SBS Collaboration Meeting
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Deep Threshold Phi-Production

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Deep Virtual Vector-Meson Electroproduction

- $p(e, eV)p$ $\quad Q^2 \gg M^2 \quad$ $W^2 \gg M^2$
  - Generalized Parton Distributions: Vector & Axial-Vector Matrix Elements
    - Energy decomposition
  - **ϕ**-production dominated by gluon matrix elements
  - S.Goloskokov, P.Kroll, *EurPhysJC* **50**, 829–842 (2007)
- Threshold J/**Ψ**-production: $Q^2 + M_{J/\Psi}^2 \gg M^2, \quad W^2 \approx \left(M + M_{J/\Psi}\right)^2$
  - **Scaler** Matrix Elements: Mass-Decomposition
  - X.D. Ji, *Phys.Rev.Lett*.74,1071(1995).
  - X.Ji *Front.Phys*.**16** (2021) 6, 64601, arXiv: 2102.07830
  - Y.Hatta D-L.Yang, PhysRevD **98** (2018) 7, 074003, arXiv: 1808.02163

Motivation for High-Q^2 Measurement of Threshold Electroproduction of ϕ-*meson*

- Perturbative scale in threshold photoproduction of J/Psi is $Q^2 + M_{J/\Psi}^2 \rightarrow M_{J/\Psi}^2 = 9.6\ \mathrm{GeV}^2$
- Threshold **ϕ**-Electroproduction at $Q^2 \geq 9\ \mathrm{GeV}^2$
  ➔ $Q^2 + M_\phi^2 > 10\ \mathrm{GeV}^2$
  should be on same perturbative footing as J/Psi photoproduction
- Goloskokov & Kroll argue DVES **ϕ**-production dominated by gluon GPDs, even in JLab 12GeV kinematics (well above threshold)
- Hatta & Strikman argue that threshold **ϕ**-Electroproduction at large Q^2 primarily sensitive to s-quark D-term (rather than gluon)

Threshold Deep ϕ

- Y.Hatta, M.Strikman,
  PhysLettB **817** (2021) 136295
  Strangeness Gravitation FFs
  - W=2.5 GeV
- $D_s(t) = D_s/[1 - t/M_D^2]^3$
- Flavor SU(3):
  - $D_s \approx D_d \approx D_u$
- A-term also in model
  $A_s(t) = 0.04/[1 - t/M_D^2]^2$
- $B_s = 0$
- $\bar{C}_s = -A_s/4$

Physics Letters B 817 (2021) 136295

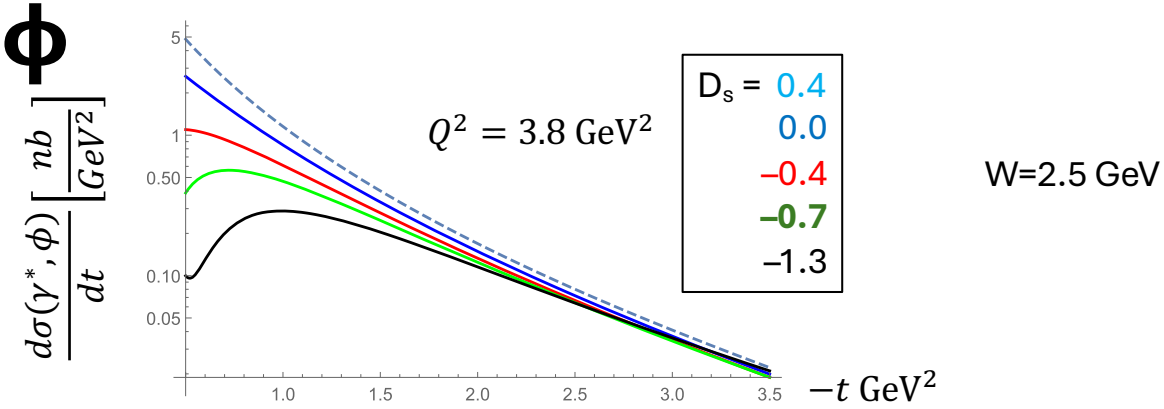


Fig. 1. Differential cross section $d\sigma/dt$ in units of nb/GeV^2 as a function of $|t|$ (in GeV^2). $W = 2.5$ GeV, $Q^2 = 3.8$ GeV^2. The five curves correspond to $D_s = 0.4, 0, -0.4, -0.7, -1.3$ from top to bottom.

