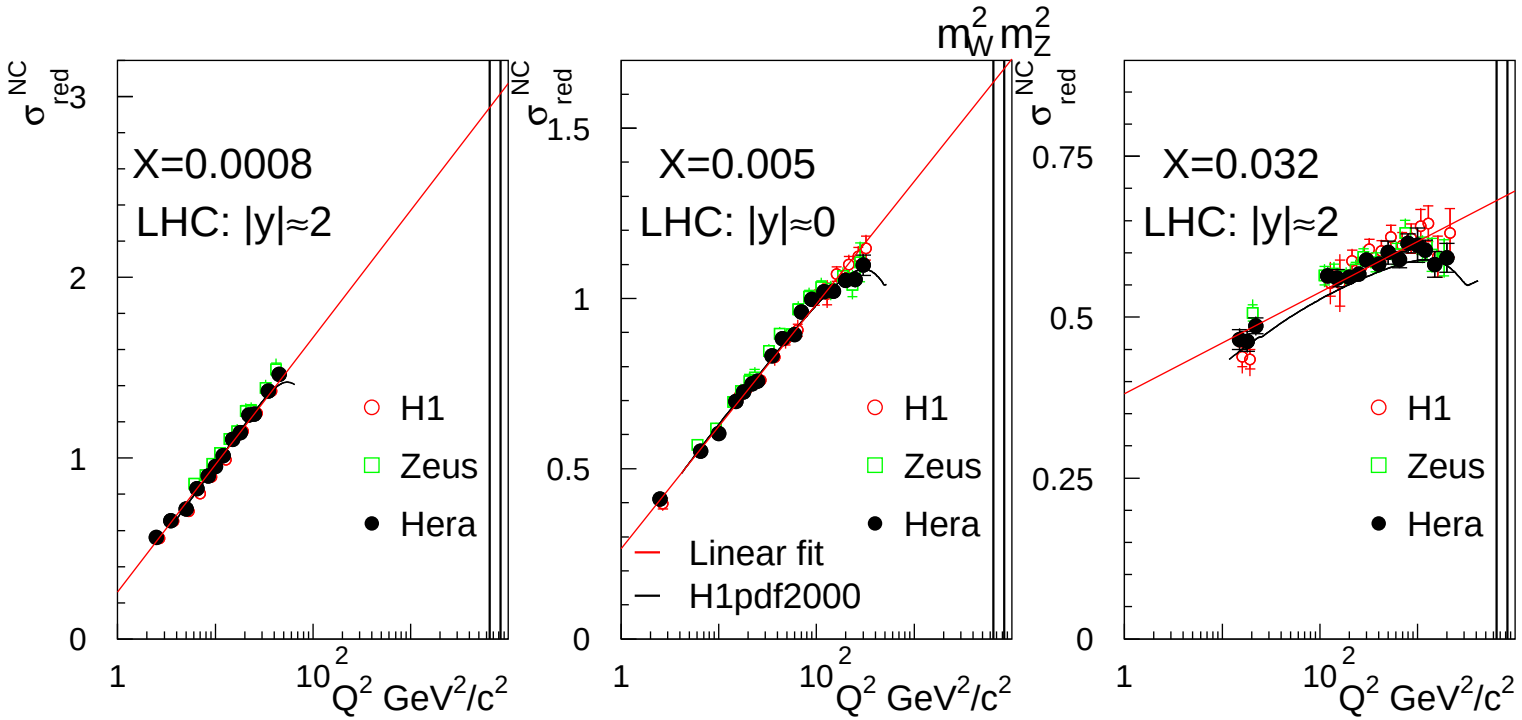
Precision PDFs from HERA for LHC — status

- Short introduction.
- Status and plans of HERA.
- Status of the high precision F_2 analysis, first new HERA-II high Q^2 results.
- Prospects for precise cross section measurement at high y.
- Preparations for low E_p run — F_L measurement.

