Exclusive vector mesons production at low t in ZEUS

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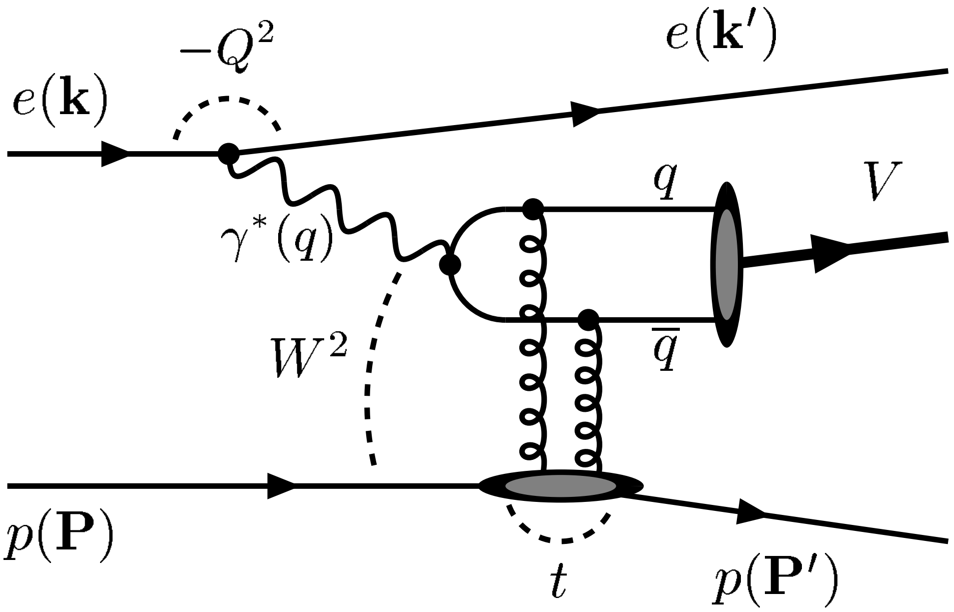
for
the ZEUS collaboration

INTRODUCTION.



$$\frac{d\sigma_L}{dt}|_{t=0} = \frac{A}{Q^6}\alpha_s^2(Q^2)\left|\left(1+\frac{i\pi}{2}\frac{d}{d\ln x}\right)xg(x,Q^2)\right|^2 ,$$

(pQCD prediction).

$$Q^2 \equiv -(k-k^{'})^2 \quad W^2 \equiv (p+q)^2$$

$$s \equiv (p+k)^2 \quad t \equiv (p-p^{'})^2$$

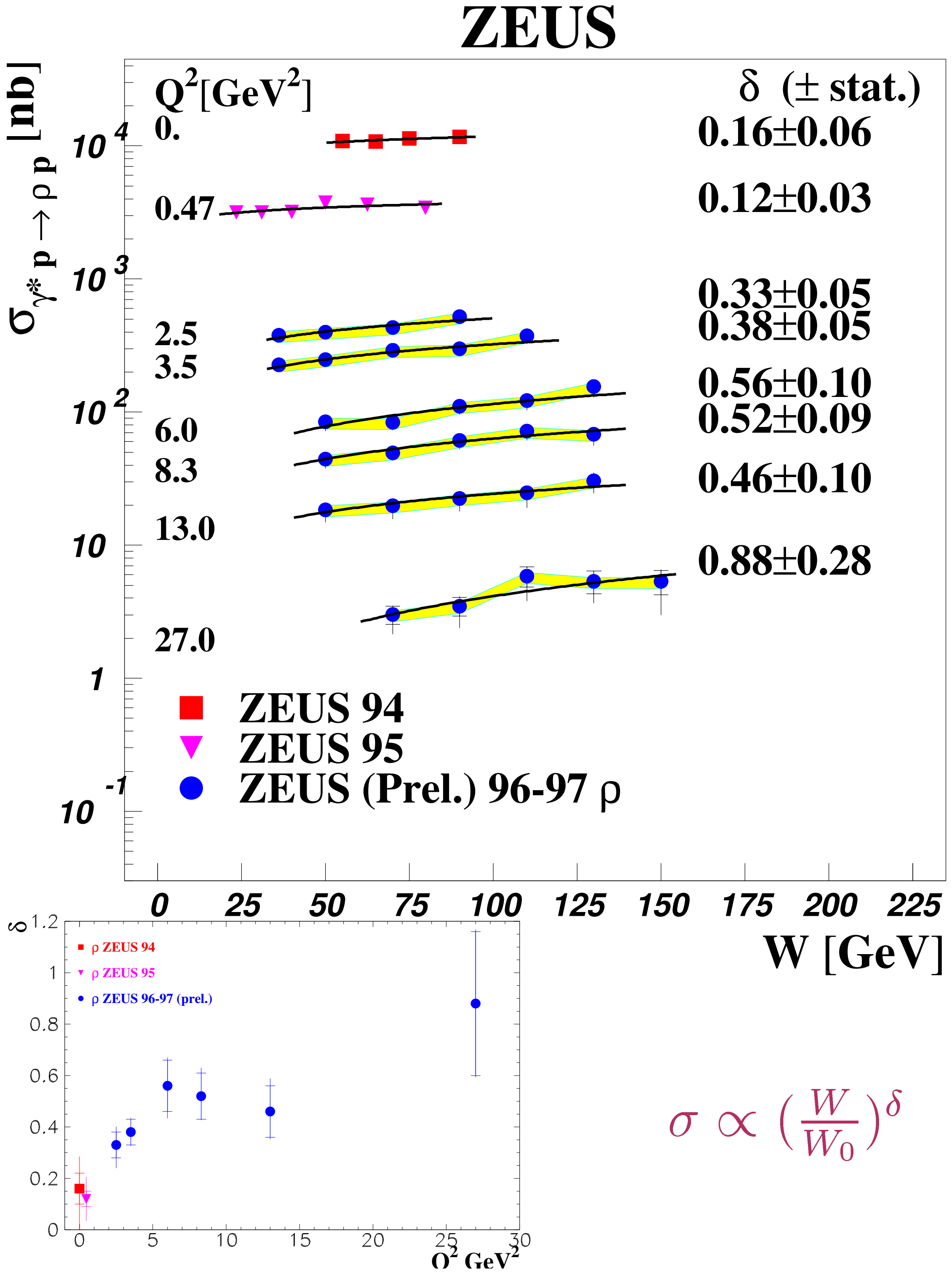
$$x \equiv \frac{Q^2}{2pq} \quad y \equiv \frac{2pq}{2pk}$$

INTRODUCTION.

- ZEUS new results since last DIS conference.
  - DIS ρ
    - $\sigma(W)$, in bins of Q^2.
    - $\sigma(Q^2)$, at $< W >= 75\,\mathrm{GeV}$.
    - $R(Q^2) = \frac{\sigma^{\gamma_L^* p}}{\sigma^{\gamma_T^* p}}$, at $< W >= 75\,\mathrm{GeV}$.
    - $R(W) = \frac{\sigma^{\gamma_L^* p}}{\sigma^{\gamma_T^* p}}$, in bins of Q^2.
    - $\sigma^{\gamma_L^* p}(Q^2)$ and $\sigma^{\gamma_T^* p}(Q^2)$, separately at $< W >= 75\,\mathrm{GeV}$.
    - $\alpha_{I\!P}(t)$ $\frac{d\sigma}{dt}$ at fixed t
  - DIS J/ψ
    - $\sigma(W)$, in bins of Q^2.
    - $\sigma(Q^2)$, at $< W >= 90\,\mathrm{GeV}$.
    - $R(Q^2) = \frac{\sigma^{\gamma_L^* p}}{\sigma^{\gamma_T^* p}}$, at $< W >= 75\,\mathrm{GeV}$.
  - Photoproduction J/ψ, $\sigma(W)$, extension of W range.
- Comparison with previous results.
- Conclusions.

