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PRELIMINARY OBSERVATION OF HIGH TRANSVERSE MOMENTUM PARTICLE PRODUCTION AT NAL

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DISCLAIMER

We have measured at NAL the yields of particles produced as a function of transverse momentum in proton-nucleus collisions. The observations were made in the region of 90^{o} in the center of mass system of the incident proton and a single nucleon at rest. We report here preliminary results from a tungsten target bombarded by 200 and 300 GeV protons.

Figure 1 shows a schematic view of the apparatus. We observe particles produced in the laboratory at a fixed angle of 77 mrad with respect to the incident beam direction. This angle corresponds to 77^{o} and 88^{o} respectively for relativistic particles in the nucleon-nucleon center of mass system. The particles are observed in a spectrometer which employs quadrupole focusing and two successive magnetic deflections. Particles were identified by the downstream Cĕrenkov counter. The solid angle of the spectrometer was $\Delta\Omega$ = 17 uster. The momentum acceptance was $\Delta P/_{P}$ = 0.1. We used scintillation hodoscopes to measure the momentum of an individual event with a standard deviation of 1%. More importantly, we used the hodoscopes to reconstruct the position of each event at the target with a standard deviation of 1 cm. horizontally and 2 mm. vertically. At high transverse momentum this check was essential to eliminate background.

We reduced the data to equivalent cross sections on nucleons by the following formula:

$$\frac{Ed^3\sigma}{dP^3} = \frac{(\text{Yield/incident proton})}{(\Delta\Omega\ \Delta P/P) \times P_L^2 \times f} \times \sigma_P$$

where f is the fraction of incident protons that interact, P_L is the observed laboratory momentum, and σ_p is the proton nucleon cross section which we take to be 40 mb. The fraction f was computed to be 0.4 for a 5 cm. long tungsten target.

Figures 2 and 3 show the measured cross sections as a function of transverse momentum for negative and positive pions. Figures 4 and 5 show the measured ratios of K^+, K^-, P and $\bar{P}$ with respect to pions for the two energies.

Some auxiliary measurements were made on beryllium and titanium to establish that none of the important features displayed by tungsten were dependent on atomic number.

The data show several important features:

1) There is an energy dependence of the cross section which grows stronger as the transverse momentum increases. This is in qualitative agreement with the work of the Saclay-Strasbourg group[1] and the CERN-Columbia-Rockefeller group[2] at the ISR.

2) The K/π ratios vary slowly with increasing transverse momentum, while P/π^+ and $\bar{P}/\pi^-$ decrease with increasing transverse momentum.

3) The ratios P/π^+ and $\bar{P}/\pi^-$ are strongly energy dependent.

