-- Charm and Beauty Dijets in Photoproduction at HERA --
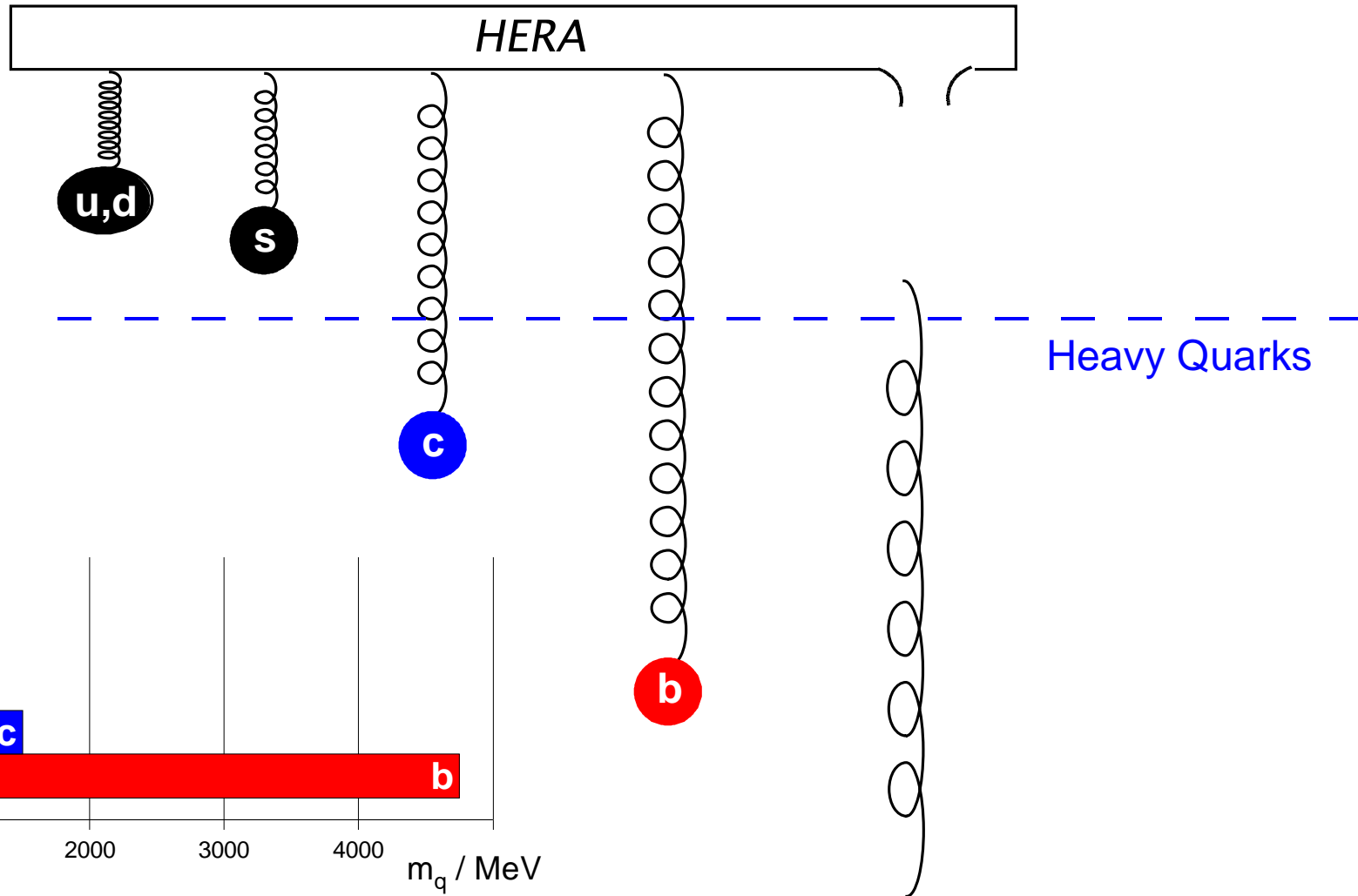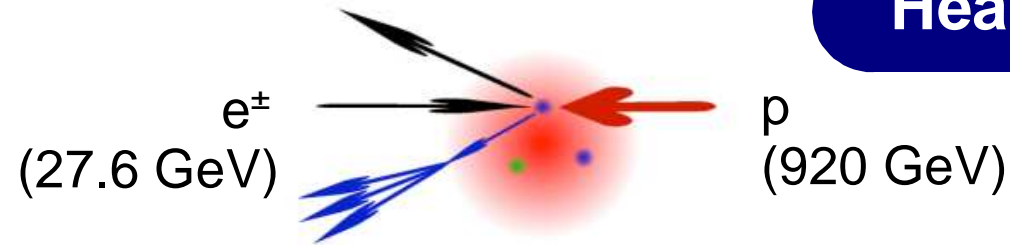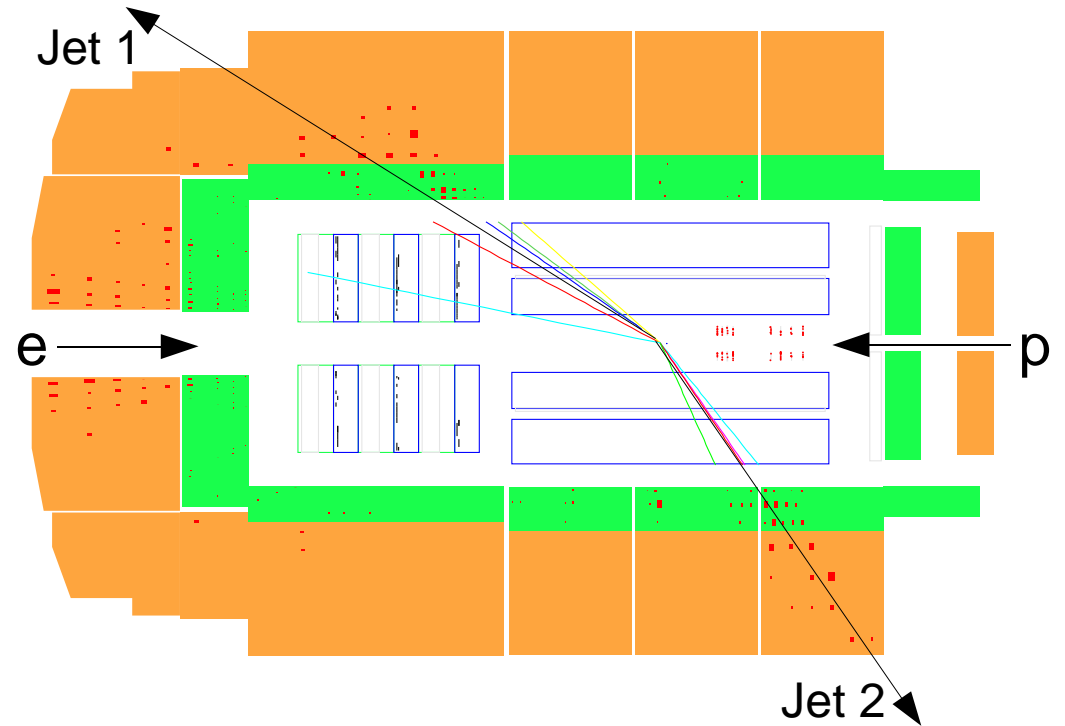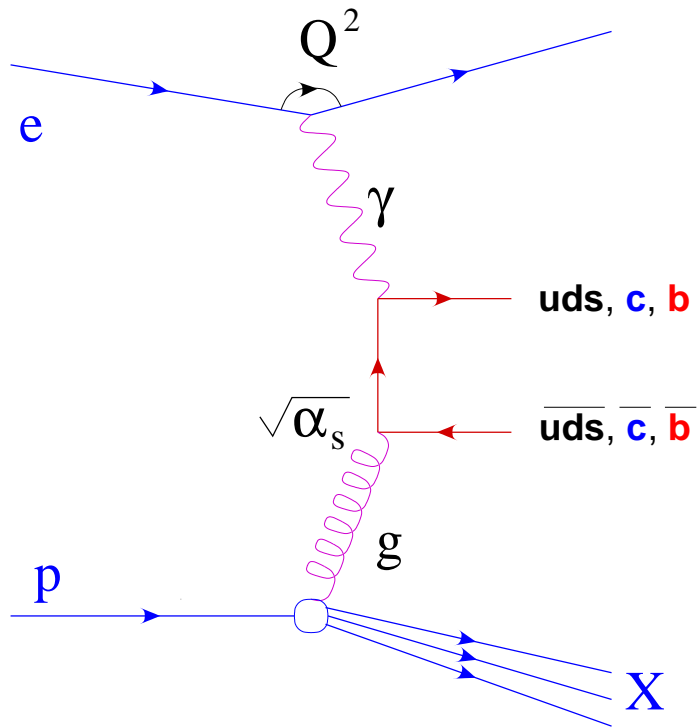
Lars Finke
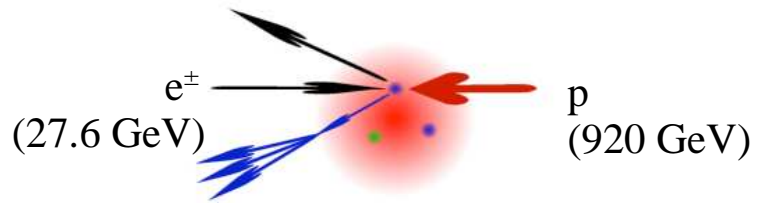**May 10, 2007**