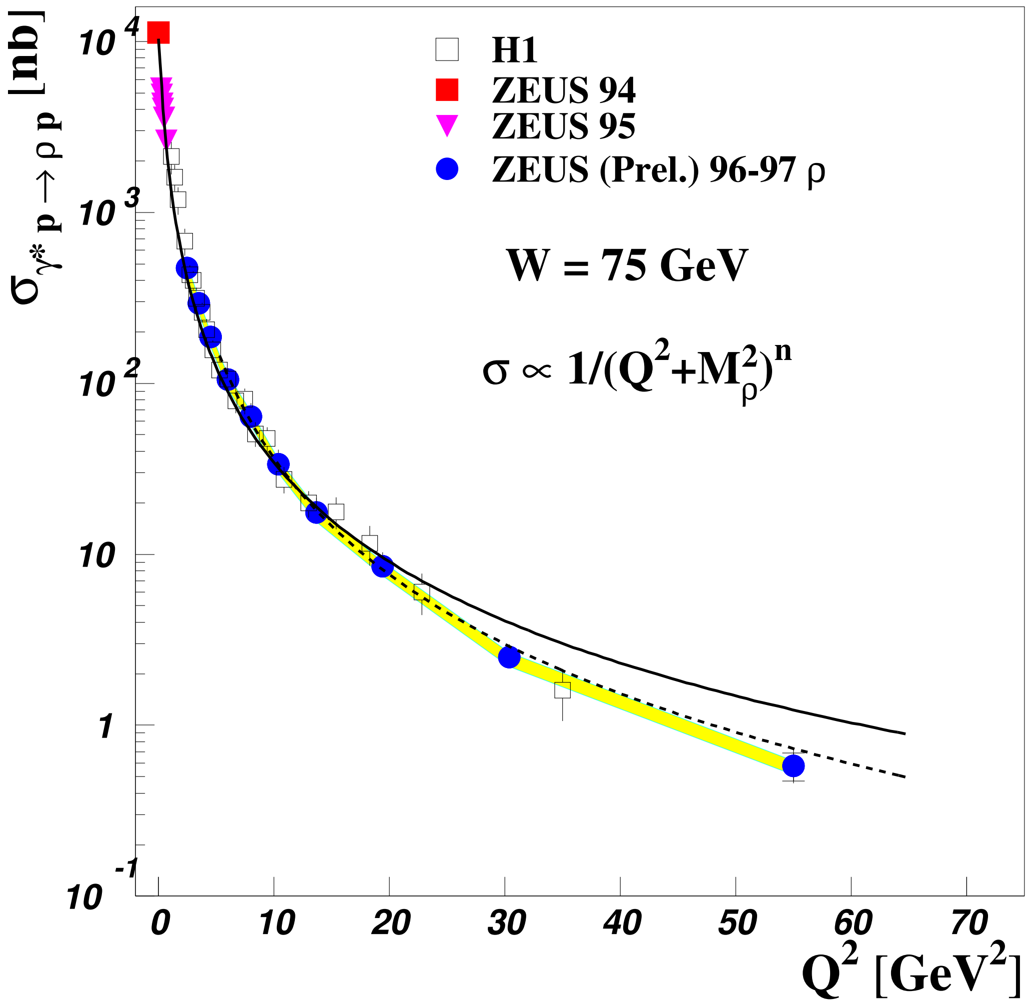
$\sigma_{\gamma * p \rightarrow \rho p}(Q^2, W)$

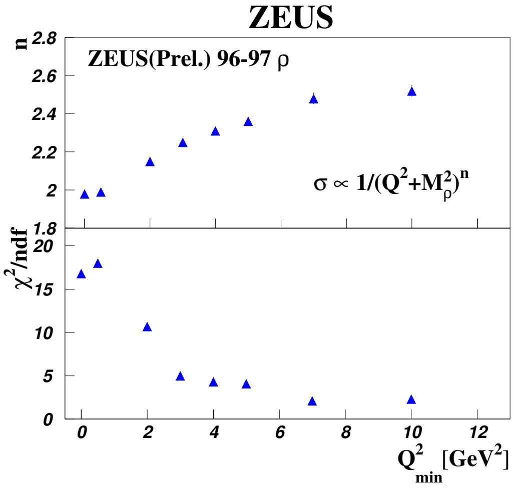
systematic error due to proton dissociation contamination, $(\delta_{cor} = 24^{+9}_{-5})\%$ (ZEUS 95)



$$\sigma \propto \left(\frac{W}{W_0}\right)^{\delta}$$

$\sigma_{\gamma * p \to \rho p}(Q^2)$





$Q^2 \geq 0\,\mathrm{GeV}^2$, $n = 1.85 \pm 0.06$

$\chi^2/ndf = 17.3$

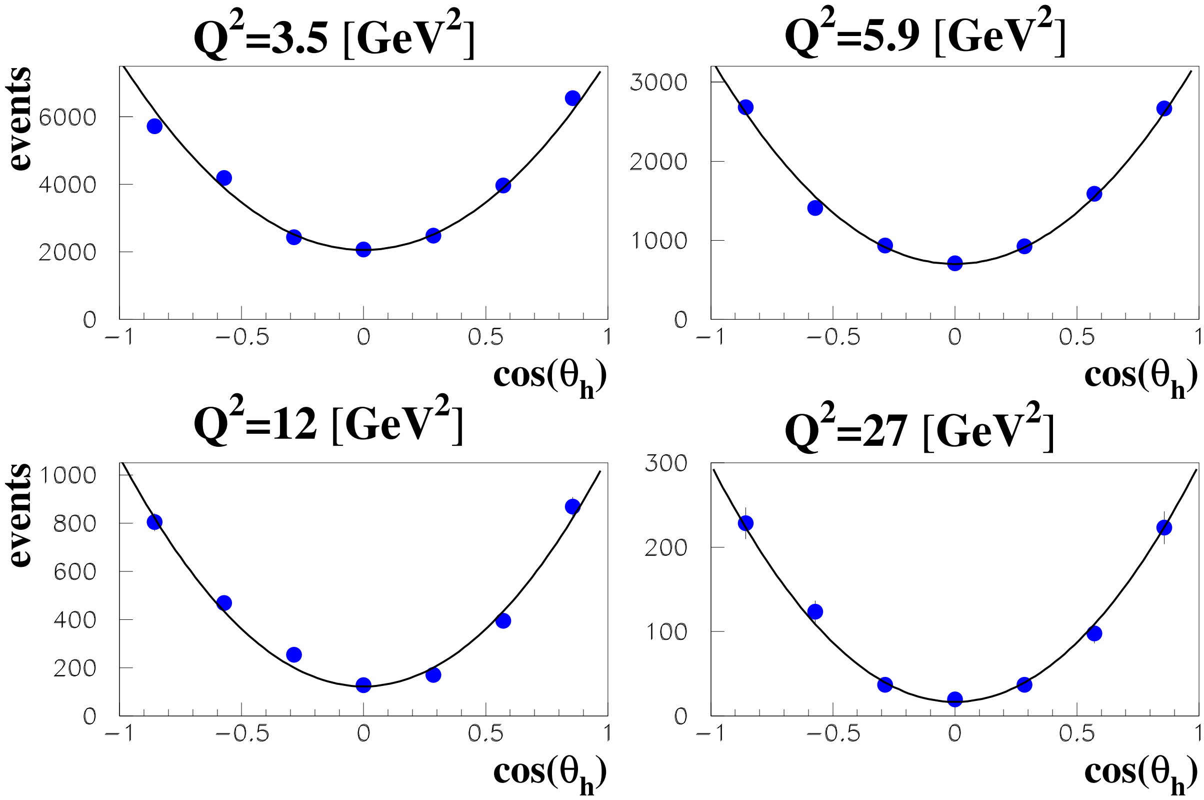
$Q^2 \geq 5\,\mathrm{GeV}^2$, $n = 2.36 \pm 0.04$

$\chi^2/ndf = 2.6$.