Acknowledgements

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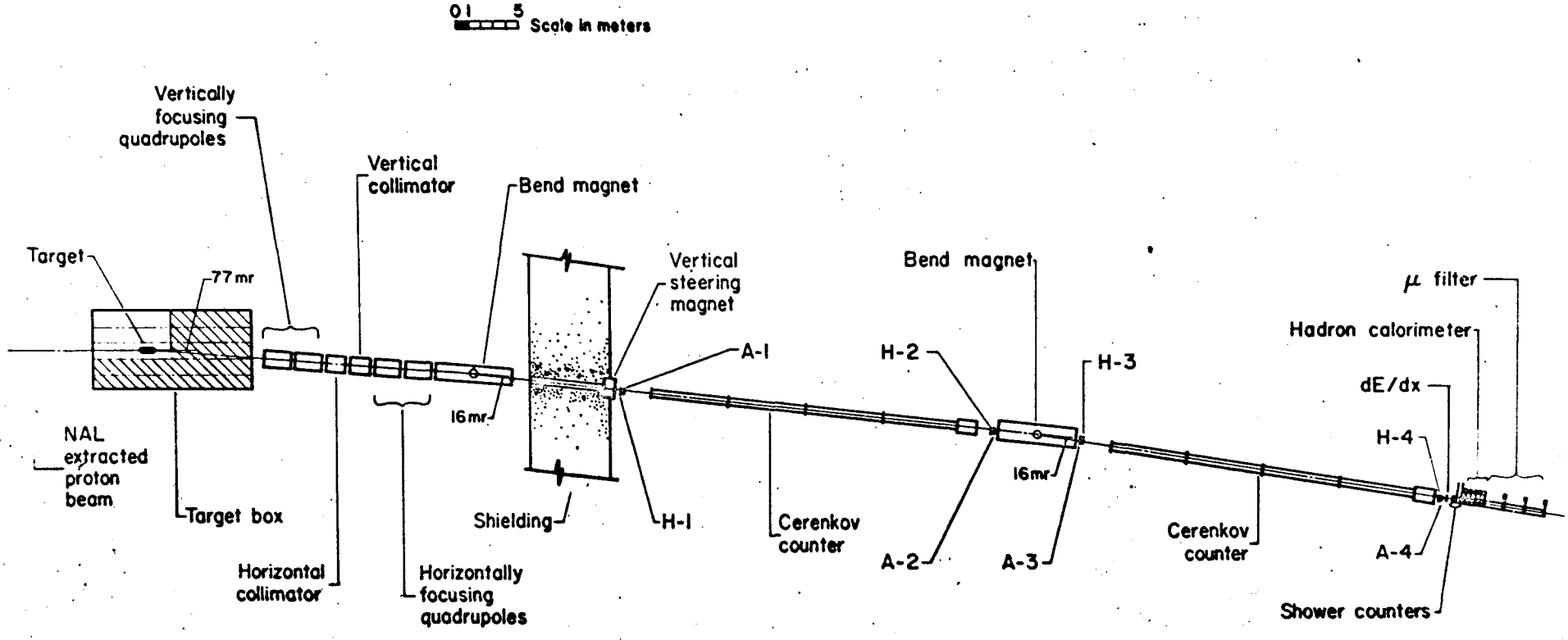
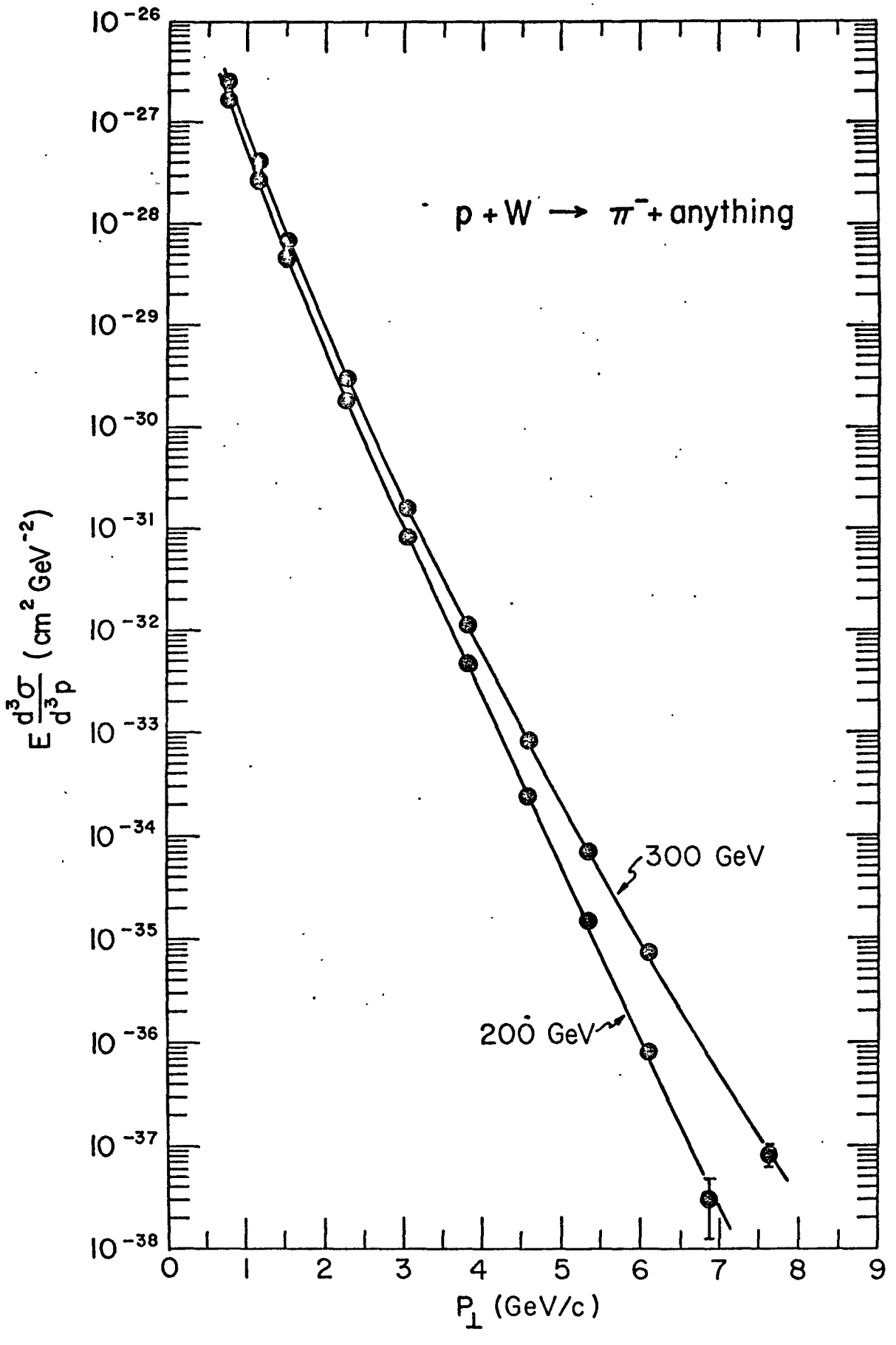
References

