MC (Mis-)Alignment Studies

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Introduction

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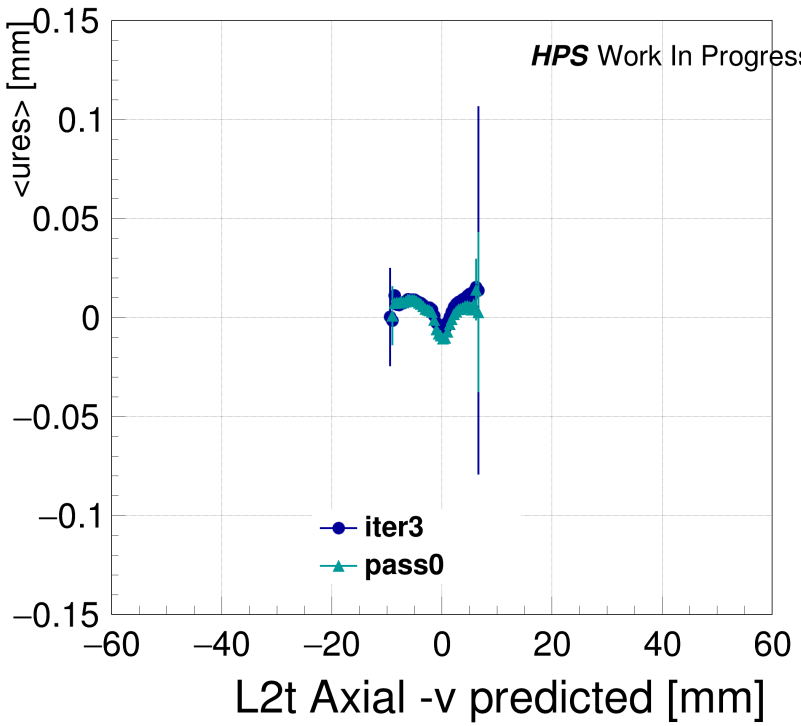
- There are some features in data alignment plots that we can't explain with tu and rw movements.
- Investigate how to recreate these shapes in MC
  - Known simple movements of sensors
- Hints towards misalignments in data
- Generally interesting to see the effect of moved sensors on residuals and kinks
  - Investigate strange behaviors
  - Determine "weak modes"

Data samples

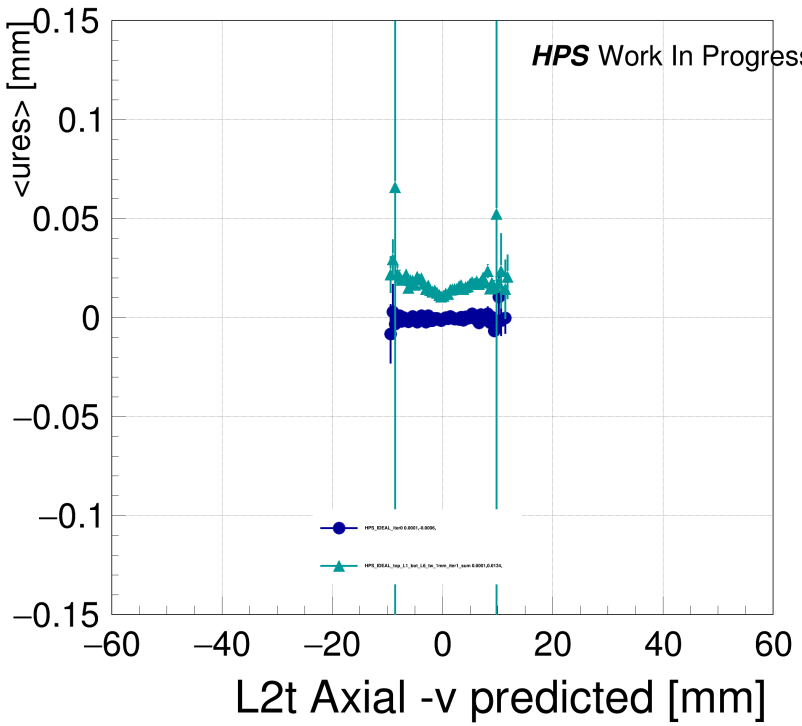
- MC data: 2019 FEE, simulated with nominal detector (HPS_IDEAL_iter0); re-reconstruct with misaligned sensors
  - Translation in w
    - L1: top -1 mm in z
    - L4: top -1 mm in z, bottom 1 mm in z
    - L6: bottom 1 mm in z
    - L7: top -1 mm in z, bottom 1 mm in z
  - Increased separation in w between axial and stereo sensors
    - L4: top 1 mm additional separation
    - L5: top 1 mm additional separation
- 2021 physics data; reconstructed with
  - pass0 (HPS_Run2021Pass0_v1) and
  - iter3 (HPS_Run2021Pass1_v0)