$cos(\theta_h)$ DISTRIBUTION

$$W(cos(\theta_h)) = \frac{3}{8\pi}(1 - r^{04}_{00}) + (3r^{04}_{00} - 1)cos^2(\theta_h)\,.$$

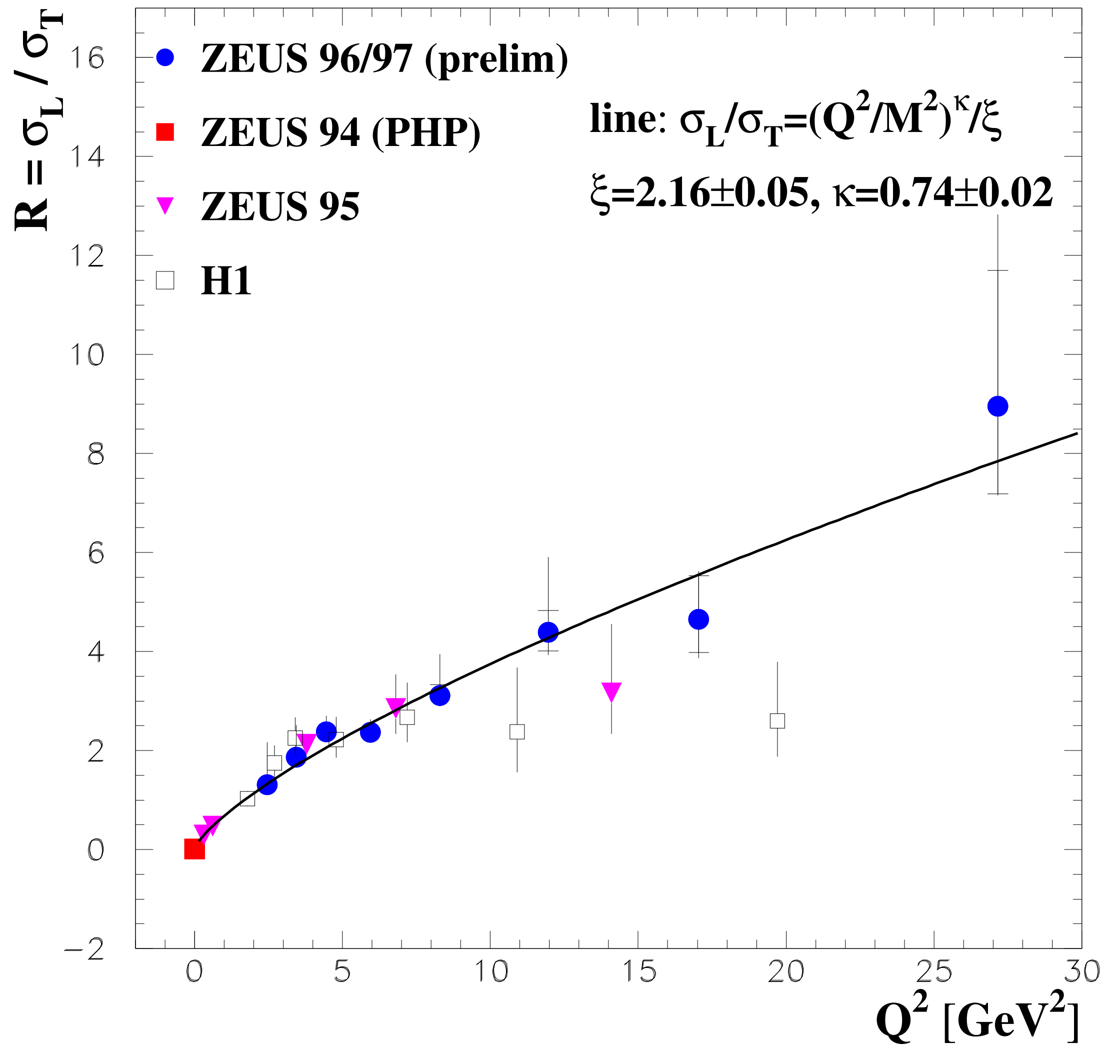
distribution in bins of Q^2 and W.



$\sigma^{\gamma^*_L p\rightarrow\rho p}/\sigma^{\gamma^*_L p\rightarrow\rho p}$

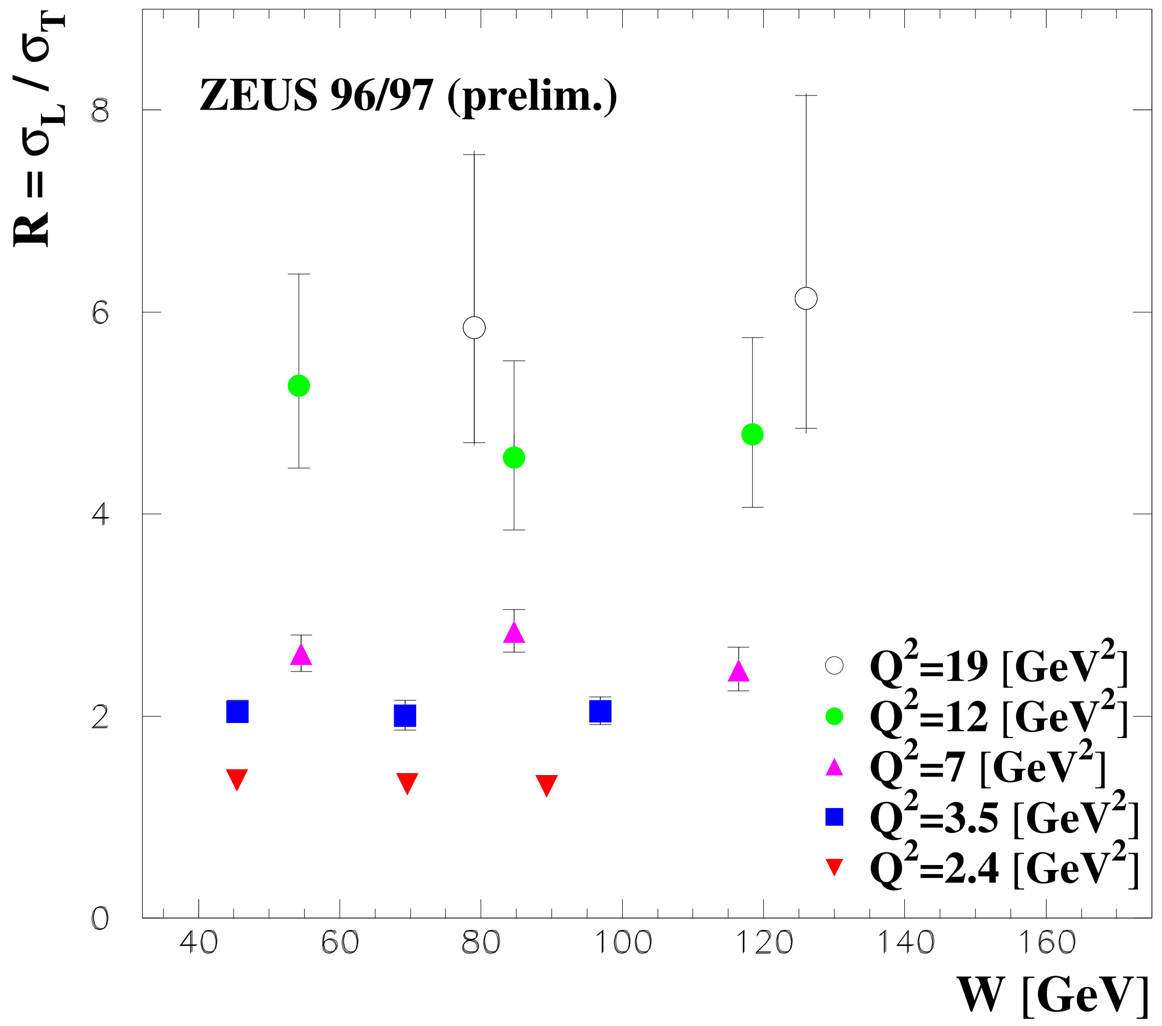
$$R = \frac{1}{\epsilon}\frac{r^{04}_{00} - \Delta^2}{1-(r^{04}_{00}-\Delta^2)},\ r^{04}_{00} \gg \Delta^2 \Rightarrow \frac{\sigma^{\gamma^*p}_L}{\sigma^{\gamma^*p}_{TOT}} \cong r^{04}_{00}$$

