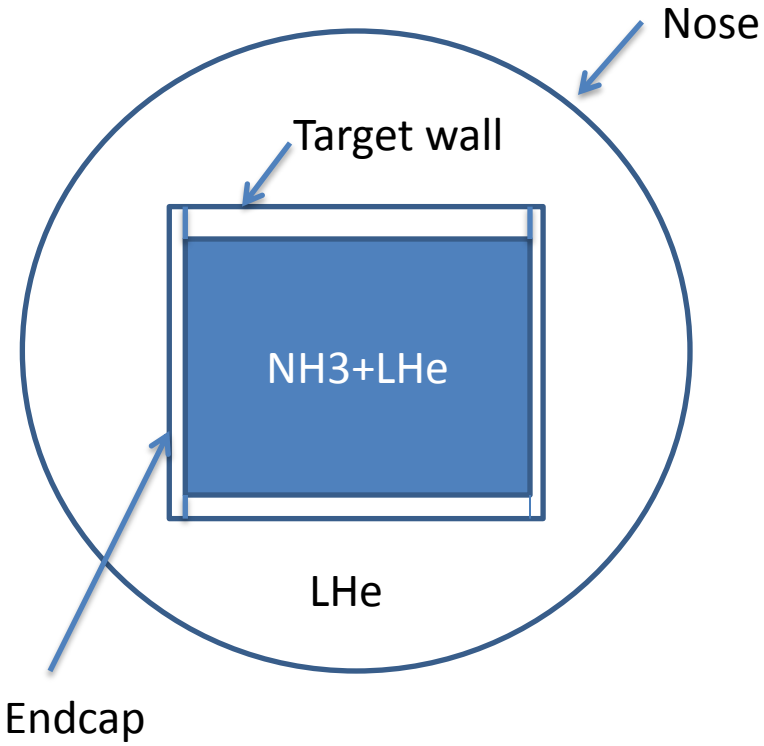
Simulation update

Packing fraction

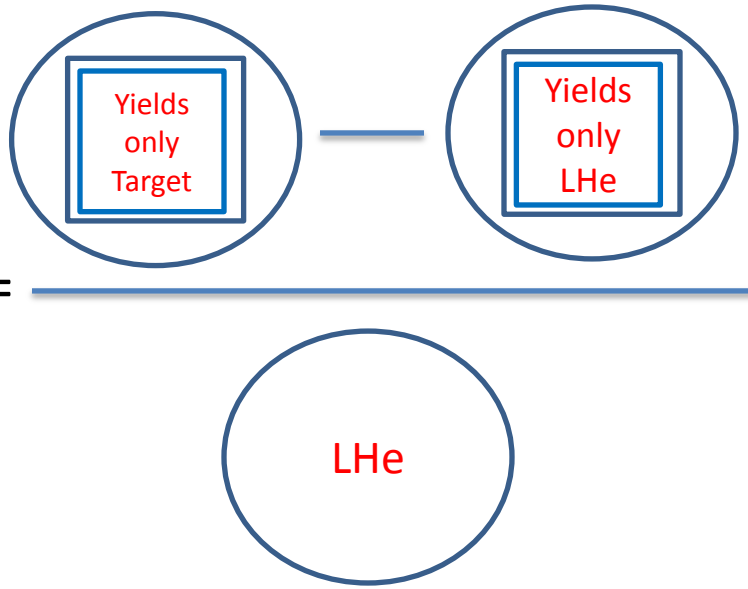
Packing fraction



- **Packing fraction:**
  - Relative ratio of ammonia to LHe in the target

1st method

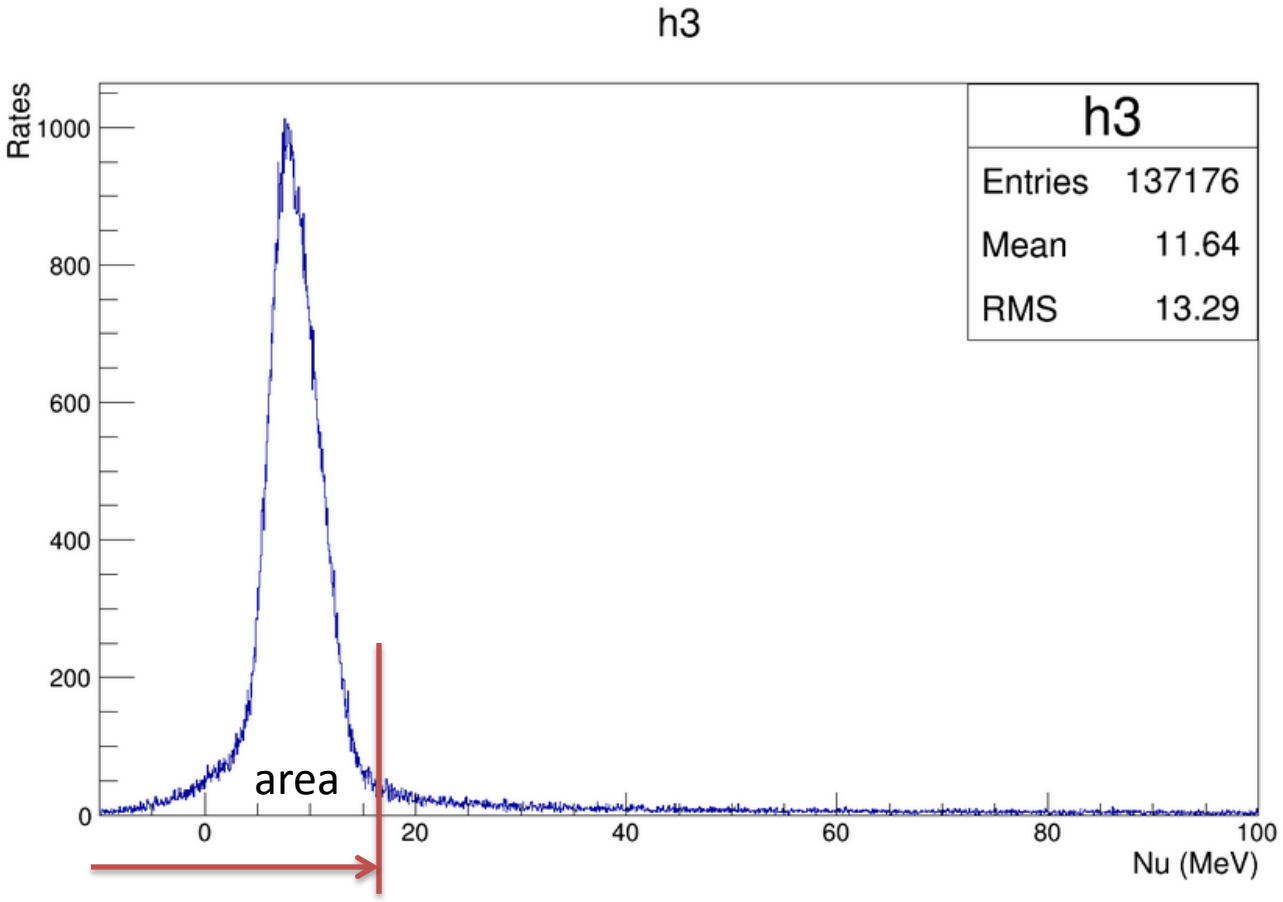
$$\frac{Y_{\exp\_target} - Y_{\exp\_dummy}}{Y_{\exp\_empty}} =$$



$$= \frac{\left[\frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3 * \sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1 - pf) * \sigma_{He}\right] - \frac{d_{He}}{M_{He}} T_{cell} * \sigma_{He}}{\frac{d_{He}}{M_{He}} T_{total} * \sigma_{He}}$$

1st method

- Relative cross section:
  detected events * cross section *e-6 = area*e-6



1st method

If assume pf =0.4

