

Systematics for The n - ^3He Experiment

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Outline

- ➊ M1 Asymmetry
- ➋ Detector Asymmetry
- ➌ Instrumental Asymmetry

M1 Asymmetry & Detector Asymmetry

$$\text{M1 Asymmetry: } A_b = \frac{M_1^{\uparrow} - M_1^{\downarrow}}{M_1^{\uparrow} + M_1^{\downarrow}} \quad (1)$$

$$\text{Detector Asymmetry: } A_d^i = \frac{Y_i - Y_{i^*}}{Y_i + Y_{i^*}} \quad (2)$$

Where, i and i^* are conjugate wire index.

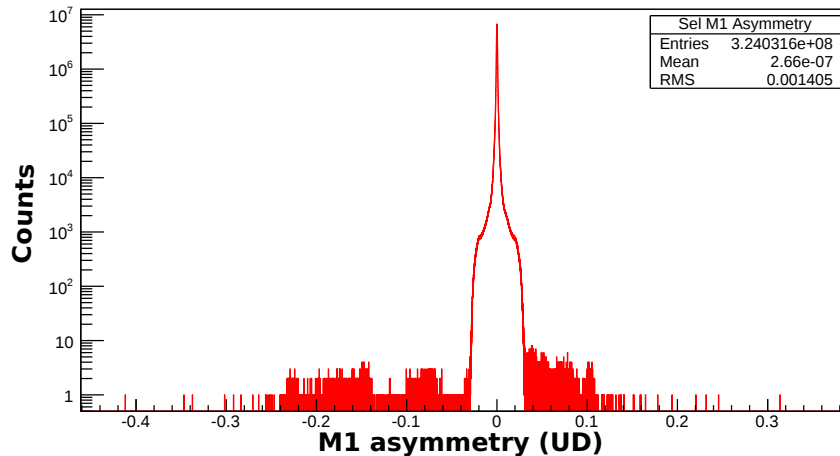
$$A_d = \frac{\sum_i w_i A_d^i}{\sum_i w_i} \quad (3)$$

$$w_i = \delta^{-2} A_{phy}^i \quad (4)$$

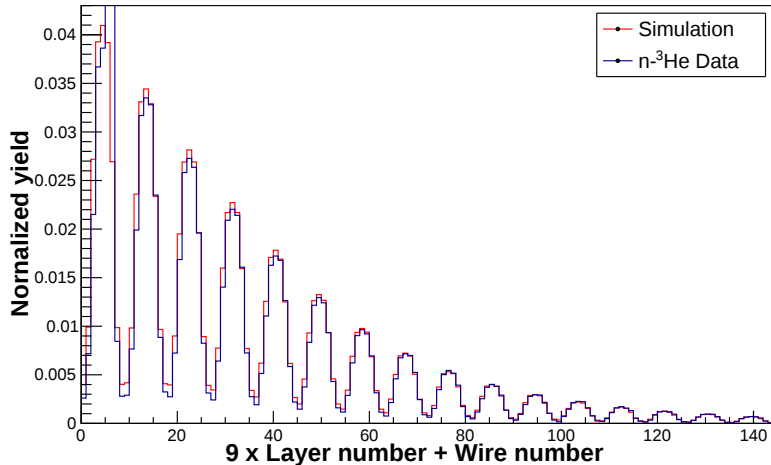
$\delta^{-2} A_{phy}^i$ is the error from the wire physics asymmetry considering all the runs in a single batch.

— $A_b A_d$?

