Physics from HERA-B

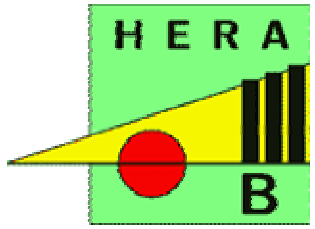
58th PRC Open session, October 28th, 2004

M. Mevius, DESY Hamburg

Outline

- Data samples
- Physics topics
- Pentaquark searches
- $\psi(2S)$ production
- A –dependence
- $b\bar{b}$ cross section
- Summary

Data samples



Minimum Bias data

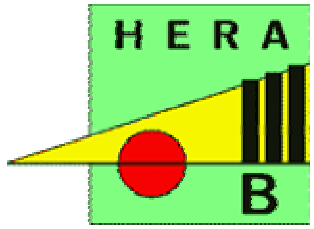
200 M events on C,Ti,W
1000 ev/s > 1TB/day

Dilepton triggered data

150 M dilepton trigger events
300 000 J/ψ (>1000 per hour)
15 000 χ_c
5 000 ψ(2S)

Hard photon trigger **35 M**

Topics under study



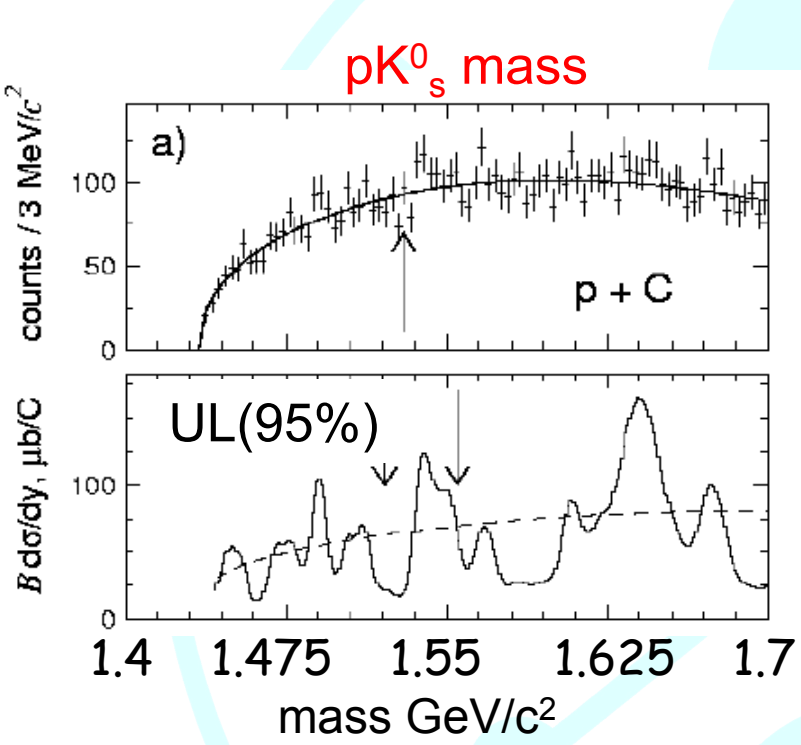
- Upper limit on BR($D^0 \to \mu^+\mu^-$) (Phys.Lett.B596:173-183,2004)
- Pentaquark searches (pK_s, $\Xi\pi$) (hep-ex/0408048) ⟵
  accepted by Phys. Rev. Lett.
- Inclusive $b\bar{b}$ cross section ⟵
- Upsilon cross section
- Production of ϕ and K* mesons
- $\psi(2S)$ production ⟵
- D^+/D^0 production ratio
- J/ψ cross section in MB

