Update on Status of DVCS Analysis from E1-6 Data

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Collaboration meeting

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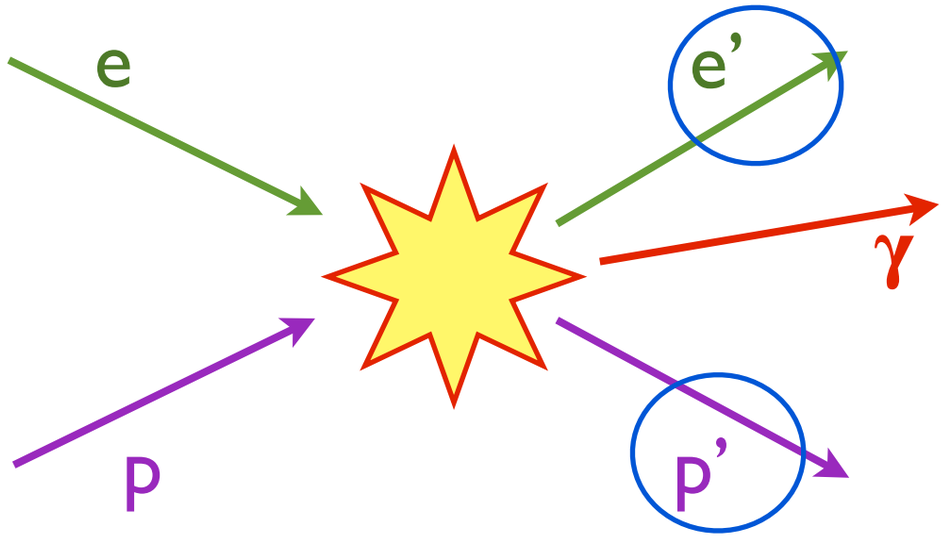
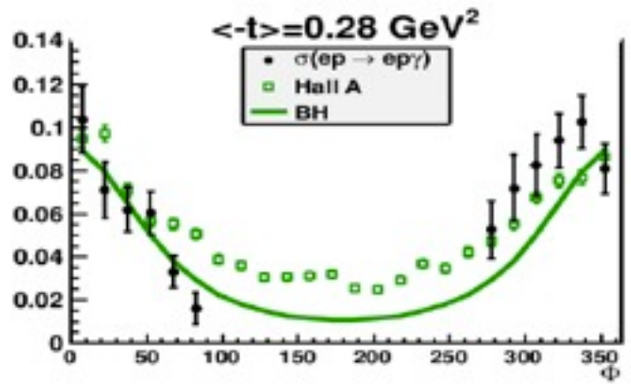
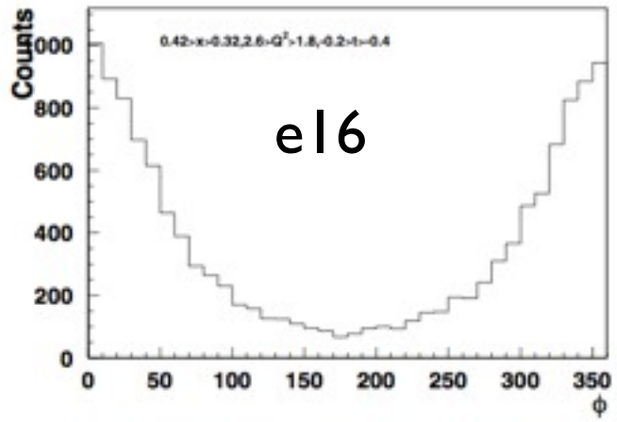
Introduction & Motivation



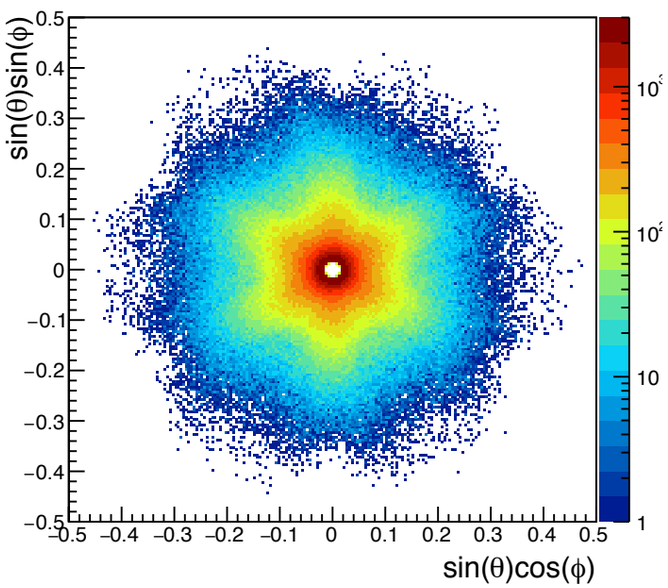
Measurement of DVCS Cross Section, via detection of final state proton p' and lepton e'.

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

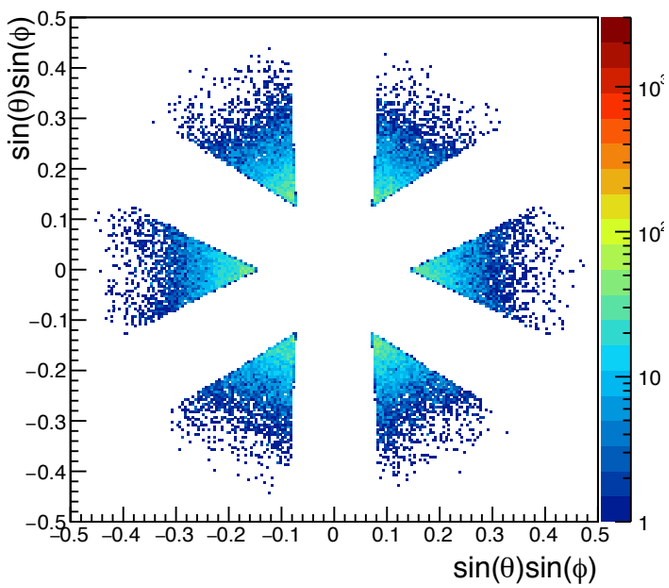




Distribution if calculated photons



photons in the fiducial volume



E1-6 experiment:

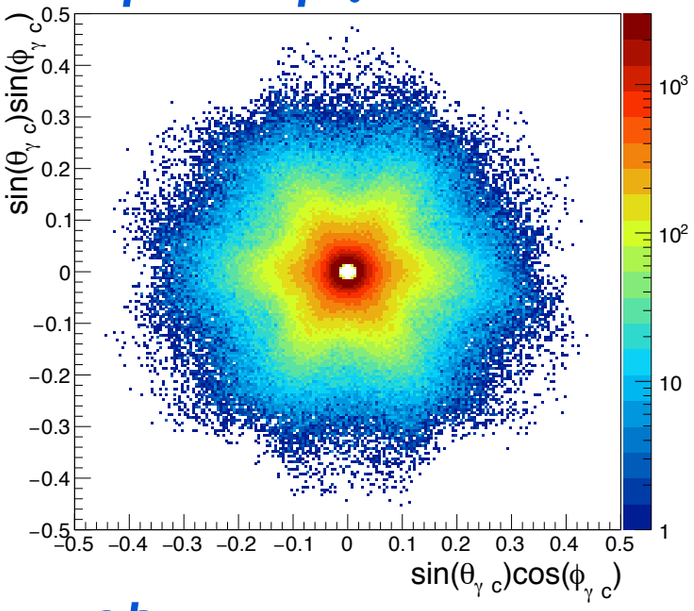
Data collected in 2001-2002.
Beam energy 5.754 GeV
5cm long liquid hydrogen target
Average beam polarization 70%

Analysis Steps and Strategy

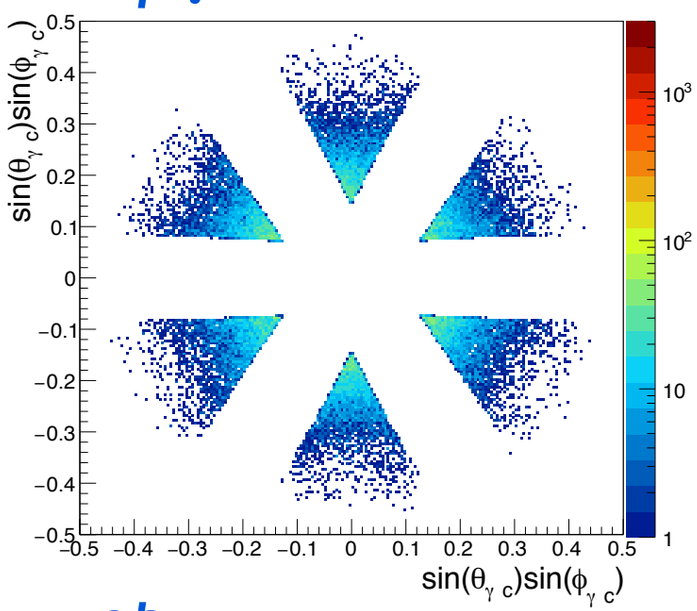
ep & epγ sample is divided in 3 subsamples

