LHRS Analysis for d_2^n

Fits to World Data

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3/1/12

Outline

Cross Section Model (1)

Motivation

- The accuracy of the cross section model has a large effect on the results of the radiative corrections
  - This was evident when comparing QFS to the Gaussian and exponential fit used for our data (shown last week)
  - The ‘optimized’ QFS model was good to 10–20% percent for most of the world data

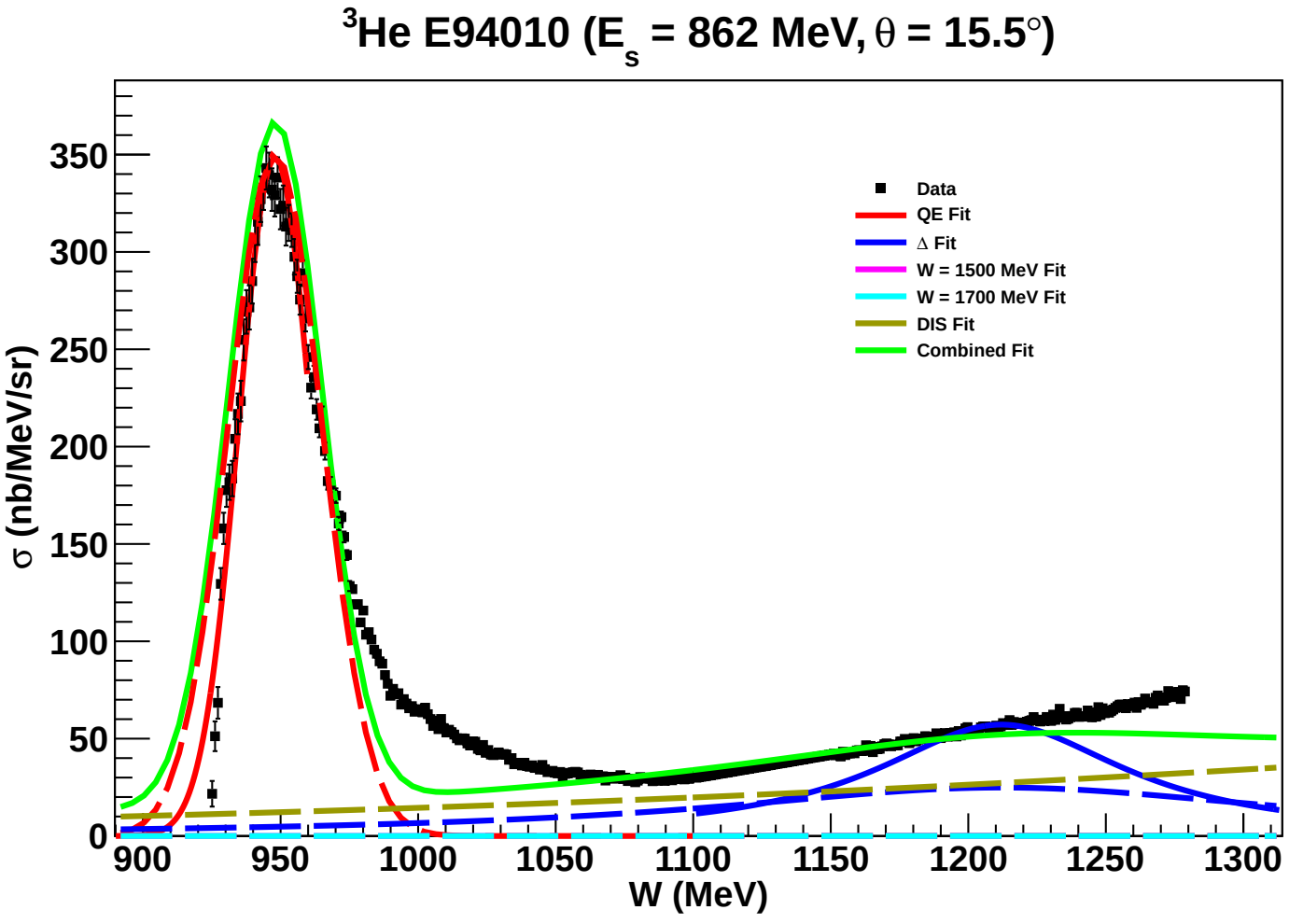
Cross Section Model (2)

Functional Form

- We fit each subprocess to an appropriate function (i.e., Gaussian, Lorentzian or exponential) as a function of W
  1. Q.E.: $f(W) = A \exp\left[-\frac{1}{2}\left(\frac{W-M_N}{\sigma}\right)^2\right]$
  2. Δ: $f(W) = \frac{1}{\pi}\frac{\frac{1}{2}\Gamma}{(W-M_\Delta)^2+\left(\frac{1}{2}\Gamma\right)^2}$
  3. R1: $f(W) = A \exp\left[-\frac{1}{2}\left(\frac{W-M_{R1}}{\sigma}\right)^2\right]$
  4. R2: $f(W) = A \exp\left[-\frac{1}{2}\left(\frac{W-M_{R2}}{\sigma}\right)^2\right]$
  5. DIS: $f(W) = A \exp\left[-\frac{1}{2}\left(\frac{W-\mu}{\sigma}\right)^2\right] + \exp\left[B - CW\right]$
- A, B, C, Γ, μ and σ are free parameters distinct for each subprocess

