

Deep Virtual Phi production

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for the Deep Phi team

Letter of Intent for Deep Virtual Φ Production with the Hall A HRS-SBS Pair as a Probe of Gluon Densities of the Proton

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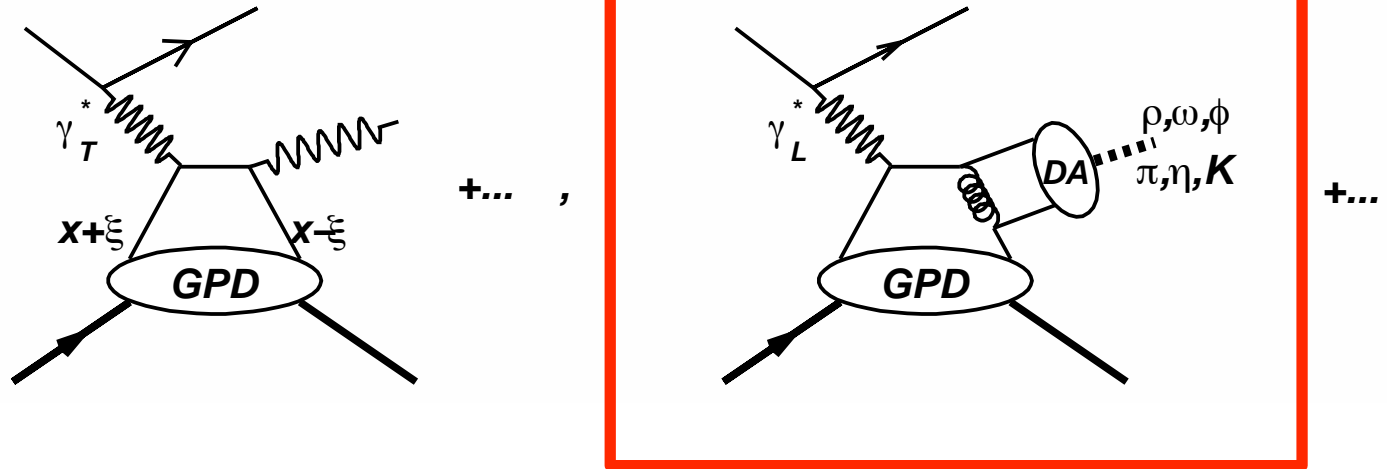
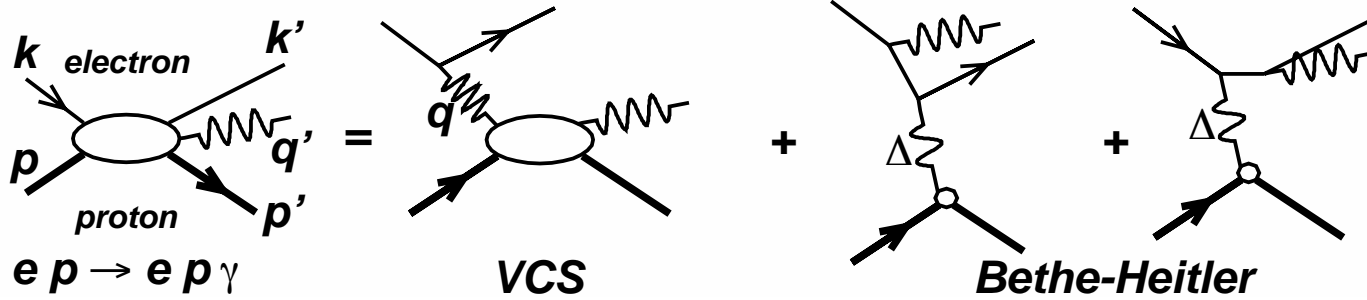
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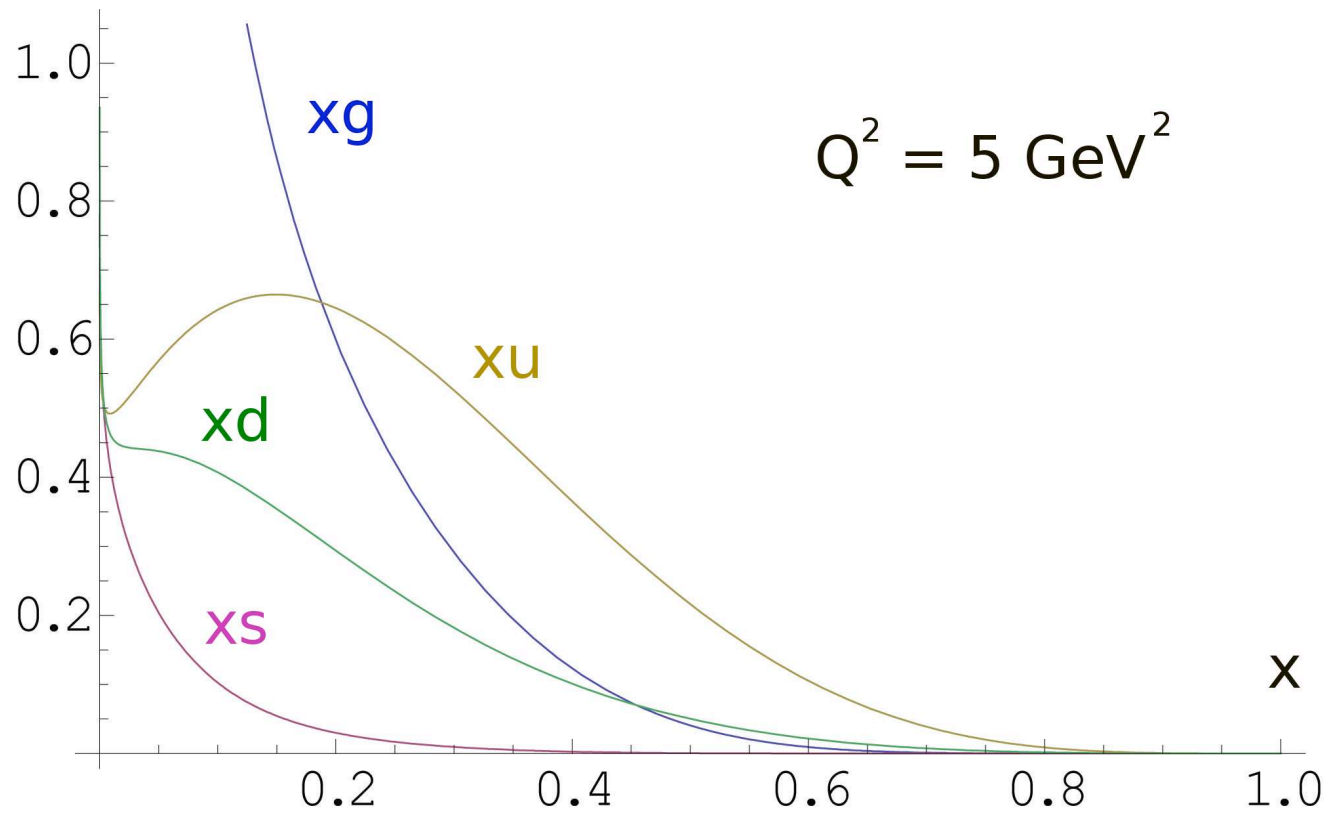
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We propose deep virtual electroproduction measurements of the $H(e, e'\phi)p$ reaction with the 11 GeV polarized electron beam in Hall A. The scattered electron will be detected in the HRS-L and the $\phi \rightarrow K^+K^-$ decay will be reconstructed in the Super Big Bite Spectrometer (SBS). We anticipate a luminosity of $4 \cdot 10^{37}/\text{cm}^2/\text{s}$. Deep virtual ϕ -meson production offers a unique access to the spatial distribution of gluons in the proton. There is evidence that corrections to the leading order scattering amplitude are understood theoretically for this channel. These corrections do not change the basic two gluon exchange mechanism. With a 30 day run at each of three kinematics centered $(Q^2, x_{Bj}) = (4.6 \text{ GeV}^2, 0.36)$, $(7.0 \text{ GeV}^2, 0.5)$, and $(10.0 \text{ GeV}^2, 0.7)$, we project yields in the ϕ -meson resonance peak of $40K$, $5K$, and $0.5K$ events, respectively.

