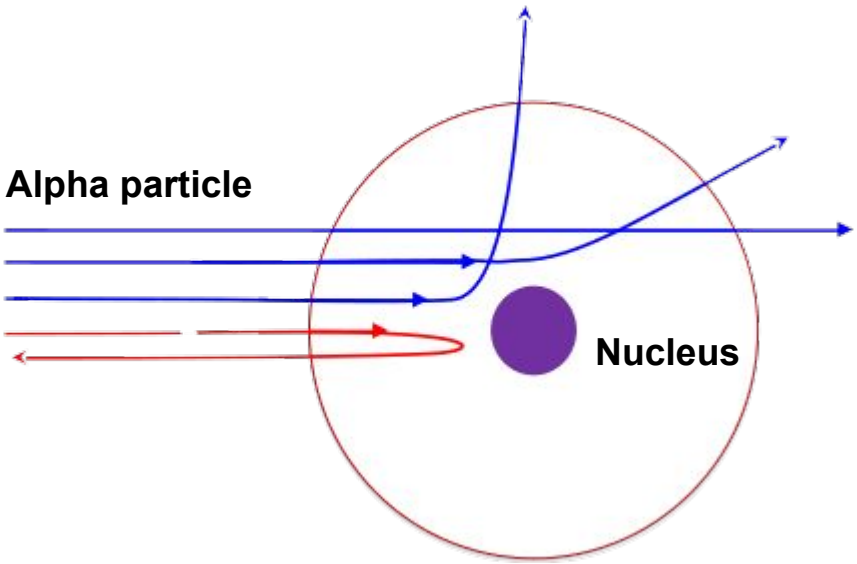
Jefferson Lab

WILLIAM & MAR
CHARTERED 1693

A Dream of Bernard Pire: Backward-angle DVCS

Wenliang (Bill) Li
on behalf of
Justin Stevens, Garth Huber, Bernard Pire,
Lech Szymanowski, Kirill
Semenov-Tian-Shansky

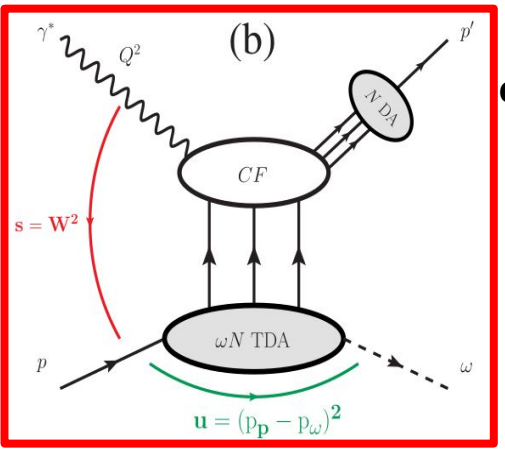
Backward-angle structure of Atom

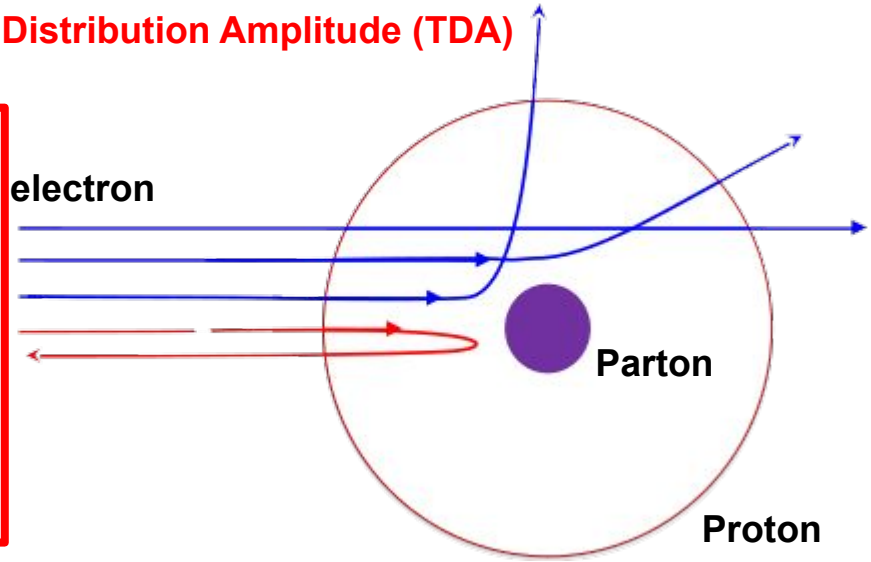


- Rutherford Experiment:
  - Need both forward and backward scattered alpha particles to yield complete atomic structure!

