Simulation update

Last time:

Yields versus BPM information

Last Time

Runs	Yields	Beam x	Beam y	Beam th	Beam ph
3503	592401	2.09	1.05	0.06082	0.00334
3574	719725	2.00	0.49	0.06011	0.00090
3864	760919	0.84	0.69	0.06083	0.00070

$beam\_x_{3503} > beam\_x_{3574} > beam\_x_{3864}$ ⟶

$\theta\_scatt_{3503} < \theta\_scatt_{3574} < \theta\_scatt_{3864}$ ⟶

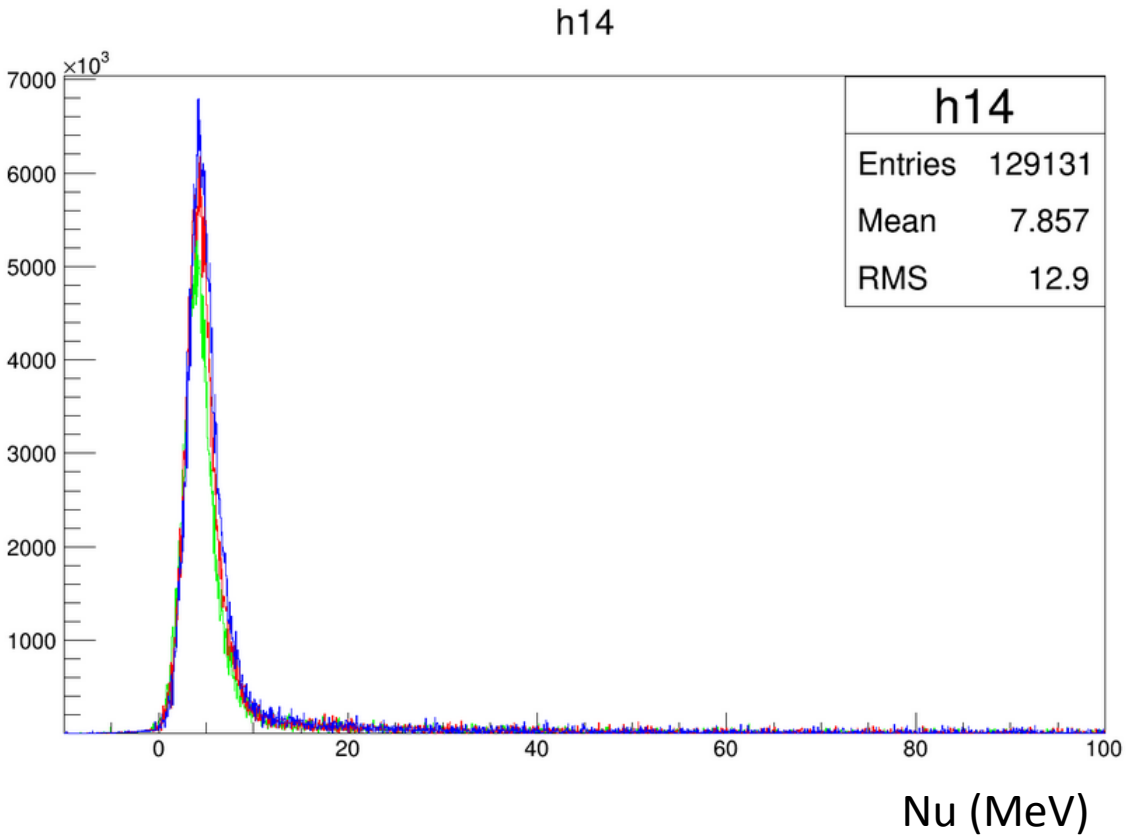
$XS_{3503} > XS_{3574} > XS_{3864}$

The same effect from beam angle beam ph, tan(beam_ph)=dx/dz in lab

Run 3491-3537
Beam variable uncertainty
2~2.4mm at target x/y
0.0023 rad for target theta/phi

Simulation

- Yields versus beam information (x, y, theta, phi)
- Start point (x, y, theta, phi)= (0, 0, 0.0636,0.0042)
- Ionization and external bremsstrahlung



- Simulated distribution
- Green:

  y=0
- Red:

  x=2.5mm
- Blue:

  x=5mm

- Simulate Yields ratio:
- 1.0000 : 1.1671: 1.3333

Yields

(x ,y, theta, phi)	Yields
(0, 0, 0.0636,0.0042)	1
X+2.5mm	1.167
X+5mm	1.333
Y+2.5mm	0.946
Y+5mm	0.896
Theta +1.5mrad	0.995
Theta +3mrad	0.985
Phi + 1.5mrad	1.148
Phi + 3mrad	1.318

