Inclusive electroproduction in the resonance region

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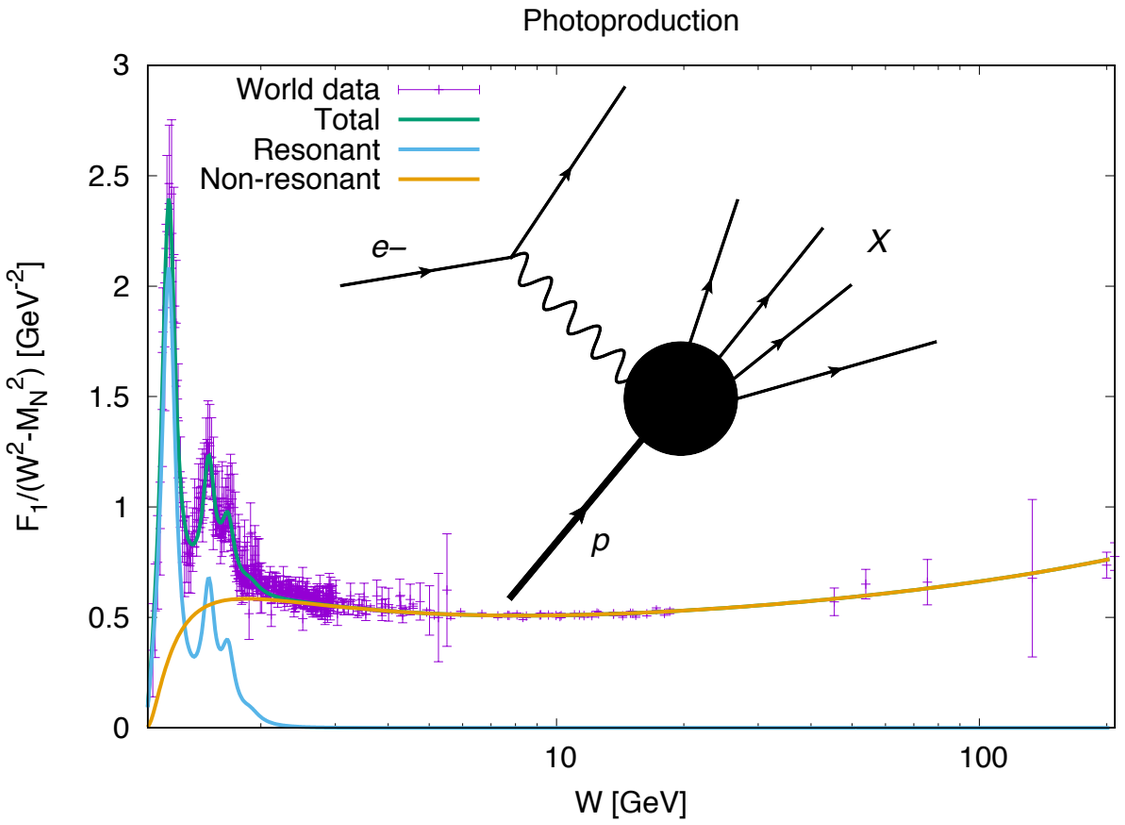
The rich nucleon excitation structure



$$F_1 \propto \sigma_T(W, Q^2)$$

$$F_2 \propto \sigma_T(W, Q^2) + \sigma_L(W, Q^2)$$

$$F_L \propto \sigma_L(W, Q^2)$$

- Structure functions/cross sections give access to PDFs
- Resonance region displays highly non-trivial behaviour with W and Q^2
- **Precise CLAS data**; CLAS12 to reach 0.05 GeV^2 < Q^2 < 12 GeV^2, W up to 4 GeV
- Tests on quark-hadron duality and access to **PDFs at large x** in global analyses

