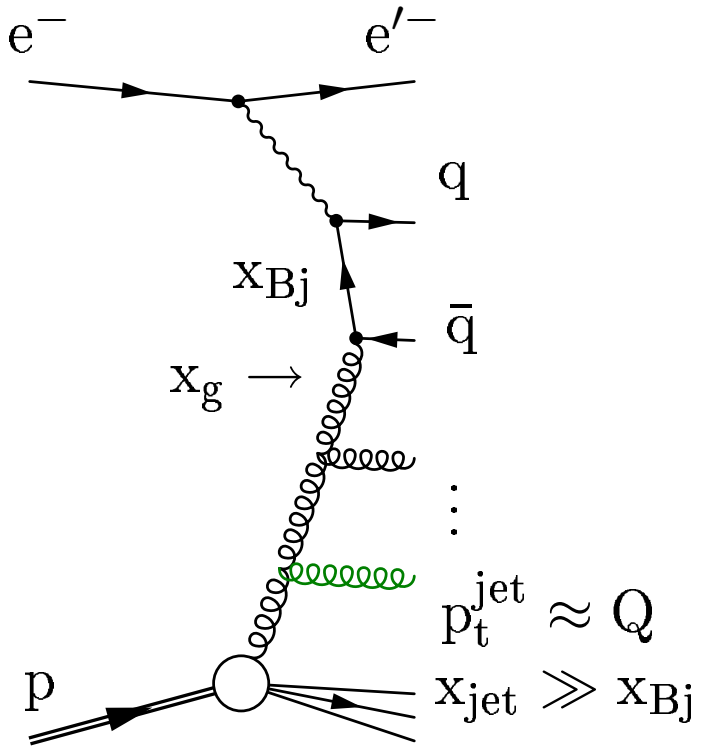
Motivation

- Forward Jets in DIS at small x_{Bj}
  - Upper scale Q^2: $0.5 < p_t^2/Q^2 < 5$
- Use charm to:
  - select BGF
  - small $x_g$region
  - Hard scale to perform pQCD in Photoproduction
  - Relatively easy to reconstruct with the meson D^*
  - use the scale $\mu^2 = 4 \cdot m^2_{c(\text{c meson})} + p_t^2$: $0.5 < p_t^2/\mu^2 < 5$



Monte Carlo Studies

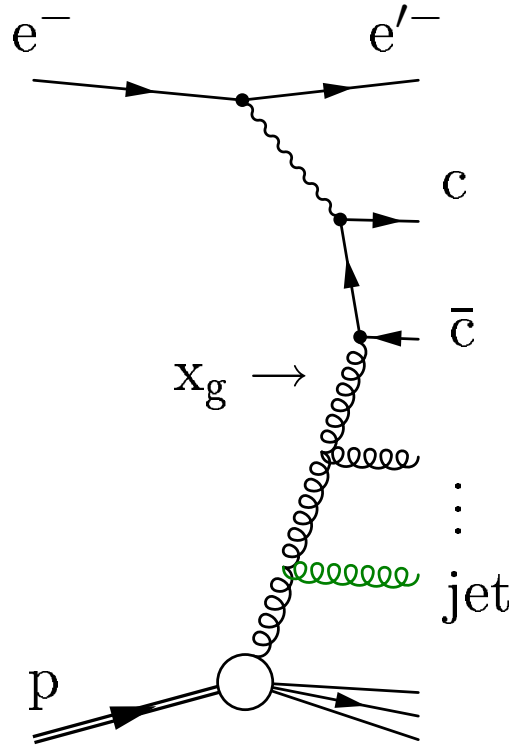
- Use the MC generators Rapgap and Cascade
- Photoproduction:
  $Q < 0.1\,\mathrm{GeV}^2 \quad 0.1 < y < 0.8$
- D^*'s: $p_t^{D^*} > 2$ GeV in $|\eta^{D^*}| < 1.5$
- Mueller Jets: $p_t^{jets} > 3.5$ GeV in $1.736 < \eta^{jets} < 2.794$
  - $x_{jet} > 0.035$
  - $0.5 < p_t^2/\mu^2 < 5$

