Azimuthal decorrelation of forward jets

The correlation in the azimuthal angle Φ between the scattered electron and the forward jet in DIS - signature of the BFKL dynamics (?)

- **Quark Parton Model** **e + q → e + q,** simple 2-body kinematics $\Delta\Phi = \Phi_{el} - \Phi_{fj} = \pi$
- As the distance in rapidity ($Y = \ln(xjet/xb_{BJ})$ between the scattered electron and the forward jet grows the probability of multi – gluon emissions is increased
- **$O(\alpha_s^n)$ processes** NLOJET++ calculations

  calculation of ΔΦ in NLO BFKL , F. Schwennsen (PhD, 2007)

  MC models with different QCD evolution schemes

2000 data , L = 51.5 pb-1,

trigger S61

DIS cuts

$5.0 < Q^2 < 85$ GeV^2

$0.1 < y < 0.7$

$0.0001 < x_{Bj} < 0.004$

$156^o < \Theta_{el} < 175^o$

$E_{el} > 10$ GeV

\+ standard technical cuts

Forward jets

Inclusive k_t- algorithm in the Breit frame

→ boost to LAB

Selection of high energy and high p_t jets close to the proton, all cuts in LAB

$7^o < \Theta_{jet} < 20^o$

$P_{t,jet} > 5.0$ GeV (!)

