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- H1 data taking in 2004
- New preliminary results and publications
- Detector preparation (shutdown)
- Conclusions

2003-2004 Data Taking



H1 Data Samples



• Many Thanks to HERA crew for bringing us into "luminous" period

New Preliminary Results

• 45 contributed papers at ICHEP 2004

Results presented for the first time at ICHEP 2004:

The first HERA II results

- Polarised CC cross section
- _ Update for the high P_{τ} phenomena
 - general search
 - isolated leptons
 - multi-leptons

Searches

- _ for Doubly Charged Higgs Bosons
- _ for Lepton Flavour Violation



Heavy Flavours

- Beauty in γp using lifetime tagging

Diffraction

- _ Diffractive D* in DIS
- _ Diffractive dijets: DIS vs. γp
- _ Diffractive CC

CC total cross section versus e⁺ beam polarisation

HERA II 60 σ^{CC} (pb) H1 (prel,) $e^{\dagger}p \rightarrow \bar{v}X$ HI 50 ZEUS (prel.) ZEUS SM (MRST) 40 Linear fit $\chi^2_{dof} = 5.4/4$ 30 20 $Q^2 > 400 \text{ GeV}^2$ 10 y < 0.90 -0.8 0.8 -0.6 0.2 0.6 -0.4 -1 -0.2 0.4Р

H1+ZEUS $\sigma_{cc}^{tot}(P_e = -1) = 0.2 \pm 1.8(sta) \pm 1.6(sys)pb$



HERA can collide polarised e with protons and flip the helicity

First cross section measurement

establish the polarisation dependence

No indication for RH currents

High P_ region surveyed: general search

Identified particles e,µ, γ , jet, ν at high P_T>20 GeV and in the central region 10°< θ <140°



Events with isolated leptons and missing P_



Candidate with muon from HERA I





Candidate with e from HERA II

$$p_T^e = 37 \text{ GeV}, p_T^{miss} = 44 \text{ GeV}, p_T^X = 29 \text{ GeV}$$





I+PTmiss at HERA I+II

| <mark>1994-2004</mark> | Electron | Muon | Tau <mark>(105 pb-¹)</mark> |
|------------------------|-------------|-----------|--|
| L=171 pb-1 | obs/exp | obs/exp/ | obs/exp |
| Full Sample | 20/16.1±2.2 | 9/4.2±0.7 | 5/5.1±1.4 |
| (HERA II) | 9 | 1 | |
| PTX>25 GeV | 10/2.7±0.5 | 6/2.6±0.5 | 0/0.5±0.1 |
| (HERA II) | 5 | 0 | |

Electrons and muons combined



Multi-lepton searches

HERA I+II 163 pb⁻¹ ICHEP 2004

- At least 2 high PT leptons (e or μ)
- $P_{T}^{1} > 10 \text{ GeV}, P_{T}^{2} > 5 \text{ GeV}$
- 20°< θ<150°
- Find events with 2 or 3 leptons
- SM: production mainly via γγ collisions



Mass of the highest P_{τ} lepton pair

| Selection | Data | SM |
|--|------|-----------------|
| ee $M_{12} > 100 \text{ GeV}$ | 3 | 0.44 ± 0.10 |
| $\mu\mu M_{\mu\mu} > 100 \text{ GeV}$ | 0 | 0.04 ± 0.02 |
| e $\mu~M_{e\mu}$ $> 100~{\rm GeV}$ | 0 | 0.31 ± 0.03 |
| eee $M_{12} > 100 \text{ GeV}$ | 3 | 0.31 ± 0.08 |
| $e\mu\mu M_{e\mu} > 100 \text{ GeV}$ | 1 | 0.04 ± 0.01 |
| $e\mu\mu M_{\mu\mu} > 100 \text{ GeV}$ | 1 | 0.02 ± 0.01 |



<u>Search for Doubly Charged Higgs Boson H++</u>

 $\mathbf{h}_{e\mu}^{\mathrm{L,R}}$

0.1 0.09

0.08 0.07

80

90

100

110

120

Multi-lepton production may be due to a doubly charged Higgs H⁺⁺ couples to leptons, not to quarks



