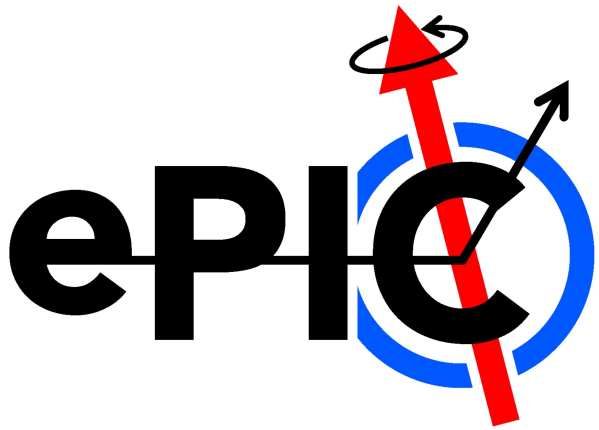
Exclusive, Diffractive, Tagging Working Group

Spencer Klein, Rachel Montgomery, **Axel Schmidt**, Daria Sokhan

January 11, 2022



Our WG Coordinates

Wiki: https://wiki.bnl.gov/EPIC/index.php?title=ExclusiveDiffractionTagging

Indico: https://indico.bnl.gov/category/419/

Mailing List: eic-projdet-excldiff-l@lists.bnl.gov

Sign-up: https://lists.bnl.gov/mailman/listinfo/eic-projdet-excldiff-l

Convenors:

- Spencer Klein srklein@lbl.gov
- Rachel Montgomery rachel.montgomery@glasgow.ac.uk
- Axel Schmidt axelschmidt@gwu.edu
- Daria Sokhan daria@jlab.org

Exclusive, Diffractive, Tagging Channels

Deep Exclusive Processes

- Deeply virtual Compton scattering
- Deeply virtual meson production
- Coherent eA DVCS/DVMP
- Time-like Compton scattering

Diffractive Processes

- Diffractive vector meson production
  - $\rho, \phi, J/\psi, \Upsilon$
- Coherent diffractive eA

Tagged Processes

- Spectator-tagged $d(e, e'_{DIS} N_s)$
- Double-tagged ^{3}He$(e, e'_{DIS} p_s p_s)$
- Sullivan process
- XYZ Spectroscopy

Backward Processes

- Backward DVCS
- u-channel meson production

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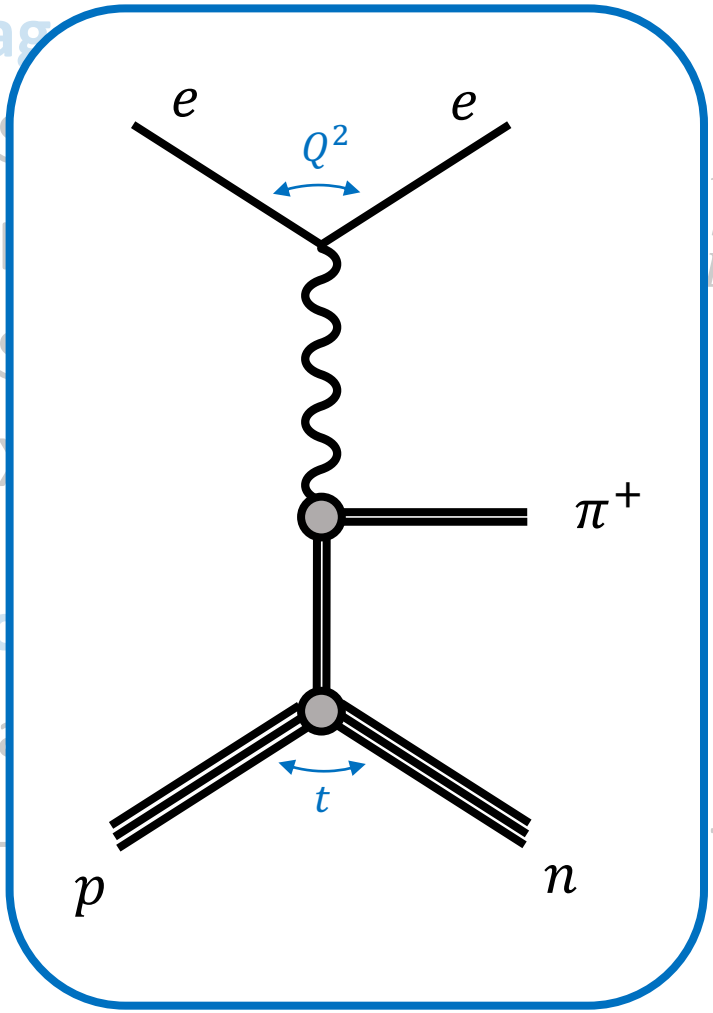

