g_1^{3He}/F_1^{3He} Fitting

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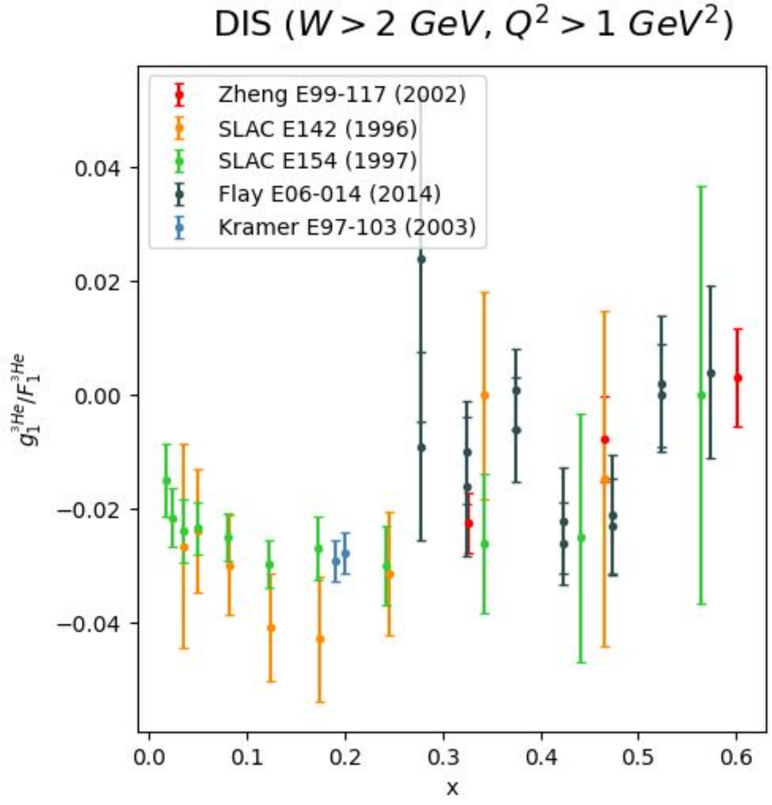
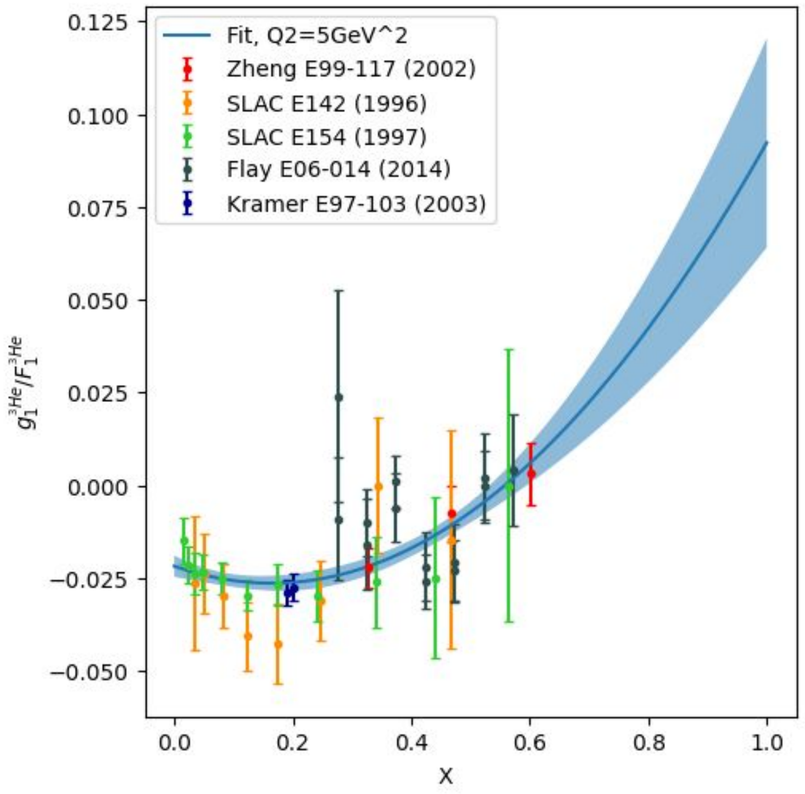
DIS Fitting

