Update on transversely polarized TCS

CPS meeting, May 29, 2020

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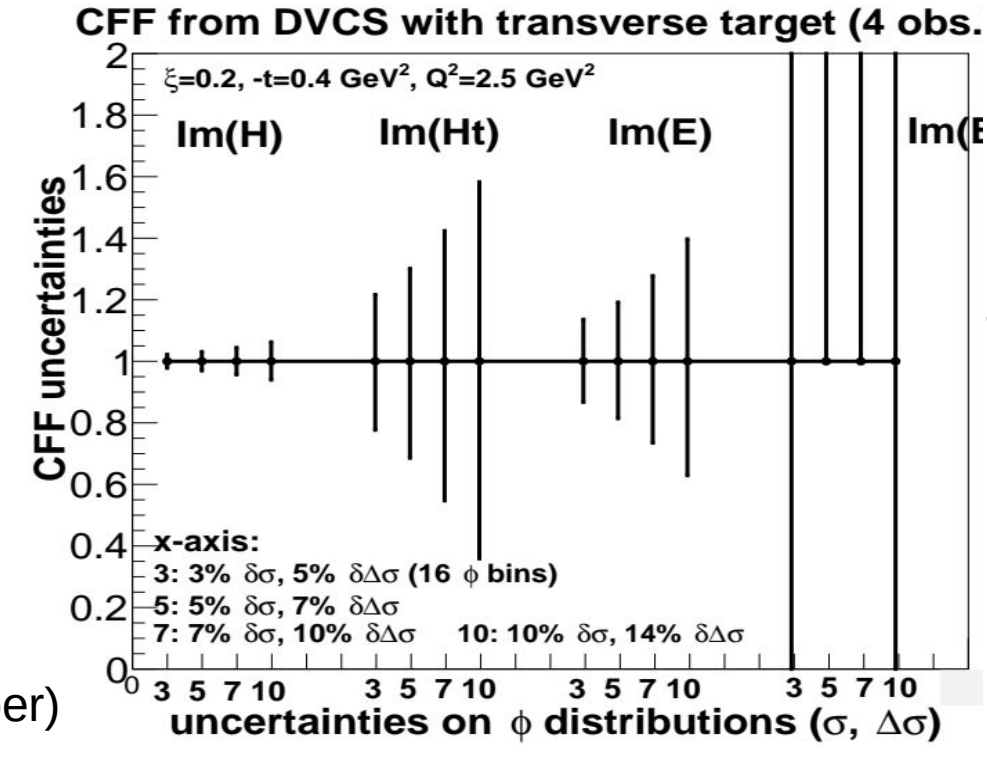
CFF extraction studies

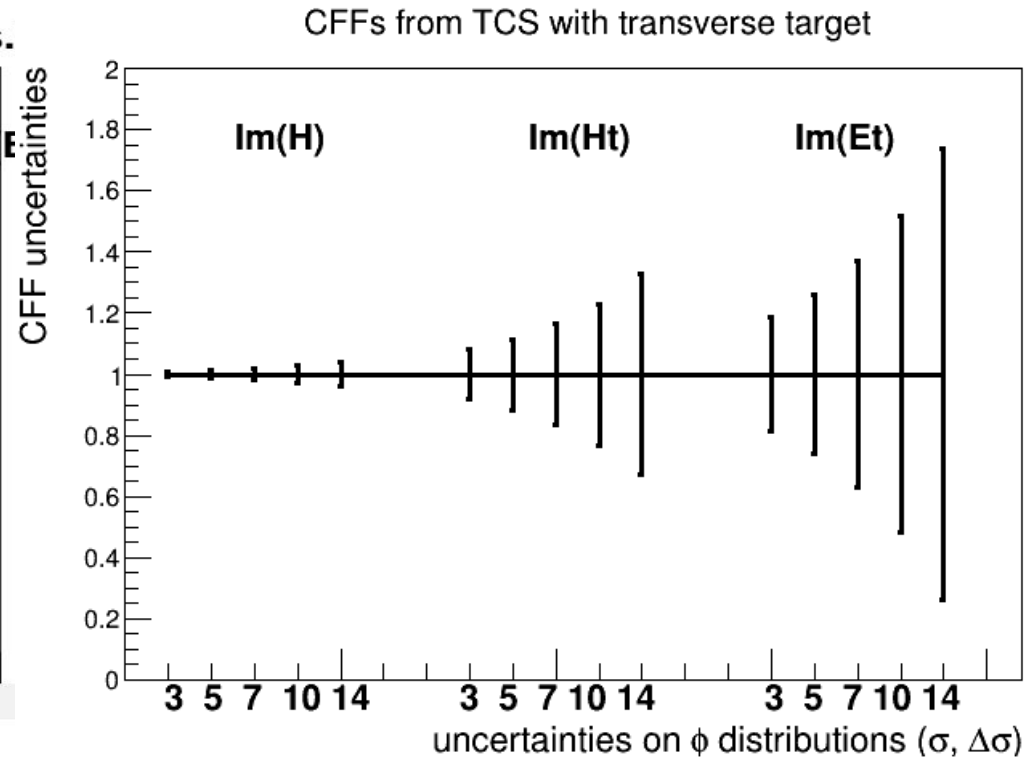
• Refer to methods in 2018 proposal appendix and Hall C note (2019).