S.Glazov, 8 June 2006, HERALHC workshop

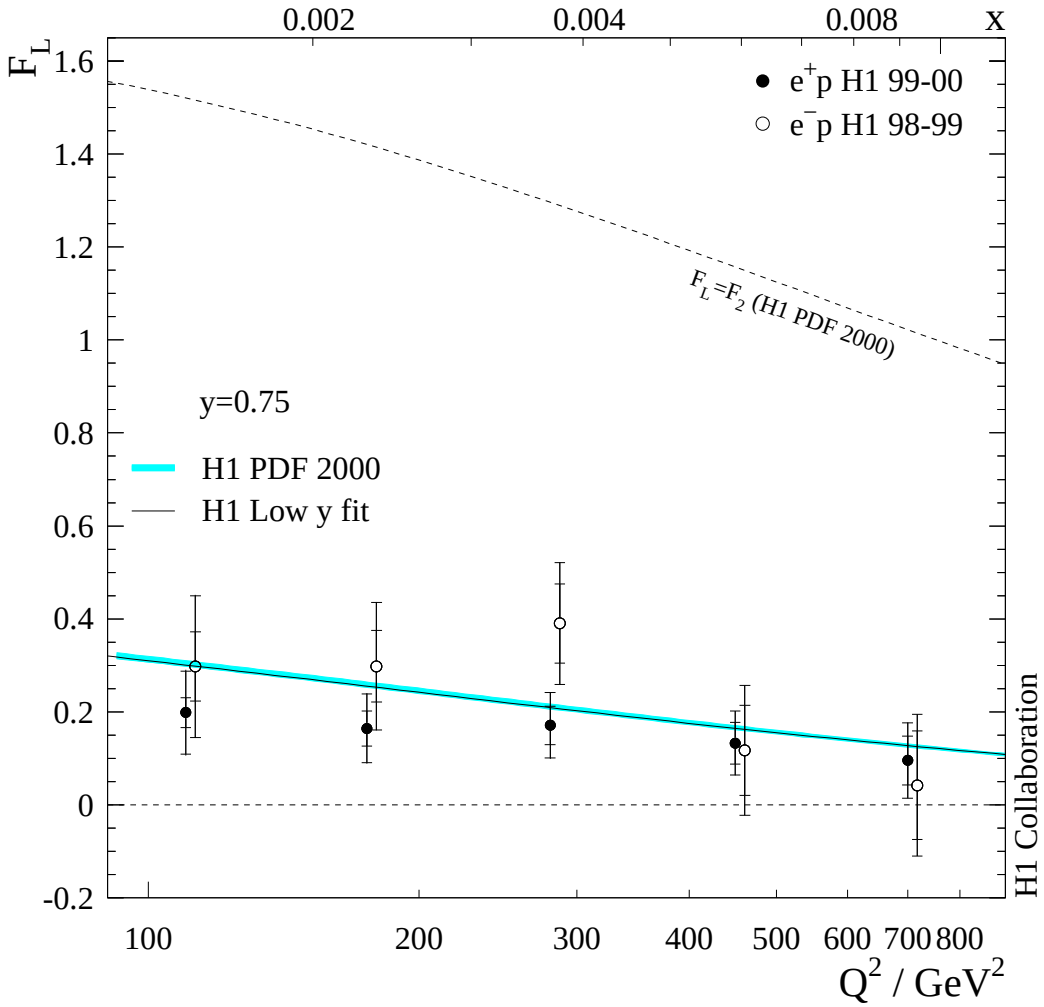
F_2 extrapolation to W, Z mass



HERA data covers complete central rapidity range of LHC for W, Z production. "Leading order" predictions can be read directly from HERA data + linear extrapolation.

Experimental part of PDF uncertainties comes from absolute F_2 normalization and the slope, $dF_2/d\log Q^2$ (gluon). Turn down of σ^{NC}_{red} for highest Q^2 ($\rightarrow$ highest y) is due to F_L.

