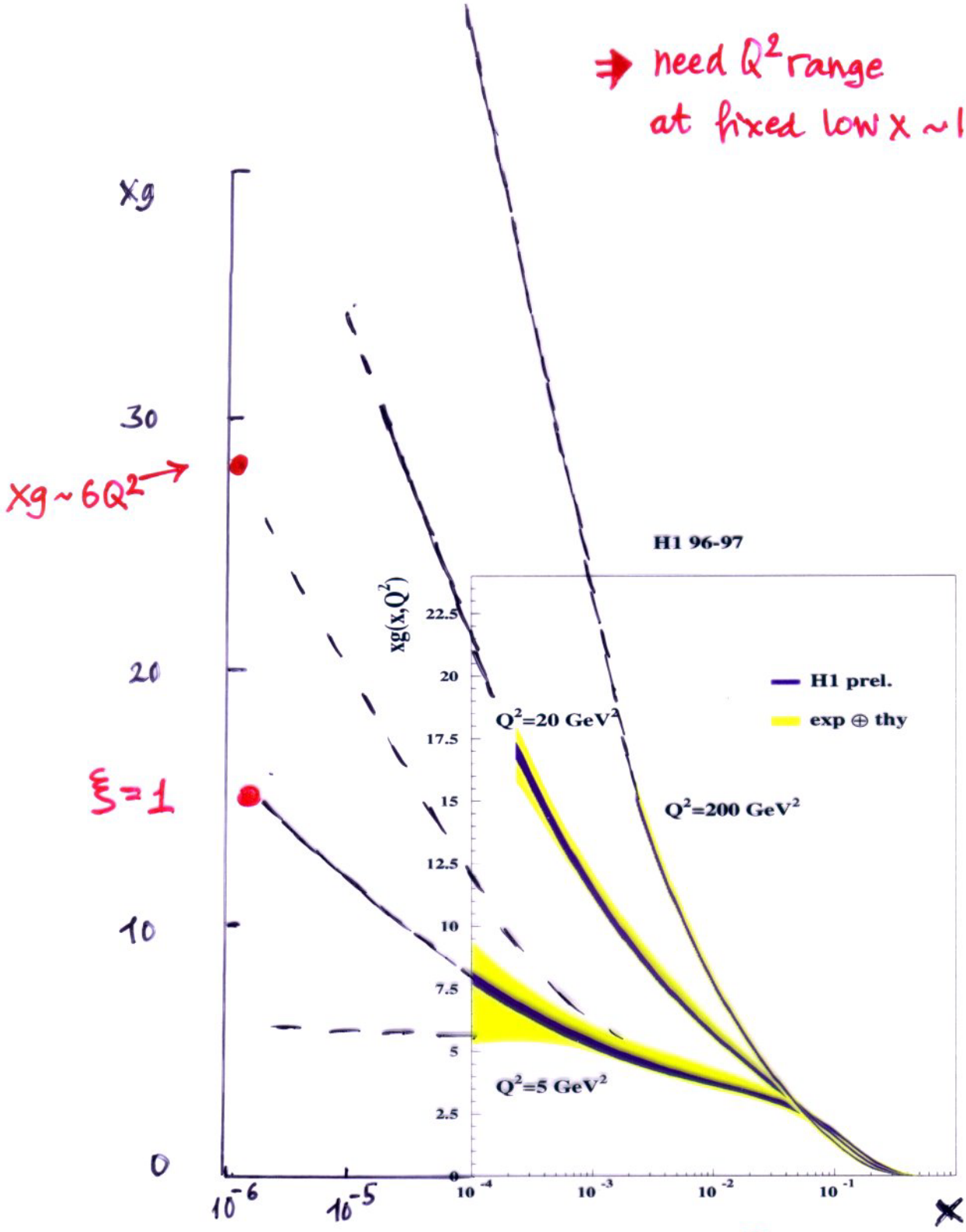
3. Low x.

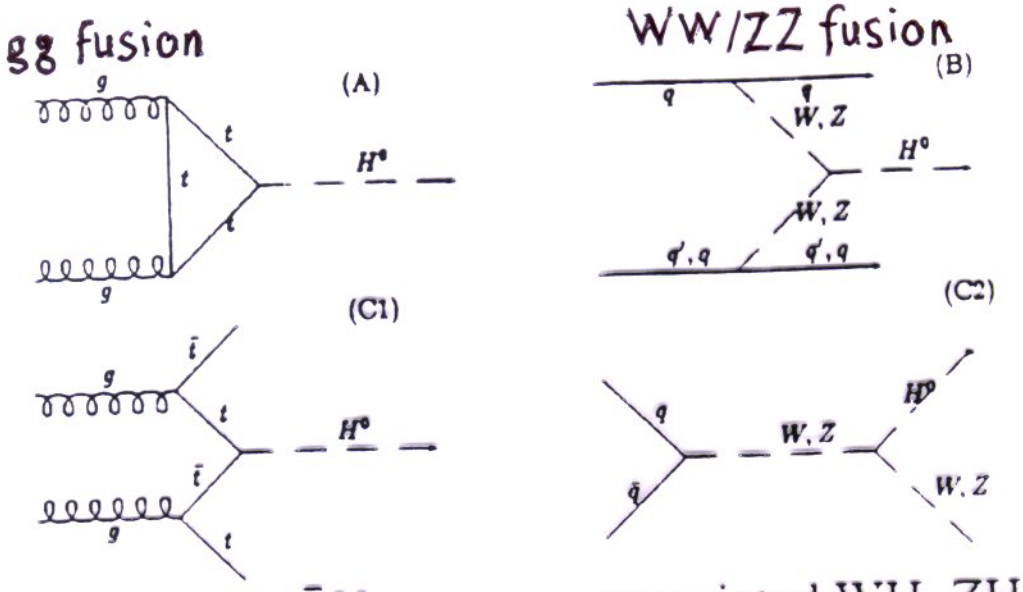
- $\frac{\partial F_2}{\partial \ln Q^2} \sim \alpha_s \cdot xg$
  - large h.o.c. (NNLO)
  - screening corr ?
  - huge HT in F_L BGBP, LT.

