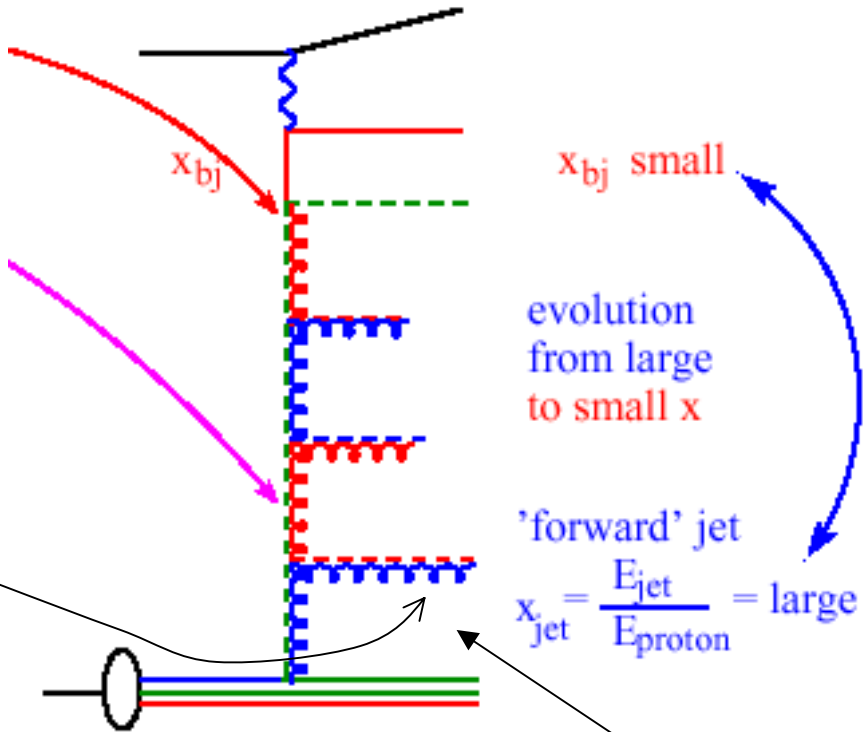
Forward photon production at HERA

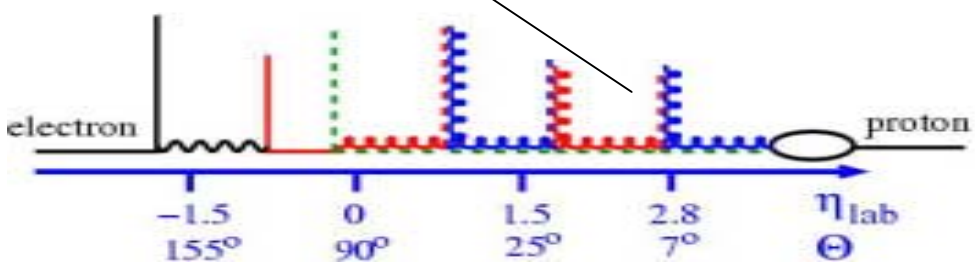
- Forward photons vs. forward jets
- Is it possible at HERA II ?