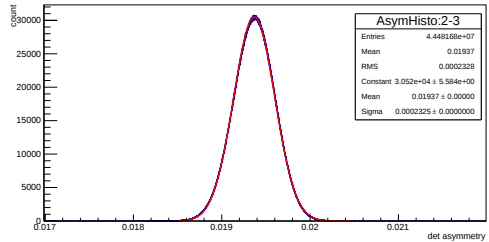
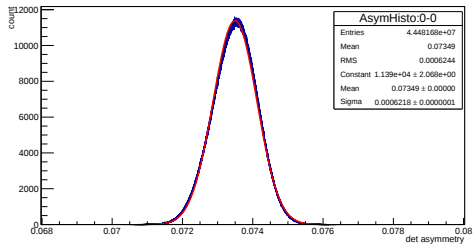
M1 Asymmetry



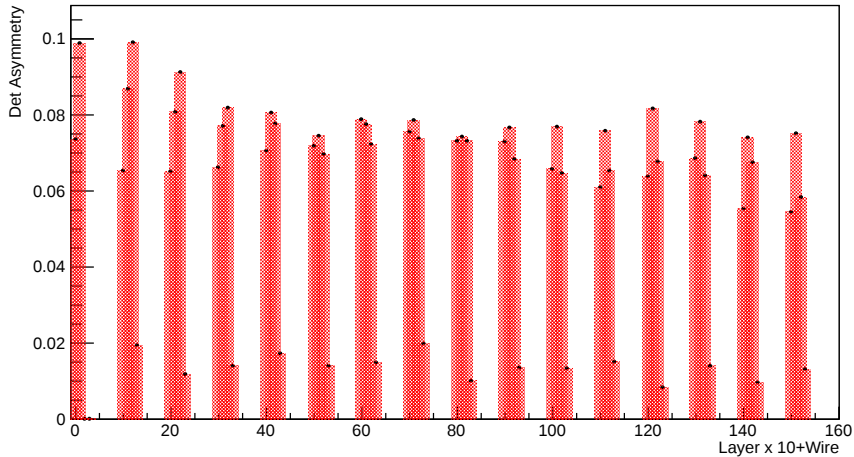
Detector Asymmetry



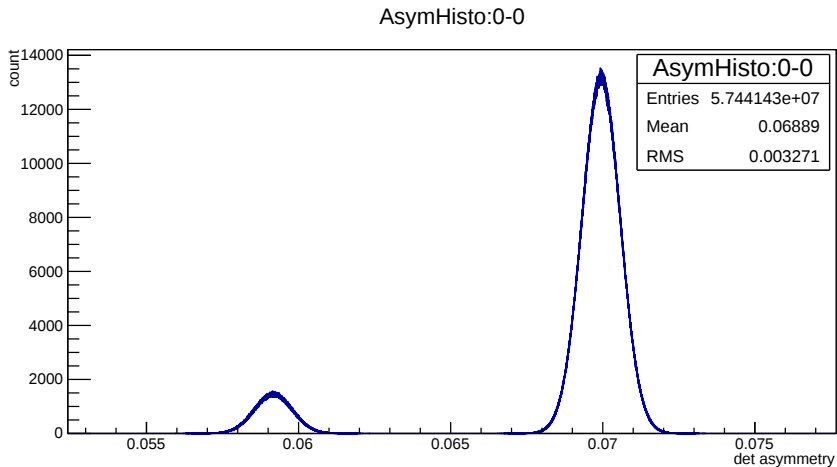
Detector Asymmetry



Detector Asymmetry



Detector Asymmetry



Instrumental Asymmetry

$$A_i = \frac{Y_i^\uparrow - Y_i^\downarrow}{Y_i^\uparrow + Y_i^\downarrow} = \frac{(S_i^\uparrow + b_i^\uparrow) - (S_i^\downarrow + b_i^\downarrow)}{(S_i^\uparrow + b_i^\uparrow) + (S_i^\downarrow + b_i^\downarrow)} \approx \frac{S_i^\uparrow - S_i^\downarrow}{S_i^\uparrow + S_i^\downarrow} + \frac{b_i^\uparrow - b_i^\downarrow}{S_i^\uparrow + S_i^\downarrow} \quad (5)$$

where $b_i^{\uparrow\downarrow}$ is the contribution from pedestal.

$$A_{inst}^i = \frac{1}{G_i} \frac{b_i^\uparrow - b_i^\downarrow}{2S^i} \quad (6)$$

