Physics highlights from Hera-B

57th PRC Open session, May 27th, 2004

- Data samples and triggers
- Results from MB data
- Results from dilepton trigger data
- Summary

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Data and triggers

Data taking:


- 210 M minimum bias events
  Logging rates: 1 kHz (1.7 TB/d)

- 150 M dilepton triggered events with ~300k J/ψ
  J/ψ rates: 1200 - 1400 / hour

- 90 M hard photon + Glueball trigger
Minimum bias topics

- Production of $\phi$ and $K^*$ mesons
- $\Lambda^0$ polarization
- Hyperon production
- Pentaquark searches ($pK_S$, $\Xi \pi$)
- Bose-Einstein correlations
- $D^+/D^0$ production ratio

See last PRC
Strangeness production

$\Lambda \rightarrow p\pi$

large statistics:

$K_S \sim 3.4 \times 10^6$ $K_S$ $\sigma \sim 4.9$ MeV

$\Lambda \sim 1.4 \times 10^6$ $\sigma \sim 1.8$ MeV

$\Lambda(1520) \sim 3000$ $\sigma \sim 8$ MeV

Good kaon ID: $10 < p < 60$ GeV

Good proton ID: $20 < p < 60$ GeV

57th Desy PRC
Production of $\phi$ and $K^*$

Differential cross sections $d\sigma/dp_t^2$ measured for three nuclei ($^{12}\text{C}$, $^{48}\text{Ti}$, $^{184}\text{W}$) up to 12 GeV$^2$/c$^2$ in $p_t^2$

$\phi \rightarrow K^+K^-$: 52600 events

$K^{*0} \rightarrow K^\pm\pi^\mp + cc$: 952000 events

Cronin effect observed for resonances
Pentaquark searches
$(\Theta^+ \rightarrow pK_S)$

No evidence of resonances in the mass region around 1530 GeV.

The upper limit on the particle yield ratio relative to $\Lambda_{1520}$ is:

$$\Theta^+/\Lambda_{1520} < 0.02 \text{ (95\% C.L.)}$$

Hermes: $\Theta^+/\Lambda_{1520} \approx 1.6 \div 3.5$

(same BR for $\Theta^+$ decays assumed)

Evaluation of the nuclear cross section upper limit in progress
Pentaquarks in $\Xi\pi$?

Statistics:
$\sim 11.300 \, \Xi^-, \sigma \sim 2.6 \text{ MeV}$
$\sim 7.700 \, \Xi^+, \sigma \sim 2.6 \text{ MeV}$

Upper limits (95% cl):
$\Xi^{--}(1862) / \Xi^0(1530) < 0.077$
$\Xi^{++}(1862) / \Xi^0(1530) < 0.058$
Dilepton trigger topics

- Production ratio of $J/\psi$ and $\psi'$
- $J/\psi$ and $\psi'$ differential distributions
- Charmonium production $A$ dependence
- $\chi_c$ production, $A$ dependence
- $b\bar{b}$ production cross section
- $\Upsilon$ production cross section
- Upper limit on $BR(D^o \rightarrow \mu^+\mu^-)$

See last PRC
χc production

χc → J/ψ γ → μ⁺μ⁻ γ

\[ R_{χc} = \frac{N(χc)}{N(J/ψ)} \cdot \frac{ε_{J/ψ}}{ε_{J/ψ}(χc) \cdot ε_{γ}} \]

εγ ≈ 0.4

Systematic studies ongoing

In 15% of μμ sample ≈1300 χc

≈10 k in full sample exp.

\[ R(χc) = 0.21±0.05 \]

2000

N(χc) = 380±74 (both μ⁺μ⁻, e⁺e⁻)

R(χc) = 0.32±0.06±0.04
**bb** production

Analysis of 2002/03 data:
- 35% of $e^+e^-$ and $\mu^+\mu^-$ statistics
- Expect $N_B \sim 100$ for full sample
- $J/\psi$ acceptance: $-0.35 < x_F < 0.15$ (90% of $bb$ cross section)

- Preliminary results of both channels are compatible
- $1.5 \sigma$ lower than 2000 measurement

\[ \sigma(b\bar{b}) = 12.3^{+3.5}_{-3.2} \text{ nb/N} \]
Limit on $\text{BR}(D^0 \rightarrow \mu^+ \mu^-)$

$\text{BR}(D^0 \rightarrow \mu^+ \mu^-) < 2.0 \times 10^{-6}$ (90% cl)
DESY-04-086
hep-ex/0405059
Submitted to Phys Lett B

CDF: $\text{BR}(D^0 \rightarrow \mu^+ \mu^-) < 2.5 \times 10^{-6}$

Currently best upper limit
Summary

- High quality of data collected
- A large variety of physics topics addressed (s, c, b and exotics)
- Preliminary results on most topics presented
- Publications on the most advanced analyses in preparation (D° →μ⁺μ⁻, Θ⁺, bb, γ, D⁺/D°, χc, ...)
- Several other topics could lead to publication, manpower permitting