- Fit DIS data (W>2 GeV and Q^2>1 GeV^2) with neutron form from Xiaochao's thesis

$$g_1^{3He}/F_1^{3He} = (a + bx + cx^2)(1 + \frac{\beta}{Q^2})$$

- Parameters *a, b, c,* and β
- *Should have a very minor dependence on Q^2*





- Good fit, very small dependence on Q^2
- Fitted curve is for constant Q^2 (5 GeV^2)

$$g_1^{3He}/F_1^{3He} = (a + bx + cx^2)(1 + \frac{\beta}{Q^2})$$

a	b	c	β
-0.021 ± 0.0029	-0.055 ± 0.030	0.17 ± 0.057	0.11 ± 0.22

DIS Fit with Mingyu Data

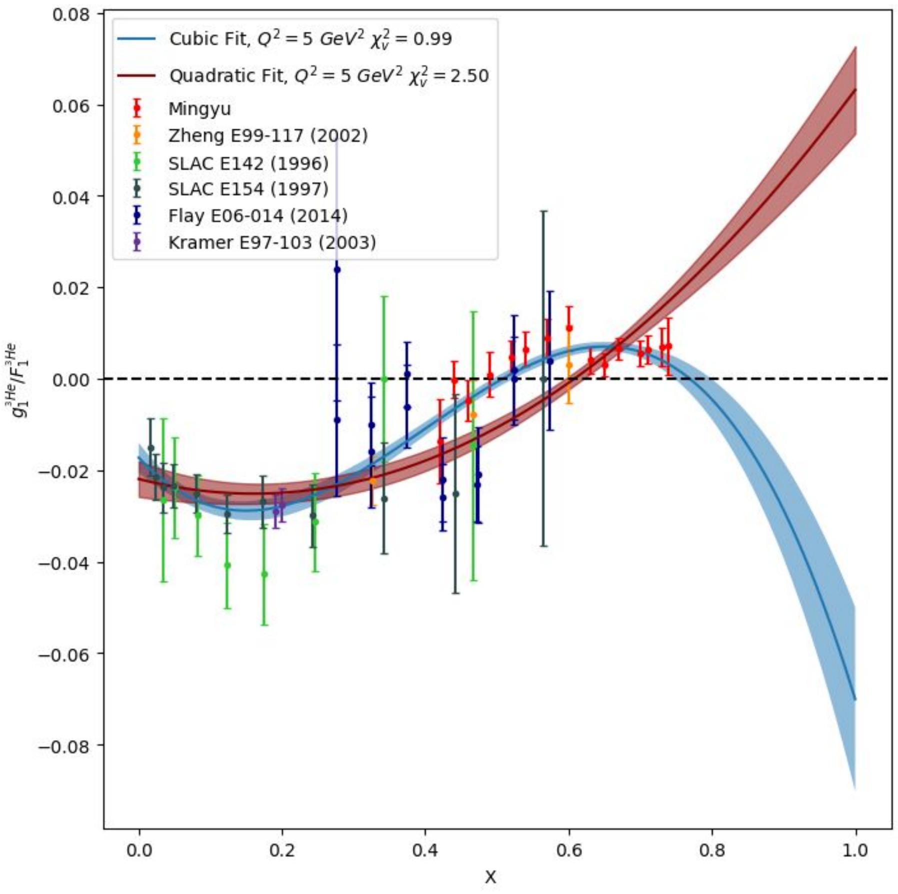
- Cubic fit with negative trend at high *X* better fits Mingyu's data than the original quadratic form
- Constrained minimum of quadratic fit to $X \approx 0.2$ and $g_1/F_1 \approx -0.03$