• Systematic studies here (all will be documented soon)
- various kinematics with 3% to 20% uncertainties on σ (5% to 28% on Δσ)
- completely model independent way [assume twist 2, LO] (4 im + 4 re CFFs) versus approximations (Im$\tilde{\mathcal{E}}$ neglected << error bars...). Remark: very conservative method in any studied cases
- interpretation of errors on CFFs from fit method (limits, correlations) and from "experimental scenario"

→ feasible to extract CFFs
→ assumptions may have to be done at some kinematics. not much impact on extracted CFFs
→ careful treatment of uncertainties is needed, fits on actual data to be interpreted with full MC
→ generally easier from DVCS in same condition but same order mag. errors. depend kinematics

(Marie Boer)

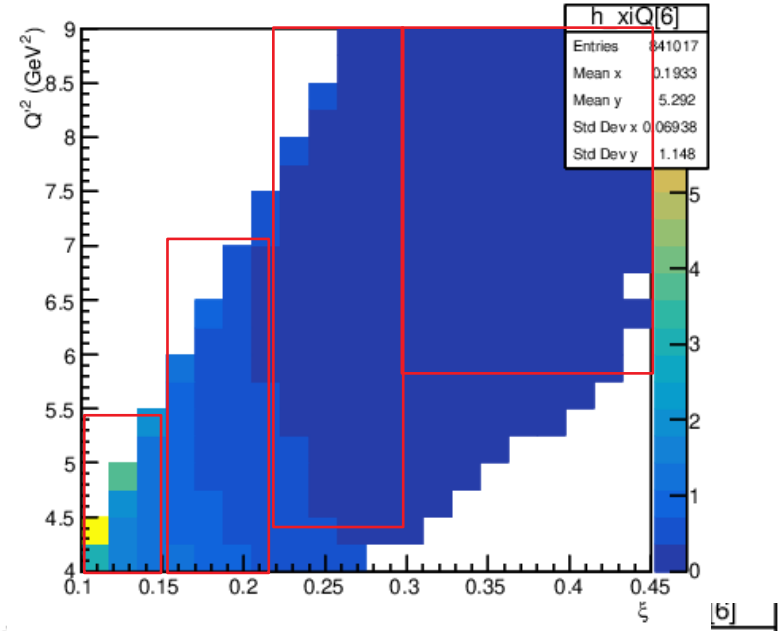


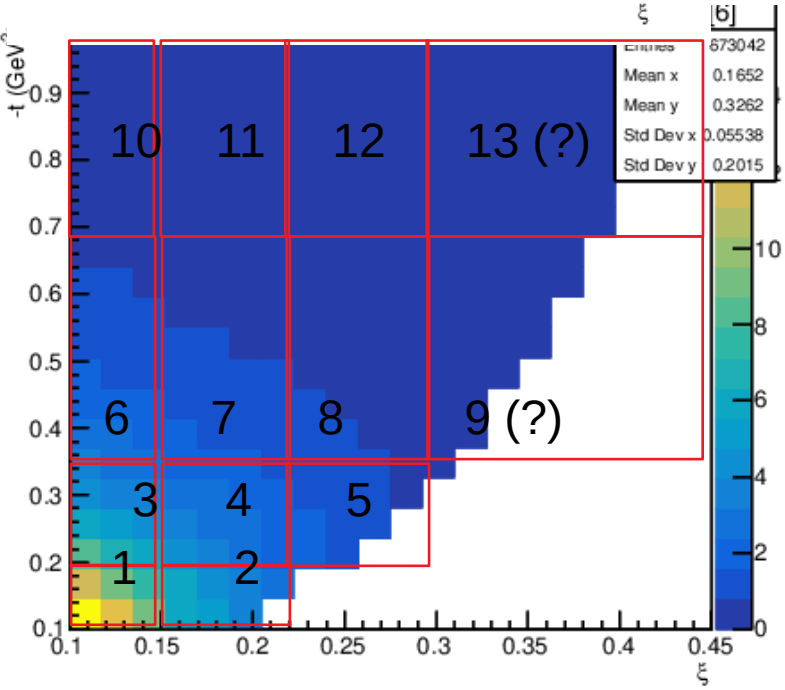


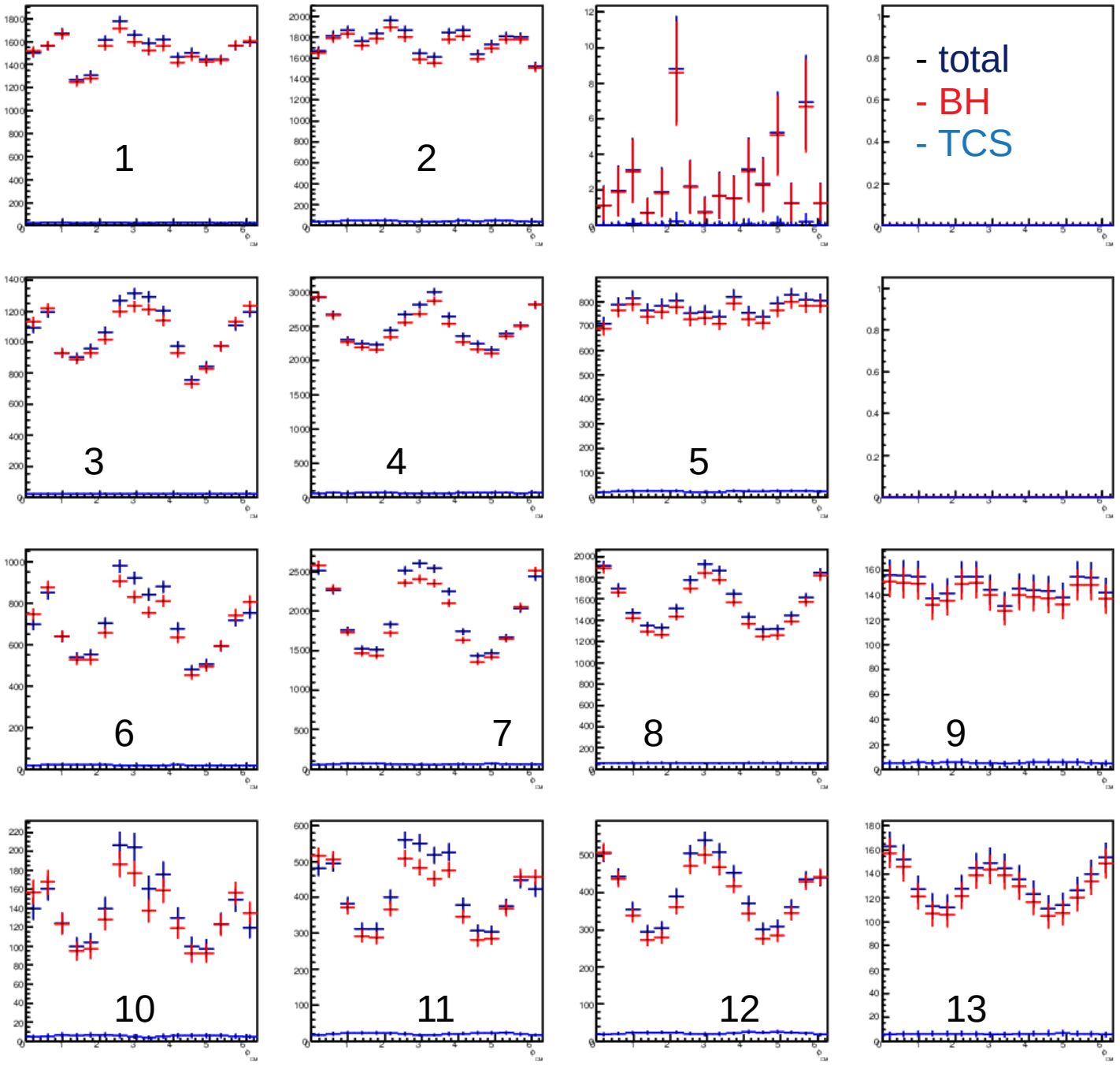
Unpolarized count distributions and binning

(fig. 36, 37 of 2018 proposal)

Remark: counts to be double checked - used strict θ cut, not the final files
similar binning as in the past, added a few bins, however will have limited statistics

