The Linked Dipole Chain MC-1

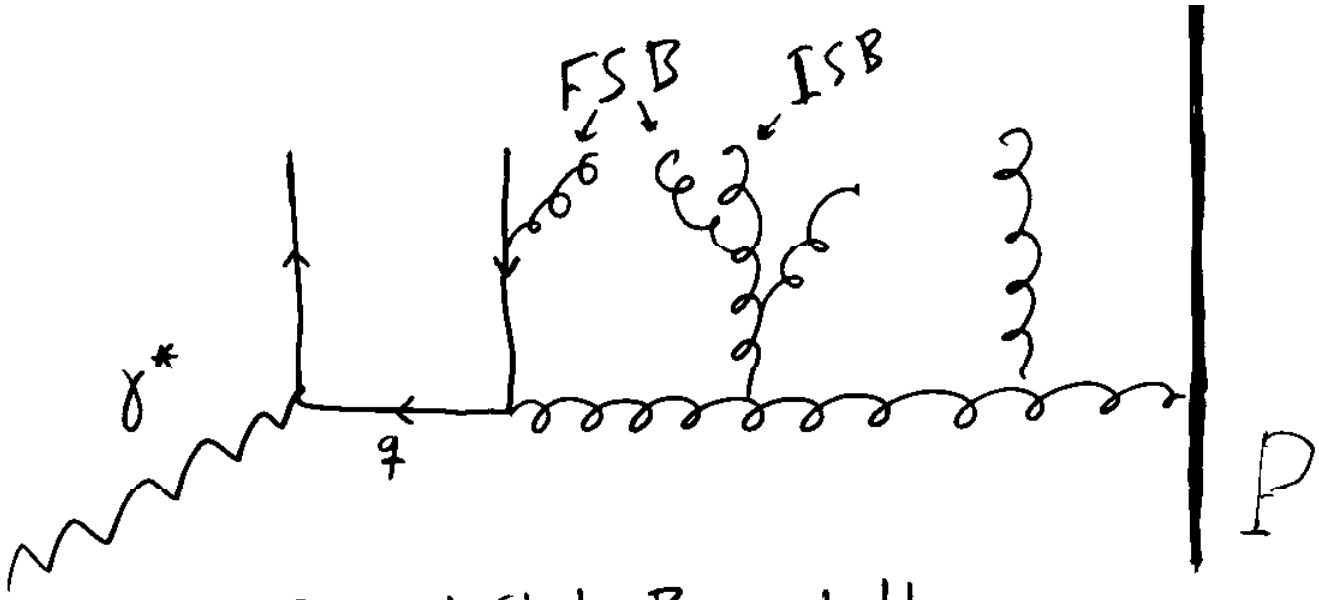
Hamid Kharraziha, Dept. of Theoretical Physics, Lund

- We are developing a full scale MC for e-p collisions!

This talk:

- The LDC-model
- the dipole model
- Some leading log results
- The full MC

Collaborators: B. Andersson, P. Edén, G. Gustafson
L. Lönnblad, J. Samuelson



Initial State Bremsstrahlung
Final State Bremsstrahlung

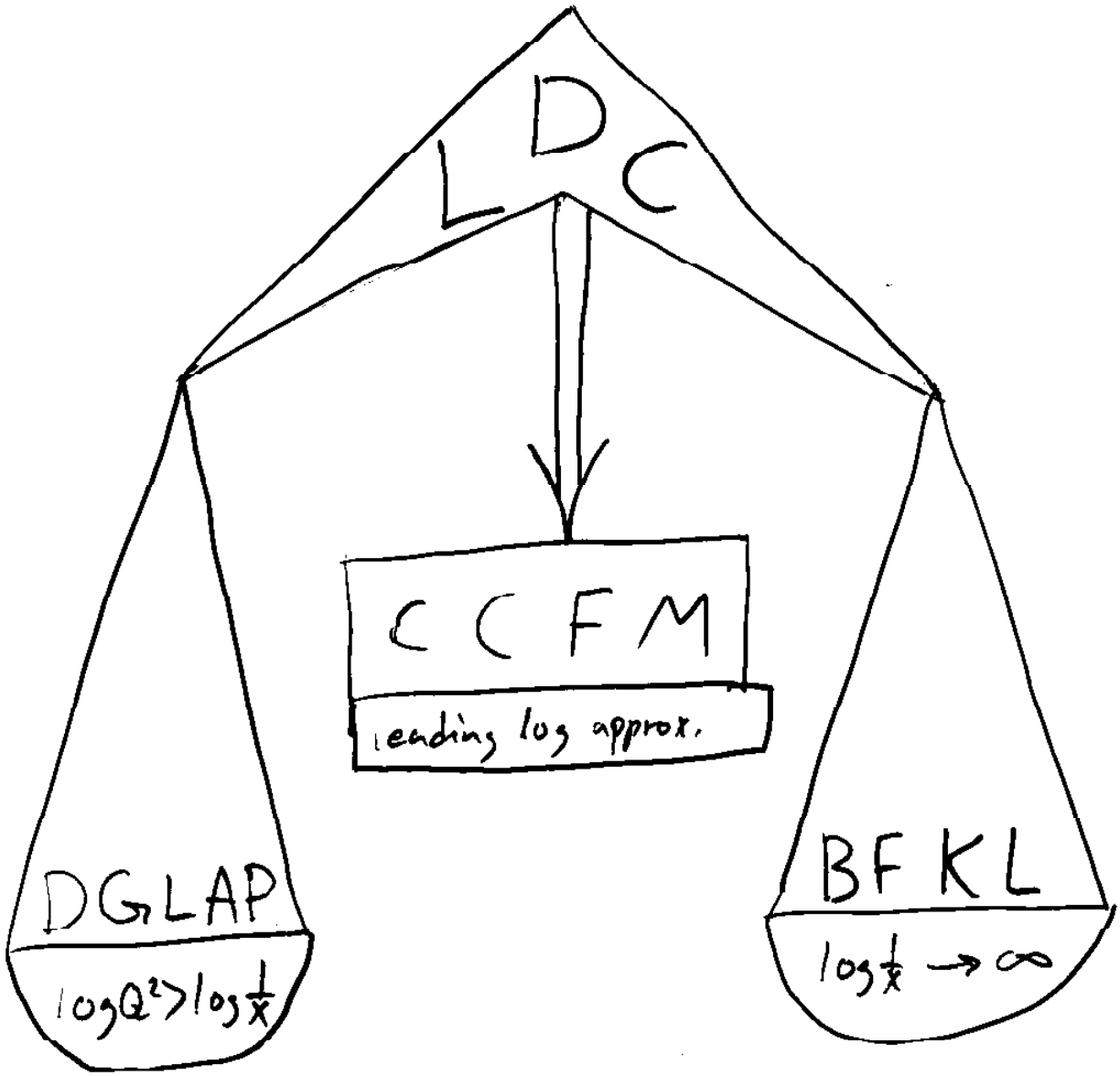
$$x_B \equiv \frac{Q^2}{2Pq} \approx \frac{q_+}{P_+} \quad , \quad Q^2 \equiv -P_\gamma^2$$

LDC

calculate: σ_{tot}, F_2
final state

Suitable for MC-package with:

- corrections to leading log
- running coupling
- FSB-shower
- hadronization


LDC
CCFM
leading log approx.
DGLAP
$\log Q^2 > \log \frac{1}{x}$
BFKL
$\log \frac{1}{x} \to \infty$

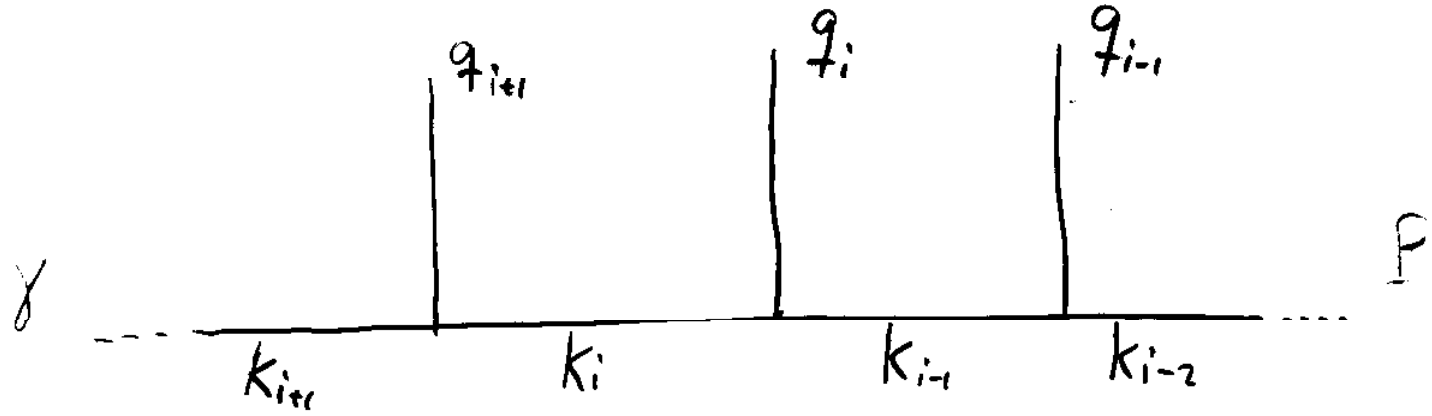
Starting point:

with CCFM + modification & extension one ha

i) prob. dist. for ISB-emissions

ii) phase space for ISB-emissions

iii) phase space for FSB.



