u-Channel DVCS: Future Prospects

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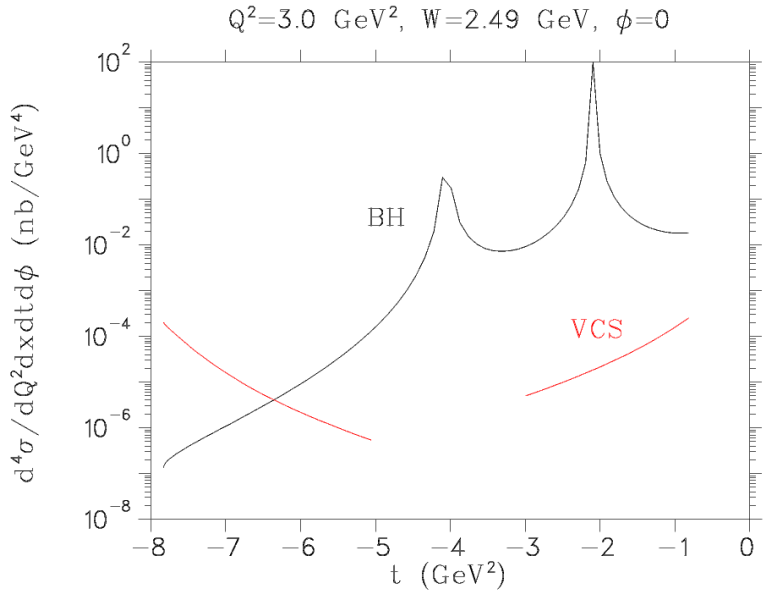
Why u-Channel DVCS?

"Since the study in terms of GPDs of [DVCS] in the forward region has been very fruitful to understand the underlying structure of the hadron, we foresee that the corresponding one with TDAs of the backward region be of equal importance, if not more since it involves the exchange of 3 quarks"

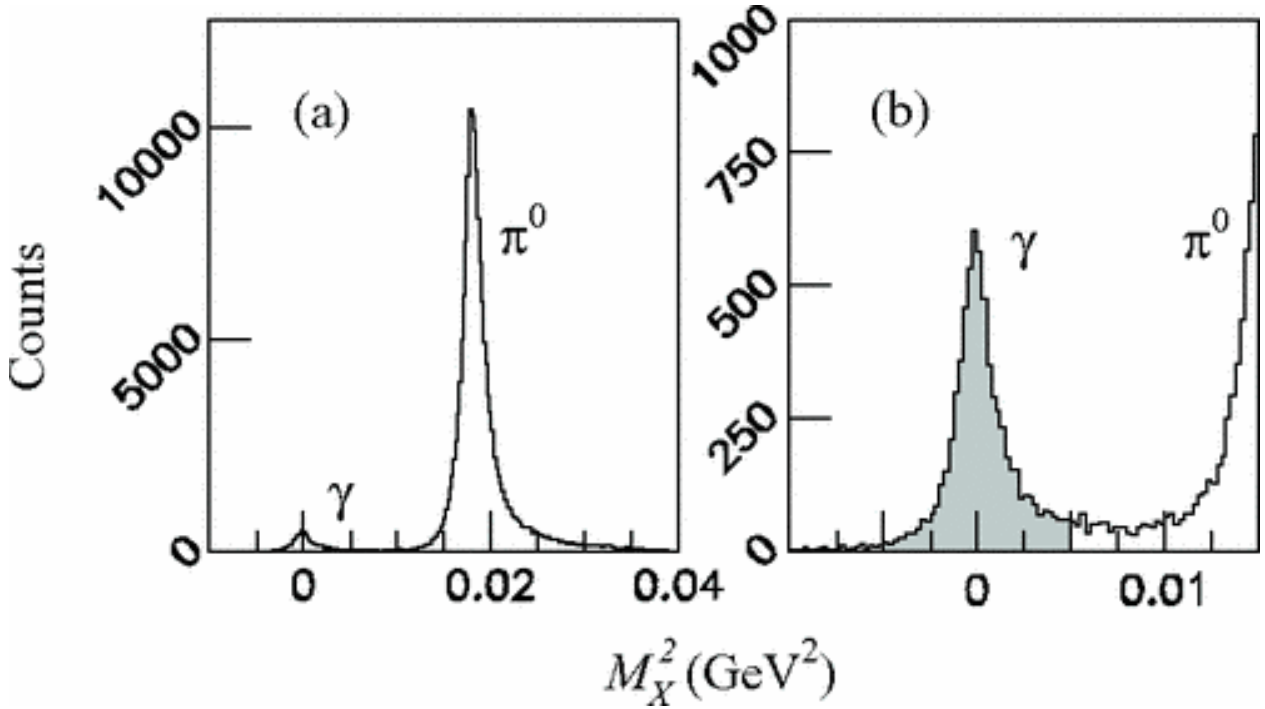
J.P. Lansberg, B. Pire, and L. Szymanowski, *Backward DVCS and Proton to Photon Transition Distribution Amplitudes,* Nuclear Physics A **782** 16c–23c (2007).



