Multiple interactions and underlying event in photoproduction of jets at HERA

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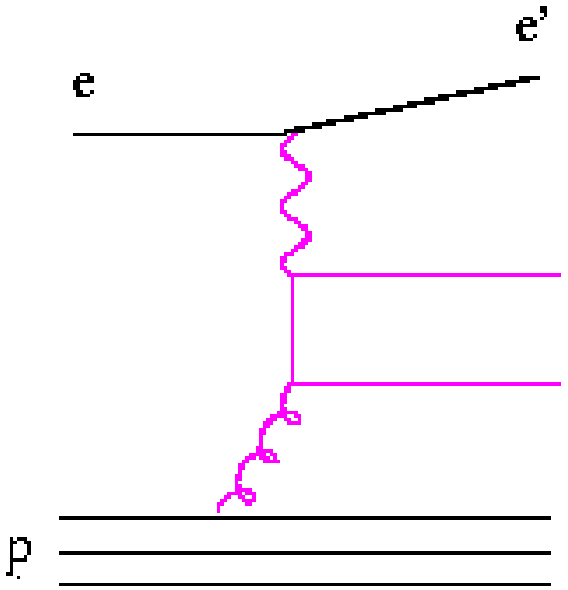
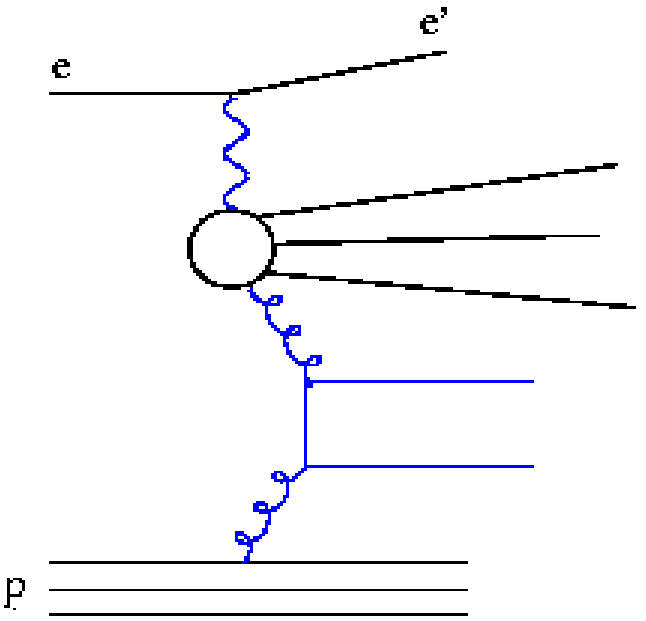
MULTIPLE INTERACTIONS - WHAT?