ISB phase space:

$$P_+ > q_{+1} > q_{+2} > \dots > q_{+n}, \quad q_{-1} < q_{-2} < \dots < q_{-n} < P_-$$

$$q_{\perp i} > \min(k_{\perp i}, k_{\perp i-1})$$

Emission prob.:

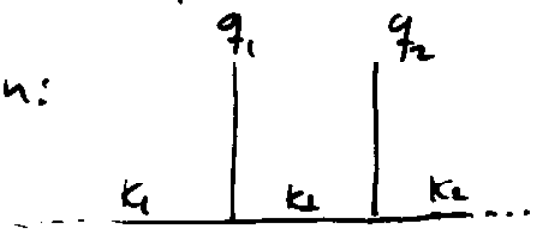
* factorization $dP = dP_1 dP_2 \cdots dP_n$

* $dP_i = \bar{\alpha} \dfrac{d^2 \bar{q}_{\perp i}}{q_{\perp i}^2} \dfrac{dz_{+i}}{z_{+i}}$

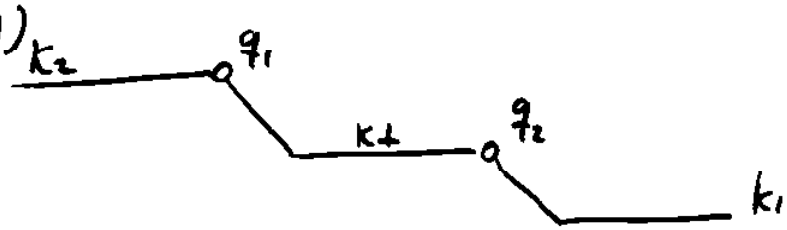
$z_{+i} = \dfrac{k_{+i}}{\ } < 1 \qquad \bar{\alpha} = \dfrac{3\alpha_s}{\ }$

$$dp_i = \bar{\alpha}\,\frac{dk_{\perp i}^2}{k_{\perp i}^2}\,\frac{dz_{+i}}{z_{+i}} \cdot \min\left(1, \frac{k_{\perp i}^2}{k_{\perp i-1}^2}\right)$$

along the chain:



i)

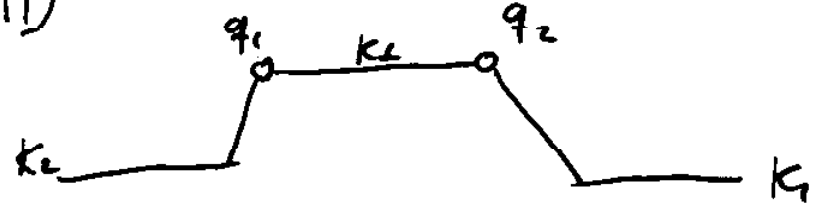


$$dp \propto \frac{1}{k_\perp^2}\,\frac{1}{k_{\perp 2}^2}$$

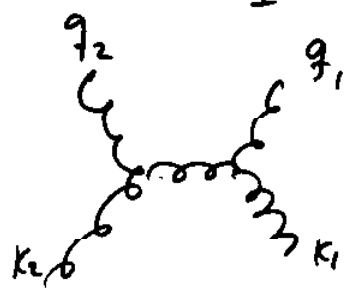
↑

ordinary DGLAP

ii)



$$dp \propto \frac{1}{k_\perp^4}$$



hard subcollision with

$\hat{t} \approx k_\perp^2$

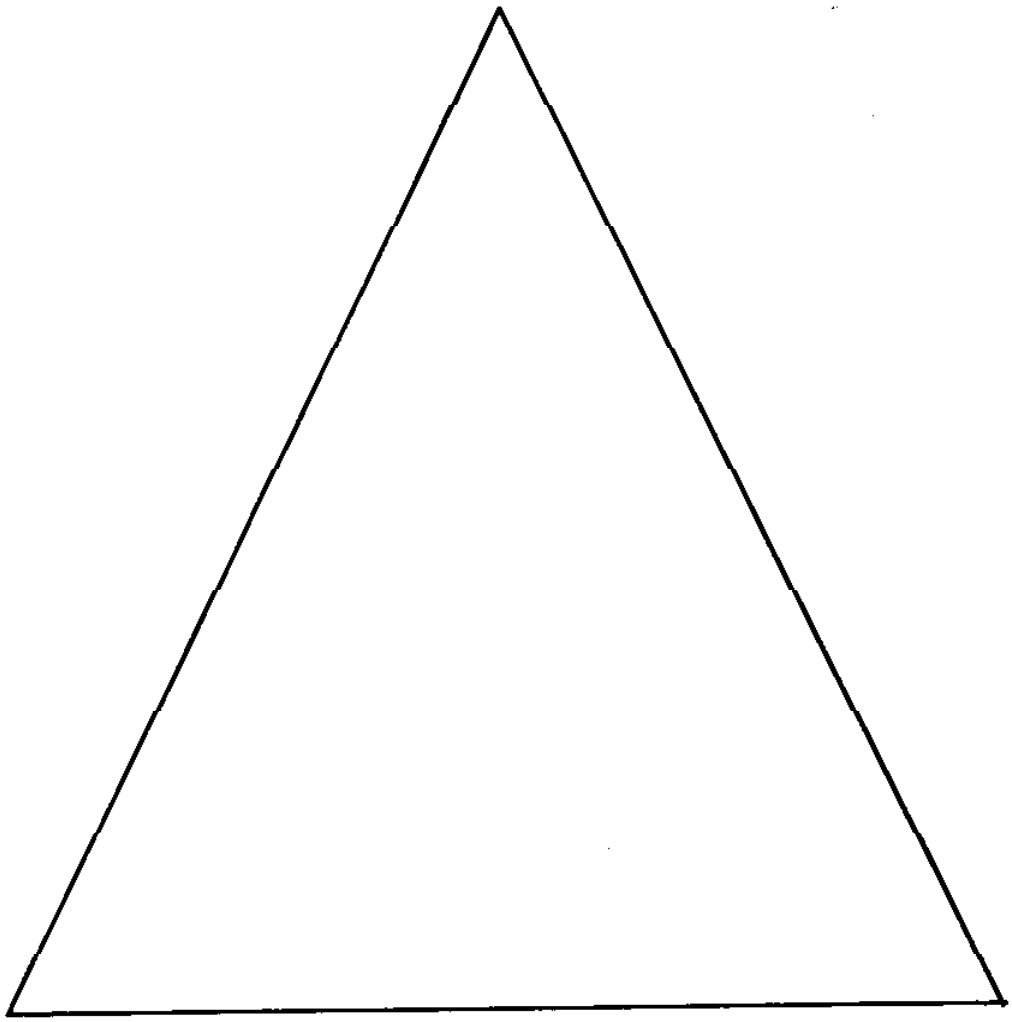
iii)

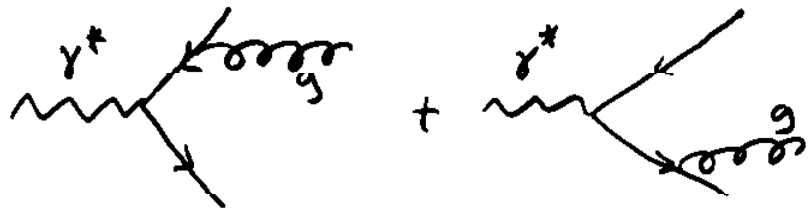
$$dp \propto \frac{1}{k_{2\perp}^2}\,\frac{1}{k_{1\perp}^2}$$

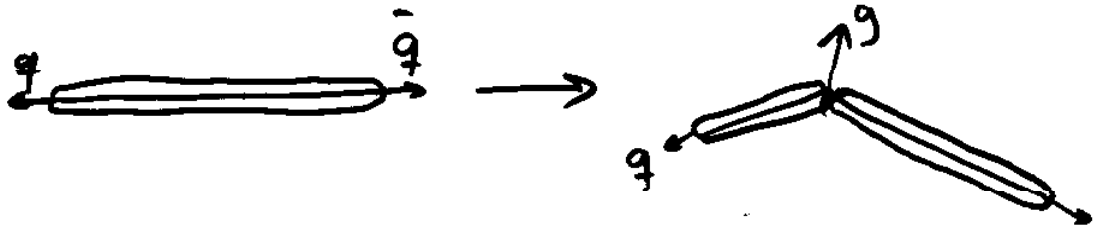
infrared safe!

