COMMENTS

Observation of Increasing Charged Multiplicity as a Function of Transverse Momentum in $p + p \rightarrow \pi^+ + \mathrm{MM}$ at 28.5 GeV/c*

E. W. Anderson,† T. S. Clifford, G. P. Fisher,‡ G. P. Larson,§ E. Lazarus, K. M. Moy,‖ F. Turkot,¶ P. Schübelin, W. N. Schreiner, and L. von Lindern**
Brookhaven National Laboratory, Upton, New York 11973

and

L. J. Gutay and A. Laasanen
Purdue University, Lafayette, Indiana 47907

and

G. B. Collins, J. R. Ficenec, D. R. Gilbert,†† B. C. Stringfellow,‡‡ and W. P. Trower
Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
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We have measured the mean charged multiplicity $\bar{n}_c$ as a function of the transverse momentum $p_\perp$ of a forward π^+ meson for fixed missing mass MM in the reaction $p + p \rightarrow \pi^+ + \mathrm{MM}$ using the multiparticle Argo spectrometer system. We observe an increase similar to that seen in $p + p \rightarrow p + \mathrm{MM}$ at the same incident energy.

In an earlier Letter[1] we reported the behavior of the average charged multiplicity,[2] $\bar{n}_c(p)$, as a function of the transverse momentum of a forward proton p_3 in the reaction

$$p_1 + p_2 \rightarrow p_3 + \mathrm{MM} \tag{1}$$

for different intervals of missing mass MM. $\bar{n}_c(p)$ exhibited a rise of $\Delta\bar{n}_c \sim 0.6$ charged particles over an interval of $\Delta p_\perp \sim 0.3$ GeV/c and was approximately independent of $p_\perp$ outside that interval. The location of the rise moved towards smaller values of $p_\perp$ with increasing MM. Since the reaction

$$p + p \rightarrow \pi^+ + \mathrm{MM} \tag{2}$$

may illuminate the theoretical understanding[3] of this effect, we have studied it in the same way as Reaction (1) and report our results here.

The data samples represented by Reactions (1) and (2), which we will refer to as proton data (165 000 events) and pion data (32 000 events) respectively, were taken concurrently using the multiparticle Argo spectrometer system (MASS) operating in a 28.5-GeV/c diffracted proton beam from the Brookhaven National Laboratory alternating gradient synchrontron. The forward π^+ meson was detected, momentum analyzed, and identified by the high-momentum spectrometer, while all other charged particles were detected in the vertex spectrometer.[4] The apparatus has been described elsewhere.[5] In addition to using the pattern recognition code PITRACK[6] and applying corrections to $\bar{n}_c$ as described in Ref. 1, we have fitted by least squares all tracks of each event to a common vertex.

In Fig. 1(a) we present the behavior of $\bar{n}_c(\pi^+)$ with $p_\perp$ of the forward π^+ for three intervals of MM, and in Fig. 1(b), for comparison, the behavior of $\bar{n}_c(p)$ with $p_\perp$ of the forward proton. The proton contamination in the pion data is $\leq 10\%$ in the lowest MM bin and $\leq 3\%$ in the higher bins. The data show a rise which moves towards smaller $p_\perp$ values for increasing MM and is located at $p_\perp \sim 0.85$ GeV/c for MM = 5.5 GeV.

In order to further demonstrate the similarity of $\bar{n}_c(\pi^+)$ and $\bar{n}_c(p)$ as a function of $p_\perp$ for the proton and pion data, we display in Fig. 2 their difference, $\Delta = \bar{n}_c(p) - \bar{n}_c(\pi^+)$, as a function of $p_\perp$ for three intervals of MM. Inspection of the figure reveals a striking independence of Δ with re-