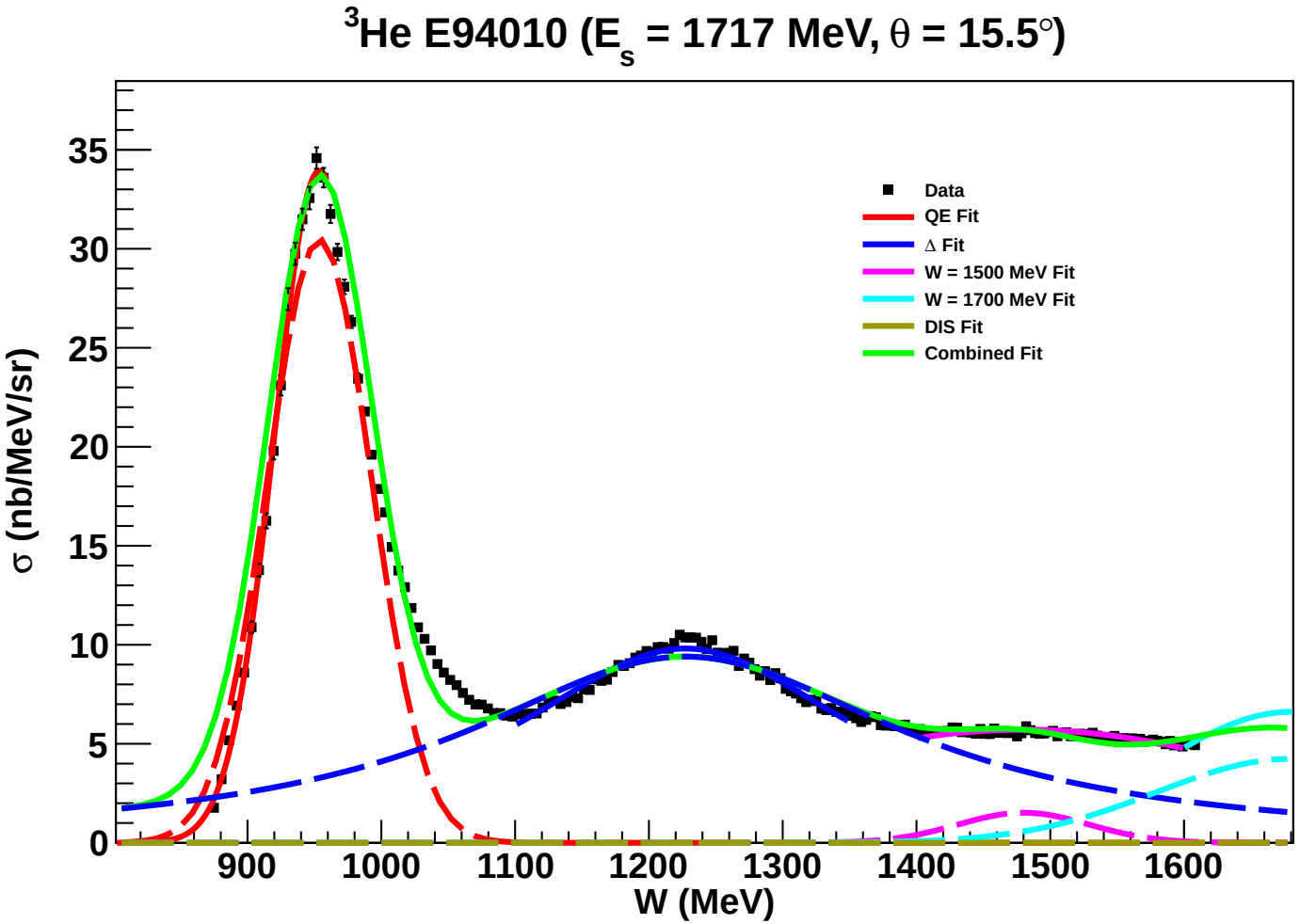
Cross Section Model (3)