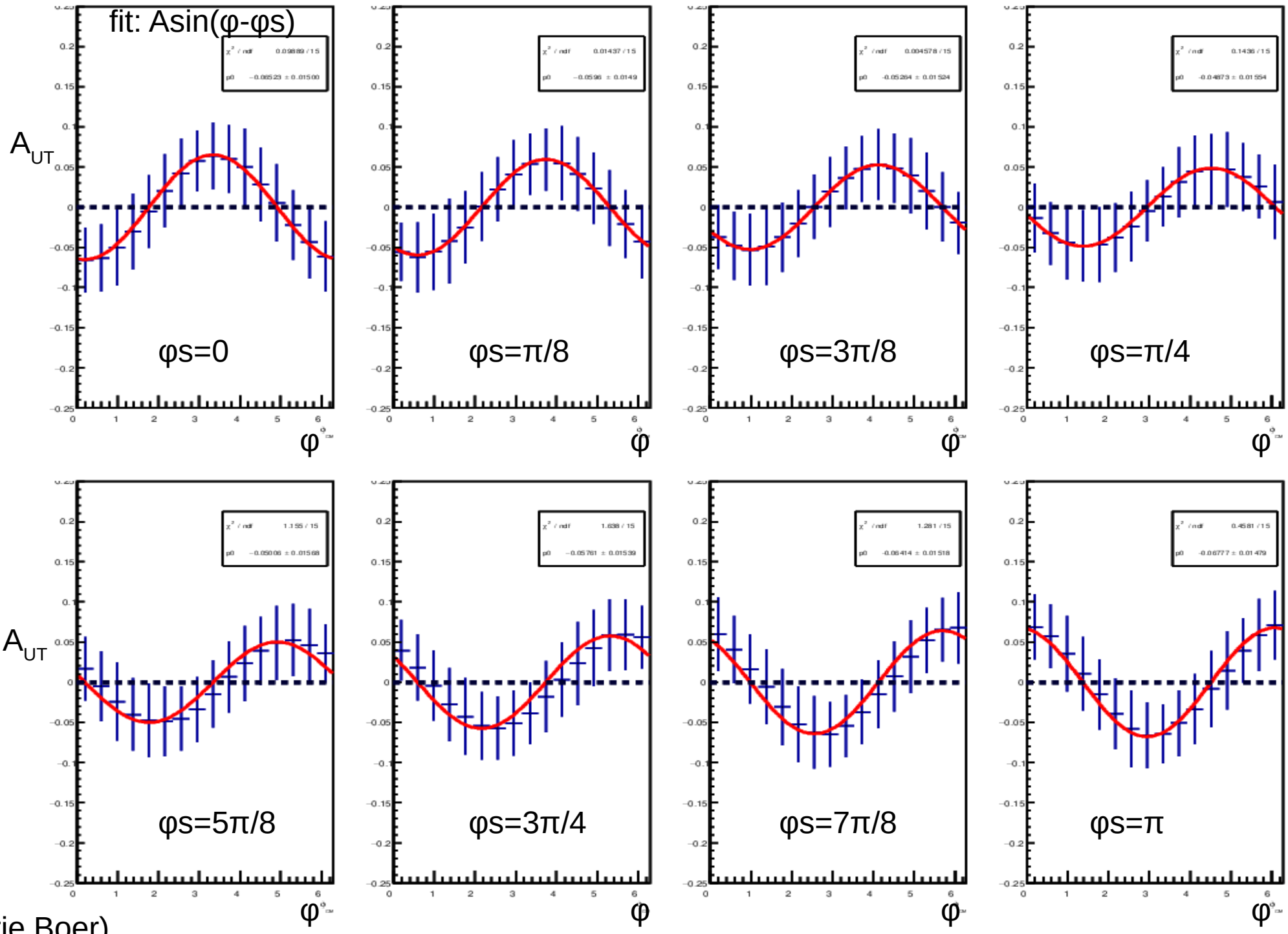






(Marie Boer)

Asymmetries in reference bin (#4)



(Marie Boer)

Dominating Background

Looking at main photoproduction backgrounds

- $\gamma p \rightarrow N\pi^+\pi^-$ ~140 μbarn
- $\gamma p \rightarrow p\pi^+\pi^-\pi^0$ ~40 μbarn
- $\gamma p \rightarrow p\pi^+\pi^-$ ~35 μbarn
- $\gamma p \rightarrow p\rho$ ~6 μbarn
- $\gamma p \rightarrow pe^+e^-$ ~ <

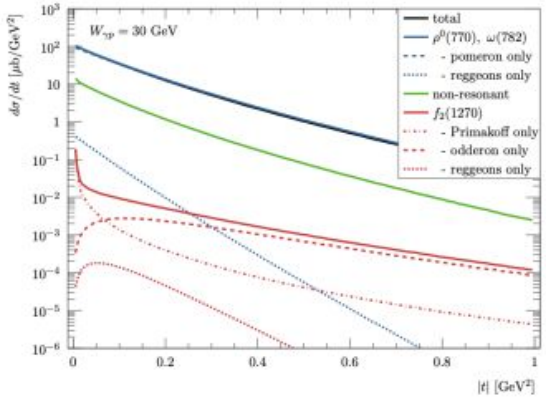
Assuming NPS pion suppression of ~5×10^{-4} higher cross sections should be considered

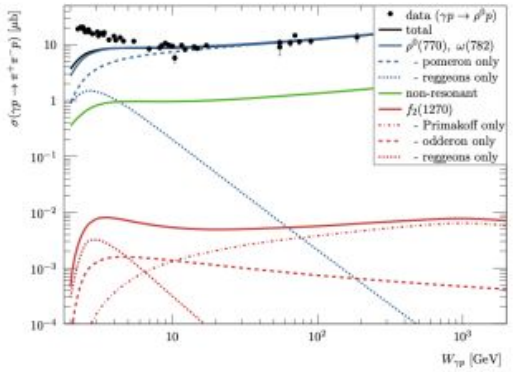
Phase space sensitivity can play a big role in strength of channel

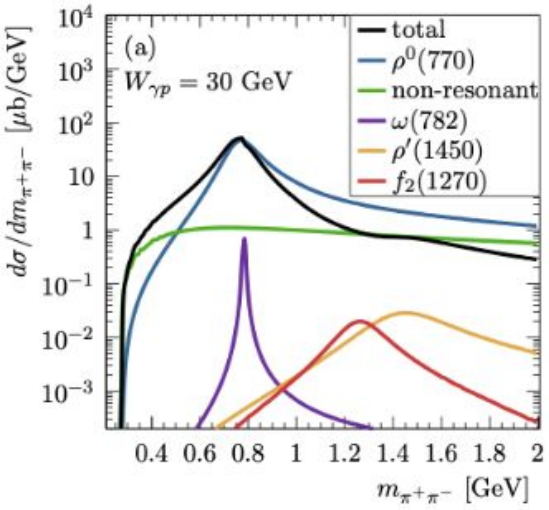
(Dustin Keller)

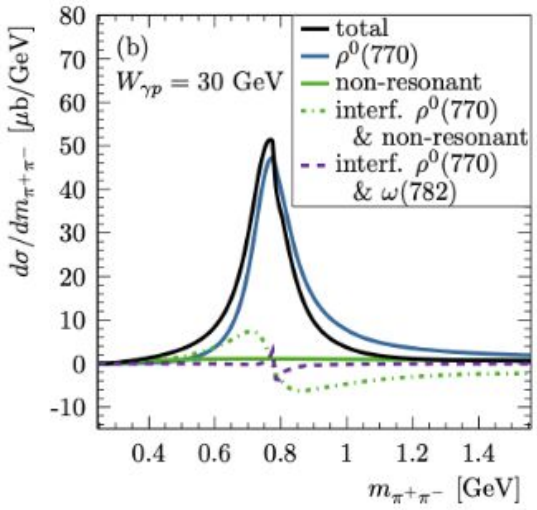
Produced Event Generator for $\gamma \rightarrow \pi^+\pi^- p$

