CORRELATIONS IN HADRON PRODUCTION IN 1.8 TEV $\bar{P}P$ COLLISIONS

V. PAUL KENNEY
Department of Physics, University of Notre Dame, Notre Dame, IN 46556, USA

for

Duke-FNAL-Iowa State-Notre Dame-Purdue-Wisconsin E735 Collaboration
N.N. Biswas(4), T. Alexopoulos(6), C. Allen(5), E.W. Anderson(3), H. Areti(2), S. Banerjee(4), P.D. Beery(4), A. Bujak(5), D.D. Carmony(5), T. Carter(1), P. Cole(5), Y. Choi(5), R. De Bonte(5), A. Erwin(6), C. Findeisen(6), A.T. Goshaw(1), L.J. Gutay(5), A.S. Hirsch(5), C. Hojvat(2), V.P. Kenney(4), C.S. Lindsey(3), J.M. LoSecco(4), T. McMahon(5), A.P. McManus(4), N. Morgan(5), K. Nelson(6), S.H. Oh(1), J. Piekarz(4), N.T. Porile(5), D. Reeves(2), R.P. Scharenberg(5), S.R. Stampke(4), B.C. Stringfellow(5), M. Thompson(6), F. Turkot(2), W.D. Walker(1), C.H. Wang(3), and D.K. Wesson(1)

(1)*Department of Physics, Duke University, Durham, North Carolina 27707*
(2)*Fermi National Accelerator Laboratory, Batavia, Illinois 60510*
(3)*Department of Physics, Iowa State University, Ames, Iowa 50011*
(4)*Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556*
(5)*Department of Physics and Chemistry, Purdue University, West Lafayette, Indiana 47907*
(6)*Department of Physics, University of Wisconsin, Madison, Wisconsin 53706*

Production of TOF-identified $\pi^{\pm}$, $K^{\pm}$, $\bar{P}/P$

We report on the analysis of 400,000 mass-identified hadrons with $0.2 < p_t < 1.5$ GeV/c from the first run of a spectrometer system with TOF in the C0 intersection at the Fermilab 1.8 TeV $\bar{p}p$ collider [1,2]. Distributions $d^2N/dydm_t^2$ as a function of $m_t = (m^2 + p_t^2)^{1/2}$ are shown in Fig. 1. The distributions for K, $\bar{p}$, and at least the high-momentum part of π are approximately exponential. A Boltzmann distribution fit with T = 230 MeV is shown "to guide the eye". No single temperature, in fact, fits all three distributions well, which may suggest that transverse flow distorts the T values significantly.

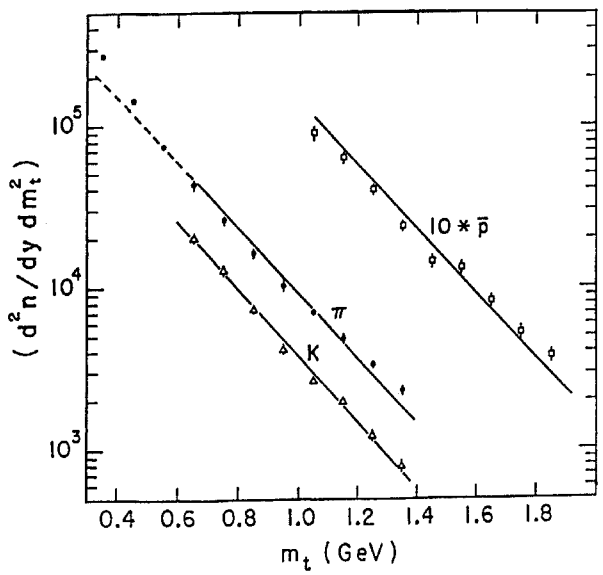

Fig. 1 $d^2 N/dydm_t^2$ vs m_t

In Fig. 2 we compare K/π and $\bar{p}/\pi^-$ ratios as a function of m_t at $\sqrt{s}$ = 1.8 TeV (open circles, this experiment) with UA2 data [3] at $\sqrt{s}$ = 0.54 TeV (crosses). The present results agree well with data from lower energy, and no significant dependence of either ratio on m_t is apparent.

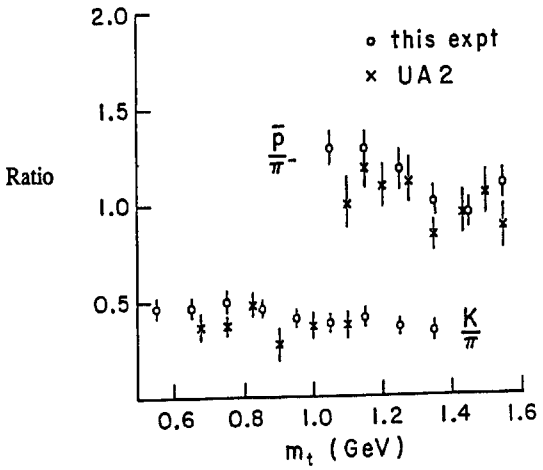

Fig. 2 K/π and $\bar{p}/\pi^-$ vs m_t

Forward-Backward Pseudorapidity Correlations

In an analysis by Sudeshna Banerjee [4], long-range correlations are studied in the same data sample. If N_F = number of forward particles with positive pseudorapidity η and N_B = the number of backward

particles with negative η, then we parameterize $\langle N_B \rangle = a + b\, N_F$, where the slope parameter b measures the strength of the long-range correlation. Fig. 3 shows $\langle N_B \rangle$ as a function of N_F for different η intervals in the forward (incident p beam) and backward (incident $\bar{p}$ beam) directions. The measured correlation strength b can be parameterized as $b = A + B\, \ln S$; the present data and results from UA5 [5] for different η ranges shown in Fig. 4 are consistent.