$$R = \frac{\sigma(D^* + \text{Mueller jet})}{\sigma(D^*)}$$

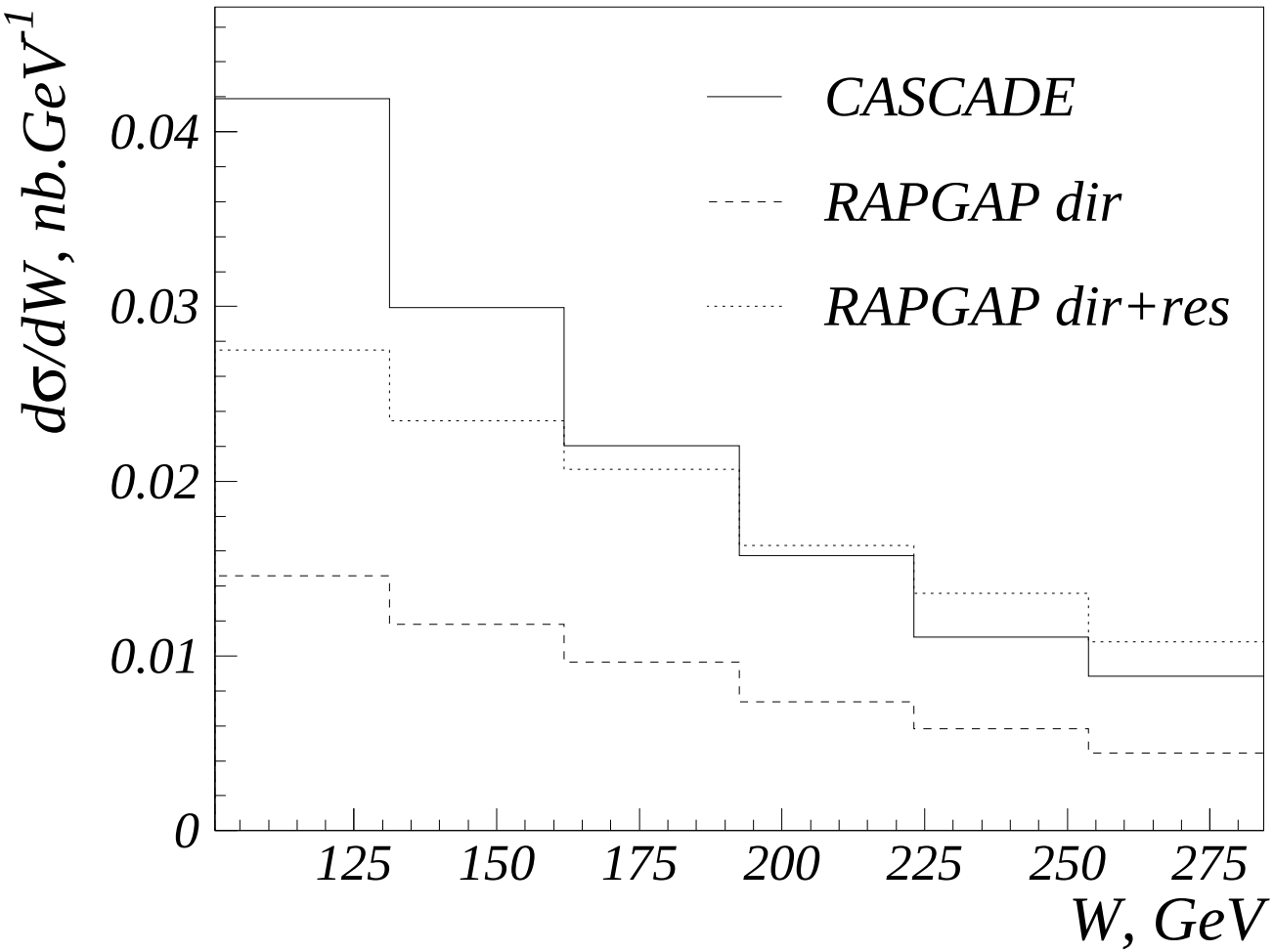
- Cascade:
  $R = 3.082 \cdot 10^{-3}$
- Rapgap direct:
  $R = 2.512 \cdot 10^{-3}$
- Rapgap direct+resolved:
  $R = 2.489 \cdot 10^{-3}$