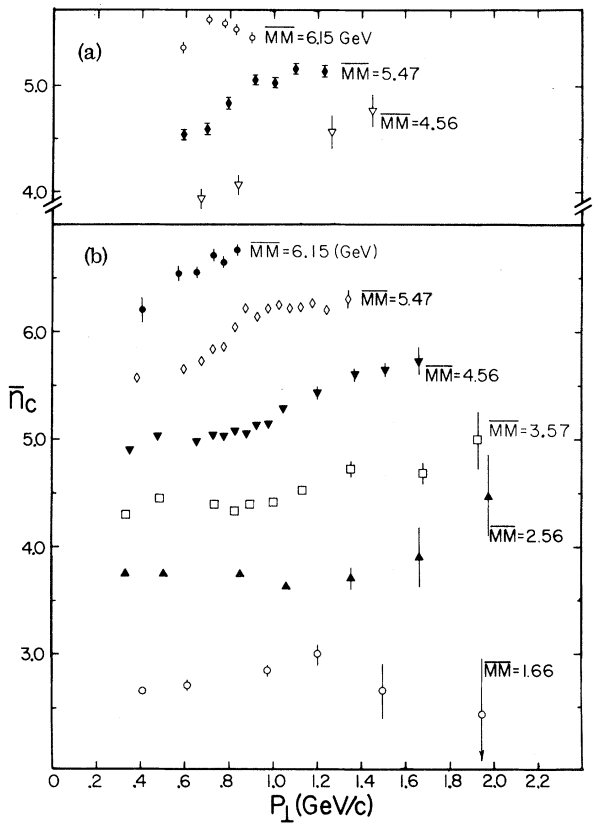

FIG. 1. (a) Charged-particle multiplicity $\bar{n}_c(\pi^+)$ versus $p_\perp$ of a forward π^+ meson in the reaction $p+p \to \pi^+ + \mathrm{MM}$. (b) Charged-particle multiplicity $\bar{n}_c(p)$ versus $p_\perp$ of a forward proton in the reaction $p+p \to p + \mathrm{MM}$.

spect to $p_\perp$ and MM. We also note that $\bar{n}_c(\pi^+)$ is lower by ~1.1 charged particles compared to

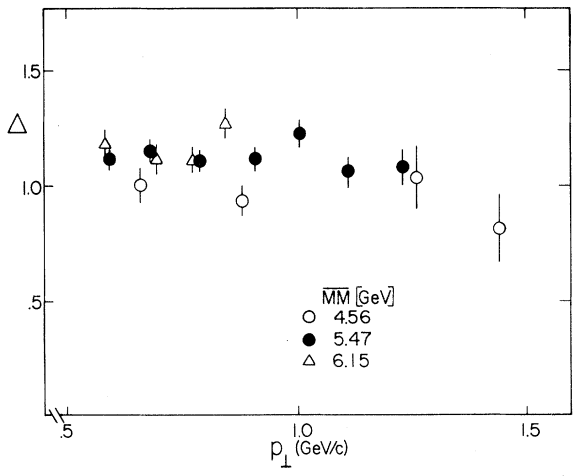

FIG. 2. Difference between proton and pion data multiplicities $\Delta = \bar{n}_c(p) - \bar{n}_c(\pi^+)$ versus $p_\perp$ for three intervals of MM.

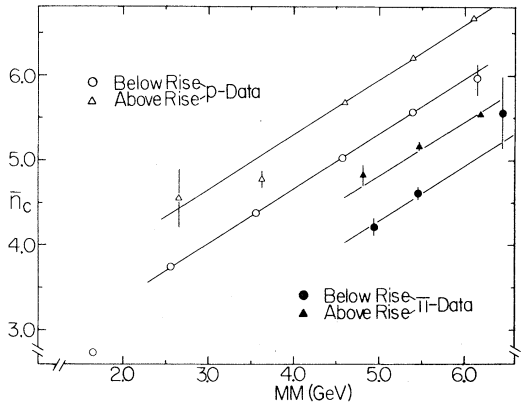

FIG. 3. MM dependence of $\bar{n}_c(p)$ and $\bar{n}_c(\pi^+)$ before and after the rise.

