

Abdennacer Hamdi

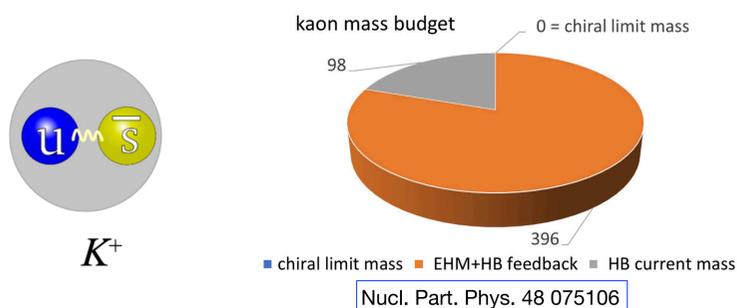
On behalf of the KaonLT Collaboration
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abdennacer.hamdi@uregina.ca

Kaon Structure at Low Photon Virtuality

Motivation

- Simple valence structure of the kaon is an ideal test to our understanding of bound quarks
 - Higgs mechanism is not sufficient to explain the kaon mass
 - Emergent Hadronic Mass from QCD dynamics!



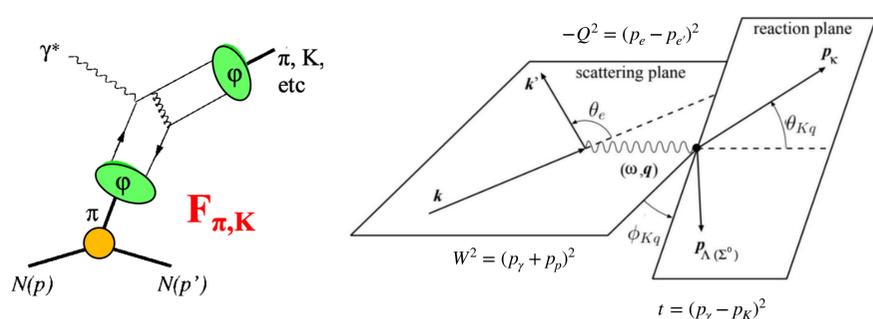
- QCD dynamics are studied in exclusive nuclear reactions
 - The electromagnetic form factor of kaons is directly connected to their internal structure.
 - Form factor is related to kaon longitudinal cross section

$$\sigma_L \propto \frac{-tQ^2}{(t-m_K^2)^2} g_{KNV}^2(t) F_K^2(Q^2, t)$$

Exclusive Kaon Electroproduction

Kaon is produced in the t-channel exchange of the meson pole term

- Interaction with "kaon cloud" is sensitive to longitudinal cross section (σ_L)
- Interaction with "core" ($p/\Lambda\Sigma^0$) is sensitive to transverse cross section (σ_T)
- JLab kaon form factor measurements access photon virtuality $Q^2 > 0.3 \text{ GeV}^2$
- Detector acceptance allows to probe both $K^+\Lambda$ and $K^+\Sigma^0$ channels



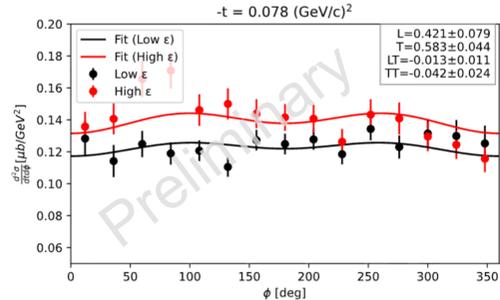
Longitudinal-Transverse (L-T) Cross Section Separation

- L-T separation can be utilized to separate σ_L from σ_T by performing two scattering measurements at different ϵ values with fixed Q^2 and W , and full ϕ_{Kq} coverage

- Simultaneous fit of the unseparated cross section with:

$$2\pi \frac{d^2\sigma}{dt d\phi} = \epsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\epsilon(\epsilon+1)} \frac{d\sigma_{LT}}{dt} \cos\phi + \epsilon \frac{d\sigma_{TT}}{dt} \cos 2\phi$$

$-t = 0.078 \text{ (GeV/c)}^2$



$$\epsilon = \left(1 + 2 \frac{(E_e - E_{e'})^2 + Q^2}{Q^2} \tan^2 \frac{\theta_e}{2} \right)^{-1}$$

