**Physics Results from the H1 Experiment at HERA**

**Inclusive Measurements**

The NC inclusive cross section measurement is performed in the range of four momentum transfer squared $Q^2$ up to 30000 GeV$^2$ and Bjorken $x$ between 0.00005 and 0.65. The above distributions display the extracted proton structure functions $F_2$ (left), $x_F$ (upper right) and $F_3$ (lower right).

**Parton Distribution Functions**

The NC and CC cross section data in ep and e^+p scattering measured by the H1 experiment are used to perform new NLO QCD analyses in the framework of the Standard Model to extract flavour separated parton distributions of the proton. Five components of the proton structure are extracted, as shown below.

**Electroweak Unification**

Deep Inelastic Scattering (DIS) at HERA proceeds via virtual boson exchange in Neutral Current (NC) and Charged Current (CC) interactions. The cross section for each process is measured to be of the same order at the Electroweak Unification Scale.

**Hadronic Final States**

**Jets and Event Shapes**

The measured inclusive jet photoproduction cross section is remarkably well described by NLO QCD across more than 6 orders of magnitude (left). The measurement of event shape variables yields a consistent picture, constraining the values of $a_1$ and the power correction parameter $a_2$ (right).

**Beauty**

Heavy Quark Production

New cross section measurements of D+ meson (far left) and beauty photoproduction with semimuonic decay (left) are performed by H1. The D+ data are described by NLO QCD calculations. The measured dijet–muon cross section is found to be 1.5 times the theoretical prediction.

**Diffractive Final States**

Approximately 10% of low $x$ DIS events involve a diffractive exchange resulting in a large rapidity gap. Using the virtual photon to probe the structure of the exchange, H1 measures the diffractive cross section up to a $Q^2$ of 6000 GeV$^2$. The measured cross section at medium $Q^2$ is displayed on the left. NLO QCD fits are performed to extract diffractive parton densities, shown below. The extracted PDFs are dominated by the gluon component and form the basis of the successful predictions for diffractive dijet and D* cross sections shown below.

**General Search Analysis**

A model independent search for deviations from the Standard Model examines over 20 different high transverse momentum final states. The search confirms the observed excesses in the above analyses and exhibits good agreement with the Standard Model prediction in the remaining event classes.

**Rare and Exotic Processes**

**Isolated Leptons**

Events containing isolated leptons in coincidence with large missing transverse momentum are observed at H1. An excess of approximately 3σ above the Standard Model prediction (dominated by W production) is observed at large values of hadronic transverse momentum, as detailed in the above table.

**Multi Electron Production**

Multi electron production is studied at high electron transverse momentum. In events with electron pair invariant masses greater than 100 GeV, 3 di-electron events and 3 tri-electron events are observed compared with an expectation of 0.30 ± 0.04 and 0.23 ± 0.04 respectively. These events are displayed on the left.

**R Violating SUSY**

Competitive limits are set by many H1. Beyond the Standard Model analyses, a search for squark production in R-parity violating supersymmetry yields no significant deviation from the Standard Model. Squark masses below 275 GeV are excluded for a Yukawa coupling of electromagnetic strength.