
# Multiplicity structure of diffractive events in H1

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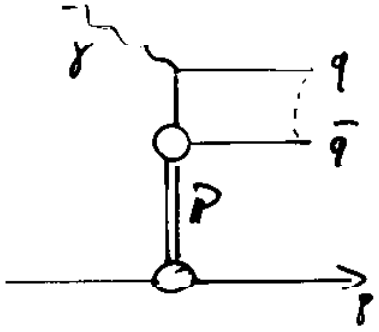
- Pictures of diffraction
- Multiplicity structure of the hadronic final state
- Measures of correlation
- Experimental procedure
- H1 preliminary results
- Conclusion

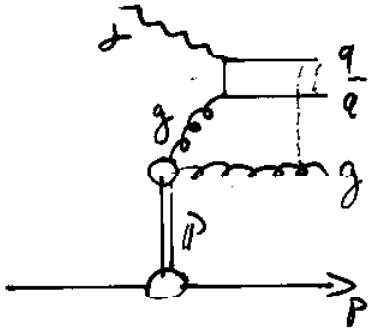
# Pictures of diffraction

## deep-inelastic $\gamma^*$IP scattering

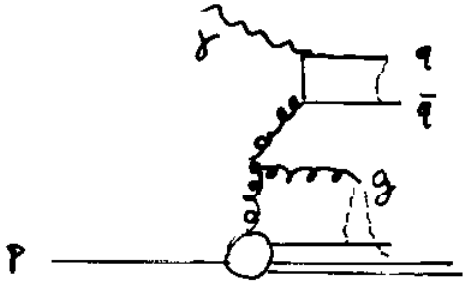

1. quark initiated




2. gluon initiated (BGF)



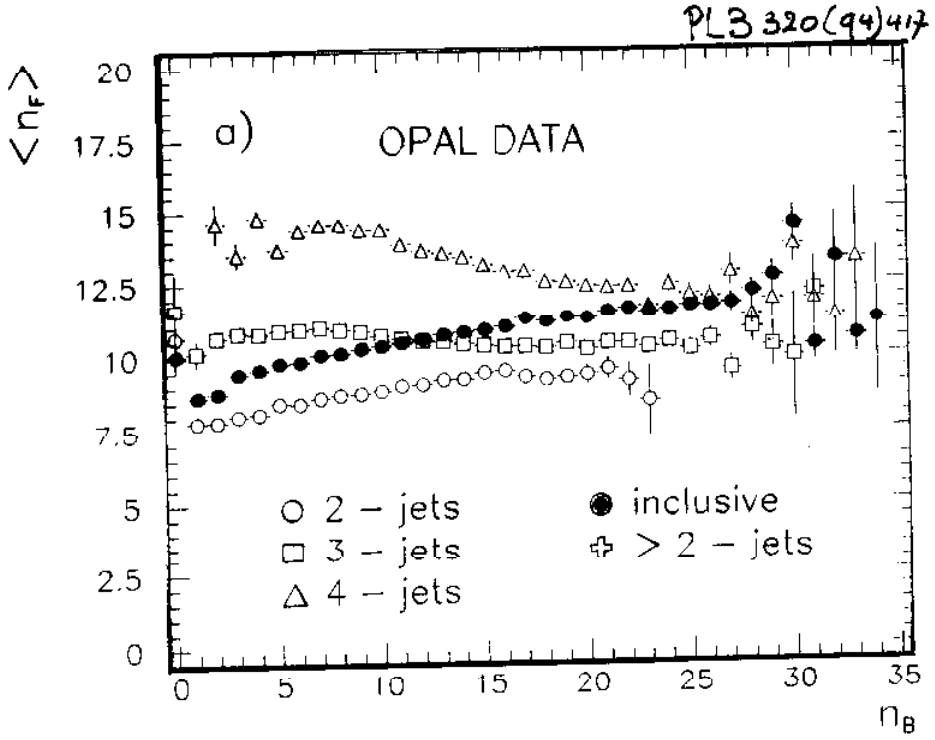

3. soft color interactions
(PLB 355 (1995) 573)




1+3 some resemblance to $e^+e^- \to q\bar{q}$

2 more complex; multiple color strings are possible between outgoing partons

# Multiplicity structure of the hadronic final state




$b = 0,103 \pm 0,007$

⇒ Mixture of jet topologies creates the correlation

⇒ correlation ~ $\langle k^2 \rangle - \langle k \rangle^2$

with k ≈ number of jets
(ZPC 18 (1983) 85)

