Data Quality Check for 2.2 GeV, 2.5T, Transverse (Including RHRS runs)

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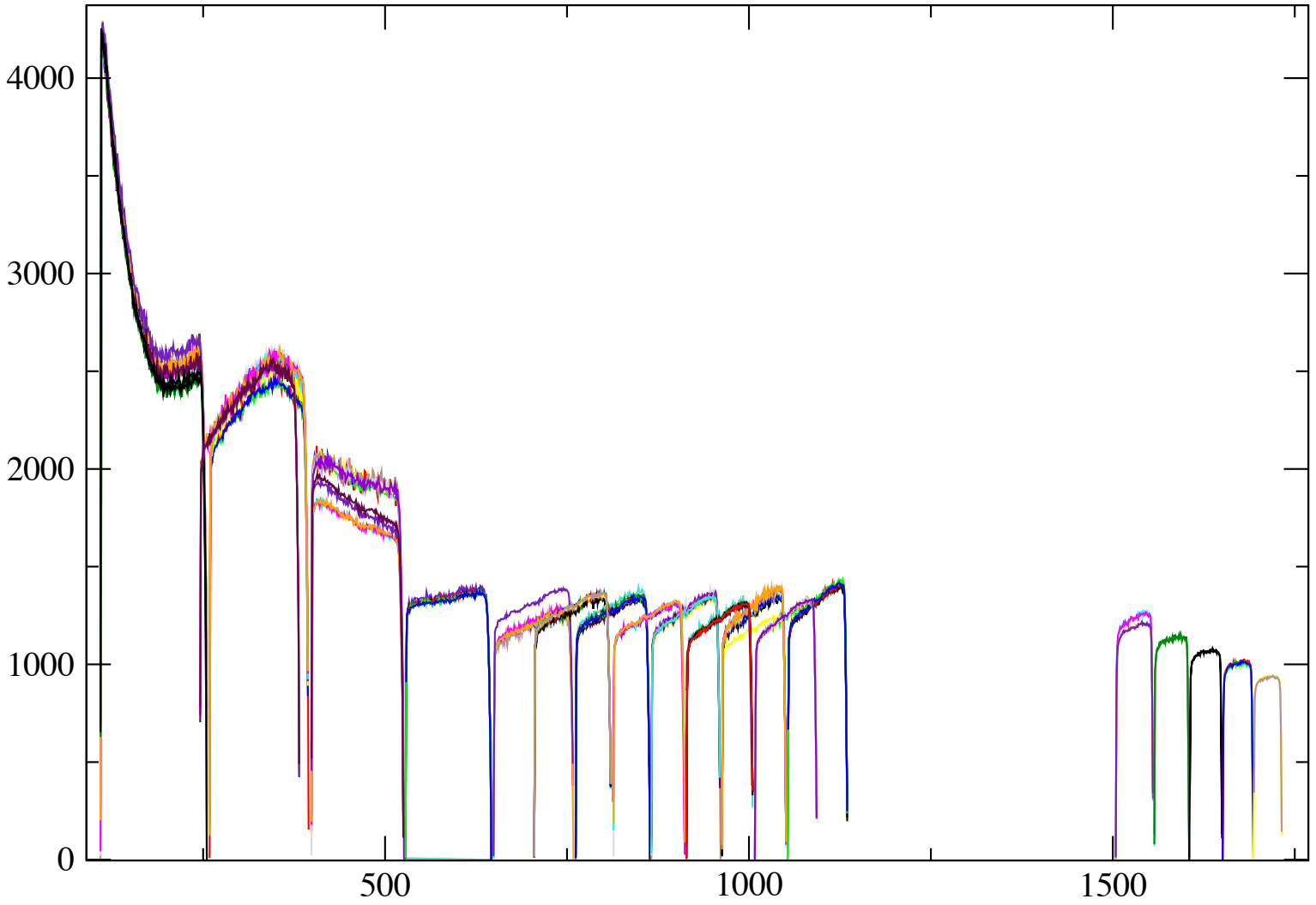
2/4/15