Observables

- The HFS mass
  - $W^2 = \frac{M^2(Q\bar{Q})}{x_g}$
- $\Delta\eta = \eta^{D^*} - \eta^{jet}$
  - Rapidity range for an evolution
- $\Delta p_t = \vec{p}_t^{\,D^*} - \vec{p}_t^{\,jet}$
  - Estimate additional radiation between the D^* and the forward jet
- $\Delta\phi = |\phi^{D^*} - \phi^{jet}|$
  - Sensitive to higher order gluon emission

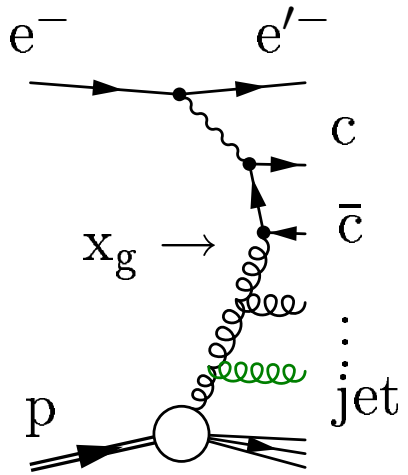


W

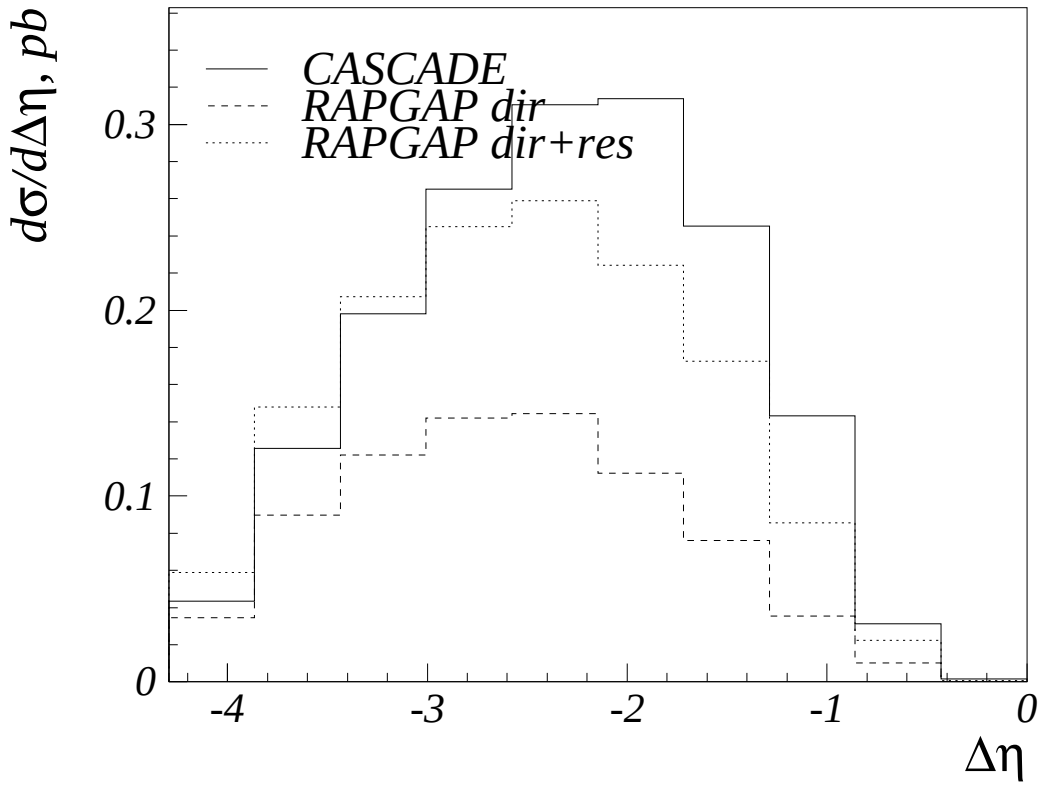

dσ/dW, nb.GeV^{-1}
0.04
0.03
0.02
0.01
0
125
150
175
200
225
250
275
W, GeV
CASCADE
RAPGAP dir
RAPGAP dir+res