Bethe-Heitler suppressed compared to DVCS at large t (u-channel)!

→ Experimentally measured cross sections will depend bilinearly on (proton-to-photon) TDAs

Backward-Angle VCS from Hall A

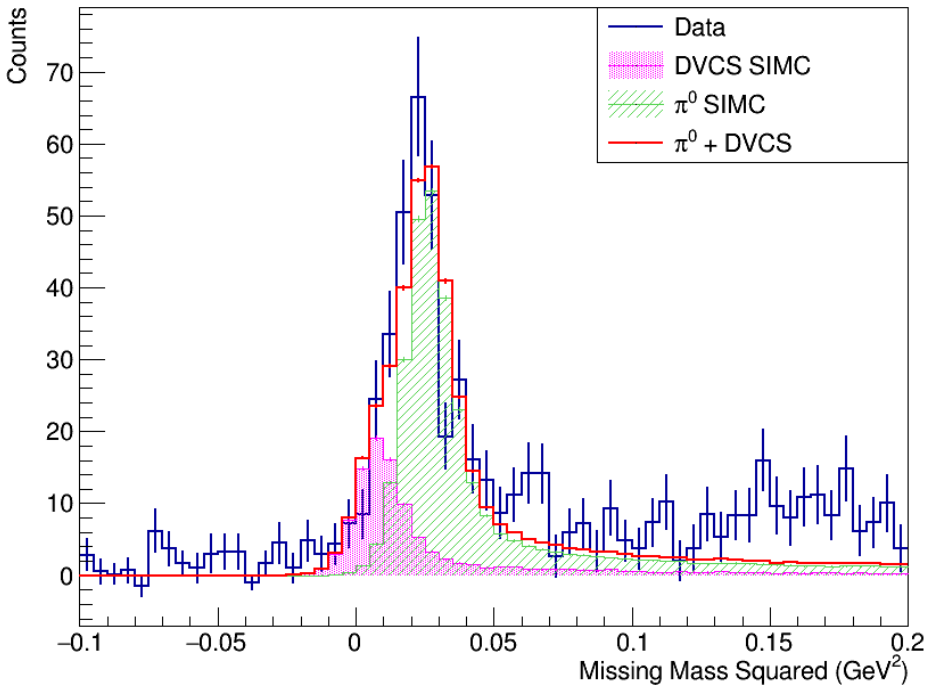


- Backward VCS from 1.45<W<1.6 GeV, $0.5 < Q^2 < 2.0$ GeV^2 in E93–050
- e' and p' detected in HRS, π^0 and γ reconstructed from M_X^2

G. Laveissiere et al. (Hall A Collaboration), *Virtual Compton scattering and neutral pion electroproduction in the resonance region up to the deep inelastic region at backward angles*, Phys. Rev. C **79**, 015201.

u-Channel DVCS in KaonLT

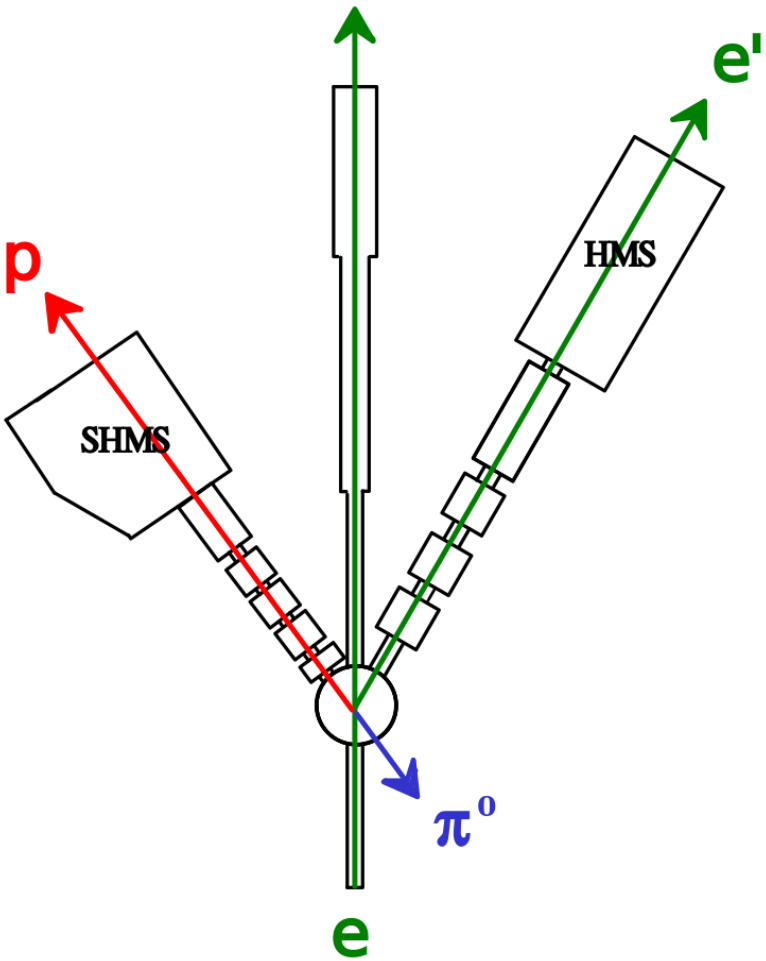
Unexpected signal in KaonLT data on very edge of focal plane:



