

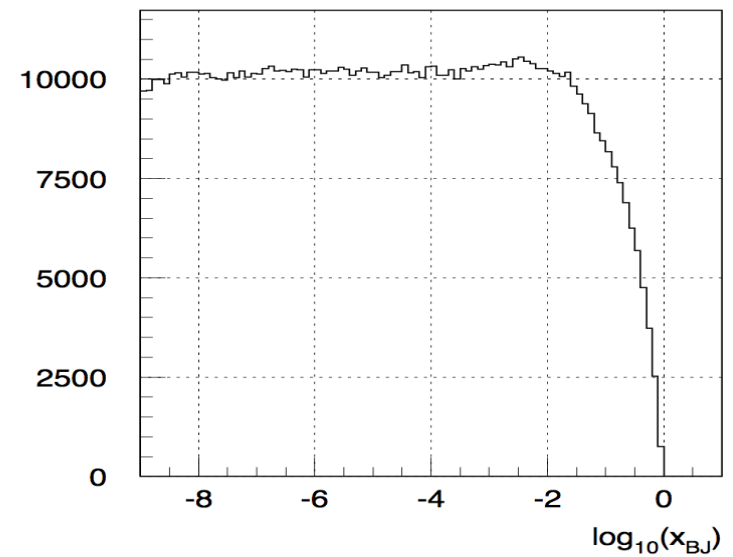
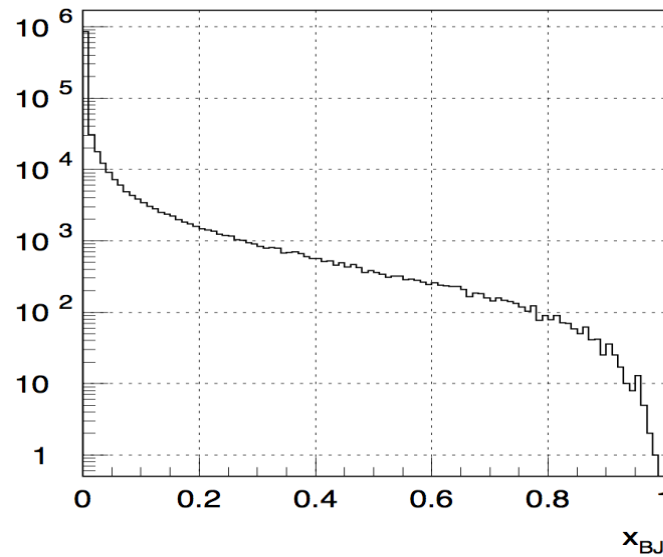
## Charm production rate

Sergey Furletov

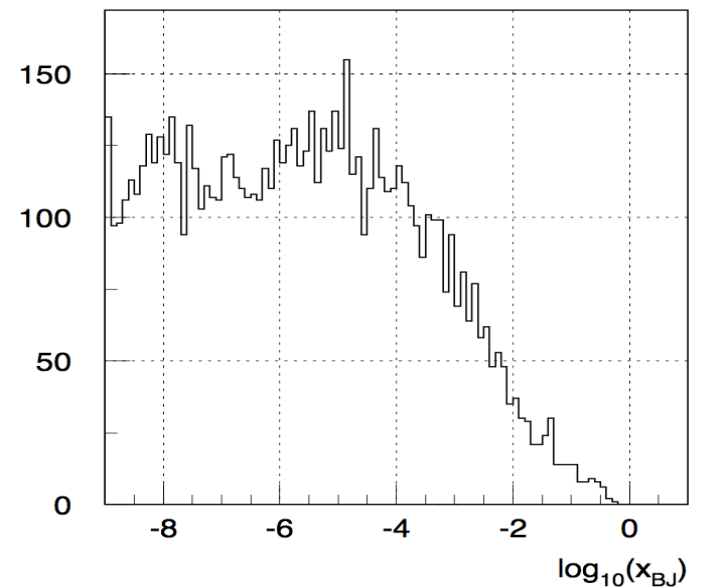
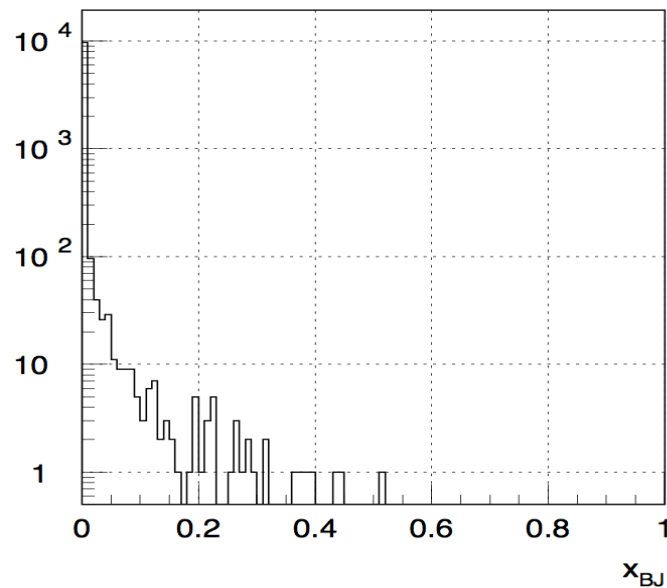
25 May 2016