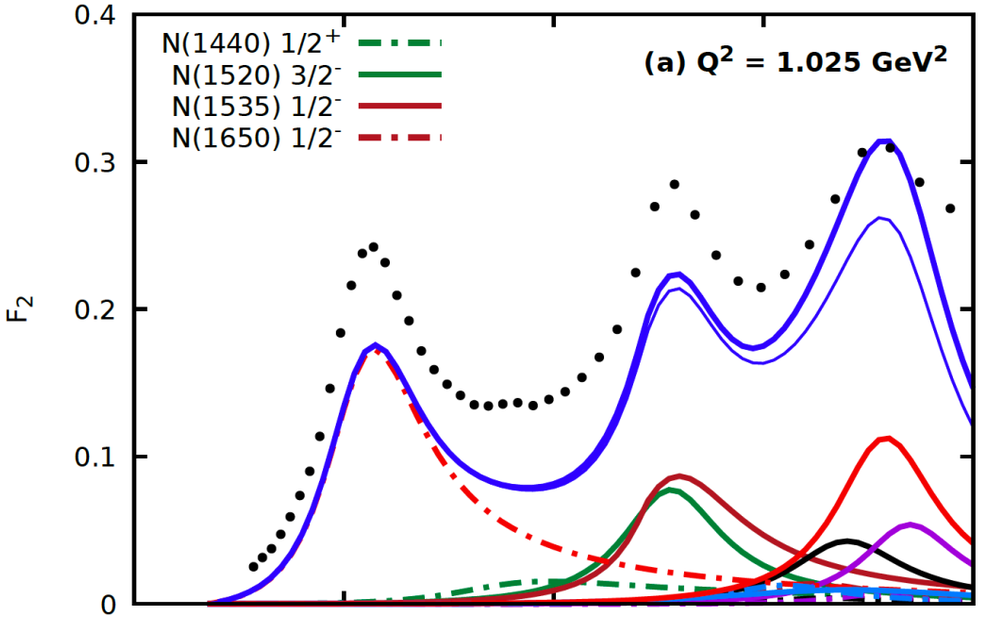
From exclusive to inclusive electron scattering

$$\sigma_{T,L}(W,Q^2) = \sigma^{R}_{T,L}(W,Q^2) + \sigma^{NR}_{T,L}(W,Q^2)$$

Breit-Wigner resonance model: coherent sum!

Mokeev et al., PRC 86 (2012) 035203

$$\sigma^{R}_{T,L}(W,Q^2) \propto \Gamma^{T,L}_{\gamma}(M_r,Q^2)$$



https://userweb.jlab.org/~mokeev/resonance_electrocouplings/

https://userweb.jlab.org/~isupov/couplings/

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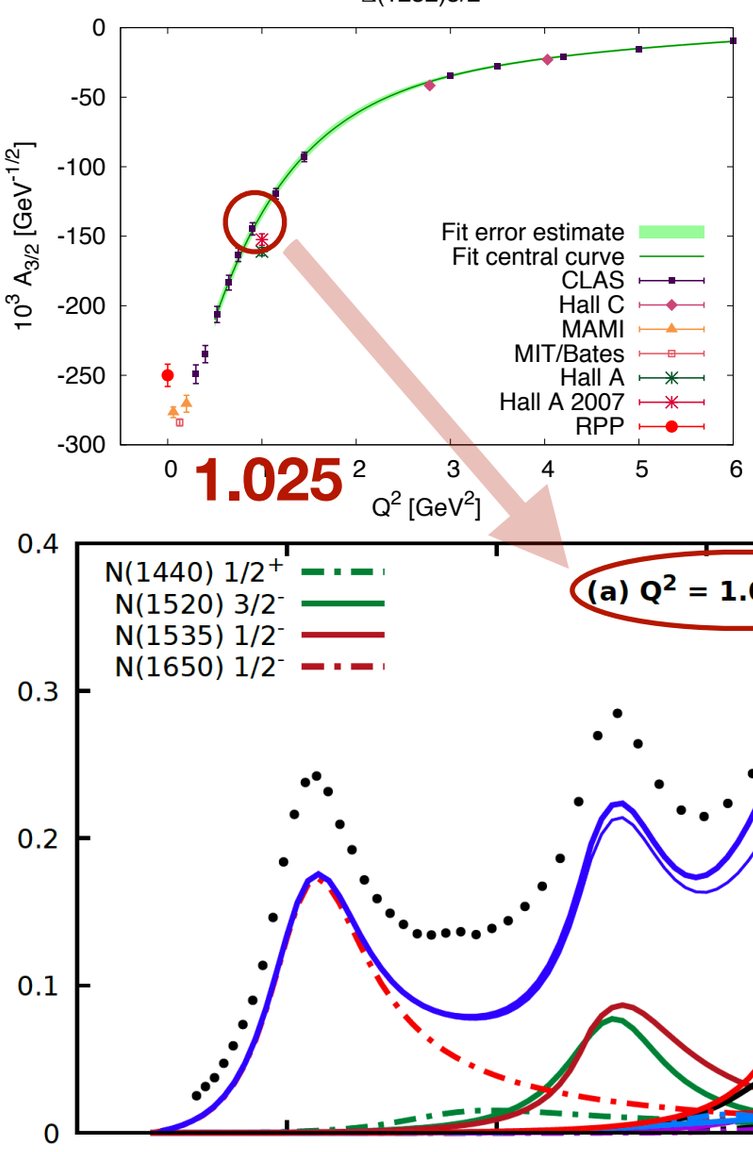


Breit-Wigner resonance model: coherent sum!

