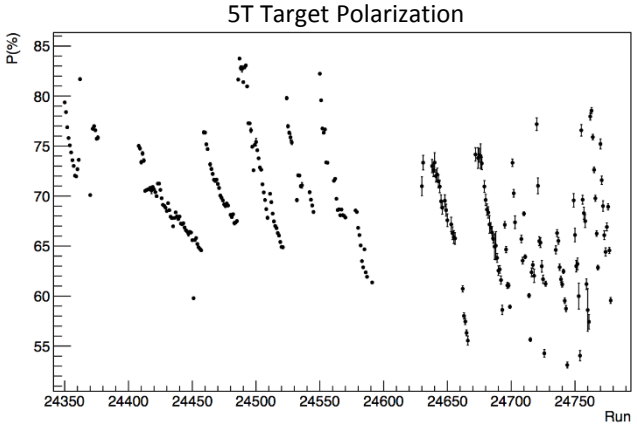
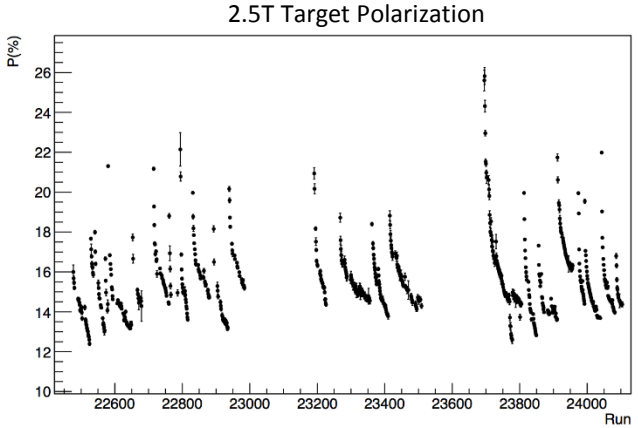
Analysis Update

Toby Badman

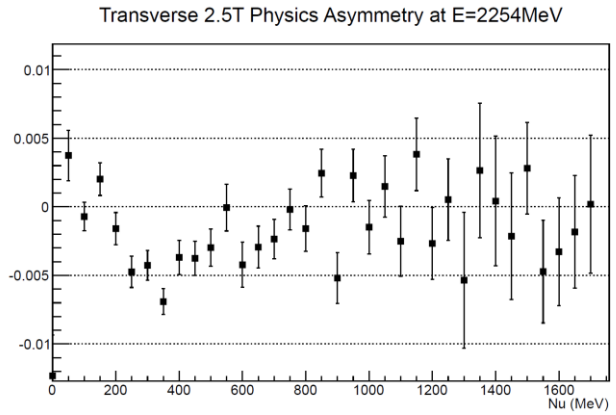
Completed Work

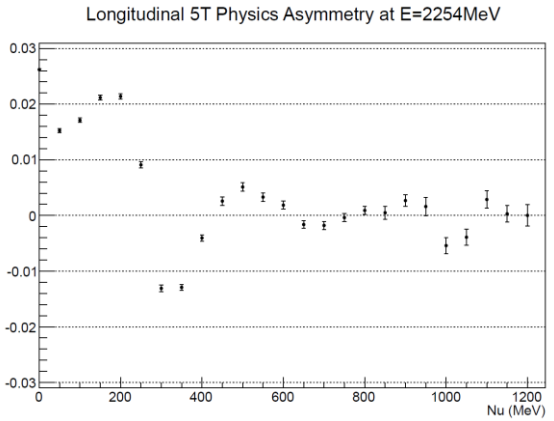
- Target polarization and uncertainty for 2.5T and 5T finished





- Raw asymmetries for all beam energy settings finished (two examples shown).