Fits to Data



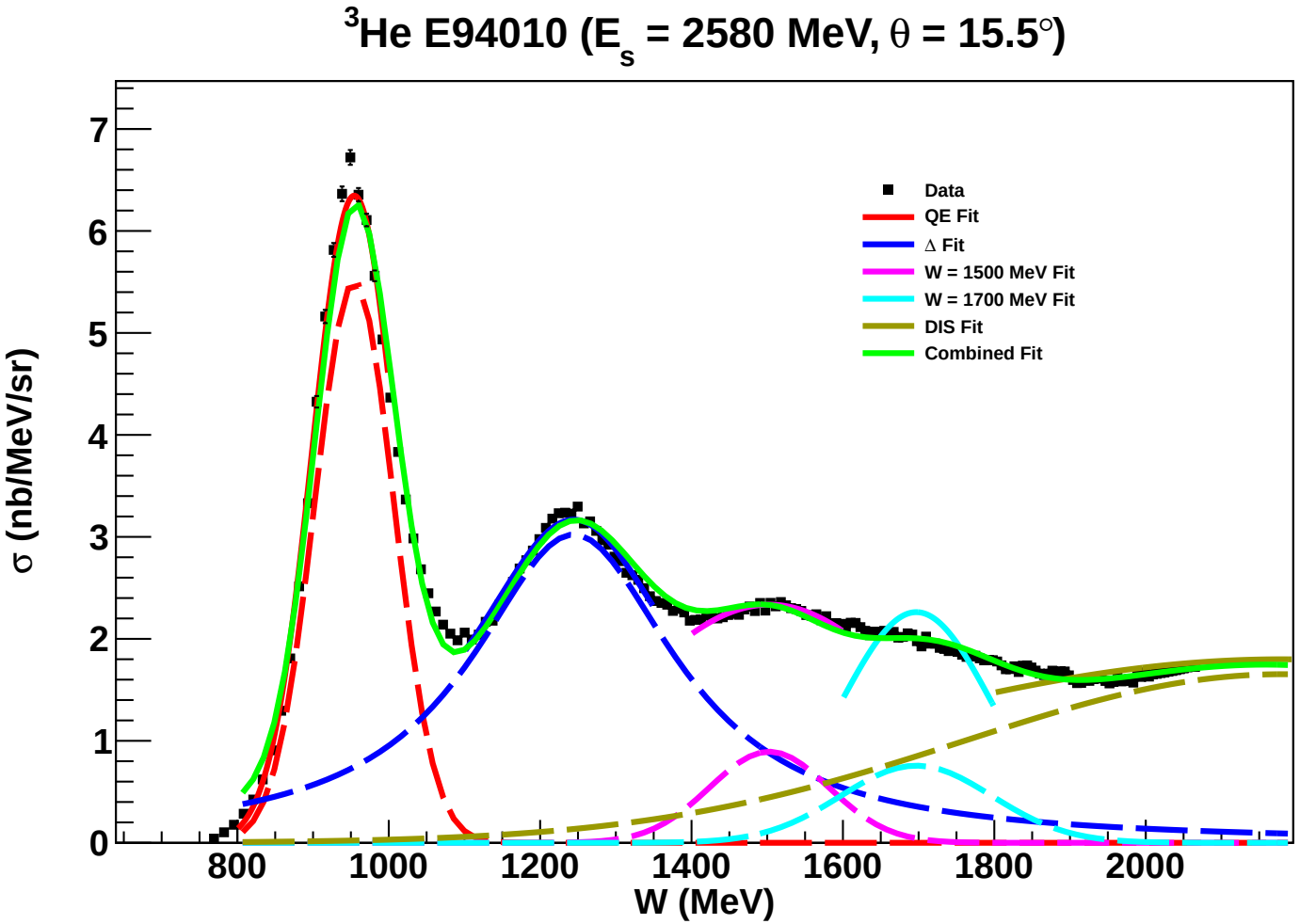
Cross Section Model (4)

Fits to Data



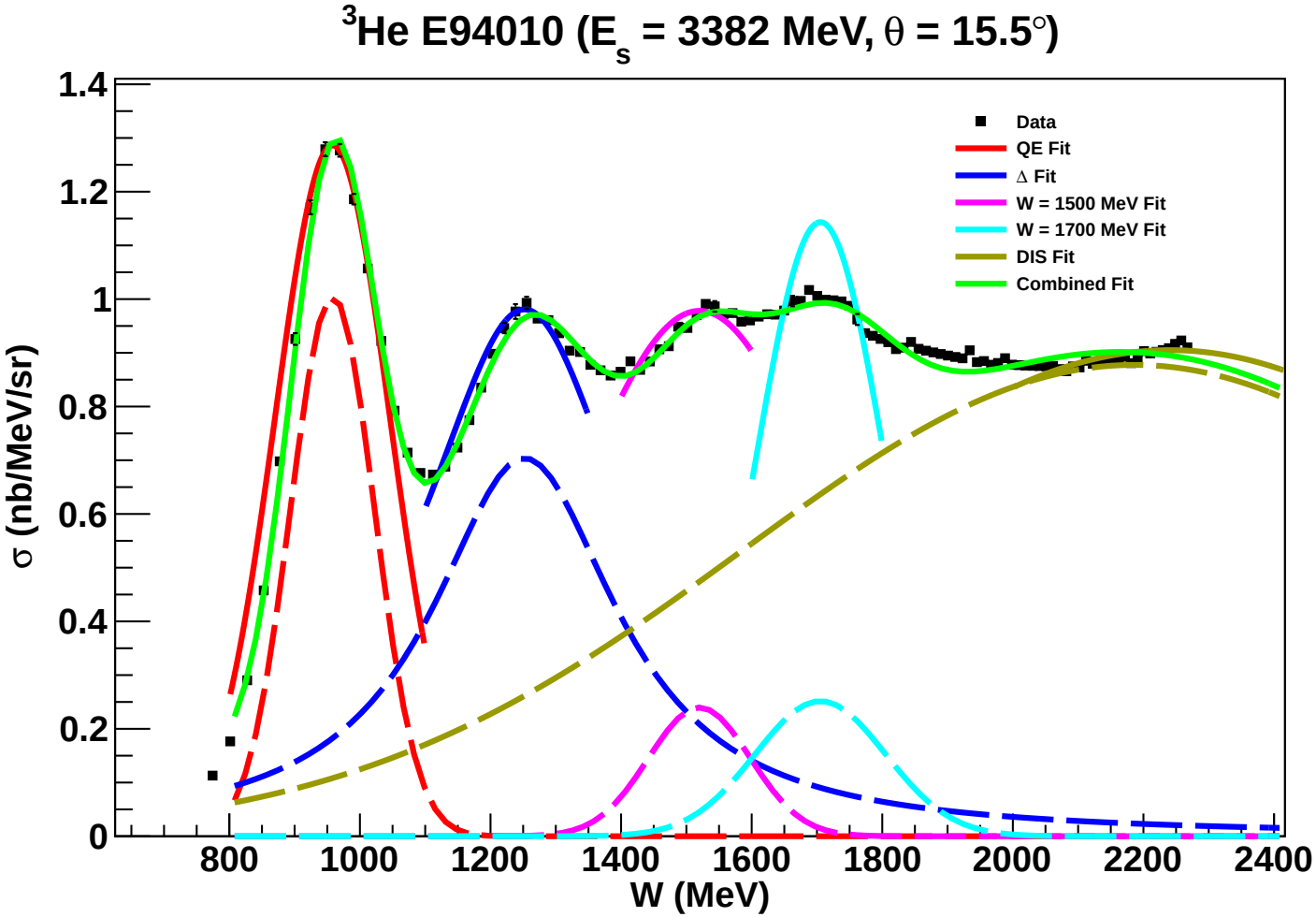
Cross Section Model (5)