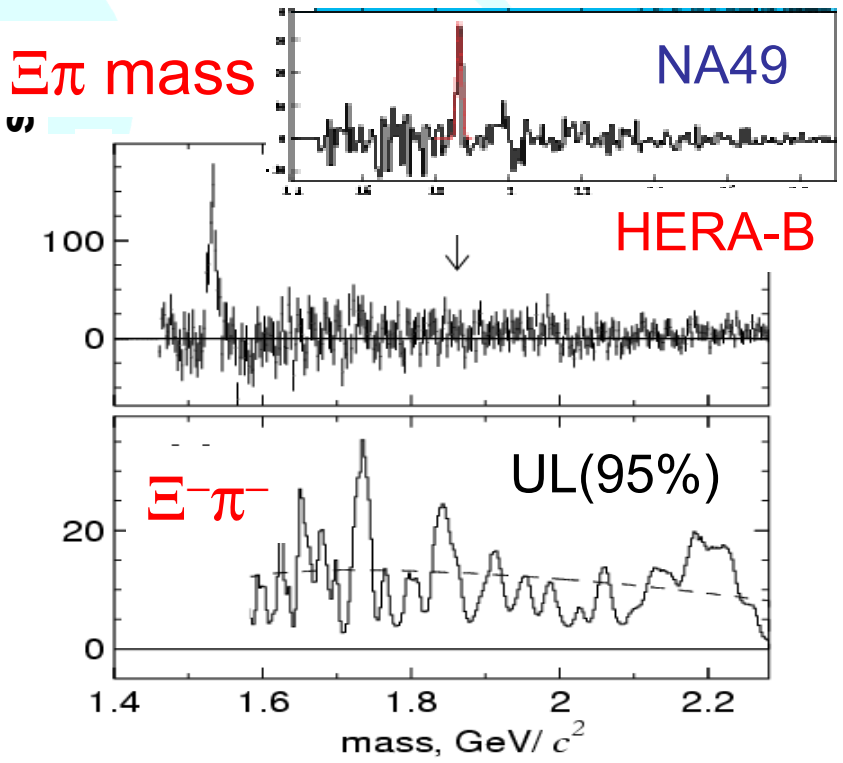
Topics cont'd

- Hard photon production
- Λ^0 polarization
- χ_c production
- A dependence charmonium production
- J/ψ differential distributions
- V^0 and hyperon production
- Jet production

Θ^+, Ξ^{--} Searches

(hep-ex/0408048) accepted by Phys. Rev. Lett.