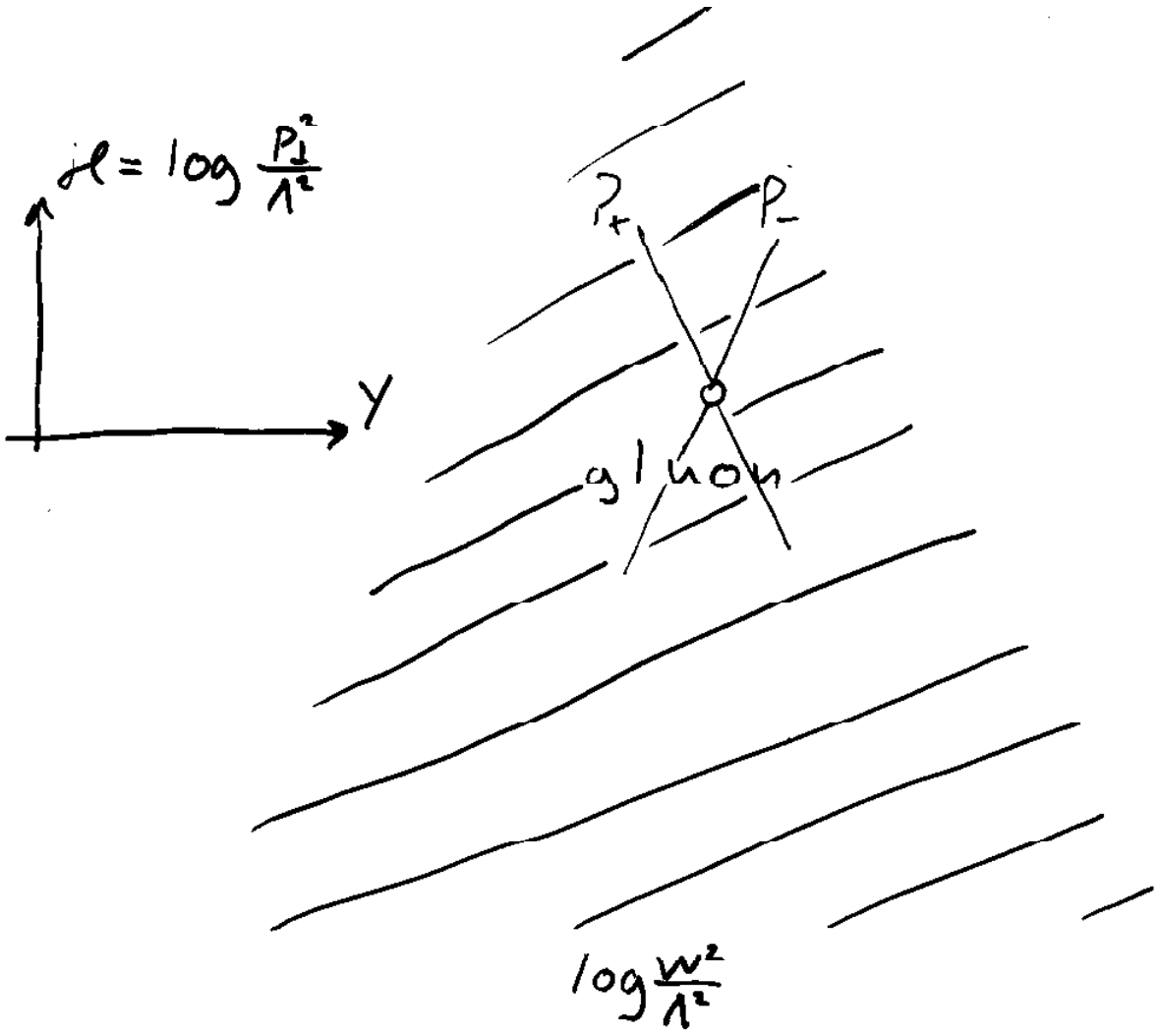
(no $\frac{1}{k_\perp^2}$)

triangle

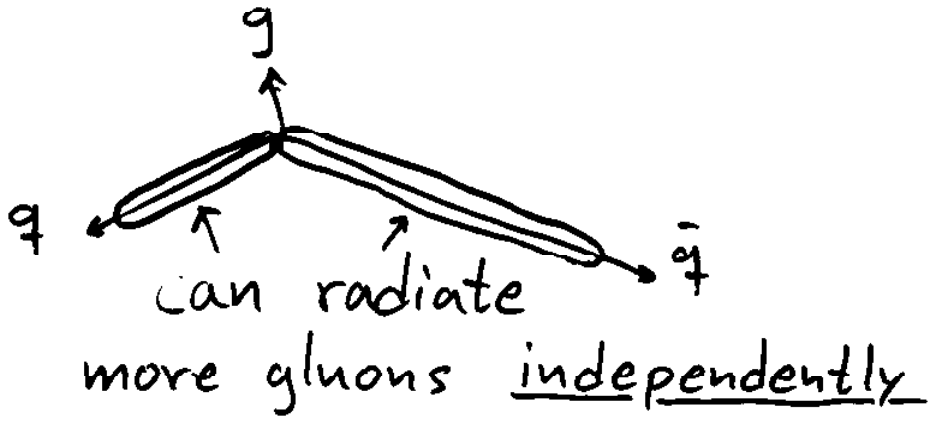


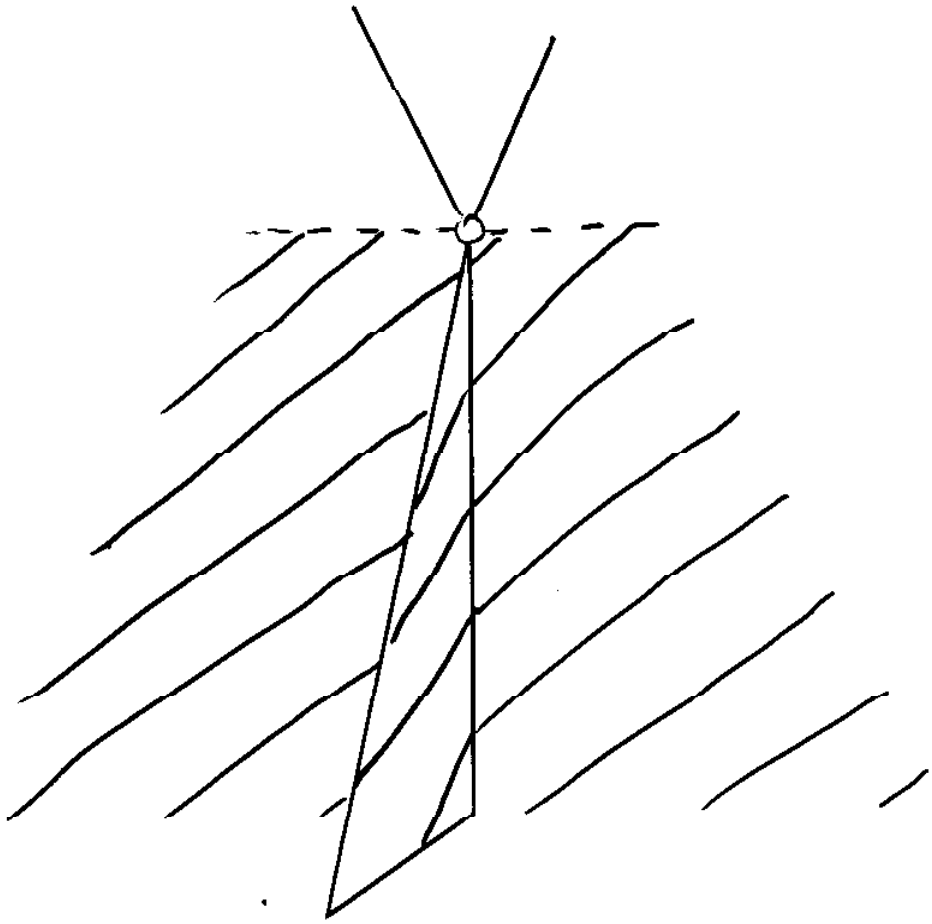
conventional: 

dipole: 