Fits to Data



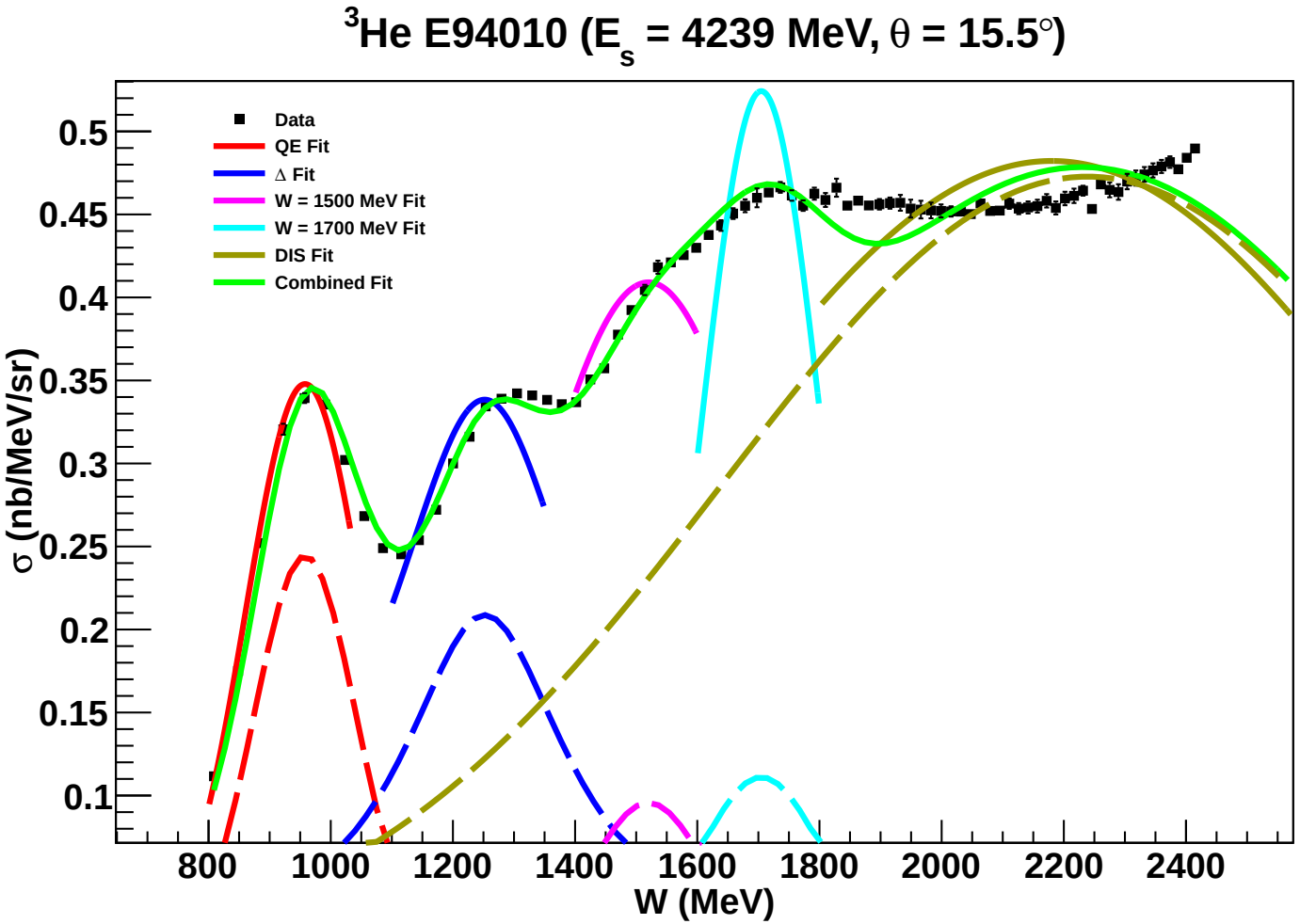
Cross Section Model (6)