spatial distributions of calculated photons

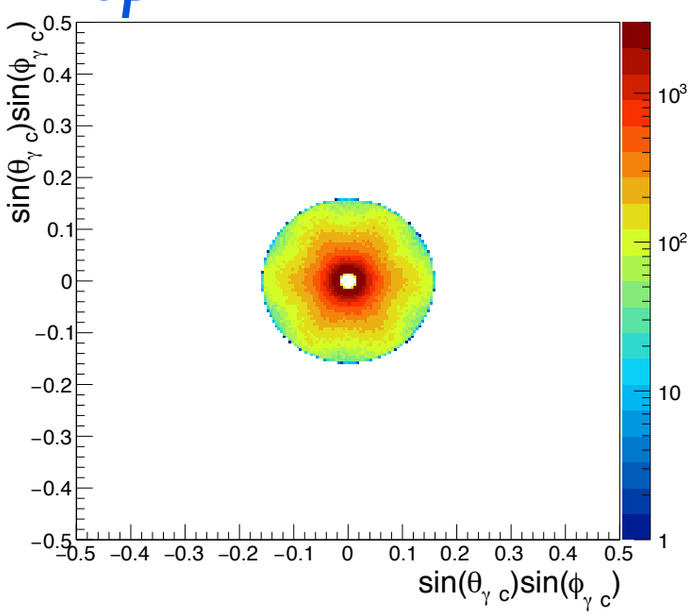
ep & epγ



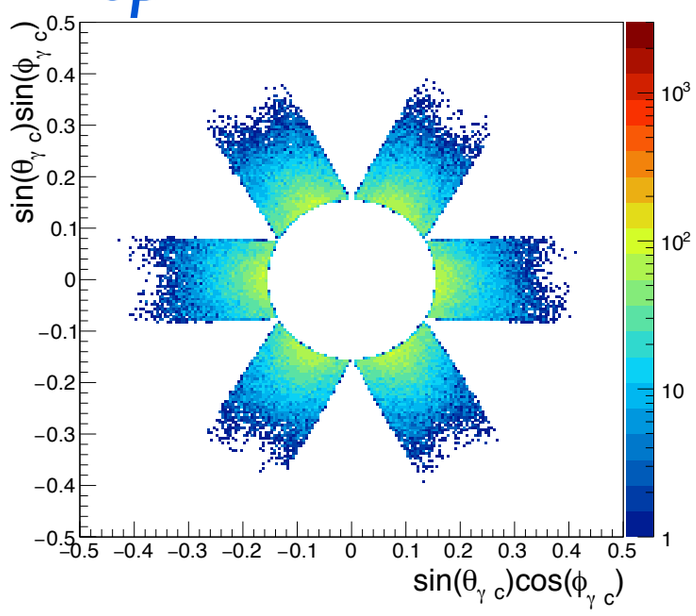
epγ



ep



ep



1.) separate analysis of ep, epγ, epγγ samples.

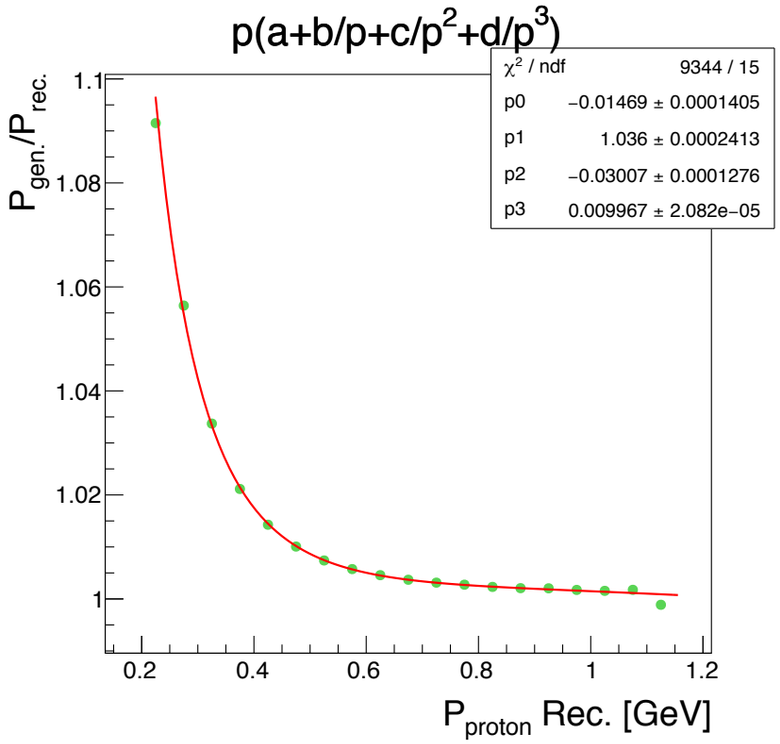
2.) epγγ - to estimate exclusive pion contribution.

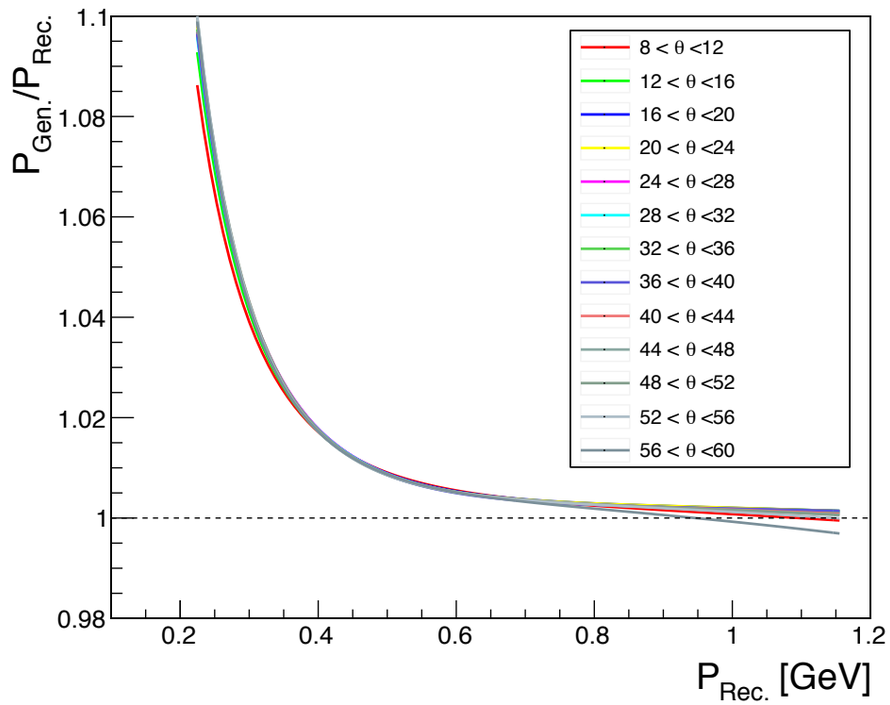
3.) epγ - to validate the analysis procedure.

4.) ep - cross-check of MC normalization

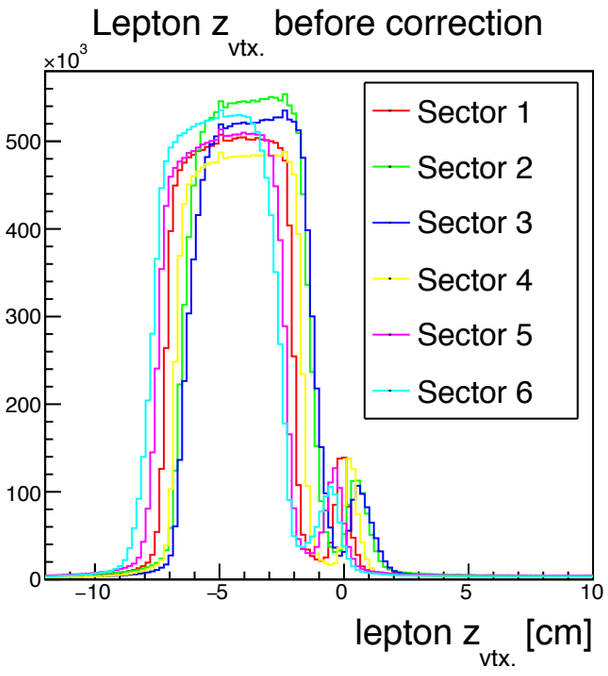
Event Selection & Data Quality

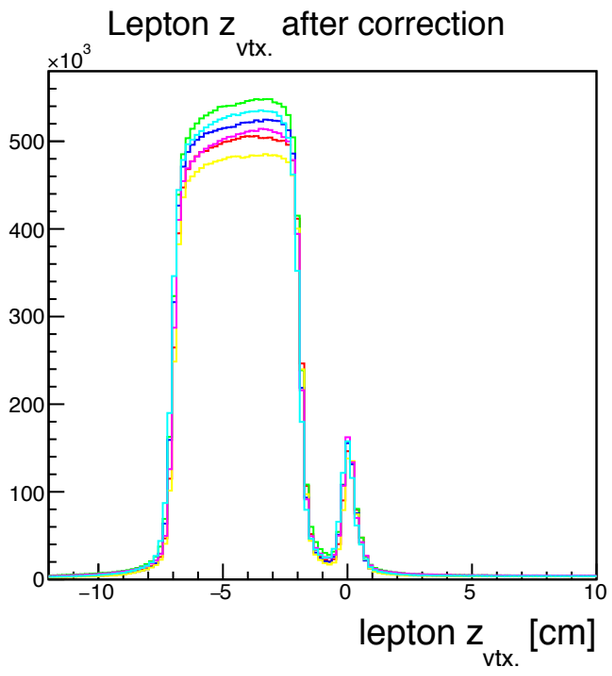
charged particle momentum correction based on mc (energy loss corrections)

