Observation of Events at Very High Q^2 in e^+p Collisions at HERA

J. Gayler, H1 Collaboration [a]

[a]DESY,
D 22603 Hamburg, Germany

Results obtained by the H1 Collaboration in deep-inelastic e^+p scattering up to 4-momentum tranfers Q^2 up to 35000 GeV^2 are presented. At $Q^2 > 15000$ GeV^2 12 events are observed in neutral current (NC) interactions, where only 4.71 ± 0.76 events are expected. In charged current (CC) interactions in the same range of Q^2 4 events are observed, while the standard expectation is 1.77 ± 0.87 events.

1. Summary

A full account of the discussed experimental details can be found in [1] and references therein.

Data were presented on neutral current (NC) and charged current (CC) deep inelastic scattering at high momentum transfers Q^2. The NC and CC results are consistent with the standard DIS expectation in the kinematic range $2500 < Q^2 < 15000$ GeV^2. However at $Q^2 > 15000$ GeV^2 12 events were observed in NC interactions where only 4.71±0.76 are expected. In CC interactions 4 events were observed in the same kinematic range, where 1.77 ± 0.87 events are expected. The probabilities to record the observed number or more events are 6×10^{-3} in the case of NC and 0.14 in CC interactions. The excess in NC interactions is most prominent at an interval of 25 GeV around the mass $M = \sqrt{xs} = 200$ GeV, with $y = Q^2/M$ above 0.4. Here 7 events were observed while only 0.95 ± 0.18 are expected.

For the large number of observed events in neutral current e^+p scattering at momentum transfers $Q^2 > 15000$ GeV^2 no explanation was found based on conventional expectation for deep inelastic scattering processes.

The presented results, together with comparable results of the ZEUS Collaboration [2], led to phenomenological analyses in which possible modifications of the proton structure functions are discussed [3] or in which the results are tentatively interpreted as a sign of new physics. Here the most favoured scenarios are Leptoquark production (see e.g.[4–7]), R-parity violating Super Symmetry (e.g.[4,6,8,9]) or the effect of contact terms (e.g.[4,7,10,11]).

The H1 results are based on an integrated luminosity of 14 pb^{-1} taken in the years 1994 to 1996. Future data will have to show whether the observation is due to unexpected physics or to a statistical fluctuation.

REFERENCES

1. H1 Collaboration, C. Adloff et al., Z. Phys. C74 (1997) 191.
2. ZEUS Collaboration, J. Breitweg et al., Z. Phys. C74 (1997) 207.
3. S. Kuhlmann, H. L. Lai and W. K. Tung, MSU-HEP-70316, hep-ph/9704338.
4. G. Altarelli et al., CERN-TH-97-040, hep-ph/9703276.
5. J. Blümlein, DESY 97-32, hep-ph/9703287.
6. J. Kalinowski et al., DESY 97-38, hep-ph/9703288.
7. K. S. Babu et al., IASSNS-HEP-97-55, hep-ph/9703299.
8. D. Choudhury and S. Raychaudhuri, CERN-TH-97-026, hep-ph/9702392.
9. H. Dreiner and P. Morawitz, hep-ph/9703279.
10. V. Barger et al., MADPH-97-991, hep-ph/9703311.
11. Ann E. Nelson, Phys. Rev. Lett. 78 (1997) 4159.