Forward jets

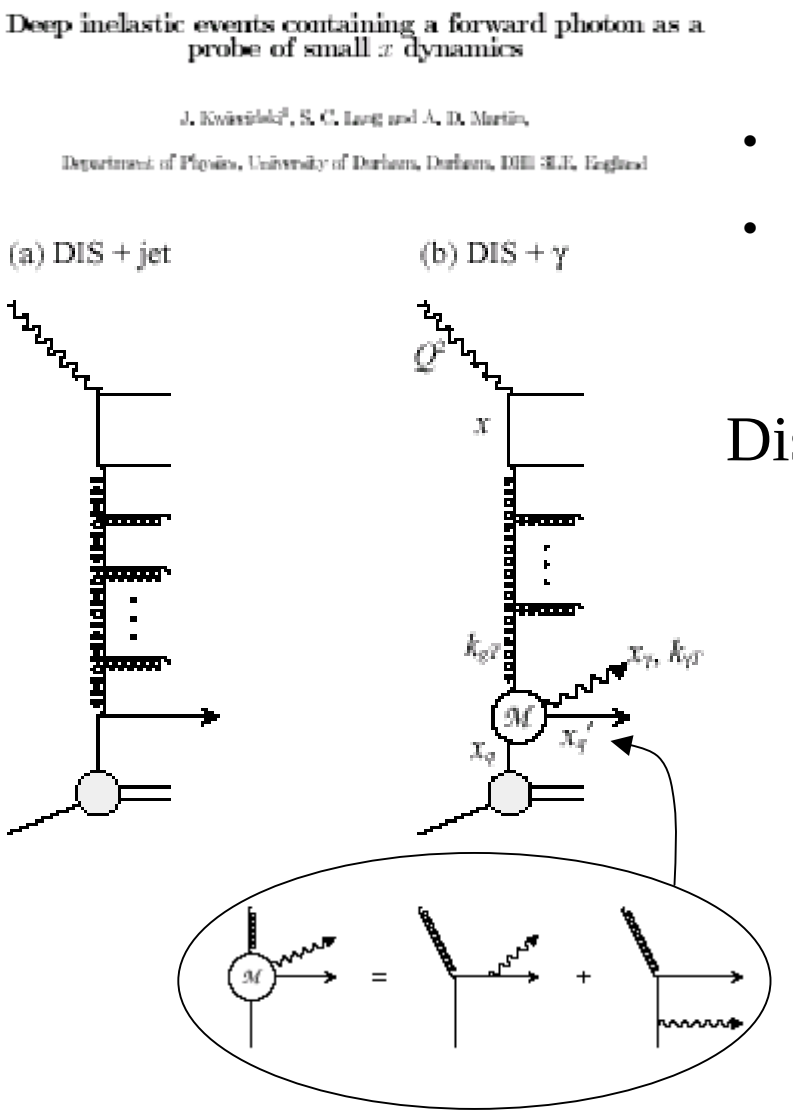
Large x_{jet}/x_{bj} to enhence phase space for BFKL evolution

$p_{tjet}^{\ 2} \approx Q^2$ to supress DGLAP evolution





Forward jets vs forward photons



Advantages:

- Smaller hadronization corrections (?)
- Measurement of the quark initiated cascade

Disadvantage: $\frac{\alpha}{2\pi} \approx 1/1000$

but:

- No acceptance cut for jet
- Separation cone for photon

1/400 cross section reduction

(but dependent on particular choice of cuts)

Forward photon cuts

$$x_\gamma > \beta_\gamma$$

$$\downarrow$$

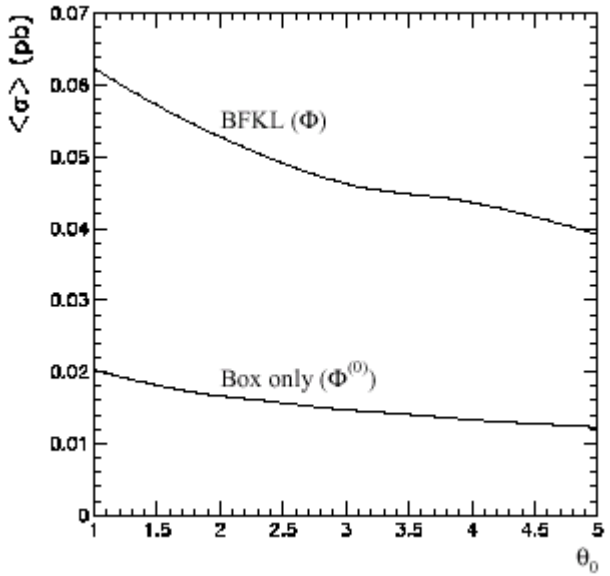
$$x_\gamma > \sqrt{x k_{\gamma T}^2 / Q^2}.$$

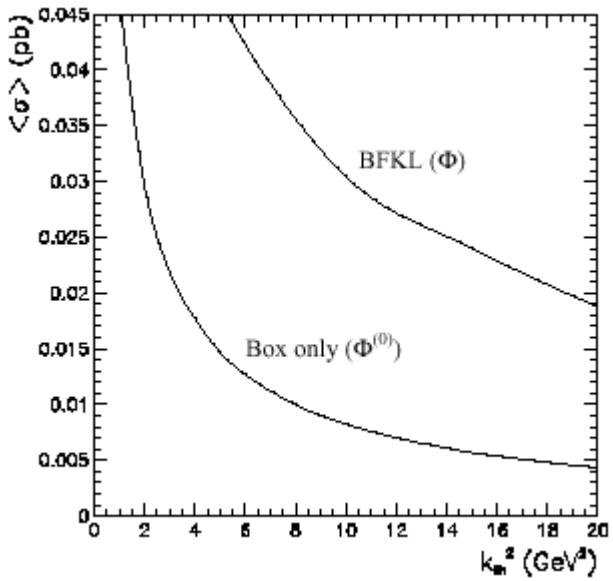
Photon in proton hemisphere (not from the „box”)