UL(95%)$B\cdot d\sigma/dy|_{y=0}$ =
4-16 μb/N
@ 1521-1555 MeV/c^2

Θ+ / $\Lambda(1520)$ < 3 – 12 %

UL(95%)$B\cdot d\sigma/dy|_{y=0}$ =
2.5 μb/N @ 1862 MeV/c^2

Ξ^{--} / Ξ^- < 3/B %

Ξ^{--} / $\Xi(1530)^0$ < 4/B %

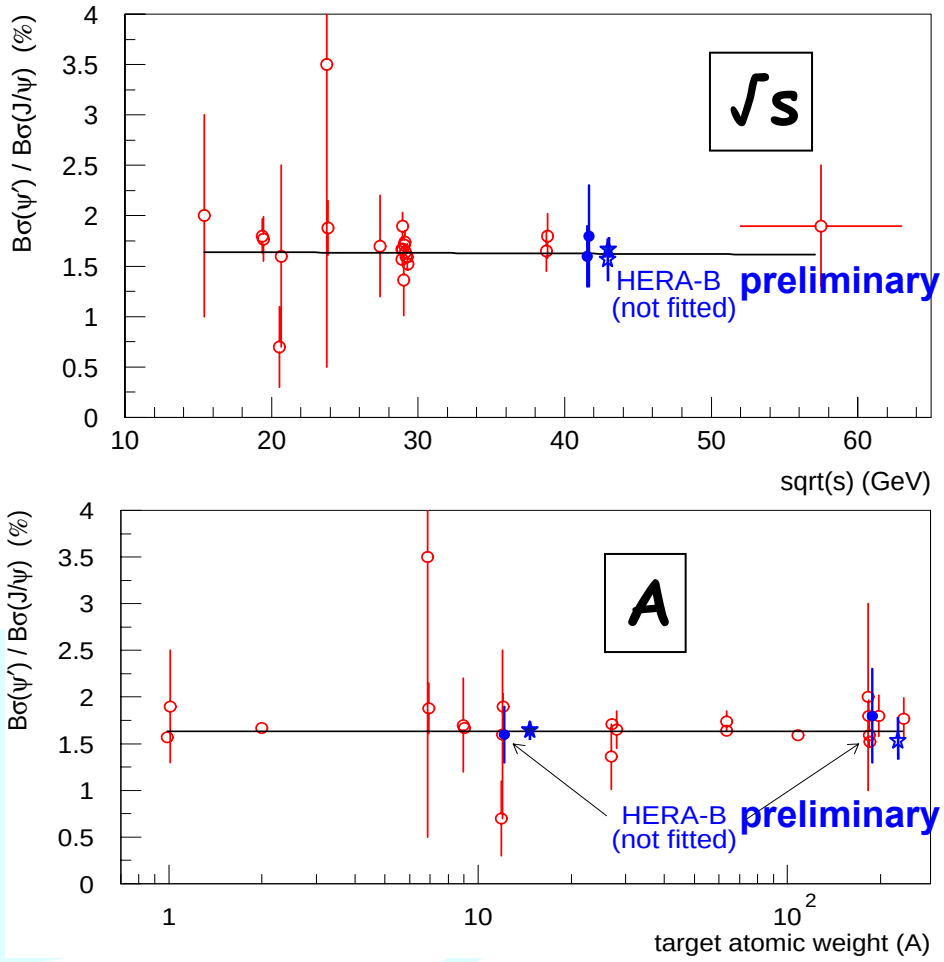
ψ(2S) / J/ψ Production Ratio

$$\frac{BR(\psi(2S)\to l^+l^-)\cdot\sigma_{\psi(2S)}}{BR(J/\psi\to l^+l^-)\cdot\sigma_{J/\psi}}=\frac{N_{\psi(2S)}}{N_{J/\psi}}\frac{\varepsilon_{J/\psi}}{\varepsilon_{\psi(2S)}}$$

Preliminary results for

$$\frac{\mathbf{Br'\cdot\sigma(\psi')}}{\mathbf{Br\cdot\sigma(J/\psi)}}\ [\%]$$

Target	electron	muon
C	**1.6 ± 0.2**	**1.65 ± 0.1**
W	**1.8 ± 0.4**	**1.54 ± 0.2**