$\Delta\eta$

- $\Delta\eta = \eta^{\mathrm{D}^*} - \eta^{\mathrm{jet}}$

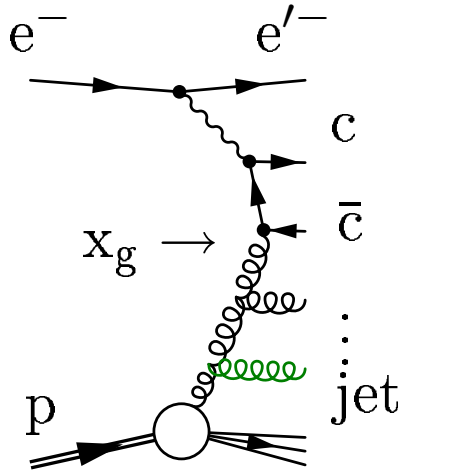


- Significant tail towards large $\Delta\eta \Rightarrow$ large rapidity range for an evolution

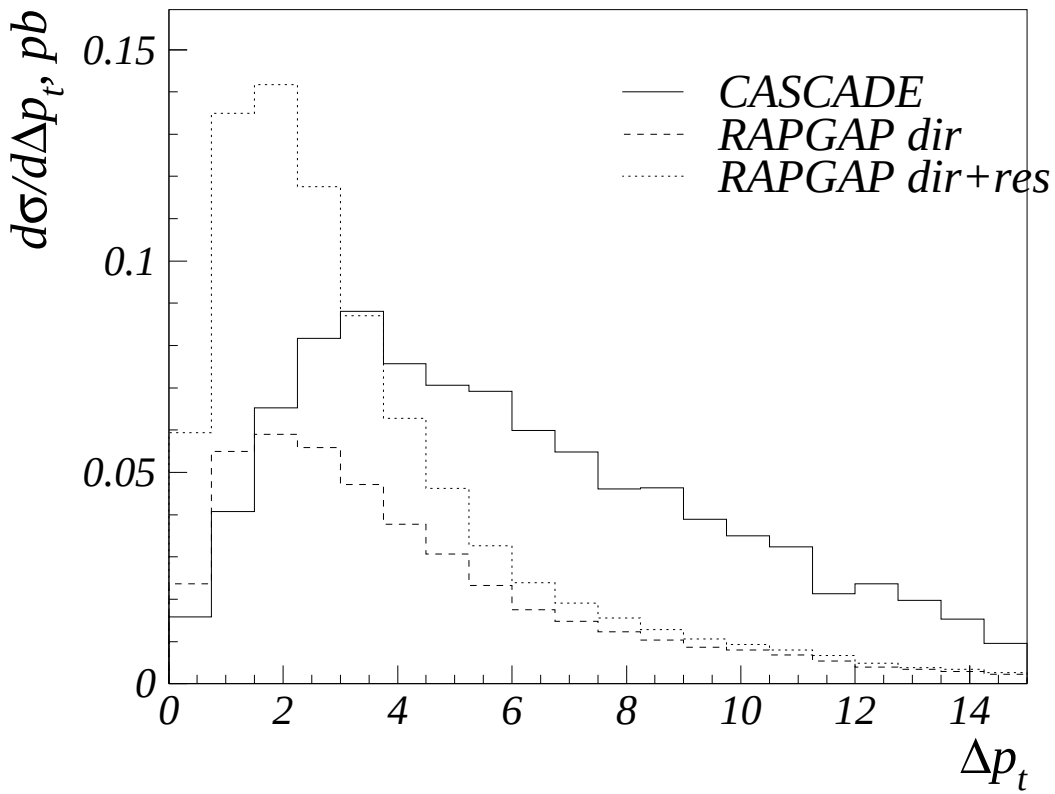


Δp_t

- $\Delta p_t = p_t^{D^*} - p_t^{jet}$

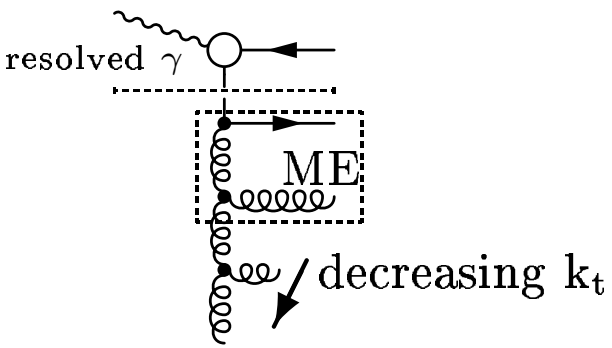


- Well correlated for both components of Rapgap
- Large values of $\Delta p_t \Rightarrow$ decorrelation for Cascade