photoproduction $\leftrightarrow$ $Q^2 < 1.0$ GeV^2



DIRECT



RESOLVED

$\gamma q \rightarrow gq$

$\gamma g \rightarrow qq$

$qq \rightarrow qq$

$qq \rightarrow gg$

$gq \rightarrow gq$

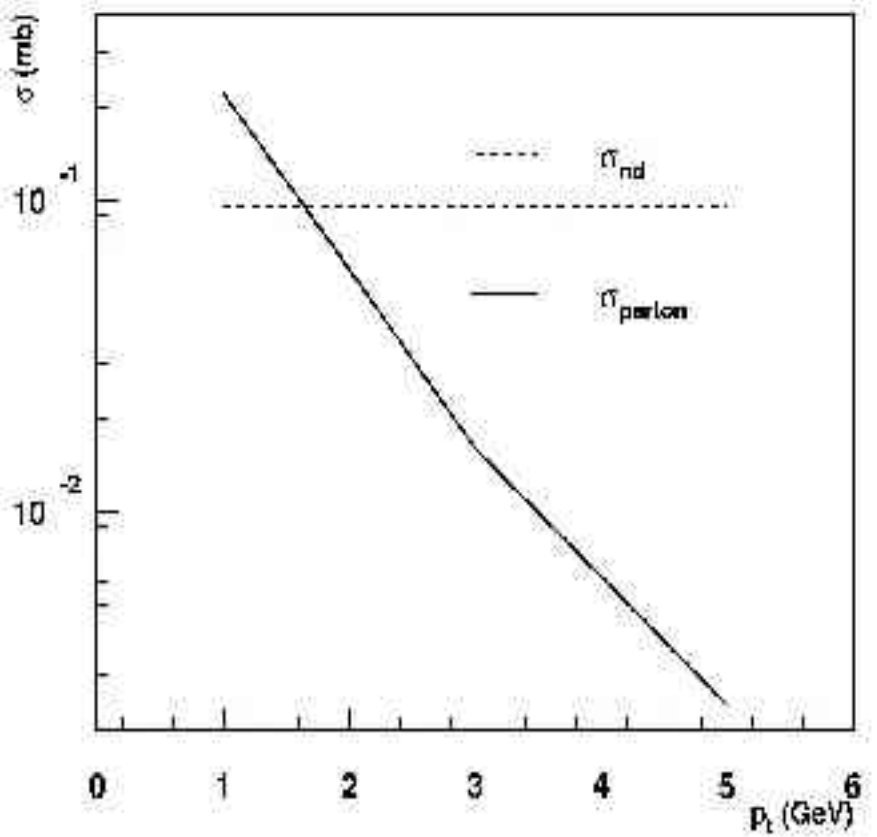
$gg \rightarrow qq$

$gg \rightarrow gg$

MULTIPLE INTERACTIONS - WHY?

Basic partonic perturbative cross section

$$\sigma_{\mathrm{hard}}(p^2_{\perp\,\mathrm{min}}) = \int_{p^2_{\perp\mathrm{min}}} \frac{d\sigma_{\mathrm{hard}}(p^2_\perp)}{dp^2_\perp} dp^2_\perp$$



Diverges faster than $1/p^4_{\mathrm{t\ min}}$

as $p_{\mathrm{t\ min}}$ -> 0 and...