$$g_1^{3He}/F_1^{3He} = (c(x-x_0)^2 + y_0)(1 + \frac{\beta}{Q^2})$$

x_0	y_0	c	β
0.16 ± 0.057	-0.025 ± 0.0032	0.12 ± 0.030	0.026 ± 0.29

$$g_1^{3He}/F_1^{3He} = (a + bx + cx^2 + dx^3)(1 + \frac{\beta}{Q^2})$$

a	b	c	d	β
-0.017 ± 0.0032	-0.17 ± 0.048	0.68 ± 0.15	-0.57 ± 0.13	0.04 ± 0.20



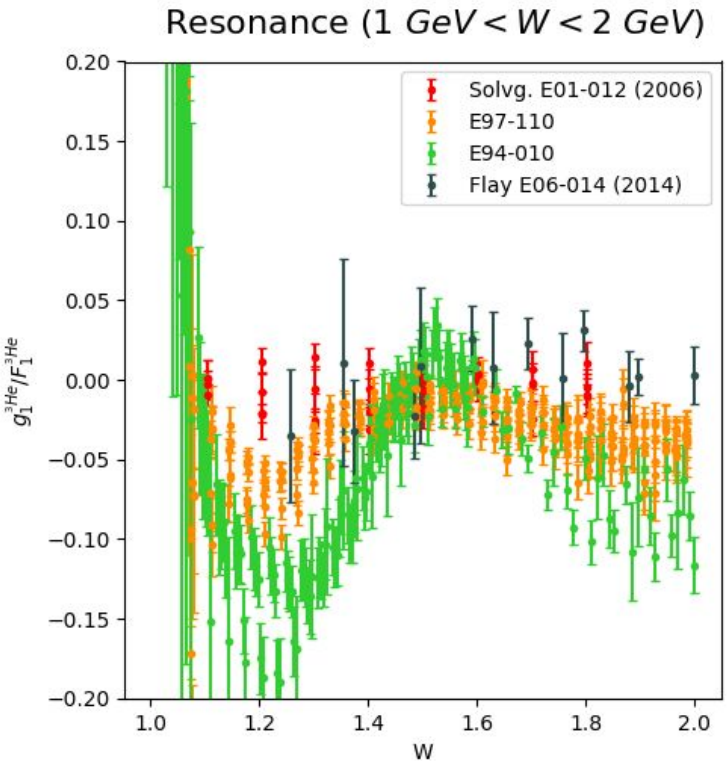
Resonance Fitting

Should rearrange B-W formula so *k* means the peak height (final slide)

- Fit g_1/F_1 resonance peaks with Breit-Wigner distribution

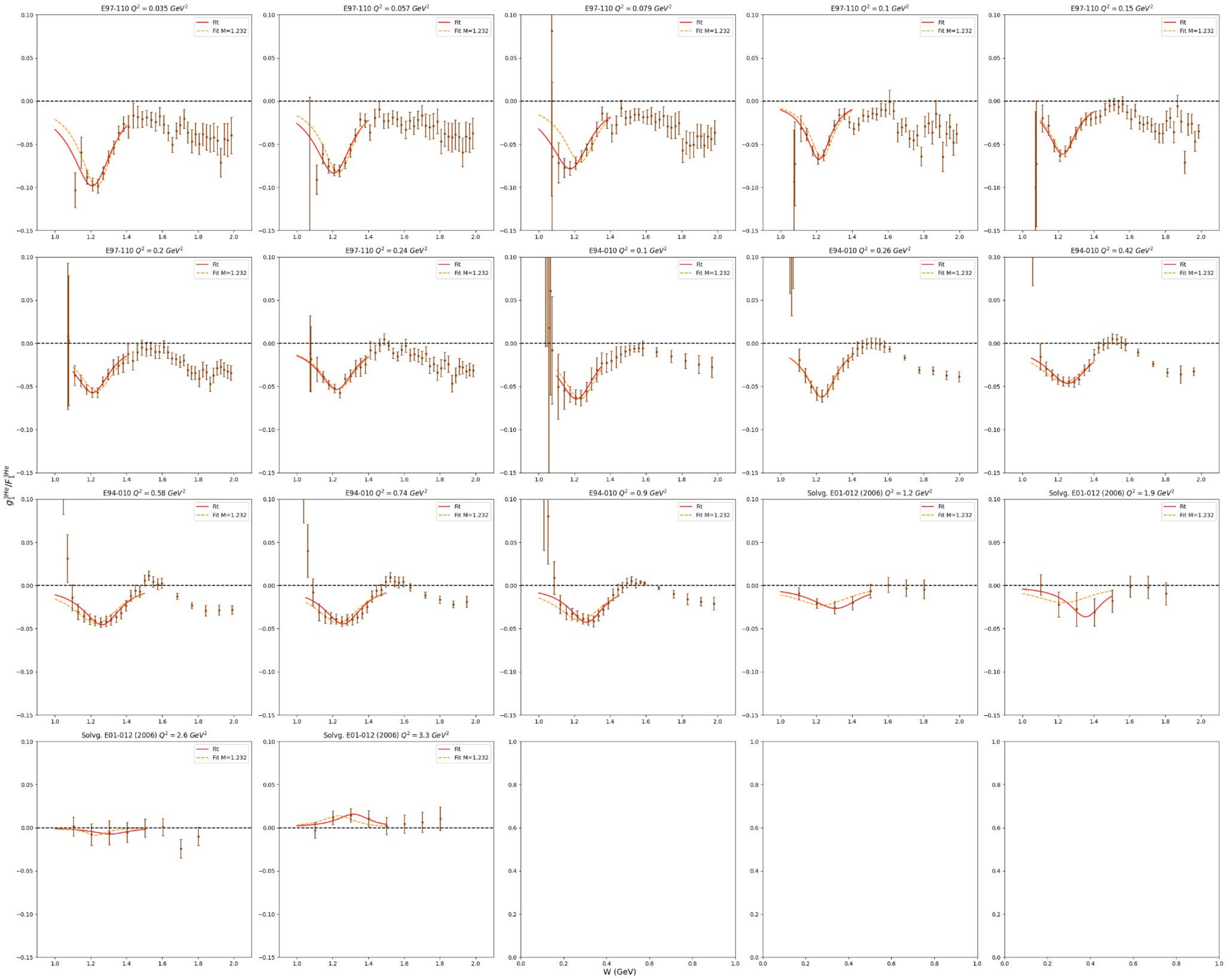
$$f(E) = \frac{k}{(E^2 - M^2)^2 + M^2\Gamma^2}$$