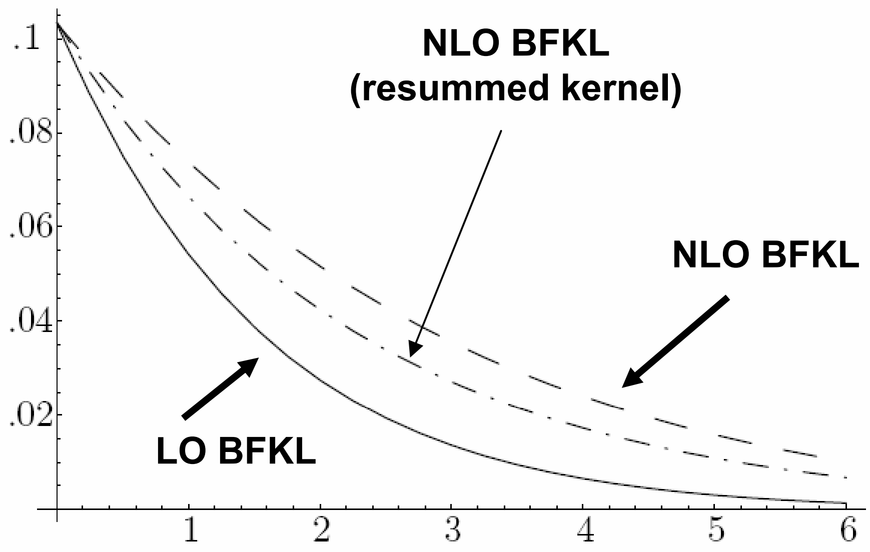
$x_{jet} = E_{jet}/E_P > 0.035$

$0.5 < p_t^2 / Q^2 < 5.0$

~ 20 000 forward jet events

Forward jet production at NLO BFKL

<cos 2ΔΦ>



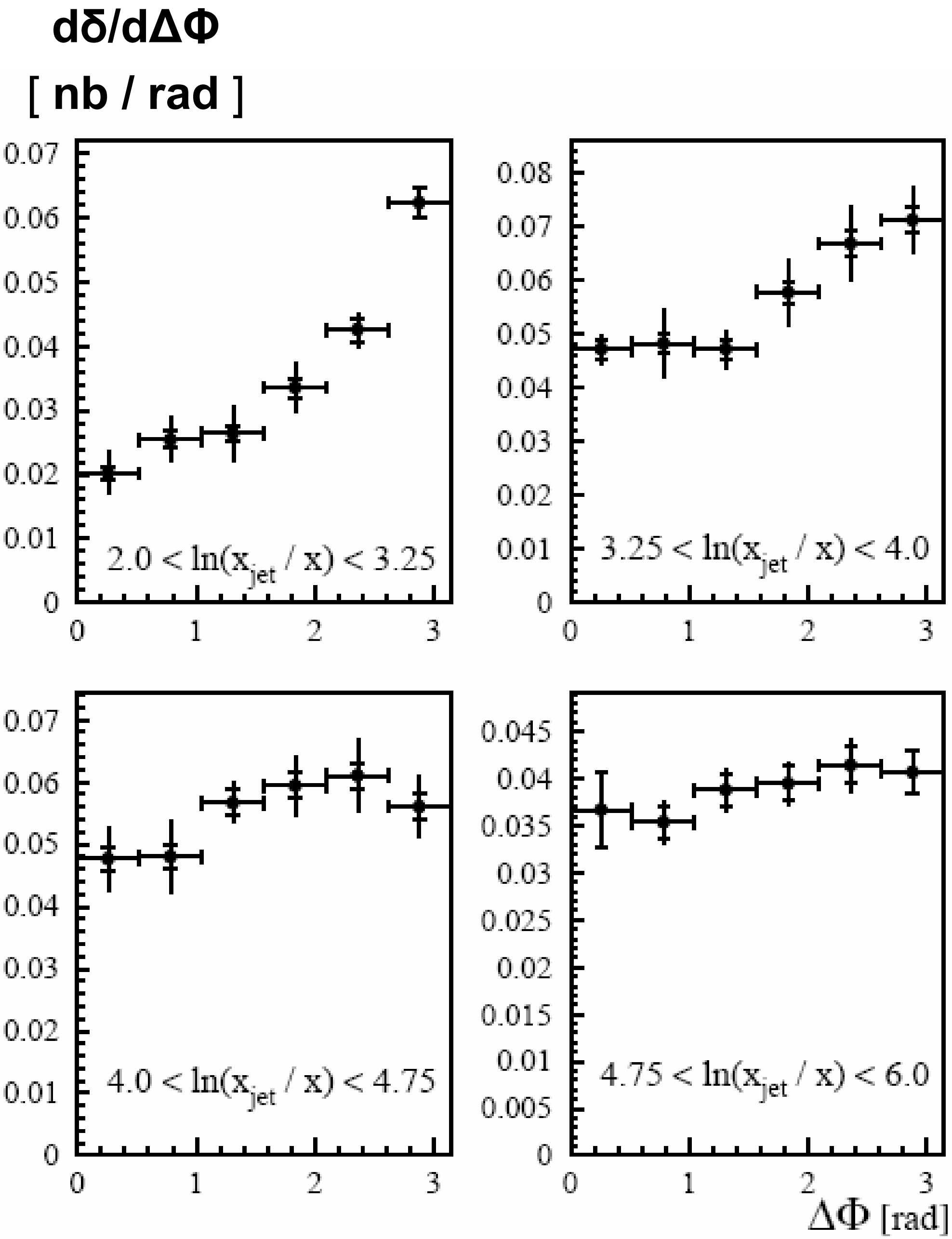
the BFKL kernel calculated to the NLO accuracy :

Resummation of terms ~ $\alpha_S(\alpha_S Y)^n$

Y = ln(xjet /x_{BJ})

(HERA LAB frame, forward jets with ZEUS cuts)

- **The forward jet more decorrelated from the scattered electron for larger rapidity difference (center of mass energy)**
- **The azimuthal angle correlations increase when HO corrections are included for a fixed value of x_{Bj}**
- **Some angular deccorelation exits even for very small Y**



Cross sections corrected to hadron level

statistical errors + systematic errors from the model dependence

Experimental problems :