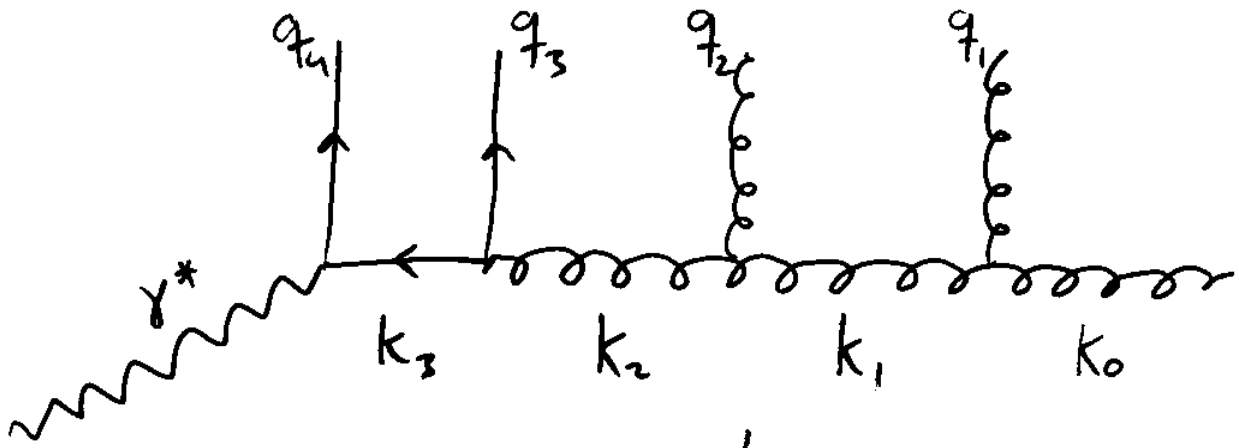


W = total available energy

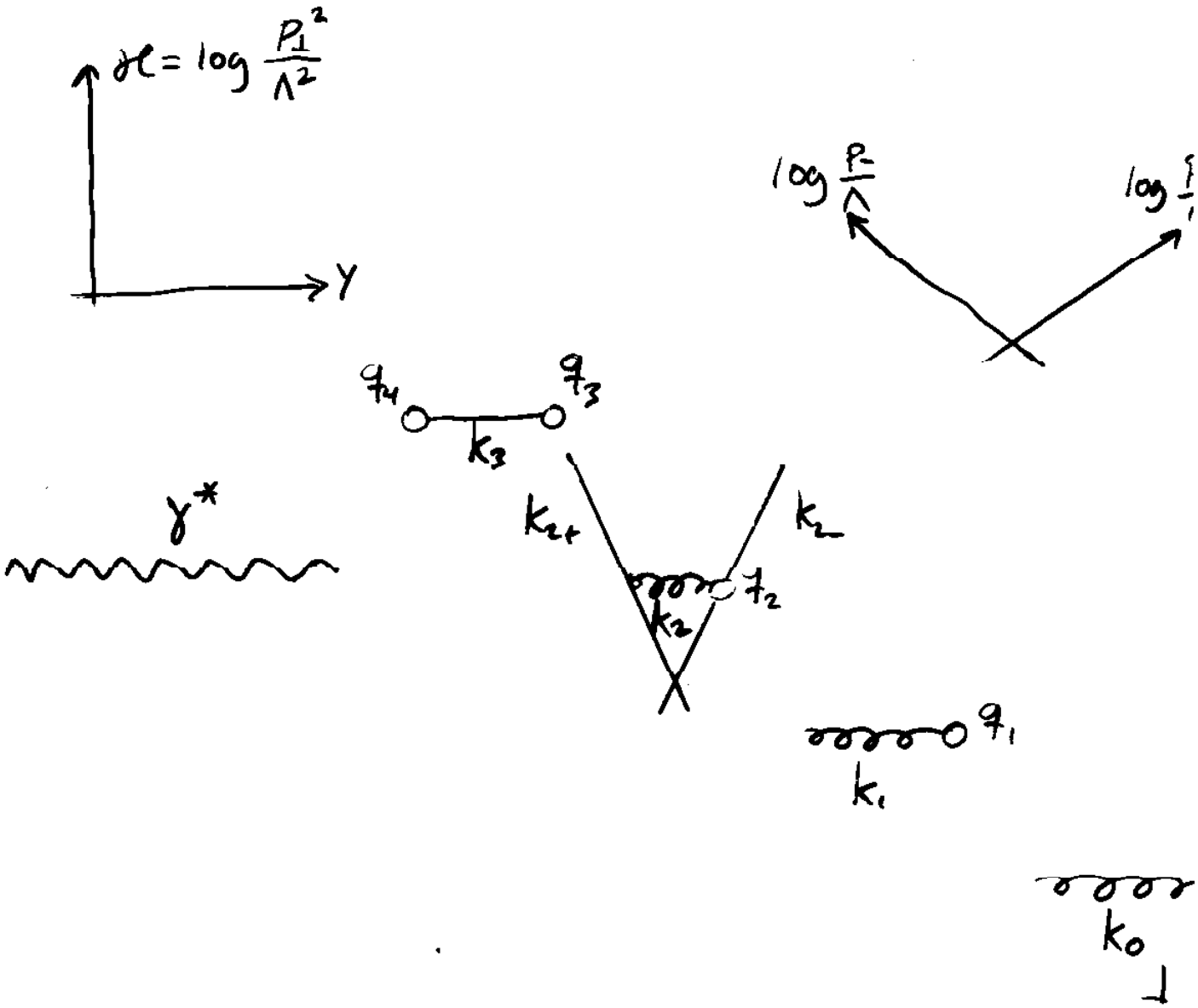

g
q
$\bar{q}$
can radiate
more gluons independently



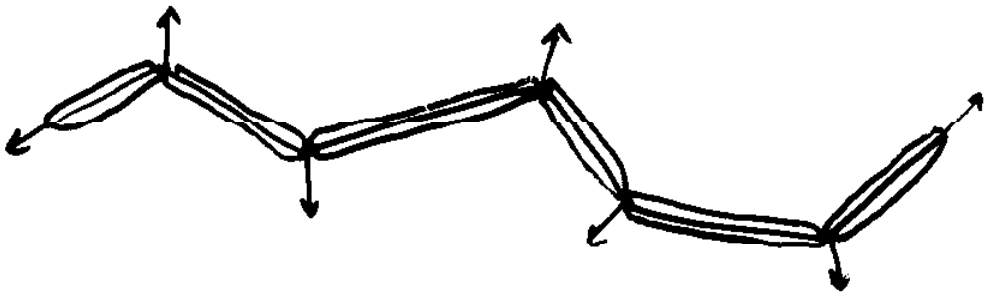
ISB