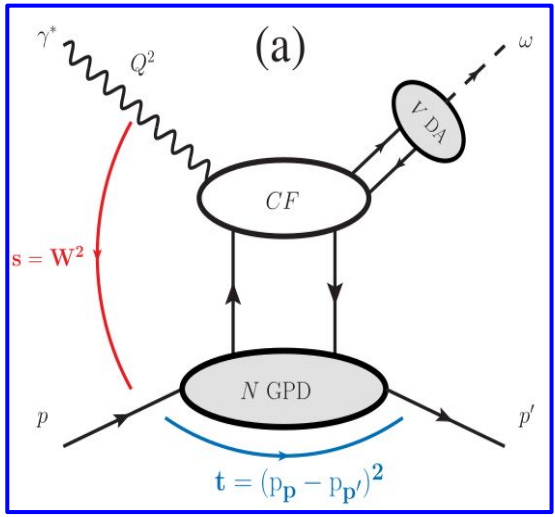
Backward-angle structure of Proton

Meson-nucleon Transition Distribution Amplitude (TDA)

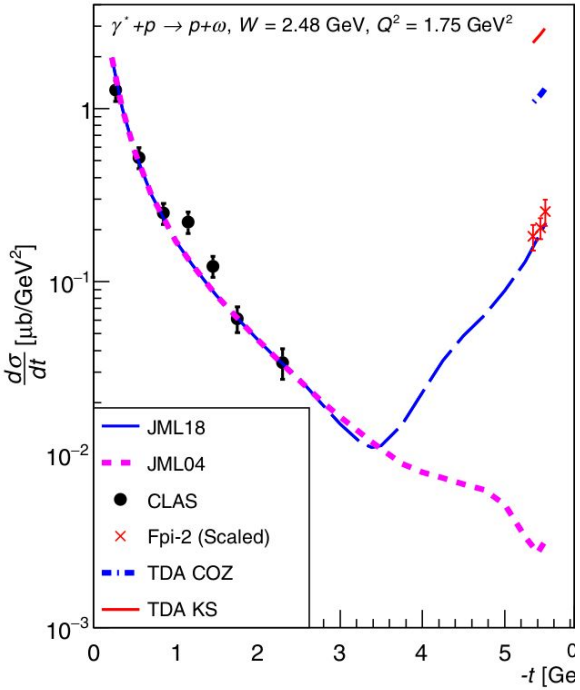




GPD



- Complete description of Nucleon
  - GPD = Computer tomography of the proton?
  - TDA = description of the parton behaviour with in the nucleon in the Backward angle
- Backward-angle cross section is not 0!
  - backward angle cross sectiion is 1/10 of the forward angle cross section



