THERA meeting ; 01.12.2000
L. Gladilin for HFL working group

1 Heavy Flavour Physics

Heavy quarks are produced copiously in ep collisions. The total charm and beauty cross sections at HERA are of the order of $1\,\mu b$ and $10\,nb$, respectively [1]. Charm production at HERA was studied by the H1 and ZEUS collaborations in both photoproduction and DIS regimes [2, 3, 4]. General agreement with pQCD expectations was observed in DIS case while a description of charm photoproduction cross sections is more problematic for present pQCD calculations. First measured beauty photoproduction cross sections at HERA [5, 6] lie above the fixed-order NLO QCD predictions [7]. No measurements of the beauty productiuon in DIS regime at HERA was performed up to now.

An increase of the centre-of-mass energy of ep collisions from $\approx 300\,\mathrm{GeV}$ at HERA till $\approx 1\,\mathrm{TeV}$ at THERA will result in increasing of charm and beauty production cross sections by factors ≈ 3 and ≈ 5, respectively [8, 9, 10]. Fig. 1 shows $p_\perp^{c,b}$ and $\eta^{c,b}$ distributions at HERA and THERA calculated with FMNR NLO code [7] for the process of photon-gluon fusion at $Q^2 < 1\,\mathrm{GeV}^2$.

QCD test

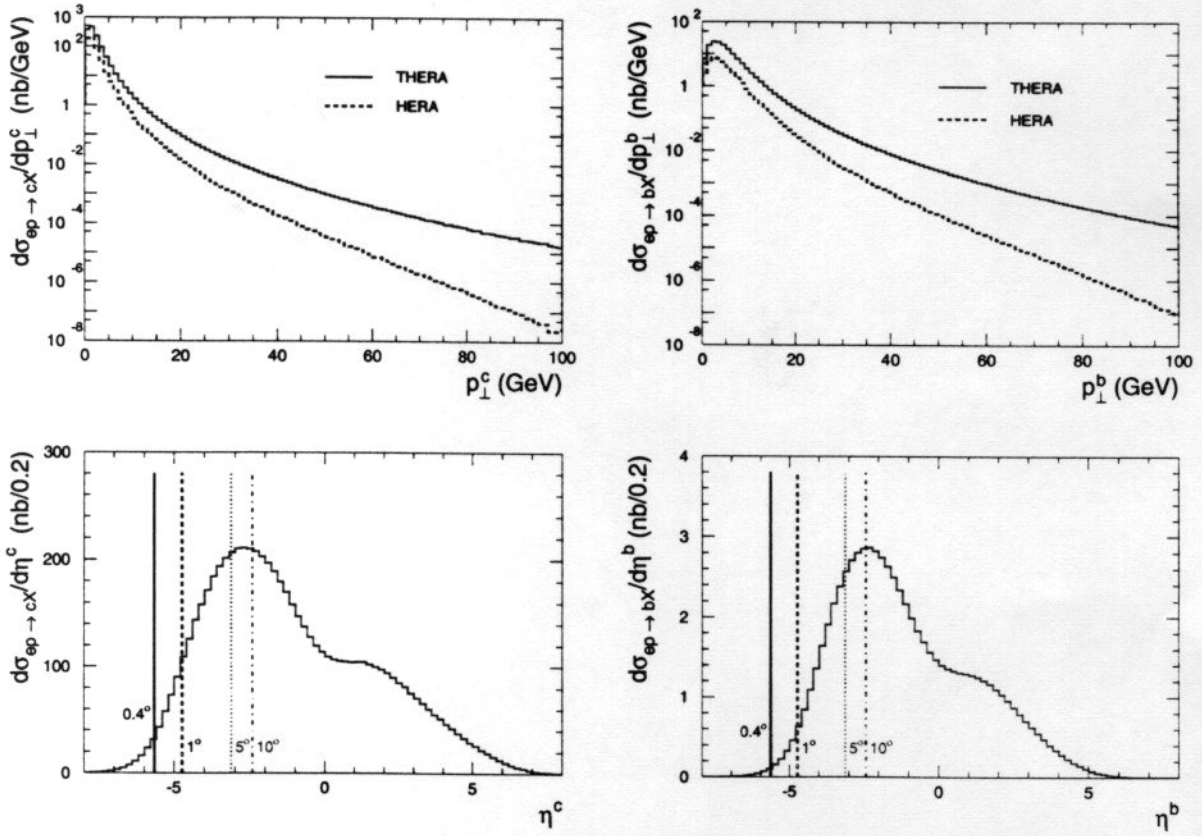

Figure 1: *$p_\perp^{c,b}$ and $\eta^{c,b}$ distributions for photon-gluon fusion at $Q^2 < 1\,GeV^2$.*