Dilution Analysis

- $A_{raw} = \frac{(Y_+ + \frac{1}{2}Y_{bg}) - (Y_- + \frac{1}{2}Y_{bg})}{(Y_+ + \frac{1}{2}Y_{bg}) + (Y_- + \frac{1}{2}Y_{bg})} = \frac{Y_+ - Y_-}{Y_+ + Y_- + Y_{bg}}$

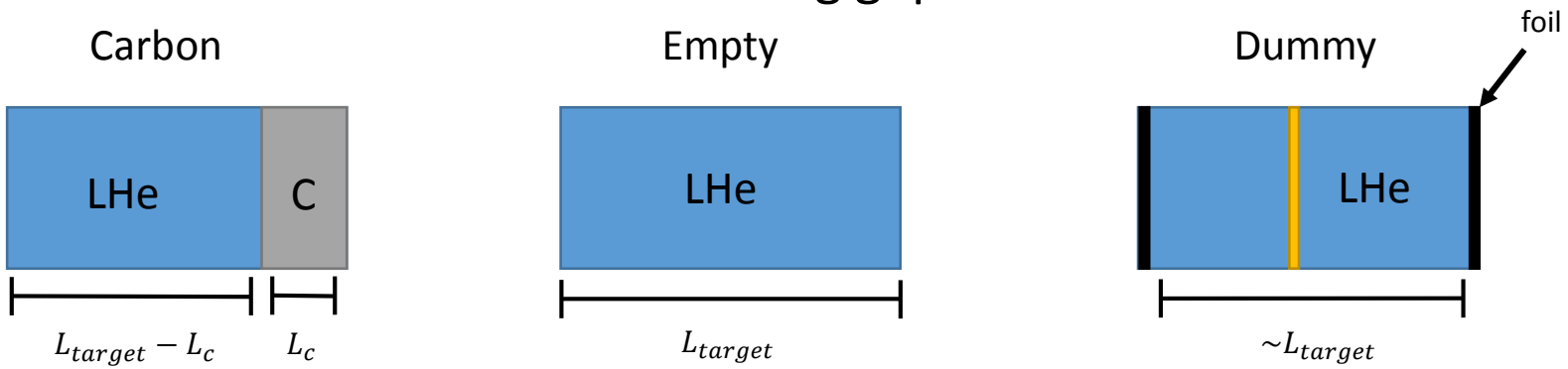
- $A_{phy} = \frac{1}{P_b P_t}\underbrace{\left(\frac{Y_+ + Y_- + Y_{bg}}{Y_+ + Y_-}\right)}_{1/f}\underbrace{\left(\frac{Y_+ - Y_-}{Y_+ + Y_- + Y_{bg}}\right)}_{A_{raw}} = \frac{1}{f P_b P_t} A_{raw}$

- $f = \frac{Y_+ + Y_-}{Y_+ + Y_- + Y_{bg}} = \frac{Y_H}{Y_{total}} = 1 - \frac{Y_N + Y_{He} + Y_f}{Y_{total}}$ →

Y_N = Nitrogen yield
Y_{He} = Helium yield
Y_f = Foil yield
Y_{total} = Production yield

Dilution Analysis

- 3 different ‘dilution’ runs taken during g2p:



- Each background material can be represented in terms of dilution runs as:

$$Y_{Foil} = Y_{Dummy} - Y_{Empty}$$

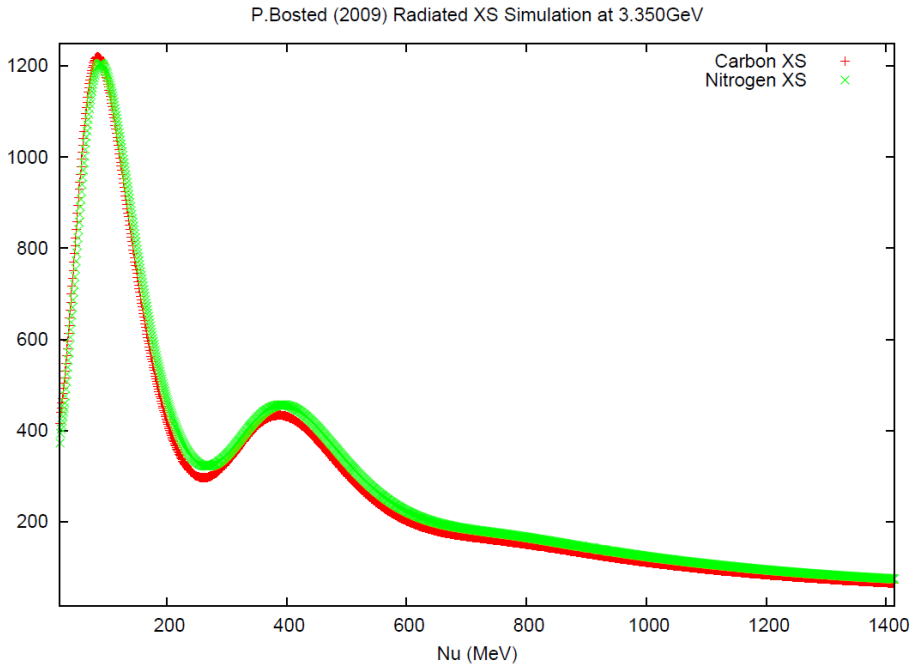
$$Y_{Helium} = (1 - pf)\alpha Y_{Empty}$$