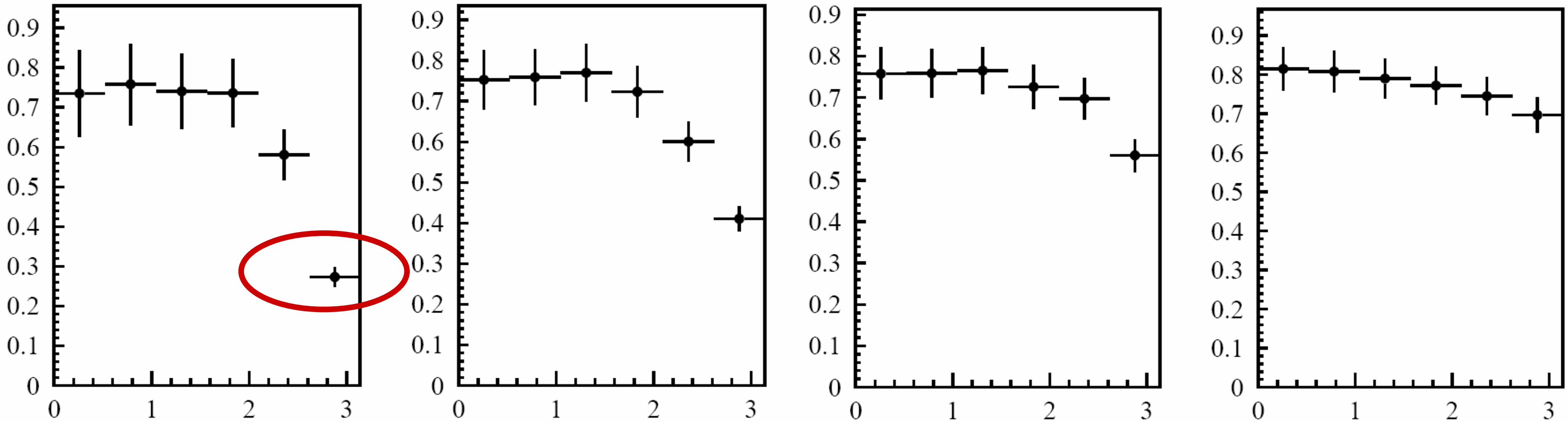
Large trigger and detector corrections at $\Delta\Phi \sim \pi$

mainly for small separation in rapidity between the forw. jet and the scattered electron,
from the contribution of QPM-like events to forward jet sample

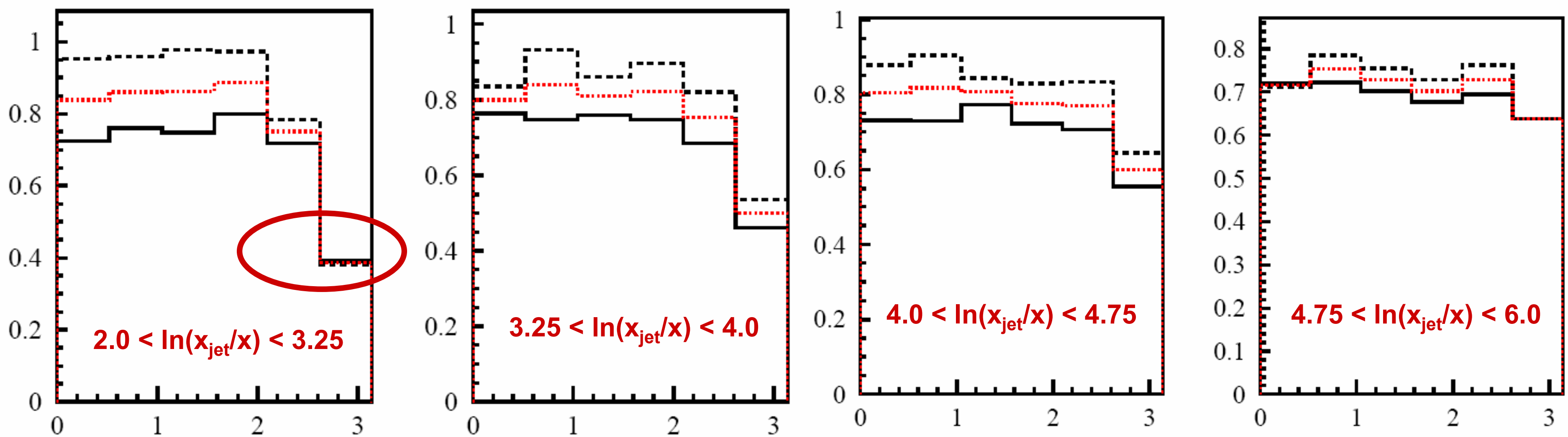
QED radiation from the lepton :

- **→ measured y higher than real one**
- **→ forward jet from the struck quark**

Trigger efficiency (S61)