detectors $\rightarrow$ plots and data from Cam

V-shape in ures vs v distribution

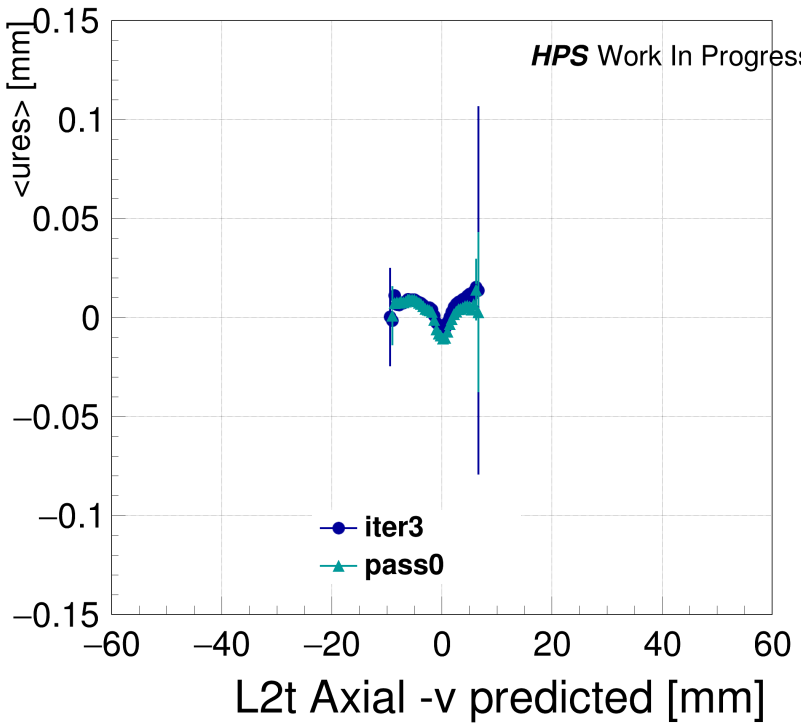


2021 data

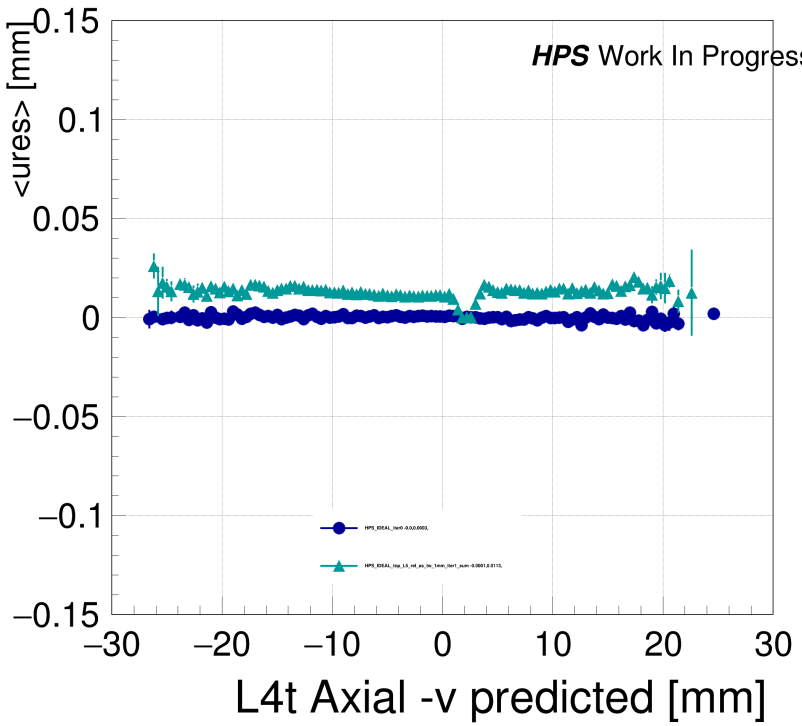


MC L1 1 mm tw

V-shape in ures vs v distribution

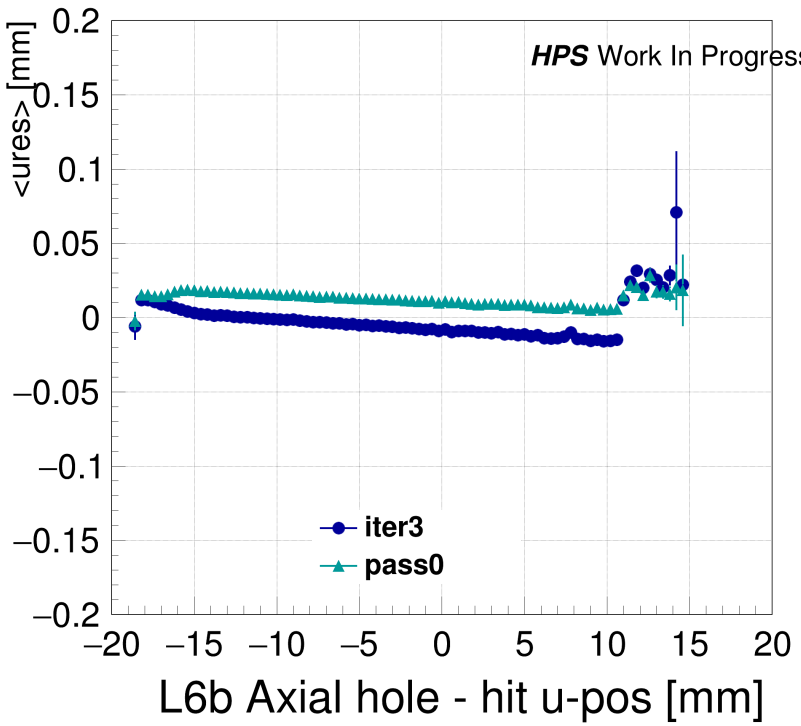


2021 data