(Δ - measure of SCHNC; $\Delta = 0.079 \pm 0.016$ (ZEUS 95))



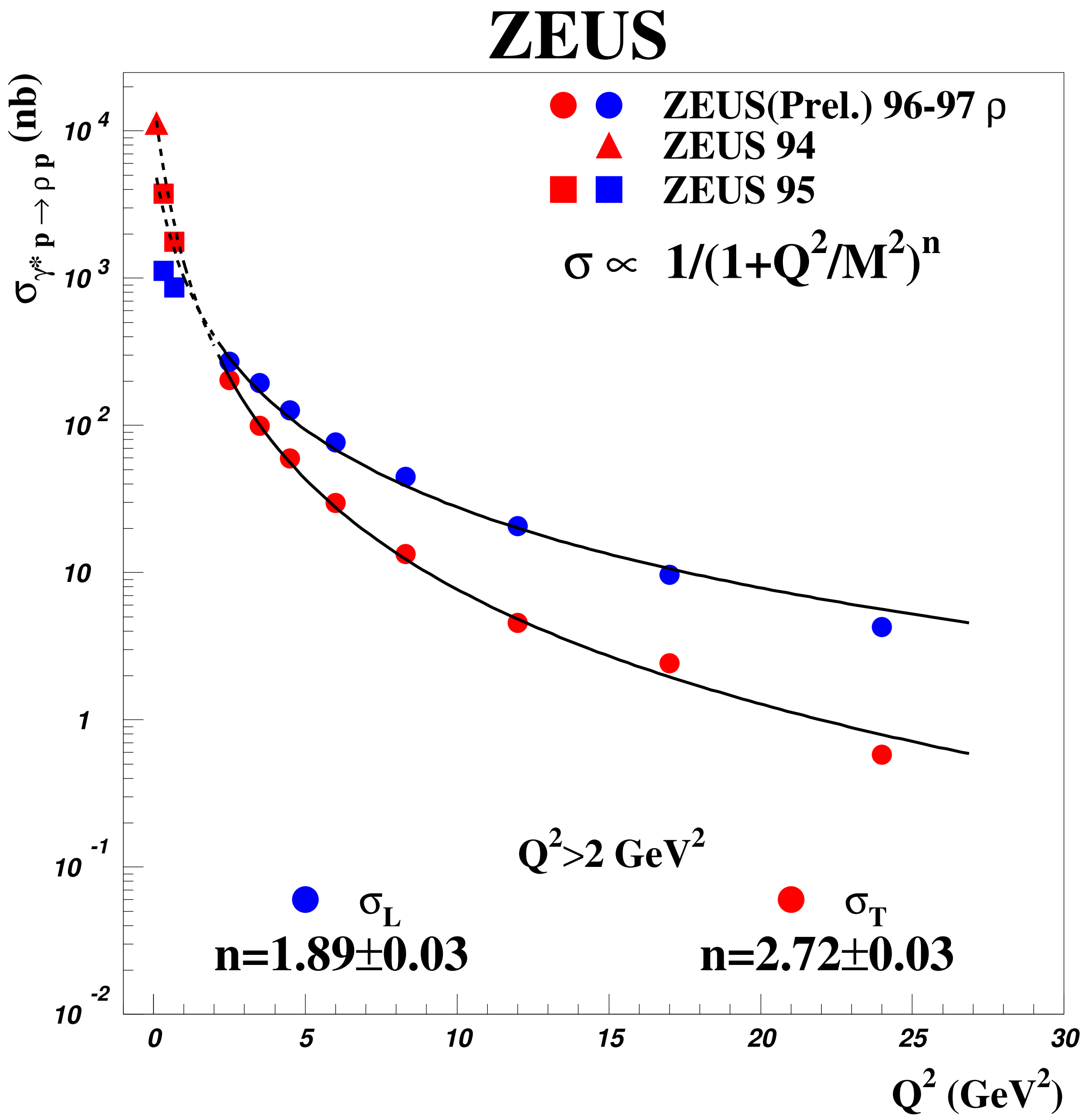
R INCREASES WITH Q^2.

$R(W)$ FOR FIXED Q^2



NO W DEPENDENCE.

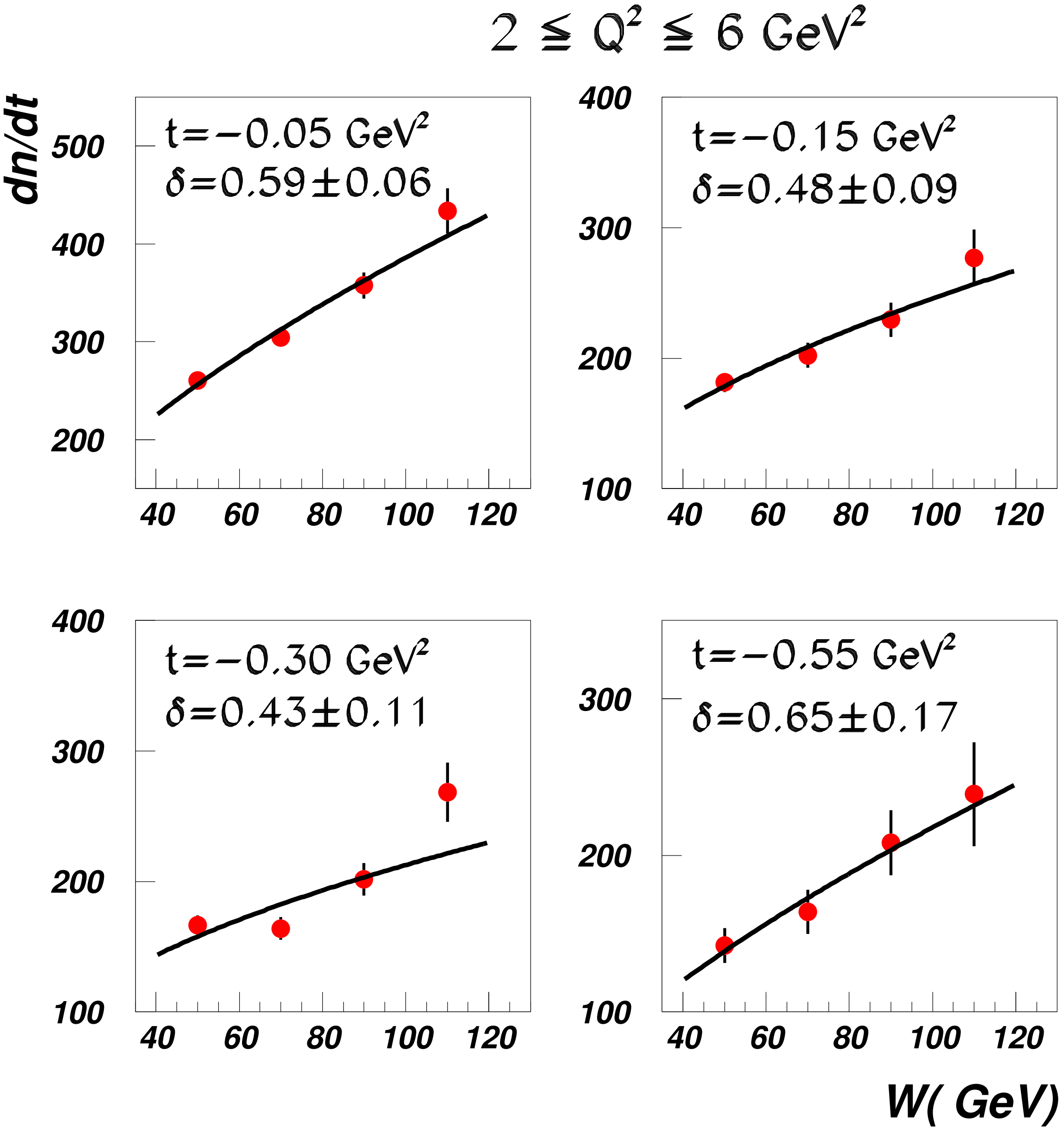
$\sigma_{\gamma^*_{L,T}p\rightarrow\rho p}(Q^2)$