⇒ need Q^2 range at fixed low $x \sim 10^{-4}$



↳ saturation in perturbative region $x \lesssim 10^{-5}$ $Q^2 \gtrsim 3$ GeV^2?

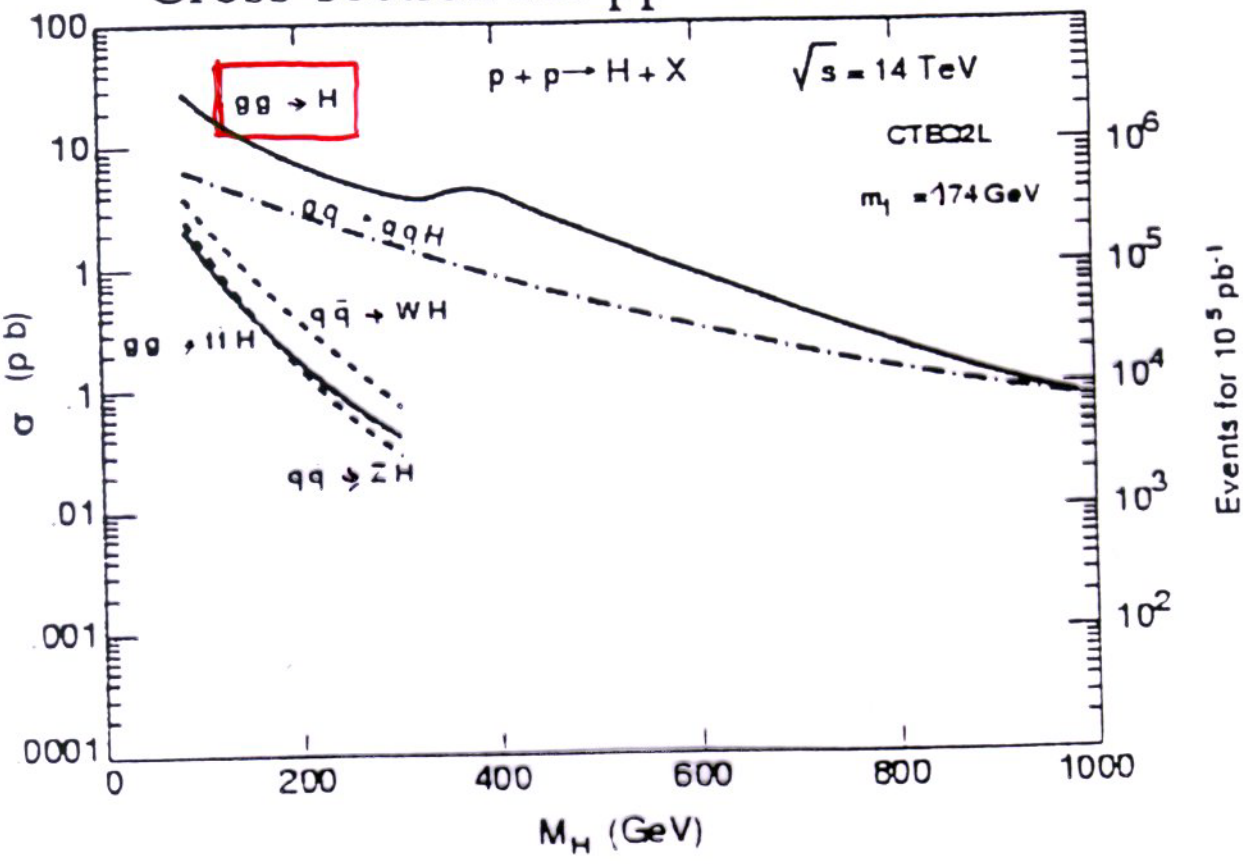
Higgs production at LHC



associated $t\bar{t}H$

associated WH, ZH

Cross-section for pp → H + X



