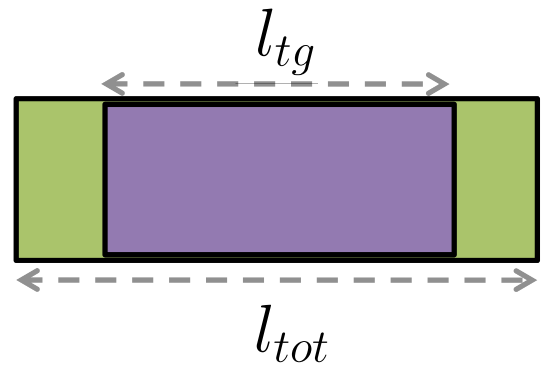
Analysis Updates

M. Cummings

1/7/15

Packing Fraction Method



$$Y_{prod} = Y_{He}^{out} + (1 - p_f) Y_{He}^{in} + p_f Y_N + p_f Y_H$$

$$Y_{tg} = Y_{prod} - Y_{He}^{out}$$

Yield from materials within the target cell

$$Y_{He}^{out} = \frac{(l_{tot} - l_{tg})}{l_{tot}} Y_{dummy}$$

$$Y_{He}^{in} = \frac{l_{tg}}{l_{tot}} Y_{dummy}$$

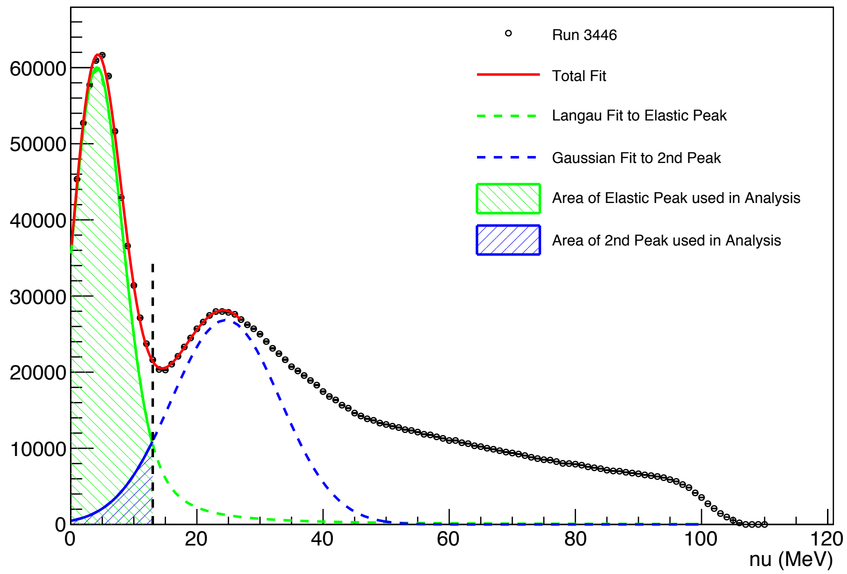
$$(1 - p_f) = \frac{Y_{He}^{in}}{Y_{tg}}$$