SEPARATE MEASUREMENT OF σ_L AND σ_T

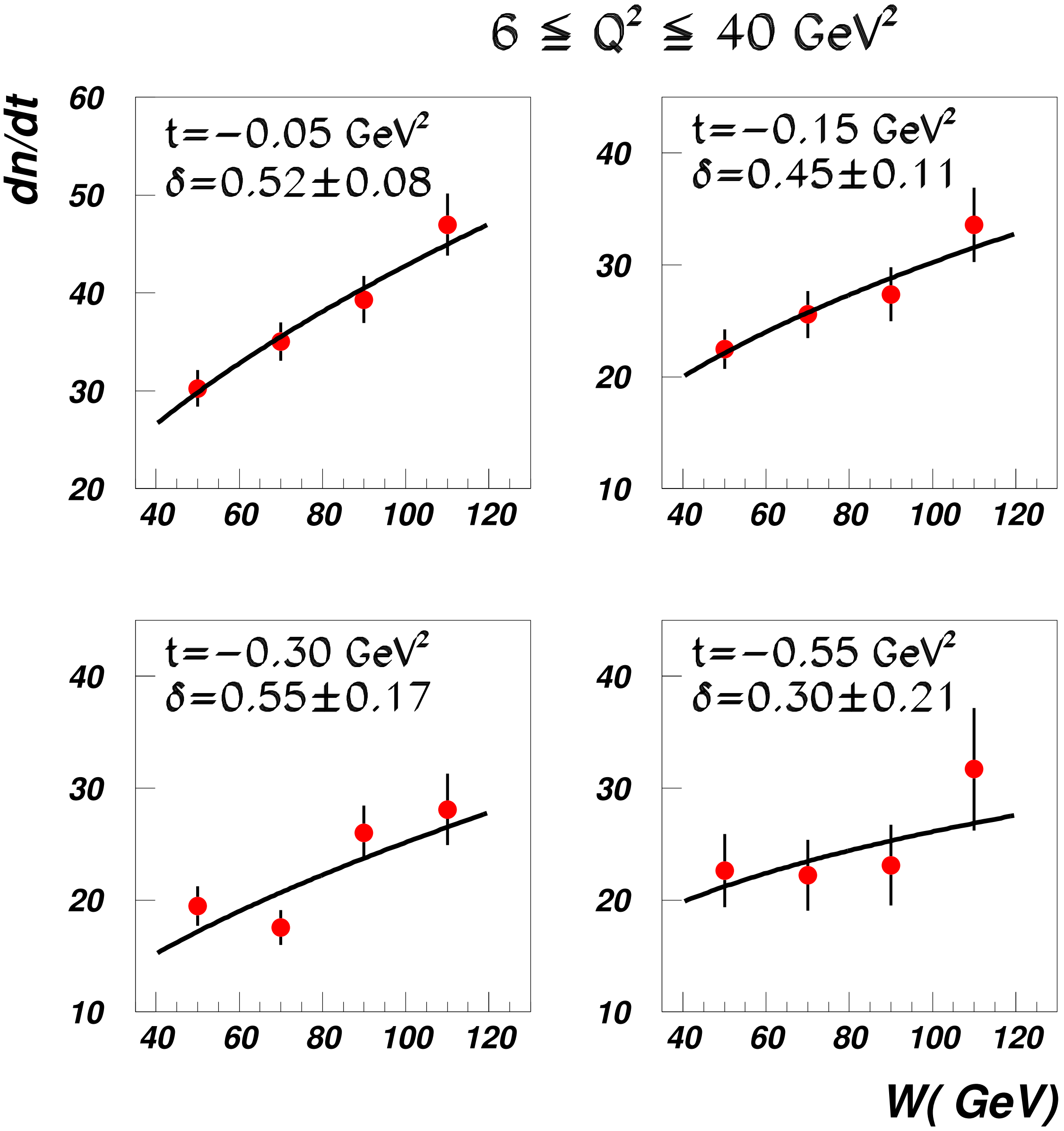
$\alpha_{I\!P}(t)$ EXTRACTION.

$\frac{dN}{dt} \propto (\frac{W}{W_0})^{\delta}$, Four t bins for $2 < Q^2 < 6\,\mathrm{GeV}^2$



