ELECTROWEAK RESULTS at HERA

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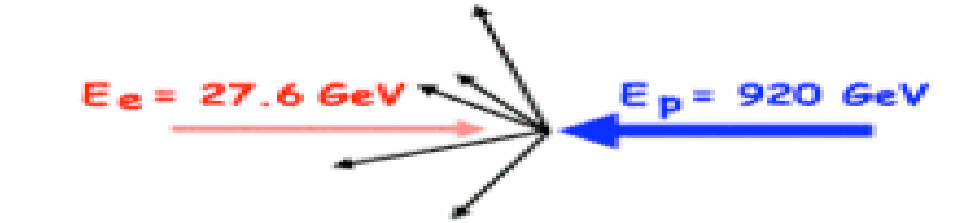
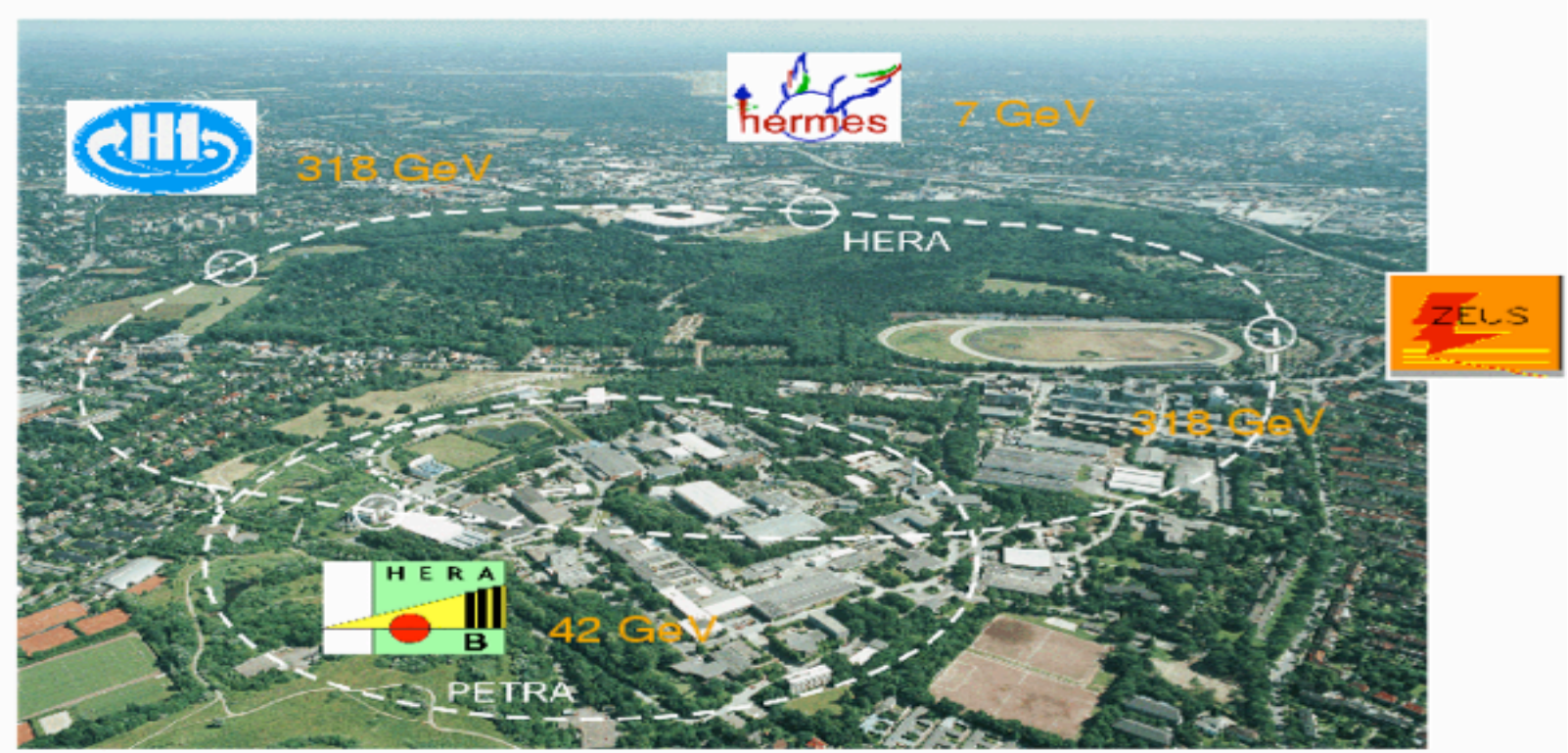
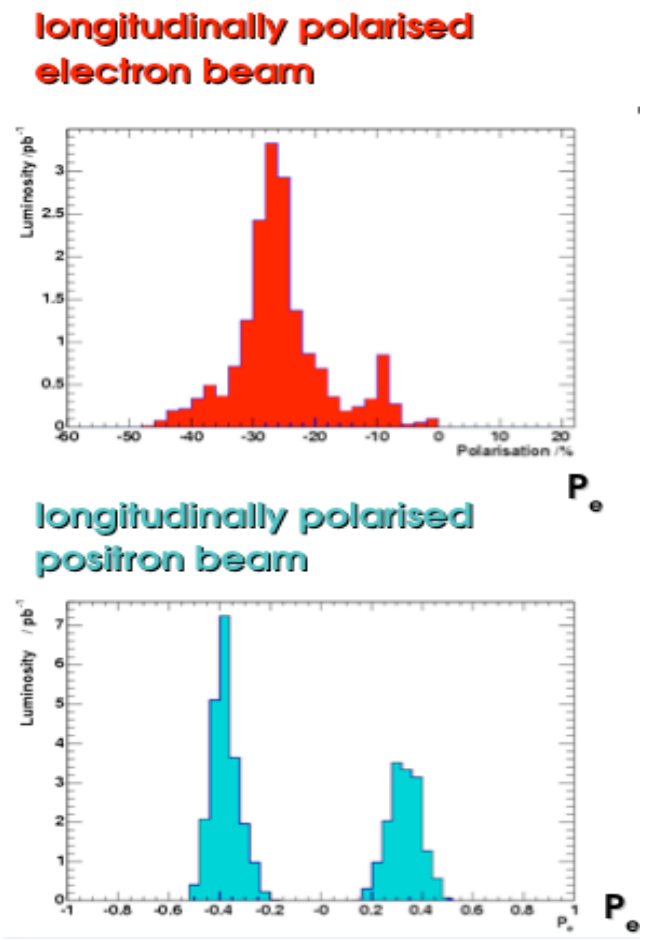
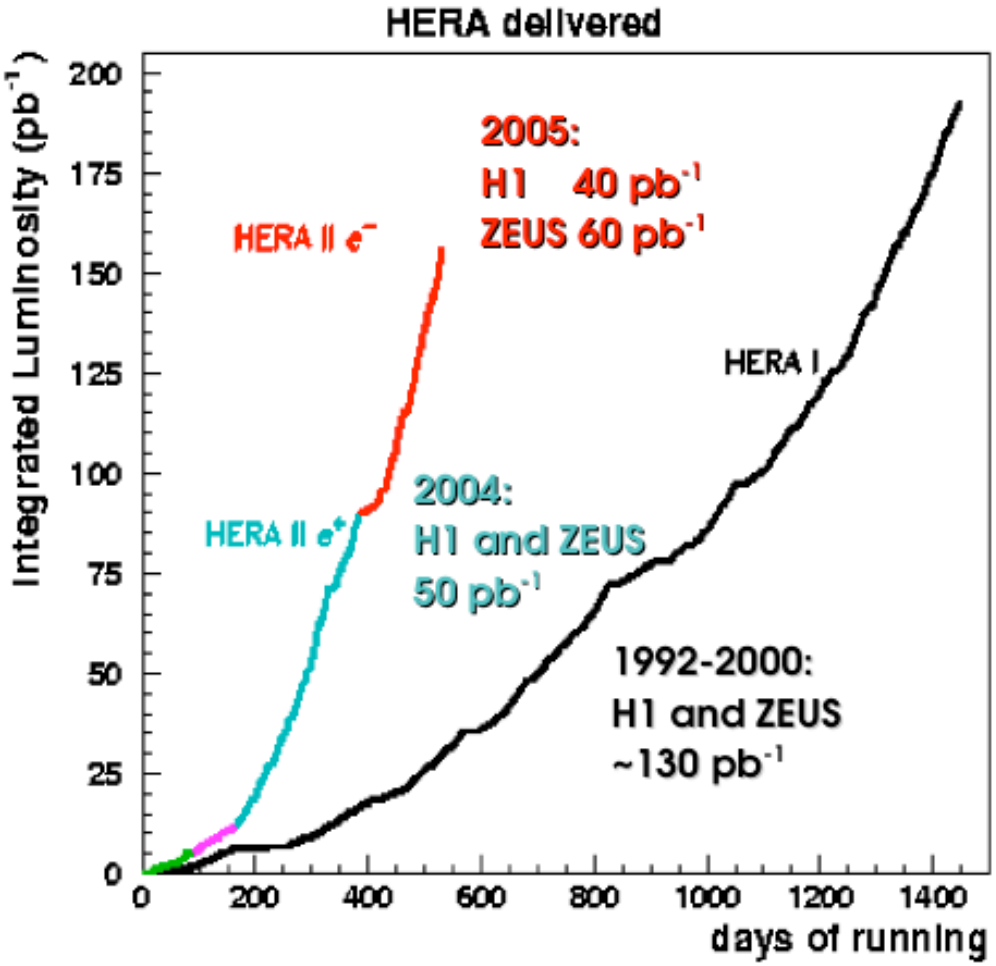
Ep COLLIDER and EXPERIMENTS