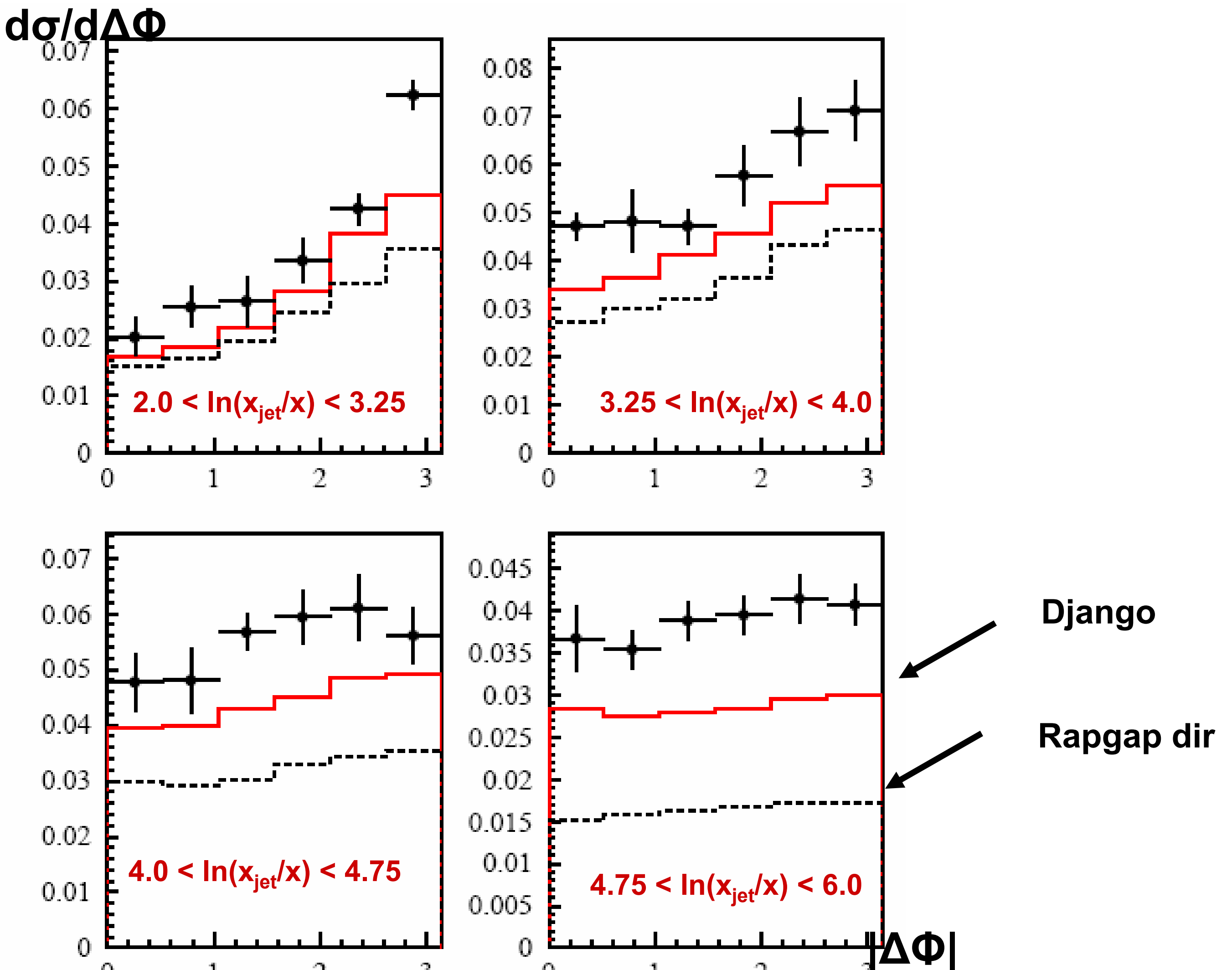


Detector corrections (Django and RAPGAP)