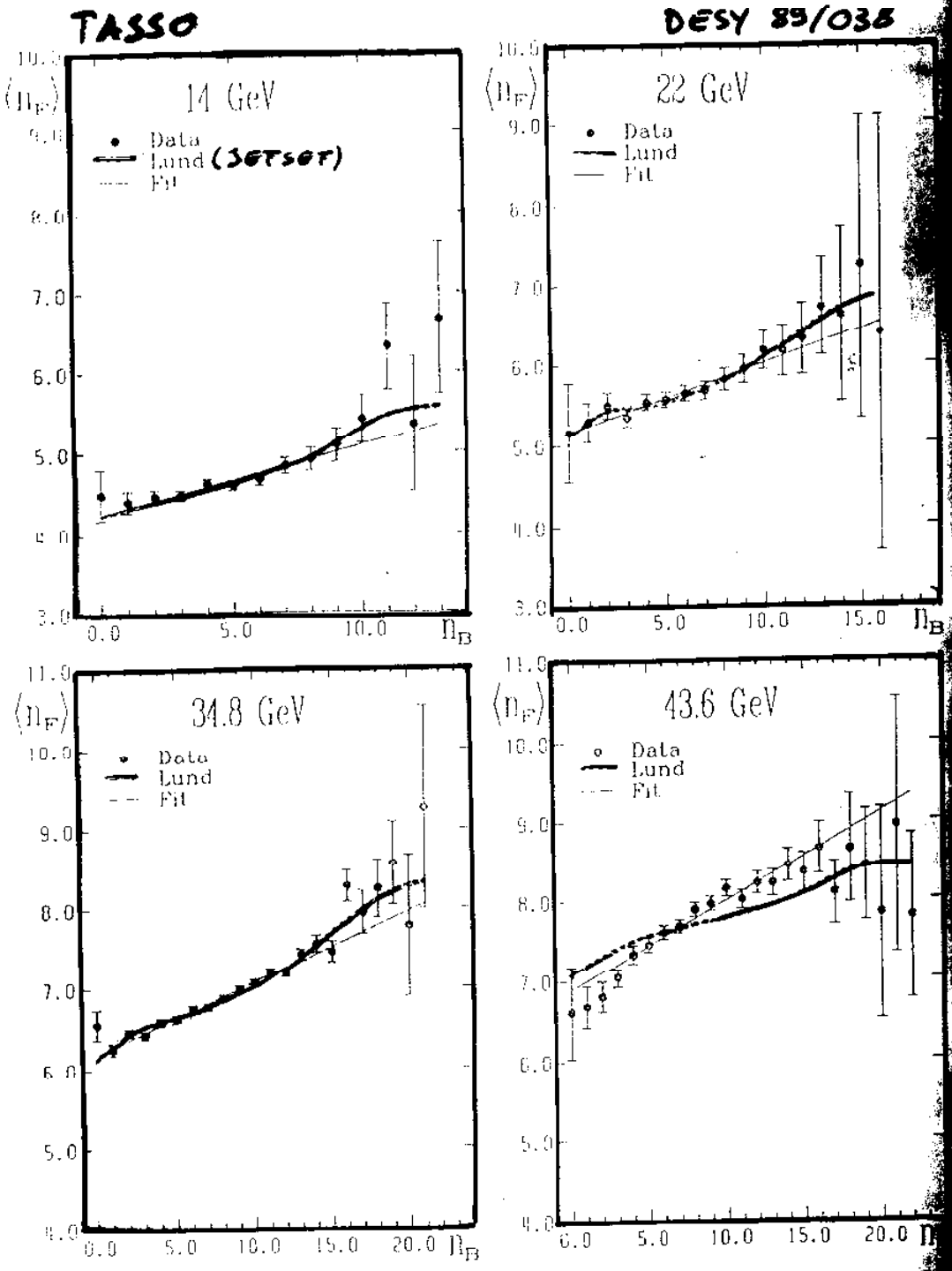



Figure 11: The dependence of $\langle n_F \rangle$ on $n_B$ for the full phase space data.

# Measures of correlation

Correlations are reflected in the two-particle density:

$$\rho_2(y_1, y_2) \neq \rho_1(y_1) \cdot \rho_1(y_2)$$

Multiplicity distributions : we measure $P_n$, the probability to have $n$ charged particles in the final state.

- Second factorial moment

$$\tilde{R}_2 = \langle n(n-1) \rangle = \sum_n P_n n(n-1)$$

$$= \int_\Delta \rho_2(y_1, y_2) dy_1 dy_2$$

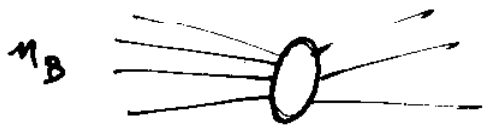
$$R_2 = \frac{\tilde{R}_2}{\langle n \rangle^2}$$

- Dispersion

$$D^2 = \langle n^2 \rangle - \langle n \rangle^2$$

$$\tilde{R}_2 = D^2 + \langle n \rangle^2 - \langle n \rangle$$

- Forward-backward correlations




$$\langle n_F \rangle = a_F + b_F n_B$$
$$\langle n_B \rangle = a_B + b_B n_F$$

$$D^2 = D_F^2 + D_B^2 + 2\rho D_F D_B$$

for symmetrical situations:

$$\rho \equiv \frac{D^2 - D_F^2 - D_B^2}{2D_F D_B} = b_F = b_B$$

if particles are distributed binomially (uncorrelated) between forward and backward hemispheres:

$$\rho_{BD} = \frac{D^2 - \langle n \rangle}{D^2 + \langle n \rangle}$$

# Experimental procedure

- Reconstruction of kinematics
  - → $x$, $Q^2$ from scattered positron
  - → $M_X$, $x_{IP}$ from combination of tracks and energy clusters
  - → $x_{IP}$ determines the boost to the $\gamma^*$IP centre of mass system
- Kinematical selection