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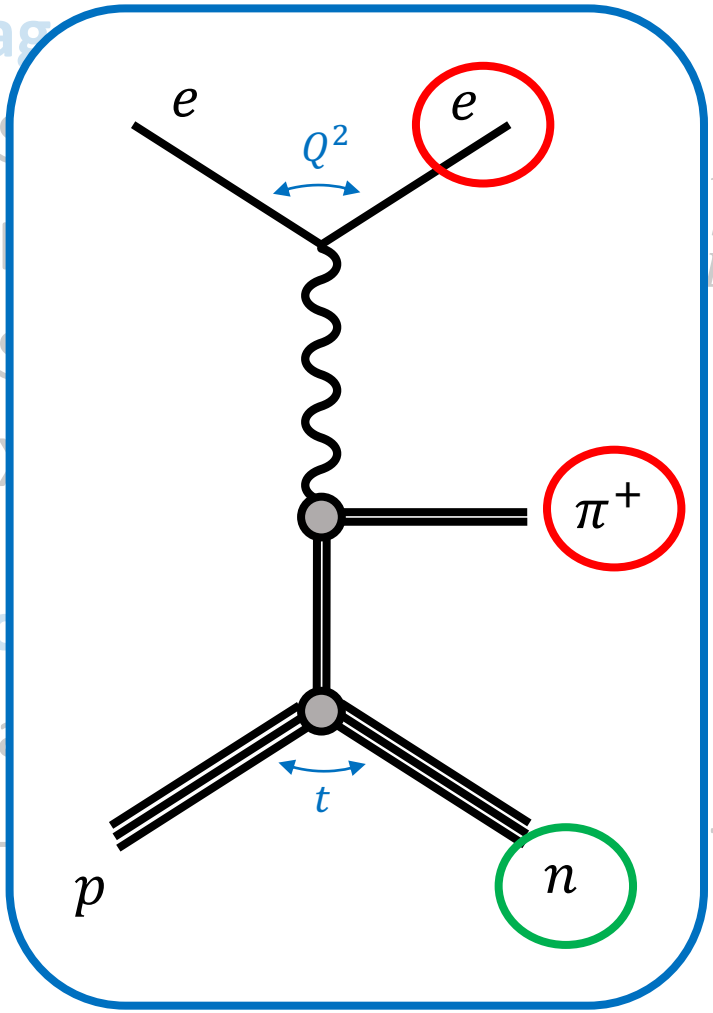

