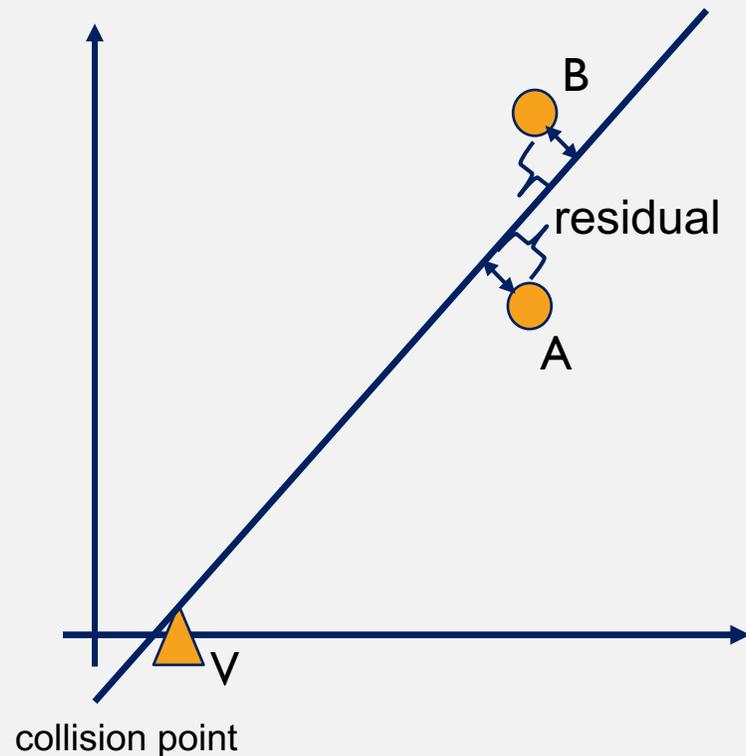


residual解析 (最小二乗法に誤差を重み付け)

NWUB4 寺坂優里

研究概要



INTT MT

A:inner layer hit position
B:outer layer hit position

粒子が通った飛跡を再構築するため
検出器のヒット位置A,Bと衝突点の3点で
最小二乗法を使って線をひく



A,Bでズレ(residual)が生じる



最小二乗法に重み付けをしてより
現実的な飛跡を引く

2024/2/21

2

最小二乗法に誤差を重み付け

- ・ 測定点の誤差：1[cm]
- ・ 衝突点の誤差：0.05298[cm]

$$L = \sum \left(\frac{y_i - (ax_i + b)}{\Delta s_i} \right)^2 \quad \Delta s_i: \text{誤差}$$

a,bでLを偏微分して行列式に変形しa,bを求める

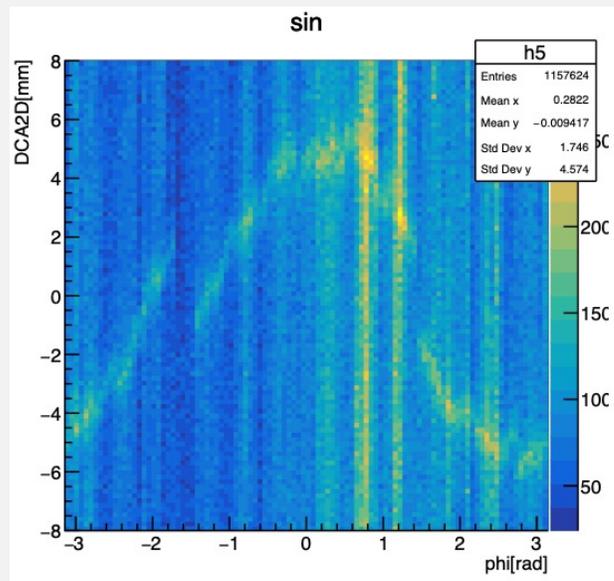


$$a = \frac{\sum \frac{1}{\Delta s_i^2} \sum \frac{x_i y_i}{\Delta s_i^2} - \sum \frac{x_i}{\Delta s_i^2} \sum \frac{y_i}{\Delta s_i^2}}{\sum \frac{x_i^2}{\Delta s_i^2} \sum \frac{1}{\Delta s_i^2} - \left(\sum \frac{x_i}{\Delta s_i^2} \right)^2}$$

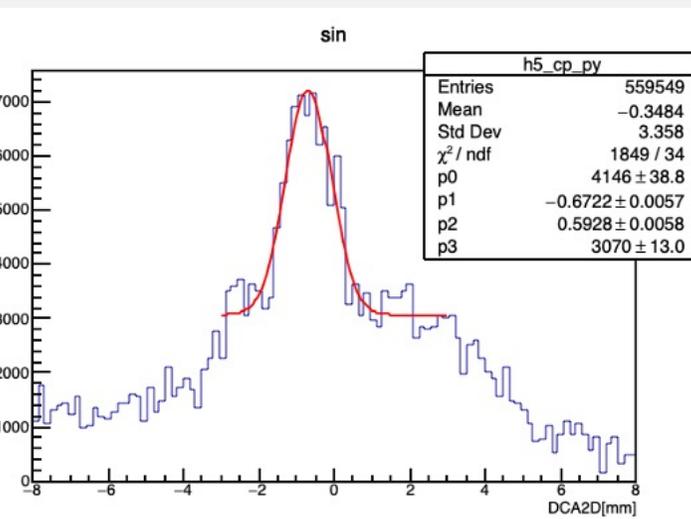
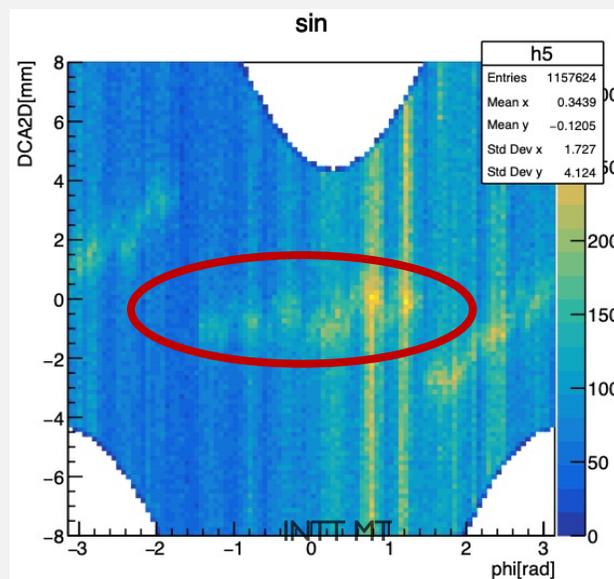
$$b = \frac{-\sum \frac{x_i}{\Delta s_i^2} \sum \frac{x_i y_i}{\Delta s_i^2} + \sum \frac{x_i^2}{\Delta s_i^2} \sum \frac{y_i}{\Delta s_i^2}}{\sum \frac{x_i^2}{\Delta s_i^2} \sum \frac{1}{\Delta s_i^2} - \left(\sum \frac{x_i}{\Delta s_i^2} \right)^2}$$