ultrahigh energy neutrino physics

ν from AGN, γ ray bursts → earth tomography with ν's

Amanda, Nestor, Antares, ... R. Gandhi. hep-ph/0011176

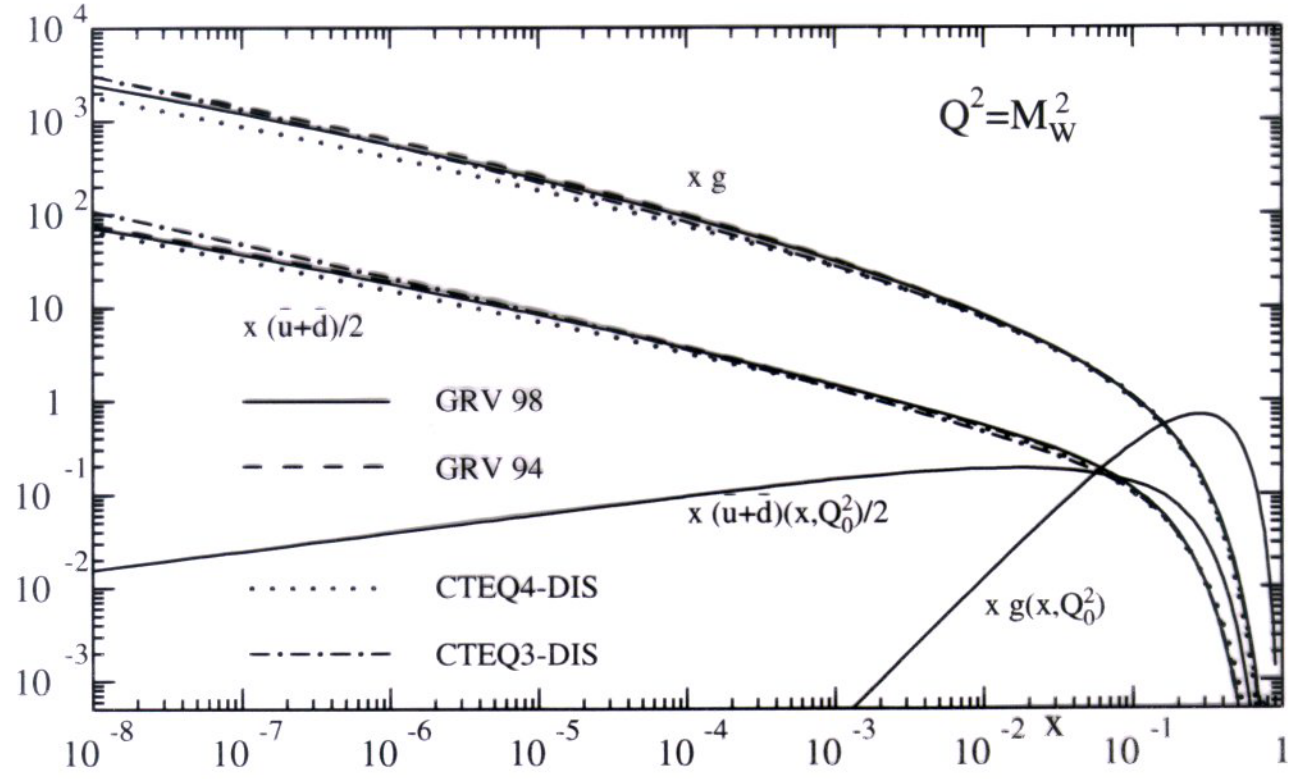
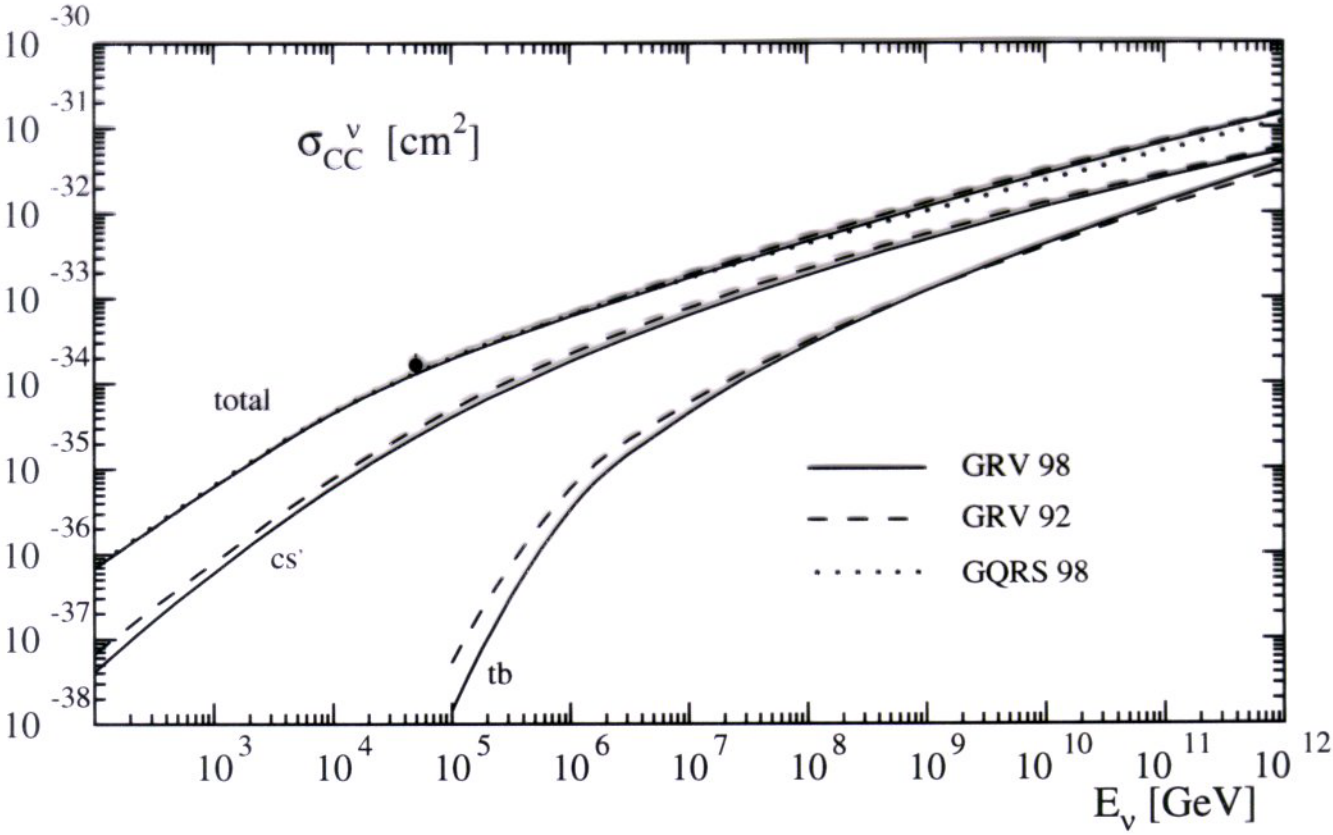
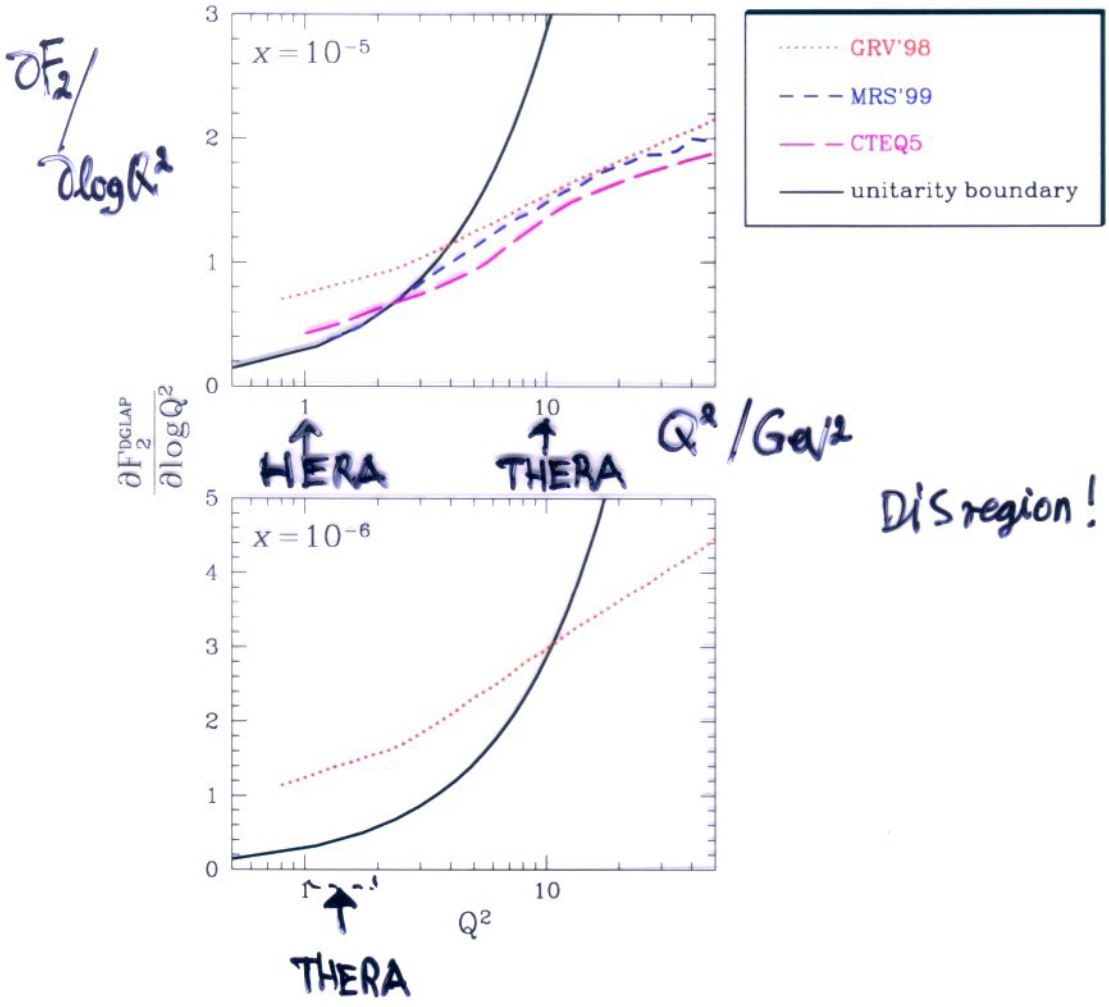