$e^{\pm}$
(27.6 GeV)

p
(920 GeV)

HERA

u,d

s

c

b

Heavy Quarks

ud

s

c

b

| 0 | 1000 | 2000 | 3000 | 4000 | m_q / MeV |

$e^\pm$
(27.6 GeV)

p
(920 GeV)

Q^2

e

γ

uds, c, b

$\sqrt{\alpha_s}$

$\overline{uds}$, $\overline{c}$, $\overline{b}$

g

p

X

Jet 1

e

p

Jet 2

→ Quark flavour separation based on different lifetimes

D+

D0

B+

B0

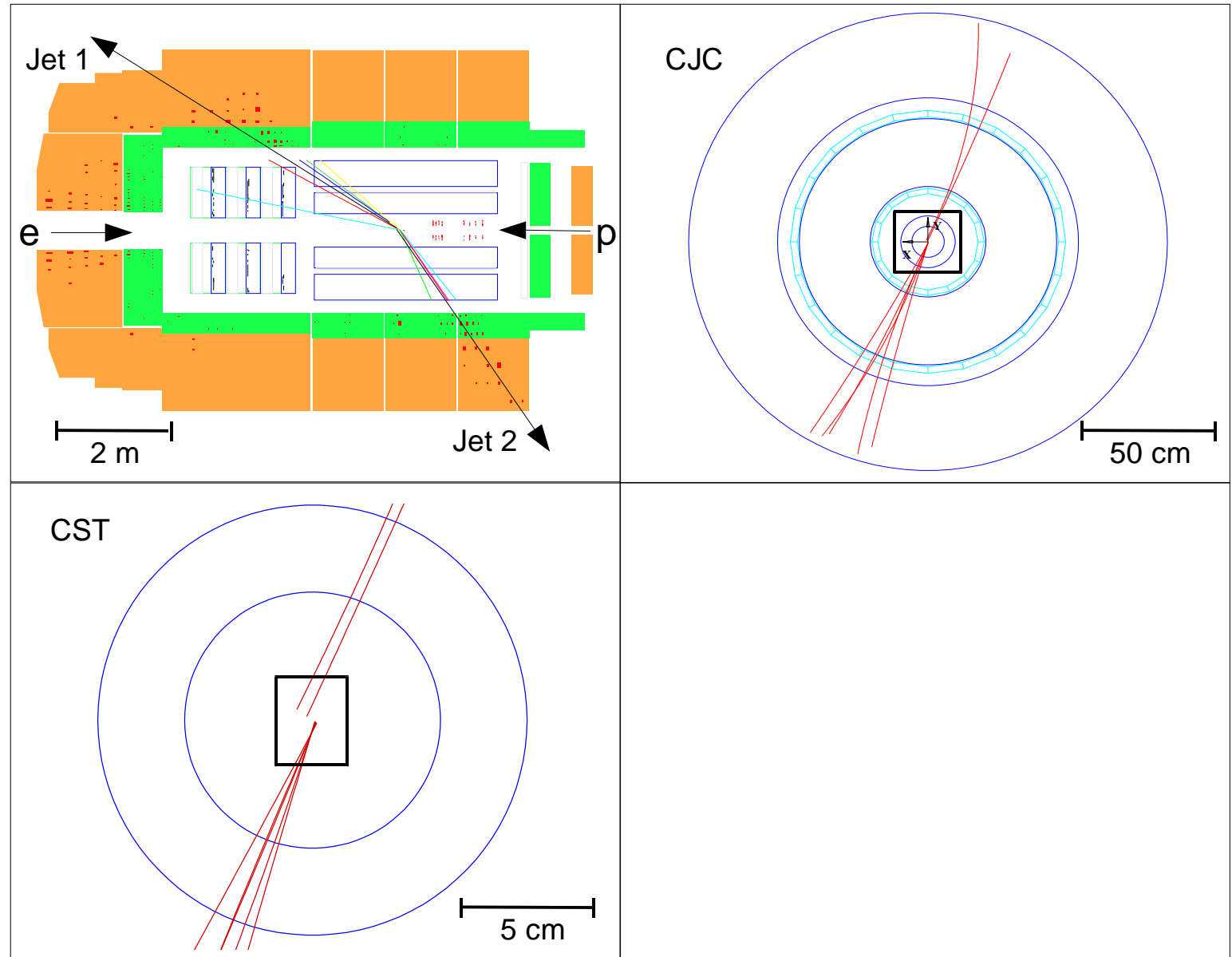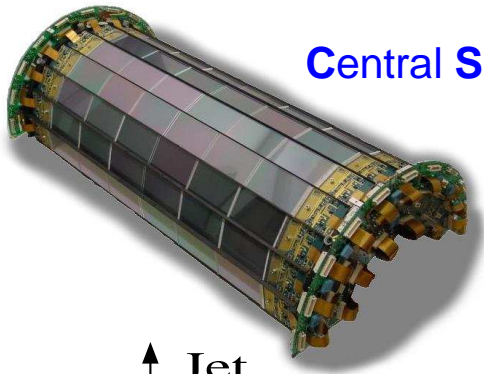0   0.5   1   1.5 τ / ps
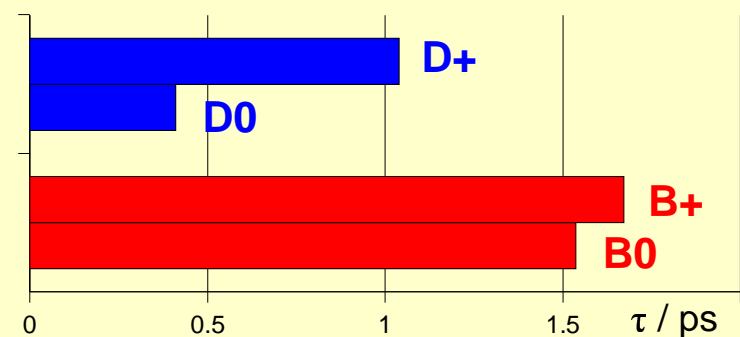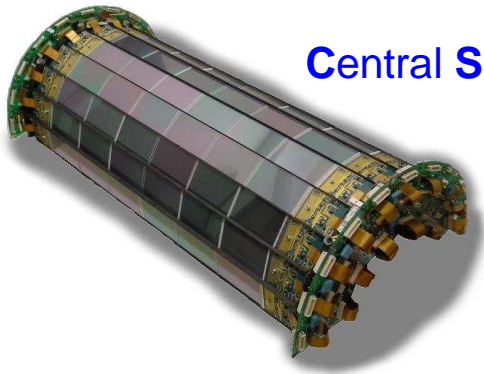
Central Silicon Tracker (CST)