Fits to Data



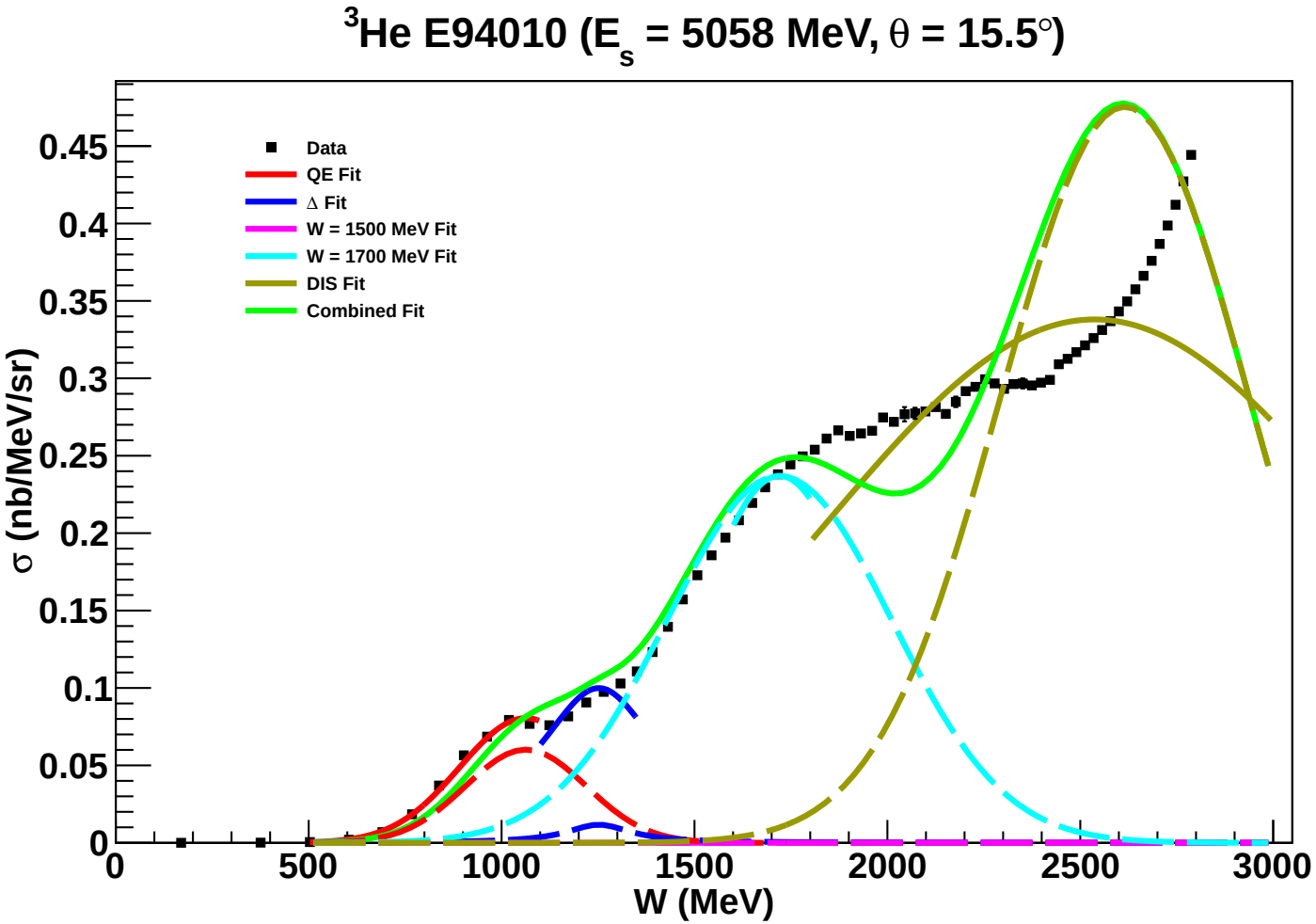
Cross Section Model (7)