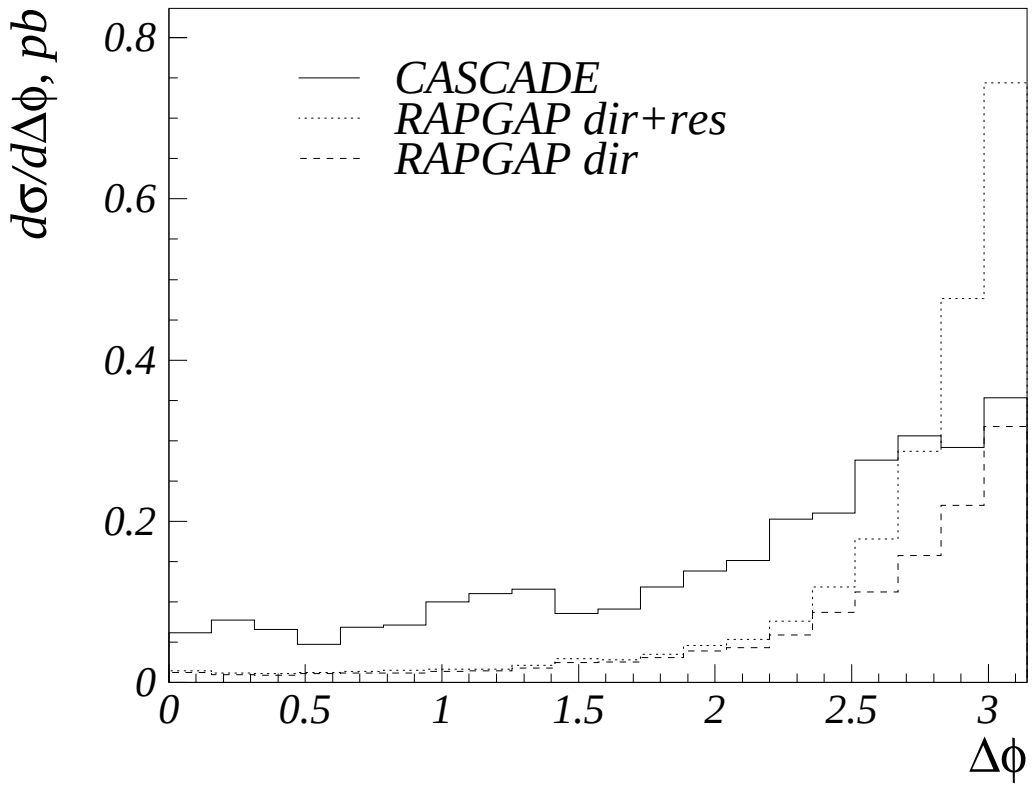


$\Delta\phi$

- $\Delta\phi = |\phi^{\mathrm{D}^*} - \phi^{\mathrm{jet}}|$



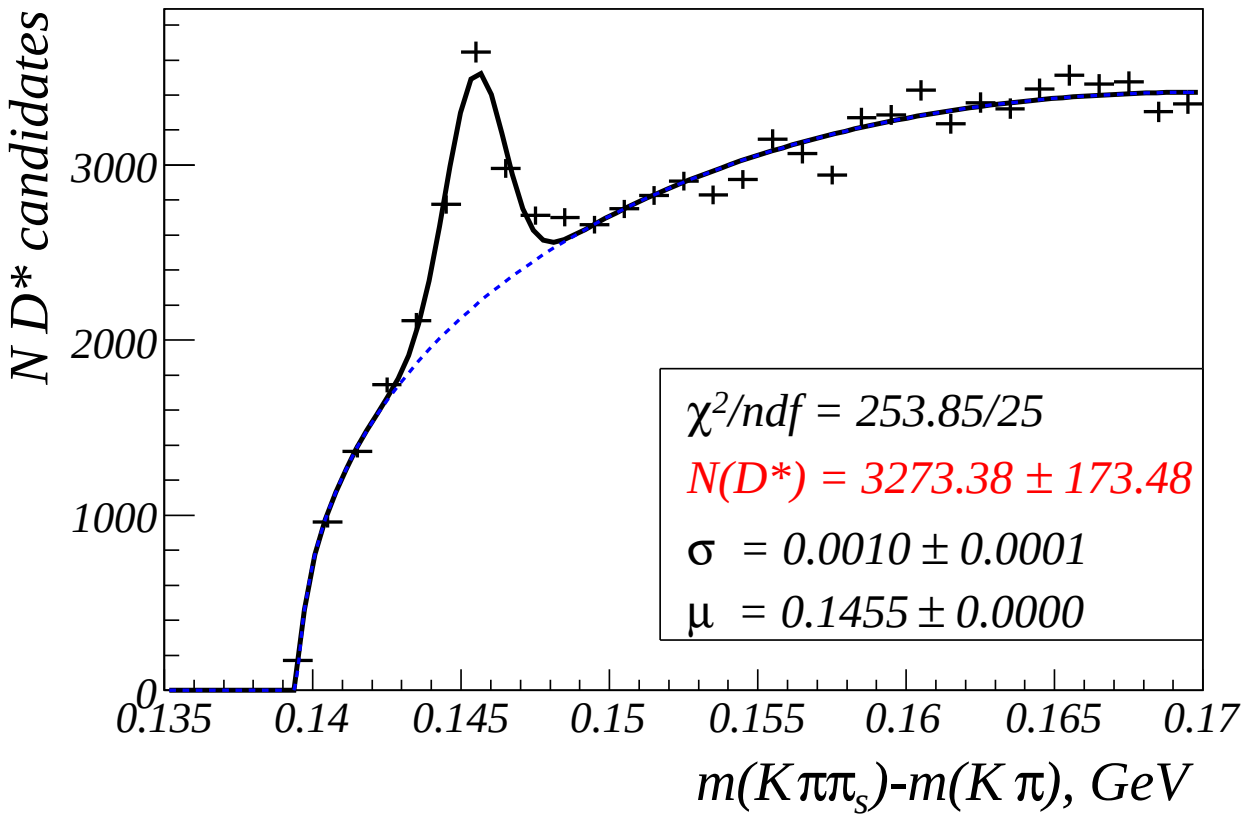
- Both components of Rapgap contribute mainly for large $\Delta\phi$
- A tail towards small $\Delta\phi$ for Cascade



