Packing Fraction Update

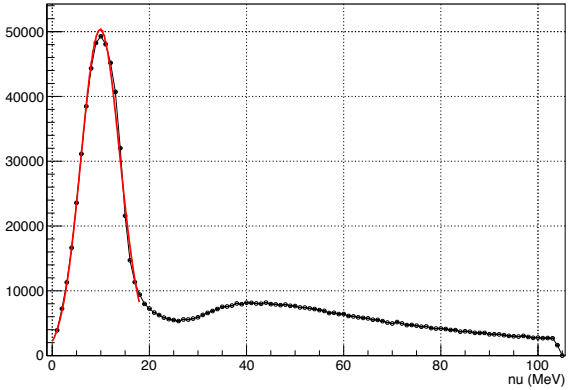
M. Cummings

11/6/13

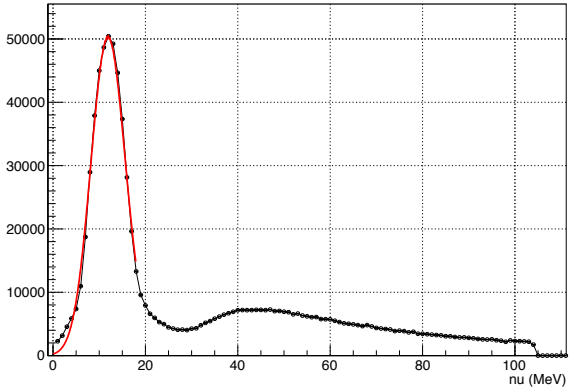
Previous Fits of Dilution Runs

Landau-Gaussian Convolution Fit of Elastic Peak

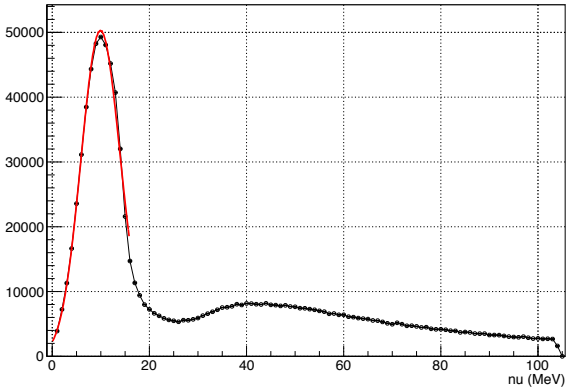
Carbon Run 3447



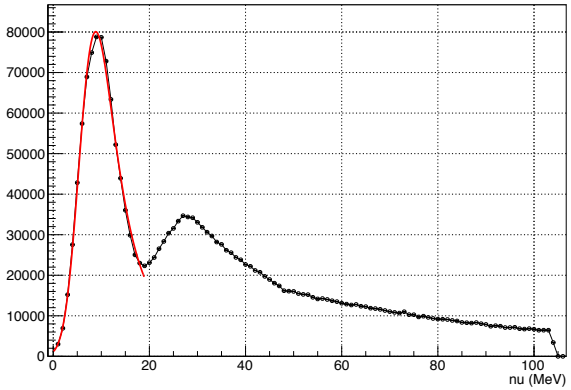
Dummy Run 3448



Empty Run 3449



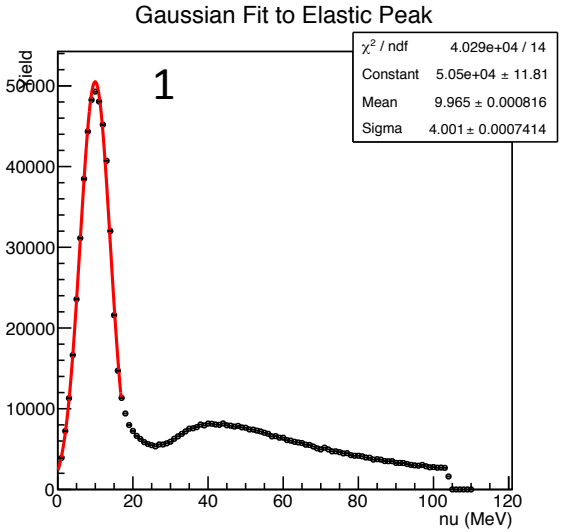
Packing Fraction Run 3865

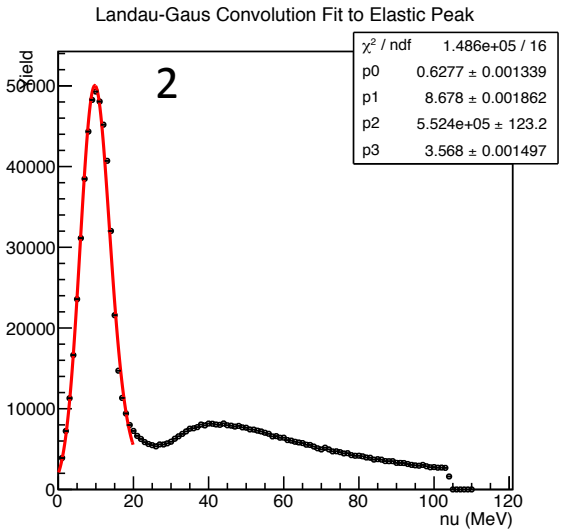


Doesn't account for contribution from QE peak or hydrogen elastic peak

Updated Fitting Routine

Carbon Run 3447



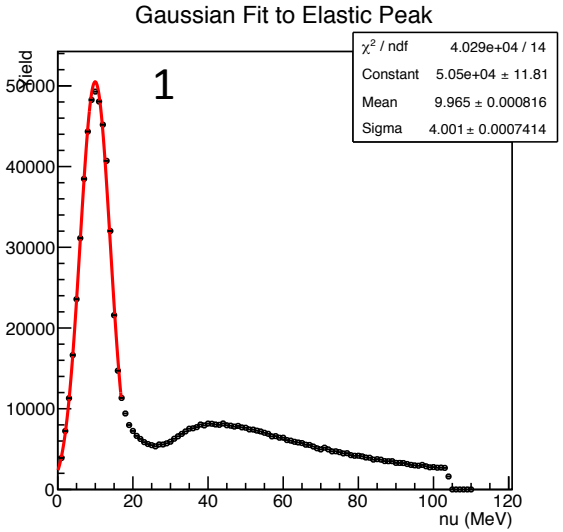


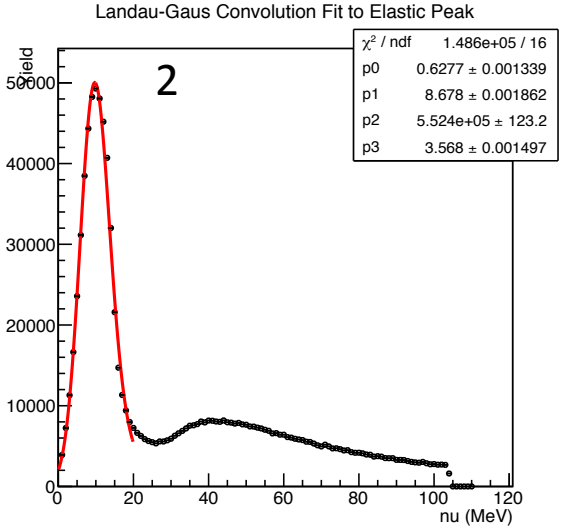
1. Gaussian fit to elastic peak to obtain starting parameters