衝突点の誤差を求める

測定点の誤差 : 1 [cm]
衝突点の誤差 : 0.5928 [mm]



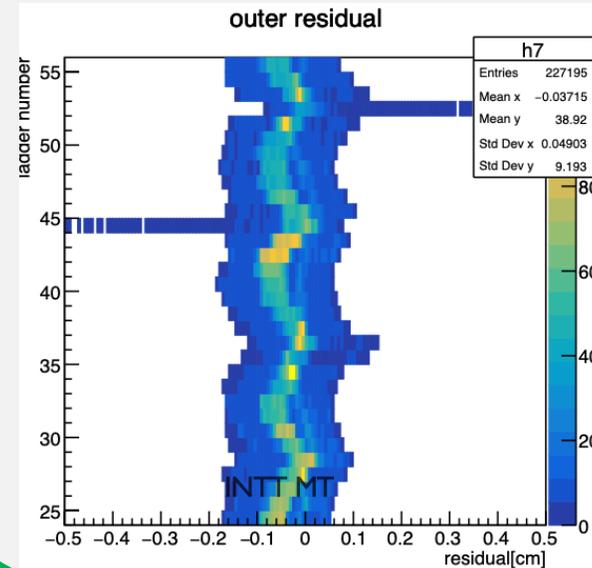
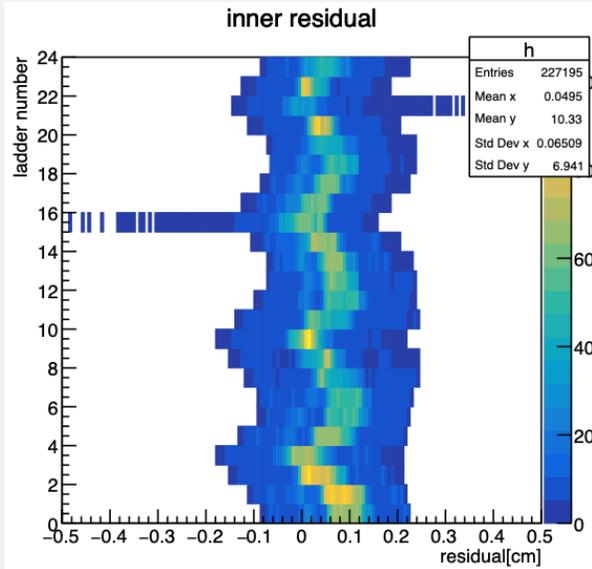
- 衝突点(0,0)でのDCA2dとphiの二次元ヒストグラム
- sinカーブをフィッティングさせて実際の衝突点を求める



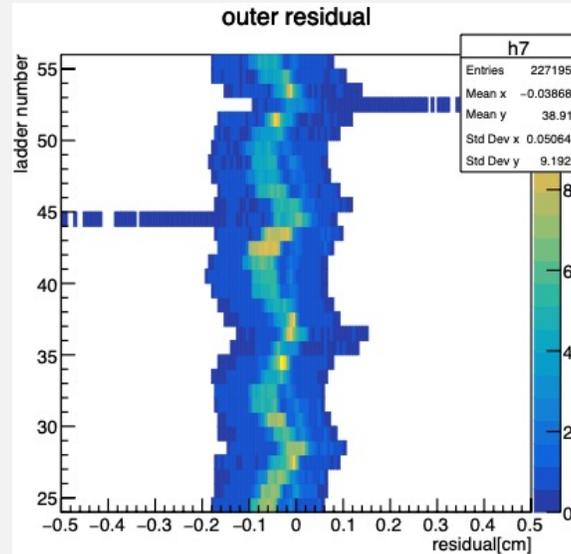
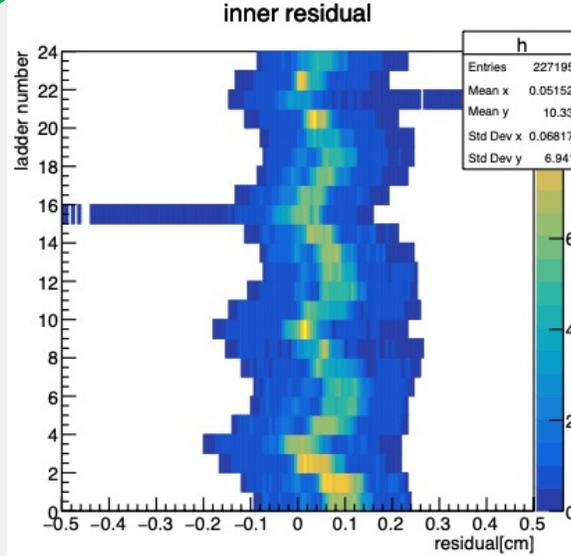
- 実際の衝突点(-0.780972, 5.62854)
- y軸に射影
- 左図の赤い印のところにgausをフィッティング
- 衝突点の誤差→0.5928 [mm]