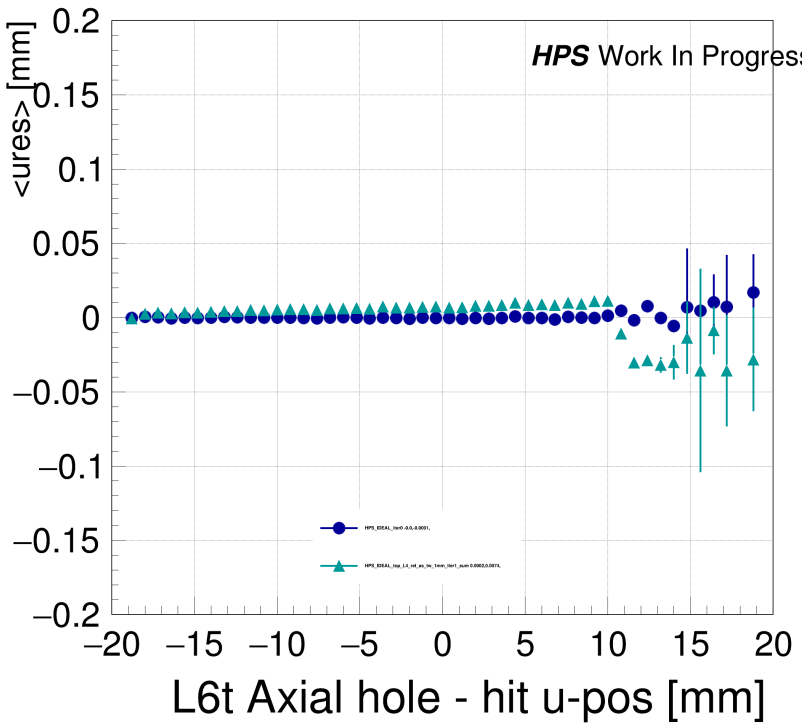


MC L5 1 mm axial-stereo rel. tw

Step in ures vs u distribution

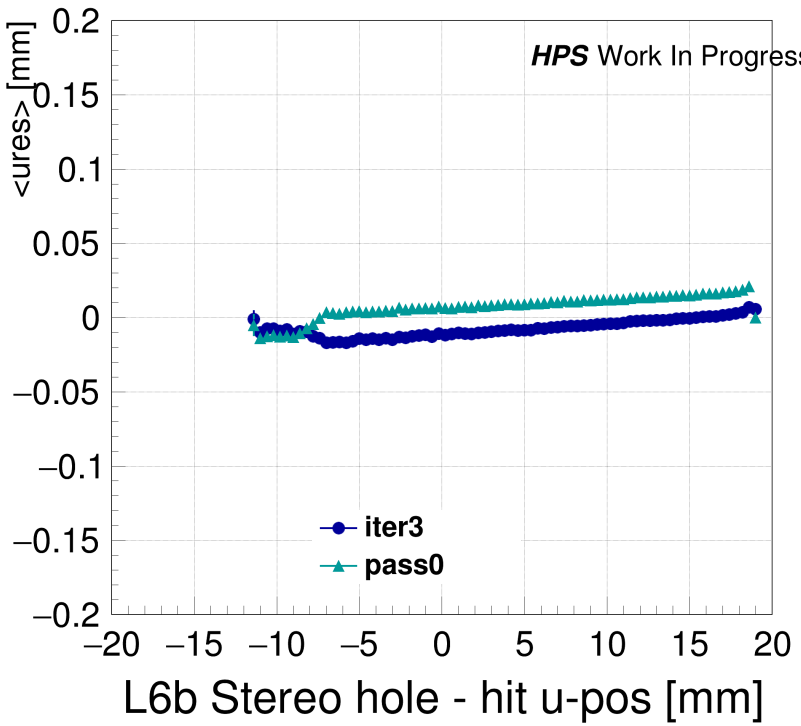


2021 data

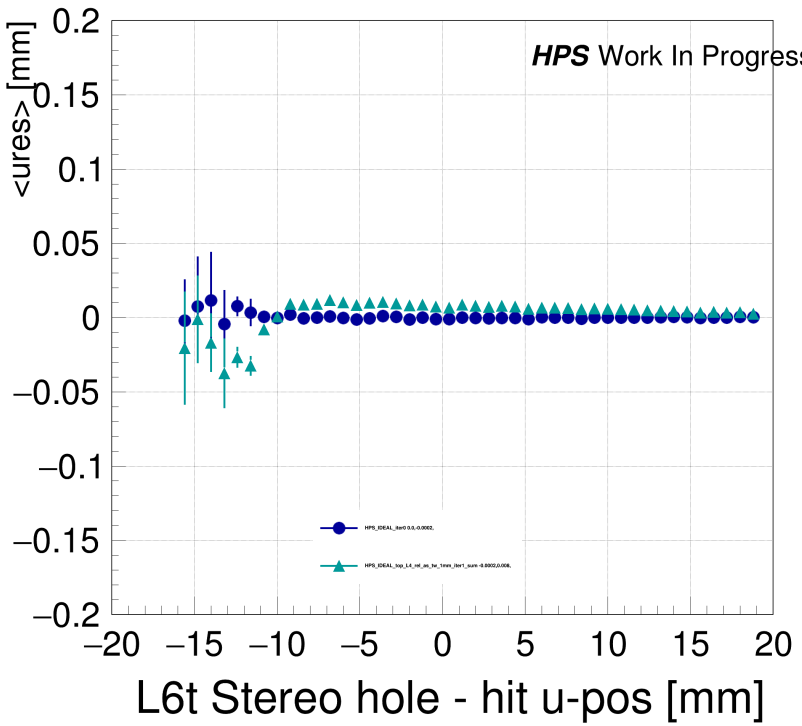


MC L4 1 mm axial-stereo rel. tw

Step in ures vs u distribution

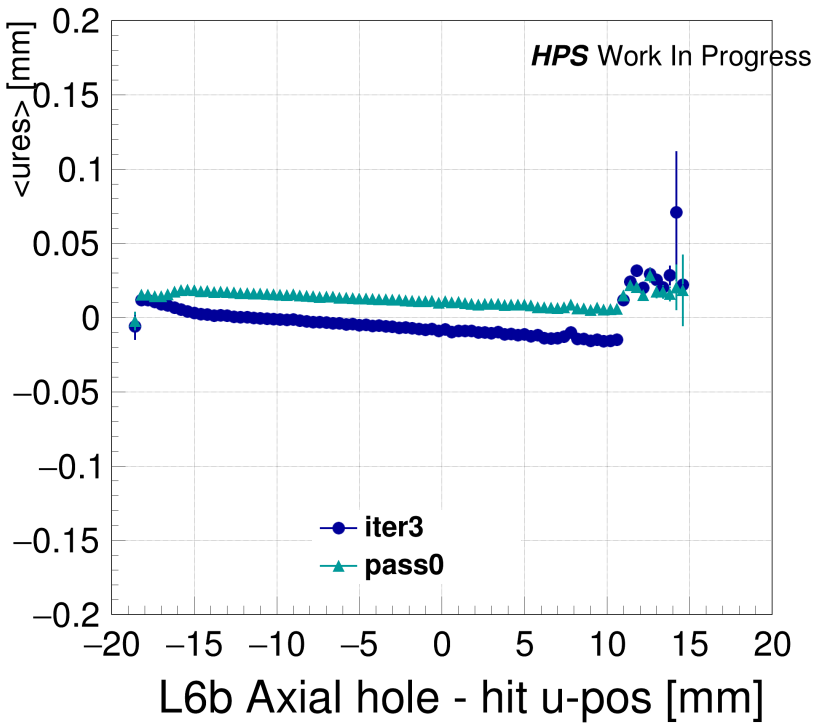


2021 data