Deep Exclusive Reactions



Gluons



Theory 1

Exclusive electroproduction of strange mesons with JLab 12 GeV*

M. Strikman

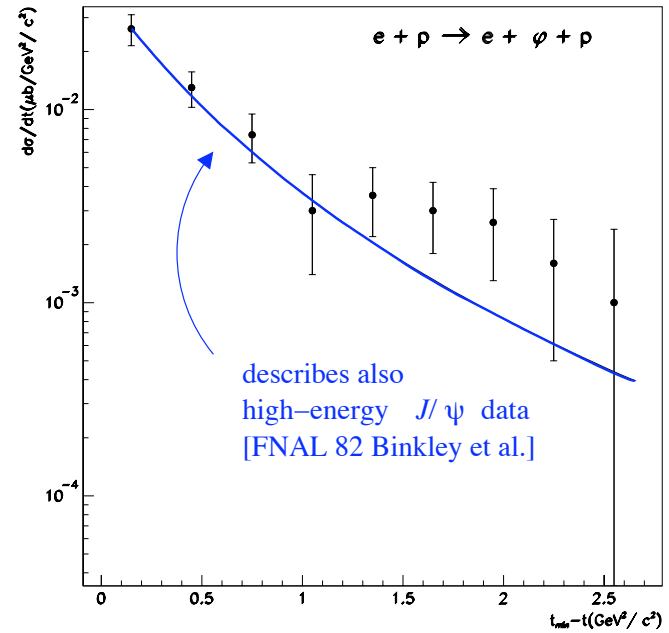
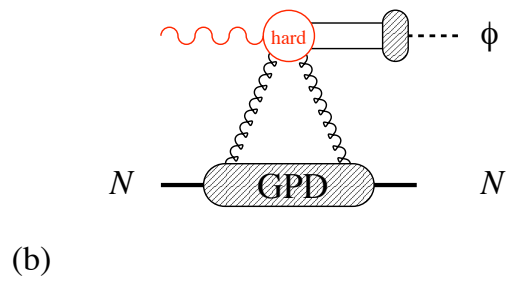
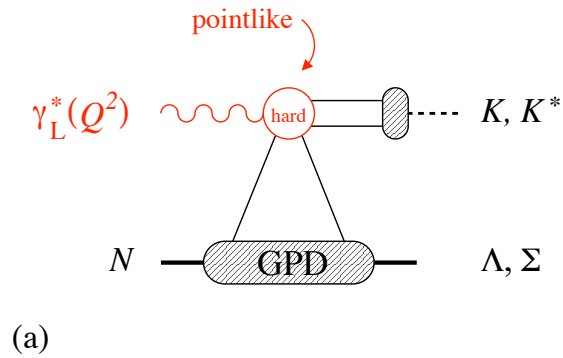
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We summarize the physics topics which can be addressed by measurements of high- Q^2 exclusive electroproduction of strange mesons, $\gamma^* N \rightarrow \phi N, K^* \Lambda, K \Lambda, K \Sigma$, at Jefferson Lab with 11 GeV beam energy. The proposed investigations are aimed both at exploring the reaction mechanism (dominance of point-like configurations) and extracting information about baryon structure from the data (generalized parton distributions, or GPDs). They include (a) probing the t -dependence of the nucleon's gluon GPD (transverse spatial distribution of gluons) in ϕ meson production; (b) separating the nucleon helicity-flip and nonflip quark GPDs in $K^* \Lambda$ production with measurement of the Λ recoil polarization; (c) probing strangeness polarization in the nucleon in $K \Lambda$ and $K \Sigma$ production. These studies rely only on the analysis of cross section ratios, which are less affected by the theoretical uncertainties of present GPD-based calculations than absolute cross sections.