Consistency check: H1 F_L determination at high Q^2



Determination of F_L as

$$F_L = \frac{Y_+}{y^2}\left(F_2^{fit} - \sigma_r\right)$$

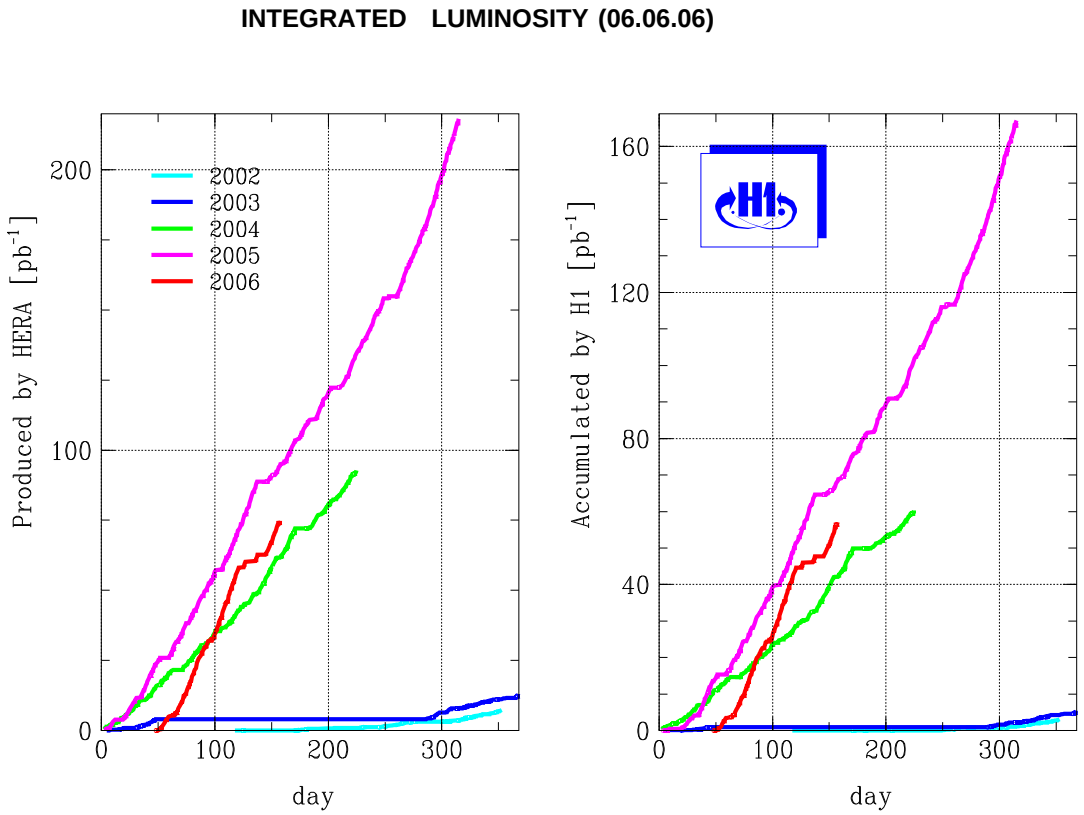
Important consistency check of gluon determined from F_2 scaling violation vs X-section decrease at high y.

Still large statistical uncertainties, to be improved with HERA-II

Summary of the introduction: HERAforLHC item list

- $1-2\%$ precision F_2 structure function measurement for x in $0.0005-0.1$ range (Q^2 range from 5 to 1000 GeV^2). For low Q^2 — work on systematics. For high Q^2 — more data statistics.
- Measurement of xF_3 at lowest possible x — check of flavor decomposition.
- Combination of H1 and ZEUS data.
- Extension of the measurement to high y
- Low energy run to measure F_L