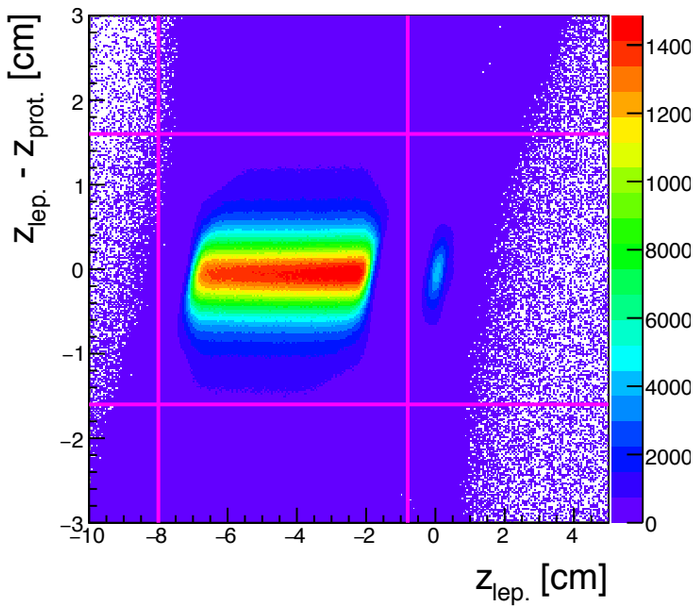




z-vertex correction and cuts



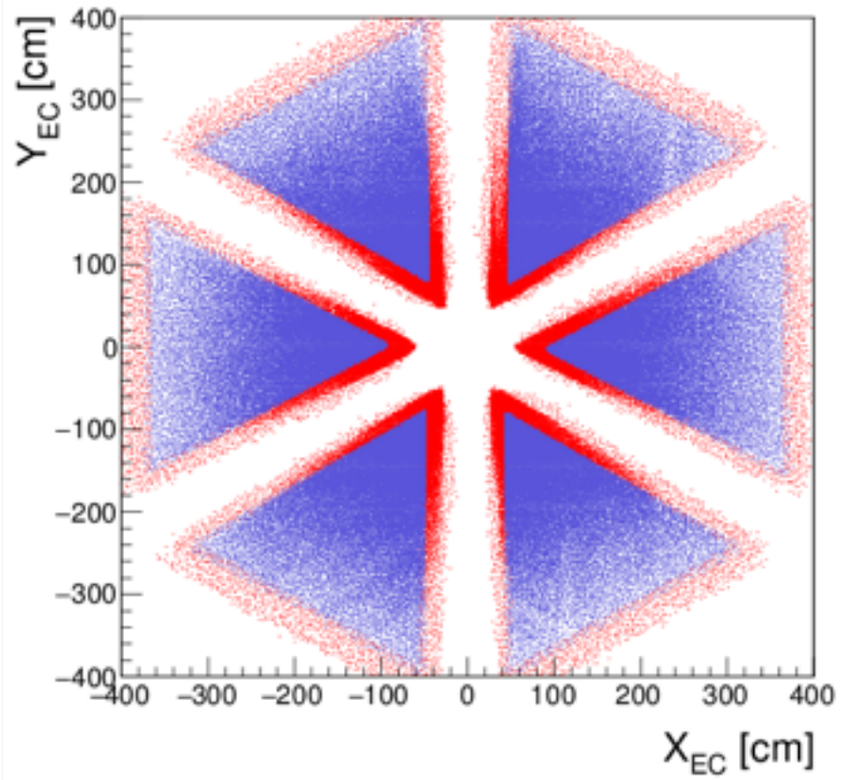




Event Selection & Data Quality

fiducial volume cuts

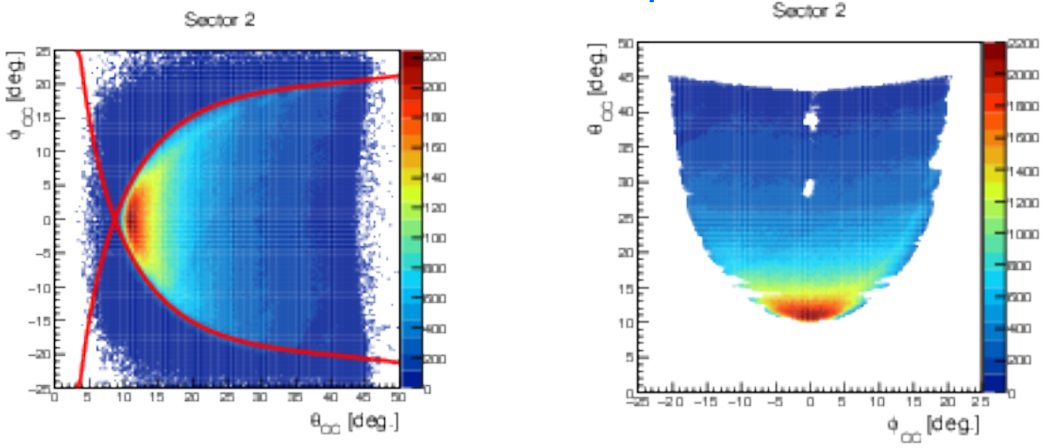
EC



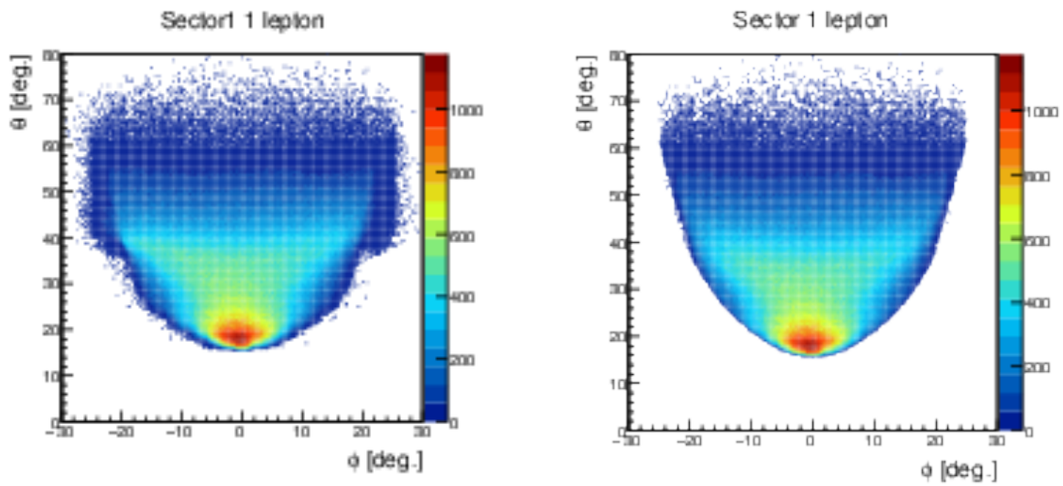
before the cut

after the cut

CC



DC



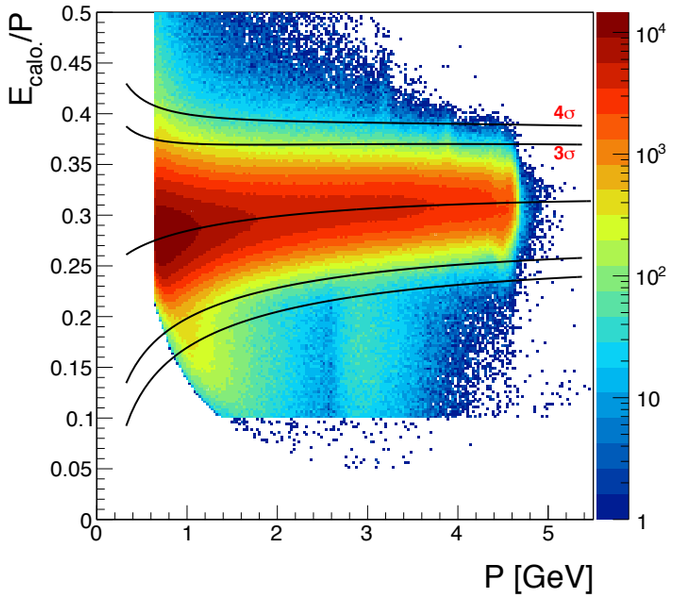
electron DQ cuts

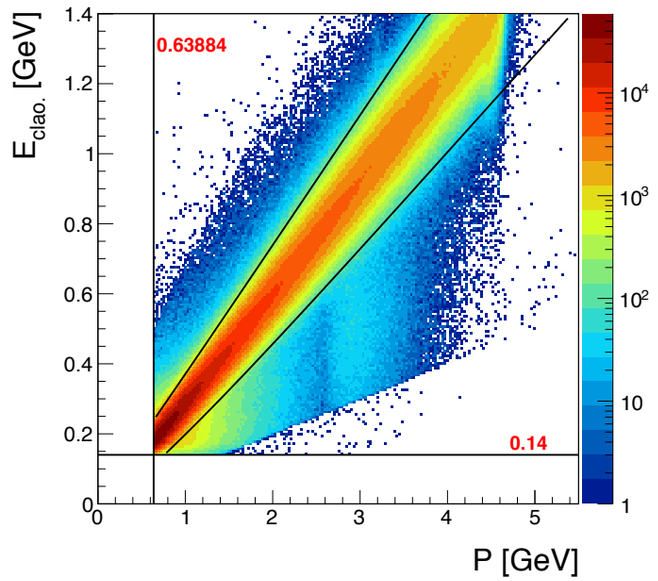
$$E_{inner} > 0.06$$

$$E_{total} > 0.14$$

