

Photoreactions with Pions at High Transverse Momenta

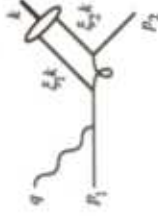
Andrei Afanasev
Jefferson Lab

Hall C at 12 GeV Meeting, April 9–10, 2002

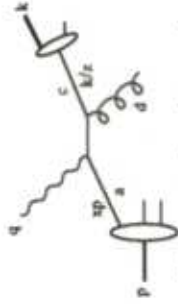
Quark-Parton Model for Meson Electro- and Photoproduction

A. AFANASEV, JLab

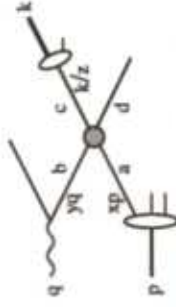
Quark-Parton Model Mechanisms Contributing to Inclusive Photoproduction



'Direct Process'

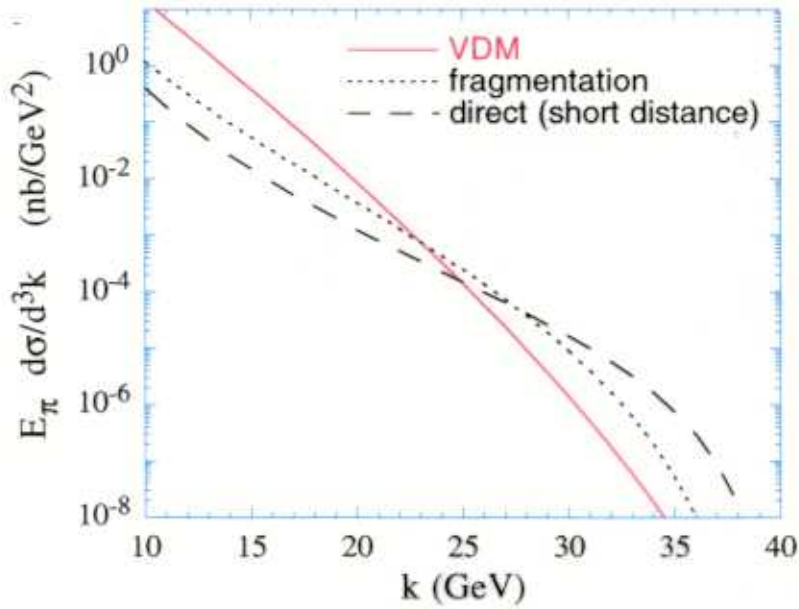


'Fragmentation Process'



'Resolved Photon Process'