Beauty Sample Event

➜ Silicon Strip Sensors

➜ 2 layers

➜ **Lifetime effect
   ~ resolution**
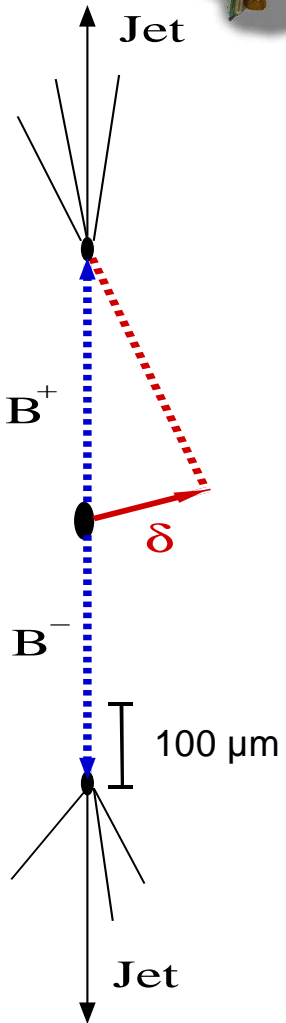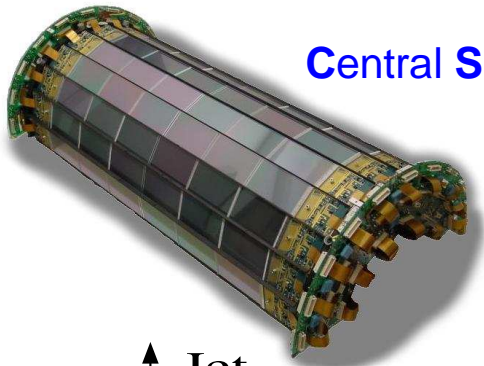
Jet 1

e

p

2 m

Jet 2

CJC

50 cm

CST

5 cm

Central Silicon Tracker (CST)

Beauty Sample Event

Jet

B^+

δ

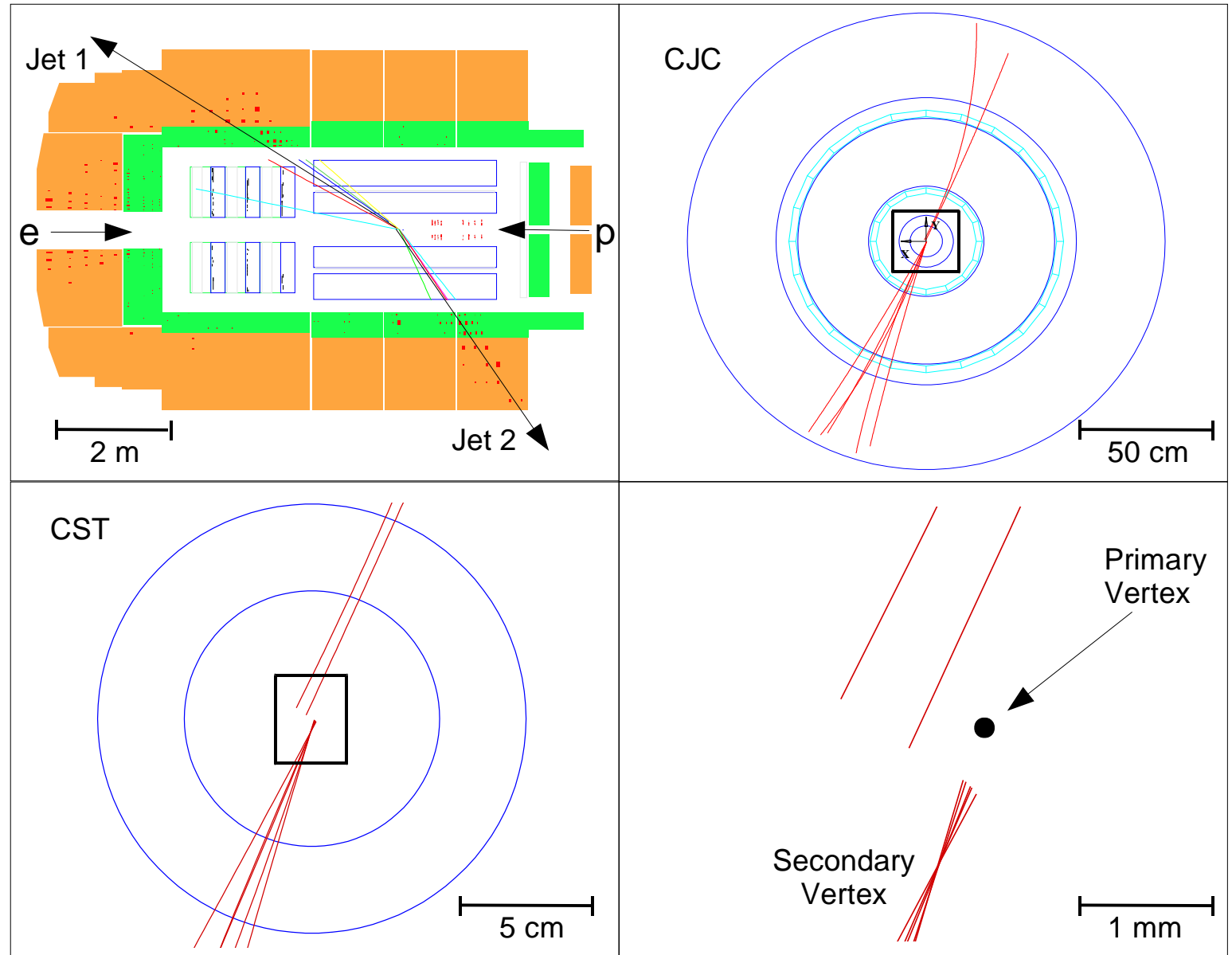B^-

100 μm

Jet

Jet 1

e

p

Jet 2

2 m

CJC

50 cm

CST

5 cm

Primary Vertex

Secondary Vertex

1 mm

Central Silicon Tracker (CST)