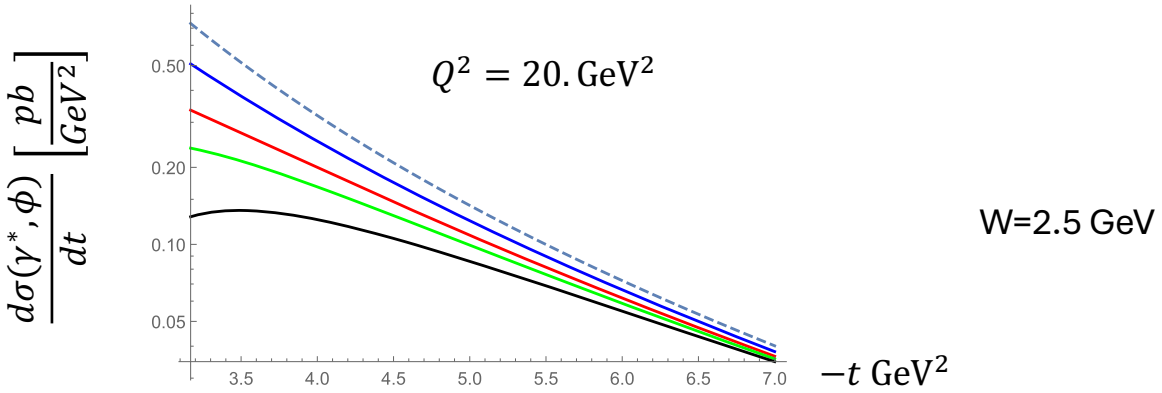
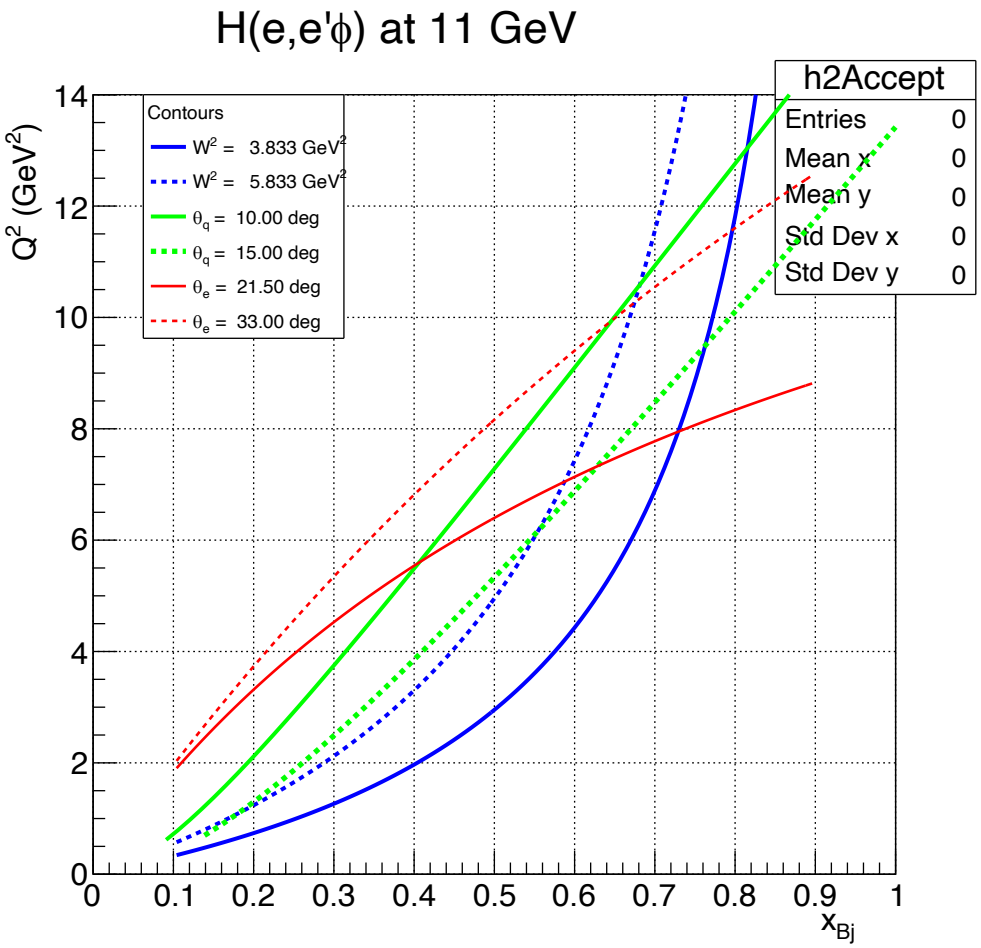


