DVEP Cross Sections Roadmap

January 24, 2020
MIT-UConn Analysis Meeting

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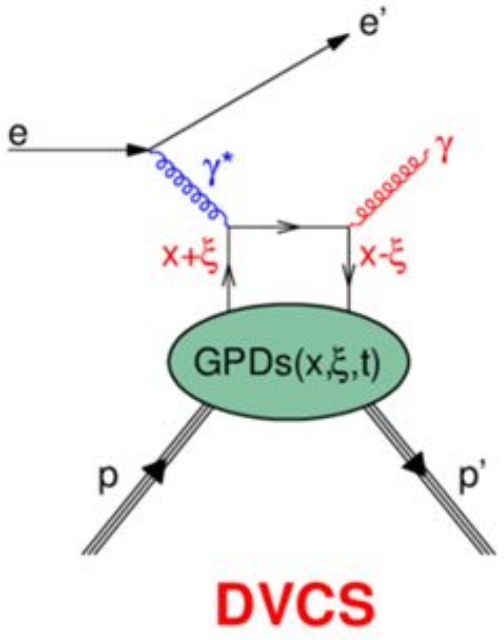
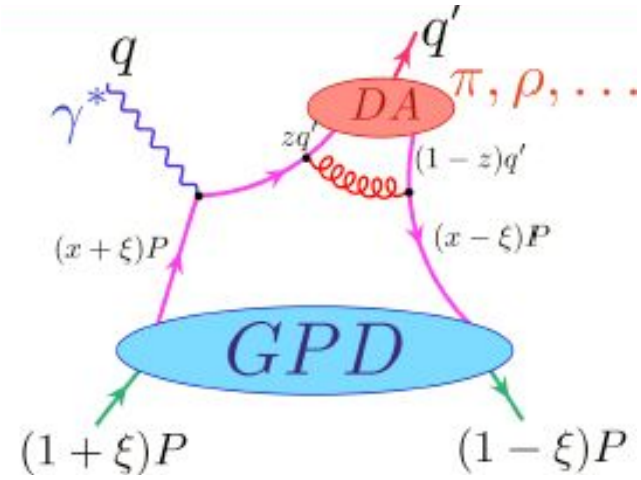
DVEP Cross Sections

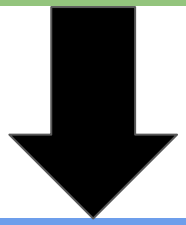
DVCS Cross Section - Sangbaek
Deeply Virtual Phi Production - Patrick
Deeply Virtual Pion Production - Bobby





DVEP Cross Section Path

(1) Understanding Raw Data
- Detector efficiencies etc.
- Luminosity measurement
- PID algorithms
- Which subset of data to use



