LHRS Analysis for d_2^n

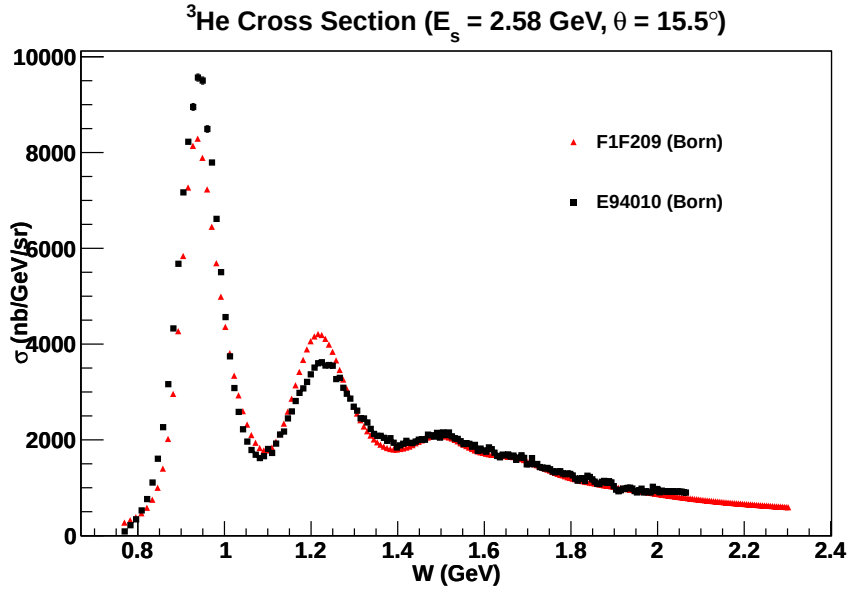
Radiative Corrections to Real Data and Their Systematic Errors

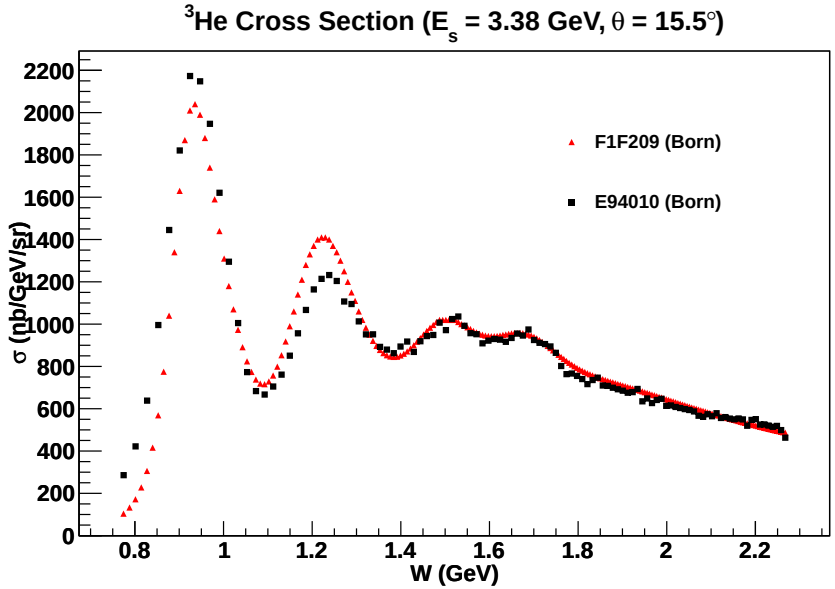
D. Flay

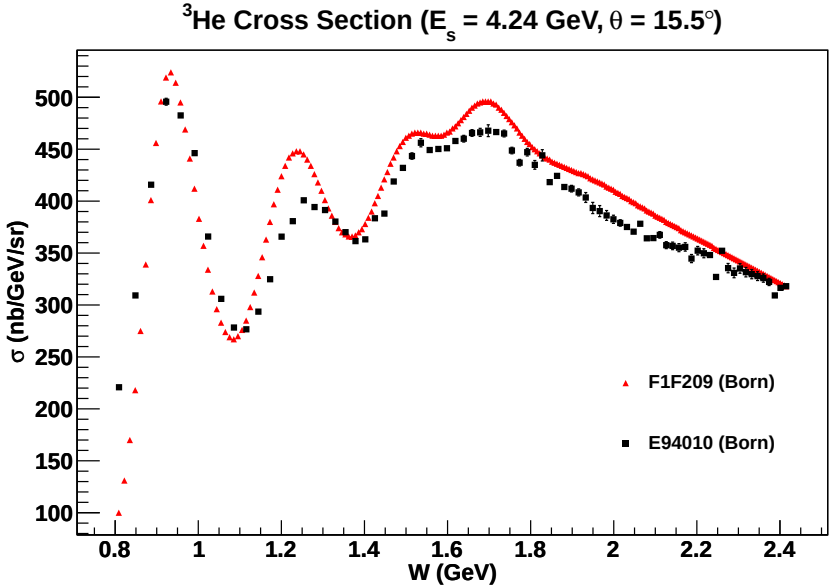
4/26/12

Outline

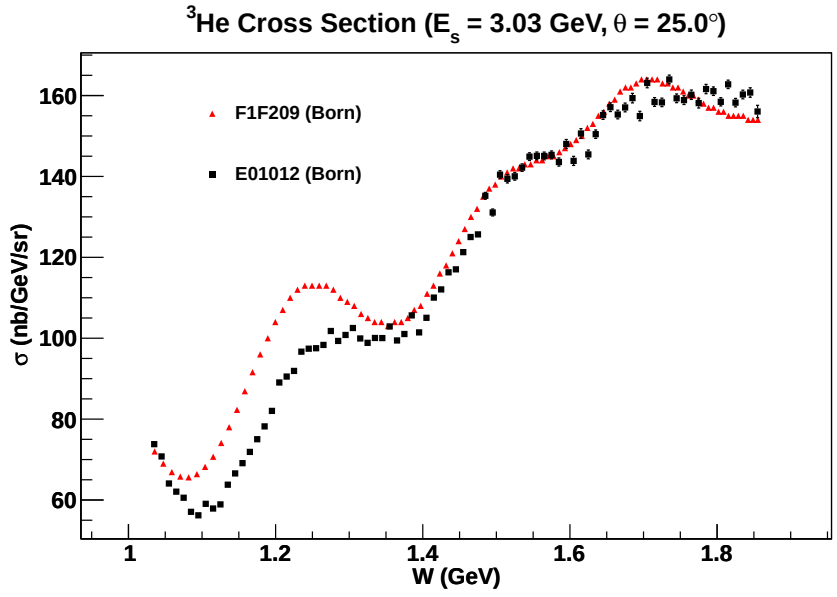
F1F209 Cross Section Model (1)