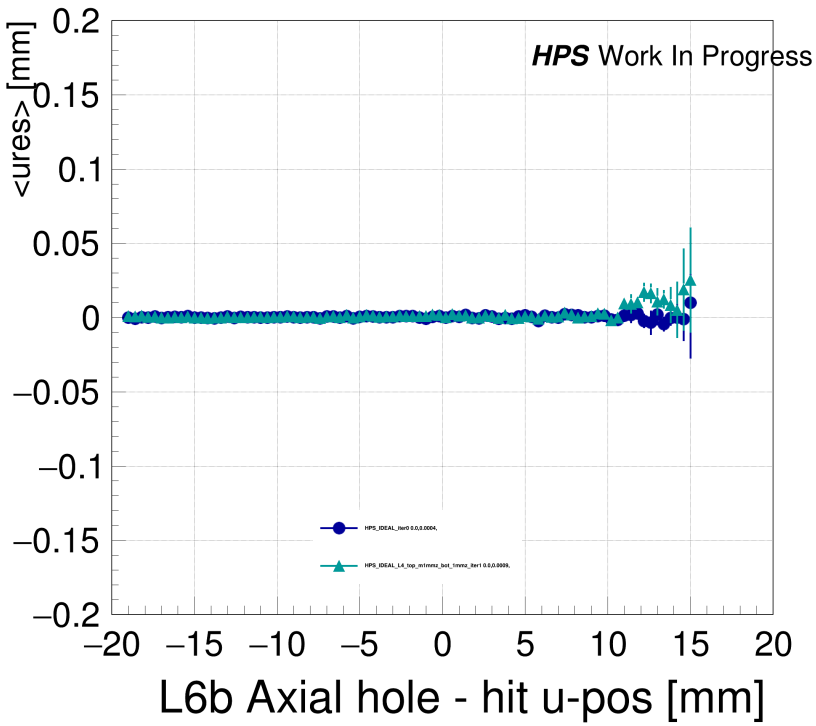


MC L4 1 mm axial-stereo rel. tw

Step in ures vs u distribution

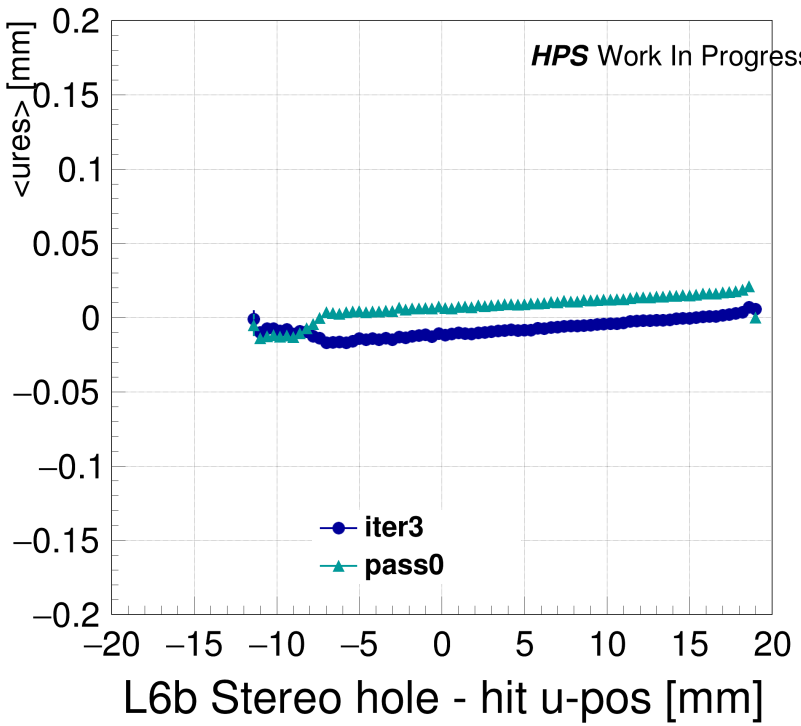


2021 data

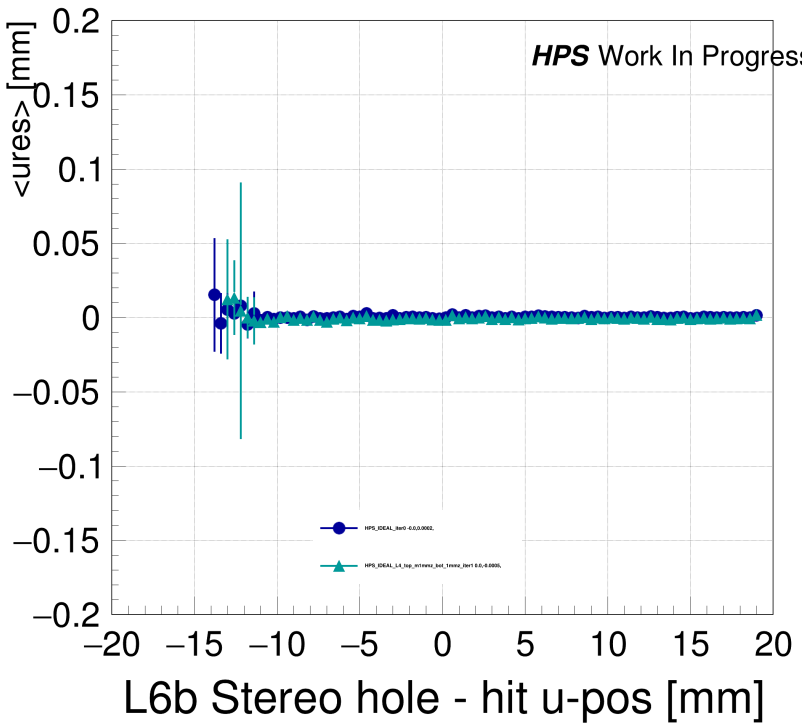


MC L4 1 mm tw

Step in ures vs u distribution



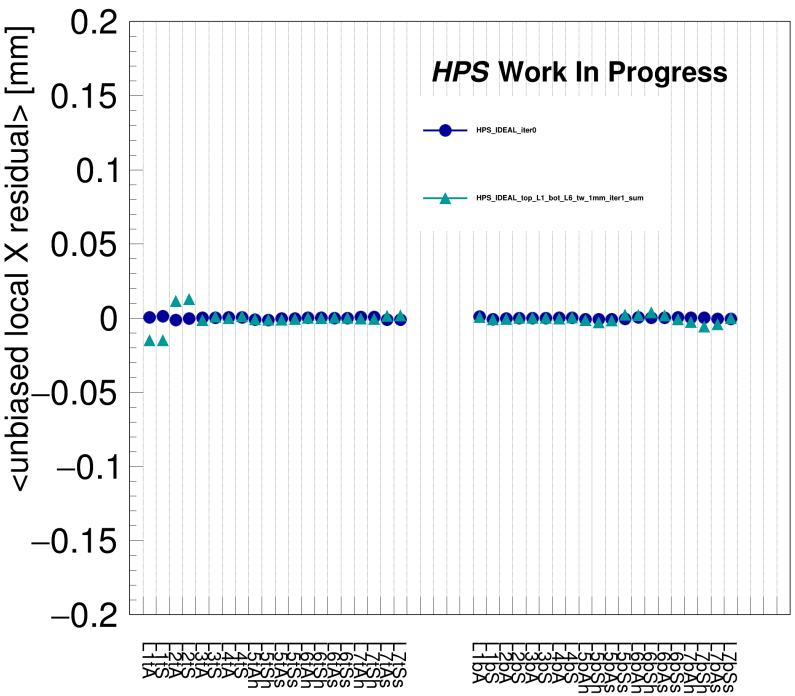
2021 data