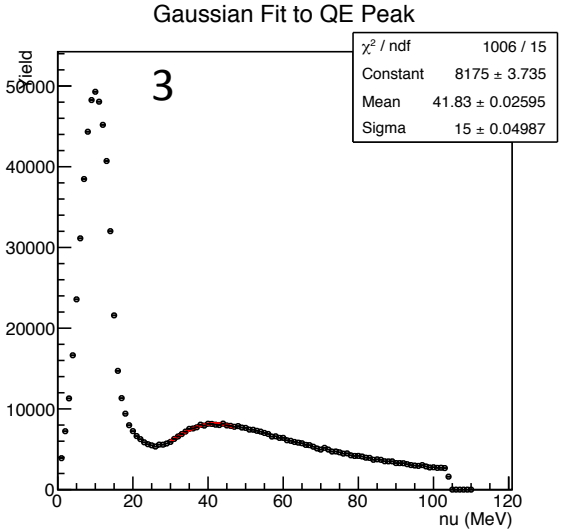
2. Landau-Gaussian fit to elastic peak

Updated Fitting Routine

Carbon Run 3447



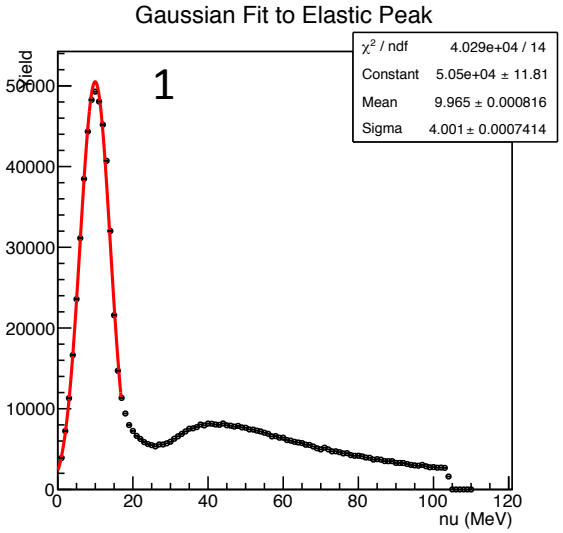


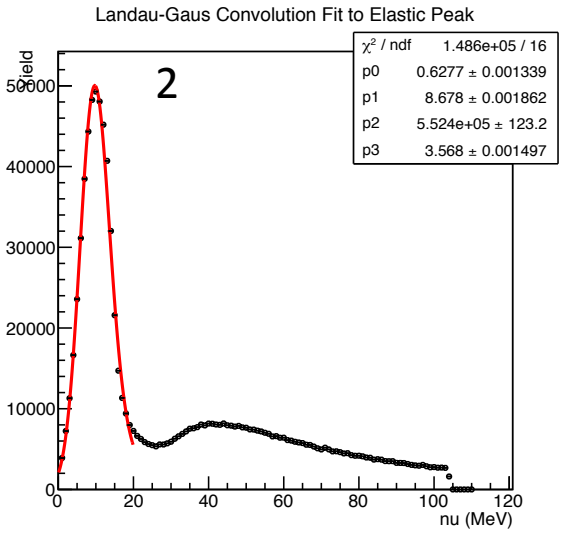


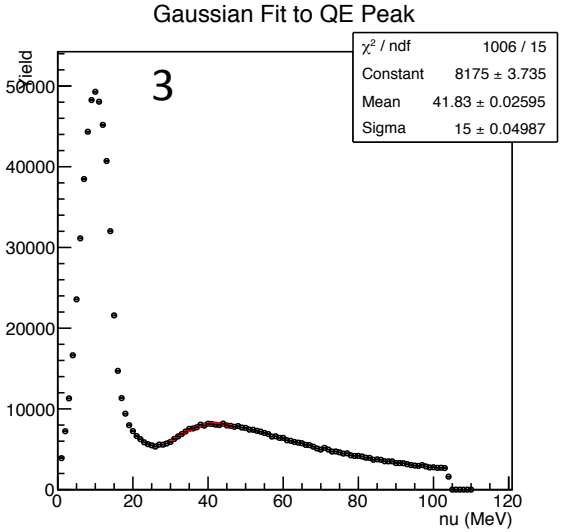
1. Gaussian fit to elastic peak to obtain starting parameters
2. Landau-Gaussian fit to elastic peak
3. Gaussian Fit to quasi-elastic peak

