Simulation update

Last time:

Pf Uncertainty study

Last Time

Pf Uncertainty Study

- For example 2.2GeV, 2.5T

Runs	Yields	Beam x/mm	Beam y/mm	Beam th/rad	Beam ph/rad
3446	814930	4.57	3.38	0.0635	0.0042
3447	508891	4.53	3.41	0.0636	0.0042
3448	426499	4.62	3.30	0.0635	0.0042
3449	428489	5.89	1.69	0.0619	0.0056

Materal 7, septum 40-32-16

Last Time Pf Uncertainty Study

$$\frac{Y_{\exp\_target} - Y_{\exp\_dummy}}{Y_{\exp\_carbon} - Y_{\exp\_LHe}} = \frac{\text{NH3 Target} - \text{Dummy target}}{\text{carbon} - \text{Dummy /empty target}}$$

Nose filled with He

$$= \frac{\left[\frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3*\sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1-pf) * \sigma_{He}\right] - \frac{d_{He}}{M_{He}} T_{cell} * \sigma_{He} + \frac{d_{He}}{M_{He}} (T_{total} - T_{cell}) * (\sigma_{He1} - \sigma_{He2})}{\frac{d_C}{M_C} T_C * \sigma_C + \frac{d_{He}}{M_{He}} (T_{total} - T_{endcap}) * \sigma_{He3} - \frac{d_{He}}{M_{He}} (T_{total} - T_C) * \sigma_{He2} + \frac{d_{He}}{M_{He}} T_{endcap} * \sigma_{Al}}$$

Pf= 0.67

a) $\delta_{Pf}/_{Pf} = 7.19\%$, 1mrad uncertainty

- assume run 3446,3447,3448, relative beam shift is small, bpm absolute uncertainty 1mrad
- So $\delta\left(\frac{\sigma_{He}}{\sigma_{He1}}\right) = 0, \delta(\sigma_{He2}/\sigma_{He1}) = 0, \delta(\sigma_{He3}/\sigma_{He1}) = 0,$
- $\delta\left(\frac{\sigma_N}{\sigma_{He1}}\right) = 4.74\%, \delta\left(\frac{\sigma_H}{\sigma_{He1}}\right) = -0.95\%, \delta\left(\frac{\sigma_C}{\sigma_{He1}}\right) = 3.63\%$