Theory 2



Theory 3

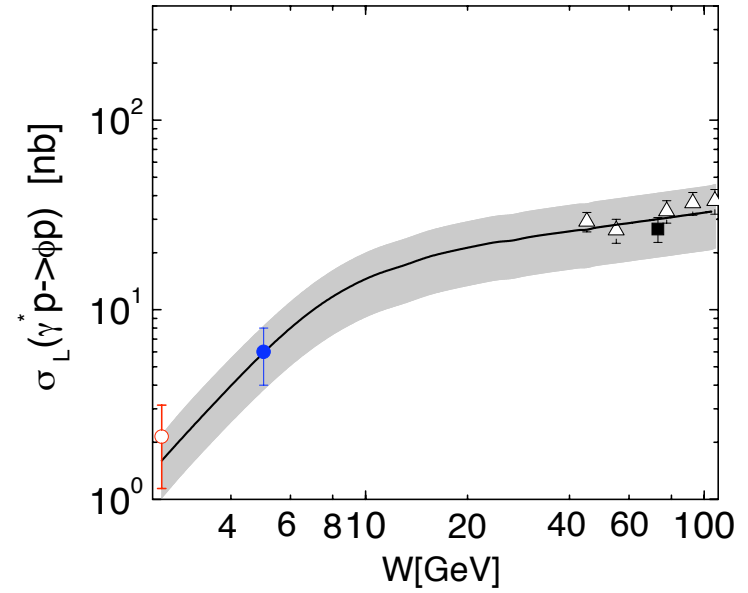
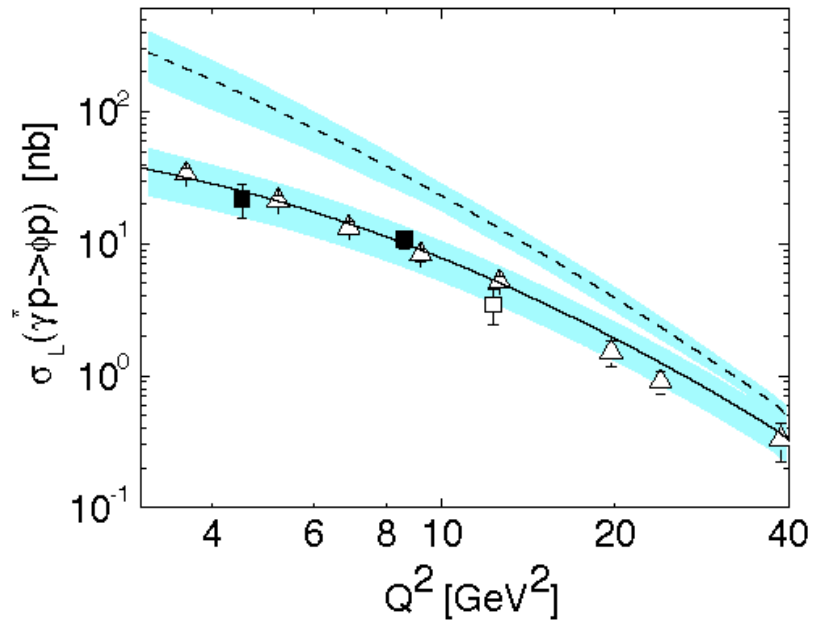
Electroproduction of phi mesons is in many ways the simplest hard exclusive process accessible at JLab with 6 and 11 GeV beam energy. Like rho and omega production, phi production proceeds by exchange of vacuum quantum numbers between the target and the projectile

However, contrary to the light vector mesons, in phi production quark exchange is suppressed, making it a clean probe of the gluon field in the nucleon.

