# Longitudinal Data and g1

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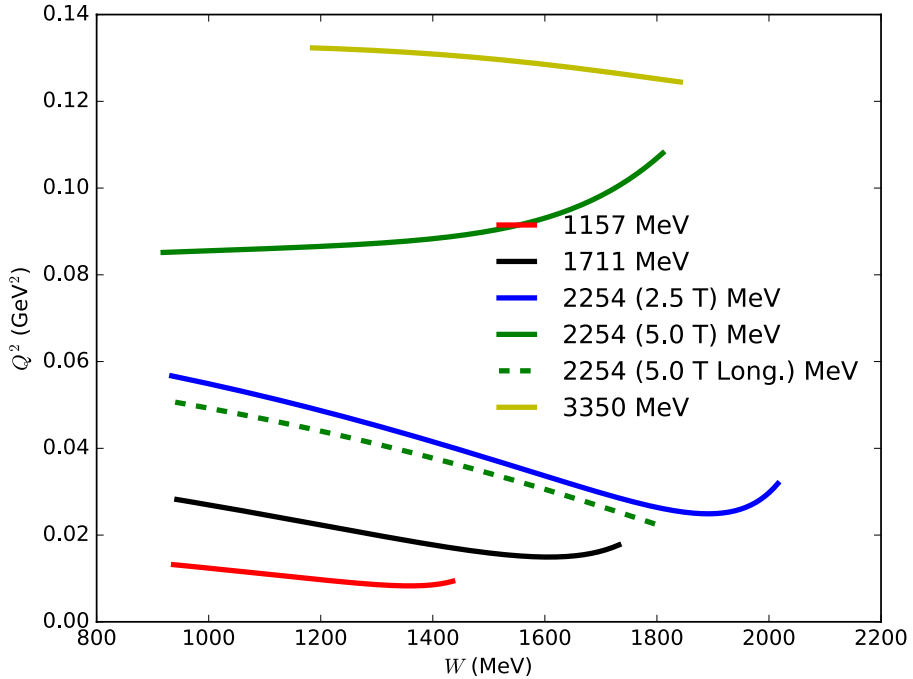
# Overview

- Last week showed Born polarized cross sections (DS) with systematic error
- This week will go one step further and extract $g_1$ and evolve to constant $Q^2$
  - Keeping track of the systematic errors as I go
- Focusing on longitudinal data for this week
- With SSF's can then evaluate moments!
- Just for clarity: longitudinal data -> 2.2 GeV 5T, θ = 5.77°