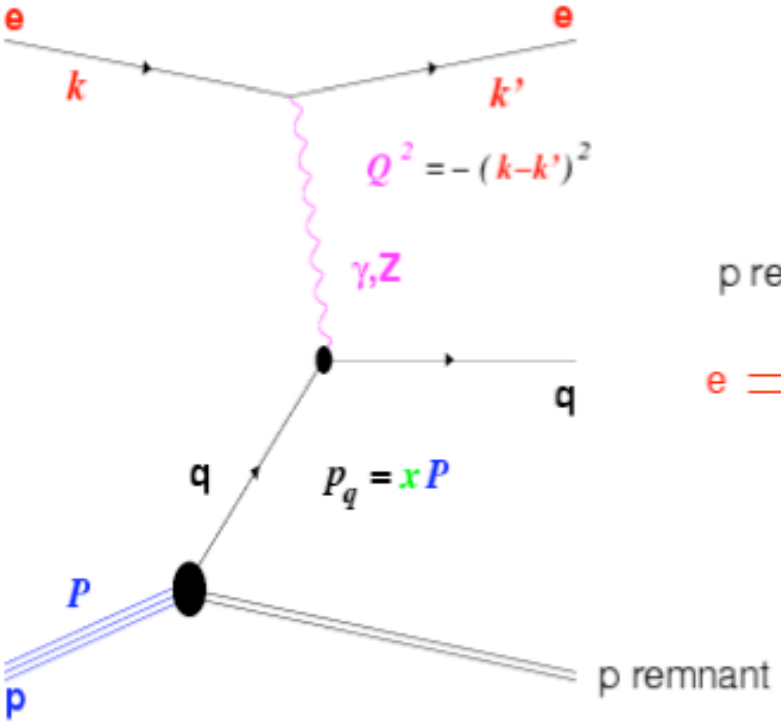
LUMINOSITY and POLARISATION



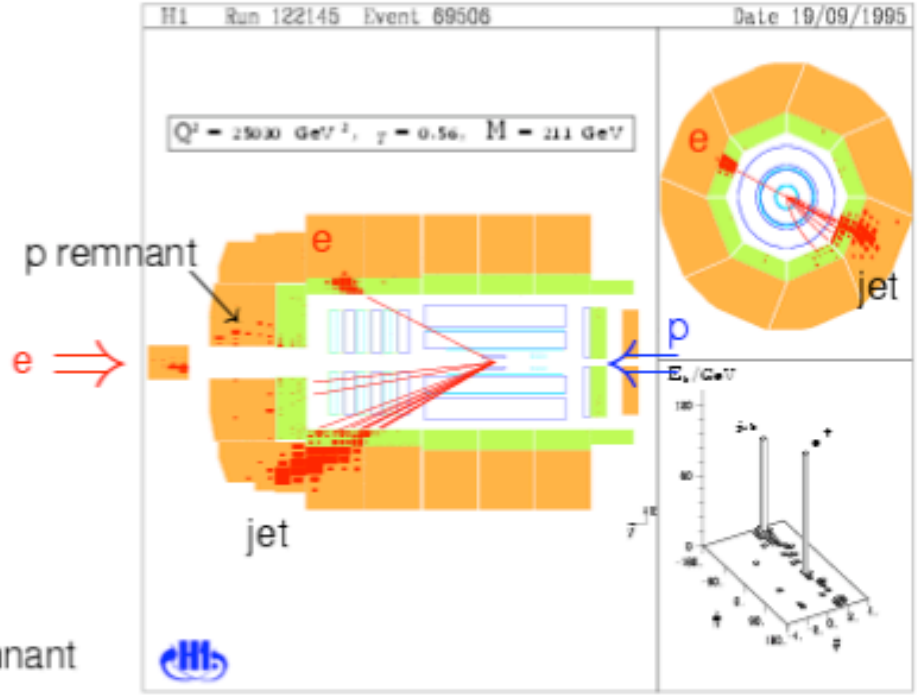


NEUTRAL CURRENT SCATTERING

deep inelastic scattering (DIS):

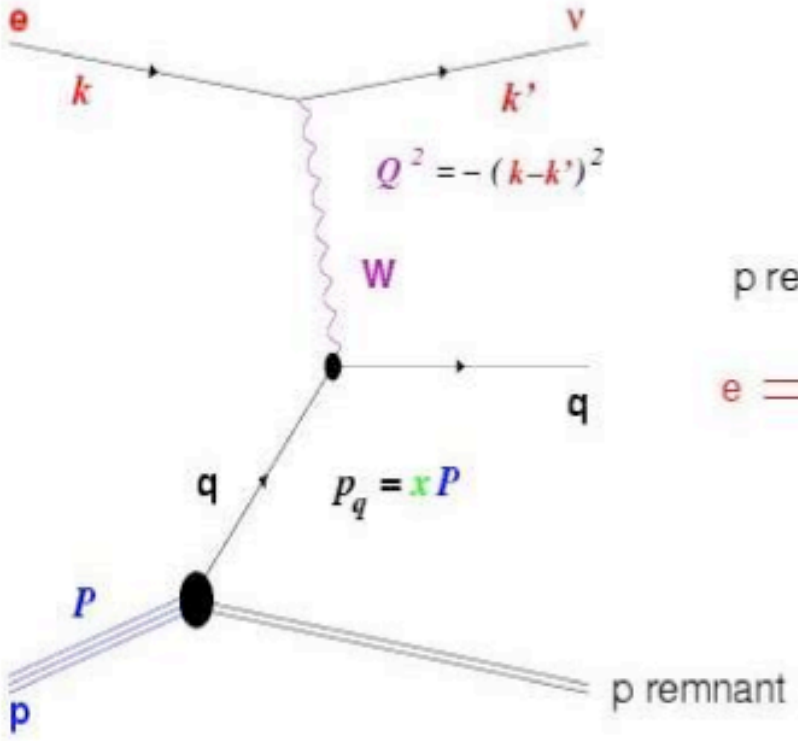


H1 detector

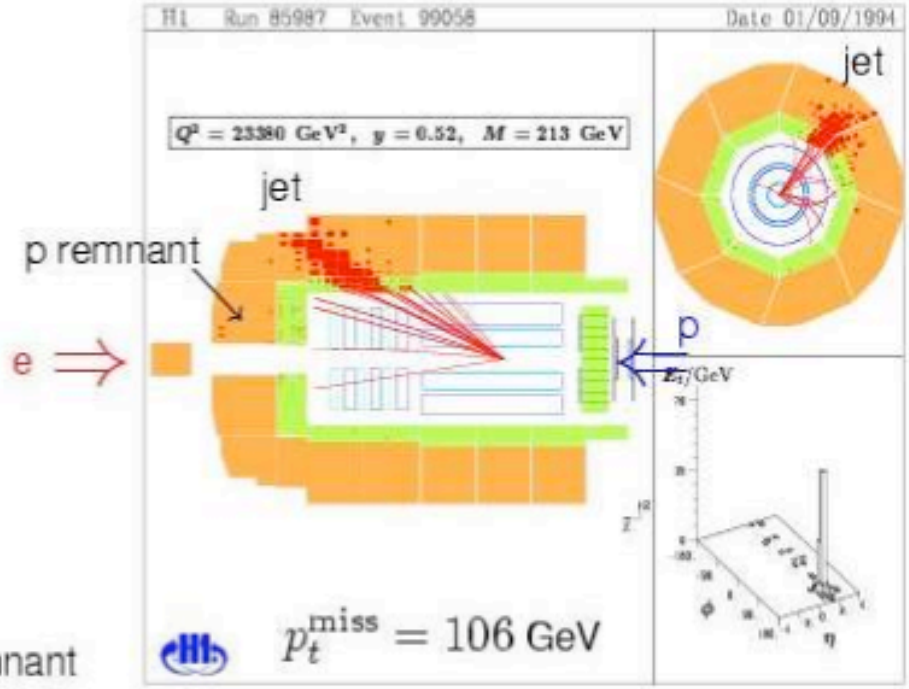


CHARGED CURRENT SCATTERING

deep inelastic (DIS) scattering:



H1 detector



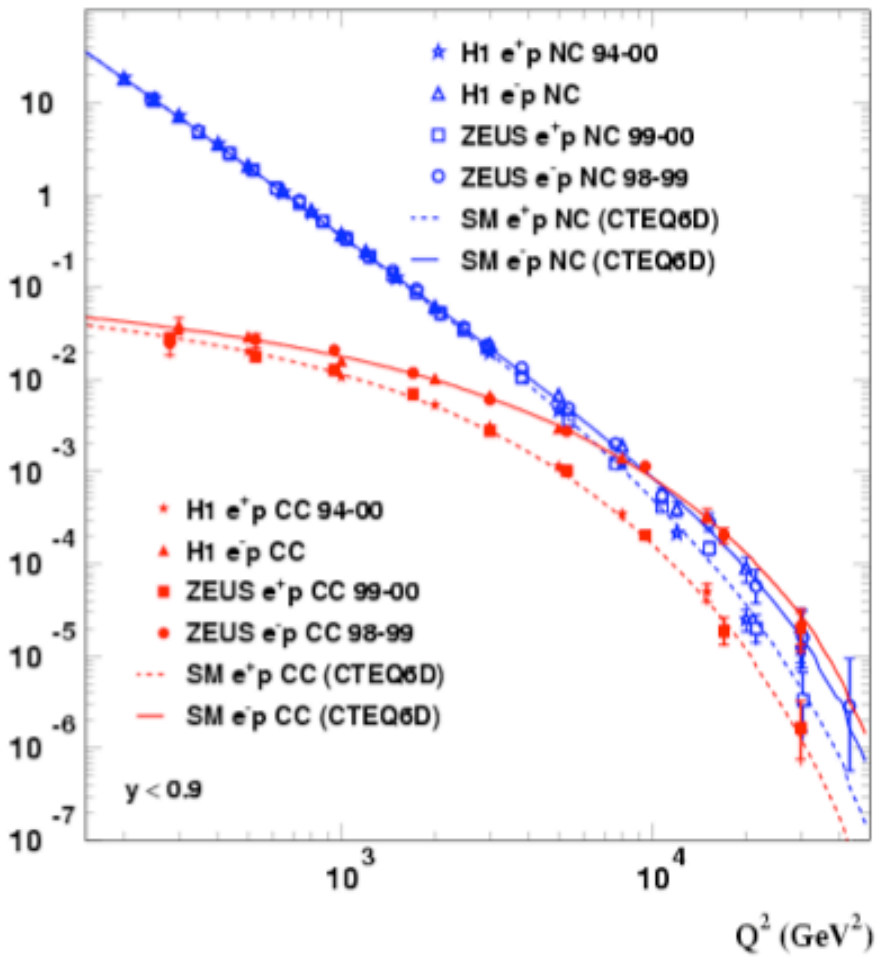
CC andNC SCATTERING XSECTION

$\sim 1/Q^4$

photon

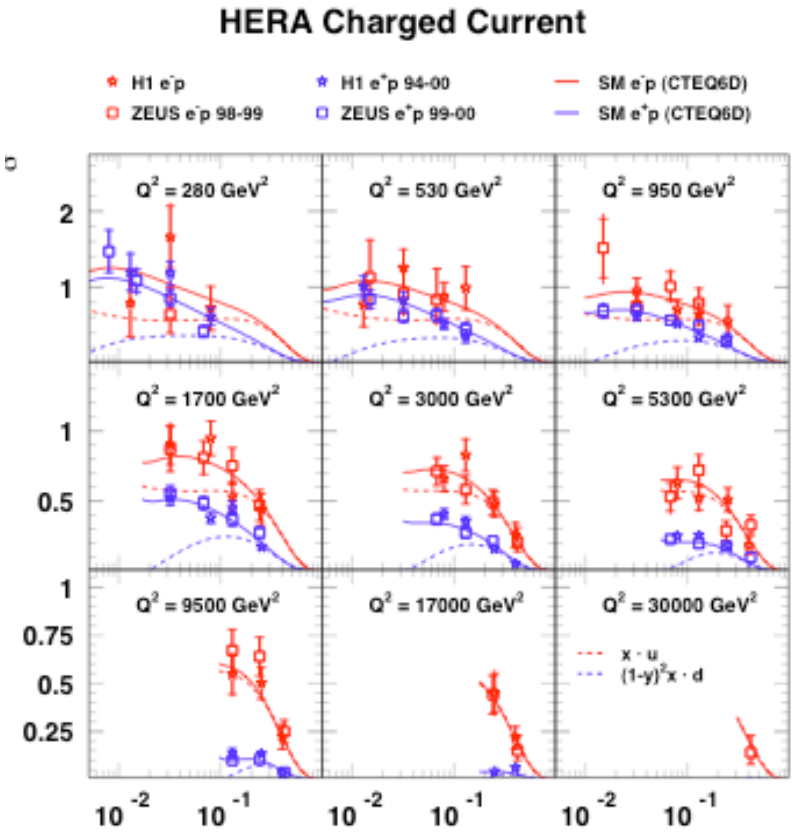
$\sim \left[\frac{M_W^2}{(Q^2+M_W^2)}\right]^2$