Based on model and experimental data









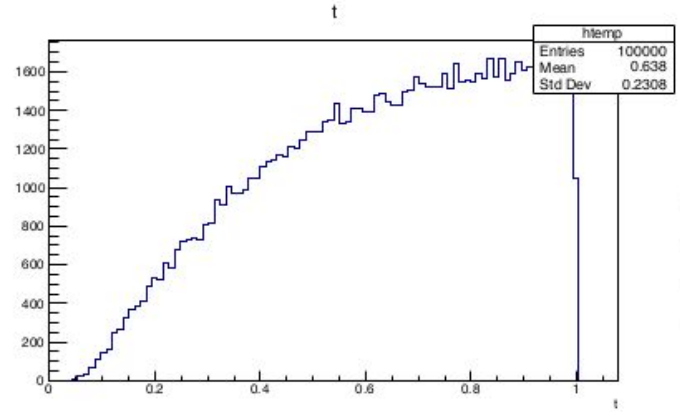
arXiv:1409.8483v1 [hep-ph] 30 Sep 2014

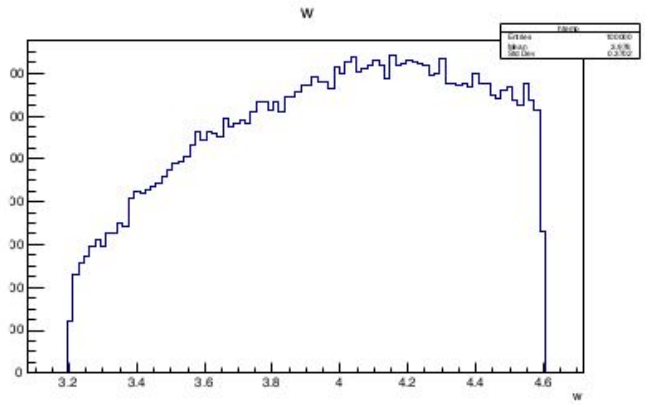
- $W_{\gamma p} = 3.3 - 4.6\ GeV$
- $Q^2 = 4 - 9\ GeV^2$
- $-t < 1\ GeV^2$
- Extrapolate model to mass range
- For ρ data is used
- Separate total and non-resonance
- BG big even with NPS dis-π/e

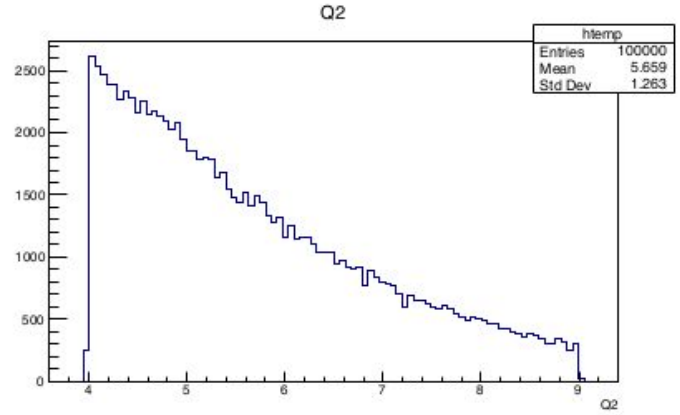
(Dustin Keller)

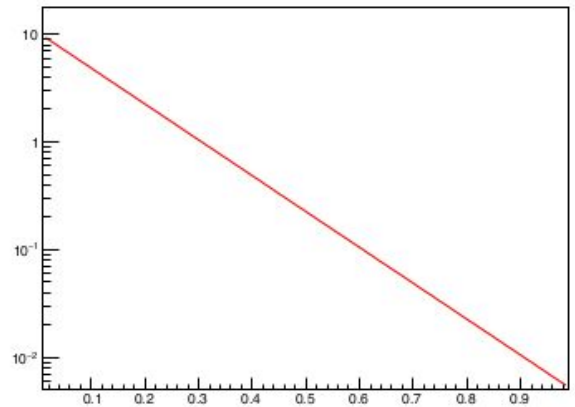
Generator Tuned to Feature Space

weight defined by cross sections









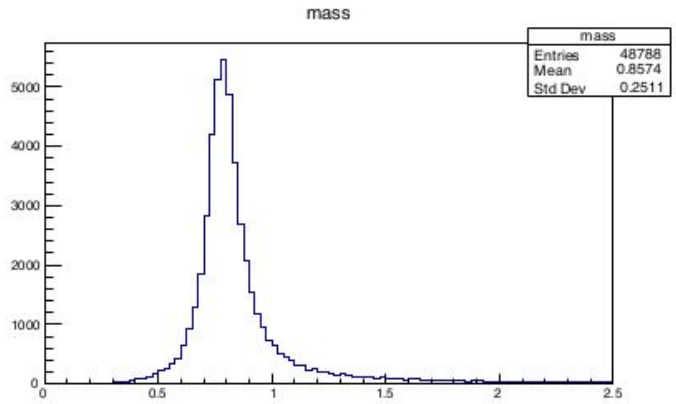
t-distrubution

Total contains all $\gamma \rightarrow \pi^+\pi^-p$

- MC based generation over phase-space
- Match t-slope and mass spectrum
- Match kinematic distribution
- Cross section per event