HERA status and plans

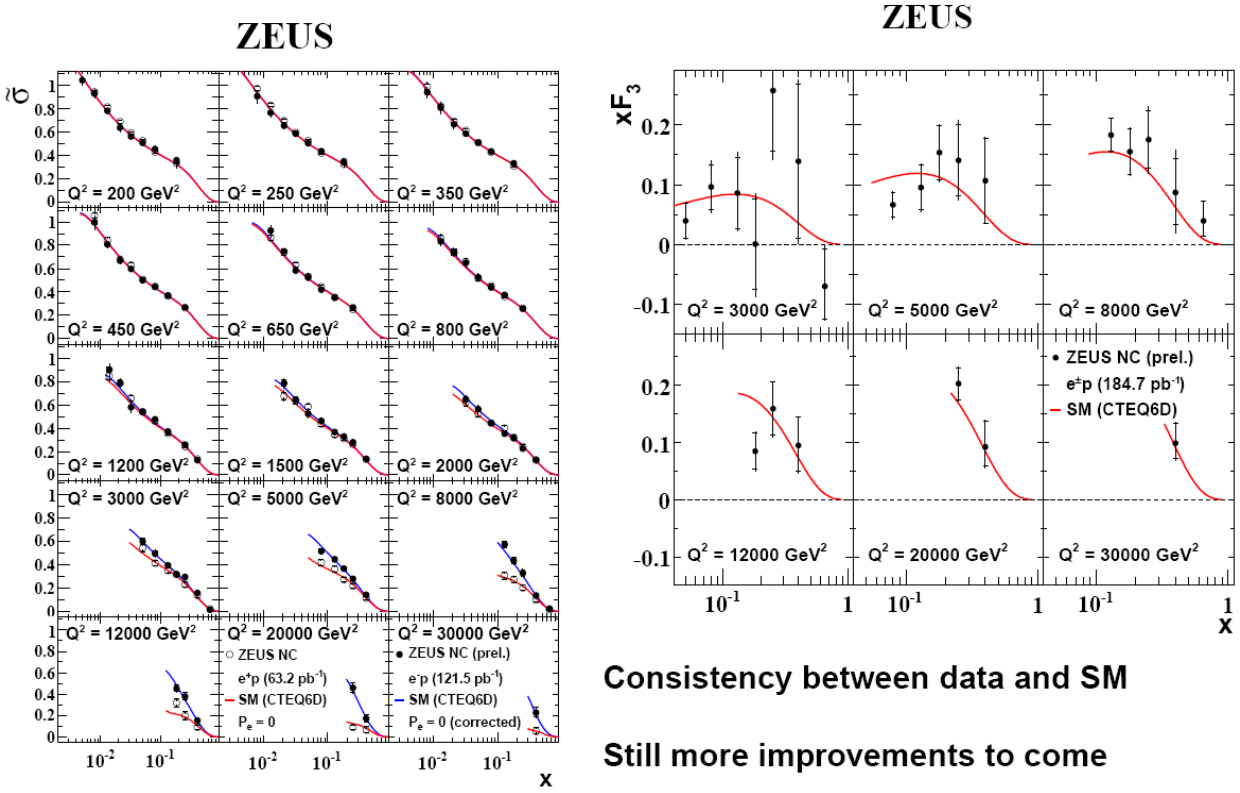


2004 — e^+, 2005/06 (so far) — e^-. Plan to switch back to e^+ end of June, stay with e^+ till the end of operation (end of June 07). Estimated 20 pb^{-1} per month.

Take 3 months low proton energy run to collect 10 pb^{-1} of data for F_L measurement.

New results with HERA-II data

Neutral current cross sections



Consistency between data and SM

Still more improvements to come

Preliminary measurement of xF_3 is also reported by H1. Not so low x so far ...

Status of F_2 analysis for low $Q^2 < 100$ GeV^2

Goal: to get cross section measurement with $\sim 1\%$ precision.

- (H1) Uses data collected in 2000, HERA-I configuration.
- Data calibration, alignment, selection efficiency under control.