exceeds eventually

total inelastic cross section,

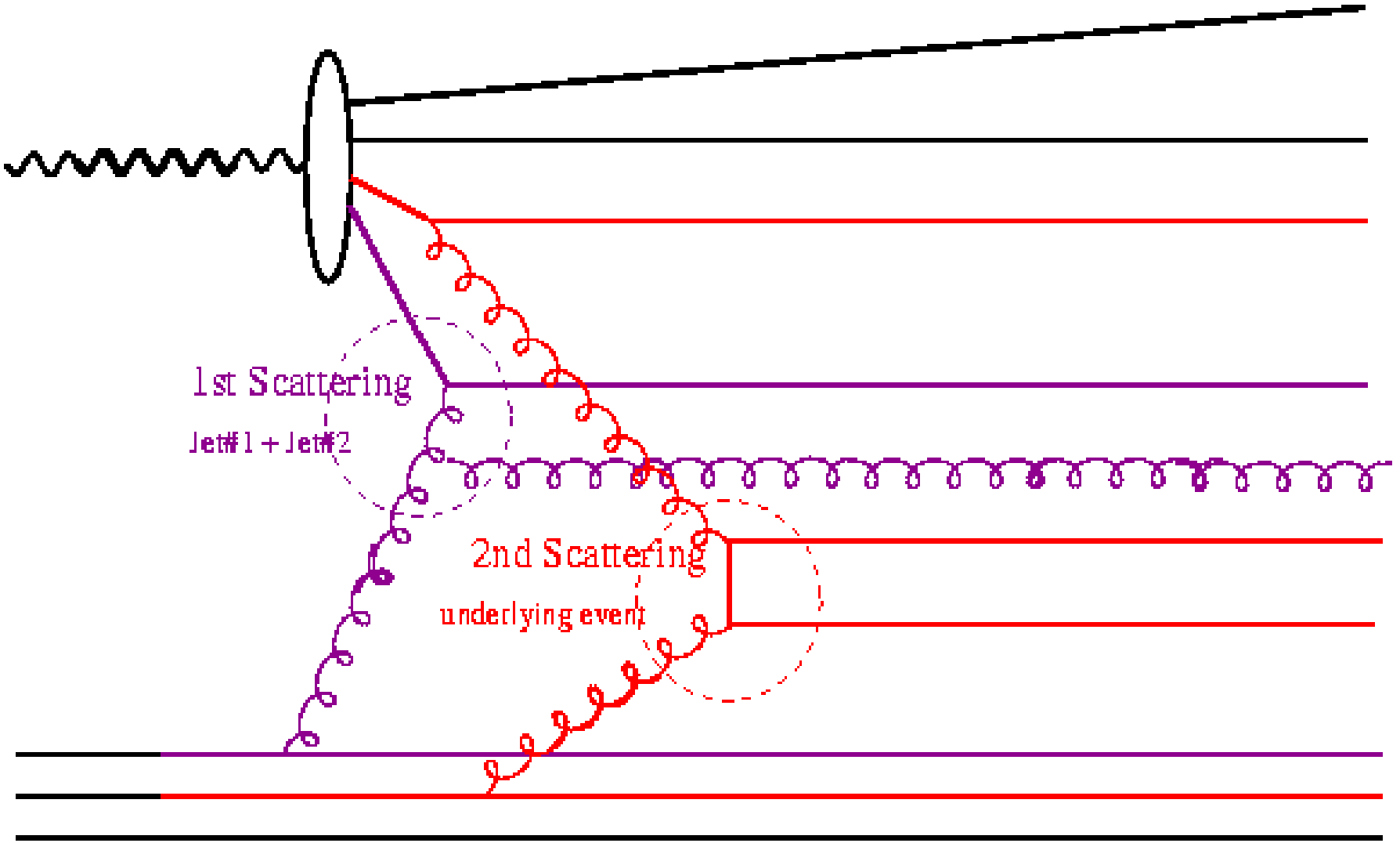
resulting in multiple scatterings

the average number of scatterings

per event is given by:

$$\langle n \rangle = \sigma_{\mathrm{hard}}(p_{\perp\mathrm{min}})/\sigma_{\mathrm{nd}}$$

MULTIPLE INTERACTIONS - WHAT?



MULTIPLE INTERACTIONS - WHERE?

We are looking for:

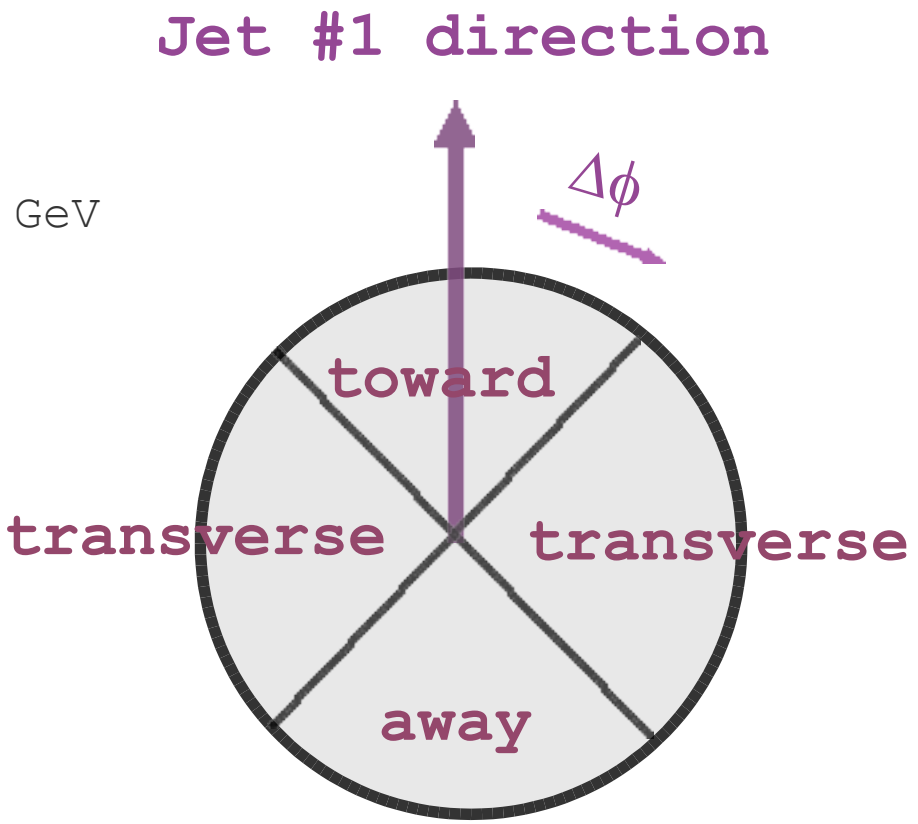
- events with at least 2 Jets
- $-0.5 < \eta < 2.5$
- $E_T(\text{Jet\#1}) > 5.0$ GeV, $E_T(\text{Jet\#2}) > 4.0$ GeV

We define 3 regions:

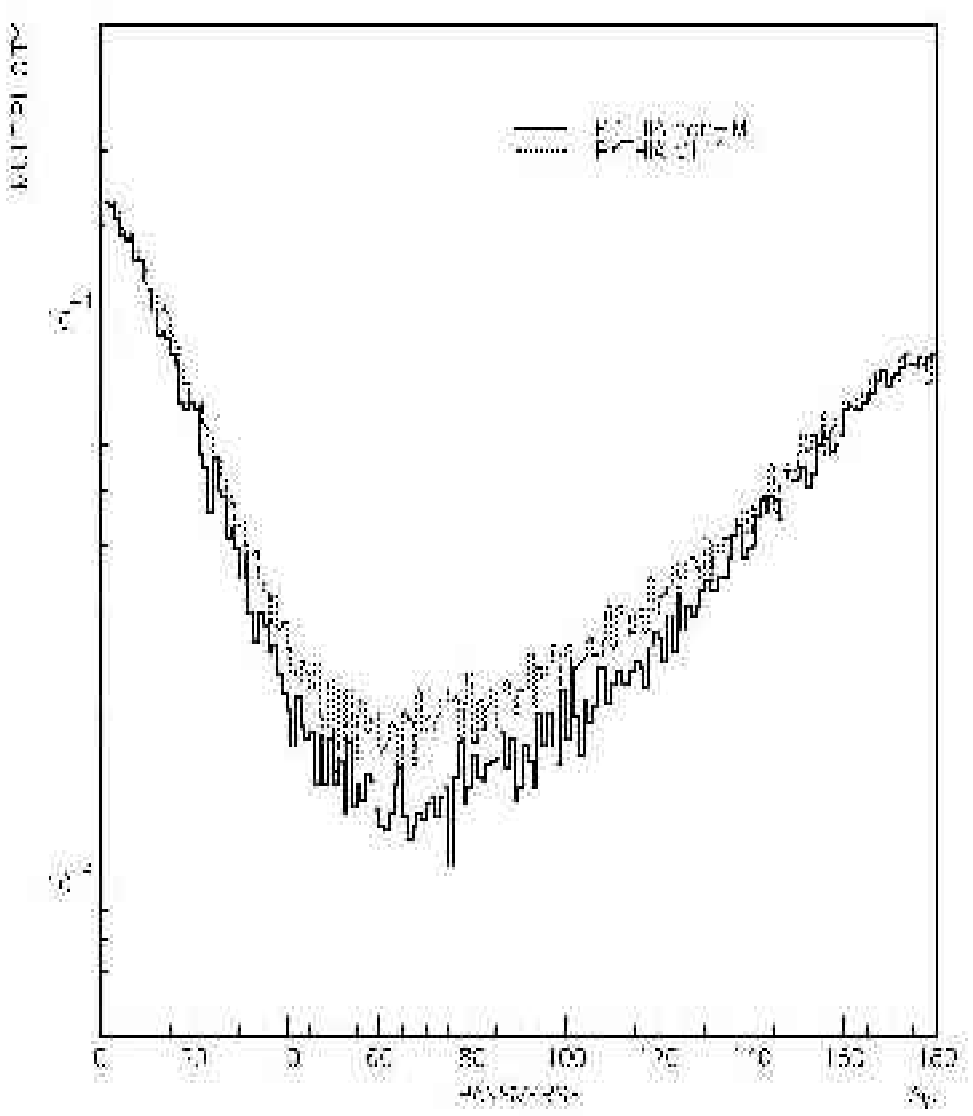
- toward in $|\Delta\phi| < 50$
- away in $|\Delta\phi| > 100$
- transverse in $50 < |\Delta\phi| < 100$

Interesting evidence:

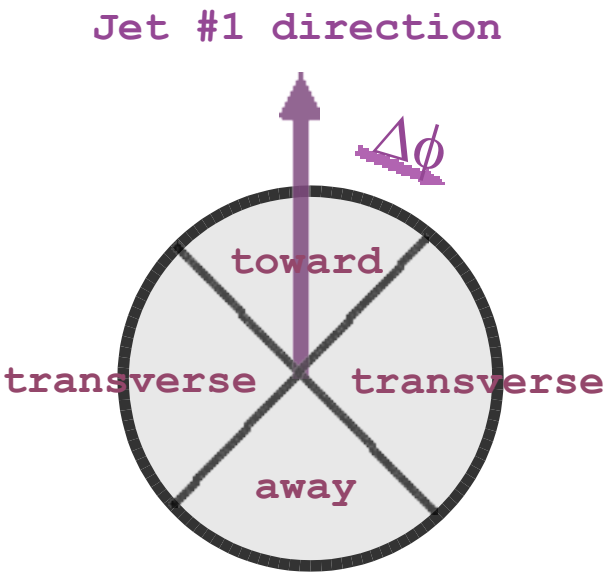
- multiplicity as a function of $\Delta\phi$
- $\langle N_{ch} \rangle$, $\langle p_T \rangle$ as a function of $p_T(1\#\text{Jet})$