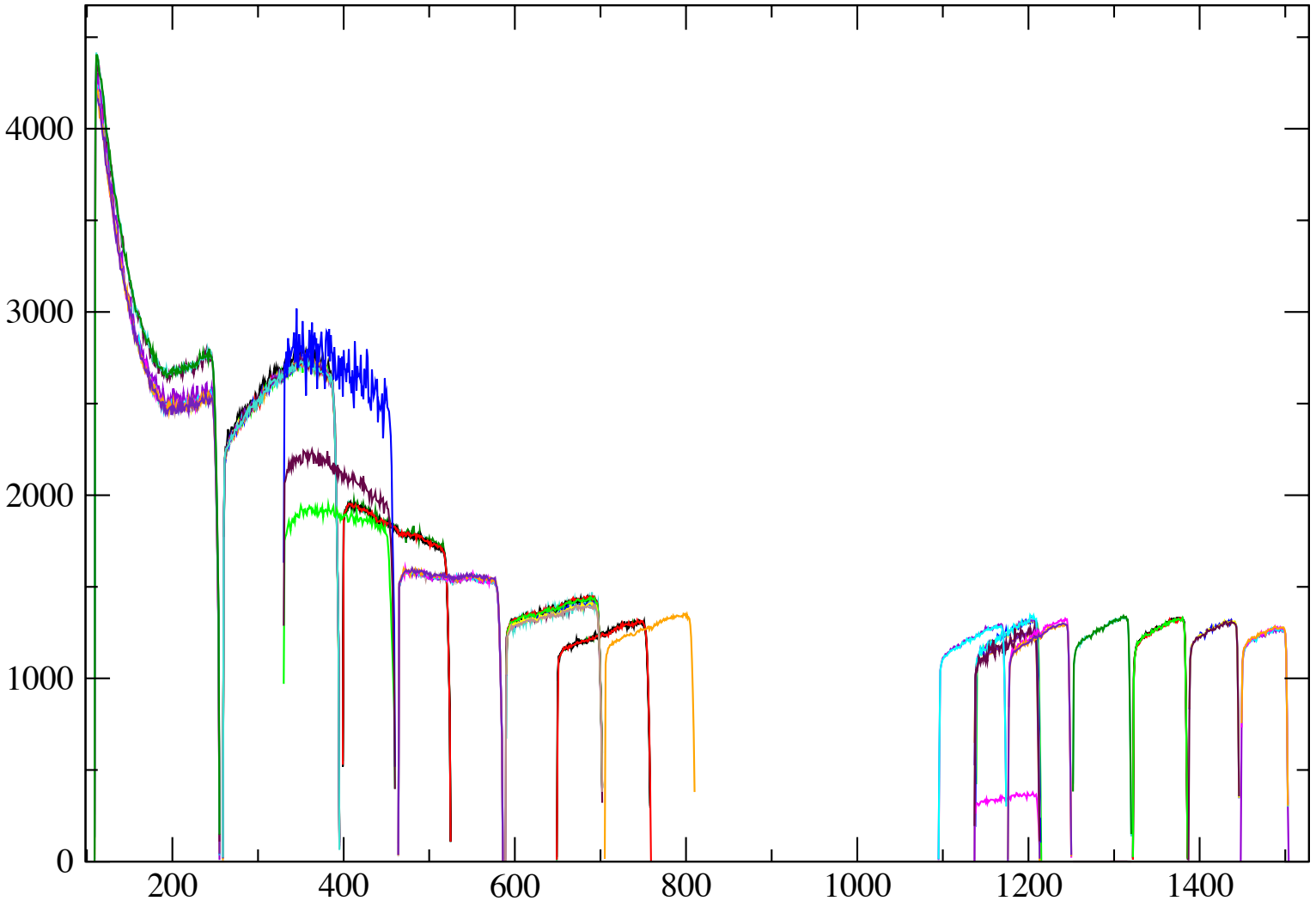
2.2 GeV, 2.5T, Transverse Setting

- LHRS:
  - 37 unique settings (different p0 or material)
  - 259 production runs
- RHRS:
  - 34 unique settings
  - 221 production runs
- Problem settings are consistent with LHRS