$\bar{n}_c(p)$; this can be qualitatively understood by the fact that MM in the pion data contains both nucleons while in the proton data, MM contains only one.

In Fig. 3 we display the MM dependence of $\bar{n}_c$ before and after this rise for both the proton and the pion data. All four data sets are compatible with a common slope of 0.65 ± 0.01 GeV^{-1} ($\chi^2 = 16.4$ for 11 degrees of freedom with a single datum point contributing more than half of the χ^2). From the intercept differences we find the average value of the rise $\Delta\bar{n}_c = 0.58 \pm 0.05$ and the average proton-pion multiplicity difference $\Delta = 1.08 \pm 0.05$.

In conclusion, we have observed a distinct increase of $\bar{n}_c(\pi^+)$ in pp collisions at 28.5 GeV/c as a function of the transverse momentum of a forward π^+ meson in close analogy to the behavior of the charged multiplicity with transverse momentum of a forward proton.

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†Present address: Iowa State University, Ames, Ia. 50010.

‡Present address: R & D Associates, Santa Monica, Calif. 90401.

§Present address: University of Wisconsin, Madison, Wis. 53706

‖Present address: Seton Hall University, South Orange, N. J. 07079.

¶Present address: Fermi National Accelerator Laboratory, Batavia, Ill. 60510.

**Present address: Max-Planck Institute for Psychiatry, 8 Munich 40, Germany.
††Present address: University of Toronto, Toronto, Canada.
‡‡Present address: CERN, Geneva 23, Switzerland.

[1]A. Ramanauskas *et al.*, Phys. Rev. Lett. 31, 22 (1973). See also E. W. Anderson *et al.*, in Proceedings of the Seventeenth International Conference on High Energy Physics, London, England, 1–10 July 1974 (to be published).

[2]We include the trigger particle in the charged-particle multiplicity $\bar{n}_c$.

[3]R. Blankenbecler, S. H. Brodsky, and J. F. Gunion, Phys. Lett. 42B, 461 (1972); S. Kanofsky and K. Klenk, Phys. Rev. Lett. 31, 1322 (1973); S. Choudhury, Lett. Nuovo Cimento 11, 530 (1974); L. J. Gutay and P. Suranyi, Phys. Rev. D 9, 2501 (1974); C. Hamer, Phys. Rev. D 10, 1458 (1974).

[4]J. R. Ficenec *et al.*, Nucl. Instrum. Methods 113, 535 (1973).

[5]E. W. Anderson *et al.*, to be published, and BNL Report No. 19254, 1974 (unpublished).

[6]D. R. Gilbert *et al.*, Nucl. Instrum Methods 116, 501 (1974).

ERRATA

SOLAR OBLATENESS, EXCESS BRIGHTNESS, AND RELATIVITY. H. A. Hill, P. D. Clayton, D. L. Patz, A. W. Healy, R. T. Stebbins, J. R. Oleson, and C. A. Zanoni [Phys. Rev. Lett. 33, 1497 (1974)].

The following typographical error should be corrected. The number on page 1499, column 2, line 32, should read $\Delta_{\odot} = 18.4 \pm 12.5$ arc msec.

SPECTRUM OF HEAVY MESONS IN e^+e^- ANNIHILATION. Barry J. Harrington, Soo Yong Park, and Asim Yildiz [Phys. Rev. Lett. 34, 168 (1975)].

In the abstract, the parenthesis "(in particular, one at approximately 4.0 GeV)" should be corrected to read "(in particular, one at approximately 4.18 GeV)."

Equation (5) should read

$$\int \sigma_{e^+e^- \to \text{any}}\, dE = (6\pi^2/M^{(n)2})\Gamma_l\,,$$

where $M^{(n)2}$ is the corrected factor for $M^{(n)}$ which appears in our manuscript.