# Pythia, kinematic plot x

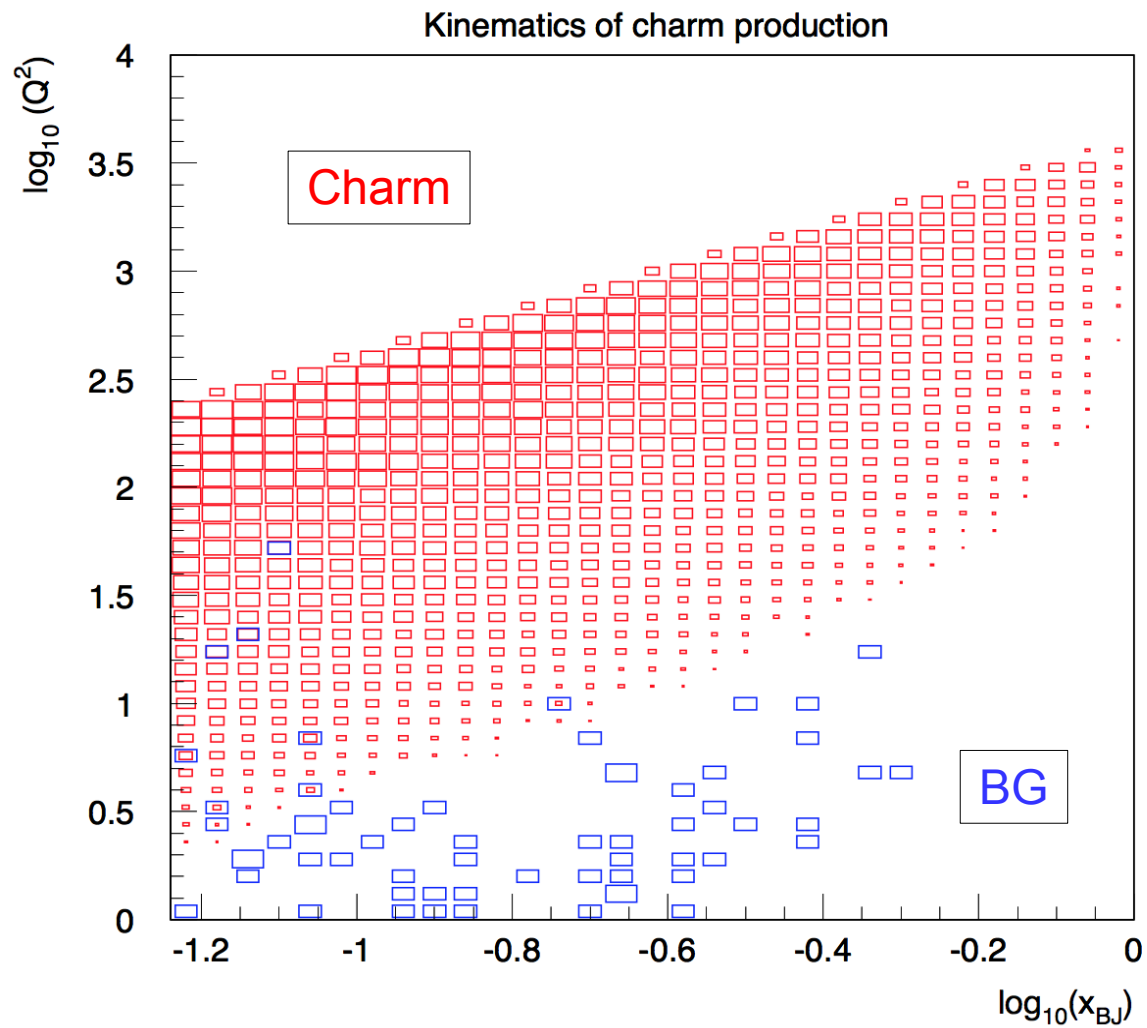
Charm  
MSEL=4  
xsec=120nb



BG  
MSEL=2  
xsec=30000nb  
250x



# Pythia, kinematic plot $x-Q^2$

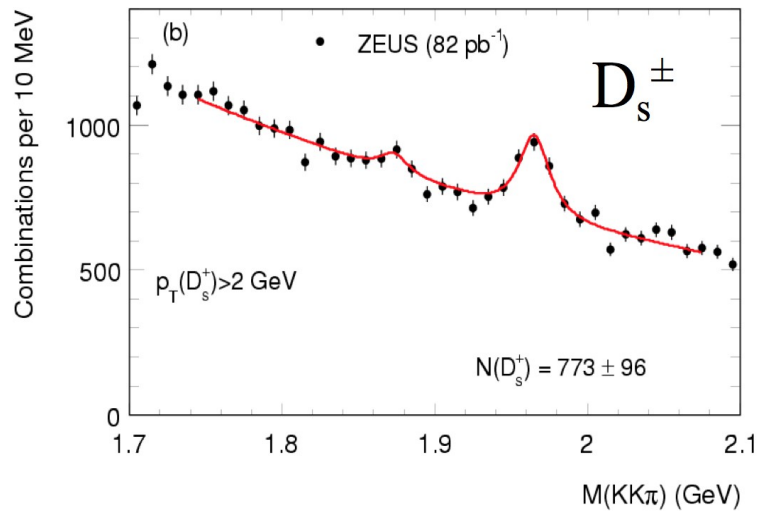
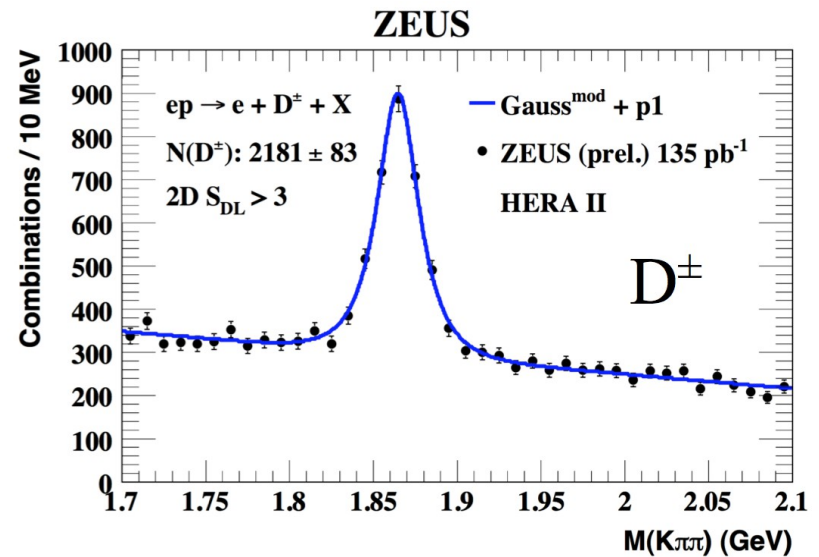
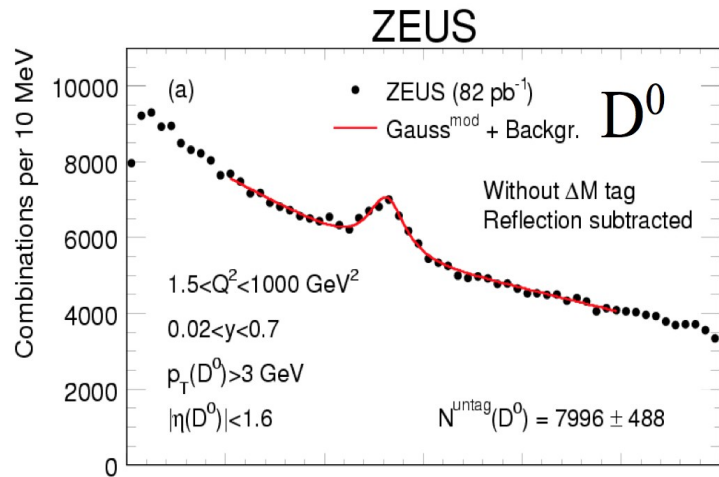