重み付け前後のresidual分布の比較

before



after

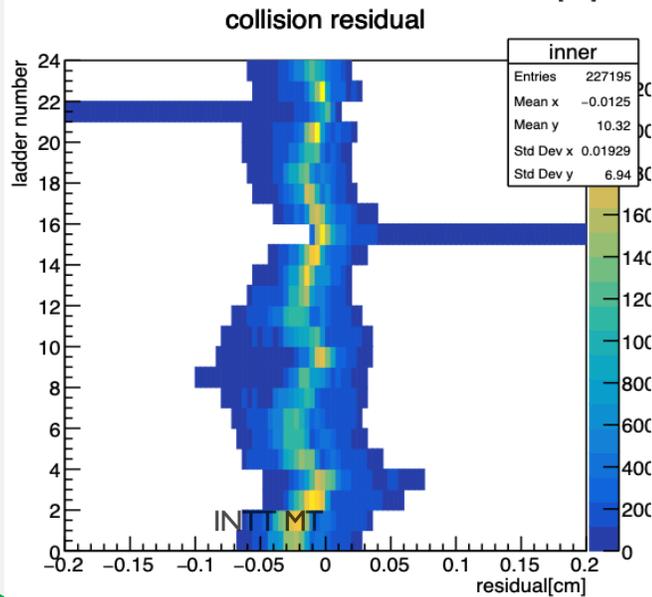
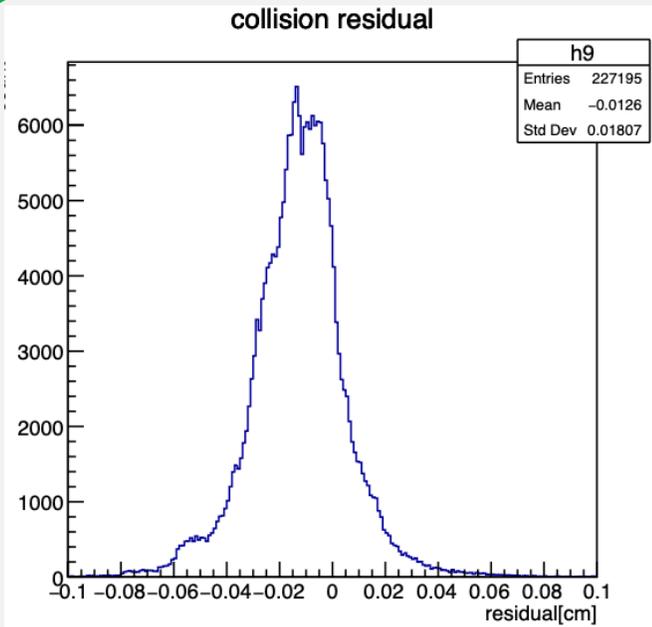


$d_{ang} < 0.05$

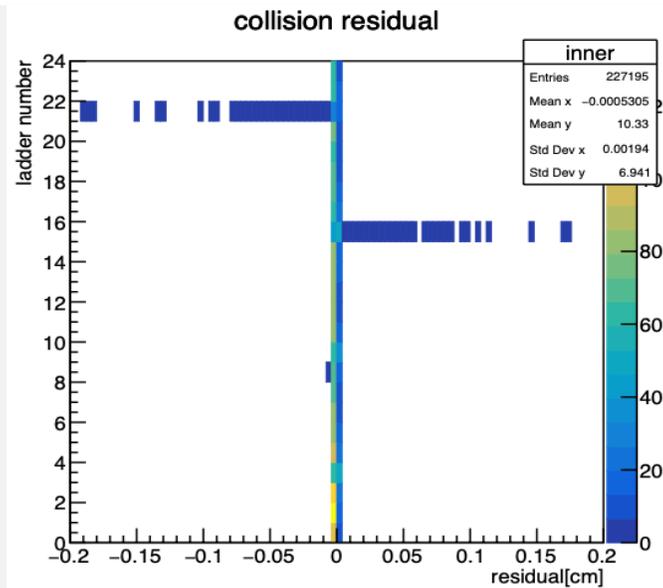
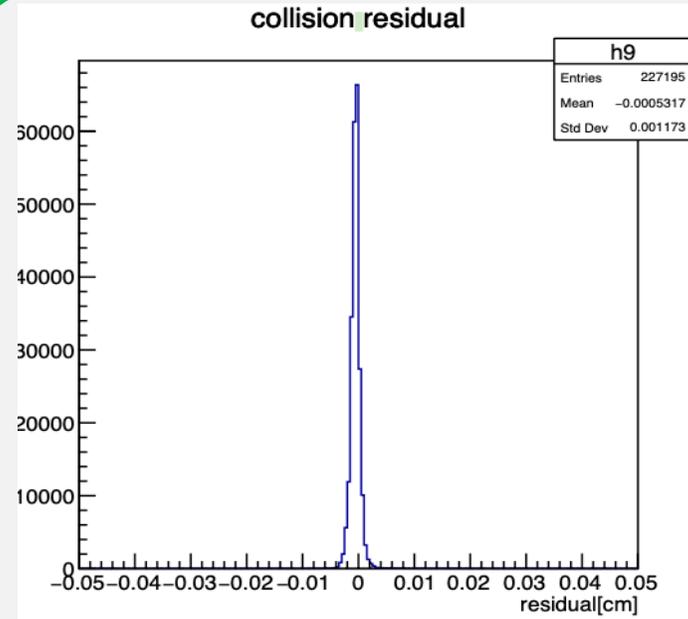
あまり変化が見られない、
重み付けの方が少し値が大きい