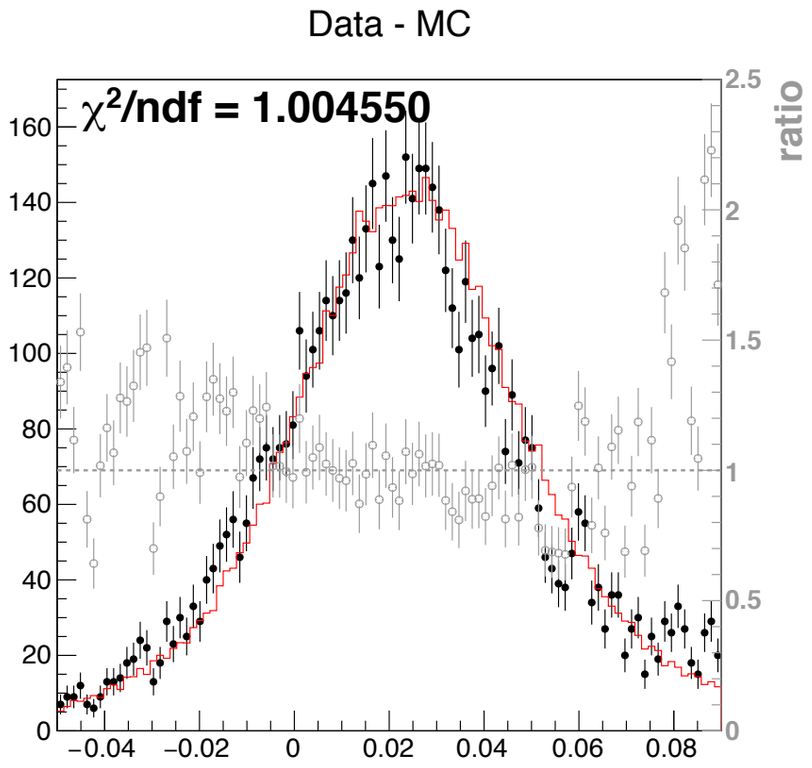
$$E_{total} > E_{inner}$$

$$E/P < 3\sigma$$





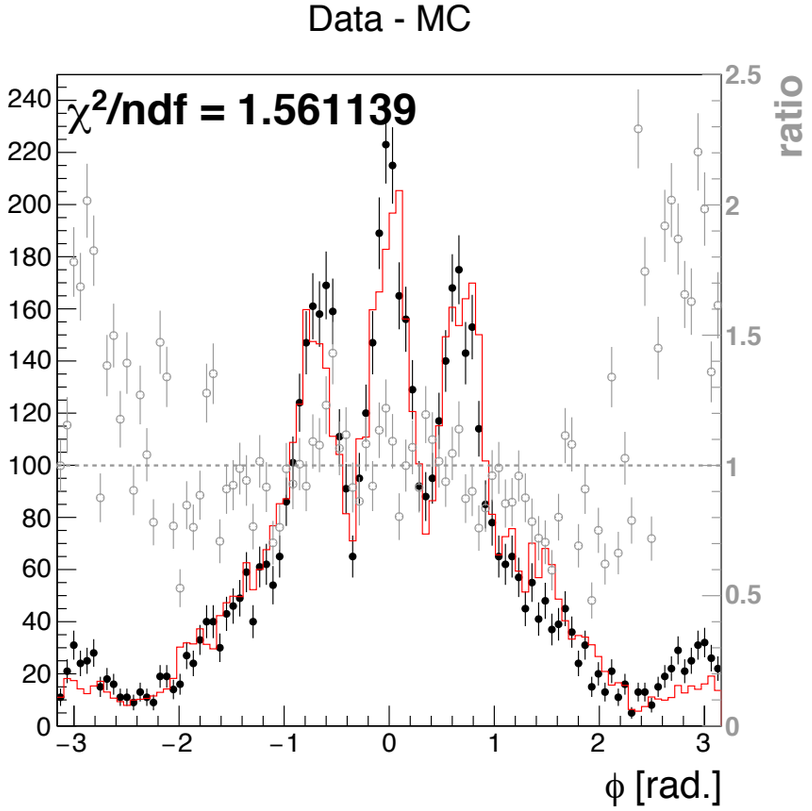
Exclusive pion contribution ($ep\gamma\gamma$ sample)

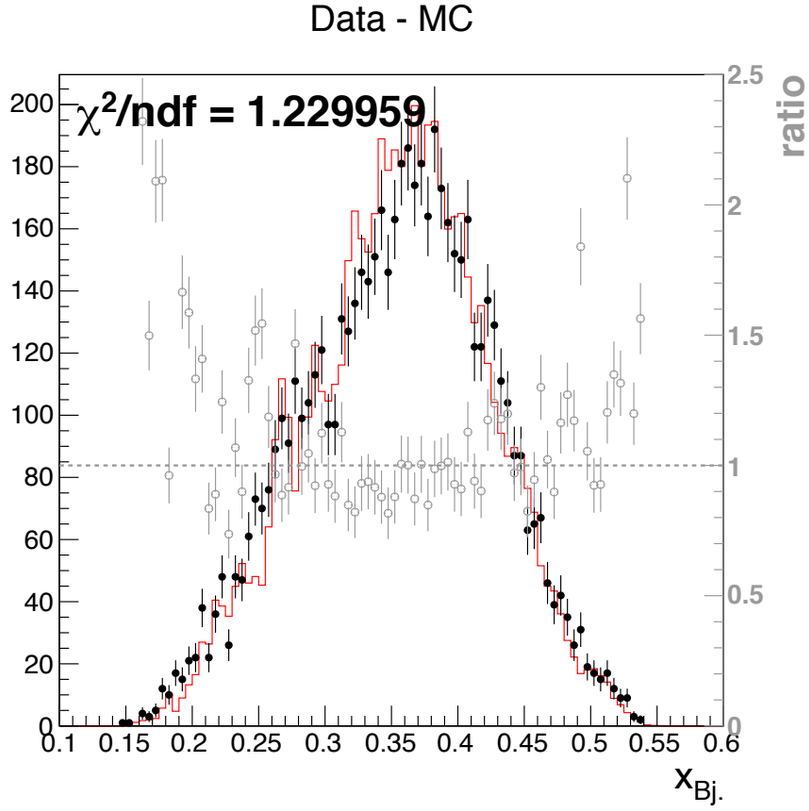


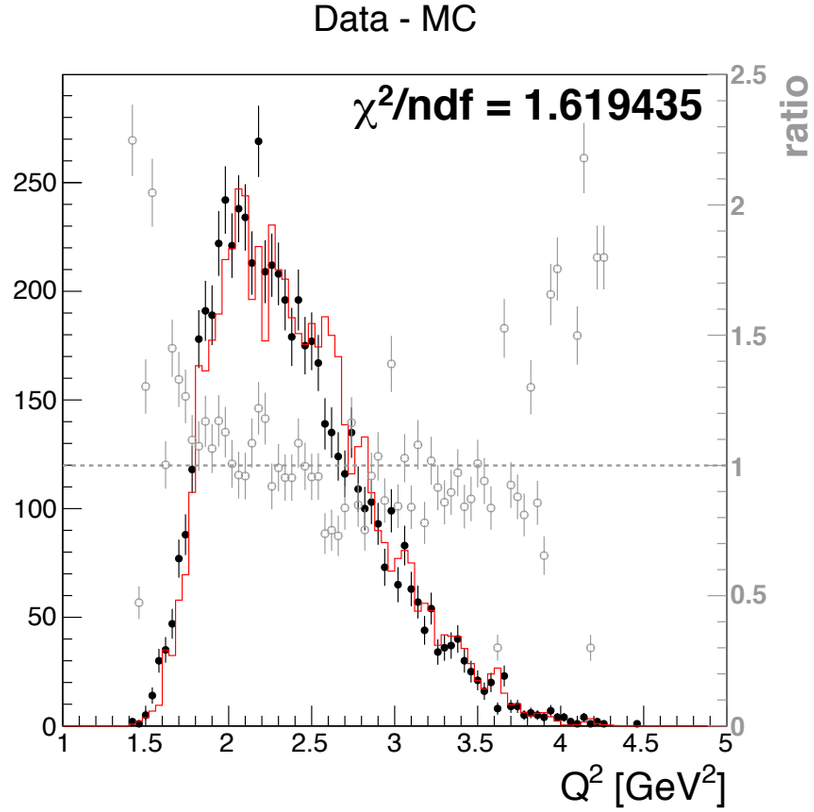
Background contribution estimated from MC:

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

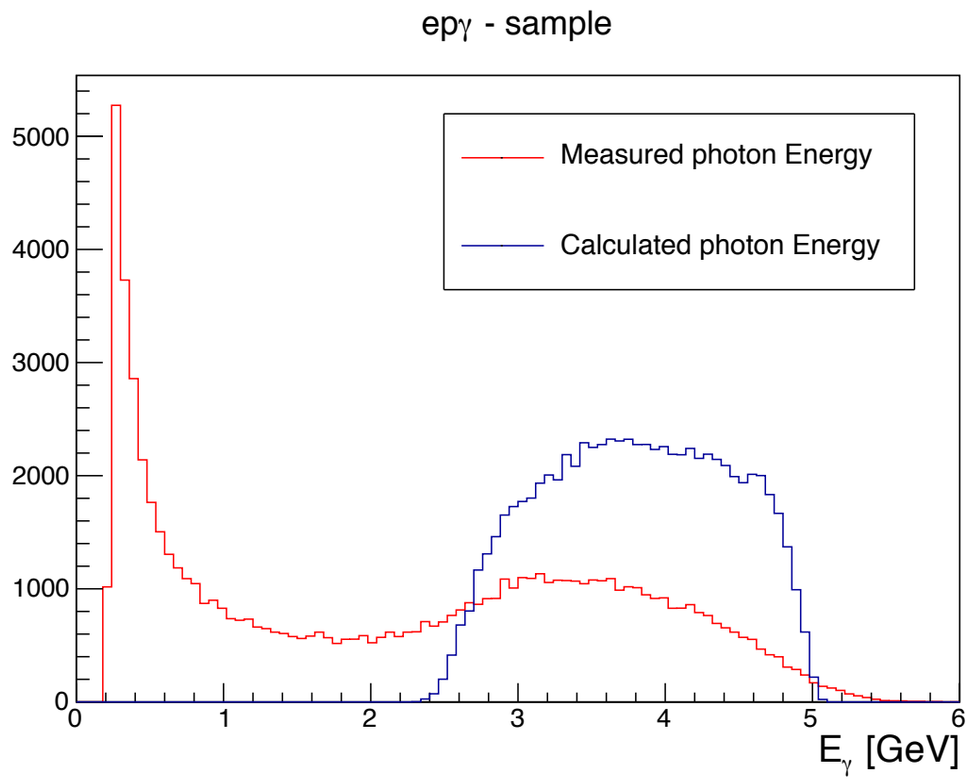
Normalization factor obtained from exclusive pion analysis:







$ep\gamma$ sample



$ep\gamma - sample$

$W^2 > 4\ [GeV^2]$

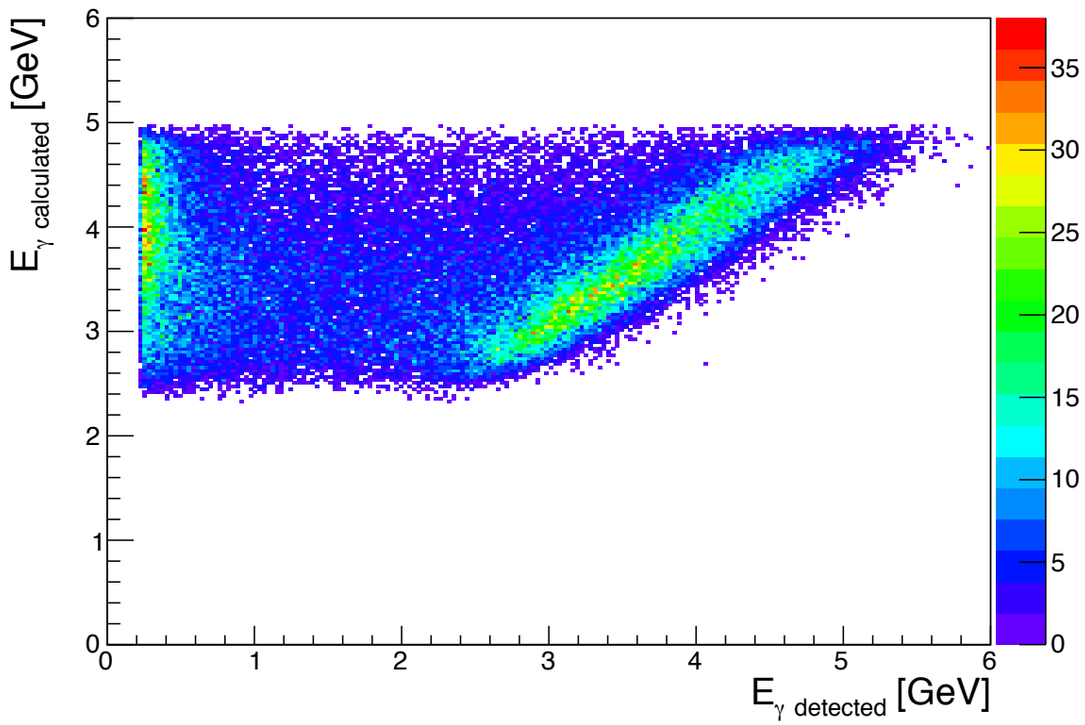
$-\ t < 0.52\ [GeV^2]$

$-\ 0.08 < M_x^2(epX) < 0.08\ [GeV^2]$

$photon\ fiducial\ volume\ cuts$

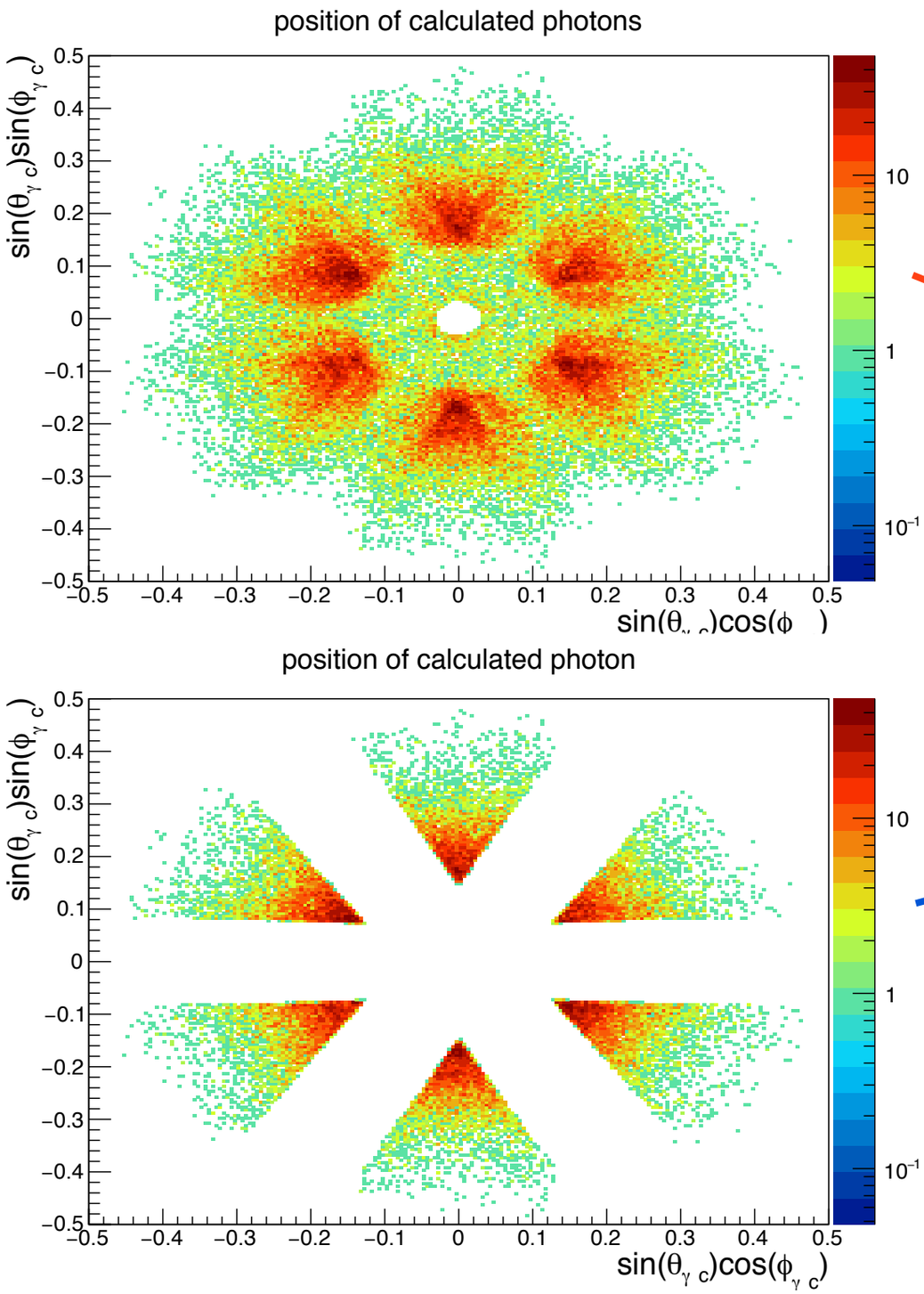
Photons are detected but not used in the event selection

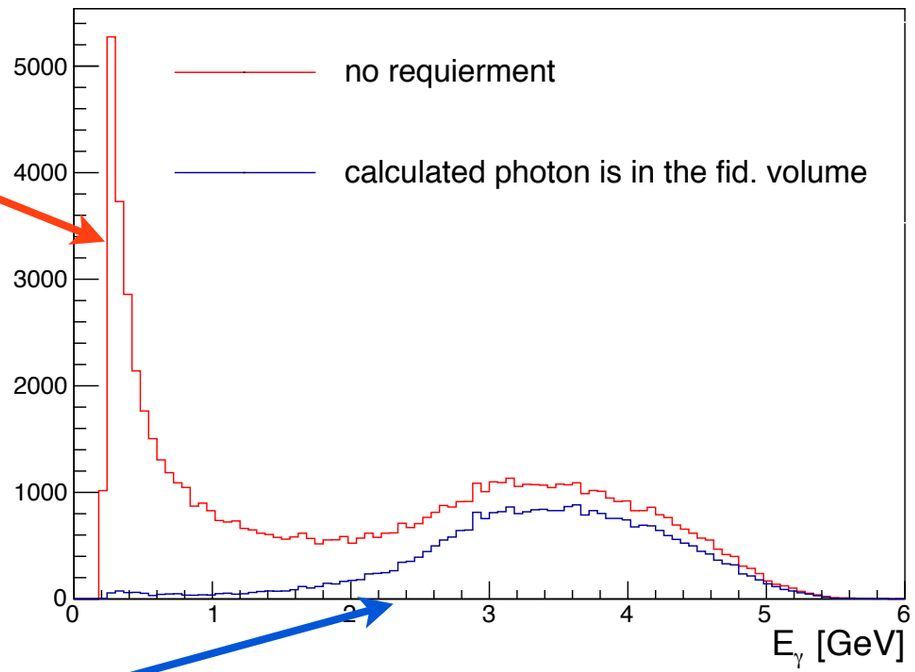
Low energy photons originating from background processes are not described by exclusive pion production