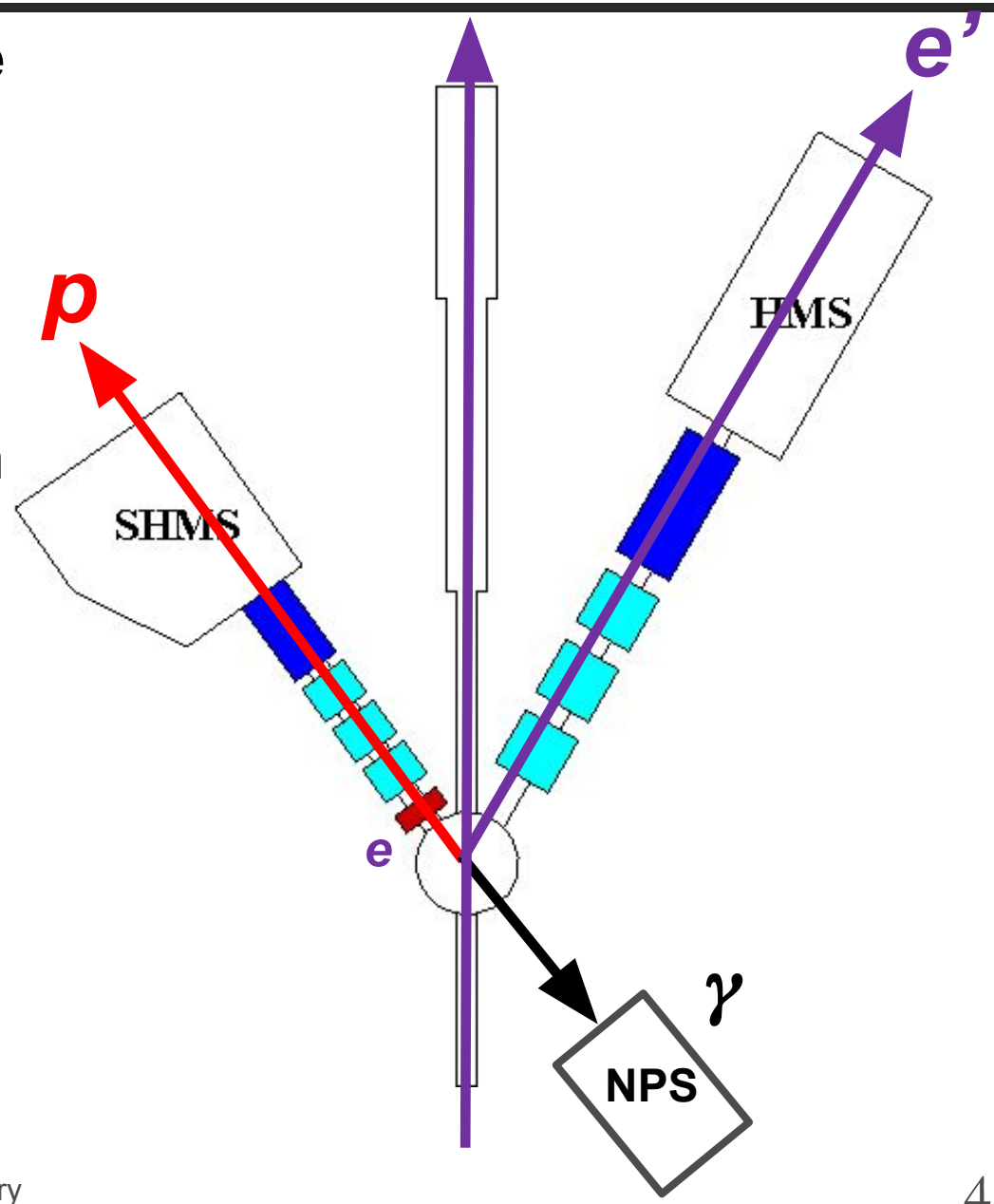
Wenliang Li, Dept. of Physics, College of William and Mary

What does Backward-angle DICS looked in Hall C