重み付け前後の衝突点のresidualを比較

before



after



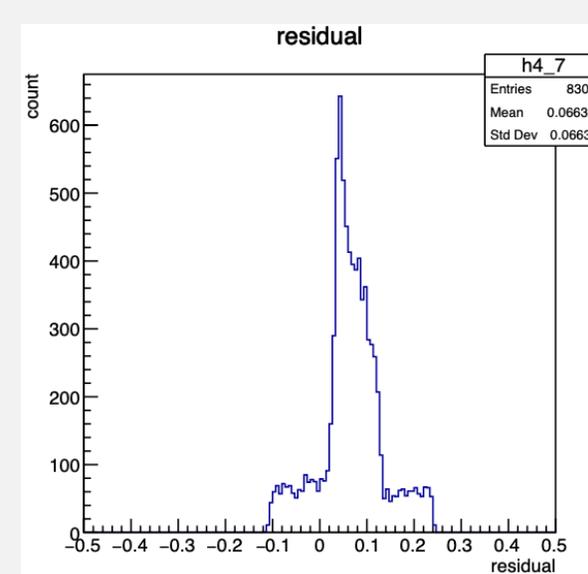
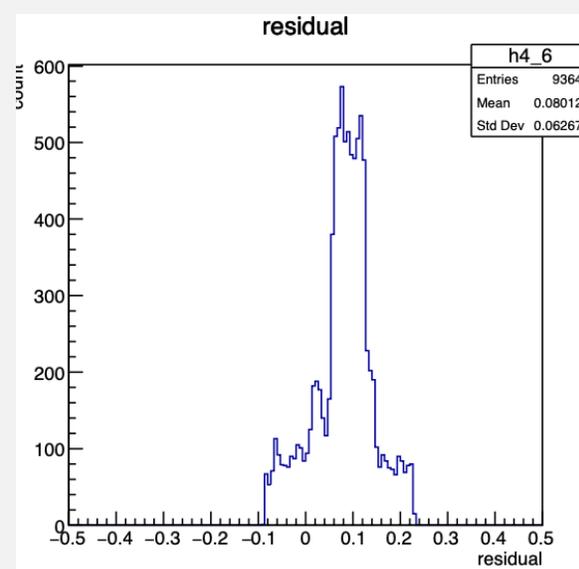
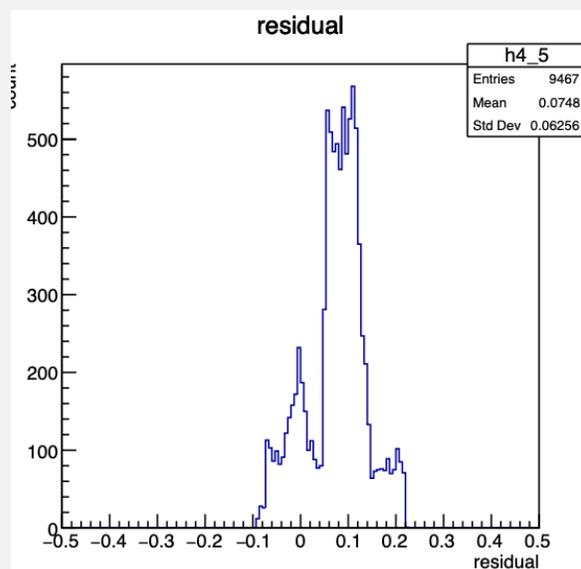
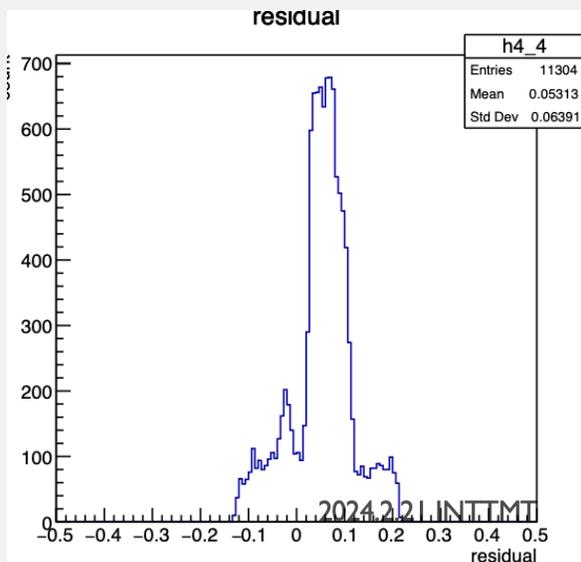