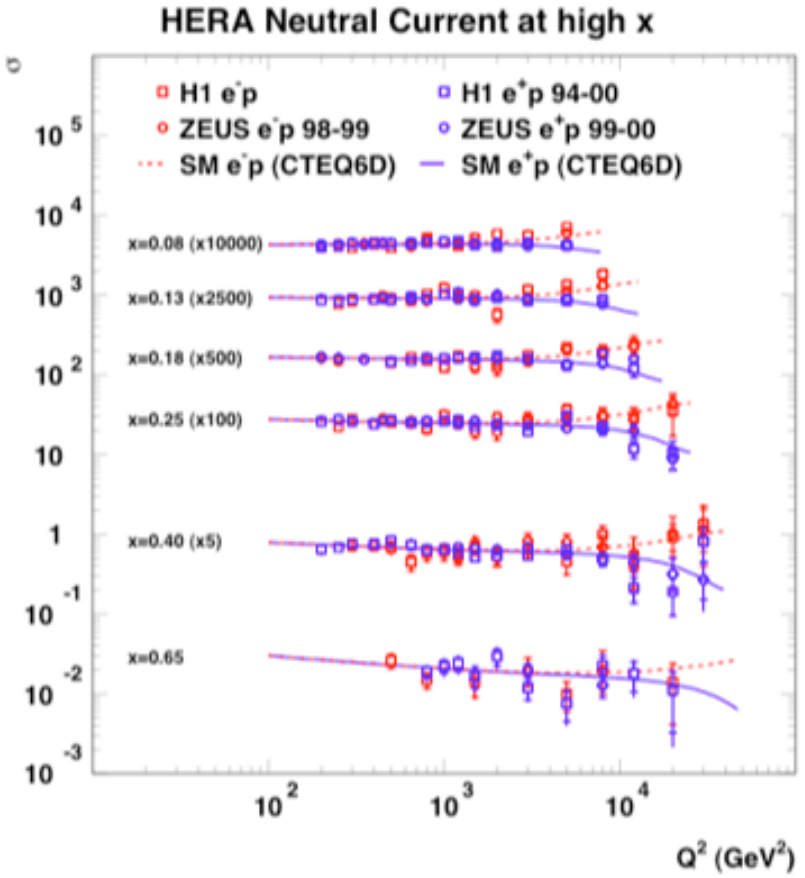
W boson



unification of electromagnetic and weak interations

HERA CC and NC DATA





CC XSECTION + STANDARD MODEL

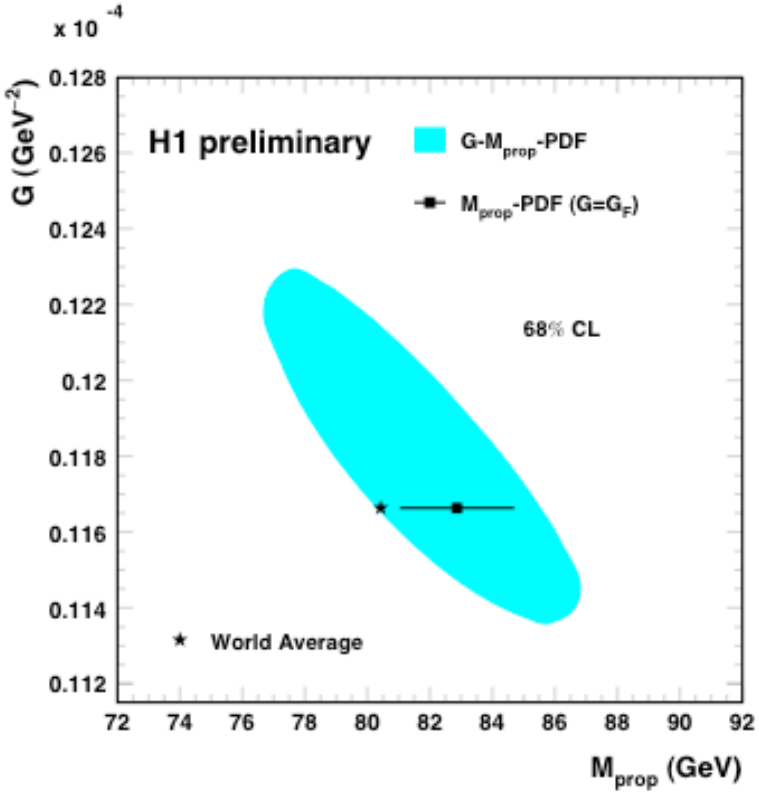
$$\frac{d^2\sigma^{\pm}_{CC}}{dx\,dQ^2} = \frac{G^2}{2\pi}\cdot\left(\frac{M_W^2}{Q^2+M_W^2}\right)^2\cdot\Phi^{\pm}(pdfs)$$

Mw is propagator mass (enters in Q2 dependency)
Fermi constant G includes most of the radiative corrections

$$\frac{d^2\sigma^{\pm}_{CC}}{dx\,dQ^2} = \frac{\pi\alpha^2}{4M_W^4\left(1-\frac{M_W^2}{M_Z^2}\right)^2}\cdot\frac{1}{|1-\Delta r|^2}\cdot\left(\frac{M_W^2}{Q^2+M_W^2}\right)^2\cdot\Phi^{\pm}(pdfs)$$

OMS scheme : Mw also enters in normalization
Radiative correction Δr computed in SM framework

W-MASS from PROPAGATOR



G-Mprop-QCD fit

➡ fix GF to the SM value and fit propagator mass with pdfs

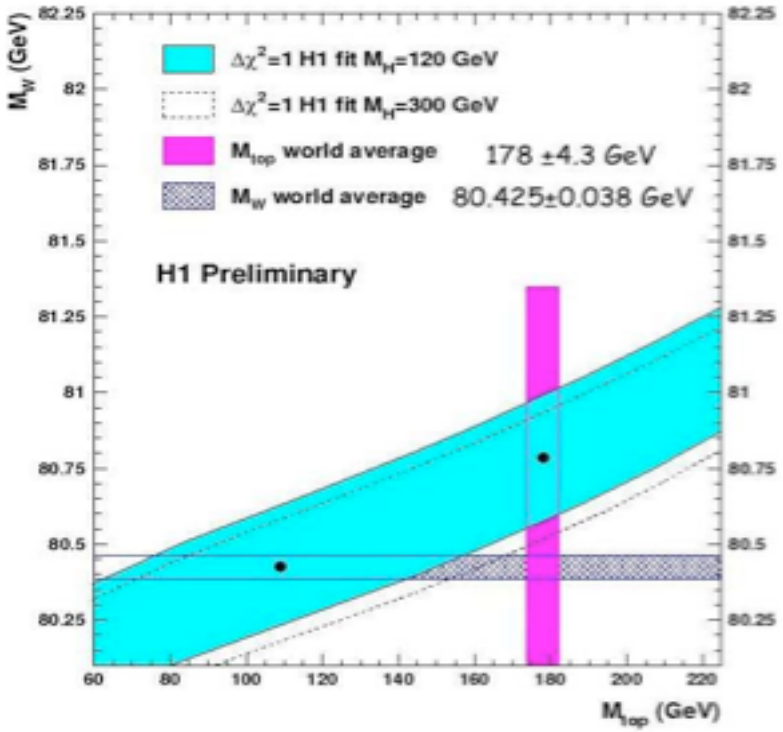
Pdfs fixed to H1PDF2000 fit
Mw= 82.370 ± 1.572 GeV

Fit of pdfs + Mw (as the propagator mass)

$$M_W = 82.87 \pm 1.83\,(\mathrm{exp})\,^{+0.30}_{-0.16}\,(\mathrm{mod})\ \mathrm{GeV}$$

Model uncertainties (α_s, Q_0^2,...)

STANDARD MODEL OMS SCHEME

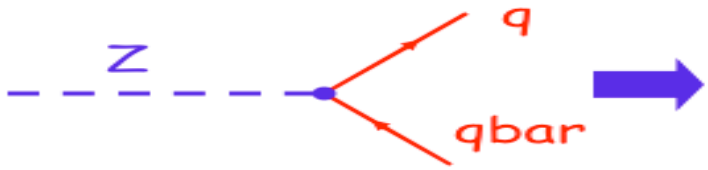


$$M_W = 80.786 \pm 0.207(\text{exp})\ ^{+0.048}_{-0.029}\ (\text{mod}) \pm 0.025\,(\text{top}) \pm 0.033\,(\text{th}) - 0.084\,(\text{Higgs})\ \text{GeV}$$

(120->300 GeV)

$$\Rightarrow \sin^2\theta_W = 0.2151 \pm 0.0040\,(\text{exp})\ ^{+0.0019}_{-0.0011}\ (\text{th})$$