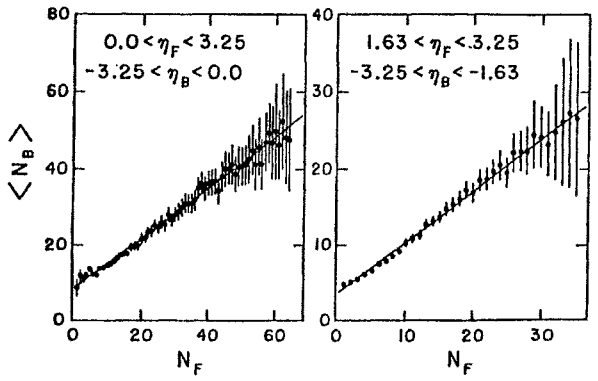

Fig. 3 $\langle N_B \rangle$ vs N_F

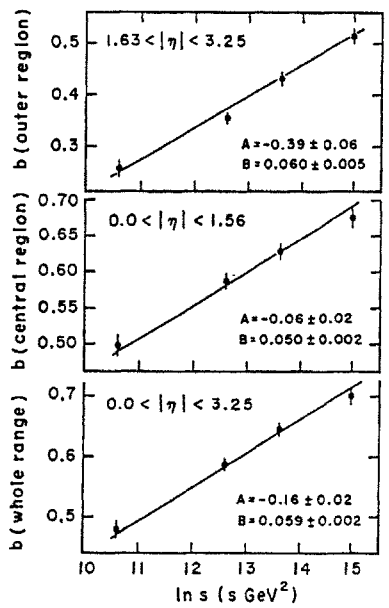

Fig. 4 b vs $\ln S$

Bose-Einstein Correlations for Pion Pairs

Peter Beery [6] has studied Bose-Einstein correlations by determining the ratio R of the distribution of like-sign pion pairs divided by a distribution of unlike-sign pion reference pairs in the same data. Following a similar procedure to that of the UA1 collaboration [7], R is parameterized in terms of the Lorentz-invariant q_T, $R(q_T)^2 = N\,[1 + \lambda \exp(-r_T^2 q_T^2)$, where λ is a measure of the degree of coherence, r_T measures the source dimension, and N provides over-all normalization. Fig. 5 shows $R(q_T^2)$ as a function of q_T for $0.04 < q_T < 1.0$ GeV/c, where we exclude data at very low q_T in

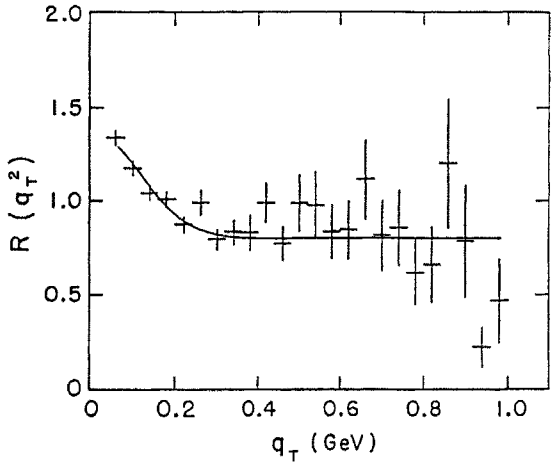

Fig. 5 $R(q_T^2)$ vs q_T

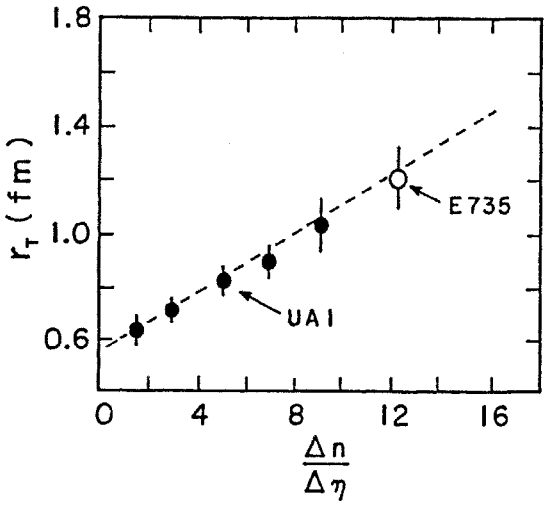

Fig. 6 r_T vs $\Delta n/\Delta\eta$

which spurious pairs may arise from δ-ray misidentification. The data are fit with $\lambda = 0.72 \pm 0.07$ and $r_T = 1.19 \pm 0.12$ fm. This measurement is consistent with the dependence of r_T on rapidity density, $\Delta n/\Delta\eta$, seen by UA1, Fig. 6.

References

1. S. Banerjee et al., *Nucl. Inst. Meth.* **A269** (1988) 121.
2. T. Alexopoulos et al., *Phys. Rev. Lett.* **64** (1990) 991.
3. M. Banner et al., *Phys. Lett.* **122B** (1983) 322; *Z. Phys.* **C27** (1985) 329.
4. S. Banerjee, *Ph.D. Thesis, University of Notre Dame* (1990).
5. G.J. Alner et al., *Nucl. Phys.* **B291** (1987) 445; R.E. Ansorge et al., *Z. Phys.* **C43** (1989) 357.
6. P.D. Beery, *Ph.D. Thesis, University of Notre Dame* (1990).
7. G. Salvini, UA1 Collaboration, in *Proceedings of the XXIV International Conference on High Energy Physics, Munich* (1989) p.636.