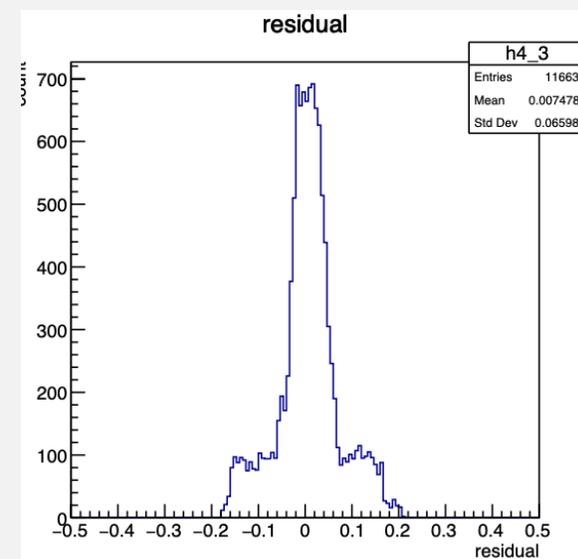
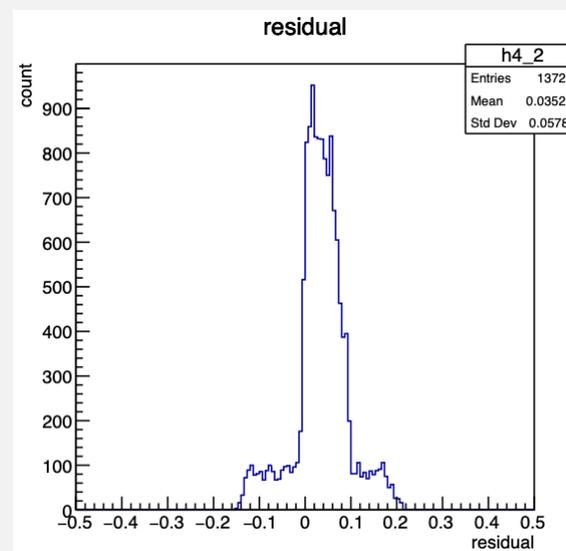
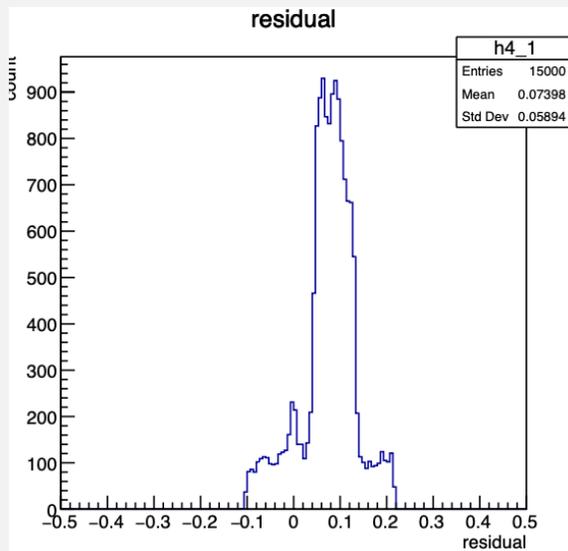
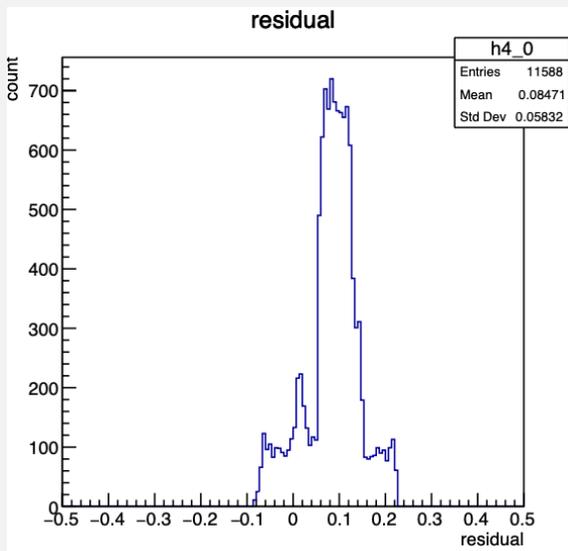
値が小さくなっている