  $7.5\ \text{GeV}^2 < Q^2 < 100\ \text{GeV}^2$

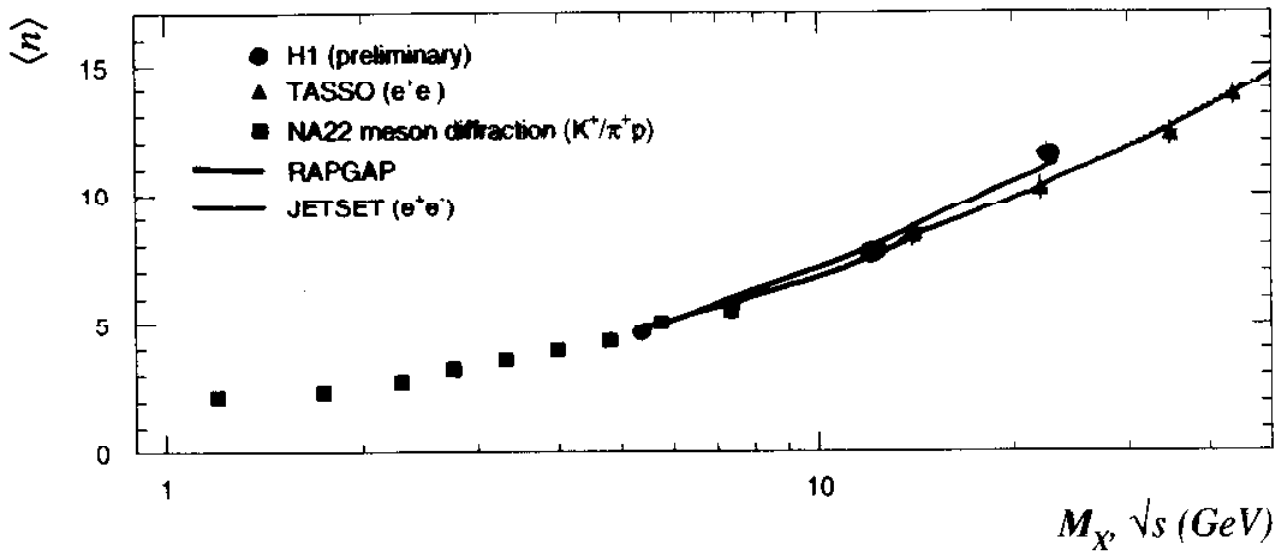
  $0.05 < y < 0.6$

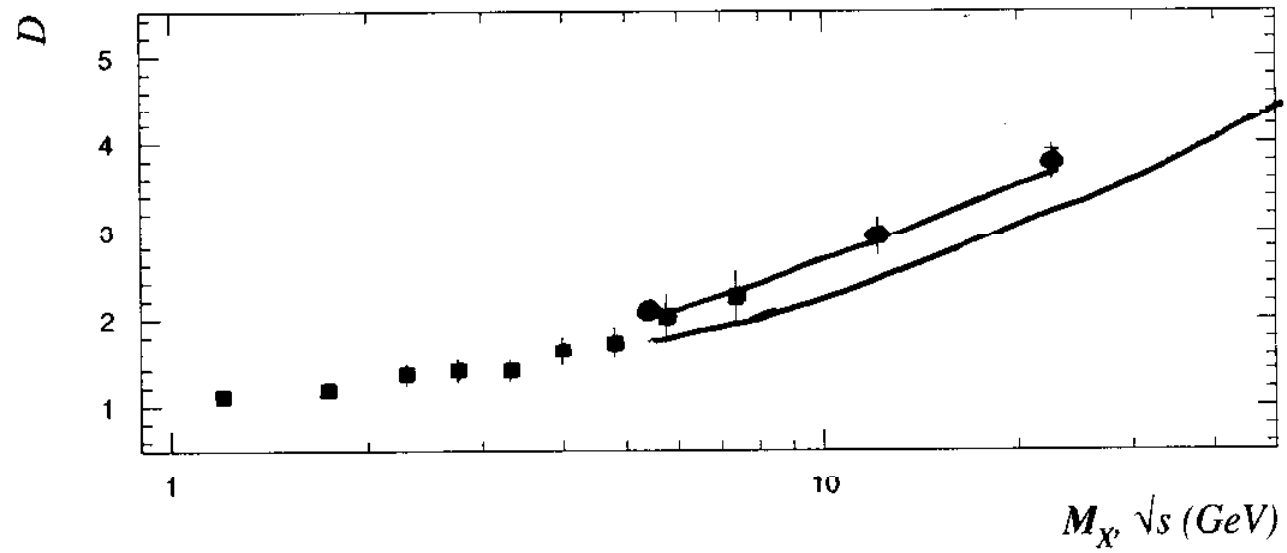
  $x_{IP} < 0.025$

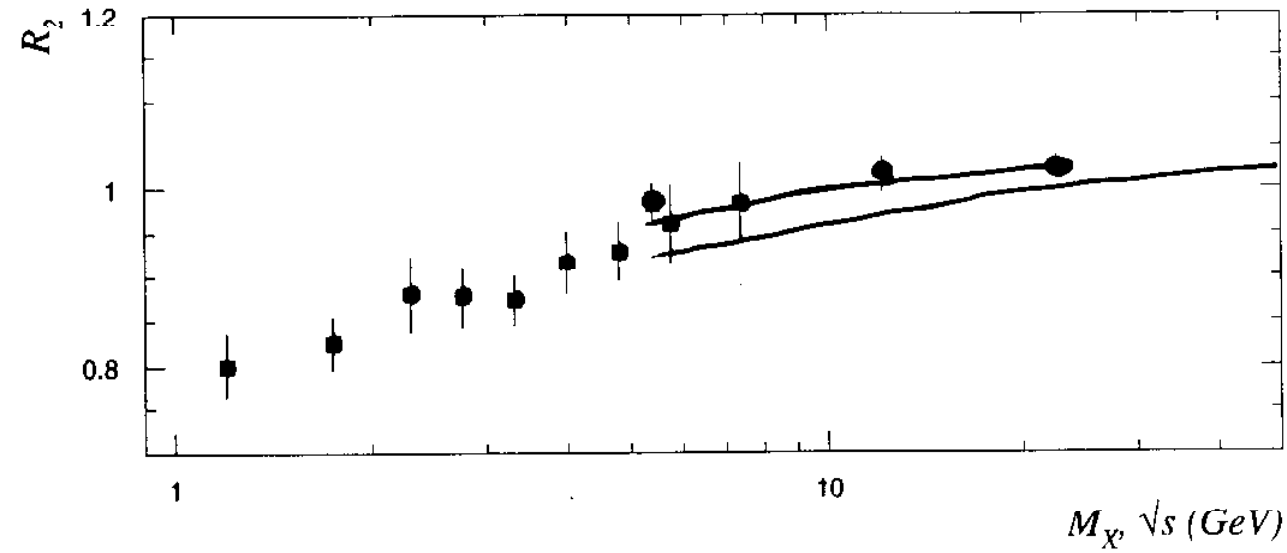
  $M_X > 3\ \text{GeV}$

- Charged particle selection
  - → measured by Central Tracker
  - → successfully fitted to primary event vertex
  - → multiplicity corrected with matrix migration method based on Monte Carlo simulation
- Event sample
  - → 3760 diffractive events