Exclusive **Triple coincidence**
LT separation measurement

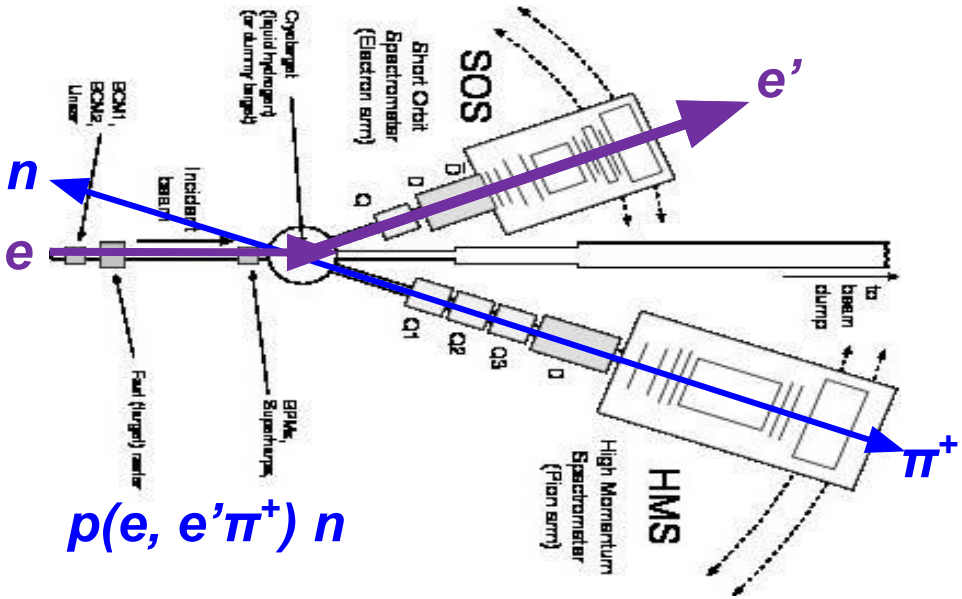
p(e, e'pγ)