まとめ、今後の予定

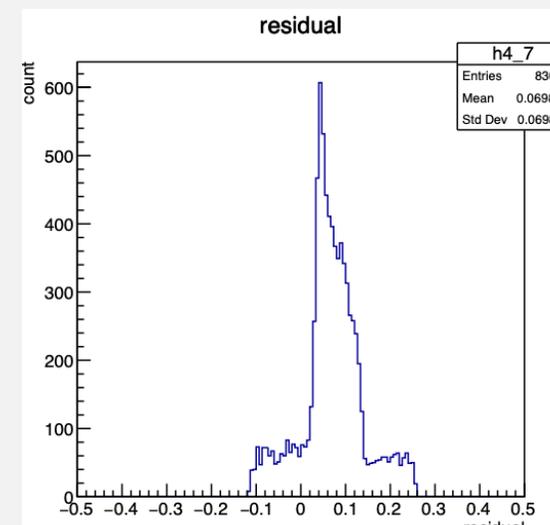
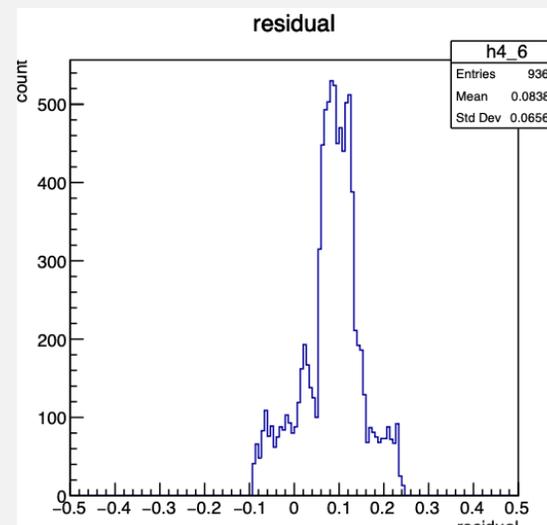
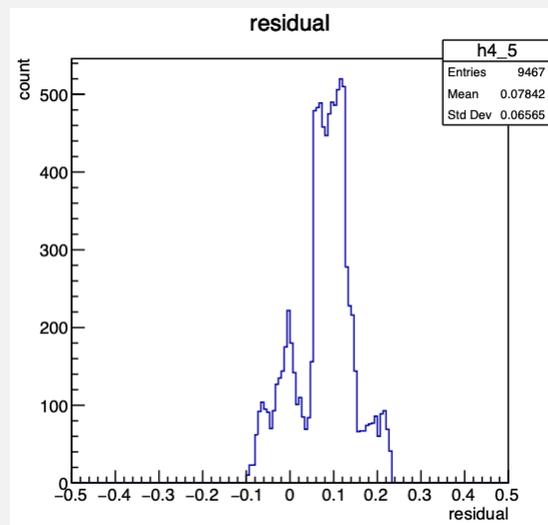
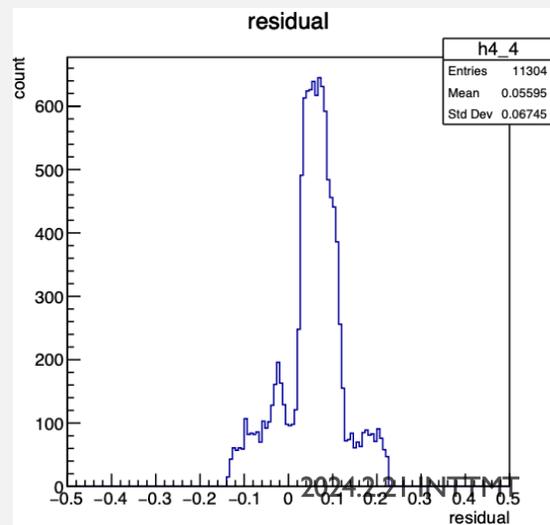
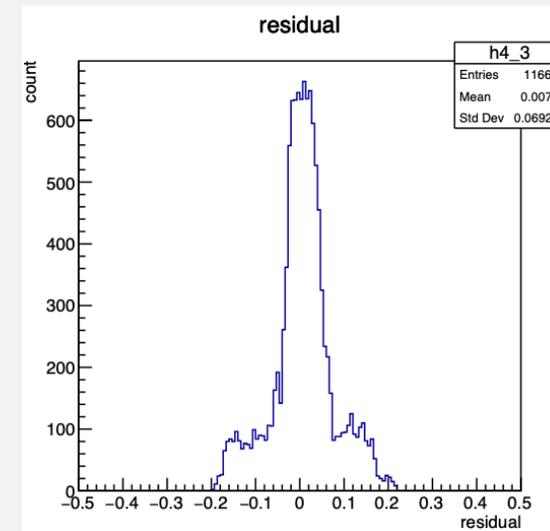
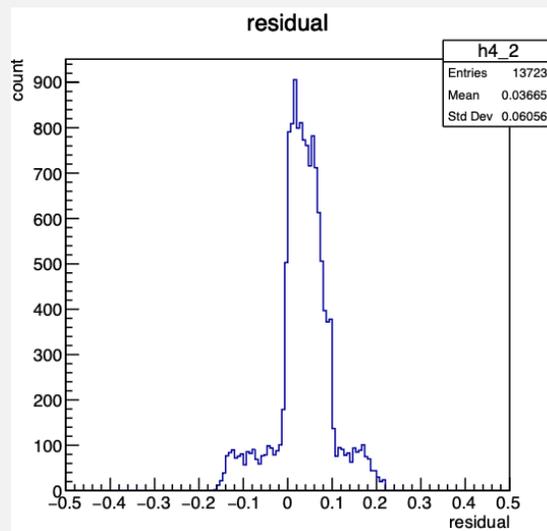
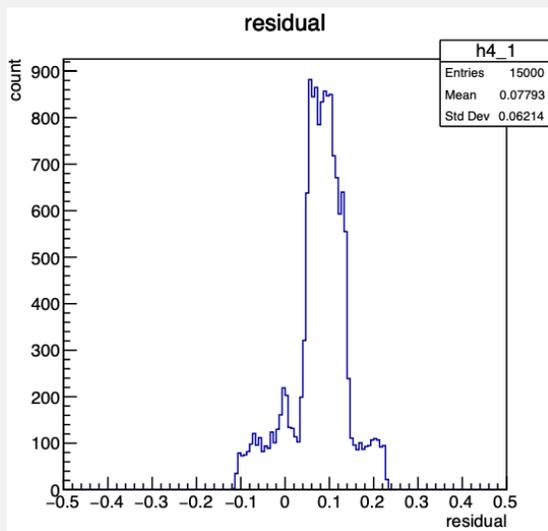
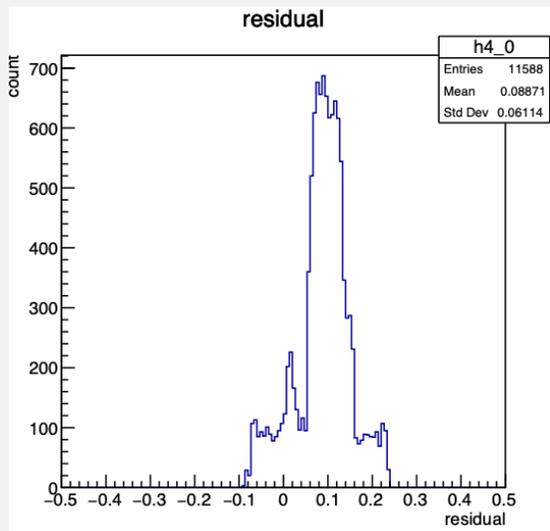
- 最小二乗法に誤差を重み付けできた
- 新しいデータでresidualを解析