Photoproduction, $Q^2 < 1$ GeV^2
BGF in fixed-order NLO (FMNR)
GRV98

Proton structure

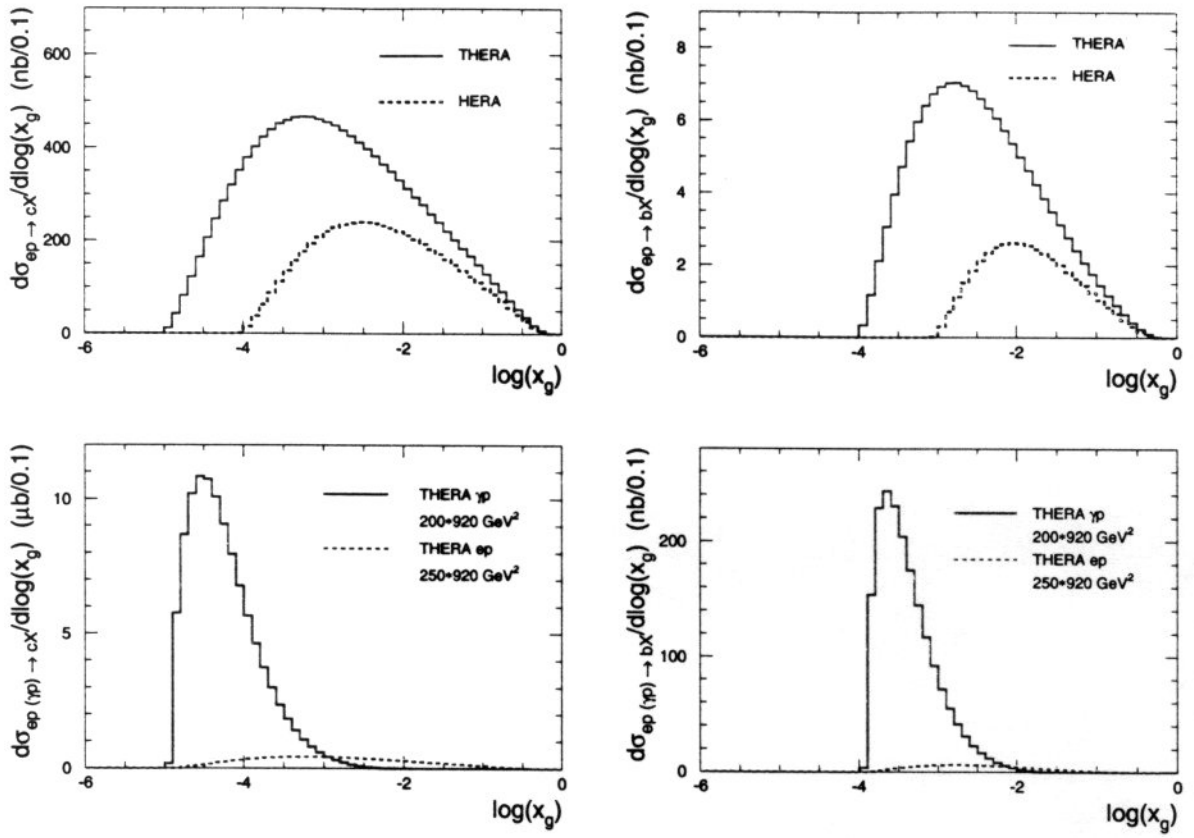

Figure 2: *Charm and beauty production cross sections in* $\log x_g$ *for photon-gluon fusion at* HERA, THERA and γp option of THERA.

Photoproduction, $Q^2 < 1\,GeV^2$

BGF in fixed-order NLO (FMNR)

