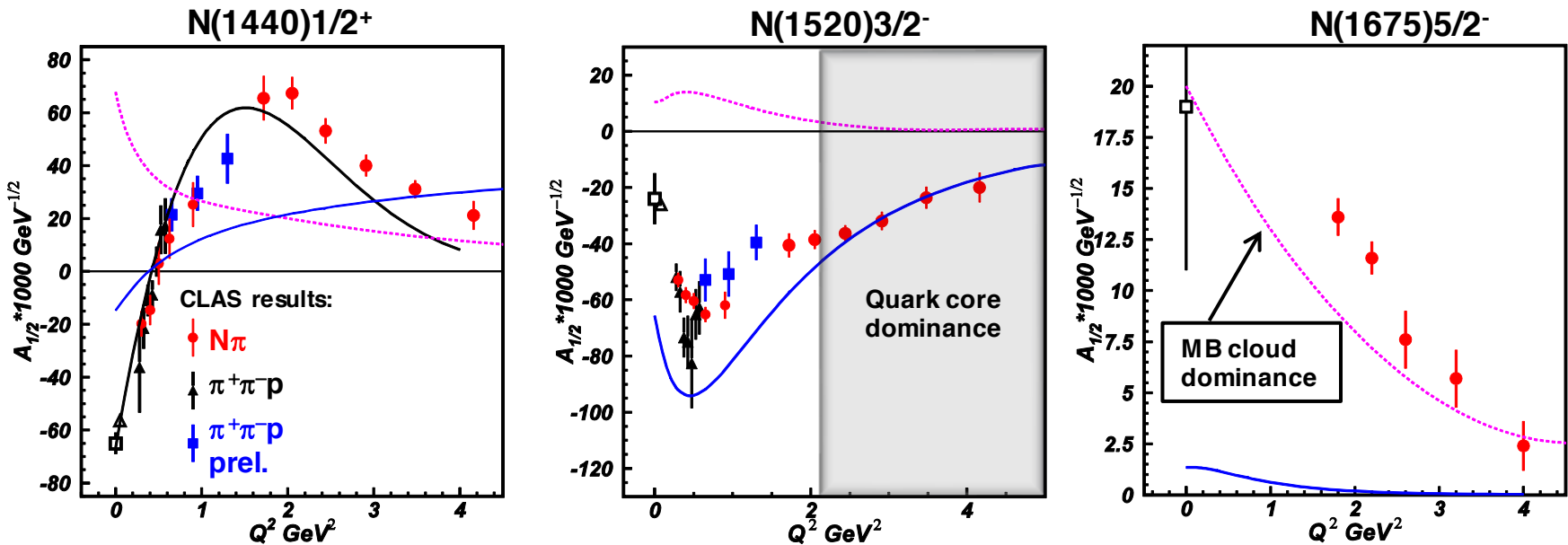


# The Need to Extend the Studies of $N^*$ Structure

Studies of  $N^*$ -electrocouplings over a broad range of photon virtuality  $Q^2$  offer unique information on the non-perturbative strong interaction that determines the structure of different excited nucleons.

Insight on  $N^*$  structure from the CLAS@JLAB data on exclusive meson electroproduction (Review papers: I.G. Aznauryan & V.D. Burkert, *Progr. Part. Nucl. Phys.* 67 (2012) 1; I.G. Aznauryan et al., *Int. J. Mod. Phys. E22* (2013) 1330015).



Consistent results on  $N^*$ -electrocouplings from independent analyses of different meson electroproduction channels suggest reliable extraction of these fundamental quantities.

Complex interplay between internal core of three dressed quarks and external meson-baryon cloud in the structure of  $N^*$  states is strongly dependent on the resonance quantum numbers.