Data Selection

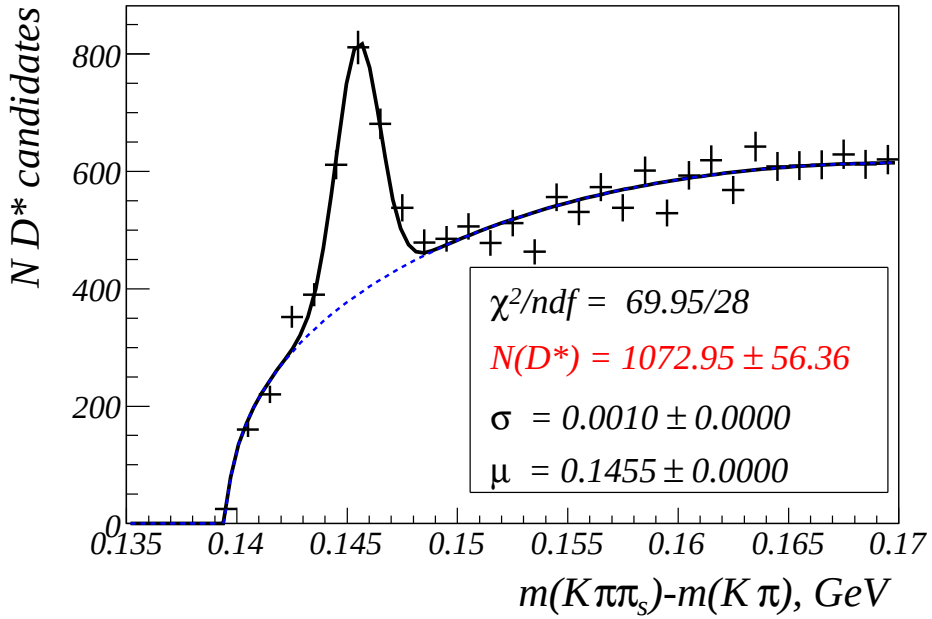
- Tagged photoproduction in the region $0.29 < y_{Bj} < 0.65$ collected in 1999 and 2000
- The charmed D^* meson was reconstructed with the golden decay channel: $D^{*\pm} \rightarrow D^0 \pi_s^{\pm} \rightarrow K^{\mp} \pi^{\pm} \pi_s$
  - use the Δm method
  - $p_{D^*}^t > 2\,\mathrm{GeV}$ in $|\eta| < 1.5$
- Jets were found with the k_t inclusive algorithm
  - $p_{jet}^t > 3.5\,\mathrm{GeV}$ in $-1.5 < \eta < 2.8$
  - For forward Jets $\eta > 1.7$
- No x_{jet} and p_t^2/μ^2 cuts were applied due to lack of statistics

