Overview of CLAS12 Run Group K Experiments

Joshua Artem Tan
on behalf of CLAS Collaboration Run Group K

Outline

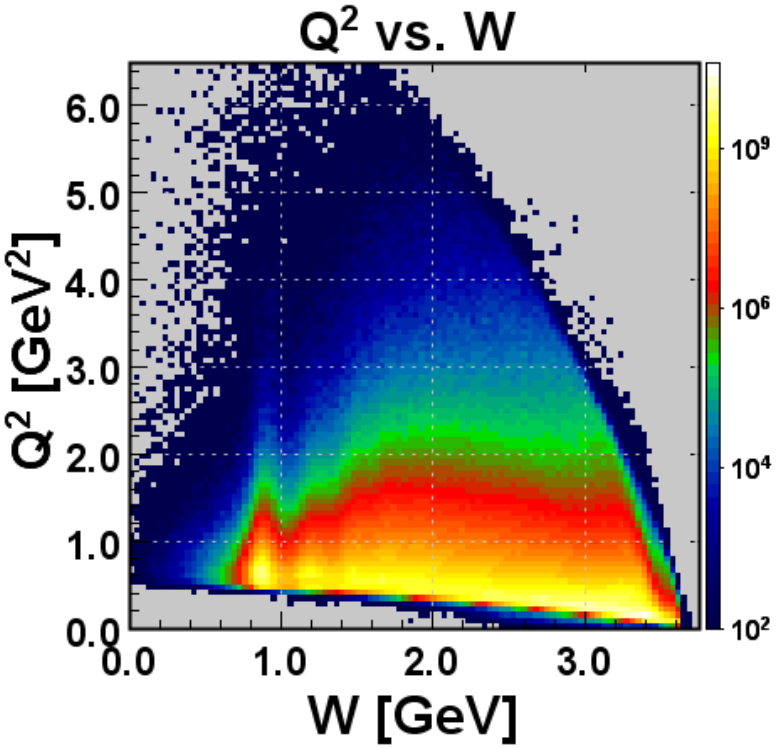
I. Introduction to CLAS12 Run Group K

II. N^* Studies via KY Electroproduction

III. Search for Hybrid Baryons

IV. Deeply Virtual Compton Scattering

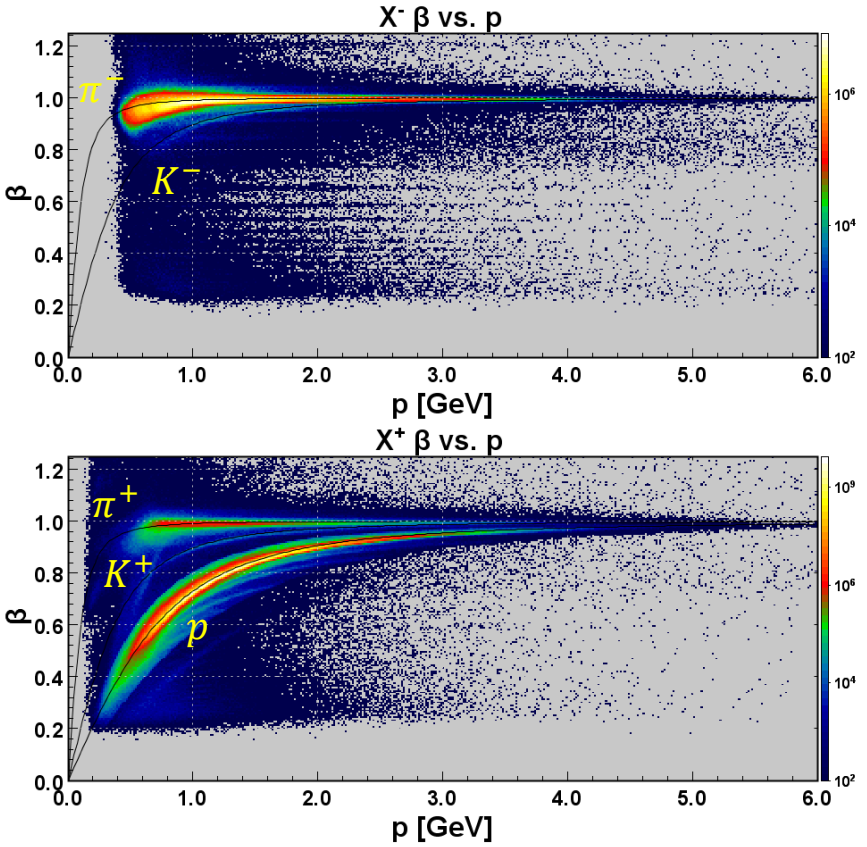
Introduction to CLAS12 Run Group K



Inclusive Spectrum:

$$Q^2 = -q^2$$

$$W = \sqrt{(q+p)^2}$$

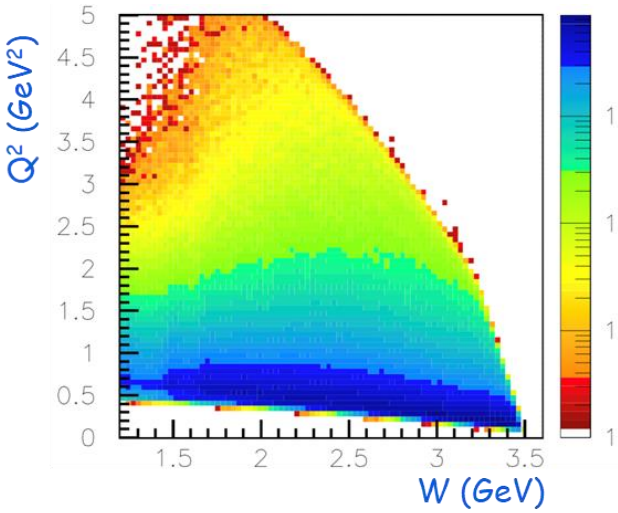


Particle ID

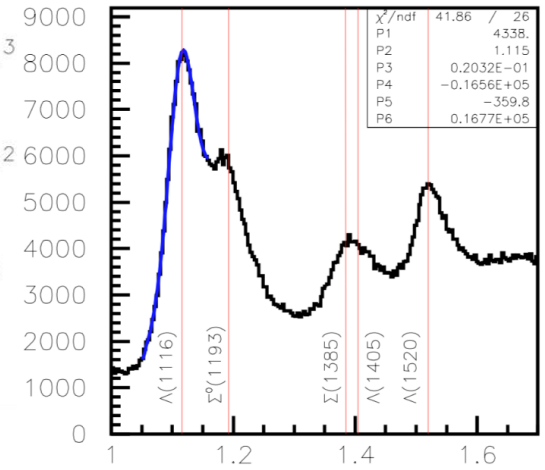
Run Group K:

- Run at 6.5 GeV and 7.5 GeV in Dec. 2018
- Acquired 7% of approved beam time
- Longitudinally polarized electrons on unpolarized H_2 target