[1]M. Banner et al, Phys. Letters 44B, 537 (1973

[2]F. W. Busser et al. paper #204 submitted to this conference

NAL EXPERIMENT 100 APPARATUS

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200 GeV
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$P_\perp$ (GeV/c)
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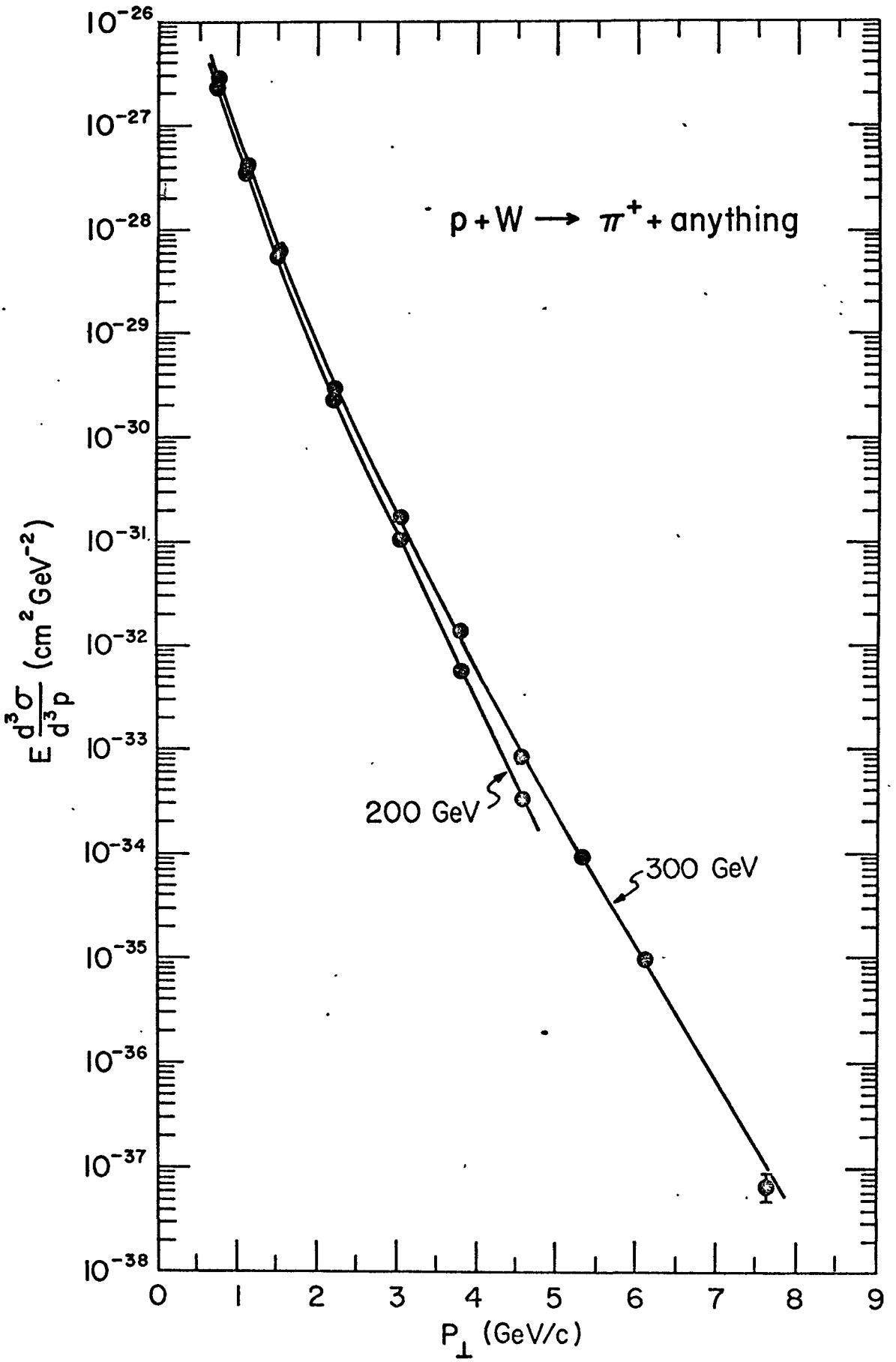
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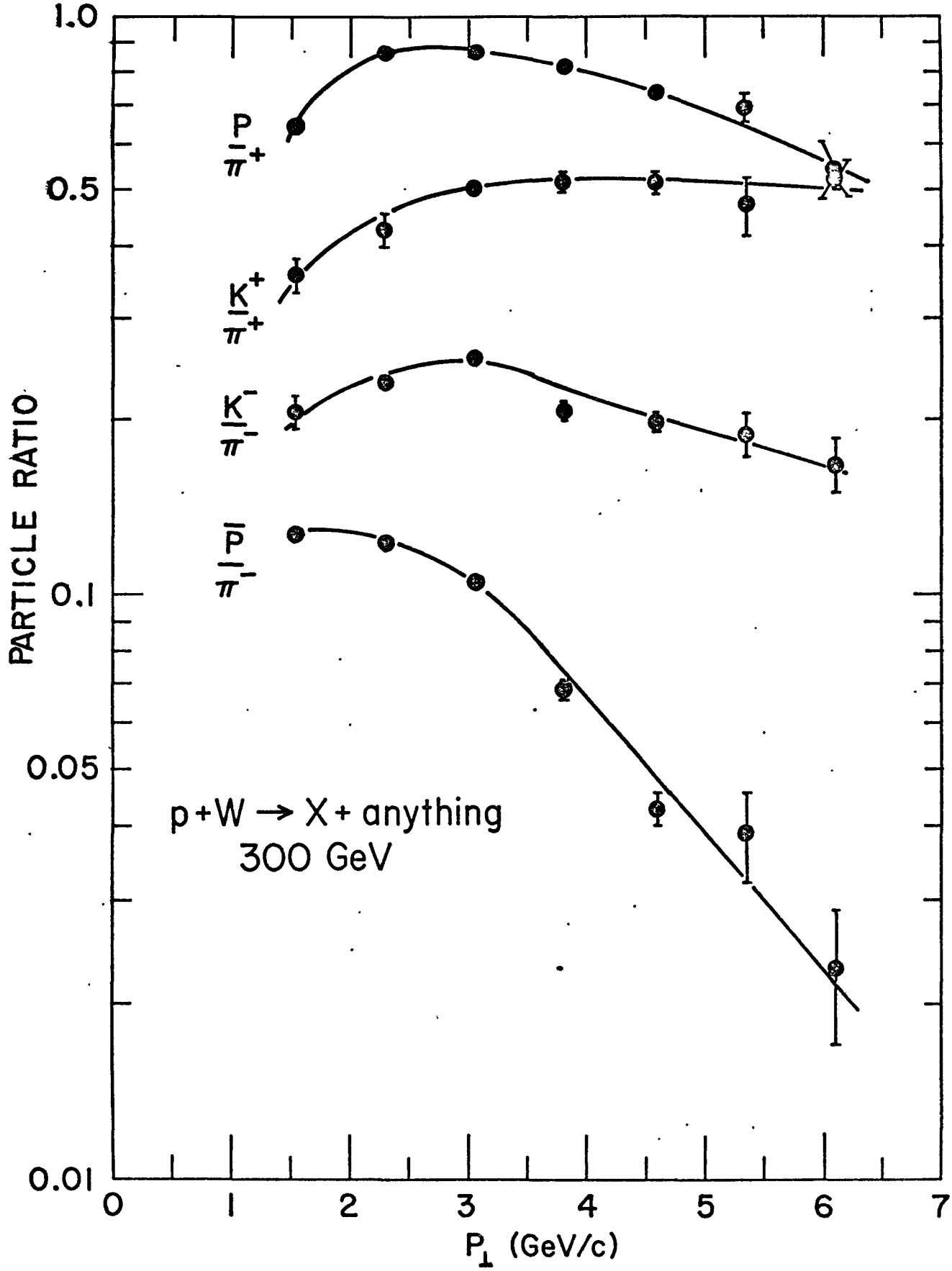
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PARTICLE RATIO
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$\frac{K^+}{\pi^+}$