GRV 98

Photon structure

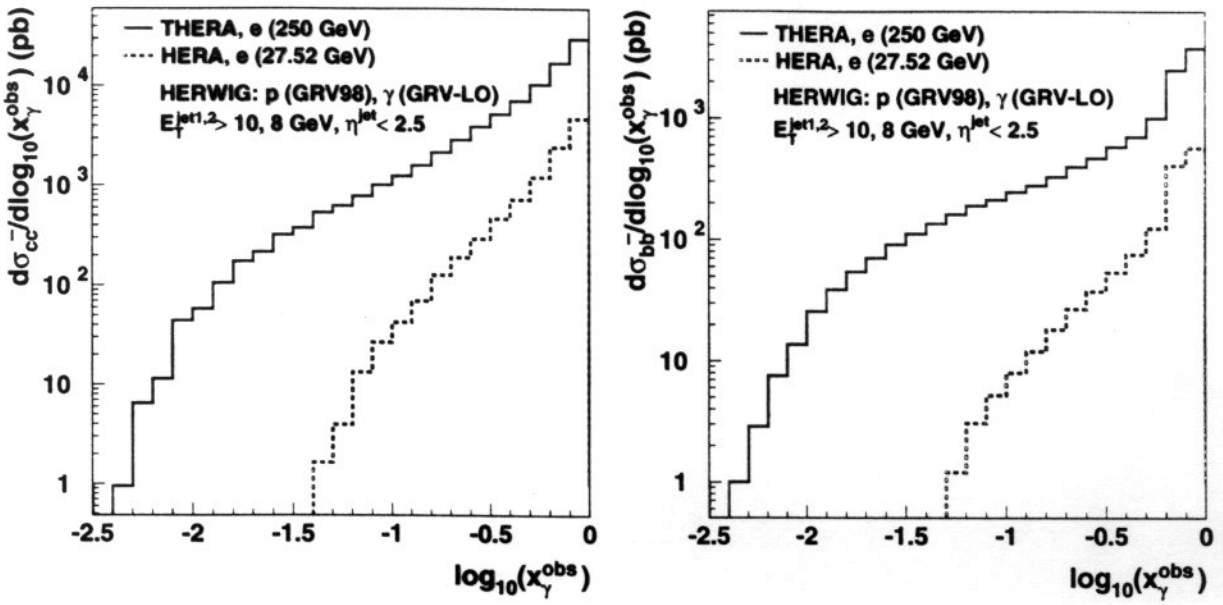

Figure 3: *The differential cross section* $d\sigma/dx_\gamma^{\rm obs}$ *for charm and beauty dijet photoproduction at* HERA and THERA.

$$x_\gamma^{\rm obs} = \frac{\Sigma_{\rm jet1,2}(E_T^{jet}\ e^{-\eta^{jet}})}{2E_e y}$$