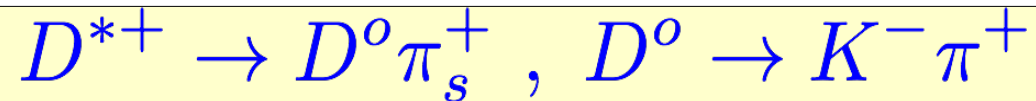
# Pythia MSEL=4

1M events	N charm	N D*	%%
No cuts	2M	7000	0.7%
Q2>10	280k	1500	0.15%
Q2>10 0.05<x<0.2	90k	400	0.04%

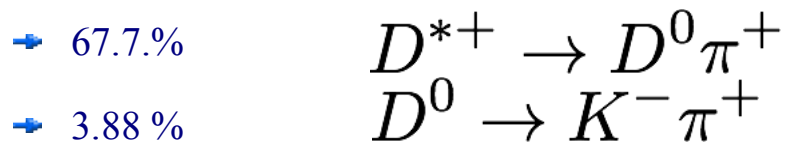
# Backup Slides

# Other charmed mesons





- Branching : BR ~2.5 %



- Acceptance (Zeus) : Acc ~11%

$$N = \sigma \times \mathcal{L} \times BR \times Acc$$

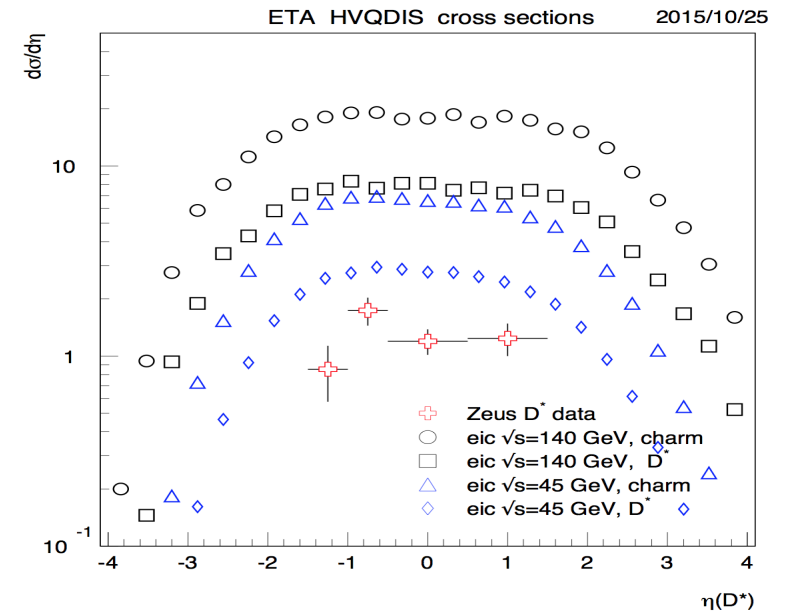
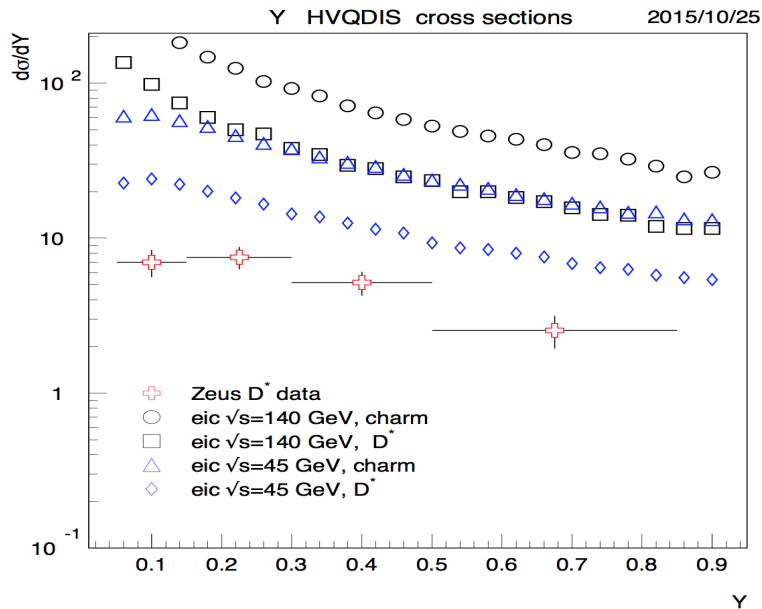
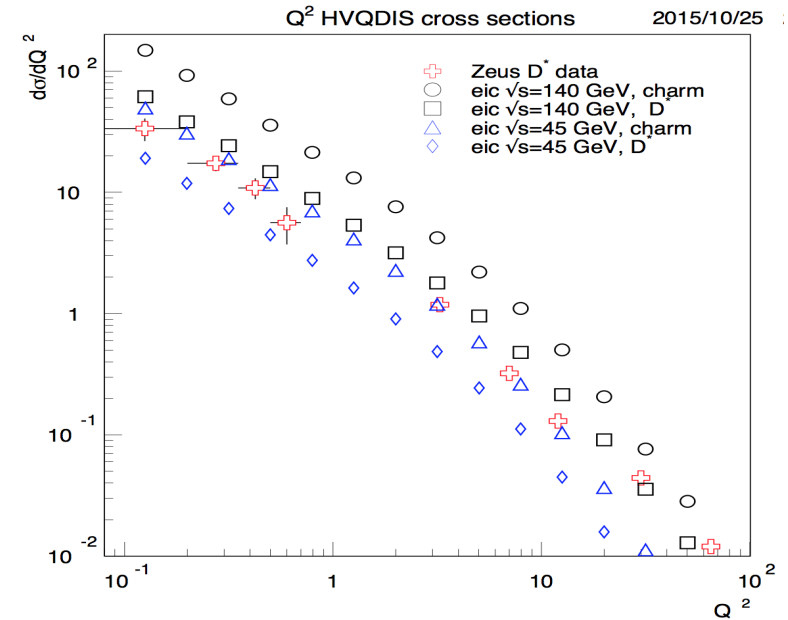
$$N = \sigma \times 100 fb^{-1} \times 0.0257 \times 0.1 \sim \sigma [nb] \times 10^6 \times 0.282$$