Tag in the ZDC

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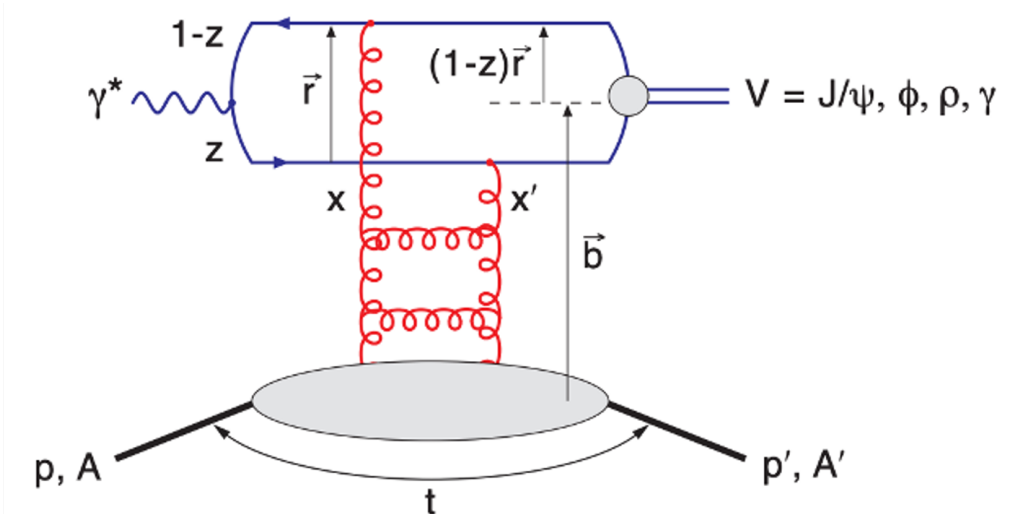

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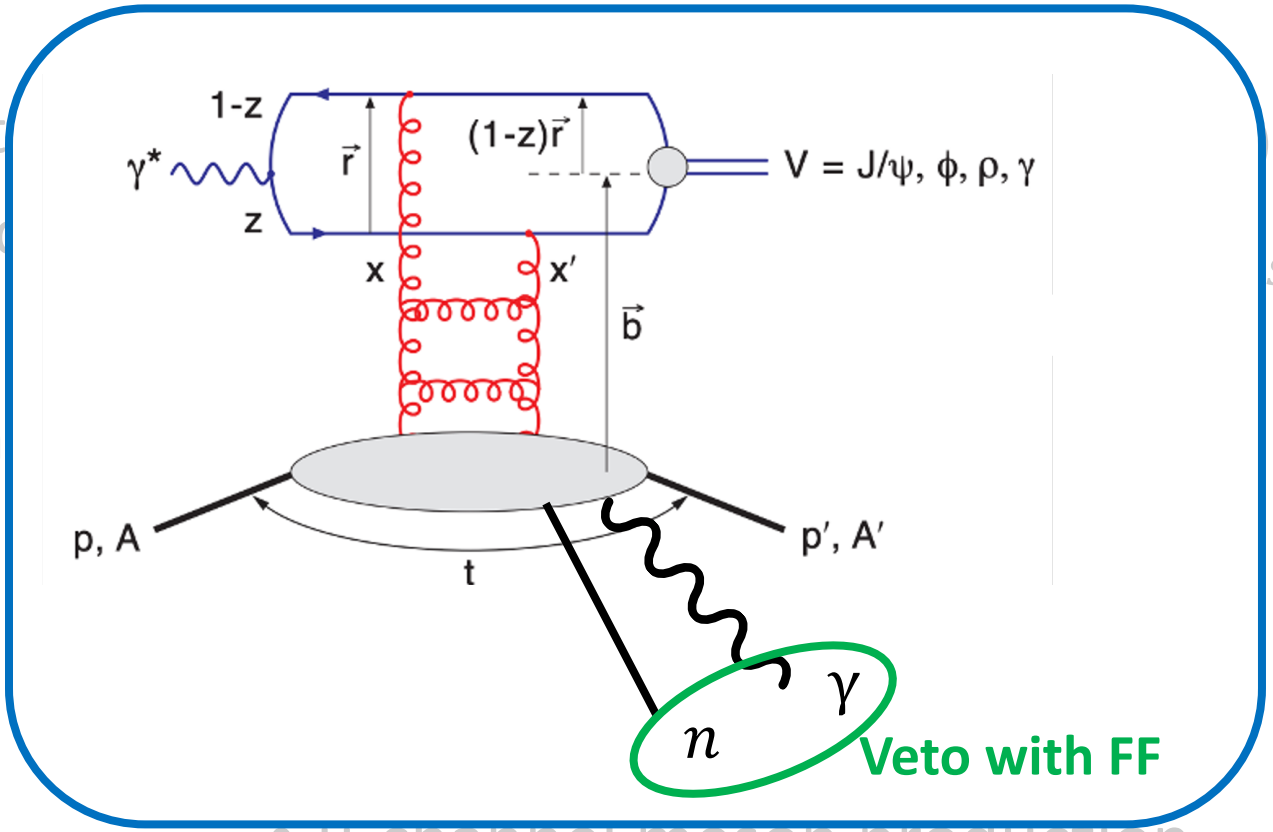