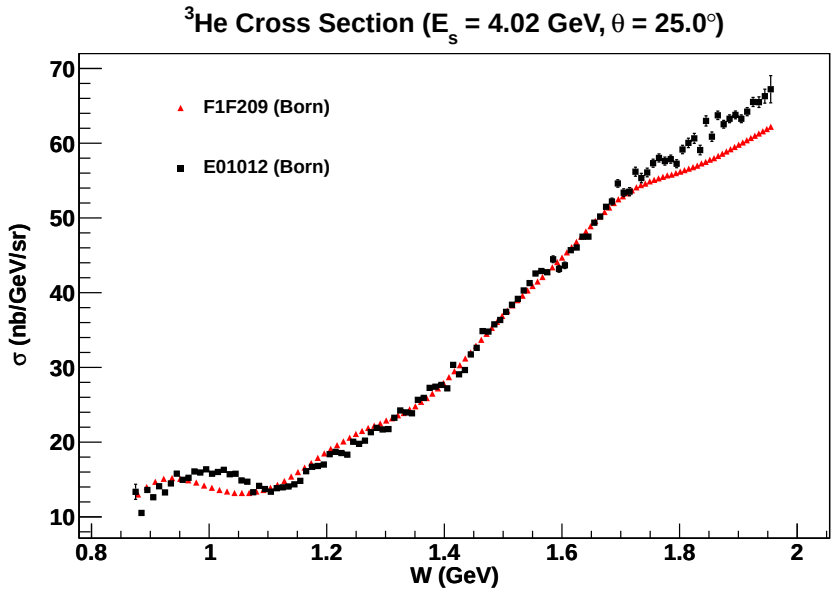


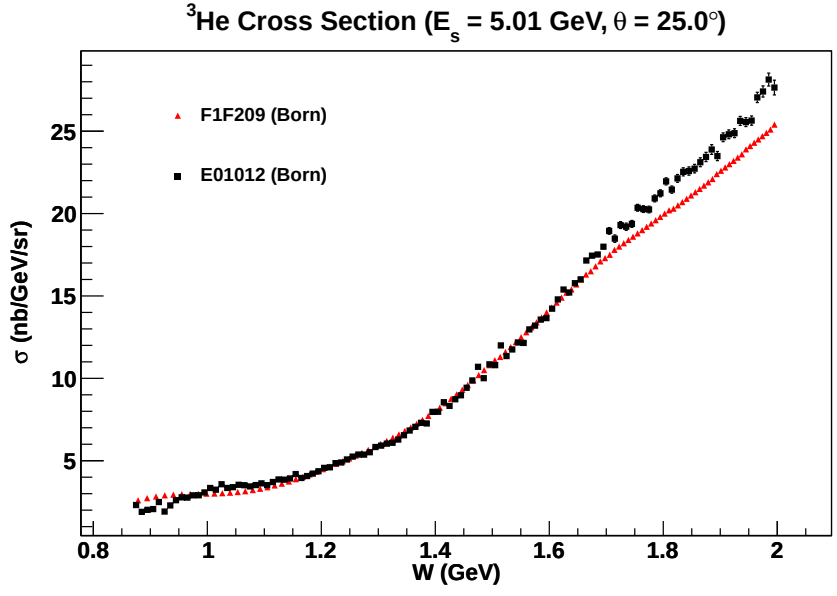


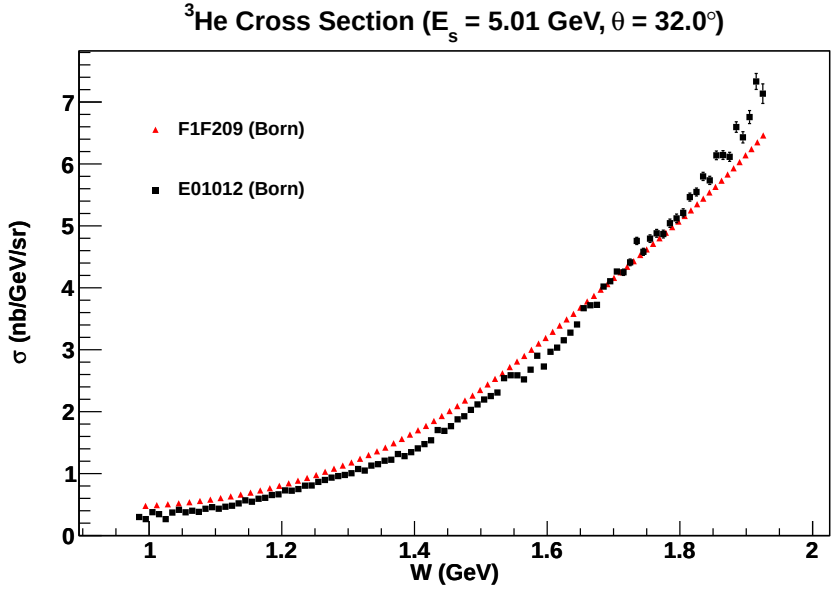


F1F209 Cross Section Model (2)