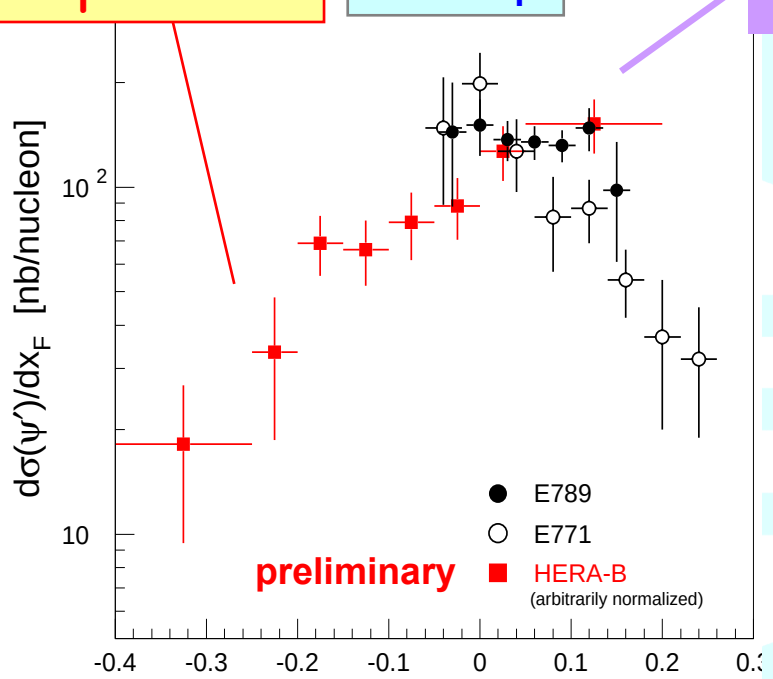
ψ(2S) differential distributions

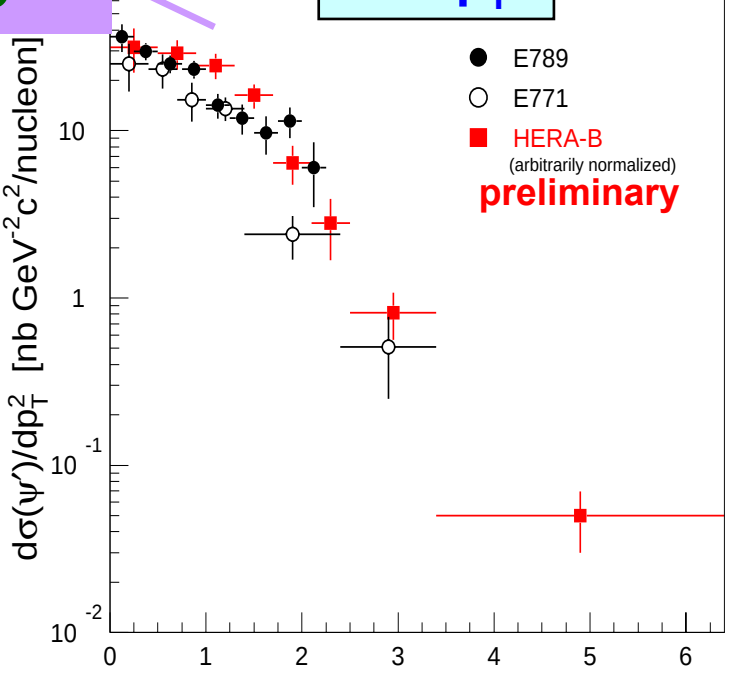
$x_F < 0$

$d\sigma/dx_F$

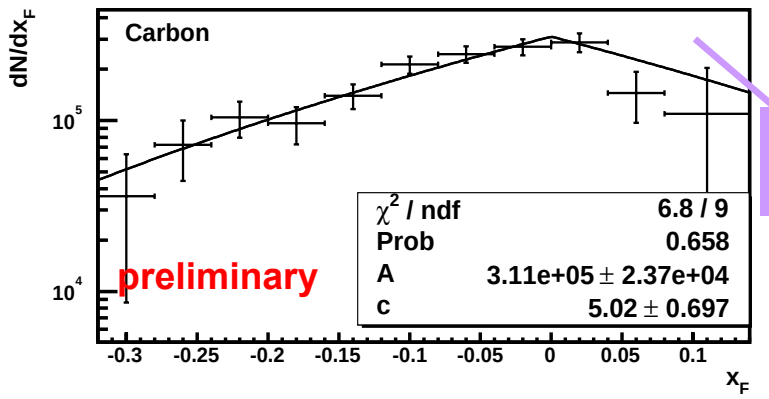
e^+e^-

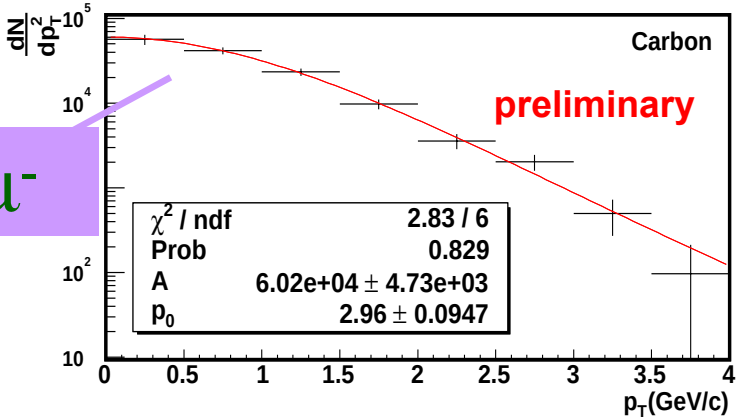
$d\sigma/dp_T^2$





$\mu^+\mu^-$



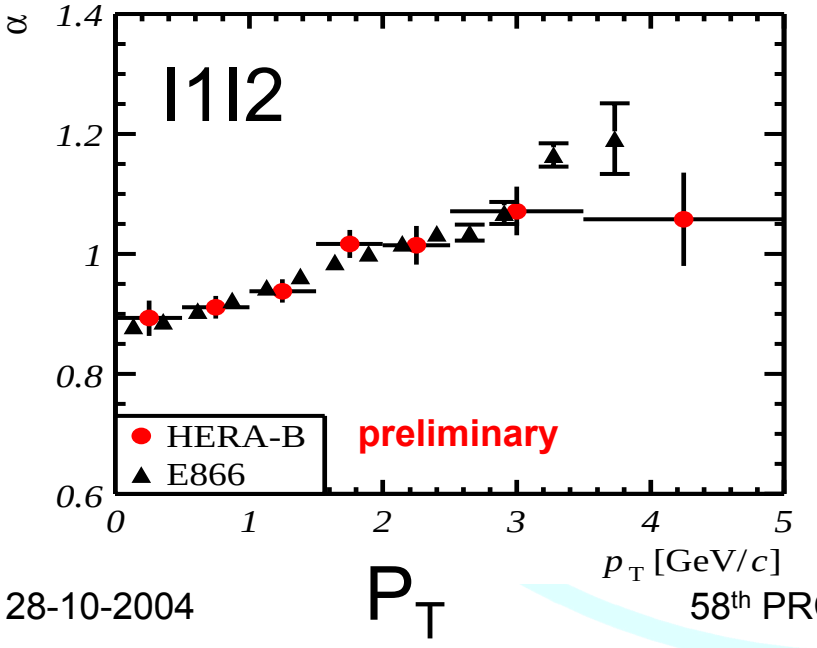


J/ψ A dependence

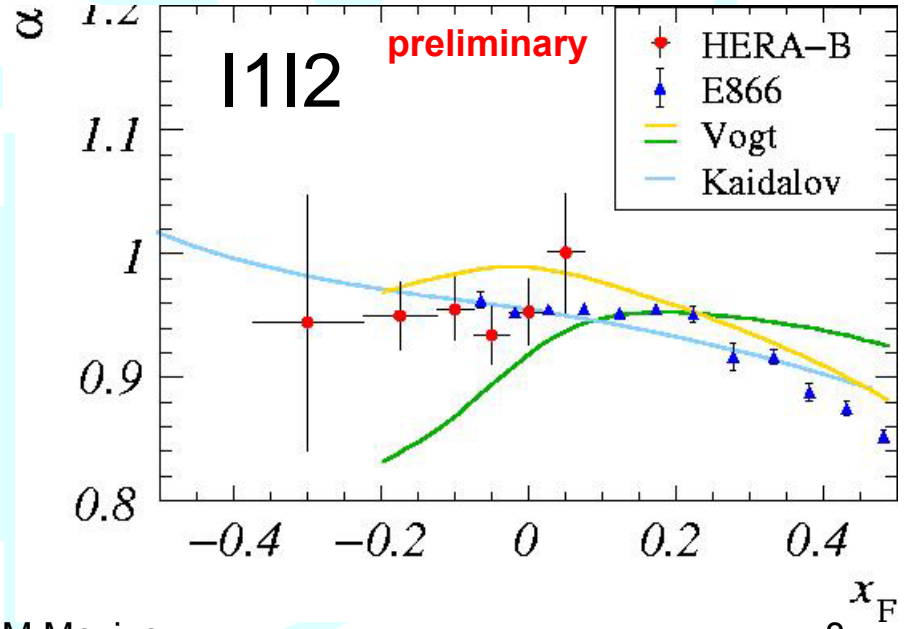
$$\sigma_{pA} = \sigma_{pN} \cdot A^{\alpha}; \quad \sigma = N/(\varepsilon \cdot L)$$

$$\alpha = \frac{1}{\ln(A_W / A_C)} \cdot \ln\left(\frac{N_W}{N_C}\frac{L_C}{L_W}\frac{\varepsilon_C}{\varepsilon_W}\right)$$

- only 1 target config (C-W)
- ~15 % of $\mu^+\mu^-$ sample
  similar results for e^+e^-
- Hera-B normalization
- Statistical errors only



P_T



$b\bar{b}$ production

$b(\bar{b}) \rightarrow \mathbf{B} \rightarrow J/\psi + \mathbf{X}$

$J/\psi \rightarrow \mu^+\mu^-$; e^+e^-

Measurement relative to direct J/ψ production
to minimize trigger/reconstruction uncertainties

ε_R= relative efficiency≈1

$$\sigma_{b\bar{b}} = \sigma_{J/\psi} \cdot \frac{n_B}{n_{J/\psi}} \cdot \frac{1}{\varepsilon_R \cdot \varepsilon_B^{\Delta z} \cdot Br(b\bar{b} \rightarrow J/\psi + X)}$$