- Detect e' and p', reconstruct π^0 and γ from M_X^2
- Resolution worse than Hall A data (higher momentum)
- Mostly exclusive π^0, but data are better described by including some DVCS contribution
- Current work: estimating systematic uncertainties (Dex summer project)

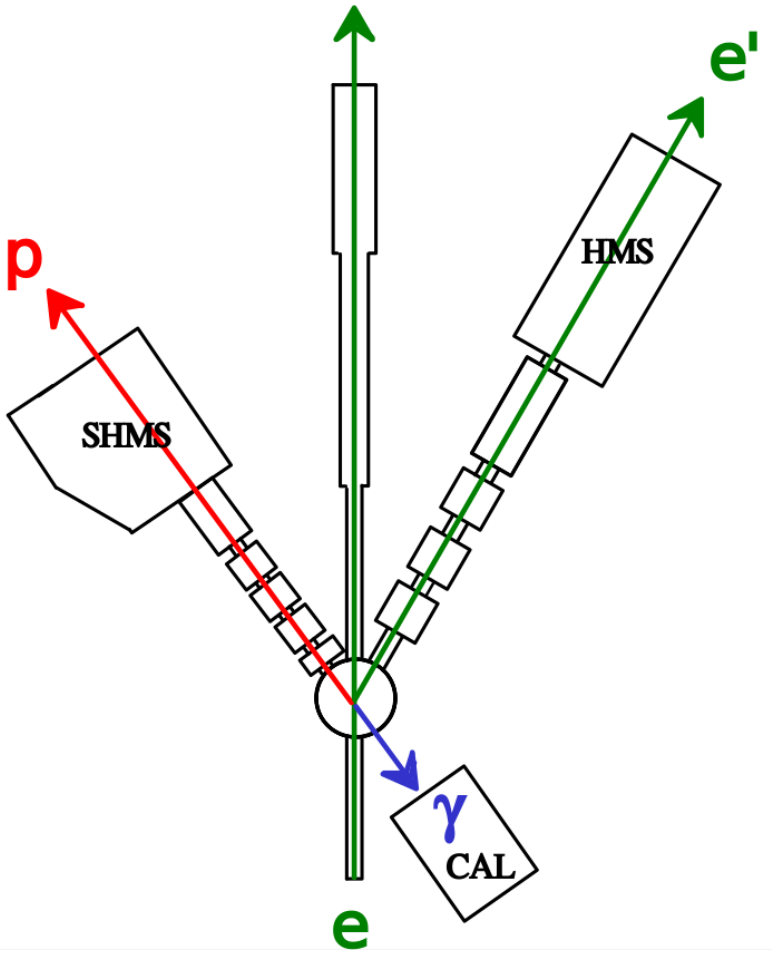
u-Channel DVCS in the π^0 Experiment

- Dedicated u-channel π^0 experiment E12-20-007 (approved PAC 48)
- **Goal:** LT separation of $p(e, e'p')\pi^0$ to verify TDA factorization



- Running 7 days in 2027!
- Three Q^2 points at fixed x_B for one scaling study
- Possibility of also acquiring u-channel DVCS data in this run period
- π^0 centred on focal plane → could validate KaonLT signal

Direct Detection of u-Channel DVCS



- Future experiment opportunity!
- Triple coincidence: HMS+SHMS+Calorimeter (NPS?)
- Need sufficient energy and angular resolution to distinguish γ from π^0 background
- Goal: resolution on par with Hall A VCS

LOI to PAC 55 (2027): Alicia, Garth, Bill

Full proposal 2028/2029, after preliminary analysis of π^0 data

Open Questions

Lots to work out, including:

- Choice of calorimeter
- Placement of calorimeter in Hall C
- Hadron vs electron arm spectrometer
- Exact target kinematics

I intend to include this in my Hall A/C talk in order to spark conversations at JLab in June.

> What do you think? Comments, questions, and concerns?