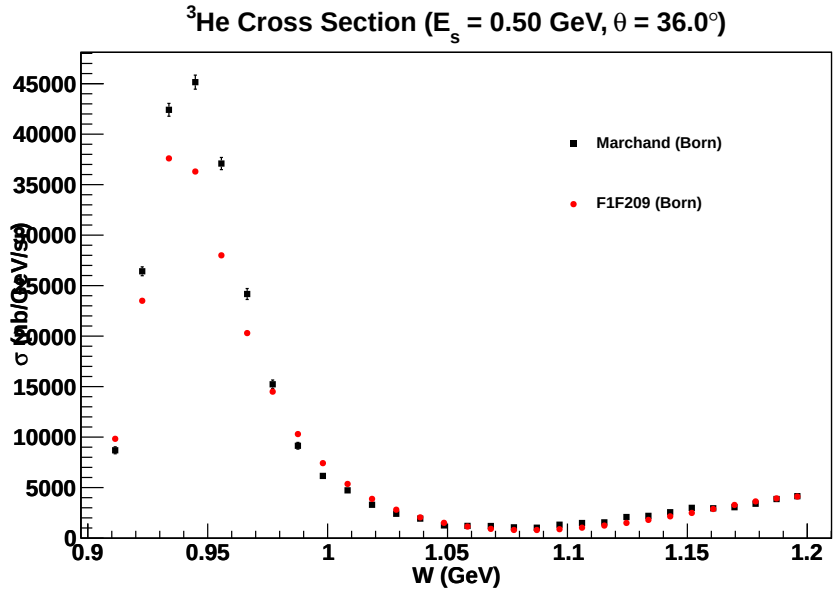


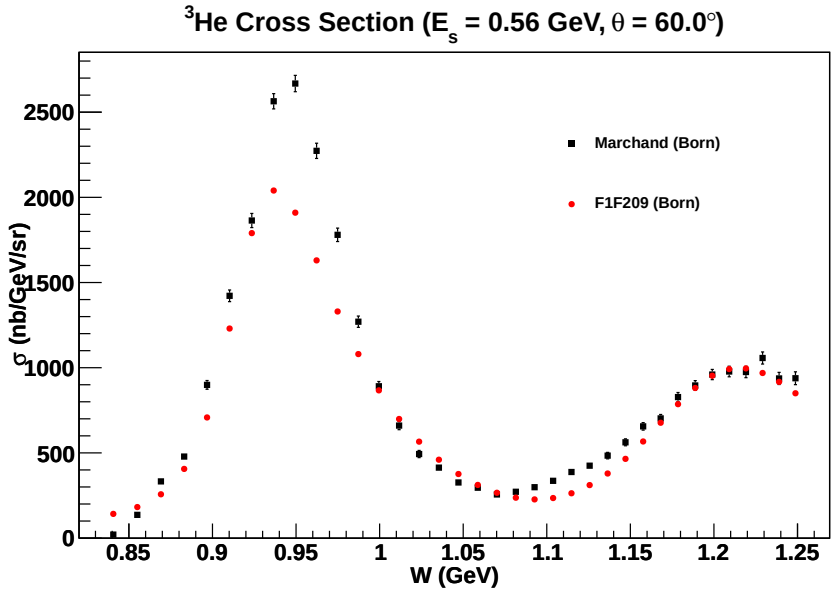


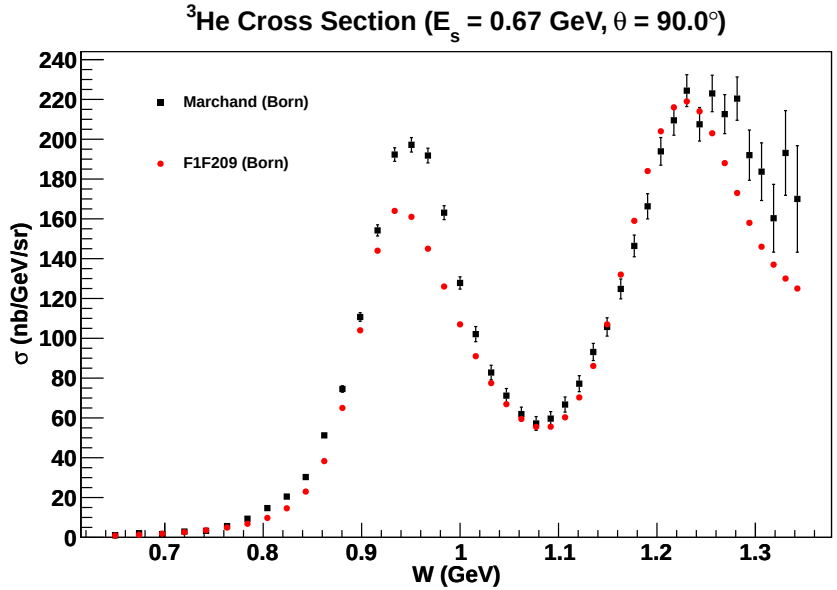




F1F209 Cross Section Model (3)