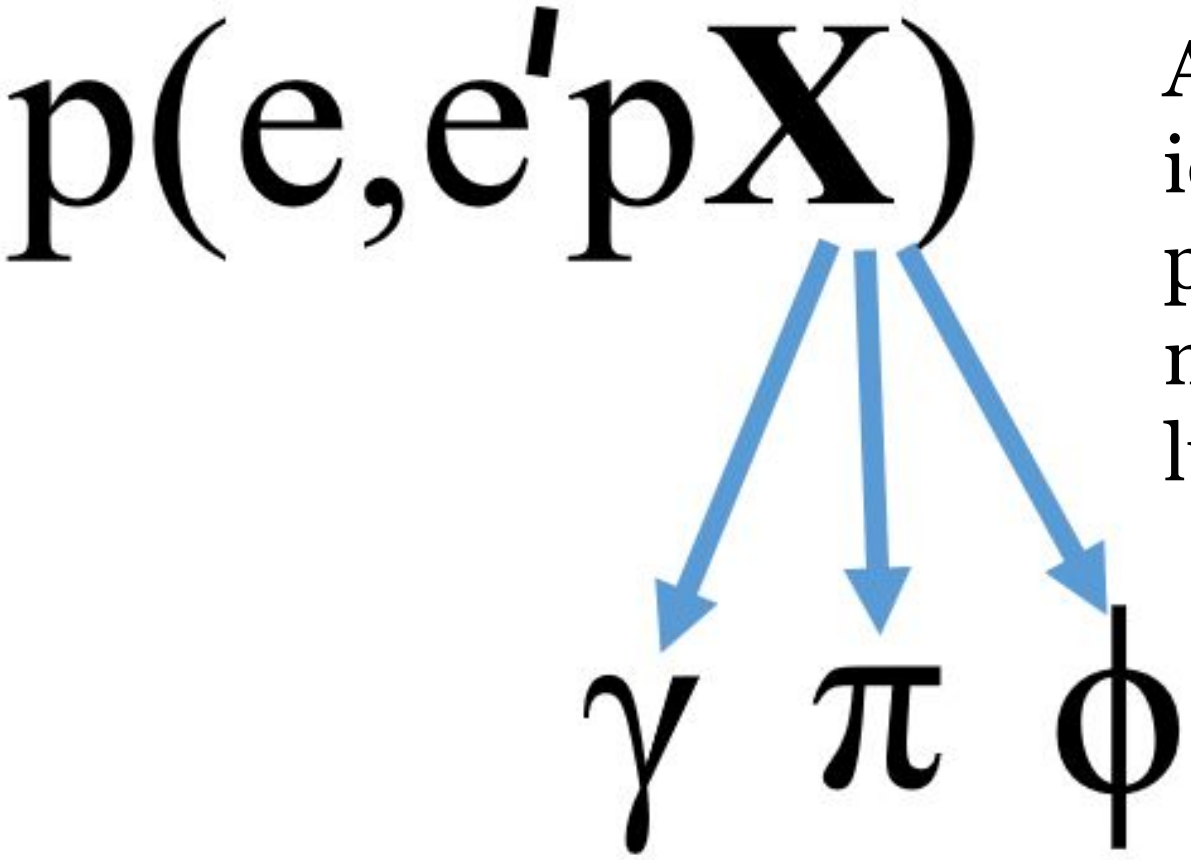
(2) Physics Analysis
- Kinematic fitting
- Multi-dimensional binning
- Radiative Corrections
- Monte Carlo
-

Results

- Much work to be done on (1), but the desire is to work on (1) and (2) simultaneously and iteratively; understand limiting parts of whole analysis scheme

- Working to find a reasonable path through (1) to get first order results out in the near future

The 3 Channels Share Common Structure



All need to identify electron, proton, have measure of luminosity, etc.