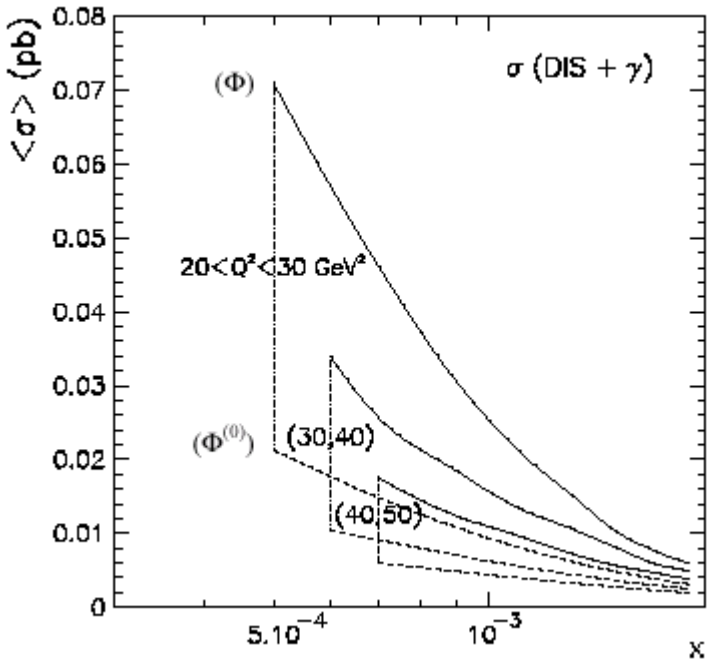
$x_q > x_\gamma > \sqrt{x k_{\gamma T}^2 / Q^2}.$ usually stronger then $x_q > 10x$

$\theta_{\gamma q'} > \theta_0$ Separation cone (3-10 deg.)

$\theta_{\gamma p} > \overline{\theta}_0$ Detector cut ~5 deg. in H1


<σ> (pb)
BFKL (Φ)
Box only (Φ^(0))
θ0


<σ> (pb)
BFKL (Φ)
Box only (Φ^(0))
k_m^2 (GeV^2)