Relative σ_N: 56.53
Relative σ_{He}: 24.16
Relative σ_H: 0.21

Total yields: 4.58

If assume Pf=0.6

Relative σ_N: 54.88
Relative σ_{He}: 23.25
Relative σ_H: 0.28

Total yields: 5.46

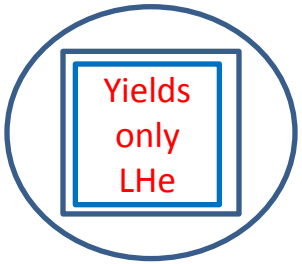
$$Y_{sim\_target} = \frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3 * \sigma_H) + \frac{d_{He}}{M_{He}} T_{cell} * (1 - pf) * \sigma_{He}$$
$$= m * pf + b$$
$$= 4.40 * pf + 2.82$$

Different pf also bring different energy loss

1st method

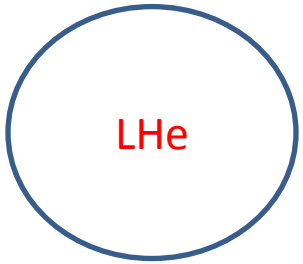
If assume pf =0.4
Relative σ_N: 56.53
Relative σ_{He}: 24.16
Relative σ_H: 0.21
Total yields:

If assume Pf=0.6
Relative σ_N: 54.88
Relative σ_{He}: 23.25
Relative σ_H: 0.28
Total yields:
Yields= 4.40 *pf + 2.82