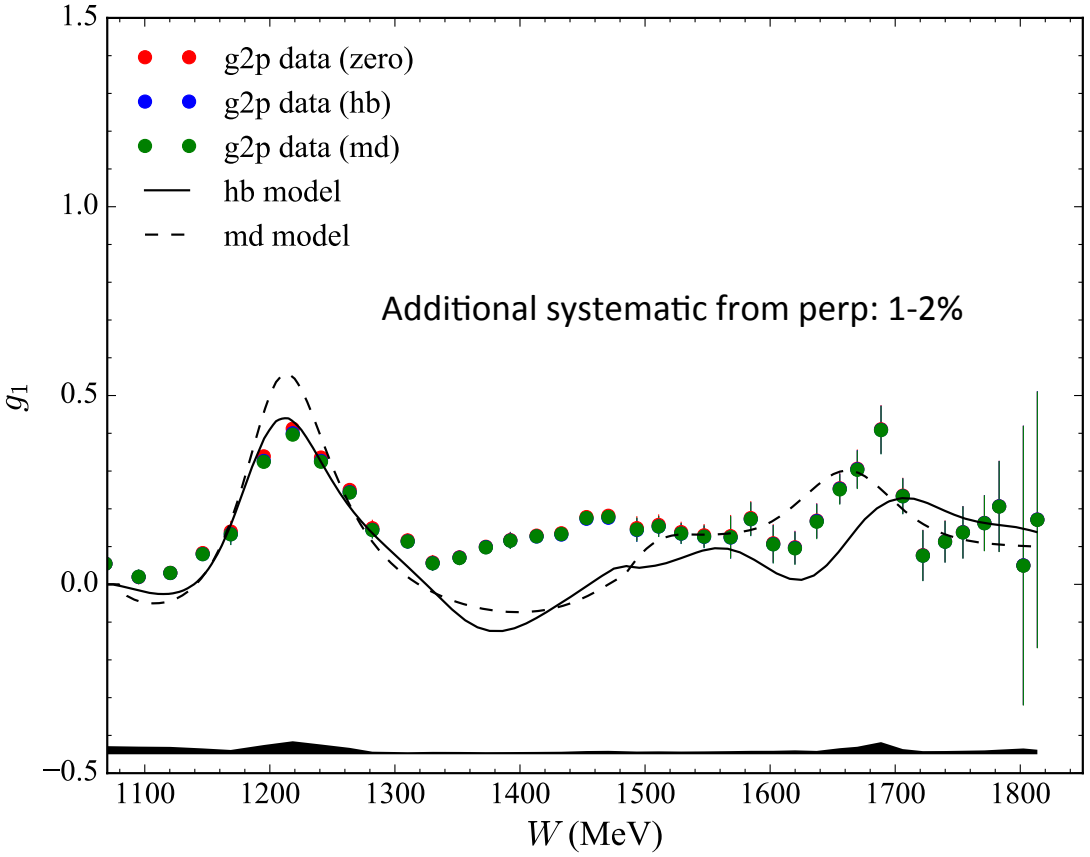


# Extracting the SSF

$$g_1 = \frac{MQ^2}{4\alpha_e^2}\frac{y}{(1-y)(2-y)}\left[\Delta\sigma_{\parallel} + \tan\frac{\theta}{2}\Delta\sigma_{\perp}\right]$$

For 5.77° -> 0.05

Use MAID/Hall B/Assume 0 for perpendicular component and take STD of $g_1$ as systematic