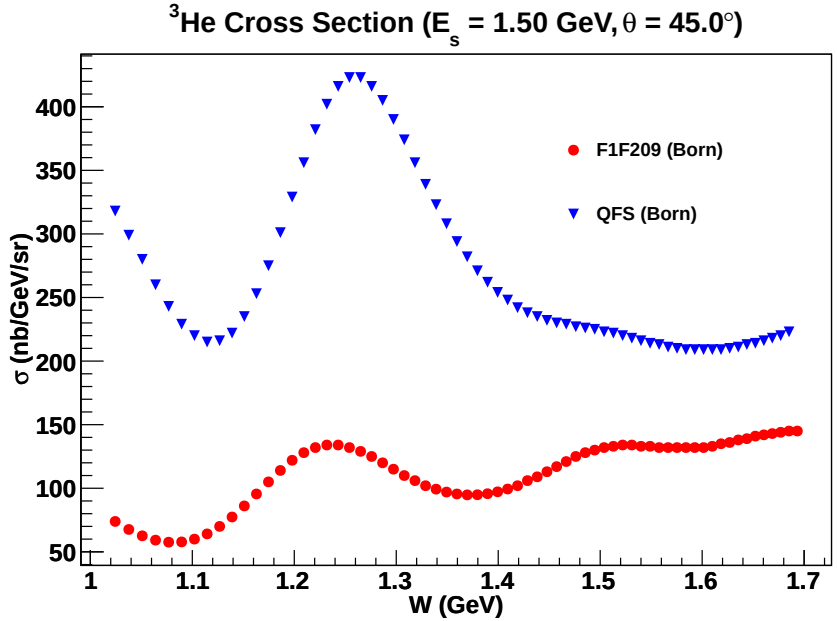


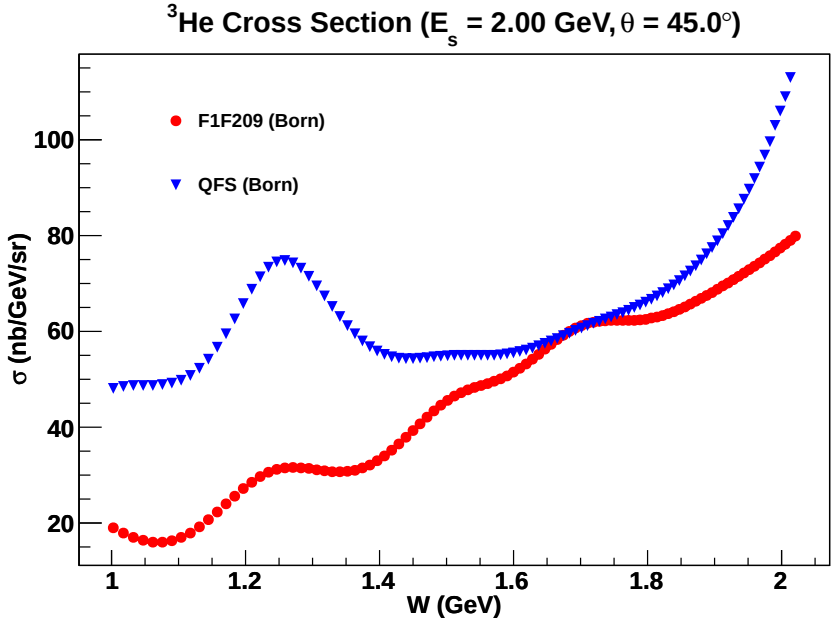


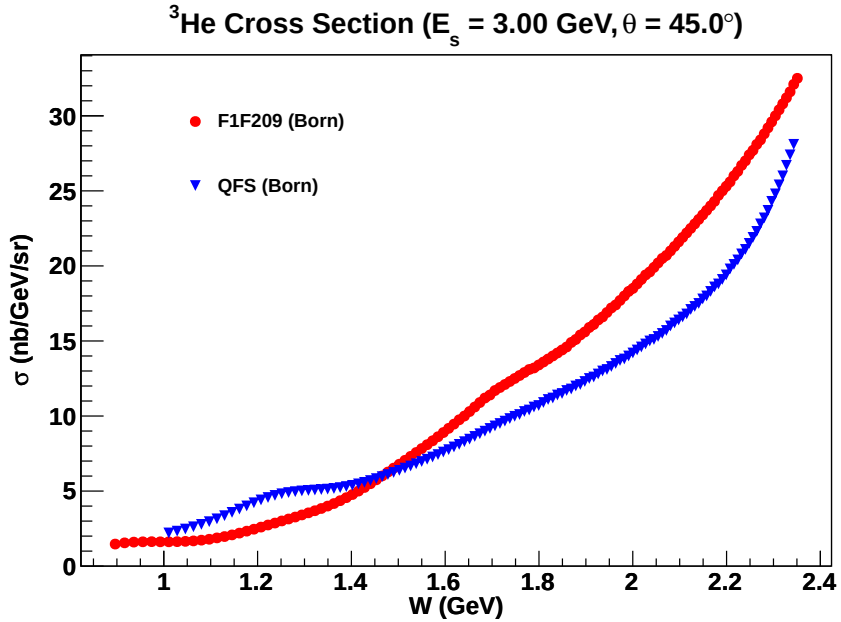


- This scaled version of F1F209 fits reasonably well to world data at various E_s, θ

F1F209 Cross Section Model (4)



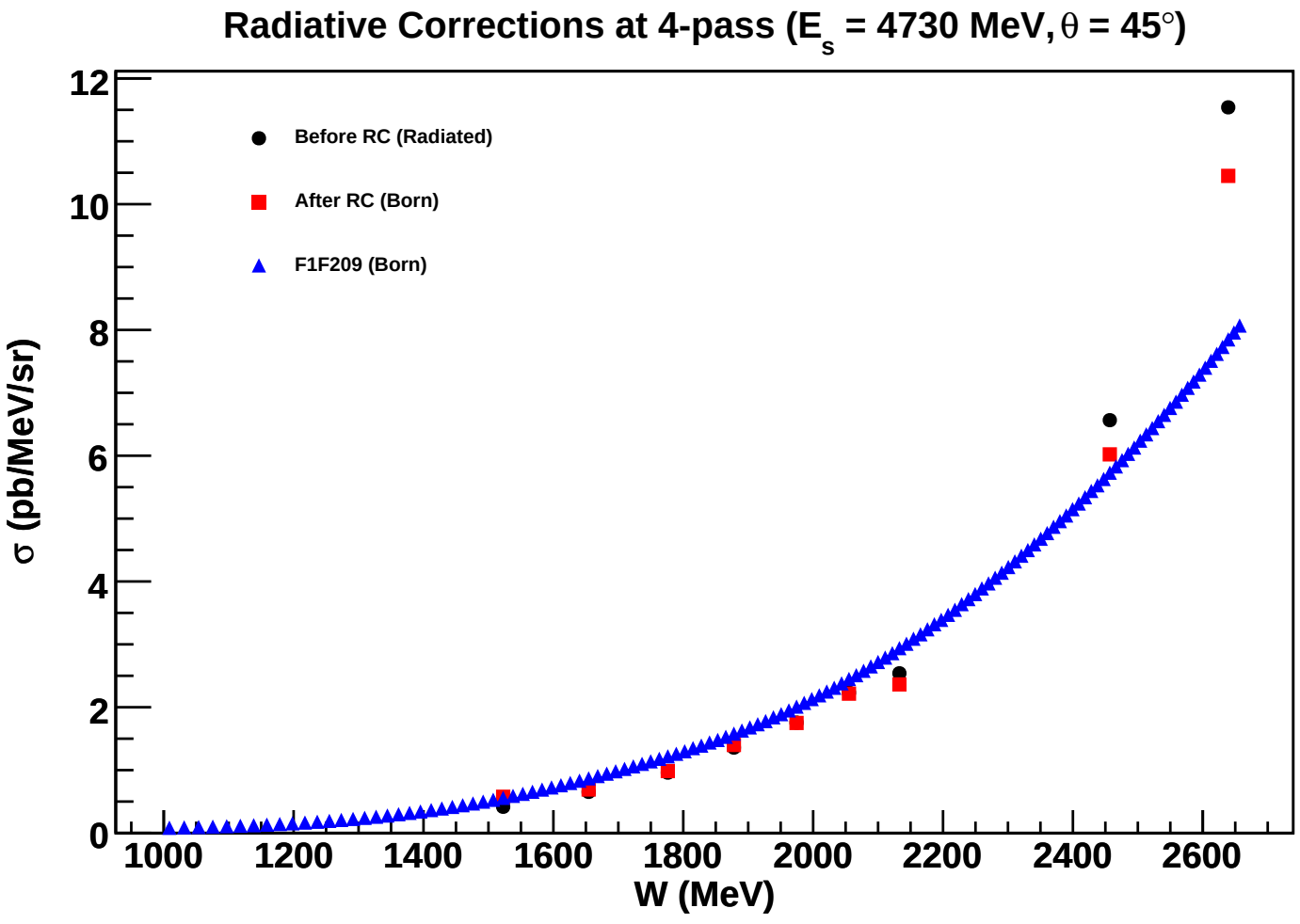




- Here we note the difference between QFS and F1F209
- Use these three (F1F209) spectra plus our data as the input to RADCOR to obtain the RC's