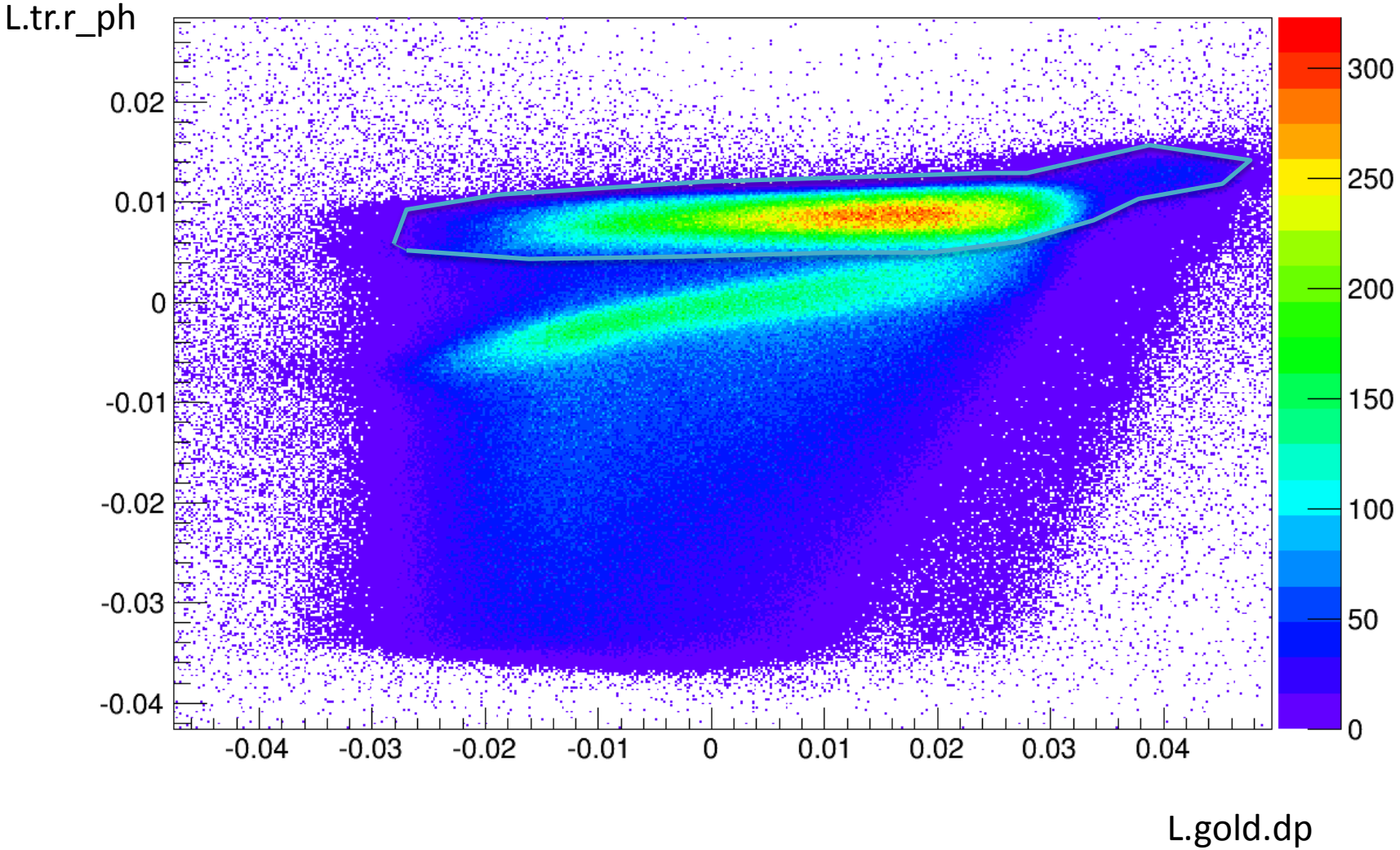
Pf Uncertainty Study

- For example 2.2GeV, 5T, Longitudinal

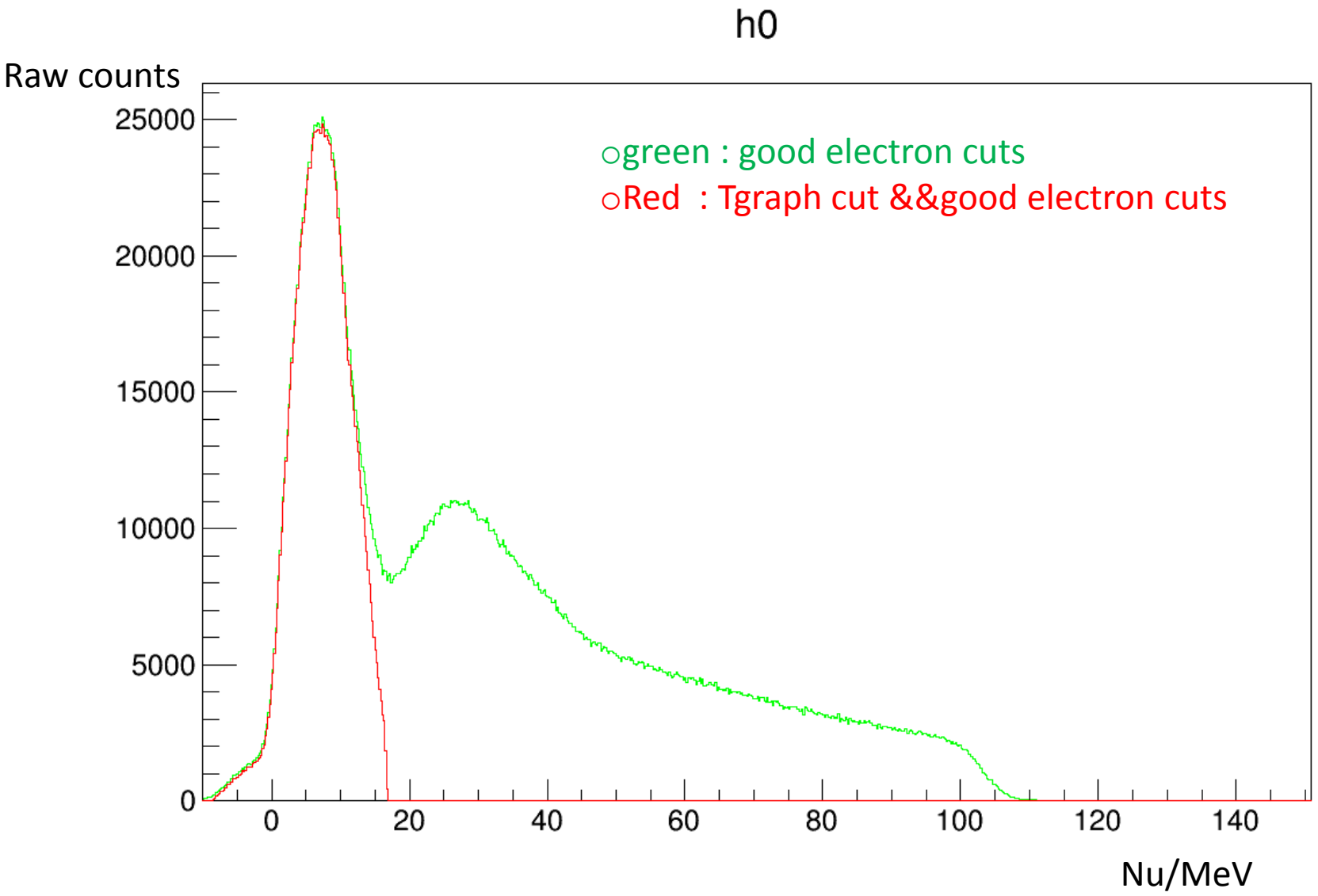
Runs	type	Beam x/mm	Beam y/mm	Beam th/mrad	Beam ph/mrad
5649	carbon	0.22	-3.84	-0.54	0.10
5650	empty	0.16	-3.59	-0.30	0.02
5651	dummy	-0.23	-3.76	-0.53	-0.40
5652	production	0.34	-3.65	-0.40	0.19