Central Silicon Tracker (CST)

H1

- Data
- b
- c
- uds
- sum

S_1

Entries

H1

- Data
- b
- c
- uds
- sum

S_2

Jet

B^+

δ

B^-

100 µm

Jet

CST

5 cm

S_2

S_1

Primary Vertex

Secondary Vertex

1 mm
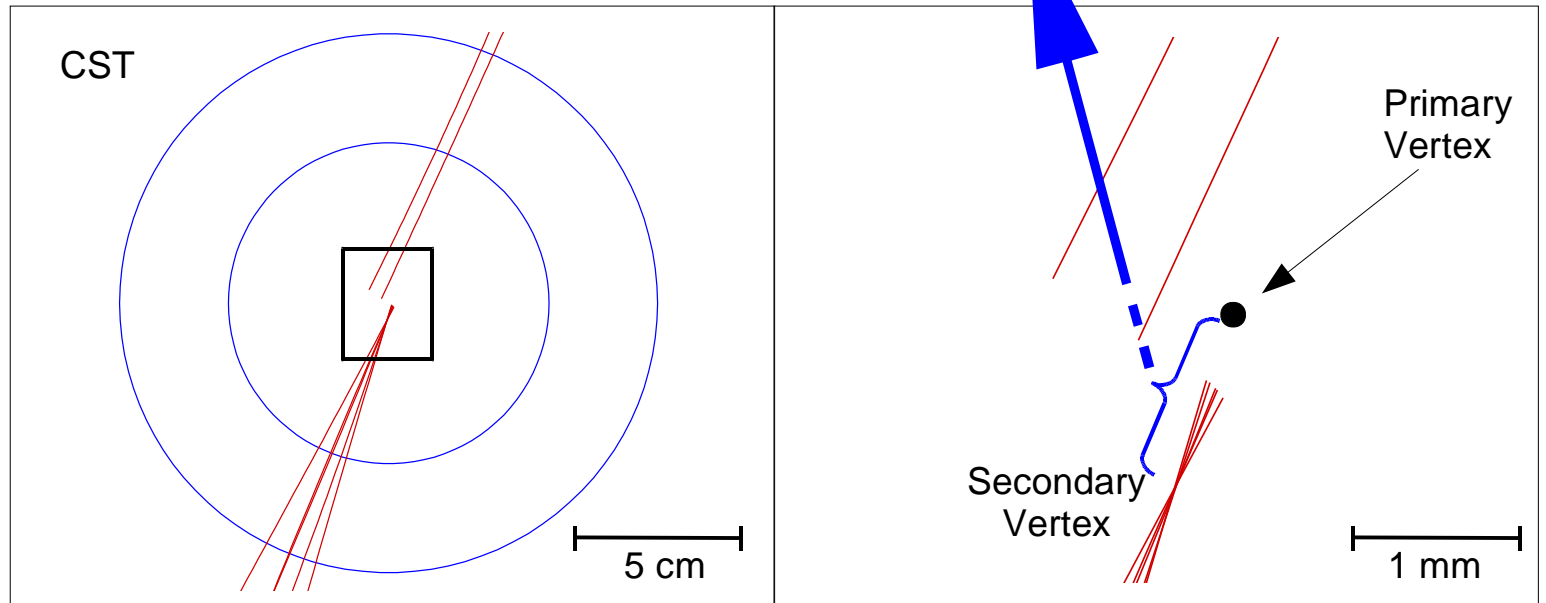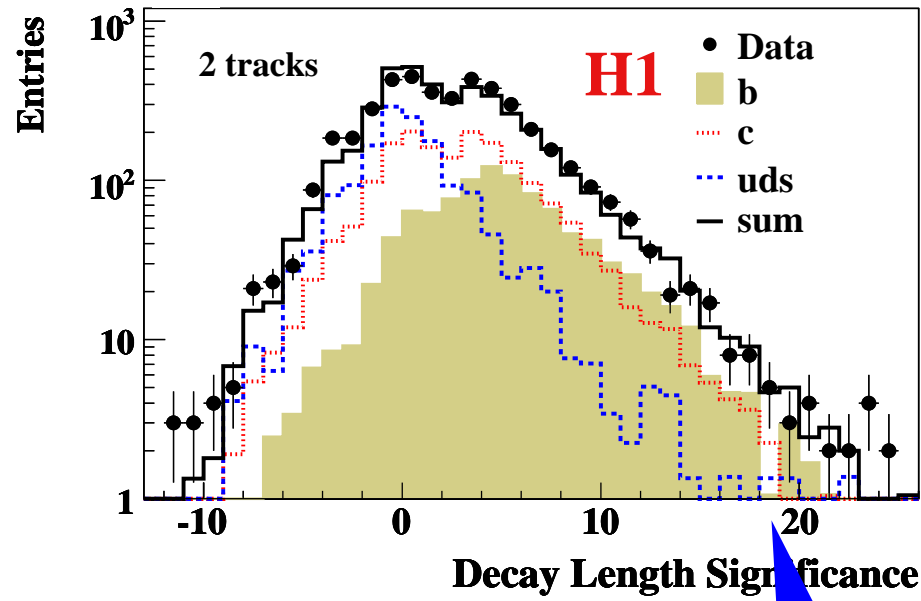