Fits to Data



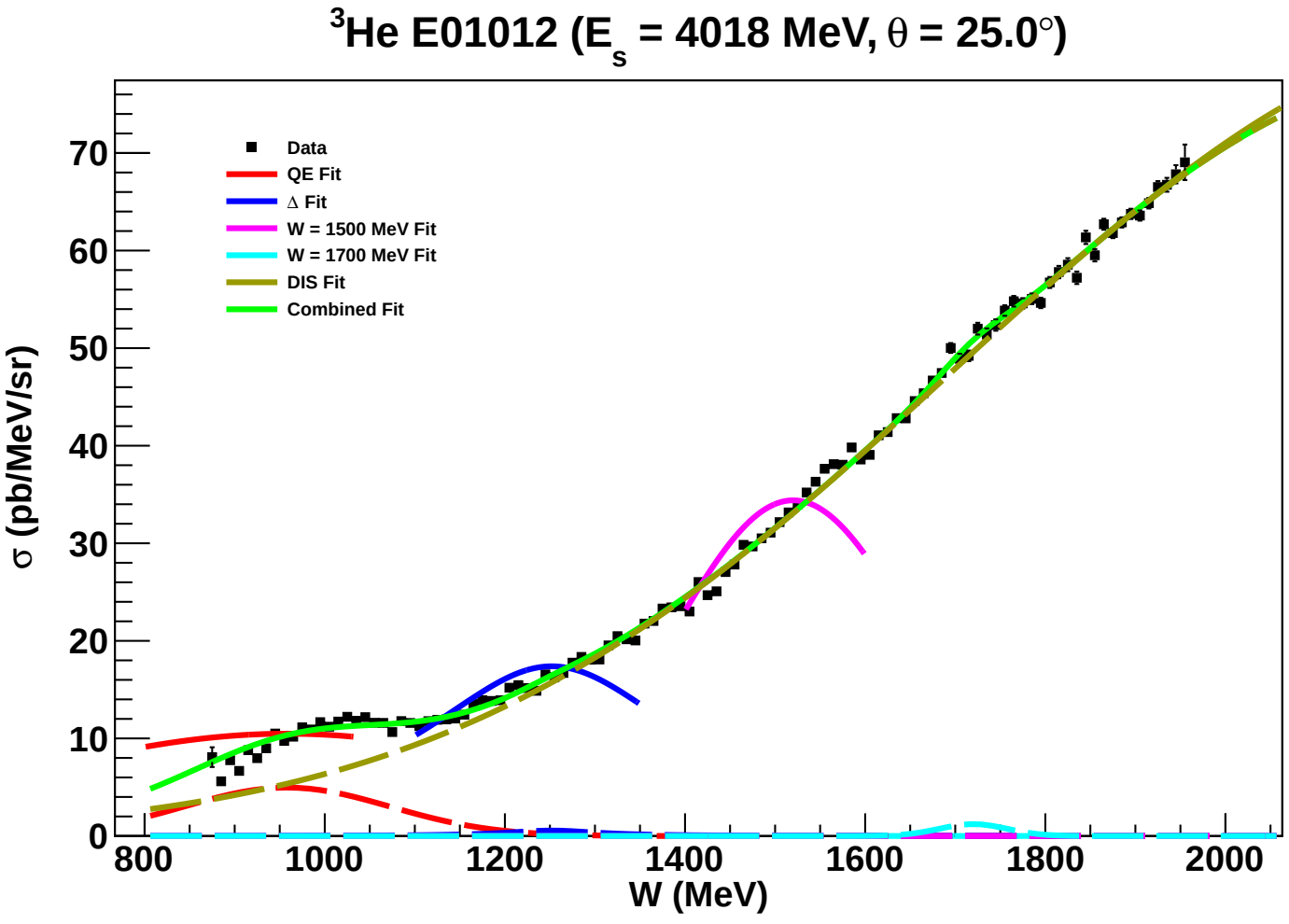
Cross Section Model (8)

Fits to Data



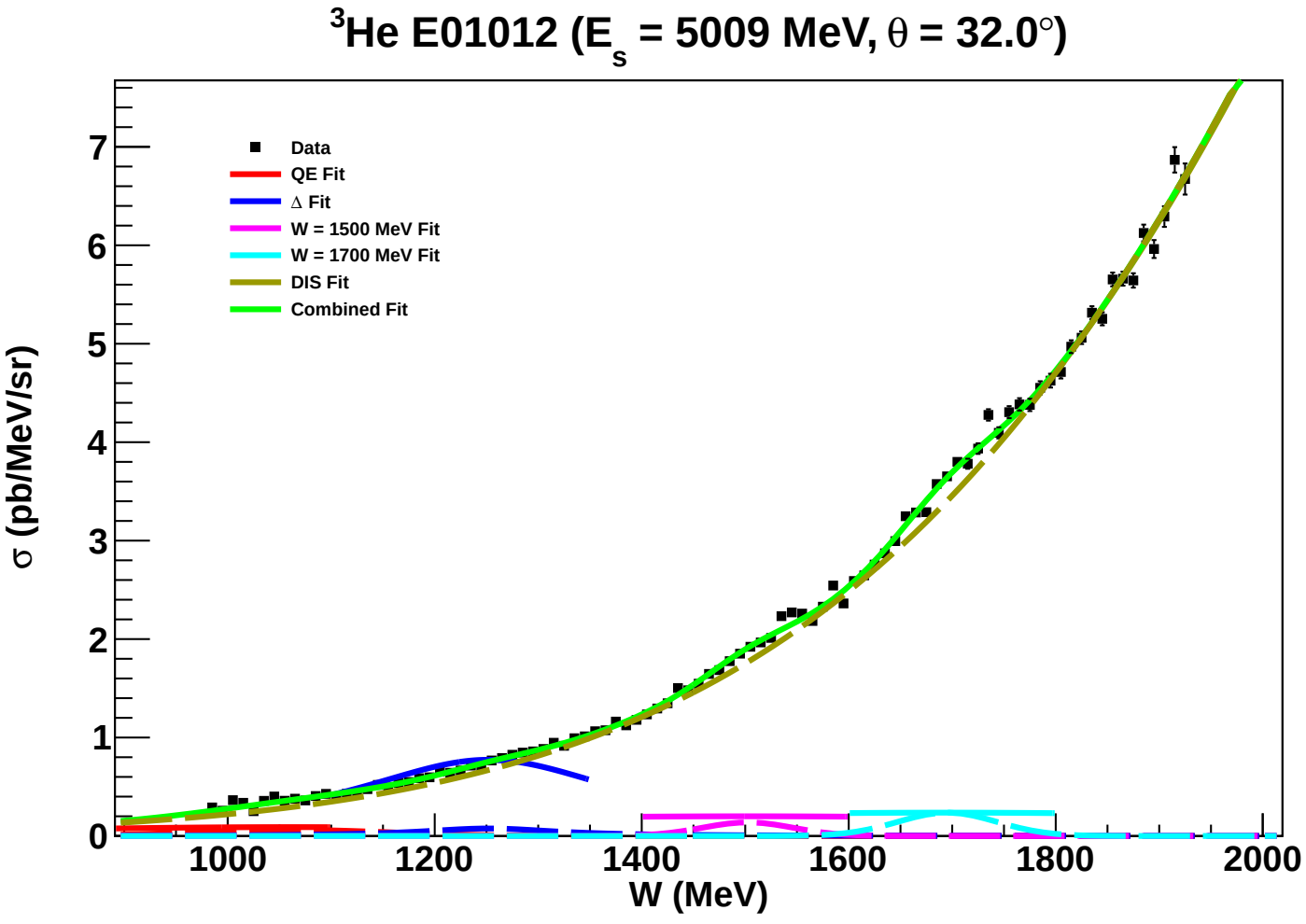
Cross Section Model (9)