Materal 18, septum 40-00-16

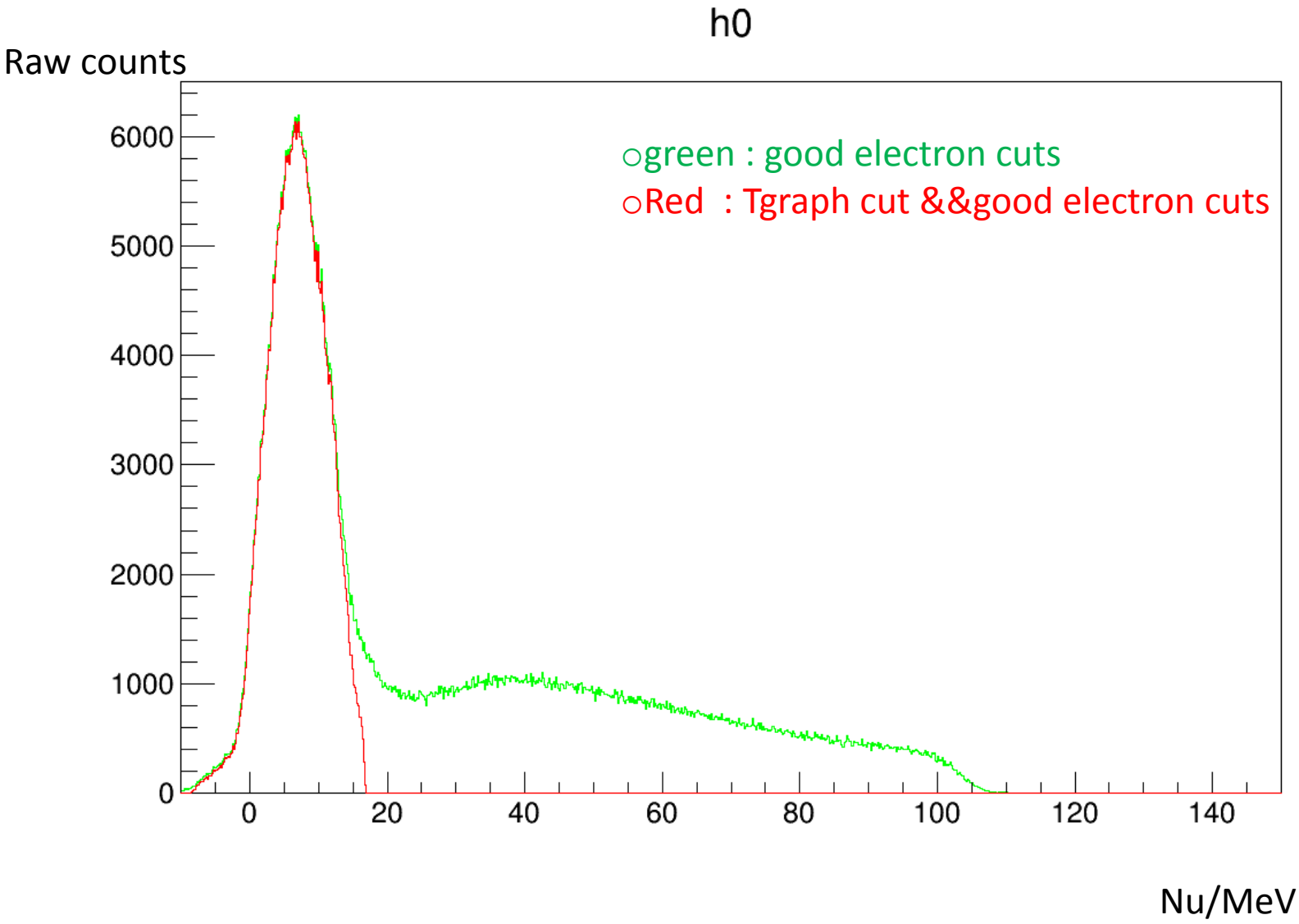
Run 5652


L.tr.r_ph
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
300
250
200
150
100
50
0
L.gold.dp