  - *k is a constant*
  - *Γ is the width at half max*
  - *M* is the mass of the resonance
- *k*, *Γ* depend on Q^2
- Unsure what the relationship between *k*, *Γ* and Q^2 is
-> fit for constant Q^2 and fit the parameters versus Q^2

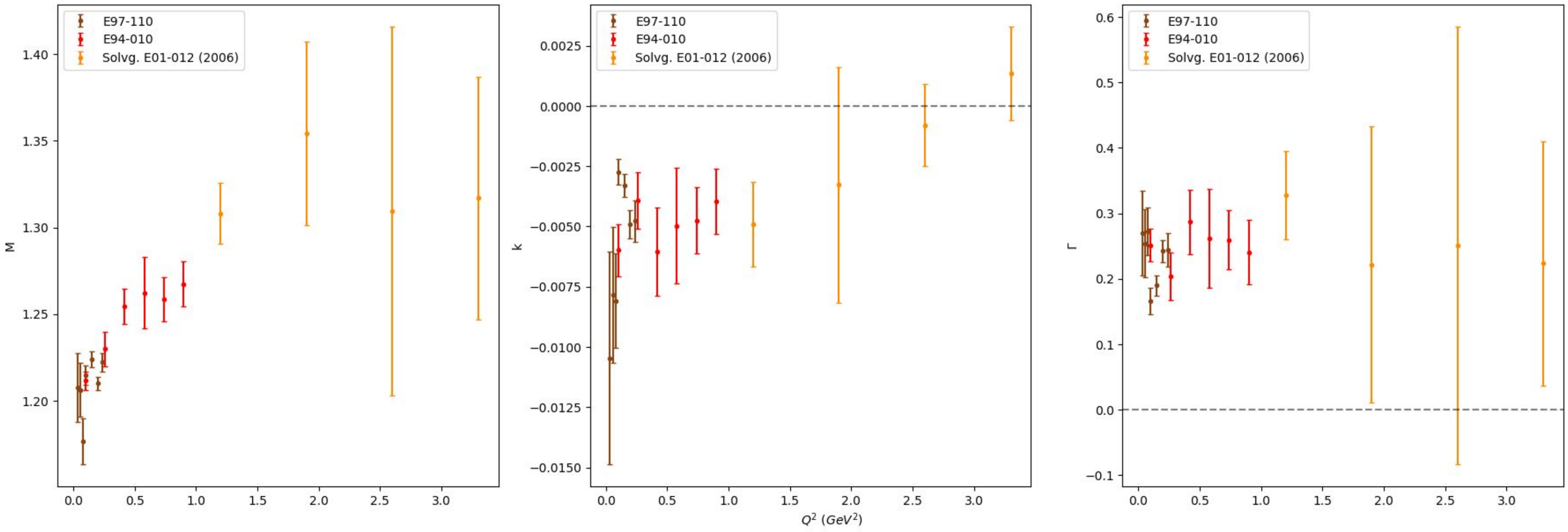


Delta Peak Fits

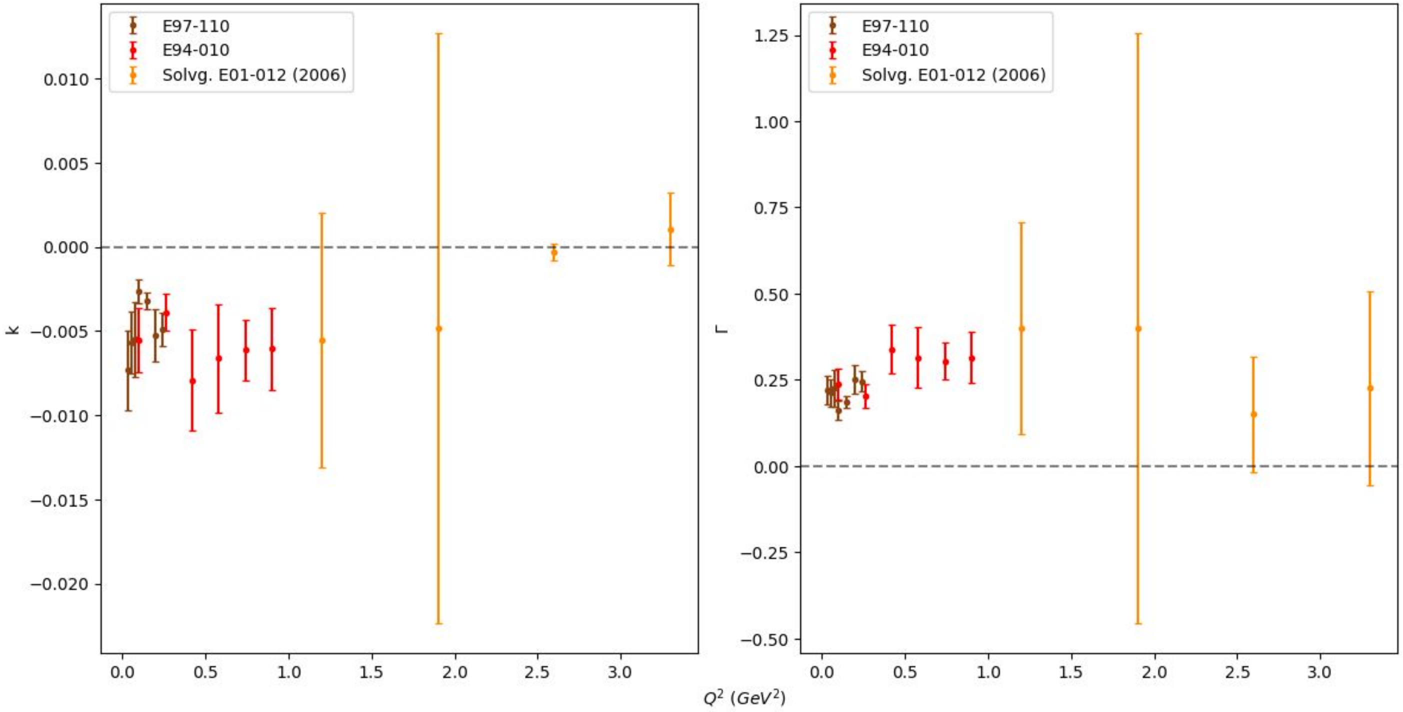
- Yellow = fixed M fit
- Red = variable M fit
- Should fit k and Γ from the *variable* M fits



M, k, and Γ vs Q^2 (floating M Delta fit)

