H1: status and prospects

- H1 detector status
- Recent H1 physics results
- Summary and conclusions
H1 detector status

Detector performance after the 2003 shutdown

– Data taking, background conditions
– First Data

Status of repaired/new components

– CIP (Central Inner Prop. Chamber)
– VFPS (Very Forward Proton Spectrometer)
– FTT (Fast Track Trigger)
H1 high $Q^2$ events

PT=50 GeV
$Q^2=6000$ GeV$^2$

Charged current
with 2 jets

PT(e)=95 GeV
$Q^2=14000$ GeV$^2$

First HERA data
at high $Q^2$ with polarized positron beam

Neutral current
Data taking, background conditions

- Data taking has started
- Background similar to Feb 2003
  - Vacuum conditioning worked
- Background is dominated by p-beamgas
- Present limit: 30x60 mA²

• Extrapolate CJC currents: factor 3 improved vacuum needed to run at HERA II design currents
First data

NC high $Q^2$ data, SM prediction

LAr calorimeter

H1 Detector is well prepared for HERA II data

Kinematic peak

SpaCal

Silicon detectors S/N

BST: 34
CST: 20
FST: 32

D* reconstruction

J/ψ from $e^+e^-$ and $μ^+μ^-$

Tracking detectors
CIP: status after shutdown

Reconstruct vertex position for L1 trigger, separate ep collisions from background
Chamber and readout (optical links, FPGA based trigger) working well, hit efficiency close to 100%

CIP vertex trigger is used to trigger ep events and to veto non-ep events from collimators C5a, C5b

Repair was a success — CIP has become a vital part of the H1 trigger
VFPS installation

Very Forward Proton Spectrometer installed in HERA tunnel (at 220 m).
Build for precise measurements of diffractive reactions
Data taking started last week.
Commissioning with proton beam ongoing.
Fast Track Trigger

FTT: reconstruct tracks from 12 layers of CJC wires

FTT hardware installed, readout working
Trigger programming (FPGA, DSP) ongoing

CJC track with FTT hits in all layers

Provide Trigger information on

- L1 (2\mu s): coarse tracks
- L2 (20\mu s): vertex-fitted tracks
- L3 (100\mu s): invariant masses
Recent H1 physics results

53 papers sent to EPS 2003 — HERA I data still providing many new results

New results and publications since the last PRC

- $\gamma p \rightarrow \gamma Y$ at high $|t|$ 
- DVCS 
- Beauty in photoproduction 
- NLO treatment of diffractive final states 
- Event Shapes in DIS 
- Squarks in R-parity violating SUSY 
- Generic Search for new physics 
- Search for superlight gravitino 
- Search for Contact Interactions 
- Diffractive $J/\psi$ Production at high $|t|$ 
- Multi-electron production 
- Search for Single Top 
- Dijets and azimuthal decorrelations at low $x$ 
- Multi-muon production
Beauty in photoproduction

B-identification based on $p_T^{\text{rel}}$ and lifetime information (CST).

Progress: precision, differential distributions

H1 and ZEUS in agreement. Data 1.8$\sigma$ above NLO.
Diffraction and NLO QCD in DIS

Diffractive PDFs extracted from $F_2^D$ assuming factorisation + NLO QCD

Does it describe diffractive dijet and charm production?
Diffraction and NLO QCD in DIS

Data described by NLO QCD + diffractive PDFs
QCD factorisation works in DIS (and yp)
Event shapes in DIS

Sensitive to $\alpha_s$ and hadronisation effects $\bar{\alpha}_0$

Example: $\tau = (1$-thrust$)$

H1 analysis: fit differential distributions with NLO + NLL + PC
Event shapes in DIS

Fit differential event-shapes to NLO + NLL + PC

Fit result:

PC parameter $\bar{\alpha}_0$

strong coupling constant $\alpha_S$

Good agreement for different event shapes.
**R_p violating SUSY — squark search**

**Squark production**

\[
\begin{align*}
    & e \\
    \rightarrow & \text{Squark}
\end{align*}
\]

**R_p violating coupling \( \lambda' \)**

**Coupling of em strength: exclude squark up to 275 GeV.**

All \( e^+p \) and \( e^-p \) data at CM-energy 320 GeV included.

**New: perform scan in tan(\( \beta \)) for mSUGRA model**
Generic search for new physics

Reconstruct high-$p_T$ objects ($e, \gamma, \mu, \nu, \text{jet}$)

$p_T > 20$ GeV, $10^\circ < \theta < 140^\circ$

Scan invariant mass and sum of transverse momenta, find “most interesting” region

Use full HERA I

luminosity: $115$ pb$^{-1}$

Overall good agreement with SM

in 25 search channels

Model-independent search confirms excess
in $\mu$-$\nu$-jet channel studied in other analyses.
Summary and Conclusions

- Detector working well – first data looks good
  Congratulations to HERA for the promising startup
- HERA I data still is a rich source for new analyses
  (e.g. QCD tests, searches for new physics)
- Exciting physics program has started with HERA II:
  - New detector components
  - High luminosity and polarisation
- Goal: exceed HERA I luminosity before next big shutdown
- Long-term goal: collect 1 fb\(^{-1}\) of data + low energy run
H1 CJC currents history