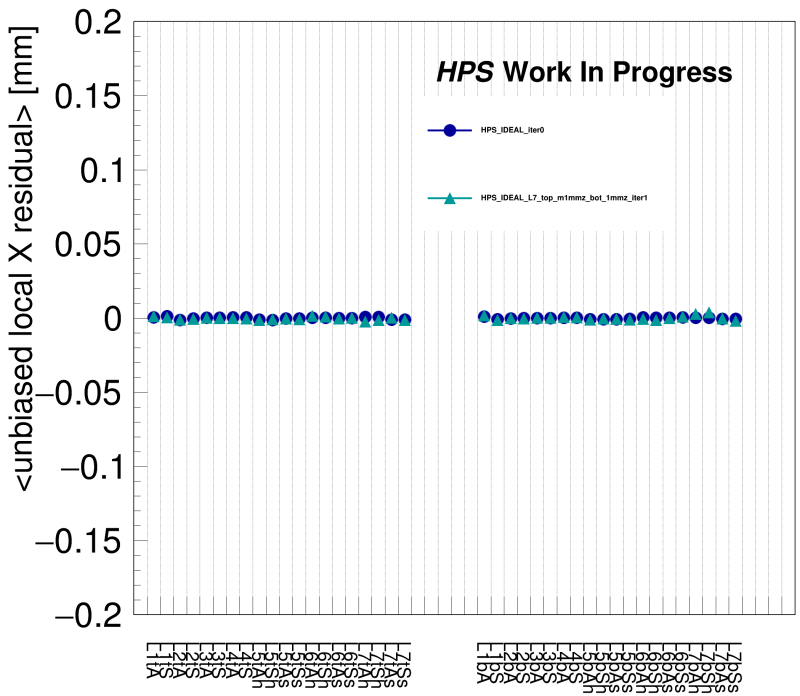
MC L4 1 mm tw

“Weak modes” in w movements

u residuals in all layers



MC L1 top, L6 bot 1 mm tw

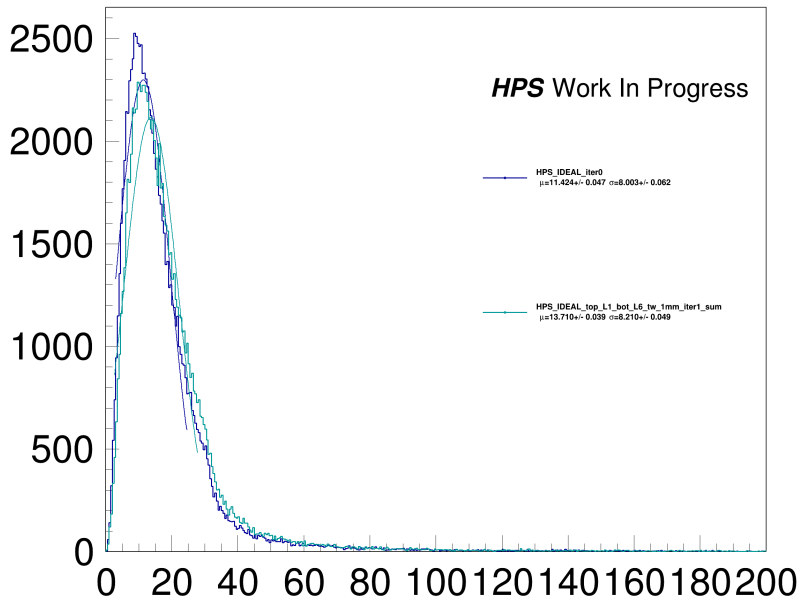


MC L7 1 mm tw

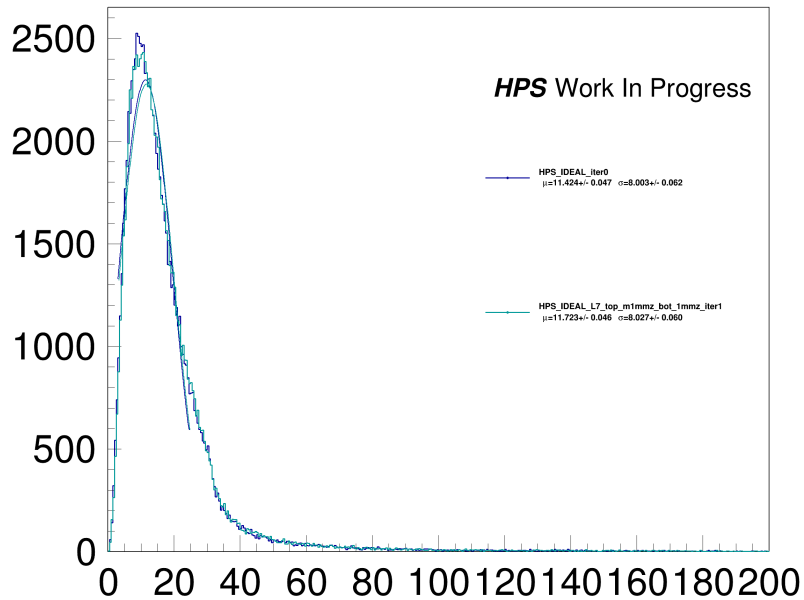
- L6 and L7 w movements have very little influence on residuals