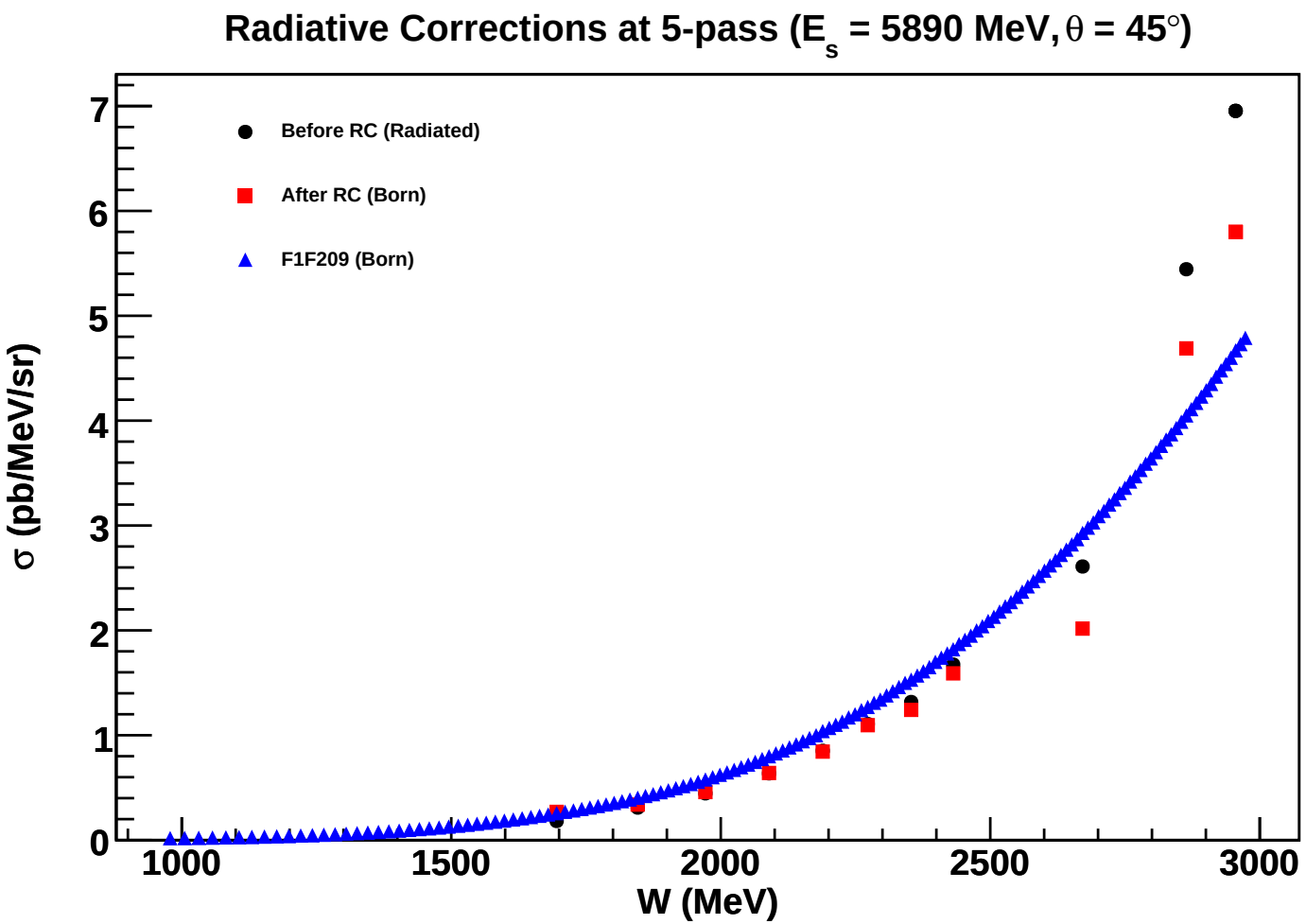
RC's to Real Data (1)

Results at E_s = 4.73 GeV



RC's to Real Data (2)

Results at E_s = 5.89 GeV



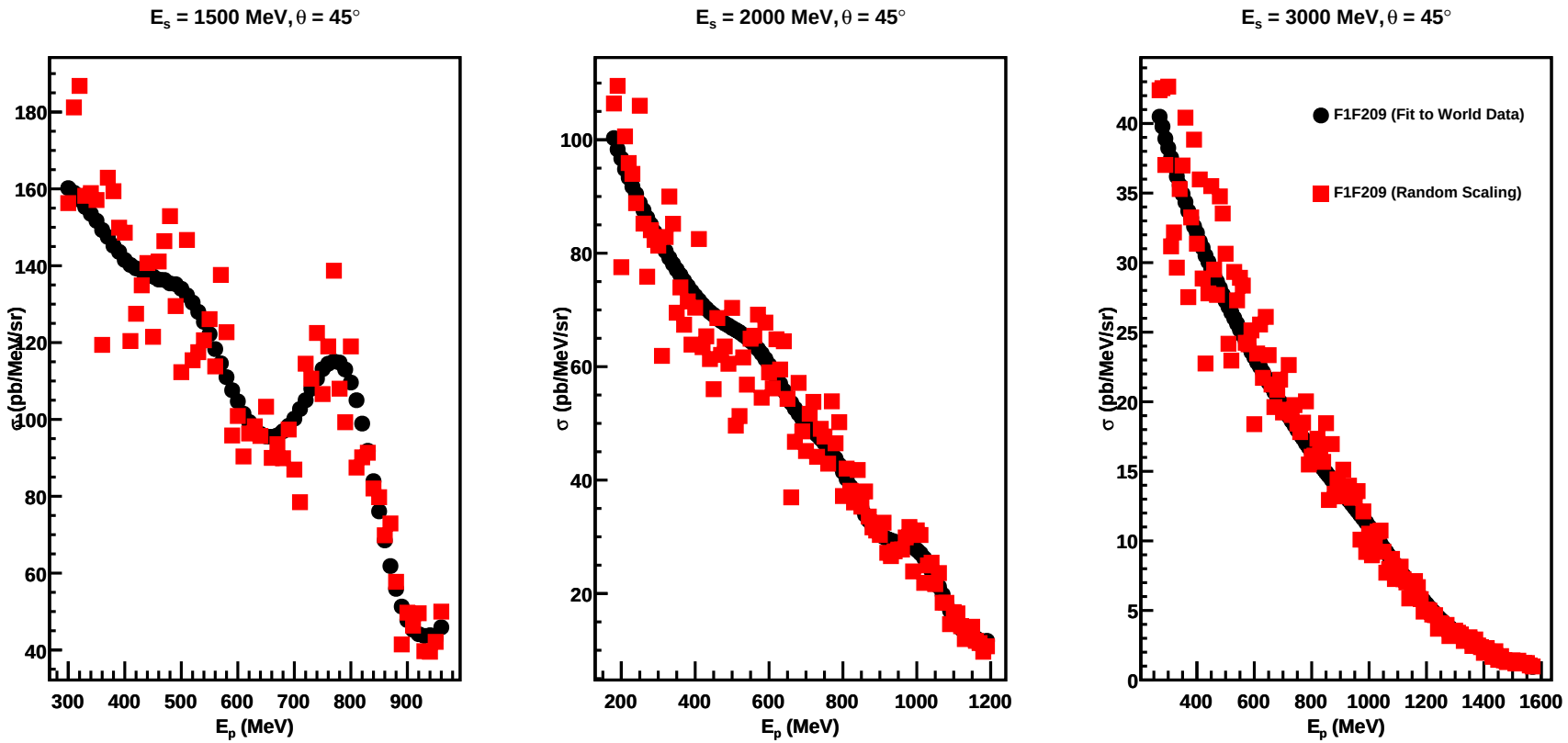
Systematic Errors (1)