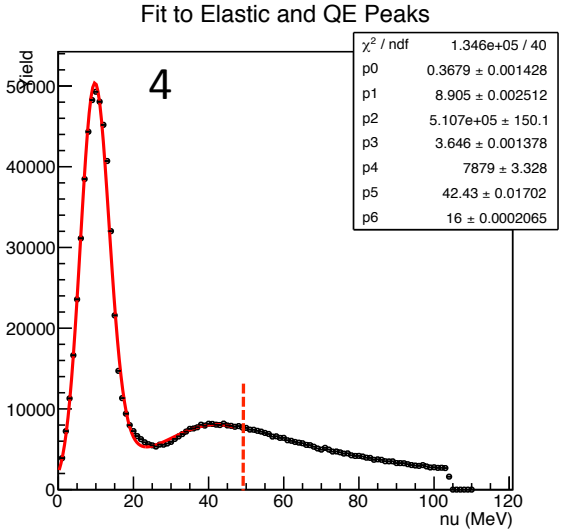
Updated Fitting Routine

Carbon Run 3447





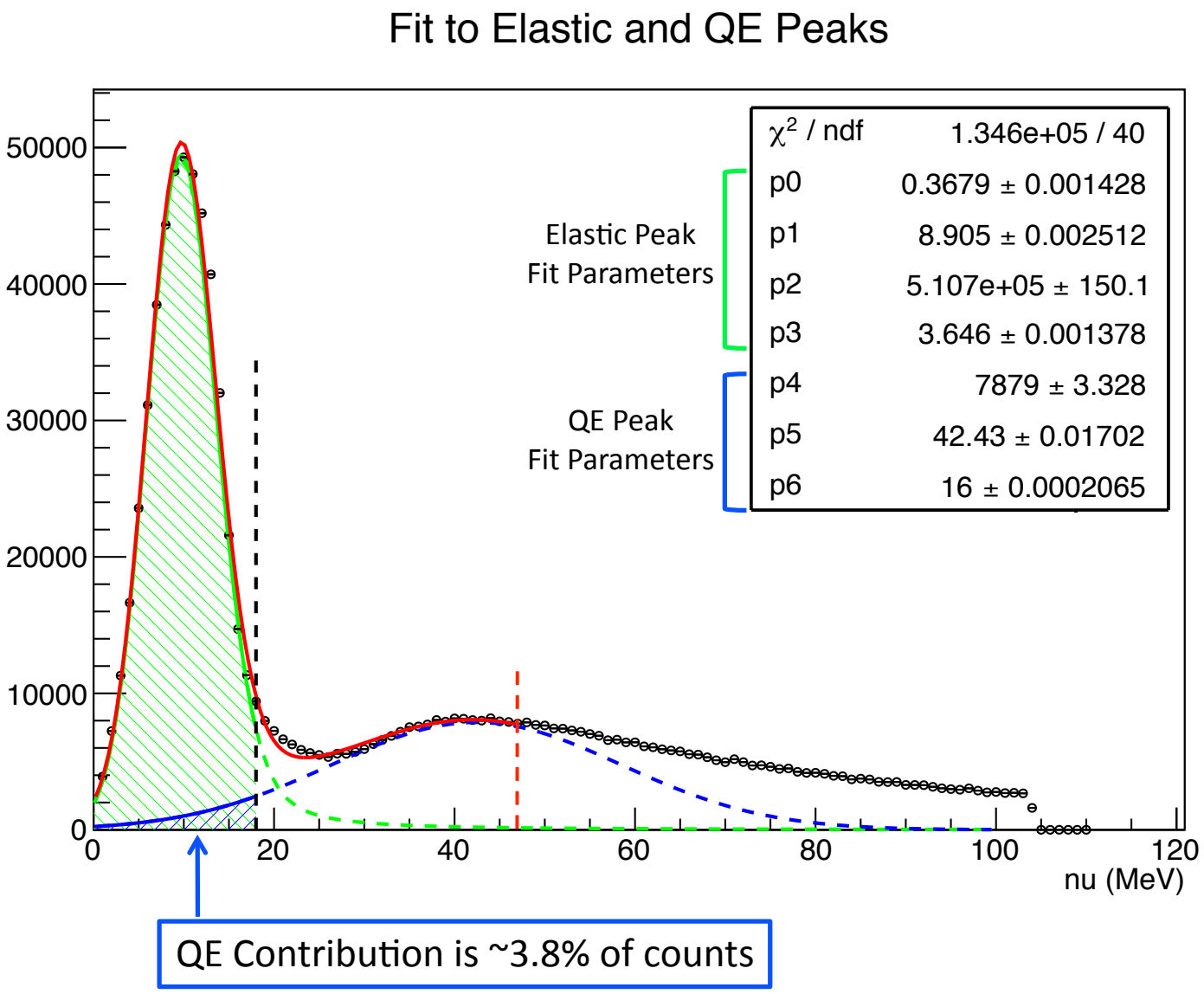




1. Gaussian fit to elastic peak to obtain starting parameters
2. Landau-Gaussian fit to elastic peak
3. Gaussian Fit to quasi-elastic peak
4. Final fit combines both functions