Material 7 RHRS – Global Picture

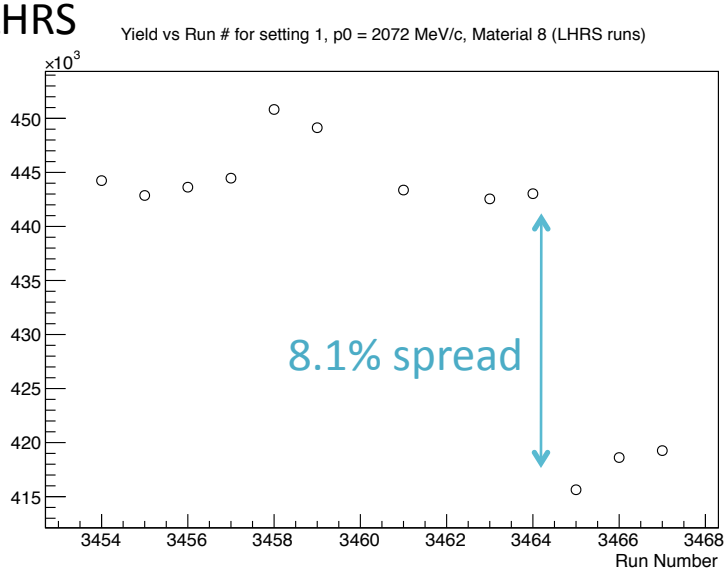


Material 8 RHRS – Global Picture

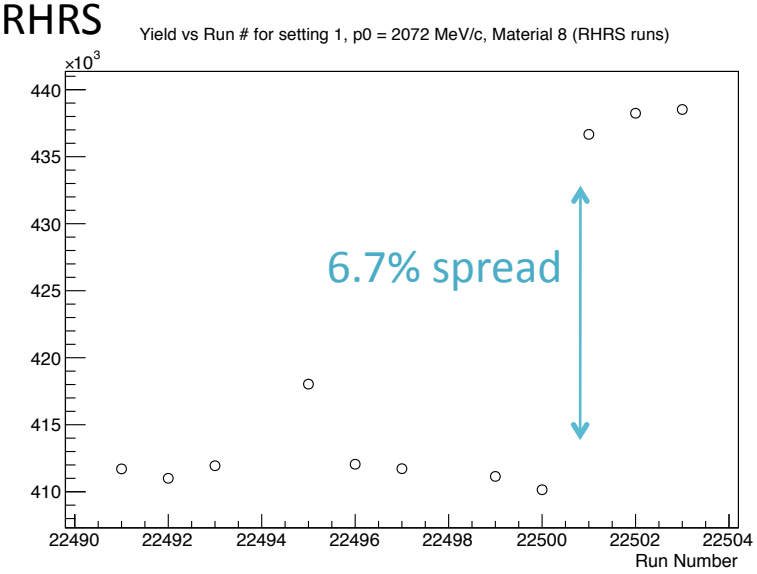


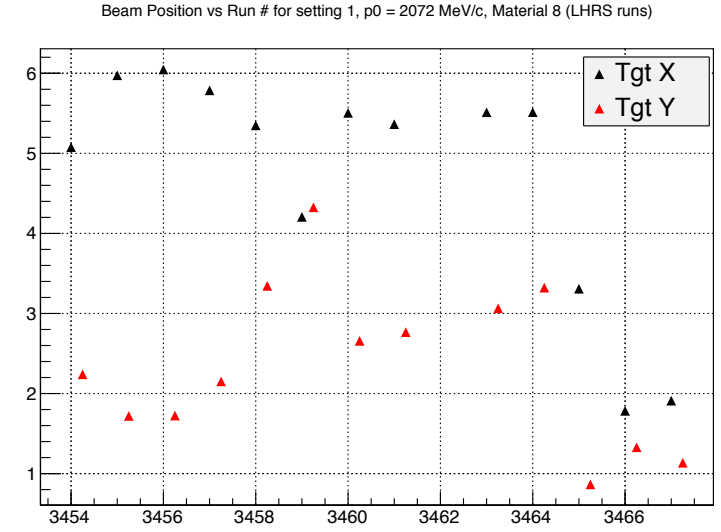
p0 = 2.072 GeV/C, material 8

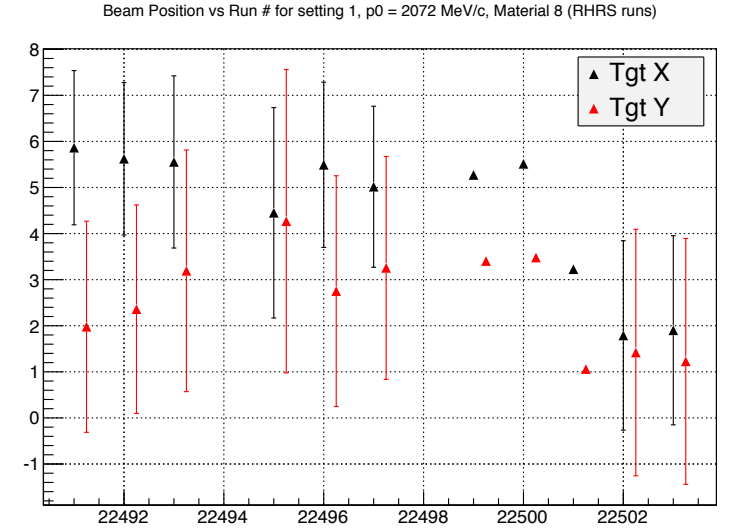
LHRS



RHRS

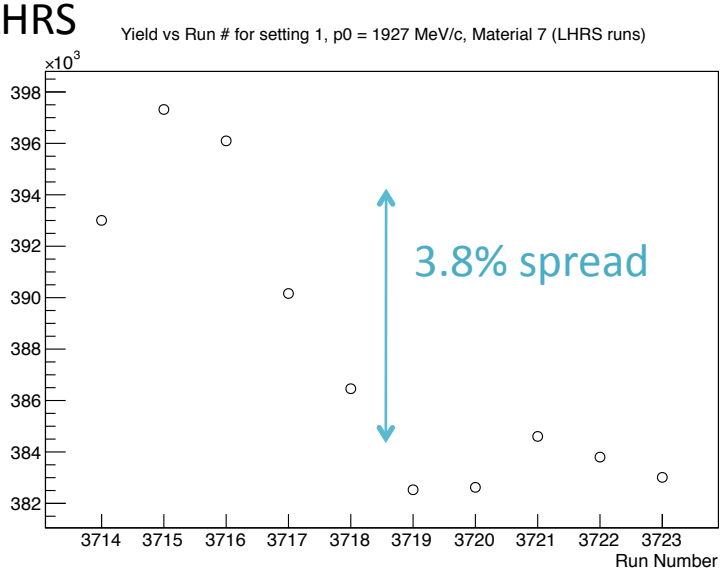




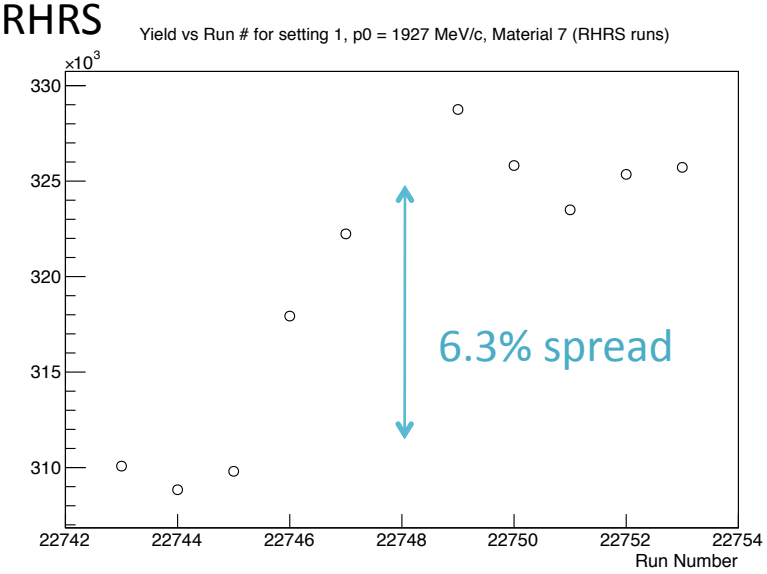


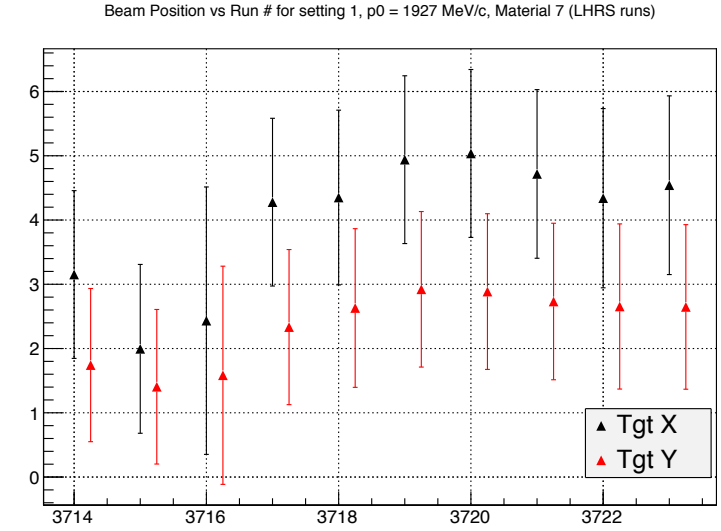
p0 = 1.927 GeV/C, material 7