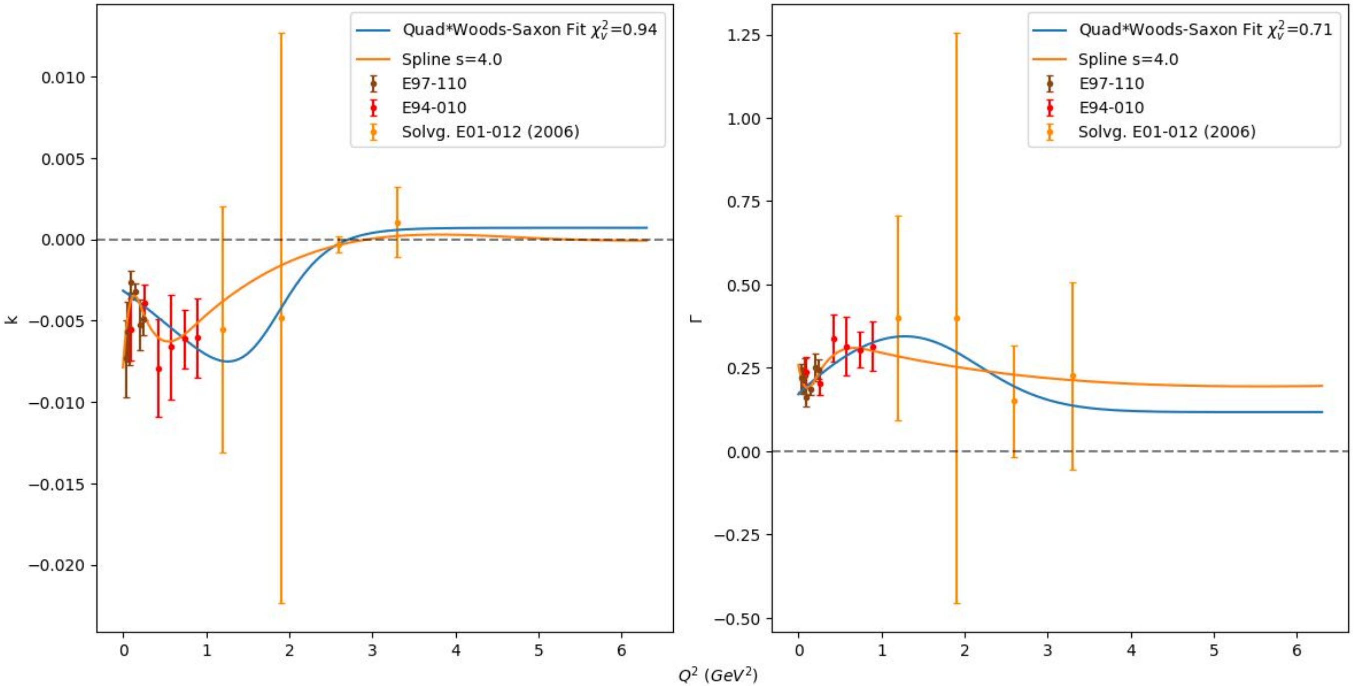


k and Γ vs Q^2 (fixed M Delta fit)



k, Γ Global Fits (fixed M)

- Fitted k and Γ values from "fixed" Delta fit for all bins with cubic spline and "Woods-Saxon" form times quadratic
    - Added extra term y_0 for constant end behavior for the latter
- Set Woods-Saxon parameters p_0, p_1, p_2 to constants and adjusted them to get better fits



Should do away with spline and refit (check final slide)