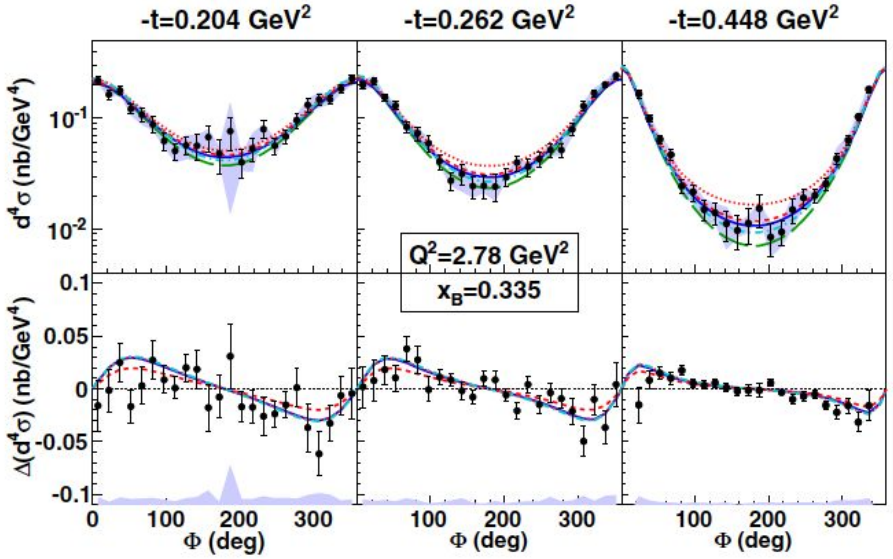
DVCS Cross Section Path

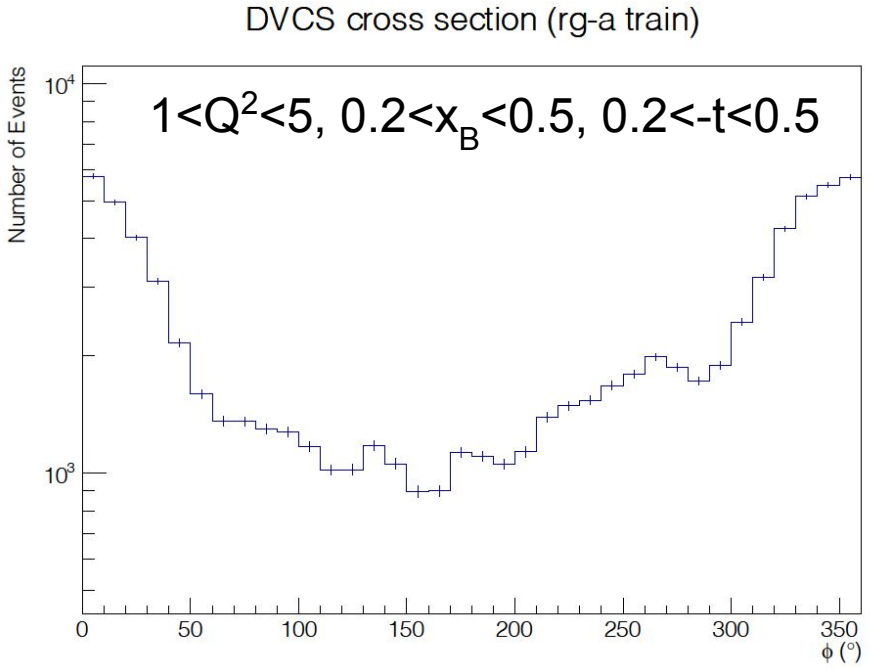
Previous Results (cross sections)

Hall A, Phys. Rev. C 92, 055202 (2015)

CLAS, Phys. Rev. Lett. **115**, 212003 (2015)

\+ Analysis note





DVϕP Analysis Goals

- Measure σ(Q^2,W)
- Measure dσ/dt'
- Extract R and σ_L from angular distributions

$$\sigma(Q^2, W, E_{beam}) = \frac{1}{\Gamma(Q^2, W, E_e)} \frac{d\sigma_\phi}{dQ^2 dW}$$

$$\frac{d\sigma}{dQ^2 dW} = \frac{1}{BR_{\phi \to K^+K^-}} \frac{n_W}{\mathcal{L}_{int} \Delta Q^2 \Delta W}$$

DVϕP Cross Section Path

- Electron PID
- Fiducial Cuts
- Hadron PID
- Momentum and energy loss correction
- Eliminate hyperon background
- Acceptance Corrections
- Radiative Corrections

DVπP Cross Section Path

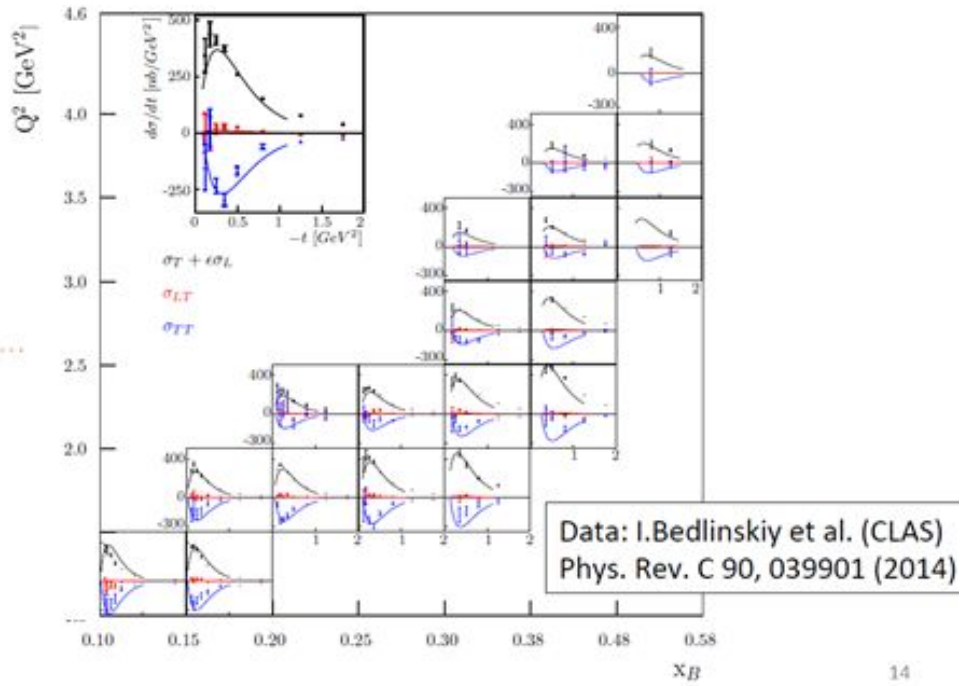
Particles:

Outgoing electron - detected as in DVCS, DVϕP
Proton - detected as in DVCS, DVϕP
Pion - Reconstructed from photons
Photons - detected as in DVCS

$$p(e,e'p\pi)$$

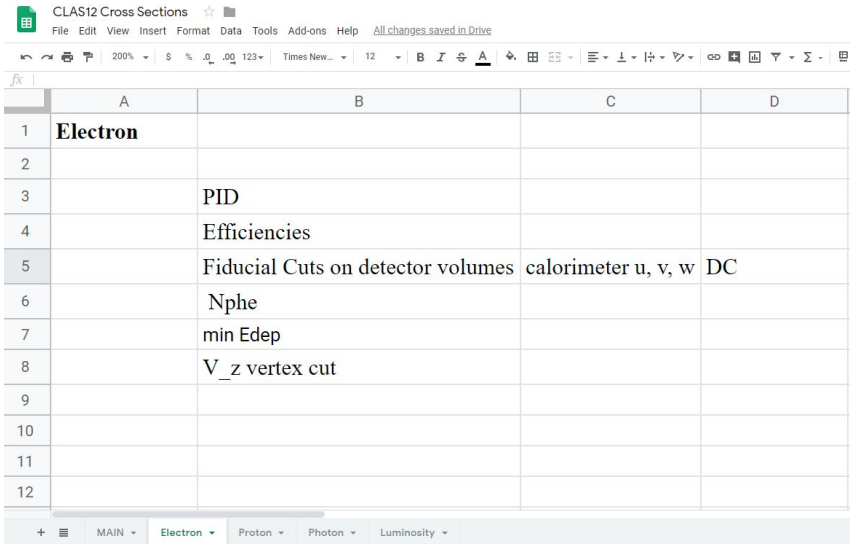
Physics:

- **Kinematic Fitting / Exclusivity cuts**
- **Monte Carlo:** aao_rad

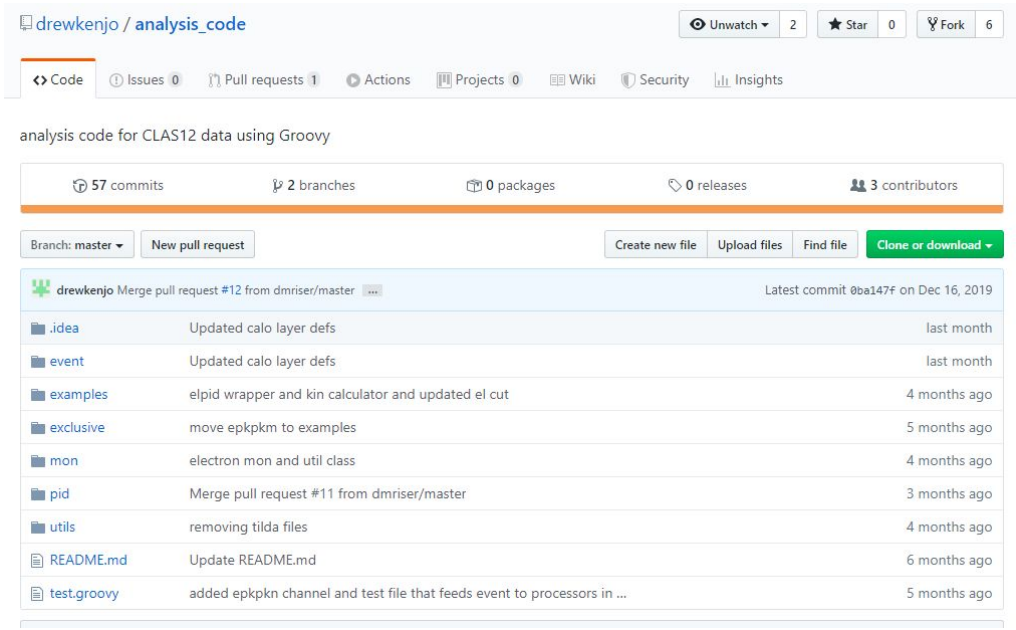


Infrastructure Set Up for Collaborative Work

- Github repo, Slack, and Google Drive for collaboration
- Hope to resume normal meetings as in Summer 2019