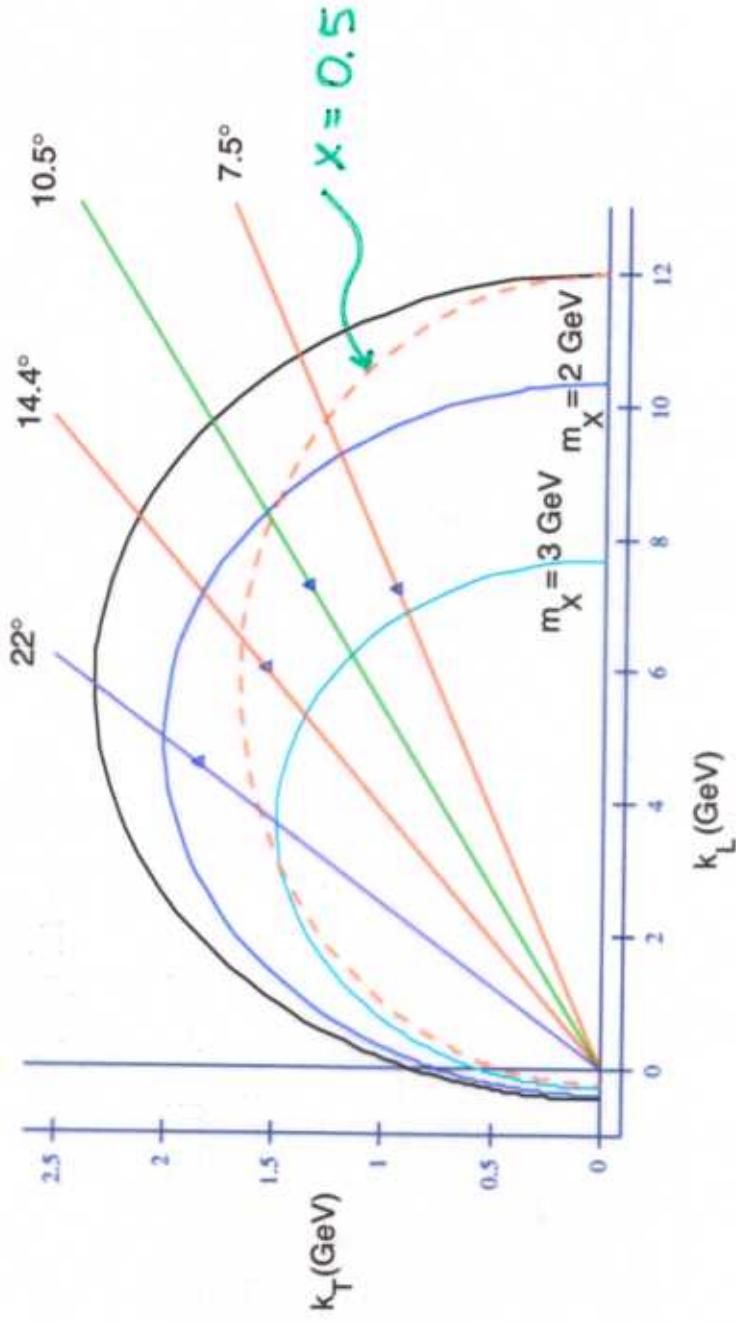


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SLAC E155 kinematics

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Kinematic Regions for $\gamma N \rightarrow \pi X$



Connection to Deep-Virtual Meson Production

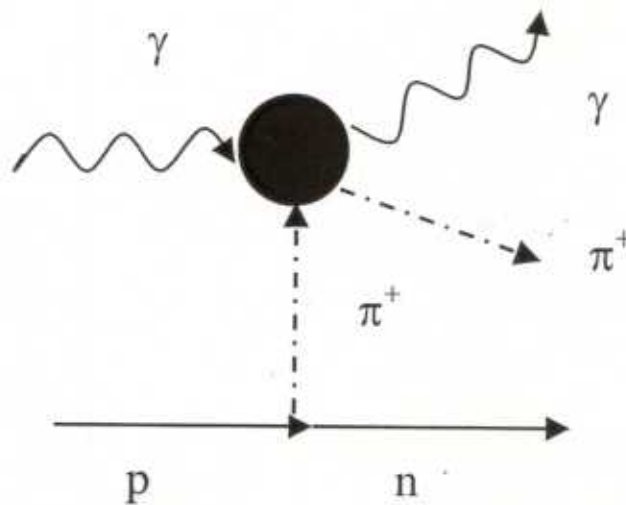
- Need to understand and control the mechanism of meson production off a quark ($\gamma^* q \rightarrow \pi q$) in order to analyze GPDs from Deep-Virtual Meson Production
- Look at both high- Q^2 /low t and low- Q^2 /high- t
- Do L/T separations
- A sign of trouble with a theory: GPD-based calculation of wide-angle $\gamma N \rightarrow \pi N$ using a hard-gluon mechanism for $\gamma^* q \rightarrow \pi q$ undershoots experimental measurements by a factor of ~ 10
- A sign of hope: For 12 GeV CEBAF, virtuality of the exchanged particle (gluon?) corresponds to $Q^2 = 20-35 \text{ GeV}^2$ in the elastic pion form factor case \Rightarrow Semi-Exclusive channel is very efficient in reaching highly virtual states



Radiative Pion Photoproduction

(Compton Scattering on the Pion)

Andrei Afanasev, JLab



Considered as a way to measure pion polarizabilities:

- D. Drechsel, L.V.Fil'kov, Z.Phys. **A349** (1994) 177. (Theory).
- T.A. Aibergenov, Ch.J.Phys., B36 (1986) 948 (Experiment).
- J. Portoles, M.R. Pennington, hep-ph/9407295 and 2nd DAΦNE Physics Handbook (Review of Pion Polarizabilities).