Kaon L-T Experiment in Hall C



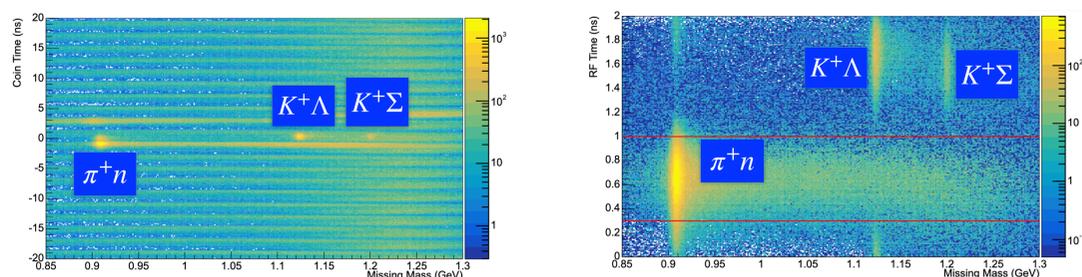
$Q^2 \text{ (GeV}^2\text{)}$	$W \text{ (GeV)}$	χ_B
0.5	2.4	0.09

HMS		SHMS	
$P \text{ (GeV/c)}$	$\theta \text{ (deg)}$	$P \text{ (GeV/c)}$	$\theta \text{ (deg)}$
0.968	21.14	2.583	6.79

Azimuthal Angle ϕ	Beam Energy (GeV)	
	3.8 (Low ϵ)	4.9 (High ϵ)
Center	✓	✓
Left	✓	✓
Right	✗	✓

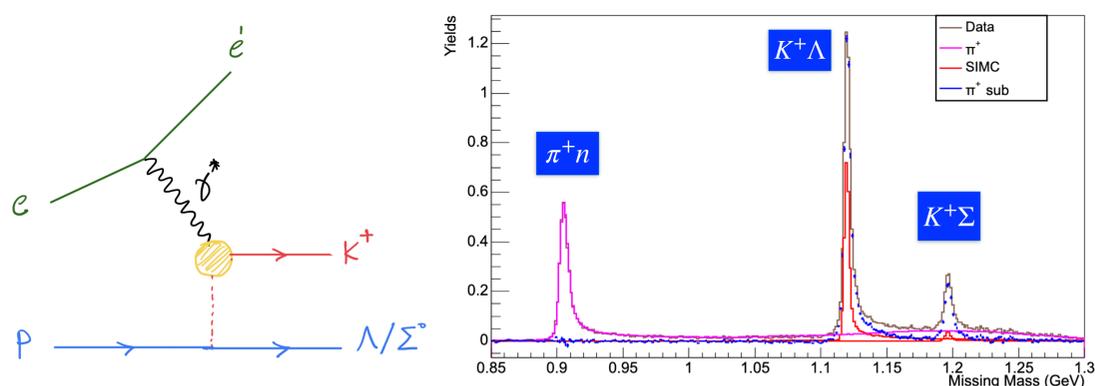
Event Selection Using Timing Measurements

- Coin Time = $t_{\text{HMS}} - t_{\text{SHMS}}$, helps distinguish between real and random events
- RF Time = $t_{\text{SHMS}} - t_{\text{RF signal}}$, adjusted for particle type using time of flight



$$\text{Missing Mass} = \sqrt{(P_e + P_p - P_{e'} - P_{K^+})^2}$$

Missing Mass



Results & Outlook

- First measurement of the $p(e, e'K^+)\Lambda, \Sigma^0$ polarized cross sections at this kinematic $Q^2 = 0.5 \text{ GeV}^2, W = 2.4 \text{ GeV}$

- Compare data to:

- Theory, VGL Regge Model [Phys.Rev.C 61(2000)025204]
- Previous measurement [Z.Phys.C 3 (1979) 101, 1979]

- Evaluate systematic uncertainties on cross sections

- If data allows extract the form factor, and if not

- Probe the reaction mechanism by measuring $\frac{\sigma_T(\gamma^*p \rightarrow K^+\Sigma^0)}{\sigma_T(\gamma^*p \rightarrow K^+\Lambda)}$

- First attempt to measure kaon form factor indirectly, this measurement can **only** be done at JLab Hall C