BACK UP

Residual one-dimensional distribution for each ladder before weighting (a part)

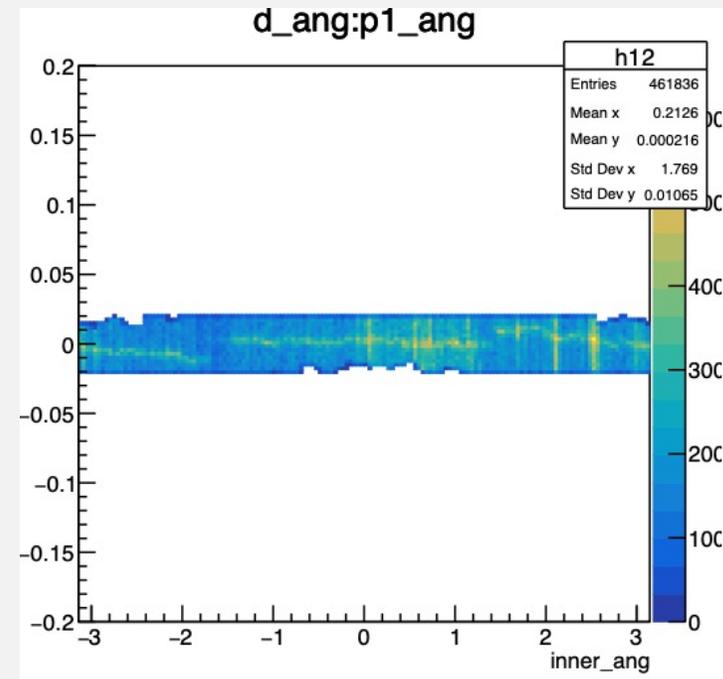
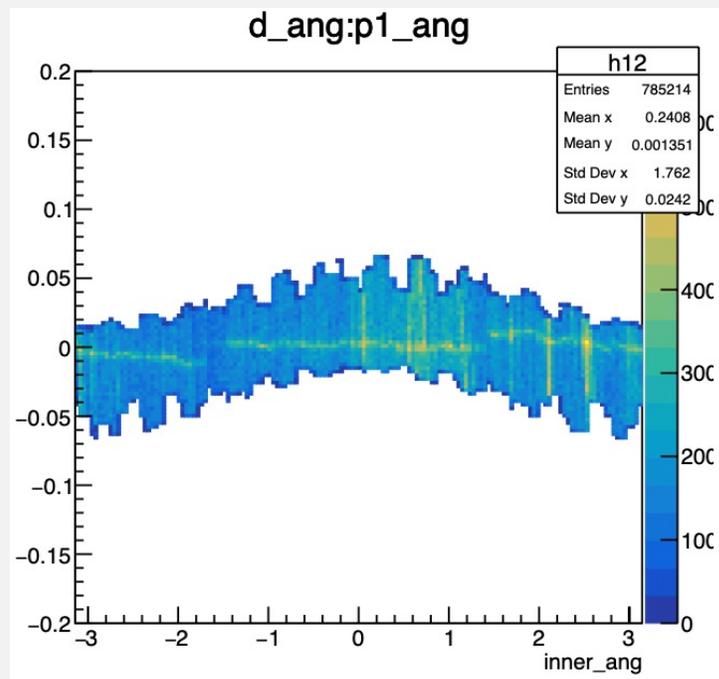
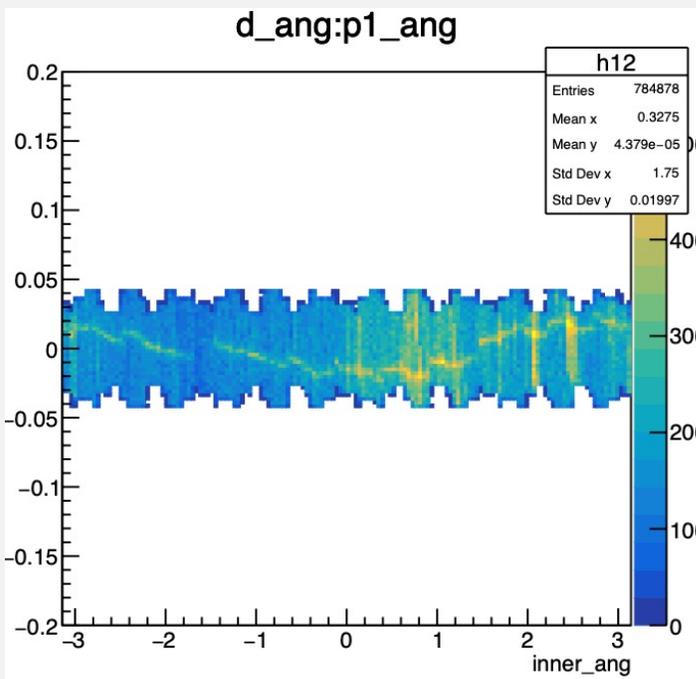


Residual one-dimensional distribution for each ladder after weighting (a part)