	Cross section	N D*
$\sqrt{s} = 45$	11 nb	$\sim 3 \times 10^6$
$\sqrt{s} = 145$	38 nb	$10^7$
$\sqrt{s} = 45, x > 0.01$	3.3 nb	$10^6$

# HVQDIS for $ep$ at EIC

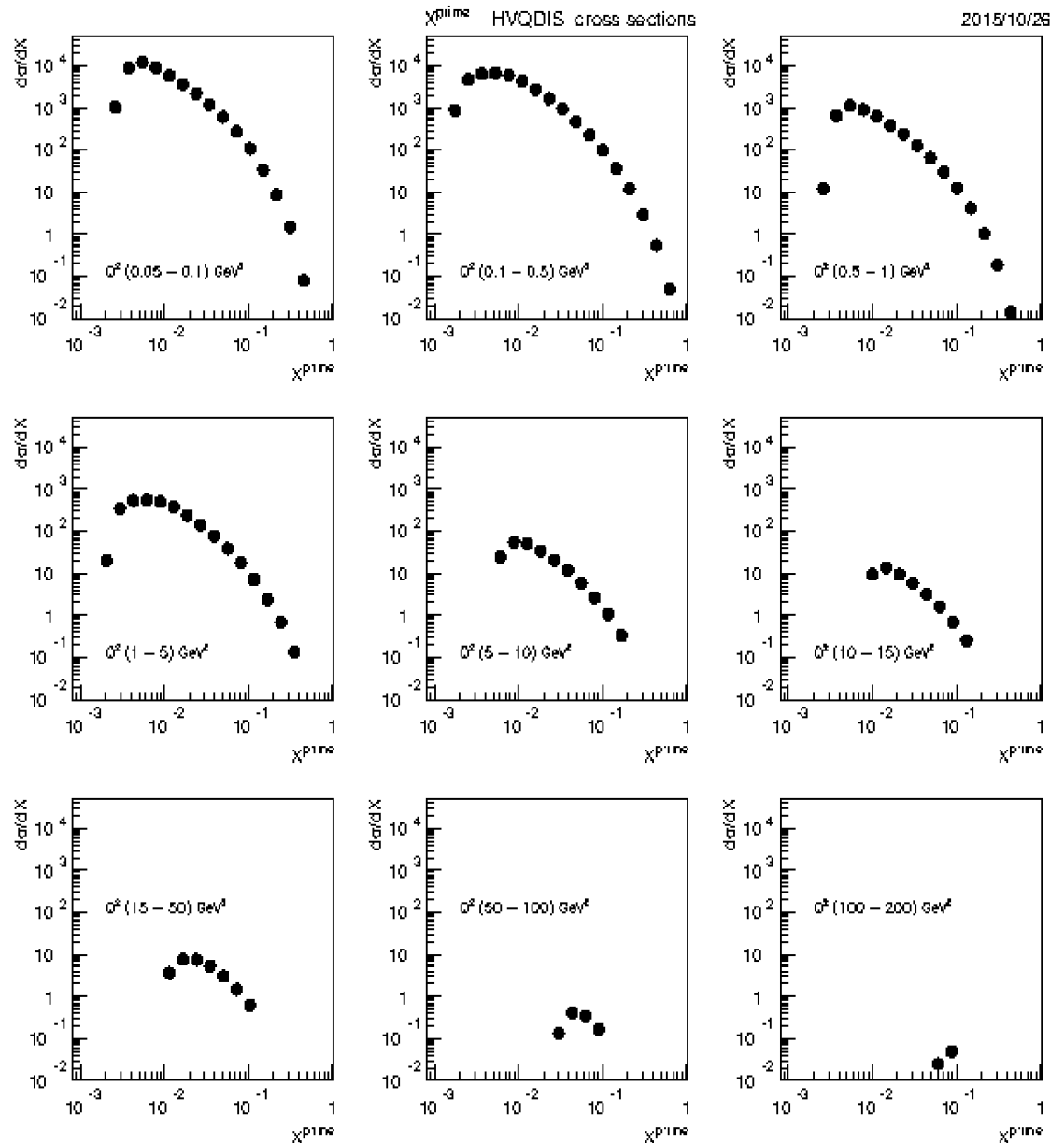
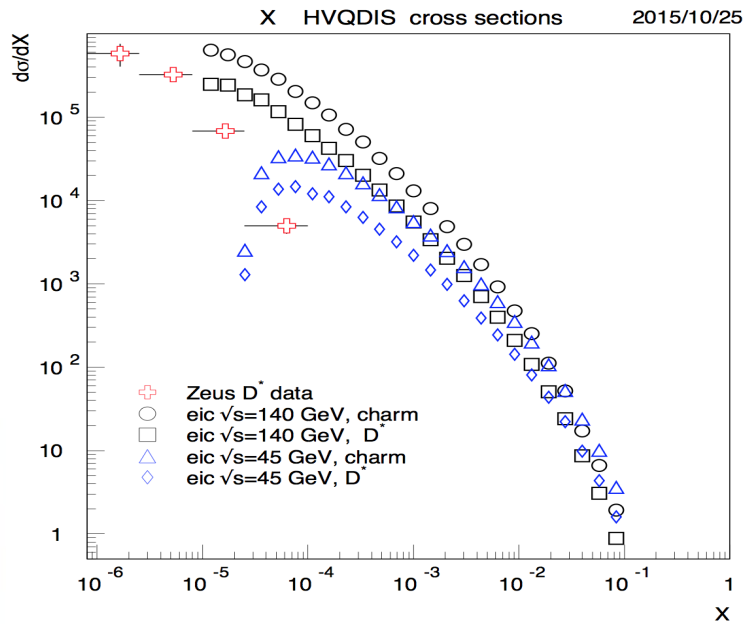
Calculation is done for 2  $ep$  energies of EIC:

- $E_e=10\text{ GeV}$ ,  $E_p=50\text{ GeV}$ :
  - ➔ Total charm cross section : 28 nb
  - ➔ Total  $D^*$  cross section : 11 nb
- $E_e=20\text{ GeV}$ ,  $E_p=250\text{ GeV}$ :
  - ➔ Total charm cross section :  $\sim 93\text{ nb}$
  - ➔ Total  $D^*$  cross section :  $\sim 38\text{ nb}$
- Zeus data are shown for different kinematic region :
  - ➔ for estimation only





# HVQDIS for $ep$ at EIC



- *BGF process probes the gluon density in the target at light-cone momentum fractions :*

$$x' > x (1 + 4 Mc^2/Q^2)$$

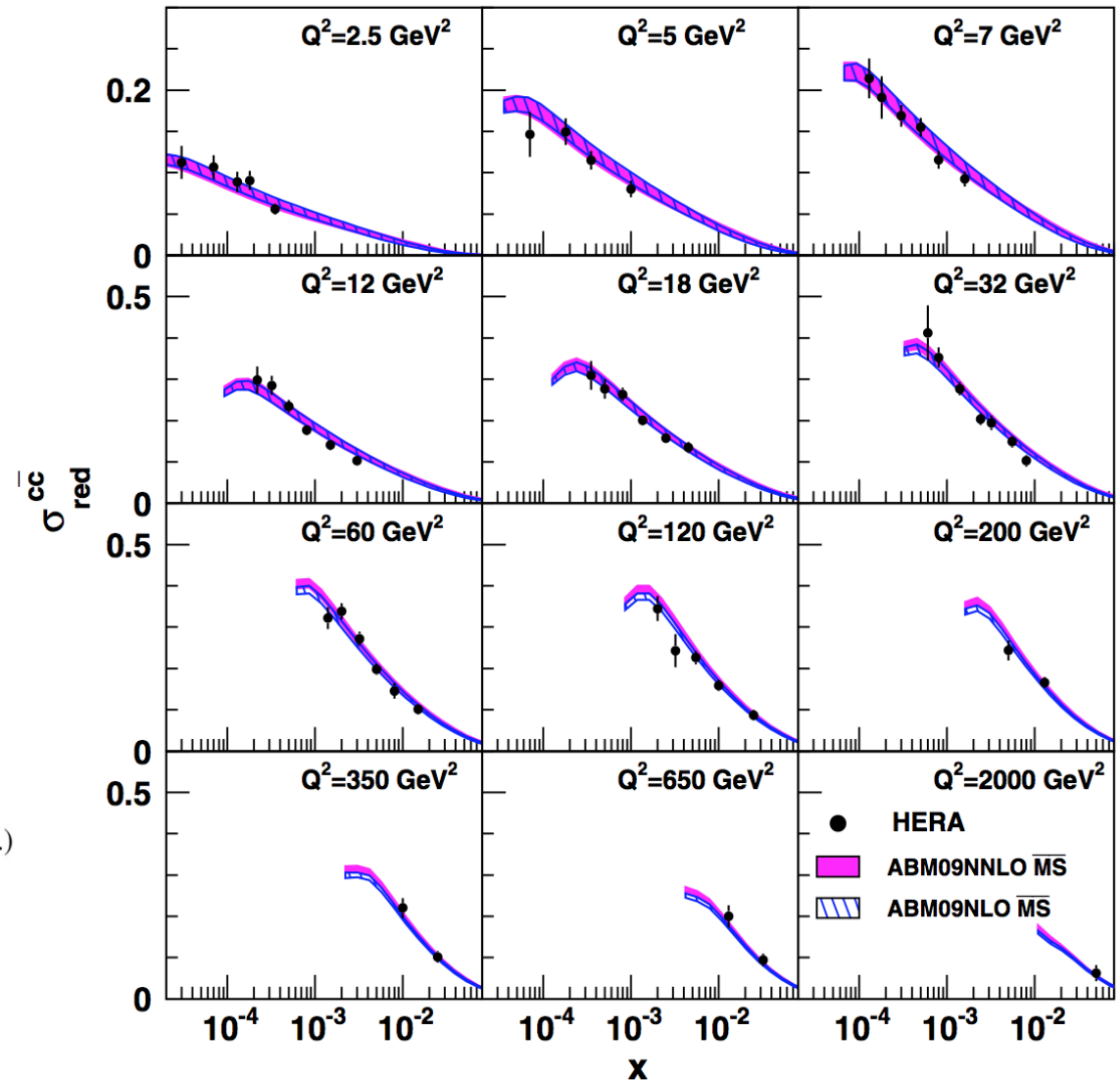
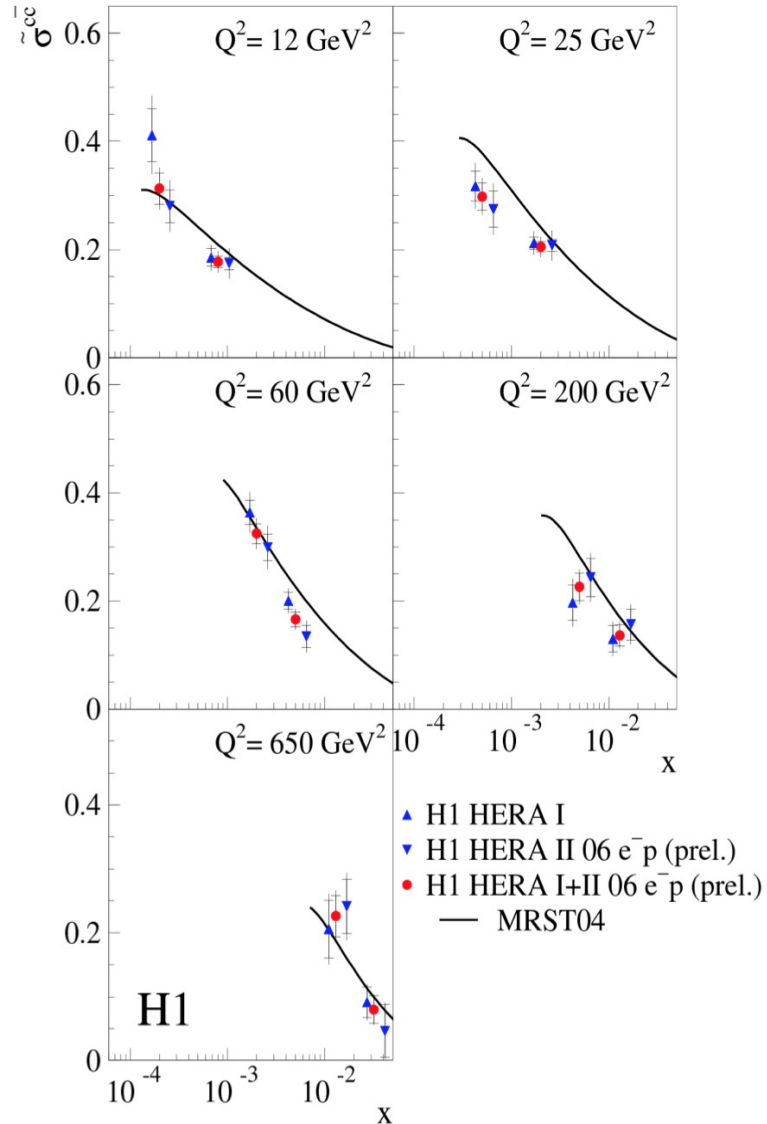
where  $x$  is the Bjorken variable and  $Mc^2$  the heavy quark mass.

- *Calculation for  $d\sigma/dx$  is done for  $x'$*
- *The results show good sensitivity to the gluon density even at  $x' > 0.1$ .*