Method

- We test two different components to the radiative correction results:
  1. Model dependence
     - Vary the cross section by up to $\pm$ 20% at random bin-by-bin in E_p
  2. Number of input spectra used in RADCOR

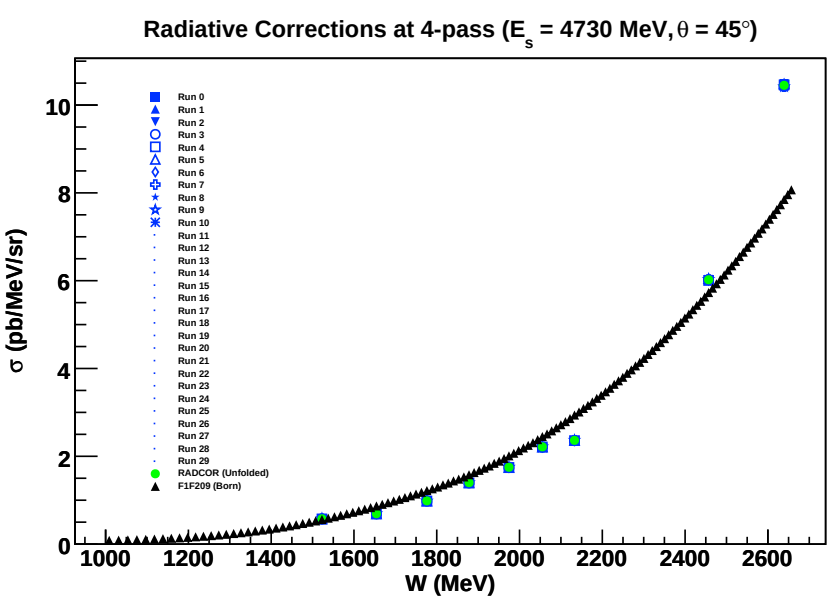
Systematic Errors (2)

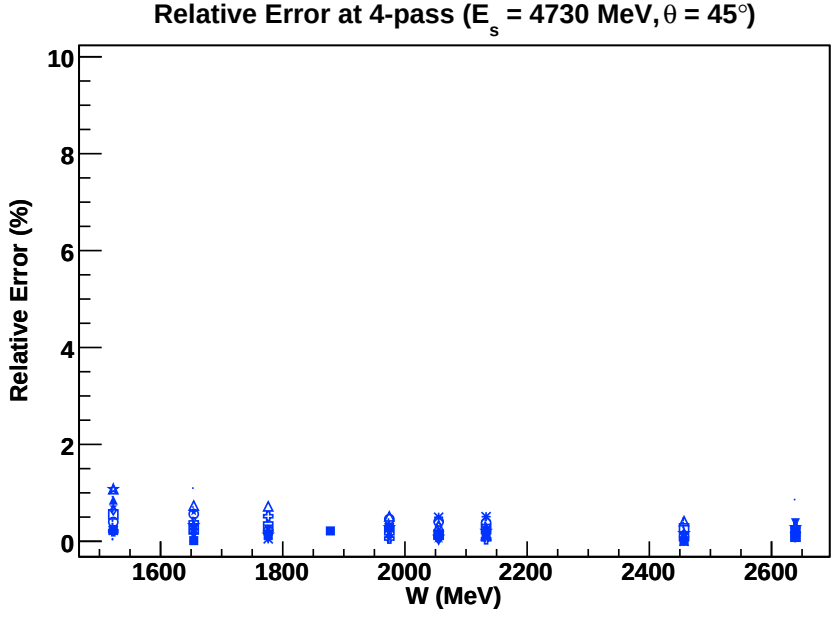
Model Dependence: Example Run 27 (of 60)



Systematic Errors (3)

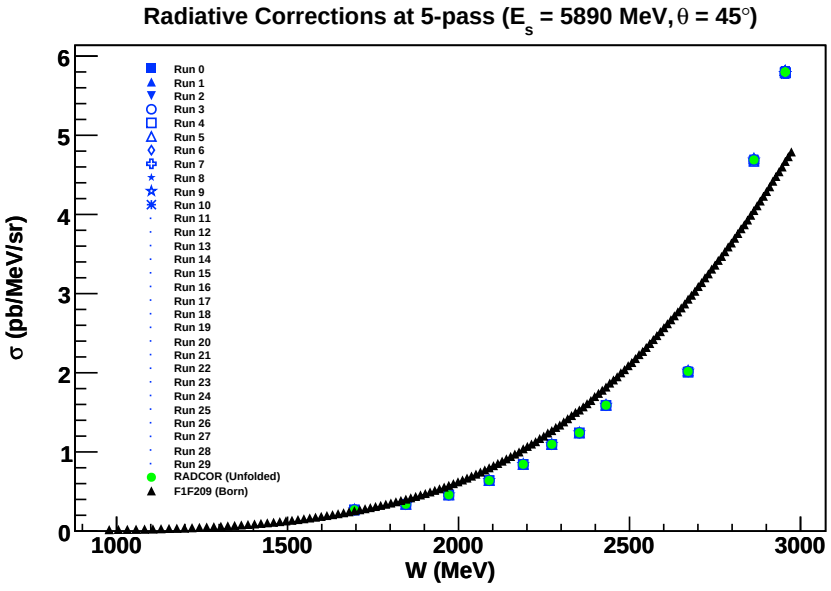
Model Dependence: Results at E_s = 4.73 GeV