Inclusive D* Sample

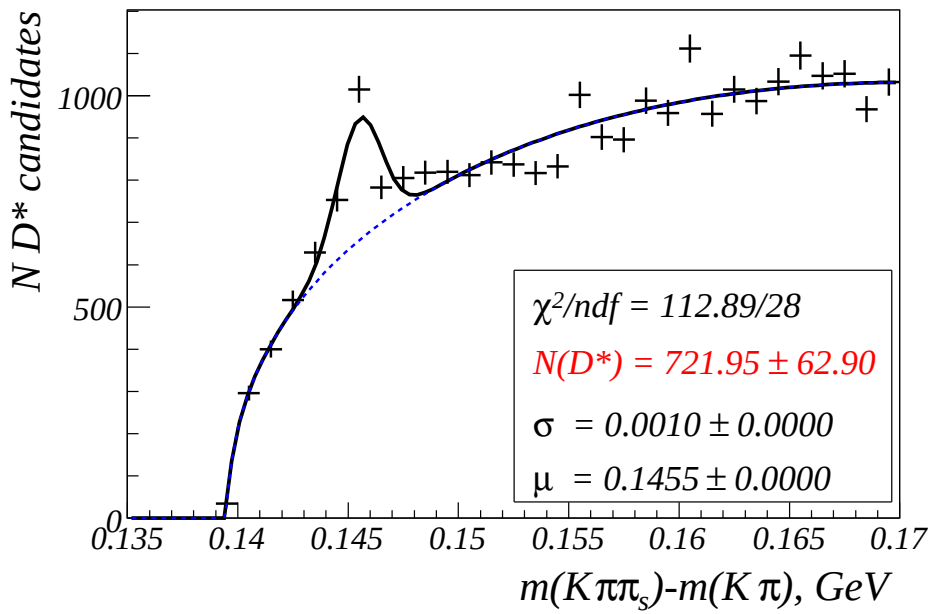


Δm in bins of $\eta^{\rm jet}$

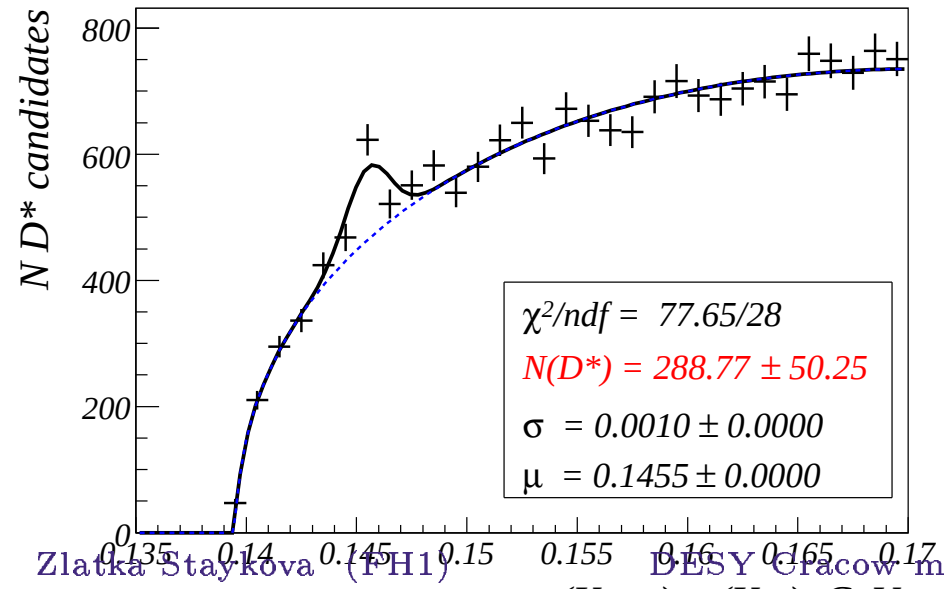
$-1.5 < \eta^{\rm jet} < 0$



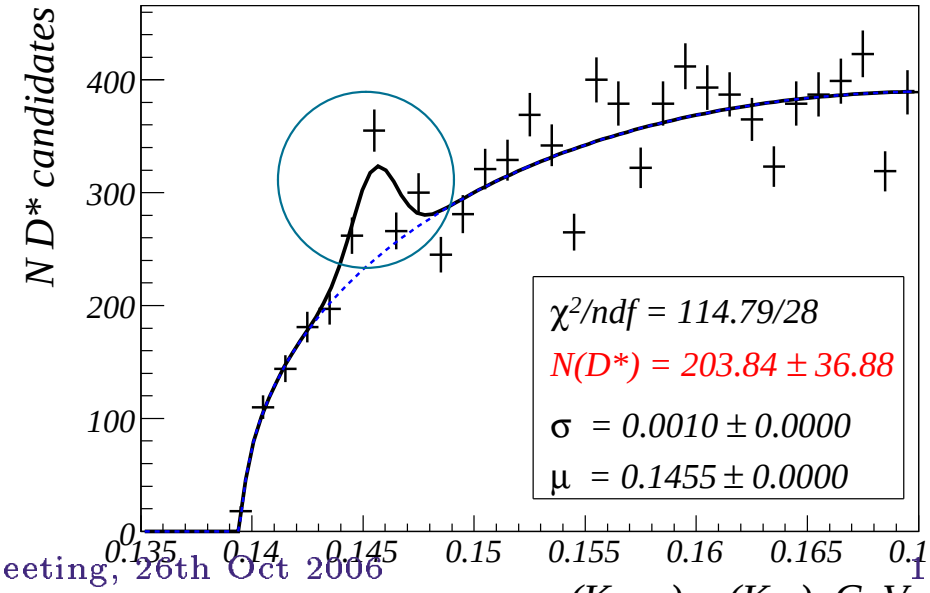
$0 < \eta^{\rm jet} < 1$



$1 < \eta^{\rm jet} < 1.7$



$1.7 < \eta^{\rm jet} < 2.8$



Conclusions and Outlook

Conclusions:

- D^*+forward Jet correlations: the relevant quantities are W, $\Delta\eta$, Δp_t and $\Delta\phi$
- Prestudies on D^*+Forward Jet using data from H1
- The D^* signal is still visible over large background
- The measurement is important for deeper and detailed understanding on parton dynamics
- Other decay channels or even life-time tagging of the heavy quark may be used in order to increase the statistics

Next Steps:

- Investigate the signal and background behavior
- Increase the statistics with untagged photoproduction and open the phase space in y