HERA cross section

Beauty production at HERA is suppressed by 2 order of magnitude with respect to charm, due to the larger mass and smaller electric charge of the b quark.
Total cross section is dominated by photoproduction
Final states: steeply falling p_T spectrum -> challenge for secondary vertex.

$\sigma(e^+p \to e^+\underline{b}\, X) \sim 1.6 \pm 0.4$ nb
$\sigma(e^+p \to b\underline{b}\, X \to \mu X) \sim 160 \pm 30$ pb PhP : Q2<1 GeV2
$\sigma(e^+p \to b\bar{b}\, X \to \mu X) \sim 30 \pm 8$ pb DIS: 1<Q2<100 GeV2

$\sigma(ep \to eb\bar{b}\, X \to ejj\ \mu eX) \sim 9.4 \pm 1.2$ pb
$\sigma(ep \to eb\bar{b}\, X \to ejj\mu\mu X) \sim 10.4 \pm 1.5$ pb

Beauty at HERA

Before the use of silicon microvertex detectors, the principal way to identify beauty events was to reconstruct leptons and measure their momentum p_T^{rel} perpendicular to the axis of an associated jet.

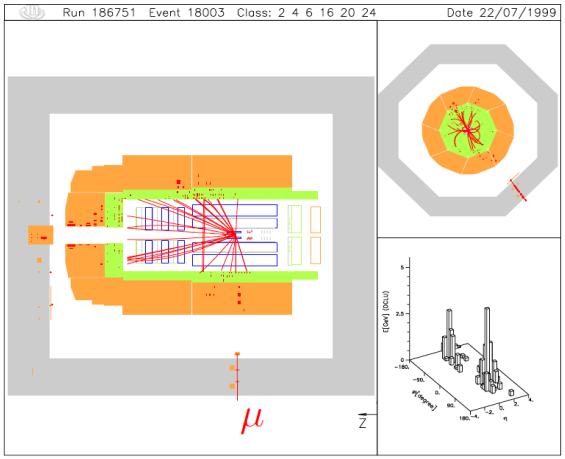
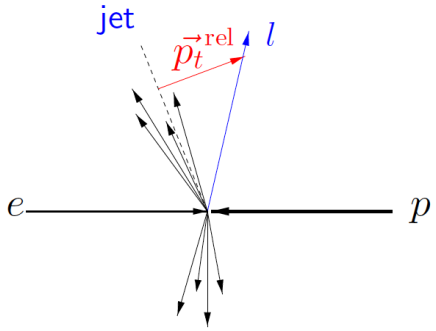


Figure 1. A beauty candidate in the H1



- $Q^2 > 2\,\mathrm{GeV}^2$
- $0.05 < y < 0.7$
- $-0.9 < \eta^\mu < 1.3$ and $p_t^\mu > 2.0\,\mathrm{GeV}$ or $-1.6 < \eta^\mu < -0.9$ and $p^\mu > 2.0\,\mathrm{GeV}$
- $E_{t,Breit}^{jet} > 6\,\mathrm{GeV}$
- $-2.0 < \eta_{lab}^{jet} < 2.5$

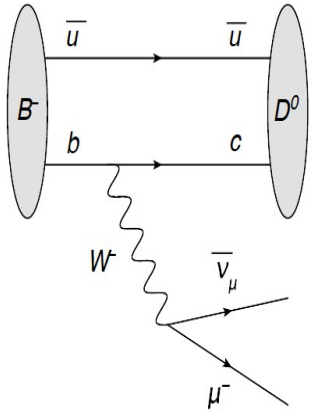


Figure 2.15.: Quark level diagram for the decay $B^- \to D^0\mu^-\nu_\mu$.