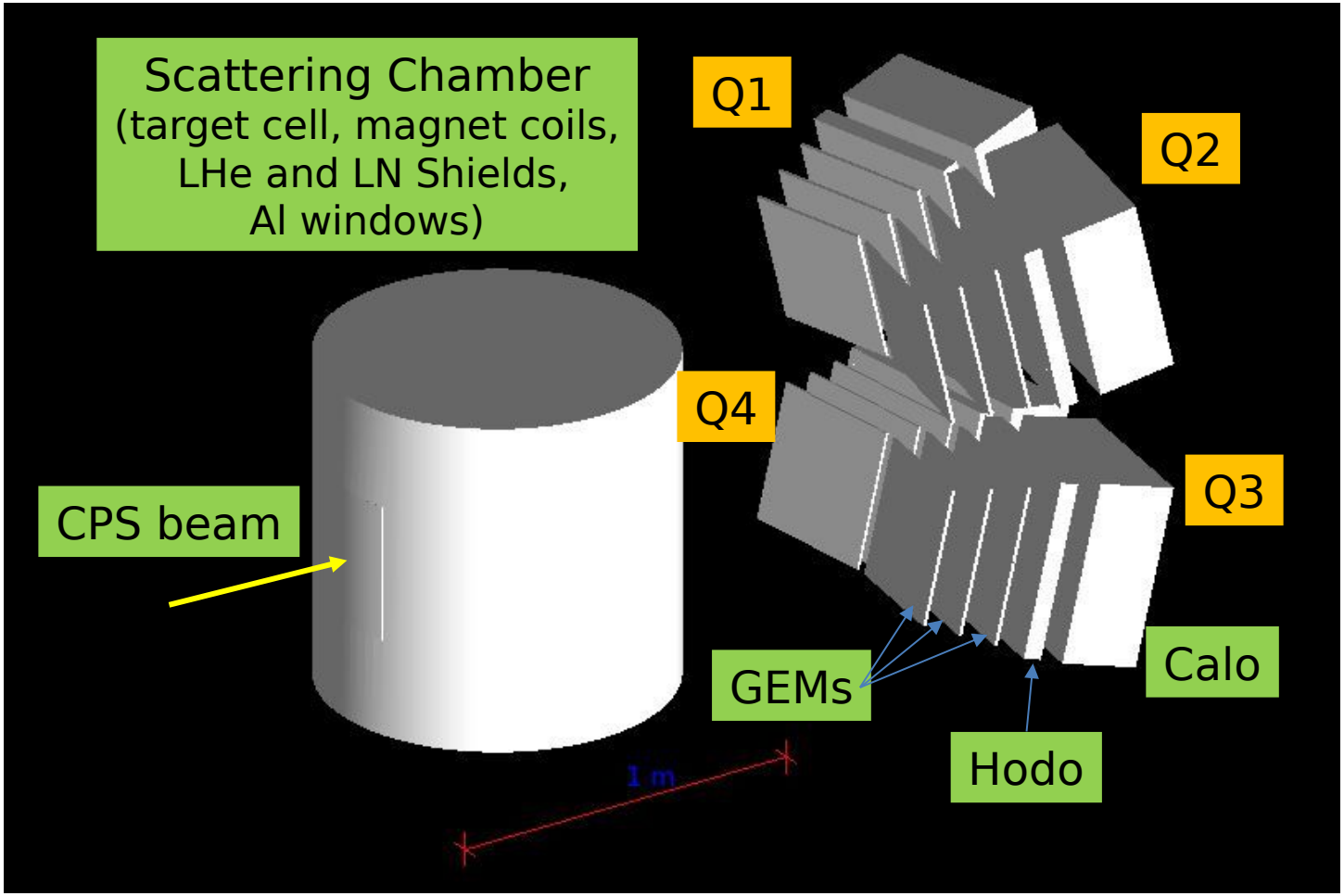
Resonance version $\gamma p \rightarrow \rho p$

- MC based generation over phase-space
- Tail from mass peaks



(Dustin Keller)