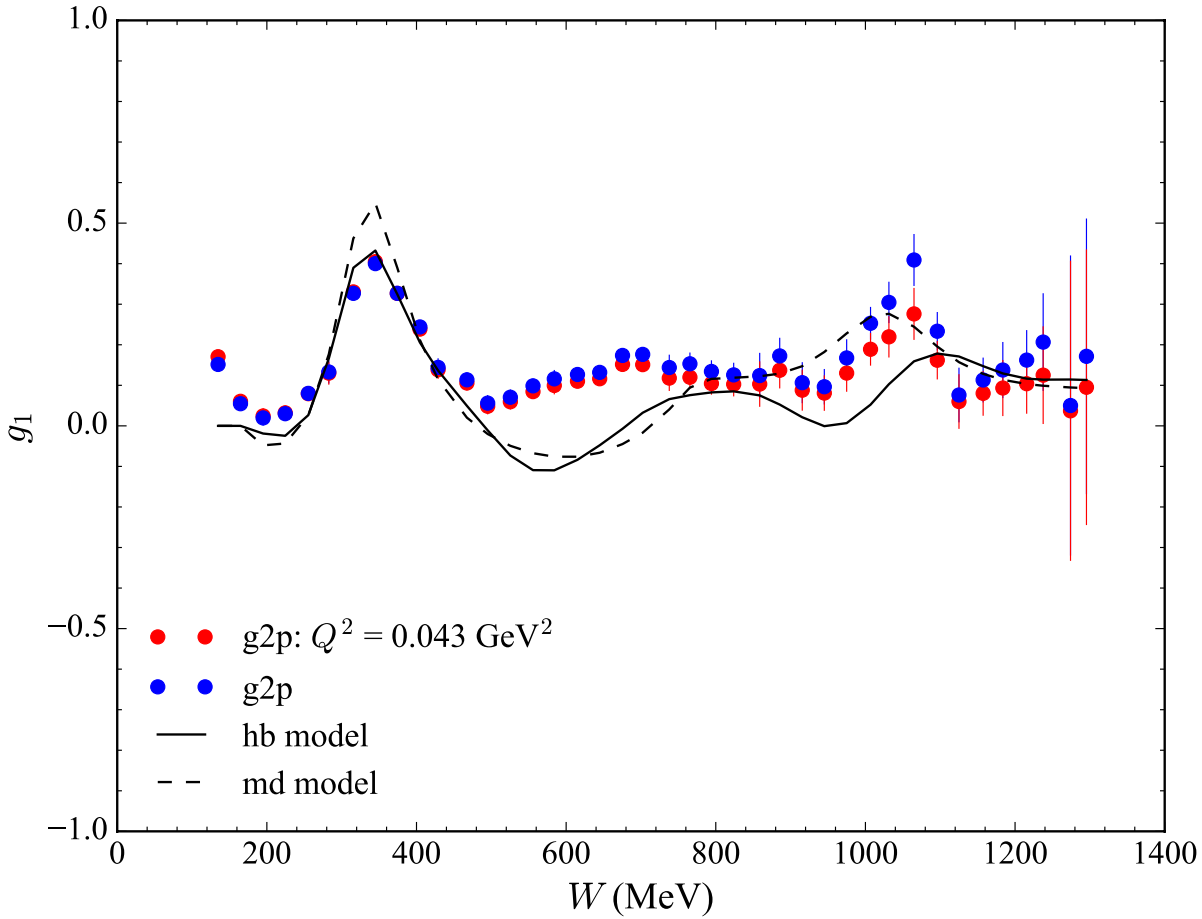


# Evolving to Constant $Q^2$

Method: Run HallB/Maid models at the $Q^2$ of the data and the $Q^2$ I want to evolve it to

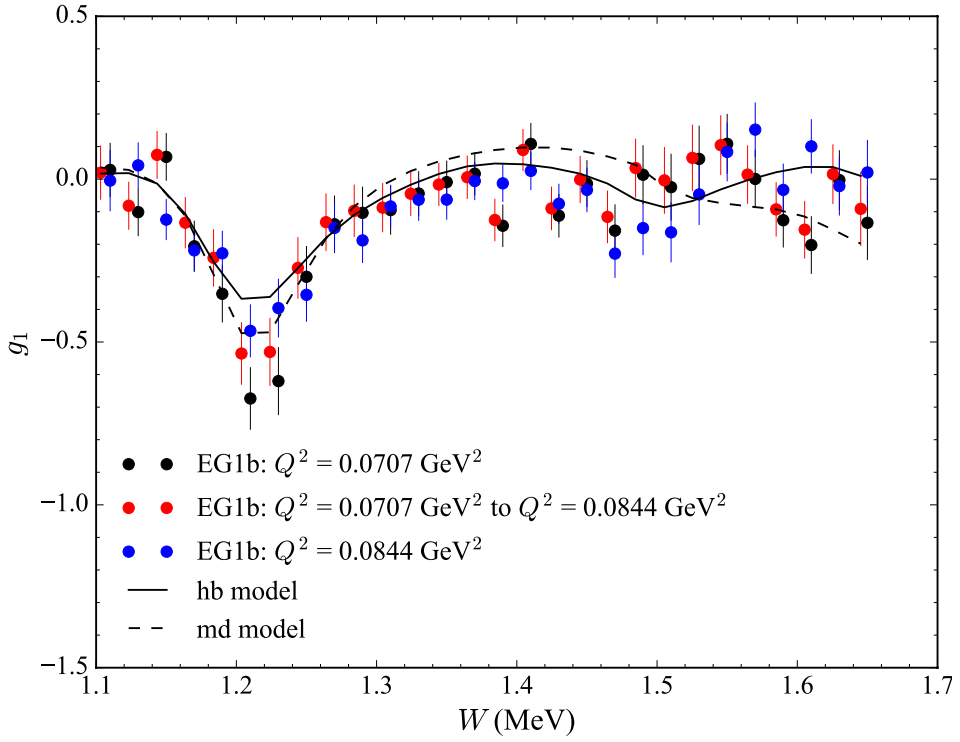
Apply correction of form δ = (Q2_data/Q2_const)*[(Model(Q2_const) – Model(Q2_data)]

