Kinematics studies for DVCS and deep exclusive π^0

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Introduction

GPDs are extracting from deep exclusive processes such as DVCS (ep$\rightarrow$ epγ) or DVMP (ep$\rightarrow$ ep$\pi, \phi, \eta \cdots$).

To put the most stringent constrains on a GPD, the dream would be to have:

- Many observables on many channels: cross sections, beam/target asymmetries,
- Differential in Q^2, t, Φ_{LH}, x_B if allowed by statistics,
- with the fewest holes as possible in the acceptance => Focus of the beginning of this study.

These holes can be caused by:

- unsubtractable contamination,
- gaps between detectors.

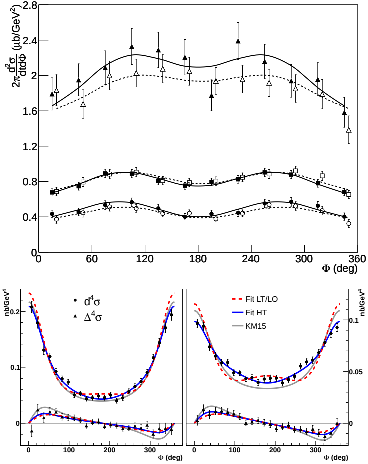
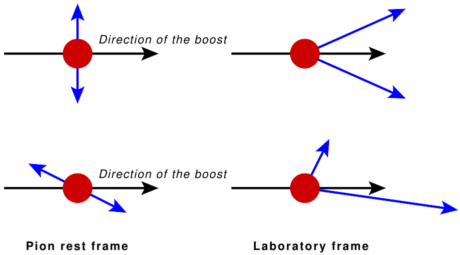


Figure: ep$\rightarrow$ epπ^0 (top) and ep$\rightarrow$ epγ (bottom) cross sections.

π^0 contamination for DVCS

The main background for DVCS is the ep$\rightarrow$e'p'π^0 $\rightarrow$ e'p'$\gamma\gamma$.

The π^0 energy is shared between the two photons depending on the symetry of the decay and you may reconstruct a single photon.



In other words, it is a fraction of the decays which are responsible of the DVCS contamination. By Monte-Carlo simulation, you can estimate this fraction as long as you have a sample of properly identified π^0s in data for normalization.

Limitations for π^0 detection

The two photons are too close to each other and we only reconstruct one.

- *Parameter :* Angular resolution of Hadron Endcap EM calorimeter.
- Expected to have a small cross sections for $Q^2 > 100$.
- The valence region no longer accessible for $s = 18 \times 275$ GeV^2.

The two photons have an energy below some threshold:

- *Parameter :* Energy threshold in Barrel and Hadron Endcap EM.
- Definitely getting π^0-events in these areas.
- But what kind of EM background?
- How much data at a given threshold?

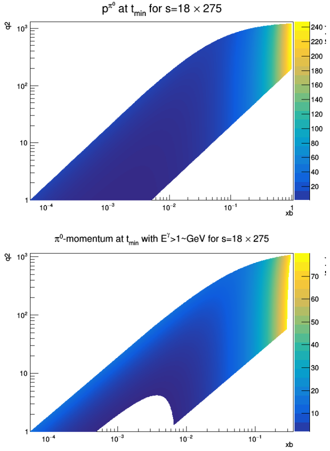


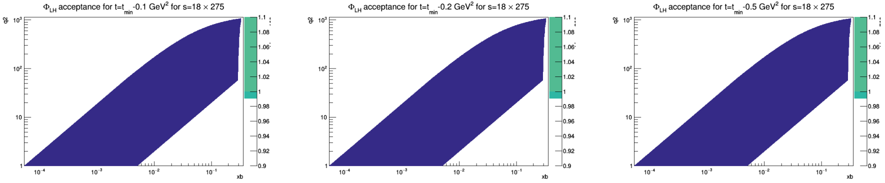
Figure: π^0 Energy distribution for $t = t_{min}$ (Highest energy for a given Q^2/x_B).

Proton acceptance and Φ_{LH} coverage for s=18$\times$275

Considering the following angular coverage for the proton:

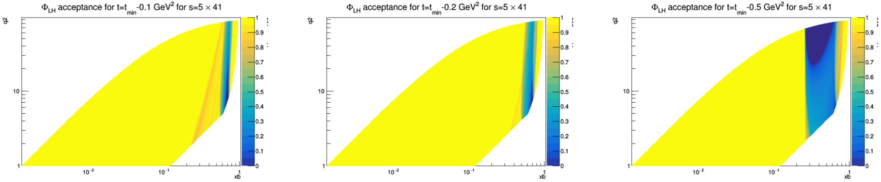
- Roman pots from 0.001 to 0.005 rad.
- B0-tracker from 0.006 to 0.020 rad.
- Hadron endcap for angles greater than 0.035 rad.

We can evaluate the Φ_{LH}-coverage for harmonics studies.

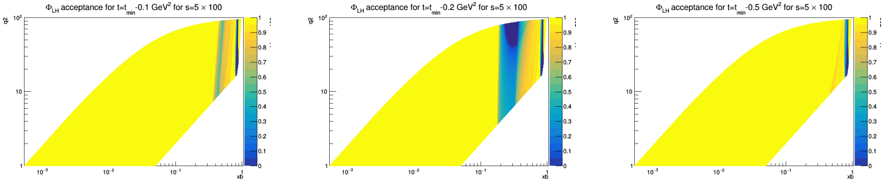


No issue for proton detection at s=18$\times$275 for t smaller than t_{min}-0.1. No acceptance for t_{min}-0.05.

Proton acceptance and Φ_{LH} coverage for low s



Low-t protons for s=5×41 are sent in B0. The phase space where the acceptance is no longer 1 (blue) corresponds to gap between B0 and Hadron endcap.



Low-t protons for s=5×100 are sent in roman pots. The first blue line is the gap between Roman pots and B0, the second between B0 and Hadron endcap.

Conclusions

- Identification of phase space areas sensitive to detector characteristics.
  → Low Q^2/High-x_b with minimal energy deposit in EM.
  → Proton acceptance for high-xb for low-s configurations.
  Which s-configuration is the best?
- Need to study tracking resolution effect on exclusivity variables.
- Much complex: Is it worth pushing to change some limitations?
  → Depends on the expected statistics.
  → Relevance of the phase space in the GPD extraction.
- Work in collaboration with PARTONS and Kresimir Kumericki for GPD phenomenology studies.