$$k = (a + bx + cx^2)\left(\frac{0.7}{1.0\ +\ e^{(x-1.7)/0.3}}\right) + y_0$$

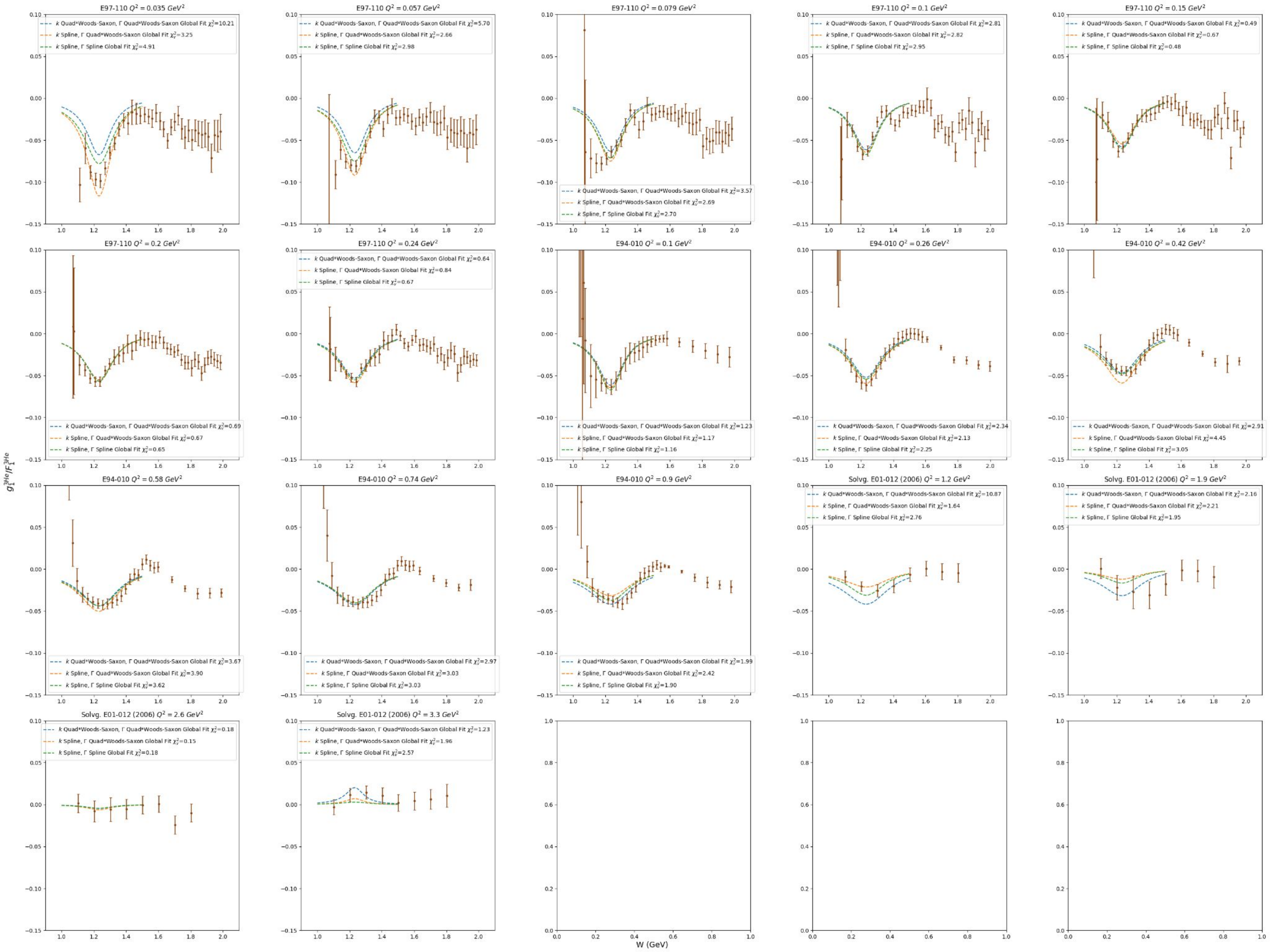
$$\Gamma = (a + bx + cx^2)\left(\frac{1.3}{1.0\ +\ e^{(x-2.0)/0.5}}\right) + y_0$$

$$y = (a + bx + cx^2)\boxed{\left(\frac{p_0}{1.0\ +\ e^{(x-p_1)/p_2}}\right)} + y_0$$