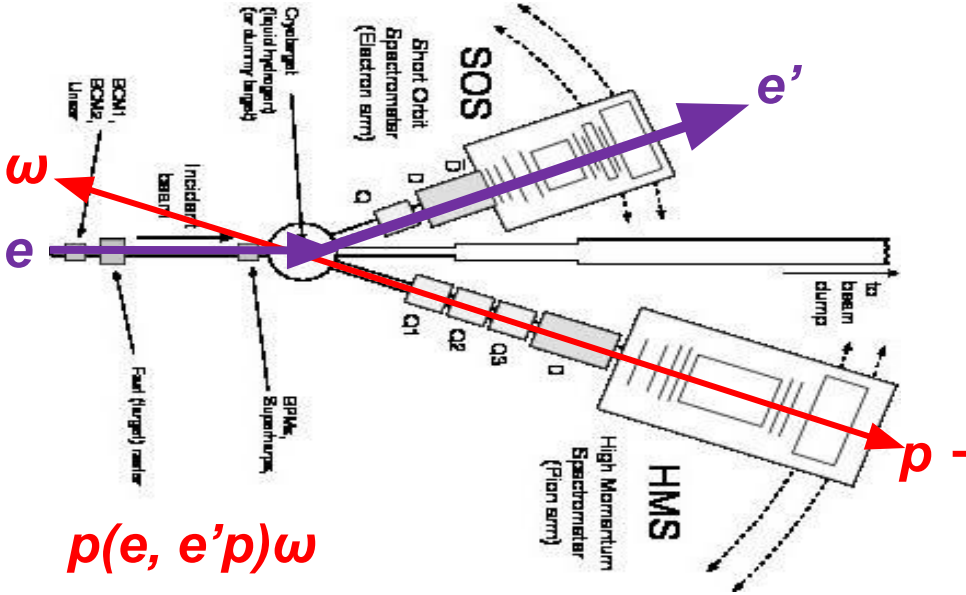
~200-500 MeV Real Photon

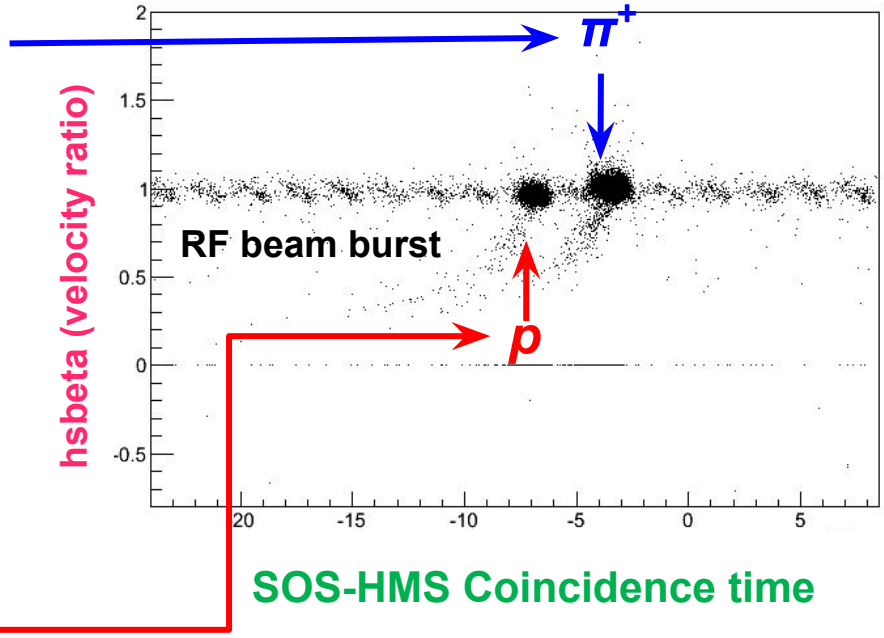


Backup

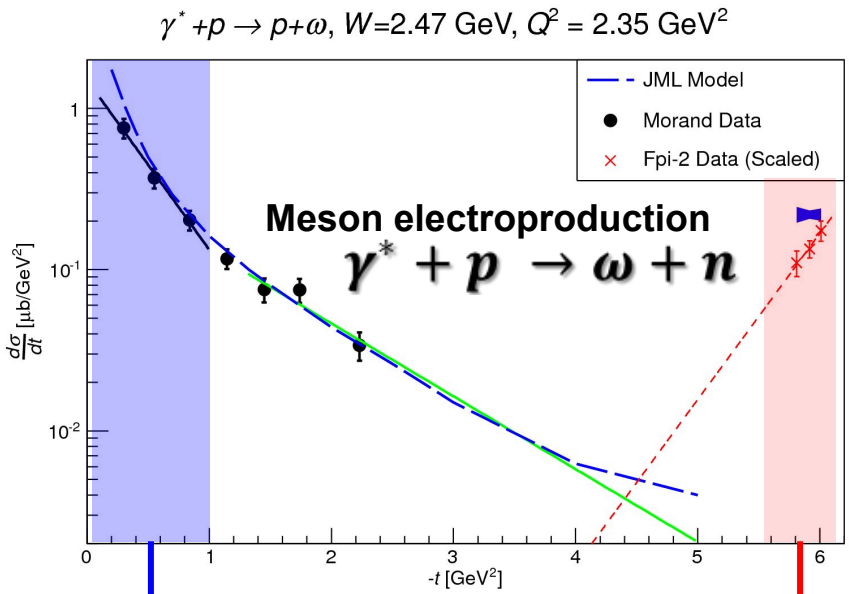
What is Backward Angle Physics ?