Fig. 1



Unitarity.

At THERA:

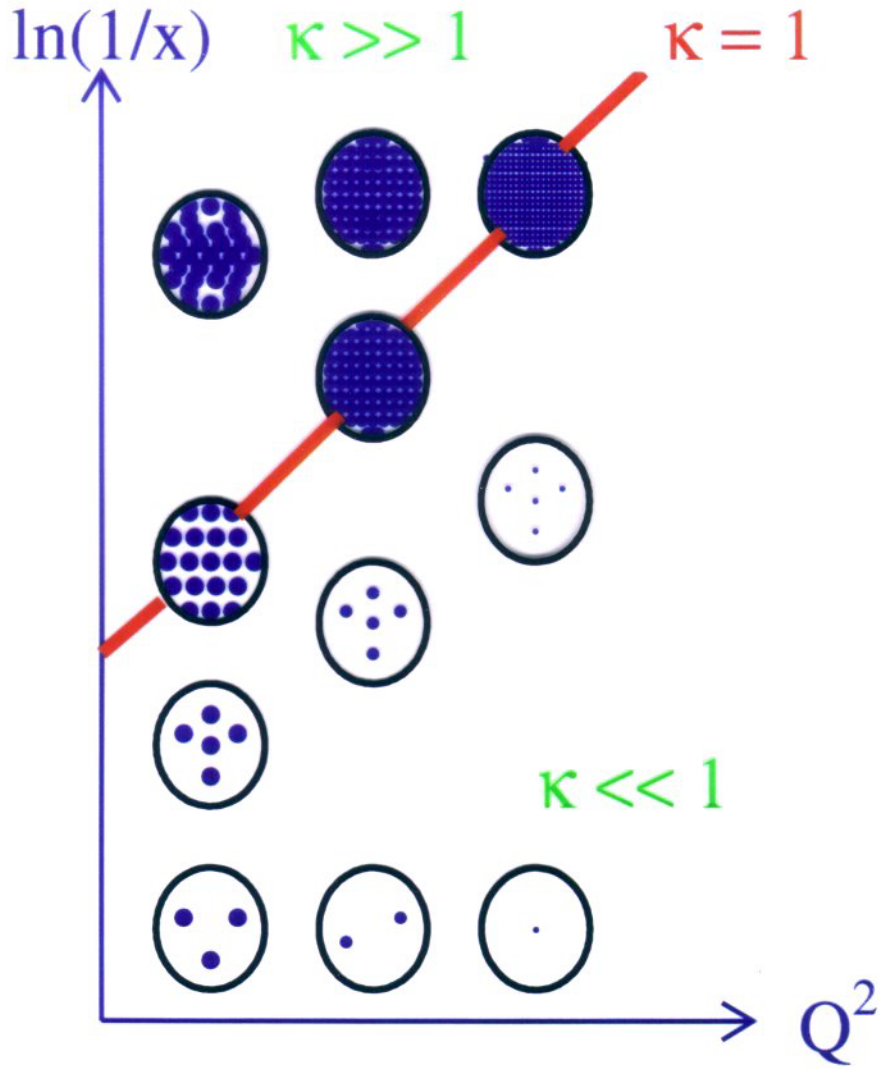


DIS region!