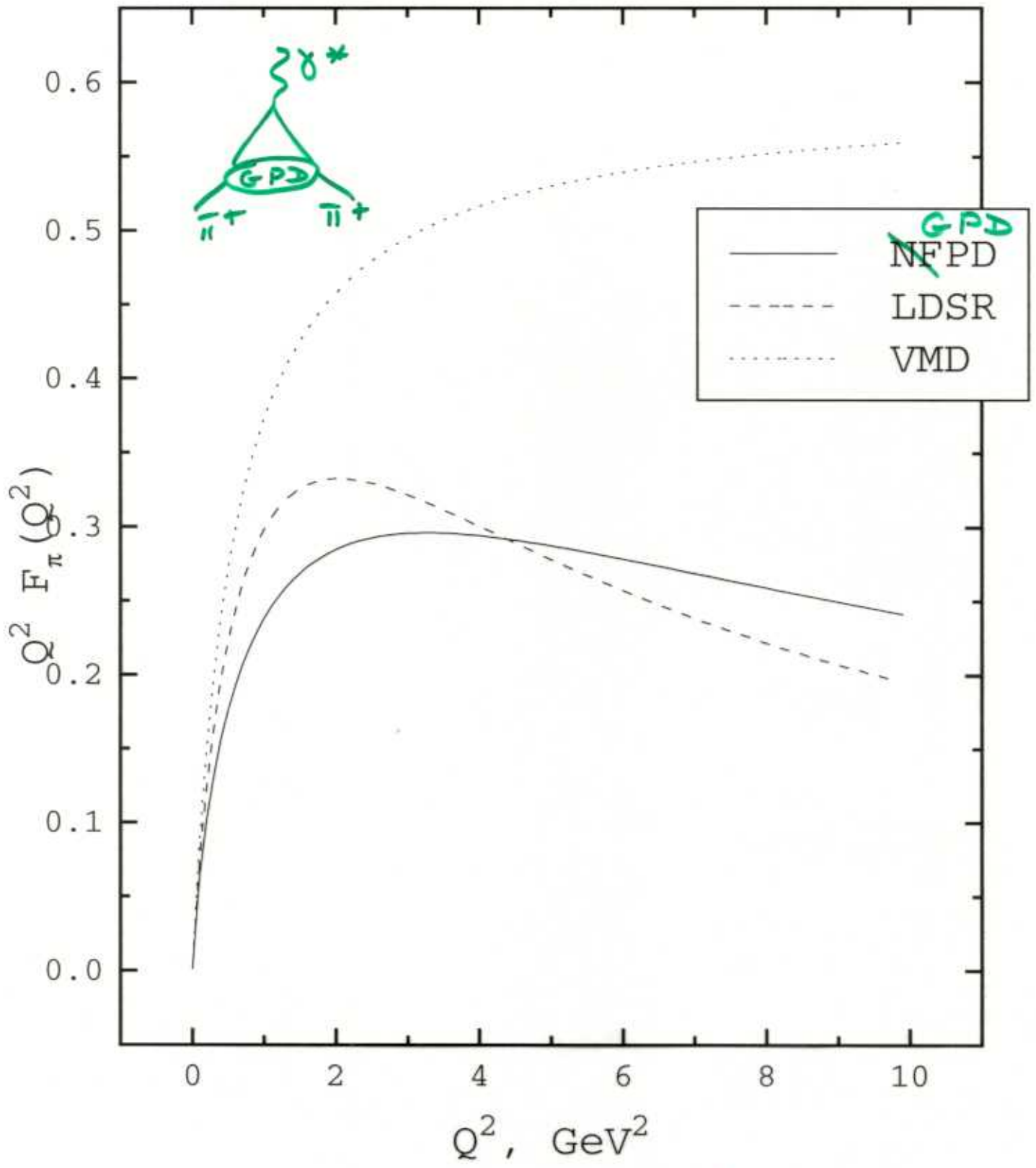
High Energies:

QCD Sum Rules: Radyushkin, Sterman, Coriano.