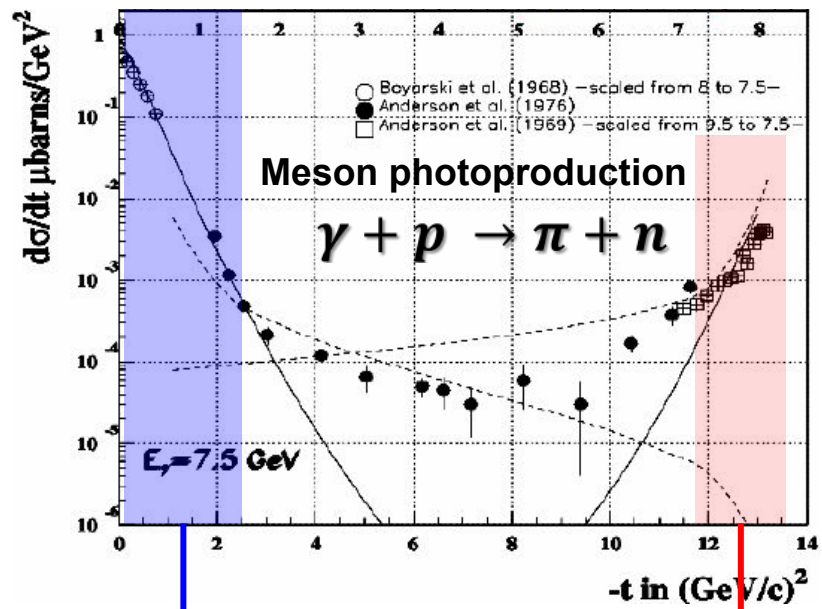






Backward Angle Physics: Access to Unknown Kinematics

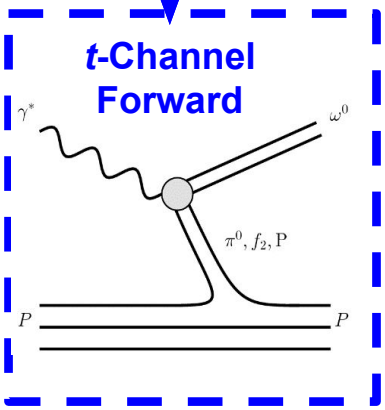


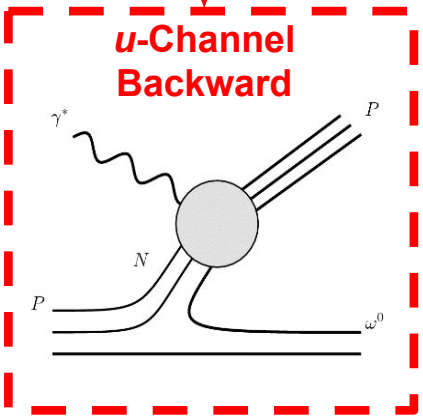


M. Guidal, J.-M. Laget, and M. Vanderhaeghen. *Physics Letters B*400(1):6 – 11, 1997.111

Meson pole

Baryon pole

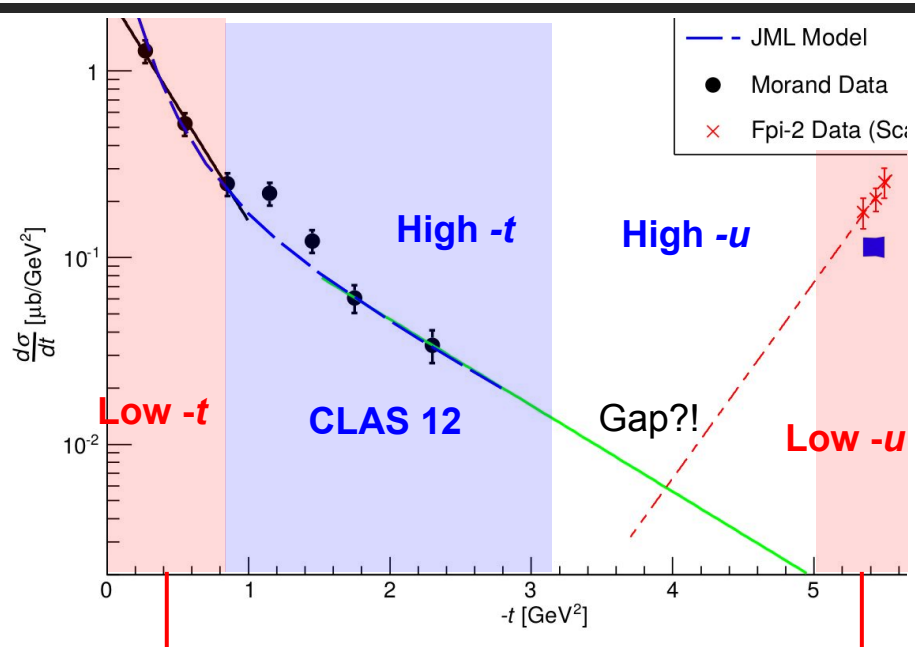




Soft structure -> Hard -> Soft transition !

What can we learn from the backward angle observable?