Woods-Saxon

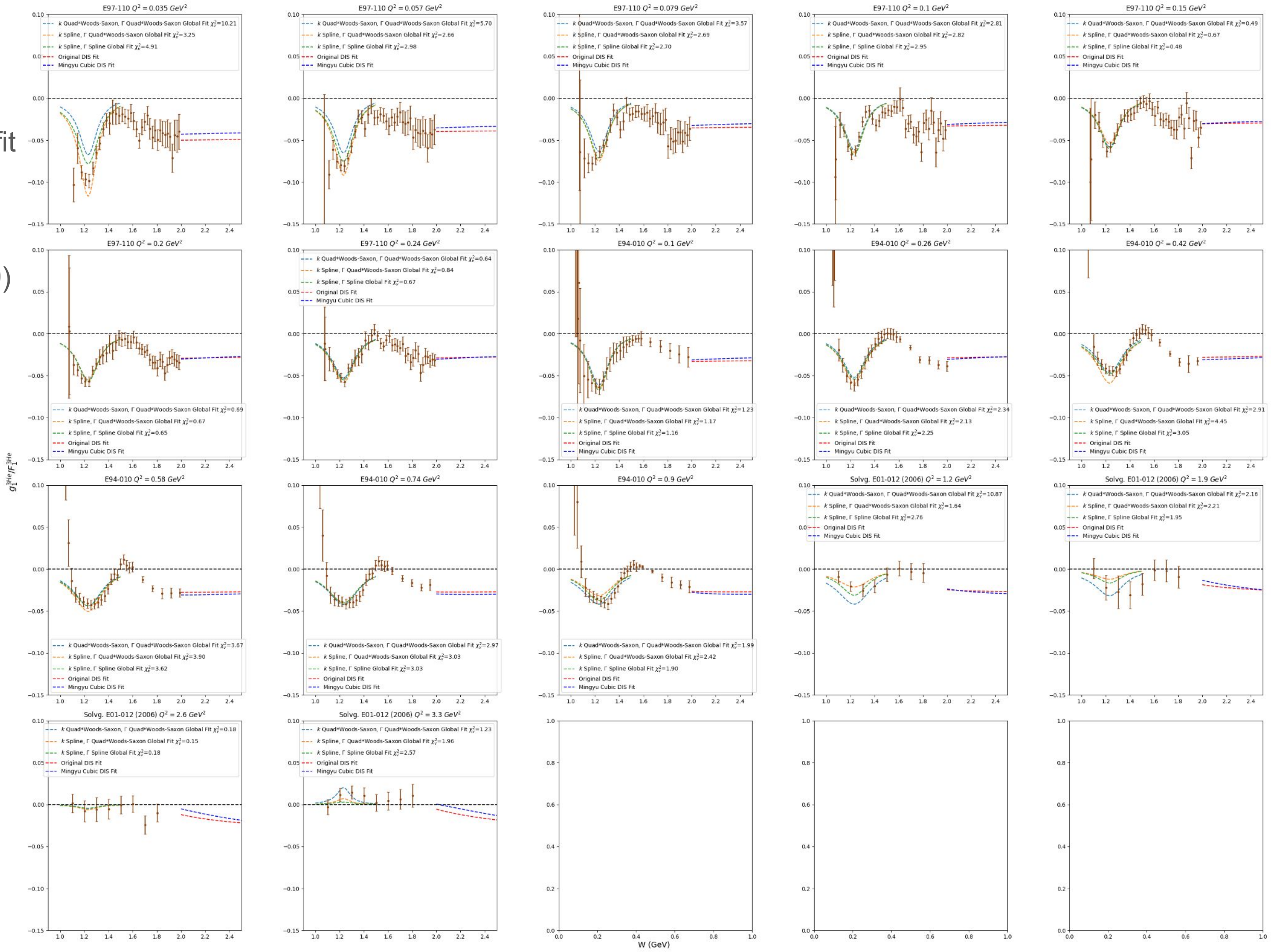
Fitted curves for spline of k and Γ, quad*Woods-Saxon fits of k and Γ, and spline of k and Woods-Saxon fit of Γ

- Spline generally does much better
- Spline of k and quad*Woods-Saxon fit of Γ seems to be the best approach



Extended Quadratic and Cubic DIS fits to resonance region

- Substituted β from cubic fit into quadratic form to get better behavior in resonance region (β=0.11059 $\rightarrow$ β=0.04469)



Continuing Work Notes (To Do)

- Change Breit-Wigner so k represents the actual peak height and refit Delta peaks:
    - substitute with k_new = $k/(M^2 * \Gamma^2)$
- Try fitting the varying mass parameters (M, k, Γ) as well
- Fit the four red gamma points (from E94-010) as a constant and add the result (with uncertainty) at high Q^2 to restrict the gamma fit at high Q^2 - this is more obvious with the Γ values from the fixed fits, but it should work for the variable mass fits (Γ should become constant)
- For the gamma fit, try the quadratic times woods-Saxon to avoid higher order polynomials at low Q^2. Try p_1=0.5 and p_2=0.1
    - Try to push the jump to lower Q^2
- Several ideas for connecting DIS fit to resonance:
    - fit the residual between Delta fit and actual points at the middle region (W=1.5) and add to Breit-Wigner fit in order to hit those points
    - Need a smooth function to connect DIS to Breit-Wigner function at W=1.8 - maybe linear and add in wiggles for lower Q^2 (Q^2=0.1 & 0.5) bins which appear to have some structure.