GPD: Afanasev, hep-ph/9808291;

Bakulev, Ruskov, Goeke, Stefanis, hep-ph/0004111

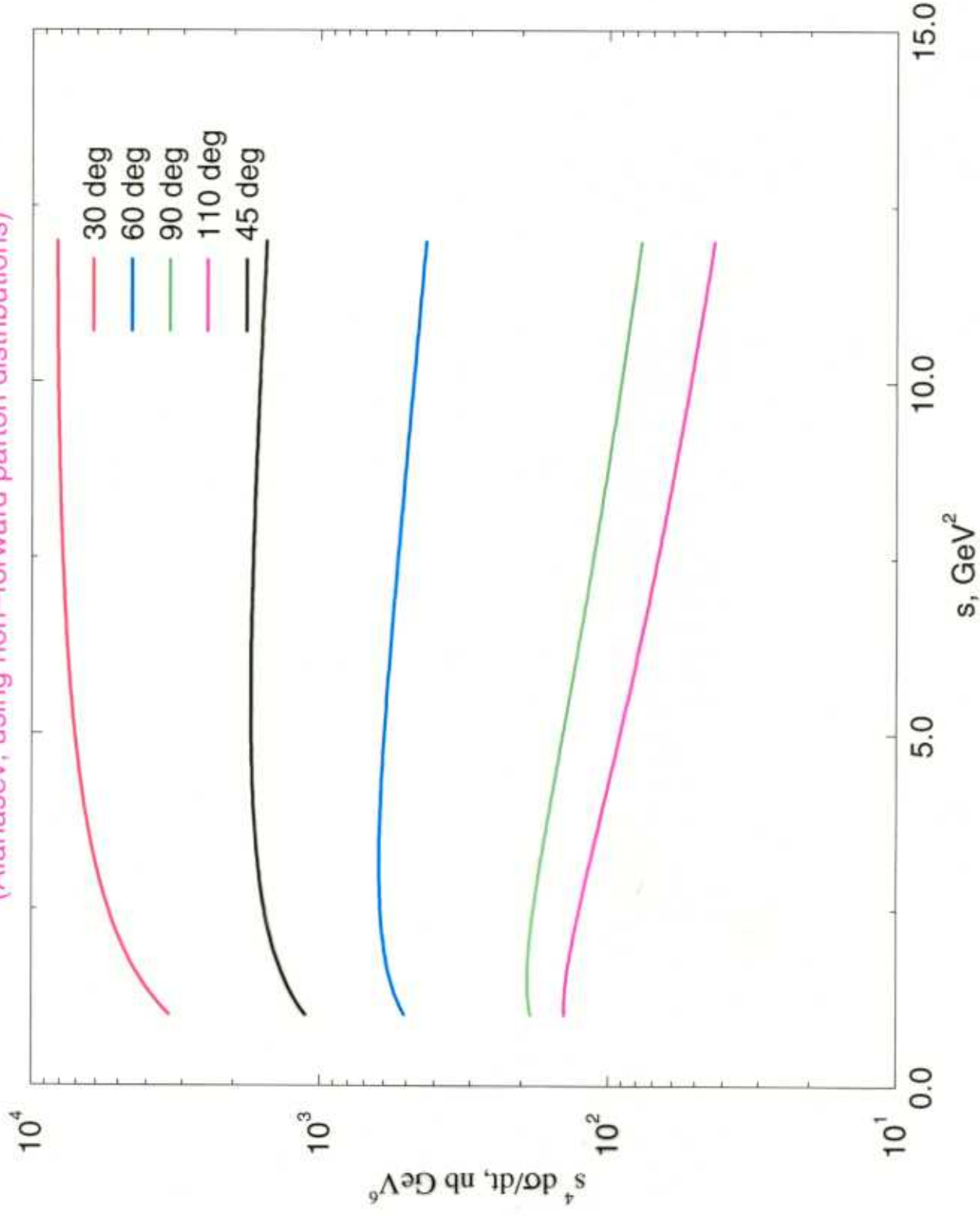
Pion Elastic Form Factor



AA, hep-ph/9808291

Pion (Real) Compton Scattering

(Afanasev, using non-forward parton distributions)



AA, hep-ph / 9808291