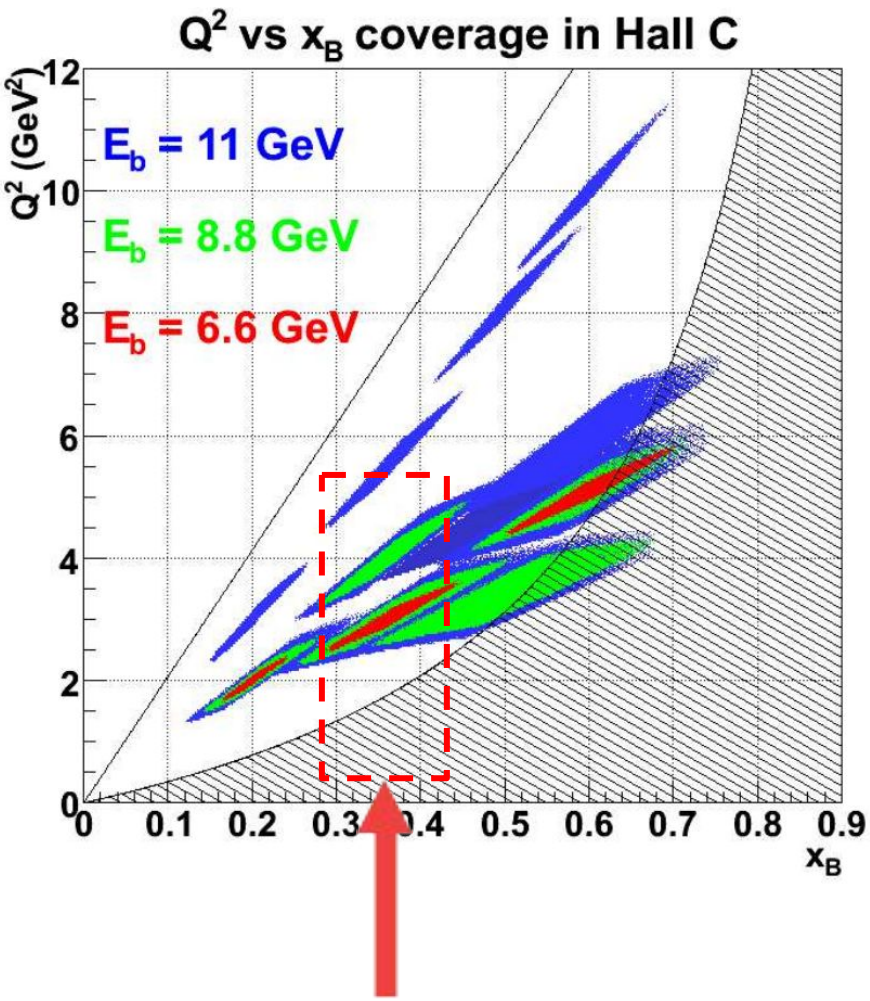
- Why Now?
  - Backward angle cross section is demonstrated to be non-zero!
- Compete picture of *-t* evolution
  - Provide low *-u* cross section
- Regge Model
  - Study the baryon Regge pole (trajectory)
- GPD factorization at larger *-t (*TDA*)* in the backward angle
  - Alternate or parallel methodology
- Quantify physics meaning of *u*
  - *t* -> impact parameter
  - *s*-> invariant mass
  - Q^2 -> Resolving power
  - ***u* -> ?**
    - **better understanding t leads to understand of *u***



Hall A/C LT separation near meson and baryon pole (extreme forward/backward angle)

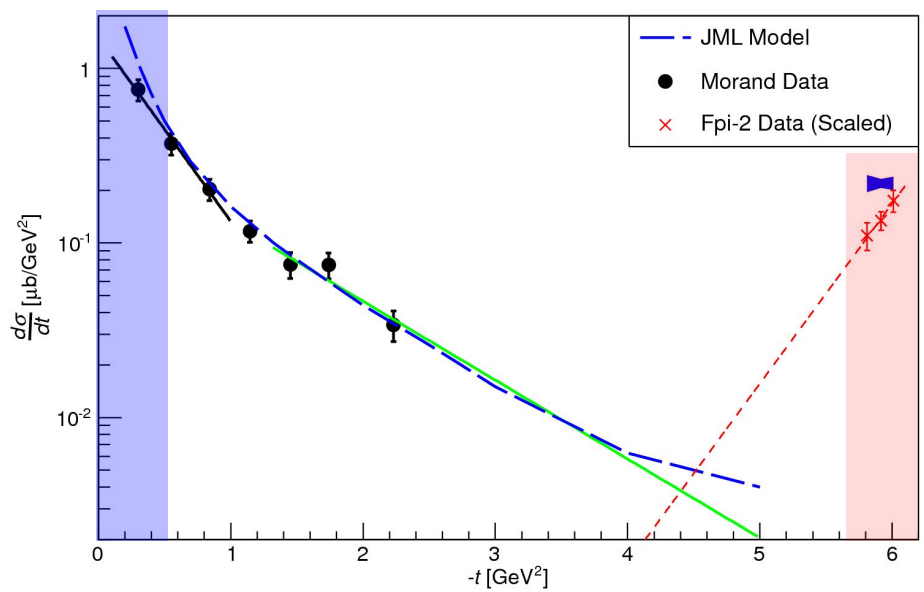
Q^2=1 GeV, W=1.5 GeV

At What Kinematics?