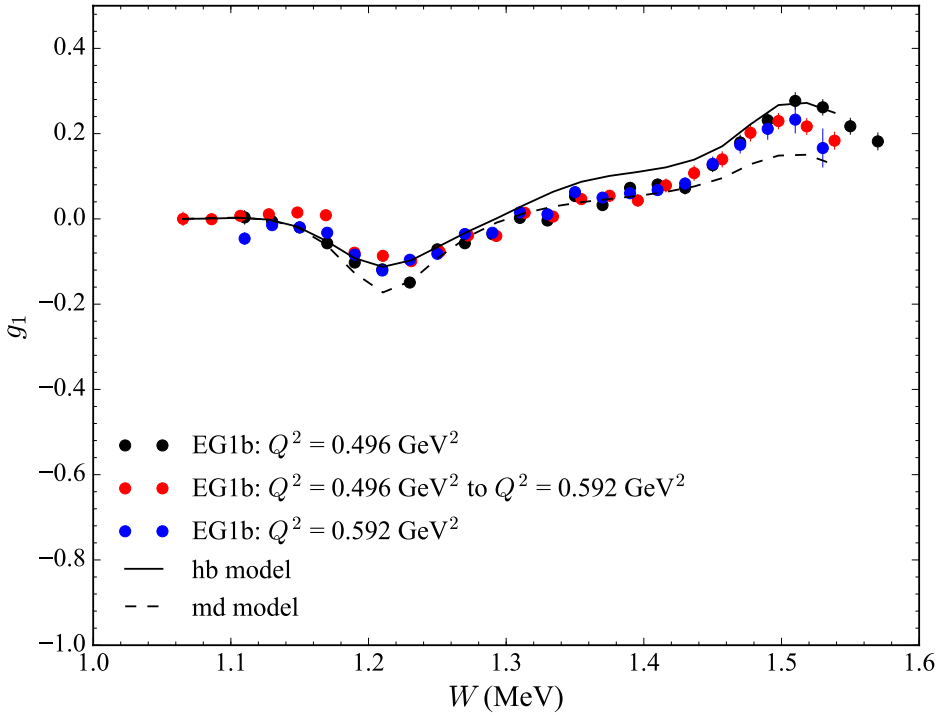
Difference between HallB and MAID results is systematic