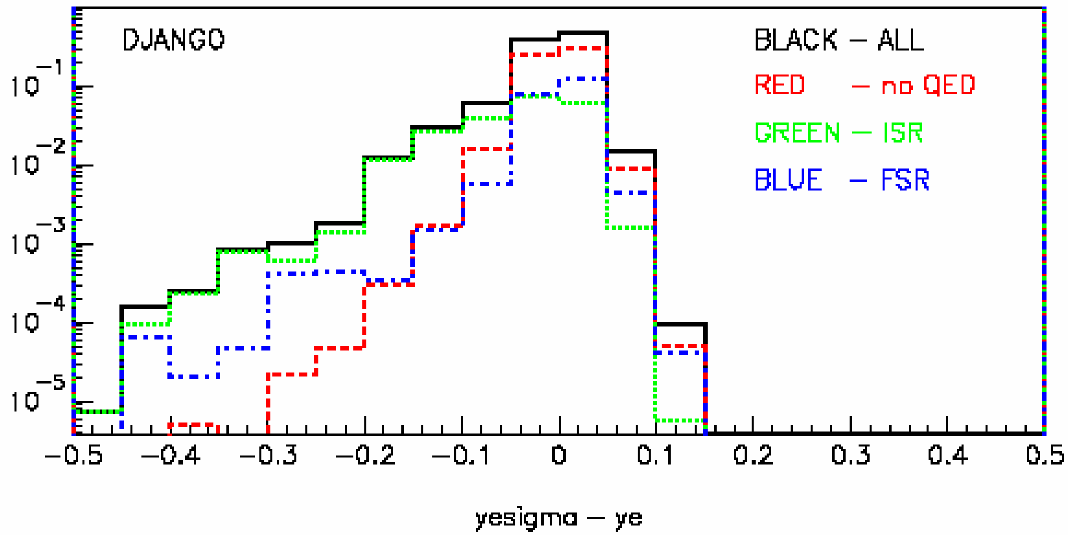


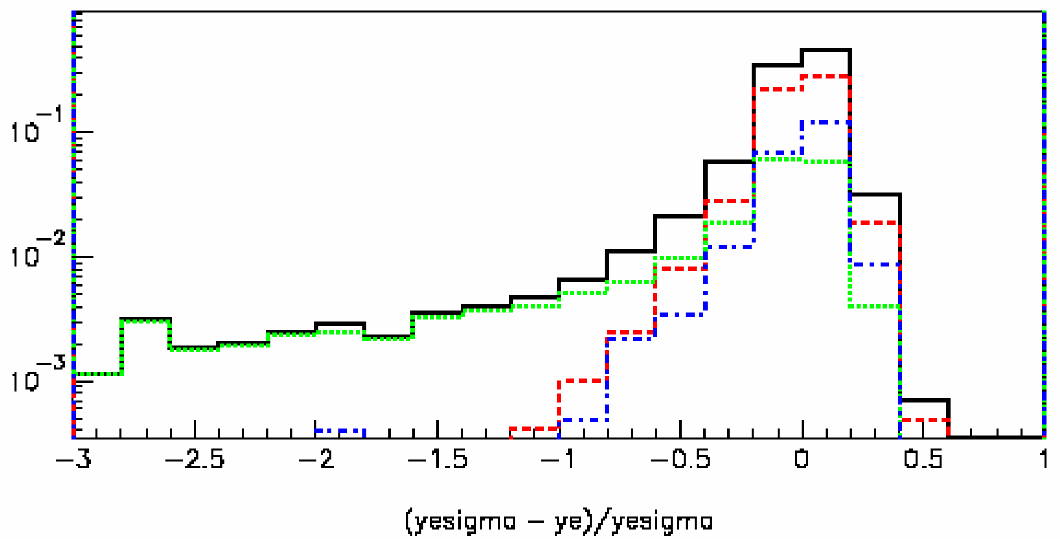
higher x → **Lower x**

Comparison to QCD models



Monte Carlo generators, DJANGO and RAPGAP dir, do not describe well the shape and the magnitude of the cross sections





Remove background from QED radiation :