Photoproduction, $Q^2 < 1$ GeV^2

HERWIG

DIS, $Q^2 > 1$ GeV^2 (NC)
- test of QCD
- F_2^c, F_2^b

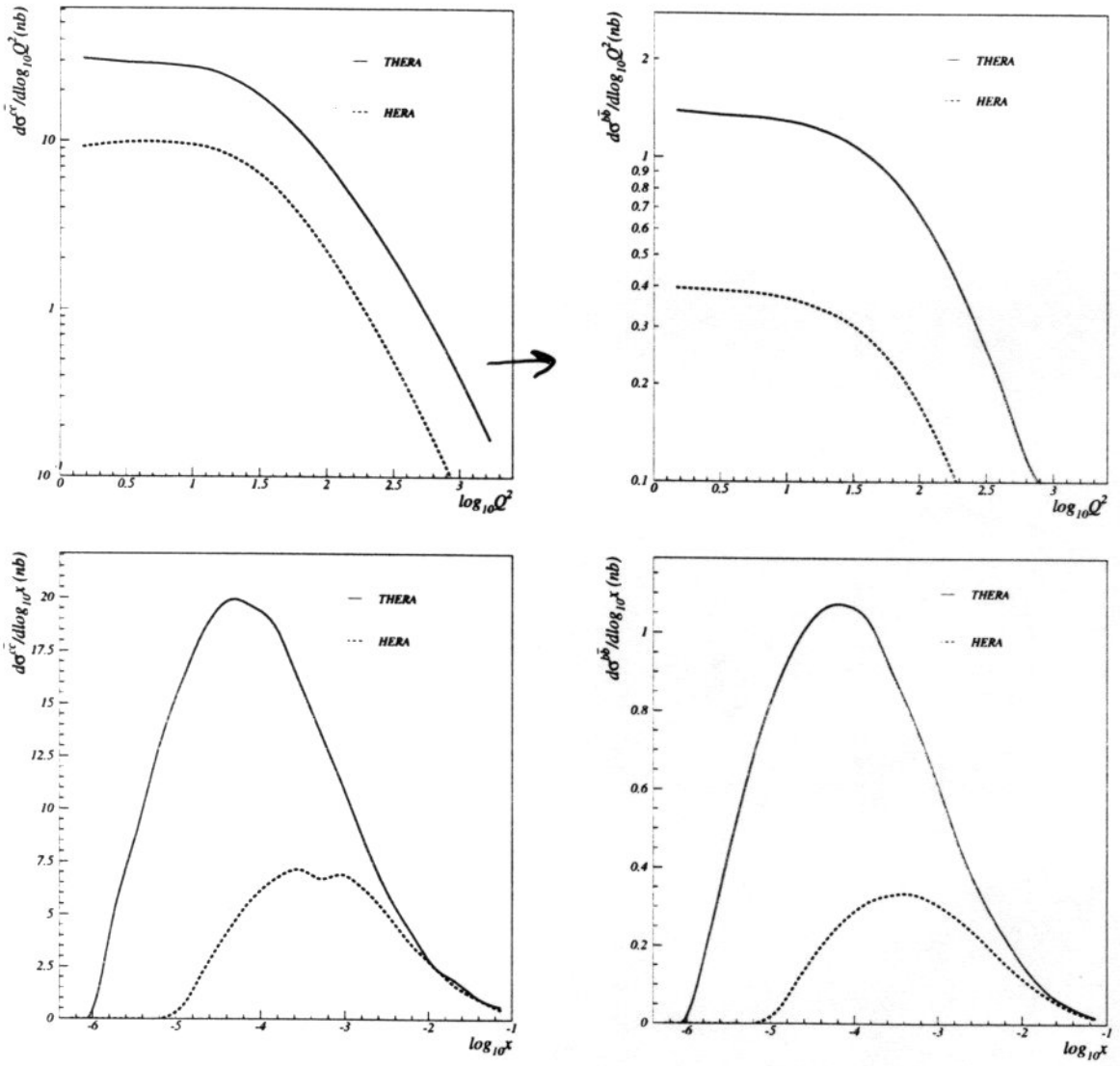

Figure 4: *Charm and beauty DIS cross sections in* $\log Q^2$ *and* $\log x$ *at* HERA and THERA.

fixed-order NLO (HVQDIS)
GRV98

Charged Current DIS, $Q^2 > 1\,GeV^2$

- QCD test
- F_2^s
- ?

	HERA	THERA
$W^+ s \to c$	3.2 pb	17 pb
$W g \to c \bar{s}$	7.7 pb	47 pb

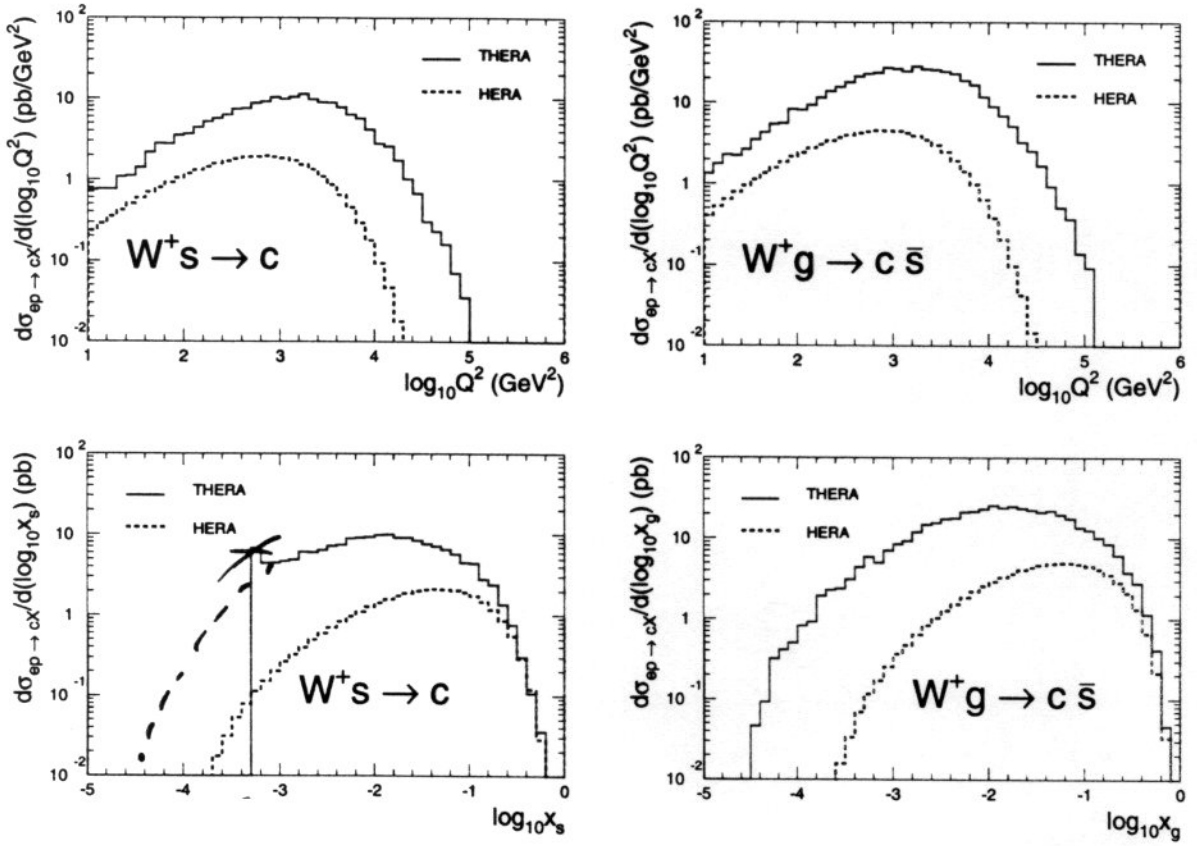

Figure 5: *Charge Current charm production cross sections in* $\log Q^2$ *and* $\log x_{s(g)}$ *at* HERA and THERA.

HERWIG 6.1
GRV98

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