# Comparing with Hall B

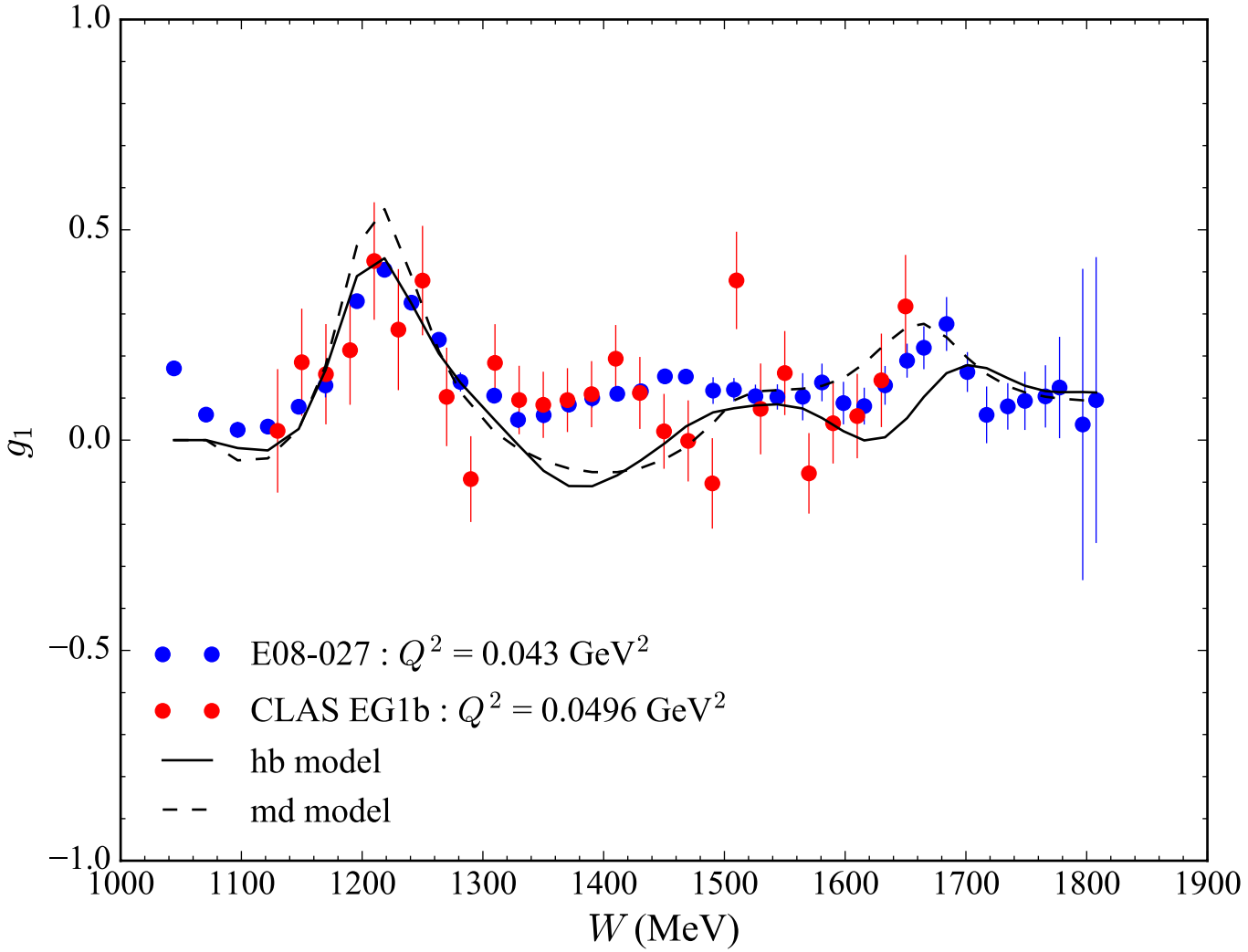
Test evolution procedure on  Eg1b data
Data taken from clas database: http://clas.sinp.msu.ru/jlab/