Assumes uniform acceptance throughout

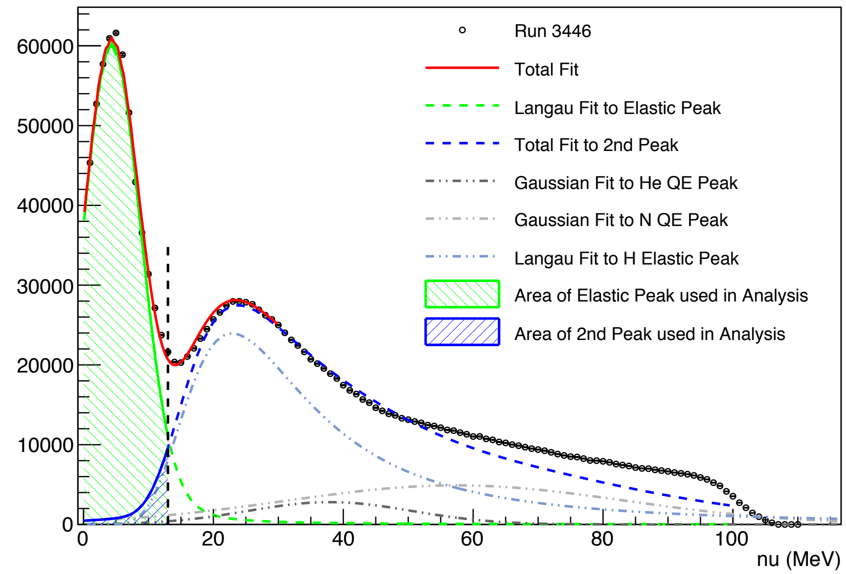
Packing Fraction Method

- Finished update of fitting routine
  - Used QFS model to understand contributions from different materials

Old Fit

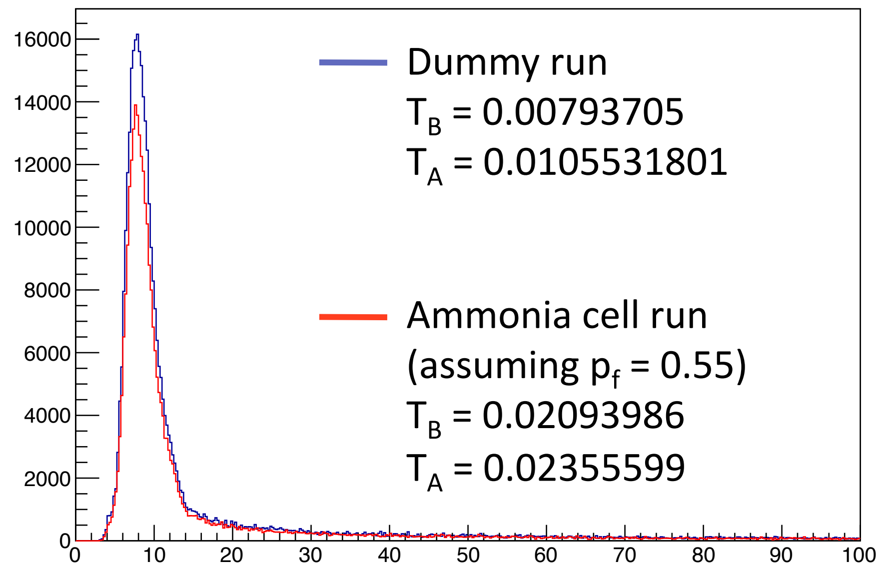


New Fit

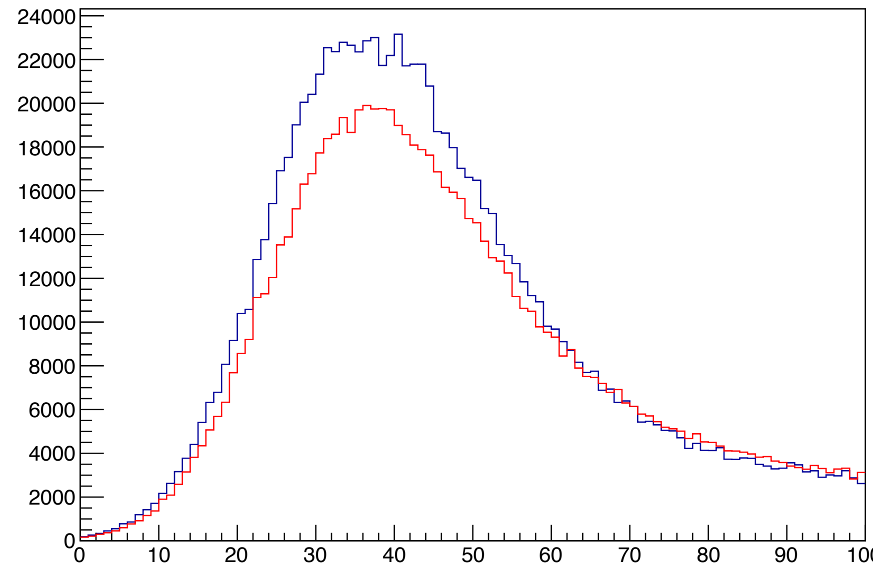


Rad Length Scaling

Elastic Peak



Quasi-Elastic Peak



Purpose: Scale radiation length in dummy run to production run

Method: Yields generated using g2psim for 2 different radiation lengths. The ratio is used to scale Y_{dummy} rad length to match Y_{prod}

