LHRS Analysis for d_2^n

E_p and W Statistical Errors, ^{12}C Raw Cross Section

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Outline

E_p and W Statistical Errors

Method

- Sum over all runs per E_p bin and grab the mean and use the RMS as the error

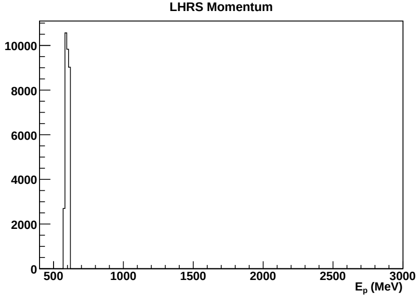


Figure: The ExTgtCor_L.p variable. Electron cuts applied.

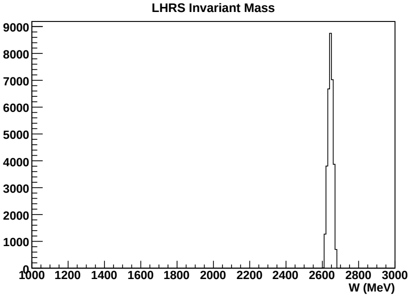


Figure: Square-root of the PriKineL.W2 variable. Electron cuts applied.

E_p Statistical Errors

- P_0 is the momentum setting on the spectrometer
- P_0, Mean and RMS are in MeV

E_s = 4730 MeV		
P_0	Mean	RMS
600	598.99	12.06 (2.01%)
800	798.44	16.13 (2.02%)
1120	1118.11	22.45 (2.01%)
1190	1187.65	23.90 (2.01%)
1260	1256.79	25.42 (2.02%)
1340	1336.08	27.06 (2.03%)
1420	1415.75	28.21 (1.99%)
1510	1504.54	30.11 (2.00%)
1600	1592.84	31.88 (2.00%)

E_s = 5890 MeV		
P_0	Mean	RMS
600	598.85	12.08 (2.02%)
700	698.61	14.11 (2.02%)
900	898.05	18.25 (2.03%)
1130	1127.74	22.77 (2.02%)
1200	1197.60	24.21 (2.02%)
1270	1267.61	25.53 (2.01%)
1340	1337.50	27.08 (2.02%)
1420	1416.24	28.59 (2.02%)
1510	1504.26	30.37 (2.02%)
1600	1594.31	32.14 (2.02%)
1700	1693.16	33.17 (1.96%)

W Statistical Errors

- W_0 is calculated from P_0
- W_0, Mean and RMS are in MeV

E_s = 4730 MeV		
W_0	Mean	RMS
2639.18	2644.58	13.63 (0.52%)
2456.81	2462.49	19.57 (0.79%)
2132.82	2140.35	31.13 (1.45%)
2055.16	2064.35	34.86 (1.69%)
1974.44	1983.75	38.37 (1.93%)
1877.94	1890.20	42.37 (2.24%)
1776.21	1788.90	47.00 (2.63%)
1654.30	1670.70	54.05 (3.23%)
1522.66	1544.91	60.73 (3.93%)

E_s = 5890 MeV		
W_0	Mean	RMS
2955.29	2960.49	14.54 (0.49%)
2863.75	2869.26	17.50 (0.61%)
2671.30	2677.97	24.21 (0.90%)
2431.21	2439.62	33.13 (1.36%)
2353.28	2362.09	35.96 (1.52%)
2272.69	2282.77	39.29 (1.72%)
2189.12	2199.26	43.47 (1.98%)
2089.54	2101.84	48.09 (2.29%)
1971.50	1987.96	54.24 (2.73%)
1845.92	1864.53	61.05 (3.27%)
1695.52	1719.47	67.13 (3.90%)

^{12}C Raw Cross Section (1)

Special Cuts

- We only have E_s = 5.89 GeV, E_p = 0.60 GeV data (12 runs)
  - 10 multi-foil runs, 2 single-foil runs
  - For the multi-foil runs, we choose the foil that is the furthest upstream to best avoid straggling

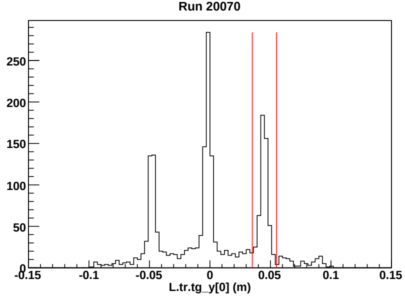


Figure: The y_{tgt} variable. The red lines indicate the cut placed on the furthest upstream foil. This is the first foil the beam sees and thus will reduce straggling.

^{12}C Raw Cross Section (2)

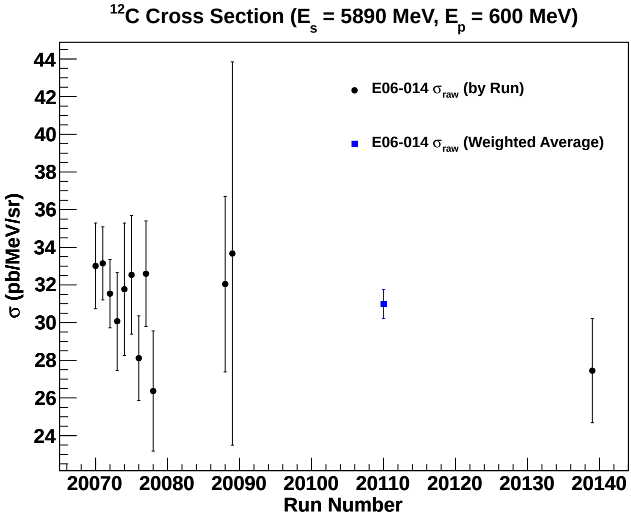
Calculating the Cross Section for a Point Target

- Since this is a point target, the calculation is slightly different:

$$\begin{aligned} \frac{d^2\sigma}{d\Omega dE_p} &= \frac{N_{\text{cut}}}{(Q/e)(N_A/A)\rho x}\frac{1}{\varepsilon t_{LT}}\frac{1}{\Delta\Omega\Delta E_p} \\ x &= t/\sin\theta \\ t &= \text{Thickness of the foil} = 0.252\text{ mm} \end{aligned}$$

^{12}C Raw Cross Section (3)

E_s = 5.89 GeV Results



Summary

- Statistical error in E_p is $\sim$2%
- Statistical error in W is $\sim$0.5–4%
- ^{12}C raw cross section is consistent whether or not we use a multi-foil target as compared to single-foil target (as it should be)
  - Still need to find world data to compare to!

What's Next?

- Currently working through the magnetic flux calculation for the water (and ^{3}He) cell
  - Should have something for next time (waiting on Yawei for some information)
- Geant4 BigBite simulation
  - Start looking at bend-up and bend-down acceptances, E/p