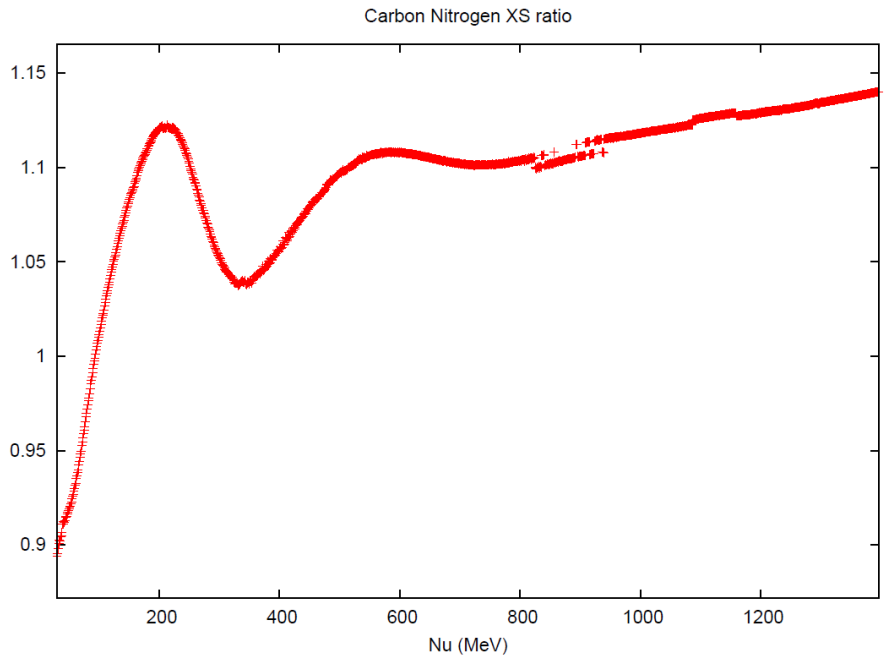
$$Y_{Nitrogen} = \gamma pf \frac{\rho_N L_{target} M_C}{\rho_C L_C M_N}\left(Y_{Carbon} - \left(1 - \frac{L_C}{L_{target}}\right)\beta Y_{Empty}\right)$$