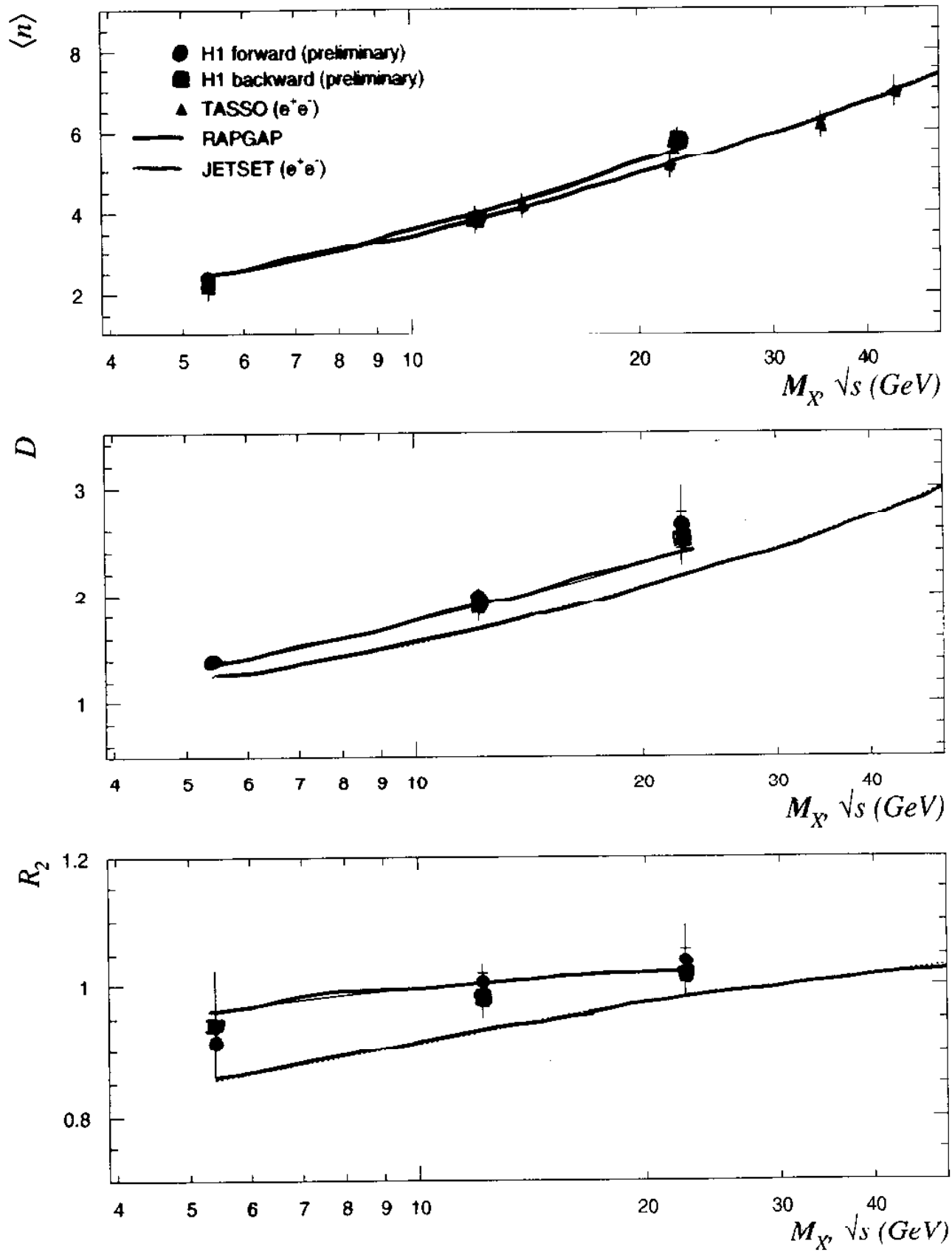
# Full event multiplicity moments



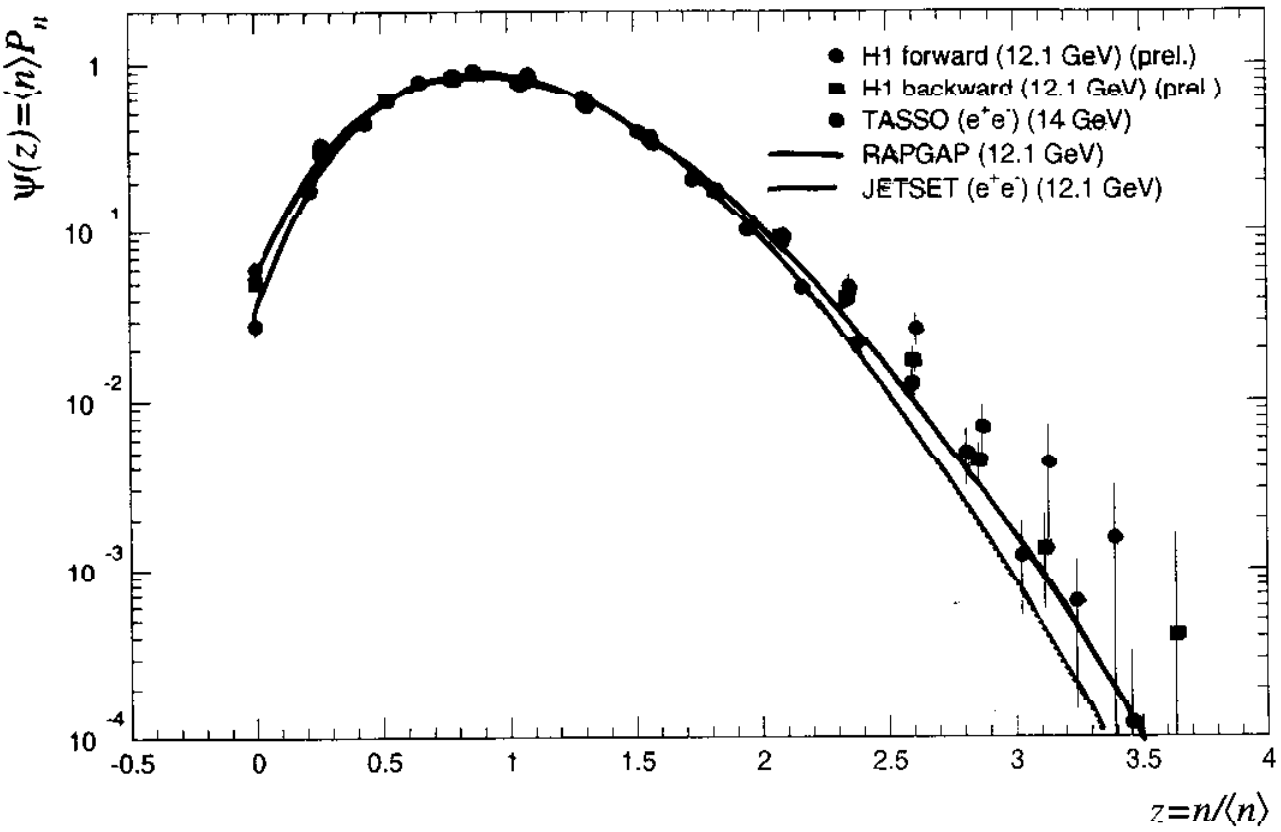



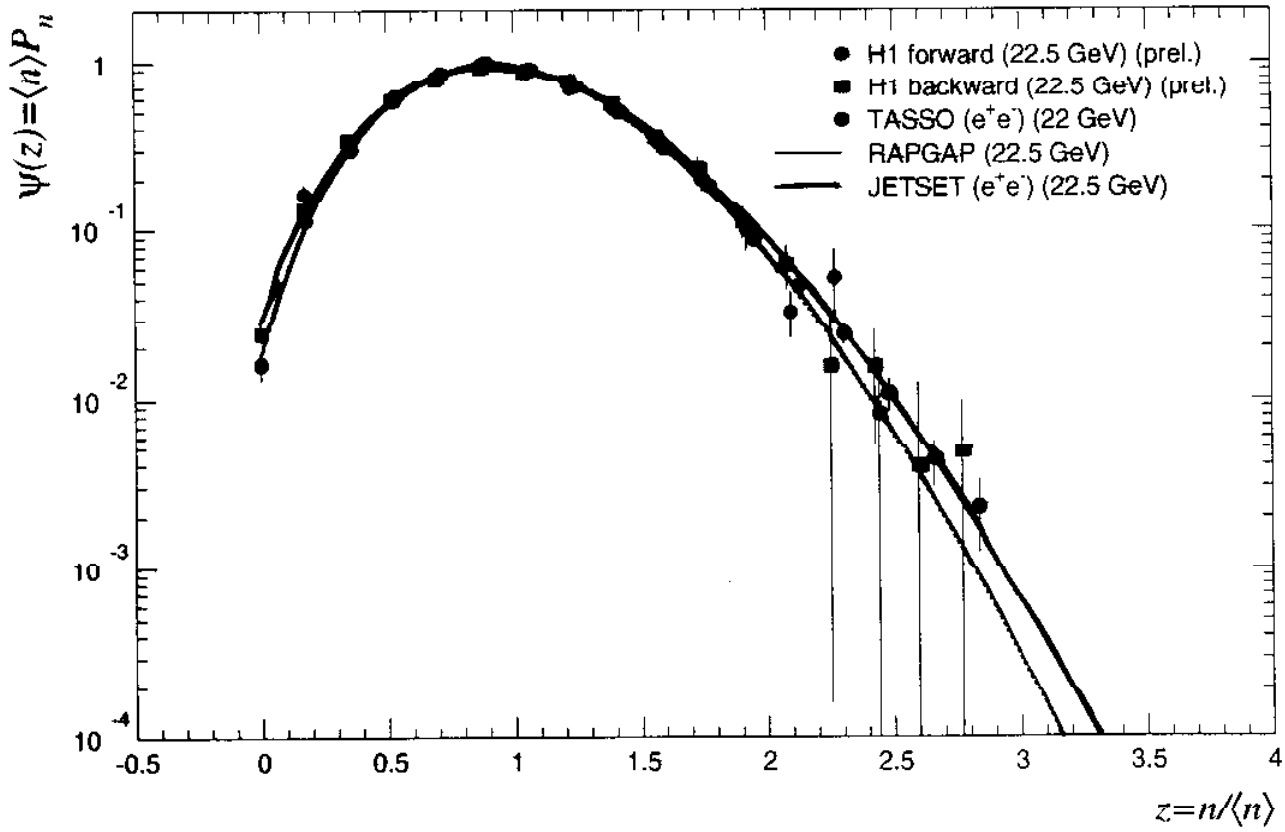



# Single hemisphere multiplicity moments