“Weak modes” in w movements

χ^2 distribution – bottom, negative tracks



MC L6 1 mm tw

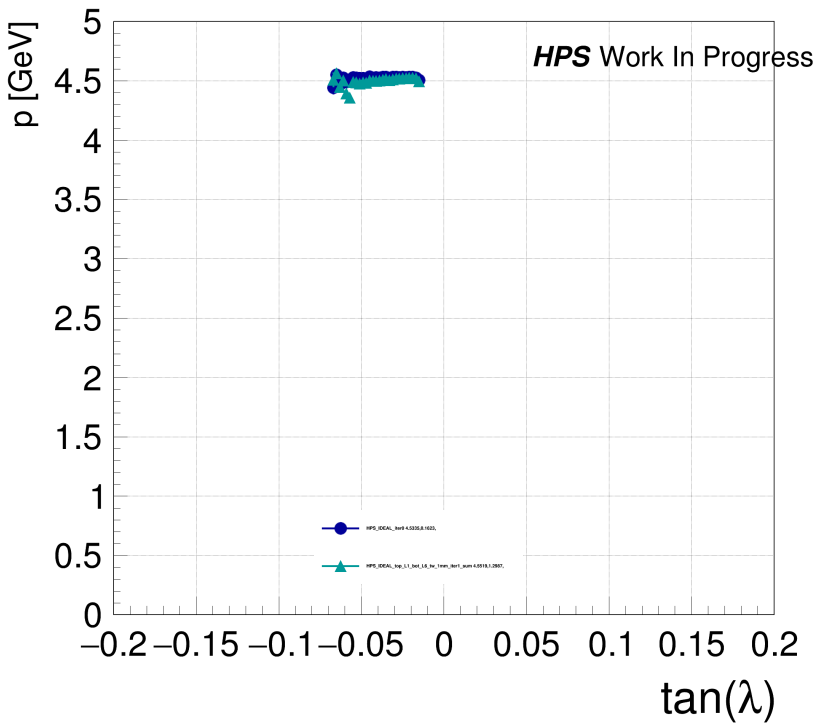


MC L7 1 mm tw

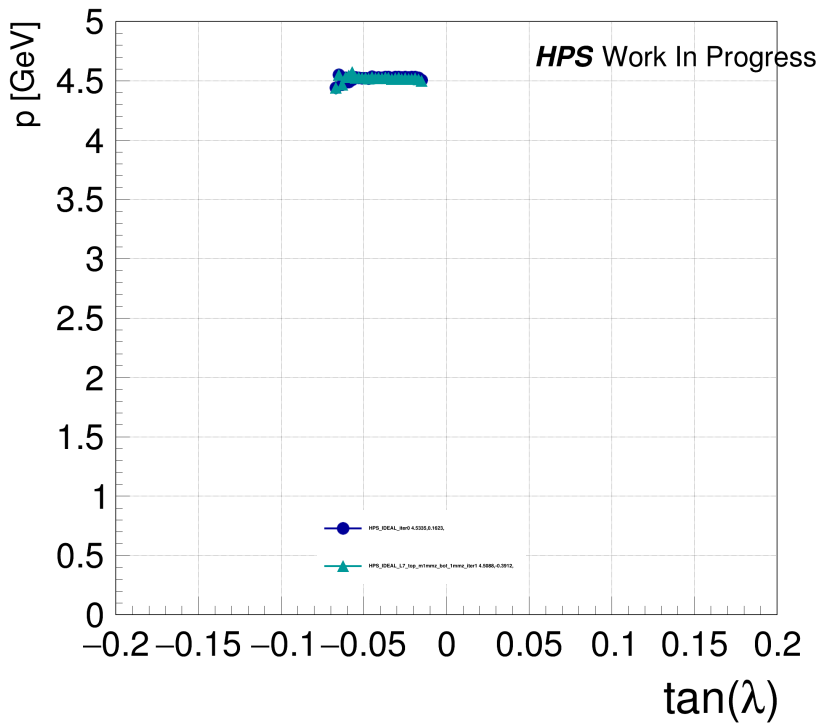
- Minor influence on χ^2 distribution

“Weak modes” in w movements

p vs tan λ distribution – bottom



MC L6 1 mm tw

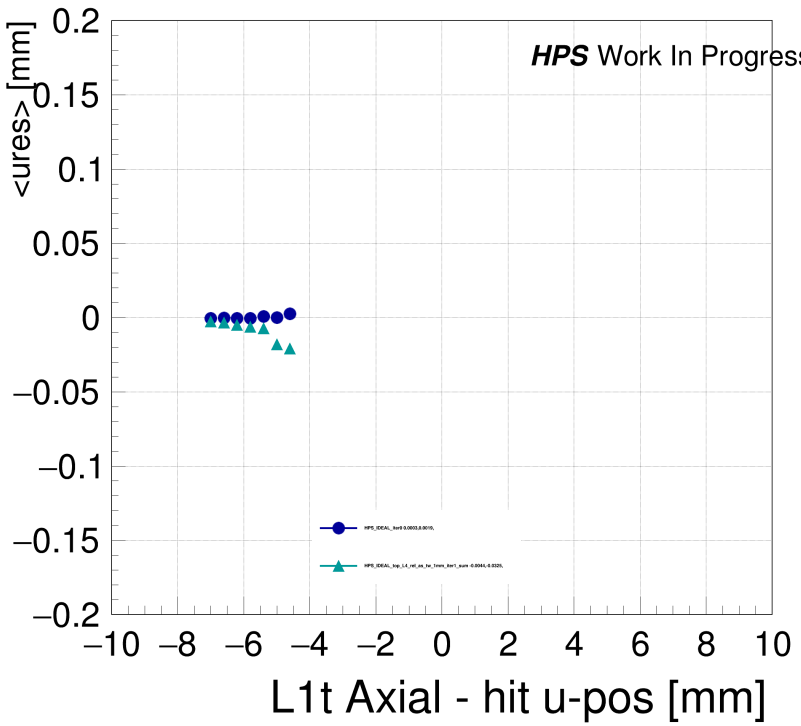


MC L7 1 mm tw

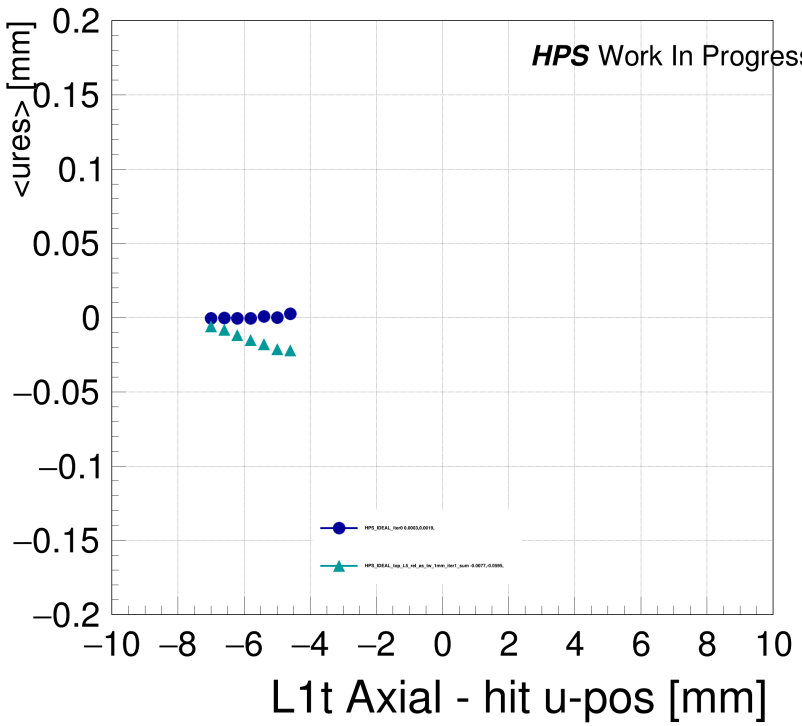
- Minor influence on momentum vs tan λ distribution