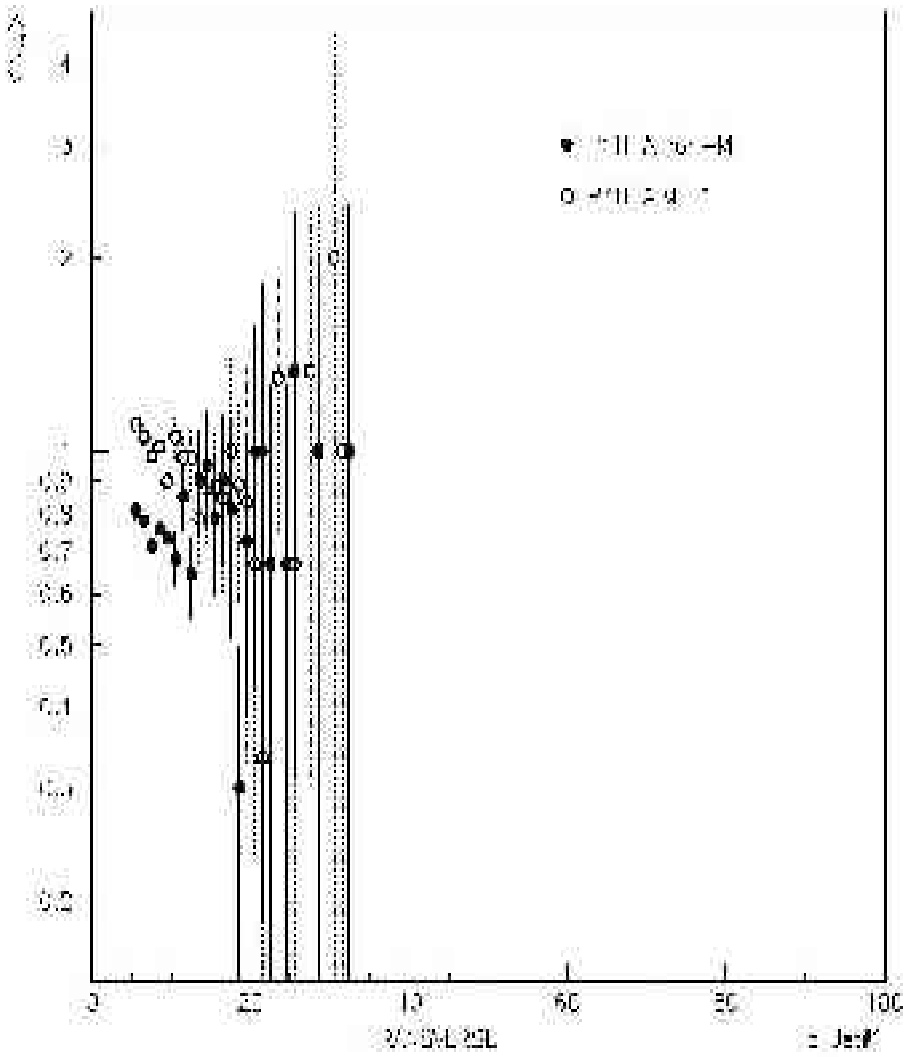
MULTIPLE INTERACTIONS - WHERE?