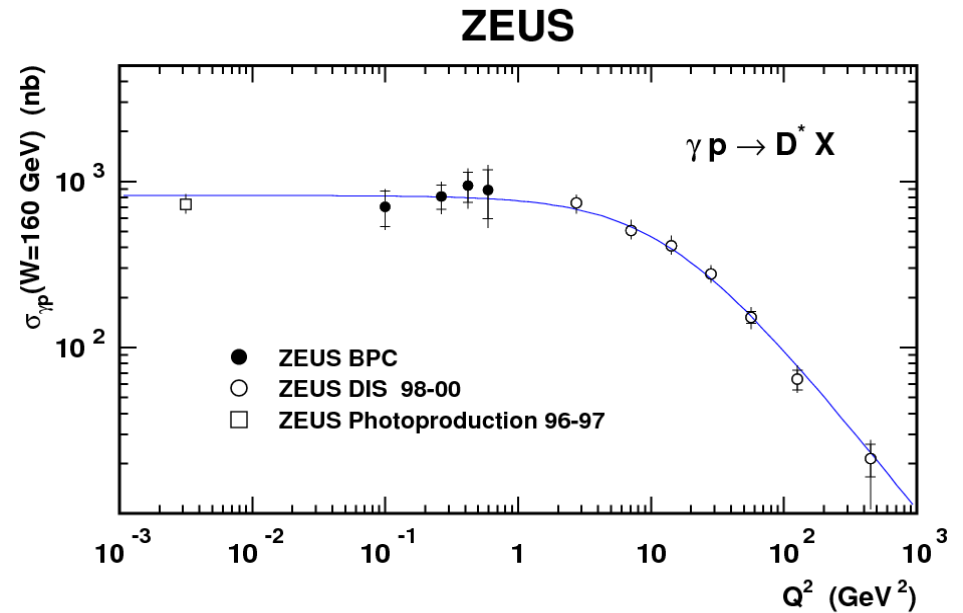
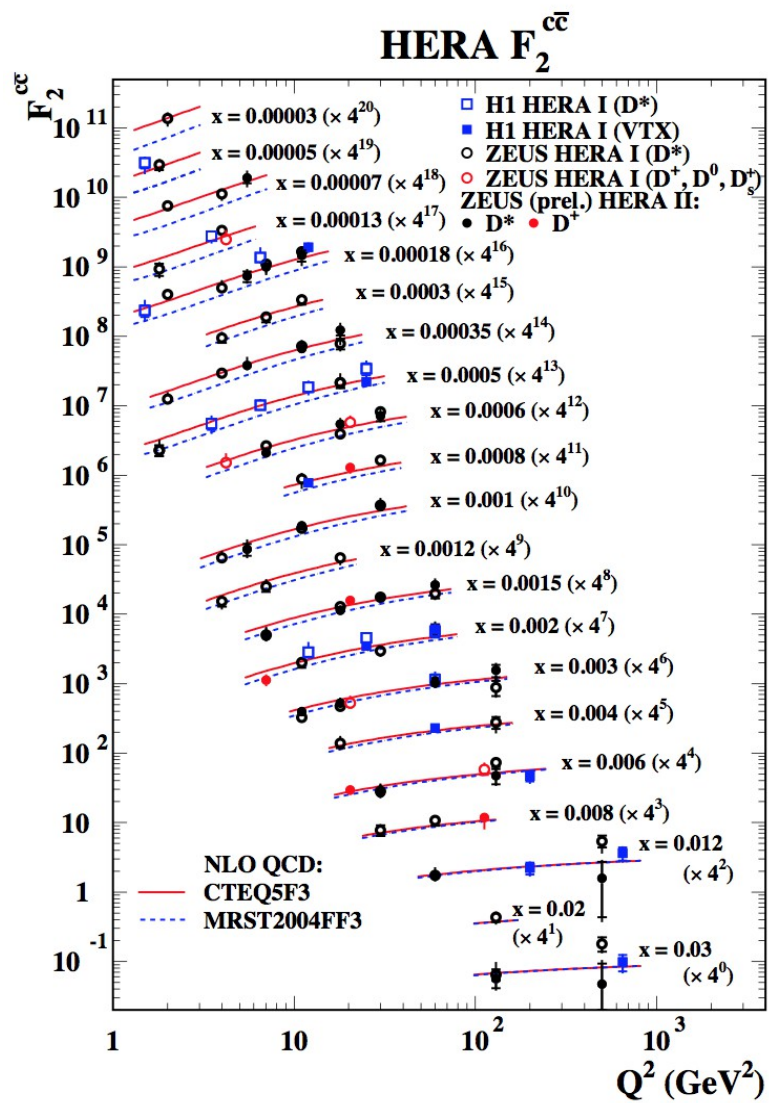
# H1 and ZEUS combined data

Rev. Mod. Phys., Vol. 86, No. 