Separation of axial-stereo sensors: L4 + L5

Effect in L1



MC L4 1 mm axial-stereo rel. tw

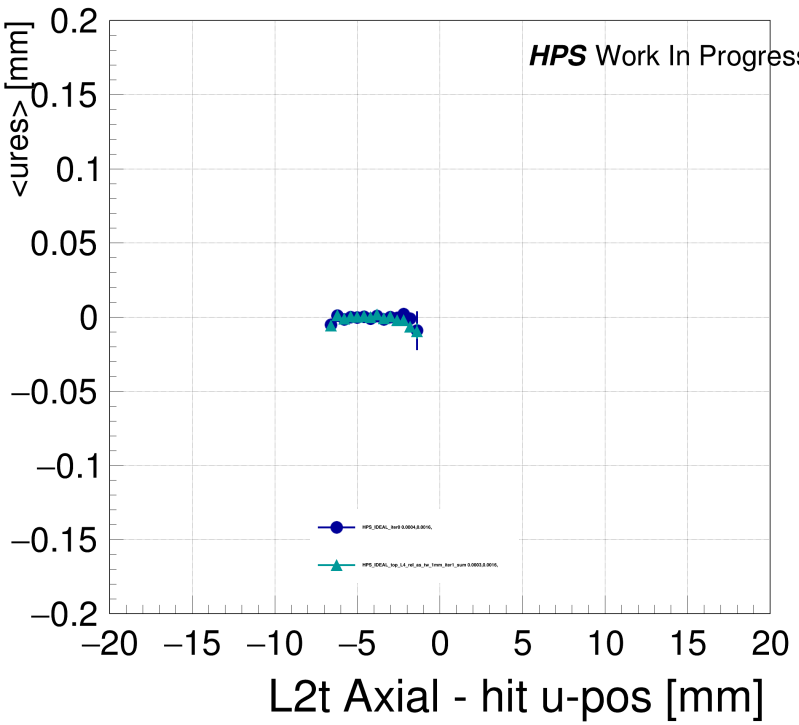


MC L5 1 mm axial-stereo rel. tw

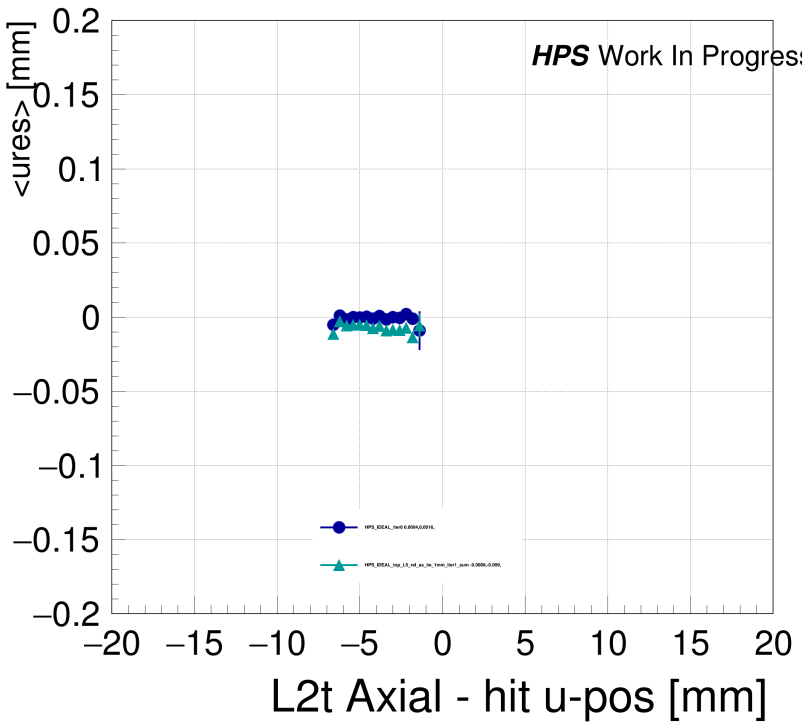
- L4 and L5 movements have strong effect on L1 residuals