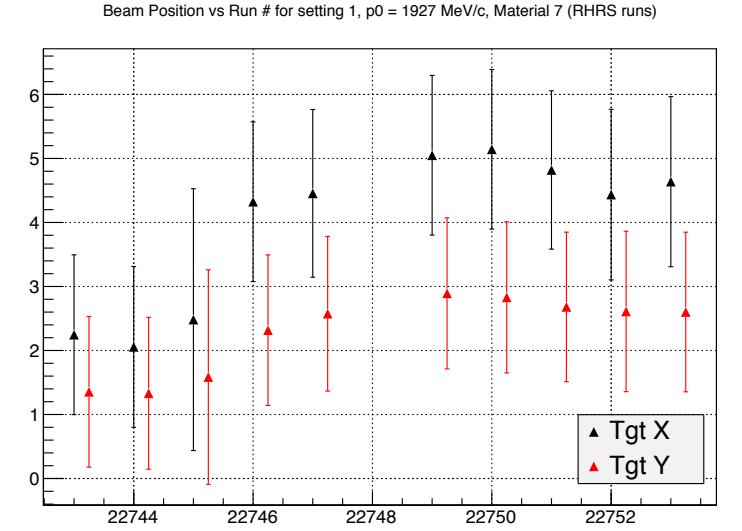
LHRS



RHRS

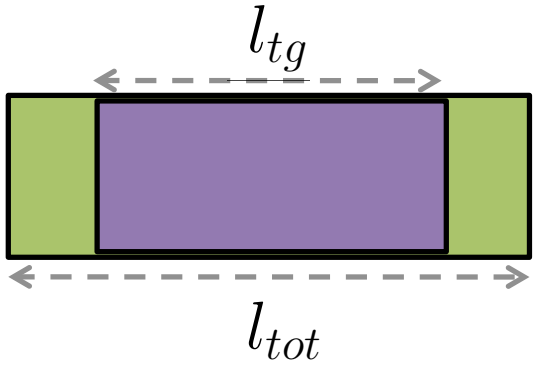






Update on Packing Fraction:

$$Y_{prod} = Y_{He}^{out} + (1 - p_f) Y_{He}^{full} + p_f Y_{NH_3}^{full}$$



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

$$Y_{He}^{full} = \left(\frac{l_{tg}}{l_{tot}} \right) Y_{dummy}$$

$$p_f = \left(\frac{l_{tot}}{l_{tg}} \right) \left(\frac{Y_{prod}}{Y_{dummy}} - 1 \right) \left(\frac{Y_{NH_3}^{full}}{Y_{He}^{full}} - 1 \right)^{-1}$$

Need input from cross sections

Update on Packing Fraction:

$$p_f = \left(\frac{l_{tot}}{l_{tg}}\right)\left(\frac{Y_{prod}}{Y_{dummy}} - 1\right)\left(\frac{Y_{NH_3}^{full}}{Y_{He}^{full}} - 1\right)^{-1}$$

$$Y_x \sim \sigma_x \cdot \rho_x \cdot A_x$$

$$\rho_x = \frac{\rho_{mass} \cdot l_x \cdot N_A}{M_{molar}}$$

$$Y_{NH_3}^{full} = \sigma_N \cdot \rho_N \cdot A_N + \sigma_H \cdot \rho_H \cdot A_H$$