[27.5 ····> 250··· 500 GeV.]

E upgrade · single arm
dedicated · both arms.

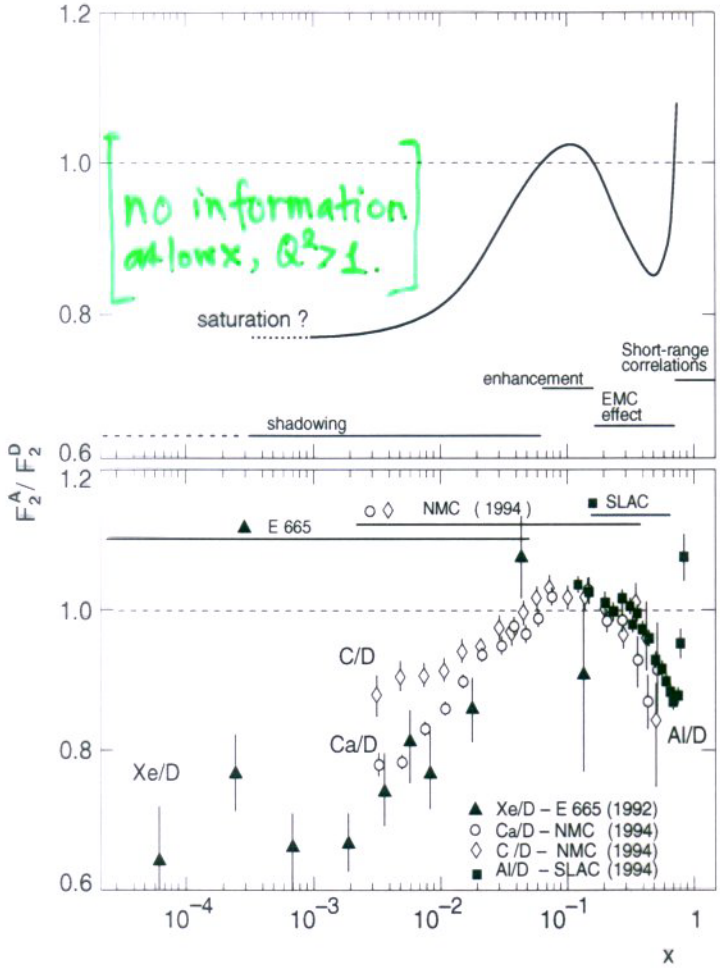
Gluon Saturation

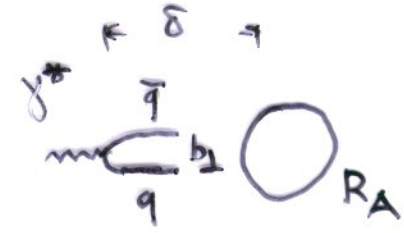


$$\kappa = \frac{\sigma}{\pi r_p^2}$$

does r_p "grow" at small x?

Summary of the current information on A-dependence of parton densities at $x \leq 0.2$





low x $\delta = \frac{1}{2 m_N x} \gg 2 R_A$

$|q\bar{q}\rangle$ not $\gamma^* A$ i.e.

- $b_\perp$ large : $\sigma \sim A^{2/3}$ shadowing hA i.e.
- $b_\perp$ small : $\sigma \sim A$ colour transp.
- $b_\perp$ small & x very small : large xg : perturbative colour opacity $\sigma \sim A^{2/3}$

Results for $R_A(x, Q^2) = \frac{2}{A} \frac{F_{2A}(x,Q^2)}{F_{2D}(x,Q^2)}$:

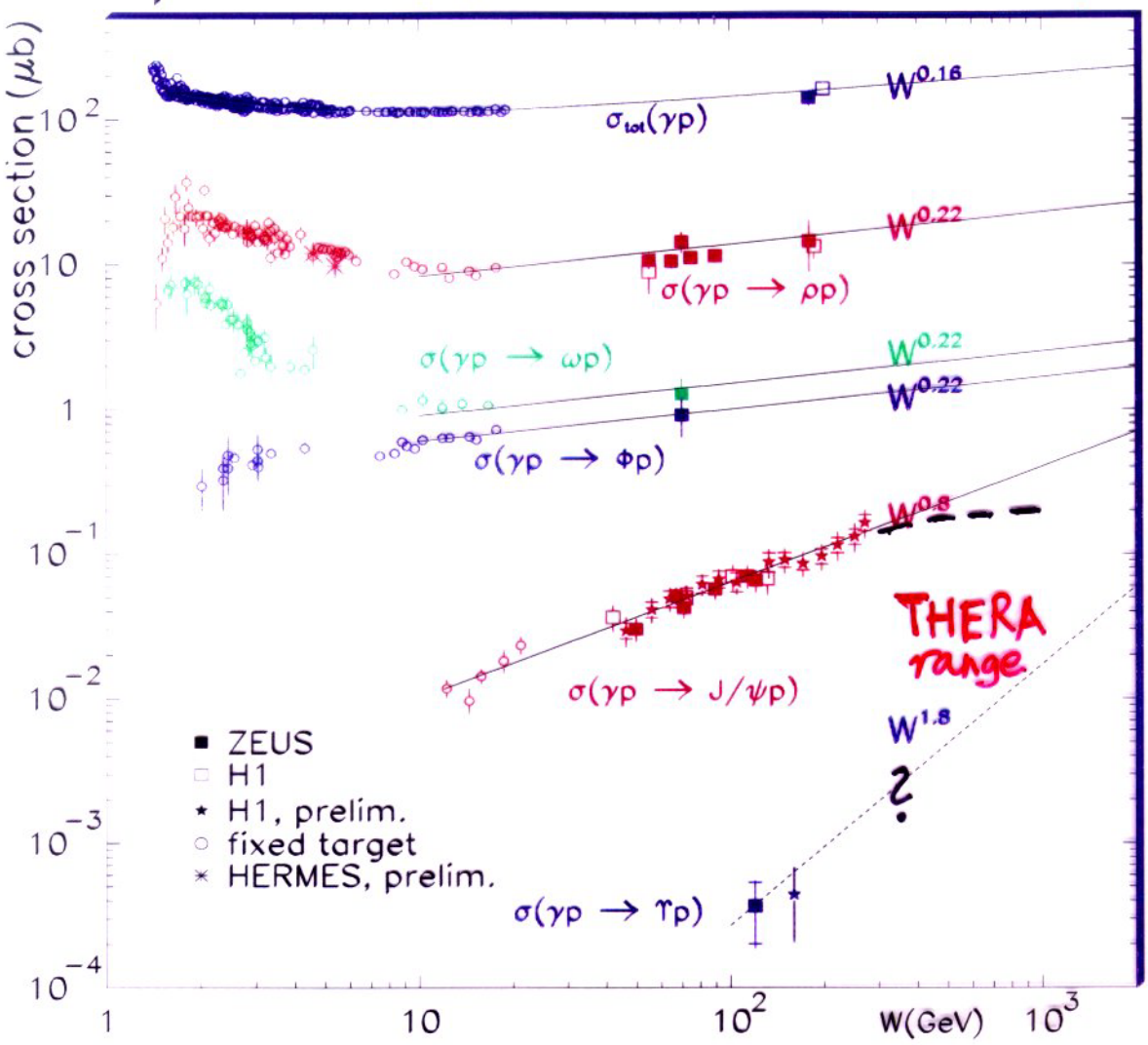
- $x \sim 0.1$ enhancement: $R_{A=40}(x \sim 0.1) \sim 1.05$
- Shadowing for $x \leq 0.04$
- Q^2 scaling of $R_A(x, Q^2)$

very interesting already for HERA.

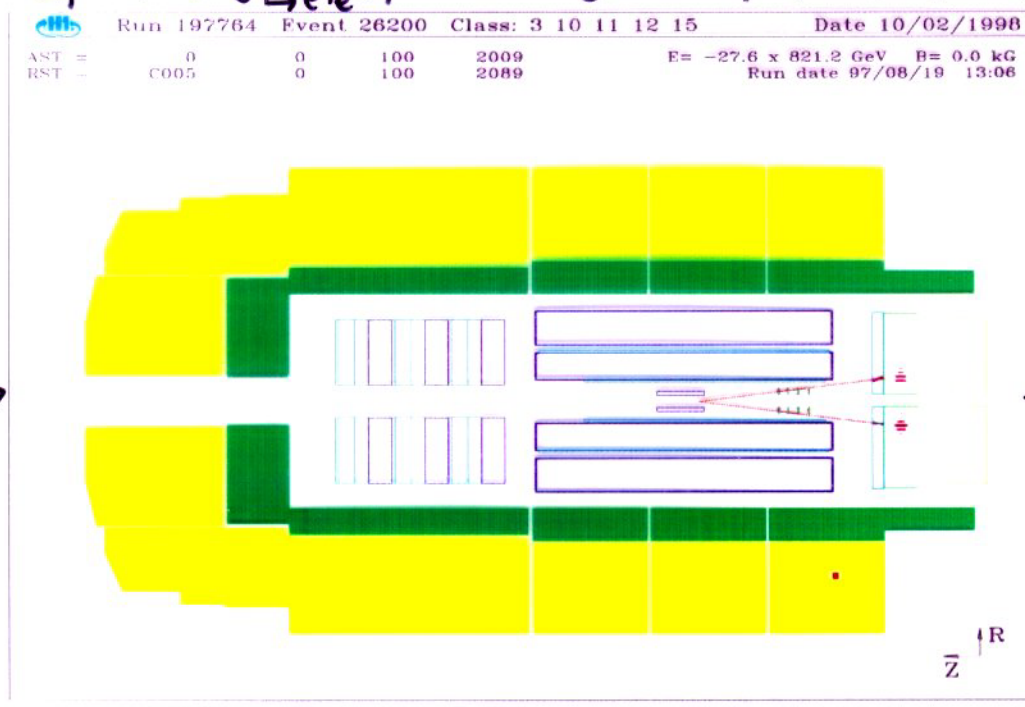
$$\frac{x g_A}{A} \leq 30 A^{1/2} \frac{Q^2}{10 GeV^2}$$

stronger bound than for p .