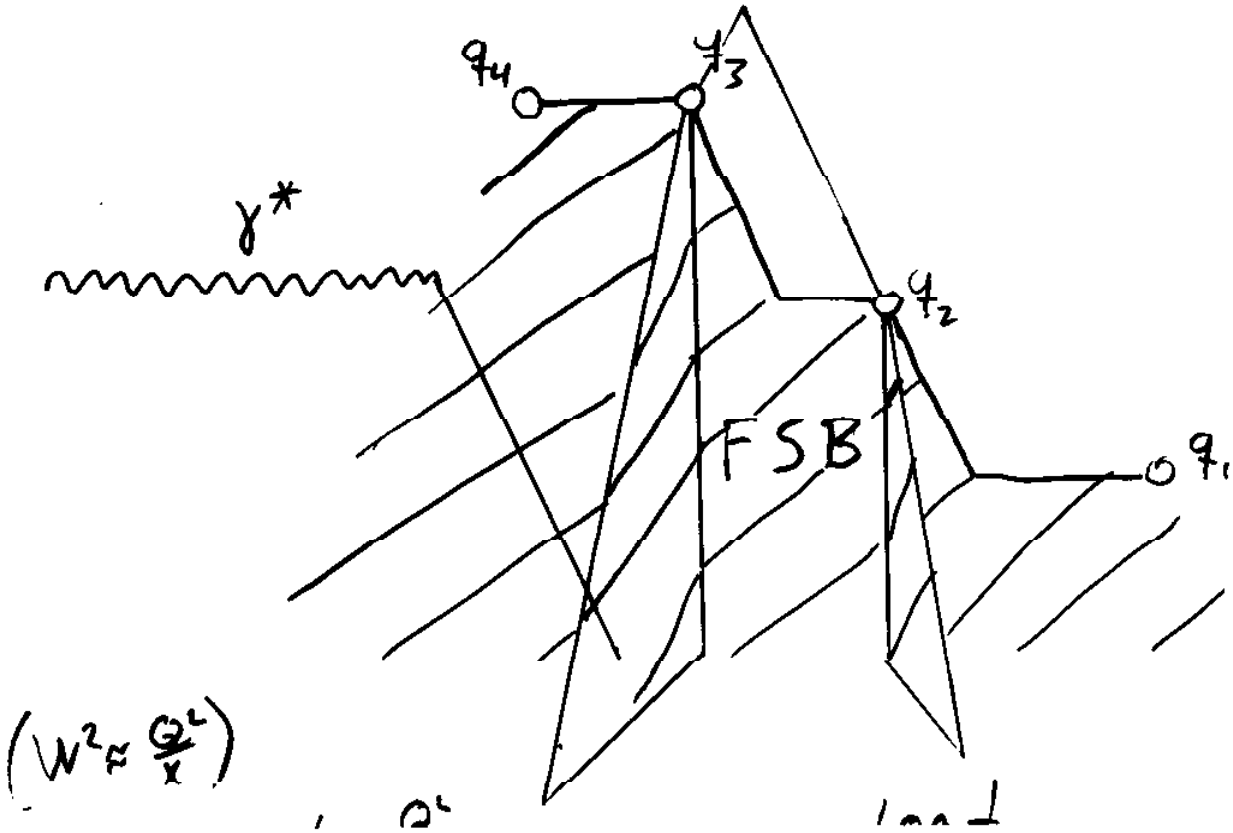


propagators

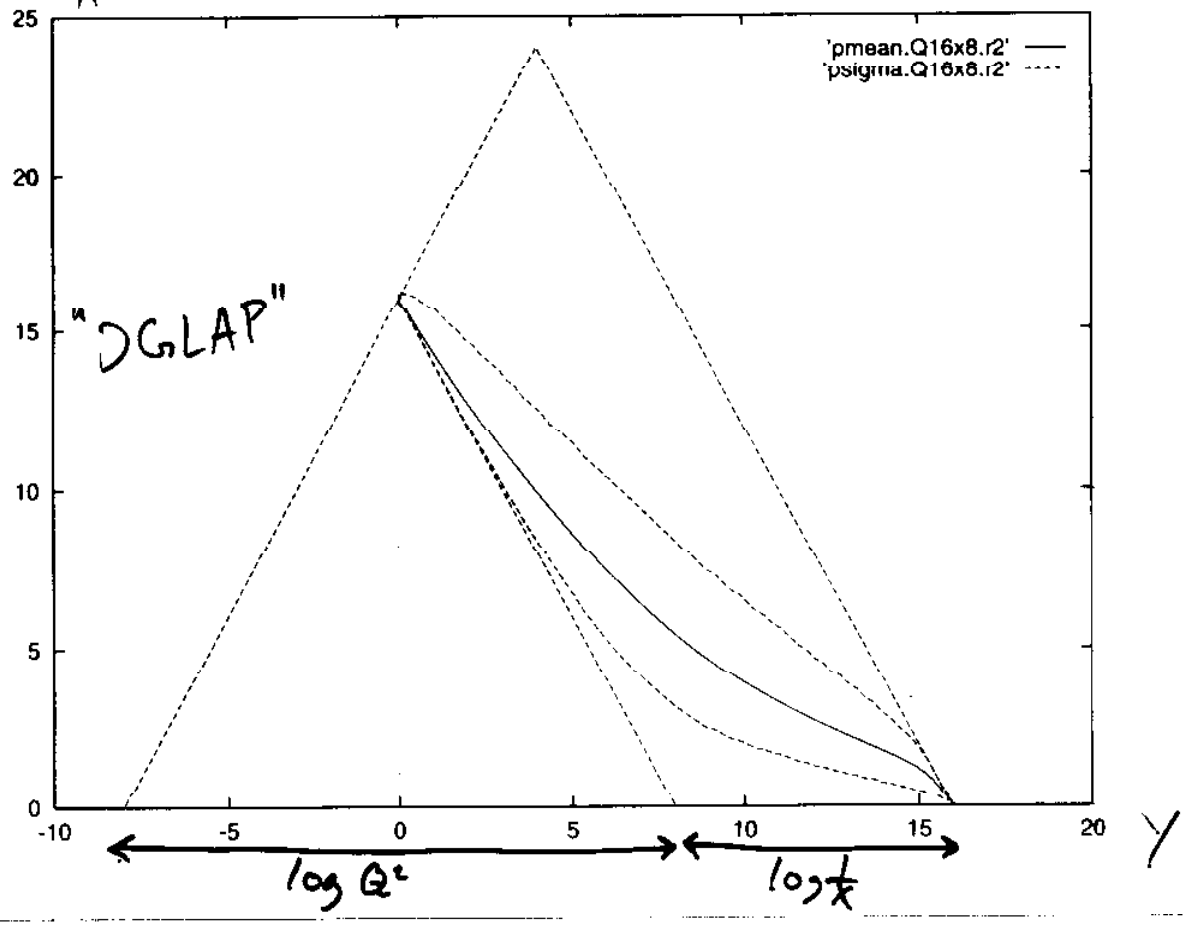


The Linked Dipole Chain

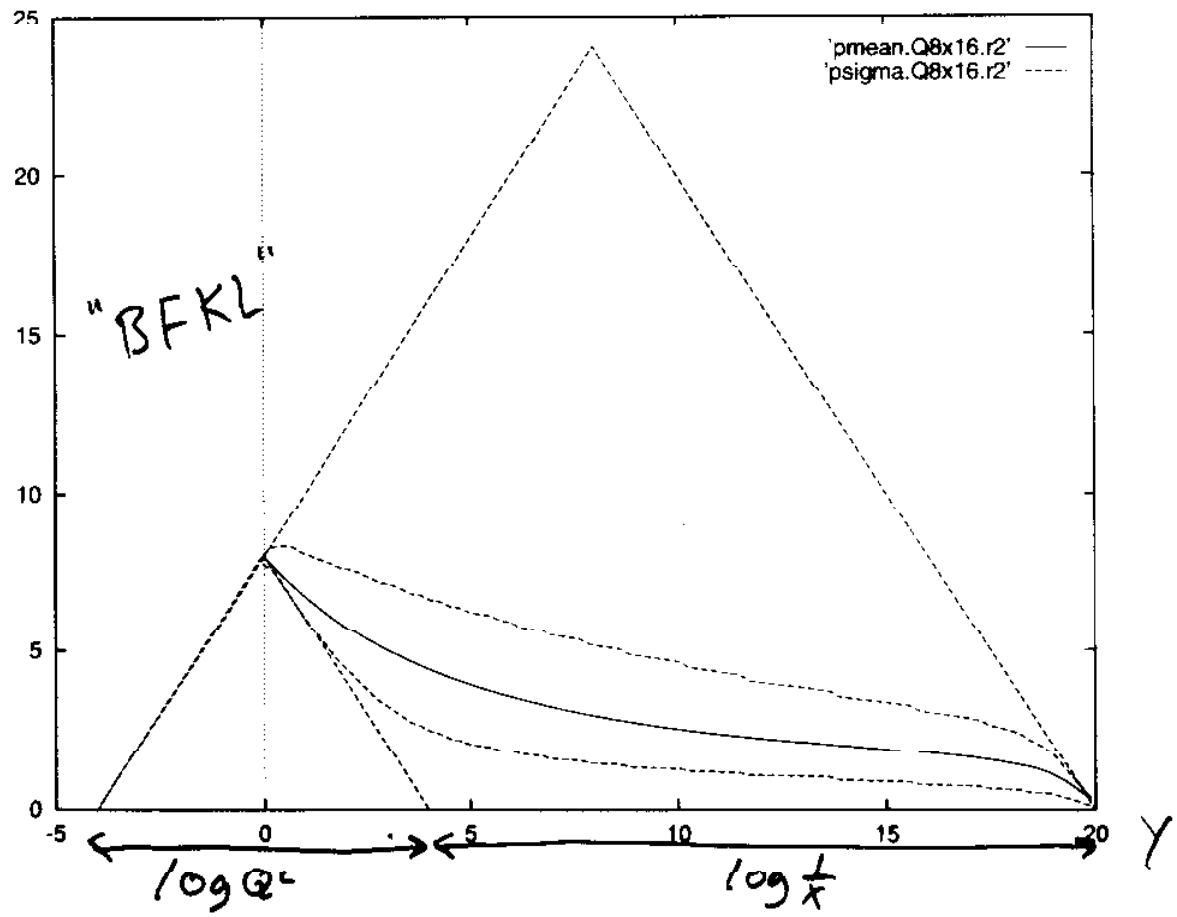




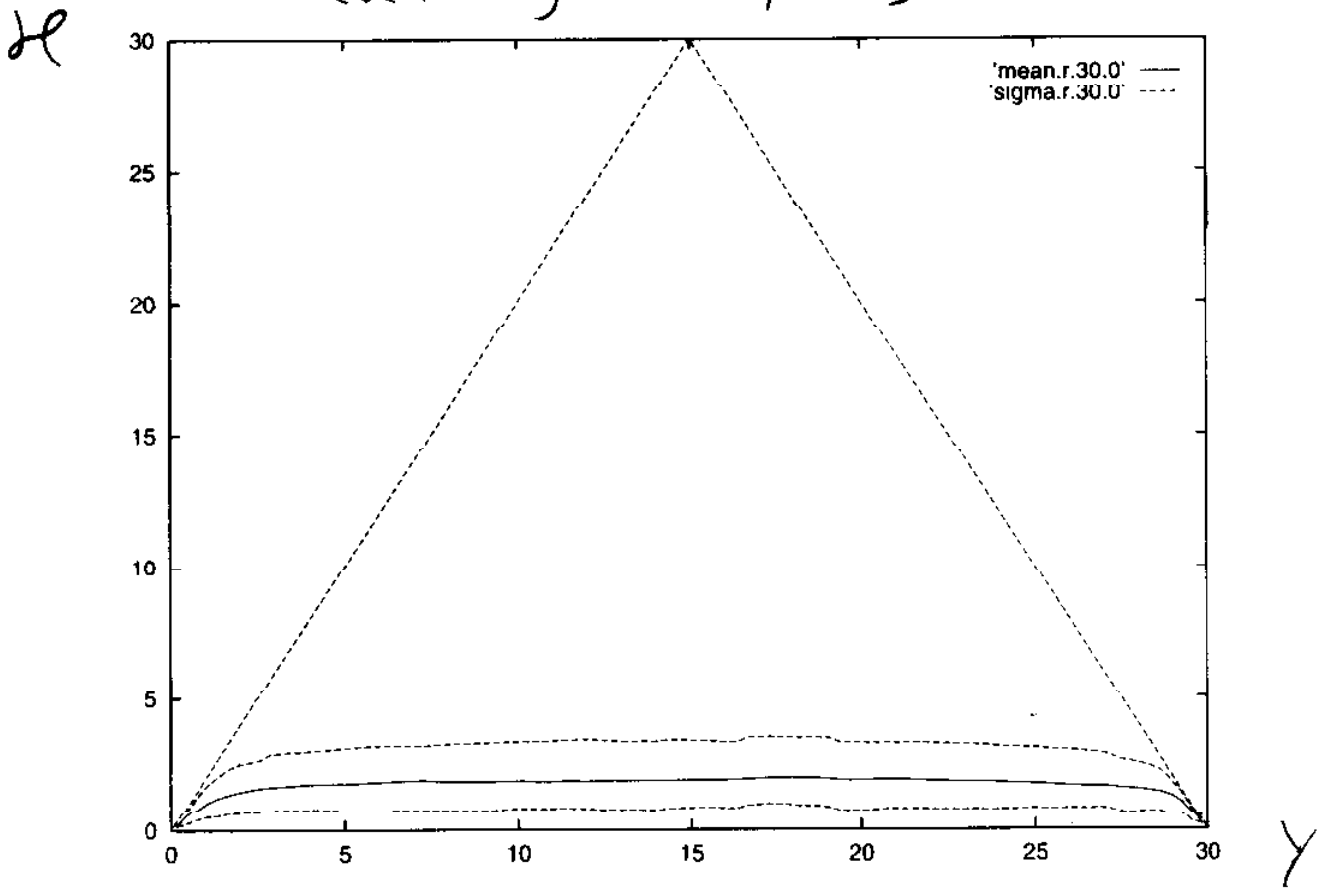
$\ell = \log \frac{1}{\Lambda^2}$ mean path