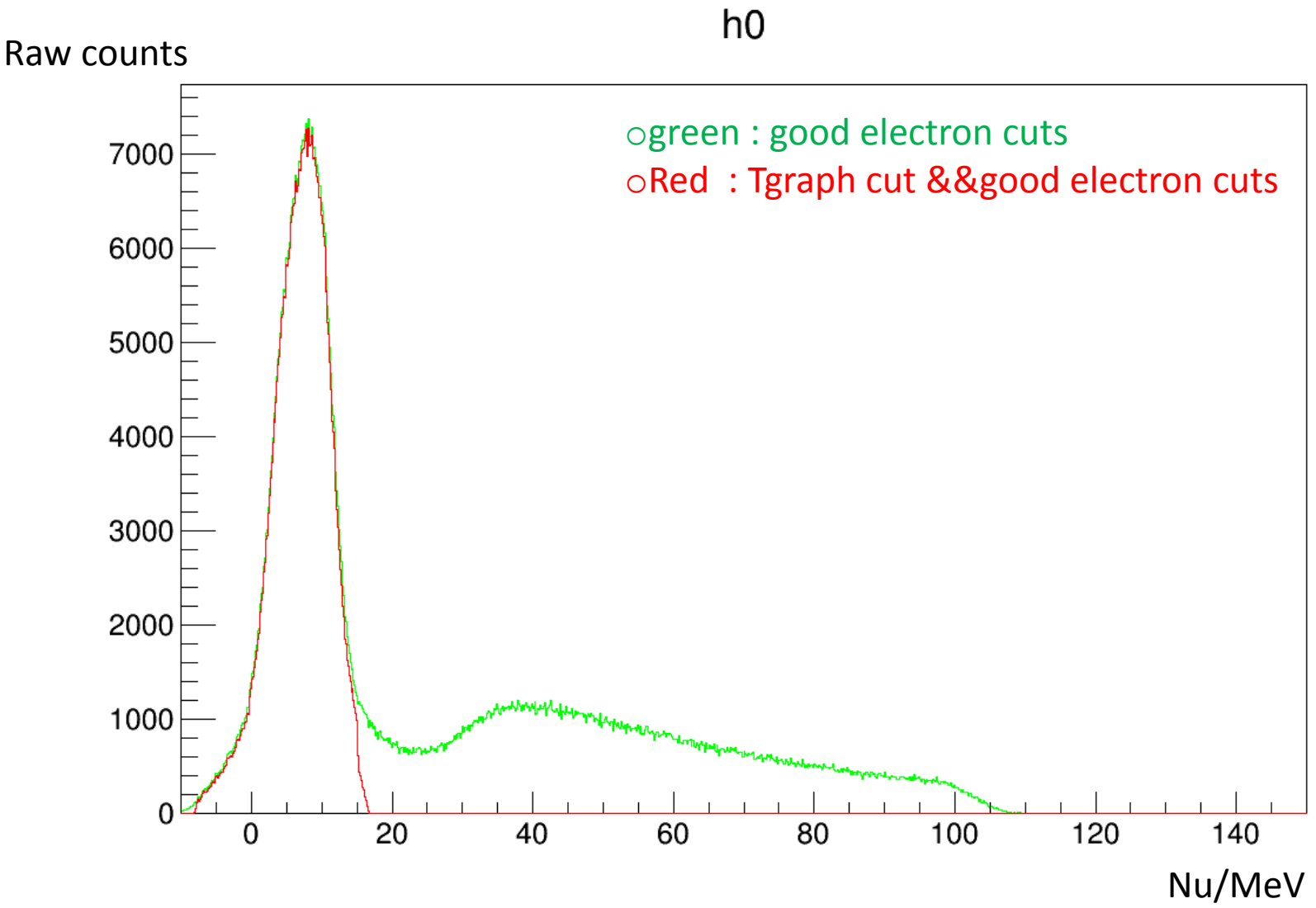
Production Run 5652, After 2d graph cut



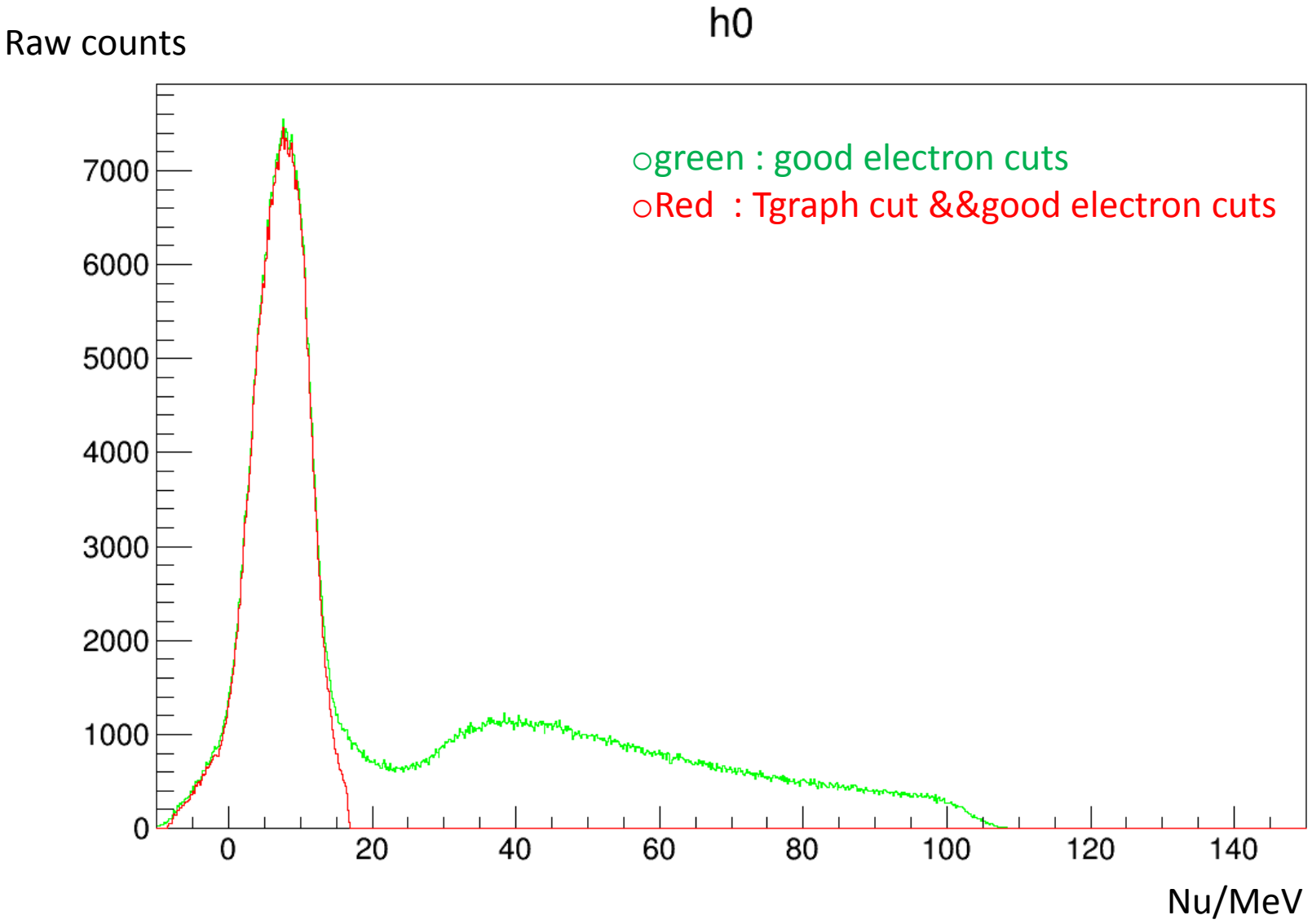
Carbon Run 5649, After 2d graph cut



Empty Run 5650, After 2d graph cut



Dummy Run 5651, After 2d graph cut



Pf Uncertainty Study

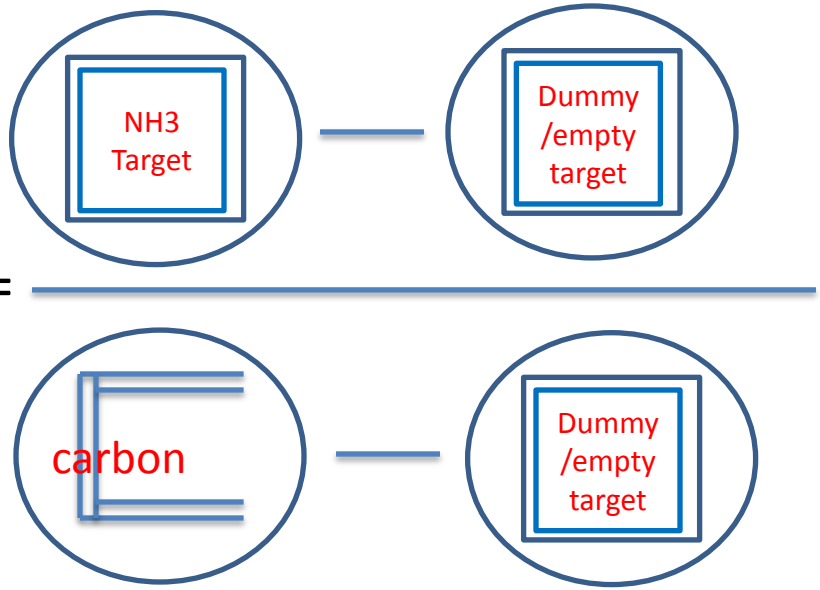
- For example 2.2GeV, 5T, Longitudinal

Runs	Yields	Beam x/mm	Beam y/mm	Beam th/mrad	Beam ph/mrad
5649	855025	0.22	-3.84	-0.54	0.10
5650	481113	0.16	-3.59	-0.30	0.02
5651	480956	-0.23	-3.76	-0.53	-0.40
5652	832366	0.34	-3.65	-0.40	0.19

Apply the same 2D cut for dilution runs
Yields corrected with efficiency, charge…
Materal 18, septum 40-00-16

Pf Uncertainty Study

$$\frac{Y_{\exp\_target} - Y_{\exp\_dummy}}{Y_{\exp\_carbon} - Y_{\exp\_LHe}} =$$



Nose filled with He