TCS Setup

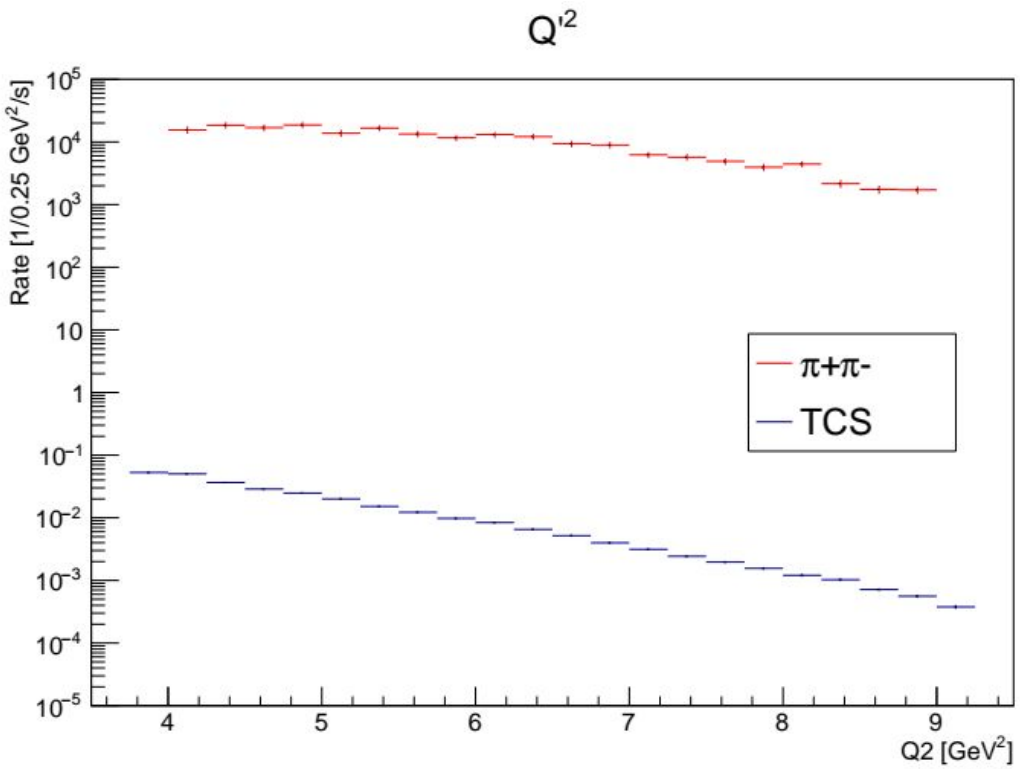


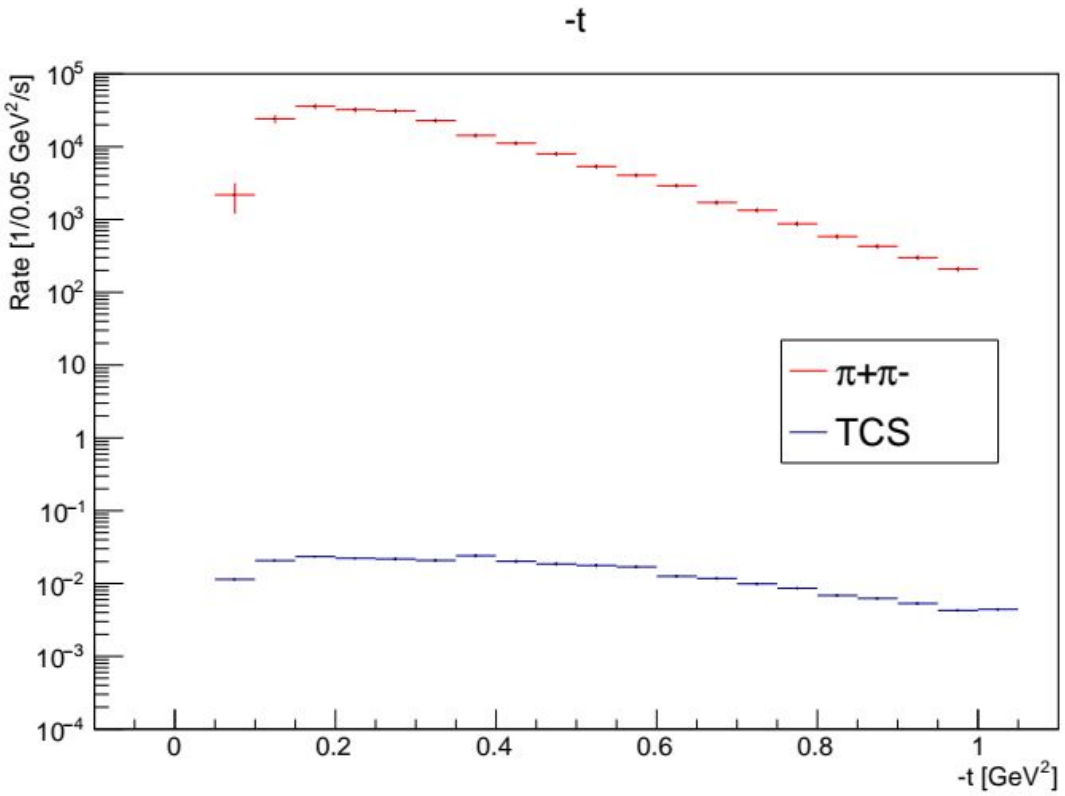
- CPS photon beam
- JLab/UVA NH_3 (g2p) polarized target (rotated 90^0)
- Triple-GEMs for e^+ , e^- , p tracking
- Hodoscopes for p detection/ PID

  (“passive”)
- $PbWO_4$ calorime-ters for e^+ , e^- detection/PID

(Vardan Tadevosyan)

TCS versus π+π-





π+π- events generated by Dustin's generator ("total" mode).
TCS events from Marie's DEEPGen generator.

Event selection:

- request leptons (or pions) firing at least 2 trackers in a stack;
- request leptons (or pions) energy deposition in the calorimeters > 1 GeV;
- request proton firing at least 2 trackers in a stack.