Note:

a. Use Pengjia's Beam coordinates tan (phi) =dx/dz

a. "Y+5mm" means only change Y pos to be 5mm

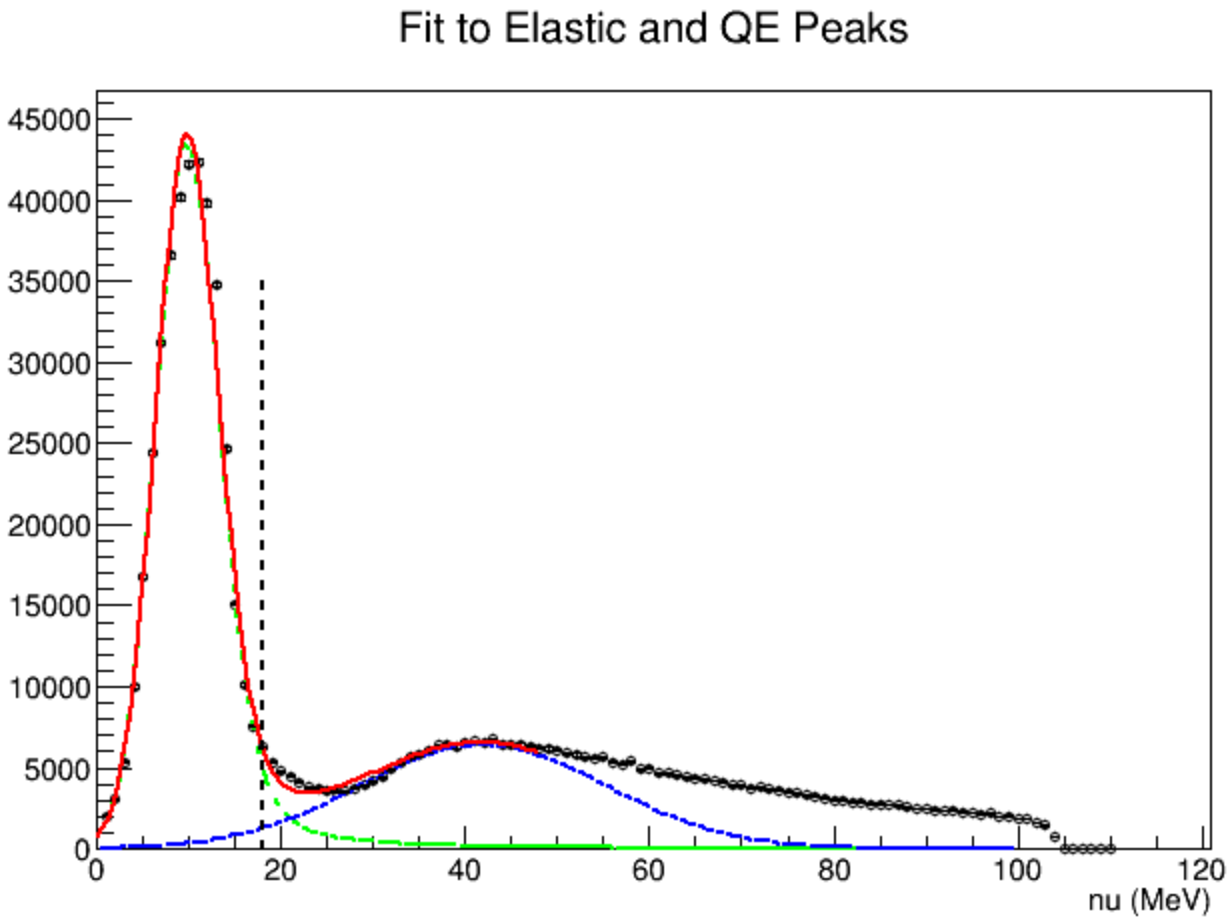
b. All the yields normalized by the yields for configuration (0, 0, 0.0636,0.0042)

c. not consider the relationship between phi versus x and theta versus y

Packing fraction

- Beam information uncertainty
- Choose the runs almost the same time as dilution runs