In progress:

- Improvement in luminosity determination. "Satellite bunch" correction, more differential calculation in order to perform detailed cross checks (e.g. F_2 vs colliding bunch). Goal is to reach $< 1\%$ luminosity uncertainty (currently 1.4%).
- Improvement in MC simulation: better simulation of the detector underlying activity using events collected during the data taking with random triggers. Important for measurement at low y.

Time scale for publication: end of HERA running.

Measurements at high y

High y cross section is sensitive to F_L and thus gives additional handle on the gluon density: $\sigma_r = F_2 - \frac{y^2}{Y^+} F_L$

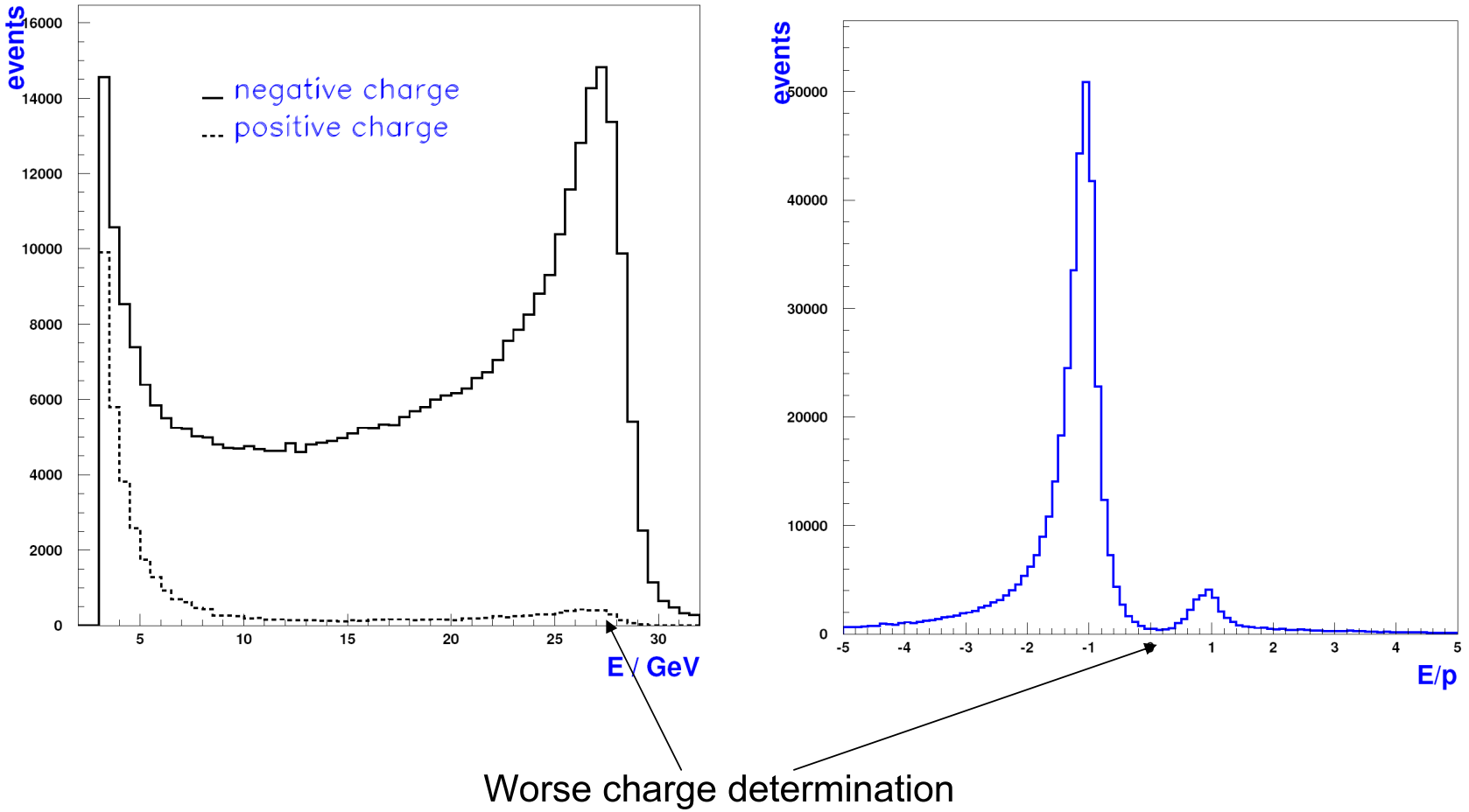
High y corresponds to scattered electron with low energy: $y \sim 1 - E'_e/E_{beam}$; main problem of the analysis is photoproduction background.