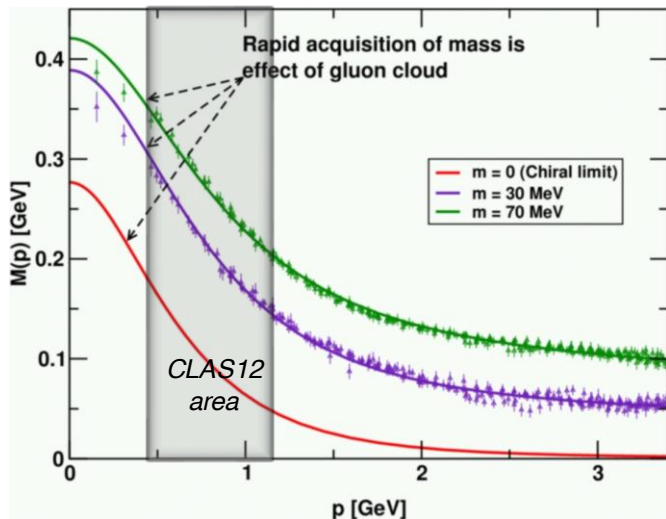
- Growth of relative quark core contribution with  $Q^2$  in gradual transition to almost unexplored domain of quark core dominance at  $Q^2 > 5.0 \text{ GeV}^2$ .

# N\* Structure at High Photon Virtualities in Exploration of Strong Interaction

CLAS12 is the only facility foreseen in the world capable of determining electrocouplings of all prominent N\* at  $5 < Q^2 < 12 \text{ GeV}^2$ . For the first time, almost direct access to the quark core at the distances where the transition from quark-gluon confinement to perturbative QCD regime is expected.

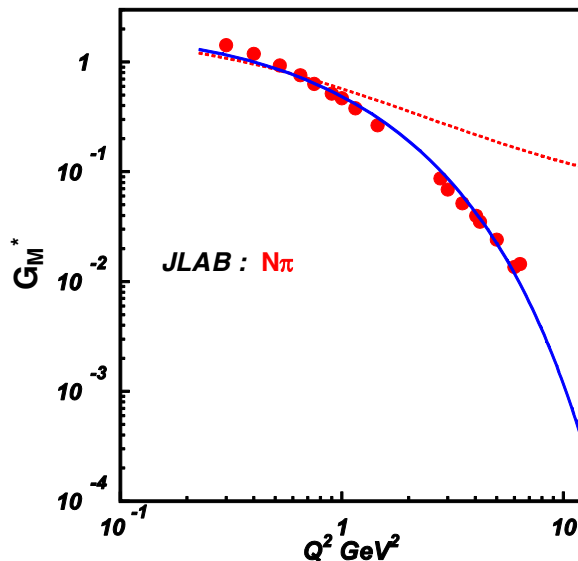
## Dressed quark mass function

C.D. Roberts, *Prog. Part. Nucl. Phys.* (2008) 50.



## $\Delta(1232)3/2^+$ Jones-Scadron convention

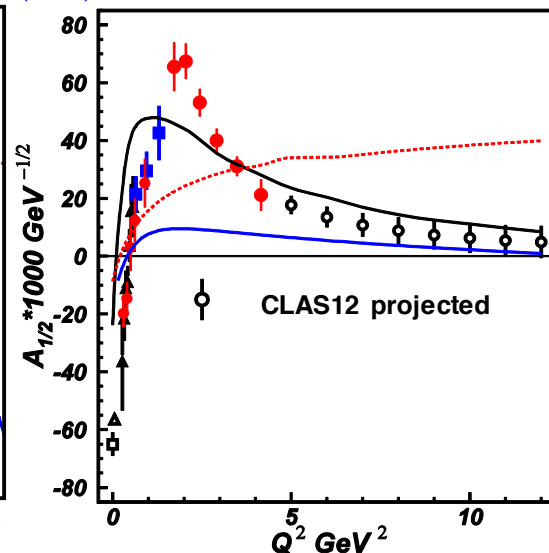
J. Segovia et al., *arXiv:1408,2919 [nucl-th]*.



## N(1440)1/2+

D.J. Wilson et al., *Phys. Rev C85 (2012) 045205 DSEQCD*.

I.G. Aznauryan & V.D. Burkert, *Phys. Rev. C85 (2012) 055202 LF QM*.



Consistent results on quark mass function from electrocouplings of different resonances at  $Q^2 > 5 \text{ GeV}^2$ :

- will prove relevance and reliable access to this fundamental ingredient;
- **address two of the most challenging problems in the Standard Model: the emergence of the dominant part of hadron masses and quark-gluon confinement.**

DSEQCD : ..... constant quark mass. (quark core only)  
 ——— running quark mass.  
 Light Front Quark Model ——— running quark mass from DSEQCD. (quark core & MBcloud)

**Studies of Nucleon Resonance Structure from the exclusive meson electroproduction experiments with CLAS12@JLAB offer an important contribution to the Long Range Plan.**