Mokeev et al., PRC 86 (2012) 035203

$$\sigma^{R}_{T,L}(W,Q^2) \propto \Gamma^{T,L}_{\gamma}(M_r,Q^2)$$

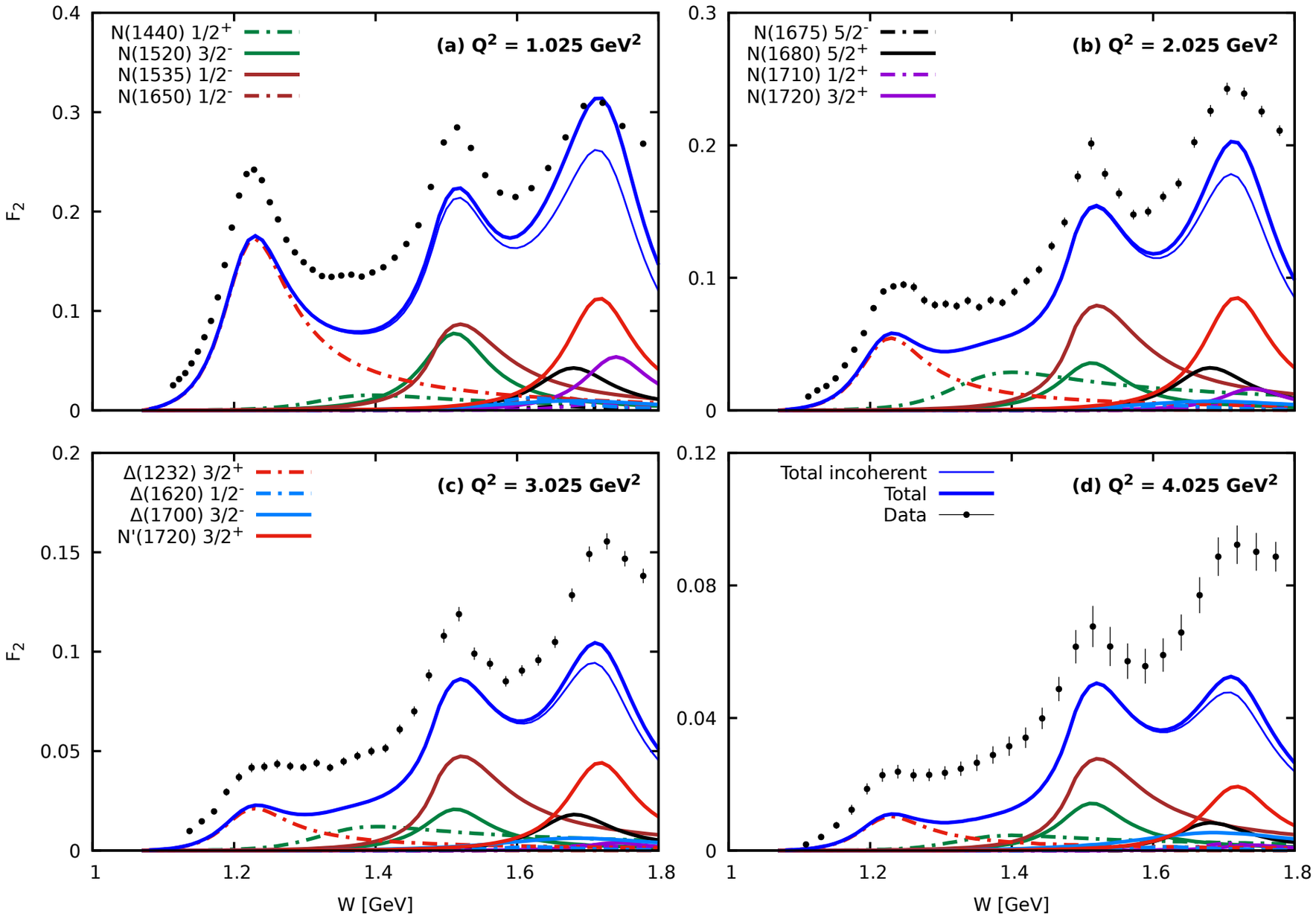
World and CLAS data on longitudinal and transverse **electrocouplings** allow us to determine each of the resonant contributions separately:

$$\Gamma^{T}_{\gamma}(M_r,Q^2) \sim \left|A_{1/2}(Q^2)\right|^2 + \left|A_{3/2}(Q^2)\right|^2$$

$$\Gamma^{L}_{\gamma}(M_r,Q^2) \sim \left|S_{1/2}(Q^2)\right|^2$$

https://userweb.jlab.org/~mokeev/resonance_electrocouplings/ *https://userweb.jlab.org/~isupov/couplings/*

Resonant contributions at different Q^2



Tails of resonances give substantial contributions to neighbouring regions!