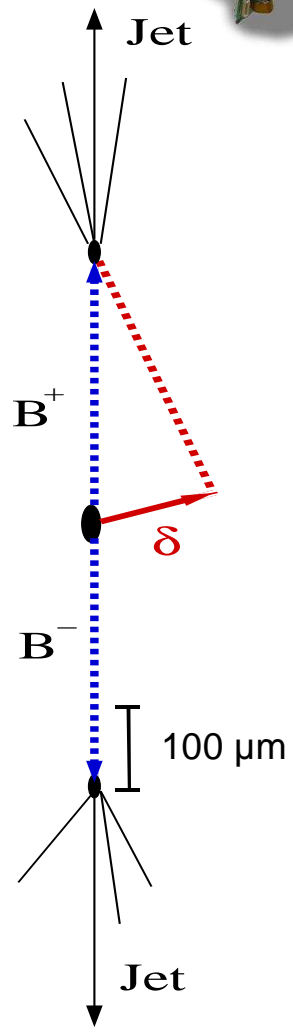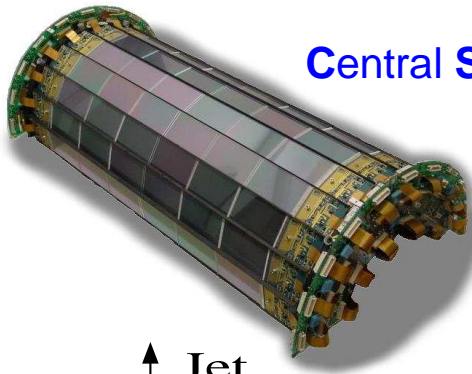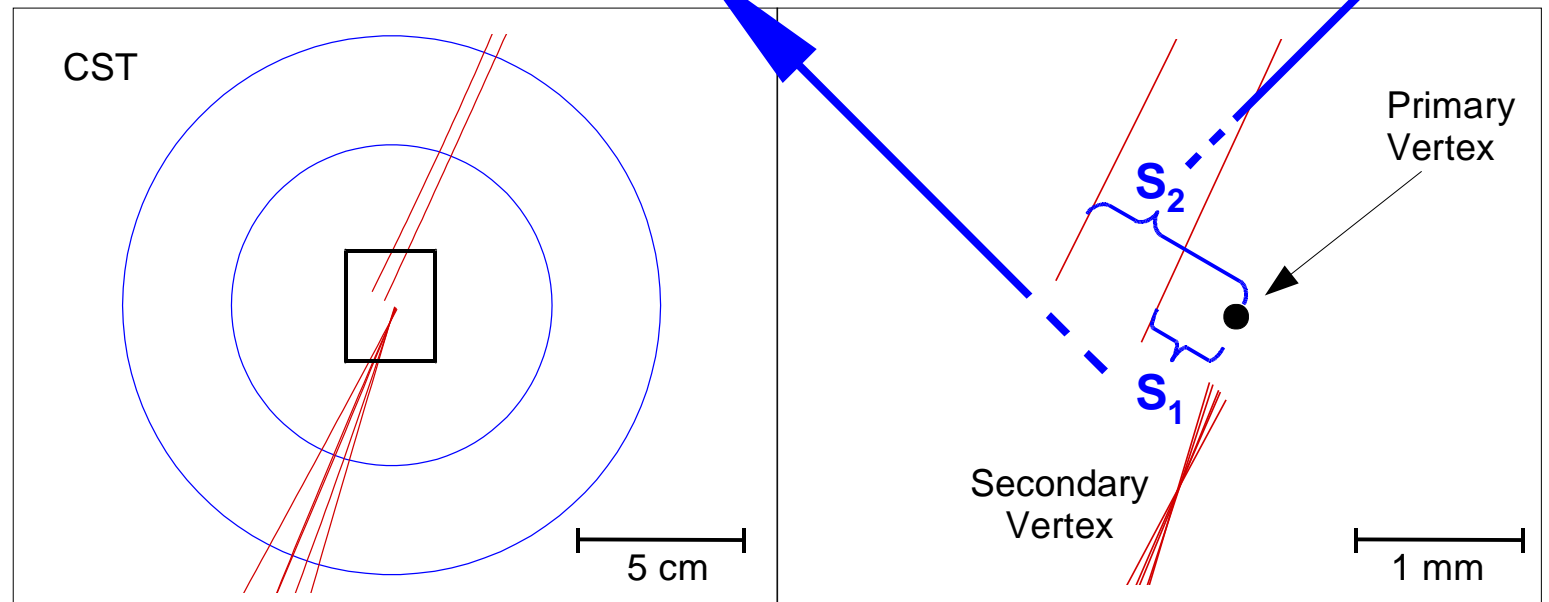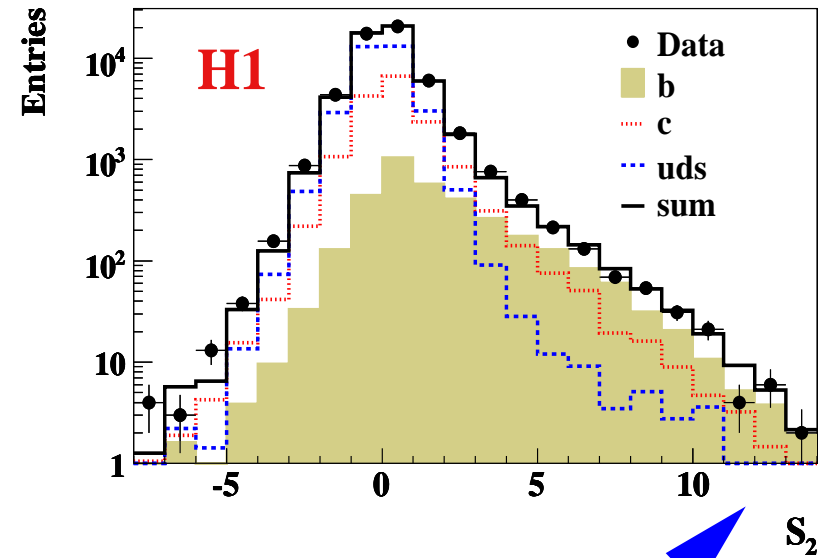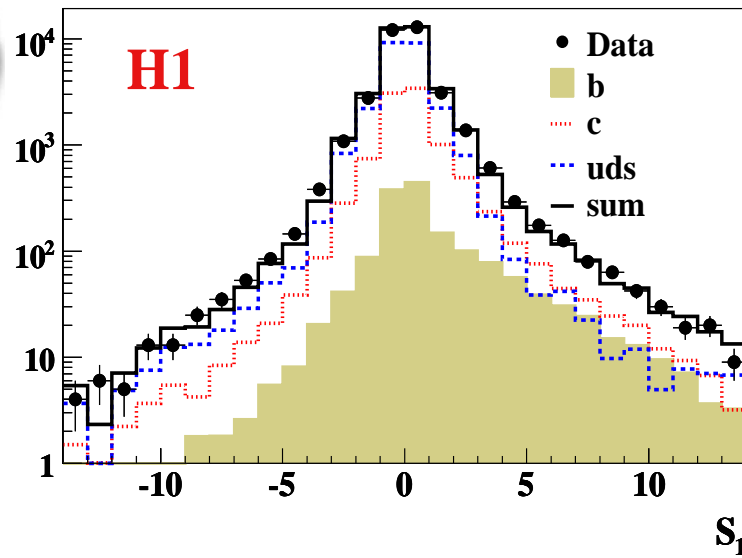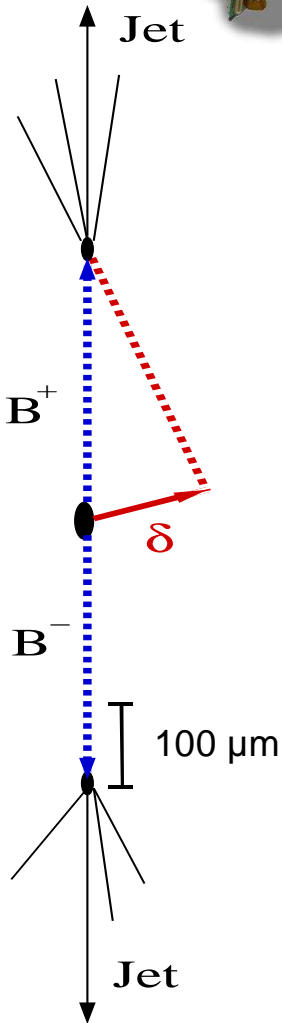
➜ First simultaneous measurement of charm and beauty in photoproduktion at HERA