$e\rho\gamma$ sample

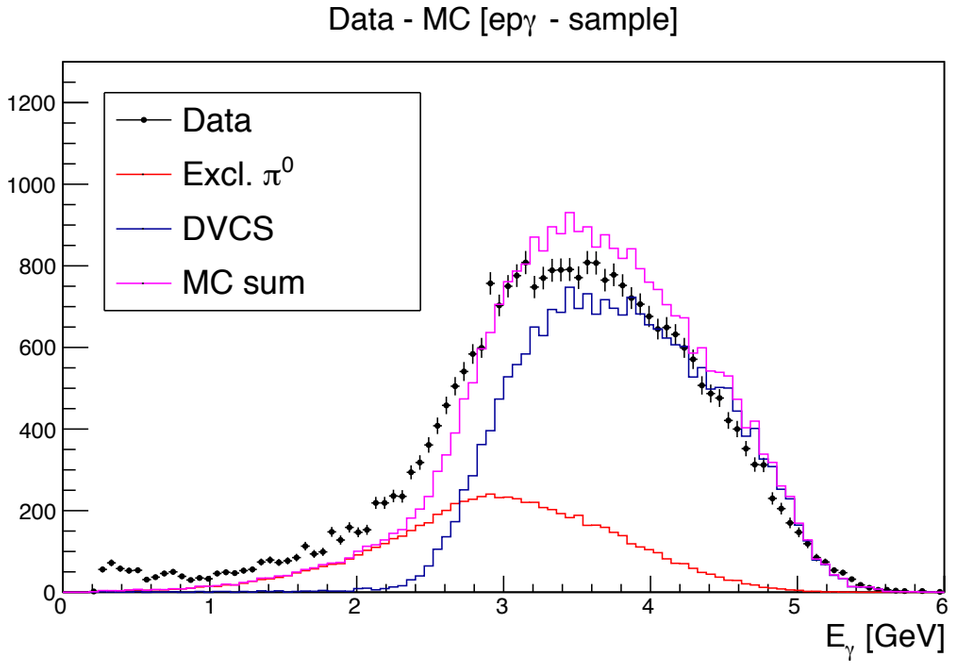
Calculated photon spatial distribution

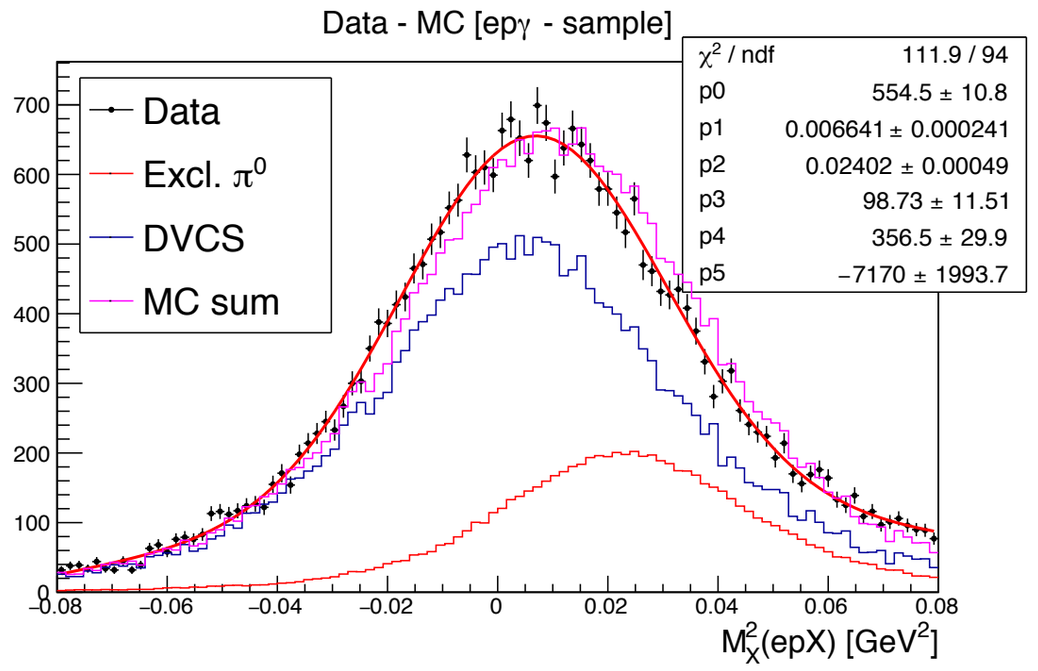


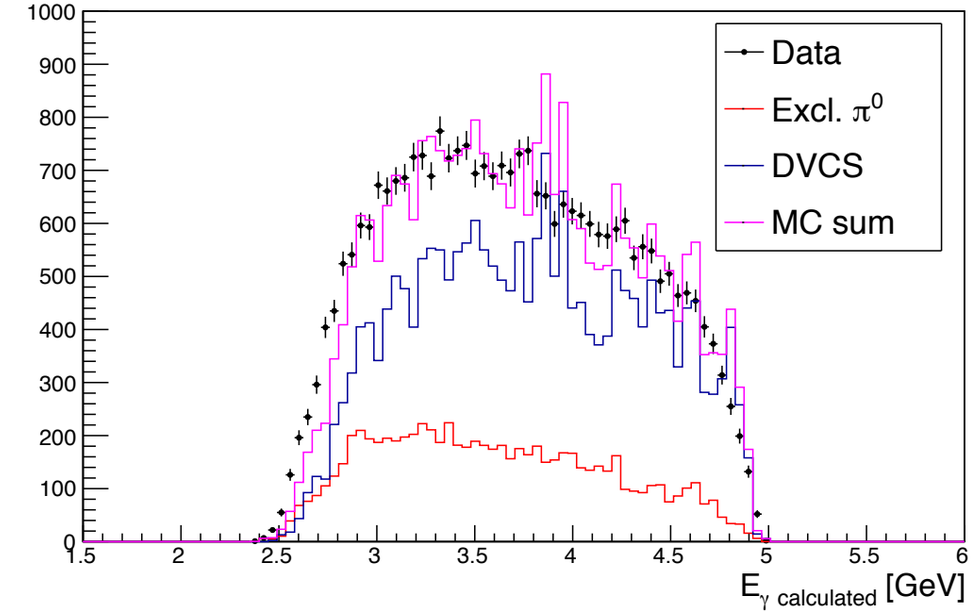


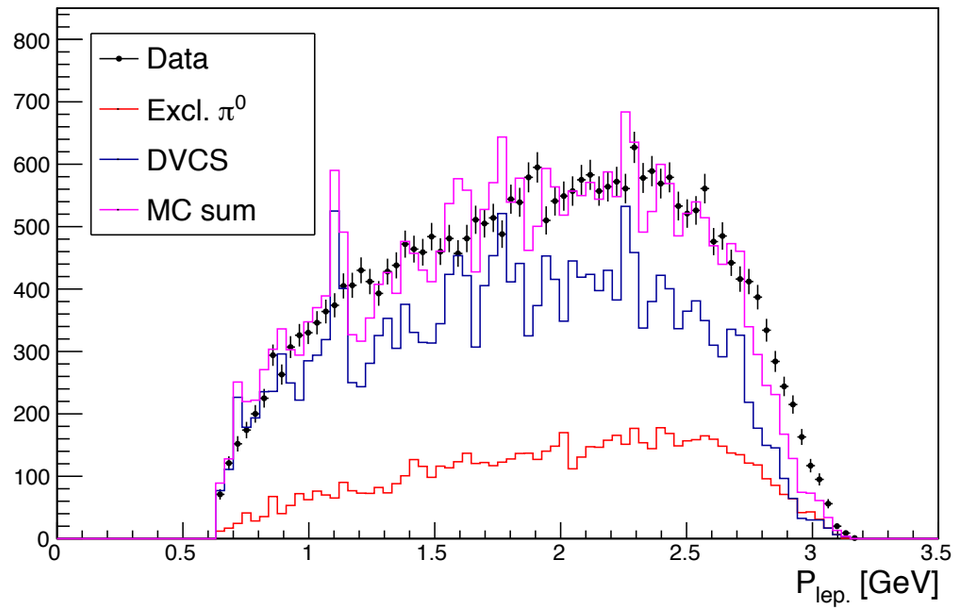
large spatial separation between detected and calculated photons is attributed to the background processes

Data - MC ($ep\gamma$ sample)









Sufficiently good description of the measured yield by the simulation of two independent processes.