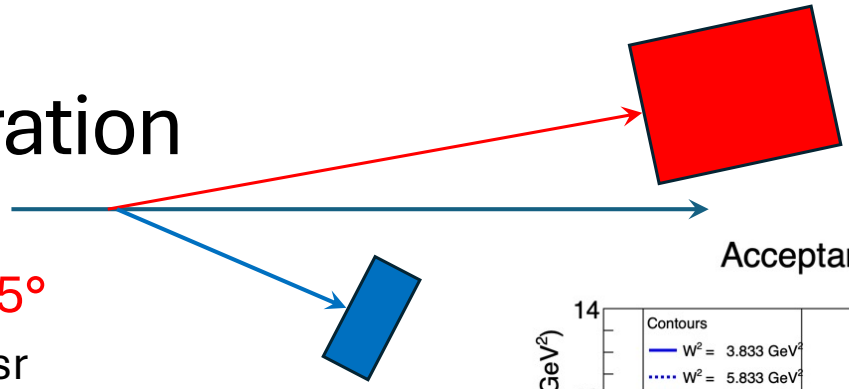
Fig. 2. Differential cross section $d\sigma/dt$ in units of pb/GeV^2 as a function of $|t|$ (in GeV^2). $W = 2.5$ GeV, $Q^2 = 20$ GeV^2, $\sqrt{s_{ep}} = 30$ GeV. The five curves correspond to $D_s = 0.4, 0, -0.4, -0.7, -1.3$ from top to bottom.

The 11 GeV Window of Opportunity

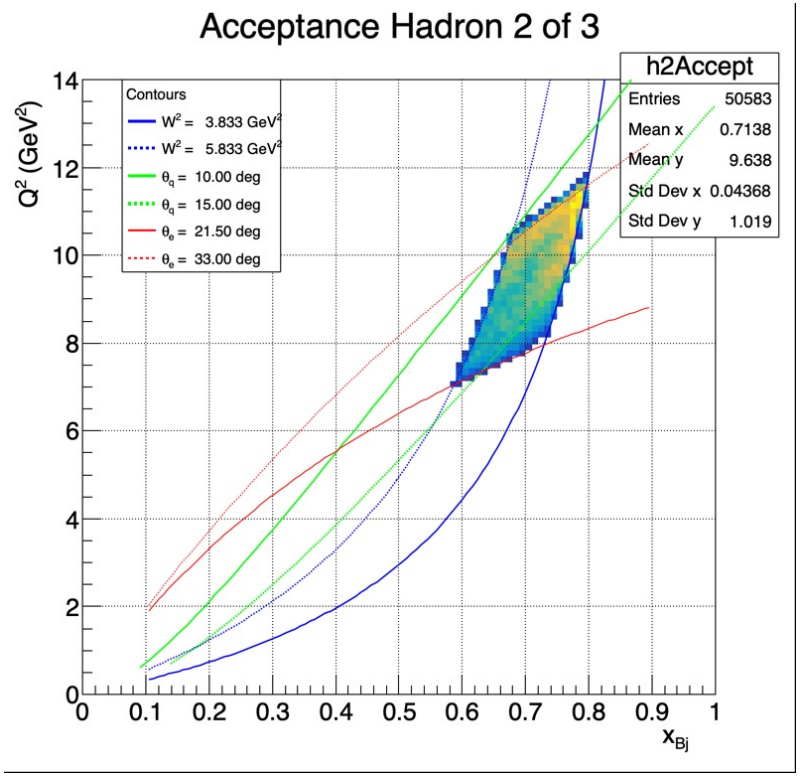
- Near threshold, proton and phi ~colinear
- Large Q^2: ϕ is boosted forward, K^+K^- are in small decay cone.
- Detect scattered electron in BigBite, all hadrons in SBS.
- SBS Hcal for triggering
- SBS PID with Aerogel RICH?