$H^{\pm\pm} \rightarrow e^{\pm}e^{\pm}, \mu^{\pm}\mu^{\pm}, e^{\pm}\mu^{\pm}$ H1 limits on left- and right-handed couplings h_{au}^L , h_{au}^R 0.9 **e**μ 0.8 0.7 excluded 0.6 0.5 Excluded by Excluded by 0.4 LEP CDF, h^L_{ett} 0.3 0.2 $BR(H \rightarrow e\mu)=100\%$ H1 Preliminary

130

140

M_H (GeV)

150

NEW ICHEP 2004

Search for Lepton Flavour Violation

New Result

for ICHEP 2004



Beauty Measurement using b-lifetime tagging

Use of precision silicon (CST) tracking for inclusive b-tagging



Inclusive beauty measurement in photoproduction



Exclusive Diffractive Processes

- Diffractive NLO PDFs (DPDF) from F_2^{D} data
 - Predict exclusive processes
 - **DPDF** * Hard Scattering ME
 - (QCD factorisation)
- Diffractive DIS: D*, di-jets
- Factorisation works





Diffractive D* production (DIS)



ICHEP 2004 Dijets in Diffractive Photoproduction



Diffractive CC

- 2% of the CC processes are diffractive
 - $M_{y} < 1.6 \text{ GeV}$ $|t| < 1 \text{ GeV}^{2}$
 - 14 CC events with undissociated proton (63 pb⁻¹)

ICHEP 2004



Agreement with the H1PDF fit

Publications in 2004

- Search for Squark Production in R-Parity Violating Supersymmetry • at HERA
- Measurement of Anti-Deuteron Production and a Search for Heavy • Stable Charged Particles at HERA
- Evidence for a Narrow Anti- Charmed Baryon State •
- Forward $\pi 0$ Production and Associated Transverse Energy Flow in ulletDeep-Inelastic Scattering at HERA
- Measurement of the Proton Structure Function F, at Low Q² in QED • Compton Scattering at HERA
- Search for bosonic stop decays in *R*-parity violating supersymmetry ۲ in e+p collisions at HERA
- Measurement of Prompt Photon Cross Sections in Photoproduction Since the last PRC at HERA
 - A General Search for New Phenomena in ep Scattering at HERA
 - Inclusive Production of D^+ , D^0 , D^+ and D^{*+} Mesons in DIS at HERA

Preparing the new data taking: shutdown activities

- FST and BST taken out, will be re-installed next year
- Repair of CST
- Repair of CIP
- New Background monitor
- New Roman Pots for FPS
- New Ethernet based DAQ
- Maintenance and improvements in other areas
 - VFPS, Calo, FTT, SlowControl,...

New Absorber 4 at NR11, welded flange New beam pipe @6m



H1 is ready for data taking Improvements continue to fully profit from large luminosity still to come from HERA





Forward Silicon Tracker (FST)

- Installed in 2000
- Successful run in 2004
- May 2004: Water Leak caused corrosion
- Radiation dose high (~100Gy)
- Rebuild FST with rad.hard chips and new silicon wafers
- Ready for 2005 summer shutdown



- **BST** Backward Silicon Tracker:
 - Blocked cooling pipes: repair and reinstall with rad-hard electronics in 2005 shutdown.
 - New scintillator radiation monitor installed at BST position



- ¹/₄ not operational due to a short
- successfully repaired





Single track trigger ϵ (cosmics)



- **CIP** Central Inner Proportional Chamber
- successfully repaired

Conclusions

- HERA I analyses and publications continue to be interesting
- HERA II data has been taken and analysed
 - First preliminary results presented for summer conferences (CC, Searches)
- Hardware work (shutdown):
 - FST/BST taken out, back in 2005
 - Improvements CST,CIP,DAQ,Slow Control,FPS,FTT,VFPS...
 - H1 ready for the best lumi, still to come
- H1 Collaboration looks forward to a high luminosity data taking period