$\frac{K^-}{\pi^-}$
$\frac{\bar{P}}{\pi^-}$
p+W → X+ anything
300 GeV
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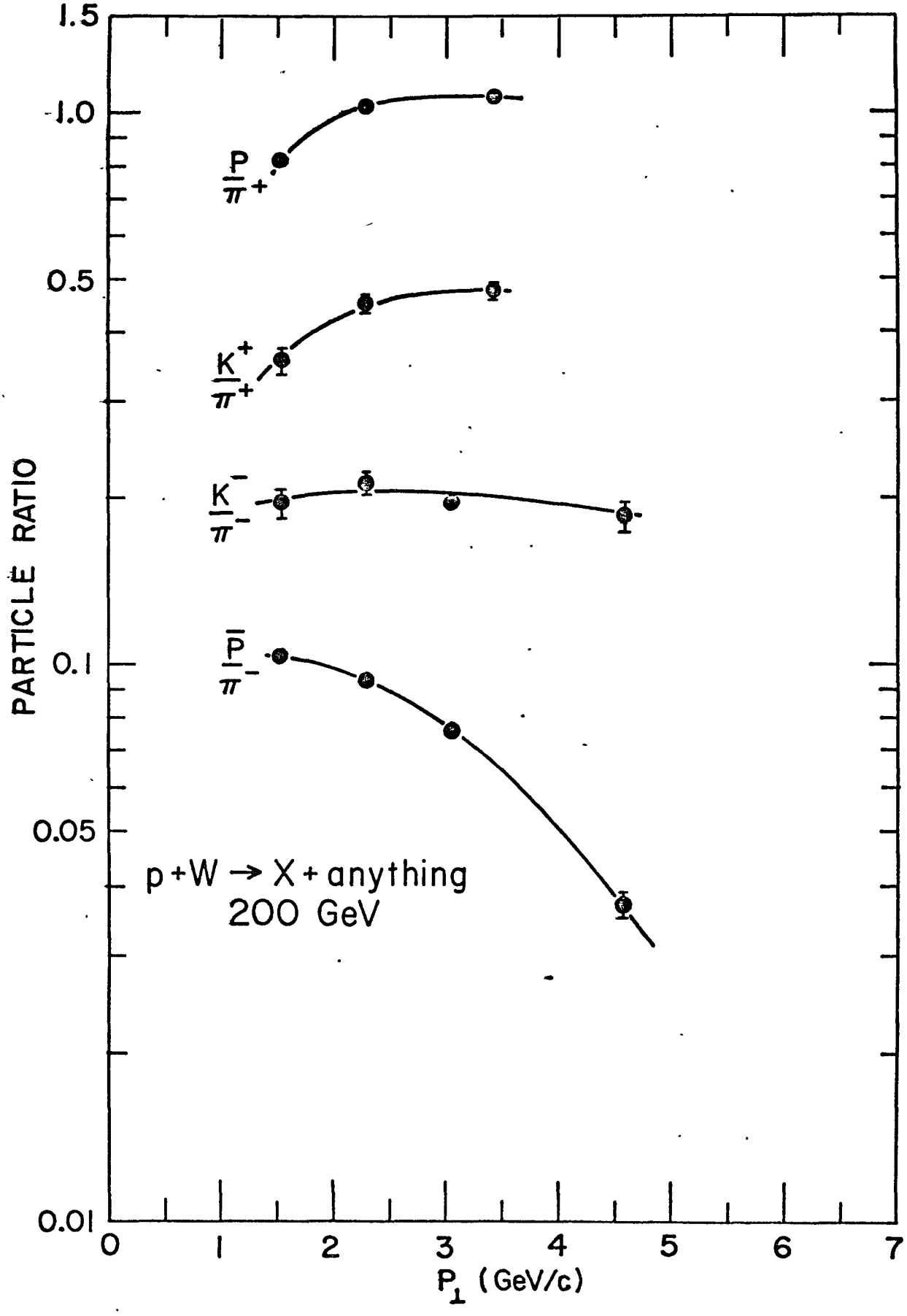
6
7
$P_\perp$ (GeV/c)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$P_\perp$ (GeV/c)