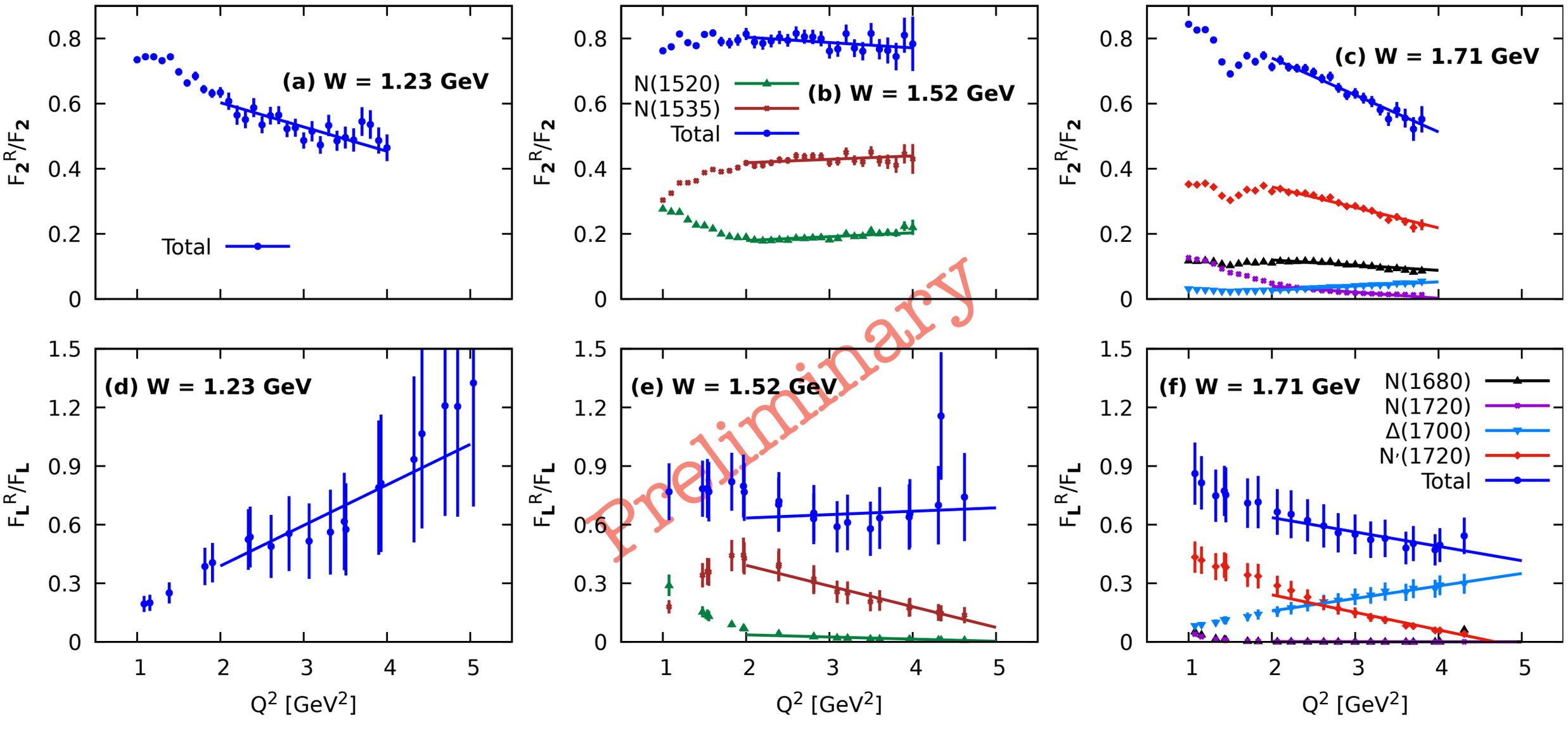
Second resonance region decreases less with Q^2: intricate differences in Q^2 evolution of electrouplings.