	A	B	C	D
1	**Electron**			
2				
3		PID		
4		Efficiencies		
5		Fiducial Cuts on detector volumes	calorimeter u, v, w	DC
6		Nphe		
7		min Edep		
8		V_z vertex cut		
9				
10				
11				
12				



Mechanisms to Cross-Check Work

- Symmetry across 6 detector sectors
- Time dependence of data
- Elastic scattering (well known)
- Elastic DIS (well known)

Wrap Up

- Hoping to resume normal analysis meetings (bi-/weekly?)

- Develop Helicity Amplitude Grid

- Plan to work intensively for next two months, share progress at next group meeting (at JLab?)

Backup Slides

MC Event Generator

Generally,

simulate N points randomly over phase space

accept/ reject based on “weights”, i.e., differential cross sections

if (weight) < (maximal weight) * (random number), reject

whole processes can be optimized by better sampling algorithm

DVCS

dvcsgen and genepi from gpd data

DVCS cross section 4 fold (5 fold with degeneracy for unpol. target)

dvcsgen gets maximal weight by non-probabilistic sampling (center of bin)

DVEP Cross Sections

5 fold cross sections: x_B, Q^2, t, ϕ_e, ϕ_γ

ϕ_e and ϕ_γ correlated unless transversely pol.

hydrogen target is unpol., so 4 fold cross sections

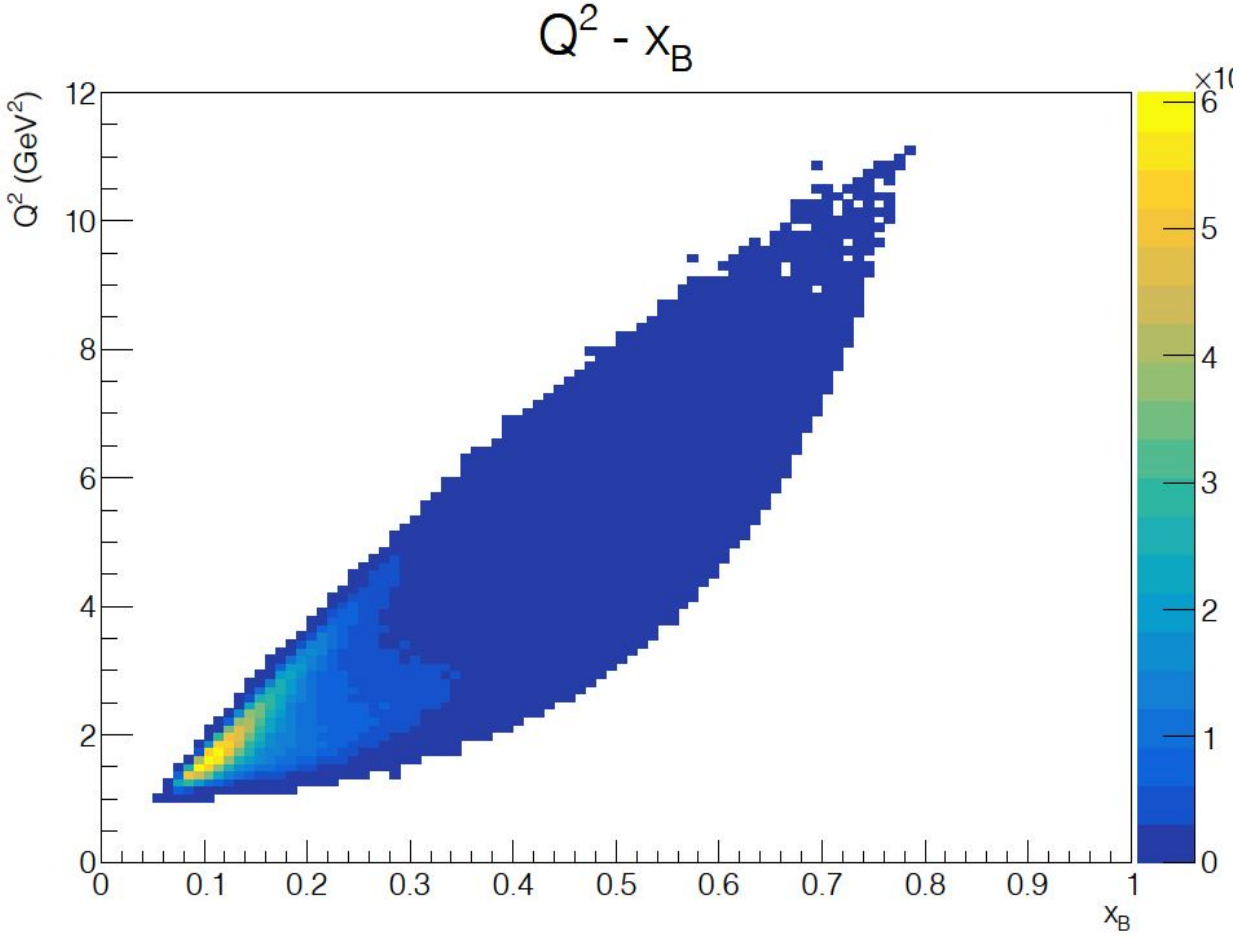
No TH4F due to memory issue -> need nice binning