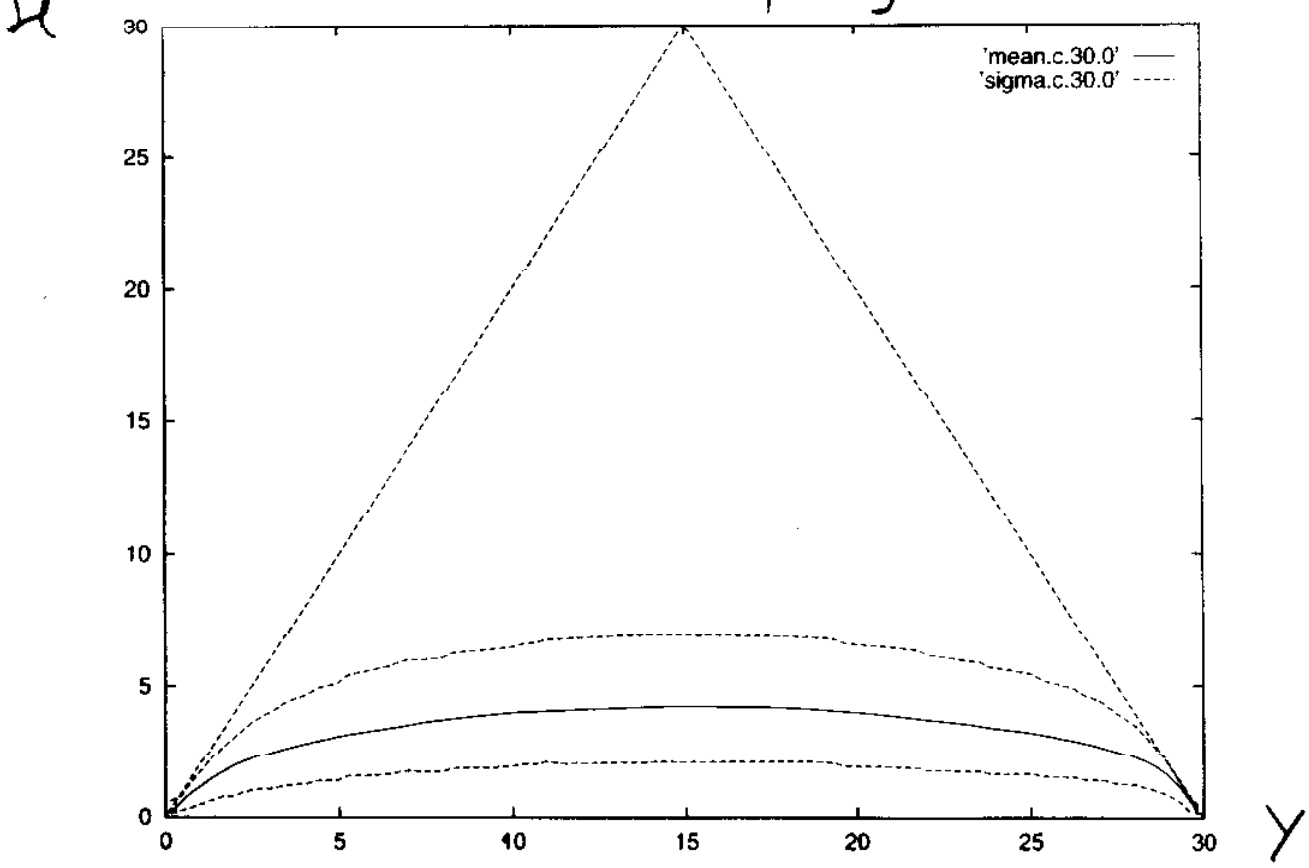
ℓ



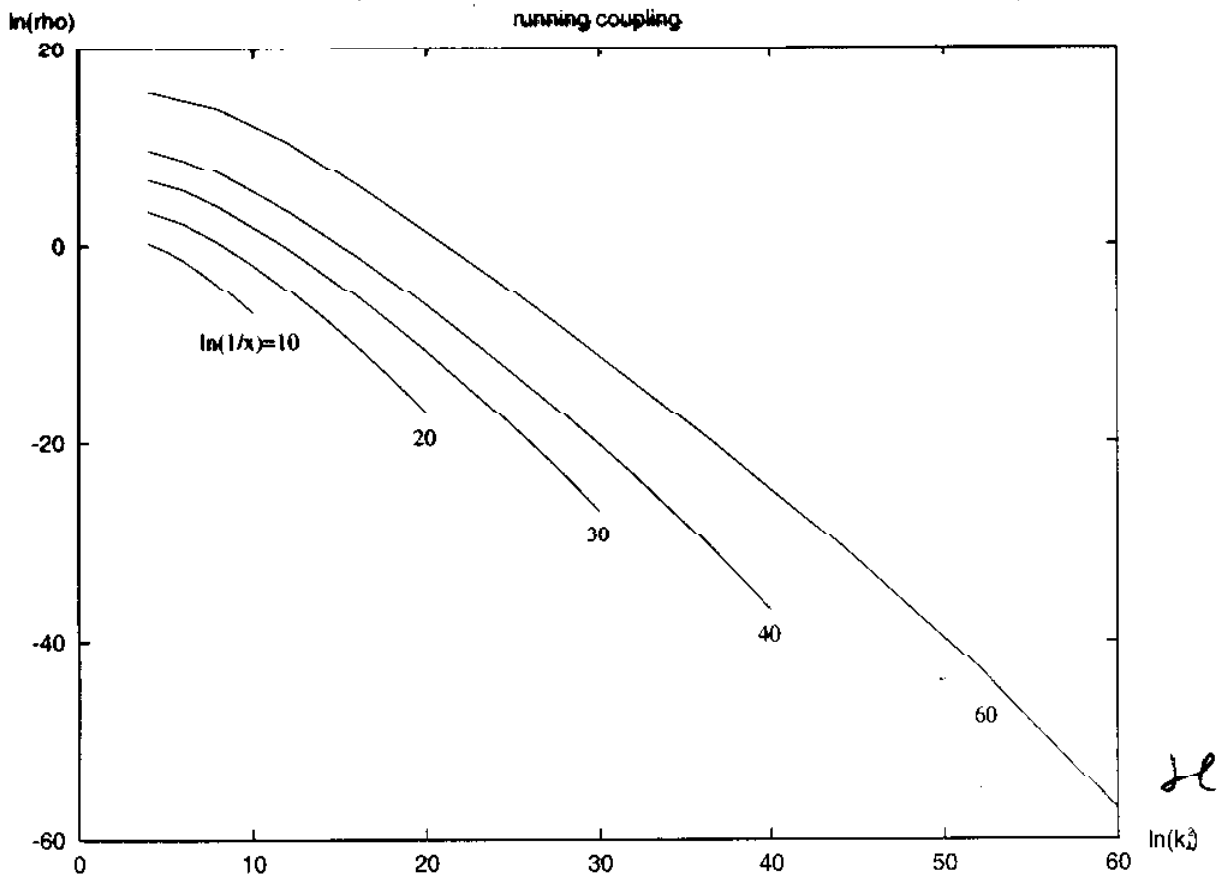
Running coupling

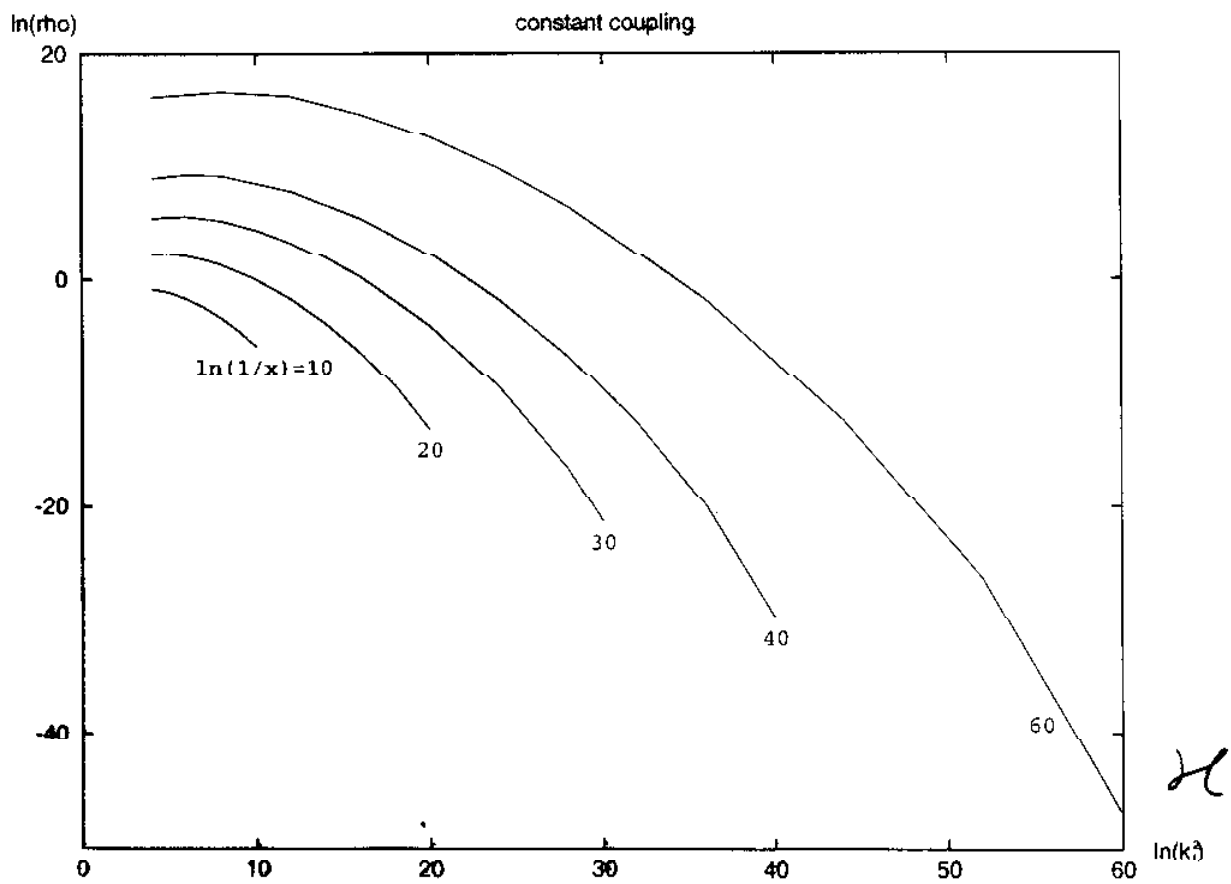


Constant coupling

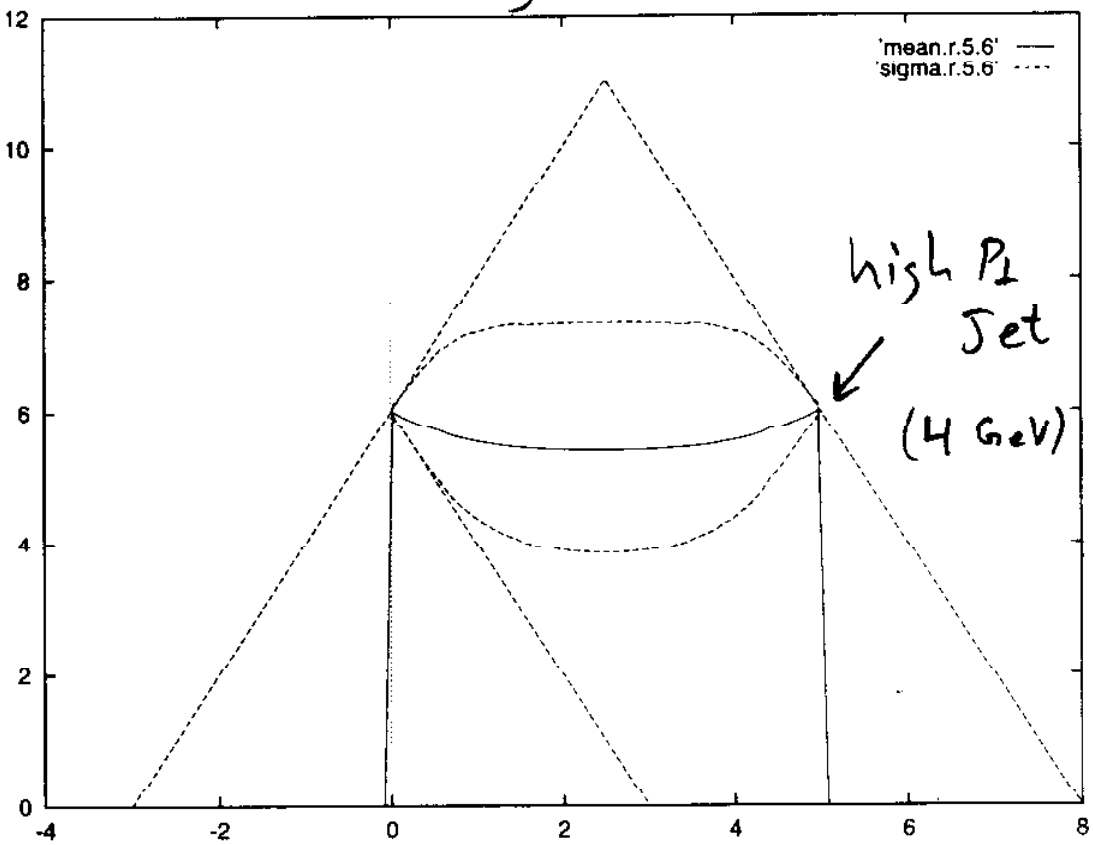


ln(ρ) mid rapidity parton density



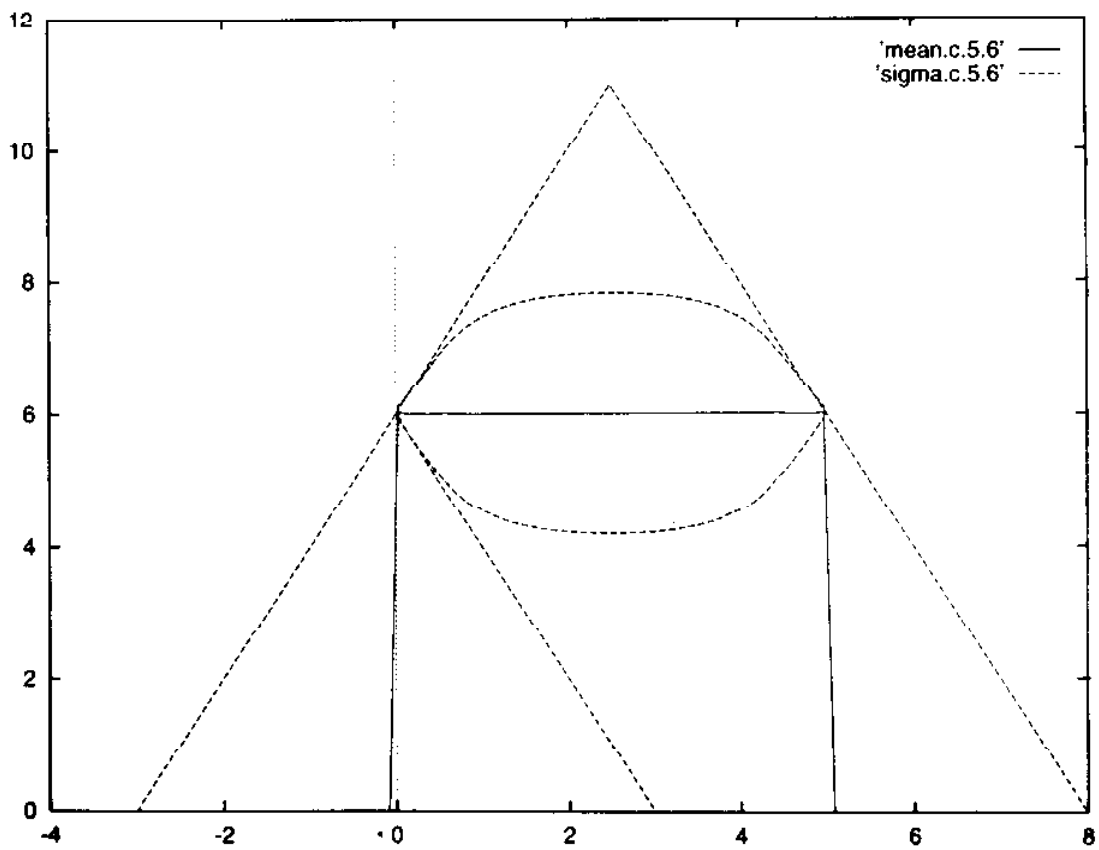


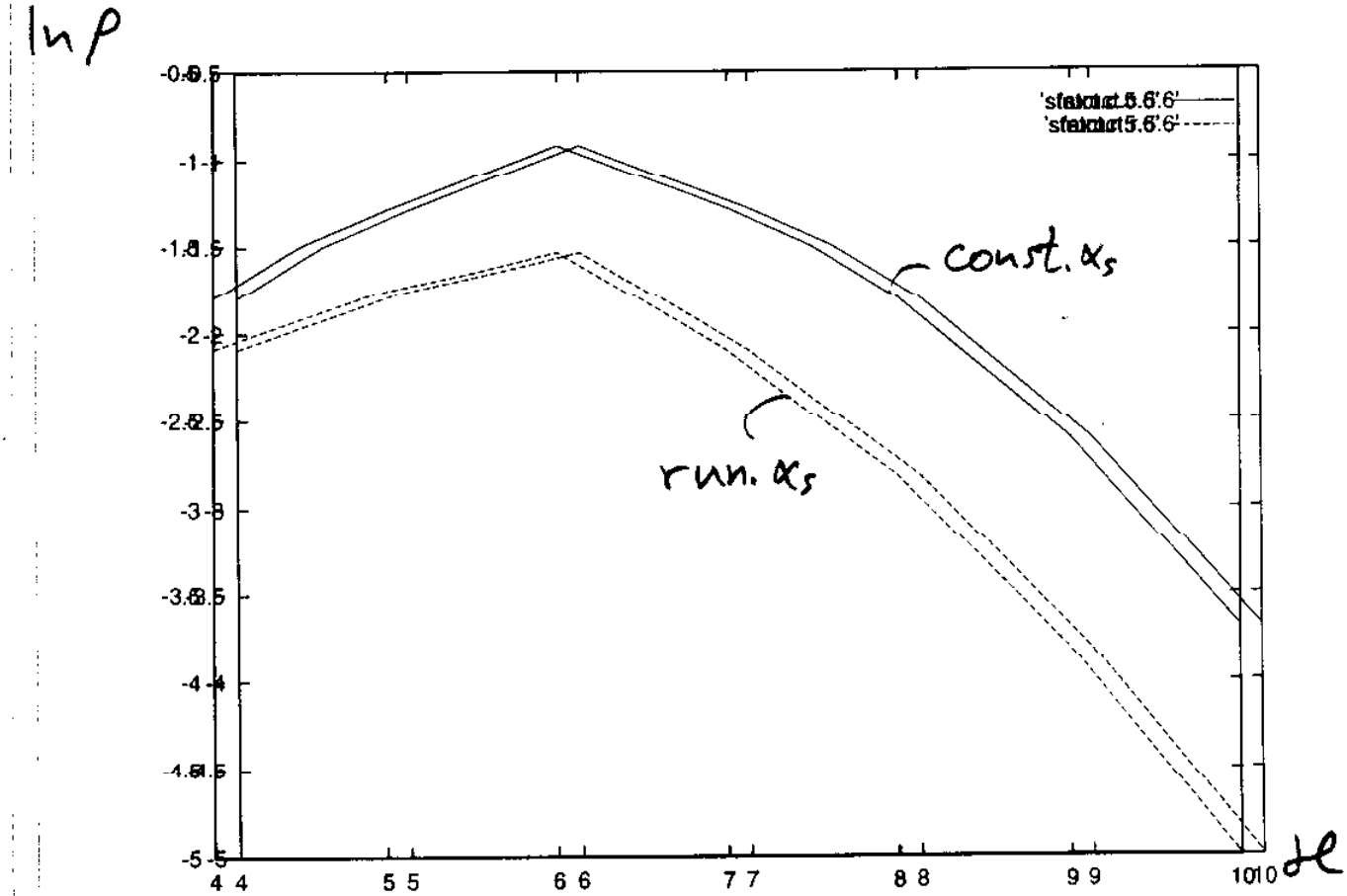