ep sample

$ep - sample$

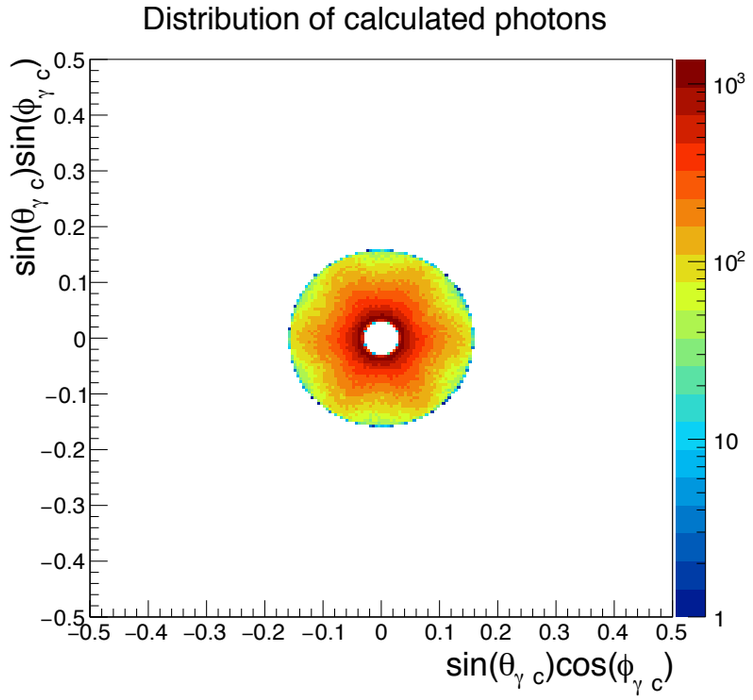
$W^2 > 4\ [GeV^2]$

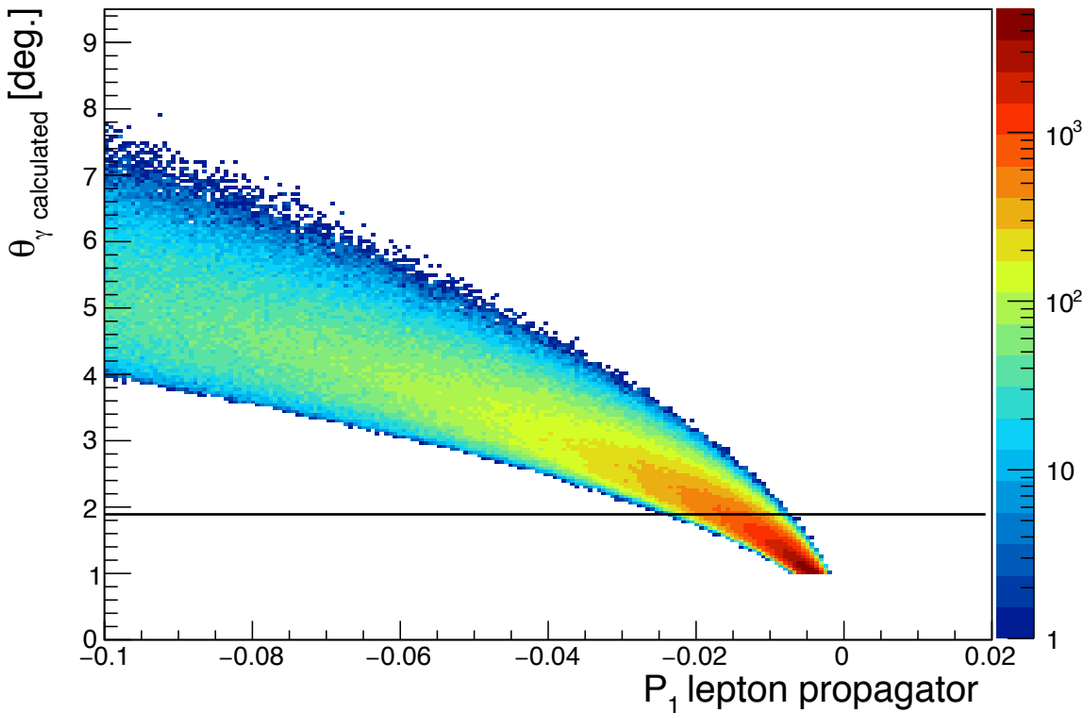
$-\ t < 0.52\ [GeV^2]$

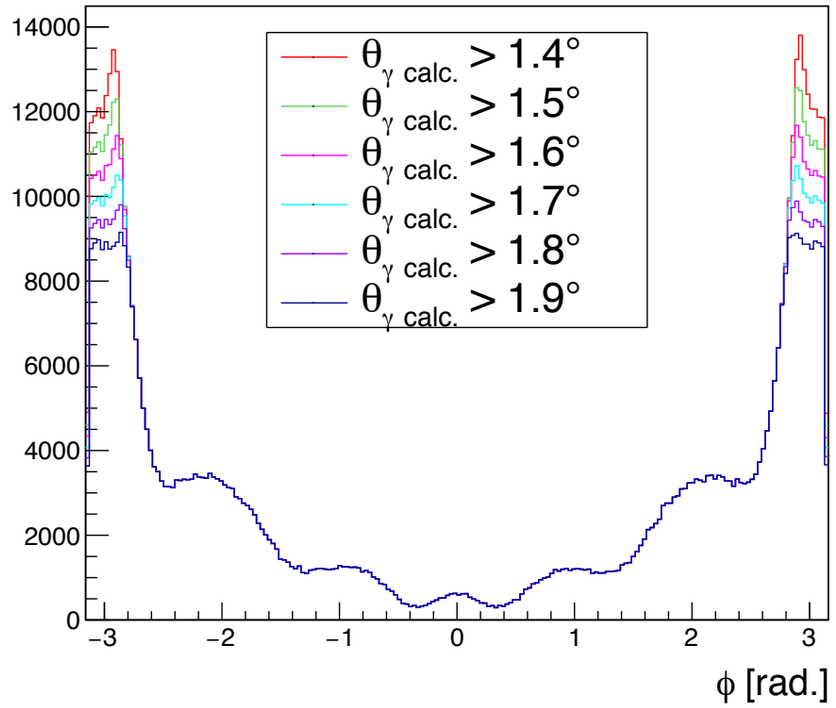
$-\ 0.08 < M_x^2(epX) < 0.08\ [GeV^2]$

$\theta_{\gamma\, calculated} > 1.9^\circ$

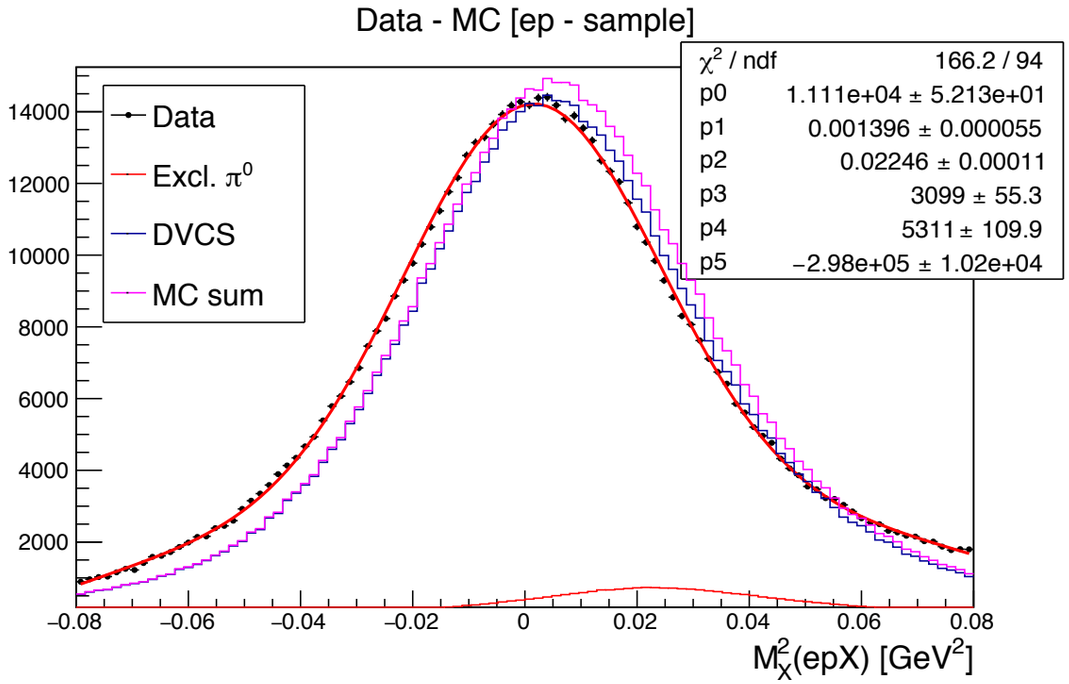
minimum cut on opening angle of calculated photons is equivalent to minimum cut on lepton propagator (imposed in simulation)

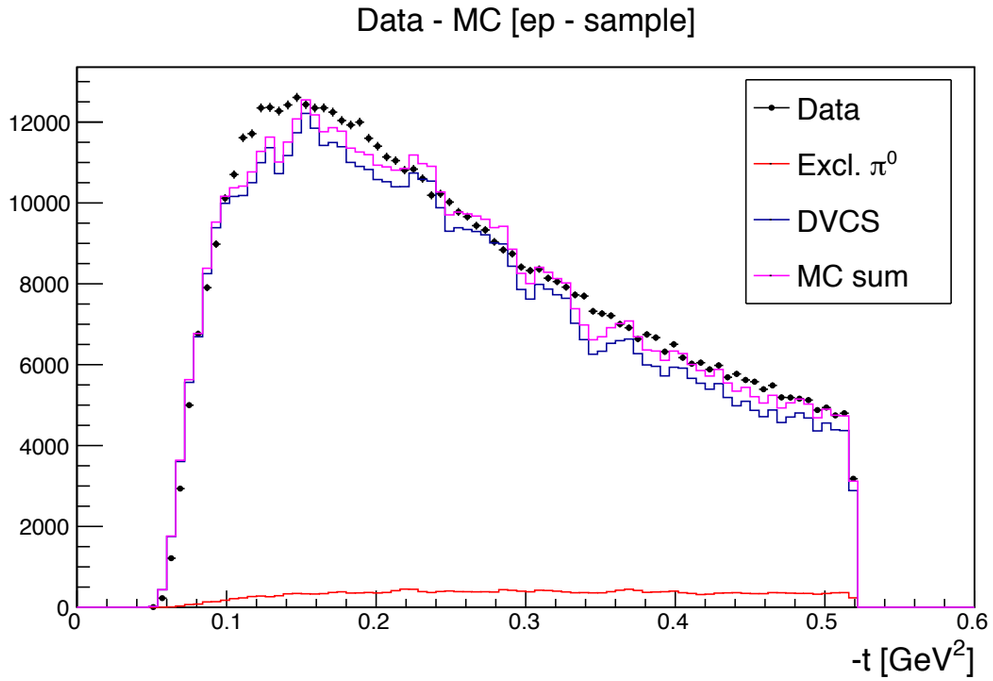


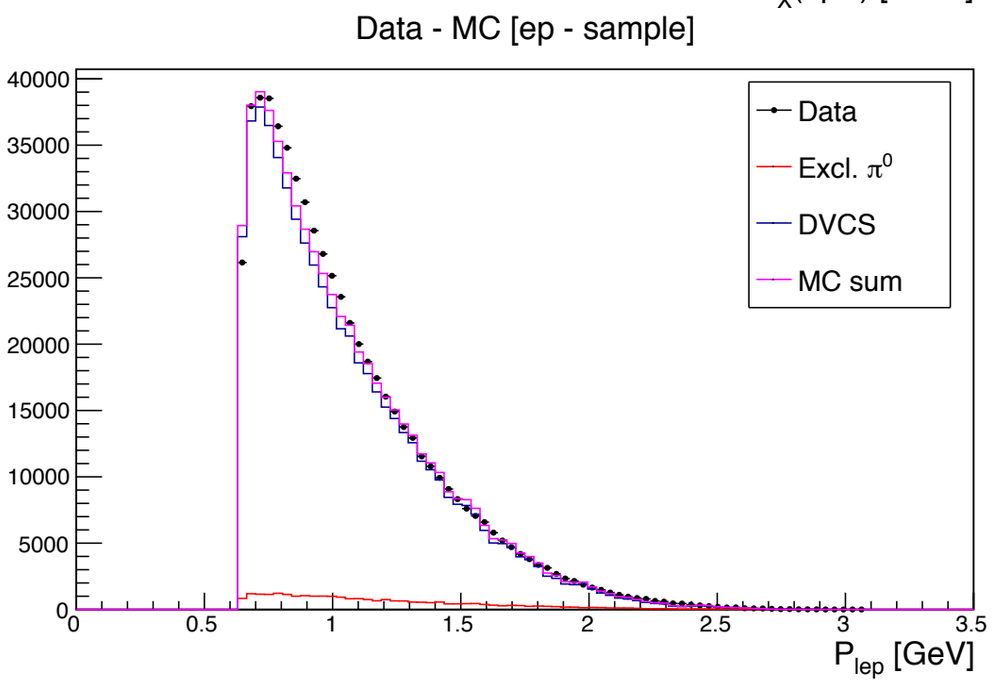


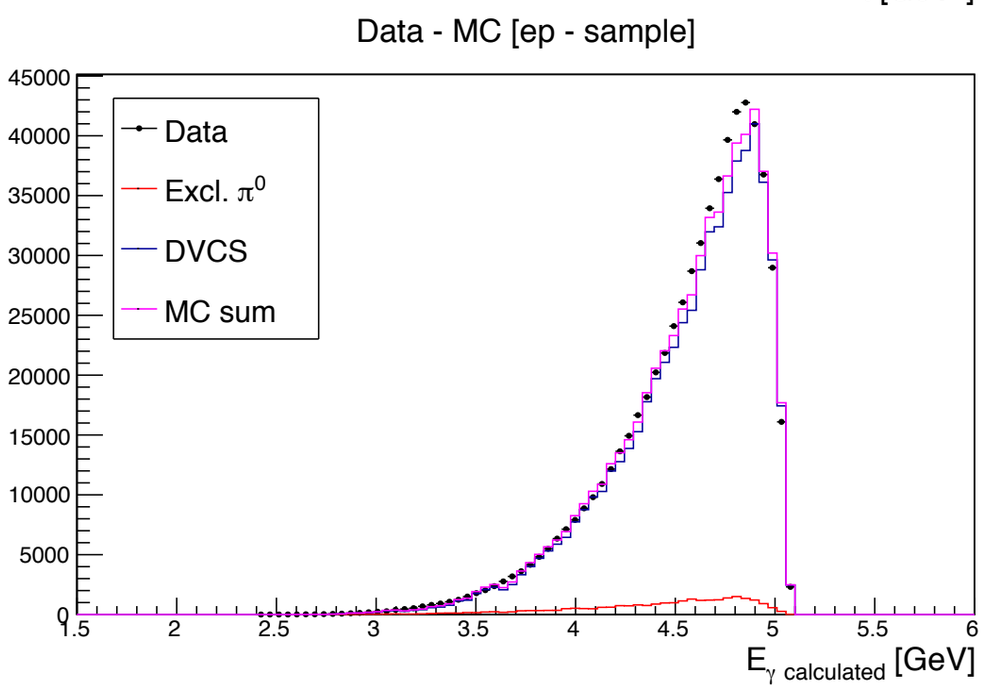


Data - MC (*ep* sample)