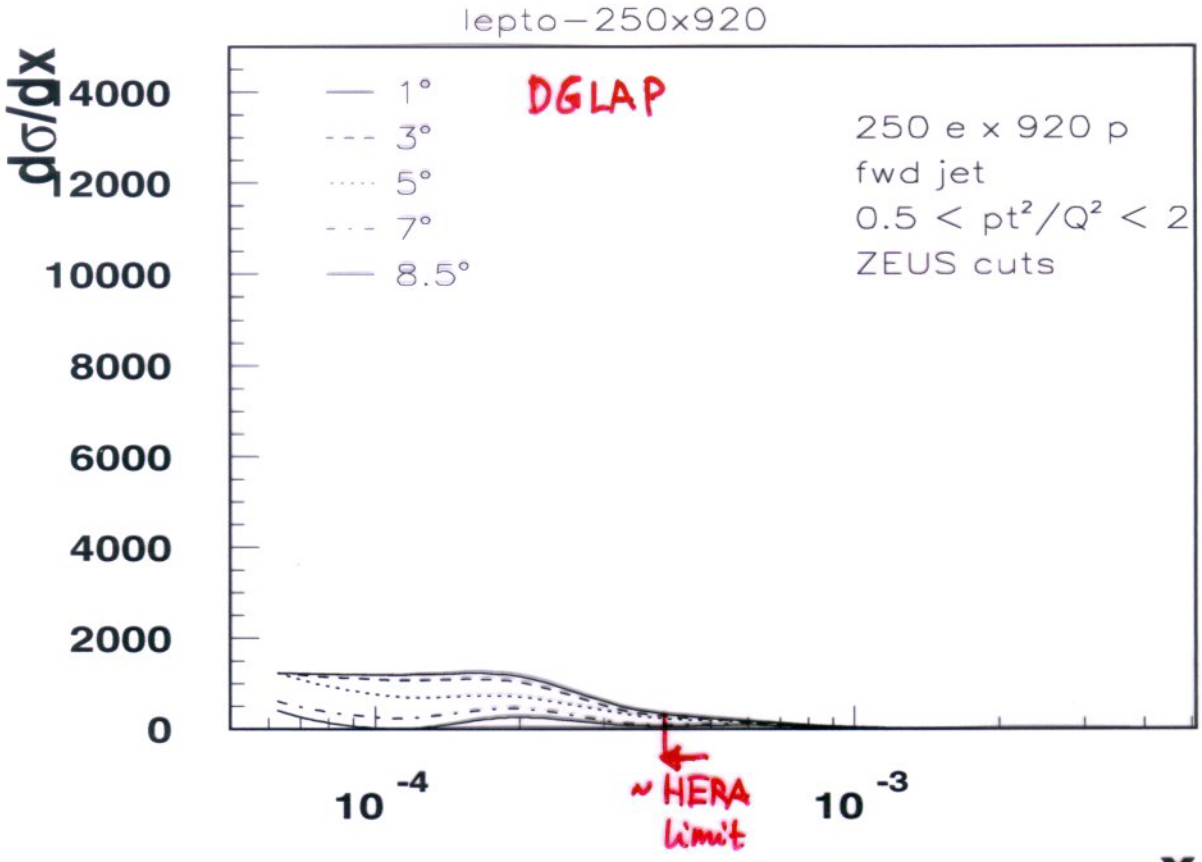
- MFGS: $\hat{\sigma} = b_1^2 \cdot d_s \cdot xg$
  - predict taming of $\mathcal{F}, \Upsilon$ in γ, γ^* . i.a. blackening ??



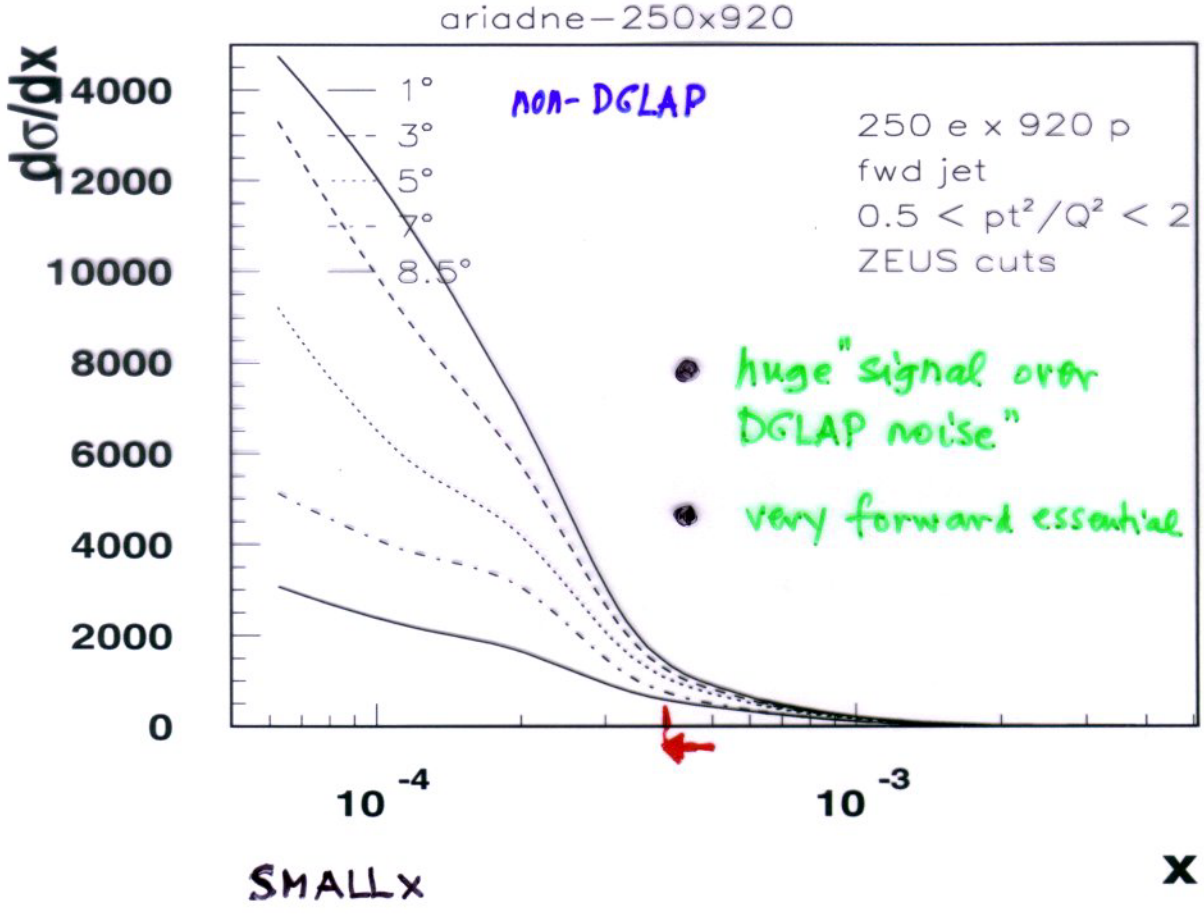
$ep \to e\, \mathcal{J}_{\to e^+e^-}\, p$ at large $W = \sqrt{sy}$: backward