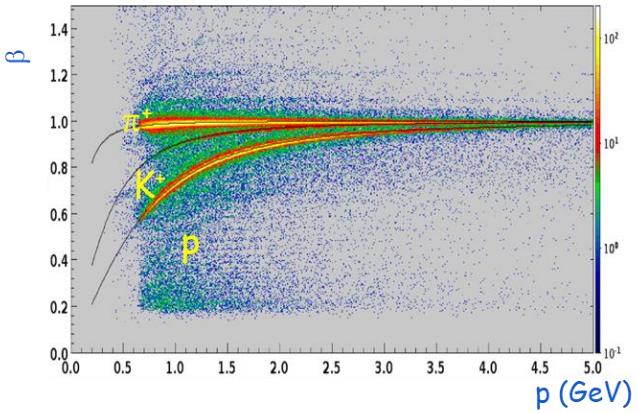
N^* Studies via KY Electroproduction



Kinematic Coverage



$MM(e'K^+)$

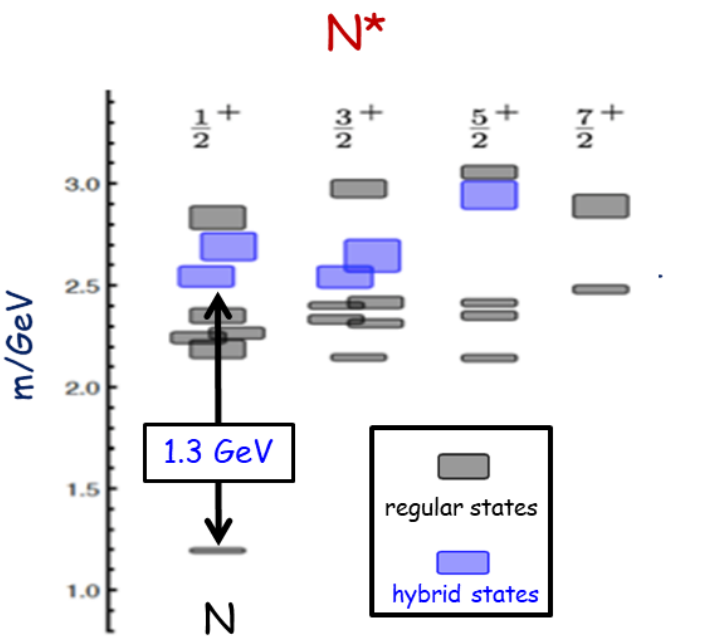


Particle ID

Run Group K:

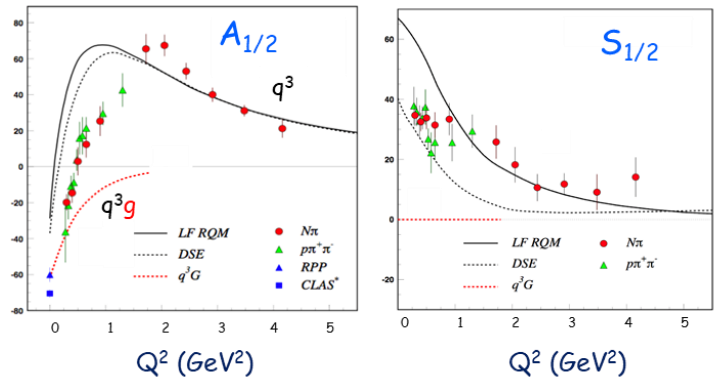
- Extraction of $\gamma_v p N^*$electrocouplings from KY electroproduction off protons.
- Comparison with the results from $N\pi$, $\pi^+\pi^- p$ electroproduction off protons.
- Explore the interplay between meson-baryon and quark degrees of freedom in the N^* structure.
- Shed light on dynamics of dressed quark mass generation and di-quark correlations in different excited nucleon states.
- A unique experimental input on many facets of strong QCD in generation of the excited nucleon states of different structural features.

Search for Hybrid Baryons

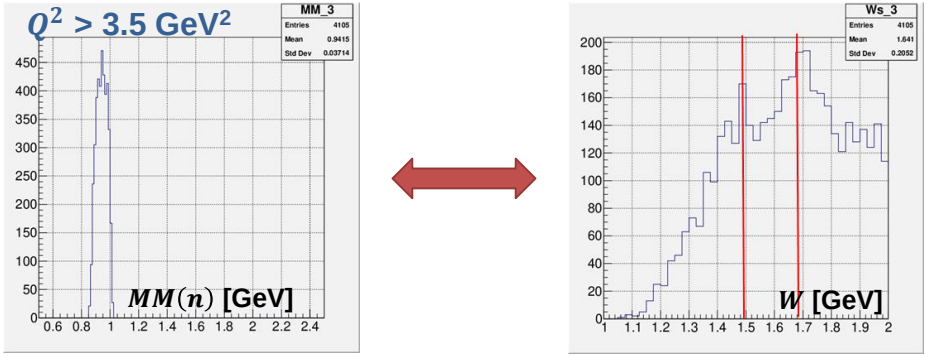


m_π=396 MeV

JLAB LQCD Group Results



Results and Predictions for $N(1440)1/2^+$

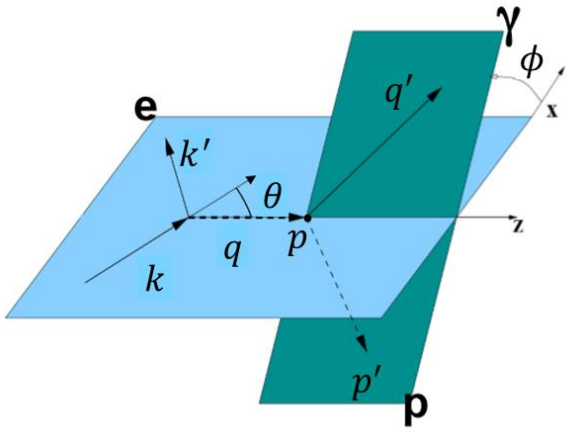


$MM(n)$ and W distributions of π^+n Exclusive Events

Search for hybrid baryons with CLAS12:

- N^* spectrum from Lattice QCD predicts the existence of hybrid baryons.
- Glue is a possible structural component of excited baryon states
- W distributions from π^+n exclusive events demonstrate the structures corresponding to the 2nd and 3rd resonance regions.

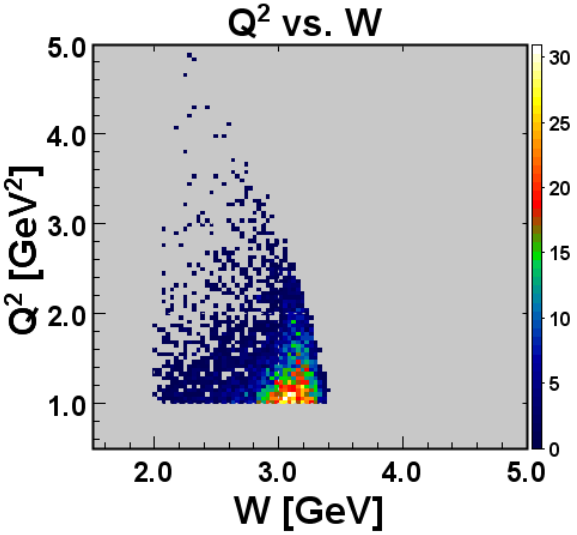
Deeply Virtual Compton Scattering



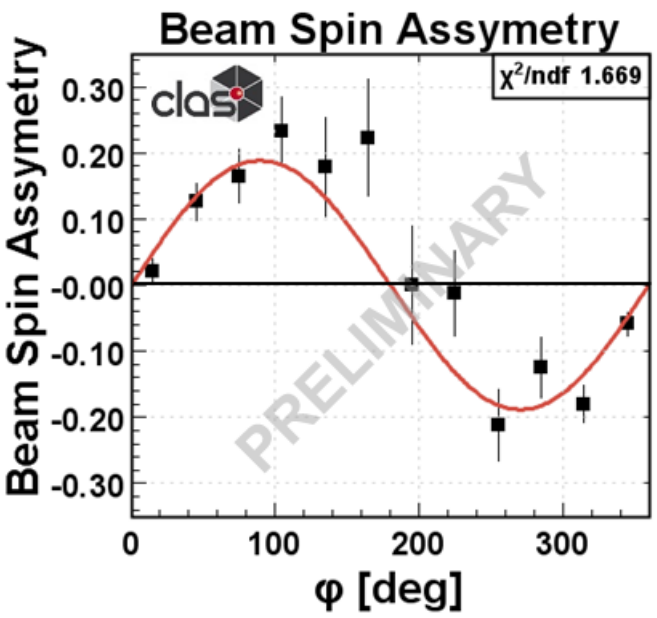
DVCS Kinematics:

$$A_{\mathrm{LU}}(\phi) \propto s^{\mathcal{J}}_{1,\mathrm{unp}} \sin(\phi)$$

$$A_{\mathrm{LU}}(\phi) = \frac{1}{\varepsilon} \frac{N^{\uparrow}(\phi) - N^{\downarrow}(\phi)}{N^{\uparrow}(\phi) + N^{\downarrow}(\phi)}$$



Kinematic Coverage



Beam Spin Asymmetry

Deeply virtual Compton scattering (DVCS) at 6.5 and 7.5 GeV polarized electron beam:

- Measure beam spin asymmetry describing DVCS and Bethe-Heitler (BH) interference term for unpolarized target
- Access chiral-even GPDs: H^q, $\widetilde{H}^q$, and E^q

Thank You!!!