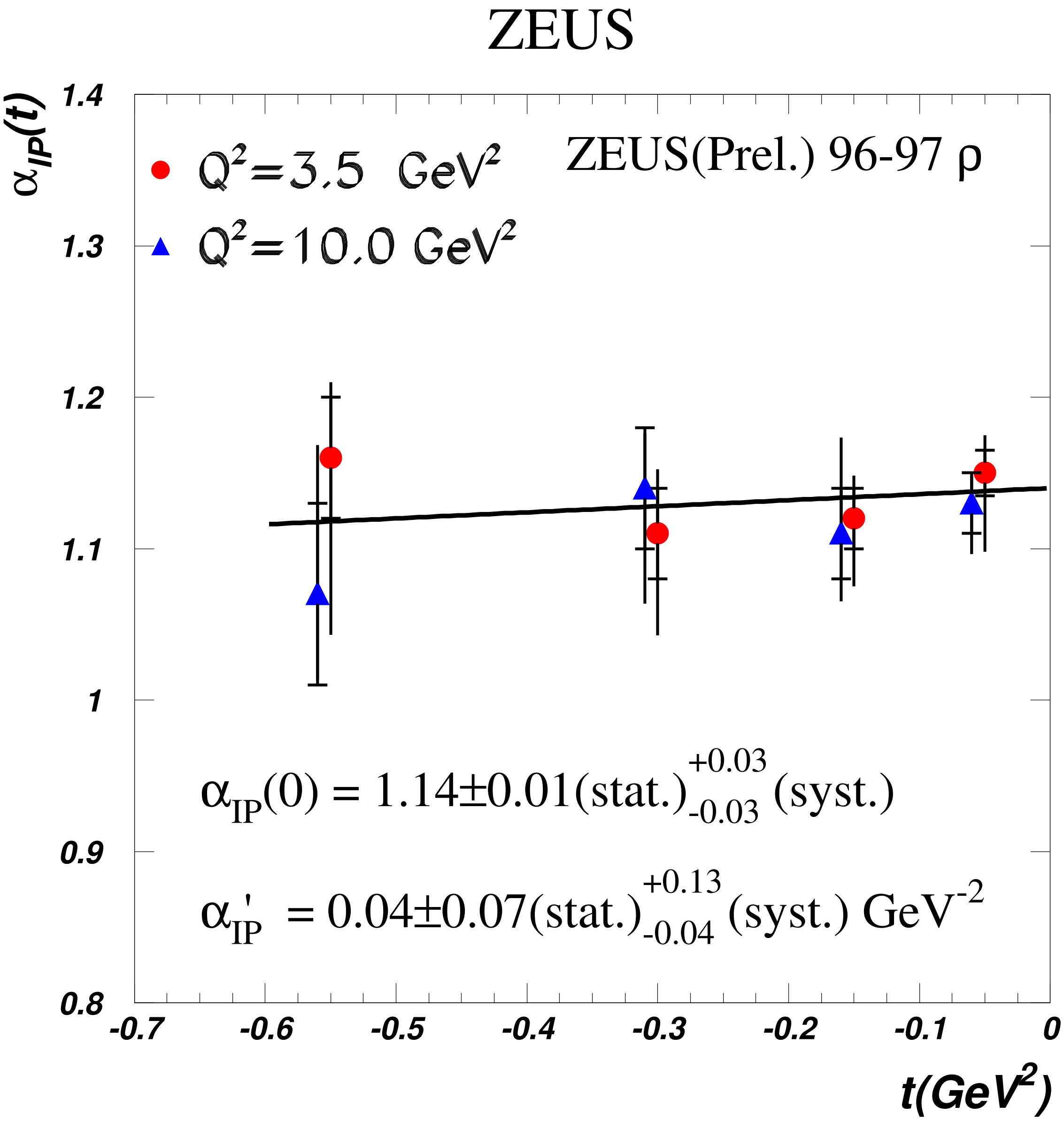
$\alpha_{I\!P}(t)$ EXTRACTION.

$\frac{dN}{dt} \propto (\frac{W}{W_0})^\delta$, Four t bins for $6 < Q^2 < 40\,\mathrm{GeV}^2$.



POMERON TRAJECTORY FROM DIS ρ

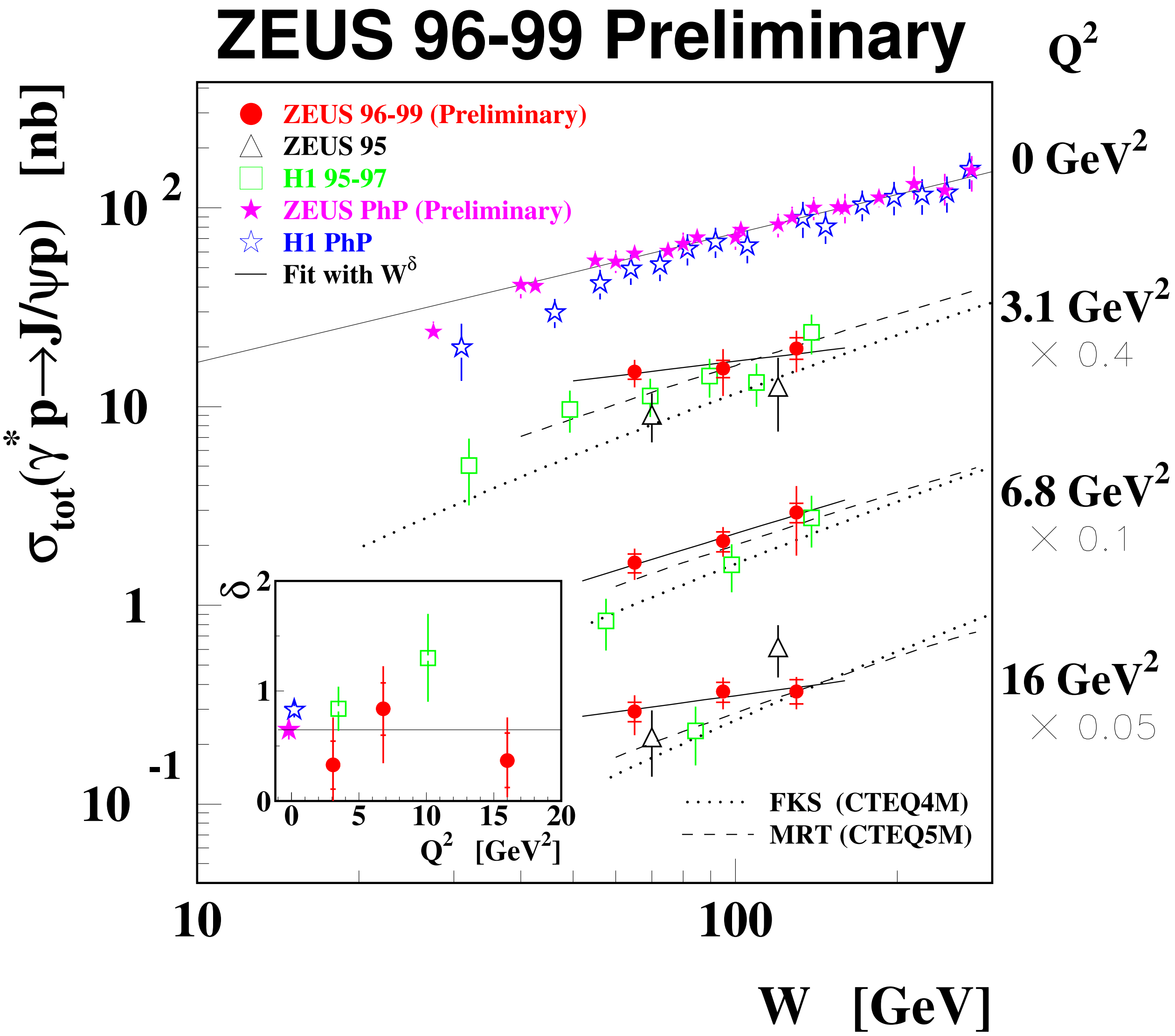
$$\frac{d\sigma}{dt} \propto W^{4(\alpha(t)-1)},\ \alpha(t) = \alpha_0 + \alpha' t$$



FIRST MEASUREMENT OF $\alpha_{I\!P}(t)$ IN DIS.