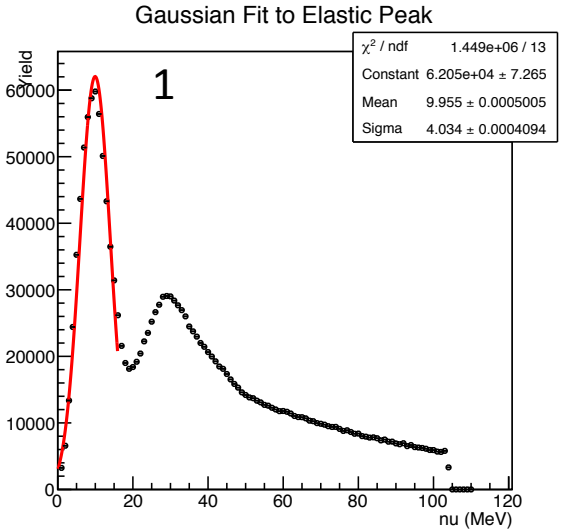
Updated Fitting Routine

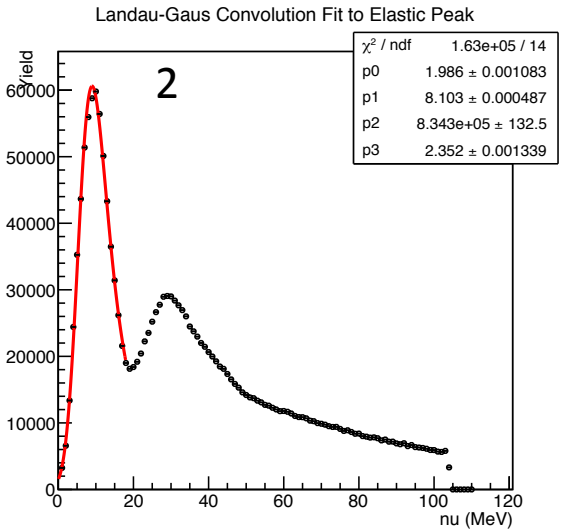
Carbon Run 3447

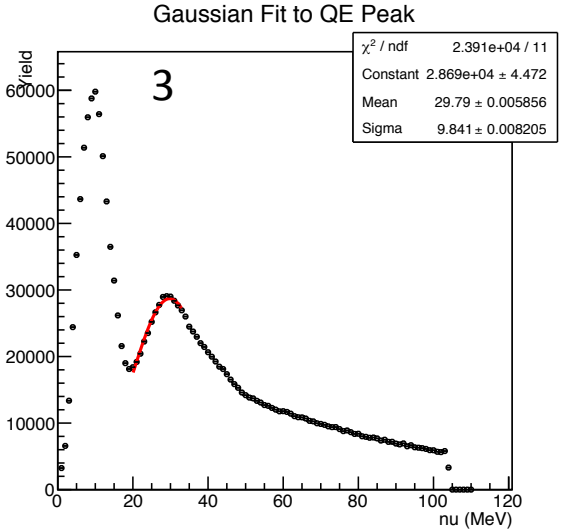


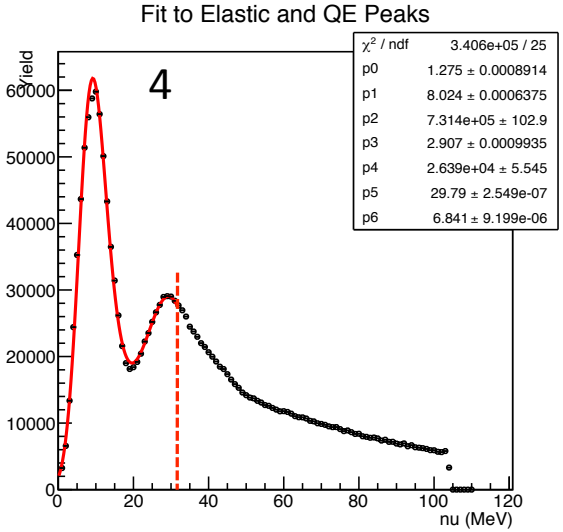
Updated Fitting Routine

Packing Fraction Run 3503







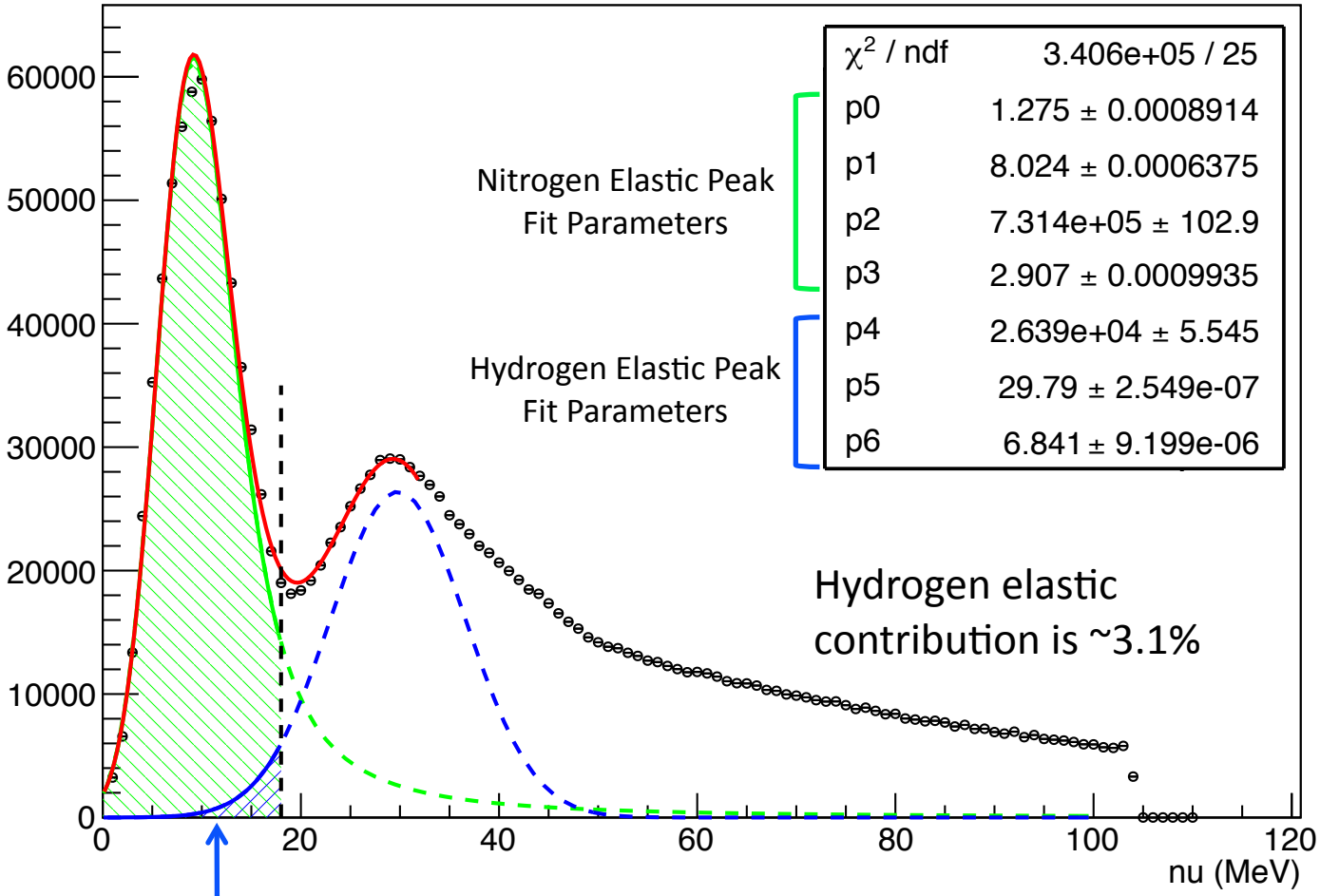


1. Gaussian fit to elastic peak to obtain starting parameters
2. Landau-Gaussian fit to elastic peak
3. Gaussian Fit to quasi-elastic peak
4. Final fit combines both functions