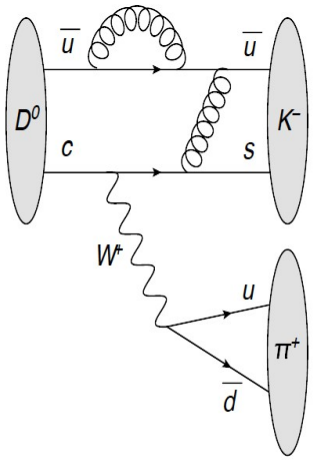
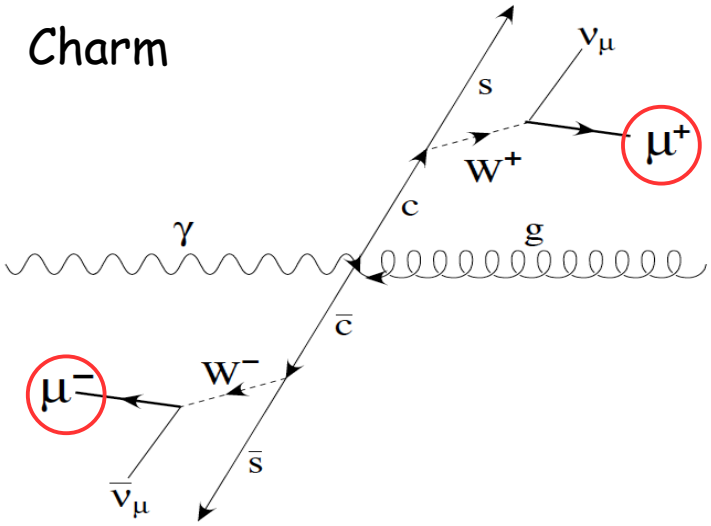


Figure 2.16.: Quark level diagram for the decay $D^0 \to K^-\pi^+$.