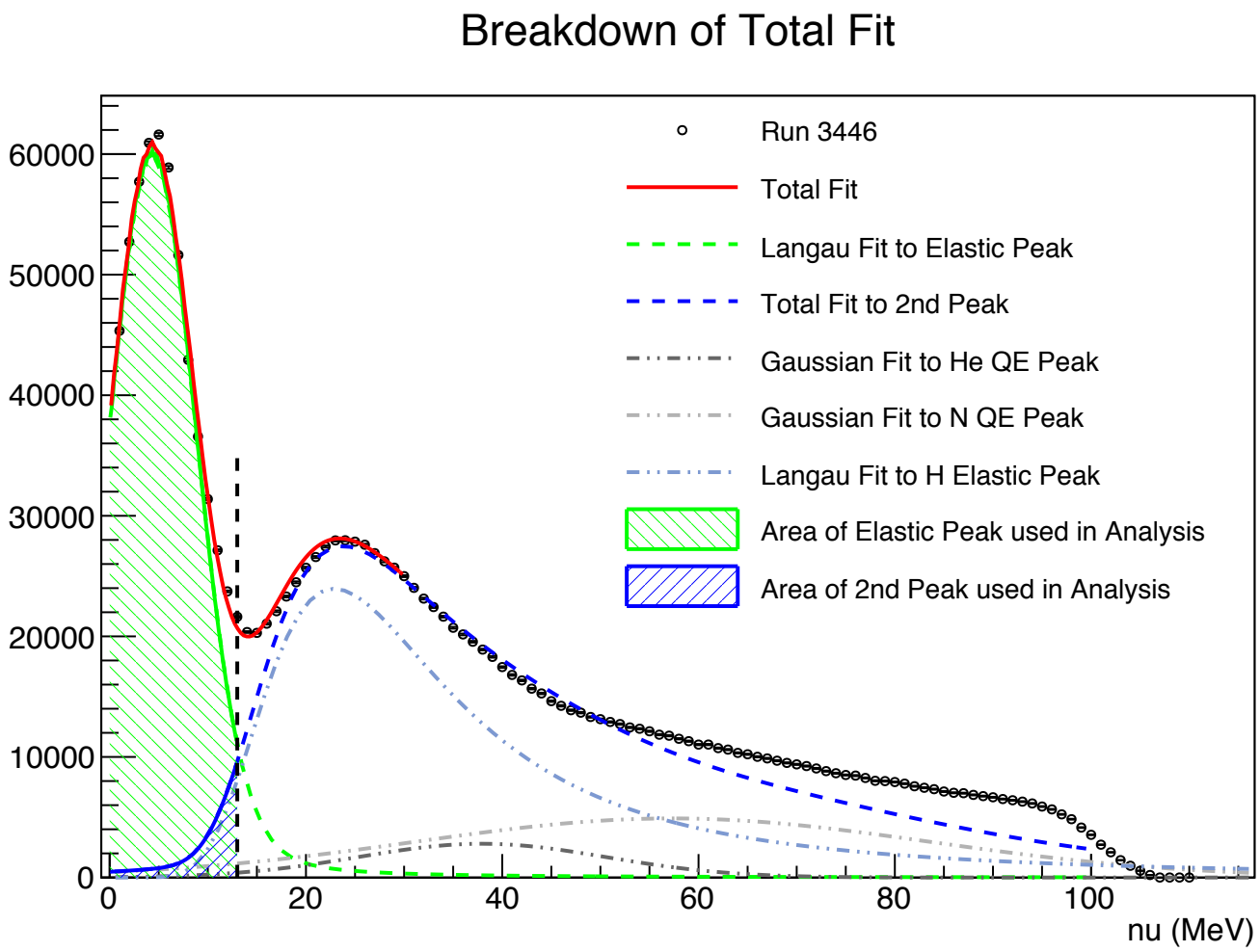
$$Y_{He}^{full} = \sigma_{He} \cdot \rho_{He} \cdot A_{He}$$

σ_x = cross section
ρ_x = target # density

A_x = $\frac{\text{\# of counts in cut}}{\text{total \# of counts in fit}}$

l_x = length of material
ρ_{mass} = mass density
M_{molar} = molar mass
N_A = Avagadro's #

Reminder: Updated Fitting Routine



Update on Packing Fraction:

$$p_f = \left(\frac{l_{tot}}{l_{tg}}\right)\left(\frac{Y_{prod}}{Y_{dummy}} - 1\right)\left(\frac{Y_{NH_3}^{full}}{Y_{He}^{full}} - 1\right)^{-1}$$

$$Y_x \sim \sigma_x \cdot \rho_x \cdot A_x$$

$$\rho_x = \frac{\rho_{mass} \cdot l_x \cdot N_A}{M_{molar}}$$

$p_f = 0.620$
(with previous method: pf = 0.600 ± 0.026)

$$Y_{NH_3}^{full} = \sigma_N \cdot \rho_N \cdot A_N + \sigma_H \cdot \rho_H \cdot A_H$$