-> hard to MC integrate to get cross sections

-> hard to estimate event rates, treat the data

DVCS from rg-a train

$1<Q^2<5$, $0.2<x_B<0.5$, $0.2<-t<0.5$



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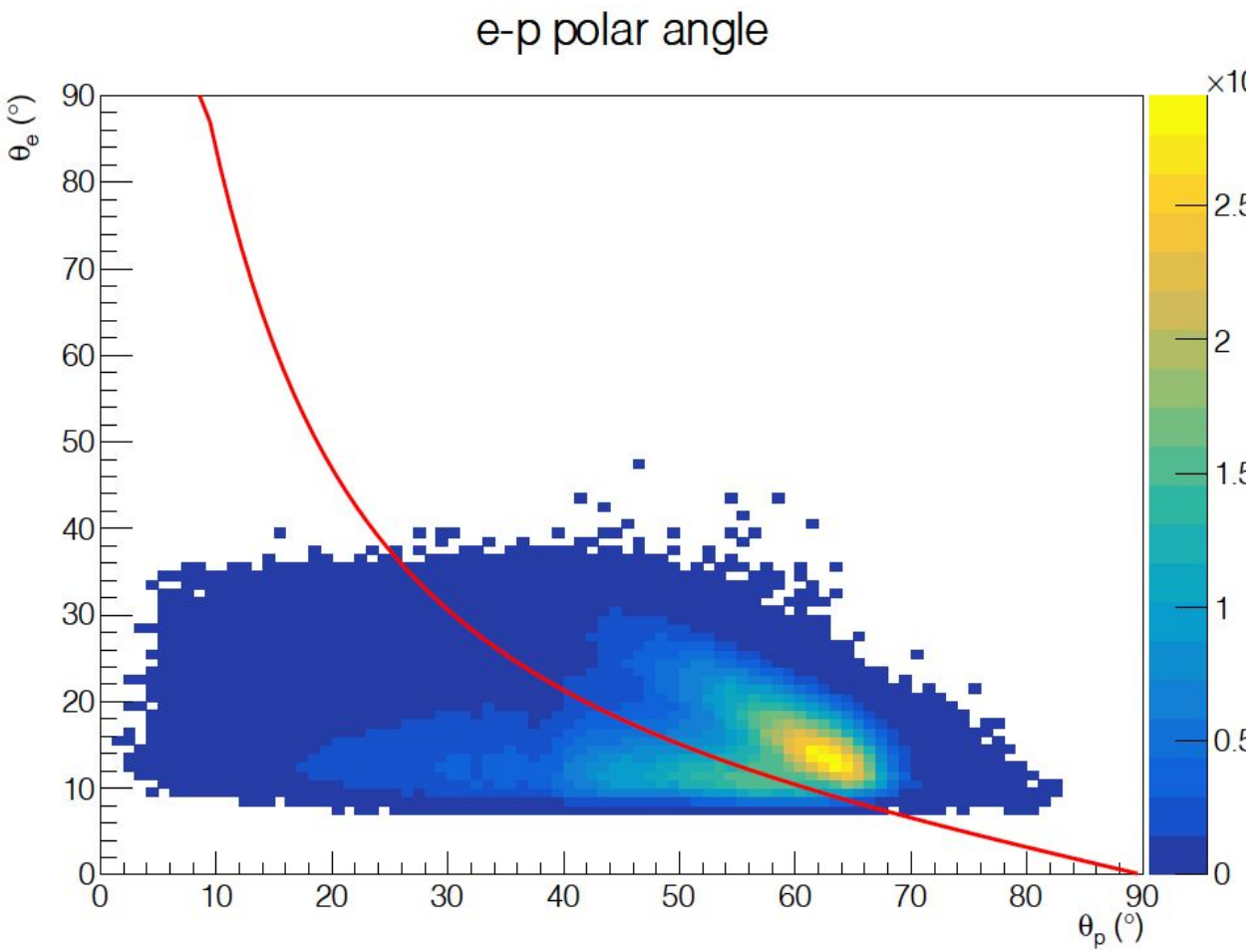