Fits to Data



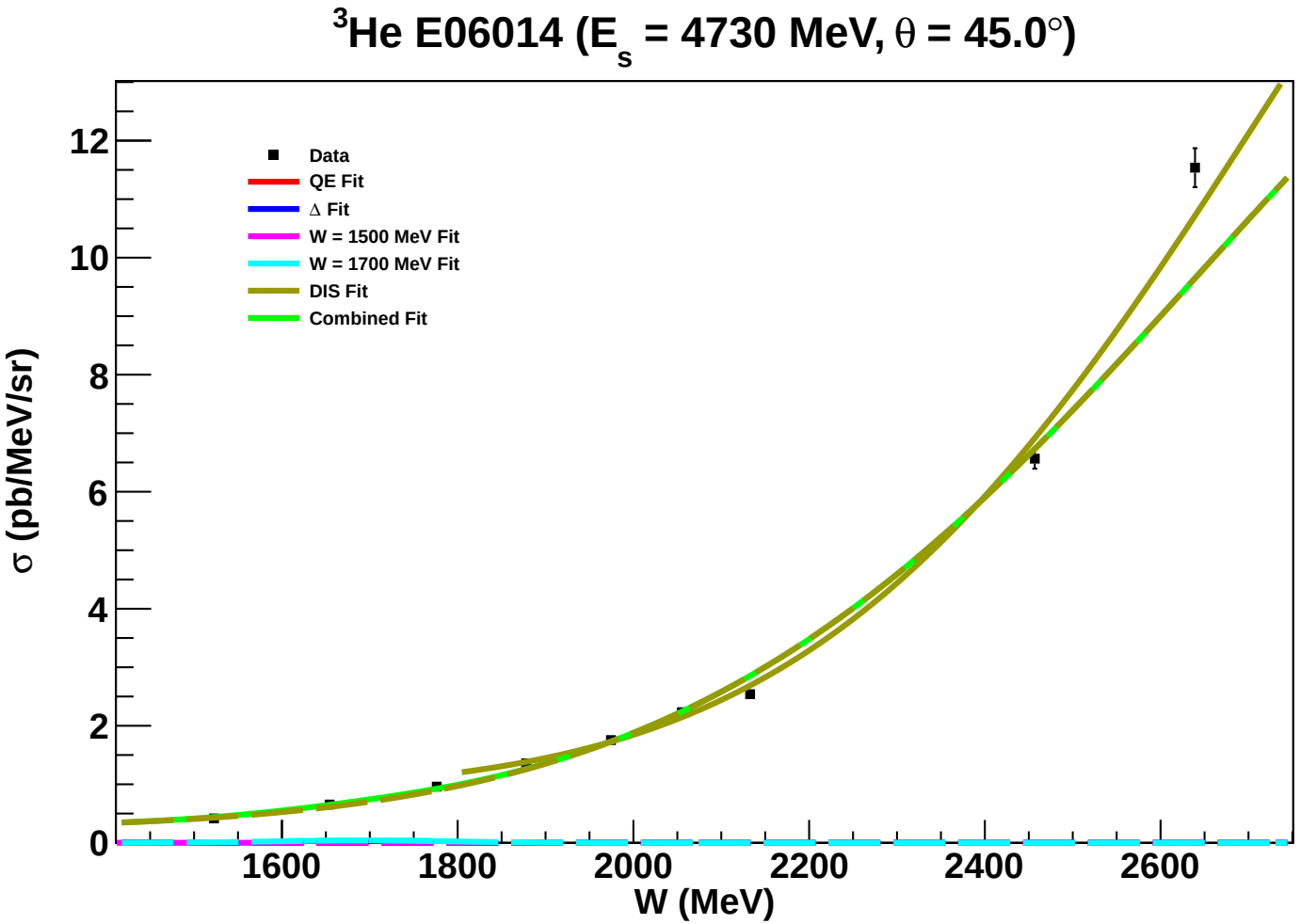
Cross Section Model (10)