2nd and 3rd resonance regions remain strong at all Q^2:

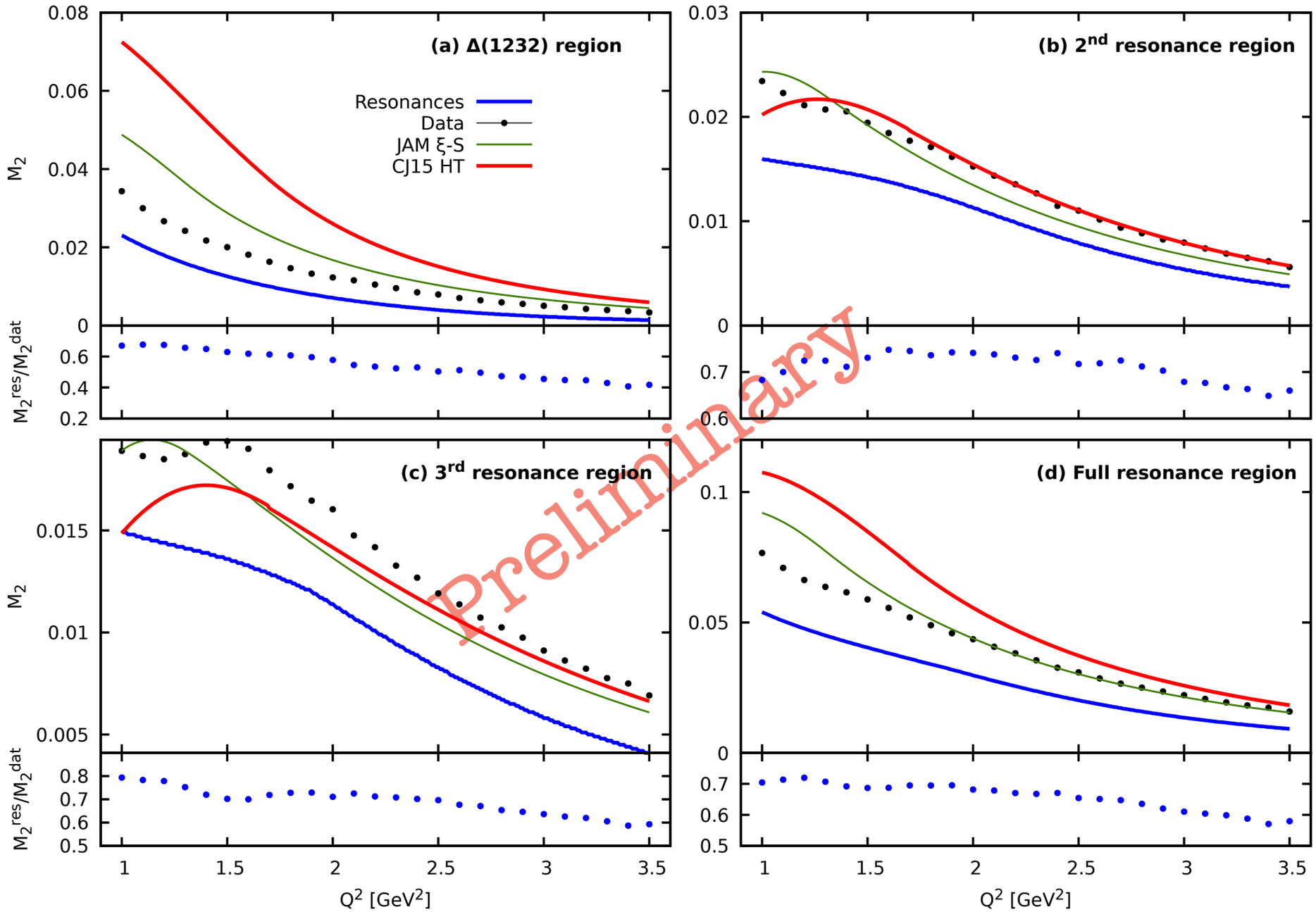
studies of respective electrocouplings at larger Q^2 with CLAS12 is very promising.

Q^2 evolution of ratio resonance/total

- Resonance contributions decrease with Q^2, but so do the total contributions
- Δ(1232): even at 4 GeV^2, ~50% significance; 2nd region: nearly flat ratio
- Points to non-vanishing resonances!



Truncated moments



Integration over energies: better comparison in regions with resonant structures: global duality onset at $Q^2 > 3.0\ GeV^2$ motivates CLAS12 studies!

Resonance contributions stay relatively large in the whole range.

Summary and outlook

- Computed coherent sum of **resonant contributions to structure functions**.
- CLAS electrocouplings allow mapping of highly non-trivial behaviour for first time.
- **Resonances** compared to full data **do not seem to vanish** at larger Q^2: promising prospects for CLAS12!
- Towards an insight into PDFs at large x and duality behavior in truncated moments.
- Extension to polarized structure functions.