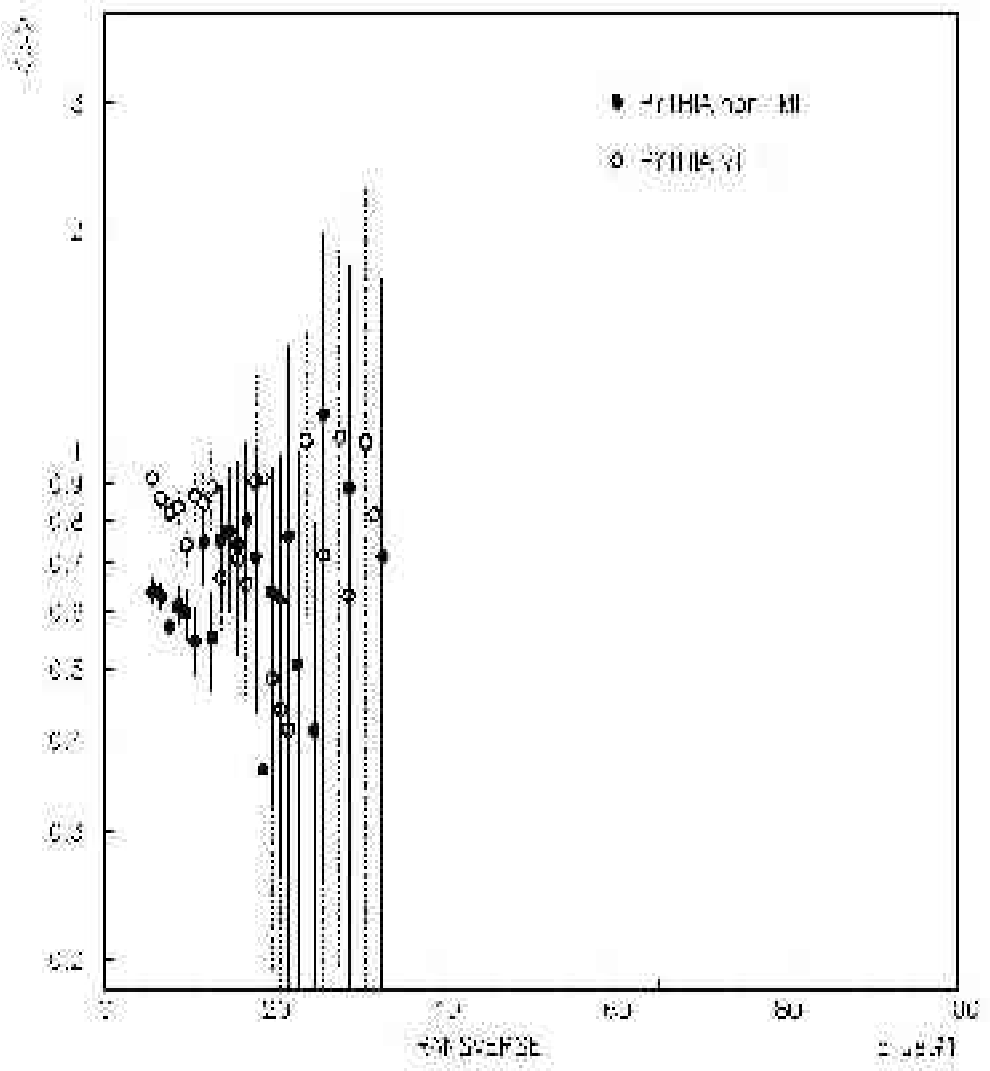
multiplicity as a function of $\Delta\phi$



MULTIPLE INTERACTIONS - WHERE?



$\langle N_{ch} \rangle$ as a function of p_T(1#Jet)



$\langle p_T \rangle$ as a function of p_T(1#Jet)

MULTIPLE INTERACTIONS - SUMMARY

- MI clearly visible in the low p_T region !!!

interesting problems (for future summer students?):

- comparison with data

- what's going on in the higher p_T ?

RANDOM NUMBER GENERATORS

Birte Domnik

- Investigation of RNG: RANLUX (5 levels) & QUANTIS
- RANLUX: pseudoRNG
- QUANTIS: trueRNG based on quantum effect
- test development
- check the performance in RAPGAP (y distributions)
- same results for RANLUX (level > 3) & QUANTIS

  (lower levels of RANLUX - fake physical effects)

STRANGE PARTICLES PRODUCTION

Michal Deák

- production of strange neutral particles Φ, K^0 and Λ
- comparing data from ZEUS & H1 with RAPGAP

- differential cross sections affected by individual processes (QCDC, light and heavy q production, resolved photon, PS)
- checked the consistency of data with different PDF
- discovered inconsistencies between data and MC !!!

- conclusions: the shapes of pseudorapidity distributions are defined by the heavy quark production, and strongly affected by QCDC.