<σ> (pb)
σ (DIS + γ)
(Φ)
20<Q^2<30 GeV^2
(Φ^(0))
(30,40)
(40,50)
5.10^-4
10^-3
x

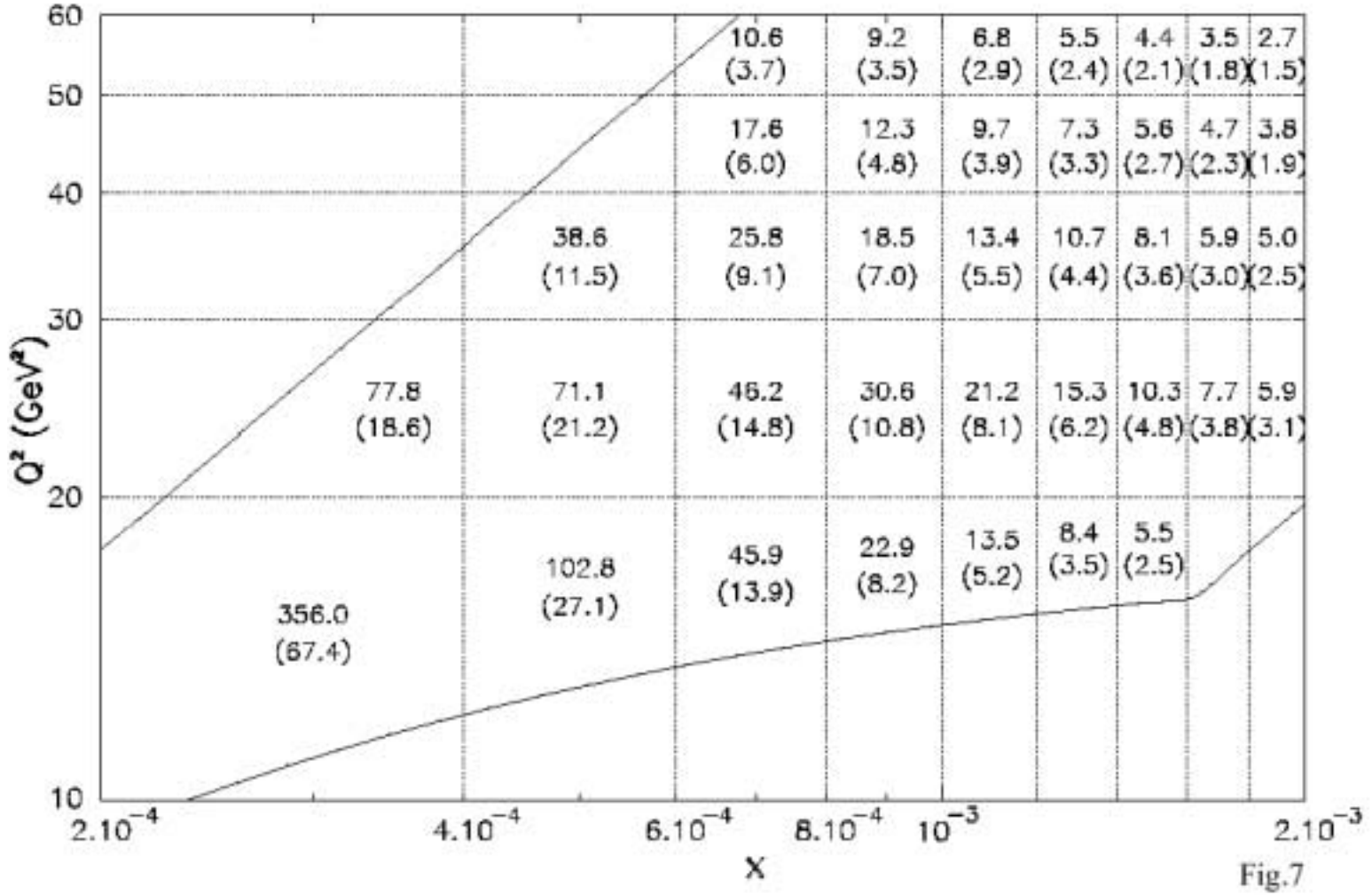
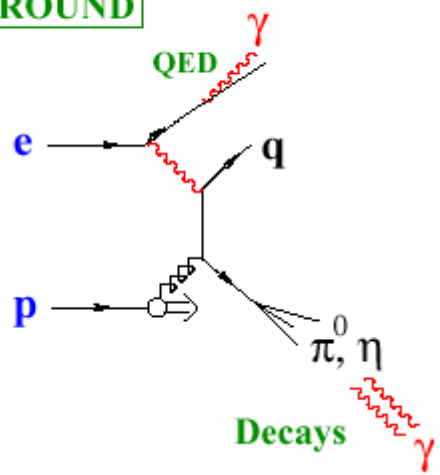


Fig.7

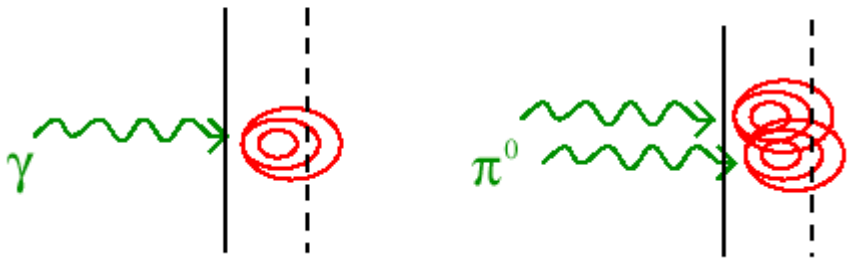
$\theta_{\gamma p} \geq \overline{\theta_0} = 5^\circ$ $\quad$ $\theta_{\gamma q} \geq 3^\circ$ $\quad$ $k_{\gamma T}{}^2 \geq 5$ GeV^2

Can we supress with background ?

BACKGROUND



π^0 and γ showers have different shapes



The background showers are

<R> (cm)

- **less narrow** → **measure** **Transverse size** $< R > = \frac{\Sigma_i r_i \varepsilon_i}{\Sigma_i \varepsilon_i}, \quad \varepsilon_i = energie\ density$
- **less compact** → **measure** **Hot core energy fraction** $HCF = \frac{Energy\ in\ shower\ core\ (4 \quad 8\ cells)}{Total\ Energy}$
- **start earlier** → **measure** **First layer energy fraction** $FLF = \frac{Energy\ in\ first\ layer}{Total\ Energy}$

Use these variables to distinguish γ's and π^0's, η's

Can we do it really ?

- Recently H1 has measured prompt photons production in the central region basing on shower shape difference between π^0 and γ
- In forward calorimeter we have better granulation and vertex is further from calorimeter
- But tracking (needed to veto charged particles) is not so good as in the central region
- At least it is worth trying – forward photons are probably only experimental handle on quark initiated cascade

To be done :

- Simulation on hadron level, to choose optimal cuts
- Simulation on detector level to see if we can manage background