Fits to Data



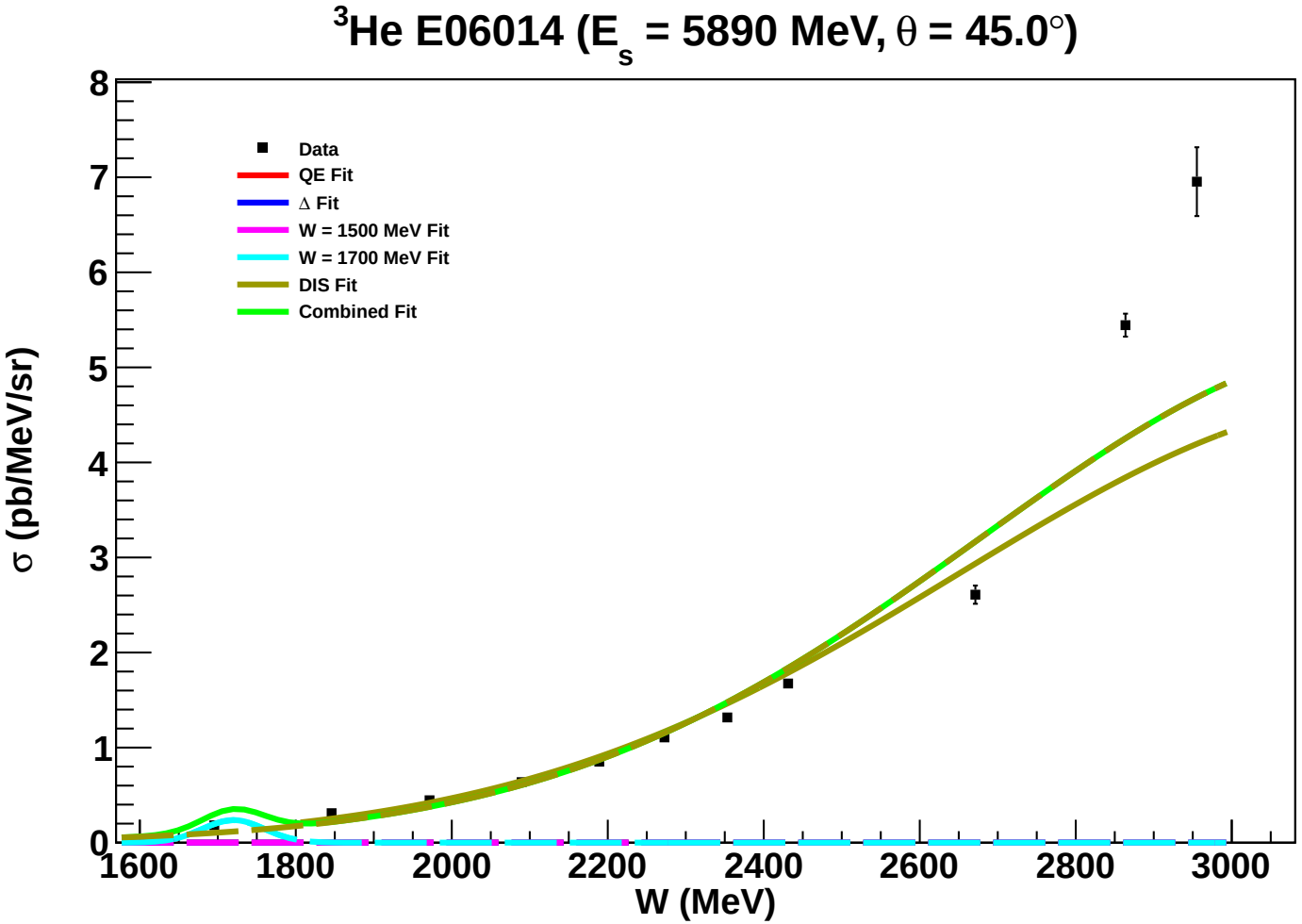
Cross Section Model (11)

Fits to Data



Cross Section Model (12)

Fits to Data



Cross Section Model (13)

Discussion

- The model does a nice job of describing not only Karl's data, but also Patricia's and most of our data
  - The starting point of the parameters for Patricia's and our data was taken to be the values obtained at similar E_s values obtained for Karl's data
  - The fits shown on Patricia's and our data have minimal optimization of said parameters
- At high E_s in Karl's (and our) data, it is evident that we need to be a bit more careful with the model of the DIS region (currently working on this)
- The advantage of this model over QFS is that we can cover all of Karl's data and we have a very accurate picture of Patricia's data (see the QE peak at 4-pass) and the description of our data is quite good as well (besides the needed tweaks at high W)

Summary

- New fit gives very nice results for data at various E_s and θ with minimal tweaks to parameters
  - Need to tweak the DIS fit
- Compared to QFS, the new fit uses less than half of the number of parameters (12 as opposed to 36)
  - M_N, M_Δ, M_{R1}, M_{R2} are fixed

What's Next?

- Tweak the fit for the DIS region (sum-of-exponentials fit, valid for $W > 2\,\mathrm{GeV}$)
- Convert the fits into functions of E_s, E_p and θ
  - Determine functional form of the free parameters $A, B, C, \Gamma, \mu, \sigma$ in terms of E_s (and θ if necessary) for each subprocess
  - Allows us to determine any ^{3}He cross section we need for our radiative corrections