SBS Configuration

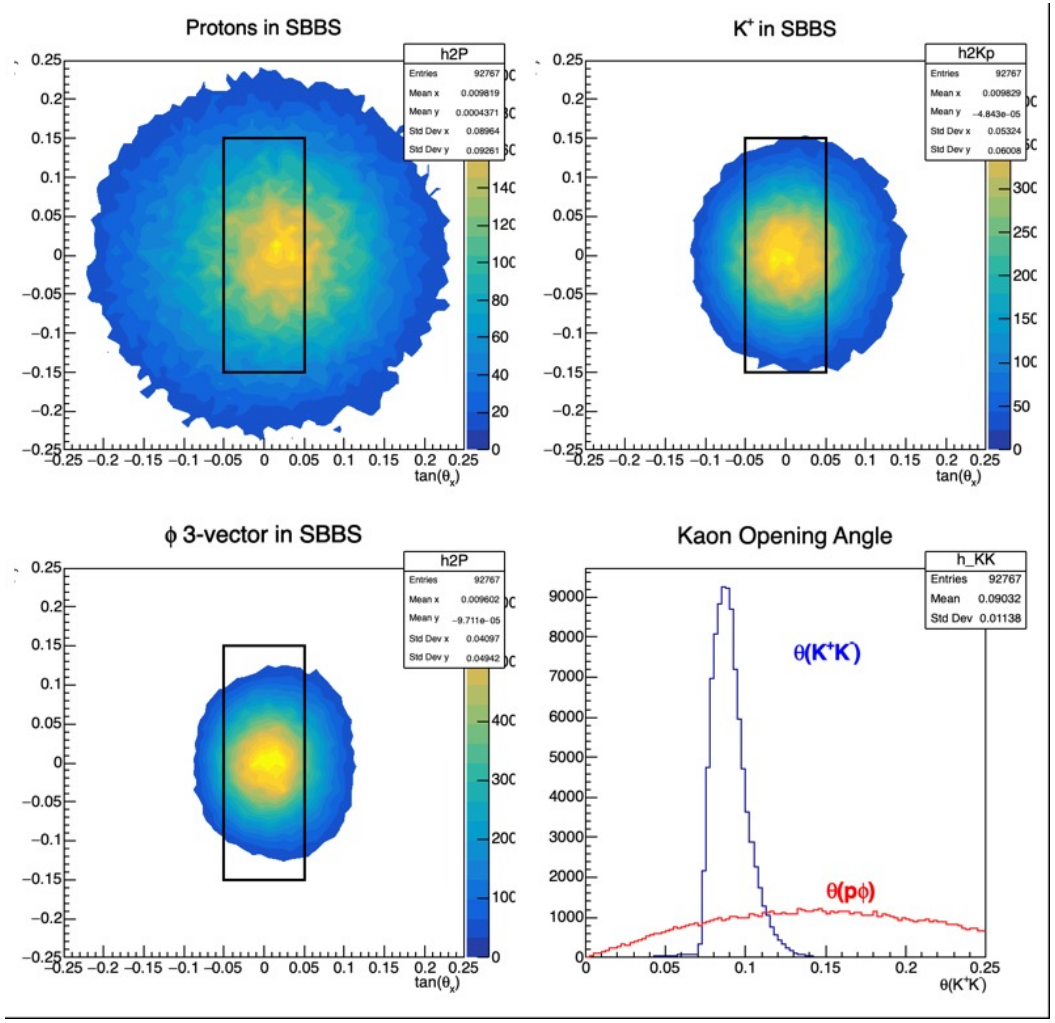


- Center SBS at 12.5°
  - Solid Angle 30 msr
  - 3:1 V:H Aspect ratio
- NPS Calo at –27.5°
  - BigBite “Sweep”
  - Calo at 3m
  - $\Delta\Omega \approx 50$ msr