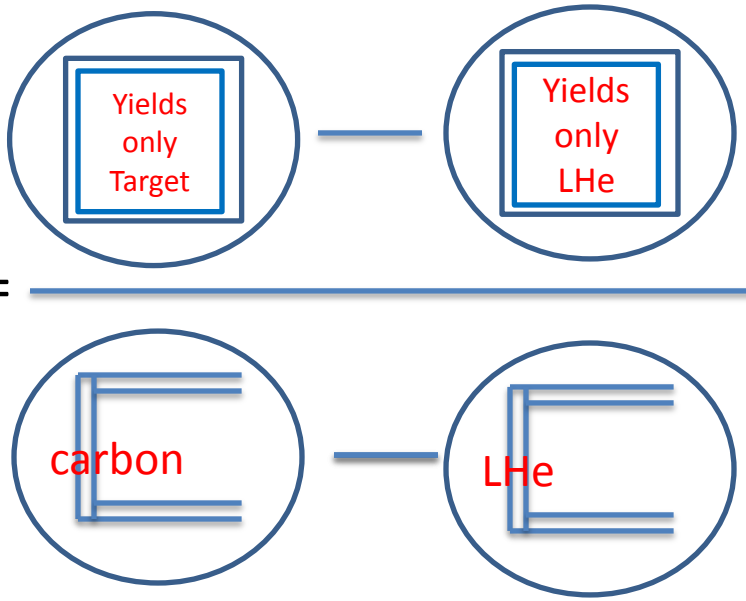
Runs	Yields	Beam x	Beam y	Beam th	Beam ph
3446	814930	4.66	3.31	0.0635	0.0043
3447	508891	4.53	3.41	0.0636	0.0042
3448	426499	4.62	3.30	0.0635	0.0042
3449	428489	5.89	1.69	0.0619	0.0056



- Yields fit the elastic peak and integral Nu (0, 100) MeV

Packing fraction

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



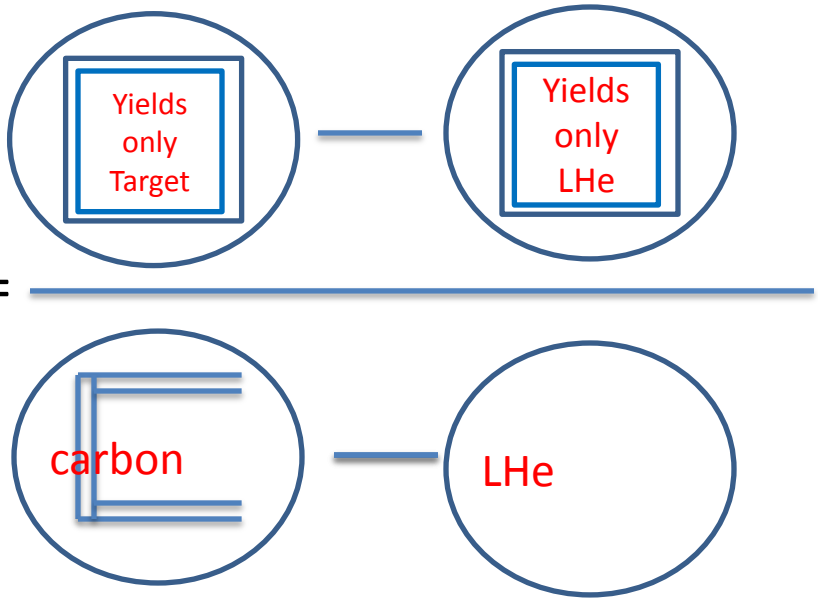
Nose filled with He

$$= \frac{\left[\frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3 * \sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1 - pf) * \sigma_{He}\right] - \frac{d_{He}}{M_{He}} T_{cell} * \sigma_{He\_dummy}}{\frac{d_C}{M_C} T_C * \sigma_C - \frac{d_{He}}{M_{He}} \left((T_{total} - T_C) * \sigma_{He_{carbon}} - T_{total} * \sigma_{He_{new}}\right)}$$

$$\boldsymbol{pf = 0.583}$$

Packing fraction

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



Nose filled with He

$$= \frac{\left[\frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3 * \sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1 - pf) * \sigma_{He}\right] - \frac{d_{He}}{M_{He}} T_{cell} * \sigma_{He\_dummy}}{\frac{d_C}{M_C} T_C * \sigma_C - \frac{d_{He}}{M_{He}} \left((T_{total} - T_C) * \sigma_{He_{carbon}} - T_{total} * \sigma_{He_{new}}\right)}$$

$$\boldsymbol{pf = 0.389}$$

Runs	Yields	Beam x	Beam y	Beam th	Beam ph
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3449	428489	5.89	1.69	0.0619	0.0056

- Look at the table 3448 vs 3449
- Yields the same
- Beam information not the same, will get a ratio of yields 1:1.2 from simulation
- Will add cross coil to see the difference