Exclusive, Diffractive, Tagging Channels

Far-forward and/or far-backward systems, multiparticle final states

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Working Group Goals

- Validate the detector performance, particularly of the far-forward (and backward) designs in terms of physics (reach, uncertainty) in addition to detector performance (resolutions, efficiencies)

- Develop tools for the selection and reconstruction of exclusive events.

- Improve the discrimination of coherent and incoherent events

- Strengthening and expanding the ePIC physics program.

Current status

- Simulation samples for several generators have been produced.
  - Limitations to Far Forward reconstruction
- First ePIC simulation results will be shown by Kong Tu in the next talk.

```
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│  │        └─ minQ2=100   1094
│  ├─ EXCLUSIVE
│  │  ├─ DIFFRACTIVE_JPSI_ABCONV
│  │  │  └─ Sartre
│  │  │     ├─ Coherent   9443
│  │  │     └─ Incoherent   3027
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│        │  └─ hepmc_ip6
│        │     └─ radcor  58263
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   ├─ EXCLUSIVE
   │  ├─ DVCS_ABCONV
   │  │  ├─ 10x100   1045
   │  │  ├─ 18x275    985
   │  │  └─ 5x41    453
   │  └─ TCS_ABCONV
   │     ├─ 10x100
   │     │  └─ hel_minus   2790
   │     ├─ 18x275
   │     │  ├─ hel_minus    126
   │     │  └─ hel_plus    148
   │     └─ 5x41
   │        ├─ hel_minus    440
   │        └─ hel_plus    440
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      ├─ Lambda_ABCONV   4492
      └─ pythia6
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         │     └─ radcor  44740
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               ├─ noradcor   9329
               └─ radcor   7856
```
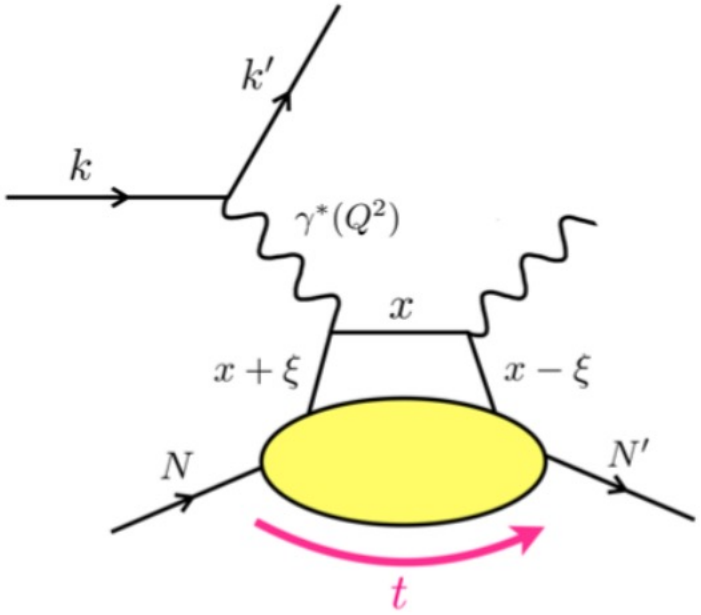

