STATUS OF DVCS ANALYSIS FROM EI-6 DATA

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Introduction & Motivation



Measurement of DVCS Cross Section, via detection of final state proton p' and lepton e'.

Large statistics & broad kinematic coverage => large coverage of Φ acceptance.

E1-6 experiment:

Data collected in 2001-2002. Beam energy 5.754 GeV 5cm long liquid hydrogen target Average beam polarization 70%

spatial distributions of calculated photons $ep \& ep \gamma$ $ep \gamma$ $f_{u}^{0} f_{u}^{0} f_{u}^{0}$

sin(θ, c)cos(φ, _)



sin(θ, c)sin(φ,)

Event Selection ($ep(1\gamma)(2\gamma)$ sample)

Primary selection - Events with exactly on 1 negative track with the id = 11, 1 positive track, any number of neutral clusters

Requirements on event vertex

Electron identification -	EC fiducial cuts CC fiducial cuts DC fiducial cuts CC matching CC efficiency Requirements on Calo response
Proton identification -	DC fiducial cuts Requirement on reconstructed ToF mass.
Photon identification -	EC fiducial cuts Requirement on EC time. Spatial separation from charged tracks on EC. Minimum energy deposition in Calo.
Corrections	Energy loss correction for electrons & protons Momentum & angle corrections for electrons Energy correction for photons



Exclusive pions ($ep(2\gamma)$ **sample)**

Exclusive Pion Selection: I electron, I proton & 2 photons

Kinematic requirements:

$$\begin{split} W^{2} &> 4 \; [GeV^{2}] \\ &- t < 0.52 \; [GeV^{2}] \\ &- 0.05 < M_{X}^{2}(epX) < 0.09 \; [GeV^{2}] \\ P_{ele.} &> 0.7 \; [GeV] \\ P_{\pi^{0}} &> 2.5 \; [GeV] \\ Sector(\gamma 1) = Sector(\gamma 2) \end{split}$$

MC is normalized to Data with the scale factor for

$$\frac{N_{\pi^0}^{Data}}{N_{\pi^0}^{MC}} = \frac{9529}{135217}$$

Same scale factor is used to evaluate exclusive pion contribution in DVCS process: ep + $ep\gamma$ sample

$$N_{0,1\gamma}^{Data\,\pi^{0}}(x,Q^{2},-t,\phi) = \frac{N_{\pi^{0}}^{Data}}{N_{\pi^{0}}^{MC}} N_{0,1\gamma}^{MC}(x,Q^{2},-t,\phi)$$



Exclusive pions ($ep(2\gamma)$ sample)

Data - MC comparison exclusive π^0 :





Exclusive photons (epy sample)





1.2

 E_{calo} [GeV]

5 Ε_ν [GeV]

Exclusive photons (epγ sample)

Data - MC comparison exclusive photons: (exclusive π^0 , DVCS, MC sum)





Exclusive Event Selection: | electron, | proton & 0 or | photon

Kinematic requirements:

 $W^2 > 4 \ [GeV^2]$ $0.07 < -t < 0.52 \ [GeV^2]$ $|M_X^2(epX)| < 0.08 \ [GeV^2]$ $P_{ele.} > 0.7 \ [GeV]$ $t < t_{min}$ $\theta_{\gamma calc.} > 2^\circ$

Statistics:

739647 events

0.15-0.17

0.07-0.16

0.17-0.19

0.16-0.22

0.19-0.21

0.22-0.28





XBi

-t

Data - MC comparison (exclusive π^0 , DVCS, MC sum):





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Data - MC comparison (exclusive π^0 , DVCS, MC sum):





DVCS (ep + epγ sample) X-section





DVCS (ep + epγ sample) X-section





Comparison with Published Results

Binning Used in Published analysis.



Kinematic requirements to match the conditions of Published results

$$\theta_{ele} > 21^{\circ}$$

$$\theta_{ele} < 45^{\circ}$$

 $P_{ele} > 0.8 \quad [GeV^2]$
 $\theta_{\gamma calculated} > 5^{\circ}$



Comparison with Published Results

Bin5 $x_{Bj} - [0.17 - 0.20]$ $\theta - [25.5 - 45]$





Aram Movsisyan, DPWG meeting 30.03.2017

Comparison with Published Results

Bin17 $x_{Bj} - [0.35 - 0.38]$ $\theta - [28 - 45]$





Conclusion & Outlook

- a. Sufficiently good description of exclusive pion production by MC simulation allows to measure DVCS via detection of only electron and proton.
- b. Further improvement of Data-MC comparison can be obtained by improved particle ID and implementation of radiative corrections.
- c. Preliminary results are consistent with published CLAS data.
- a. Improve data-mc comparison.
- b. Radiative Corrections.
- c. Check sensitivity to background subtraction.
- d. Estimation of systematic uncertainties for the measurement of cross sections.

Thank you!