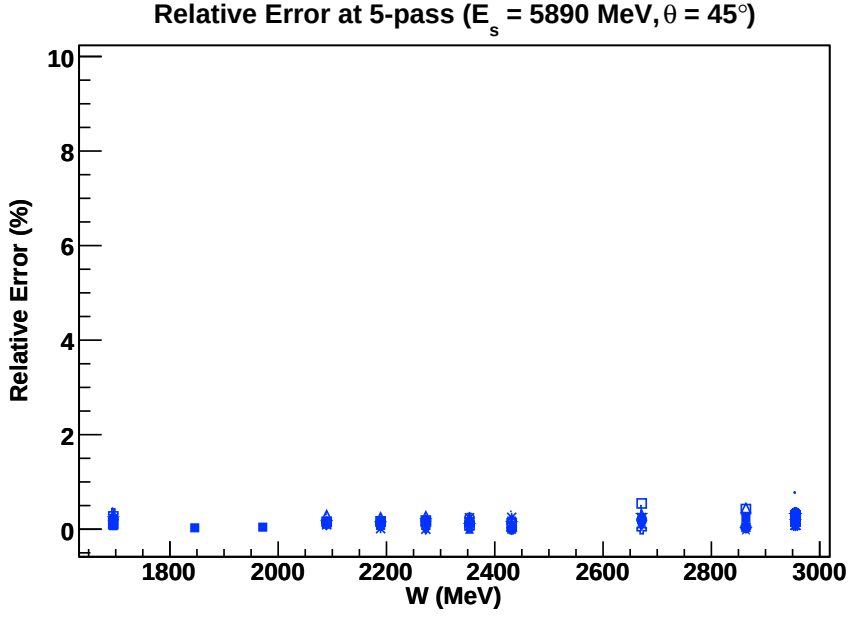




Systematic Errors (4)

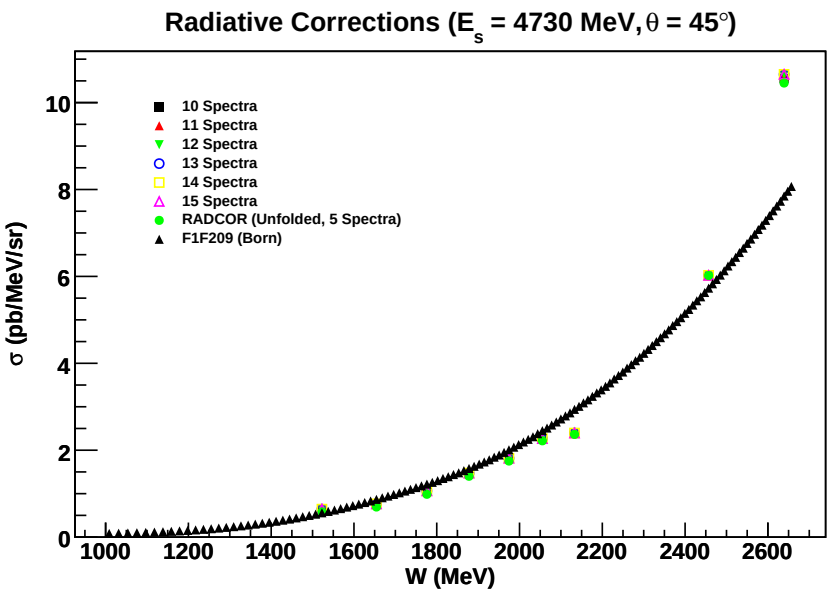
Model Dependence: Results at E_s = 5.89 GeV

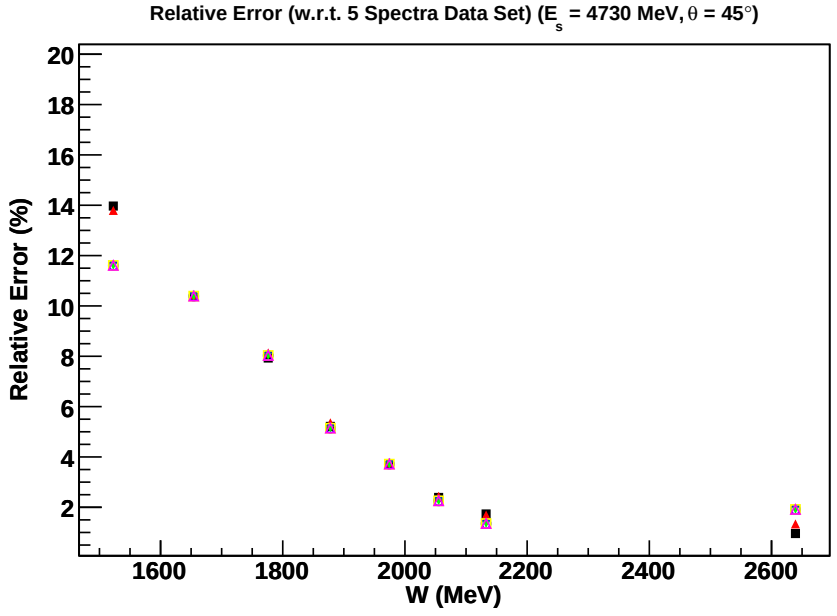




Systematic Errors (5)

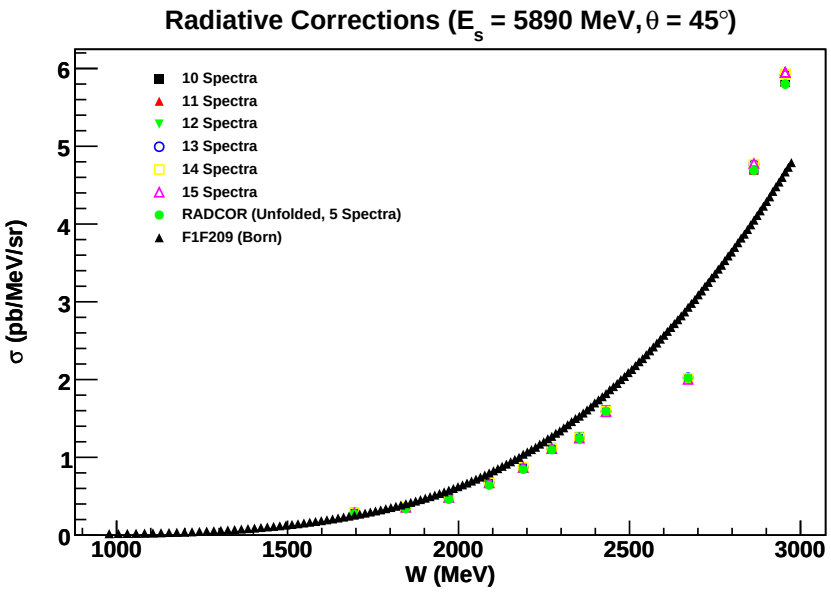
Varying the Number of Spectra: Results at E_s = 4.73 GeV