make cuts on kinematic variables

$y_{e\Sigma} - y_e$, $(y_{e\Sigma} - y_e)/y_{e\Sigma}$, etc

$$y_{e\Sigma} - y_e > -0.2$$

$$(y_{e\Sigma} - y_{e)} / y_{e\Sigma}) > -1.0$$

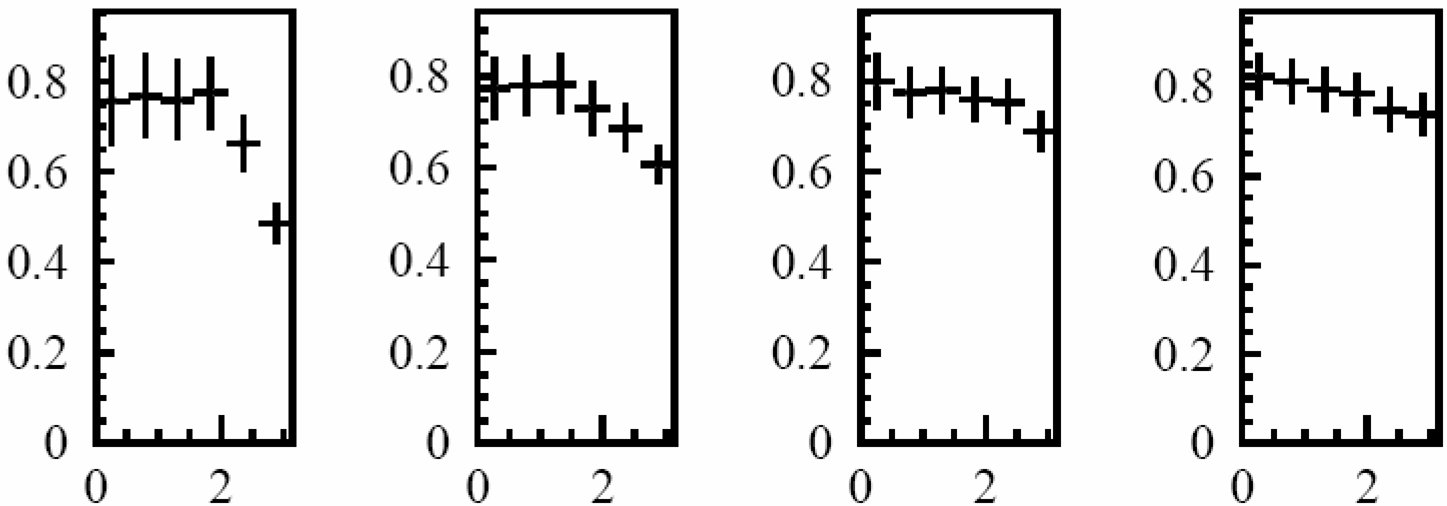
lose ~10% of events in data

(cuts need tuning)

→ **better trigger efficiency**

→ **better detector corrections**

Trigger efficiency



Cuts on y variables – improvement in the trigger efficiency ~ΔΦ= π

Plans

- **cross sections in $\Delta\Phi$:**

  clean experimental data sample (improve trigger efficiency, detector corrections)

- **determination of the dependence of** **$<\cos 2 \cdot \Delta\Phi>$ vs. ln(xjet / x_{BJ})**

  and comparison with NLO BFKL predictions (contact F. Schwennsen)

- **studies of topologies with the forward jet and additional hard jet in the central region**

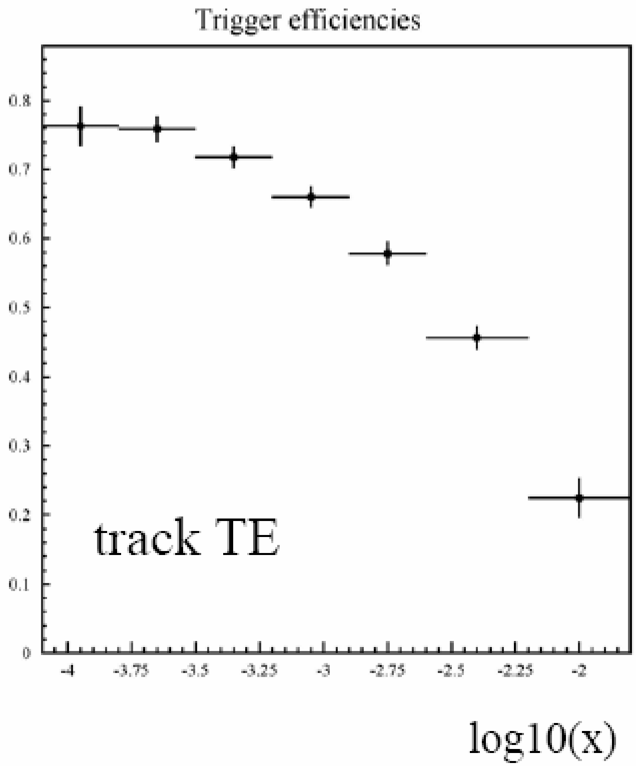
- **calculation of other systematic uncertainties – in progress**