Relative σ_{He}: *25.71*
Total yields: 2.63

Exp. runs	yields
Run 3553	697610
Carbon	474834
dummy	391535
empty	391514



Relative σ_{He}: 26.36
Total yields : 3.71

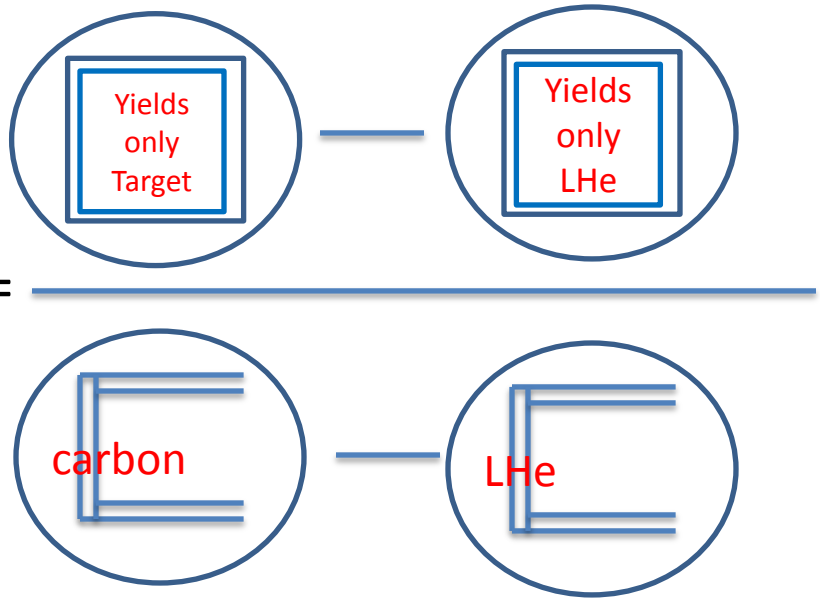
$$\frac{Y_{\exp\_target} - Y_{\exp\_dummy}}{Y_{\exp\_empty}} =$$

$$\frac{Y_{\mathrm{sim}\_target} - Y_{\mathrm{sim}\_dummy}}{Y_{\mathrm{sim}\_empty}}$$

$$\boldsymbol{pf = 0.62}$$

2nd method

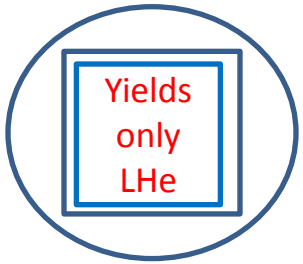
$$\frac{Y_{\exp\_target} - Y_{\exp\_dummy}}{Y_{\exp\_carbon} - Y_{\exp\_LHe}} =$$

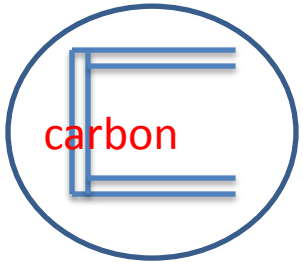


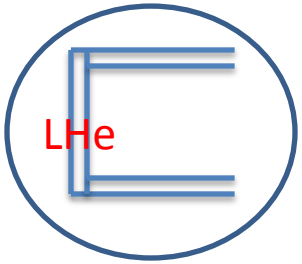
Nose filled with He

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

2nd method







If assume pf =0.4
Relative σ_N: 56.53
Relative σ_{He}: 24.16
Relative σ_H: 0.21
Total yields:

If assume Pf=0.6
Relative σ_N: 54.88
Relative σ_{He}: 23.25
Relative σ_H: 0.28
Total yields:
Yields= 4.40 *pf + 2.82

Relative σ_{He}: *25.71*
Total yields: 2.63

Relative σ_{He}: 49.06
Total yields : 0.83

Relative σ_{He}: 20.77
Total yields : 0.08

Exp. runs	yields
Run 3553	697610
Carbon	474834
dummy	391535
empty	391514

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

$$\frac{Y_{\mathrm{sim}\_target} - Y_{\mathrm{sim}\_dummy}}{Y_{\mathrm{sim}\_carbon} - Y_{\mathrm{sim}\_LHe}}$$

$$\boldsymbol{pf = 0.59}$$

2^{nd} method

- Some simple test:

Exp. runs	yields
Run 3553	697610
Carbon	474834
dummy	391535
empty	391514

Experiment yields:

$Y_{carbon}: Y_{dummy}: Y_{empty}$

= 474834: 391535: 391534
= 1.213: 1.000:1.000

$\approx$

Simulation yields:

$Y_{carbon}: Y_{dummy}: Y_{empty}$

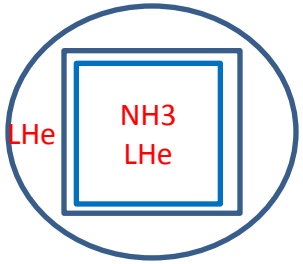
$\approx$ (0.83+3.71): 3.71: 3.71
= 1.224: 1.000:1.000

For dummy target, Al contribution estimated

3rd method

- Total yields compare:

$$Y_{total} =$$



$$= IA_{acceptance} \frac{d_{NH3}}{M_{NH3}} T_{cell} * pf * (\sigma_N + 3 * \sigma_H) +$$

$$\frac{d_{He}}{M_{He}} T_{cell} * (1 - pf) * \sigma_{He} + \frac{d_{He}}{M_{He}} T_{out} * \sigma_{He} + \frac{d_{Al}}{M_{Al}} T_{Al} * \sigma_{Al} + \cdots$$

Need : Beam and acceptance well known:

Todo

- Working on the radiative correction to elastic peak.
- Need bmp information for better simulation
- Need inputs from data (rates) . Huge deviation from rates lead to large uncertainty of packing fraction.