W = 2.65 GeV, x = 0.36

Q2	E_{Beam} (GeV)	HMS Angle Degree	SHMS Angle Degree	NPS Angle Degree	ε	-t	-u'
3	6.6	26.5	-11.7	168.3	0.54	>7.5	0.0
	10.9	11.8	-16.2	163.8	0.86	>7.5	0.0
4	8.8	22.9	-10.3	169.7	0.55	>10.2	0.0
	10.9	15.6	-12.4	167.6	0.73	>10.2	0.0



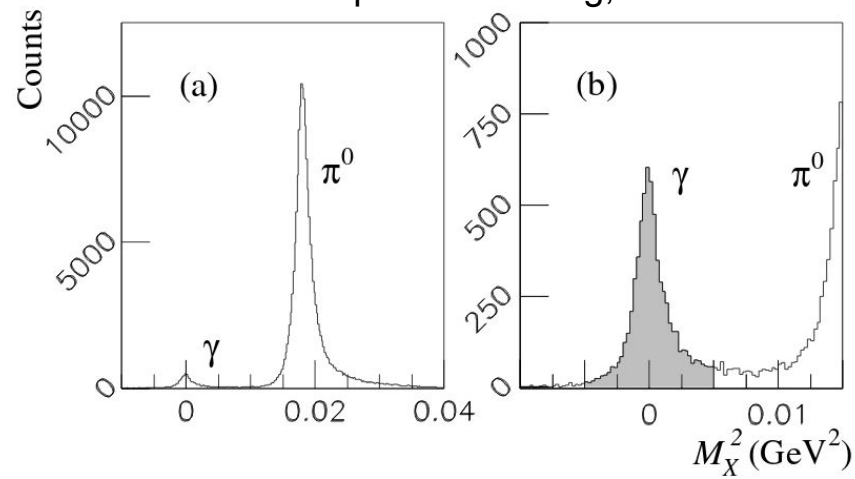
Forward Angle Pi0 and DVCS

Forward Angle Pi0 and DVCS

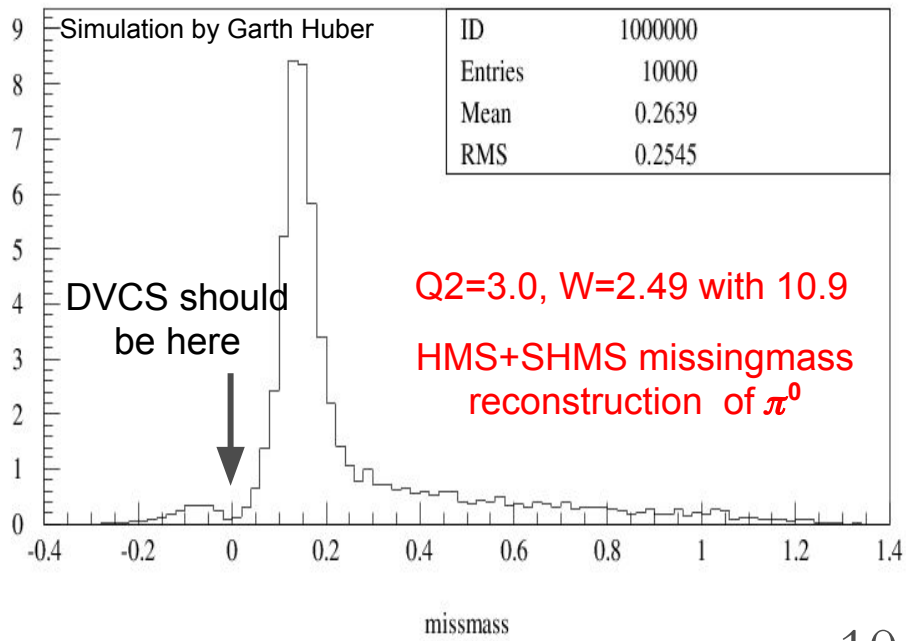
Requirements for Backward Angle DVCS and π^0 Program

- **Backward angle π^0 Program**
  - *W* = 2.65 GeV, *x* = *0.36*, Q^2= 3, 4 GeV
  - **Standard L/T Separation**
    - SHMS + HMS
  - Missingmass reconstruction method applies.

Hall A Backward Angle Virtual Compton Scattering, 2009



- Backward Angle DVCS Program
  - Run simultaneously with the π^0 Program
  - LT Separation?
  - Require NPS for ~300 MeV real photon (possible?)
  - A three ton stand required.
  - Triple coincidence



- LOI for PAC 2018