For p_f = 0.55:
Scale (elastic) = 0.833
Scale (QE) = 0.858

Contributions to Uncertainty

- Propagation of Uncertainty
- Difference between sum and fit in determining area of elastic peak
- Rad Length Scaling (stdev of scaling parameter)
- Variation in p_f resulting from adjusting nitrogen parameters

Result:

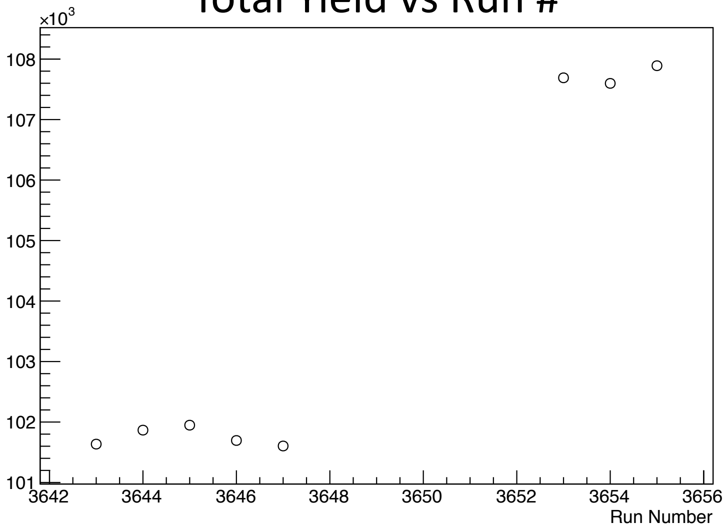
$$p_f = 0.600 \pm 0.026$$

(Using run 3446, 2.2 GeV, 2.5T, Transverse Setting)

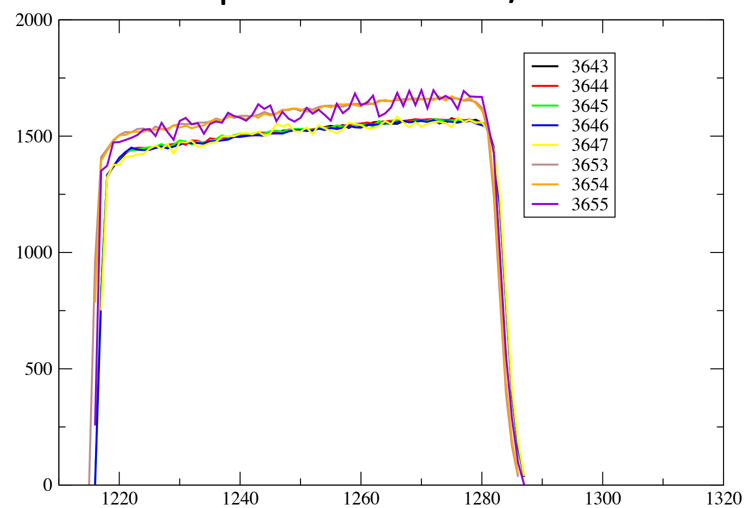
Next: determine p_f for other settings/materials