$$Y_{He}^{full} = \sigma_{He} \cdot \rho_{He} \cdot A_{He}$$

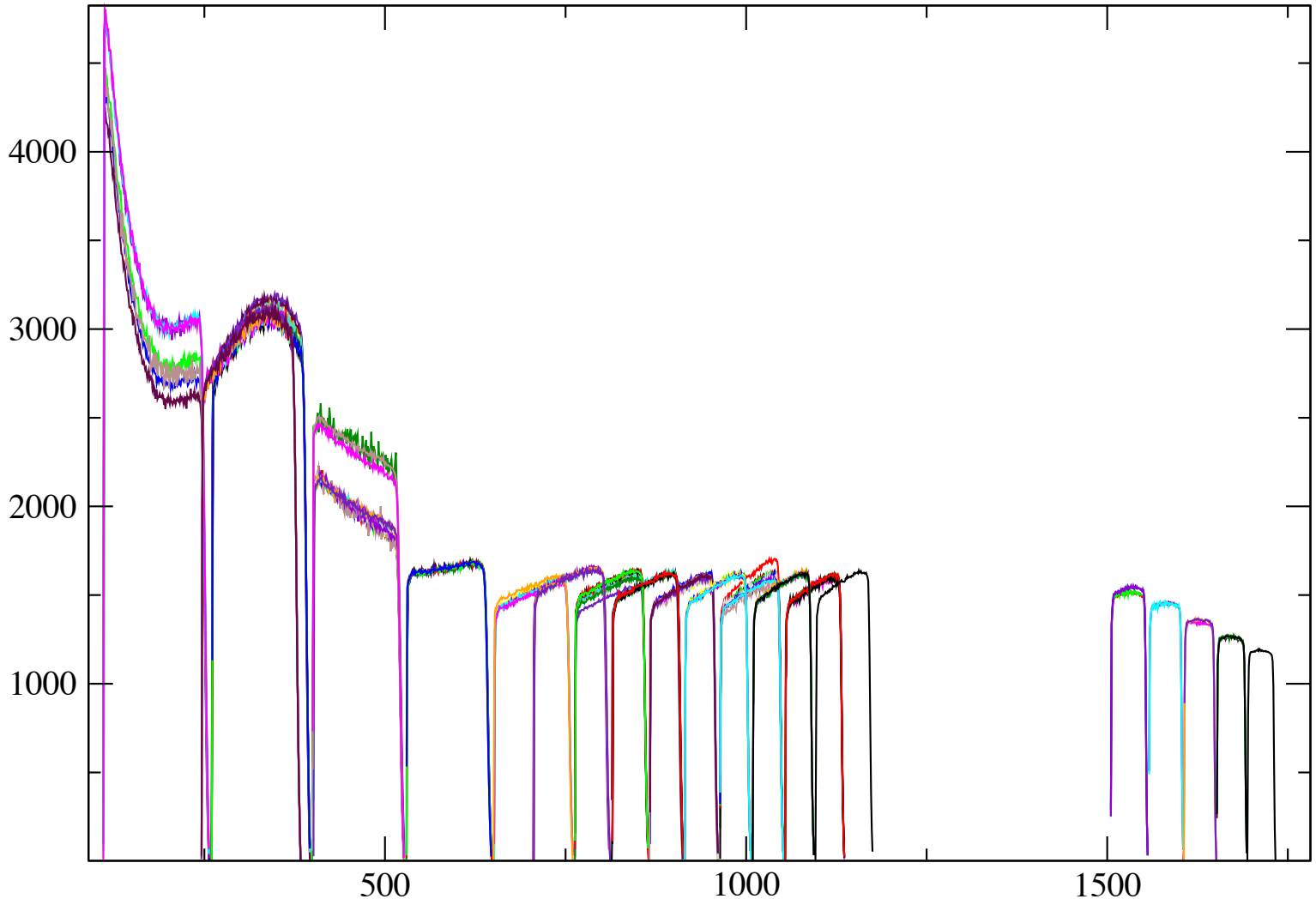
To Do:

- Tie up loose ends on RHRS data quality check

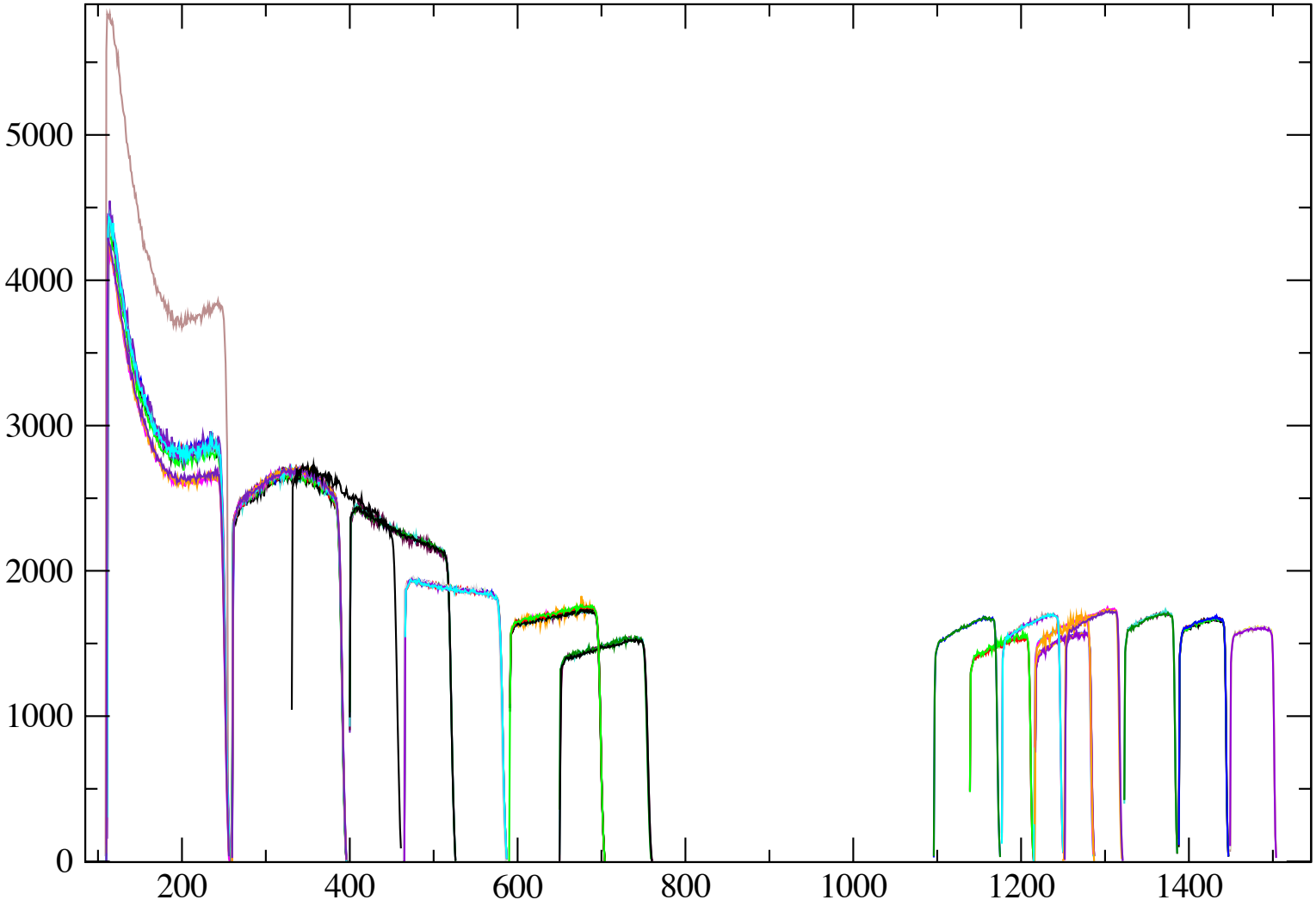
- Packing Fraction:
  - Cross section ratio is unradiated – need to adjust this
  - Still need to extract p_f values for all materials – will start with settings that don't have yield issues
  - Working on technote

Backup

Material 7 LHRS – Global Picture



Material 8 LHRS – Global Picture



Update on Packing Fraction:

$$p_f = \left(\frac{l_{tot}}{l_{tg}}\right)\left(\frac{Y_{prod}}{Y_{dummy}} - 1\right)\left(\frac{Y_{NH_3}^{full}}{Y_{He}^{full}} - 1\right)^{-1}$$

l_{tot} = 42 mm
l_{tg} = 28.2 mm

$\rho_{mass\text{-}He}$ = 145 x 10^{-6} g/mm^3
$\rho_{mass\text{-}NH3}$ = 817 x 10^{-6} g/mm^3

M_{He} = 4.00262 g/mol
M_N = 14.0067 g/mol
M_H = 1.00794 g/mol

σ_{He} = 180.81 μB
σ_N = 313.46 μB
σ_H = 126.12 μB

A_{He} = 0.929
A_N = 0.927
A_H = 0.024