$\sigma_{\gamma * p \to J/\psi p}(Q^2, W)$

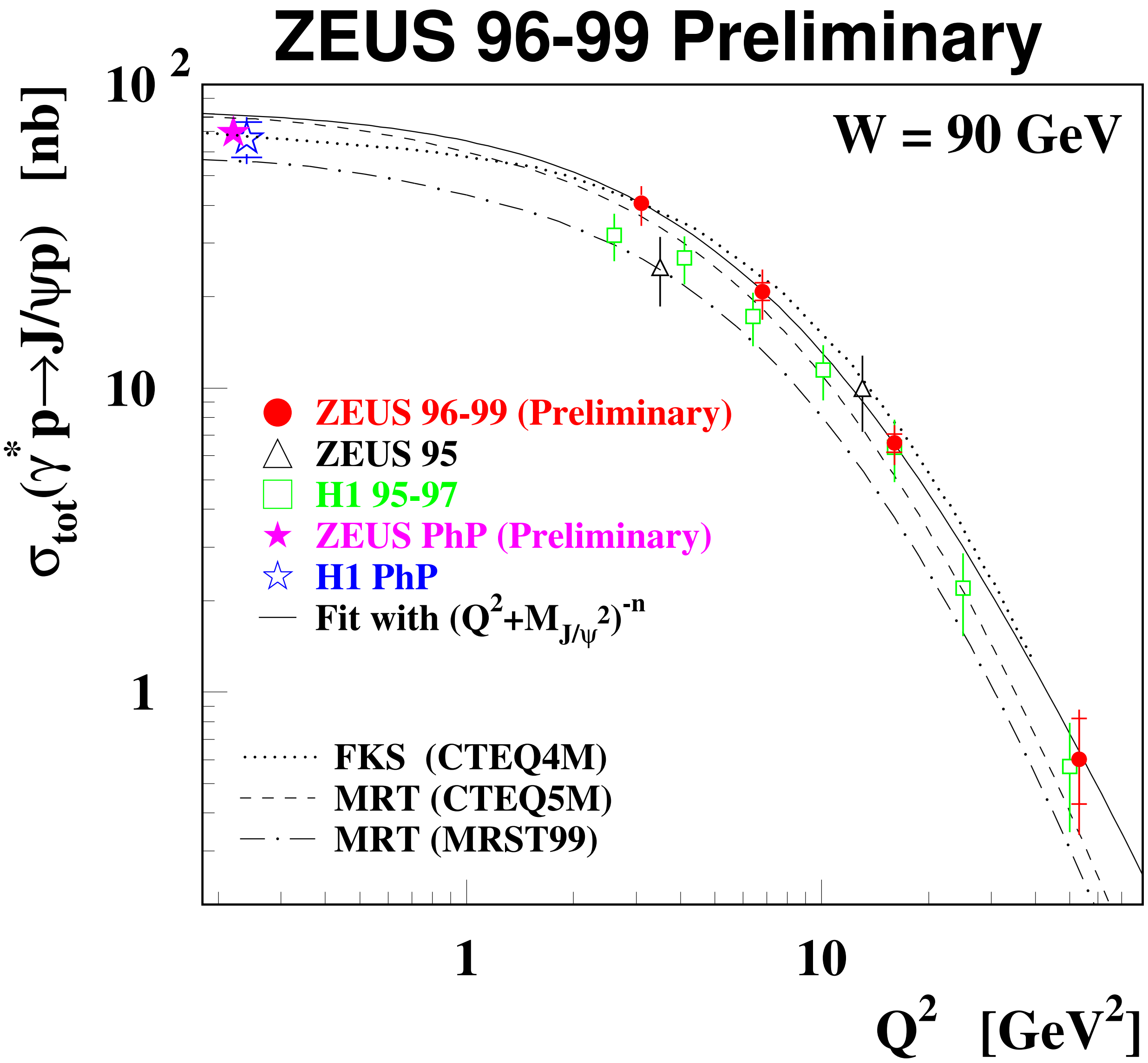
$\sigma \propto (\frac{W}{W_0})^\delta$



ZEUS $\delta_{J/\psi}$ is constant with Q^2.

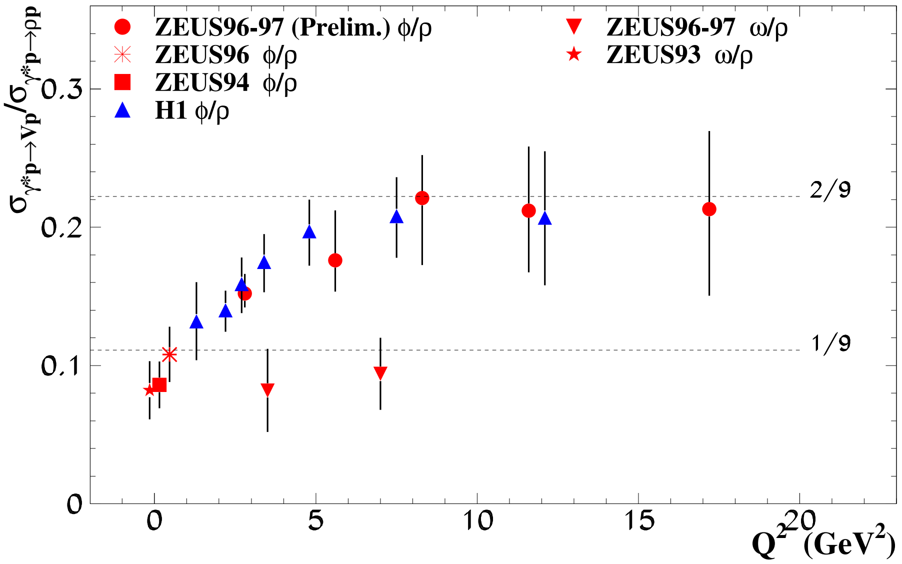
$\sigma_{\gamma * p \rightarrow J/\psi p}(Q^2, W)$

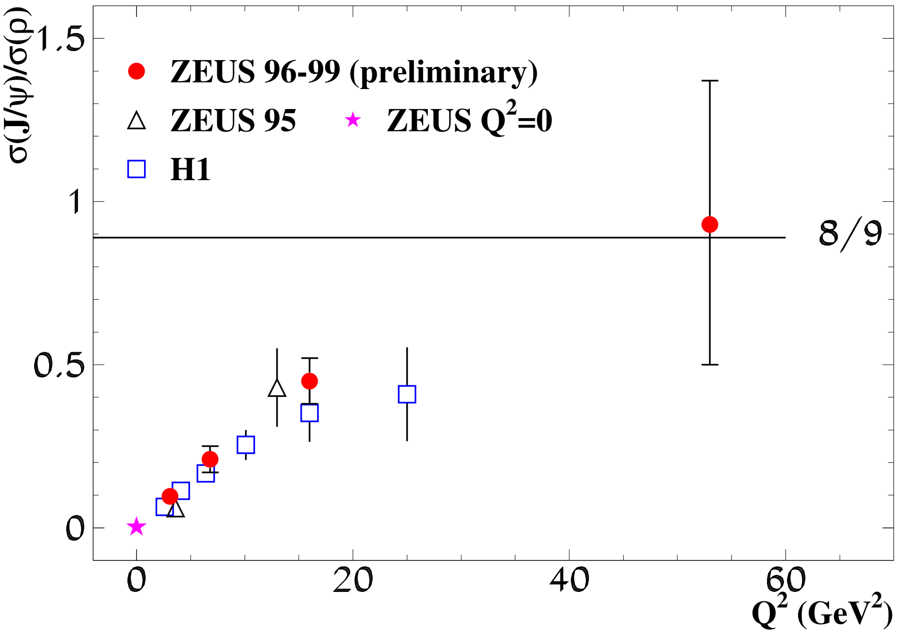
$n = 2.60 \pm 0.11(stat.)^{+0.09}_{-0.08}(syst)$ fit for $Q^2 > 3\,\mathrm{GeV}^2$.



General agreement with theoretical predictions.