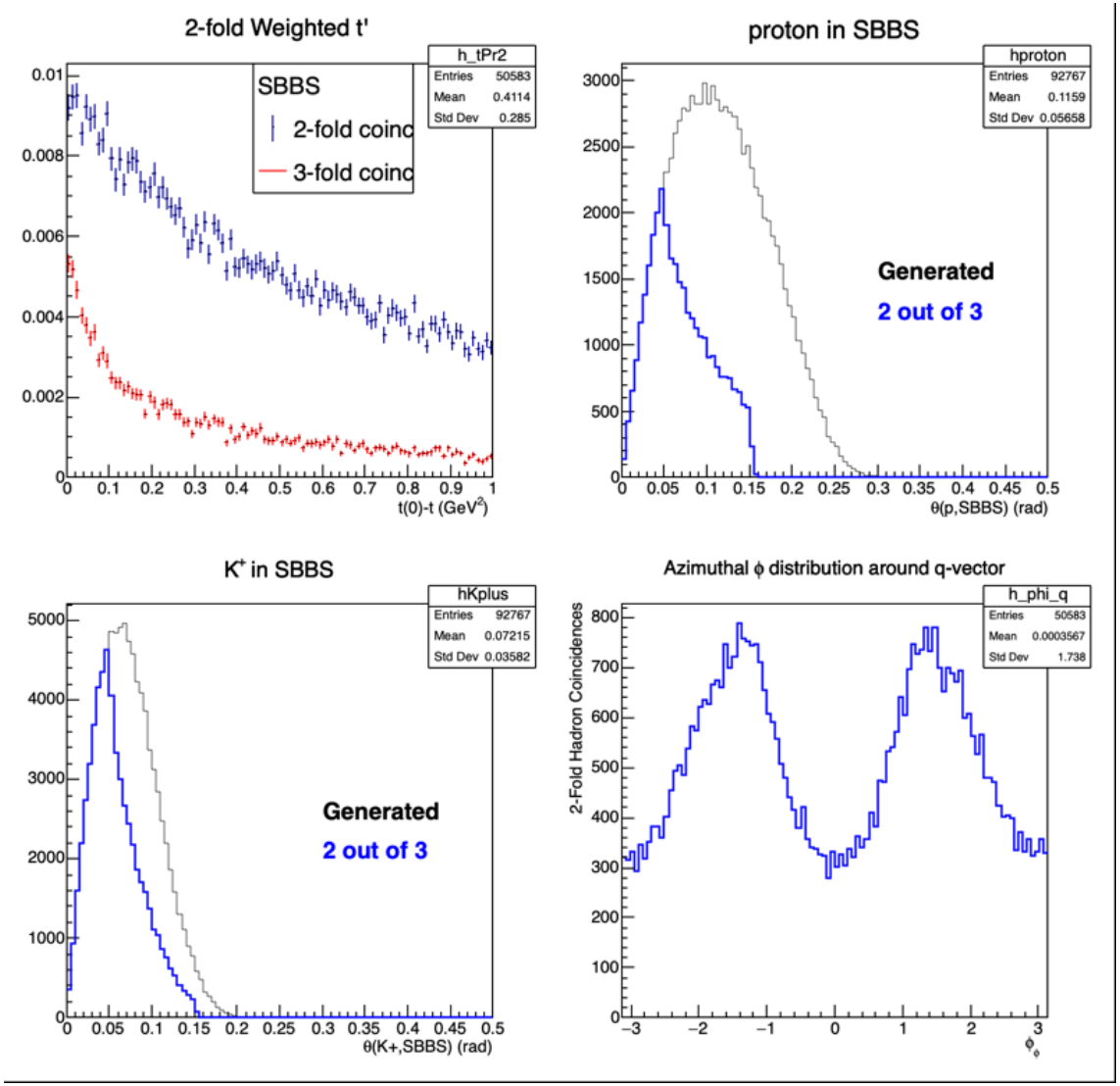
Phase Space Simulation

- Generated Hadrons
- Electrons detected



Accepted Events

- Not great
- Maybe sufficient to do a measurement?



Things to do:

- Get cross section model in appropriate W^2, Q^2 range
- Determine realistic acceptance and resolution models of SBS and electron arm
- Detailed simulations
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- Suggestions and collaborators welcome!