Total number of files: 416377
Total size: 42 TB

From Wouter's talk, Monday

Deeply Virtual Compton Scattering

(work presented by Salvatore Fazio)



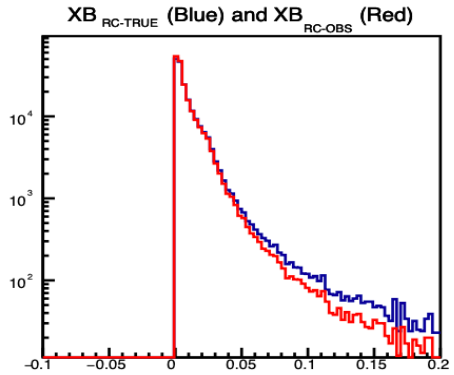
EpIC Event Generator

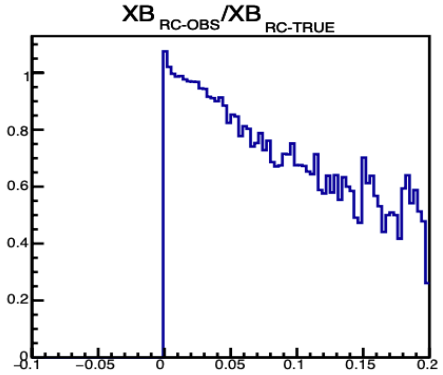
- Based on PARTONS framework
- GK/KM20 GPD models
- RCs in collinear approximation

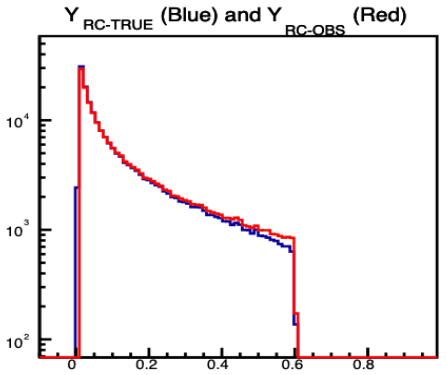
Kinematics:

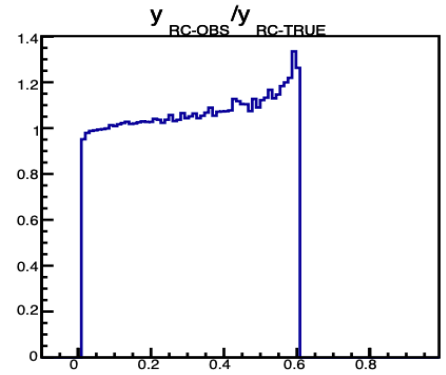
- $10^{-4} < x_B < 0.63$
- $1 < Q^2 < 100$ GeV^2
- $0.04 < |t| < 1.3$ GeV^2
- $0.01 < y < 0.6$

- Optimizing cuts to minimize impact of RCs.
- Working to build full analysis of reconstructed simulation



