

LONGITUDINAL MOMENTUM DISTRIBUTIONS FOR PROTONS
PRODUCED IN pp COLLISIONS AT HIGH ENERGY (#'s 824,940)

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Results are presented on the longitudinal momentum spectra for protons produced in high-energy pp collisions at NAL and at the CERN Intersecting Storage Rings.

Figure 1 shows a preliminary measurement of the proton momentum spectrum, in the range $-0.8 > x > -1$ where $x = p_L^{\text{cm}}/p_{L\text{max}}^{\text{cm}}$, for the inclusive reaction $pp \rightarrow p + \text{anything}$. These data¹ are from an exposure of the NAL 30-in. bubble chamber to 102 GeV/c protons. The distribution shown includes the results for the elastic sample, for the inelastic two-prong sample and for all events with more than two-charged particles. The curves in Fig. 1 are predictions based on triple-Regge model calculations² by Ellis and Sanda and give a good description of the data.

The reaction $pp \rightarrow p + \text{anything}$ has been studied more extensively at the CERN ISR.³ Figure 2 shows the longitudinal momentum distributions obtained at $s = 1995 \text{ GeV}^2$ for inelastic protons for the following values of the transverse momentum: $p_T = 0.7, 0.8, 0.9, 1.0, 1.1, \text{ and } 1.2 \text{ GeV}/c$. The errors are made up of statistical errors ($\gtrsim 5\%$) combined quadratically with a 7% systematic error. The general features of the proton spectra are i) a hump near $x = 0.6$ and ii) a sharp peak at $x = 1$.

These general features may be understood in terms of a diffraction dissociation model calculation by Gottfried and Kofoed-Hansen.⁴ This model assumes that one or both of the colliding protons is excited to a fireball state and then disintegrates. The results of this fit are shown as the curves in Fig. 2. If taken literally, the model yields cross sections of 6.9 mb for single and 12.8 mb for double proton excitation at $s = 1995 \text{ GeV}^2$. Data, by the same group of Albrow et al., have also been obtained at lower ISR energies and fitted successfully using a triple Regge formulation.

References

¹ J. Chapman et al., #824.

² S. D. Ellis and A. I. Sanda, private communication. See also Phys. Letters 41B, 87 (1972).

³ M. G. Albrow et al., #940.

⁴ K. Gottfried and O. Kofoed-Hansen, Phys. Letters 41B, 195 (1972).

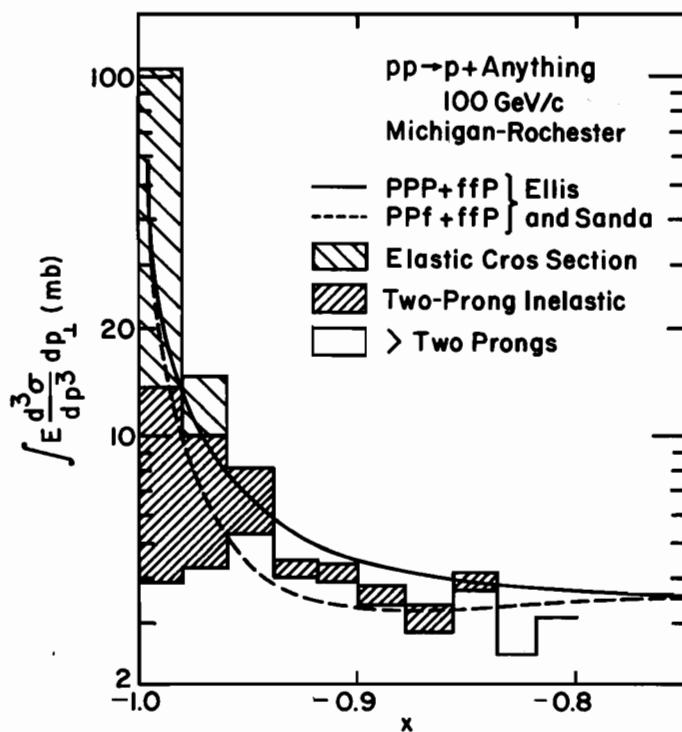


Fig. 1. x distribution for the inclusive reaction $\text{pp} \rightarrow \text{p} + \text{anything}$ at 102 GeV/c.
 Data of Ref. 1.

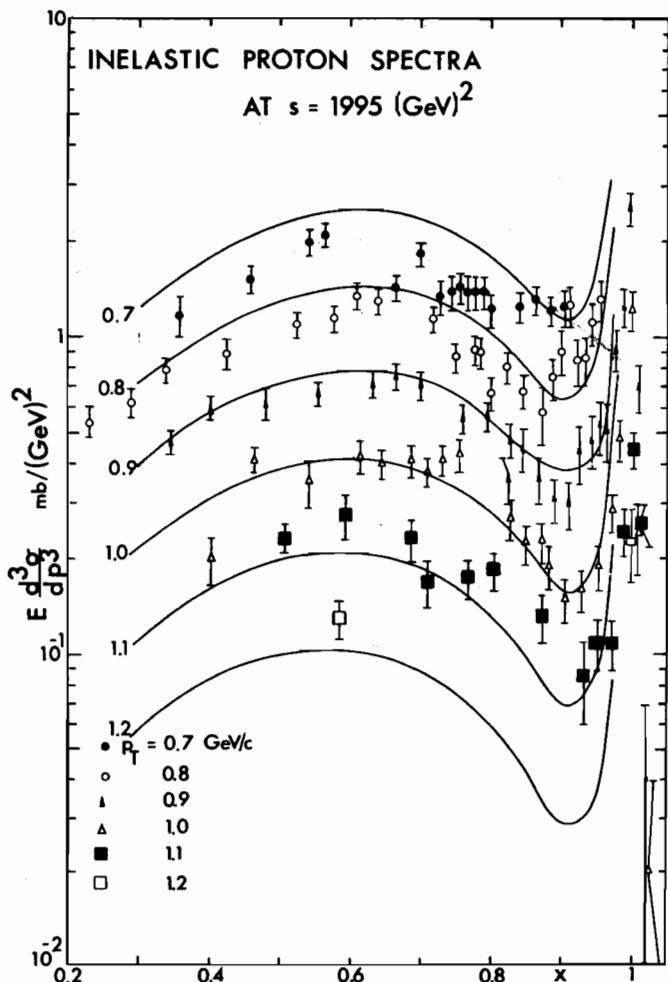


Fig. 2. Longitudinal momentum spectra of inelastic protons for values of p_T between 0.7 and 1.2 GeV/c. The curves were obtained from the diffraction dissociation model of Gottfried and Kofoed-Hansen.⁴ Data of Ref. 3.