B selection eff. from MC
30-45%

B Selection:

- Lepton impact to the wire
- Distance of J/ψ to wire

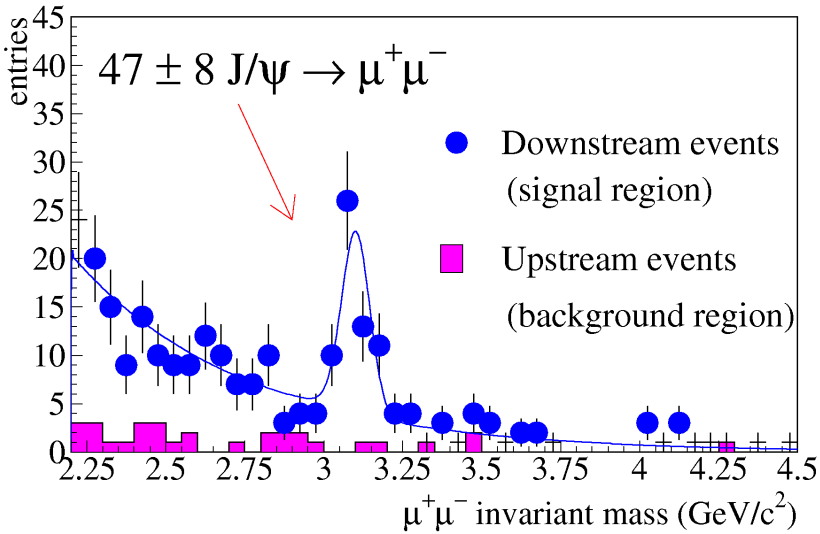
$b\bar{b}$ production

Full statistics

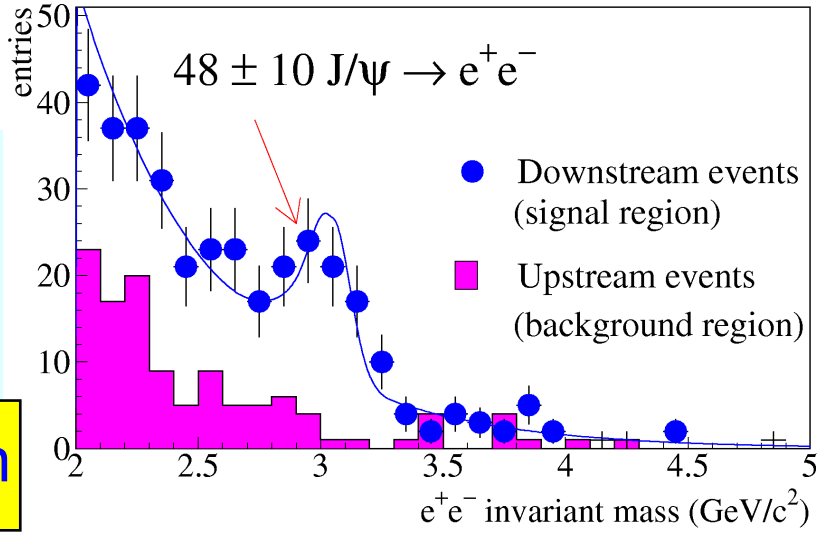
preliminary

$$\frac{\sigma(b\bar{b})}{\sigma(J/\psi)} = 0.027 \pm 0.004 \pm 0.005$$

20% sys. error under investigation
main contribution:
Br($b\bar{b} \rightarrow J/\psi X$) = 2.32±0.20%



E771/E789 : scaled to 41.6 GeV
σ(J/ψ)=357 ± 2 ± 36 nb/nucleon



preliminary

$$\sigma(b\bar{b}) = 9.8 \pm 1.4 \pm 2.0 \text{ nb/nucleon}$$

Summary

- Good data quality
- Several QCD related results expected
- Preliminary results on most topics presented at conferences (>40)
- 2 papers finished
  (BR($D^0 \to \mu^+\mu^-$) (UL) ,pentaquark (UL))
- Publication on advanced analyses in preparation
  ($b\bar{b}$, Υ, D^+/D^0, ϕ/K^*, J/ψ, $\psi(2S)$,...)
- Other topics could lead to publication, manpower permitting
- Analysis will continue until end 2005