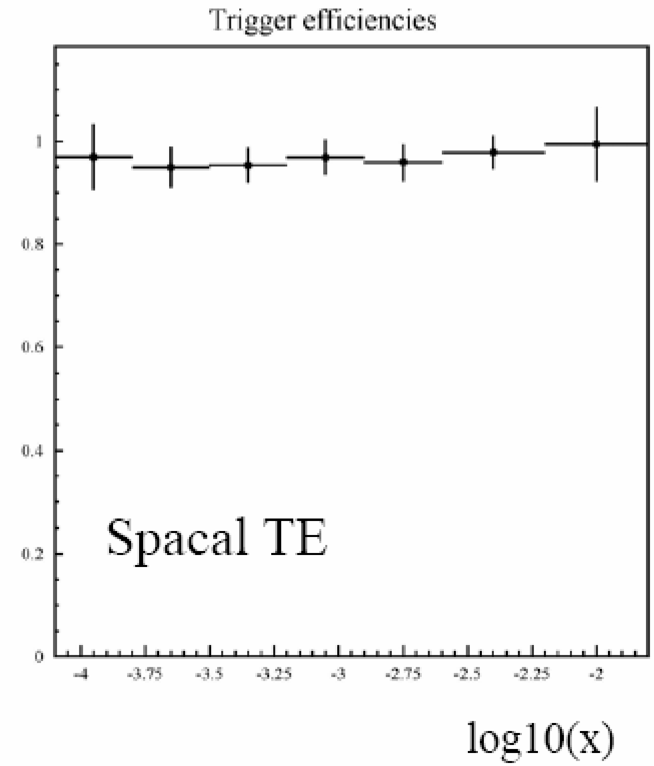
- **comparison with RAPGAP (direct + resolved components) and CASCADE**

- **comparison with NLOJET++ predictions**

Additional slides

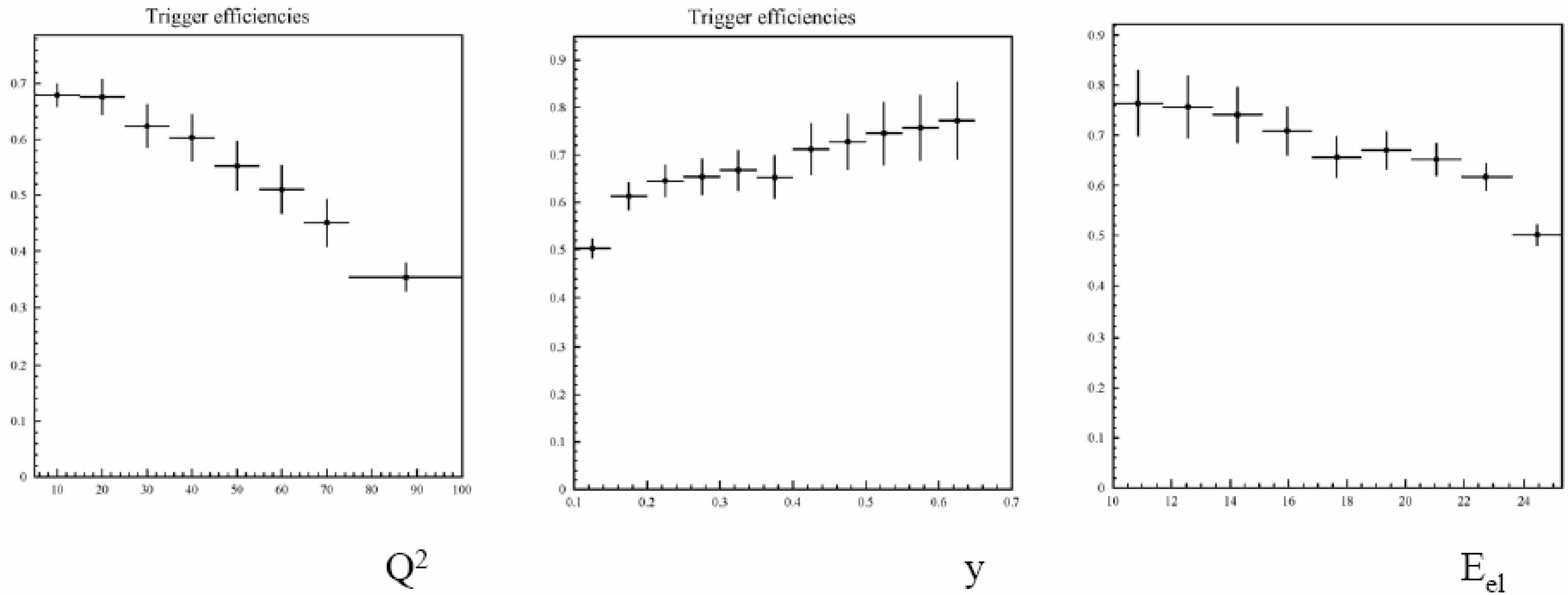
Efficiency of the subtrigger S61





Main contribution from track trigger elements

Efficiency of the subtrigger S61



Efficiency of the subtrigger S61