running α_s



$\Delta y = 5$

constant α_s




ln ρ
const. α_s
run. α_s
$\mathcal{L}$

The realistic MC

H.K, L. Lönnblad

A package with three parts:

i) ISB emissions & LDC-evolution

energy conservation

corrections to leading log

full splitting functions (quarks)

matrix element corrections for the electroweak vertex

- one also needs low virtuality input parton distributions

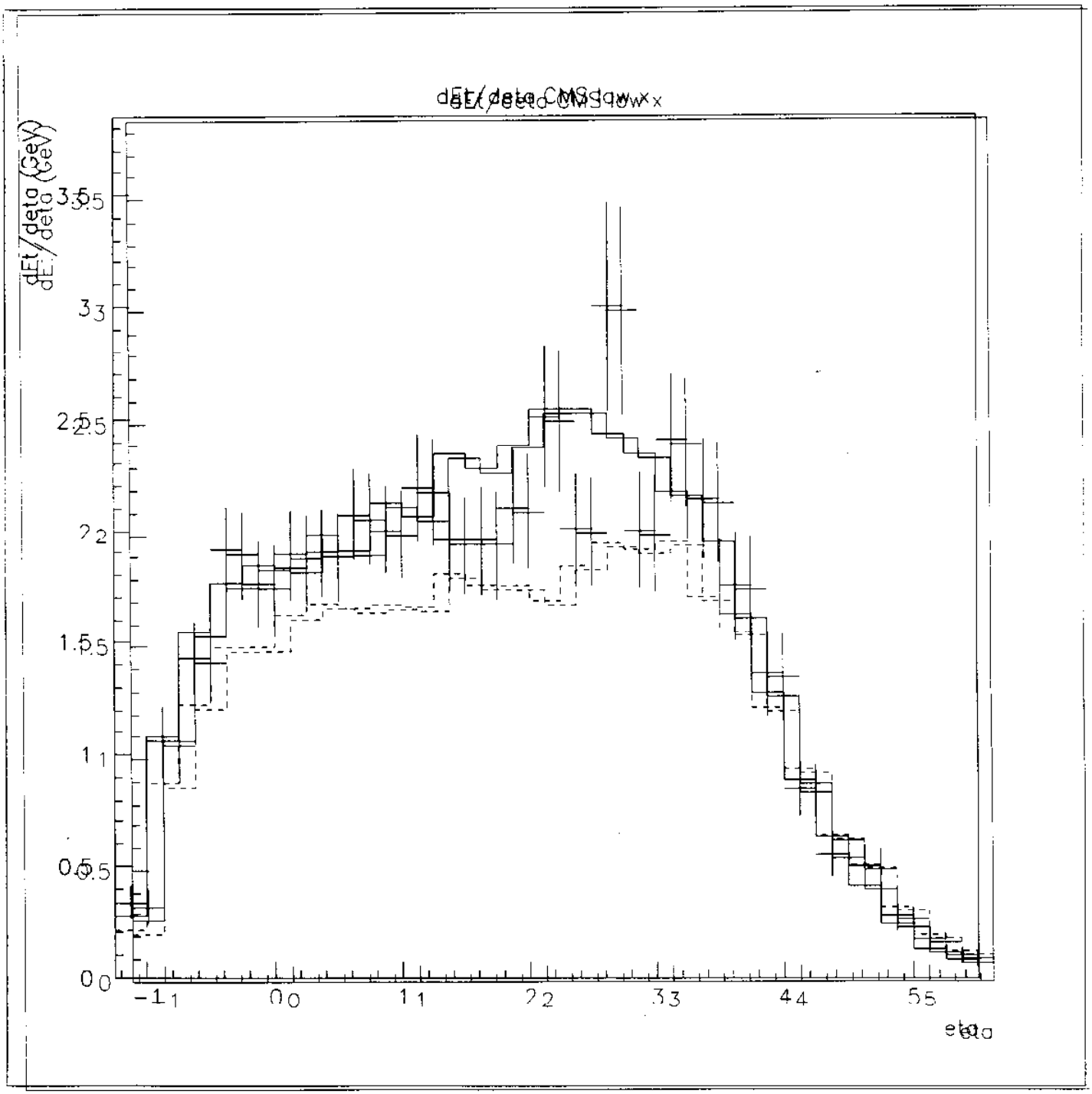
ii) FSB emissions: Using (modified) ARIADNE MC (dipoles)

iii) Hadronization: Using the JETSET MC

Soon Available!

but...

- debugging
- fit input distr. to F_2 and


dEt/deta (GeV)
3.5
3
2.5
2
1.5
1
0.5
0
-1
0
1
2
3
4
5
eta