α, β, γ are used to scale material radiation lengths

Dilution Analysis

Finding α, β and γ

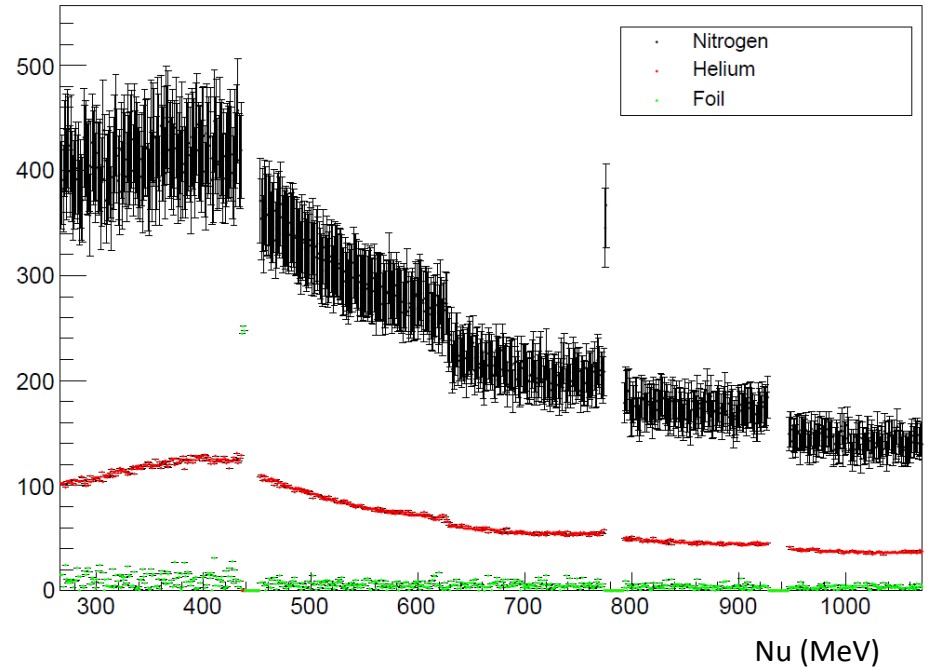




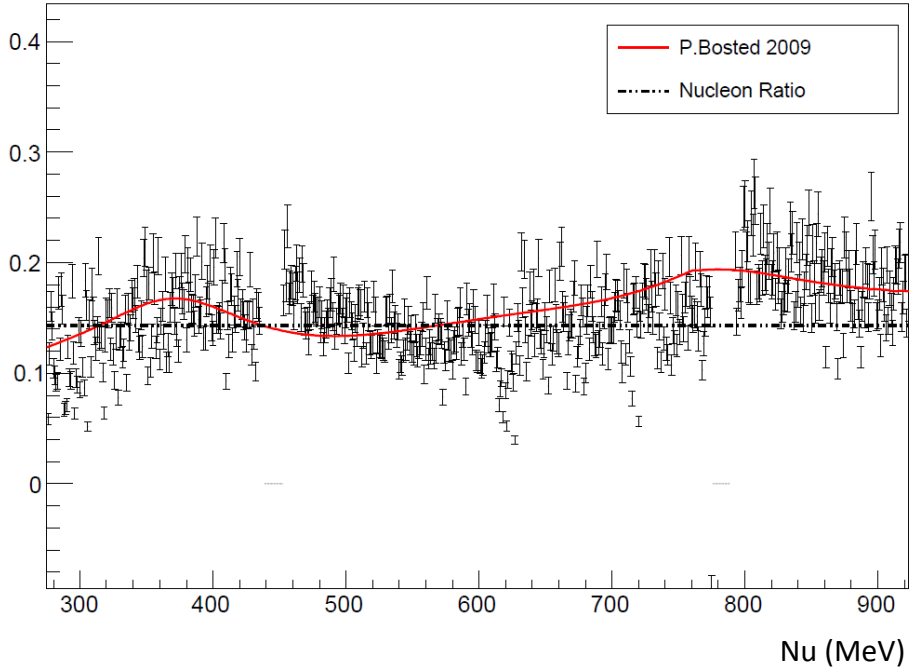
- The Carbon and Nitrogen XS are fully radiated using experimental parameters.
- Similar ratios are found for Helium and Carbon (by varying radiation thickness)