Beauty



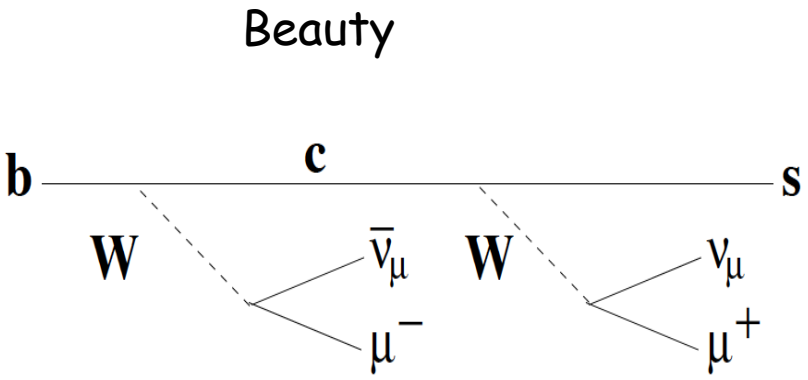


Figure 2.12: *Cascade decay of a beauty quark.*

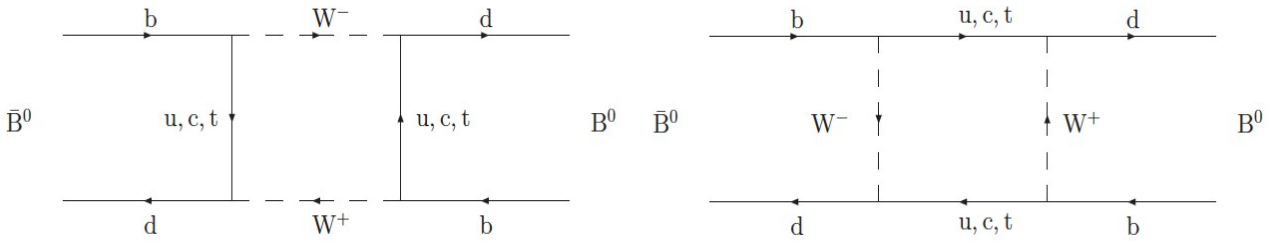
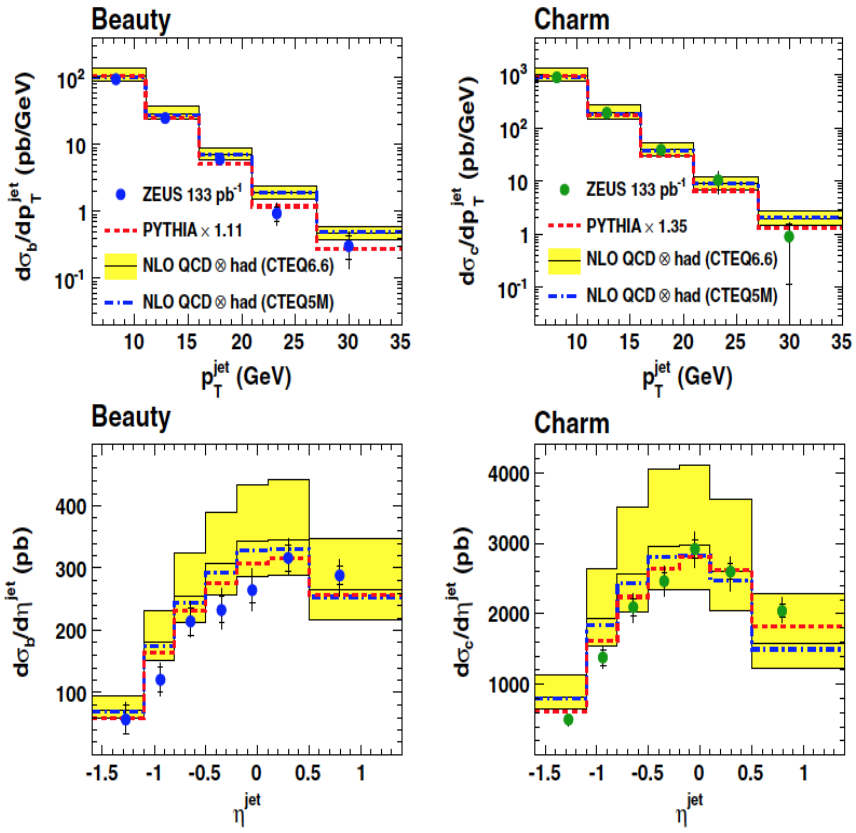
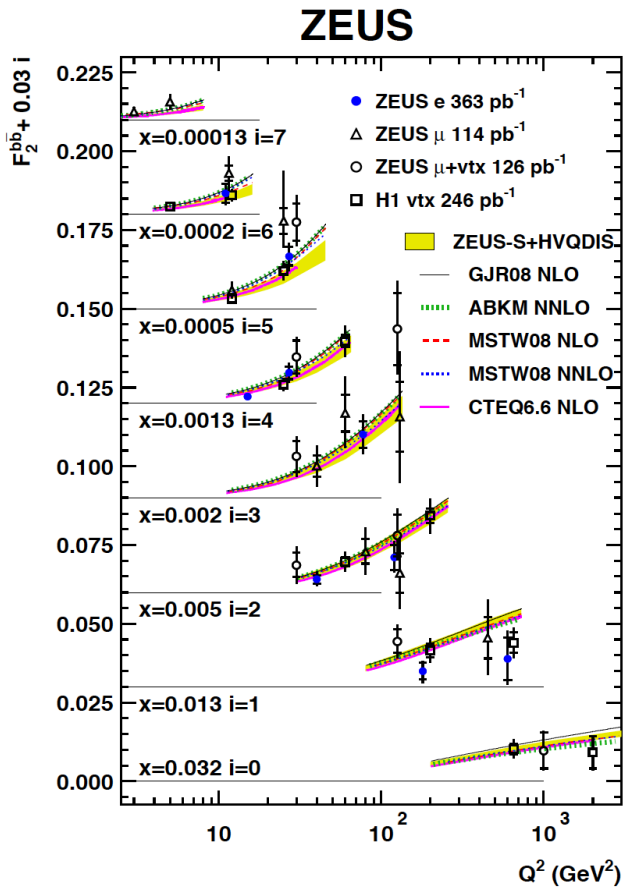


Figure 2.13: *Feynman diagrams for $B^0 - \bar{B}^0$ mixing.*

Beauty at HERA





Beauty at EIC

HVQDIS: Full NLO result, CTRQ5F3, no fragmentation

Mass	ep: 10/100 Q2	Other cuts 0<y<1, 0.5<PT<20 GeV	σ(nb)
4.18 GeV	0.01<Q2<5000	0<x<1	0.3002 ($\pm 2.18 \cdot 10^{-3}$)
4.18	1<Q2<5000	0<x<1	0.11805 ($\pm 1.4 \cdot 10^{-4}$)
4.18	1<Q2<5000	0.1<x<1	$1.0229 \cdot 10^{-3}$ ($\pm 1.5 \cdot 10^{-6}$)
4.18GeV	1<Q2<5000	0.1<x<1,	$1.01218 \cdot 10^{-3}$ ($\pm 1.6 \cdot 10^{-6}$)
4.07	1<Q2<5000	0<x<1	0.13133 ($\pm 1.4 \cdot 10^{-4}$)
4.66	1<Q2<5000	0<x<1	$7.5378 \cdot 10^{-2}$ ($\pm 8.7 \cdot 10^{-5}$)
4.75 GeV	1<Q2<5000	0<x<1	$6.94 \cdot 10^{-2}$ ($\pm 7.9 \cdot 10^{-5}$) $5.962 \cdot 10^{-2}$ - pythia

Backup

Search for Exotic Particles at EIC

"Everything is allowed what is not prohibited..."

Julia Furletova

U.S. DEPARTMENT OF ENERGY
JSA
Jefferson Lab