Separation of axial-stereo sensors: L4 + L5

Effect in L2



MC L4 1 mm axial-stereo rel. tw

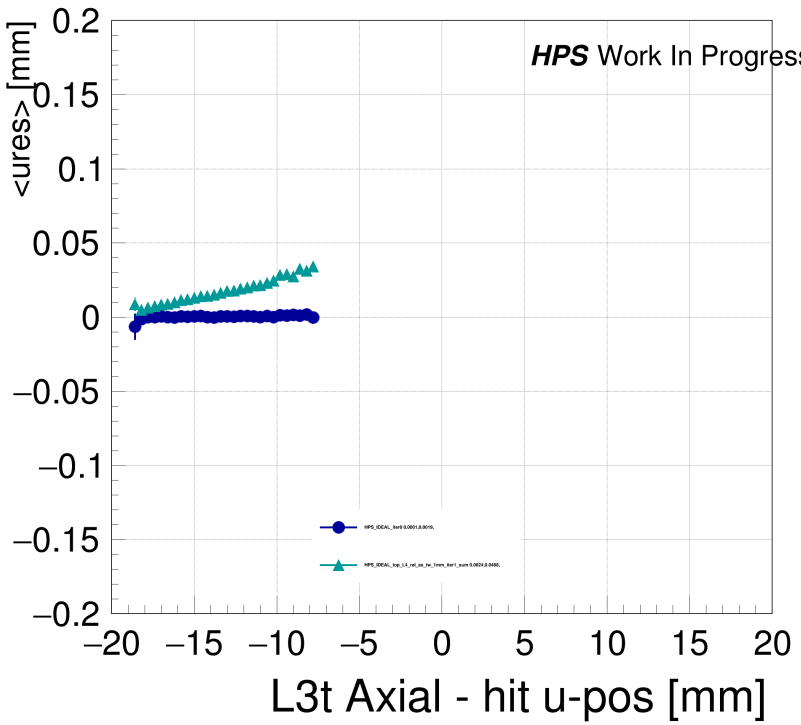


MC L5 1 mm axial-stereo rel. tw

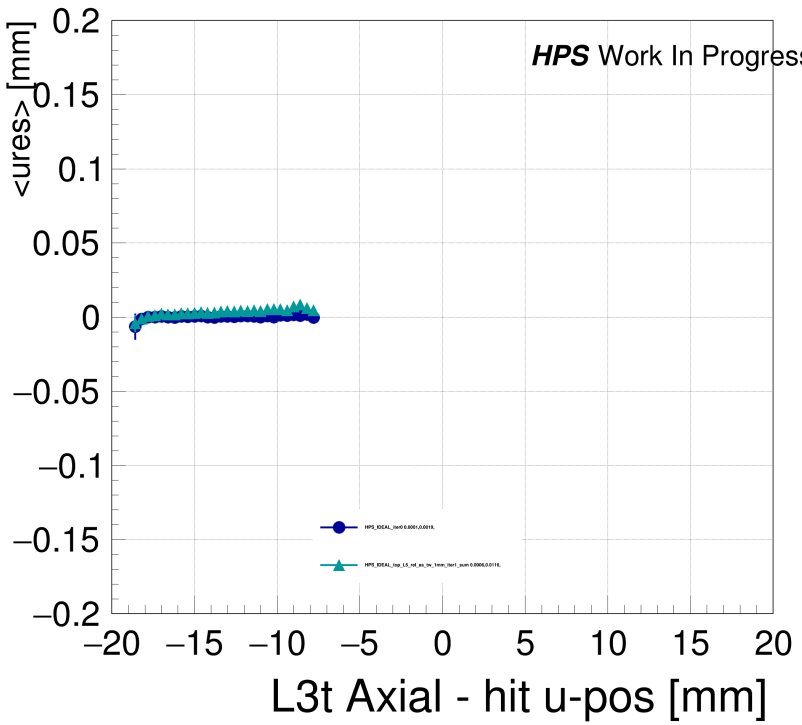
- L4 and L5 movements have little effect on L2 residuals

Separation of axial-stereo sensors: L4 + L5

Effect in L3



MC L4 1 mm axial-stereo rel. tw



MC L5 1 mm axial-stereo rel. tw

- L5 movements have little effect on L3 residuals

Separation of axial-stereo sensors: L4 + L5

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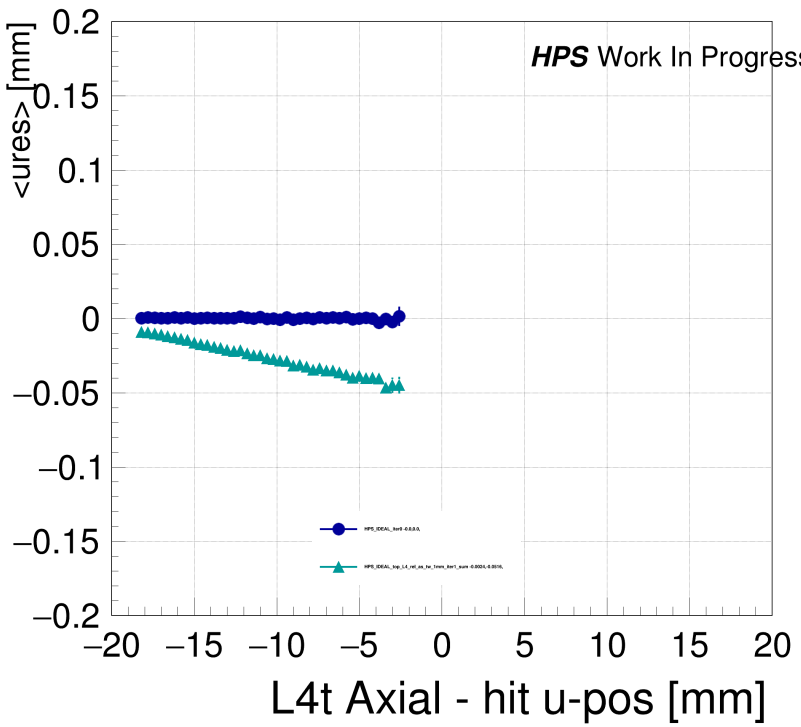
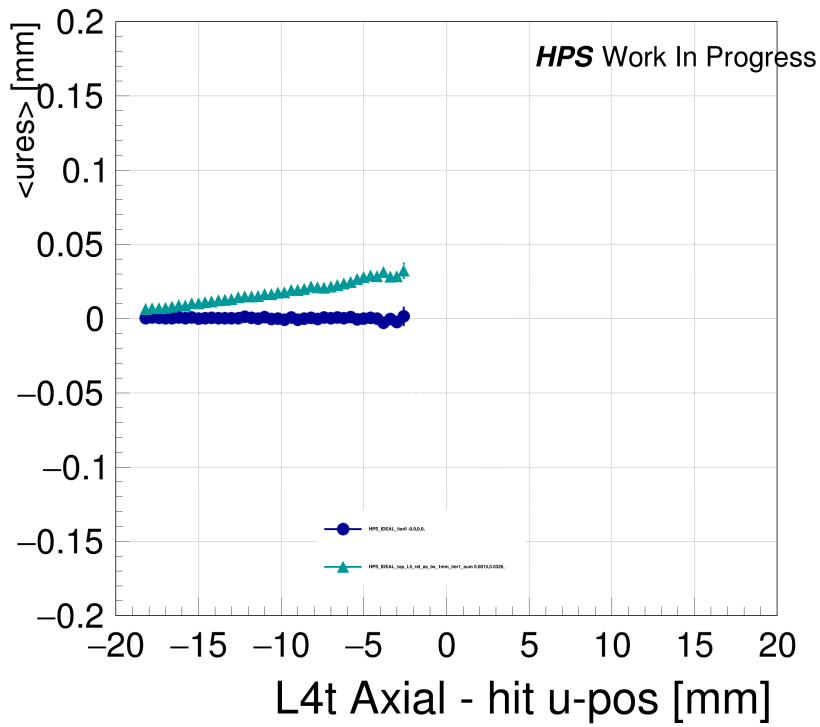
Effect in L4



MC L4 1 mm axial-stereo rel. tw



MC L5 1 mm axial-stereo rel. tw

- L4 and L5 movements have strong effects on L4 residuals

Outlook

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- Data sample: repeat study with tritrig+beam and physics trigger MC sample
- Distance between axial and stereo sensors
  - Increase distance for multiple modules at once
  - Reduce the distance
- Other movements:
  - Understand diagonal shape in E/p (PF last week)
  - rv of double sensors $\rightarrow$ investigate geometry
- Aligning misaligned detectors: can we recover from tw movements?