QUARK COUPLINGS to Z and DIS



$$\frac{ig}{\cos\theta_W}\gamma^{\mu}\frac{v_q - a_q\gamma^5}{2}$$

$a_q = I_3^L$ Axial coupling, I^3=+1/2 for u, -1/2 for d

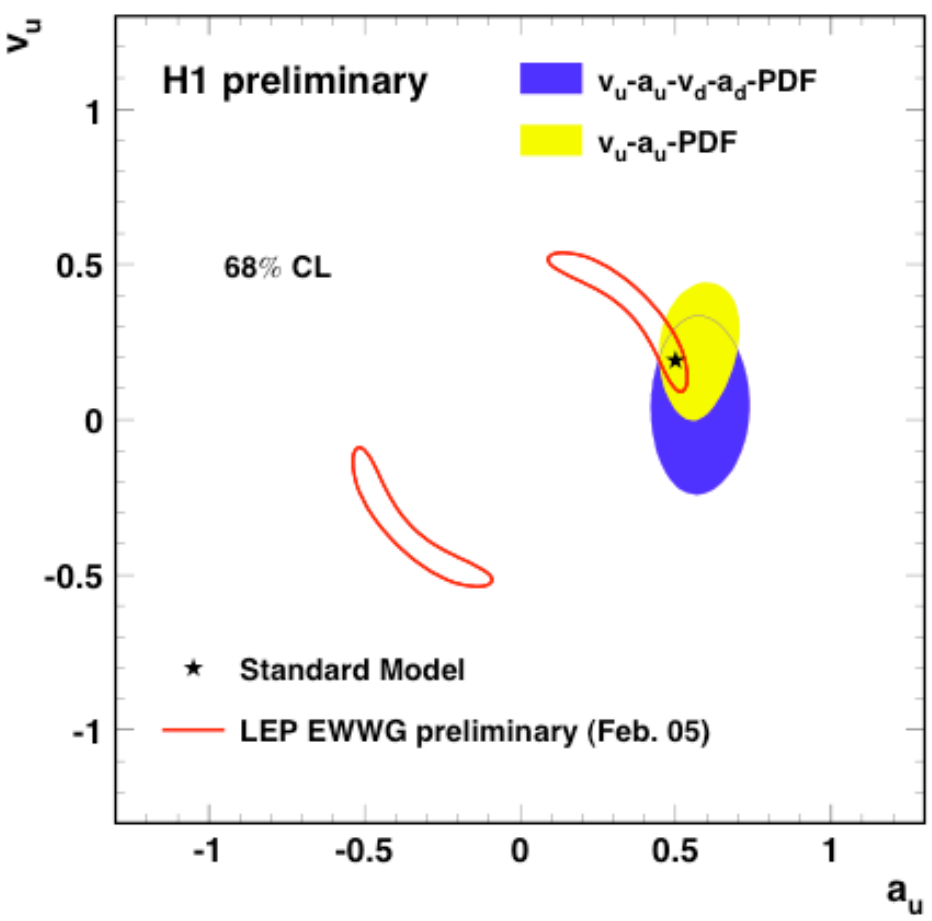
$v_q = I_3^L - 2e_q \sin^2\theta_W$ Vector coupling

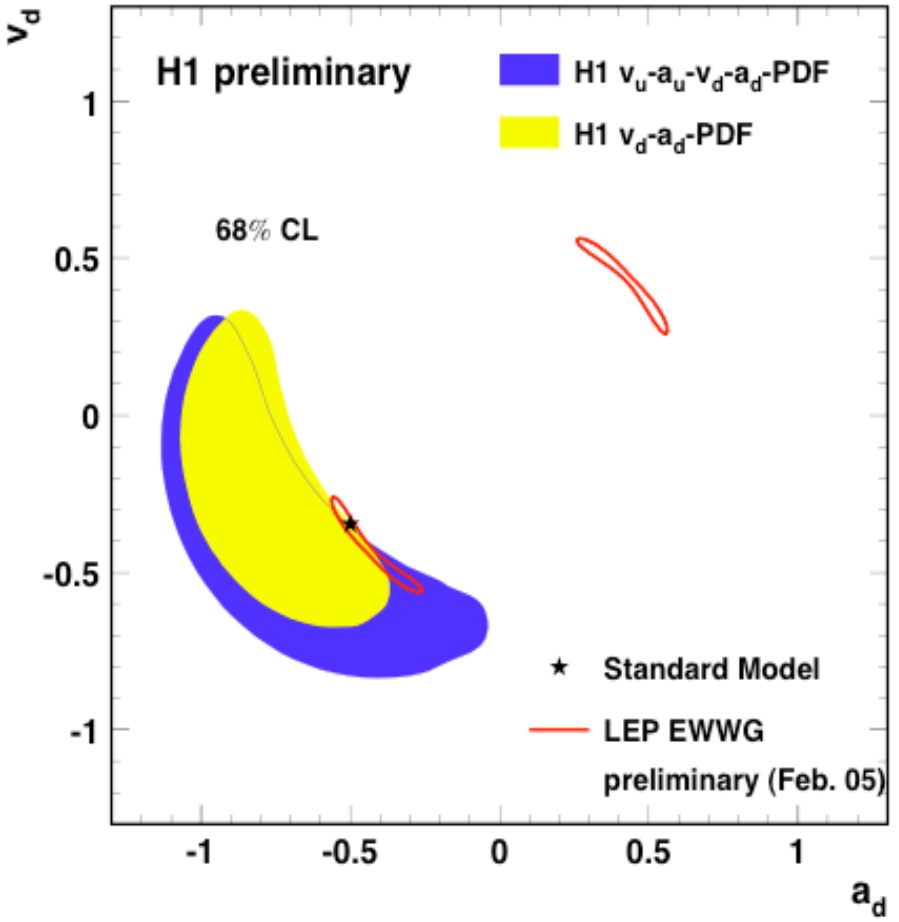
$$F_2 = \sum_q \left[e_q^2 - 2e_q v_q v_e \chi_Z + \left| v_q^2 + a_q^2 \right| \left| v_e^2 + a_e^2 \right| \chi_Z^2 \right] x(q+\bar{q})$$

$$xF_3 = \sum_q \left[-2e_q a_q a_e \chi_Z + 4 v_q a_q v_e a_e \chi_Z^2 \right] x(q-\bar{q})$$

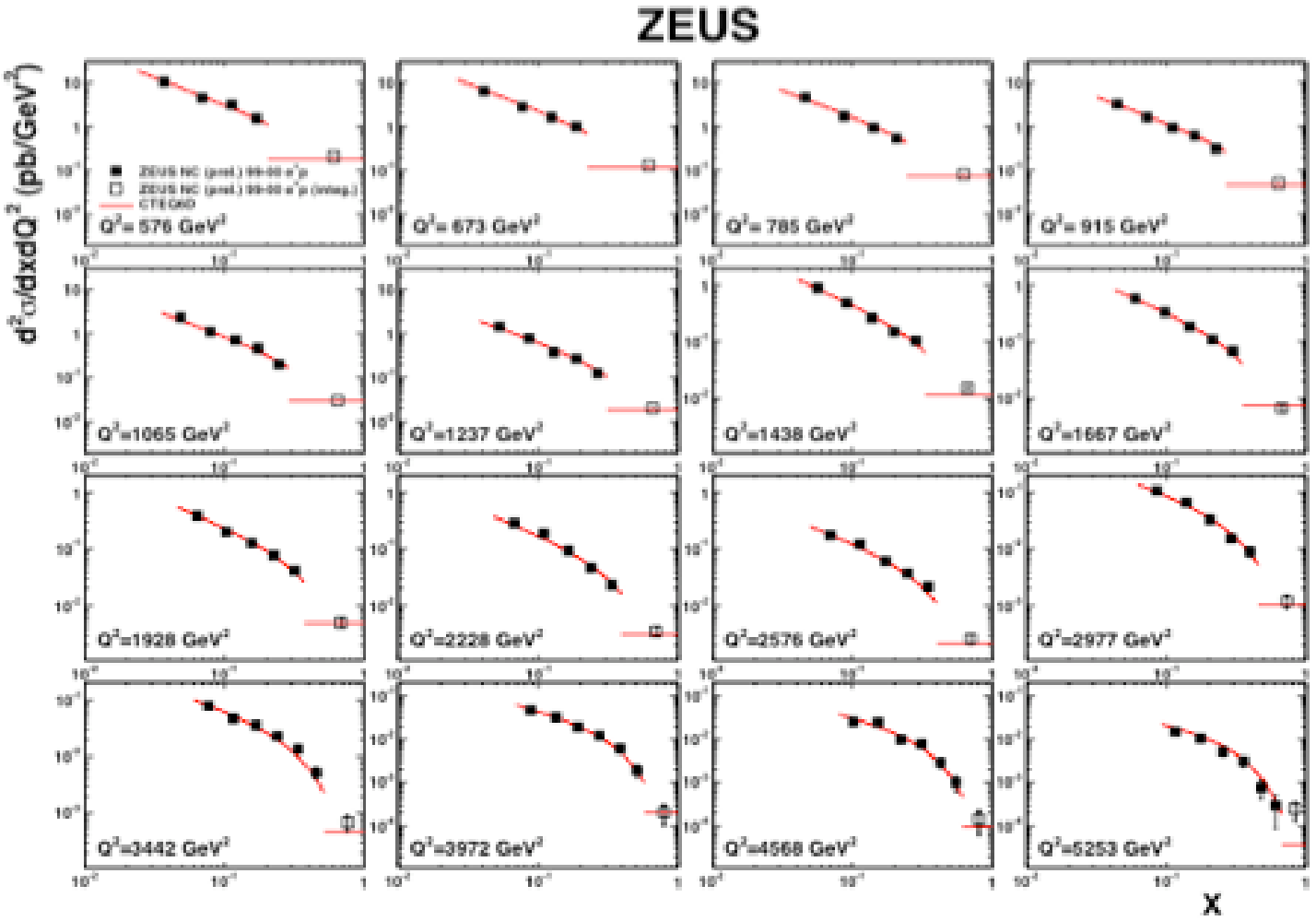
➡ Determination of the four a_U, v_U, a_D, v_D