3, July–September 2014

H1 c CROSS SECTION IN DIS

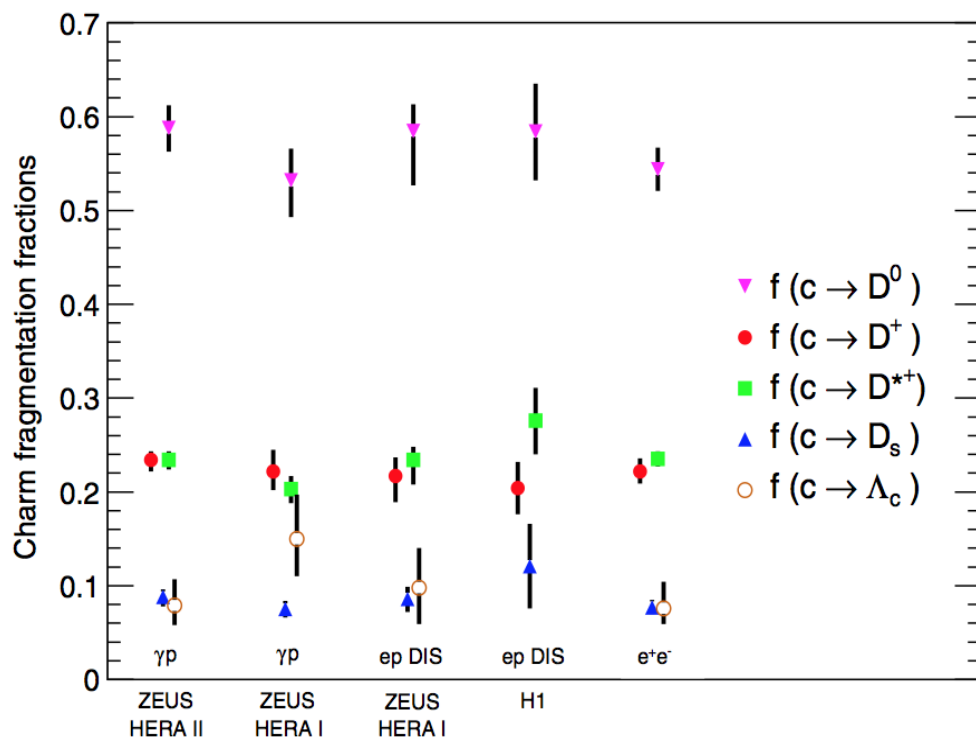
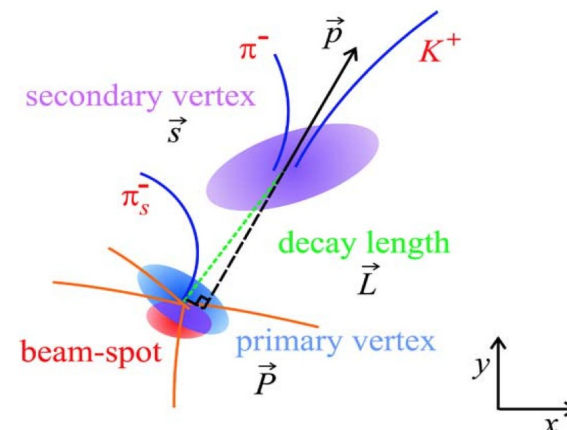