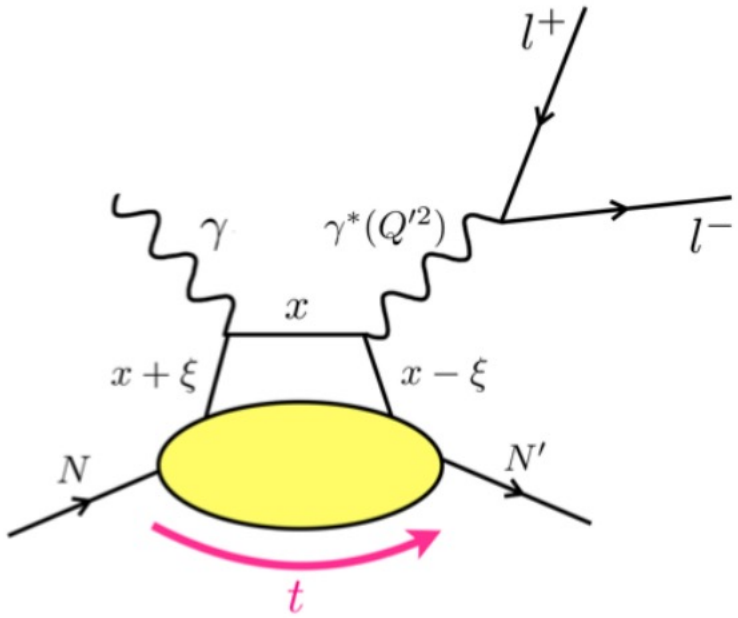




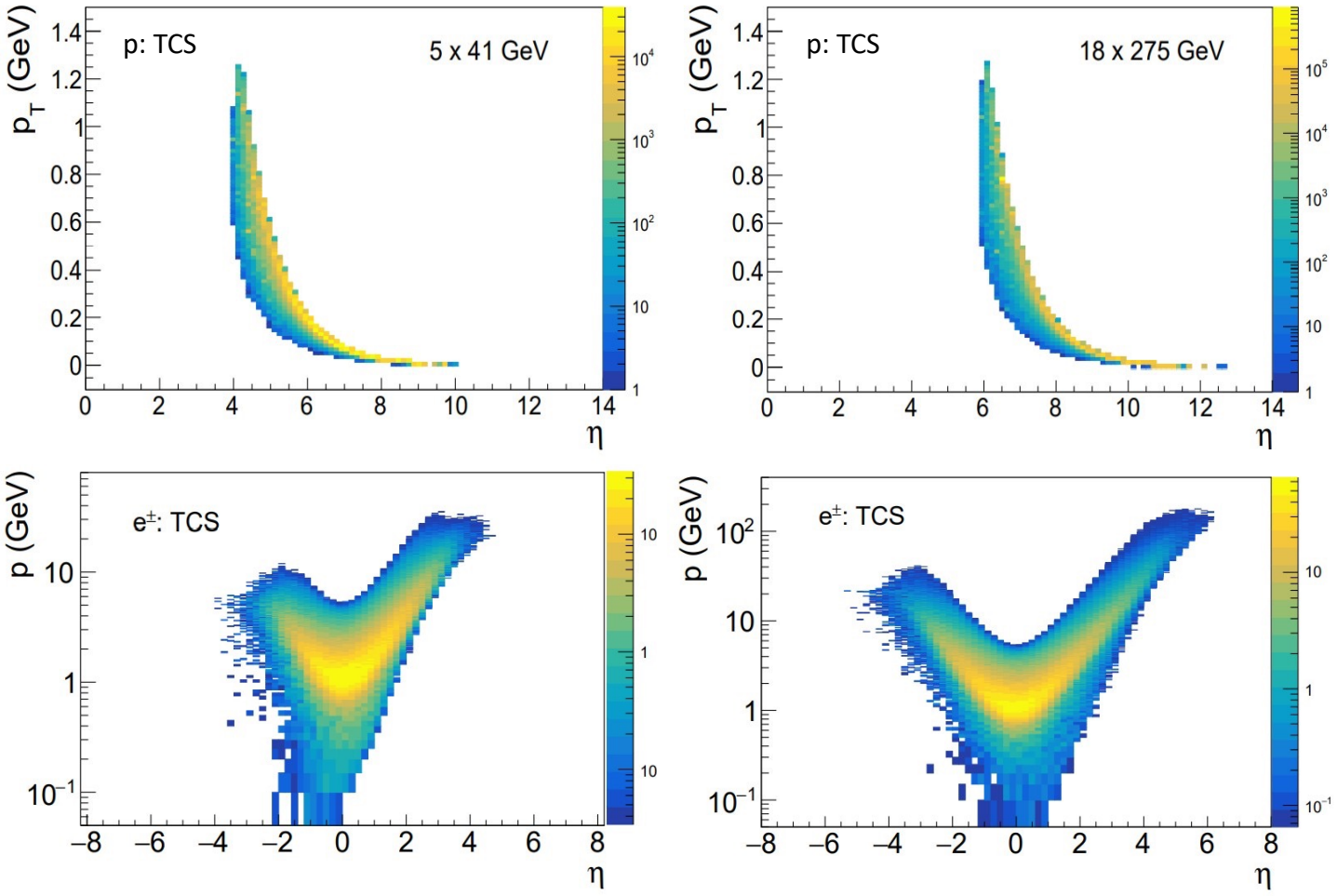


Time-Like Compton Scattering

(work presented by Kayleigh Gates, Daria Sokhan)

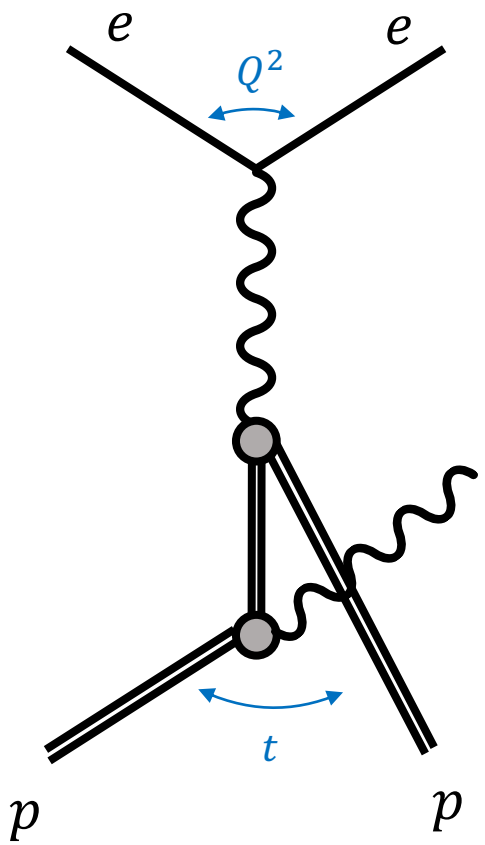


- Proton in B0/Roman Pots
- Decay lepton pair in barrel calorimeters
- Undetected scattered lepton, reconstructed as missing X
  - Opportunity for the low-Q2 tagger to improve selection of the signal