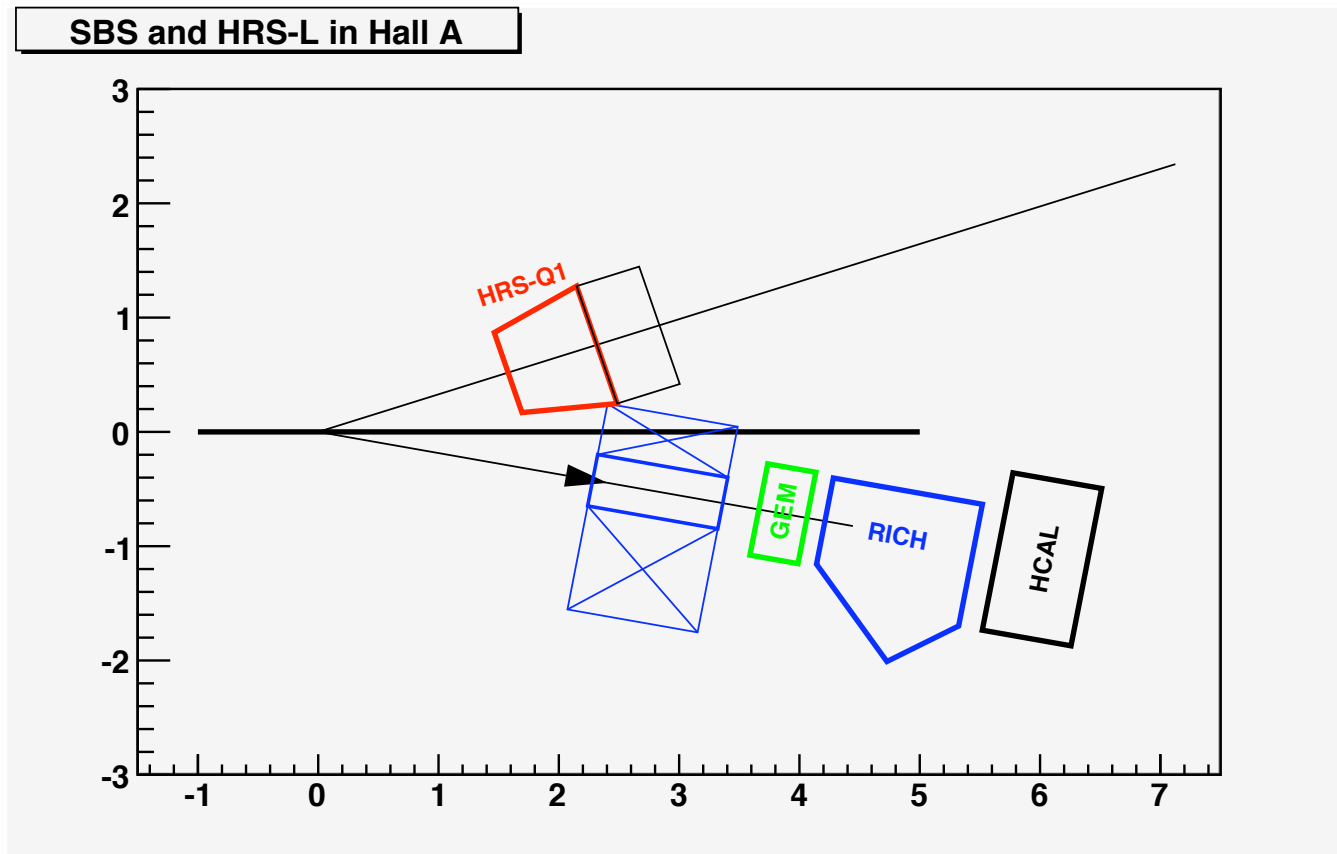
Calculations of the phi production cross section in the leading-twist approximation, using standard parametrizations of the strange quark and gluon GPDs at a low scale, suggest that phi production is dominated by the gluon GPD even at JLab

Experimentally, the analysis of phi meson production is aided by the fact that one can infer the polarization of the produced vector meson from the measurement of its decay angular distribution and use s-channel helicity conservation to extract σ_L , eliminating the need for explicit L/T separation by way of measurements at different beam energies (Rosenbluth separation).

Existing data



Layout of Experiment



MC of the experiment