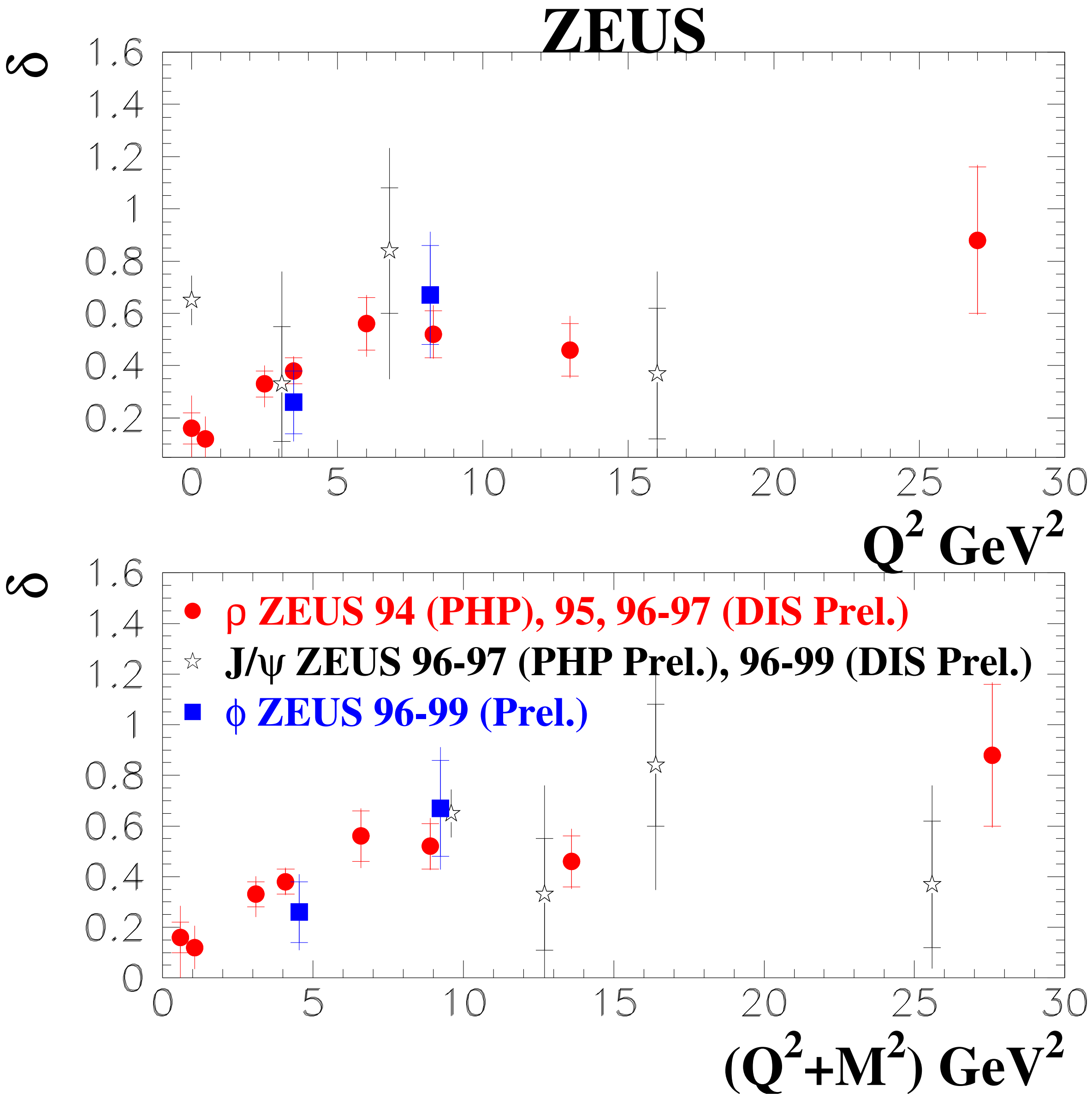
From γq coupling expect $\rho : \omega : \phi : J/\psi$ to be 9:1:2:8





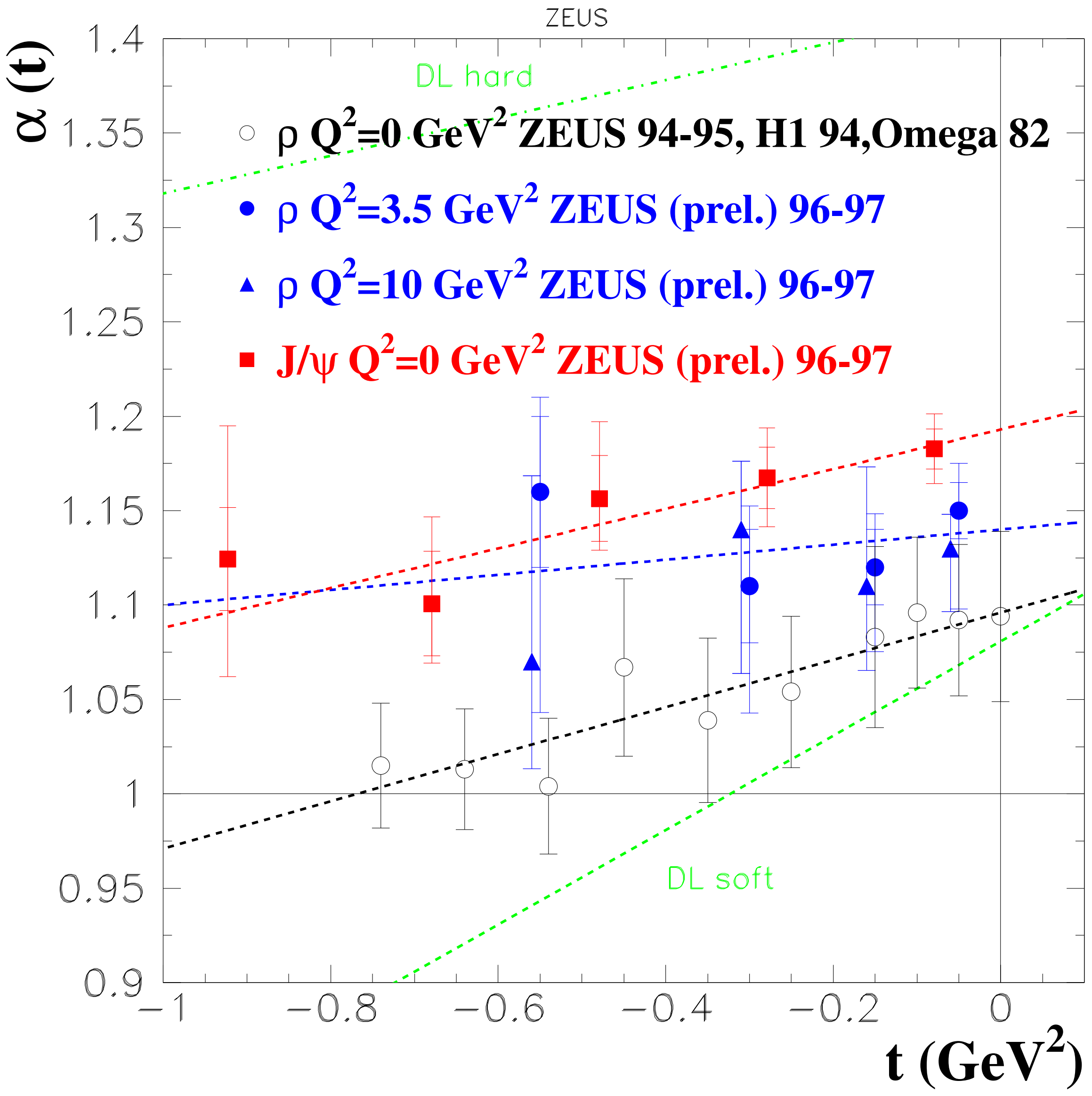
Is SU(4) symmetry restored at large Q^2 ?

$\sigma(\gamma * p \rightarrow V p)$



δ_ρ and δ_ϕ aligned as function of $Q^2 + M^2$

$\alpha_{I\!P}(t)$ FROM ρ AND J/ψ



NO UNIVERSAL POMERON.

CONCLUSIONS

- δ_ρ increases with Q^2.
- R_ρ increases with Q^2.
- R_ρ flat in W.
- $\delta_{J/\psi} \sim$ constant with Q^2.
- $\mathbb{P}$ trajectory measured in ρ DIS.
- No universal Pomeron.