Variation in Yields

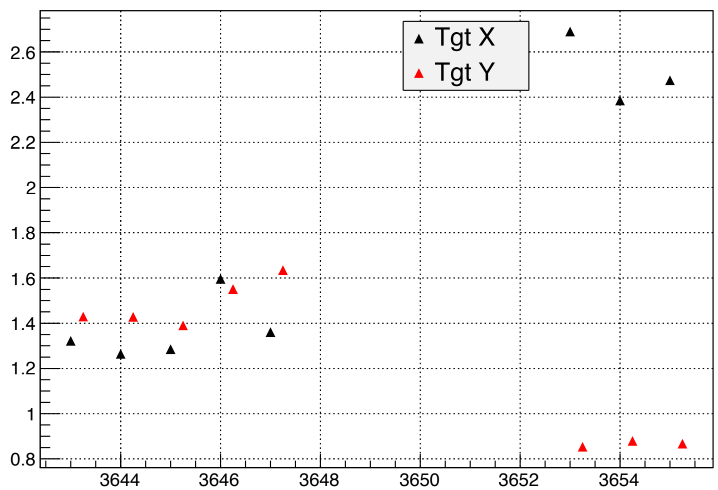
Total Yield vs Run #



p0 = 1.003 GeV/c



Beam Position vs Run #



- Working on data quality check for setting 1: E = 2.2 GeV, 2.5T, transverse

Timeline for Analysis Projects

- Packing Fraction
  - Method is complete, need to extract p_f values for all materials
  - Should take ~1 week
- Understanding Yield Discrepancies
  - Helping Toby with data quality checks
  - Working on 2.2 GeV, 2.5T, transverse setting
- P_bP_t check using elastic asymmetries
  - Should take 1-2 months?

Backup

P_bP_t Check using Elastic Asymmetries

$$A \equiv \frac{\nu_z z^* G_M^2 + \nu_x x^* G_E G_M}{(\tau G_M^2 + \epsilon G_E^2)/[\epsilon(1+\tau)]} \qquad A = \frac{1}{f P_b P_t} A_{exp}$$

Form Factor Parameterization from:

"Relativistic Transverse Images of the Proton Charge and Magnetic Densities",
Venkat/Arrington/Miller/Zhan (2010)
http://arxiv.org/pdf/1010.3629.pdf

$$\tau = \frac{Q^2}{4M^2}$$

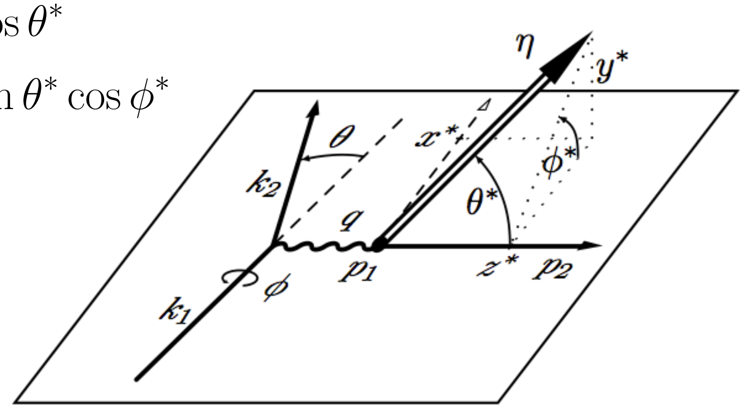
$$\epsilon = \left(1 + 2(1+\tau)\tan^2\frac{\theta}{2}\right)^{-1}$$

$$\nu_z = -2\tau \tan\frac{\theta}{2}\sqrt{\frac{1}{1+\tau} + \tan^2\frac{\theta}{2}}$$

spin orientation:

$$z^* = \cos\theta^*$$

$$x^* = \sin\theta^* \cos\phi^*$$



P_bP_t Check using Elastic Asymmetries

$$A \equiv \frac{\nu_z z^* G_M^2 + \nu_x x^* G_E G_M}{(\tau G_M^2 + \epsilon G_E^2)/[\epsilon(1+\tau)]} \qquad A = \frac{1}{f P_b P_t} A_{exp}$$

2.2 GeV, 5T Longitudinal, Material 18:

Average Polarization Values:
P_t = 74.4%
P_b = 82.46%

A_{pred} = -0.0317221

A_{raw} = -0.00954804
↓
f = 0.49

- Still in progress
- Updates:
  - Method to determine scattering angle
  - Include radiative corrections