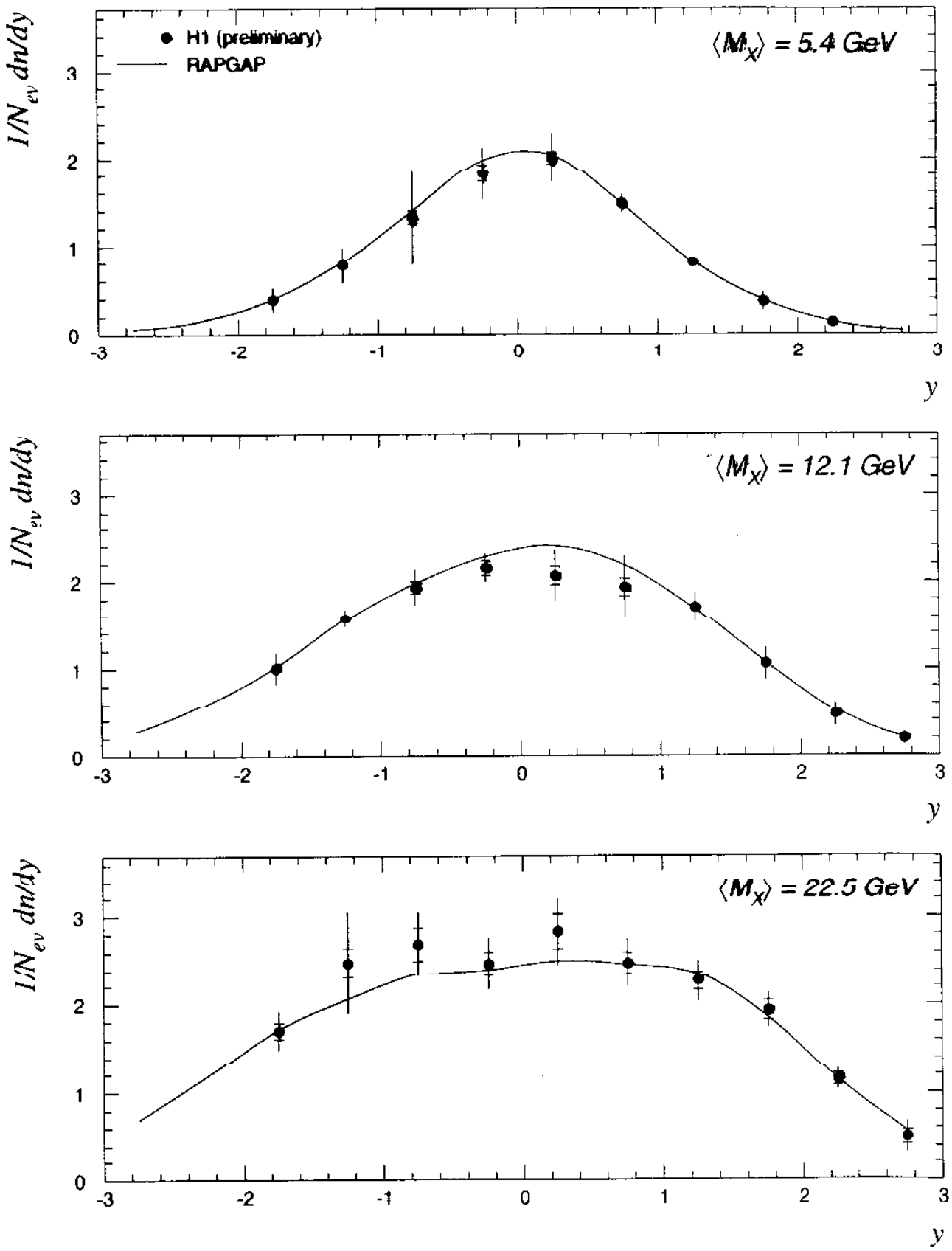


# Single hemisphere KNO distribution

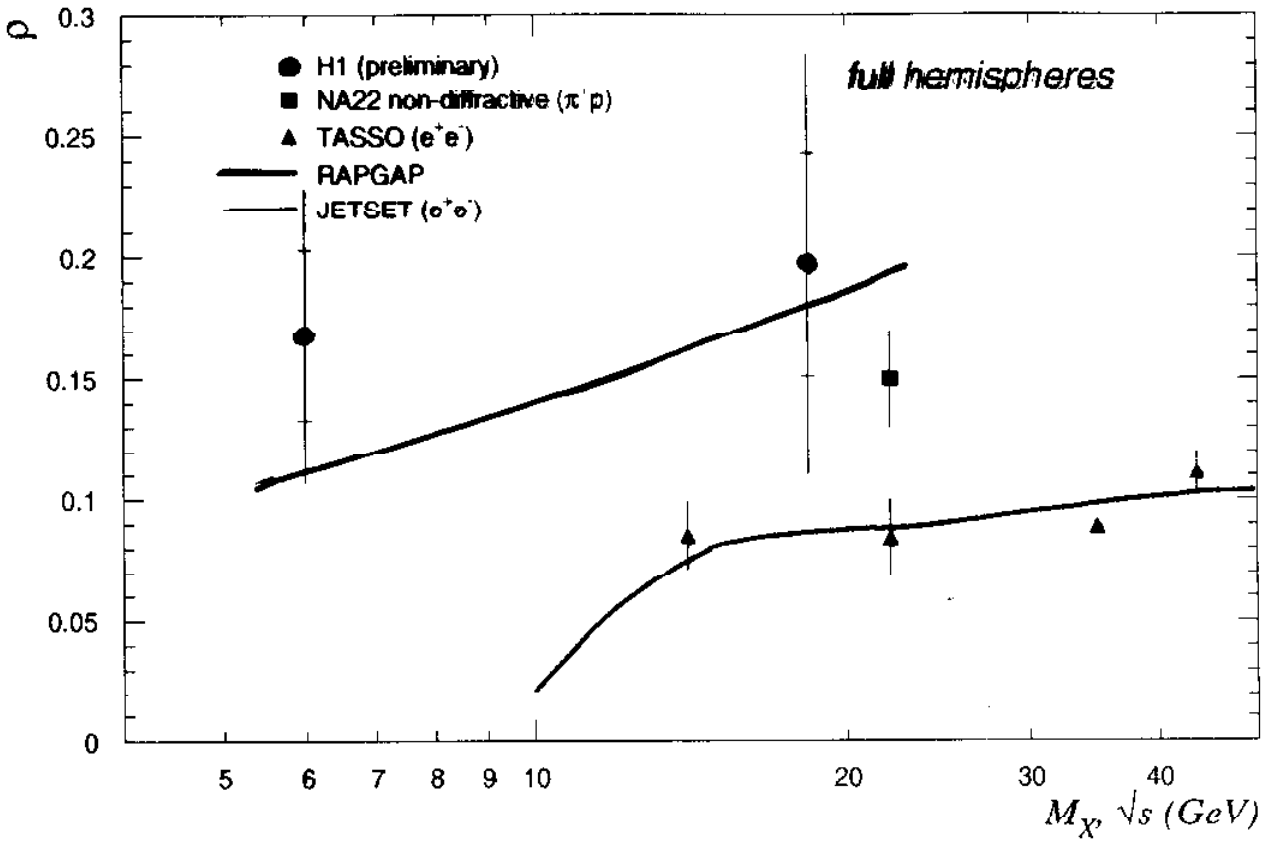


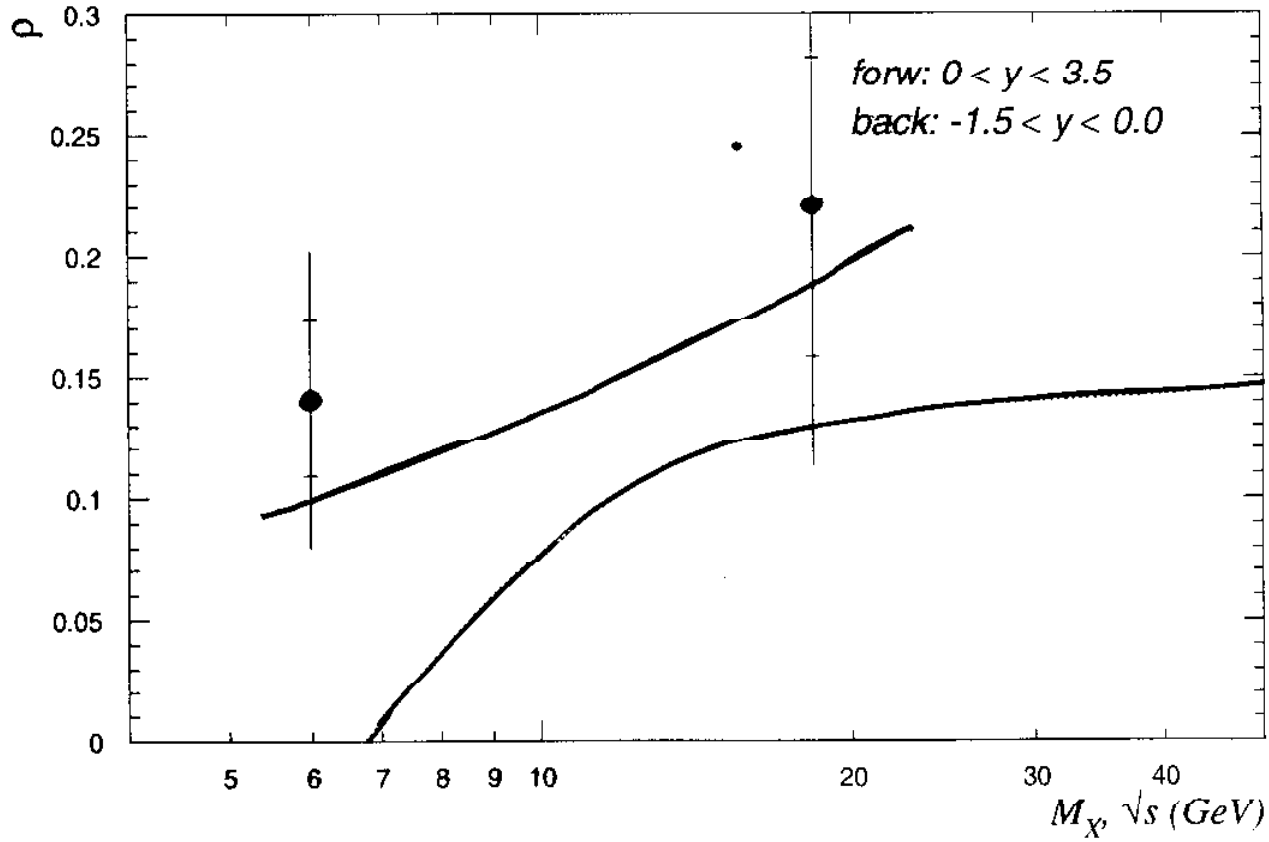



# Rapidity spectrum



# Forward-backward correlation



# Conclusions

- The hadronic final state of diffractive events in H1 resembles $e^+e^-$ annihilation in some aspects:

  → mean multiplicity
  → KNO distribution

- Dispersion, second factorial moment and forward-backward correlation however, are higher :

  → fragmentation of the diffractive system is more complex than the fragmentation of a single string

  → boson-gluon fusion-like processes are favored