(Vardan Tadevosyan)

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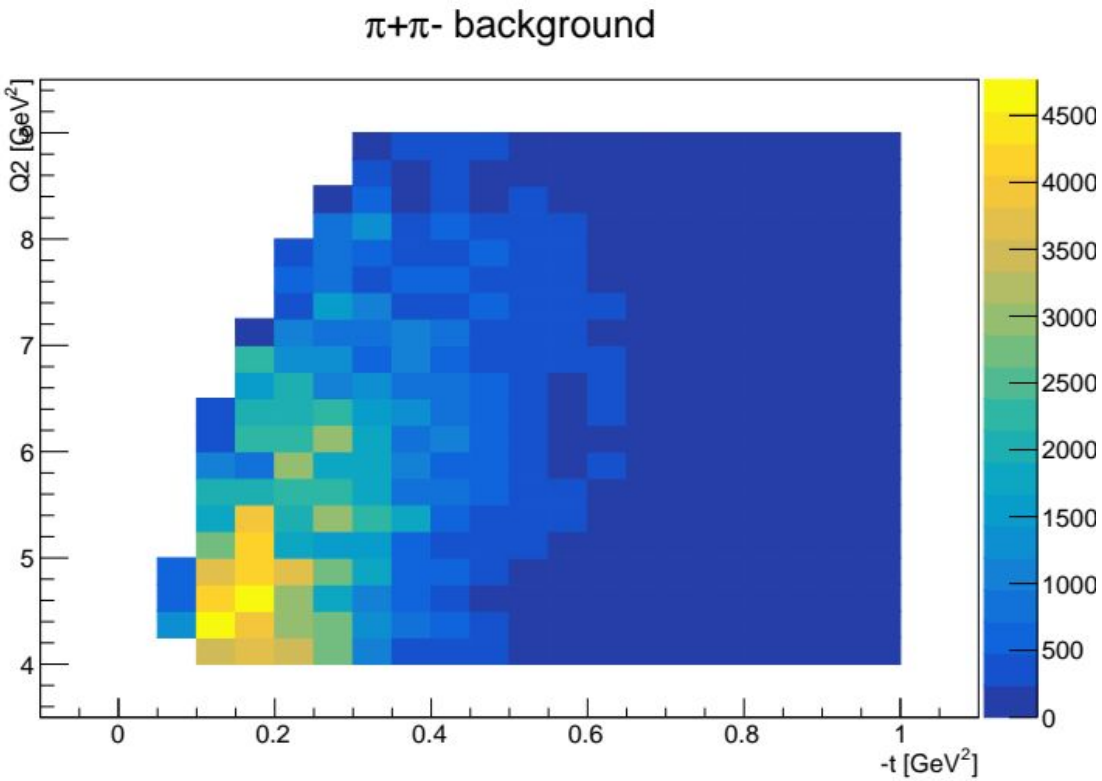

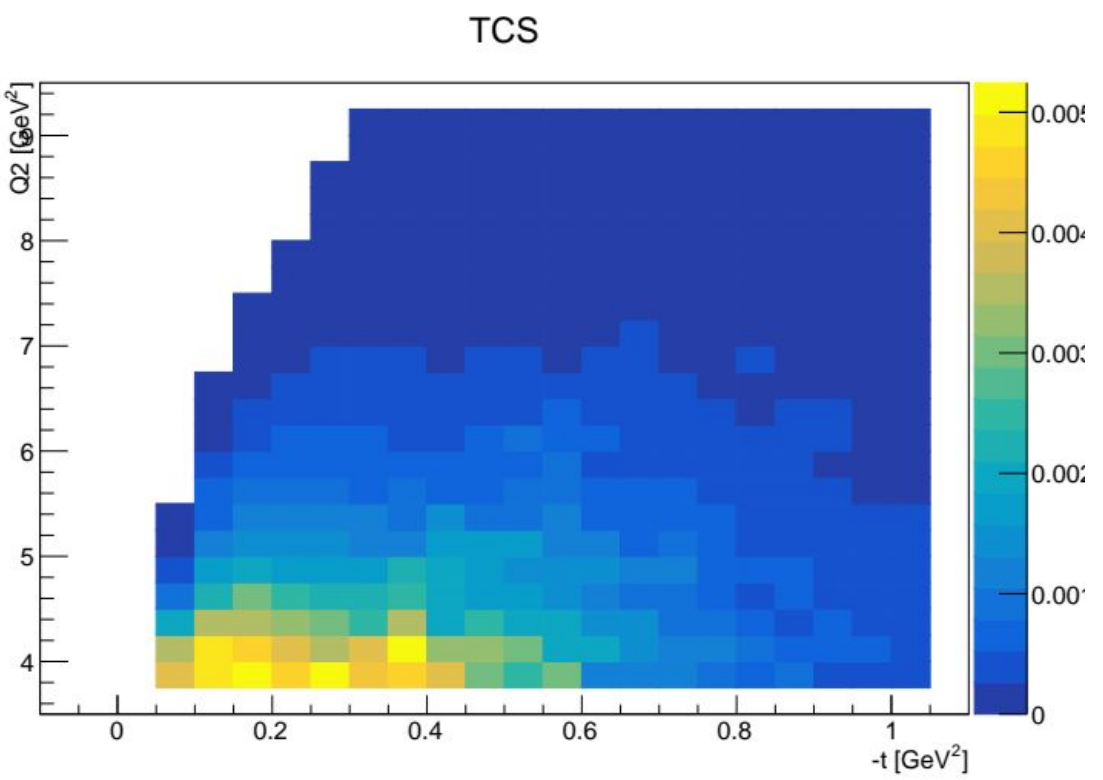

(Vardan Tadevosyan)