角度相関

図： $\phi_2 - \phi_1$ と ϕ_1 の角度相関



衝突点が(0,0)じゃないため
 ϕ_1 と ϕ_2 に角度差が生まれ
波線ができてしまう



実際の衝突点(-0.0780972,0.56284)
からの角度差を描画



幅を狭めて d_ang のカットを
キツくした

$d_ang < 0.1$ のみ

INTT MT

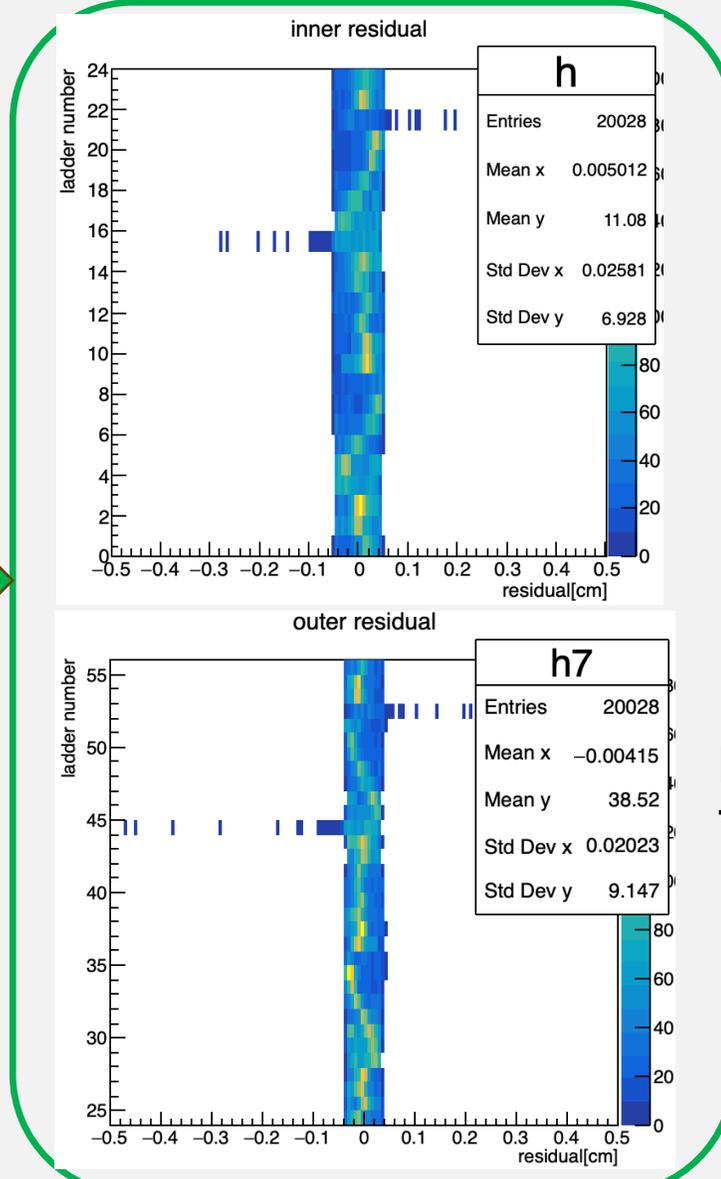
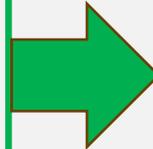
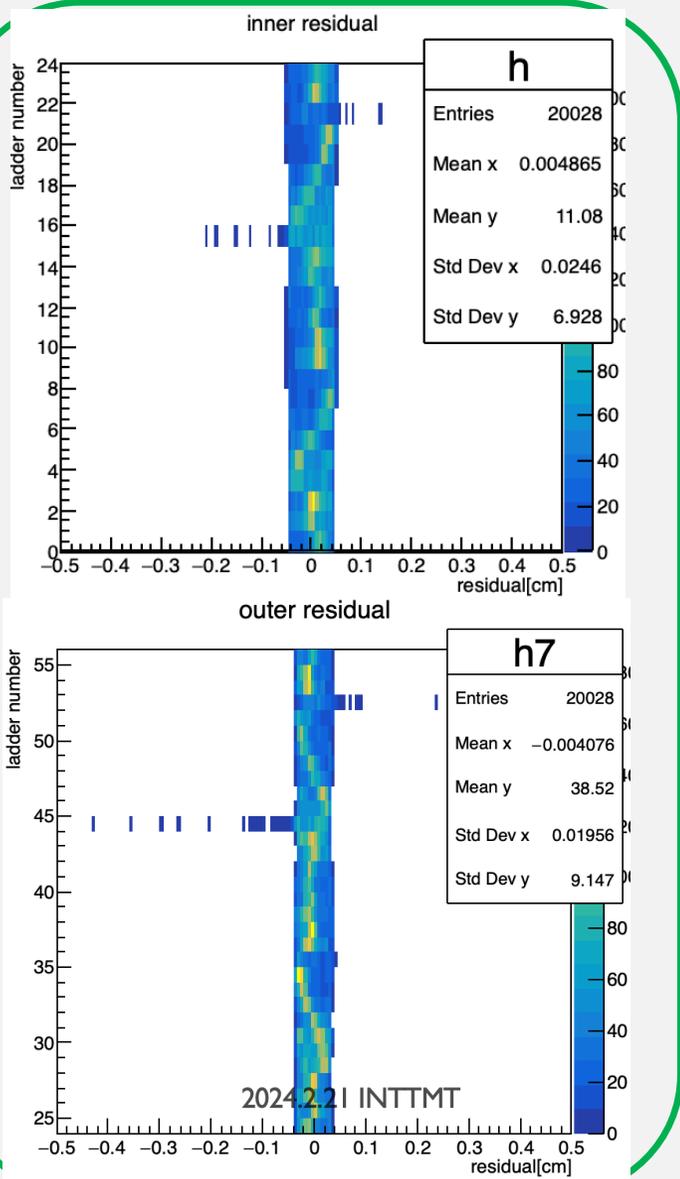
$d_ang < 0.01$ のみ

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Comparison of residual distribution before and after weighting

before

after



$d_{\text{ang}} < 0.01$

あまり変化が見られない、
重み付けの方が少し値が大きい

Not much has changed.
The value is slightly larger after weighting.