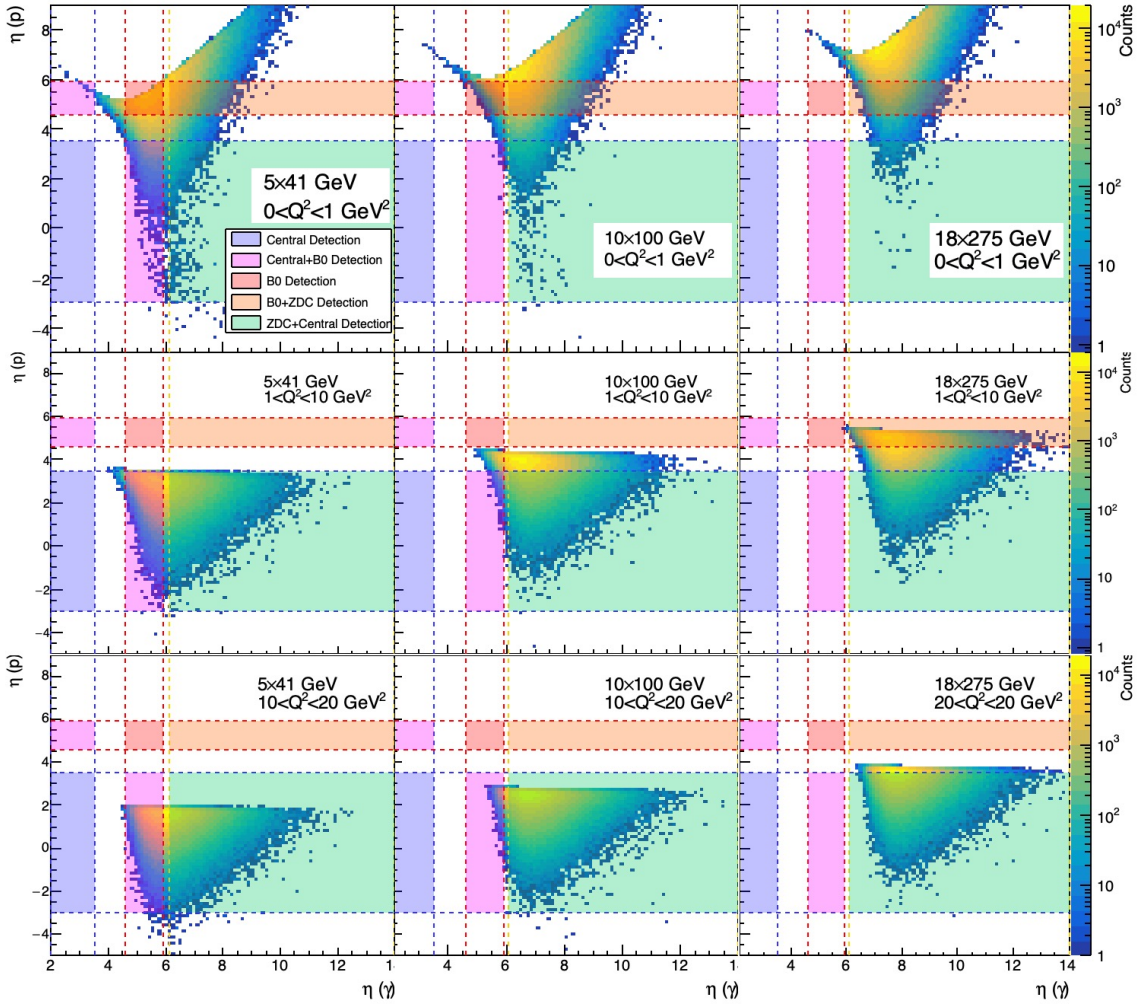


Backward-Angle (u-channel) VCS

(work presented by Zachary Sweger)



- Backward-angle VCS / VMP can constrain parton correlations (TDAs)
- Custom cross section model parameterizing W-, u-dependence based on fits to existing backward data.
- ZDC and B0Cal will play a key role in detecting the photons.



Join us!

There are so many channels to investigate, tools to develop.

See our wiki page, write to us, to get involved!

- Spencer Klein srklein@lbl.gov
- Rachel Montgomery rachel.montgomery@glasgow.ac.uk
- Axel Schmidt axelschmidt@gwu.edu
- Daria Sokhan daria@jlab.org

BACK-UP

Comparison of ATHENA and ECCE studies

Studies for proposal	ATHENA	ECCE
DVCS in ep	EpIC	MILOU3D
DVCS (incoherent) in ed	EpIC	
DVCS in He-4		TOPEG
TCS in ep	EpIC	EpIC
J/ψ in ep		eSTARlight, IAger
J/ψ in eA		eSTARlight, IAger
ϕ in eAu/Pb	SARTRE, BeAGLE	SARTRE, BeAGLE
$\Upsilon(1S, 2S, 3S)$ in ep	eSTARlight, IAger	
u-channel: ω, ρ in ep	eSTARlight	
$X, Y, \psi(2S)$ in ep$\rightarrow J/\psi\pi^+\pi^- p$	elSpectro	elSpectro
Pion Form Factor		DEMPgen
Pion Structure Function		EIC_mesonMC
A_1^n (He-3 double tagging)		DJANGOH