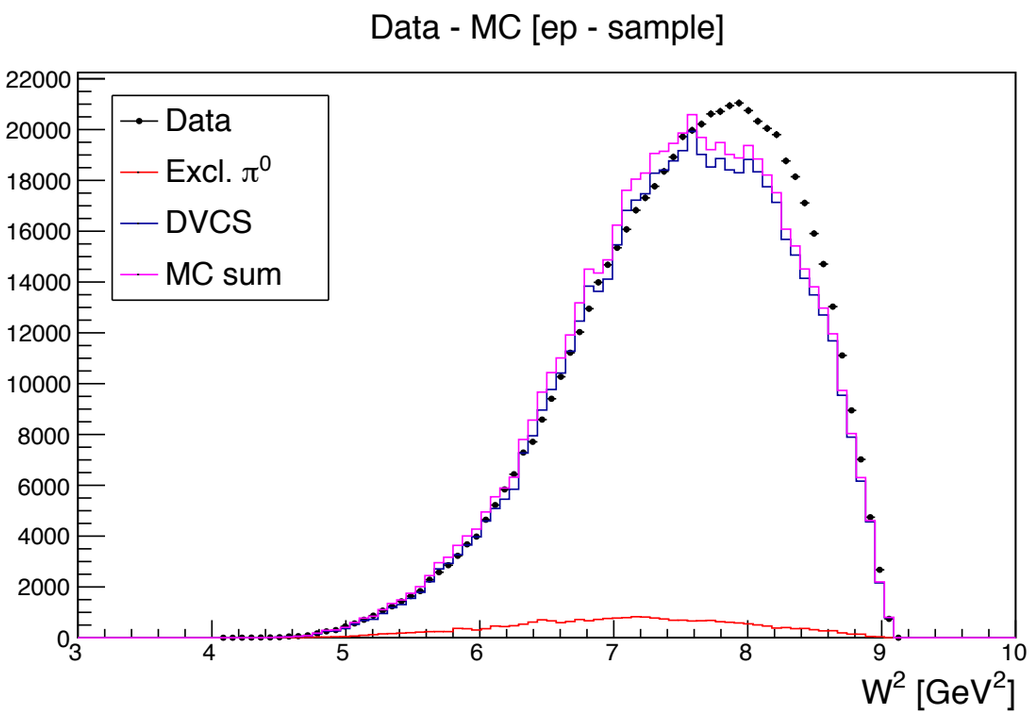


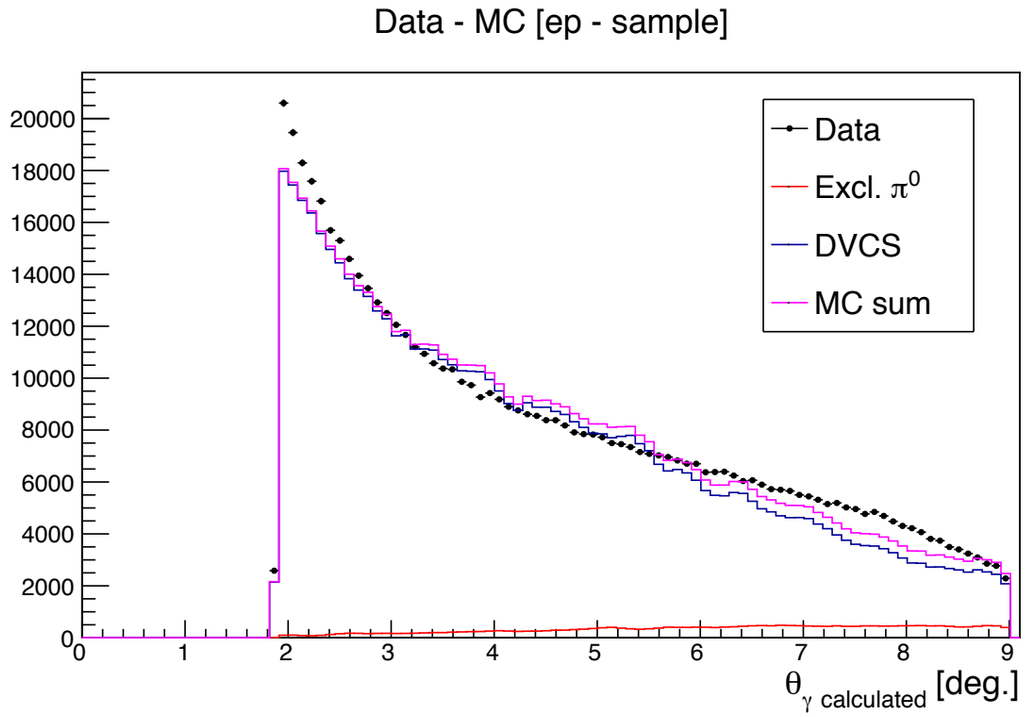


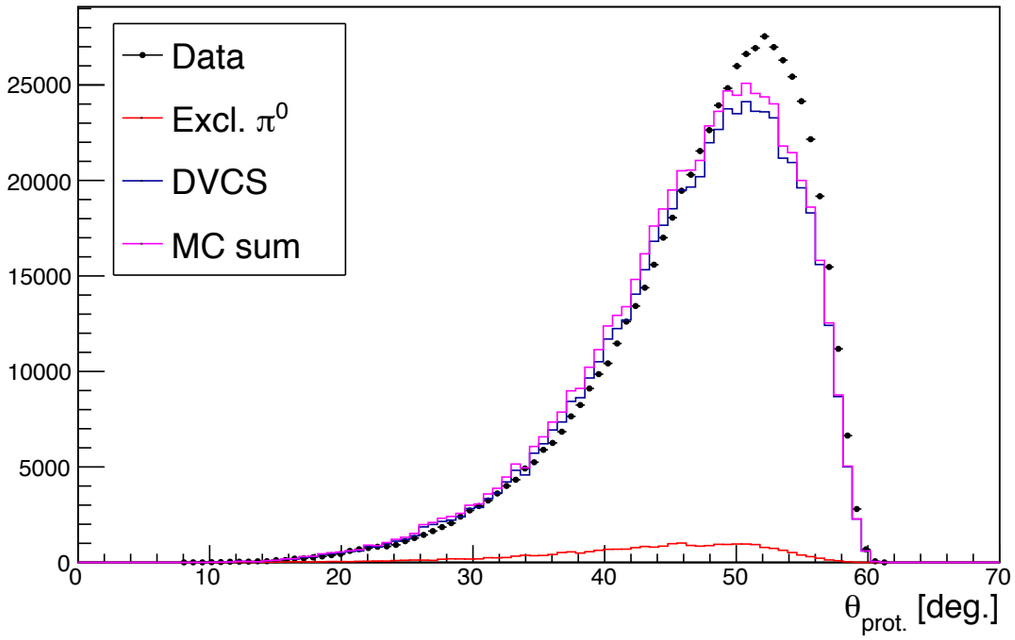
Normalization of DVCS process is obtained from the analysis of epγ sample

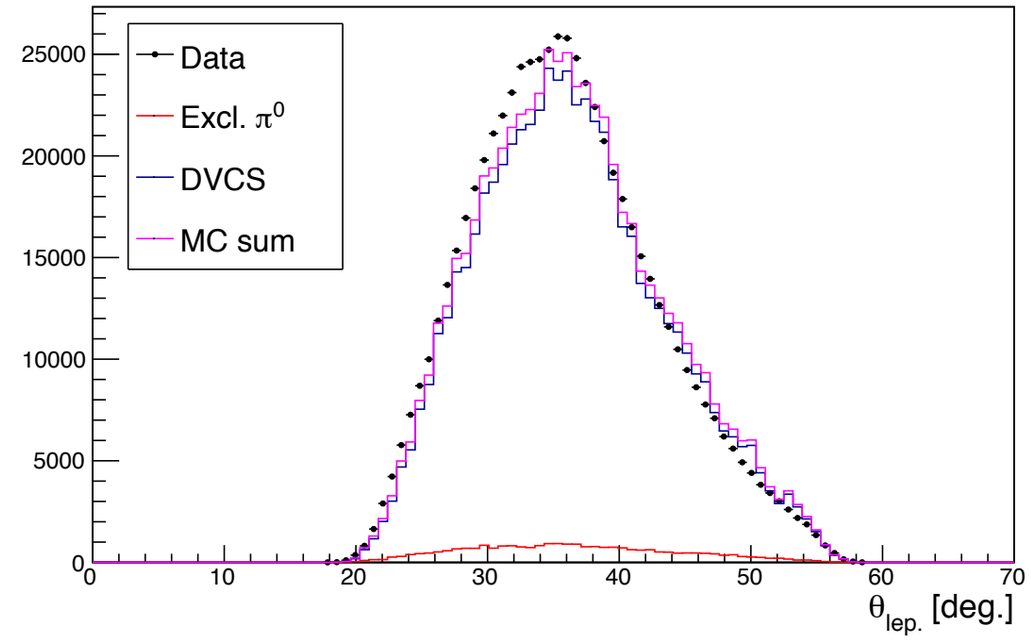
Good description of data by MC simulations

Data - MC (*ep* sample)









At small angles of emitted photons exclusive pion contribution is suppressed

Conclusion & Outlook

a. Sufficiently good description of data by MC simulation allows to measure DVCS via detection of only electron and proton.
b. Further improvement of Data-MC comparison can be obtained considering additional processes (like Δ+ production) and radiative corrections.
c. Analysis procedure implemented separately on *epγ* and ep samples is self-consistent.

a. Check for possible contribution from Δ+ production.
b. Further fine tuning of selection procedure.
c. Estimation of systematic uncertainties for the measurement of cross sections.

Thank you!