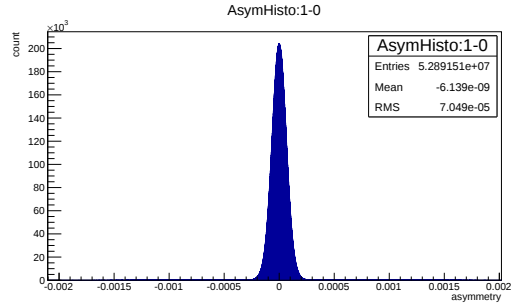
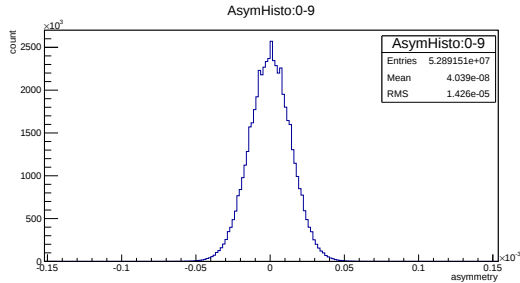
$$A_{inst} = \frac{\sum_i w_i A_{inst}^i}{\sum_i w_i} \quad (7)$$

$$(\delta A_{inst})^2 = \frac{\sum_i w_i^2 (\delta A_{inst}^i)^2}{(\sum_i w_i)^2} \quad (8)$$

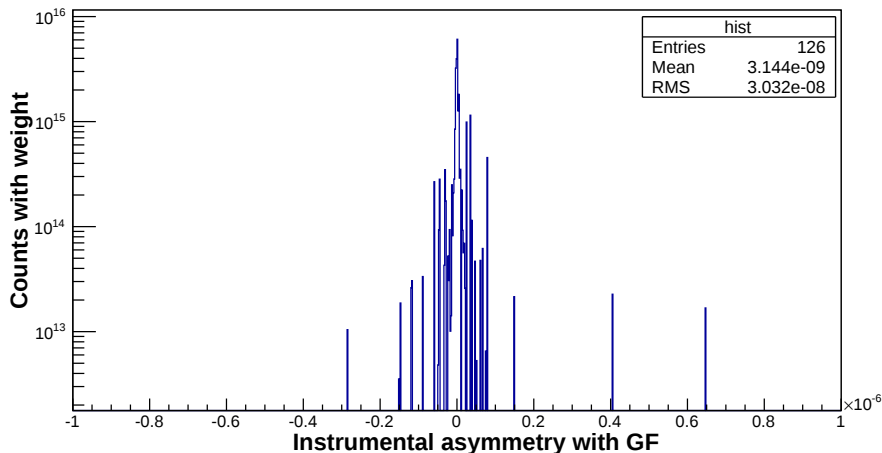
where,

$$w_i = \delta^{-2} A_{phy}^i \quad (9)$$

Instrumental Asymmetry



Instrumental Asymmetry



Instrumental Asymmetry

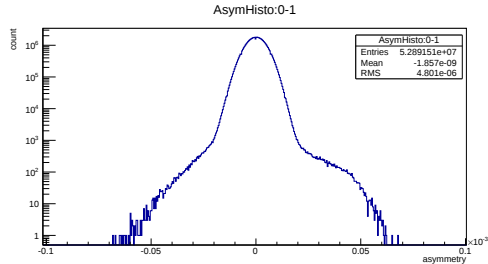
Analysis of all the no-beam data using Eq. 7 and Eq. 8 gives,

$$A_{inst} = (3.14 \pm 0.60) \times 10^{-9}. \quad (10)$$

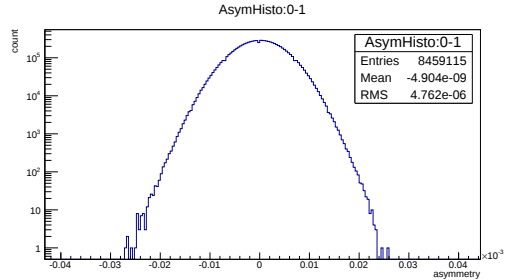
This includes three types of no-beam runs —

- Maintenance day runs
- Long time accelerator down runs
- Accidental no beam runs during normal operations

Instrumental Asymmetry: Summer runs vs all runs



(c) All runs



(d) Summer runs