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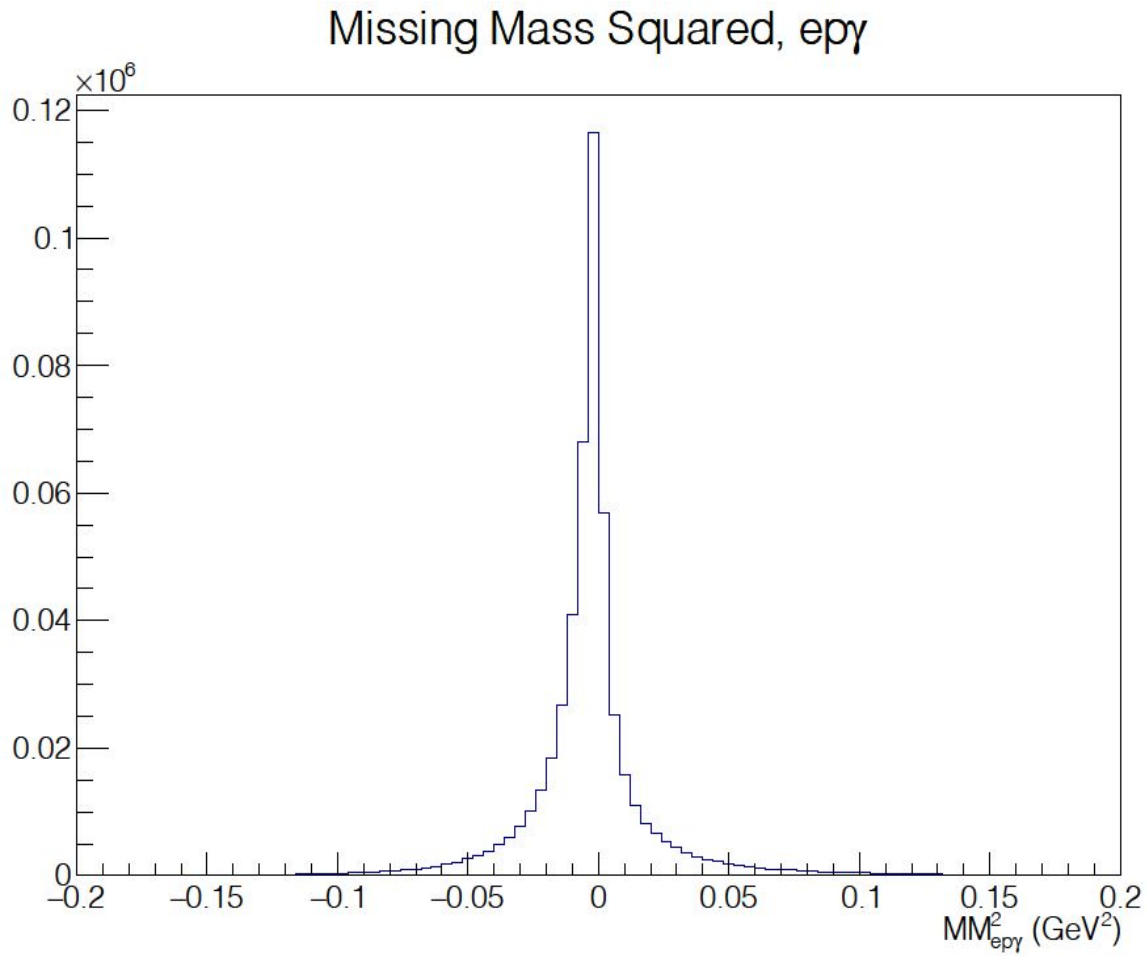