RESULTS on U and D QUARKS

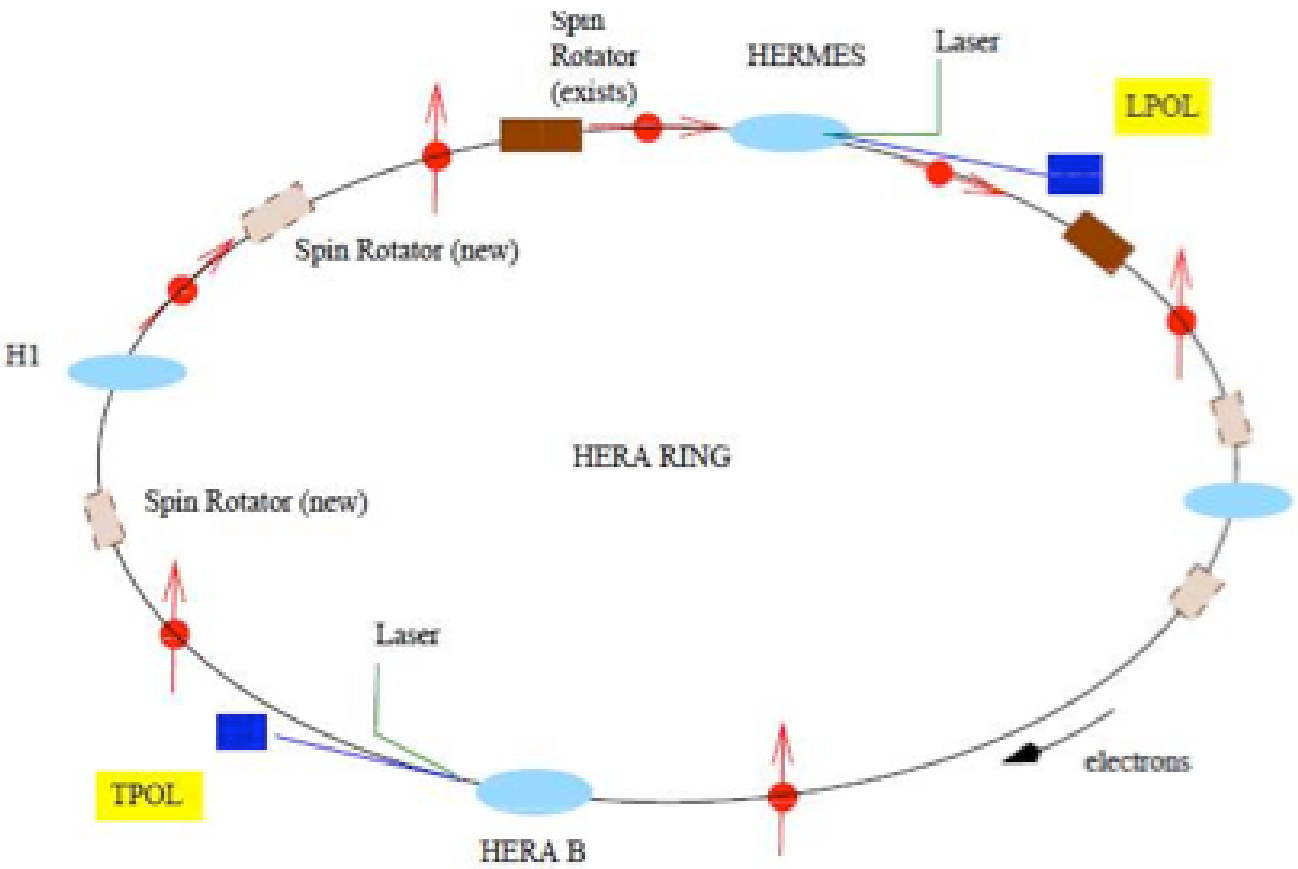




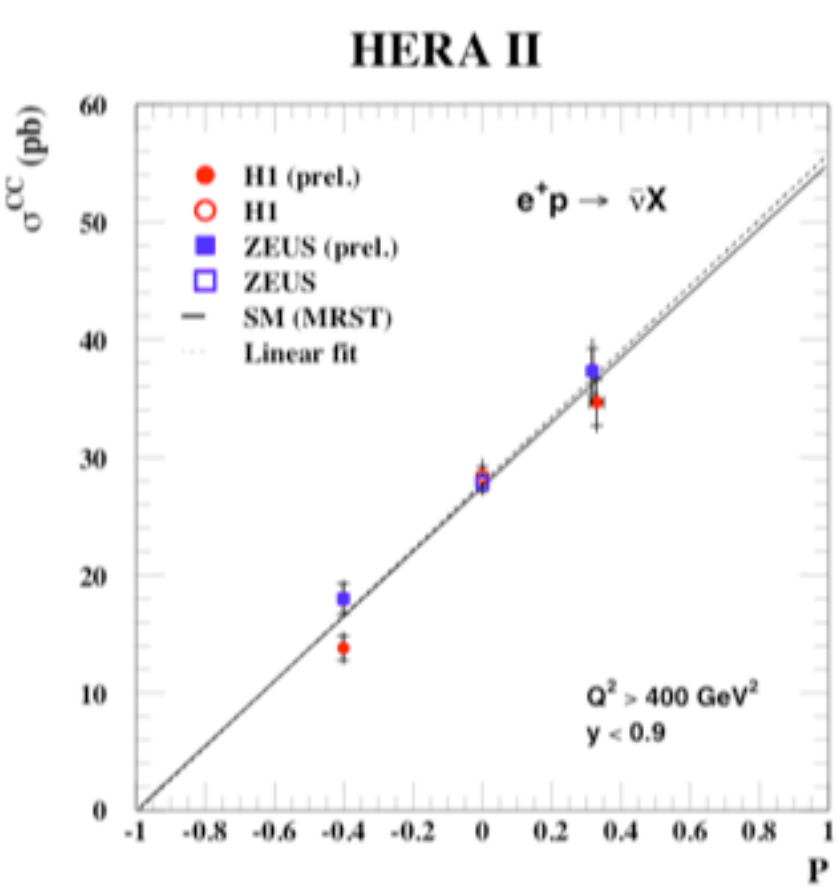
NC at large X Improvement ZEUS

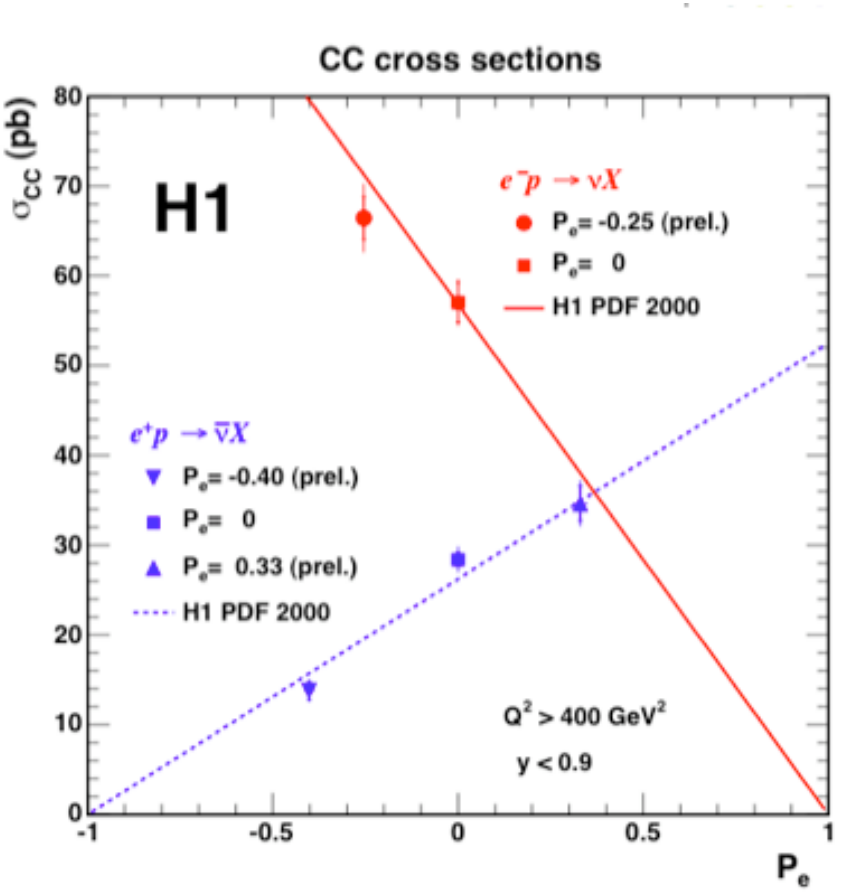


POLARISATION at HERA



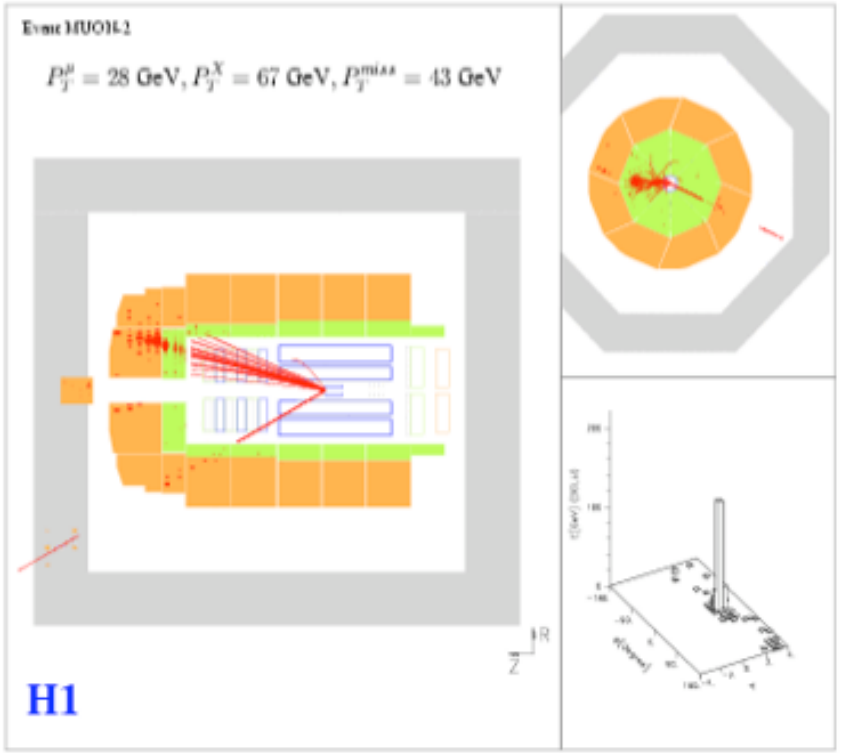
HERA SPIN DEP. XSECTION





HIGH Pt unbalanced LEPTON Events

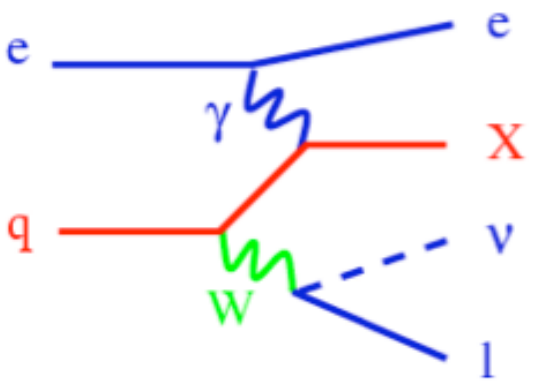
$e^+p \rightarrow \mu^+X + PTmiss$



- isolated lepton (e or μ)
- high hadronic p_T
- missing calorimeter p_T

Standard Model:

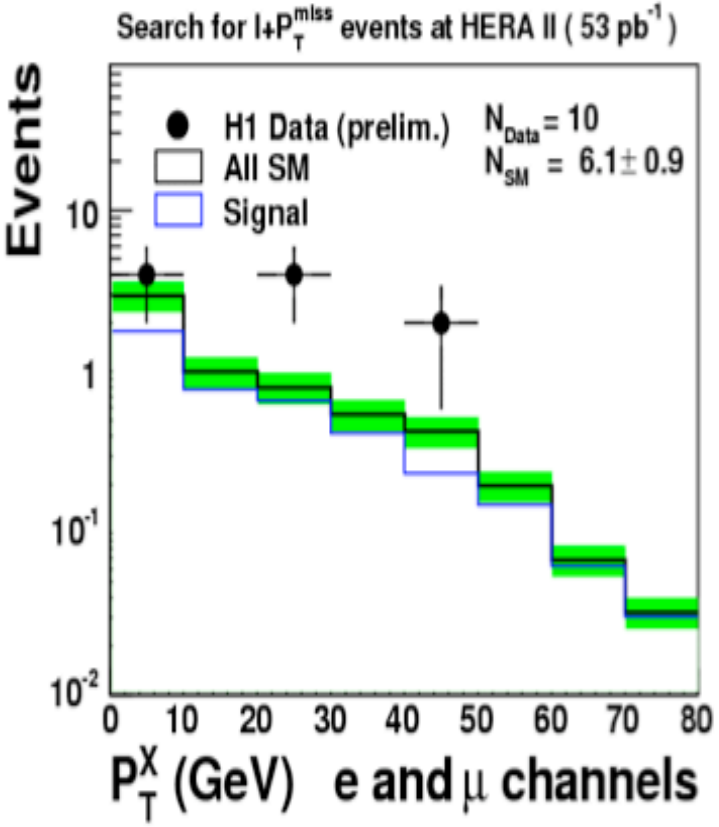
dominated by W production

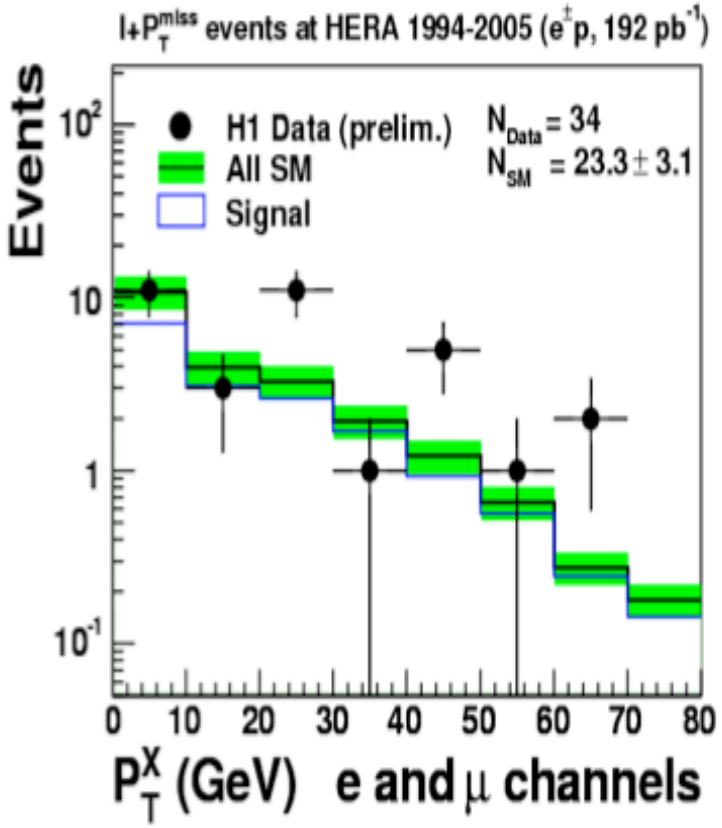


in NLO-QCD: Diener, C.S., Spira

Eur. Phys. J C 25 (2002) 405

Unbalanced LEPTON EVENTS



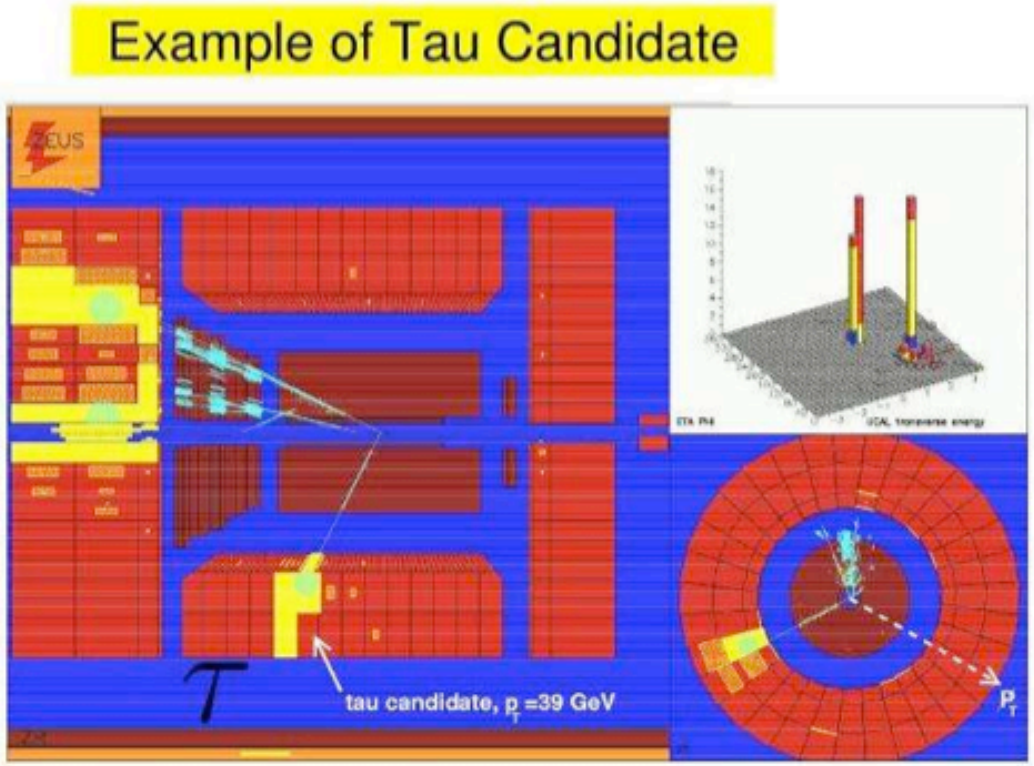


H1 and ZEUS RESULTS

H1 1994-2005 $\mathcal{L}(e^{\pm}p) = 192\ \mathrm{pb}^{-1}$	Electron obs./exp.	Muon obs./exp.	Tau$^{\mathrm{prel.}}$ obs./exp.	W contrib. $e\mu\,(\tau)$
Full sample	25/18.4 $\pm$2.5	9/4.9 $\pm$0.8	5 / 5.81 $\pm$1.36	$\approx$75(15)%
$P_T^X > 25$ GeV	11/2.9 $\pm$0.6	6/2.9 $\pm$0.6	0 / 0.53 $\pm$0.10	$\approx$85(50)%

ZEUS 1994-2000 $\mathcal{L}(e^{\pm}p) = 130\ \mathrm{pb}^{-1}$	Electron obs./exp.	Muon obs./exp.	Tau obs./exp.	W contrib. $e\mu\,(\tau)$
Full sample	24 / 20.6 $\pm$3.2	12 / 11.9 $\pm$0.6	3 / 0.4 $\pm$0.12	$\approx$17(48)%
$P_T^X > 25$ GeV	2 / 2.9 $\pm$0.46	5 / 2.75 $\pm$0.21	2 / 0.2 $\pm$0.05	$\approx$50(50)%

ZEUS Tau EVENT