Updated Fitting Routine

Packing Fraction Run 3503

Fit to Nitrogen and Hydrogen Elastic Peaks



Method to Extract PF

$$Y_{pf} = Y_{^{14}N} + Y_{^{4}He} + Y_{^{27}Al} + Y_{H_3}$$

Need simulation to determine σ_H

$$\downarrow$$

$$Y_{pf} = \frac{\rho_N l_{tg} pf}{M_N}\sigma_N + \frac{\rho_{He} l_{tg}(1-pf)}{M_{He}}\sigma_{He} + Y^{out}_{He} + Y_{Al}$$

$$\downarrow$$

$$Y_{pf} = l_{tg} pf\left(\frac{\rho_N}{M_N}\sigma_N - \frac{\rho_{He}}{M_{He}}\sigma_{He}\right) + Y_{dummy}$$

$$\sigma_C = \frac{M_C}{\rho_C l_C}(Y_{carbon} - Y_{empty})$$

$$\downarrow$$

$$\sigma_N = \frac{Y_{pf}}{Y_{carbon}}\sigma_C$$

$$\sigma_{He} = \frac{M_{He}}{\rho_{He}(l_{tg} + l_{out})}Y_{empty}$$

Results Using Updated Fits

2.2 GeV, 2.5T, Transverse, Material #7

Known Values:

ℓ_{tg} = 28.2 mm
ℓ_{out} = 13.8 mm
ℓ_{carbon} = 1.016 mm

ρ_C = 2267 g/mm^3
ρ_{He} = 145 g/mm^3
ρ_N = 817 g/mm^3

M_C = 2.326E-29 g
M_{He} = 6.647E-30 g
M_N = 1.993E-29 g

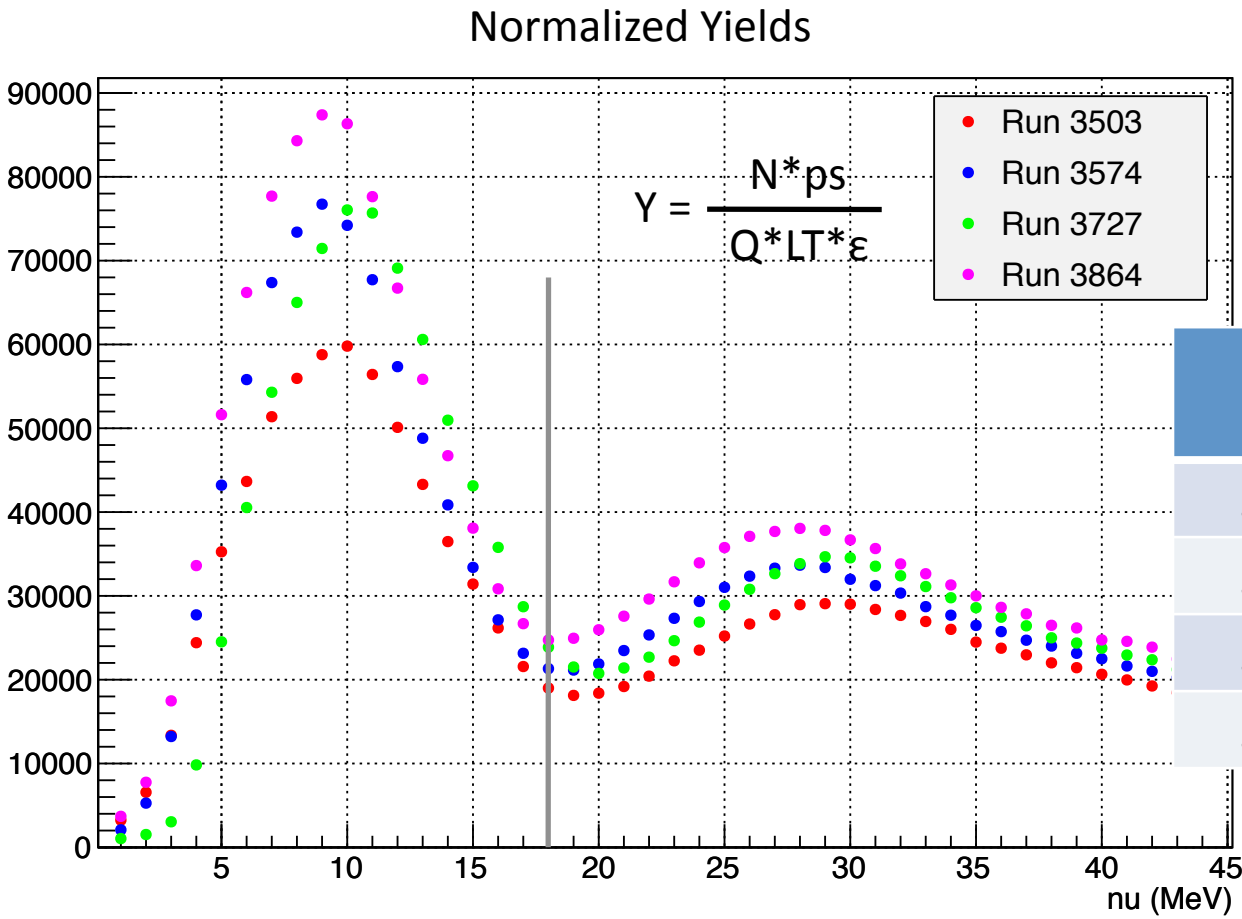
Calculated Values:

σ_{He} = 4.273E-28
σ_C = 9.203E-28
σ_N = 1.068E-27 ← Scaled using run 3727

Run	Yield from Fit	PF
3503	606230	0.270
3574	732731	0.429
3727	703172	0.392
3864	849059	0.576

Packing Fraction Runs for Material #7

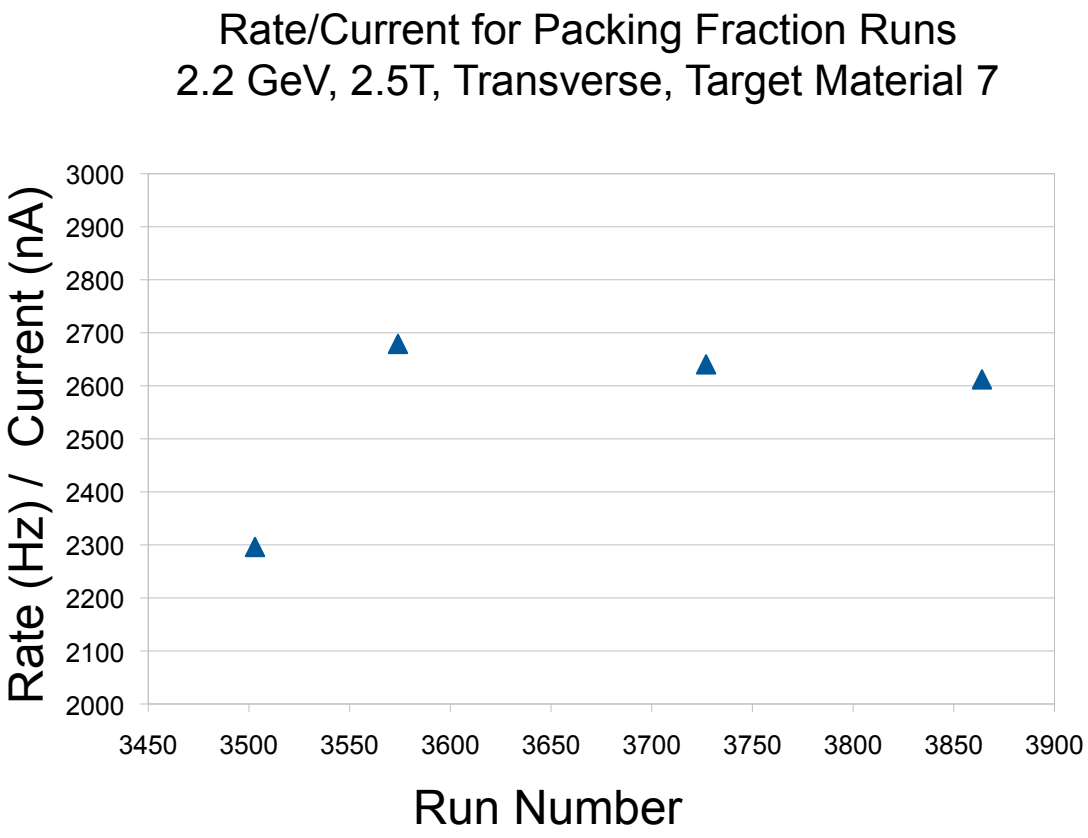
2.2 GeV, 2.5T, Transverse



Run	Peak Location	Area (0-18)
3503	8.024	606230
3574	7.811	732731
3727	9.038	703172
3864	7.739	849059