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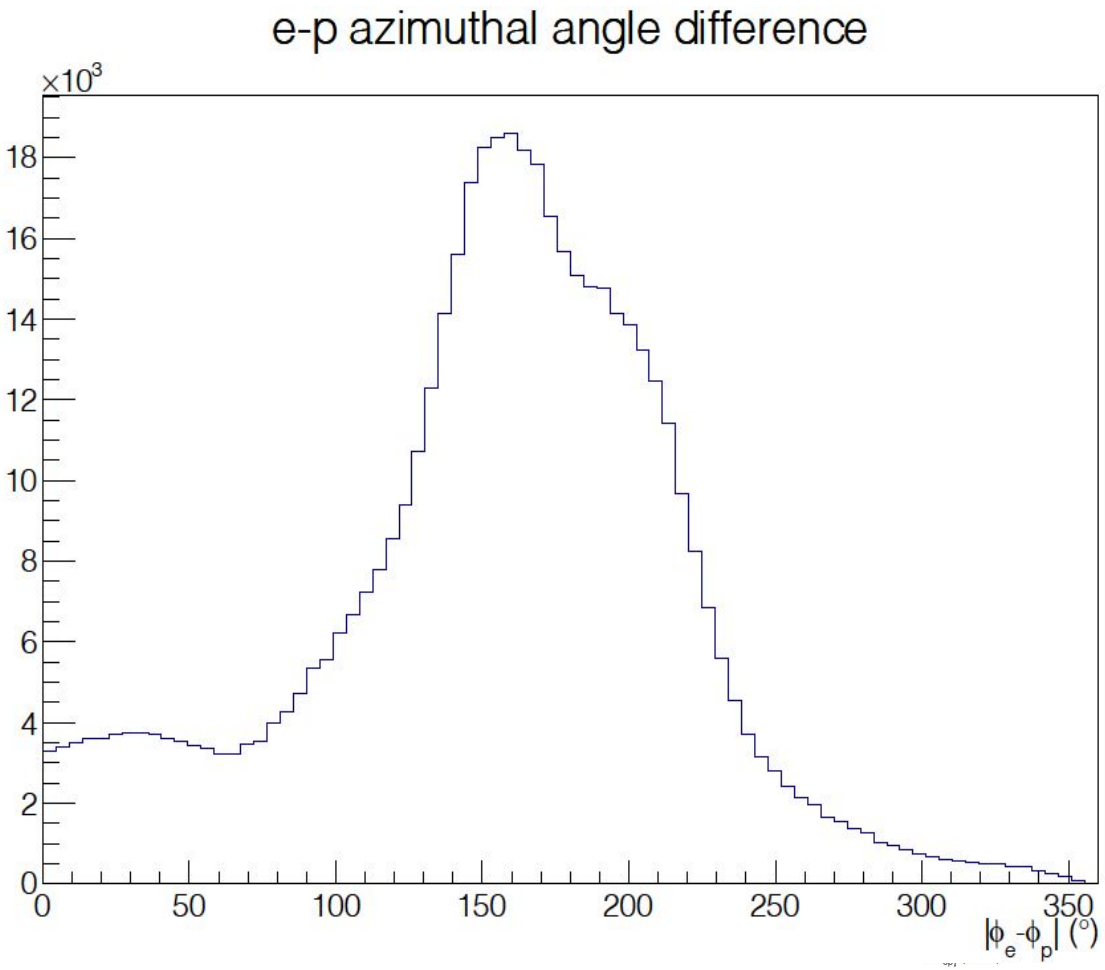

Backup Slides

$p(e,e'p\pi)$ $p(e,e'p\gamma)$

$p(e,e'p\phi)$