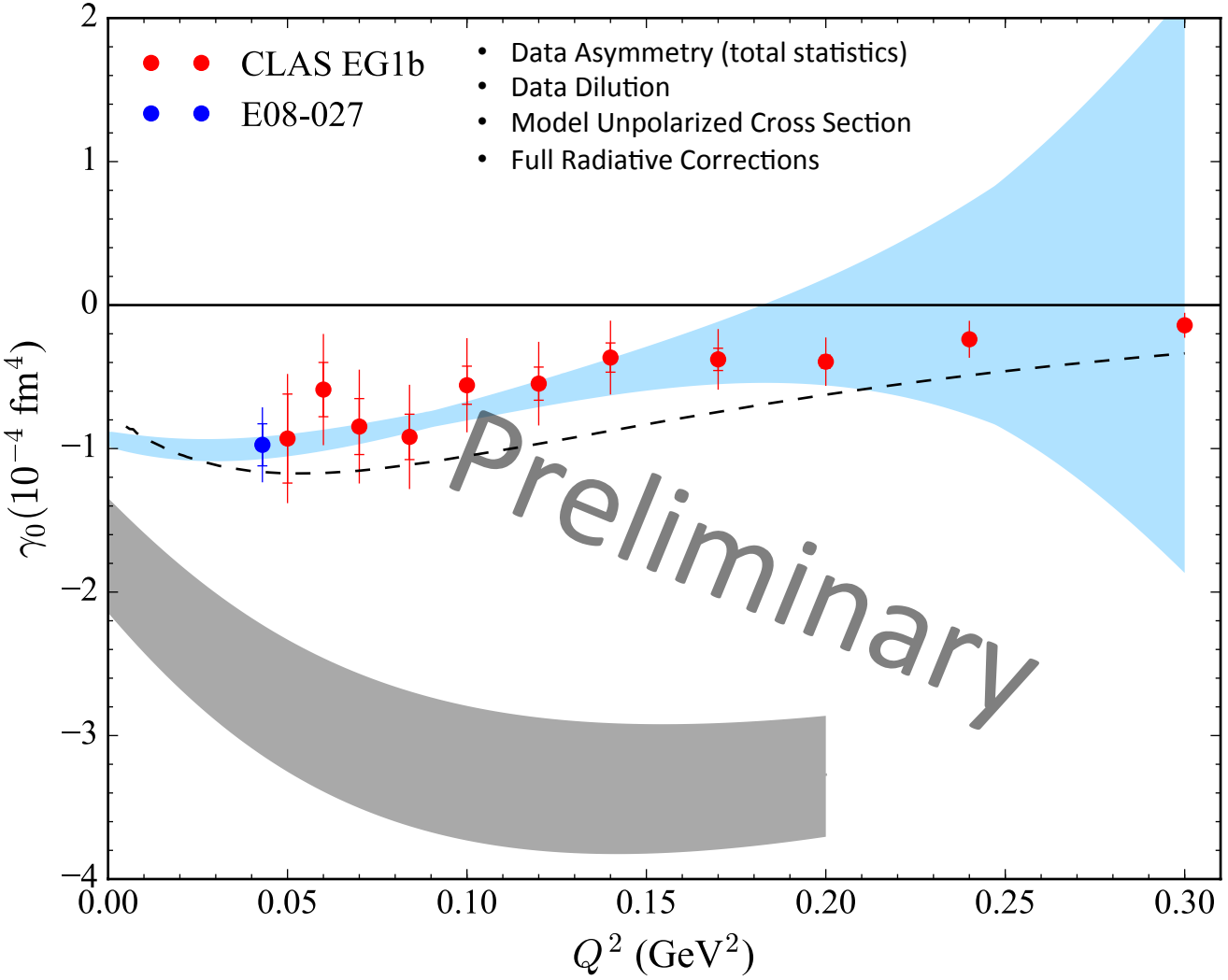
# Comparing with Hall B

Compare g2p longitudinal data with lowest $Q^2$ Eg1b data



# $\gamma_0$ Moment

$$\gamma_0(Q^2) = \frac{16\alpha M^2}{Q^6}\int_0^{x_0} x^2\left[g_1(x,Q^2) - \frac{4M^2}{Q^2}x^2 g_2(x,Q^2)\right]dx.$$



# Explaining the Previous Slide

- Blue band is updated Pascalutsa calculation that Vince sent to mailing list
- Grey band is Meissner calculation from same email
- Inner error bars are statistical/outer are total (sys/stat add in quadrature)
- Checked integration using Seonho Choi's Better Simpson routine and python trapezoidal integration
  - Better Simpson also does uncertainty calculation and agrees with Monte-Carlo method
- Additional systematics:
  - $g_2$ contribution : 30% change in $g_2$ creates a 12% spread in $\gamma_0$ -> Assume 12% additional systematic added in quadrature
  - Integrate by samples error:
    - Compare an integration by samples at same binning as g2p data of HallB $\gamma_0$ to gaussian quadrature integration where integration calls HallB model whenever it needs it
    - New systematic 3%
  - Low x-portion (as evaluated in HallB model) is three orders of magnitude smaller than measured contribution so ignore

# Going Forward

- Longitudinal data looks good and at lower $Q^2$ than previously published
- Have confidence in my moment calculations and integration
- Moving onto other $g_1$ quantities and also our transverse data
- Questions/Comments/Concerns?