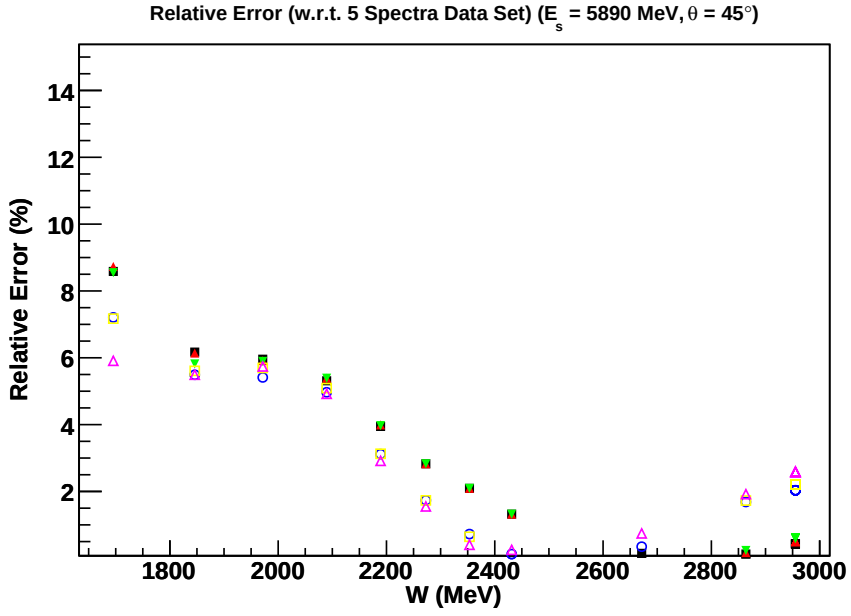




Systematic Errors (6)

Varying the Number of Spectra: Results at E_s = 5.89 GeV





Systematic Errors (7)

Roundup: E_s = 4.73 GeV

Systematic Errors: Cuts							
E_p (MeV)	GC (%)	PR (%)	β (%)	dp/p (%)	θ (%)	ϕ (%)	y (%)
600	0.10	0.10	0.20	0.8	1.0	2.2	1.0
800	0.20	0.10	0.20	0.8	1.0	2.0	1.0
1120	0.15	0.10	0.22	0.6	1.0	2.0	1.0
1190	0.08	0.10	0.18	0.6	0.8	2.0	0.8
1260	0.08	0.10	0.15	1.0	1.0	2.0	1.0
1340	0.10	0.12	0.20	1.0	1.0	2.0	1.0
1420	0.22	0.10	0.18	1.0	0.8	2.2	1.0
1510	0.15	0.10	0.20	1.0	1.0	2.2	0.8
1600	0.15	0.10	0.38	1.0	1.0	2.2	1.0

Systematic Errors: Radiative Corrections			
E_p (MeV)	$t_{b,a}$ (%)	σ_m (%)	N_σ (%)
600	1.5	2.0	2.5
800	1.5	2.0	2.0
1120	1.5	2.0	2.0
1190	1.5	2.0	3.0
1260	1.5	2.0	4.0
1340	1.5	2.0	6.0
1420	1.5	2.0	8.0
1510	1.5	2.0	11.0
1600	1.5	2.0	15.0

- $t_{b,a}$ = Varying the radiation lengths t_b and t_a by $\pm$ 10%
- σ_m = Varying the F1F209 model bin-by-bin in E_p by as much as $\pm$ 20%
- N_σ = Increasing the number of input spectra to RADCOR

Systematic Errors (8)

Roundup: E_s = 5.89 GeV

Systematic Errors: Cuts							
E_p (MeV)	GC (%)	PR (%)	β (%)	dp/p (%)	θ (%)	ϕ (%)	y (%)
600	0.12	0.10	0.20	0.8	0.8	2.0	1.2
700	0.02	0.10	0.12	0.8	0.8	2.0	1.2
900	0.12	0.10	0.18	0.8	0.8	1.5	1.2
1130	0.22	0.12	0.25	0.8	0.8	2.2	1.2
1200	0.20	0.10	0.18	0.8	1.2	2.2	1.5
1270	0.10	0.11	0.18	0.8	0.8	2.2	1.2
1340	0.10	0.12	0.20	0.8	1.5	2.2	1.2
1420	0.12	0.12	0.25	0.8	0.4	2.2	1.2
1510	0.02	0.22	0.42	0.8	1.2	1.5	1.0
1600	0.08	0.10	0.22	0.8	1.2	2.0	1.0
1700	0.22	0.12	0.80	0.8	1.2	2.0	1.0

Systematic Errors: Radiative Corrections			
E_p (MeV)	$t_{b,a}$ (%)	σ_m (%)	N_σ (%)
600	1.5	1.5	3.0
700	1.5	1.5	2.0
900	1.5	1.5	1.0
1130	1.5	1.5	2.0
1200	1.5	1.5	2.5
1270	1.5	1.5	3.0
1340	1.5	1.5	4.0
1420	1.5	1.5	6.0
1510	1.5	1.5	6.0
1600	1.5	1.5	6.0
1700	1.5	1.5	8.5

- $t_{b,a}$ = Varying the radiation lengths t_b and t_a by $\pm$ 10%
- σ_m = Varying the F1F209 model bin-by-bin in E_p by as much as $\pm$ 20%
- N_σ = Increasing the number of input spectra to RADCOR

Systematic Errors (9)

Roundup: Totals

- Computing the in-quadrature sums of the cut and RC systematic errors, respectively:

E_s = 4730 MeV		
E_p (MeV)	Cuts (%)	RC (%)
600	2.75	3.54
800	2.59	3.20
1120	2.54	3.20
1190	2.39	3.91
1260	2.65	4.72
1340	2.66	6.50
1420	2.75	8.38
1510	2.75	11.28
1600	2.83	15.21

E_s = 5890 MeV		
E_p (MeV)	Cuts (%)	RC (%)
600	2.60	3.67
700	2.60	2.92
900	2.24	2.35
1130	2.77	2.92
1200	3.04	3.28
1270	2.76	3.67
1340	3.04	4.53
1420	2.68	6.36
1510	2.36	6.36
1600	2.67	6.36
1700	2.79	8.76

Summary

- Unfolding the real data shows reasonable agreement with the F1F209 model
- RC systematic error dominates ($\sim$ 5–6% on average) compared to the errors from the cuts ($\sim$ 3%)
  - Largest source of systematic error is from N_σ (interpolation method)

What's Next?

- BigBite Geant4 simulation
  - I have Vahe's code and runs just fine on a fresh install of Geant 4.9.5
- Target: Help out Matt with the water calibration