➜ Dynamic of the production process

➜ Correlations

Comparison to NLO QCD

➜ Charm consistent with NLO (α_s^2) QCD

➜ Beauty somewhat higher than NLO QCD

Similar situation at LEP and TEVATRON

Charm

$ep \rightarrow ec\bar{c}X \rightarrow ejjX$

H1

- ● Data
- - - - Pythia
- ⋯⋯ Cascade
- ▬ NLO QCD ⊗ had

Beauty

$ep \rightarrow eb\bar{b}X \rightarrow ejjX$

H1

- ● Data
- - - - Pythia
- ⋯⋯ Cascade
- ▬ NLO QCD ⊗ had
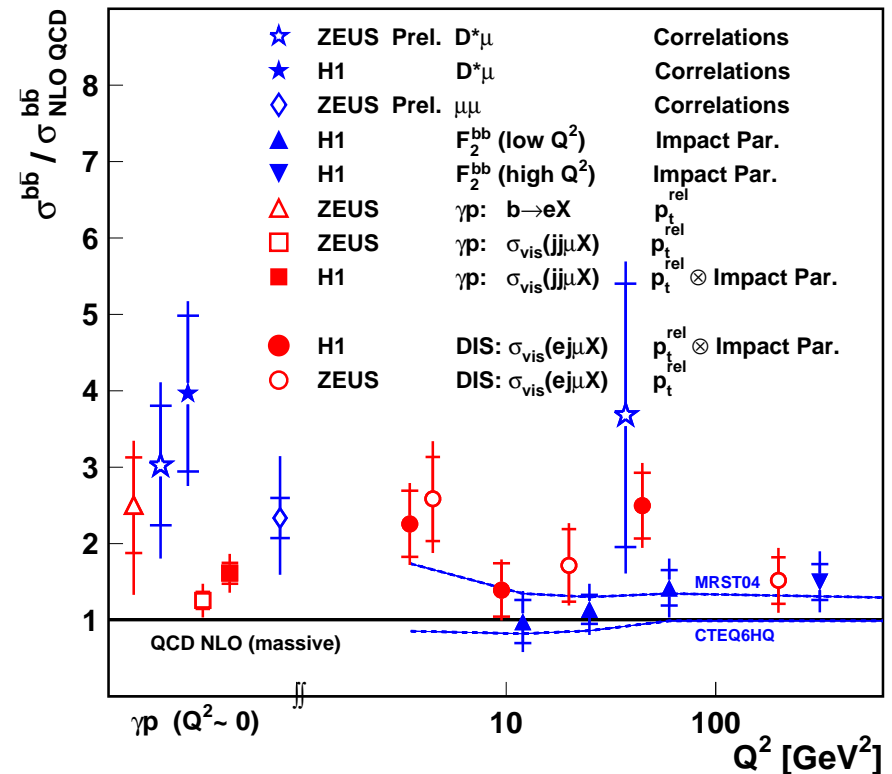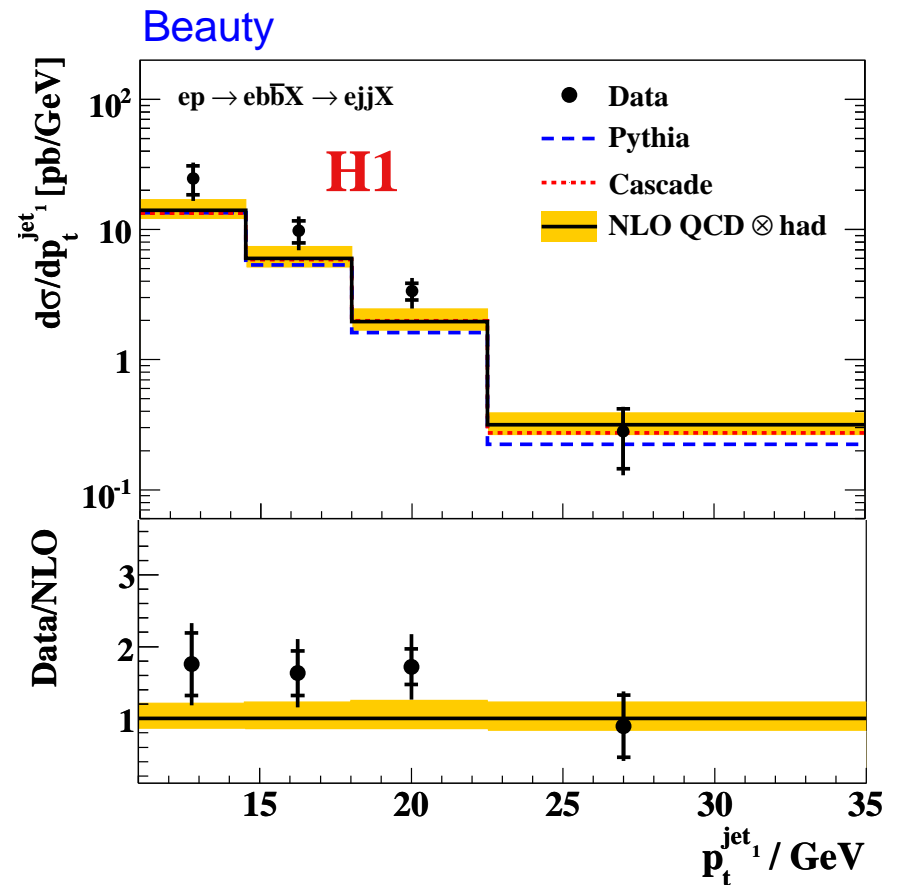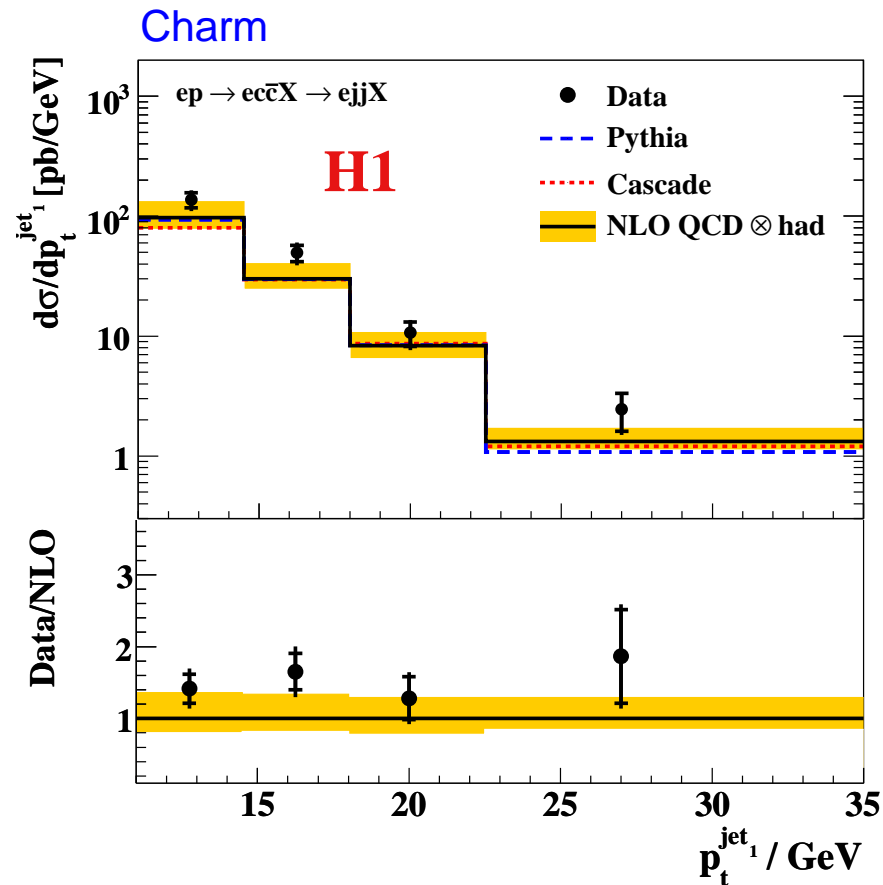
→ Highest p_t region ever reached at HERA for charm & beauty jets.