Packing Fraction Runs for Material #7

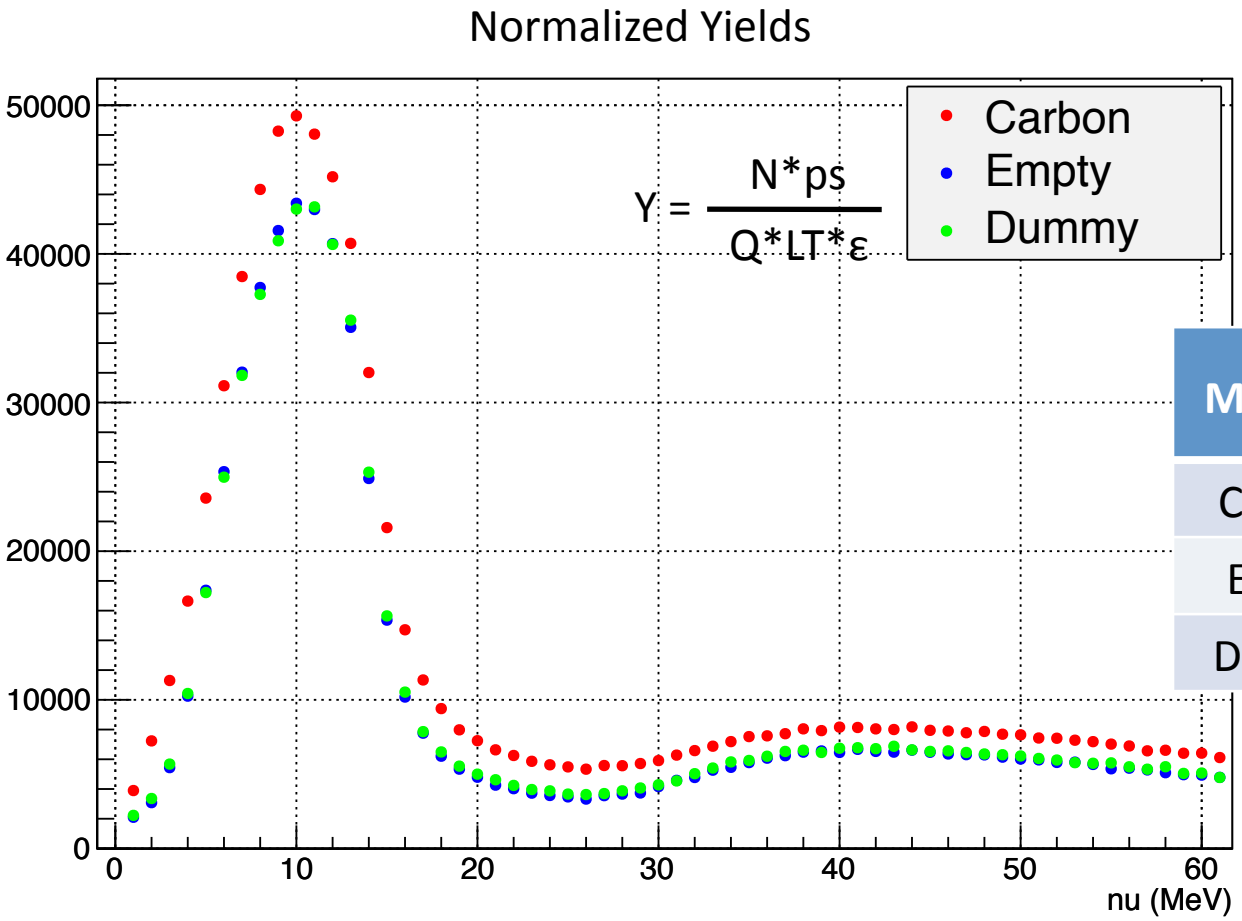
2.2 GeV, 2.5T, Transverse



Run	Peak Location	Area (0-18)
3503	8.024	606230
3574	7.811	732731
3727	9.038	703172
3864	7.739	849059

Dilution Runs

2.2 GeV, 2.5T, Transverse



Material	Peak Location	Area (0-18)
Carbon	8.905	474834
Empty	9.024	391514
Dummy	9.021	391535

To Do

- Understand variance in packing fraction runs
- Include contribution from hydrogen elastic peak
- Any suggestions from this meeting?