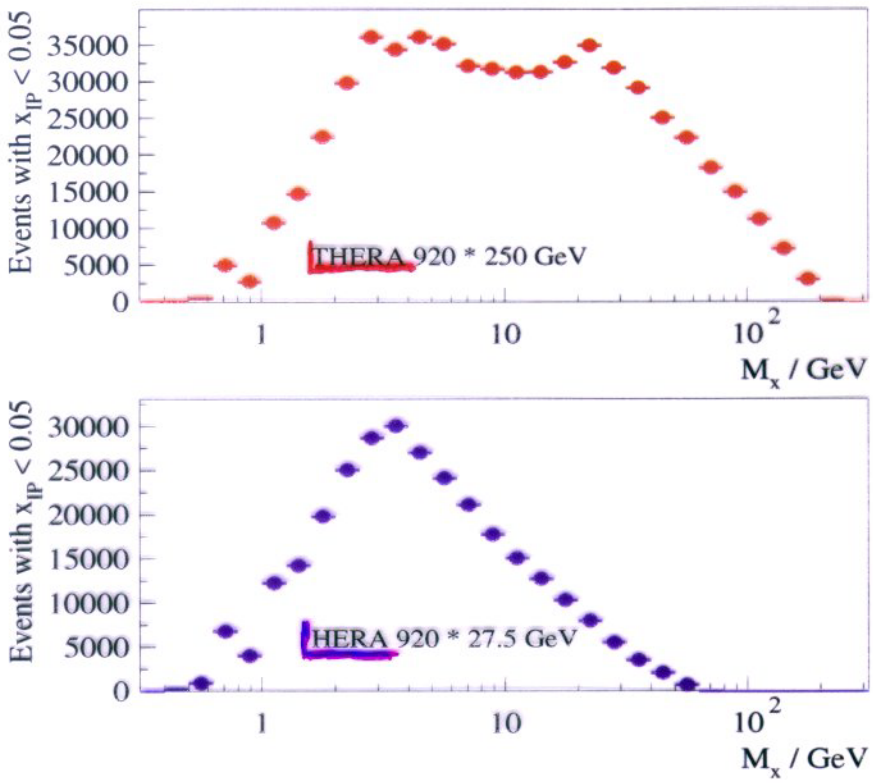
forward jets & low x dynamics



still do with DGLAP
+ resolved γ & scale choice $> p_T^2$



RAPGAP MC MODEL (Extrapolated H1 QCD fit)



$$x_{IP} = \frac{M_X^2 + Q^2}{W^2 + Q^2}$$

extended phase space for jets

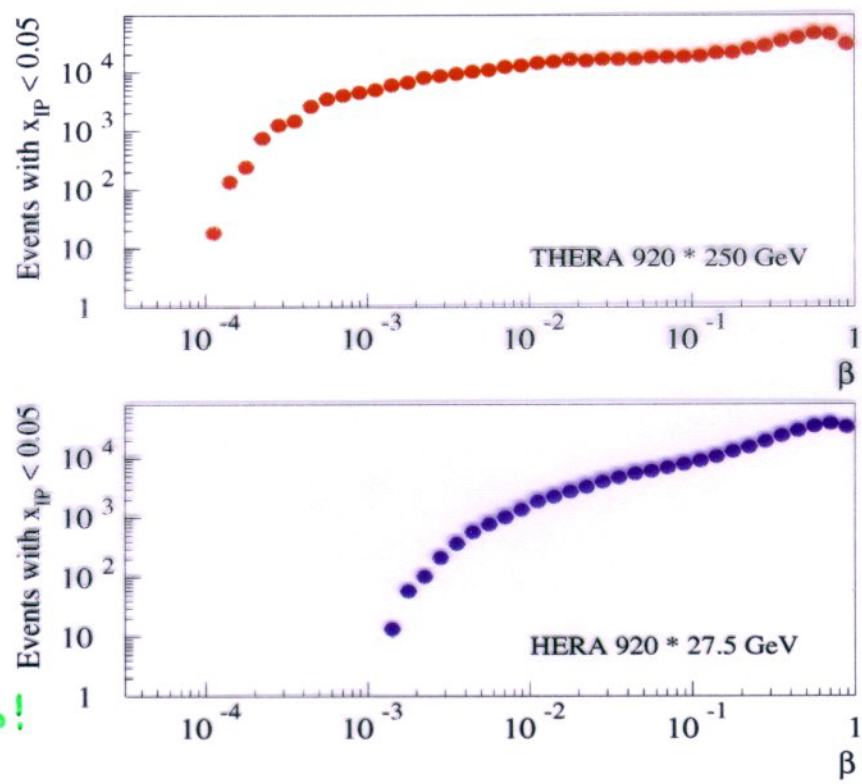
(q - g jet characteristics distinguish pert. 2gluon exchange from resolved IP)

RAPGAP MC MODEL (Extrapolated H1 QCD fit)

$$\beta = \frac{x}{x_{IP}} = \frac{Q^2}{Q^2 + M_X^2}$$

Low β extension

- heavy flavour
- gluon



"the nature of diffraction" !

- nuclear shadowing (LT) ~ diffractive parton densities! – FS98 –
- Feinberg Pomeranchuk Nuov. Cim. Suppl. III, No 4, p. 652, 1956