→ **Charm**: Larger theory errors, data consistent with NLO. MC models similar to FMNR.

→ **Beauty**: Data somewhat higher than all QCD models. Shape well described.

Charm

Beauty

$\frac{d\sigma}{dp_t^{jet_1}}$ [pb/GeV]

10^3 ep

10^2

10

Data/NLO

3

2

1

$\frac{d\sigma}{dp_T^b}$ (pb/GeV)

10^3

10^2

10

1

10^{-1}

$\frac{d\sigma}{dp_T^b}(ep \to ebX)$

$Q^2 < 1\,GeV^2$, $0.2 < y < 0.8$, $|\eta^b| < 2$

NLO QCD (FMNR)

kt fact. (LZ J2003 set 1)

✚ H1 99-00 b jet
▼ H1 99-00 b→μ jet
● ZEUS 96-00 b→μ jet
△ ZEUS (prel) 04 b→μ jet
○ ZEUS 96-97 b→e
□ H1 97-00 b→D*μ
■ ZEUS 96-00 b→D*μ
★ ZEUS (prel) 96-00 bb→μμ

0   5   10   15   20   25   30

$\langle p_T^b \rangle$ (GeV)

de

QCD ⊗ had

30   35

$p_t^{jet_1}$ / GeV

→ Highes

→ **Charm**: FMNR.
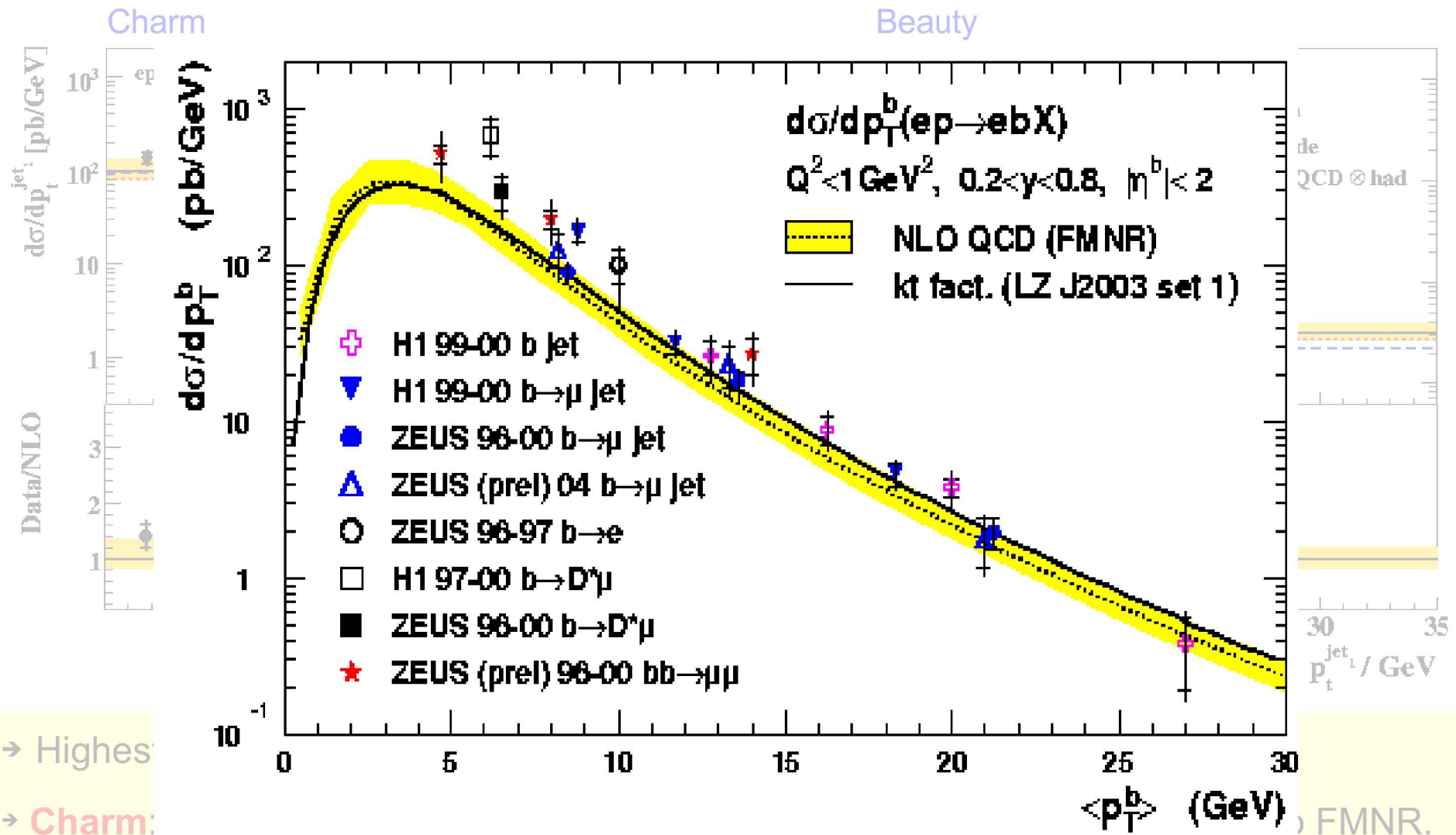
→ **Beauty**: Data somewhat higher than all QCD models. Shape well described.