$$= \frac{\left[\frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3*\sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1-pf) * \sigma_{He}\right] - \frac{d_{He}}{M_{He}} T_{cell} * \sigma_{He} + \frac{d_{He}}{M_{He}} (T_{total} - T_{cell}) * (\sigma_{He1} - \sigma_{He2})}{\frac{d_C}{M_C} T_C * \sigma_C + \frac{d_{He}}{M_{He}} (T_{total} - T_{endcap}) * \sigma_{He3} - \frac{d_{He}}{M_{He}} (T_{total} - T_C) * \sigma_{He2} + \frac{d_{He}}{M_{He}} T_{endcap} * \sigma_{Al}}$$

Pf= 0.51

a) $\delta_{Pf}/_{Pf} = 7.61\%$, 1mrad uncertainty

- assume run 5652,5649,5660, relative beam shift is small, bpm absolute uncertainty 1mrad
- So $\delta\left(\frac{\sigma_{He}}{\sigma_{He1}}\right) = 0, \delta(\sigma_{He2}/\sigma_{He1}) = 0, \delta(\sigma_{He3}/\sigma_{He1}) = 0,$
- $\delta\left(\frac{\sigma_N}{\sigma_{He1}}\right) = 4.74\%, \delta\left(\frac{\sigma_H}{\sigma_{He1}}\right) = -0.95\%, \delta\left(\frac{\sigma_C}{\sigma_{He1}}\right) = 3.63\%$

Todo

- Apply to other energy settings/material