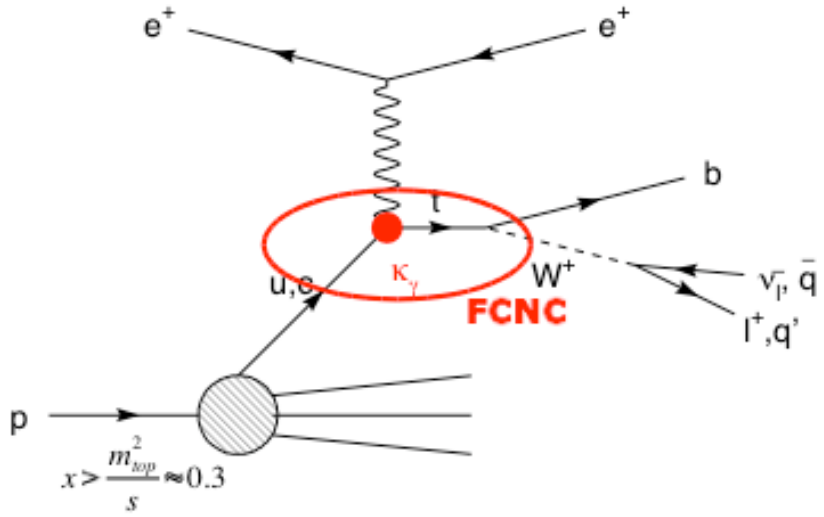


$P_T^{CAL} = 39\ GeV \quad P_T^{X} = 37\ GeV \quad M_T = 68\ GeV$

τ jet: collimated "pencil like"

Single TOP PRODUCTION?

Motivation: explains the large hadronic Transverse Momenta observed in the "Isolated Lepton" Events as P_T of b-Jets resulting from t → bW Decays



- SM single top Production highly suppressed (σ < 1fb)
- Flavour-Changing Neutral Current (FCNC) Interactions may yield observable Cross-Sections

LIMITS on FCNC TOP

Semi-leptonic Channel

$\sigma = 0.41^{+0.29}_{-0.19}$ pb

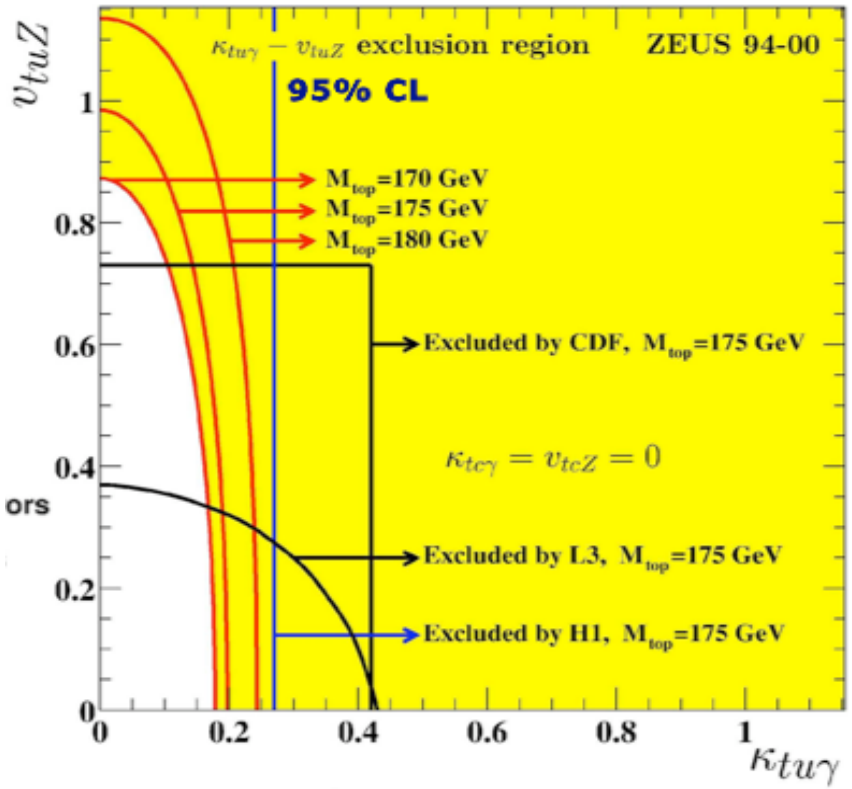
Hadronic Channel

$\sigma = 0.04^{+0.27}_{-0.23}$ pb

Combined Channel.

$\sigma = 0.29^{+0.15}_{-0.14}$ pb

$\kappa_{tu\gamma} = 0.20^{+0.05}_{-0.06}$



→ These Limits do not exclude the Interpretation of the "Isolated Lepton" Events as resulting from Decays of single top Quarks produced by FCNC Interactions

SUMMARY