Quark Fractions

Fractions normalized to **measured** flavor inclusive dijet cross sections

$$\sigma \sim e_q^2$$

+2/3e

-1/3e

Naïve quark charge counting assuming **all quarks to be massless**:
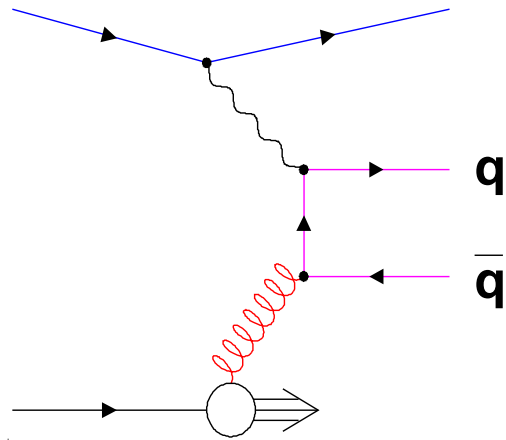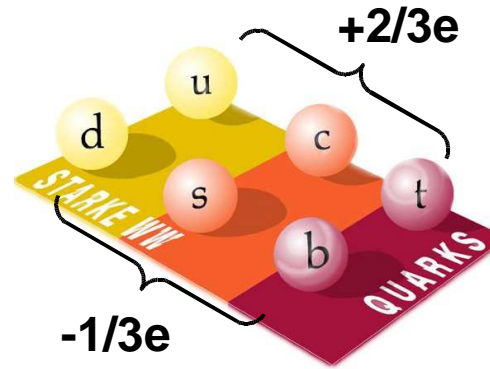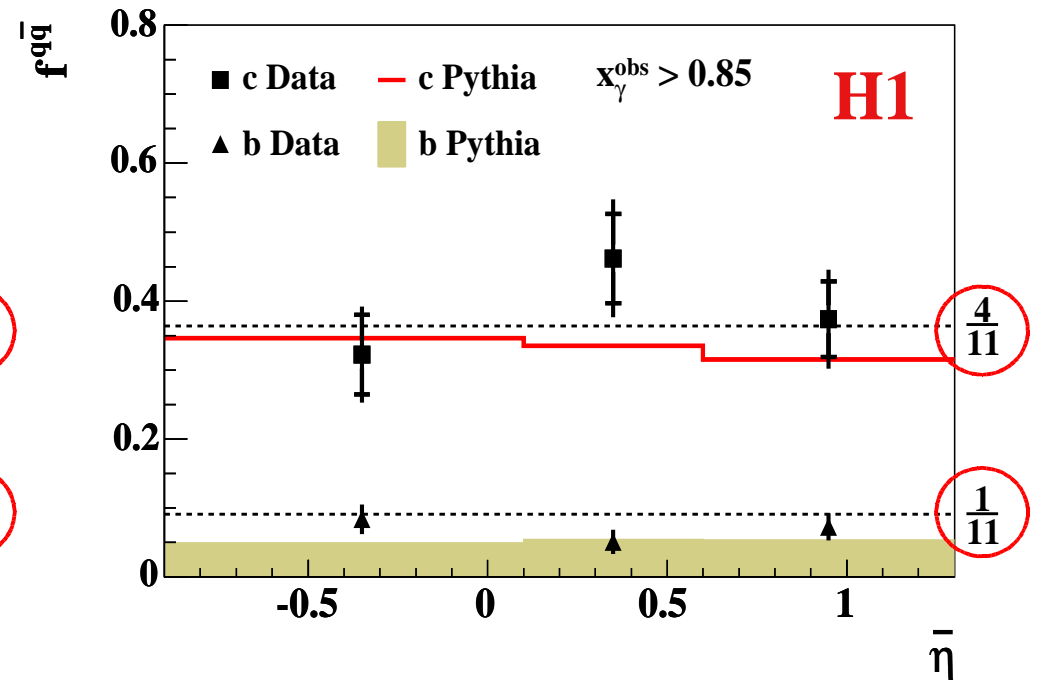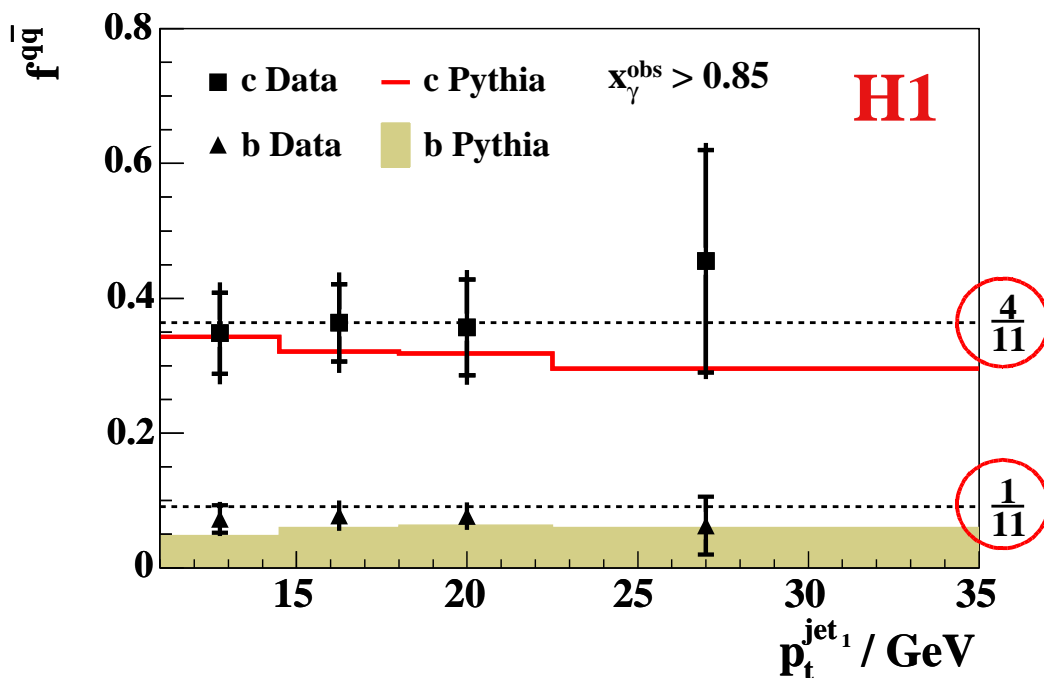
→ $\sigma^{uds} : \sigma^{charm} : \sigma^{beauty} = 6/11 : 4/11 : 1/11$

Acknowledgment

Danke!!!

It is a pleasure for me to express my gratitude to everyone who supported me during the course of my stay at H1.

Special thanks go to my supervisor Prof. Dr. Beate Naroska for her excellent support, advice and confidence in my work throughout my research. This was truly appreciated.
I am thankful to Prof. Dr. Rolf-Dieter Heuer for kindly accepting to be my second referee.
I wish to thank Andreas Meyer for all the help and countless discussions we had about details of the analysis. It would not have been possible for me to reach so far were it not for his experience, advice and motivation.
Many thanks go to the whole H1 collaboration, especially the members of the Heavy Flavour Working Group, for the friendly and professional atmosphere I enjoyed. Here my special thanks go to Olaf Behnke for his many fruitful ideas and the stimulating discussions we had.
Special mention to those who participated in the proofreading of the manuscript.
Further thanks go to the H1 Hamburg group, who are too numerous to mention, for their good team work and the enjoyable atmosphere we shared. I would like to thank especially Michael Steder and Shiraz Habib for their company, bad coffee and many meaningless discussions. I thank Maria Martisikova, with whom I shared my office space, for the encouraging times and good working environment.
My stay at DESY would not have been so pleasant were it not for my colleagues and best friends Johannes Haller, Linus Lindfeld and Carsten Schmitz.
Lovely thanks go to charming Mona for being the beauty in my life.
Finally I would like to thank my family for their invaluable support during the past 29 years. This work would not be possible without all of them.