Key idea: measure background directly in data using tracks with wrong charge. Use data collected with e^+ and e^- beams to check potential charge asymmetry of the background (may arise from difference of the detector response).

H1 uses central drift chambers to measure $0.9 < y$ for $Q^2 > 10$ GeV^2. Low electron energy triggers are difficult because of high background rate (~ 100 Hz). Luminosity collected so far 25 pb^{-1} with e^+ and 45 pb^{-1} with e^-.

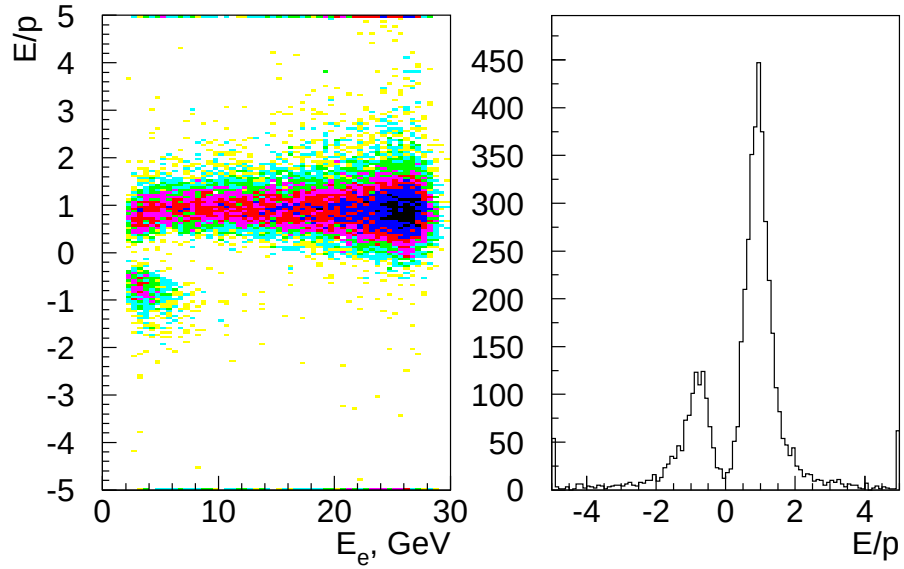
High y analysis of HERA-II data

After all cuts (3 < E < 32 GeV) - 2005



Estimated stat. uncertainty for $0.9 < y < 0.75$ bins is $\sim 1\%$.

Data 2006 — Backward Silicon Tracker



Scattered electron angles $175^o < \theta_e < 170^o$ are covered in H1 by stand-alone silicon tracker (BST).

BST (together with FST) was re-installed in H1 during the shutdown. After a commissioning period, both trackers are fully operational. With an initial alignment charge determination in BST can be obtained.

Now taking the remaining e^- data ...

Preparation to Low Energy Run

PRC has recommended to perform 3 months long low proton energy run to collect 10 pb^{-1} of data. Exact date for the run is being discussed. Two options: Jan 2007 or the last 3 months of HERA operation.

Meanwhile collaborations need to prepare for this run: trigger setup, special runs ... Special runs may include "shifted" Z_v run (by about 30 cm) at nominal E_p energy to equalize the acceptance such that the scattered electron for given Q^2 reconstructs at the same spot in the calorimeter as for low E_p run.

Last year of HERA operation should bring many new exciting results.