Dilution Analysis – 3.350 GeV 5T Transverse

3.350GeV 5T Transverse Background Yields



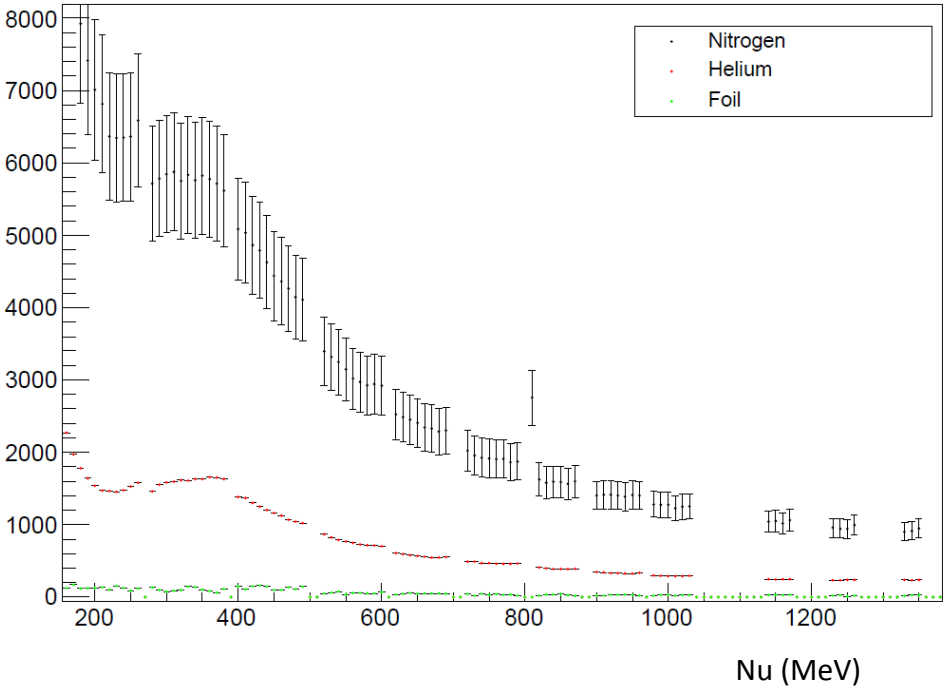
3.350GeV 5T Transverse Dilution



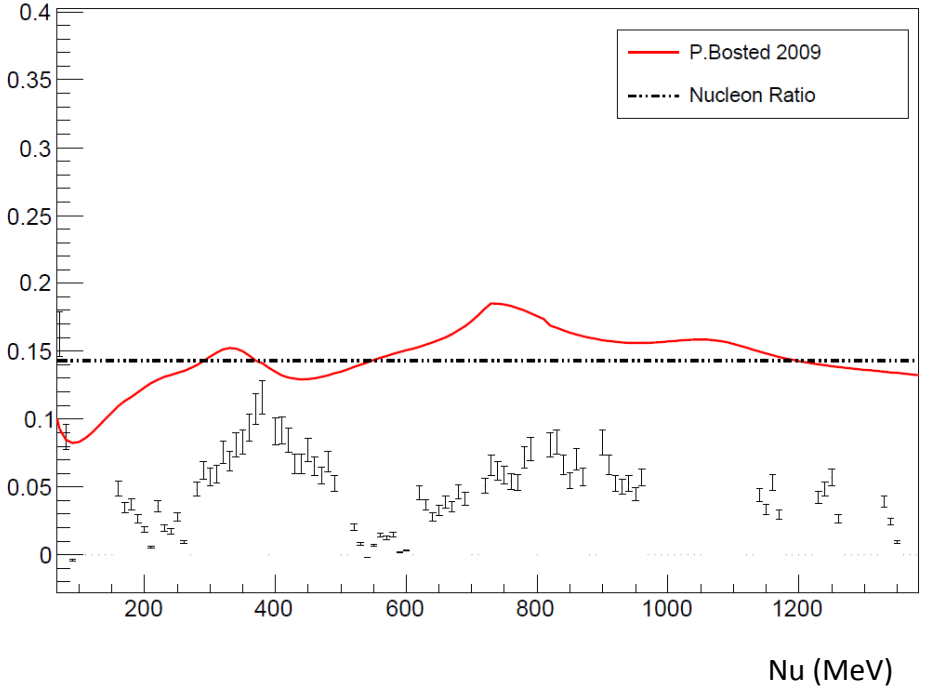
3.350GeV setting complete (Just need to adjust binning and add systematic uncertainty from Helium and Carbon models).

Dilution Analysis – 2.254 GeV 5T Transverse

2.254GeV 5T Transverse Background Yields



2.254GeV 5T Transverse Dilution



Currently looking at the 2.254GeV setting, trying to figure out why the dilution is so small.

Dilution Analysis – What's left

- Continue quality checking data (very time consuming)
  - Radiation thickness
  - Yield drifting
  - Bad/missing runs
  - Etc...
- Cell Length calculation. Low priority (adds to systematic uncertainty, but will not dominate).
- Incorporate tuned N14 sim. and tune He-4, C12 P.Bosted sim. to our production data. Low Priority (will have small effect on uncertainty and scaling factors).
- Look at the rest of the g2p settings.

Future Work

- Physics asymmetries using calculated dilution
- Apply asymmetries to cross sections (experimental or simulated?) for $g_2$calculation.
- Use g_2 to find Longitudinal Transverse Spin Polarizability and B.C. sum rule?

- Anticipated graduation Spring 2016