# Charm production in ep scattering at HERA

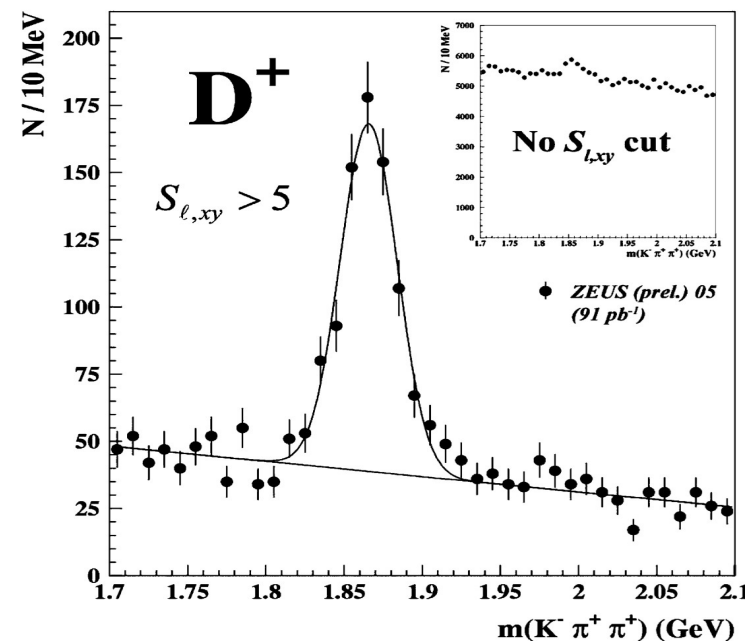


# Other charmed mesons

- Charm fragmentation to other mesons is measured.
- However reconstruction most of them require microvertex to resolve primary and secondary vertices.
- Right-bottom plot shows reconstruction of  $D^+$  with microvertex and without.

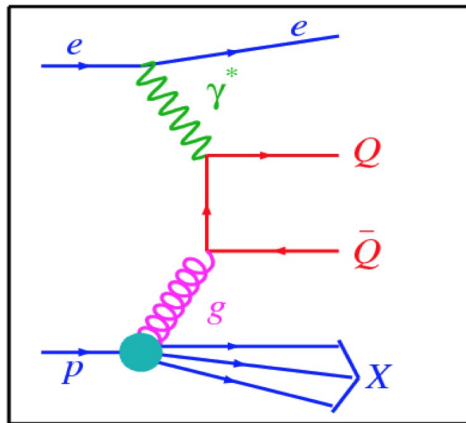


Abramowicz, H., et al. (ZEUS Collaboration), 2013b, J. High Energy Phys. 09, 058.

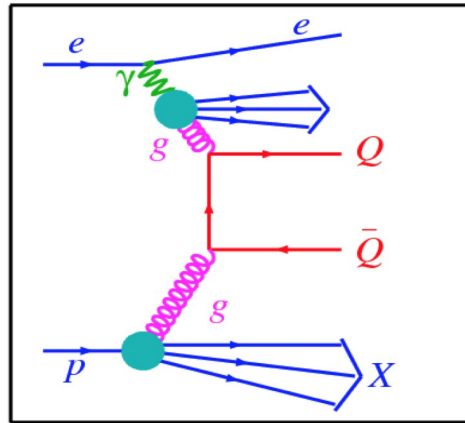


N. Coppola, IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 54, NO. 5, OCTOBER 2007

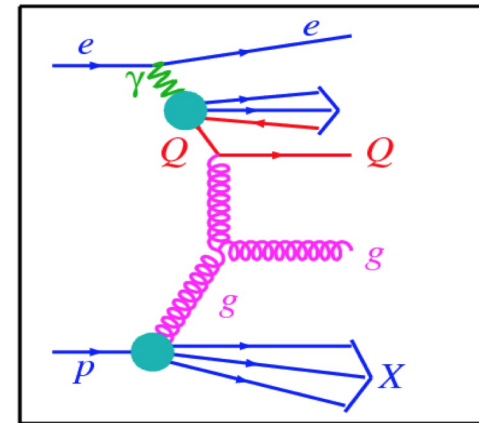
# Charm production at HERA



Direct



Resolved



Excitation

# ZEUS detector

<b>Zeus Run 47350 Event 135</b>		<b>date: 21-01-2004 time: 23:08:17</b>		
$E = 32.22 \text{ GeV}$	$E_T = 8.55 \text{ GeV}$	$E-p_z = 16.80 \text{ GeV}$	$E_T = 21.86 \text{ GeV}$	$E_b = 1.91 \text{ GeV}$
$E_{T1} = 8.45 \text{ GeV}$	$p_{T1} = 1.05 \text{ GeV}$	$p_{Tx} = -1.04 \text{ GeV}$	$p_{Ty} = 0.17 \text{ GeV}$	$p_z = 15.42 \text{ GeV}$
$\text{phi} = 2.98$	$t_1 = -1.02 \text{ ns}$	$t_b = -3.20 \text{ ns}$	$t_r = -1.29 \text{ ns}$	$t_g = -1.19 \text{ ns}$

